FEATURE ARTICLE: ADOPTION OF AN OFFICIAL ISEA GLOSSARY

by

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ABSTRACT
The International Society for Exposure Analysis (ISEA) and its Nomenclature Committee have been involved since the mid-1990s in an intermittent but ongoing effort to develop an official ISEA glossary. Several related activities have stimulated greater interest and discussion nationally and internationally on a common exposure language. Among these activites are a 1997 *Journal of Exposure Analysis and Environmental Epidemiology* feature article on exposure and dose definitions and a 1999-initiated project of the International Programme on Chemical Safety (IPCS) (WHO/ILO/UNEP) to confront terminology issues hindering harmonization in the area of exposure assessment. Recently the ISEA members voted in support of adopting the IPCS glossary as the official ISEA glossary, and the ISEA Executive Board agreed to accept this recommendation. In this feature article we (1) describe the process through which the ISEA adopted the IPCS glossary as the official ISEA glossary, (2) present the joint IPCS/ISEA glossary of terms and their definitions, and (3) discuss plans for how the glossary can be used by ISEA and updated over time by ISEA and IPCS. The glossary is intended to be a living document that reflects the latest usage and maintains international harmonization of exposure terminology that can be practically applied to improve communication in exposure and related fields.

INTRODUCTION
As a major international organization in the science of exposure analysis, the International Society for Exposure Analysis (ISEA) must provide leadership for the exposure research community worldwide. At professional meetings and in the peer-reviewed literature, however, discrepancies in the use of exposure-related terms have for many years presented communication challenges for exposure assessors and experts. This problem has created the need for more precise understanding of and agreement on commonly used exposure terms. The effort to develop an ISEA glossary has been ongoing for a number of years through the ISEA Nomenclature Committee.

In 1999, the International Programme on Chemical Safety (IPCS) of the World Health Organization (WHO) initiated a Harmonization Project with an Exposure Assessment Planning Workgroup to confront the issues hindering harmonization in the area of exposure assessment (http://www.who.int/ipcs/methods/harmonization/en/). The Terminology Subcommittee of the Harmonization Project developed a glossary of 39 terms, based on an in-depth review of 57 glossaries of terms used in health sciences and risk assessment (IPCS, 2001; http://www.who.int/ipcs/publications/methods/harmonization/en/compilation_nov2001.pdf), and on a previously published framework of exposure terminology (Zartarian et al., 1997). In addition to presenting the glossary of terms, the IPCS project report (IPCS, 2002; http://www.who.int/ipcs/methods/harmonization/areas/en/ExposureTeminology.pdf) and the subsequent WHO report (WHO, 2004) present several examples intended to illustrate the use of these terms in exposure assessment. The selection of the 39 terms and their definitions was based on common use in exposure assessment and the strong need to reduce confusion. After reviewing all available definitions, the subcommittee recommended a single definition for each term, but noted where different definitions are also used. The committee did not intend that the resulting glossary be a comprehensive list of all terms used in the exposure sciences; rather, it focused on commonly used and often confusing terms that pose barriers to communication. This

glossary of exposure assessment terminology along with examples of using the definitions can be found on the WHO/ IPCS website: (http://www.who.int/ipcs/methods/harmonization/areas/en/ExposureTeminology.pdf) (linked with the ISEA website). The examples illustrating how these terms apply to the inhalation, dermal, and dietary ingestion routes are not intended to be comprehensive, but to provide several contextual frameworks that could be applied to other case studies of interest.

Because the IPCS glossary helps facilitate communication and consistency of language used in the exposure sciences, the ISEA Nomenclature Committee considered its use as the official glossary of the ISEA. After the glossary underwent several rounds of external peer review through IPCS, it was circulated to ISEA members and presented at two ISEA conferences (Callahan et al., 2001; Hammerstrom et al. 2002). It was subsequently presented and discussed at a special session of the ISEA 2003 Conference in Stresa, Italy (McKone and Bahadori, 2003).

The ISEA Nomenclature Committee recommended that ISEA adopt the IPCS glossary as the official ISEA glossary, but input from all ISEA members was also requested by the ISEA Board for their final decision. With the Board's approval, the Nomenclature Committee included a ballot item in the 2004 ISEA election process to vote on agreeing with the committee's recommendation for ISEA to adopt the IPCS glossary. As part of the annual election process. background materials were provided to all ISEA members on the IPCS terminology project, including a reference for the IPCS terminology workgroup report with the terms and illustrative examples using the terms. The ballot requested that if an individual voted on the election ballot to not adopt the IPCS glossary, specific feedback and comment be provided as to why the person disagreed and/or what she or he would like changed, since a negative vote would be of much greater value to the Board in making its final decision if at least a brief explanation were provided. The voting deadline was June 17, 2004.

