Questions & Answers

On this page we try to provide answers to the questions you have asked - apologies it has not been updated for a while. However, we hope the information that is available here is useful.

- **To ask a question please use the *Ask a question* form.**
- **Please use this form to comment on any of the questions or the answers provided.**

Other useful Q&A sources:

- Entering data into the wildlife transfer database.
- Technical issues related to the ERICA Tool (on Facilia website)

Posted: 28/05/2014
From:
Renee Silke, Canada

Biota-sediment accumulation factors?

Question
Are there any published attempts to determine biota-sediment accumulation factors for radionuclides?

Answer:
We have not supported the biota-sediment CR given it merges together both CR(biota-water) and kd and is hence even more site specific than CR(biota-water). The on-line database (http://www.wildlifetransferdatabase.org/) does actually contain a relatively large number of CR(biota-sediment) values. Over >95% of these values originate from Canada from grey literature predominantly associated with U-industry related studies. However, as we have reservations about this approach (and given the data are very biased to Canadian studies) we have not summarised or presented these in the IAEA/ICRP reports or associated papers.
You could access the summarised CR(biota-sediment) (view summary results option) from the on-line database. However, these values have not been as well QC'd as the CR(biota-water) values.
See also Copplestone et al. 2013 (http://dx.doi.org/10.1016/j.jenvrad.2013.05.007).

Answered by Nick Beresford (NERC-CEH), 10/09/2013

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Posted: 28/05/2014
From:
Zoltán Dezs, Hungary

PDFs for CR values in ERICA Tool?

Question
In the documentations concerning the derivation of CR values used in the ERICA Tools (e.g Hosseini et al., 2008; Beresford et al., 2008) it is written that "*w here a mean and a standard deviation could be determined from the raw data being used to derive the parameter, a lognormal distribution was applied*". However, in my opinion, the means and SDs given are not the geometrical ones but the arithmetical ones.
To our knowledge, the statistical description of lognormal distributions requires the use of geometrical means and GSD. For example, in case of uranium CR of trees in terrestrial environment, in the ERICA Tool the following is given: lognormal(0.006794210843500887,0.014144979928509134,0.0,Infinity), based on 521 data entries. In the IAEA Wildlife Transfer Database, for the same 521 data entries the above data are given as AM and ASD as well as a geometrical mean of 0.002929 kg/kg with geometrical SD of 3.654965.
Our questions are:
1. In case of lognormal distributions the GM gives the most probable value of the distribution and it is usually lower than the AM. Does the ERICA Tools calculate/estimate the geometrical mean based on the AM and ASD given? Furthermore, does it apply as the most probable value?
2. Similarly, in case of Tier 3 calculations, does the ERICA Tools calculate/estimate the GSD based on the AM and ASD given? Does it apply during the probability propagation calculations correctly?

Answer:
The mean and SD given in ERICA are arithmetic (not geometric) and these values are used as the inputs for assumed lognormal distributions. There may be additional information in the 'D-ERICA' report - available from https://wiki.ceh.ac.uk/x/swbbBg
Thorne, 2013 (http://dx.doi.org/10.1088/0952-4746/33/2/N1) discusses AM v's GM application in screening assessments.
See also Avila et al. 2014 (J. Radiol. Prot. 34, 261-262) (http://dx.doi.org/10.1088/0952-4746/34/1/L01) for comment on Thorne (added 26/05/2014)

Answered by Nick Beresford (NERC-CEH), 27/05/2014

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Posted: 28/05/2014
From:
Mirjana Cujic, Serbia

Doses to worms on soil surface?

Question
If I have dose rate for P-32 in Gy/h for medium, how I can calculate activity in organism (worm), in this case organism is on medium (i.e. soil), not inside?
In ERICA database there is no value for DCC for P-32 for worm on soil the soil surface.

Answer:
If you select one of the default reference organisms then the DCCs should be for the mass as defined in Table 9 of the help file (i.e. 2.05E-12 kg for freshwater phytoplankton). The restrictions on size relate to organisms you can create.

Answered by Nick Beresford (NERC-CEH), 27/05/2014

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Posted: 28/05/2014
From:
Ben Jaeschke, Sweden

Mass of phytoplankton?

Question
In ERICA-Tool the help file documentation states that aquatic organisms have a minimum size of 1E-6 kg when calculating DCCs, but the Reference Phytoplankton has a mass of 1E-12 kg. Is it somehow possible to use the smaller reference value, or is the minimum mass upheld during assessment?

Answer:
If you select one of the default reference organisms then the DCCs should be for the mass as defined in Table 9 of the help file (i.e. 2.05E-12 kg for freshwater phytoplankton). The restrictions on size relate to organisms you can create.

Answered by Nick Beresford (NERC-CEH), 13/09/2013

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Posted: 28/05/2014
From:
Ben Jaeschke, Sweden

Assessments for Organisms living in air?

Question:
I am running an assessment using the ERICA tool, and am looking to create site-specific organisms in ERICA Tool. At present there appears no way to model organisms that live in trees or generally above the ground (external dose approximately equal to IN AIR). For example bats, or epiphytic lichens in trees.
Do you have any suggestions for how best to model these habitats?
One possible method would be to classify the specimen as “bird and flying insect”, but would this be acceptable?

