GLOSSARY OF TERMS

This glossary is intended to provide the reader with working definitions of many of the technical terms and acronyms which appear in the risk assessment. Various government agencies and organizations may have different definitions for these terms; thus the definitions are intended only to provide guidance to the reader as to how these terms are used within this report. Sources for these definitions include a variety of documents prepared by the United States Environmental Protection Agency (U.S. EPA), New York State Department of Health, Health Canada, U.S. Federal Drug Administration (USFDA), International Programme on Chemical Safety (IPCS), Agency for Toxic Substances and Disease Registry (ATSDR), and the World Health Organization (WHO).

The SARA Group would also like to thank Dr. Ron Brecher and the scientists at GlobalTox for their contributions to this glossary.

95th Percentile

The 95th percentile of a set of measurements is the value below which 95% of the results fall.

95% UCLM

See *95% Upper confidence limit of the mean.*

95 % Upper confidence limit of the mean (95%UCLM)

The upper bound 95th percentile on the value of the mean of a normally distributed sample parameter that one can be confident (at a specified level) is not exceeded by the true mean of the population.

AAQC

See *Ambient Air Quality Criteria.*

Absorbed fraction

The fraction of an inhaled or swallowed compound that is absorbed into the blood stream. See also Bioavailability and Bioaccessibility.

Absorption

The process of assimilating one material into another (i.e., when a sponge takes up water). Metals can also be absorbed into the bloodstream and transported to various body organs after breathing or inhaling airborne dust or swallowing dust and soils. Rarely, metals might be absorbed through the skin into the bloodstream and then transported to other organs. However, this is not the main source of absorbed metals in their various forms.

Acceptable daily intake (ADI)

Estimated maximum amount of an agent, expressed on a body mass basis, to which individuals in a (sub)population may be exposed daily over their lifetimes without appreciable health risk.

Acceptable risk

A risk management term. The acceptability of the risk depends on scientific data, social, economic, and political factors, and the perceived benefits of producing or using a product associated with exposure to an agent.

Acidification

The process by which soil, surface water (such as lakes and rivers) or ground water becomes increasingly acidic due to phenomena such as acid rain.

Active transport

Active transport is the mediated transport of biochemicals and other atomic/molecular substances, across membranes. Unlike passive transport, this process requires chemical energy. In this form of transport, molecules move against either an electrical or concentration gradient (collectively termed an electrochemical gradient). This is achieved by either altering the affinity of the binding site or altering the rate at which the protein changes conformations.

Acute

Occurring over a short time. An acute or short-term exposure can result in short term or long-term health effects. An acute effect happens within a short time after an exposure (*i.e.*, may be minutes or days).

ADAF

See *Age-dependent adjustment factor***.**

Additivity

Consequence which follows exposure to two or more physico-chemical agents which act jointly but do not interact: commonly, the total effect is the sum of the effects of separate exposure to the agents under the same conditions. Substances of similar action may show dose or concentration addition.

ADI

See *Acceptable daily intake***.**

Adolescent

Within this document, an adolescent is a person more than 12 and less than 18 years old.

Adult

Within this document, an adult is any person over the age of 18 years.

Adverse health effect

A change in body function or cell structure that might lead to disease or health problems.

Age-dependent adjustment factor (ADAF)

An age-dependent adjustment factor, or ADAF, combined with age-specific exposure estimates are recommended by the U.S. EPA when assessing cancer risks for some substances. Typically, these factors are used to provide an addition layer of "safety" when evaluating carcinogenic risks to sensitive age groups as part of a lifetime risk evaluation, above and beyond any uncertainty factors already incorporated within the dose response relationship for that substance.

Agency for Toxic Substances and Disease Registry (ATSDR)

As an agency of the U.S. Department of Health and Human Services, the mandate of ATSDR is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and disease related to toxic substances. Further information can be found on http://www.atsdr.cdc.gov/.

Ambient

Environmental or surrounding conditions. Ambient air is usually outdoor air (as opposed to indoor air).

Ambient Air Quality Criteria (AAQC)

Air quality criteria established by the MOE for specific chemicals and substances above which there is the risk of potential for adverse effects. These effects can be health-based, or protective of other important endpoints (*e.g.*, corrosion, odour, staining, *etc*.). In Ontario, these criteria are usually developed for annual averages or on a 24-hour basis in $\mu g/m^3$, though criteria are also available for 1-hour and 10-minute exposure durations for select chemicals.

Analyte

A chemical for which a sample (such as soil, water, air, blood, urine or other substance) is tested. For example, if the analyte is nickel, the laboratory test will determine the amount of nickel in the sample.

Antagonism

A phenomenon where two or more agents in combination have an overall effect which is less than the sum of their individual effects. In biochemistry and toxicology, the term commonly refers to interference in the physiological action of a chemical substance by another having a similar structure or chemical behaviour.

Anthropogenic

Arising from human activity (*i.e.*, caused by humans).

Area-wide risk assessment

A spatially wide-ranging risk assessment intended to estimate the risk to an identified community or communities of identified receptors (human and ecological). This type of risk assessment is conducted over a large geographical area and is not confined by property boundaries as is usually the case for a site-specific risk assessment (SSRA). Therefore, significantly more time and effort are required to collect the data necessary to conduct an area-wide risk assessment *versus* a SSRA.

Arithmetic mean

The average value of a data set. The arithmetic mean is obtained by adding together the values in the data set and dividing by the number of observations.

Asthmatics / asthma

Asthmatics are people who suffer from asthma, a disease involving episodes ("asthma attacks") where the breathing tubes become constricted making it difficult to breath.

Atmospheric deposition

The process by which substances in the atmosphere are deposited upon surfaces, for example soil, buildings or the surface of lakes or rivers.

ATSDR

See *Agency for Toxic Substances and Diseases Registry***.**

AWRA

See *Area-wide risk assessment.*

Background level

A typical or average level or concentration of a chemical or substance in the environment. Background often refers to naturally occurring or uncontaminated levels, and it should be noted that these vary from one location to another. Background concentrations of metals are usually greater in Northern Ontario due to the presence of the Canadian Shield and other natural geological formations.

Benchmark

A reference point (such a regulatory standard or guideline) against which a measurement can be compared (as a noun), or the act of comparing a measurement to a reference value (as a verb). See *Critical exposure ratio, Preliminary remediation goal* and *Probabilistic risk assessment.*

Binary mixture

A mixture of two components.

Binary weight-of-evidence (BINWOE)

This approach uses qualitative judgment of pairwise interactions data to evaluate mechanistic evidence, strength of interactions data, influence of exposure duration, route and sequence for interaction between two components.

BINWOE

See *Binary weight-of-evidence.*

Bioaccessibility

The mass fraction of a substance that is converted to a soluble form, and is therefore potentially available for uptake, under conditions of the external part of the membrane of interest. If one is evaluating bioaccessibility *via* the oral route, it is the fraction of a substance that becomes solubilized within the gastrointestinal tract (*i.e.*, stomach and small intestine). This may also

include the fraction of the substance, in the form of ultrafine (nano) particles, which is translocated directly into cells or the blood circulation. In the case of dermal exposures, it is the fraction solubilized on the outside of the skin (*i.e.*, in sweat). See *Relative Bioaccessibility*.

