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RESPONSE TO COMMENTS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT 1998 ANNUAL REPORT, MONITOIRNG EVENTS 11-13 SITES 1, 3, & EASTERN PLUME NAVAL AIR STATION, BRUNSWICK, MAINE

COMMENTOR: Michael Barry **DATE: 29 July 1999**

Thank you for the opportunity to review the above report, which is much improved from last year's report. EPA appreciated working with the Navy in 1998 to increase understanding of the plume. In our review we focused upon several long term concerns; among them:

- Possible past or current plume infiltration to bedrock.
- Possible plume movement in a previously unforseen direction.
- Stalled plume movement along the eastern edge and possible discharge to surface water.

Our recommendations propose investigative work, as we believe should be expected as part of normal long term operations in the resolution of a large VOC plume. We also recognize that further actions should be performed in the context of the relative risk posed. Our general and specific comments are attached.

1998 marks only the third full year of monitoring and remedy operation. Though uncertainties remain, much has been accomplished. Results from this year indicate to EPA that:

- The cap and slurry wall at sites 1 and 3 have been effective in stopping groundwater flow through the landfill and reducing contaminant concentrations at several key monitoring points (see enclosed graphs).
- New direct push and monitoring wells results and examination of the geology indicate to EPA that the eastern and southeastern boundaries of the plume are probably secure.
- Installation of extraction well EW-2A significantly increased mass removal of VOCs and established a large capture zone in the highly contaminated deep sand.
- The ArcView CD produced by the Navy and EA will enable a much clearer review of the huge amount of available data; in fact it made our detailed review possible.

EPA accepts the Navy's response to our comments on monitoring events 11, 12, 13 and the 1997 annual report. We recommend that EPA's substantive comments be discussed at a technical meeting in the fall. At that meeting we will have more specific details to our general recommendations included in the comments. Further, our comments in this letter represent our basic synopsis for the 5 year review. If you have any questions, please contact me at 617-918-1344 or barry.michael@epa.gov.

Sincerely,

Michael S. Barry
Remedial Project Manager
Federal Superfund Facilities Section

GENERAL RESPONSE TO COMMENTS

During a technical meeting held on 22 and 23 November 1999, the EPA and ME DEP made presentations to further detail their geology and hydrogeology comments on the draft 1998 Annual Report for Sites 1 and 3 and Eastern Plume. During these discussions the EPA noted that several general comments related to a general program overview, and are not comments directly related to the 1998 Annual Report.

During discussions at these meetings, the Navy provided an assessment of these comments. Therefore, this response letter will not address comment concerning site geology which were discussed at this technical meeting, but instead will provide a summary of the Navy's position on these topics.

As noted during the 22 and 23 November 199 technical meeting, the Navy believes the existing focus of the long-term monitoring program on the overburden aquifer is appropriate, although additional investigation of the southern terminus of the Eastern Plume is warranted. The additional investigations recommended in EPA comments (clay linears, fracture trace analysis, seismic surveys, potential for DNAPL) are not warranted at this time. Additional extraction wells are planned to be installed in Eastern Plume in 2000. If persistent groundwater contamination remains after these wells become operational, a re-assessment of these topics might be considered.

General Comments

1. **Possible Exposure Of Bedrock to Contamination.** Contamination from Site 11 may have reached bedrock undetected via two "no clay" zones.

    a. Figure 3-29 of the 1998 annual report indicates thin clay between MW-1101 and MW-308. A *shallow* " no-clay" zone is just downgradient of Site 11 at MW-323. The major contamination observed in 1991 from Site 11 passed through this shallow no-clay zone, over bedrock and into the deep coarse sand directly overlying bedrock to reach the deep sand aquifer (Figures 1 and 2). Once in the deep sand aquifer, the contamination passed over a comparatively thin layer of clay to the bottom of the clay trough West of MW-308 where a second zone of no-clay exists (Figure 3).

        i. Rebutting high bedrock contamination, MW-323 demonstrated only mild contamination which was *theorized* to be the result of vertically upward flow gradients. In addition, MW-308 has reported no contamination, which was attributed to *observed* vertically upward gradients.

ii. However, both wells are located on bedrock peaks, which are more resistant rock and less prone to fracturing. Fractures are more likely to reside to the side of such peaks. Consequently, the current bedrock network is not well-designed to capture possible bedrock contamination of major fractures. This is especially true if contamination reached bedrock through the deep coarse sand directly downgradient from MW-323.

iii. Since both areas are related to bedrock highs, they are most likely actually elongated with a South Southwest-North Northeast orientation, rather than circular as on the isopach map (Figure 3-29); (this is probably a software contouring artifact). An elongated orientation of bedrock peaks is observable in the islands and marine peninsulas to the South (Figure 4).

