

**Peer Review of USEPA Building Preliminary
Remediation Goals (BPRG) for Radionuclides
By Dennis Paustenbach , ChemRisk, Inc.
(May 23, 2006)**

General questions

1a. Are the purpose and scope of the guidance document clear?

Response: I think the discussion of the purpose could be improved.
Here are my suggestions:

- 1) State in the first paragraph of the introduction "how" the BPRG is going to "assist" risk assessors. I think what you mean is that you have developed a procedure which helps identify concentrations of radionuclides in soil which should not pose an increased health risk to residents.
- 2) The words "streamlining" the remediation are used in the first paragraph of the introduction. I guess I would say that "The BPRG approach should allow the risk manager to quickly identify the likely costs of various target soil clean-up concentrations". Is that what you mean to say?
- 3) It seems to me that you have developed this tool to allow risk managers to quickly identify likely soil clean-up levels....and that the results should be similar to those which will result from the application of more sophisticated approaches.
- 4) Paragraph 3 of the introduction. There is a grammatical problem with the sentence that says "important to demonstrate the equations".

1b. Does the document accurately represent existing guidance regarding risk-based PRGs and explain how it fits within this existing context?

Response: In large measure, this is accomplished.

- 1) I have no significant comments on this matter. It would be good if the document would cite the other PRG documents.

1c. Does the document clearly state for what purposes it is applicable and for what purposes it should not be used? Please explain.

Response: The ideas are all presented but it would be much better if a heading were provided that said "proper and improper uses of the BPRG". I would suggest that bulleted examples of when it should be used and not be used be provided. This would remove any ambiguity.

2a. Is the intended audience of the BPRG calculator clear?

Response: As before, I think the document would be improved if a separate heading were added with the title "intended audience". From what I can determine, nearly anyone can find a benefit.

2b. Can the calculator be effectively used as is currently presented for site-specific BPRG calculations?

Response: Yes. I have some recommendations about how to make it more effective to the user. First among them is to provide a set of supplemental references. There are a couple dozen key documents, which are not government publications, that should be brought to the attention of the readers.

2c. Does the supporting material provide the appropriate level of detail, technical content, and referencing for the intended audience?

Response: This is an area that needs improvement. More explanation is needed regarding why certain exposure factors were selected. The studies underpinning the selection should be discussed and cited. If the desire is to keep this document simple, then the details that I am recommending could be provided in an appendix.

2d. Please explain and identify specific recommendations for improving the BPRG calculation tool.

Response: Actually using the tool could be a bit more straightforward for those who don't often use "on line" programs.

3a. Is the approach reflected in the BPRG calculator consistent with existing risk-based PRG guidance and practice and does the calculator adequately account for differences between:

- i) outdoor and indoor environments; and
- ii) chemical and radiological contaminants?

Response:

- a) I did not find it easy to understand how the various exposure factors varied between the indoor and outdoor environment.
- b) For example, on page 7 of 19, there is a discussion of the Exposure Parameter Justification. This would be better organized by discussing the Exposure Factors for Estimating Outdoor Intake...followed by a discussion of Exposure Factors used to Estimate Intake due to Indoor

exposure. This is necessary and the original references, not EPA guidance, should be cited. The reader deserves to know the rationale for the selection (in summary form). Otherwise, they must go back and look at the original EPA document (which sometimes is not current and sometimes weighs data in a very conservative manner).

- c) For example, under exposure time, you are referred to the exposure scenarios to figure out how the hours were distributed between the "time indoors" vs "time outdoors" for the various age groups.
- d) Along these lines, it has been advocated in a number of papers that humans can be placed into as many as 3-5 categories (age brackets) over their lifetime. As exposure factors become more refined, I think this is appropriate. For example, age 0-1.5, 1.5-3.0, 3-9, 9-18, 18-70 years. This may be more detail than needed in this document.
- e) The above recommendation applies to each of the exposure factors. It would be good to make the "indoor" vs "outdoor" assumptions more clear.

3b. What other important factors, if any, should be considered in the BPRG equations? Please explain.

Response: I have NOT run a sensitivity analysis on the equations but I believe this needs to be done. I could do it if I looked at the document for another week.