A significant majority of the ISEA members voted to adopt the IPCS glossary. Through this ballot process seven sets of comments were sent to the Nomenclature Committee Chair. Five sets of comments were associated with votes against the adopting the glossary and two sets of comments were supportive. Among the five sets of comments that took issue to some extent with adopting the glossary the following concerns were brought out:

- The glossary should be a living document that can be modified over time.
- Aggregate exposure and cumulative exposure should be defined based on the US Food Quality Protection Act (FQPA) definitions.
- The terms and definitions are more useful for modellers than for experimentalists or public health officials.
- The American Industrial Hygiene Association (AIHA) Exposure Assessment Strategies Committee should formally review the ISEA glossary.

In addition, specific suggestions were made to modify some of the definitions slightly. Several of these issues have already been discussed by ISEA and/or IPCS. In the interest of time to produce a working baseline glossary, however, both organizations agreed that these comments would be considered further for the next iteration of the glossary.

On September 9, 2004, the ISEA Board voted to adopt the IPCS glossary and voted to designate it as the joint IPCS/ISEA glossary so that modifications to the initial glossary would be harmonized between the two groups over time. The ISEA Board's decision to accept the recommendation of the Nomenclature Committee and adopt this glossary was based both on the votes received on all returned ballots and on specific comments provided by voters via email or the addendum.

OFFICIAL IPCS/ISEA TERMS AND DEFINITIONS

Below is the IPCS glossary of terms that has been adopted as the official ISEA glossary. We refer the reader to the WHO and IPCS reports (WHO, 2004; IPCS, 2002) and websites indicated above for several examples illustrating how these terms can be used for the inhalation (a carbon monoxide example), dermal (a DDT example), and dietary ingestion (lycopene in tomatoes, manganese in a vitamin pill examples) exposure routes.

absorption barrier

Any exposure surface that may retard the rate of penetration of an agent into a target. Examples of absorption barriers are the skin, respiratory tract lining and gastrointestinal tract wall (cf. exposure surface)

activity pattern data

Information on human activities used in exposure assessments. These may include a description of the activity, frequency of activity, duration spent performing the activity, and the microenvironment in which the activity occurs.

acute exposure

A contact between an agent and a target occurring over a short time, generally less than a day. (Other terms, such as "short-term exposure" and "single dose," are also used.)

agent

A chemical, biological, or physical entity that contacts a target.

background level

The amount of an agent in a medium (e.g., water, soil) that is not attributed to the source(s) under investigation in an exposure assessment. Background level(s) can be naturally occurring or the result of human activities. (Note: natural background is the concentration of an agent in a medium that occurs naturally or is not the result of human activities).

bioavailability

The rate and extent to which an agent can be absorbed by an organism and is available for metabolism or interaction with biologically significant receptors. Bioavailability involves both release from a medium (if present) and absorption by an organism.

biomarker/biological marker

Indicator of changes or events in biological systems. Biological markers of exposure refer to cellular, biochemical, analytical, or molecular measures that are obtained from

biological media such as tissues, cells, or fluids and are indicative of exposure to an agent.

bounding estimate

An estimate of exposure, dose, or risk that is higher than that incurred by the person with the highest exposure, dose, or risk in the population being assessed. Bounding estimates are useful in developing statements that exposures, doses, or risks are "not greater than" the estimated value.

chronic exposure

A continuous or intermittent long-term contact between an agent and a target. (Other terms, such as “long-term exposure,” are also used.)

contact volume

A volume containing the mass of agent that contacts the exposure surface.

dose

The amount of agent that enters a target after crossing an exposure surface. If the exposure surface is an absorption barrier, the dose is an absorbed dose/uptake dose (see uptake); otherwise it is an intake dose (see intake).

dose rate

Dose per unit time.

exposure

Contact between an agent and a target. Contact takes place at an exposure surface over an exposure period.

exposure assessment

The process of estimating or measuring the magnitude, frequency and duration of exposure to an agent, along with the number and characteristics of the population exposed. Ideally, it describes the sources, pathways, routes, and the uncertainties in the assessment.