Bioaccumulation

Some chemicals are not excreted quickly if the rate of absorption (see absorption) into the body is greater than rate of excretion from the body; their concentrations can build-up in parts of the body where they are stored. Total chemicals in the body (referred to as the "body burden") may build up if a person is exposed to a substance for a long period of time.

Bioavailability

The fraction of a substance to which an organism has been exposed that is absorbed into the blood stream. The bioavailable fraction is also sometimes referred to as the absorbed fraction or f_{abs}. *Absolute bioavailability* refers to the fraction or percentage of a chemical that is ingested, inhaled or applied to the skin that is absorbed and reaches systemic blood circulation. *Relative bioavailability*, as it pertains to risk assessment, has been defined as the difference in absorption of a chemical from the environmental medium of concern (*e.g.*, food, soil and/or water) *versus* the absorption from the vehicle (or medium) used in the toxicological study from which the toxicity-based reference value is derived.

Biokinetics

Processes affecting the movement of molecules from one internal body compartment to another, including elimination from the body.

Biological monitoring

Measuring either chemicals or the various by-products they produce in the body by sampling biological materials (blood, urine, breath, *etc*.). The prime objective of biological monitoring is to obtain measurements of chemical exposure in humans, animals or plants.

Biota

Plants and animals (including microbes) in an environment.

Biotransfer Factor (BTF)

Measure of the net transfer of a chemical directly from an exposure medium, such as soil or food, into an organism (such as beef or dairy cattle).

Bronchi

The largest breathing tubes in the lungs.

BW

Body weight.

Cal/EPA

See *California Environmental Protection Agency***.**

California Environmental Protection Agency (Cal/EPA)

The state organization in California that pioneered many of the methods used in current risk assessments.

Canadian Council of Ministers of the Environment (CCME)

A group comprised of 14 environment ministers from the federal, provincial and territorial governments which promotes effective intergovernmental cooperation and coordinated approaches to inter-jurisdictional issues such as air pollution and toxic chemicals. Although the CCME establishes nationally-consistent environmental standards, strategies and objectives, it has no authority to enforce them on individual jurisdictions.

Cancer

Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control. A cancer can be defined as benign or malignant tumours, the latter of which are invasive and can metastasize (*i.e.*, spread) within the body.

Cancer Risk Level (CRL)

Risk characterization for chemicals with non-threshold-type dose responses (*i.e.,* carcinogens) consists of a calculation of the Cancer Risk Level (CRL), which is defined as the predicted risk of an individual in a population of a given size developing cancer over a lifetime. The CRL is expressed as the prediction that 1 person per ***n*** people would develop cancer, where the magnitude of ***n*** reflects the risks to that population.

Cancer slope factor / Unit risk cancer estimate (SF, q_1*, URE)

A measure of the relationship between exposure to a carcinogen and the increased risk of cancer, and corresponds to risk per unit of exposure. The cancer slope factor is used to estimate the increased risk of cancer resulting from a lifetime of exposure to a substance.

Capping

Using an engineered barrier, such as a thick layer of clay to cover impacted soil to prevent direct exposure to substances beneath the cap, and/or to prevent or reduce the infiltration of rain water into the impacted soil.

Carcinogen / Carcinogenic

A substance or chemical that can cause cancer. Knowledge that a chemical or substances can cause cancer is usually obtained from laboratory studies in animals. Only infrequently do we know that a substance definitely causes cancer in humans. Sometimes the cancer effect is dependent on the type of exposure.

Cardiovascular disease

Diseases of the heart and blood vessels.

Cation

A positively charged ion.

CBRA

See *Community-based risk assessment.*

CCME

See *Canadian Council of Ministers of the Environment.*

CDC

See *Centers for Disease Control and Prevention.*

CEM

See *Centre for Environmental Monitoring at Laurentian University, Sudbury, Ontario.*

Centers for Disease Control and Prevention (CDC)

A major operating component of the U.S. Department of Health and Human Services, responsible for public health efforts to prevent and control infectious and chronic diseases, injuries, workplace hazards, disabilities, and environmental health threats.

Centre for Environmental Monitoring (CEM)

The Centre for Environmental Monitoring, founded in 2000 at Laurentian University in Sudbury, Ontario, is engaged in interdisciplinary research that uses the superb natural laboratories of the region to study the effects of both emissions and of abatement technologies on both affected and near-pristine land systems, as well as on human health issues through studies of water quality.

Central nervous system (CNS)

The part of the nervous system that includes the brain and the spinal cord and their coverings.

Central Tendency Exposure Estimate (CTE)

An estimate of the most likely, most common, or average exposure in a population.

Chemical of concern (COC)

A chemical of interest which is present at concentrations which exceed Ontario Ministry of the Environment "Table A" guidelines, or which is below Table A, but exceeds "background" concentrations and may pose a risk to human health and/or the environment, as evaluated in a screening-level risk assessment or other established screening criteria.

Chemical Speciation

See *Speciation.*

Child

In this document, the "child" lifestage is a person more than 5 and less than 12 years old.

Chronic

Occurring over a long period of time, several weeks, months or years, depending on the exposed species.

Chemical Speciation

See *Speciation.*

CHQ

See *Critical Hazard Quotient.*

COC

See *Chemical of concern*.

COI

See *Community of interest*.

Community-based risk assessment (CBRA)

A spatially wide-ranging risk assessment intended to estimate the risk to an identified community or communities of identified receptors (human and ecological). This type of risk assessment is conducted over a large geographical area and is not confined by property boundaries as is usually the case for a site-specific risk assessment (SSRA). Therefore, significantly more time and effort are required to collect the data necessary to conduct a CBRA versus a SSRA.

Community of interest (COI)

A group of people or geographical community identified at the beginning of the risk assessment process that are potentially exposed to the chemicals of concern, and who are therefore, subjects in the human health risk assessment process.

Compartment

In the context of exposure modelling, a "compartment" is a functional unit of the model. For example, a model of uptake and distribution of a chemical may consider the gut, the blood and the liver as three different compartments.

Complexation

The process whereby a substance becomes bound up with other materials to form a "complex". Complexation may make the substance less available for absorption by an exposed organism, and thereby reduce the chance of harmful (or beneficial) effects. For example, some metals are complexed by organic matter in soils, rendering them less toxic; some medicines are complexed by materials in the food we eat, rendering them less well absorbed and therefore less effective.

Composite sample

A sample of water, soil or other medium, which is made by combining two or more samples from the same or different locations (depending on the objective of the investigation).

Concentration

The proportion of one substance contained in a given amount of a specific media. The unit is a concentration unit which has two components: the numerator (*i.e.*, quantity of chemical present) and the denominator (*i.e.*, quantity of the media or volume of solution in which the chemical is present). For example, an arsenic soil concentration of 10 mg/kg (*i.e.*, 10 ppm) represents 10 mg of arsenic present within 1 kilogram of soil.

Concentration Ratio (CR)

The concentration is similar to the *hazard quotient*, where the exposure and exposure limit are expressed as concentrations (rather than as doses). See *Hazard quotient.*

Conceptual Model

A written description and a visual representation of the relationships between humans and ecological species and the chemicals to which they may be exposed.

Contaminant

A substance that is present in an environment where it does not belong.

