



**RESPONSES TO WEB-BASED CONSULTATION ON DRAFT BNFL REPORT:  
 “RADCONTAB 0.3: A look-up tables tool for radiological assessment of contaminated land on Nuclear Licensed Sites”**

**THIS VERSION DATED 5 JANUARY 2005  
 REFLECTING LATEST VERSIONS OF THE TOOL (RADCONTAB 0.5) & REPORT (Draft 7)**

Source of comment (including affiliation)	Summary of comment	BNFL response	Explanation of BNFL response
I Barraclough, Enviros	My main comment is that the logic of the scope is slightly odd. The scope explicitly excludes the long term implications of the contamination and land uses that are incompatible with a nuclear-licensed site. This rules out (obviously intentionally) any usefulness for assessments linked to delicensing the land, but I would think it also (perhaps also intentionally) makes it unsuitable for Part IIa-type assessments, which need to consider potential as well as current impact (e.g. potential impact on groundwater of contamination in the soil, which is not included in the look-up tables). Hence, it is not really a general tool for assessment of the need for and efficacy of remediation. This leaves it as a tool for assessment of the immediate situation, the sort of hazard assessment relevant to IRRs/NIA/HSWA regulation (i.e. ‘NII territory’), which seems to fit the stated intention.	Noted for future consideration	These exclusions from the scope are indeed intentional, as set out in the specification, which was subject to extensive consultation. BNFL would welcome views as to whether the spreadsheet-based structure of RADCONTAB is thought suitable to be extended to radiological assessments in the context of de-licensing and the future Part IIa regime for radioactive contamination.
I Barraclough, Enviros	This scope does not sit very easily with the omission of short-lived radionuclides. Yes, the focus might be on historical contamination, but if the interest is only in short-term assessment then it must be on the <u>overall</u> situation in the short-term. On a nuclear licensed site, this should take account of any	Not incorporated in full.	In practice, any ground contamination containing short-lived radionuclides (i.e. in the immediate aftermath of a spill or leak) will be dealt with in the short term by immediate actions by the Licensee. These actions will be driven by direct measures of radiation dose and contamination levels,

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	short-lived contamination, even if that is not the primary focus.		leading to imposition of additional controls required to implement the IRRs. RADCONTAB is designed to allow assessment of residual contamination over medium term timescales (i.e. several years). This is made clearer in the final report. See Section 1.5 paragraph 3.
I Barraclough, Enviros	More philosophically, the scope suggests a rather short-term attitude, which I'm not sure SAFEGROUNDS ought to be encouraging.	Noted	We reject the notion that the development of a tool focused on short to medium term applications implies a 'short-term attitude'. We agree that long term radiological assessments (especially after de-licensing) will need different tools, some of which exist already. It is emphasised that BNFL has never sought SAFEGROUNDS endorsement of RADCONTAB. We are grateful for the use of the SAFEGROUNDS web-site as a means of consulting as widely as possible on the project.
I Barraclough, Enviros	I like the approach of having text discussing the choice of parameter values rather than just tables of default or recommended values.	Noted.	
I Barraclough, Enviros  G2	The report says how important it is to consider data uncertainties, and discusses some of them, but not others. In particular, it is fairly clear that the user input parameters are uncertain, but data such as dose coefficients are tabulated as though relatively certain. In fact, any of the dose coefficients is probably more uncertain than, say, breathing rates. (Of course, this report is by no means unique in this respect).	Noted.	The final report contains strengthened statements on uncertainty in dose coefficients and other 'hard-wired' parameters (e.g. soil to wild food transfer factors).  See Section 4.2, final paragraph. Section 4.3.7 first paragraph.
I Barraclough, Enviros	It might have been worth a few words to explain why such a comprehensive assessment contains no consideration of fauna as 'wild foods'. It is a long shot to suppose that someone might	To be incorporated.	The final report addresses these comments. We did consider including fauna, but this would require soil to fauna transfer factors that do not exist and would vary