Answer:
Yes I think this is acceptable however, you might have a problem with the limitations on sizes which can be created for organisms in air – 35 g to 2 kg. Most/all bat species in the UK have a mass below this. There is a limited evaluation of the impact on estimated dose for organisms outside this mass range .... select help from the ‘add organism’ screen and it should take you to correct place in the help file. Otherwise you probably need to also acknowledge that you are assuming no contribution to dose from the tree.

Answered by Nick Beresford (NERC-CEH), 10/09/2013

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Posted: Asked by course participant (21-23 March 2012 Melbourne, Australia)

Does high energy beta become low energy beta?

Question:
Is dividing beta emissions into two categories: low energy (< 10keV) and high energy (> 10 keV) an adequate simplification or does this introduce significant uncertainty for beta energy that is degrading as it enters the biota, losing energy in the process?

Answer:
The low beta component is calculated separately because a higher relative biological effectiveness (RBE) has been observed for tritium (see references). It is prudent to assume that the experimental RBEs for tritium reflect the elevated LET values for low energy beta particles and electrons, and thus we recommend application of a weighting factor of 3, greater than unity to all such beta particles and electrons, regardless of the radionuclide from which they originate. For high-energy betas and electrons the weighting factor is 1, indicating same RBE than the reference radiation (gamma).

We think that the uncertainty introduced in the assessment is marginal – intermediary energy beta rays would have to be between these two extremes so no more than a factor of 3 uncertainty would be expected as a beta particle slows down in matter, becoming a low-energy electron. The lack of experimental data prevents us from making a more conclusive statement.

Answered by Jordi Vives i Batlle (SCK•CEN, Belgium) 12/04/2012

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Posted: 05/03/2012
From:
Phil Crouch
Australia

ERICA EMCLs

Question:
I have done a freshwater assessment with natural (U series) radionuclide concentrations of about 0.2 Bq/L. This is around half of our drinking water standard, but when I put it into ERICA I get a number of organisms with dose rates up to 200 - 300 microGy/h, and hence well over the ERICA default screening level. It seems very odd that there should be a result like that from water meeting drinking water standards, and I was wondering if you have any comments.

Answer:
We had noticed this for a few radionuclides although there has been no subsequent discussion.
For instance the Am-241 EMCL is considerably below the WHO Guidance Level of 1 Bq/l (although the WHO GL for U-238 is 10 Bq/l).
There are also some 'oddities' between drinking water GLs and the concentration in water which would produce human food which would not be allowed into the foodchain, e.g. at 10 Bq/l of Cs (the WHO GL) the concentration in fish would be 25,000 Bq/kg.
Drinking water standards are obviously set to limit the dose to humans from the consumption of water (for the WHO values aim seems to be to restrict dose to <0.1mSv/a via drinking water). In the case of wildlife then the organisms are permanently in water and potentially getting a dose from sediment (which may be the largest component of dose to the most exposed organism depending upon the radionuclide).
That said we are aware that some of the ERICA EMCLs are unrealistically low, there are a few freshwater ones which are below natural background concentrations. Some of this is probably due to the pdf assigned to the sediment-water distribution coefficient (another example you've already come across is the prevalence of lichen as a limiting organism in terrestrial ecosystems).

Answered by Nick Beresford (CEH) and David Copplestone (Stirling University) 2/03/2012

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Posted: 24/02/2012
From:
Chantal Medri
Canada

Dose rate equation

Question:
I am looking for the dose rate equation used by ERICA which takes into account the media. For instance, for the aquatic organism, I expect that the calculated dose rate should look something like this:

D= DCC(ext, water) [OF(water)+ 0.5xOF(water surface)+ 0.5xOF(sediment surface)]xC(water) + [OF(sediment)+ 0.5xOF(sediment surface)]xC(sediment).

However, I have not been able to find any documentation that supports this.
Furthermore, are the DCCs for water and sediment the same? Sediment is denser than water, so I expected that different DCCs should be used.

Answer:
Your equation is the correct representation of the calculation of total EXTERNAL dose rate (for the total dose rate then obviously need to include internal exposure). This does not appear to be in documentation although equations for individual elements of dose (e.g. external from sediment at the sediment interface etc.), including internal dose rate estimation, are presented in the Help file and Brown et al. 2008 paper.
You are also correct in that typical wet sediment densities tend to be greater than those for water but this difference isn't normally huge especially where the porosity, and therefore the water content, is high. In some cases you may get a factor of 2 to 3 difference between wet sediment and water but in view of all the other uncertainties this is fairly minor. For sake of simplicity using the same DCC for water and sediment isn't such a poor approximation and it gets around the problem of having to decide on an arbitrary reference density for wet sediment.

Answered by Justin Brown (NRPA, Norway) and Nick Beresford (CEH) 24/02/2012

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Posted: 24/02/2012
From:

Chantal Medri
Canada

Double counting contribution from daughters

Question:
Seeing as the DCCs that are calculated include progeny with half-lives less than 10 days, does that mean that if I included a radionuclide with a half-life of less than 10 days in my assessment, that its contribution will be double counted?

