



ERICA

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D-ERICA Annex B: Glossary

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ERICA (Environmental Risk from Ionising Contaminants: Assessment and Management) concerns an integrated approach to scientific, managerial and societal issues concerned with the environmental effects of contaminants emitting ionising radiation, with emphasis on biota and ecosystems. The project started in March 2004 and ended by February 2007.



Erica tetralix L.

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Electricité de France	EDF





Annex to D-ERICA: Glossary

The aim of this extended glossary and abbreviation list is to enable the ERICA Consortium to use the same terminology and abbreviations when writing the project various deliverables. Its purpose is to ensure consistency and avoid misunderstandings during discussions at various meetings, including during the EUG events, where a number of professionals from a wide range of background meet.

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Glossary

Absorbed dose	Quantity of energy imparted by ionising radiation to unit mass of matter such as tissue. Unit gray, symbol Gy. 1 Gy = 1 joule per kilogram.
Accuracy	Qualitative concept describing the closeness of the agreement between the result of a single measurement or calculation and the true or accepted value of the measurand (see precision). The tendency of values of an estimator to come close to the quantity they are intended to estimate. See also Precision.
Activity concentration	The activity per unit mass or volume in which the radionuclides are essentially uniformly distributed, <i>e.g.</i> Bq kg ⁻¹ , Bq l ⁻¹ .
Air kerma	The kerma value for air. Under charged particle equilibrium conditions, the air kerma (in gray) is numerically approximately equal to the absorbed dose in air (in gray). See also kerma.
ALARA principle	“As low as reasonably achievable”, refers to actions directed to limiting doses to individuals, the number of exposed individuals, and the probability of receiving a dose.
Allometric	Correlation of changes in any organism part (<i>i.e.</i> contaminant concentration) to organism size and metabolic needs.
Assessment criteria	Preparation of a procedure for summarising the results of the evaluation and takes, as input, management criteria specific to a particular environment which may influence the relative importance of different quality characteristics (ISO 9126).
Assessment endpoint	The biological effect inferred from the measurements or predictions and which the assessment framework is designed to study. An explicit expression of an ecological value to be protected.
Assessment factor	See safety factor
Assessment framework	Identification and demarcation of the assessment boundaries. In FASSET, the FASSET assessment framework contains the process from problem formulation through to characterisation of the effects of radiation on individuals. The overall assessment system describes the tools, methods and information flow used to carry out the impact assessment.
Assessor	The person using the ERICA integrated approach.
Authorisation	The granting by a regulatory body or other governmental body of written permission for an operator to perform specified activities.
Background	The doses, dose rates or activity concentrations associated with natural sources or any other sources in the environment that are not amenable to control.
Benchmark	Concentration, dose or dose rate that are assumed to be safe based on exposure–response information (<i>e.g.</i> ecotoxicity test endpoints).





Beta Distribution	Flexible, bounded Probability Distribution Function described by two shaped parameters. It is commonly used when a range of the random variable is known.
Bioaccumulation	The process whereby an organism accumulates substances in living tissues to concentrations higher than those existing in the surrounding media (<i>e.g.</i> soil, water and water).
Bioassay	A test to determine the relative strength of a substance by comparing its effect on a test organism with that of a standard preparation.
Bioavailability	Term used to describe the way contaminants are absorbed by humans and other animals.
Biodiversity	The number and abundance of species found within a common environment. This includes the variety of genes, species, ecosystems, and the ecological processes that connect everything in a common environment.
Biological half-life	The time required for a biological system (<i>e.g.</i> an animal) to eliminate, by natural processes, half the amount of a substance that has been absorbed into that system.
Biomagnification	Situations where the concentration of certain substances increase as one moves higher up the food chain.
Biomass	The total weight of all living organisms in a biological community.
Biosphere	That part of the environment normally inhabited by living organisms. In practice, the biosphere is not usually defined with great precision, but is generally taken to include the atmosphere and the Earth's surface, including the soil, surface water bodies, seas and oceans and their sediments. There is no generally accepted definition of the depth below the surface at which soil or sediment ceases to be part of the biosphere, but this might typically be taken to be the depth affected by basic human actions, particularly farming. In waste safety in particular, the biosphere is normally distinguished from the geosphere.
Biota	The animal and plant life of a given region.
Common Locations CLs	Use of the Kruskal-Wallis statistic to identify changes in the distribution of y across the range of individual x_i 's.
Common means CMNs	Use of the F-statistic to identify changes in the mean value of y across the range of individual x_i 's.
Common Medians CMDs	Use of the χ^2 statistic to identify changes in the median value of y across the range of individual x_i 's.
Conceptual model	Representation of the environmental system and of the physico-chemical and biological processes that determine the transport/transfer of contaminants from sources through environmental media to receptors within the system.
Confidence	Is used to represent trust in a measurement or estimate.
Confidence interval	An interval for which one can assert with a given probability, called the degree of confidence or the confidence coefficient that it will contain the true value of the parameter it is intended to estimate. The endpoints of a confidence interval





