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Standard Terminology Relating to Biological Effects and Environmental Fate[1]

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1. Scope

1.1 This terminology document defines terms commonly used in standards developed by ASTM Committee E47 on Biological Effects and Environmental Fate. This terminology document is intended to be consistent with the use of terms in ASTM standards related to this field and, to the extent possible, with use by other organizations.

1.1.1 If a specific Committee E47 standard uses one of these terms in a different context, then the term must be defined in that standard. A term used only in a specific ASTM standard need not be included in this terminology document.

2. Terminology

2.1 *Definitions:*

acute test—a comparative study in which organisms, that are subjected to different treatments, are observed for a short period usually not constituting a substantial portion of their life span.

DISCUSSION—There is no specific test duration that represents a distinct boundary between acute and chronic test durations for any species. Although acute or chronic test procedures may specify standard duration(s), these durations have not been intended to define an acute:chronic boundary.

Acute tests often utilize mortality as the only measure of effect; chronic tests usually include additional measures of effect such as growth or reproduction.

attraction—a response towards or to facilitate contact with a material or condition.

avoidance—a response away from or to limit contact with a material or condition.

BAF (bioaccumulation factor), *n*—the quotient obtained by dividing the concentration of a substance in an organism (or specified tissue) by its concentration in a specified exposure medium, for example, air, food, sediment, soil, water, when several media are possible sources (see **bioaccumalation**).

behavior, *n*—observable, recordable, or measurable actions or activity of an organism.

DISCUSSION—This definition conveys the idea of motion whether motility is involved or not, and excludes physiological responses, death, and so forth, from the concept. It avoids the issue of internal versus external stimuli.

bioaccumulation—the net accumulation of a substance by an organism as a result of uptake from all environmental sources.

bioassay—an experiment that uses living whole organisms, tissues or cells to measure the presence, the concentration, or the relative potency of one or more chemicals.

DISCUSSION—A bioassay must include the appropriate controls(s). There is no intended stipulation of endpoint for such a test; the response may be positive of negative. This term defines a subset of the protocols (methods) referred by the term "biological assay" (Finney, 1947)

bioconcentration—the net accumulation of a substance by an aquatic organism as a result of uptake directly from aqueous solution.

biomagnification—the increase in tissue concentration of poorly depurated materials in organisms along a series of predator-prey associations, primarily through the mechanism of dietary accumulation.

biomarker, *n*—a biological measure (within organisms) of exposure to, effects of, or susceptibility to, environmental stress using molecular, genetic, biochemical, histological, or physiological techniques.

biomarker assay—an experiment that uses a molecular, genetic, biochemical, histological, anatomical, or physiological technique to assess exposure, response, or susceptibility of an organisms tissue or cells to environmental stress.

chronic test—a comparative study in which organisms that are subjected to different treatments are observed for a long period or a substantial portion of their life span.

DISCUSSION—There is no specific test duration that represents a distinct boundary between acute and chronic test durations for any species. Although acute or chronic test procedures may specify standard duration(s), these durations have not been intended to define an acute:chronic boundary.

Acute tests often utilize mortality as the only measure of effect; chronic tests usually include additional measures of effect such as growth or reproduction.

[1] This terminology is under the jurisdiction of ASTM Committee E50 on Environmental Assessment, Risk Management and Corrective Action and is the direct responsibility of Subcommittee E50.47 on Biological Effects and Environmental Fate.

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control sediment—a sediment that is essentially free of contaminants and is used routinely to assess the acceptability of a test.

depuration—loss of a substance from an organism as a result of any active or passive process.

dietary accumulation—the net accumulation of a substance by an organism as a result of ingestion in the diet.

EC50—a statistically or graphically estimated concentration that is expected to cause one or more specified effects in 50 % of a group of organisms under specified conditions.

ED50—a statistically or graphically estimated dose that is expected to cause one or more specified effects in 50 % of a group of organisms under specified conditions.

exposure—contact with a chemical or physical agent.

fate, environmental—the form and location of a material resulting from transport and transformation.

hazard—the adverse effect(s) that may result from exposure(s).

hydric soil—soil that is formed under conditions of saturation, flooding, or ponding long enough to develop anaerobic conditions in the upper part, thereby influencing the growth, survival, and reproduction of plants, microorganisms, and invertebrates.

IC50—a statistically or graphically estimated concentration of test material that, under specified conditions, is expected to cause a 50 % inhibition of a biological process (such as growth or reproduction) for which the data are not dichotomous.

indigneous species—a species that is likely, due to historical presence, to occur at a specified site for some portion of its life span.

DISCUSSION—This definition is intended to remove the requirement that the species occur presently at a site. This definition excludes species that have been introduced either intentionally or unintentionally by man whether recently or in the remote past. The terms "indigenous" and "native" are synonymous in this context.

interstitial water—water occupying space between sediment or soil particles (syn. **pore water**).

key species—a species of special concern for ecological reasons.