Answer:
Simple answer is yes if you did this you would double account (this is discussed a little in Vives i Batlle et al. 2007 and Ber esford et al. 2010) But if you are using the ERICA Tool (and I think the same is true of RESRAD-BIOTA, which uses a longer cut-off time than 10 d) this should not occur with the default radionuclide list. It would if, for instance, you were considering U-235 and added Th-231 to the radionuclide list (using the 'add isotope' option in Tier 2 or 3) as Th-231 will already be included in the U-235 DCC.

Answered by Nick Beresford 24/02/2012

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Posted: Asked by course participant (12-13 October 2011 CEH Lancaster)

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Can marine CR values be applied to freshwater ecosystems?

Question:
How can we best use CR (transfer) values from the marine ecosystem for the freshwater ecosystem if we do not have freshwater data?

Answer:
This was an approach used to provide some default CR values within the original parametrisation of the ERICA Tool. However, it is not one we would recommend. There are perhaps more intelligent ways the available data could be used, e.g. are ratios between CR values for given elements or organisms in marine and freshwater similar? The Wildlife transfer Database contains data for estuarine/brackish water ecosystems in addition to freshwater and marine, these may provide a better surrogate CR value for other aquatic ecosystems. However, this needs to be investigated before we would recommend such an approach.

Answered by Nick Beresford (CEH) 1/05/2012

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Posted: 07/02/2011

DCC Database

From:
Maria Sotiropoulou
Demokritos
Greece

Question:
How can I upload my own database?
Probably I do something wrong, because when I create my database excel file, I can see it in the Parameters Database, but I cannot choose it.
To be more specific. If I create my own DCC database and I want to compare these values, how can I do it? The only way I have found is through "My ERICA Database" files, where I change each time the DCC.xls file (that has been created in the user file). Is this the only way? Can I do this process while the tool is running,so I don't have to create each time the same simulation?

Answer:

*You can see the DCC values by selecting **Database** and then **Parameter Database** from most screens within the ERICA Tool.*
If you use the Tool to create DCC values for new organisms or new radionuclides you will also see these. The DCCs in the database are broken down into radiation type and exposure route.
You can view and export the DCC values to Excel.
If you are suggesting editing the DCC database (i.e. the Excel file within "My ERICA Database") we do not recommend this as it can lead to problems of traceability when you conduct future assessments.
If you have DCC values generated outside of the Tool, which you want to compare with those in the Tool, then why not do this in Excel? If you do not want the ERICA DCCs split into radiation type you can generate an 'overall' DCC by running the Tool. For instance, for the external DCC for soil you would input a value of 1 Bq/kg in soil and input 0 as the activity concentration in your organism(s), to determine the internal DCC input 1 Bq/kg as the organism activity concentration and 0 as the soil, water or sediment activity concentration, etc..

Answered by Nick Beresford 10/02/2011

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Posted: 14/01/2011

Calculating Environmental Media Concentration Limits?

From:
Hildegarde Vandenhove
SCK•CEN
Belgium

Question:
Can you calculate Environmental Media Concentration Limits (EMCL) values as used in the ERICA Tool?

Answer:
You can estimate EMCL values using Tier 3 of the ERICA Tool. You need CR values with associated probability distribution functions (pdfs) for the radionuclide you are interested in (and kd values together with associated pdfs if considering an aquatic ecosystem). You need to make predictions for all reference organism assuming 1 Bq per unit media concentration; note for aquatic ecosystems you need to determine both a water and sediment EMCL separately. The EMCL is calculated by dividing your screening level dose rate (10 Gy/h default in the ERICA Tool) by the 95th percentile dose rate to the most exposed organism (i.e. the highest 95th percentile dose rate for any reference organism) assuming 1 Bq per unit media concentration.

The process of determining the EMCL using Tier 3 of the ERICA Tool is as follows:

- Enter 1 radionuclide at a time as need to include all the reference organisms (otherwise there may too much data to 'run' the assessment with sufficient simulations).
- Enter your mean concentration ratio (CR) and associated standard deviation (SD) values for each reference organism using the 'Edit distribution' tab choosing the appropriate distribution function (generally select 'lognormal' if n>1 and 'exponential' if n=1, leaving the 'lower' and 'upper cut off' as their default if you have no information).
- Check Occupancy Factors are those which would result in maximal exposure for a particular reference organism.
- Enter a value of 1 into the media concentration cells. Note for aquatic ecosystems you will need to run water and sediment as separate assessments (when you estimate the water EMCL enter a value of 1 into the water activity concentration and leave the sediment blank; when estimating the sediment EMCL enter a value of 1 into the sediment activity concentration and leave the water blank).
- Select all the simulation parameters displayed and enter at least 1000 as the number of simulations.
- The statistics associated with the total dose rate are now available for each reference organism separately.
- Find the organism predicted to be most exposed where this is defined as that with the highest predicted 95th percentile total dose rate.
- The EMCL is then be calculated by dividing your screening dose rate by the predicted 95th percentile dose rate for the most exposed organism (assuming unit activity concentration in the media).

The ERICA default EMCL values were calculated outside of the Tool using a Monte Carlo approach.

More infomation can be found in the ERICA Tool help file and Brown, J.E., et al. 2008. The ERICA Tool. *J. Environ. Radioact.*, 99, 1371-1383 (http://dx.doi.org/10.1016/j.jenvrad.2008.01.008).