Response – These topics were discussed at the 22 and 23 November 1999 technical meeting. The Navy believes continued focus of the long-term monitoring network on the unconsolidated overburden aquifer is appropriate, and does not believe additional monitoring of bedrock is necessary at this time. The contours of the top of bedrock contour map could be drawn in many ways based on existing data, and therefore no changes will be made to Figure 3-29 until additional data is available.

b. If the above is the case, contamination had more opportunity to reach bedrock than originally thought. To further understand this possibility, a *preliminary* fracture trace analysis was developed for the area of the Eastern Plume.

i. Fracture trace analysis is based on the theory that glacial bedrock erosion was enhanced in areas of less competent rock, such as *along* major fractures, at the *intersection* of major fractures, or along a number of parallel smaller fractures. While, the bedrock contour map of Figure 3-28 could be used to develop a fracture trace analysis, the top-of-clay contour map (Figure 8-9, E.C. Jordan, 1991) is a better choice for this purpose. As the clay layer is the primary stratigraphic feature closest to bedrock, bedrock topography is reflected in the top-of-clay surface in a damped fashion. Since far more wells reached the clay surface than reached bedrock, the top-of-clay surface has a greater spatial resolution than the recently developed bedrock contour map.

ii. The top-of-clay contour map (E.C. Jordan, 1991) was first modified with data made available in the recent supplemental study (EA, 1998).

Subsequently, linear alignments of depressions, valleys, and ridges were used to identify possible bedrock fracture traces (Figure 5). Since such linear traces have yet to be geologically verified, they are referred to as clay-linears through the rest of this document. Similarly, traces (or linears) developed from the stream valleys of USGS topographic maps are referred to as hydro-linears to reflect the source data; and traces based on the bedrock contour map are referred to as bedrock-linears.

iii. In Figure 6, three clay-linears (CL-1, CL-2, CL-3) can be seen immediately downgradient of Site 11, in the general vicinity where maximum contamination was observed by E.C. Jordan in 1991. Note that CL-2 and CL-1 underlie brief linearities in Mere Brook. While the evidence for hydro-linear, HL-1 along Mere Brook is less compelling than for other traces, if such a feature exists, it could have had a significant role in controlling aspects of the coarse sand layer topography; and in the transferring contamination in ways that may be contrary to that predicted by the local hydrologic flow regime.

iv. Supporting evidence that clay-linears CL-1, CL-2 and CL-3 are the likely convergence of three major bedrock fractures can be found by simple extension of these traces South. Figure 7 demonstrates that CL-1 is discernible to the South as a series of narrow bedrock controlled bays over the 4.8 mile interval shown. CL-2 is discernible as a series of aligned bedrock depressions, and linear marine shorelines over approximately the same distance. CL-3 closely approximates the abrupt elevation change along the linear western marine shoreline of an extensive peninsula. These patterns are discernible in some cases up to 9 miles from the convergence point in the Eastern Plume. The match of the clay-linear projections with these marine features is impressive considering the small relative size of Eastern Plume area and the approximate nature of the top-of-clay contours.

v. If contamination has been transported to CL-3, and if CL-3 is hydraulically active, functioning as part of a larger regional bedrock flow regime, *it may have transported contamination to Middle Bay rather than to Harpswell Cove*.

b. There are several mitigating factors to the above argument:

i. The contamination has largely passed by MW-323.

ii. The raised bedrock around EW-4 may have been above the depth of the contamination by the time it reached the exposed bedrock as this is about 1600 feet downgradient of the source area.

iii. The two areas where bedrock isn't covered by clay are about 55,000 square feet, or about 1.25 acres per figure 4 of the direct push report. This relatively small area is about 1% of the eastern plume area.

iv. As stated in the cover letter, EPA recognizes that bedrock explorations should be undertaken with proper planning and in context of the potential risks posed to receptors.

Response – These topics were discussed at the 22 and 23 November 1999 technical meeting. The Navy believes continued focus of the long-term monitoring network on the unconsolidated overburden aquifer is appropriate, and does not believe additional monitoring of bedrock is necessary at this time.

2. **Possible plume movement in a previously unforseen direction.** The current overburden extraction well network will be greatly improved by the analysis and re-screening refinements suggested in Section 4.6.3. With these changes, the network can be expected to capture most, if not all, of the *known* plume. However, the extraction well network may not be as effective in areas where the plume is poorly understood. Such areas include the following:

a. *Immediately East of Merriconeag Stream*. Data from the Direct Push Study and from the Long Term Monitoring Program indicate that contamination may extend to this area. Few overburden wells exist here and sediment/surface water quality sampling has not yet rebutted possible contamination in the area. The soon to be performed diffusion sampling will go a long way toward filling this data gap. Steep westward gradients on the east side of Merriconeag stream need also be considered.

