UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
JOHN F. KENNEDY FEDERAL BUILDING
BOSTON, MASSACHUSETTS 02203-0001

December 13, 1996

Mr. Michael Light
Monsanto
800 North Lindbergh Boulevard
F2EP
St. Louis, MO 63167

RE: EPA Comments on GSIP Phase 2

Dear Mr. Light:

The Environmental Protection Agency (EPA), in consultation with the Massachusetts Department of Environmental Protection (MADEP), has reviewed the ISRT's Groundwater and Surface Water Investigation Plan (GSIP) Phase 2 Report, May 29, 1992, prepared by Roux Associates, Inc. Other agencies, such as the U.S. Fish and Wildlife Service (USFWS) and U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA), also reviewed the GSIP Phase 2 Report. A number of specific comments were generated as a result of the review, which are attached to this letter. General review comments are summarized below.

EPA disagree with many of the statements and conclusions of the GSIP Phase 2 Report. The major areas of concern include the following:

o The report suggests that Halls Brook Holding Area pond is effectively trapping and preventing the migration of sediment contamination downgradient. Based upon the information presented, EPA disagrees with this statement. Analytical data collected from downgradient depositional sediment samples SED-13, SED-21, SED-22, and SED-23 illustrate that arsenic and lead concentrations have remained relatively constant, while chromium concentrations have either remained relatively constant or increased. The data from these depositional sediment samples do not support the report's conclusions. The report compares these samples to the furthest downgradient sediment sample, SED-14, which had a sand content of 99% and an organic content of 0.2%. This is inappropriate. EPA does not consider this sample location to be optimal, because of relatively high energy conditions that do not allow the settling out of fine grained materials, and the sample data are not comparable to the upgradient depositional sediment samples (SED-9, SED-11, SED-13, SED-21, SED-22, and SED-23). Sands and gravels with low organic contents do not readily sorb contaminants. Course grained sediment samples cannot be compared to fine grained depositional sediment samples, or be used to assess contaminant transport from HBHA.

- The report suggests that the statistically significant effects associated with SED-21 (hyallela azteca survival associated with the "Number of Off-spring") and SED-24 (chironomus tentans "Avg. Weight of Surviving Larvae") sediment toxicity test, can not be related to the Site due to the poor survival results associated with the "background" samples (SED-18 and SED-19). EPA does not agree with SED-18 and SED-19 sediment samples being used as "background" locations, due to their condition and/or location. Both samples are situated relatively close to the site boundaries, which suggest they could be impacted by the Site. These locations are also situated in potentially impacted areas from former Merrimac Chemical operations, MADEP sites, or urban influences. The report identifies the condition of SED-18 as being "greasy" and having an "oily sheen". This would also exclude the sample from being considered a true background location. Lastly, EPA does not believe a sufficient number of samples were collected to adequately assess the site related sediment toxicity.

- EPA disagrees with the report's statement that the assessment for the semi-aquatic receptor's exposure scenario was highly conservative. An appropriate selection of contaminants of concern and suitable food chain modeling are necessary. EPA does not consider the assumptions conservative or appropriate for the mallard's arsenic NOAEL, site residence period, and exposure via food ingestion.

- The report presents qualitative data associated with the ecological risk assessment which indicate impacts to fish and benthic community in HBHA pond when compared to Phillips Pond. In particular, fish sampling data indicated a reduction in fish population and diversity in HBHA pond. Sediment data from GSIP Phase 1 indicate that the HBHA pond has a very poor macroinvertebrate benthic community; the Phase 1 report concludes that this may be due to anoxic conditions and site-related contaminants present in the sediments. Although, the report did not fully account for these impacts. Additional data should be collected and ecological impacts realistically evaluated.

- The report did not address the potential effects on aquatic biota of the elevated concentration of trace elements and PAHs (total PAHs: SED-21 @ 11 ppm, SED-22 @ 27 ppm, SED-23 @ 13 ppm, and SED-24 @ 98 ppm) in the HBHA sediments. Based upon the ER-L, adverse effects on aquatic organisms have been observed where contaminant concentrations in sediments were lower than those measured in HBHA. The report should discuss the elevated concentrations of contaminants that were detected in sediments and surface water, and should assess the potential risk based on comparison with ER-L for sediments and chronic freshwater AWQC concentrations for surface water.

- EPA does agree with the general paradigm assertion that metals are primarily being mobilized by reducing environments created by the animal hide residues. Although, the report makes a number of statements regarding the transport of arsenic being associated with methylated reactions, high sulfide conditions, and low Eh conditions, these statements are refuted by a significant amount of data present in the report. These statements appear to be inaccurate relative to the paradigm.

- The report does not contain sufficient data to delineate the nature and extent (horizontal and vertical) of the plumes (toluene, benzene, arsenic and chromium) or to support the conclusion that most or all of the groundwater discharges into HBHA pond. The nature and extent (horizontal and vertical) of the plumes will need to be characterized further including the overburden (shallow, intermediate and deep), bedrock and the bedrock/overburden interface. The current data presented in the report suggests contaminated groundwater migration occurs in fractured bedrock and groundwater contaminant concentrations generally increase with depth. Note: Digital presented groundwater data to the EPA in 1993 depicting benzene concentrations from the Boston Edison ROW to Digital's property. The data illustrates the highest concentrations of benzene in the groundwater have migrated beyond the Boston Edison Right-of-Way (ROW) to Digital's property (the north side of Digital's building). This plume migration was also observed during the ISRT's design of the interim groundwater remedy.

Other issues associated with the data from the report which will need to be evaluated further. Some of these issues are as follows:

- The source of the high benzene concentration detected in monitoring well OW-31 should be investigated further. It is possible that the benzene is migrating downgradient towards OW-43 and beyond. In addition, some portion of the groundwater benzene contamination is discharging into the wetlands adjacent to OW-31 (Lower South Pond). The ecological and human health impacts associated with this discharge to the surface water and sediment of remediated and unremediated sections of the pond should be evaluated.

- Areas containing hide residues and permeable covers may be acting as long term sources for the migration of dissolved metal contamination in groundwater. Under the remedy, these areas currently include the West, South and East-Central Hide Piles, as well as portions of the Boston Edison ROW. Based upon the paradigm, these areas are serving as reducing environments and causing the migration of metals downgradient.

- Overall, EPA believes there has been an insufficient amount of data collected in the study area to adequately determine the nature and extent (horizontal and vertical) of contamination in groundwater, surface water, sediment (suspended and bottom), and their impacts to the human health and the environment. Additional data must be obtained to adequately determine the nature and extent of contamination, including an overall mass balance and flux rate of contaminant migration into and out of HBHA pond; comprehensive low-flow groundwater sampling; sufficient background sampling; and sufficient ecological toxicity data. In addition, the human health and ecological risk assessment should be recalculated with appropriate COCs, exposure scenarios, and maximum and airthmetic mean concentrations. Based upon the attached EPA OSWER directive, ISRT may conduct the risk assessments as long as they comply with the OSWER criteria and EPA - Region 1 policy. EPA anticipates this work can be successfully completed with proper coordination between the Agencies and ISRT.

