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Ms. Chris Borello  
President  
Concerned Citizens of Lake Township  
P. O. Box 123  
Uniontown, OH 44685

Subject: Examination of the data and associated information on the radionuclide problem in the Industrial Excess Landfill Superfund site.

Dear Ms. Borello:

Thanks for faxing me the radionuclide data and other pertinent information on the radionuclides in the Industrial Excess Landfill (IEL), a Superfund site. From this information that you have provided to me, it appears that there is some serious concern among the public that radioactive material from the Dayton's now-closed Mound Laboratory, once part of the Federal Government's nuclear weapons complex, could have gone into the Uniontown dump.

Before going further on commenting the radionuclide data, let me state few facts on the distribution of Uranium-thorium series radionuclides and plutonium in the environment. Uranium and thorium series radionuclides are very common throughout the environment and the concentration of these nuclides varies widely. For example, in groundwater, the concentration of uranium varies over 1-4 orders of magnitude. The same thing is true with several other daughter products. However, the atomic ratio of U-238/U-235 (or the activity ratio) is a universal constant. Any deviation from this constant value indicates there is some 'non-natural' uranium that has been added to the environment. As you might know, the nuclear industry has gone after U-235 and there is a large amount of depleted uranium (depleted with respect to U-235, meaning that U-238/U-235 ratio will be higher than the natural value) or enriched uranium (enriched with respect to U-235, meaning that the U-238/U-235 ratio will be lower than the natural value). In the case of plutonium (Pu) isotopes, all the plutonium is derived from anthropogenic activity. From the weapons testing since 1952, a large amount of plutonium was released in to the atmosphere, which eventually came back to the surface of the earth. This bomb fallout-derived plutonium is seen in the soils all over the continent, in lakes, glaciers, and ocean. The Pu is highly particle-reactive, with distribution coefficient ranging from 104 to 107 cm<sup>3</sup> g<sup>-1</sup>. What this means is that if we put some Pu in the soil, most of the Pu will get adsorbed onto the soil particles and very little can undergo vertical movement. In addition, the atomic and activity ratios of Pu have been utilized to trace the sources of Pu in the environment.

With this background information, I would like to move forward with my comments on the data that you faxed to me. It is a very serious issue if we find 0.28 or 0.21 pCi/L of total Pu in the groundwater. Firstly, most likely this Pu is derived from a local source, as opposed to the global fallout. If this Pu is derived from a local source, then, obviously there must be much higher levels of Pu in the soil above the water table. In my opinion, the truth must be found by a systematic investigation on this and adjoining aquifer systems. Secondly, the concentration of Pu in other natural water systems (such as ocean water, lake water, river water, etc) is 2-4 orders of magnitude lower than the value reported here. These natural water systems are open to the atmosphere and hence got their share of global atmospheric fallout. Thirdly, if we find Pu at 92 to 190 feet down from the earth surface in groundwater system, most likely that Pu must have been derived from a local source, rather than leaching from

soils (fallout Pu) in the surface. Finally, comparing the groundwater Pu concentration with those in the soil is meaningless. We have conducted several researches along this line and published a series of articles in peer-reviewed journals.

I quickly looked at the data presented in the spreadsheet that you faxed (Table 3, November 2000 Sampling Event Data Summary). The following seems to be serious issues:

- i) MW-01D – Total Pu concentration of 0.28 pCi/L. If this is a real value, what is the source of Pu to this groundwater system? Is it possible that a large amount of Pu was dumped above the water table in this site?
- ii) MW-011 – Total Pu concentration of 0.21 pCi/L. Same as i).
- iii) MW-01D – U-235 concentration of 0.16 pCi/L as compared to U-234 concentration of 0.34 pCi/L. In most groundwater, U-234 concentration is higher than U-238. Under such a circumstance, U-238/U-235 activity ratio will be likely less than 5. In natural uranium, the ratio must be 21.76. If this data is accurate, then, it is very likely that there could be some enriched uranium above the water table.

In addition to this, the data reported by the Cohen Associates (dated June 23, 1992), indicate the following:

- i) Ra-226 concentration of 76.1 pCi/L. This is more than an order of magnitude higher than the drinking water limit set by EPA.
- ii) The U-238/U-235 activity ratio is 10.78 ( $\pm 1.33$ ), which is significantly different than the natural U value of 21.76. This discrepancy can either be due to bad data or there is some serious contamination of non-natural uranium from the nuclear material dumped in the IEL.

The data reported by Beta Laboratories, Inc indicate the following:

- i) There is some measurable amount of Co-60 ( $< 30.3$  pCi/L). Ac-227 level is excessively high. This is derived from U-235 (via Pa-231) and hence it appears there might be a large amount of non-natural uranium adjacent to the groundwater-sampling site.
- ii) Presence of high level of Th-227 also indicates there could be significant amount of U-235 (U-235 decays to Pa-231 which decays to Th-227 and so on).
- iii) Presence of Cs-137 also appears to be evident. All these data point out either all these data are bad or there is some serious problem in this area.

My overall evaluation of the documents that you have provided is that this area must be investigated thoroughly with a completely independent agency and all the future analysis must be carried out in an academic setting, where the precision could be improved by 1-3 orders of magnitude. For example, our precision on Pu analysis is about 2 orders of magnitude better than the data reported. For U-atomic ratio determination, the analysis must be carried out in a thermal ionization mass spectrometry facility (similar work was carried out in groundwater samples collected near Sandia National Laboratory in Albuquerque in New Mexico on my recommendation). It is very important that the truth is found out on this very important issue.

I hope this assessment helps you to move forward with this issue. Please feel free to contact if you have any additional questions. I can also be reached by e-mail:  
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With best regards,

Mark Baskaran