b. *Immediately South Southwest of the "DP-EP-05, DP-EP-06, and DP-EP-07" area.* Comparison of the Eastern Plume with the top-of-clay theme reveals that remnant contamination may flow from the vicinity of EW-2A directly down the top-of-clay trough to the vicinity of EW-1 rather than skirting the area due to local hydrologic flow, as indicated in Figures 3-25 through 3-27. There are no LTMP sampling points along this line (in part due to difficult terrain), and extraction pumping could have encouraged this flow. This would help explain the long accepted stationary eastern edge of the plume along with the gradients on the east

side of Merriconeag stream.

c. *In the vicinity of MW-205, the Eastern Plume appears to circumvent MW-105A.* The unusual curve of the plume around MW-105A can be explained by either no contamination or a preferential flow path leading ***around, above* or *below*** MW-105A.

   i. Preferential flow *above* MW-105A can be theorized from Figure 8 as horizontal plume flow, detectable at MW-205, but moving above MW-105A, due to a possible concavity in the semi-confining transition layer. Figure 9 demonstrates the significant confining role that the upper transition layer can have on the plume. However, the same figure also demonstrates that plume flow within forty feet above a monitoring well screen may likely be detectable in the well below at lower concentrations, even if the well were in clay. Consequently, plume flow over MW-105A is counter-indicated.

   ii. In Figure 8, MW-205 (projected 485 feet South) lies closer to contamination observed at depth in the vicinity of CP-118 than does MW-105A. Furthermore, horizontal hydraulic conductivity in the coarse sand layer may be significantly lower to the East all of MW-205. Figure 8-3, E.C. Jordan, 1991 (not presented here), indicates that hydraulic conductivity drops an order of magnitude as one moves South, from MW-319 (10-3 cm/s) to MW-229A (10-4 cm/s), and that it in drops yet another order of magnitude between MW-229A and MW-230A (10-5 cm/s). For these reasons, preferential plume flow under or West, around MW-105A, appears likely.

d. *In the vicinity of CP-118, where VOC's were detected just above the top-of-clay in 1991*. This was lost or discarded over the years of Eastern Plume work (as possibly happened to the contamination observed in 1991 at CP-115 near MW-331) and is the closest thing to a VOC "smoking gun". CP-118 is South of Mere Brook, and the VOC's (150 ppb of trichloroethane per figure 8-20 of the 1991 supplemental RI) were observed well prior to extraction pumping. Though the concentrations are below the MCL for TCA, this does suggest the possibility of deep flow contrary to that indicated for the area in Figures 3-12 through 3-18. Such a situation could result from a deeper regional flow regime underlying a local flow regime, or narrow preferential flow paths in the overburden. If this deep contamination is real, EW-1 may likely capture it. However, clearly, our knowledge is incomplete in this area.

e. *In the vicinity of the intersection of CL-3 and HL-1 (Figure 6).* If major bedrock fractures do intersect under the clay in this area, a bedrock depression may likely exist under the clay, impacting preferential flow along clay troughs. There are no data points in this area to evaluate this.

Response – These topics were discussed at the 22 and 23 November 1999 technical meeting. The Navy believes additional investigations along the southern terminus of the Eastern Plume are warranted to more fully investigate the downgradient edge of the plume, and to more accurately assess the potential for conductive geologic strata in the overburden. It is anticipated that scope of these investigations will be discussed with the RAB during 2000.

2. **Stalled Eastern Edge of Eastern Plume and Possible Discharge to Surface Water.** The stalled leading-edge of the overburden Eastern Plume remains an enigma and we believe clearly merits further investigation.

a. The stationary leading edge may be the result of discharge to surface water or nearby wetlands, but surface water samples to date have not indicated this. Upcoming sediment diffusion sampling should eliminate the masking of contamination due to dilution of groundwater discharge in the stream.

i. The original artesian condition of MW-311 suggests that discharge to the stream would normally be greatly limited, however the well was reportedly allowed to flow uncapped for several years; this could in fact be the cause of the shallow contamination near MW-311.

ii. Contrary to this, the 1998 Direct Push study indicated (DP-EP-05) that a thin coarse sand interval rises to within twenty feet beneath Merriconeag stream, and contamination may extend to the opposite bank. This issue requires further investigation.

b. There is evidence to suggest that the deep overburden plume was diverted along a previously unknown and unusual flow path to the Southwest prior to pumping operations. This evidence, much of it mentioned in the prior section, includes:

i. The unusual plume flow near MW-205.

ii. The VOC's observed at CP-118 contrary to the local hydrologic flow regime.

iii. Reduced hydraulic conductivity in the vicinity of MW- 229A.

iv. The lack of contamination observed in the vicinity of MW- 229A prior to pumping operations (Figure 8-20, E.C. Jordan, 1991)

v. The possibility of a more complex top-of-clay surface due to the possible intersection of HL-1 and CL-3, and other linear traces of bedrock.

vi. The projection of CL-3 to the southwest *along observable topographic depressions* to the ocean

vii. Very limited and low level VOC's that are also COC's were detected.