- o Consistent with EPA's 1992 Final Comprehensive State Ground Water Protection Program Guidance (CSGWPP) and 1996 Final Ground Water Use and Value Determination Guidance, an appropriate "Use and Value" determination should be made with the groundwater impacted by the Industri-plex Site. The purpose of the Use and Value Determination is to identify whether the aquifer at the site should be considered a "High", "Medium", "Low" use and value. MADEP, consistent with a Memorandum of Agreement (MOA) now being developed, will prepare a draft Use and Value Determination as early as possible in the GSIP Phase 3 scoping process to support effective data gathering. A final Use and Value Determination will be prepared after the investigative data has been obtained. EPA intends to use the Use and Value Determination as a management tool in the remedial action development and selection process. Note: EPA does not intend to re-open remedy selection decisions based on this guidance.

In accordance with the Consent Decree, EPA will require a GSIP Phase 3 to be completed for the Industri-Plex study area. The goal will be to collect a sufficient amount of data to adequately assess the site's impacts to human health and environment. The GSIP Phase 3 Report will be a comprehensive stand alone document, including the newly collected data and any previously collected relevent and appropriate data. EPA will continue to work cooperatively with ISRT and their designated contractors to ensure that the data collected is sufficient and applicable to the comprehensive GSIP Phase 3 investigation. This form of partnering will make the GSIP Phase 3 activities more efficient.

EPA, MADEP, USFWS and NOAA would like to meet with ISRT and their contractors to discuss, as necessary, issues related to EPA's comments and GSIP Phase 3 approach. EPA would like to hold this meeting after ISRT and their contractors have had adequate time to review the enclosed comments.

I am looking forward to this meeting and continuing our positive working relationship through the GSIP Phase 3 portion of the Remedial Action. If you have any questions regarding this letter or attached comments, please contact me at (617) 573-9622.

Sincerely,

Joseph F. LeMay

Joseph F. LeMay, RPM
MA Superfund Section

cc: Dan Winograd, EPA
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Ken Munney, USFWS
Bruce Yare, Monsanto
Douglas Swanson, Roux

GSIP Phase 2 Comments

1) Page 2, Section 1.2, bullet 1: The Report failed to define groundwater quality horizontally and vertically within the aquifer. There were only four shallow bedrock wells installed and sampled within the entire study area, two of which the text considered upgradient. Also, the saturated thickness of the overburden varies greatly throughout the study areas from 0 to 100 feet. Vertical delineation (shallow, intermediate and deep overburden) of groundwater quality was not sufficiently characterized. The data collected during the two investigations suggest that contamination generally increases with depth, and fractures in bedrock serve as migration pathways. The groundwater data collected from bedrock areas is insufficient at characterizing the nature, extent and migration of contamination at the site. The data is also insufficient at evaluating the bedrock contamination's contribution to surface water and sediment contamination and migration.

2) Page 2, Section 1.2, bullet 2 & 3: Insufficient data was provided to adequately determine ecological impacts downgradient of the site.

3) Page 3, Section 1.2, bullet 3: Insufficient data was collected to determine percentage of ground water discharging into HBHA pond.

4) Page 5, Section 1.2, bullet 2: The evaluation of the data in depositional areas of HBHA pond (SW-9, SW-11 & SW-13) and depositional ponds downgradient of HBHA pond (SW-22 and SW-23) do not suggest there is any significant reduction in sediment metal concentrations. The furthest downgradient sediment sample SW-14, contained sand @ 99% and organic content of 0.2%, and is considered a non-depositional area. This sample can not be used for comparison with depositional areas upgradient. Therefore, the text's conclusion based upon the sampling results of SW-14 that metals contamination is not migrating from the study area and is effectively trapped in HBHA is inappropriate and inaccurate.

The sediment samples from SED-13, SED-21, SED-22, SED-23 and SED-24 do not support the report's conclusion that HBHA is effectively trapping and preventing the migration of contaminants. Based upon the downgradient depositional sediment data, metals concentrations have not consistently been reduced from those in HBHA.

Downgradient Sediment Locations in Consecutive Order	% solids	As (ppm)	Pb (ppm)	Cr (ppm)
SW-9 (90')	5% sands/20% OC	9830	611	1092
SW-11 (90')	0% sands/16% OC	1750	320	529
SW-13 (90')	13% sands/10% OC	1330	275	382
SW-21 (91')	12.1%	607	294	441

SW-22 (91')	8.1%	1380	452	1040
SW-23 (91')	20.9%	791	348	2180
SW-14 (90')	99% sands/ 0.2% OC	21	7	14

5) Page 8, Section 1.3.1.1: Two piezometers were installed adjacent to OW-31, one north of West Hide Pile, and one south of West Hide Pile. The text's statement, "four piezometers were installed adjacent to Observation Well OW-31", is inaccurate.

6) Page 10, last paragraph: Please explain why the bedrock monitoring wells were not relocated and the investigation continued?

7) Page 11, Section 1.3.2.1 and Page 64, Section 2.1.5.4: EPA does not consider SED-18 and SED-19 background samples of the study area. SED-18 is situated on property formerly owned by Merrimac Chemical. Immediately to the northwest of this sampling location was a former lagoon which was subsequently filled. In addition, to the northeast, across the MBTA railroad tracks is a barrel reconditioning company. It was also noted in the field sampling log that the sample SED-18 had any oily sheen and petroleum odor. On page 69, the text also references this sampling location as impacted ("downstream of a confirmed MCP disposal site, and downstream of an active NPDES industrial effluent"). SW-19 is situated in a wetland which is surrounded on three sides by urban roadway, within 50 feet of the sampling location. More representative depositional background sample locations will need to be selected for comparison with depositional areas downgradient.

8) Page 11, Section 1.3.2.1: The text does not sufficiently characterize the nature and extent (horizontally and vertically) of contaminants in depositional sediment areas. Additional analytical data will be necessary to sufficiently characterize contamination in depositional sediments.

9) Page 16, Section 2.0: COCs for human health and ecological risk assessments should be re-evaluated and approved by EPA prior to conducting any risk assessments. Mercury, copper, nickel, zinc, cadmium, benzene and PAHs should be considered for COCs. PCB and pesticide Also, the risk assessments should be revised with arithmetic means, not geometric means.

10) Page 17: The Phase 2 Investigation indicates that benzene contaminated groundwater is discharging to Lower South Pond. Plate 2 indicates the presence of benzene in the sediments of the Lower South Pond. The nature of the benzene source appears be a point within or adjacent to the West Hide Pile and should be further investigated. The nature of the source of benzene contamination should be determined and removed, if appropriate.

11) Page 19, Section 2.1.1, Paragraph 1: The text states: "the absence of benzene immediately south of the West Hide Pile suggests that the West Hide Pile is not the source of this detection." This statement is inaccurate. Based upon Plate 3, Elevation of Water Table, piezometer WP-5 is not situated downgradient of the Monitoring Well OW-31. Therefore, it is inappropriate to

compare the results of WP-5 to the migration of benzene from OW-31. The closest points of monitoring downgradient flow from OW-31 are monitoring wells OW-37 and OW-43. Monitoring Well OW-37 did not detect any concentration of benzene, while OW-43 detected benzene at a concentration of 518 ppb. Based upon the current hydrological data, and the lack of hydrological data east and northeast of OW-43, the benzene concentrations at OW-43 could be a result of benzene migration from OW-31. Additional data is needed in the area to determine the extent of benzene migration. Also, data will be needed from the surface water and sediments to determine the benzene's ecological and human health impact to the unremediated and remediated portions of the pond.