Critical Hazard Quotient (CHQ)

A regulatory established benchmark of "safety" on which Hazard Quotients from a HHRA can be compared. For example, a CHQ of 1.0 is typically established when an assessment includes all relevant exposure pathways. However, if an assessment only evaluates a single or few sources of contamination, then an allocation of 20% of the residual tolerable daily intake for each of the five major media (*i.e.,* air, water, soil, food, consumer products) is typically used (*i.e.*, a CHQ of 0.2).

CR

See *Concentration ratio.*

CRL

See *Cancer Risk Level.*

CTE

See *Central Tendency Estimate*.

Data gap

Refers to a type of data which is unavailable or limited, and which would likely reduce uncertainty in the risk assessment if it were to be available or if the data set were more complete.

De minimis

From the Latin '*de minimis non curat lex*' ('the law does not concern itself with trifles'), this term refers to a very small level of risk. In Canada, incremental lifetime cancer risks in the range of 1-in-a-million (1×10^{-6}) to 1-in-a-hundred-thousand (1×10^{-5}) are usually considered *de minimis.* Also see *Acceptable risk.*

Demographic profile

A description of a group of people (*e.g.*, a community) in terms of the distribution of such factors as age, gender, household income, type of housing, occupation, educational background, *etc*.

Dermal

Referring to the skin. For example, dermal absorption means absorption through the skin.

Dermal sensitization

Dermal sensitization is a type of allergic reaction that occurs following an initial (or "sensitizing") exposure to some substances, for example nickel. Once a person is sensitized to a substance, even a small subsequent exposure (sometimes called a "challenge" exposure) to the substance can elicit dermal effects such as a rash.

Desorption

The opposite of sorption. See *Sorption.*

Detection limit

The lowest amount of substance that a laboratory can reliably measure using a specific analytical technique. Detection limits are usually defined in relation to a particular measurement methodology of a laboratory. The concentration of a chemical is measured in a sample of air, water, soil or other medium. Whether or not a chemical can be shown to be present in a measurable concentration depends on the detection limit. The detection limit seldom, if ever, denotes a concentration of zero.

Deterministic / Deterministic risk assessment

Refers to a mathematical approach commonly used to estimate exposures in risk assessments. In a deterministic risk assessment, each variable (for example body weight, inhalation rate, time spent indoors per day) is assigned a single value. See also *Probabilistic / Probabilistic risk assessment.*

Dose

The amount of chemical or substance taken in or absorbed by an exposed individual. Dose often takes body weight into account. For example, to receive equivalent doses of medicine, children are given smaller amounts than adults. The unit is mg/kg for example. The dose rate is the frequency that the dose is applied, such as "mg/kg body weight per day". Acute toxicity usually refers to single doses, while chronic toxicity refers to given dose rates.

Dose-response relationship

The relationship between the amount of a substance absorbed (*i.e.*, dose) and the resulting changes in body function or health (*i.e.*, response).

Ecological risk assessment (ERA)

A risk assessment focused on estimating potential risks to a defined set of environmental biota (plants and animals) from exposure to a particular agent or agents. The ERA process includes four basic steps: receptor characterization, exposure assessment, hazard assessment, and risk

characterization. The Sudbury Soils Study ERA can be found in Volume 3 of the Sudbury Soils Study report.

EDI

See *Estimated daily intake*.

Effect

Change in the state or dynamics of an organism, system, or (sub)population caused by the exposure to an agent.

Endpoint

An adverse effect on a living system (from single organisms to entire ecosystems) which is studied in an experiment, or an adverse effect whose prevention or minimization is the basis of a benchmark. See also *Effect* and *Benchmark*.

Emissions

Materials released to the environment from a source. Emissions may be released from localized sources (such as an industrial smokestack), diffuse sources (such as a landfill site) or mobile sources (such as an automobile).

Environmental Fate

Pattern of distribution of an agent, its derivatives, or metabolites in an organism, system, compartment, or (sub)population of concern as a result of transport, partitioning, transformation, or degradation.

EPC

See *Exposure Point Concentration*.

Epidemiology

The study of disease in human populations. An epidemiological study often compares two or more groups of people who are as alike as possible, except for the factors being investigated. The factor could be exposure to a chemical or the presence of a health effect. The investigators try to determine if any factor is associated with the health effect outside of what may be considered "chance".

Note: Epidemiologic studies do not prove the "cause" of the health effect, they measure an "association" between the health effect and various factors. The true cause of any adverse effect is determined by the amount and quality of evidence available from many sources such as clinical medicine, toxicology, cellular biology, chemistry, *etc*.

ER

See *Exposure ratio*.

ERA

See *Ecological risk assessment*.

Essential metal

An essential metal is a metal required by the body for normal healthy function. It must have a specific role in an enzyme or cofactor, and a deficiency should produce a disease or impairment of function.

Estimated daily intake (EDI)

See *Estimated Total Daily Intake.*

Estimated total daily intake (ETDI or TDI)

The total exposure to a substance that is estimated to occur each day, considering all exposure media (for example, food, water, air and soil) and routes (for example, swallowing, inhaling or coming into skin contact).

ETDI

See *Estimated Total Daily Intake.*

EU

See *Exposure unit*.

Exposure

Exposure is any contact with a chemical by swallowing, breathing or direct contact (such as through the skin or eyes). Exposure may be either short term (acute) or long term (chronic). Exposure can vary greatly, and is often associated with specific activities or behaviours of people or ecological organisms. It is quantified as the amount of a substance that can be absorbed, or the amount available for inhalation or ingestion.

Exposure assessment

A process that estimates or measures the amount of a chemical or substance that enters or comes into contact with a person or ecological organism. An exposure assessment also takes into consideration the length of time and the nature of a population exposed to a chemical.

Exposure pathway

The pathway a chemical, substance or agent may take to reach or cause exposure of humans or other living organisms. Pathways link a source of a chemical, substance or agent (*i.e.,* soil) to its eventual entry into the body.

Exposure point concentration (EPC)

The concentration of a chemical or substance in its transport medium (*i.e.*, air, food, water, *etc*.) at the point of contact where exposure occurs.

Exposure ratio

See *Hazard quotient*.

Exposure route

The route through which a substance can enter the body. Inhalation (breathing), ingestion (swallowing) and dermal contact (skin contact) are the three exposure routes considered in this document.

Exposure scenario

A combination of facts, assumptions, and inferences that define a discrete situation where potential exposures may occur. These may include the source, the exposed population, the time frame of exposure, microenvironment(s), and activities. Scenarios are often created to aid exposure assessors in estimating exposure under varying conditions.

Exposure unit (EU)

A discrete area, with specific exposure characteristics, delineated for evaluating within the assessment process. For example, each of the COIs in the HHRA are considered EUs for the purpose of establishing potential health risks and risk management action (if required) for each of the COCs.

Extrapolation

A mathematical technique for using data from a situation that has been studied to gain insights about one that has not. Three kinds of extrapolation are commonly seen in risk assessments: 1) health effect data obtained in animal experiments can be extrapolated to understand health effects of a substance in humans; 2) a chemical's effects at high doses are often used to make predictions about effects at lower doses; and, 3) a chemical's effects following exposure *via* one exposure route are sometimes used to make predictions about effects following exposures *via* other routes.