viii. The highest concentration COC, 1,1,1-TCA, was not present; other solvents that are typically lower in concentration were not present other than trace PCE.

ix. SW-14, near MW-311, reported a greater number of VOC detects than other stations, albeit at very low levels and without 1,1,1-TCA.

x. The VOC mix of MW-311 and MW-332 are nearly identical, yet 1,1,1,-TCA is not indicated in the stream water.

c. This suggests that surface water sampling may be ineffective for sampling VOC transfers from ground water, and that sediment vapor samplers should be utilized to detect, localize and possibly quantify VOC release to surface waters. Depending on the results, this could indicate discharge to bedrock less or more likely.

d. Given the above data a real risk to human health or the environment due to any VOC's discharge to Mere brook is unlikely.

Response – These topics were discussed at the 22 and 23 November 1999 technical meeting. Sediment vapor sampling conducted during 1999 along Mere Brook and Merriconeag Stream did not indicate chlorinated VOC from the Eastern Plume are flowing into these surface water bodies. As noted in the previous response to comment, the Navy believes additional investigations of the overburden aquifer along the southern terminus of the Eastern Plume are warranted to more fully investigate the downgradient edge of the plume, as suggested in this comment.

4 **The Deep Potentiometric Surface (EPA had the same comment to the event 14 report).** Figures 8 and 10 depict the generally accepted interpretation of deep groundwater flow to Merriconeag stream in the vicinity of MW-309B. This is in contrast to the deep flow interpretation of the 1991 E.C. Jordan study, and to the observed plume flow of the northern lobe. Closer inspection of the potentiometric surface reveals that this interpretation is highly dependent on incorporating MW-309B in the contouring process. However, to incorporate MW-309B in the deep flow contouring, one must assume that there is a good connection between the deep coarse sand and the bedrock shoulder that MW-308 and MW-309B reside in. There is considerable evidence to suggest this may not be true.

a. Figure 1 (enclosed in hard copy letter only) contains a geologic cross-section that includes MW-308 and MW-309B. Contrary to the interpretation of Figure 1, there is no physical evidence to indicate that coarse sand directly contacts bedrock near MW-308. Rather, the transition layer is interpreted to enclose the coarse sand on 3 sides, to the North and South and may do so here as well. The significant confining nature of the transition layer may have resulted in the lack of significant contamination observed in surface water sampling, and at MW-308 and MW-309B. Furthermore, the 2 wells MW-309A and MW-309B, installed in bedrock capped by clay, demonstrate significant vertical flow upward, from a source likely within the sharp bedrock rise to the East, rather than from a source in the West.

b. Recommendation. Until contamination is discovered East of the deep coarse sand layer, consider the eastern edge of the coarse sand layer to be a no-flow or very-low-flow boundary. Review the wells and piezometers available for gauging the eastern edge of the deep coarse sand, and modify the long-term monitoring plan to increase the spatial resolution of the well network along the eastern edge. After these steps, contouring of the deep potentiometric surface should more accurately reflect observed plume flow.

Response – These topics were discussed at the 22 and 23 November 1999 technical meeting. The connection of the shallow bedrock well MW-309B to the deep sand interval cannot be conclusively determined at this time. The use of MW-309B in contouring of the deep flow interval is believe to provide important data, and therefore this point will be maintained in the deep groundwater potentiometric contour maps. The following note has been added to the deep contour maps which include MW-308B:

The degree of hydraulic connection of bedrock well MW-309B with the deep sand interval is unknown, although data from this well was used for contour map generation.

5. **VOC Contour Display, figure 14 (EPA had the same comment to the event 14 report).**

   a. Plume coverage. There is no physical evidence to indicate that the plume disappears in the 400 or so feet between EW-4 and MW-331. On the contrary, plume flow had to have historically existed in this area and was depicted as such in the monitoring event report 13 report (figure 14). Thus, it's likely a single plume exists, rather than two separate lobes.

   b. 100 ppb VOC contour. The VOC concentrations at P-105 historically tracked those of P-106; this was confirmed in the Geostatistical Assessment. Though EPA concurred with removing P-105 from the LTMP, we are certain the plume remains north of EW-5.

   Response – We agree with this comment. Beginning with the Monitoring Event 15 report, the Eastern Plume has been drawn as a single plume rather than as 2 separated lobes. In subsequent reports, starting with Monitoring Event 16, the 100 ppb contour line will be drawn around P-105 as suggested in this comment. These changes will be made starting in 1999, and the total VOC contour maps included in the 1998 Annual Report have not been changed.