12) Page 19: The objective of this task, as presented in the Work Plan, was to investigate groundwater underflow at the HBHA pond and the impact of that underflow in an area west of the water body. Bedrock and glacial till highs west of the HBHA pond may drive the local hydrogeologic system and minimize the significance of underflow in this direction, however the fact that arsenic was detected in well cluster OW-30, suggests this area should be evaluated further. From this presentation the Report seems to refocus on underflow in a north south direction. This discussion suggests confusing conclusions with no supporting data. The ROUX presentation of August 7, 1992, took the underflow discussion one step further when statements were made that the arsenic plume in the vicinity of HBHA pond had stopped its southern migration in the vicinity of the central portion of the HBHA pond. If this argument is made, then data to support discharge of most of the groundwater plume into HBHA pond needs to be presented. The objective of the task should be clarified.

13) Page 19: The discussion presented in the Phase 2 report minimized the significance of underflow at the HBHA pond and in several instances (such as page 19, third paragraph and bullets and page 22, first paragraph) suggests most or all groundwater is discharging into the HBHA pond. This theory was further stated by ROUX representatives during the August 7, 1992 project status presentation. Mass balance data was not presented to support this suggested conclusion. A calculation presented in the report indicated that groundwater discharge into the HBHA pond (page 34, first paragraph) is only 720 cubic feet per day and does not support the conclusion that a great portion of the aquifer is discharging to surface water at this point.

This section needs to be clarified, objectives of the task clearly stated and conclusions revised. Based on data presented, groundwater underflowing the HBHA pond in a north - south direction appears to be occurring. If this is an issue, additional data points (wells) should be installed, and a mass balance completed.

14) Page 21-22, Section 2.1.3: The delineation of bedrock was interpreted by Golder Associates through pre-existing USGS bedrock maps and geophysical data. No monitoring well/boring data were collected from the western, eastern and southern HBHA pond to verify/support the bedrock delineation. Additional groundwater data will be necessary to characterize the extent of the bedrock and contaminant migration.

15) Page 24, Section 2.1.3: The data collected during the two investigations (2 on-site bedrock wells and 2 upgradient bedrock wells) suggest that groundwater contamination generally increases with depth, and fractures in bedrock serve as a migration pathway. The groundwater data collected from bedrock areas are insufficient at characterizing the nature, extent (horizontal and vertical) and migration of contamination at the site. The data is also insufficient at evaluating the contribution of bedrock aquifer contamination to surface water and sediment contamination and migration. Two on-site bedrock monitoring wells are not considered adequate coverage for bedrock aquifer characterization when the site is over 240 acres (excluding downgradient areas of the site). Additional analytical data will be necessary to characterize the extent of the plumes as well as the interactions between the bedrock and unconsolidated aquifers. In addition, GSIP Phase 1 (pages 21-29) indicate the following: K values increase with depth at the site; groundwater may not be discharging into HBHA pond during high precipitation events; and deep groundwater flows along the main buried valley axis and does not flow into HBHA pond. Data will need to be collected during high precipitation events, and the location of the buried valley determined.

16) Page 24: The conclusion as presented in the Phase 2 report states "due to the low conductivity of the crystalline bedrock observed at three of the four bedrock well locations investigated, the crystalline bedrock does not appear to be a pathway for the transport of organic constituents, except at Observation Well OW-55". Insufficient data exists to support this conclusions presented on page 24 (third paragraph) and page 77 (third paragraph). The only bedrock borehole which intersected fractured bedrock allowing groundwater flow also contained appreciable concentrations of site-related contaminants. An analysis of bedrock fracture patterns should be conducted to guide the placement of boreholes to intersect zones of potential bedrock contaminant transport pathways. The possibility of vertical bedrock fracturing and appropriate investigation methods to assess these potential contaminant pathways should be considered.

17) Page 26, paragraph 4: The concentration of total chromium in surface waters is stated to range from 8.5 to 195 ug/L. At no point in the ecological assessment are these values evaluated for potential to cause adverse effects. The chronic ambient water quality criterion (CAWQC) for hexavalent chromium is 11 ug/L, and the CAWQC for trivalent chromium is 120 ug/L (based on a water hardness of 50 mg/L). Based on these criteria, it seems prudent to discuss the implications of chromium concentrations measured in surface waters.

18) Page 27: The concentrations of several of the PAHs measured in site sediments exceed concentrations reported to cause adverse biological effects in benthic biota. However, these elevated PAH values were not assessed in any way. For example, Long and Morgan (1990) compiled and ranked sediment concentrations of individual chemicals, including several PAHS, that were associated with adverse effects on benthic biota. The 10th percentile of these ranked values was designated the Effects Range-Low (ER-L), and the 50th percentile was designated the Effects Range-Median (ER-M). The maximum detected concentrations of anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, phenanthrene, and pyrene all greatly exceed both the ER-L and ER-M values established by

Long and Morgan. ER-L and ER-M values have not been established for several other PAHs detected, but alternative benchmarks values may be available. An appropriate discussion of potential for adverse effects to ecological receptors from PAHs in sediments is warranted.

19) Page 28, Section 2.2.2: Table 9 depicts increased sediment concentrations of PAHs indicating contamination migrating via the surface water pathway through the site and downgradient of HBHA pond. Soil data exists (Figure 14: Results of Task S-1 TCL/TAL Analyses) which supports the presence of high PAHs on-site. This data illustrates high PAHs in soils along New Boston Street, between Merrimac and New Boston Street, and along the Janpet and WIA properties. However, the text does not make reference to this contamination or identify it as a concern.

20) Page 29, Section 2.2.2, paragraph 2: It is expected that depositional areas will have higher contaminant concentrations than non-depositional areas. Fine grained sediments are expected in depositional areas, and sands and gravels in non-depositional areas.

With regard to sediment sample SED-23, the sample had a percent solids of 20.9%. Relative to all the other sediment samples collected in the study area, 20.9% solids reflect a sample collected in a depositional area containing high organic content and fine grained sediment. Therefore, SED-23 is considered a representative depositional sample with a normal percentage of fine grained sediment. SED-23 was also considered valid by the laboratory's validation procedures, and its contaminant concentrations would not be considered anomalous.

The text points out that SED-23 has a lower percentage of fine grained sediment than the other GSIP Phase II sediment samples when the overall variations for percent solids ranged from 8.1% to 20.9% solids. These variations are relatively small when compared with the GSIP Phase I sediment data. Specifically, SED-14 had a very high sand content of 99% and an extremely low organic content of 0.2%. The text does not mention that the percent sand and organic content of SED-14 is significantly different with large variations when compared to depositional sediment samples (such as SED-9 with 5% sands and 20% organic content, SED-11 with 0% sands and 16% organic content, and SED-13 with 13% sand and 10% organic content). However, the text compares the result of SED-14 with depositional areas upgradient, and suggests upgradient sediments do not migrate beyond SED-14. This is inappropriate. Non depositional sand samples with low organic contents are not expected to sorb contaminants and can not be compared to fine grained depositional sediment samples.