are referred to as the (upper and lower) confidence limits; they are generally values of random variables calculated on the basis of sample data.

Consensus building	Process aimed to reach agreement on particular points through informed debate and discussion. The aim is to produce an output that all stakeholders involved can agree with and sign up to. This is different to consultation where areas of disagreement are bound to remain because consultation is really about finding out the different opinions and views so that the decision makers can consider all aspects when making decisions. In contrast, consensus building attempts to bring all parties to some form of agreement. For example, it might be possible to get consensus on what might considered to be a trivial exposure to ionising radiation for non-human species or that the assessment tool was fit for purpose. Whilst the aim of the process might be to come to some form of consensus, this is not always possible. In these cases, the reasons for disagreement should be recorded as it might shed light on key issues for consideration by decision-makers.
Consultation	A process that can be used for the purpose of discussion on, for example, appropriate input values into the assessment and for gaining an understanding of the stakeholders' points of view and arguments.
Contaminant	Any physical, chemical, biological, or radiological substance or matter that has a potentially adverse effect on air, water, or soil, with the implication that the amount is measurable.
Correlation	In general, the term denotes the relationship (association or dependence) between two or more qualitative or quantitative variables. See also CC (Correlation Coefficient).
Correlation coefficient CC	A measure of the linear relationship between two quantitative variables. It is denoted by the letter r and its values range from -1 to +1, where 0 indicates the absence of linear relationship, while -1 and +1 indicate, respectively, a perfect negative (inverse) and a perfect positive (direct) relationship.
Cumulative Distribution Function CDF	$F(x)$, expresses the probability the random variable X assumes a value less than or equal to some value x, $F(x)=\text{Prob}(x. x)$. For continuous random variables, the cumulative distribution function is obtained from the probability density function by integration. In the case of discrete random variables, it is obtained by summation.
Cytogenetic effect	An observed effect in chromosomes that can be correlated with adverse hereditary effects (effects that are inheritable and appear in the descendants of those exposed) or genetic effects.
Dispersion model	Model for the representation of the spreading of contaminants in air (aerodynamic dispersion) or water (hydrodynamic dispersion) resulting mainly from physical processes affecting the velocity of different molecules in the medium.
Distribution Function	A function whose values $F(t)$ are the probabilities that a random variable assumes a value less than or equal to t.
Dose	See absorbed dose
Dose rate	Dose (normally absorbed dose) received over a specified unit of time.