Answered by Cath Barnett 31/01/2011 Amended 16/04/2012

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Posted: 17/12/2010

How can you differentiate between dose from sediment and that from water?

From:
Marko erne
Jožef Stefan Institute
Slovenia

Question:
RESRAD-BIOTA calculates the dose to biota separately from water and sediment? In ERICA we can not distinguish between sediment and water dose rates. It would be an option just to run ERICA separately for water and separately for sediment, but it is still not possible due to sediment calculation using default Kd? Is RESRAD-BIOTA more appropriate for such purpose?

Answer:
RESRAD-BIOTA does report the external dose rate from sediment (Levels 2 and 3). The ERICA Tool reports a combined external dose rate. However, you can determine the external dose rate from sediment in the ERICA Tool. To do this enter the water activity concentrations as 0. If you do this the reported dose rates will be the external dose rate from exposure to sediment only. Similarly if you want to estimate the external dose rate from water only, enter the sediment activity concentration as 0.

Answered by Nick Beresford 17/12/2010

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Posted: 14/12/2010

CRs and occupancy factors for fish in the ERICA Tool

From:
Marko erne
Jožef Stefan Institute
Slovenia

Question:
The CR value for Pb (300, IAEA, Safety report series no 19) in ERICA Tool is the same for benthic and pelagic fish. How is the internal dose estimated in the tool as the uptake of Pb should be different between benthic and pelagic fish? Internal dose depends only on CR value and is more or less related to uptake from water as the CR values are a ratio between biota concentration and water and not biota concentration and sediment? The contribution of feeding habitats to the internal dose is possible only in RESRAD-BIOTA? Barbarel that feeds with small invertebrates on the bottom of river is definitely exposed to higher internal dose. RESRAD-BIOTA should handle this.

If we use 100% occupany at the sediment-water interface for a benthic species of fish, does the tool calculate the dose only from sediment? If we do not have the sediment data, but we have the water data and 100% occupancyat the water-sediment interface, how does the tool deals with this?

Answer:
When the ERICA database was derived those responsible for deriving the freshwater CR values assumed (pressumably because of a lack of available data at that time) that the Pb concentration ratio (which estimates the activity concentration in fish simply from that in water) was the same for benthic and pelagic fish. Therefore, the estimated whole-organism Pb-210 activity concentrations in the benthic and pelagic fish will be identical. The internal dose rates will be similar for the two fish as the differences in their geometry do not result in large variation in DCC values.

The allometric foodchain modelling functionality available in RESRAD-BIOTA is not applicable to fish.

If you assume that an organism is at the sediment water interface the external does rate is estimated as:
0.5(DCCexternal*sediment activity concentration) + 0.5*(DCCexternal*water activity concentration).*

Sediment will generally contribute the most to the total external dose rate of benthic organism assumed to spend 100% of their time at the sediment-water interface.

If you do not have sediment activity concentrations to input these will be estimated from kd and input water activity concentrations.

Answered by Nick Beresford 15/12/2010

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Posted: 13/12/2010

ERICA Tool create organism wizard - how are dimensions and mass used?

From:
Jordi Vives i Batlle
SCK•CEN
Belgium

Question:
I have a question on ERICA. When you create an organism you can give a mass and you can give dimensions. Nothing prevents me for, say, creating an organism which is a sphere of radius 1 cm, but of different mass: 1 kg, 100 kg... this seems to contradict a bit the assumption of unit density for organisms.

Answer:
When you use the create organism function the Tool uses the mass entered, the ratios of the dimensions and assumes a density of 1 g/cm3 to estimate the organism size. So if you enter 1 kg as mass you would actually get the same result regardless of the dimensions you enter as long as the ratio of the dimensions is the same (try creating a 1 kg organism of 1mx1mx1m and compare your resultant DCC values to those of a 1kg organism of 0.01mx0. 01mx0.01 m).

See Ulanovsky et al. (2008) for a more complete explanation.

Answered by Nick Beresford & Justin Brown (Norwegian Radiation Protection Authority) 13/12/2010

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Posted: 03/12/2010

What distribution should I use?

From:
Marko erne
Jožef Stefan Institute
Slovenia

Question:
I would like to know, if the assessment would be satisfactory, if I use an average value and thus use an exponential distribution or should I use the average + SD and use lognormal? An average value is an average of 12 samples taken each month through year from one monitoring place. So SD are calculated from 12 samples from one monitoring place and are not related to different places in specific
river. The assessment with average value without SD should represent satisfactory results compared to average + SD in my case? Dose rates should be in the same range when using exponential or lognormal?

Answer:
Easy part of your question first - your mean estimate when using a mean and PDF in Tier 3 of the ERICA Tool will be similar to estimate using Tier 2 and inputting a mean value only; it will not be exactly the same as Tier 3 is probabilistic. The mean estimates using either a lognormal or an exponential distribution in Tier 3 will be similar. The percentiles, minimum and maximum values will be different and dependent on the SD used for the lognormal distribution.

Which should you use? As is often the case there is no definitive answer to this. It depends what your criteria are - do you want to ensure your assessment is conservative? If yes then try both distributions in the Tool and compare your answers - it is relatively straightforward to do.