6. **GIS Data.** The CD of Geographic Information Systems (GIS) data has proven extremely beneficial to the analysis in this letter. During this analysis, a few discrepancies in the data layers turned up. While it is understood that these data layers are still considered preliminary, discrepancy details are included under the Specific Comments section for the benefit of the data developers.

   a. A preliminary GIS data layer of the Top-of-Clay Contour Map (Figure 8-9, E.C. Jordan, 1991) was developed to assist with this analysis. Since the lateral extent of the Eastern Plume is approximately contained by the -20 foot top-of-clay contour, this layer contains the -20, -40, -50, -60, and -70 foot contours, modified to accommodate additional data from the 1998 supplemental investigation (EA, 1999). In addition, GIS data layers for geologic profile lines (E.C. Jordan, 1991), and for the preliminary fracture trace analysis of this review were developed. All data layers were only approximately geo-referenced on the basis of cultural and natural features of other themes, which was sufficient for the general analysis of this review.

   Response – This comment does not apply to the 1998 Annual report, although the GIS will be revised in 1999 based on the specific comments EPA has provided. It is anticipated these changes will be made when the GIS is re-issued with data from 1999 sampling rounds.

7. **Sites 1 and 3.** Water level has remained steady and contaminant concentrations area clearly decreasing at three key locations (see enclosed graphs):

   a. Arsenic at MW-218 is still above the MCL but is lowering and there are no human receptors.

   b. Zinc in surface water is now below the federal and Maine AWQC.

   c. Mercury in leachate sediment has been consistently under screening levels for the last several events.

   Response – We agrees with these observations, which suggest the landfill cap and slurry wall at Sites 1 and 3 are limiting surface water/groundwater impacts in the vicinity of Sites 1 and 3.

Recommendations *EPA recommends development of the following general supplemental investigations, more specifics can be discussed at upcoming technical meetings:*

1. To assess possible bedrock contamination, the lateral extent of both no-clay areas should be identified and further reviewed for possible roles in contamination transfer. A more thorough fracture trace analysis should be performed, and geophysical efforts should be made to verify the reality and extent of all traces including HL-1, CL-1, CL-2, and CL-3. Subsequently, areas of discharge to surface water should be identified and investigated.

2. Given the importance of both the upper and lower surfaces of the coarse sand layer at the terminal end of the Eastern Plume, it is recommended that this investigation resolve these surfaces in greater detail. This effort would include further fracture trace analysis and geophysical verification of traces, if this is not been performed for the recommendation above.

3. Following the above, we recommend Direct Push investigation of:

   a. possible contamination along the top-of-clay trough, between plume lobes encompassing EW-1 and EW-2A;

   b. the vicinity of CP-118 to address the possibility of unmonitored contamination this area;

   c. the unusual curve of Plume around MW-105A. (If this theory proves accurate, the EPA further recommends investigation into

similar concavities of the semi-confining lower surface of the upper transition layer for possible contamination.)

d. *the intersection of HL-1 and CL-3, if determined by geophysics to have formed a bedrock depression*

e. *the overburden stratigraphy East of Merriconeag Stream to assess the possibility of the deep coarse sand layer and associated contamination extending to this area.*

4 *To assess possible contamination reaching wetlands and streams, we recommend using sediment vapor diffusion samplers because they tend to be more successful at detecting contamination than the acquisition of surface water samples. Note: this is underway.*

5 *Use of GIS map algebra to align two-dimensional contours of 1) bedrock topography, 2) top-of-clay topography, and 3) top-of-coarse-sand topography before conversion to surfaces for the final three-dimensional GIS visualization system. Simple conversion of the current layers would be inappropriate since contouring of these surfaces was performed independently of each other.*

Response – The recommendations put forth by EPA were discussed at the 22 and 23 November 1999 technical meeting. As noted, the Navy feels that at this time further investigations should be limited to the southern terminus of the Eastern Plume. Further discussions with the RAB are anticipated during 2000 to define the scope and extent of the additional investigations to best satisfy EPA, ME DEP and Navy priorities.

<u>Specific Comments; (E) designates an editorial comment or suspected typo error, (R) designates a recommendation only.</u>

1. **Section 2.2, Para. 1, Bullet 4; Section 2.3, Para. 2. (E)** "Presumscot" should be "Presumpscot".

Response – The word Presumpscot has been spelled correctly.

2. **Section 2.3, Para. 2.** Please update this paragraph to indicate that the trough-shaped depressions in the top-of-clay are present along both eastern and western boundaries of the plume. Please include a brief discussion of the mechanism by which VOCs might be concentrated in the depressions or in overhead confining concavities.

Response-- This issue was discussed at the 22 and 23 November 1999 Technical Meeting and the Navy does not feel additional discussions of this topic are necessary at this time. Therefore, no changes were made to the 1998 Annual Report.

3. **Sections 3.1 and 3.2 (R).** The graphs included in these text sections greatly improves data presentation and comprehension. Recommend assigning figure numbers to the graphs in future reports.

Response – This recommendation will be considered in future Annual Reports, although no changes to the 1998 Annual Report were not considered to be necessary.

