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Melissa Taylor, Remedial Project Manager
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Office of Site Remediation and Restoration
5 Post Office Square
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RE: Town of Concord, 2229 Main Street Oversight Committee
Comments on Baseline Human Health Risk Assessment December 2010

Dear Ms. Taylor,

Our committee is agreed that we were all very happy with EPA's comments on this Human Health Risk Assessment, and we are supportive of all of those comments, particularly the requests for better labeling of geographic areas in different contexts and the addition of figures that will make the document easier to understand. We appreciate all of the hard work that has brought us to this point in our investigation. We also appreciate the chance to comment during all stages of this investigation, and we are pleased and impressed with the amount of data that has been collected at this site and included in this document.

Here are the comments from the 2229 Main Street Oversight Committee concerning the December 2010 draft of the Human Health Risk Assessment. We have concerns about several ways in which exposure pathways are limited. There are also some minor technical errors in the document that do not seem to affect the general outcome of the document – in particular in the way risk from uranium is calculated in the Stow Town Forrest. We also have some strong feelings about changes that could improve the readability of the document. There are detailed notes from different members of the committee below, but I will try and summarize the concerns.

These are the concerns about the substance of the document:

- In the case of a home garden, there is not enough consideration of exposure to soil through adherence to the surface of root crops, or the plant uptake of heavy metals. (Kerry)
- Risk from hot spots at the edge of the bog and northeast wetlands may be averaged out by a poor choice of exposure area boundaries. (Pam)
- The exposure areas in the bog should have the same boundaries in this document and in the Environmental Risk Assessment. (Pam)

- The exposure to surface water and sediments in the bog and northeast wetlands should include swimming. (Pam)
- The exposure time for soil should include rainy days, and should only exclude days when the ground is frozen. (Len)
- The dust inhalation model for a resident should be the same as for a construction worker for at least one year's worth of exposure. (Len)
- The skating rink should be listed as a site specific type of exposure. (Steve)
- The exposure pathway due to vapor intrusion is incomplete. (Len)
- The safe limit for 1,4-dioxane in drinking water should use the more protective Massachusetts drinking water standard. (Len)
- The radiation risk from subsurface soil is confusing – this may be an error in how it is calculated, or may be our misunderstanding about the model for how one is exposed to subsurface soil. (Fred)
- The uranium risk in Stow Town Forrest does not include risk from the daughter products of natural uranium. (Fred)
- Figures 5-7 & 5-12 seem to have the wrong numbers for total hazard index and excessive lifetime cancer risk – is this related to target organ? If so it should be explained. (Fred)

These are the concerns about the presentation of the document:

- The Executive Summary and Conclusions should communicate more detail to someone who has not read about the site before, should be more readable, and should use more specific terms like "incremental risk".
- The acronym list should be complete, and the first use in the Conclusions should spell out each acronym.
- The area designations should always include both the number and the verbal description of the area. (i.e. "northeast wetland.")
- In section 5 the risk data should be presented with 2 significant figures.
- Information in table 6.2, areas that are within the risk range of 10^-6 to 10^-4 but do not exceed 10^-4 should be highlighted differently and discussed separately from areas of no risk.
- There should be more informative summary figures. Pie charts that show relative risks of different COCs have very different total values, and this can be deceptive about what is really a significant contributor to risk. Perhaps some additional figures that are scaled to the same total risk, such as a bar graph like figure 5-14, or pie charts that are to the same actual risk scale (so that areas with lower risk will only show some of the pie taken.)

More detailed comments from individual committee members are listed below.

Thank you,

Pamela R Rockwell

Pam Rockwell
Chairman, Concord Town 2229 Main Street Oversight Committee (StarMet/NMI)

Comments from Len Rappoli:

Using the dispersion model for dust inhalation
On pages 43 and 44, in the section describing exposure to soil in the dust of ambient air, there are two different models for how much soil gets into the air depending on whether you are a construction worker (dispersion model) or a resident (jury model.) The dispersion model, which is used for the construction activities, is the more protective model. Since a resident might be present during construction, the dispersion model should be used to calculate the resident's exposure to soil in the dust of ambient air for the time estimated that a construction worker would be exposed, listed as one year in Section 3.3.2.