You appear to be questioning how representative your input data are? I'm afraid that you are best placed to answer this yourself. However, if your data are from close to the release source then you can have some confidence that they will give a conservative assessment downstream. If your data are distant from the source and you want to ensure populations upstream from your sampling site are protected then you need to obtain more samples from approriate locations or make predictions using a dispersion model.

Answered by Nick Beresford 08/12/2010

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Posted: Asked during training course 24-26th November 2011

OBT

From:
Franck Jourdain
CEA
France

Question:
How would you assess OBT releases using the ERICA Tool?

Answer:
None of the radiological environmental assessment tools that we are aware of are parameterised for OBT. Obviously OBT activity concentrations in biota could be input into the ERICA Tool (Tier 2 or 3) if available and dose rates estimated. If measured biota activity concentrations are lacking then, for aquatic ecosystems, you would need appropriate CR values for OBT; these could be used to replace the default CR values in Tiers 2 or 3. For terrestrial ecosystems it may be a little more complicated if you have measured/modelled OBT concentrations in soil since the CR values relate wholebody activity concentrations to those in air. You could use the Tool to give you the absorbed dose rate assuming 1 Bq/kg in the organisms of interest. If you had appropriate CR values you could then estimate the internal dose rate as: **media activity concentration x CR x absorbed dose rate per Bq/kg**. *External dose rates from H-3 can be assumed to be zero.*

The DCC values within the ERICA Tool (or RESRAD-BIOTA) can be used to generate unweighted internal dose rates for H-3 regardless of if present as HTO or OBT. The user can then define their own radiation weighting factor for low energy beta emitters (such as H-3). Note some dose coefficients for human assessment (effective dose coefficients) relate weighted absorbed dose rates to the activity ingested or inhaled and consequently these are higher for OBT than HTO as a consequence of the longer retention time of OBT compared to HTO. However, the DCC in the ERIA Tool relate absorbed dose rate to the whole organisms activity concentration and consequently under the simplified assumption of homeogenous distribution would be the same for HTO and OBT.

The underlying methodology used to estimate the CR values for terrestrial organisms in the ERICA Tool accounts for OBT and HTO intakes; the equations, presented in Galeriu et al. 2003, could be used to derive OBT CR values.

Galeriu D, Beresford, N.A., Melintescu, A., Avila, R. and Crout, N.M.J. 2003. Predicting tritium and radiocarbon in wild animals Contributed Papers Conf. on the Protection of the Environment from the Effects of Ionizing Radiation (Stockholm, 2003) (Vienna: IAEA) pp 186-9 (IAEA-CN-109).

Answered 29/11/2010

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Posted: Asked during training course 24-26th November 2011

Chemical risk assessment

From:
Maria Psaltaki
National Technical University of Athens
Greece

Question:
Are there models similar to the ERICA Tool available for chemical risk assessment?

Answer:
Those we are aware of are the SADA package, RESRAD-ECORISK and RESRAD-Chem. All are freely available although we note the RESRAD website states that RESRAD-Chem and RESRAD-ECORISK are no-longer being updated.

Answered 29/11/2010

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Posted: Asked during training course 24-26th November 2011

Assessment of estuarine ecosystem

From:
Sarah Hunak
AMEC
UK

Question:

How would I conduct an assessment of an estuarine ecosystem using the ERICA Tool?

Answer:
The ERICA Tool is not parameterised to consider estuarine ecosystems. However, the IAEA handbook on radionuclide transfer to wildlife will provide summary tables for estuarine ecosystems as will the on-line wildlife transfer database. Data will be more limited than for other ecosystems and will initially originate largely (perhaps only) from studies of the Baltic Sea and a number of Japanese estuaries. The issue of Radiation Environmental Biophysics contai ning papers associated with the wildlife transfer database has a paper on transfer to estuarine wildlife by Takata et al.; the same authors have also recently published estuarine kd values.

If you do not have CR or kd values specifically for estuarine ecosystems then we suggest selecting the value which will result in the most conservative assessment from either the marine or freshwater ecosystem.

Answered 29/11/2010

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Posted: 18/11/2010

Non-human biota, environment or wildlife?

From:
Marko erne
Jožef Stefan Institute
Slovenia

Question:
What is more appropriate term for non-human organisms: radiological risk to biota or environmental risk from ionising radiation to biota? The opinion of many radiologist is, that the term radiological relates to humans only? The biota dosimetry is relatively young science, so this is probably the reason of many disagreements.

Answer:
The terms non-human biota and non-human species appear to be the most widely used to date. However, most often we mean wild species and consequently 'wildlife' may be more appropriate and understandable by the wider scientific community and public (the IAEA use 'wildlife' in their draft handbook of transfer parameters). In this context wildlife is defined as any undomesticated plant, animal or other organism.

Are we protecting wildlife or the environment? The available approaches generally aim to protected wildlife at the population level. Therefore, we are aiming to protect the environment by ensuring the protection of the biotic components (although this may be accomplished via benchmarks expressed as activity concentrations in the abiotic components (i.e. soil, sediment, water or air)).