- a) A sensitivity analysis would tell me which factors are "driving" the results. Normally, it is the degree of loading of the dust onto the hand or fingers which drive the assessment (then ingested). Sometimes, it is the actual ingestion of soil.
- b) After one understands what is driving the outcome, then you want to drill down and see if the exposure factor selected is truly based on the weight of evidence or if it is simply "a conservative value that has been used in regulatory guidance for many years".
- c) The dissipation rate constant (k) is important. As noted in the document, sometimes it can drive an assessment (for certain classes of chemicals). One has to be careful with the selection of this value for radionuclides.

4a. Are the BPRG equations, sources of toxicity information, and exposure parameter default variables and values supported by risk assessment literature, existing guidance, and/or site-specific BPRG experience?

Response: As noted previously, unless one goes into the literature which is cited and analyzed in the various EPA guidance documents that are cited here, you can not determine whether the default variables and values are the correct ones. I did not permit myself enough time to do this but it can probably be done within a week (if you wanted to grant me

this amount of time).

- a) There is no doubt that I would prefer that the "primary" original study upon which the exposure factor has been selected should be cited in this document. That would alert the reader to the citation as well as the "age" of that document. Often, that alone is enough to tell the reader that the value is solid or suspect.
- b) The BPRG is clear about where the data were obtained but, as I mentioned, you have to go back and carefully examine the batch of supporting documents. This could easily be rectified by have a supplemental reference list that lists all relevant articles, by topic.
- c) I don't have a sense that this document communicates to the reader the importance of exposure to indoor dust? For example, it is normally exposure to carpets, upholstery, and toys that are the most important sources of intake by children. Surfaces on which foods are prepared are stored is often the most important source of exposure for adults.
- d) The "point-kernal method" discussed on page 17 of 19 is new to me. I would like to be directed to the original literature on this method. Currently, I can't offer constructive thoughts.

4b. Does the BPRG calculator address the most important and appropriate exposure scenarios, exposure pathways, and exposure routes?

Response: Some of my prior responses are applicable to this question.

- a) The default inputs for residential exposure calculations are quite conservative (e.g. likely to overestimate the true risk). For example, it is assumed that 100% of the time is spent indoors, that large areas of surfaces are touched, that there is NO dissipation (no cleaning of surfaces or other losses due to other factors), etc.
- b) It was not clear to me how the indoor worker and resident excel spreadsheets varied. I don't think they were provided.
- c) If there was a true PDF format, I would like to have reviewed it.
- d) Insufficient detail was provided for me to understand the various pathways and routes EXCEPT by carefully reviewing the equations. I did not see text that described how the equations were built. Normally, all of the factors (abbreviations) are described immediately below each equation. That is NOT how this is set up on the web site in the equations section. HOWEVER, it is presented in this manner in the section which discusses residential exposure to settled dusts.
- e) It would help if an example calculation were offered. From what I can determine, the current default values provide a very "upper bound" estimate of risk. Usually, one doesn't maximize ALL exposure factors when trying to identify a screening value.

- f) Perhaps, IF this approach is simply one for identifying “acceptable or virtually safe” soil or housedust concentrations, then it is fine but this should be explained to the reader.
- g) My major fear in putting out a document like this is that it will be used by persons who want a particular outcome which would enhance their own lives (thorough the legal system).

4c. Is the construction of the calculator appropriate and reasonable given the available methods, documented experience, and current practice? Please explain.

Response: My answer is fairly brief. If the objective is to generate a “best estimate” of the soil or dust concentration that is safe, then the approach is too conservative. If it is to provide a concentration which will protect the “reasonably maximally exposed (RME)” person (an outdated term), then it is probably ok.

- a) I would NOT call this calculator a reflection of “best practice”. It would be much better if one were to do this using a monte carlo approach and, using some fairly well accepted PDFs, then you could more clearly portray the risk to the RME.
- b) It is my view that it is now possible to predict, with a fairly high degree of accuracy, the likely intake of any contaminant if you truly understand the distribution of concentrations on the SURFACE of the contaminated media (soil, housedust, upholstery, toys, working surfaces, etc). It is not clear to me why this tool should not provide both a “best estimate” of intake and an RME type of result.
- c) As noted, I happen to support providing the results at the 25, 50 and 95th percentile using a monte carlo approach....since this is going to be set up using the “calculator” format. This would make obtaining this kind of information very trivial for the novice risk assessor.

d)

5a. In addition to comments provided in response to the above questions, are there any shortcomings of the guidance that diminishes its effectiveness?