Exposure to soil on rainy days
On page 47, the model for exposure of a resident by direct contact with surface soils is limited by the weather to 161 days a year. The assumption is made that when the ground is frozen, or there is substantial precipitation occurring, the resident will be inside and will not be in contact with outside soil. This does not take into account the exposure path of a child to mud on a rainy day. Children will still play outside in the rain, and mud will adhere to them, probably more efficiently than dry soil. On a day with some rain, adherent mud will be present the rest of the day as well.

In the case of exposure to soil on rainy days, as stated in Appendix E, USEPA prefers the use of a site-specific exposure frequency for this site. The EPA national default value for evaluating direct contact with soil is 350 days but is designed to be protective of all areas of the US. For this site the RA subtracted 99 precipitation days March through November when according to the RA, outdoor play is unlikely to occur. However, the RA subtracted all days with 0.01 inches or more of precipitation. 0.01 inches of precipitation will not prevent children from playing outside. Only all day precipitation events of 1 inch or more should be subtracted.

The model should be adjusted to only exclude days when the ground is frozen or there is more than an inch of rain during an all-day rain event, and the model should take into account the increased adhesion of mud.

Significant figures
In section 5 the risk data should be presented with 2 significant figures to make the document more readable.

Vapor Intrusion
Risk from upward vertical migration of contaminants in response to a concentration gradient has been overlooked. The concentration gradient of chlorinated compound molecules migrating upward from a zone of high contaminant concentration to an overlying zone where the contaminant concentration is low should be considered, and the risk from vapor intrusion should be evaluated.

1,4-dioxane drinking water standard.
The MA Office of Research and Standards (ORS) guidance for 1,4-Dioxane is 3 parts per billion. This value should apply to the Acton Well Field because MA has primacy for implementing the provisions of the Safe Drinking Water Act and ORS has chosen to adopt the more stringent

standard. The other reason the ORS standard should be used rather that USEPA standard of 6.1 ppb is because 1,4-dioxane is likely to be carcinogenic to humans but not enough is known about human cancer risk assessment, only from studies in mice and rats. The safe limit for 1,4-dioxane in drinking water should use the more protective Massachusetts drinking water standard.

Comments from Pam Rockwell:

Exposure to sediments and surface water in the northeast wetland and sphagnum bog
In section 3.2.3, there is a discussion of how a person would be exposed to sediments or surface water in the northeast wetland and sphagnum bog. Because these areas are wetlands, exposure is limited to a trespasser. Because they are in awkward locations, it is suggested that access will be limited. Because the water is not deep enough or accessible enough to be a recreational swimming or boating area, it is assumed that the only exposure that a trespasser will have is by wading, and therefore there will be much more limited ingestion of surface water and dermal contact with sediments.

In fact, just because these areas are not legally buildable, does not mean that they will not be part of someone's backyard and therefore regularly accessible to adults, children, and pets. If there are residences built on other areas of the site, these areas will be more accessible than they are now over the steep hill from Cranberry Lane. If someone should fall into the water and flail, this could lead to more exposure to sediments and water than wading, or even typical recreational swimming.

This may seem like an unusual occurrence, but if the cooling pond is filled in, then these areas could be downhill from a playing field, and children might regularly chase lost balls into these areas. Another local example would be Fred Olsen, a former abutter who walked his dog on this property many years ago. Like all dogs, he would love to go for a swim in local surface water, or explore smelly, swampy areas. Fred attributed the early death of this dog from his exposure to the cooling pond water (perhaps correctly). But Fred's dog was well behaved, and Fred never had to run after him to fetch him out of the cooling pond. A future resident might need to regularly chase after a wet smelly, sediment covered pet in the bog or wetland. A thin coating of ice, or a deceptively stable looking surface, could regularly lead to an unintentional swim. Flailing to regain one's footing in the water might result in much more unintentional gulping of surface water and adherence of sediments to clothing and hair. Certainly the characterization of this exposure as wading does not accurately reflect the increased exposure to materials in the bog and wetlands because of the unique awkwardness of how one enters these areas. And that does not take into account the exposure from the sediment covered pet.