21) Page 26-29: The conclusion of the Phase 1 RI regarding trapping of contaminated sediments in HBHA was briefly mentioned in the GSIP Phase 2 RI during a summary of the Phase 1 results (Pg. 5). However, the results from the Phase 2 sampling do not support the conclusions made during Phase 1. The maximum concentrations of arsenic, chromium, cadmium, copper, nickel, and zinc detected in sediments collected from HBHA (using combined results from both Phase 1 and Phase 2 studies) were found in samples collected from the southernmost stations in the pond/wetland area (SW-22 and SW-23). These results are not consistent with the theory that

northern portion of HBHA is trapping contaminated sediments so that they do not reach the southern portion of HBHA. The data indicate contaminant migration from the site to sample location SED-23, at Mishawum Road. The sample location density should be increased prior to making remedial action decisions.

22) Page 30, Section 2.3.1.2: The text states, "if the true detrital sediment is the black ooze, the post-construction deposited sediment volume is approximately 9,700 cubic yards." The text indicates that a minimum volume of 9,700 cubic yards of black ooze (excluding the volume lost to migration beyond the HBHA pond) is generated every 18 years (1974 to 1992) and released to HBHA pond, which was constructed around 1974. Prior to the construction of the HBHA pond, this contamination migrated downgradient in the Aberjona River Watershed and deposited into depositional areas, such as the former Mishawum Lake. A portion of the lake was filled in about the same time HBHA pond was constructed to promote development of the watershed. Recent State 21E Site Assessment soil boring data collected from the former Mishawum Lake (filled in portion) illustrate high levels of metals contamination in the lake bed (As @ 636, 3,810 and 4,910 ppm; Cr @ 4,360, 3,400 and 3,440 ppm; Pb @ 460, 1540 and 1,890 ppm; and Hg @ 25, 38 and 65 ppm). Additional data should be collected to determine the nature and extent of contaminants in the unfilled portion of the Mishawum Lake, as well as other depositional areas, to evaluate their impact to the ecology and human health, and data from the filled portion of the Mishawum Lake, to evaluate any impacts on future exposures.

Based upon the historical operations of the site, EPA believes contamination migration had occurred from the Site by uncontrolled surface water and sediment erosion since the 1850's. This migration may have been magnified since the deposition of animal hide residues on-site (mid 1930's) through groundwater discharging into surface water bodies and the precipitation of dissolved metals into the sediment. The completion of the protective cover portion of the Remedial Action should stabilize the site and prevent on-site contaminant migration through erosion pathways. Other contamination migrations pathways may exist from other potential sources, such as dissolved metals in groundwater and depositional areas with high metals concentrations (e.g. HBHA pond), and should be evaluated and investigated further.

23) Page 31: The water/sediment interface is described as "a black suspension of fine-grained sediments (black ooze)" on page 31, third paragraph. A very low surface water velocity is required to transport such a "suspension" of sediment. Considering this, it does not seem appropriate to conclude that the "HBHA pond and associated wetland is effective in trapping organic and inorganic compounds transported on fine-grained sediment, and is preventing down stream migration of this sediment" (page 5, second bullet). Also, downgradient depositional sediment contaminant concentrations indicate that the HBHA pond does not act as an effective trap preventing downgradient migration.

24) Page 34, Section 2.3.1.4.2: The groundwater seepage rate volume of 720 cubic feet per day, which is estimated to be 0.3% of the total discharge into HBHA pond, appears to be significantly low. The adjusted rate of 15% also appears to be very low. This would mean that 99.7 to 85% of

the HBHA pond was fed by surface water discharge. During the summer months minimal surface water discharge occurs into HBHA pond, but the pond maintains a high water level throughout the year, with minimal water level fluctuations. This suggests that a large portion of the surface water in HBHA pond is supplied by groundwater discharge. Additional data should be collected to assess the volume of groundwater discharging to the HBHA pond compared to the volume of groundwater continuing to flow in the buried bedrock valley underlying the Digital Property, as well as the extent of groundwater contamination plumes and their discharge locations and rates. A mass balance and contaminant flux analysis of the system should be conducted.

25) Page 34, Section 2.3.1.4.2: There was a major precipitation event at the end of September 1991, which may have obscured the normal results of the October 4, 1991, surface water monitoring and discharge rate calculation. According to USGS data from Reading, MA, the rainfall on the following dates were recorded: 9/23/91 @ 0.12 inches; 9/24/91 @ 0.06 inches; 9/25/91 @ 3.29 inches; and 9/26/91 @ 1.01 inches. This data illustrates that 4.30 inches of rain fell from September 25 to September 26. Due to the possibility that the surface water level in the area may have been artificially elevated during the October 4, 1991 surface water monitoring, the calculated groundwater discharge rates may be underestimated.

26) Page 34: The discussion on page 34, first and second paragraphs should include an explanation of the apparent discrepancy of groundwater contribution to the HBHA pond.

27) Page 34, Section 2.3.1.4.3: This Section presents a groundwater retention time in the black suspension which is based on no transport or turbation of this suspension. If such sediment disturbance or transport occurs, retention time will decrease due to release of pore water to the surface water. What is the effect of a shorter residence time in the event sediment is distributed by high water flows during storm events or by wildlife (ducks) observed at the pond? Will "premature" release of groundwater to the HBHA result in the observed occurrence of benzene in the surface water? What are the effects of such a release?

28) Page 39, Section 2.3.2.1: The text states, "while arsenic concentrations in the sediments were similar in the North, Central and South Areas of the pond (Figure 21), the pore water concentrations in the north area were an order of magnitude lower (Figure 20) than in the Central and South Areas, indicating that the axis of the arsenic plume is intersection the HBHA pond near the Central areas." This does not explain why similar sediment concentrations of arsenic are located upgradient in the north section of HBHA pond [Note: the highest sediment concentration of arsenic in HBHA pond was collected from SED-9 in the north section of HBHA pond with an arsenic concentrations of 9,830 ppm.] In addition, the highest benzene concentrations in the sediment were detected in the black ooze at the north section of HBHA pond, a magnitude higher than the central and southern areas. Based upon Water Table Contour Figure 3, the Benzene Plume Figure 5 and the Arsenic Plume Figure 7, contamination discharge into HBHA pond occurs over the extent of the plumes. The plumes are depicted in the north and central areas for arsenic, chromium and benzene. The text's statements appear to be inaccurate, since the plume seems to discharge in both the north and central areas.

29) Page 40, Section 2.3.2.3: For the same reasons described above, data exists which disputes the claim that "chromium plume is intersecting the HBHA pond near the Central Area." In addition, sediment sample SW-9 had the highest chromium concentration in HBHA pond and was situated in the north section of the pond.