Response: I don’t understand your question?

5b. Is anything missing that, if included, would improve its effectiveness? Please explain and identify specific recommendations for improving the calculator.

Response: I think I have identified the “missing pieces”. These could easily be addressed if the effort were invested. I am a bit surprised, given the age of this document, that the BPRG has not matured to a more significant degree. Having said that, it will not be difficult to do this if EPA wishes to invest the effort.

Much was learned as a result of the WTC experience, as well as the studies of some areas where housedust has been evaluated. There will also be much learned from the Univ of Michigan study of the City of Midland, Michigan.

Specific topics

1. Is the discussion of background sources of radionuclide contamination complete and are adequate guidance and citations provided to account for background in BPRG calculations? Please explain.

Response: I will defer to others on the panel on this question.

The following peer review questions relate to BPRGs for specific exposure pathways.

2. BPRGs for Settled Dust

- a. Are the equations, default values, and other input parameters appropriate for establishing risk-based BPRGs for this pathway? Please explain.

Response: I am not certain. Let me explain since I can not seem to find the core information in the materials which I have reviewed.

- 1) the key factor which dictates the magnitude of settled dust is the outdoor soil concentration and the outdoor concentration of airborne dust
- 2) then, the key factor is the particle size of the airborne particles and the particle size of the surface soil (which will be tracked indoors)
- 3) the K (dissipation factor) needs to be applied on a “per surface” basis. That is, kitchen counters get cleaned by the hour or several times a day. Conversely, other surfaces such as floors may not get cleaned for days or even weeks. Exposure frequency to each varies significantly. This should be accounted for.
- 4) I have mentioned previously that the duration values are too strict.

5) One major factor which is NOT discussed in this document is the enhancement factor between outdoor soil and indoor dust. This is not discussed much in the literature but I would direct you to an article I wrote ten years ago. It is the only such paper on this topic of housedust (Paustenbach, Long, et al...in the Inter J of Toxicology). Basically, for many chemicals, housedust often contains a higher concentration of contaminant than the outdoor soils. There are many reasons why this might occur.

b. Do the equations, default values, and other input parameters adequately account for risks to children? Please explain.

Response: This is also a difficult question to answer due to the inadequate documentation to the primary literature.

c. Is the use of the external ground plane slope factor appropriate? Please explain.

Response: I did not have a chance to evaluate this carefully.

d. Is the use of the dissipation rate, including a default input parameter of 0, appropriate? Please explain.

Response: It depends on what you want from the "calculator".

1) Clearly, a dissipation factor of zero is never going to be accurate. There is no good reason to include it if "zero" is going to be adopted except that persons can apply these formula to cite specific situations if they wish.

2) As mentioned previously, I would recommend dividing the surfaces in the house into 5-10 boxes and use different dissipation factors for each "box" or "bin".

3) There appears to be an attempt to do this in the "residential equation" using the term "fraction of time spent in compartment".

3. BPRGs for Indoor Air

a. Are the equations, default values, and other input parameters appropriate for establishing risk-based BPRGs for this pathway? Please explain.

Response: I need to examine this more carefully. From what I can determine, for the non-volatiles, it appears to be acceptable.

b. Do the equations, default values, and other input parameters adequately account for risks to children? Please explain.

Response: I would refer you to the two publications which specifically discuss exposure factors for children. One is by Val

Zartarian and the other is by Williams and Paustenbach. Both are fairly comprehensive. I doubt that they were considered (based on my review of the BPRG document).

- c. Is the use of the external submersion slope factor appropriate? Please explain.

Response: I need to look at this more carefully. I suspect that a health physicist (like Widner) can give more insight than me.

4. BPRGs for External Exposure

- a. Are the equations, default values, and other input parameters appropriate for establishing risk-based BPRGs for this pathway? Please explain.

Response: No comments.

- b. Do the equations, default values, and other input parameters adequately account for risks to children? Please explain.

Response: No comments.

- c. Is the adjusted dose rate in for using the external infinite source slope factor in a contaminated room appropriate? Please explain.

Response: No comments.