Geometric mean

Related to the arithmetic mean, in that it is a measure of central tendency. The geometric mean typically has an equal number of data points above and below it, and is appropriate to use to characterize certain types of data (*i.e.*, "log-normally" distributed datasets). See also *Arithmetic mean* and *Central tendency estimate.*

Geometric standard deviation (GSD)

The standard deviation of the geometric mean. Calculated as the antilog of the square root of the variance of the log-transformed data and thus provides an indication of variability.

Gradient

The change in concentrations of a chemical, substance or agent over distance. For example, with a source of the chemical, substance or agent (*i.e.,* a smokestack), its concentration will decrease as distance away from the source increases, resulting in a gradient.

Greater Sudbury Area (GSA)

The current study area, including the City of Greater Sudbury and the surrounding region (approximately 40,000 km^2) located just south of the Sudbury Basin in the core of the Canadian Shield in Northern Ontario. Included in the study area are the primary COIs of Copper Cliff, Coniston, Falconbridge, Hanmer, and Sudbury Centre.

GSA

See *Greater Sudbury Area.*

GSD

See *Geometric standard deviation.*

Guideline

Recommended limit for some parameter or substance in a specific medium and/or environment. For example, health guidelines are upper limits of exposure, below which adverse health effects are absent or minimized.

Gut

The digestive system.

Half life / half lives

In this report, the term half life refers to the time it takes for the body to eliminate half of the amount of a substance taken in.

Hazard

Inherent property of an agent or situation having the potential to cause adverse effects when an organism, system, or (sub)population is exposed to that agent or situation.

Hazard quotient (HQ)

The ratio of estimated site-specific exposure to a single chemical over a specified period to the estimated daily exposure level, at which no adverse health effects are likely to occur. This risk characterization metric is typically used in the evaluation of non-carcinogenic chemicals. Also known as an *exposure ratio (ER)*.

HC

See *Health Canada.*

Health Canada (HC)

The Canadian Federal department responsible for helping Canadians maintain and improve their health.

Health assessment

A process to determine the health impacts related to particular events or circumstances, such as the release of a chemical, substance or agent into the environment. It includes a health interpretation of all the information known about the situation. The information may include some or all of the following: site investigation (environmental sampling and studies), exposure assessment, risk assessment, biological monitoring and health effects studies. The information is used to advise people how to prevent or reduce their exposures, to determine if remedial actions are necessary, or the need for additional studies.

The types of studies carried out in a health assessment can include studies of the environment (soil measurements, chemical availability, *etc.*) or studies of the people living in the environment (epidemiological studies or biological monitoring studies).

Health outcome

Any health condition associated with or possibly resulting from an exposure.

Health effects studies

Studies that examine historical health impacts that may result from particular events, such as exposure to hazardous or other substances. Health effects studies may include, but are not limited to, epidemiological studies and exposure and disease registries.

Note: Ontario already has a longstanding *cancer registry* (since the 1940s) and contributes to a national birth defects registry (since late 1980s). These registries can provide data and information on the occurrence of these "outcomes" by census tracts in the province. This is ongoing and need not be instituted for any single community.

Health registry

A health registry is a system of ongoing registration, the institution that carries out the work, and/or a place where registers are kept. In this context, a health register constitutes a list or file of all cases of people known to have been exposed to a specific substance (such as a virus, bacteria, heavy metal), or a record of people displaying a specific health effect (such as cancer or a communicable disease). Exposure registries are used primarily in occupational settings where workers may be exposed to relatively high levels of hazardous substances (*i.e.,* National Radiation Dose Registry). In Ontario, there are no population-based hazardous substances exposure registries. Ontario has extensive experience with cancer (*i.e.*, Cancer Care Ontario) and reproductive outcome (birth defects) registration and with occupation-specific exposure registration (*i.e.*, Ontario miners).

Hematopoetic system

The blood-forming system.

HHRA

See *Human health risk assessment.*

Homeostatic

Being in a state of homeostasis. The property of an open system, especially living organisms, to regulate its internal environment to maintain a stable, constant condition, by means of multiple dynamic equilibrium adjustments, controlled by interrelated regulation mechanisms.

Human health risk assessment (HHRA)

A risk assessment focused on estimating potential human health risks to a defined set of individuals from exposure to a particular agent or agents. The HHRA process includes four basic steps: problem formulation (hazard identification), exposure assessment, hazard assessment, and risk characterization.

Hi-vol sampler

An instrument that is used to collect air samples for measurement of concentrations or levels of particles or substances in air. Hi-Vol air samplers have a high ratio of airflow to trapping medium and are used to measure low concentrations of chemicals or substances in the part per billion (ppb) range or less over long periods of time (up to 24 hours or more).

HQ

See *Hazard quotient*.

Incremental lifetime cancer risk (ILCR)

The predicted incremental risk of an individual in a population of a given size developing cancer as a result of an exposure to a particular agent(s). The ILCR is calculated as the estimated lifetime average daily dose (LADD) multiplied by the cancer slope factor (q_1*).

IEUBK

See *Integrated exposure uptake biokinetic model*.

Incremental lifetime cancer risk (ILCR)

The predicted risk of an individual in a population of a given size developing cancer over a lifetime as a result of exposure to a particular agent or agents at a specified daily rate over a lifetime of 70 years. The ILCR is calculated by multiplying the lifetime average daily dose by the cancer slope factor (q_1*).

Inhibition

The restraint, suppression, or arrest of a process or the action of a particular cell or organ; the prevention or slowing of the rate of a chemical or an organic reaction.

ILCR

See *Incremental lifetime cancer risk.*

Ingestion

Taking a substance into the body by swallowing it, whether incidentally or purposely.

Inhalation

Breathing or inhaling air, and the substances it contains, into the lungs.

In utero

In the womb.

Integrated exposure uptake biokinetic model (IEUBK)

The IEUBK model is a computer model developed by the U.S. EPA to model exposure from lead in air, water, soil, dust, diet, paint, and other sources. It uses pharmacokinetic modelling to predict blood lead concentrations (PbB) in children 6 months to 7 years old.

In vitro

In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal.

In vivo

Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice.

Latency period

The period of time between exposure to an agent, such as a virus, bacteria or toxic chemical, and the onset of any health effect.

Leach

A material is said to leach from soil when it is removed by water or other liquid passing through the soil. The water carrying the leached material is called *leachate*. The physical process by which leachate is produced is called *leaching*.

Lesion

A wound or damage to something. For example, a DNA lesion is damage to the genetic material.

LOAEL

See *Lowest observed adverse effect level.*

Lowest observed adverse effect level (LOAEL)

The lowest dose in an experiment which caused an adverse effect.

MAC

See *Maximum acceptable concentration.*

Market Basket

The amounts of different foods and beverages that are consumed by a person during a specific period of time.

Mass Fraction

The mass fraction usually refers to the fraction of the total amount of soil dust or other particles, by mass, having less than a certain size, for example the mass fraction of particles having less than 10 microns would be the fraction of the total mass of a sample that is associated with particles less than 10 microns in size.