30) Page 38-40: The discussion of the distribution of chromium and arsenic in HBHA pond sediments leads to the conclusion that ground water plumes intersect the HBHA pond at a specific location (page 39, first paragraph and page 40, first paragraph). Earlier work presented on Plates 8, 9 and 10 indicates that arsenic and chromium are present in stream sediments and surface water upgradient of the holding area and may also contribute to the contaminant mass in the Holding Area and could mask the actual location of the plume axes. It is not appropriate to locate the axis of a plume based on such indirect evidence. The leading edge of the plume should be delineated by groundwater samples collected from monitoring wells.

31) Page 40-41: The range of Kd values presented for benzene appears high compared to values predicted by equilibrium partitioning (EP). Based on the range of total organic carbon (TOC) in site sediments (0.02 to 13.4%), a log Kow of 2.13, and accepted Kow/Koc relationships, EP predicts Kd values ranging from approximately 0.1 to 57 for benzene. The interstitial water (IW) concentrations of benzene measured in the equilibrators were assumed to be based on equilibrium conditions, yet it is possible that equilibrium conditions did not exist when the equilibrators were retrieved, resulting in IW concentrations lower than expected. Therefore, calculated Kd values would be higher than expected, based on IW conc = Sed Conc/Kd. Documentation of equilibrium conditions would support the use of the methodology selected for determining IW concentrations and the resulting calculated site-specific Kd values presented in this document.

32) Page 45; Section 2.3.2.7: See previous comments on Page 39, Section 2.3.2.1; Page 40, Section 2.3.2.3; Page 38 - 40; and Page 40 - 41.

33) Page 46, Section 2.4.1, Sulfide, and Page 57, Section 2.4.5, para 3: In addition, sulfur was extensively used on the site between the 1850's and 1930's, which may have been another source, coupled with reducing environment caused by the animal hide residues, contributing to aqueous sulfide.

34) Page 47, Section 2.4.1, Eh/pH: Well OW-36 is not downgradient of the West Hide Pile, based upon the Plate 3 map.

35) Page 48, Section 2.4.1, DOC: See comment for Page 36, Section 2.3.2.1.3.

36) Page 50, Section 2.4.2, Para 4, and Page 82, Task M-1 and M-2: The text states, "the less extensive distribution of MMA compared to total arsenic, despite the greater mobility of MMA, suggest that MMA is demethylated once it leaves the sulfidic ground waters. This interpretation is consistent with the Site paradigm, which hypothesized that methylated arsenic was formed in the reduced zone but was later oxidized in the higher-Eh zones away from the hide piles." This

paradigm with MMA being demethylated once it leaves ground water > 1 mg/L of sulfide, applies to a very limited number of monitoring wells OW-31, OW-16, OW-41, and OW-12 (based upon Figures 32 and 41). The paradigm suggests that this occurs in combination with the higher sulfide concentrations and lower Eh zones. However, two of the four monitoring wells, OW-31 and OW-16, have relatively high values of Eh at 400 and 310, respectively, while the other monitoring wells have low values of Eh at -72 and -89 (Figure 34). Therefore, this portion of the paradigm does not accurately apply to the site.

37) Page 52, Section 2.4.3, TOC: Another cause of high organic carbon in some areas of the subsurfaces on-site may be related to filling of wetlands or the disposal/relocation of wetland related materials on the site since 1853.

38) Page 54, Section 2.4.4, para 2, and Page 82, Task M-1 and M-2: The text states, "arsenic transport is enhanced by methylation reactions occurring in the water with sulfide above 1 ug/L, but is retarded where sulfide concentrations are below 1 mg/L." Based upon the data provided in the Figures 32, 33 and 41, total arsenic concentrations do not appear to be increased by methylation reactions or high sulfide conditions. See comment for Page 50, Section 2.4.2, Para 4. Again, this portion of the paradigm applies only to a limited number of wells OW-31, OW-16, OW-41, and OW-12. There are twice as many monitoring wells with high levels of total arsenic which refutes the paradigm, including OW-36, OW-37, OW-43, OW-11, OW-48, OW-47 and OW-42. What is causing these high concentrations? The conclusions stated in the report do not appear accurate.

39) Page 56, Section 2.4.5 and Page 57, Section 2.4.5, para 1: See comment Page 54, Section 2.4.4, para 2.

40) Page 57, Section 2.4.5, para 2, and Page 82, Task M-1 and M-2: The text states, "in contrast, more oxidizing conditions exist across the remainder of the Site, with Eh potentials above zero (figure 34) and dissolved oxygen above 1 mg/L. As ground water flows from reducing to oxidizing zones, geochemical reactions occur that limit the mobility of dissolved metals leached as precipitation infiltrates through impacted soils and hide material." The text indicates that Eh above zero and DO above 1 mg/L will cause the metals to precipitate out of solution. However, many high concentrations of dissolved metals exist in monitoring wells with Eh levels above zero, including OW-31, OW-36, OW-37, OW-43, OW-16, OW-47, OW-48 and OW-42. In fact, the only wells with an Eh below zero were OW-12 and OW-41. In addition, based upon GSIP Phase 1 Figure 47 - Concentration of Dissolved Oxygen in Ground Water, there are many wells situated with in this arsenic plume, as well as the arsenic plumes downgradient from the East and West Hide Piles, which exhibit dissolved oxygen above 1 mg/L, including OW-31, OW-36, OW-37, OW-43, OW-38, OW-45, OW-46, OW-47, OW-48, OW-49, OW-50, and OW-42. Therefore, the paradigm does not appear accurate. The paradigm should be re-evaluated.

41) Page 59: The ecological assessment should comprehensively appraise the actual or potential hazard to the various types of biota associated with the Halls Brook Holding Area (HBHA) and downstream drainages. The results of the site-wide ecological assessment in Phase 1 were not

sufficient to characterize the risk to aquatic receptors in HBHA. Only one fish, a golden shiner, was caught in the HBHA pond during the Phase 1 fish survey. The information collected during the Phase 2 fish survey should have been used to further develop the risk assessment for aquatic receptors in HBHA.

42) Page 60, Section 2.5.1.2.2: The text states that the laboratory conducting sediment bioassay tests received the sediments at "temperature ranged from 10 - 12° C." This temperature range is above the ideal EPA CLP temperature of 4° C. Could this temperature range have affected the test results?

43) Page 62, Section 2.5.1.3: The text states that "the control chambers were inadvertently filled with deionized water instead of reconstituted freshwater. This error was discovered and corrected prior to the addition of test organisms." This may have impacted the test results if the samples collected for analysis were filled with deionized water. Did the error with the deionized water only happen with the control samples? How may this error affect the test results? Could the test organisms been subjected to an osmotic shock from deionized water remaining in the sediment pore water? Why weren't the control chambers re-established, and the materials related to the error discarded? Please clarify. Toxicity tests should be conducted under the same experimental conditions for all chambers, including the controls; therefore, uncertainty and non-reproducibility of the results are also issues that should be acknowledged.

44) Page 63: SED - 18 should not have been selected as a background location for sediment bioassay based on the field description of the sample: "{the sample}...had an oily sheen, a "greasy" texture, and exhibited a hydrophobic characteristic ("beading") typical of sediment containing petroleum hydrocarbons." This sampling location is also downstream from two other potential contaminant sources. A less disturbed and more representative background location should have been selected.

