DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Agency for Toxic Substances
and Disease Registry

Memorandum

Date May 15, 1992

From Section Chief, FPB, DHAC (E56)
Environmental Health Scientist, ESS, RPB, DHAC (E32)

Subject Health Consultation: Radiation Testing of Groundwater at Industrial Excess Landfill, Uniontown, Ohio.

To Louise Fabinski
Senior ATSDR Region V representative, Chicago, IL

Through: Director, DHAC, (E32)
Acting Branch Chief, RPB (E32) KG
Chief, ESS, RPB, DHAC (E32) MCH

BACKGROUND AND STATEMENT OF ISSUES

The Agency for Toxic Substances and Disease Registry (ATSDR) received a request from the U.S. Environmental Protection Agency (U.S. EPA) to outline our position on radiation testing of groundwater at the Industrial Excess Landfill (IEL). The same request was made to all members of the Technical Information Committee (TIC) due to differences of opinion among TIC members. The opinions will be provided to EPA's Science Advisory Board.

ATSDR's position, as outlined in this consultation, is based on the need to determine possible adverse health effects if radioactivity exceeding EPA's drinking water standards are found. Other considerations shaping the parameters of our response are the past history of radiation testing at IEL, community concerns, and man-made radiation in groundwater at other sites.

History of Radiation Testing at IEL

Two prior rounds of radiation testing of water samples at IEL (December 1990 and August 1990) have been invalidated by U.S. EPA because of laboratory failure to follow proper quality assurance/quality control (QA/QC) procedures. Verbal discussions with the TIC indicated some high readings of tritium that were called false positives by U.S. EPA. In June of 1991, U.S. EPA and Ohio EPA split samples for analyses. U.S. EPA did not analyze their samples for radiation. Split samples sent by Ohio EPA, from the June 1991 sampling, to a contractor also showed a high tritium reading (over 1,000,000 pCi/L) in one out of six wells. No tritium was detected in the other five wells. The contractor stands behind their data and indicates that proper laboratory QA/QC was followed. The

well with the high reading, RW-48, was tested prior to and after the June sampling with results both times of non-detection of tritium [1].

DISCUSSION

Radiation is an issue at IEL because some citizens reported seeing a truck bearing the radiation symbol at the landfill and laboratory invalidations have made them suspicious. False positive highs for tritium have made this radioisotope a top community concern at IEL. Therefore, this discussion focuses on tritium production and release into the environment. Some of the problems encountered thus far in the testing process are discussed including laboratory procedures.

Tritium is produced by two major processes - during nuclear operations and via cosmic ray interactions in the atmosphere [2]. There are no radioactive materials that decay into tritium. Atmospheric production of tritium has been estimated to produce sufficient quantities to reach a steady state inventory of 26 x 10^6 Curies (26 MCi) [3]. Tritium in groundwater, due to atmospheric precipitation, is reported at a concentration of 19 pCi/L [2, 3].

Tritium in groundwater at other sites is discussed below so that the results at IEL, in particular the anomolous readings, can be put into perspective. At the U.S. Department of Energy (DOE) facilities that either produce tritium or have in the past processed reactor fuel to extract plutonium, tritium has contaminated the groundwater extensively. At facilities where tritium was produced, the maximum level in groundwater is approximately 3.5 billion pCi/L (Savannah River Site) [4]. Near reactor operations, levels are reported in excess of 1,000,000 pCi/L and in fuel reprocessing areas, maximums approaching 5,000,000 pCi/L have been found [5]. In low level radioactive waste burial sites, tritium has been detected in maximums near 2,000,000 pCi/L [6]. With respect to IEL, 1,000,000 pCi/L, is an extremely high level given that the landfill at no time was designated as a low level radioactive waste burial site. This leads us to believe that a problem exists with respect to the QA/QC of the sample.

Due to the problems encountered thus far at IEL with QA/QC of radiological analyses, a short summary of our knowledge on these procedures is presented: When samples are returned to the laboratory, a small sample is treated with either sodium hydroxide or potassium permanganate. The sample is distilled and an aliquot is removed for Liquid Scintillation Counting (LSC). The aliquot should be from the middle of the distillation run because early or late distillates may contain interfering materials. After mixing with the organic scintillators used, the sample must sit in the dark (one hour

for toluene based to 24 hours for dioxane based) to allow for decay of chemiluminescence else spurious high counts will indicate high levels of tritium (EPA Procedure 906.0).

According to a memorandum from Betz Analytical Services dated November 22, 1991, the sample that had the elevated tritium levels was not treated in a similar manner to the other samples. The sample in question was filtered prior to distillation because it was cloudy in appearance. If distillation was used as reported in their memo, the necessity to filter the sample prior to distillation is questioned.

ATSDR is proposing two rounds of radiation testing. The first round is the comprehensive sampling round for radiation testing as already planned by U.S. EPA. This includes a complete group of radiological parameters (gross alpha, gross beta, a gamma scan, and specific quantitation of tritium, radon, radium 226/228 and uranium) on approximately 67 wells. In addition, a second round of testing is recommended which includes samples taken **quarterly** over a year and composited for a single group of analyses per well. The second round of analyses could consist of a set number of wells (approx. 30% of the original number and strategically located to get all directions of groundwater flow from the site). The same radiological parameters tested in round one are recommended for round two.