Dose-effect	A biological effect at the molecular, cellular, tissue or whole body level of organisation following exposure of a contaminant that, in the case of ERICA, would be ionising radiation.
Dose-response	A correlation between a quantified exposure (dose) and the proportion of an exposed population that demonstrates a specific effect (response).
Driving force	An influence that causes change, <i>e.g.</i> legislation.
Ecological impact	The total effect of an environmental change, natural or man-made, on the community of living things.
Ecological receptor	Living organisms at various organisation level (<i>i.e.</i> ecosystems, communities, populations, individual organisms (except humans – note that humans are included when the term “environmental receptors” is used) potentially exposed to and adversely affected by stressors because they are present in the source(s) and/or along stressor migration pathways.
Ecosystem	The interacting system of a biological community and its nonliving surroundings.
Effect	A biological change caused by exposure to a contaminant.
Effective Concentration(x) EC _x , ED _x , EDR _x	<p>The concentration of a substance that is estimated to cause some sub-lethal toxic effect on x % of the test organisms under specified conditions. The duration of the exposure must be specified.</p> <p>The concentration of a substance that is estimated to cause an effect x on the test organisms under specified conditions. The duration of the exposure must be specified. x is defined as the percent change in the (average) level of the endpoint considered $x\% = 100 \left(\frac{y(EC_x)}{y(0)} - 1 \right) \%$. The same definition can apply for the Dose (ED_x) or the dose rate (EDR_x). Currently, these parameters are estimated by modelling (concentration-effects, dose-effects or dose rate-effect modelling).</p>
Endpoint	In the context of ERICA an endpoint can be described as the biological effect or type of biological effects of concern at the end of the assessment. Alternatively it may be whatever the end of the assessment is agreed to be (for example it might be the requirement of legislation for example to protect a particular species.
End-Users Group EUG	End-Users Group, formed under ERICA to provide advice to the ERICA Consortium from the perspective of being users of ERICA outputs.
Engagement	A general term to cover information provision, information feedback, involvement and consultation and extended involvement (Institute of Environmental Management and Assessment, 2002).
Environment	Water, air, land, plants and man and all other organisms living therein, and the inter-relationships that exist among them.
Environmental Impact Statement EIS	An Environmental Impact Statement is a document providing information for decision makers on the positive and negative effects of an action, practice or policy, which identifies and evaluates the environmental impacts of the hazard

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EIS	source and feasible alternatives, including taking no action.
Environmental justice	Often used interchangeably with the term environmental equity, refers to the distribution and effects of environmental problems and the policies and processes to reduce differences in who bears environmental risks. In a general sense, it includes concern for disproportionate risk burden placed upon any population group, as defined by gender, age, income, race, nationality or generation.
Environmental Media Concentration Limit	The environmental media concentration limit is defined as the Predicted no Effects dose rate or screening dose-rate ($\mu\text{Gy h}^{-1}$) divided by the value F which is the dose rate that an organism will receive for the case of a unit concentration in environmental media ($\mu\text{Gy h}^{-1}$ per Bq l^{-1} or kg of medium). In other words this is the environmental concentration of a radionuclide which would give rise to a dose rate of concern.
Environmental quality criteria	The levels of pollution and lengths of exposure, above which adverse effects may occur on health and welfare.
Environmental quality standards	The level of pollutants prescribed by law or regulation that cannot be exceeded during a specified time in a defined area.
Exposure	The co-occurrence or contact between the organism of interest (see receptor) and the stressor (<i>e.g.</i> , radiation or radionuclide).
Exposure assessment	The process of measuring or estimating the intensity, frequency, and duration of exposures to an agent currently present in the environment or of estimating hypothetical exposures that might arise from the release of new chemicals into the environment.
Exposure pathway	A route by which radiation or radionuclides can reach humans and cause exposure – an exposure pathway may be very simple, <i>e.g.</i> external exposure from airborne radionuclides, or a more complex chain.
False positive	A false positive is where the assessment result indicates that the assessment is satisfactory and meets the assessment criteria specified in the problem formulation stage of the assessment but in reality there is a risk of harm in the environment.
Fecundity	The survival of offspring.
Fertility	The ability to produce offspring.
FRED	FASSET Radiation Effects Database, see www.ERICA-project.org .
FREDERICA	Database that stems from the FASSET Radiation Effects Database (FRED), which was supplemented during the ERICA project (hence the name FREDERICA) with new data, including some from the FP5 EPIC project.
Gaussian distribution	See Normal Distribution
Hazard	A condition or physical situation with a potential for an undesirable consequence, such as harm to health or the environment. The term is used to indicate the likelihood that a contaminant will cause an adverse effect, to man or the environment, under the condition in which it is





produced or used. Thus, the hazard is a function of two broad considerations, the potential of the contaminant to harm biological systems and its potential for exposure such that the adverse effect can occur.

