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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

November 10, 2001

W. David Fennimore
Earth Data, Inc.
Whiteland Technology Center
924 Springdale Drive
Exton, PA 19341

RE: **Galaxy/Spectron Superfund Site, Elkton, Maryland - RI/FS Comments**

Dear Mr. Fennimore:

The U.S. Environmental Protection Agency (EPA) Region III has reviewed the Draft Remedial Investigation (RI) dated March 2001 and the Draft Feasibility Study (FS) dated June 2001. EPA has the following general comments:

It is EPA's understanding that the contamination found in the shallow site soils is of significant levels that treatment is not only practical it is required as it poses a principle threat as defined in the National Contingency Plan (NCP). EPA agrees that the stream liner system has greatly improved the conditions of the site (e.g., odors, seeps etc) and it is ultimately envisioned as a part of the final remediation. However at its current rate of contamination removal via "flushing" it may not be practical or cost effective to operate the system indefinitely. In addition, while the stream liner system is currently effective in removing a portion of the contaminated groundwater discharge there is an additional portion of contaminated discharge which is unaccountable.

EPA requests that the FS fully consider and evaluate the following source reduction alternatives: 1) biodegradation, 2) chemical oxidation, 3)bioventing/biosparging, and 4) thermal heating (radio frequency heating, steam, etc). In addition, fully consider and evaluate upgradient groundwater controls in light of these alternatives.

It is EPA's, and I believe Maryland Department of the Environment's (MDE), hope that we can cooperatively develop a proposed plan of action that reduces source contamination in a timely manner while being cost effective. Please address each of the attached 'specific' comments on the RI and the FS within thirty (30) days of receipt of this letter. EPA and MDE are willing to meet to discuss the attached comments prior to your response.

If you have any questions feel free to contact me at (215) 814-3451.

Sincerely,

Robert J. Sanchez
Remedial Project Manager

cc: Tom Morris, IBM
Rick Grills, Maryland Department of the Environment
Jim Gravette, Maryland Department of the Environment

Galaxy/Spectron Superfund Site, Elkton, Maryland - RI/FS Comments

Comments on the Feasibility Study Report for Site Soils and Overburden Ground Water, Galaxy/Spectron Site, Elkton, Maryland, June 2001

1. **Section 3.1**: The FS does not provide a clear identification of contaminates. Up to 65% of DNAPL are unknowns. What will be the impact of these unknowns on treatment alternatives? The FS should summarize the clean up objectives of the RI. The FS does not screen impact of shallow groundwater to residences.

2. **Section 3.3.1**: Develop technical and cost evaluations for a system that would isolate the site from upgradient "clean water" flows. The evaluation should consider the benefits of isolating contaminated soils and the possible increase of capacity potential of the Waste Water Treatment Plant (WWTP).

3. **Section 3.3.2**: It is true that due to the shallow water table across the site, soil vapor extraction (SVE) technologies will have limited effect due to short-circuiting without the use of low permeability covers. However, the greatest concentrations of VOCs at the site are near or under existing concrete slabs and asphalt covers. These existing covers can be used with horizontal SVE technology to be an effective treatment option. The alternatives presented in Section 4 do not provide for such option. It is understood that the alternatives with the SVE include placement of a low permeability cover and demolition of existing buildings and slabs. To lower costs, the remediation could be done is phases, first utilizing the existing covers and then after the source material in the vadose zone has been treated to developed goals, the existing covers could be demolished and replaced with a vegetative cover. It is important to re-emphasize that the RI did not include sampling under these existing buildings and slabs. The source material that is likely present under these structures needs to be addressed by the FS.

4. **Section 3.3.2: Biodegradation**: It is true that when bioventing includes only adding air, that this application is primarily suitable for aerobically degradable VOCs, however, other inputs can be added to enhance anaerobic degradation. For example, bioremediation was performed on a maximum 10 ft. thick vadose zone contaminated with up to 250 mg/kg TCE and 1,000 mg/kg TCA at the Dover Air Force Base (Engineered Approaches to In-Situ Bioremediation of Chlorinated Solvents: Fundamentals and Field Applications, EPA 542-R-00-008, July 2000, Case Study 9). At this site, they enhanced co-metabolic biodegradation by adding low concentrations of propane to the subsurface. Biodegradation technologies for the vadose zone are applicable to this site and should not be eliminated.