Matrix

A material such as soil, water, air, plant tissue, animal tissue, food, *etc*. within which a SOI resides. The plural of matrix is matrices. See also *Medium.*

Maximum Allowable Concentration (MAC)

A type of drinking water criterion established in Ontario (as a standard) and in Canada (as a guideline). The MAC represents the highest (maximum) permissible level of a chemical or substance in drinking water. MACs are established to protect against adverse health effects of substances in people; other types of criteria are established based on effects other than health (*e.g*., taste or odour).

MDL

See *Method detection limit.*

Media

Soil, water, air, plants, animals or any other parts of the environment that can contain chemicals, agents or substances. Body tissues or fluids such as blood, bone or urine may also be media. The singular of "media" is "medium."

Median

The mid-point of a data set. The median of the data set is the value that divides the data set into two equal groups (half have values less than the median; half have values greater than the median).

Metabolism

All the naturally occurring chemical reactions within the body that enable the body to work. For example, food is metabolized (chemically changed) to supply the body with energy. Chemicals can be metabolized and made either more or less harmful by the body. In general, metabolism makes chemicals less harmful (detoxifies substances). Occasionally, metabolism can activate a chemical to increase its potential to do biological harm.

Method Detection Limit (MDL)

The minimum concentration of a substance being analyzed that has a 99 percent probability of being identified using a specific analytical technique. Method detection limits are defined in relation to a particular measurement methodology of a laboratory. See also *Detection limit*.

mg/kg

Milligram per kilogram.

Microenvironments

Literally, a small environment. Different microenvironments refer to different local conditions within a generally similar area (*i.e.*, the environment). For example, the microenvironment of the laundry room of a house may be relatively humid compared to other locations in a home.

Ministry of Natural Resources (MNR)

Provincial government body in Ontario responsible for protecting and managing the province's natural resources.

MNR

See *Ministry of Natural Resources.*

Mode of Action

The mode of action of a substance is defined as the general recognition of the broad biochemical pathways (such as DNA synthesis, protein synthesis, cholesterol synthesis) which are inhibited or affected by a substance. The mode of action is distinguished from the mechanism of action of a substance, which is defined as the mechanism by which a toxicologically active substance produces an effect on a living organism or in a biochemical system. The mechanism of action is usually considered to include an identification of the specific targets to which a toxicologically active substance binds or whose biochemical action it influences.

Modelling

The process by which scientists consider many scenarios of exposure for the purpose of determining the associated health risks. A selected scenario may be preferred for a given site when information is known about the site and about the behaviour of the chemical or substance. In most cases modelling involves the use of mathematical equations to inter-relate the factors critical to the process being studied. These mathematical equations have been developed through studies of factor inter-relationships. Models are used to predict events expected in the future, or that have occurred in the past, when direct measurements are not feasible. Models can be used to assist in designing studies to obtain direct measurements of the processes of concern.

MOE / MOEE

See *Ontario Ministry of the Environment (and Energy)*.

Monte Carlo techniques

Problem solving numerical methods used to approximate the probability of certain outcomes by running multiple trial runs, called simulations, using random variables. Using random numbers and trial and error, these techniques are used to repeatedly calculate mathematical equations to arrive at a solution.

Morbidity

Illness or disease. Morbidity rate is the illness or disease experience in a population. This consists of the number of events per unit population per unit time.

Mortality

Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

Mutagen / Mutagenic

Something that causes a change in the genetic material, or DNA, is considered to be mutagenic, and is called a mutagen. The resulting change will then be inheritable at the cellular level.

National Academy of Sciences

An American academy that has recommended approaches for risk assessment, among other things.

NOAEL

See *No observed adverse effect level*.

Neoplasm

A benign or carcinogenic tumour.

No observed adverse effect level (NOAEL)

The highest dose in an experiment which did not cause an adverse effect.

Non-essential metal

A metal which is not required or used in the body for normal healthy function.

Odour threshold

For most people, the odour threshold is the lowest concentration of a chemical that most people can detect and identify by smell. Different chemicals have different odour thresholds. Also, some people can smell a chemical at lower concentrations than other people.

Ontario Ministry of the Environment (and Energy) (MOE / MOEE)

Provincial body responsible for development, implementation, and enforcement of regulations, as well as various programs and initiatives, which address environmental issues having local, regional and/or global effects. They were formerly known as the Ministry of the Environment and Energy, but are currently known as the Ministry of the Environment. The MOE are a member of the Sudbury Soils Study Technical Committee.

Oral

By mouth. Oral exposure refers to exposure by swallowing a material. Also see *Ingestion.*

Organic

Originally coming from plants or animals, and made primarily of carbon and hydrogen and oxygen, and may also have other elements such as sulphur and nitrogen. Organic chemicals are a class of chemical compounds.

OTR_{98}

Ontario typical range. This value represents the 98th percentile of background concentrations determined by the Ontario Ministry of the Environment.

Oxidic

In this report, oxidic refers to a compound containing nickel and oxygen.

PAH

PAH is an acronym for *polycyclic aromatic hydrocarbons*. All PAH contain only carbon and hydrogen, and are produced as by-products of incomplete combustion. They are commonly found in soot, and are emitted during the combustion of fossil fuels and wood.

Particulate matter (PM)

A general term that refers to dust, soot, and smoke that is emitted from such sources as factories, vehicles, and fires. A numeric subscript indicates the upper limit of the particles of interest (*i.e.,* PM_{10} refers to particulate matter less than 10 microns in aerodynamic diameter).

Partisol lo-vol

A type of air sampling equipment.

Parts per billion (ppb)

Units of concentration (*i.e*., µg/kg, ng/g, *etc.*)

Parts per million (ppm)

Units of concentration (*i.e*., µg/g, mg/kg, *etc.*)

Passive diffusion

Passive transport is a means of moving biochemicals, and other atomic or molecular substances, across membranes, without the use of chemical energy. Passive diffusion is the net movement of material from an area of high concentration of that material to an area with lower concentration and is dependent on the permeability of the cell membrane.

PBPK

See *Physiologically-based pharmacokinetic model*.

PCBs

PCB is an acronym for "polychlorinated biphenyls". These substances were used in, among other things, electrical transformers and fluorescent light ballasts. They are not chemicals of concern in this study.

PDF

See *Probability density function.*

PDI

See *Permissible daily intake* or *Acceptable daily intake.*

Permeability

The property of a physical entity to permit gases or liquids, and substances contained in them, to pass through. For example, a highly permeable soil, such as sand, allows a liquid to pass through quickly, while soils composed predominantly of clay have a low permeability. The permeability of membranes of cells in the body governs the passage of substances into, and out of, the cells.

Permissible daily intake (PDI)

See *Acceptable daily intake*.

Persistence

The quality of a chemical or substance to remain unaltered for a long period of time (such as in the environment or in the body).

Physiologically-based pharmacokinetic model (PBPK)

A theoretical model that describes the fate of a chemical in the body using mathematical equations. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Perinatal mortality

Mortality shortly after birth.

Permeability

The property of a physical entity to permit gases or liquids, and substances contained in them, to pass through. For example, a highly permeable soil, such as sand, allows a liquid to pass through quickly, while soils composed predominantly of clay have a low permeability. The permeability

Permissible daily intake (PDI)

See *Acceptable daily intake*.