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G3	eat, say, a pigeon or rabbit that has been on a contaminated area (or come into contact with it or its droppings), but it is not entirely obvious that it is more far-fetched than the blackberries and mushrooms being on just that bit of land that is contaminated and outside the fence.		enormously from site to site, depending on land use and the habits of the fauna concerned, including faunal ‘occupancy’ of the contaminated soil. Even then, the user would have to make assumptions about how much of the hypothetical contaminated fauna would be killed and consumed by local people. This type of assessment is in our view in the same category as agricultural use of parts of nuclear licensed sites – i.e. highly site-specific. Section 2.2.5, final paragraph.
I Barraclough, Enviros G4	Some mention of the reasons for not considering radon from Ra-226 contamination might be worthwhile, just to make clear it wasn’t forgotten.	To be incorporated.	The final report addresses this comment. Appendix 1: New paragraph 5 added.
G Smith, Enviros	I would hope that we do not get into endless debate on specific values of parameter. The conceptual framework is more important (and the processes included in the models).	Noted.	Our aim has been to make the ‘hard-wired’ parameter values as non-controversial as possible (within an ICRP-based assessment context). The main exceptions may be the soil to wild food transfer factors, for which there are few available data. We have sought to put the onus on the user to justify the input parameters, so there is likely to be some debate over very application of the tool. We consider that the conceptual framework and is appropriate to the stated scope of the tool. We have kept the modelled processes to a minimum.
J Penfold, Quintessa	We would like to endorse previous comments that the look-up tables represent a very useful addition to the tools available to undertake assessments of contaminated land on nuclear licensed sites. We see that a key benefit is that they can be regarded as a standard source of data and models that will help engender consistency in the approach to simple assessments, which also	Noted.	

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	encourage the user to define assessment-specific values for key parameters. We recognise that not all stakeholders will necessarily agree with the approach, and that it is only suitable to apply in certain circumstances, but there remain good arguments for a degree of consistency in approach amongst the nuclear industry.		
J Penfold, Quintessa  G5	It would be of benefit if there were some additional guidance on when and where the look-up tables should be used. This could refer to the SAFEGROUNDS land management guidance. This could recognise the different levels of detail that could be required (i.e. akin to the Tiered approach for general contaminated land), and at what level the look-up tables fit	To be incorporated.	The final report addresses this comment.  Section 1.2, paragraph 3.
J Penfold, Quintessa	The models and data are clearly presented and referenced, in terms of the equations and their implementation in the spreadsheet.	Noted.	
J Penfold, Quintessa  G6	In relation to Section 4 (guidance on inputs), the specification of a potential exposure group, and choice of parameter values to represent the exposure group, is never easy. There is a substantial amount of discussion of the issue in the literature. Although most guidance relates either to prospective assessments associated with disposed waste (e.g. the BIOMASS programme <sup>1</sup> ) or assessments of present-day routine discharges (e.g. the work of the National Dose Assessment Working Group <sup>2</sup> ) the general principles are relevant. We think, therefore,	To be incorporated.	The final report addresses this comment.  Section 4.2, new paragraphs introduced.

<sup>1</sup> International Atomic Energy Agency. 'Reference Biospheres' for Solid Radioactive Waste Disposal – Report of BIOMASS Theme 1 of the BIOSphere Modelling and ASSESSment Programme. Report IAEA-BIOMASS-6, 2003.

<sup>2</sup> See [http://www.ndawg.org/Subgroup\\_habit.htm](http://www.ndawg.org/Subgroup_habit.htm)

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	<p>that some additional guidance on this issue would be of benefit.</p> <p>A clear and logical procedure for describing the potential exposure group (in qualitative terms) is also a very useful preface to the task of selecting an appropriate, and consistent, set of parameter values.</p>		
J Penfold, Quintessa	<p>In relation to the information currently presented in Section 4, we think the distinction between qualitative and quantitative guidance is a good way of structuring the advice.</p>	Noted.	
J Penfold, Quintessa  G7	<p>At present, Section 4.2 only really lists the choices that can be made in terms of age and whether the exposed individual is a worker or member of the public. As noted above, we think that this section would benefit from substantially more information, such as how many potential exposure groups is it reasonable to consider (and what ages?), how are they to be selected and defined (in qualitative terms), the identification of relevant pathways for each, and the nature of the exposure group (pessimistically-defined, or representative of a 'real' person?). Underlying the process of selecting potential exposure groups for consideration is an inherent desire to manage the uncertainties by identifying and selecting a sufficient diversity to cover the range of situations that, in practice, could occur. This aspect (indeed, the management of uncertainties in general) is not discussed. Finally, it may be worth noting that workers and public may need to be considered against different assessment criteria.</p>	In part to be incorporated	<p>Section 4.2 references section 2.1 where there is more background information to the exposure groups listed. Some qualitative guidance is now provided on the need to cover a number of exposure groups and subsequent coverage of various exposure pathways. See Section 4.2, new paragraphs introduced.</p>
J Penfold, Quintessa  G8	<p>In Section 4.3.1 (guidance on inputting concentrations in soil and water), we think it would be useful to note the importance of radionuclides that may be difficult measure. This naturally</p>	To be incorporated.	<p>The final report addresses this comment in a qualitative manner, noting the difficulties with the 'fingerprint' approach for contaminated ground, due to different</p>