The recommendation for a composite sampling round on a per well basis is made because it will allow for an average annual radionuclide concentration at a given location. This measurement will allow for the calculation of the average committed dose to the total body. EPA's drinking water standard for tritium and other beta emitters is a dose of 4 millirem/yr. At this dose the average annual concentration of tritium meeting this standard is approximately 60,000 pCi/L (Based on EPA's current method of calculating the dose). Their previous method of calculating a dose for tritium yielded a more conservative concentration of 20,000 pCi/L. In order to determine health effects, ATSDR would like the data to reflect an average annual concentration so that a comparison to the dose of 4 millirem/yr can be made.

The composite samples should address the citizens concerns that one round of sampling could miss the radiation due to a fluctuating groundwater table. **The composite sample will reflect seasonal variations but will not distinguish those variations.** An average annual concentration would be a useful indicator for man-made as well as naturally-occurring radioisotopes.

CONCLUSIONS

Tests of radioactivity in groundwater should include samples which represent seasonal fluctuations and yield data for the calculation of an average annual dose.

The reported value of over 1,000,000 pCi/L in RW-48 is most likely in error because tritium in groundwater is not expected to vary from a level below detection limits to an extraordinarily high value and back to non-detectable in a short time span. In addition, this sample was not reportedly handled in a similar manner to other samples run due to its filtering. This calls into question whether proper QA/QC was followed.

RECOMMENDATIONS

1.) **ATSDR is proposing two rounds of radiation testing.** The first round is the comprehensive sampling round for radiation testing as already agreed to by US EPA. In addition, a second round of testing is recommended which includes samples taken **quarterly** over a year and **composited** for a single round of analyses per well.

2.) The sampling rounds for radiation testing must follow stringent field controls and QA/QC. If the samples fail the QA/QC, then the sampling must be repeated until QA/QC protocol is met.

3.) If the two rounds of radiation testing do not show concentrations exceeding the limits for radioactivity in drinking water, then additional sampling is not recommended.

4.) U.S. EPA should consider having an independent assessor present during the proposed sampling rounds to observe the procedures of the sample collection. Once the samples are delivered to the laboratory, the independent assessor could also observe the sample preparation and determinations.

These conclusions and recommendations are specific to IEL and are not considered to be applicable to other situations. As new data become available, these recommendations will be reviewed so that an evaluation of their continuing relevancy can be made. Questions or comments on this consultation should be directed to Laura Barr at 404-639-0645.

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REFERENCES

1) Ohio EPA, Residential Well Sampling Results, Industrial Excess Landfill, Stark Co., Ohio, June 1991.

2) Eisenbud, M., Environmental Radioactivity From Natural, Industrial, and Military Sources. New York: Academic Press, Inc., 1987.

3) Kathren, R., Radioactivity in the Environment Sources, Distribution, and Surveillance. New York: Harwood Academic Publishers, 1984.

4) Savannah River Site Environmental Report for 1988.

5) Hanford Site Environmental Monitoring Report for Calendar Year 1990. Pacific Northwest Laboratories.

6) ATSDR Public Health Assessment for the Maxey Flats Disposal. Site (1989).

DEPARTMENT OF HEALTH & HUMAN SERVICES

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Memorandum

Date July 22, 1992

From Section Chief, FPB, DHAC (E56)
Environmental Health Scientist, ESS, RPB, DHAC (E32)

Subject Addendum to May 15, 1992, Health Consultation on Radiation Testing of Groundwater at IEL

To Louise Fabiniski
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Through: Director, DHAC (E32)
Chief, RPB, DHAC (E32) SWF
Chief, ESS, RPB, DHAC (E32) BCH

It has been brought to our attention that paragraph three in the Discussion section of our consultation could be misinterpreted. In order to clarify this and other concerns the following explanations are given:

1) ATSDR believes that the 1990 radiation data has been inconclusive in showing whether radiation at levels of health concern exist in groundwater at Industrial Excess Landfill. Our discussion of tritium in groundwater at other sites was included so that concentrations found at IEL would have a frame of reference. **We did not intend to infer that high levels of radiation could not exist in the landfill because it was not listed as a low level radioactive waste burial site.** We understand that IEL could have been used as an illegal dumpsite.

The explanation for our opinion that the 1,000,000 pCi/l in RW-48 was most-likely an error comes in the second paragraph of the Conclusions section. Since this sample was handled differently from the others, the QA/QC is still questioned as stated in the health consultation.

2) The third recommendation states that if after the two rounds of testing no radiation exceeding the drinking water standards is found, no additional testing is recommended. This includes testing on both monitoring and residential wells. However, if future data indicates that any additional confirmatory testing is necessary, this recommendation will be reevaluated.

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cc:
Chris Borello
Community Leader