5. **Section 3.3.3**: **Chemical Oxidation**: The statement, " Some limited bench-scale laboratory work indicate that persulfate may be an effective oxidizing agent for these constituents, but this technique has not been demonstrated at a pilot- or full scale basis to be effective", is not accurate. This technology has been used on a full-scale basis and should not be eliminated as an applicable technology. Recent case studies of full scale use of this technology that have been effective for chlorinated ethanes are found in the 2nd International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Conference Proceedings, Monterey CA, May 2000, Battelle Press.

6. **Section 3.3.3: Enhanced Biodegradation**: The statement that treatability studies would be required and for this reason the technology should be deleted is not valid. Treatability

Studies are part of the RI/FS process under the ARARs governing this site. If treatability studies are needed to assess the appropriate treatment for source reduction to meet the remediation objectives as stated in Section 2.2, then these studies need to be performed.

The statement that, one concern is the numerous VOCs present and relatively high dissolved-phase concentrations of VOCs could prohibit biological growth, is not necessarily true dependant on the type of bacteria and the conditions created for their growth. This is why bench scale studies are performed. Higher concentrations of VOCs may actually improve the conditions for biodegradation (Accelerated Bioremediation of Chlorinated Solvents – Workbook prepared by RTDF Bioremediation Consortium, June, 2000). This technology should be retained.

7. **Section 4**: The alternatives evaluated in the FS need to include the treatment technologies listed above that should not have been eliminated. Source reduction through these treatment technologies of the VOC mass in the vadose zone, saturated soil layer and overburden groundwater will reduce the contribution to the existing groundwater collection and treatment system. The long-term cost and future use benefits of aggressive source reduction compared to the proposed natural flushing were not presented. There was not an end point for treatment. Consider treatment of the saturated soils and overburden groundwater using: 1) biodegradation, 2) chemical oxidation, 3)bioventing/biosparging, 4) thermal heating (radio frequency heating, steam, etc) or other technologies could also have wider benefits by addressing potential DNAPL at the surface of the bedrock and contribution from the bedrock groundwater near the creek. The overall benefit of source reduction is the decrease time and cost for operating and maintaining the current groundwater collection and treatment system. The long-term viability of this system was not discussed and evaluated. Long-term wear and tear on the liner, and the long-term effects of large storm events on the system could result in very costly maintenance, repairs, and possibly replacement. Source reduction through aggressive treatment technologies provides long-term cost and site-use benefits that need to be addressed in this FS and the alternatives developed and selected. In addition,

8. As stated under the Remedial Action Objectives in Section 2.2, two of the objectives listed include:

   a) Each remedial action shall use permanent solutions and alternative treatment technologies or resource-recovery technologies to the maximum extent practical (40 CFR 300.430 (f)(ii)(E)).

   b) Remedial actions are preferred "in which treatment that permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants is a principal element" (section 121(b)). If the treatment or recovery technologies selected are not a permanent solution, an explanation must be published.

The alternative selected, Alternative 3, dose not address these objectives in that it does not effectively reduce or eliminate one of the primary sources of contamination at the site. The previous and more recent estimates on the contribution of VOC mass from the overburden groundwater to the stream are from 24 to 33 percent. This contribution is significant with regard to potential long-term operation and maintenance of the existing groundwater collection and treatment system. The following issues need to be address in this FS and the selected alternative:

The selected alternative assumes that the mechanism of flushing is adequately removing the source mass from the site. This assumes that the sources are predominately in the saturated zone soils and groundwater. The RI did not clearly define the sources of the VOC mass that is being contributed by the overburden groundwater, specifically which portions were from the vadose zone, from the saturated overburden, the dissolved phase in the overburden groundwater or DNAPL at the surface of the bedrock. Flushing will not address the source material in the vadose zone. Flushing may be effective over a 30 year period in high permeability areas (e.g., site sandy soils layers); however, it may never be able to flush contaminated silt layers. Treatment of the overburden soils and groundwater relying on natural flushing could take significantly longer to reduce the contributions to the creek such that the groundwater collection and treatment system could be turned off. Comparisons to the long-term cost effectiveness of addressing the source mass in the vadose and saturated zone using aggressive treatment compared to relying on natural flushing needs to be presented in the FS. If the source mass can be effectively treated, and there are technologies available for this application, then the long-term operation and maintenance costs of the groundwater collection and treatment system could be reduce. It should be in the interest of all parties that the long-term cost effectiveness of the proposed remediation be thoroughly evaluated. It is the current industry practice to use aggressive treatment of sources using applicable treatment technologies to reduce the cost of long-term operation and maintenance of groundwater collection and treatment systems. Cost benefit of aggressive treatment for source reduction and decrease in long-term operation of the groundwater collection and treatment system has not been addressed.