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	raises the specification and use of radionuclide scaling factors (or 'fingerprints') to determine approximate concentrations of unmeasured radionuclides. We think this technique should be referred to in this section.		environmental mobilities of different radio-elements. It does not suggest any fingerprint ratios. See Section 4.3.1, paragraph 1.
J Penfold, Quintessa G9	A diagram of the geometries used for direct radiation calculations would be helpful	Not incorporated.	No diagram given; instead Section 4.3.3 references geometries described in Section 2.2.1
J Penfold, Quintessa G10	In Section 4.3.5, having noted the variability of dust concentration parameters, it might be helpful to include some 'further reading' references, although there is of course the possibility that this would detract from the (eminently reasonable) recommended values. One useful source is NCRP report No 129 <sup>3</sup> (although this does relate to the assessment of contaminated soil in the US, and some environmental factors may differ from the UK).	To be incorporated.	We have obtained NCRP report no. 129 which indeed is a useful information source. Final report refers to it in section 4.3.5 for further reading.
J Penfold, Quintessa G11	We think it would also be useful to refer to the different aerosol particle sizes that are inherent in the ICRP dose coefficients for workers and members of the public here (as is done in Appendix A).	To be incorporated.	See final report, Section 4.3.5, paragraph 1.
J Penfold, Quintessa G12	The same comment as noted for 4.3.5 applies here, in respect of the soil ingestion rates. NCRP report 129 also has some useful discussion of this issue.	To be incorporated.	We have obtained NCRP report no. 129 which indeed is a useful information source. Final report refers to it in section 4.3.5 for further reading.
J Penfold, Quintessa G13	The calculated doses for some radionuclides (most obviously tritium) could be dominated by the water ingestion pathway. Whilst there are already some caveats in the report, we think it	Not incorporated.	We consider that Section 4.3.8 is satisfactory as it is.

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<sup>3</sup> National Council on Radiation Protection and Measurements (NCRP). Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies. NCRP Report No. 129, January 1999.

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	may be worth providing more specific notes of caution concerning the use of any results calculated for water ingestion, in the context of the likely areas of application of the look-up tables.		
J Penfold, Quintessa G14	Examples are always a useful way of ensuring that a tool is used correctly. We think that the example presented in Appendix 5 could benefit from some more description, in particular to illustrate why particular parameter values were chosen, and how the results can be used.	To be incorporated.	Appendix 5 has been restructured and provides description of the worked example up front (via Figure A1). There is also reference to increased functionality of the tool here.
J Penfold, Quintessa	The spreadsheet is largely straightforward to understand and use, and easy to navigate. It is useful to include the suggested quantitative guidance on parameter values.	Noted.	
J Penfold, Quintessa T1	It would also be useful to include comments on the scope and applicability of the look-up tables within the spreadsheet (in case, for example, they are used without proper reference to the accompanying report).	To be incorporated.	A new 'Instruction' worksheet has been added to the spreadsheet tool. See Section 3 in revised report.
J Penfold, Quintessa T2	It would be useful for there to be additional boxes in the spreadsheet where the user can enter general information about the nature of the calculation, so that the spreadsheet could be saved with a measure of 'self documentation'. General issues that could be documented in this way might include the reason for the assessment, key assumptions, a description of the nature of the contamination, and a description of the potential exposure group that is being considered.	To be incorporated.	New Scenario Information worksheet added to spreadsheet tool. See Section 3 in report and Figure A12.
J Penfold, Quintessa T3	Given that the user is encouraged to specify their own choices for parameter values, we think it is better not to include any entries in the input boxes. These give the impression of suitable 'default' values, which might not necessarily be appropriate.	To be incorporated.	Agreed.  Will be carried out in final release version 1.0 of RADCONTAB.