Persistence

The quality of a chemical or substance to remain unaltered for a long period of time (such as in the environment or in the body).

pH

A measure of acidity. The pH scale ranges from 0 to 14, with pure water having a pH of 7. Acids have pH of less than 7 and bases (or alkalis) have pH greater than 7.

Pharmacodynamic variability

Pharmacodynamics is the study of the action of a drug in the body over a period of time, including the processes of absorption, distribution, localization in the tissues, biotransformation, and excretion. Pharmacodynamic variability defines the inherent differences or variations that exist among a group of animals or organisms in terms of these biochemical and physiological processes.

Physico-chemical properties

The physical and chemical characteristics of a substance. Examples of physico-chemical properties include boiling point, melting point, colour, odour, solubility, vapour pressure, *etc*.

Physiologically-based pharmacokinetic model (PBPK)

A theoretical model that describes the fate of a chemical in the body using mathematical equations. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica

A craving to eat non-food items, such as dirt, paint chips, and clay. Some children exhibit pica-related behaviour.

Plume

An area of increased concentrations of chemicals, substances or agents moving away from its original location in a long band or column. Subsurface plumes are in groundwater. Airborne plumes come from air emissions. See *gradient*.

PM

See *Particulate matter.*

PM_{10}

Particulate matter which is less than 10 μm in diameter. This size of particulate is small enough so as to be easily inhaled into the lungs. This is the primary particulate size fraction evaluated for potential health impacts by the HHRA.

$PM_{2.5}$

Particulate matter which is less than 2.5 μm in diameter. This size of particulate is small enough so as to be easily inhaled deep into the lower lungs (*i.e.*, alveolar), and potentially absorbed directly into the blood stream.

Population

A group or number of individuals living within a specified area or sharing similar characteristics (such as occupation or age).

ppb

See *Parts per billion.*

ppm

See *Parts per million.*

Point estimate

A single estimate of the value of a parameter, used in a deterministic risk assessment.. See also D*eterministic.*

Potential Years of Life Lost

Number of potential years of life lost in a population as a result of premature death.

Potentiation

Dependent action in which a substance or physical agent at a concentration or dose that does not itself have an adverse effect enhances the harm done by another substance or physical agent.

PRA

See *Probabalistic risk assessment*.

Pre-school Child

In this document, a preschool child is a person more than 6 months and less than 5 years old.

Preliminary remediation goal in soil (PRG_{soil})

A preliminary remediation goal in soil, or PRG_{soil}, is a benchmark clean-up criteria established by the risk assessment in which exposures would not result in any adverse health risks. In the case of the Sudbury Soils Study, this would involve the establishment of COC-specific soil

intervention levels, rather than clean-up goals for other media pathways (*i.e.*, air, water, food, *etc*.). See *Site-specific remediation goal.*

Prevalence

The number of existing disease cases in a defined population during a specific time period.

PRG

See *Preliminary remediation goal.*

Probability density function (PDF)

The mathematical equation describing a probability distribution. Probability distributions are typically used to characterize the exposure and toxicity parameters, including their variability and uncertainty, as inputs in probabilistic risk assessment models.

Probabilistic / Probabilistic risk assessment (PRA)

A risk assessment approach incorporating the probability distributions of input parameters to estimate exposures. This approach accounts for inherent variability and uncertainty in each parameter used to estimate exposure. The outcome are probability distributions of estimated exposure and risk which can then be directly compared to a toxicity benchmark to estimate the probability of exceedance. Note that toxicity values are almost always evaluated as deterministic variables (they are not characterized by probability density functions). See also *Deterministic / Deterministic risk assessment* and *Probability density function.*

Problem Formulation

Initial stage of the risk assessment, where information is gathered and interpreted to plan and focus the risk assessment.

Protocol

The detailed plan for conducting a scientific procedure. A protocol for measuring a chemical in soil, water or air describes the way in which samples should be collected and analyzed.

PYLL

See *Potential years of life lost*.

q_1*

See *Slope factor.*

QA/QC

See *Quality assurance and quality control*.

Quality assurance and quality control (QA/QC)

A system of procedures, checks, and audits to judge the quality of measurements and reduce the uncertainty of environmental data.

RA

See *Risk assessment*.

RAF

See *Relative absorption factor*.

RC

See *Risk characterization*.

Reasonable maximum exposure (RME)

In the current risk assessment, the 95% upper confidence limit on the mean of the point estimate of exposure was used to estimate a maximum exposure to which communities of interest could potentially be exposed, for the purpose of estimating risk.

Receptor

An individual (person, plant, animal) that could come into contact with hazardous substances.

Recommended Exposure Level

The maximum level of a contaminant at which no known or anticipated adverse effect on human health would occur, and that includes an adequate margin of safety. Recommended levels are non-enforceable health goals.

Reference concentration (RfC)

An estimated air concentration of a specific chemical or substance which is likely to be without risk of deleterious effects to people, animals or plants, even if the exposure continues over a lifetime. Typically expressed in mg/m^3 or $\mu g/m^3$.

Reference dose (RfD)

An estimate of a rate of exposure of people, animals or plants that is likely to be without risk of deleterious effects, even if the exposure continues over a lifetime. Reference doses are adjusted for sensitive sub-groups of the population. Typically expressed in mg/kg bodyweight/day or µg/kg bodyweight/day.

REF

See *Recommended Exposure Level*.

Relative absorption factor (RAF)

When evaluating the toxicity of a particular chemical or substance, the relative absorption difference between two different routes of exposure (*i.e.*, oral and dermal) can be expressed as a relative absorption factor (RAF). This factor can then be applied to exposure estimates to adjust these exposures prior to comparison with other exposure limits when route-to-route extrapolation is necessary (*e.g.*, converting an oral exposure limit to a dermal basis).

Relative Bioaccessibility

The bioaccessibility analyses conducted for the current study was relative in nature in that it is intended to be used simply as a correction factor to account for the differences in the "bioaccessible fraction" of a metal observed among different environmental media (*e.g.*, soil/dust

versus food). In this way, it can be used to compare the bioaccessibility of the metals in the GSA-specific soil and dust with the bioaccessibility of the metals used within the toxicological study on which the TRV is based.

Relative risk

The ratio of the disease rate among exposed people to the disease rate among unexposed people. It is understood that the disease rate among unexposed people is the "background risk" from all else considered and exposure to the substance in question excluded.

Remediation / Remedial

Correction or improvement of a problem, such as work that is done to clean up or stop the release of chemicals from a contaminated site. After investigation of a site, remedial work may include removing soil and/or drums, capping the site or collecting and treating the contaminated soils and/or fluids.

Renal

To do with the kidney.

Respiratory Tract

The respiratory tract consists of the nose, mouth, windpipe, lungs and related structured required for breathing.

Request for proposal (RFP)

The official document produced by a group or organization that requests vendor bids for a specific project or projects and also lists project specifications and application procedures. As part of the Sudbury Soils Study, the Technical Committee produced an RFP outlining the study requirements, to which the SARA Group (among others) responded in a competitive bid process.

RfC

See *Reference concentration*.

RfD

See *Reference dose*.

RFP

See *Request for proposal*.

Risk

Risk, in the context of a human health risk assessment, is the likelihood of injury, disease or death that will be caused by an action or condition.