45) Page 64: The text of the fish sampling survey should be rewritten and expanded. The report asserts that the same species found during the site-wide Phase 1 survey were caught in the HBHA pond during Phase 2 and the text implies that all trophic levels were sampled, which was not the case. For clarity, it should be stated that predator fish could not be captured during the survey.

The amount of sampling effort in the HBHA pond and Philip's Pond should be included in the text. Although only eight fish were captured in HBHA pond, apparently a greater effort was required to collect this number of fish than in Phillip's Pond, the background area. Three successful HBHA pond collection dates are listed in Table 30, but the text does not indicate how many additional 24-hour net sets were unsuccessful. If the experimental gill net was consistently ineffective in catching predator fish, other methods (e.g. angling, electrofishing) should have been employed to obtain the desired sample.

A characterization of the HBHA pond fishery based on the survey results would be an informative component of the risk assessment. Only one golden shiner was caught in the HBHA pond during the Phase 1 survey. Several days of gill netting were required to collect eight fish of three species in the HBHA pond during Phase 2. The potential causes for this degraded fishery should be discussed in the report.

46) Page 64, Section 2.1.5.4: See comment for Page 11, Section 1.3.2.1.

47) Page 64, Section 2.5.2.1: The text states, "compared to Philips Pond (PP), fish appeared to be less abundant within the HBHA as the field sampling time for the latter had to be increased to obtain a similar yield. Foragers were also not recovered from HBHA, although a large school was observed at SED-13 during summer of 1991." This data indicates that the fish population and diversity were diminished in the HBHA pond. This suggests a negative impact to fish diversity in HBHA pond is probably related to the contamination present in the pond. In addition, GSIP Phase 1 also identifies HBHA being negatively impacted by COCs. The text stated, "samples taken from the Hall's Brook Holding Area indicate that this pond has a poor macroinvertebrate community... These conditions, in addition to the presence of constituents of concern (e.g. metals) that have migrated from the Site, may explain the virtual absence of benthic fauna at these stations." The report should have evaluated and addressed these issues.

48) Page 65: At the top of the page, the plan states that "foragers" were not collected from the HBHA pond. Table 30 indicates that three golden shiner, a forage species, were collected.

49) Page 65: The results of the tissue analyses do not indicate if the concentrations are reported in wet weight or dry weight. It is inappropriate to compare the HBHA pond information with other data-sets without this specification.

50) Page 66: The freshwater fish fillet and whole body metal concentration ranges selectively gleaned from the Eisler series do not necessarily represent "normal" concentrations in fish tissue. The higher values listed in the GSIP in some instances represent the maximum values encountered during field collections cited by Eisler. The Eisler values are considered representative of fish tissue chemical concentrations from a variety of relatively non-contaminated and contaminated locations.

51) Page 66, Section 2.5.2.3, para 2: The detection limits for semi-volatiles were extremely high. Given the high levels of PAHs in the sediments, additional analytical data should be generated for fish and benthos at appropriate detection limits to evaluate the impact of PAHs on ecological receptors. Fish tissue analyses (at background and site-related samples) should include testing for P-450 enzymatic activity. Additional fish studies should also include a detailed qualitative fish assessment including species, age, size, lesions, abnormal growths, etc.

52) Page 67: Until the reasons for the apparently degraded fishery in the HBHA pond are ascertained, it is premature to state that arsenic "is not considered a threat to local wildlife."

53) Page 67, Section 2.5.3: An up-to-date comprehensive review of toxicological information, including toxicity benchmarks, should be conducted for the evaluation and discussion of the

contaminant database generated for the study area. Other Eisler monographs have been published on the hazards of other contaminants to wildlife. In 1996, the Society of Environmental Toxicology and Chemistry published, through CRC Press, the book "Environmental Contaminants in Wildlife; interpreting tissue concentrations". EPA published a two-volume "Wildlife Exposure Factors Handbook" (December 1993, EPA/600/R-93/187a,b), which provides information useful for supporting the assessment of contaminant exposure through food chain/web modeling. NOAA published the document by Long and Morgan, 1991, and an article was published by Long and collaborators in 1995. EPA has also published various "ECO Updates" which provide national guidance for ecological risk assessments (including one issue with "Ecotox Thresholds"), as well as regional guidance documents. Other sources of toxicity benchmark values may also be appropriate. When specific benchmarks are not available, appropriate extrapolations between related species and surrogate data between similar compounds should be used.

54) Page 68, paragraph 2: The first sentence appears to support eliminating all volatile and semi-volatile organic compounds and many metals as chemicals of concern. The lack of chemical- and species- specific toxicity data does not, in itself, support such eliminations (the USFWS Hazard Review monographs are only one of many sources of ecotoxicity data). The evaluated concentrations of many chemicals that were not assessed is a cause for concern. The potential impacts of such chemicals should be assessed, even if only qualitatively. In addition, chemical-specific toxicity can be estimated using chemical relationships (e.g. QSARs) and species-specific toxicity values can be approximated using interspecies correlations.

55) Page 68, Section 2.5.3, para 3 and Section 2.5.3.1, para 2: COCs will need to be re-evaluated and approved by EPA. Mercury, copper, nickel, zinc, cadmium, benzene and PAHs should have been retained as COCs. There are numerous other sources of toxicological information in addition to the publications by Eisler of the USFWS. In addition to toxicity, the bioaccumulation potential of the contaminants (as well as their persistence, frequency of detection and the comparison of concentrations to background) should be considered during the selection of contaminants of concern.

56) Page 69, Section 2.5.3.1: The text states, "metals do not have a strong tendency to mobilize into surface water. Consequently, surface water is ruled out as a significant exposure source for wetland dependent birds." It does not appear appropriate to exclude surface water as an exposure scenario unless the contaminant concentrations are below the Aquatic Water Quality Criteria. Based upon GSIP Phase 1 Table 4.1, chronic toxicity was exceeded for copper, iron, lead and zinc in the total surface water, and iron and zinc in the dissolved surface water. Therefore, surface water should not be eliminated as an exposure scenario. Information on water ingestion rates (in EPA's Wildlife Exposure Factors Handbook") and contaminant concentrations in surface water can be integrated into the exposure modeling process. In addition, the statement "metals do not have a strong tendency to mobilize into surface water" is an inaccurate generalization. The issue of the mobility of metals in water should be evaluated on a metal-specific basis, as there is a wide range of mobility behaviors.

57) Page 71, Section 2.5.3.2. The text states that the lowest observed adverse effect level (LOAEL)

was used for arsenic and a no observed effect level (NOAEL) for arsenic was established by dividing the LOAEL by a safety factor of 3. EPA considers the traditional factor of 10 to be more appropriate (and conservative) for the general conversion from LOAEL to NOAEL.

58) Page 72 and 73, Section 2.5.3.4, and Page 75, Section 2.5.3.6: The text states "although mallards are migratory birds, some populations migrate the shortest possible distance to find sufficient food for winter. Because of their well-developed homing instinct, mallards tend to migrate to previously visited habitats during the fall migration. When winter conditions are favorable, some groups do not migrate at all; they remain in the same general vicinity through out the year." The exposure scenario for the mallard, particularly the 90 day Exposure Frequency (EF), may not be "highly conservative." It is likely that a number of mallards may be permanent residents or non-migratory in the urban/suburban areas of Greater Boston, and an exposure frequency of 365 days would be a more appropriate, "highly conservative" scenario for the risk assessment. Even if migratory mallards were considered, the exposure frequency of 90 days may be too short. Migrants may utilize the area between mid spring (April) and mid fall (October) producing an exposure frequency of approximately 210 days.