LC50—a statistically or graphically estimated concentration that is expected to be lethal to 50 % of a group of organisms under specified conditions.

LD50—a statistically or graphically estimated dose that is expected to be lethal to 50 % of a group of organisms under specified conditions.

life-cycle test—a comparative study in which organisms, that are subjected to different treatments, are observed at least from a life stage in one generation to the same life stage in the next generation.

lowest-observed-effect concentration (LOEC)—in a toxicity test, the tested concentration of one or more chemicals immediately above the highest tested concentration that did not result in a statistically significant change in the particular toxicological variable compared to that value in the control (s).

DISCUSSION—Within a concentration-effect curve at concentrations near the NOEC and LOEC, the following situation can occur: one concentration might induce an effect that is significantly greater than the control or background, while the next higher concentration induces an effect that is not significantly greater than control or background, and all the higher concentrations induce effects that are significantly greater than control or background. In this region of uncertainty, the concentration inducing a significant effect may be inverted one or more times. In order to avoid a situation where the LOEC is less than the NOEC, the NOEC is defined as the concentration immediately below the region of uncertainty, and the LOEC is defined as the concentration immediately above this region. If the region of uncertainty is large, the investigator may not choose to define a NOEC or LOEC.

no-observed-effect concentration (NOEC)— in a toxicity test, the tested concentration of one or more chemicals immediately below the lowest tested concentration that resulted in a statistically significant change in a particular toxicological variable compared to that value in the control (s).

DISCUSSION—Within a concentration-effect curve at concentrations near the NOEC and LOEC, the following situation can occur: one concentration might induce an effect that is significantly greater than the control or background, while the next higher concentration induces an effect that is not significantly greater than control or background, and all the higher concentrations induce effects that are significantly greater than control or background. In this region of uncertainty, the concentration inducing a significant effect may be inverted one or more times. In order to avoid a situation where the LOEC is less than the NOEC, the NOEC is defined as the concentration immediately below the region of uncertainty, and the LOEC is defined as the concentration immediately above this region. If the region of uncertainty is large, the investigator may not choose to define a NOEC or LOEC.

pore water—water occupying space between sediment or soil particles (syn. **interstitial water**).

reference sediment—a whole sediment near an area of concern used to assess sediment conditions exclusive of material(s) of interest.

replicate, *n*—each of several experimental units that are tested simultaneously using the same experimental conditions.

DISCUSSION—Replicates are independent executions of treatments upon experimental units, or multiple samples collected from a location. The observations from these multiple units provide the data from which statistics are computed. The purpose of replicates is to determine the variability of the effect of a given treatment within an experiment or to determine the variability among independent samples from a given location. In both field and laboratory experiments, study design and equipment must prevent of minimize exchange of test media between replicates. Repeat of whole experiments at different times are not considered replicates because time is a variable in the case of repeats.

resident species—a species that is regularly present at a specified site for some portion of its life span.

DISCUSSION—This definition is intended to be inclusive of species with small home ranges, species that have foraging ranges distinct from sleeping/reproducing areas, and migratory species. The definition is devoid of any reference to the type of activity within a specified site

(feeding, sleeping, reproducing, and so forth), but relates only to normal presence. The concept is inclusive of stocked populations. When stocked populations are considered, it is appropriate to state this explicitly.

risk—the probability or likelihood an adverse effect will occur.

sediment—(*1*) particulate material that usually lies below water, and (*2*) formulated particulate material that is intended to lie below water in a test.

soil, *n*—weathered, unconsolidated mineral or unconsolidated organic materials overlying parent geological substrates characteristic of terrestrial or wetland habitats.

DISCUSSION—The materials have been subjected to and show the effects of morphogenic, environmental (for example, water or temperature effects), or other factors, (for example, alteration by macro- or microorganisms or humans).

spiked sediment—a sediment to which a material has been added for experimental purposes.

surrogate species—a species that is tested to estimate responses of other species, for which direct testing is impractical.

toxicant, *n*—a chemical or combination of chemicals that adversely affects organisms, tissues, or cells at or exceeding specific exposure concentrations.

toxicity—the property of a chemical, or combination of chemicals, to adversely affect organisms, tissues, or cells.

toxicity test—an experiment used to study the adverse effect (s) of one or more chemicals on whole organisms, tissues, or cells.

DISCUSSION—A toxicity test must include the appropriate control (s). The only intended stipulation of endpoint for such a test is that the effect must be adverse. This term, defines a subset of the protocols (methods) referred to by the term biological assay. (Finney, 1947).

toxin, *n*—a naturally occurring toxicant produced during the growth and metabolism of some microorganisms, plants and animals.

uptake—acquisition of a substance from the environment by an organism as a result of any active or passive process.

whole sediment—sediment and associated pore water that have had minimal manipulation.