Hazard analysis	Procedure used to (1) identify potential sources of hazardous materials from fixed facilities or transportation accidents; (2) determine the vulnerability of a geographical area to a release of hazardous materials; and (3) compare hazards to determine which present greater or lesser risks to an individual, population, or ecological community.
Hazard identification	Recognising that a hazard exists and trying to define its characteristics. The process of determining whether exposure to an agent can cause an increase in the incidence of an adverse health or environmental effect.
Indicator organisms	A species, whose presence or absence may be characteristic of environmental conditions in a particular area of habitat.
Information provision	Can be considered more or less a one-way process (although the stakeholders might also provide specific information to the assessment). Dissemination of information related to the project and associated processes may include the use of leaflets, websites, public relations and media, open house, exhibitions, dissemination of project information and of process information, seminars to explain issues and announcements.
Kerma	The quantity K, defined as: $K = \frac{dE_{TR}}{dm}$ where, dE _{tr} is the sum of the initial kinetic energies of all charged ionising particles liberated by uncharged ionising particles in a material of mass dm. Unit: Gray (Gy).
Licence	1) A legal document issued by the regulatory body granting authorisation to perform specified activities related to a facility or activity. 2) Any authorisation granted by the regulatory body to the applicant to have the responsibility for the siting, design, construction, commissioning, operation or decommissioning of a nuclear installation. 3) Any authorisation, permission or certification granted by a regulatory body to carry out any activity related to management of spent fuel or of radioactive waste.
Linear Energy Transfer. LET	A measure of how, as a function of distance, energy is transferred from radiation to the exposed matter. Radiation with high LET is normally assumed to comprise of protons, neutrons and alpha particles (or other particles of similar or greater mass). Radiation with low LET is assumed to comprise of photons (including X-rays and gamma rays), electrons and positrons.
Lognormal Distribution	The distribution of a variable whose logarithm is normally distributed.
Lowest observed effect	The lowest observed effect concentration in a toxicity test that causes a statistically significant effect in comparison to the controls.





concentration
LOEC

Measurement endpoint	Measured or predicted value that an assessment produces. A measurable response to a stressor that is quantifiably related to the assessment endpoint.
Median	The median value of a sample is the value that divides an ordered sample into two equal halves. If there are $2n + 1$ observations, the median is taken as the $(n+1)^{th}$ member of the ordered sample. If there are $2n$ it is taken as being halfway between the n^{th} and $(n+1)^{th}$.
Monte Carlo Analysis / Simulation	It is a computer-based method of analysis developed in the 1940's that uses statistical sampling techniques in obtaining a probabilistic approximation to the solution of a mathematical equation or model. It is a method of calculating the probability of an event using values, randomly selected from sets of data repeating the process many times, and deriving the probability from the distributions of the aggregated data. Monte Carlo simulation is a method for <i>iteratively</i> evaluating a deterministic model using sets of random numbers as inputs. This method is often used when the model is complex, nonlinear, or involves more than just a couple uncertain parameters. A simulation can typically involve <i>over 10,000 evaluations</i> of the model. Monte Carlo simulation methods are applied to studying systems with a large number of degrees of freedom as disordered materials, strongly, and geometrical structures. Monte Carlo methods are used to model phenomena with significant <u>uncertainty</u> in inputs. In radiation protection, they are broadly applied to simulate radiation transport from radiation sources to defined targets.
Morbidity	A loss of functional capacities generally manifested as reduced fitness, which may render organisms less competitive and more susceptible to other stressors, which may reduce life span.
Morbidity	A loss of functional capacities generally manifested as reduced fitness, which may render organisms less competitive and more susceptible to other stressors, thus reducing the life span.
Mortality	Death; the death rate; ratio of number of deaths to a given population.
Natural background	See background
No observed effect concentration	NOEC is the highest concentration in a toxicity test not causing a statistically significant effect compared with the controls.
Non-parametric approach	Approach that does not depend for its validity upon the data being drawn from a specific distribution, such as the normal or lognormal; a distribution-free technique.
Normal	Probability distribution for a set of variable data represented by a bell shaped