4. **Section 3.2, Para. 4.** Indicating the level of Merriconeag Stream in the accompanying graph will better show change in MW-311 water level relative to the stream.

Response – This information has not been added to this graph, as the stream water elevation is not measured in the vicinity of MW-311. Therefore, the stream level could only be shown with an accuracy of +/- several feet, which was not considered to be of sufficient accuracy to display on this graph.

5. **Figure 3-21 (E).** Believe MW-324R should be MW-234R.

Response – MW-324R has been changed to MW-234R.

6. **Section 4.3.2.2.** The presence of VOCs at DP-EP-05 suggests that groundwater contamination may extend East of Merriconeag stream and thus east of the base. Please

mention that calculations show that the thin, coarse sand layer in the vicinity of MW-311 rises to just twenty feet beneath the stream, and that this layer has experienced significant artesian pressure in the past. Negating or minimizing this concern is that gradients increase sharply to the east.

Response – It is likely that the deep sand interval may be present approximately 20 ft below Merriconeag Stream, although we are not familiar with the calculations mentioned in this comment which support this hypothesis; we would request that EPA provide them to Navy. A sentence has been added to Section 4.3.2.2, Bullet 1, as shown below:

Additionally, DP-EP-05 results indicate that a narrow extension of the deep sand may rise to within 20 ft below Merriconeag Stream.

7. **Section 4.1, EW-1, Bullet 2.** Because EW-1 extends 30 feet deeper into the coarse sand than MW-229, an alternative interpretation is that additional contamination picked up by EW-1 from below the level of MW-229 contains sufficient contamination to counterbalance (to within an order of magnitude) the dilution effect of relatively clean water entering from the approximately 30 feet of screen (40% of the EW-1) in the shallow aquifer. Since MW-229 has only a 10 foot screen, this also suggests that contamination may be under-reported in this area. Data from DP-EP-04 is not helpful in examining this situation, since the apparatus was unable to collect sufficient water in the 2 four-foot samples taken in the lower 30 foot interval of EW-1.

   Response – This topic was discussed in the 22 and 23 November 1999 technical meeting. We would anticipate collecting data to address this concern as part of any future investigation of the southern terminus of the Eastern Plume. No changes were made to the 1998 Annual Report.

8. **Section 4.1, EW-2 and EW-2A, Bullet 6.** Please note in this section that VOCs may yet discharge to Merriconeag stream or the wetland on either side of the stream, North of MW-311 given:

   a. the groundwater flow vectors of Figure 3-27,

   b. the possibility of contamination similar to that of MW-331 existing to the North of this well,

   c. the apparent pinching of the coarse sand layer up towards the opposite bank in the vicinity of MW-311, and

d. the possibility of artesian pressure remaining to the North of MW-311.

Response – This hypothesis is not supported by the results of the vapor diffusion sampling completed by the EPA and ME DEP in August 1999, which showed no evidence of chlorinated VOC discharging to surface water from the Eastern Plume. No changes were made to the 1998 Annual Report.

9. **Section 4.2.1, Groundwater Flow -- General Observations, Bullet 2.** Potentiometric surfaces can be misleading because net groundwater flow is a function of both the hydraulic gradient and conductivity in three dimensions. This may exist on the eastern boundary of the Eastern Plume where the coarse sand apparently terminates abruptly at the transition layer, and deep groundwater flow may be directed more to the South than potentiometric contouring would indicate (Figure 3). Please include a brief caveat on this possibility in this section.

Response –While the conditions mentioned in this comment may exist, no direct evidence exists that would indicate the deep groundwater of the Eastern Plume is directed to the south, rather than is shown on potentiometric surface maps. further evidence to support this statement would be required before this the recommended text changes are made. No changes were made to the 1998 Annual Report.

10. **Section 4.3.1.1, Bullet 2, Dash 2.** Arsenic is redox sensitive in that it is mobile under reducing conditions. Consequently, arsenic reaching Mere Brook is likely to be deposited in sediments upon reaching the more aerobic environment. Please include a brief caveat on this. Also for your information the MCL for arsenic will likely be lowered soon because it isn't protective. This will have no affect at sites 1 and 3 because of the lack of human receptors and arsenic is already above the MCL.

    Response – The following sentence has been added to the end of Bullet 2, Dash 2:

    Note that arsenic is likely to be deposited in sediments upon reaching surface water of Mere Brook, as the solubility of arsenic decreases with increasing DO and Eh.

11. **Section 4.3.2.1, General (R).** The significant downward trend of some wells and in the trailing edge of the plume are a major accomplishment and we would think warrant a major bullet.

