

N00102.AR.002176
NSY PORTSMOUTH
5090.3a

LETTER AND COMMENTS FROM U S EPA REGION I REGARDING DRAFT RESULTS OF
RADIOLOGICAL SAMPLING OF WATER, SEDIMENT AND BIOTA NSY PORTSMOUTH ME
10/2/2000
U S EPA REGION I



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

October 2, 2000

Mr. Jeffrey Brann
Code 105.5
Building H1
Portsmouth Naval Shipyard
Portsmouth, NH 03804-5000

re: Draft Results of Radiological Sampling of Water, Sediment and Biota
Portsmouth Naval Shipyard
Kittery, Maine

Dear Mr. Brann:

The United States Environmental Protection Agency (EPA) has reviewed the draft document entitled "Results of Radiological Sampling of Water, Sediment and Biota, Portsmouth Naval Shipyard, June 1999". The report was dated August 8, 2000. Staff of EPA's National Air and Radiation Environmental Laboratory reviewed this document.

EPA's comments on this document are provided in Attachment I to this letter.

If you have any questions regarding the attached comments, please contact me at (617)918-1387.

Sincerely,

A handwritten signature in cursive script that reads "Meghan F. Cassidy".

Meghan F. Cassidy
Remedial Project Manager

Enclosure

cc: Marty Raymond/PNS
Fred Evans/NORDIV
Iver McLeod/ME DEP
Vicki Lloyd/EPA ORIA
Carolyn Lepage/Lepage Environmental
RAB Members

ATTACHMENT I

The following are EPA's comments on the draft document entitled "Results of Radiological Sampling of Water, Sediment and Biota, Portsmouth Naval Shipyard, June 1999". The report was dated August 8, 2000. Staff of EPA's National Air and Radiation Environmental Laboratory reviewed this document.

1. Section 3.2 The procedure for determining if radium-226 is present from natural sources or is artificially enhanced appears flawed. The assumptions used are not valid, especially for water and biota. Fortunately, this does not appear to be an issue based upon the results (see further comments), but EPA cannot endorse or accept this "comparison" to determine if radium-226 is natural or enhanced.

First, in water and biota, the concentrations of radionuclides, especially those from different chains, cannot be compared. It is typically incorrect to compare concentrations in water for nuclides in the same chain (e.g., U-238 is typically lower than U-234). There are too many factors associated with uranium and radium concentrations, such as solubility and biota uptake rates, that invalidate this comparison.

For soil/sediment, the comparison is not as bad, but it is still invalid unless numerous assumptions can be verified. First, it must be assumed that uranium-235 and uranium-238 exist in natural ratios (i.e., U-234 activity is 21.7 times U-235 activity). Unfortunately, even if this is true, it does not necessarily mean that radium-226 is present at that same concentration as U-234, thus making the U-235/Ra-226 comparison invalid. There are regions of the U.S. where glacial activity and other factors have caused nuclides to be present out of equilibrium. Furthermore, analytical uncertainties should be included in these types of comparisons. Finally, sealed containers are not necessarily radon tight containers. Some plastics allow diffusion of radon gas at greater rates than others. The method described does not specify that the container should be filled. It is sometimes accepted practice to assume that the radon daughters will be trapped in the crystal lattice structure and not concentrate on the top. In practice, this is not always the case; however, the resulting equilibrium should be approximate.

2. Section 3.5 discusses other naturally-occurring radionuclides. It would be useful to see the results of chain nuclides during gamma spec analyses for agreement comparison and equilibrium. Only some were listed in the report, although others were probably identified in the analyses. The Tl-208 activities do not agree with the expected activities based on the Pb-212 and Bi-212 results and the Thorium series decay scheme.

The nuclides of interest were limited. What nuclides were included in the gamma spec analysis library that could have been identified?

3. Section 4.1 states that Cs-137 was detected in four wells. These are identified in Appendix D as FW-1, FW-5, B184-MW3, and DW-10B. Based on the TAG map in Appendix I, three of these wells are in close proximity to each other. Discuss how this effects the interpretation.

4. Section 4.2 Indications that radium-226 is natural are determined (with the caution above) using mathematical comparisons and typical ranges for the nuclide. However, cesium-137 detections are simply explained as "at levels consistent with fallout from weapons testing." No reference is given to the "typical levels" from fallout, nor are any background results determined at nearby bodies of water to determine if similar conditions exist. It seems rather inconsistent that the Navy goes through all of the assumptions and corrections to attempt to "verify" that radium-226 is naturally occurring, even when it is in the middle of the "typical" range cited, but simply state that cesium-137 is from fallout without

references or other background data to confirm the statement. Additional information should be provided.