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J Penfold, Quintessa T4	It would also be useful to include a box next to the input value in which the user could enter a sentence or two referring to why the selected value was chosen.	To be incorporated.	'Basis of Input' box added to tool.
J Penfold, Quintessa T5	It might be useful to summarise the range of input data specified by the user (with associated comments entered in text boxes) on one page, which would give a convenient overview of the calculation.	To be incorporated.	Incorporated in new 'Scenario Information' worksheet.
J Penfold, Quintessa T6	It may be useful to provide a summary of the dose calculated for each pathway, and an overall 'grand total' (as presented in Figure A10 of the report).	To be incorporated.	Achieved via new 'Overview – Total Dose' worksheet added to tool. See Section 3 and Appendix 5 (Figure A13).
J Penfold, Quintessa	Previous comments on the specification of the tables mentioned the potential benefits of using the tool to calculate 'clean up levels' for a specified level of dose. Whilst it would be necessary to provide a cautionary note on the use of such results, we think that it might be helpful to include the option of calculating them.	Not incorporated.	We think that this would increase the risk of mis-application of the tool to contexts for which it is not intended. Calculation of contaminant levels equivalent to a specified level of dose would of course be straightforward to do by using an appropriate additional worksheet to be constructed by the user.
M Hill (independent consultant)	I think the look-up tables will be a valuable tool for BNFL and for other organisations. It seems to me that the tool will be particularly useful for rapid assessments of the likely significance of contamination, for example when site characterisation is in progress and there has not yet been time to carry out any detailed site-specific modelling.	Noted.	This is more or less exactly why the tool was developed.
M Hill (independent consultant) G15	That said, I think that the report needs to make it clearer that the tables should never be used as a substitute for a full radiological assessment. The main reason for this is that they only deal with doses in the short term. If only the tables were used then it would be possible to judge contamination to be insignificant on the basis of short-term doses when it would be judged to be	Incorporated.	We thought we had made this clear, but as this is a recurring comment, warnings and caveats evidently need to be strengthened.  See Section 1.5



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	significant on the basis of long-term doses.		
M Hill (independent consultant)  G16	I am not convinced that the tables can be used by ‘relatively non-specialised assessors’. It seems to me that, for some exposure pathways, assessors need to be fairly experienced in order to make sensible assumptions.	Incorporated in part.	The revised report amplifies this statement to make it clearer what is meant – i.e. a full familiarity with the underlying dose models is not required. The ‘experience’ required is indeed in making sensible assumptions (rather than in performing the right calculations). See Section 1.2.
M Hill (independent consultant)  G17	I believe that users of the tables will need more guidance than is given in them and in the report on the dermal contact, soil ingestion, wild foods and drinking water pathways. I suspect that, with only the current guidance, inexperienced users could be led to think that these pathways are much more important than they really are.	Not incorporated.	We consider that the report deals satisfactorily with these matters as is.
M Hill (independent consultant) G18	Section 1.2, page 9: This would need some redrafting if BNFL accepts my general comments above.	Incorporated.	Section 1.2 has been redrafted accordingly.
M Hill (independent consultant)	Section 2.2, page 14: I do not understand why open wounds are excluded for members of the public. Surely a child with a grazed knee could be exposed via this route.	Noted	We consider that we can exclude wounds, as they are likely to be grazes with a limited amount of surface area contact with soil contaminants, particularly if covered by clothing. We think the unlikely event of a deep gash might warrant consideration.
M Hill (independent consultant)  G19	Section 2.2.2, page 16: I think inexperienced assessors would have great difficulty in understanding what they are calculating here and why, and what the results mean. Without looking back at ICRP (1991) it is not possible to know what is meant by ‘UV exposed skin’ and how it differs from one age group to another. Nor is it clear why 0.5 is used as the fraction of UV exposed skin contaminated with soil for workers and for all age groups in the public. Plus the text refers to occupancy at the site when what is meant is time with contamination on the skin (as is	Incorporated.	Added explanation to Section 2.2.2.