Distribution	curve symmetrical about the mean. Also known as Gaussian distribution.
Parametric	Category of statistical tests based on the following assumptions: (i) data are normally distributed, (ii) variance is homogeneous, (iii) about 25 samples for each variable analysed, (iv) relations among variables are linear.
Partial Correlation Coefficient	PCC is a statistic that is calculated to measure the association between two variables after controlling (or adjusting) for the effects of one or more additional variables.
Partial Rank Correlation Coefficient PRCC	Measures the degree of relation between two variables, when a third variable is held constant. Estimates non-linear monotonic relationship and gives the unique contribution of an input parameter to the resultant dose.
Permission	See licence
Permit	See licence
Pollution	The presence of matter or energy (<i>e.g.</i> smoke, gas, hazardous or noxious substances, light, heat, litter or a combination thereof) in sufficient quantities and of such characteristics and duration as to produce, or likely to produce, undesired environmental effects.
Precautionary approach	A precautionary approach is the method or procedure that has been developed to implement the precautionary principle.
Precautionary principle	In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. (UNCED, Rio principle 15, 1992.)
Precision	The closeness of the agreement between the results of a group of independent measurements or calculations, obtained by applying a given procedure under stipulated conditions. The smaller the random part of the errors, which affect the results, the more precise the procedure is. On the contrary, systematic errors may give precise but not accurate data (see accuracy). The precision of an estimator is its tendency to have its values cluster closely about the expected value of its sampling distribution; thus, it is related inversely to the variance of this sampling distribution - the smaller the variance, the greater the precision.
Probabilistic assessment	Assessment where probability distributions are assigned to model parameters and a probability distribution of the assessment endpoint is obtained by performing Monte Carlo simulations (this is the way is done in the ERICA tool) or by other methods for uncertainty propagation.
Probability Density Function of a continuous random variable	PDF is a function that can be integrated to obtain the probability that the random variable takes a value in a given interval.
Problem	Defined as the first step of any risk assessment and is intended to identify the





formulation	context and purpose of the assessment framework. This should include ecological, political and societal issues related to questions being addressed, and integrate the process of choosing appropriate assessment endpoints, identifying sources and describing the environment.
Prospective assessment	A prospective assessment is an assessment that is conducted to determine the impact of a practice or process that has not yet commenced.
Quantile	A generic name for statistics such as deciles, percentiles, and quartiles. The q^{th} quantile of a list ($0 < q \leq 1$) is the smallest number such that the fraction q or more of the elements of the list are less than or equal to it, <i>i.e.</i> if the list contains n numbers, the q^{th} quantile, is the smallest number Q such that at least $n \times q$ elements of the list are less than or equal to Q .
Radiation weighting factor	The value of a radiation weighting factor represents the relative biological effectiveness of the different radiation types, relative to X- or gamma-rays, in producing endpoints of ecological significance. Its value represents the relative biological effectiveness of the different radiation types, relative to X- or gamma-rays, in producing endpoints of ecological significance.
Radioactive material	1) Material designated in national law or by a regulatory body as being subject to regulatory control because of its radioactivity. 2) Any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in paragraphs 401–406 of “Regulations for the Safe Transport of Radioactive Material, 1996 Edition (As Amended 2003) Requirements Details”. IAEA Safety Standards Series No. TS-R-1 2004. Some States use the term radioactive substance for this regulatory purpose. However, the term radioactive substance is also sometimes used to indicate that the scientific use of radioactive (see radioactive material (1)) is intended, rather than the regulatory meaning of radioactive (see radioactive material (2)) suggested by the term radioactive material. It is therefore essential that any such distinctions in meaning are clarified.
Radioactive substance	See radioactive material (1). It should be noted that radioactive substance is sometimes used to indicate that the scientific use of radioactive is intended, rather than the regulatory meaning of radioactive.
Radioecological sensitivity	A combination of features that include the exposure situation and biology of an organism, that contributes to the sensitivity of the organism to presence of radioactive substances in its environment.
Radionuclide	An unstable nuclide that undergoes spontaneous transformation, emitting ionising radiation.
Random Error	Result of a measurement minus its expected value. Random error is equal to absolute error minus systematic bias. Because only a finite number of measurements can be made, it is possible to determine only an estimate of random error.
Receptor	See ecological receptor