exposure concentration

The exposure mass divided by the contact volume or the exposure mass divided by the mass of contact volume depending on the medium.

exposure duration

The length of time over which continuous or intermittent contacts occur between an agent and a target. For example, if an individual is in contact with an agent for 10 minutes a day, for 300 days over a one year time period, the exposure duration is one year.

exposure event

The occurrence of continuous contact between an agent and a target.

exposure frequency

The number of exposure events in an exposure duration.

exposure loading

The exposure mass divided by the exposure surface area. For example, a dermal exposure measurement based on a skin wipe sample, expressed as a mass of residue per skin surface area, is an exposure loading.

exposure mass

The amount of agent present in the contact volume. For example, the total mass of residue collected with a skin wipe sample over the entire exposure surface is an exposure mass.

exposure model

A conceptual or mathematical representation of the exposure process.

exposure pathway

The course an agent takes from the source to the target.

exposure period

The time of continuous contact between an agent and a target.

exposure route

The way an agent enters a target after contact (*e.g.*, by ingestion, inhalation, or dermal absorption).

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.

exposure surface

A surface on a target where an agent is present. Examples of outer exposure surfaces include the exterior of an eyeball, the skin surface, and a conceptual surface over the nose and open mouth. Examples of inner exposure surfaces include the gastro-intestinal tract, the respiratory tract and the urinary tract lining. As an exposure surface gets smaller, the limit is an exposure point.

intake

The process by which an agent crosses an outer exposure surface of a target without passing an absorption barrier, i.e. through ingestion or inhalation (see dose).

medium

Material (e.g., air, water, soil, food, consumer products) surrounding or containing an agent.

medium intake rate

The rate at which the medium crosses the outer exposure surface of a target, during ingestion or inhalation.

microenvironment

Surroundings that can be treated as homogeneous or well characterized in the concentrations of an agent (e.g., home, office, automobile, kitchen, store). This term is generally used for estimating inhalation exposures.

pica

A behaviour characterized by deliberate ingestion of non-nutritive substances such as soil.

source

The origin of an agent for the purposes of an exposure assessment.

stressor

Any entity, stimulus, or condition that can modulate normal functions of the organism or induce an adverse response (e.g., agent, lack of food, drought).

subchronic exposure

A contact between an agent and a target of intermediate duration between acute and chronic. (Other terms, such as "less-than-lifetime exposure" are also used.)

target

Any biological entity that receives an exposure or a dose (e.g., a human, human population or a human organ).

time-averaged exposure

The time-integrated exposure divided by the exposure duration. An example is the daily average exposure of an individual to carbon monoxide. (Also called time-weighted average exposure.)

time-integrated exposure

The integral of instantaneous exposures over the exposure duration. An example is the area under a daily time profile of personal air monitor readings, with units of concentration multiplied by time.

time profile

A continuous record of instantaneous values over a time period (e.g., exposure, dose, medium intake rate).

uptake (absorption)

The process by which an agent crosses an absorption barrier (see dose).

PLAN FOR IMPLEMENTING AND UPDATING THE GLOSSARY

The adoption of an official glossary means that ISEA members and other exposure scientists will be strongly and actively encouraged to use these terms, especially for publishing in the *Journal of Exposure Analysis and Environmental Epidemiology* and making presentations at ISEA conferences. The official glossary will be printed annually in the *Journal* and will be referred to in instructions to authors regarding journal submissions. The glossary will also be displayed at annual ISEA conferences and ISEA members will be regularly encouraged to review the glossary and provide suggestions for enhancements to terms and definitions to reflect current usage. In addition, journal manuscript reviewers will be encouraged to look for discrepancies between definitions used in submitted papers and the joint IPCS/ISEA glossary. Please note that agreeing to adopt this glossary does not forbid deviation from these selected definitions. It implies, however, that such deviations should be indicated and explained to reduce confusion.

It is important to note that the version of the official glossary presented above is a living document that serves as a basis for a common exposure language. This glossary can be modified over time, with input from IPCS and the membership of ISEA, to reflect the current use of terms. Since both organizations agree that maintaining harmonization between the official IPCS and ISEA glossaries is extremely important, a joint protocol will be developed by ISEA and IPCS for considering requests for changes to definitions and updating terms over time in the IPCS/ISEA glossary. This process will be flexible and intended to maximize international use of these terms, in order to facilitate communication among scientists in exposure assessment and related fields.

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