59) Page 73, Section 2.5.3.4, para 3: The text states, "ingestion of COC via food was considered, but judged to be an insignificant exposure pathway for several reasons. First, floating aquatic macrophytes would be predicted to have low concentrations of COC because surface water concentrations were typical of those observed for natural waters. Second, low concentration of arsenic, chromium, and lead are anticipated in tissues of rooted aquatic macrophytes as these metals are poorly translocated to edible portions of the plant." The mallard duck also feeds on the sediment benthic community. The benthic community should be included in the food chain exposure modeling of the mallard duck. Particular attention should be given to COCs that bioaccumulate and biomagnify.

It is recommended that the diet of a breeding female mallard in the spring be used for modeling purposes in the ecological risk assessment, which is reported (in EPA's "Wildlife Exposure Factors Handbook") to include from 10.2 to 33.2% plant material, and from 66.8 to 89.4% invertebrates. Of the invertebrates, freshwater annelids (oligochaeta) represent the dietary item of higher consumption (i.e., 38.3% of diet), exceeded only by insects as a whole group (i.e., 48.1% of diet).

60) Page 74, Section 2.5.3.4, para 1: The text estimates the daily sediment ingestion rate (IR) to be the average daily food intake (560 g) multiplied by the maximum amount of sediment (2 percent) determined in the diet. EPA notes on page 73 the text reads "... overall consumption of sediment was estimated to be less than 2 percent of the dietary intake." If available in the literature, a published reference(s) should be provided to support the text statements that the maximum sediment found in the mallard duck is 2 percent.

61) Page 74, Section 2.5.3.4: The text estimated the total daily intake of sediment to half the daily rate, based upon the movement of birds between wetlands. This arbitrary assumption appears inappropriate since the study area is large area with minimal disturbances (relatively protected

industrial area), and contains several wetlands. The foraging range of the mallard should be considered in relation to the total study area, generating a "site foraging frequency" factor for modeling purposes.

62) Page 74, Section 2.5.3.4, para 2: The report indicates that chronic daily intake of COC was determined by adapting a formula used for soil ingestion for humans (EPA, 1989, RAGS, VOL. 1). The so called "availability factor" (AF) does not appear in Exhibit 6-14 for " Residential Exposure: ingestion of chemicals in soil" of the cited reference (page 6-40); adherence or absorption factors are, however, included for dermal exposure modeling only. Using AFs as presented in the report is not conservative. In addition, the use of AFs would be associated with very high uncertainty due to the extrapolation of the data from different species, as well as other experimental factors, such as different duration and routes of exposure, and use of different chemical forms of a contaminant. It is recommended that 100% availability of the contaminants ingested be applied and AFs not be used.

63) Page 76, Task G-1: Phase II investigated the extent of benzene contamination detected at OW-31. Five piezometers were installed surrounding the West Hide Pile. WP-3 was situated upgradient of the OW-31, while WP-4 was situated downgradient. The other piezometers were either dry or cross gradient from OW-31. Monitoring well OW-31 had a benzene concentration of 63,000 ppb and piezometer PW-3 had a concentration of 12,000 ppb. Monitoring well OW-43 is situated downgradient of OW-31, approximately 600 feet away, had a benzene concentration of 518 ppb. Another monitoring well, OW-37, is situated downgradient of OW-31, and did not detect benzene in the groundwater. The high concentrations of benzene from the OW-31 monitoring well is a concern to the EPA. Primarily, OW-31 is adjacent to the lower southern pond and the benzene contamination is being released into the groundwater and remediated ponds surface water and sediments. The benzene migration into the pond may have created an unacceptable impact to the ecology of the pond and human health exposures. Also, the benzene contaminated groundwater migrating from the direction of OW-31, may be migrating considerable distances and impacting the water quality further downgradient. Therefore, the source of the benzene hot spot near monitoring well OW-31 should be investigated further, and as appropriate removed.

64) Page 77, Task G-2: Phase II investigated the flow of groundwater beneath the HBHA pond through the installation of additional cluster monitoring wells and piezometers in the northern and southern areas of the HBHA pond. The data from these wells and meters is reported to indicate that groundwater does not move beneath the HBHA pond, except where the axis of the arsenic plume intersects the central portion of the HBHA pond. EPA does not believe there is sufficient monitoring well data to make any conclusion on the underlying groundwater flow. The existing bedrock data on the site does not support the text statements regarding the aquifers lateral and vertical extent. There is no boring data in the areas depicting bedrock above the groundwater table to support these statements, including the following statement, "the lateral extent of the unconsolidated aquifer on the west side of the HBHA pond is limited, due to the presence of the adjoining bedrock high which defines the westward boundary of the aquifer. Therefore, any arsenic impacted ground water on the western side of the HBHA pond will be directed eastward/southeastward back toward the HBHA pond and will discharge in the HBHA pond."

The nature of groundwater flow and contaminant transport in the vicinity of the DEC property should be further defined. This investigation should include a mass balance study of the flow and contaminant flux in HBHA pond to include surface water, groundwater, and aquifer recharge downgradient of the HBHA pond; comprehensive low flow groundwater sampling; characterization of the bedrock geometry east of the HBHA pond and DEC building to more accurately locate the buried bedrock valley; groundwater flow characteristics in the area of east and south of HBHA pond and DEC building should be investigated to determine the receptor of contaminant plumes in these areas; vertical gradient in HBHA pond; Infiltration to the HBHA pond, groundwater flow into bedrock and groundwater flow into the bedrock valley should be investigated.

65) Page 78, Task G-3: Phase 1 and Phase 2 investigations have installed and collected groundwater samples from 4 bedrock monitoring wells. Two of the bedrock monitoring wells (OW-1 and OW-4) are situated upgradient from contamination at the Site. The other two bedrock monitoring wells (OW-9 and OW-55) are situated in the south-central portion of the site, approximately 400 feet away from each other. Given the size of the site (approximately 245 acres) and the need for monitoring groundwater downgradient of the site, two bedrock monitoring wells are considered significantly deficient for characterizing the extent of contamination in the bedrock aquifer. The text does indicate that three other bedrock wells were installed in competent rock during Phase 2, and groundwater was unable to recharge sufficiently in these wells to collect samples. [Note: EPA does not know why these wells were not relocated to another area. Please explain.] Monitoring Wells OW-9 and OW-55 were installed in fracture bearing bedrock, and provided ample recharge in each well. Groundwater samples were collected from these wells and found to contain organic and inorganic (dissolved) contamination. The data collected from these two bedrock wells suggest that contamination generally increases with depth, and fractures in bedrock serve as migration pathways for groundwater contamination.

Therefore, the bedrock groundwater data is insufficient for characterizing the nature, extent and migration of contaminants in the bedrock aquifer at the site. It is also insufficient at evaluating the bedrock groundwater contamination contribution to surface water and sediment contamination and migration.