Reference organism	A series of entities that provide a basis for the estimation of radiation dose or dose rate to a range of organisms that are typical, or representative, of a contaminated environment. These estimates, in turn, could provide a basis for assessing the likelihood and degree of radiation effects.
Relative Biological Effectiveness RBE	For a given type of radiation, the Relative Biological Effectiveness (RBE) is defined as: $RBE = \frac{\text{Dose of the reference radiation needed to produce the same effect}}{\text{Dose of the given radiation needed to produce a given biological effect}}$
Response	The proportion or absolute size of an exposed population that demonstrates a specific effect. May also refer to the nature of the effect.
Retrospective assessment	A retrospective assessment is an assessment that is conducted to determine the impact of a practice or process which has already started and is either still operational or has ceased operation.
Risk	A statistical concept describing the expected frequency or probability of undesirable effects arising from exposure to a contaminant. A measure of the probability that damage to life, health, property, and/or the environment will occur as a result of a given hazard. A technical estimation of risk is usually based on the expected value of the conditional probability of the event occurring times the consequence or magnitude of the event given that it has occurred.
Risk assessment	A qualitative or quantitative evaluation of the risk posed to human health and/or the environment by the actual and/or potential presence of pollutants. It includes problem formulation, exposure and dose-response assessment and risk characterisation.
Risk characterisation	The synthesis of information obtained during risk assessment for use in management decisions. This should include an estimation of the probability (or incidence) and magnitude (or severity) of the adverse effects likely to occur in a population or environmental compartment, together with identification of uncertainties.
Risk communication	The exchange of information about health or environmental risks among risk assessors and managers, the general public, news media, interest groups, etc.
Risk evaluation	A component of risk assessment in which judgments are made about the significance and acceptability of risk.
Risk management	The selection and practical implementation of regulatory and non-regulatory responses to risk. Practical implementation of procedures, actions or policies to mitigate, reduce, remove or monitor health or environmental risks.
Risk Quotient	A risk quotient is a measure of the risk caused by each contaminant to an organism. For radioactive substances it is defined by the activity concentration of a given radionuclide in soil, water or air divided by the environmental media concentration limit for that radionuclide.
Safety factor	Measure of degree of uncertainty, caused by lack of effects data. For example, an estimated lowest observed effect concentration may, as a precautionary





approach, be divided by a safety factor (normally within the range 10 - 10 000) to safeguard against harmful effects, where the magnitude of the safety factor reflects the degree and type of uncertainty (e.g., lack of chronic exposure data, lack of data for different taxonomic groups or trophic levels, etc.).

Also known as assessment factor.

Sensitivity Analysis	The systematic investigation of the reaction of the simulation and response to either extreme values of the model's quantitative factors (parameter and input variables) or to drastic changes in the model's quantitative factors (modules). So the focus is not on marginal changes in inputs.
Source	Anything that may cause radiation exposure — such as by emitting ionising radiation or by releasing radioactive substances or materials — and can be treated as a single entity for protection and safety purposes.
Spearman Rank Correlation Coefficient	RCC is usually calculated on occasions when it is not convenient, economic, or even possible to give actual values to variables, but only to assign a rank order to instances of each variable. It may also be a better indicator that a relationship exists between two variables when the relationship is non-linear.
Species Sensitivity Distribution SSD	<p>The SSD method estimates the doses (or dose rates) below which 95 % (for example) of species in the aquatic/terrestrial ecosystem should be protected (HD_5 or HDR_5 – Hazardous Dose giving 50 % effect to 5 % of species or Hazardous Dose Rate giving 10 % effect to 5 % of species).</p> <p>The final benchmark screening values (PNED or PNEDR) are obtained by applying a safety factor (SF) of between 1 and 5 to take on board remaining extrapolation uncertainties (e.g. the irradiation pathway that could lead to a dominant internal dose by α or β emitters).</p> <p>In summary: $PNED(R) = \frac{HD(R)_5}{SF}$</p> <p>In ERICA, SSD built on ecotoxicity data obtained from the mathematical processing of the effects data within the FRED, and averaging per umbrella effect for each species (geometric mean per umbrella effect for each species, species weighted in the distribution, no weight per taxonomic group).</p>
Stakeholder	Stakeholder: anyone who has an interest in or considers themselves to have an interest in the issue and therefore it goes beyond “representatives” of groups to include “interested members of the public” (Institute of Environmental Management and Assessment, 2002).
Standardised Rank Regression Coefficient. SRRC	Estimates non-linear monotonic relationship and provides “shared” contribution of an input parameter to the resultant dose.
Standardised Regression Coefficient SRC	The regression coefficient that would result from data that have been standardised.
Statistical Independence SI	Use of the χ^2 statistic to identify non random joint distributions involving y and individual xi's.