The exposure scenario for the northeast wetland and sphagnum bog should include much more exposure time to sediments and surface water.

Exposure areas should be consistent between the BERA & HHRA
Hot spots at the edge of the bog and northeast wetlands seemed like they would have enough risk to trigger a remediation, and yet they do not, so perhaps a real risk is being averaged out by a poor choice of exposure area boundaries. Characterizing the sphagnum bog is challenging because there are areas that are significantly more contaminated than others, so the risk is not really equal across the entire bog. In discussions about the baseline Environmental Risk Assessment, it was noted that the bog should be divided into two areas. It would make better

sense to use the same division for risk characterization for humans as well. The two documents should use the same boundaries for exposure areas in the bog and wetlands, and special care should be used to be sure that risk is not inadvertently averaged out along the boundaries with the cooling pond.

Highlighting areas within the risk range in table
Information in table 6.2, that is within the risk range of 10^-6 to 10^-4 is highlighted the same as that of no risk, and language in the document reflects the same bias. Areas that are within the risk range of 10^-6 to 10^-4 but do not exceed 10^-4 should be highlighted differently and discussed separately from areas of no risk. Additionally, it might help to subdivide results into separate categories for risk ranges from 10^-6 to 10^-5 and from 10^-5 to 10^-4.

Comments from Steve Verrill:

Exposure scenario for the skating rink
The contamination of the well at the skating rink could be a contributor to the risk of a future resident who frequents the rink. This is especially a concern if VOCs were to reach the rink's well, since the water is used to make ice in a way that will provide a shortcut for vapor intrusion.

Pie charts are deceptive about total risk
The pie charts at the end of the document that show relative risks of different COCs have very different total values, and this can be deceptive about what is really a significant contributor to risk. Perhaps some additional figures can be added to the document that are scaled to the same total risk – pie charts that are to the same actual risk scale (so that areas with lower risk will only show some of the pie taken.)

Comments from Kerry Diskin:

Exposure through home grown produce
In assessing exposures through the consumption of home grown produce, consideration should be given to the inclusion of metals, radionuclides, and PAHs either through plant uptake or through soil adherence (root crops), as applicable. Although uptake by plants of PAHs is minimal, soil adherence to the surface of the root crop occurs and may result in exposure. Although washing and peeling removes the majority of PAHs, not all consumers peel and/or wash home grown produce. Plants may also uptake heavy metals.

Comments from Fred Seward:

Summary of Fred's comments
We find two apparent problems in the external radiation cancer risk, one in the way subsurface soil is treated and one in the background risk calculated for the Stow Town Forrest. In the case of greater U concentration in the subsurface compared to the surface soil, this results in an underestimation of the risk. The Stow Forrest error does not affect the risk calculations but detracts from the reader's confidence in the document. All other comments concern presentation.

Radiological cancer risk
We have looked at some but not all the Tables and Appendices. We may have missed something, but nevertheless offer the following comments.

Why are the risks for child and adult added (e.g. table 5.5 and 5.10)? Does this represent the lifetime of one individual? In table 3-6, future resident, how does "child/adult" relate to "350/161/186, 30yrs"? The numbers seem to apply to adults only.