Response –We would be interested in discussing these trends, and how they relate to other comments by DEP and EPA in light of data collected during 1999. No changes were made to the

1998 Annual Report.

12. Section 4.3.2.1, Bullet 4. We believe the north and south lobes are connected but not indicated so in the monitoring to date. The Eastern Plume can be roughly delineated by the -20 foot contour interval of the top-of-clay surface (E.C. Jordan, 1991; and Figure 5 of this report). Both MW-331 and EW-4 lie within this contour, while MW-330 lies on the outside. Comparison of VOCs observed at MW-331 with the historical VOC trend of EW-4 reveals that contamination likely exists in the interval between the 2 wells. The geostatistical report also indicated the lobes were connected statistically. Also, a composite of areas with VOCs above the MCL/MEG for events 13 and 14 would show one connected plume.

Response –We agree it is likely that the north and south lobes of the Eastern Plume are connected. It should be noted that the Geostatistical Assessment only indicated the data from the two lobes could be statistically analyzed together, but made no statement that these lobes should be connected. It is likely that two distinct lobes are present if the definition is based on the chemicals present in groundwater, although a case can be made for one plume based on total VOC concentrations. Note that in the 1999 Annual Report individual contour maps of the major chlorinated VOC will be presented, and the Eastern Plume will be shown as a single plume rather than as two separate lobes. However, no changes will be made to the 1998 Annual report based on this comment.

13. Section 4.3.2.1, Bullet 5. The addition of MW-331 significantly increased the indicated area above the MCL/MEG in the southern plume, albeit artificially. Because the MCL/MEG are so high relative to plume concentrations, large changes aren't expected by EPA. In fact, stable MCL/MEG boundaries are a sign of success that the plume isn't expanding (at least in known areas!); this was a primary goal of the remedy. We recommend modifying this bullet.

Response –We believe that this bullet accurately states the conditions as they are known to exist. Therefore, no change has been made.

14. Section 4.3.2.1, Bullet 5, Dash 3 (E). It is not clear that MW-206A to experienced significant changes in VOC levels over the past year. Please review and modify appropriately.

Response – This sentence has been modified to remove MW-206A, as shown below:

--- *However, significant changes are noted in one portion of the Eastern Plume at deep perimeter plume monitoring well MW-225A, located southwest of EW-2.*

15. Section 4.3.2.2, Bullet 1. Please include a note that DP-EP-05 results indicate that a narrow extension of the coarse sand layer rises to twenty feet below Merriconeag Stream.

Response – A sentence has been added to the end of this bullet, as shown below:

Additionally, DP-EP-05 results indicate that a narrow extension of the deep sand may rise to within 20 ft below Merriconeag Stream.

16. Section 4.3.2.2, Bullet 4. Please note that only small portions of the deep interval were sampled by DP-EP-01 through DP-EP-04. Only DP-EP-03 collected a sample deeper than -20 feet. Furthermore, contamination has been historically observed in a narrow section of the deep (-40 ft) interval at CP-118 (Figure 8-29, E.C. Jordan, 1991). Consequently, these results of DP-EP-01 through DP-EP-04 do not prove with certainty that VOC have not migrated South of these positions. Also had they reached the clay before refusal? This doesn't seem to be indicated here or in table 1 of the direct push report. Please include a brief discussion and caveat on this.

Response –Additional depths were attempted to be sampled but did not contain sufficient groundwater for sampling due to limited water bearing capacity. While the direct push sampling does not conclusively prove with certainty that VOC has not migrated south of these positions, it appears likely that water bearing capacity of these intervals are limited, and groundwater samples collected for the most promising coarse-grained intervals did not detect concentrations of VOC above MEG or MCL. Therefore, bullet No. 4 is believed to be accurate as written. Please see the electrical conductivity logs in the Direct Push Report and Figure 3-29 in the Annual Report which show approximately 45 ft of clay was encountered before refusal in DP-EP-01 through DP-EP-04. No changes have been made to the report.

17. Section 4.4.3, Bullet 4 (R). Recommend mentioning that the observed fluctuations in arsenic, iron and manganese may reflect changing redox circumstances.

Response – A sentence has been added at the end of this bullet, as shown below:

Fluctuations may also be the result of changing redox conditions.

18. Section 4.4.3, Bullet 4 (E). Believe 1988 should be 1998.

Response – 1988 has been changed to 1998.

19. Section 4.6.1 (R). The EPA concurs with the groundwater sampling program recommendations.

Response – No response needed.

20. Section 4.6.2 (R). The EPA recommends using sediment vapor diffusion samplers to assess VOC discharge to wetlands and stream banks/beds in addition to taking sediment samples in these areas. (This recommendation is overcome by events in that an initial round of about 25 samples is planned for July/August 1999 as a joint Navy/ME DEP/EPA effort.)

Response **–**The recommended vapor diffusion sampling was completed in a joint effort by ME DEP, US EPA and Navy in August 1999. Results of this sampling will be summarized briefly in the 1999 Annual Report.

21. Section 4.6.3 (R). The EPA concurs agrees with the extraction system recommendations. EW-2A has proven to be effective in removing VOC's and established a large depression cone.

Response **–** No response needed.

