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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
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BOSTON, MASSACHUSETTS 02114-2023

December 18, 2000

Mark Evans, Remedial Project Manager
U.S. Department of the Navy
Naval Facilities Engineering Command
Northern Division
10 Industrial Highway
Code 1823, Mail Stop 82
Lester, PA 19113-2090

Re: Year 2 Annual Groundwater Monitoring Report for the Defense Reutilization and Marketing Office at the Naval Submarine Base - New London

Dear Mr. Evans:

EPA reviewed the document entitled "Draft Year 2 Annual Groundwater Monitoring Report for Defense Reutilization and Marketing (DRMO)" dated October 2000. The report provides a brief review of the site history, characterization, remediation, and monitoring; a summary of data collected in the second year of monitoring (Rounds 5 through 8); comparisons of analytical results to cleanup standards and background; and recommendations for the continued monitoring program. The report was reviewed with particular attention to the consistency of the interpretations offered with the available data, and the appropriateness of the recommendations. Detailed comments are included in Attachment A.

Overall, the soil removal and cap installation appear to have been successful in limiting transport of site contaminants to groundwater. The groundwater met all primary monitoring criteria in Rounds 5 through 8. Secondary criteria are exceeded for a few SVOCs present at relatively low levels, and for arsenic, copper, lead, and zinc.

The efforts to identify via statistical methods any significant differences between upgradient and downgradient arsenic concentrations, as well as correlations of arsenic concentrations with ORP, are encouraged. Unfortunately, it appears that arsenic levels typically at or below the laboratory detection limits make this exercise of limited utility. Please see related comments on Attachment A.

I note that the secondary monitoring criterion for arsenic (0.14 μg/L, based human-health considerations for consumption of organisms, is well below the laboratory detection limits achieved (typically a few μg/L). Therefore, no meaningful comparisons can be made to this monitoring criterion. Thus, either special attention should be given to the analytical methods employed in order to lower the detection limits, or the significance of this monitoring criterion itself should be

reassessed. Arsenic at levels of a few parts per billion is quite common in groundwater, particularly in reducing environments; attempts to discriminate site impacts at this level may be difficult.

Section 5.2 presents recommendations for changes in the monitoring program. The following are general comments on these recommendations:

- The Annual Report states, "Consideration should be given to eliminating VOCs from the analytical suite." EPA does not agree with this recommendation. While it is true that VOCs detected in groundwater at the DRMO have consistently been below the primary and secondary monitoring criteria, I not that VOCs in soil at the site provided some of the motivation for the soil removal and cap installation. In addition, there are persistent, low-level detections of VOCs at 6MW10S, 6MW10D, and 6MW11D. Furthermore, there is interest in the fate of VOCs known to be present in groundwater to the southeast (in the area of Sites 3 and 7), which might be expected to discharge to the river immediately south of the DRMO area. VOCs should be retained on the analyte list for the site. EPA is open to reducing the monitoring frequency, however.

- The Annual Report recommends reduction in sampling for SVOCs to biannual from quarterly. This appears to be reasonable. Changes on the time scale of a few months are not expected at this point, and monitoring biannually or even annually may provide adequate verification of the continued low levels of SVOCs.

- The Annual Report recommends discussion of the "endpoint for groundwater monitoring if current trends continue." There should certainly be some discussion of criteria for success of the remediation and requirements (*e.g.*, wells, analytes, frequency, and duration) for long-term monitoring to verify continued integrity of the cap and stability of groundwater chemistry at the site. Because of the known presence of soil contamination and the engineered remedial measures, long-term monitoring is prudent.

I look forward to working with you and the Connecticut Department of Environmental Protection to protect the environs of the Naval Submarine base. Please do not hesitate to contact me at (617) 918-1385 should you have any questions.

Sincerely,

Kymberlee Keckler, Remedial Project Manager
Federal Facilities Superfund Section

Attachment

cc: Mark Lewis, CTDEP, Hartford, CT

Darlene Ward, NSBNL, Groton, CT
Jennifer Stump, Gannett Fleming, Harrisburg, PA

ATTACHMENT A

Page	Comment
p. 3-3, §3.2	The discussion of filtering water samples for analysis of inorganics should note that filtered samples were discontinued following Round 6 (?).
p. 4-1, §4.1	The text states (para. 3) that the primary screening criteria are the site-specific SWPCs, allowing a dilution factor of 100. Table 4-1 shows the primary criterion for arsenic to be 40 μg/L, while Figures 4-12 and 4-13 show the Connecticut SWPC for arsenic to be 4 μg/L. If the dilution factor is 100, why is the screening criterion for As not 400 μg/L, rather than 40 μg/L (as shown in Table 4-1)?
p. 4-2, §4.1	The report notes that lead was detected once at 6MW2S, in Round 8 at 9.2 μg/L. It is notable that this detection is associated with the highest turbidity recorded when sampling this well for Rounds 5-8, as lead is strongly sorbed. On the other hand, the turbidity of 6.7 NTU in Round 8 was not a great deal higher than that recorded in Rounds 5-7 (5.0, 1.0, 3.8, respectively), and is reasonably low overall.
p. 4-2, §4.1	The report concludes that total and dissolved inorganics analyses did not show discernible differences. This is a satisfying result, representing a success of the low-flow sampling method, and consistent with the relatively low turbidity encountered in most of the wells. This observation might be cited in support of the decision to drop the analysis of filtered samples from the program. (See also p. 3-3, §3.2).
p. 4-11, §4.3.3	The summary of potential COCs lists cis-1,2-DCE and trans-1,2-DCE under SVOCs, rather than as VOCs. Also, note that the text following the list states, "Only one contaminant (trans-1,2-dichloroethane) was detected ..." This should read "... trans-1,2-dichloroethene ..."
p. 4-12, §4.3.3	The text (para. 2) observes that the data for average downgradient barium concentration versus time (Fig. 4-11) yield a linear fit with a positive slope, suggesting increasing concentration with time. It is worth noting that no change at all (constant barium concentration) is also entirely within the 95% confidence bounds.
p. 4-12, §4.3.3	The text (para. 3) should provide more detail on the approach to constructing Figure 4-12, in order that readers can assess the result objectively. In particular, it appears that the average values plotted were calculated using any

unqualified or estimated (J) results as reported, and any undetected (U) or undetected but estimated (UJ) results at half the detection limit. This should be stated in the text.