Subsurface soil
The treatment of subsurface soil is unusual. The cancer risk is calculated in the same way as for surface soil. Since this is more than 1 foot below ground level and the transmission through the first foot of earth will be about 0.2, why should the subsurface soil in area A6 dominate the risk stated in paragraph 8? The reader's first impression is that attenuation has been forgotten and the risk for subsurface soil has been overestimated by a factor of 4. Section 3.2.2, however, states that subsurface soil could be excavated (in home construction?) and spread on the surface. The HHRA includes this enhanced subsurface risk in table 6-2 but not in figures 5-2 to 5-6. Since subsurface soil is not included, the risk is underestimated by 40%.* Since these figures can be taken as illustrations of the total risk, the subsurface soil should be included one way or the other.

Stow Forrest background
The notation for radionucleides is unusual to a person outside this field. U^238 + D to me meant U^238 and all the daughters. Here it apparently means only the daughters leading to U^234. Likewise Ra^228 + D refers to Ra^228 and one daughter, and Th^228 + D to Th^228 and several daughters. With this understanding, the data in the tables are consistent and show where the problem areas are.

There is a problem, however, with the background numbers for the Stow Town Forrest (Table 8-F-BKG.1). Background data from other references vary but, typically, Th is 3 times as abundant in Earth's crust as U, the average activity found in soil is 1.0 and 0.7 pCi/g and the average yearly dose due to Th and U is .2 and .1 mSv/yr respectively. Thus, we expect the background risk due to Th to be about twice that due to U.

In the Stow Town Forrest, the Th and U activities of .81 and 0.43 pCi/g are somewhat below expectation but quite reasonable. Scaling these numbers, we expect risks from Th and decay products to be about 3 times that from U and decay products. This ratio, however, is 200 in the numbers of the Table and in Figure 5-13. This cannot be correct. It looks like the daughters of U^234 have been left out. Since this is natural U in equilibrium these must be there, particularly Ra^226 + D which accounts for most of the risk. The U background is correct in table 8-F-BKG.U and scaling from this the Stow Forrest risk should be 2E-5 from Th and 8E-6 from U for a child. The adult risk is about 3 times this so total risk will be about 1E-4 for Th and 3E-5 for U in the Stow Forrest. The table and Figure 5.13 should be changed to show this.

It would help if tables were relabeled as "Calculation of Radiation Cancer Risks from Uranium"if U is the only radioactive material included. Also, if the above interpretation is correct, the Stow Forrest table label should be "Calculation of Radiation Cancer Risks from Uranium and Thorium". This would make the content clear to someone looking at just the tables.

General Impressions and Readability
The HHRA is thorough and all the information seems to be there. We have skimmed the document and attempted to understand the details of a small part: the radiological risk assessment for future residents. Some of the problems mentioned below might be due to our missing the documented explanation. If so, perhaps words could be changed, moved, or repeated to clarify.

The figures in the document are excellent. The illustration showing the location of sampling sites, by itself, should overcome potential allegations of inadequate sampling. The pie charts are nice and the color in tables to show problem areas is very helpful. Most readers will probably start with the Executive Summary and/or the Conclusions. We do have suggestions for small changes which would be helpful to the novice reader.

The acronym list is incomplete. E.g. the last paragraph of the summary uses COC, ELCR, FS, HI and none of these are in the list. This can slow and irritate the reader. All the acronyms should be here. In this respect, the Executive Summary is very good. All acronyms are defined when first used. A reader does not have to refer to a separate list. The Conclusions should do the same.

The area designations can be confusing. It takes a while to realize that, e.g., A6 is not AO6. These are described each time in the conclusions, e.g. A5 (Sweepings Piles), which is helpful. It would also be helpful to add a figure to the conclusions showing only the problem areas. This would form a clear mental image of places where remediation decisions are to be made.

About the Executive Summary
This is heavy reading and we don't see that it could be made lighter. A few comments:

Site Description, PP3, add words "... distribution system using water drawn from several wells far from the site." Make the point that this water source is not close to (or is close to) the site.

Exposure assessment, PP2, add words "... exposure to radiation from radionucleides in soil and unsubmerged sediment." The news people that covered the Japanese reactor problems thought "radiation" was a vapor that became part of the atmosphere. This counters the assumption that radiation is a gas.