Sustainability	The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.
Synergism	An interaction between two substances that results in a greater effect than both of the substances could have had acting independently.
Systematic error (Bias)	(i) In problems of estimation, an estimator is said to be biased if its expected value does not equal the parameter it is intended to estimate. (ii) In sampling, a bias is a systematic error introduced by selecting items from a wrong population.
Threshold	A pollutant concentration (or dose), below which no deleterious effect occurs.
Tier	The common denominator in tiered approaches are that complexity and realism increases with higher tiers and that the decision to continue from one tier to the next is based on identification of hazard to ecological receptors.
Toxicant	A substance that kills or injures an organism through chemical or physical action or by altering the organism's environment; for example, cyanides, phenols, pesticides, or heavy metals; especially used for insect control.
Triangular Distribution	A distribution with a triangular shape. It is characterised by its minimum, maximum and mode (most likely) values. It is often used to represent a truncated log-normal or normal distribution if there is little information available on the parameter being modelled.
Uncertainty	<p>Statistical term that is used to represent the degree of accuracy and precision of data. It often expresses the range of possible values of a parameter or a measurement around a mean or preferred value.</p> <p>Uncertainty is a statistical term that is used to represent the degree of accuracy and precision of data. It often expresses the range of possible values of a parameter or a measurement around a mean or preferred value.</p> <p>Parameter, associated with the result of a measurement or calculation that characterises the dispersion of the values that could be attributed to the measurand.</p>
Uncertainty analysis	In uncertainty analysis values of the model inputs are sampled from pre-defined distributions to quantify the consequences of the uncertainties in the model inputs, for the model outputs. So in uncertainty analysis the input variables range between extreme values investigated in sensitivity analysis.
Validation	The establishment of sound approach and foundation. The legal use of validation is to give an official confirmation or approval of an act or product.
Variability	This refers to observed differences attributable to true heterogeneity or diversity in a population or parameter. Sources of variability are the result of random processes. Variability is usually not reducible by further measurement or study, but can be characterised.
Variance	The variance of a sample is (i) the square of the standard deviation (ii) the second central moment of a population.





List of Abbreviations

ALARA	As low as reasonably achievable
BAT	Best Available Technology
BPEO	Best Practicable Environmental Option
CC	Correlation coefficient
CDF	Cumulative Distribution Function
CLs	Common Locations
CMDs	Common Medians
CMNs	Common Means
CTV	Chronic Toxicity Value
ECx	Effective Concentration at value x
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMCL	Environmental Media Concentration Limit
EQS	Environmental Quality Standard
ERA	Ecological Risk Assessment
ERICA	Environmental Risk from Ionising Contaminants: Assessment and Management
EUG	End Users Group
EUG	ERICA End Users Group
FRED	FASSET Radiation Effects Database, see www.ERICA-project.org
FREDERICA	Database that stems from the FASSET Radiation Effects Database (FRED), which was supplemented during the ERICA project (hence the name FREDERICA) with new data, including some from the FP5 EPIC project.
LC	Lethal Concentration
LET	Linear Energy Transfer.
LOAEL	Lowest Observed Adverse Effect Level
LOEC	Lowest Observed Effect Concentration
MPC	Maximum Permissible Concentration (RIVM)
NAWQC	National Ambient Water Quality Criteria
NOAEL	Lowest Observed Adverse Effect Level
NOEC	No Observed Effect Concentration
NORM	Naturally Occurring Radionuclides
PBT	Persistent, Bioaccumulative and Toxic substances.
PCC	Partial Correlation Coefficient.





PDF	Probability Density Function
PNEDR	Predicted No-Effect Dose Rate
PRCC	Partial Rank Correlation Coefficient
QSAR	Quantitative Structure-Activity Relationship
RBE	Relative Biological Effectiveness
RCC	Spearman Rank Correlation Coefficient.
RQ	Risk Quotient
SI	Statistical Independence.
SLC	Screening Level Concentration
SRC	Standardised Regression Coefficient.
SRRC	Standardised Rank Regression Coefficient
SSD	Species Sensitivity Distribution
TEL	Threshold Effects Level
TeNORM	Technologically Enhanced Naturally Occurring Radionuclides
TGD	Technical Guidance Documents
TLD	Thermo-luminescent Dosimeter
TU	Toxic Unit