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	made clear on page 26). Lastly, the note about effective dose and equivalent dose to the skin is obscure, to say the least.		
M Hill (independent consultant)  G20	Section 4.3.2, page 25: It seems rather old-fashioned to consider 2000 hours as a typical working year. In most EU countries most employees, and certainly those on nuclear sites, work rather fewer hours per year.	Incorporated	Revised value of 1800 hours per year added, though without reference. This equates to 240 working days at 7.5 hours per day. Also 21 days leave per year (including public holidays) after allowing for 52 weekends and 365 days per year.
M Hill (independent consultant)	Section 4.3.6, pages 28 and 29: The text here left me with the impression that none of the soil ingestion rates given are appropriate for contaminated land assessments for nuclear-licensed sites. It seems to me that it is not sensible to have annual ingestion rates for soil at all. It would be better for the tables to use hourly rates, and occupancies in hours per year, linked to activities on the land and differing for workers and the three public age groups.	Noted	The idea of using hourly rates and occupancies in hours per year is sensible, but current approach of using annual soil ingestion rates has been explained adequately and is consistent in terms of using annual rates (water consumption and wild foods) for other ingestion exposure pathways.
M Hill (independent consultant)  G21	Section 4.3.7, page 30: I do not believe that the ingestion rates given for blackberries and mushrooms would ever be appropriate for use in a contaminated land assessment, because they are for a 'total annual crop'. It would be more useful in the tables to give yields (ie amounts of blackberries and mushrooms that typically grow on unit area of land) and growing seasons and leave the assessor to choose occupancies.	Incorporated in part.	We agree that the ingestion rates quoted could be misinterpreted, and the report has been amended to strengthen the caveats to discourage inappropriate assessments. However, we do not see how an assessor can more easily arrive at an ingestion rate via yield and occupancy. The revised report points out what should be obvious – i.e. the amounts of wild food harvested by an individual from a contaminated area are likely to be very small.  In section 4.3.7, there is now reference to total annual crop and guidance panels have been modified, also now to deal with two separate wild food categories.

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M Hill (independent consultant)  G22	Section 4.3.8, page 31: Again the water drinking rates given are never going to be appropriate for a contaminated land assessment. I would suggest that values be given based on occasional consumption of stream or spring water during recreational activity on the land. Perhaps the tables could include volumes of water drunk per visit to the land and the assessor could input the assumed number of visits in a year.	Incorporated in part.	The revised report contains illustrations of the volume of contaminated water drunk on a visit to the land and the number of times per year that such water would be drunk.  Section 4.3.8 modified accordingly.
S Watson, NRPB  T7	The spreadsheet and accompanying report looks pretty good. Even without looking at the report first, it was fairly easy to work out what to do. However I would say having an "instruction" page with just a few notes such as to enter user values in the yellow cells, read the green cells for the results and consult the bright blue cells for guidance on parameter values would be helpful for the new user, without getting in the way of experienced users.	Incorporated.	An 'instructions' worksheet has been added.  New Instructions worksheet has been added in tool with added text in Section 3 and extra clarity proved in Appendix 5.
S Watson, NRPB  T8	Having worked that out I then found that on pages "Ext dose factor" and "Dose co intskin" the yellow cells would not allow user input, so would comment that perhaps they should be a different colour?	Incorporated.	The spreadsheet has been amended appropriately.
S Whiting & D Haigh, Golder Associates	Firstly, we feel that the tables do provide a relatively easy way of estimating dose rates for various scenarios and are a useful addition to the 'toolbox'.	Noted.	
S Whiting & D Haigh, Golder Associates	We were pleased to see the comparison with the NRPB approach and, although have not had the opportunity to do this ourselves at this stage, feel that this is a significant requirement to justify widespread use of the 'Look-Up tables'.	Noted.	
S Whiting & D Haigh, Golder	At this stage the guidance provided with the tables is minimal and it is up to the user to justify input values etc. Depending on	Incorporated.	A paragraph on the merits of realistic or conservative approaches has been inserted in the introductory sections of

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Associates  G23	the use of the table, either a realistic or conservative approach could therefore be utilised for the same scenario. It is accepted that the effectiveness of any approach will be down to the robustness but maybe some rules (or thoughts) for engagement may be useful.		the report, noting that the tool can be used for either type of assessment. See Section 1.2, final paragraph.
S Whiting & D Haigh, Golder Associates	The tables are currently deterministic and given the uncertainty associated with the input (and output) parameters a probabilistic approach may provide a more rounded result. It is recognised that this could be achieved by modifying the tables slightly and using Crystal Ball or @Risk software add-ins.	Noted.	The tool is intended for use as 'freeware' by anyone with just a Microsoft Excel licence. Users can potentially customise the tool to allow probabilistic add-ins.
H Richards, BNFL (user perspective)  T9	The use of a drop-down menu to choose between different wild food options could be the only thing preventing a summation over all exposure pathways if both types of wild food were being consumed by the exposed person being considered.	Incorporated.	Separate work-sheets for different types of wild food have been included. This action has been carried out in the tool and is illustrated in Section 3 and Figures A4 and A5 of the guide.
N Jefferies, Serco Assurance	Clarification of critical soil ingestion rate and the possibility of using an hourly rate and an exposure occupancy.	Noted.	The soil ingestion rate is considered adequately described. We would rather keep with annual ingestion rate in keeping with other ingestion pathways considered.