Answered by Nick Beresford 22/11/2010

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Posted: 20/10/2010

Wildlife transfer

From:
Marko erne
Jožef Stefan Institute
Slovenia

Question:
1) If I have only the tissue concentration, than the whole body:tissue ratios are used for the calculation of wholebody activity concentrations as repoted by Yankovich et al. (2010)?

2) If I have activity concentration for muscles and bones together, what should I do?

3) If CR values are in the range from 61 to 493 for one fish for Ra, what should I do? Should I use average or maximum? N of samples is 15.

Answer:
1. Yes Yankovich et al. 2010 presents the most up to date compilation of tissue:wholebody activity concentration ratios you can use these to convert tissue specific activity concentrations to wholebody values. Note the Yankovich et al. paper has been published today (26/10/10) in an issue of Radiation and Environmental Biopyhsics see http://www.springerlink.com/content/0301-634x/49/4/. Given the uncertainty around the collated values Yankovich et al. reco mmend that ratios of between 0.75 and 1.5 should not be applied and that a value of 1.0 should be assumed instead; in the tables available for these webp ages values between 0.75 and 1.5 have been replaced with a value of 1.0 for ease of use.

2. Might depend upon the radionuclide: you may want to convert both bone and muscle data and take average for radionuclides which do not accumulate in either of these tissues; for other radionuclides which accumulate in one of the two tissues you may have more confidence in the data for the accumulating tissue (e.g. Sr, Pu, Am and Ra accumulate in bone and have comparatively low transfers to muscle).

3. Depends upon the purpose of your assessment. If conservative then assume the maximum value, if more realistic then use an average value. Remember that in both RESRAD BIOTA and the ERICA Tool you can use a pdf to conduct a probabilistic assessment if appropriate for your purposes.

Answered by Nick Beresford 26/10/2010

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Posted: 12/10/2010

Predicting future biota and media concentrations

From:
Chutarat Saengkulž
Burapha University
THAILAND

Question:
I would like to predict of radiocesium activity in fish and water in the future using the ERICA Tool. How can I do this?

Answer:
You cannot use the ERICA Tool (or other packages such as RESRAD BIOTA) to make future predictions of water and fish activity concentrations.

How you can address this depends upon the nature of your assessment and available information:

1. If you have discharge data you could use the dis[ersion model available within the ERICA Tool to predict water concentrations (although I suspect from your previous question that this will not be the case).
2. You have data over the period 1962-2006 - consider analysing these data for time trends and making predictions for water and fish in the future outside of the ERICA Tool. Then input your results into the ERICA Tool to obtain dose rate estimates.
3. I am unsure if you are considering a freshwater or marine ecosystem? If marine then consider if you can make use of the Marine dynamic model.

Answered by Nick Beresford 26/10/2010

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Posted: 30/09/2010

Time series data

From:
Chutarat Saengkulž
Burapha University
THAILAND

Question:
I have a problem about putting data into the ERICA Tool - I have many data for cesium-137 concentrations in water and fish from 1962-2006 but I cannot put all data in ERICA Tool. Now I can input one data point from one year to calculate the absorbed dose rate. Please advise me about how to input such data into Tier 2 of the ERICA Tool.

Answer:
Currently, you cannot input time series data, or data for more than one location, into the ERICA Tool to model in a single run. This functionality is something which has been requested previously by users and it MAY be provided in future Tool versions.

How you can best proceed depends upon what you want to do to some extent. Here are two suggestions:

1. As you are only considering Cs-137 you could extract the DCC values and if required Kd and CR values from the Tool and use them in an Excel spreadsheet. If you do this then make sure you check calculations by running one or two through the Tool as well as your spreadsheet

2. If you have multiple entries for a single year you could use Tier 3 to input mean values with an associated pdf.

On a different note, it looks like you have access to a large and potentially useful dataset, please consider making this available to the IAEA working group who are collating transfer parameter values for wildlife.

Answered by Nick Beresford 30/09/2010

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Posted: 12/08/2010

Plant geometries

From:
Marko erne
Jožef Stefan Institute
Slovenia

Question:
I am trying to apply the ERICA Tool to plants. If a plant, such as the Marsh Marigold, has a large leave on top of the stem - what dimensions should be used?

Answer:
To be honest perhaps the plant geometries have not been well thought out to date - they do not really represent whole-organisms as perhaps implied by documentation accompanying the ERICA Tool. The grass geometry in the ERICA Tool is taken from the ICRP Wild Grass RAP and is a 'grass spike'; no in soil dose rates are estimated only above ground. If you are concerned that the default plant may not adequately represent the species you want to assess then have a play with the create organism function of Tier 2 or 3: create an organism to represent your marigold leaf and compare DCC values to the default grass. We'd be interested to hear what you find.

Answered by Nick Beresford 26/09/2010

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Posted: 23/09/2010

Are dose conversion coefficient formula in ERICA consistent?

From:
Marko erne
Jožef Stefan Institute
Slovenia

Question:
In the ERICA Tool are the all of the DCC values estimated using the same methodology or is Monte-Carlo simulation used on for terrestrial organisms?

Answer:
The key factor in the estimation of DCC is the absorbed fraction, and this is always calculated by Monte Carlo simulation using a phantom geometry. The only difference is that, historically, in FASSET, the aquatic and terrestrial formulas were calculated by two different Monte Carlo methods, but for ERICA the Ulanovsky and Proehl sphericity method (see ERICA papers) was adopted for everything, after having checked that, for aquatic organisms, both methods gave very similar results.