66) Page 79 and 80, Task S-1: See comments Page 11, Section 1.3.2.1, Page 27, and Page 29, Section 2.2.2, para 2. EPA does not consider SW-18/SED-18 and SW-19/SED-19 background samples. The concentrations of contaminants detected at SED-23 do not appear anomalous for a sample with 20.9 percent solids. In addition, the conclusion does not address the potential effects on aquatic biota of the elevated concentration of trace elements and PAHs (total PAHs: SED-21 @ 11 ppm, SED-22 @ 27 ppm, SED-23 @ 13 ppm, and SED-24 @ 98 ppm) in the HBHA sediments. Adverse effects on aquatic organisms have been observed at lower concentrations of contaminants in sediments than those measured in HBHA. The report should discuss the elevated concentrations of contaminants that were detected in sediments and surface water, and should assess the potential risk based on comparison with ER-L and chronic AWQC concentrations, respectively.

67) Page 81, Task S-2: See comments on Page 30, Section 2.3.1.2, Page 34, Section 2.3.1.4.2, Page

39, Section 2.3.2.1, Page 40, Section 2.3.2.2, Page 38-40, and Page 40-41.

68) Page 82 and 83, Task M-1 and M-2: See comments Page 50, Section 2.4.2, para 4, Page 54, Section 2.4.4, para 2, and Page 57, Section 2.4.5, para 2. Significant data exists which refutes some of the conditions associated with the paradigm.

The paradigm is partially correct insofar as some portion of dissolved metals in groundwater discharges to the HBHA pond and precipitates into the sediments. Insufficient data is available to determine whether all groundwater discharges into the HBHA pond. Groundwater migration of dissolved metals may occur beyond the HBHA pond (west, east and/or south of HBHA pond). Additional groundwater data will be required to determine the extent of migration and discharge points. The paradigm is incorrect with regard to HBHA pond serving as a contamination sink and adequate containment system which prevents the migration of contamination. This is illustrated in the sediments samples SW-21, SW-22, and SW-23 downgradient of HBHA pond, which have elevated levels of metals. Analytical data from nondepositional sediment areas, such as SW-14, are not considered applicable for comparison with depositional samples. Based upon the percent solids, percent silts, percent organic content, and field logs, it is apparent that many of the sediment samples collected during the study were not depositional areas. Sediment samples SW-1, SW-2, SW-4, SW-5, SW-8, SW-10, SW-12, SW-14 and SW-15 apparently were collected in non-depositional areas of the water shed. Sand and gravel samples were collected at these sample locations, unlike traditional depositional sediments with higher percents of silts and organic contents.

69) Page 84, Task E-1: See comments Page 11, Section 1.3.2.1 and Page 29, Section 2.2.2, para 2: EPA does not consider SW-18/SED-18 and SW-19/SED-19 as "background" samples. Additional investigations should be conducted in these areas to evaluate the extent of any environmental problems. Additional data should also be collected from suitable upgradient, depositional areas to serve as background locations. In comparing sample results to the control (*H. azteca* 21-day survival at 82%, *C. tentans* 14 day survival at 85%), it is noted that SED-21 and SED-23 illustrate some increased mortality with the *H. azteca* study at 62% and 73% survival, respectively, while SED-23 also illustrated increased mortality with the *C. tentans* study at 80% survival. Table 26 illustrated a statistically different "Number of Offspring" of *H. azteca* in SED-19 and SED-21 when compared with the control sediment. Table 27 illustrated a statistically different "Avg. Weight of Surviving Larvae" of *C. Tentans* in SED-24 when compared to the control sediment.

In addition, other factors are relevant to the study, such as DO and ammonia concentrations for each sample, but were not discussed in the text. These factors may have impacted the results of the study. In conclusion, EPA considers the problems with upgradient samples SED-18 and SED-19, and the limited number of samples collected for the study to be inappropriate for evaluating the site related sediment toxicity.

70) Page 84, Task E-1: See comments Page 11, Section 1.3.2.1 and Page 29, Section 2.2.2, para 2: The bioassays were conducted using appropriate test organisms. Sediments that were collected from SW-21 (located in HBHA pond) showed measurable adverse effects (a significantly low

reproductive rate of Hyalella azteca). However, the report stated that is was impossible to conclude if the response to the sediment from SW-21 was a direct result of site-related constituents (Pg. 64) because of the adverse response observed with sediments collected from the upstream "reference" stations. The possibility that the toxicity of sediments from SW-21 may have been due to site-related contamination appears to have been left unconsidered. Further investigations regarding the bioassay results should be made, and should include the following considerations:

1) The zero percent survival rate observed in sediments collected from SW-18 deserves another look. Were there high concentrations of pesticides or PCBs in sediments collected from this site? Sediments were analyzed for pesticides and PCBs, but data were not presented in the report or in the appendices. Toxicity of sediment collected from SW-18 may also have been due to the high concentration of bis (2-Ethylhexyl) phthalate.

2) Although sediment TOC and grain size were measured, no attempt was made to consider the toxicity of the sediments as a function of contaminant availability. The results of the TOC and grain size analyses were not found in the report or in the appendices.

71) Page 85, Task E-3: See comments Page 71, Section 2.5.3.2, Page 72 and 73, Section 2.5.3.4, and Page 73, Section 2.5.3.4, para 3. EPA does not consider the assumptions on the mallard's residence period and exposure via food ingestion to be appropriate or conservative. The assessment for the mallard duck should be revised with additional data and modeling should include contaminant exposure via food ingestion. An additional indicator species, such as an avian or mammalian fish predator, should also be assessed. Some suggestions include, the belted kingfisher or great blue heron, and the river otter or possibly the raccoon.

72) Table 30: A footnote to the table should state that predator fish were not caught during sampling. The predator and forage trophic levels should not be combined in the table. As noted above, the golden shiner is not a predator species.

73) Figure 54: Using maximum dissolved chromium concentrations along the vicinity of the Transect A, the following concentrations should have been utilized in the figure: OW-37 = 449 ppb; OW-54c = 145 ppb; and OW-19a = 22 ppb (phase I)

74) Figure 55: Using maximum dissolved arsenic concentrations along the vicinity of the Transect A, the following concentrations should have been utilized in the figure: OW-31 = 630 ppm; OW-45 = 999 ppm; OW-54c = 949 ppm; and OW-42 = 1,920 ppm.

75) Figure 56: Using maximum dissolved chromium concentrations along the vicinity of the Transect B, the following concentrations should have been utilized in the figure: OW-16 = 252 ppm (Phase I); OW-54c = 145 ppm; and OW-19a = 22 ppm (phase I).

76) Figure 57: Using maximum dissolved arsenic concentrations along the vicinity of the Transect A, the following concentrations should have been utilized in the figure: OW-54c = 949 ppm; and

OW-42 = 1,920 ppm.

77) Appendix B: Boring logs presented in the Appendix did not include sufficiently detailed description of the bedrock fracturing to determine the nature of the fractures, such as are the fractures open, closed, or filled. Further evaluation of this task is not possible without additional geologic data.