5. Section 5.1 The results for the gross alpha/beta and tritium should be reported as calculated rather than only the MDC. The MDC could also be reported with the results.

6. Section 5.2 How can the one gross alpha detection be attributed to uranium/thorium when no analysis of these nuclides was performed?

7. Section 5.3 EPA does not agree with the statement that potassium-40 is the cause for elevated gross beta results. Statistical review of these data indicate that 60% of the sample results do not correlate well based on a standard normal variable (Z-score) test, sign test (probability of 34 of 40 K-40 [*0.9] being less than gross beta is about $4.2E-6$), and other tests.

The graph at the end of these comments also shows that gross beta results are elevated over K-40 contribution. If the K-40 contribution were the sole source of betas, the K-40 squares would be on the gross beta line. Since almost all squares are to the right of the gross beta line, this indicates that the gross beta results are elevated above the K-40 contribution. Based upon these data, please discuss how more accurate results could be obtained. One possibility is with the filtering of samples discussed below in comments on Appendix H.

8. Section 9.0 The statement "This demonstrates that radiological controls at PNS have been effective in preventing significant amounts of Naval Nuclear Propulsion Program radioactivity from entering the environment." is rather broad. There should be some type of disclaimer, such as "based on the results of this study, indications are that radiological controls at PNS have been effective in preventing radioactivity from entering local groundwater or Upper and Lower Meade Pond." The same is true for the last paragraph of this section.

9. Appendix A Section 3. Sample Collection, e. indicates that biota and sediment samples will be collected directly into the sample containers and drained indicating that the units for both media will be pCi/g-wet. Typically sediment results are compared on a pCi/g-dry basis. Confirm how the results were actually reported and clarify how the data was compared.

10. Appendix D Radium-226 MDC values (all greater than 100 pCi/L) are high. Based on an effective dose conversion factor of $3.58E-7$ Sv/Bq and an intake rate of 1 L per day (half of the SDWA assumption), 100 pCi/L would equate to an effective dose equivalent of approximately 50 mrem/yr. These MDC values certainly don't support conclusions such as "This demonstrates that radiological controls at PNS have been effective in preventing significant amounts of Naval Nuclear Propulsion Program radioactivity from entering the environment."

In EPA's comments on the Groundwater Monitoring Plan for Radionuclides, we cautioned that gamma spectrometry may give high results due to the interference of the 186 KeV gamma peak from decay of U-235, and also that the MDA may be too high to detect Ra-226 in most if not all samples. At that time, we indicated that using the Pb-214 and Rn-222 daughters of Ra-226 should not be done for water samples unless sufficient decay time was allowed for Rn-222 to decay to equilibrium levels with Ra-226 and that this also may not provide detection limits sufficiently low to quantify Ra-226 at desired levels.

The reporting units for the sediment samples were activity per gram. Based on the sample collection procedure in Appendix A.3.e., it is assumed that the results are reported on a pCi/g-wet basis. This should be clarified in the report and will affect the ability to compare between samples since the water

content of each sample is not known and will be affected by the type sediment collected.

11. Appendix F There is a poor correlation between Tl-208 and Pb-212. Pb-212, part of the thorium chain, beta decays to Bi-212. Bi-212 then either beta decays to Po-212 (64% of the time) or alpha decays to Tl-208 (36% of the time). Therefore, the Tl-208 activity should be 36% of the Pb-212 activity. The results in Appendix F show Tl-208 concentrations slightly greater than Pb-212 concentrations. If adjustment to Tl-208 concentrations were made for the "appearance" of equilibrium with Pb-212, the report must clearly state this, although making that correction is unnecessary.

12. Appendix H Gross alpha MDC values are too high (several greater than 1000 pCi/L). If this is due to TDS, the question becomes whether the samples had significant entrained particulates which became soluble upon acidification.

EPA's comments on the Groundwater Monitoring Plan noted that the degree of suspended solids in the water, particularly the surface water, could necessitate filtering of the samples and analysis of both the filter and the filtrate to determine the radioactivity in the samples.

K-40 Contribution to Gross Beta in Groundwater Portsmouth Naval Shipyard June 1999