Answered by Jordi Vives i Batlle 23/09/2010

But note for terrestrial animals a shielding factor due to fur/feathers/skin is applied in the estimation of external dose rate. This is not used for aquatic animals.

Added by Nick Beresford 24/09/2010

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Posted: 09/08/2010

Question on aquatic ecosystem occupancies

From:
Susan Schneider
Serco
UK

Question:
In the aqueous (ie marine and freshwater) environments, I can see how the dose rates relate to fractions of time spent in-sediment and in-water, and to water and sediment concentrations (using the distribution coefficient Kd).

Looking at Tables 14 and 15 in the ERICA Help (which I realise correspond to Tier 1 assessments, and therefore have default occupancies which maximise the exposure), it looks as though time spent on the sediment surface counts as 0.5 x in-sediment and 0.5 x in-water. And at the water surface, it counts as all in-water.

Please can you clarify in Tier 2 how ERICA uses the input occupancies (of which there are four, in-sediment, sediment-surface, in water and water-surface).

Answer:
*In Tier 2 you can select the occupancy factors to be what you want - these are used to determine the external exposure only. The dose rate at water surface will be 50 % of that in water column. The DCCs for sediment and water are the same. For sediment-water interface the dose rate is ([0.5 *DCC_external*sediment activity concentration]+[0.5*DCC_external*water activity concentration]). The DCCs for sediment and water are the same. See response posted to question (from Marko erne) below re how occupancies are (not) used in estimatation of internal dose rate.*

Answered by Nick Beresford 09/08/2010

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Posted: 05/08/2010

Question about dose rate to flying animals

From:
Susan Schneider
Serco
UK

Question:
Please can you clarify about contaminated air.

Box 4.1 in The D-ERICA :Integrated Approach report, mentions chronic atmospheric releases of H, C, P and S, and in the report R+D 128, Sec 5.6, dose rates for these are calculated from concentrations in air.

Has this dependence on air concentration been removed in this more recent version of ERICA (I had previously used the prototype version, in Dec 2006)? Is the chronic atmospheric release only relevant when using the transport models?

Answer:
For H, C, S and P air concentrations are the input rather than soil concentrations. ERICA uses a specific activity approach to then estimate biota concentrations of C&H (there's an article by Galeriu et al describing this). This is in-line with approaches taken for human assessment (e.g. see IAEA 2010 TRS472). Honest answer to S and P is that ERICA adopted parameters from R&D128.

Note that the air concentrations are used to estimate activity concentrations in biota they are not used to estimate external dose rates from air. External dose rates for H, C, S and P are assumed to be zero in the ERICA Tool anyway (most models assume zero or very low external dose rates - see Vives i Batlle et al 2007.)

Answered by Nick Beresford 05/08/2010

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Posted: 05/08/2010

Question about terrestrial occupancies in ERICA

From:
Susan Schneider
Serco
UK

Question:
My question is about terrestrial occupancies in ERICA, which I would like to clarify for a report I am writing. In the database, terrestrial DCCs are provided for three habitats, in-air, in-soil and on-soil. However in the ERICA Help, only two terrestrial habitats are defined in Figure 5. Habitat 6 must be In-soil, but is habitat 5 On-soil or In-air? Is it assumed that air-borne contamination is insignificant? (I am using media concentrations, not the transport models provided in ERICA). Surely the In-air habitat would need to be included for eg birds and flying insects?

Answer:
You are correct in saying that Figure 5 shows only two habitats for terrestrial ecosystems - Habitat 5 is 'on-soil'. However, you are able to consider flying organisms and a fraction of time in-air can be defined in Tiers 2 and 3 for some organism types - 'Occupancy Factors and Radiation Weighting Factors' screen. There are some limitations on sizes of organisms for which in air dose conversion coefficients can be calcuculated using the create organism wizard (see Table 10 of the Help file). Note the dose rate estimated to a flying animals is that from contaminated soil and not contaminated air. There is no consideration of external dose rates from contaminated air in the ERICA Tool (nor is it considered in either R&D128 (exception being noble gases) or RESRAD-BIOTA). The in-air habitat is not shown on Figure 5 as this presents the habitats consider during the estimation of the Environmental Media Concentration Limits used in Tier 1; these only consider the scenarios likely to give the highest dose rate.

Answered by Nick Beresford 05/08/2010

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Posted: 28/07/2010

Use of the 'IAEA SRS-19 estuarine dispersion model' within the ERICA Tool

From:
Corynne McGuire
University of Strathclyde
UK

Question:
When using the estuarine model should I be using the estuary width and depth at the point of discharge or should it be the maximum width and maximum depth?

Answer:
Good question ... we may have added - should it be the assessment site or should it be the average values for the estuary between the point of discharge and the assessment site to your options. We would probably not suggest using the maximum values for the estuary although the minimum values should result in a conservative assessment if that is your aim. Unfortunately there appears to be no guidance on this in the IAEA SRS-19 document (http:www-pub.iaea.org/MTCD/publications/PDF/Pub1103_scr.pdf).