p. 4-12, §4.3.3

The text (para. 3) notes that the data for average downgradient arsenic concentration versus time (Fig. 4-12) yield a linear fit with a negative slope, suggesting decreasing concentration with time. It would be prudent to caution that *constant* arsenic is also entirely within the 95% confidence bounds. This is reflected in the 1σ range of slopes inferred in the linear regression, which range from -3.0 to +0.6 (μg/L)/yr (*i.e.*, zero slope is well within one standard deviation of the slope indicated by the linear regression).

p. 4-12, §4.3.3

It should be noted that any attempt to identify a time trend in the downgradient arsenic data (Figure 4-12) is strongly influenced by the detection limits achieved by the laboratory. The plot might be viewed as a plot of temporal variations in laboratory performance as much as a plot of arsenic in groundwater. For example, note that of the 28 data reported for unfiltered arsenic (4 rounds times 7 downgradient wells), only 2 are unqualified, 5 are estimated, and 21 are undetected or undetected and estimated (reported at the method detection limit). Thus, the average concentrations plotted in Figure 4-12 are heavily weighted by the reported detection limits. One half the average detection limits reported in Rounds 5-8 for downgradient wells are equal to 0.55, 1.90, 1.30, and 1.67 μg/L, respectively, and the ranking of these values (*i.e.*, 1, 4, 2, and 3 in magnitude) is the same as the ranking including the unqualified and estimated values. The average arsenic calculated for Round 5 is the lowest of the four rounds, for example, largely because the lab achieved low detection limits in this round.

p. 4-12, §4.3.3

The text (para. 3) states that declining arsenic concentrations should approach half the detection limit, and that, accordingly, an exponential function was fitted to the data (Fig. 4-13). Exactly what function is shown in the Figure? It appears that this fit may be simply the exponential, for example, $c = c_0 \exp(-kt)$, which approaches zero rather than half the detection limit. In order to approach a non-zero constant, the function should be of the form $c = c_d + (c_0 - c_d) \exp(-kt)$, where c_d is the asymptotic value. If the latter is the form used to obtain the fit shown, what value was chosen for the detection limit, given that this has been highly variable throughout the sampling program?

p. 4-13, §4.3.3

The report notes that barium shows a statistically significant correlation between concentration and ORP, but states, "Barium is a simple metal which typically is not sensitive to ORP." The next paragraph discusses possible

reasons why a spurious correlation may turn up in the statistical analysis. It might be noted, however, that Ba^{+2} may be sorbed on ferric oxyhydroxide surfaces. The iron oxyhydroxides, in turn, *are* redox sensitive; low ORP can lead to their dissolution, releasing barium to solution. Thus, the correlation found could be valid. It should also be noted that one reason that a statistically significant correlation seems to emerge for barium, but not for arsenic, is that the barium analyses are mostly well above the method detection limits for this element, and therefore, a trend is more likely to be identified.

p. 4-13, §4.3.3

The statistical analysis shows only a weak correlation of arsenic concentration and ORP. While it is beneficial to seek such a correlation in an objective, quantitative fashion, it might be noted that, in an overall sense, the association is quite evident. In particular, it is noted that, among the three upgradient wells, ten out of twelve samples taken in Rounds 5-8 showed positive ORP (the exceptions are 6MW6S and 6MW9S in Round 5, July 1999, which showed ORP of -41 and -97 mV, respectively). All unfiltered samples from these wells were ND for As. In contrast, the seven downgradient wells show a total of seven detections of As in Rounds 5-8, and all of them exhibit negative ORP (ranging from -265.8 to -64.8 mV). Thus, the association of reducing conditions with elevated arsenic is clear. One reason that the correlation may not emerge in the formal, statistical test is that the arsenic analyses lack the necessary resolution. Five out of seven "detects" in downgradient wells in Rounds 5-8 are estimated, and the two that are reported without qualifiers (4.3 μg/L in 6MW10D and 2.3 μg/L in 6MW11D, both in Round 5) are below the method detection limits reported in some rounds (*e.g.*, 4.5 μg/L for 6MW10D in Round 8). With most detections being estimates, and all being close to detection limits, the accuracy of the values used to test for correlations may simply be too low to reveal a consistent pattern.

p. 5-2, §5.1

The third paragraph remarks that there are instances where the analyses show dissolved metals analyses exceeding total metals. The explanation ("instrumentation fluctuation near the instrument detection limit") is likely correct, and serves as an indication of the kind of precision expected near the detection limits, and a reminder of the difficulty of identifying meaningful averages or trends in these data.

REFERENCE

[1] Brown and Root Environmental, "Groundwater Monitoring Plan for Defense Reutilization and Marketing Office, Naval Submarine Base, New London, Groton, Connecticut," February 1998.