Risk Characterization, PP6, change "NCP risk range of 10^-6 to 10^-4" to "NCP risk of 10^-4". Also remove 2nd word "potential" from last sentence (we think there is typo or wording problem here).

PP8, Last sentence is confusing and sounds uncertain. Which exposure areas does this refer to? It should not be difficult to calculate this without the double-counting of ingestion rate and state a number rather than to say "would not likely exceed". These words are often a red flag indicating a problem.

PP9, Next to last sentence would be more definite as, "However, the risks from background arsenic and thorium contribute (put number here)% of this. The cancer risk from the uranium content itself in this area does not exceed 10^-4.

Conclusions, Future Residential Land Use, What happened to thorium? This should be mentioned here.

About the Summary and Conclusions
The Summary and Conclusions may be the only part of this document read by some Concord residents. Most of the following is meant to make information clearer and more digestible.

First, define all acronyms when they first appear as in the Executive Summary. The first sentence should start: "The HHRA (Human Health Risk Assessment) characterized ... etc."

The summary certainly states exactly what has been done and the final risk assessments for the various areas. However, there are so many facts and conditions in each sentence that we had to read each three times to understand what was being communicated. To illustrate, the second and third paragraphs have been rearranged below to give a different presentation. The same words are used but the conclusions are up front and there are more short sentences. It is also unnecessary to repeat "based on the HHRA" or "the results of the HHRA". This is done seven times on the first page.

"Under current land use conditions, it is concluded that access to open space areas of the Site (as presently configured) would not pose risks in excess of USEPA (United States Environmental Protection Agency) thresholds. Specifically, cancer risks are within the NCP (National Contingency Plan) cancer risk range of 10^-6 to 10^-4 and non-cancer HI (Hazard Index) values do not exceed 1. This applies to children and adults (abutting residents, passive recreational visitors, children at the adjacent day camp) who may access soil, surface water, and sediment. Areas considered were unfenced open space areas of the Site, namely: portions of the Sphagnum Bog, the NE wetlands area, the Rt. 62 outfall area, and the Assabet River and associated Embayment Area. [I did not understand the sentence which includes 'modeled to protective'. Is there a typo here? If not, this needs clarification.]

For the case of a trespasser within the fenced (restricted) area of the site, there is a risk in excess of the USEPA risk threshold. The evaluation assumed access to unpaved soil and surface water in the Cooling Pond and portions of the Sphagnum Bog. Although cancer risks are within the NCP cancer risk range of 10^-6 to 10^-4, the non-cancer HI value is higher than 1 due to assumed contact with PCBs in Cooling Pond sediments."

Try to rephrase the rest of this section accordingly. The short paragraphs are OK and the summary with bullets is good but the long paragraphs are hard to follow.

To state that a risk exceeds a range is not correct. The risk exceeds the number which is the maximum of the range. In paragraph 4 this is properly done, "... a cancer risk greater than 10^-4 ...." In this spirit, in paragraph 5, replace, "...exceed the NCP risk range of 10^-6 to 10^-4." with, "exceed 10^-4." And in the next to last paragraph replace, "exceed the NPC risk range of 10^-6 to 10^-4" with, "exceed a risk of 10^-4".

In paragraph 8 replace, "accounted for" with, "excluded".

Notes

* In area A6, the subsurface activity is 3 times that in the one-foot-thick surface layer. The slope factors used assume that the activity is evenly distributed in an infinite thick slab on top of which the subject is located. To account for the increase of activity below a depth of one foot, add the risk due to the increase in concentration above the "surface" concentration which, in this case, is about 2 X the surface concentration and apply the top-foot attenuation. Thus the additional subsurface contribution is, 2 X 0.2 = 0.4, and the external radiation risk should be increased by 40%. On the other hand, if the slope factors used were indeed for only the first foot, then the additional subsurface contribution would be an additional 3 X .2 = 0.6 or 60%.