For flow rate the SRS-19 text on the estuarine model (see Section 4.2.2) states that the flow rate for the river upstream of tidal limit should be used.

Answered by Nick Beresford with input from Justin Brown (Norwegian Radiation Protection Authority) 05/08/2010

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Posted: 28/07/2010

Choice of analogue radionuclides to represent radionuclides that are not included in the ERICA Tool

From:
Corynne McGuire
University of Strathclyde
UK

Question:
I was wondering if you can offer advice on what to do when chosing analogues to represent radionuclides that are not included in the ERICA Tool or when the radionuclide is unknown and in a vague category such as other non-alpha radionuclide? I have attached an excel document with the list of radionuclides and vague categories that I will need to assess with suggested analogues.

Answer:
To represent radionuclides not included within the Tool as defaults your are assuming Pu-239 for all alpha-emitters and Tc-99 for all other categories you have to assess, which is as suggested by the England and Wales Environment Agency (EA) . You could argue this approach on the grounds of consistency. However, it depends upon the purpose of your assessment - do you want to be conservative?. If yes then the analogues suggested by EA may not always be the most conservative choices. However, the ERICA Tool allows you to explore alternatives as it has more fuctionality than the EA approach:

(a) You could add some of the missing radionuclides to the ERICA Tool and generate your own EMCLs. Some of the elements (e.g.) Ce already have transfer parameters. This would involve using Tier 3 and you would then have to compare the resultant Environmental Medial Concentration Limits (EMCLs) to your media concentrations outside of the Tool as the user cannot add EMCLs (see Brown et al. 2008 for details of how to estimate EMCLs);

*(b) look at the available EMCL values and pick the most conservative (i.e. lowest) available dependent upon emitter type. You can view the Tools EMCL value by selecting **Database** and then **Parameter Database** from any screen within the Tool.*

There is not a definitive 'correct' answer to this question - but you need to justify your choice.

Answered by Nick Beresford 05/08/2010

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Posted: 07/06/2010

Modelling exposure to Acacia trees growing on a waste burial trench

From:
Marko erne
Jožef Stefan Institute
Slovenia

Question:
Acacia has it's roots 0-2m deep in the waste (part in Zone 1 and part in Zone 2) and has also aboveground part. How to use occupancy factors in this case? The major part of the tree is above the soils, so in that case we will use on soil, but the dose from ionising radiation here is a consequence of underground direct contact and aboveground part, but according to permitted occupancies for tree reference organisms (ERICA help) we could use occupancy factor just on soil? Does this approach include also the roots? How to deal with such cases?

Answer:
This question is in regard to one of the IAEA EMRAS II programme Biota Modelling Group (WG4) scenarios - Little Forest Burial Ground, Australia. The Zone 1 referred to in the question is contamination at >1 m depth into which it is assumed the Acacia roots.

An interesting question as you are correct in that the ERICA Tool considers plants to be on the soil surface and in the case of trees the assumed geometry is the trunk (specifically the ICRP Reference Pine Tree trunk geometry as defined in ICRP Publication 108). Therefore, the default tree reference organism within the ERICA Tool may not model this scenario very well especially with regard to external dose rates. It would be a fair criticism of the currently available models to say that perhaps the dosimetry for plants requires some further thought. However, scenarios such as this are proposed to make you think and identify problems and (hopefully) solutions. It's not the purpose of the exercise to tell participants what to do - but there are (probably) ways you could try to get around the limitations of the ERICA Tool - although you may then need to consider how to interpret the results. RESRAD-BIOTA has a default geometry which is stated as appropriate for plant roots (default geometry 1 with dimensions 0.2x0.2x0.2 cm and allows any organism type to me modelled as in soil); the Environment Agency R&D128 spreadsheet model also probably has a default geometry more analogous to plant roots. Note that the default CR values in both these models can be highly conservative - read the documentation before using.

Answered by Nick Beresford 08/06/2010

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Posted: 25/05/2010

Effect of occupancy factors on estimated wholebody activity concentrations

From:
Marko erne
Jožef Stefan Institute
Slovenia

Question:
How does the geometry or occupancy factor within the ERICA Tool influence the CR value?

Answer:
There is no transformation of CRs according to geometry or occupancy factors - these are used by the ERICA Tool to determine dose rates only. Occupancy factors influence external dose estimates only. However, perhaps the guidance within the ERICA Help is to some extent misleading as it suggests the user can use the occupancy factors to model organims which do not spend 100 % of their time in a given ecosystem. However, if for example an occupancy factor of 0.4 is used the external dose rate would be reduced to 40 % of that if the organism was assumed to spend 100 % of its time in the ecosystem under consideration, whereas, the internal dose estimation (and wholebody activity concentration) would be the same (as if the animal spend 100 % of time in the ecosystem).Note that the Area Factor (AF) parameter in RESRAD-BIOTA is used in the estimation of internal dose rate (although the reported tissue activity concentration appears to stay the same regardless of the value of AF).

Answered by Nick Beresford 07/06/2010

If you want to model an organism as spending only a proportion of time in a contaminated environment using the ERICA Tool then perhaps the simplest approach is to use an occupancy factor of 1.0 and multiply the resultant dose rate by the fraction of time spent in the assessment area.

Added 09/08/2010

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