22. Section 4.6.4 (R). The EPA concurs with the additional data collection recommendations. Furthermore, as there are no significant seasonal variations in the water table, we recommend no longer collecting additional data for this purpose. Further major recommendations are contained under General Comments.

Response **–** We agree that water elevation gauging data can be collected at a reduced frequency than the currently six times per year gauging intervals. We would anticipate beginning the reduced gauging schedule to coincide with bi-annual sampling events (i.e., April and September) starting in 2000.

23. Table 1-1. Please add gas vents, gas probes or gauging point stations.

Response **–**Disagree. Table 1-1 summarizes the long-term monitoring program, and the gas probe/gas vent sampling is conducted as part of the landfill gas monitoring and inspection program. These activities are summarized in Section 3.5 of the Annual Report.

24. Figure 3-4. Please add gas probe and gas vents locations to this map.

Response **–** Disagree. Gas probe and gas vent locations are shown on Figure 3-2. Figure 3-4 summarizes the long-term monitoring sampling locations, and gas probe/gas vent sampling is conducted as part of the landfill gas monitoring and inspection program. These locations were not added to this figure so unnecessary points would distract from clearly showing the groundwater and surface water sampling locations, with is the main point of the figure.

25. Figure 3-5 (E). In note 1 gauging is misspelled.

Response – Gauging has been spelled correctly.

26. Figure 3-27.

a. The groundwater vectors inside the 100 ug/L contour near MW-334 in Figure 3-27 reflect the likely flow of groundwater, and VOCs advecting along the coarse sand layer. Please re-align the northeastern edge of the contour to parallel the flow vectors, or add a note of explanation.

Response – The change suggested in this comment is unclear, and appears to be requesting a minor change in the figure based on interpretation differences of contour shapes. Contour interpretations are likely to differ in many situations depending on professional judgement. Therefore, no changes were made to the 1998 Annual Report.

b. The 100 ppb VOC's contour in the northern plume should go around the location for P-105 because it has historically tracked similarly to P-106. The contour as drawn in the absence of event 13 data thus misrepresents probable actual values. This portion of the contour could be noted as inferred due to historical data trends or such.

Response – Please see response to EPA comment No. 12. These changes will be made in the 1999 Annual Report. No changes were made to the 1998 Annual Report.

c. The northern and southern lobes of the plume above the MCL/MEG should be connected.

Response – Please see response to EPA comment No. 12. These changes will be made in the 1999 Annual Report. No changes were made to the 1998 Annual Report.

27. Figure 3-28. The contours of the Interpreted Top Of Bedrock Elevation, Eastern Plume, may be somewhat in error, due to possible errors in cone penetrometer point locations, relative to the 1991 E.C. Jordan study. This was most noticeable for CP120, CP131, and CP156. In addition, a bedrock peak was placed at CP-155. This is in conflict with Figure 8-8 of the 1991 E.C. Jordan study, and with the shallow no-clay zone of Figure 3-29 of the 1998 annual review. Please review the locational and depth accuracies all of all source points, correct the GIS themes and re-contour this map, if necessary.

Also, please consider an alternative contouring of the peak adjacent to CP-155. Review of the source data for of the bedrock peak reveals that the orientation of the peak to be highly subjective. As can be seen in the marine peninsulas to the South, bedrock peaks in this area more

commonly have a South Southwest-North Northeast orientation.

Response – The position of the piezometers have been checked, and the data included in the GIS are believed to be correct based on their surveyed locations. Contour interpretations are likely to differ in many situations depending on professional judgement. The contours as shown are believed to accurately reflect existing site data. Therefore, no changes were made to the top of bedrock elevation figure in the 1998 Annual Report.

28. Figure 3-29. The Clay Thickness Isopach map will have also been affected by any mis-located data points. As mentioned in the comment above, at least 3 cone penetrometer points from the 1991 E.C. Jordan study are conflict with the 1998 EA maps. Please review the locational and depth accuracies all of all source points, correct GIS themes, and re-contour this map, if necessary.

Response – The position of the piezometers have been checked, and the data included in the GIS are based on their surveyed location. Therefore these locations are believed to be correct. No changes were made on this figure.

29. Appendix A-3, Seep-05. Please plot arsenic with manganese on graph 2, rather than on graph 1. This will allow a more appropriate scale for other constituents of graph 1.

Response –The plot of SEEP-05 has been revised as suggested.

30. GIS Data. There is a significant and progressive offset between the developed cultural and hydrographic GIS themes relative to the USGS raster topographic maps. This is most pronounced in the southernmost part of Merriconeag Stream.

Response – The world file of the USGS map has been edited to overlap more effectively with the base features (i.e., buildings and roads). This relatively minor change is not expected to impact use or interpretation of data presented in the GIS. It is anticipated that the GIS will be reissued in 2000 with this map change. Or, we can provide the new world file by e-mail to interested parties.