Risk Assessment (RA)

A process that estimates the likelihood or chance that people or the environment may experience adverse effects from a particular series of events or circumstances, such as exposure to chemicals, substances or agents. The four steps of a risk assessment are:

- problem formulation (also known as hazard identification);
- toxicity/effects assessment;
- exposure assessment; and,
- risk characterization.

Note: Likelihood is a quantitative term related to "probability", "chance" or to "risk".

Risk characterization

Final phase of the risk assessment, where the exposure and effects/toxicity information are combined to evaluate potential impacts, and provide a qualitative or quantitative characterization of health risk.

Risk management

The process of deciding how to reduce or eliminate possible adverse effects on people's health and the environment by considering the risk assessment, engineering factors (*i.e.*, can engineering procedures or equipment do the job, for how long and how well?) and social, economic and political concerns.

Risk management criteria (RMC)

The specific requirements outlining the maximum allowable levels for a particular parameter in a defined space and time. When these requirements are exceeded, risk management options must be considered.

Risk-specific dose (RsD)

The dose associated with an acceptable increased cancer risk (*i.e.*, one-in-a-million or 10^{-6} in Ontario) from a lifetime exposure (*i.e.*, 70 year average) to the chemical or substance being evaluated.

RMC

See *Risk management criteria*.

RME

See *Reasonable maximum exposure.*

RMSL

See *Risk Management Soil Level.*

Route of exposure

The way in which a person or other organism in the natural environment may come in contact with a chemical, substance or agent. These are typically through inhalation, ingestion, or *via* dermal absorption. For example, drinking (ingestion) and bathing (skin contact) are two different routes of exposure to chemicals that may be found in water. See "Exposure."

RsD

See *Risk-specific dose.*

r-Value

A measure of the correlation between two variables. An r-value of 0 means there is no correlation. An r-value of +1 means there is perfect correlation, and that when one variable increases the other one increases (example: as driving speed increases, miles travelled during a 3-hour drive increase). An r-value of -1 means there is perfect correlation, and that when one variable increases, the other one decreases (example: as driving speed increases, the time needed to travel a certain distance decreases).

Safe

In common language, safe means free from harm or risk. In scientific language, any exposure to most chemicals, substances or agents have some risk, although that risk may be extremely small. Therefore, scientifically, safe means at very low or negligible risk.

Scanning electron Microscopy

Scanning electron microscopy is a technique used to observe very small things. In this report, this technique was used to examine the mineral forms of metals present in soil to help determine their likely source(s).

Scenario

A hypothetical situation evaluated in a HHRA.

Screening-level Risk Assessment (SLRA)

Simplest form of risk assessment which uses conservative assumptions to identify chemicals, exposure pathways or areas of the risk assessment which are considered safe (usually within a large factor of safety), and potentially eliminate them from further detailed consideration. This information allows a more detailed risk assessment to focus on the priority issues of concern at a site to examine the actual levels where a risk is evident.

SDHU

See *Sudbury and District Health Unit.*

SEM

See *Scanning electron microscopy.*

Sequential leach analysis/extraction

Sequential leach analysis is a long-standing, documented analytical technique used to predict metal associations in soils. The chemical models that provide the rationale for these methods have been based on equilibrium reactions, or on empirical determinations from wet chemical methods that rely on the sequential extraction of various phases using progressively more aggressive extraction techniques.

SF

See *Cancer slope factor*.

Site-specific risk assessment (SSRA)

A risk assessment conducted on a relatively small spatial scale and designed to account only for the characteristics of the individual property under study. This type of risk assessment tends to be performed within the boundaries of ownership of a particular property. Essentially, the opposite of an area wide risk assessment (AWRA).

Slag

Waste rock remaining following removal of desired components from an ore through the use of smelting or similar process.

Slope Factor

See *Cancer slope factor.*

SLRA

See *Screening level risk assessment.*

Soil Risk Management Level (SRML)

Soil Risk Management Levels (SRMLs) are used to guide potential risk management or remediation activities. SRMLs are also referred to as risk management criteria (RMC), soil intervention levels, or premiminary remediation goals (PRGs) by some agencies.

Solubility

The capacity of a substance to be dissolved by another medium, such as gas, water, or another liquid. A highly water-soluble chemical compound such as table salt is easily dissolved in water. Motor oil, a complex chemical mixture, is only very slightly soluble in water.

Soluble Nickel

Soluble nickel is the combination of nickel and other chemicals that will dissolve in water. Water-soluble forms of nickel, such as nickel sulphate, inhaled as dust particles in the air dissolve into the bloodstream.

SOP

See *Standard operating procedure.*

Sorption

The attachment of a material onto the surface of another material (for example, metals attached to soil particles) by weak physical and/or chemical bonds. See also *Desorption*.

Speciation

A process used to examine the different forms, or species, of a metal separately. This allows an HHRA to consider the differing toxicity of the different forms of a metal.

Species

May refer to a particular type of organism or a particular form of a substance. For example, nickel and arsenic can exist in a variety of forms (or species), which differ in their chemistry, environmental fate and toxicity.

SSRA

See *Site-specific risk assessment.*

SSS

See *Sudbury Soils Study.*

Standard Operating Procedure

A standardized and clearly documented procedure for completing a task, such as collecting a soil sample, or analyzing a water sample.

Stakeholder

Any person or organization with a stake, or interest, in the outcome of process.

Strength of Evidence

An approach to interpretation of scientific information from different lines of investigation by evaluating the relative strengths or merits of each line of evidence. When using a weight of evidence approach to evaluating risk, it is also important to evaluate the strengths of each piece of evidence in relation to the other lines of evidence.

Stochastic

A model or equation that incorporates a random variable. Refer to *probabilistic*.

Sudbury & District Health Unit (SDHU)

The Sudbury & District Health Unit (SDHU) is a progressive, accredited public health agency that delivers provincially legislated public health programs and services to the residents of the Sudbury and Manitoulin Districts. The health unit works with individuals, families, and the community and partner agencies to promote and protect health and to prevent disease. A teaching health unit affiliated with Laurentian University, the SDHU is the northern site of the provincial Public Health Research, Education and Development Program (PHRED), with academic linkages to several programs including the Northern Ontario School of Medicine. The SDHU is a member of the Sudbury Soils Study Technical Committee.

Sudbury Soils Study (SSS)

In recent years, several studies have shown there are areas in Sudbury with elevated metal levels in the soil. These areas are generally close to the historic smelting sites of Coniston, Falconbridge and Copper Cliff. Although these metals do occur naturally in all soils, the studies indicate that the higher amounts in surface soil (the top 5 cm. of soil) are the result of local mining, smelting and refining operations. In 2001, the Ontario Ministry of the Environment (MOE) released a report that identified that the concentrations of nickel, cobalt, copper and arsenic exceeded the generic MOE soil quality guidelines.

Under Ontario legislation, this triggers the need for more detailed study. Therefore, the MOE made two recommendations:

1. That a more detailed soil study be undertaken to fill data gaps; and,
2. That a human health and ecological risk assessment be undertaken.

Both Inco Limited and Falconbridge Limited voluntarily accepted the recommendations and began working together with other key stakeholders to establish what is commonly referred to as "The Sudbury Soils Study". The current volume is the results of the human health risk assessment conducted as part of the Sudbury Soils Study.

Synergism

A phenomenon in which two or more discrete influences or agents acting together create an effect greater than the sum of the effects each is able to create independently.

Tailing Piles

Tailings are the crushed/finely ground waste rock by-product of mineral processing before smelting. They consist of the gangue minerals that surround the ore being mined. They are separated from the concentrate by either mechanical or chemical methods and are then either back filled in old underground workings or stored on the surface in an impoundment. The most common storage method is in a dry form in piles.

Target organ

An organ (such as the liver or kidney) that is more sensitive than other organs to the toxic effects of a chemical, substance or agent.

TC

See *Technical committee*.

TDI

See *Tolerable daily intake*.

Technical Committee (TC)

Six organizations, identified as major stakeholders in maintaining of a healthy environment in Sudbury, have been given the responsibility to oversee the Sudbury Soils Study. They are the Sudbury & District Health Unit (SDHU), Ministry of Environment (MOE), City of Greater Sudbury, Vale Inco, Xstrata Nickel, and Health Canada.

As the study's Technical Committee, their role is to provide overall management of the process: provide scientific direction and review of the study, and select and manage a qualified consultant to develop comprehensive risk assessments to protect human and ecological health.

Threshold

The dose or exposure below which an adverse effect is not expected.

Toddler

See *Preschool child*.

Tolerable Daily Intake (TDI)

Analogous to *Acceptable daily intake (ADI).* The term "tolerable" is used for agents that are not deliberately added, such as contaminants in food.

TOR

See *Typical Ontario resident*.

Total Suspended Particulates (TSP)

A measure of the total number of particles of solid or liquid matter - such as soot, dust, aerosols, fumes and mist - found in a sample of ambient air. Typically assumed to be composed of suspended particulate that have aerodynamic diameters less than 40 μm.

Toxicity

A general term that can refer either to a substance's toxic potency, or the type(s) of effects that a substance can have (for example, ocular toxicity refers to effects on the eye; respiratory system toxicity refers to effects on the respiratory system).

Toxicity assessment

Step in the risk assessment process involving the evaluation of the toxicological properties and effects of a chemical, with special emphasis on establishment of dose response characteristics.

Toxic Equivalency Factors (TEFs)

Toxic Equivalency Factors (TEFs) are toxicity potency factors that are used globally as a consistent method to evaluate the toxicities of highly variable mixtures of dioxin compounds. In the dioxin family, 2,3,7,8-TCDD is the most studied and the most toxic member, and it is assigned a TEF of one. The values of individual TEFs indicate how closely compounds resemble and how toxic they are, relative to the compound 2,3,7,8-TCDD.

Toxic Potency

This general term refers to the inherent potency of a substance to cause a harmful effect. In general, the lower the dose at which effects occur, the higher the potential potency.

Toxicity Reference Value

A toxicity reference value, or TRV, is an estimate of the dose (in this document, usually a daily dose over a long period of time) of a substance that is associated with a specific level of risk, or that is considered to be safe. Toxicity reference values are used to evaluate whether estimated or measured exposures are likely to cause adverse health effects. Toxicity reference values are also used to develop guidelines and standards, such as drinking water quality guidelines.

Toxicodynamics

Process of interaction of potentially toxic substances with target sites, and the biochemical and physiological consequences leading to adverse effects.

Toxicokinetics

The characteristics of a substance with respect to its absorption into the body, distribution to different tissues, metabolism, and excretion from the body. May be abbreviated as *ADME*.

Transfer factor

A mathematical value that is used to describe how much of a material in one matrix is transferred to another (for example, one might wish to know how much nickel might be expected in a fruit based on the concentration of nickel in soil that the fruit was grown in).

TRV

See *Toxicity reference value.*

TSP

See *Total suspended particulates.*

Tumorigenic concentration

Abbreviated as TC05, the tumorigenic concentration is defined by Health Canada as the concentration of a substance in air associated with a 5% increase in tumor incidence, based on animal studies.

Typical Ontario resident (TOR)

Hypothetical receptor used in the HHRA to evaluate potential exposures and risks experience by a typical Ontario resident, based on ambient or background concentrations in water, air, soil, dust, and food sources. Predicted TOR exposures can then be compared with the exposures attributed to smelting activity, to give an indication of total exposure to COCs from all known sources.

UCL95

See *95% Upper confidence limit on the mean.*

UF

See *Uncertainty factor.*

µg

Microgram (1 x 10^{-6} grams).

Uncertainty analysis

A detailed examination of the potential sources of variability and uncertainty within the data, and their influence on risk assessment results. See *Uncertainty Factor*.

Uncertainty factor (UF)

One of several factors used in calculating the reference dose from experimental data. UFs are typically used to account for such uncertainties as: (1) the variation in sensitivity among humans (i.e., intraspecies); (2) the uncertainty in extrapolating animal data to humans (i.e., interspecies); (3) the uncertainty in extrapolating data obtained in a study that covers less than the full life of the exposed animal or human; (4) the uncertainty in using LOAEL data rather than NOAEL data (see LOAEL and NOAEL); and, (5) uncertainties associated with the adequacy of the database of experimental data.

United States Environmental Protection Agency (U.S. EPA)

The federal agency responsible for developing and enforcing regulations to implement environmental laws enacted by Congress. EPA is responsible for researching and setting national standards for a variety of environmental programs, and delegates to states and tribes the responsibility for issuing permits and for monitoring and enforcing compliance.

Unit risk cancer potency estimate / Cancer slope factor (q_1*, SF, CSF)

An upper bound estimate of the increase risk of cancer resulting from a lifetime exposure to a particular agent or chemical.

U.S. EPA

See *United States Environmental Protection Agency.*

Variance

Variance is a measure of scatter of data around the average value of the data set. The variance is defined as the square of the standard deviation for a normally distributed data set.

Weight-of-evidence

An approach to interpretation of scientific information from different lines of investigation. Literally, the taking of evidence from all disciplines to make a judgement about the cause of an outcome (e.g., taking animal data, human data, chemical and molecular data to state with confidence that smoking causes cancer of the lung).

WHO

See *World Health Organization.*

WOE

See *Weight-of-evidence.*

World Health Organization (WHO)

The United Nations agency which works in a variety of ways and with a variety of agencies internationally to attain the highest level of physical, mental, and social well-being for all people.

XAFS

See *X-ray absorption fluorescence spectroscopy.*

X-ray Absorption Fluorescence Spectroscopy (XAFS)

Spectroscopy is the study of spectra, that is, the dependence of physical quantities on frequency. X-ray absorption spectroscopy determines the electronic structure of materials using x-ray excitation and the range of electromagnetic spectra in which a substance absorbs. Fluorescence spectroscopy or fluorometry is a type of electromagnetic spectroscopy used for analyzing fluorescent spectra. Spectroscopy is often used in physical and analytical chemistry for the identification of substances, through the spectrum emitted or absorbed. This analyses is sensitive to chemical state (*i.e.*, valency) and local atomic structure around the atom of interest (*i.e.*, type, number, length and spatial orientation of linkages to neighbouring atoms). Also referred to as *X-ray Absorption Fine-Structure*.

Zooplankton

Very small animals that live suspended in oceans, lakes, rivers or other bodies of water.