The long-term use of the site has not been adequately addressed in the FS or the selected alternative. Without addressing source reduction, uses of the site will be restricted due to limitation of intrusive activities and regrading to provide for ball field and park lighting and structures. Furthermore, if the long-term goal is to provide an accessible park to the public, leaving source material in the vadose and overburden soils and groundwater does not provide for potential future decisions to aggressively treat the soils and groundwater in order to reduce the time the groundwater collection and treatment system operates. It would be very disruptive if in the future, treatment of source material were performed when the site is accessible to the public.

9. A National Historic Preservation Act Report needs to be completed prior to the demolition of structures.

Galaxy/Spectron Superfund Site, Elkton, Maryland - RI/FS Comments

Specific Comments on Remedial Investigation and Risk Assessment Report for Site Soils , Galaxy/Spectron Site, Elkton, Maryland, March 2001

1. Figures 5-4, 5-6, 5-8, 5-10 should show only those borings/geoprobe locations that are within 25 ft. of the cross-section. The ground elevation should be shown through the cross-section. Although this information is presented in various formats in other figures, these cross-sections should include stratigraphy and shallow groundwater elevation. It is difficult to interpret these cross-sections in order to develop appropriate contaminant pathway models. It is important to discuss and present in clear graphical format in the RI the nature and extent of the contamination. The figures presented are very helpful in this analysis, but a graphic presenting the contamination data with its relationship to the ground surface and shallow groundwater is needed. Specifically if the VOC contamination in the soils is primarily below the shallow groundwater depth, than the source and pathway of shallow groundwater contamination would be different if the higher concentrations are in the vadose zone. This type of discussion and presentation is needed in the RI in order to evaluate the applicable alternatives in the Feasibility Study. The report has not presented a comprehensive analysis of site data to support the statement that 'additional containment, removal and/or treatment options for overburden ground water beyond continuing to operate the Creek Liner to be warranted.' There are very high contaminant concentrations in the overburden aquifer and soils. These high concentrations will continue One specific area where extent of contamination is in question is to the far Northwest of the site. Logs indicate contamination at depth with a field PID meter but a sample at this depth was not taken to the lab for analysis (See sampling log for PSB-12 and 14).

2. The discussion of the existing creek remediation system should include a discussion of the effectiveness of this system in removal of contaminant mass from the site. What percentage of the site contamination is being removed by the existing system? How long will the system need to operate including the treatment system? There is a discussion of mass flux calculations in Section 2.2, p. 2-2. Have these been updated since the focused RI? The mass flux discussion presented in Section 5 of the Draft Focused Remedial Investigation Report 4 May 1994, concludes the shallow groundwater contributes one third of the relative mass contributions. Has this estimate been refined since that report? The sources of the shallow groundwater contamination should be identified as part of the mass flux discussion. If sources of shallow groundwater contamination such as residual contamination in the site soils and the dissolved contamination in the shallow groundwater itself can be effectively remediated to reduce the mass flux to the creek, the long-term cost of remediation may be reduced. If this percentage is approximately 33%, then it may be cost effective to actively reduce the inputs from this source. If these estimate have been refined and the contributions lower and therefore not cost effective, this needs to be backed up with the mass calculations and discussion of contribution from the various sources. This information is needed to properly evaluate the alternatives presented in the FS.

3. Page 2-3, Section 2.3, 6th bullet: Why is the shallow soil not a source? A discussion is needed to make the case for the shallow soil not contributing to the shallow groundwater contamination if this is the position being taken. There is no easily enforceable mechanism to prevent the installation of a drinking water well on the Galaxy/Spectron site, consequently, a future use scenario of ground water used as drinking water source is

possible. Please reflect this in the report narrative. The Risk Assessment should have included this scenario as the overburden aquifer is currently used for drinking water (RES-10) and would be classified as a class IIa. Because it is one of EPAs expectations as outlined in the NCP to restore aquifers to their beneficial use, an Remedial Action Objective (RAO) for shallow soils and ground water is to remediate these media in order to restore the overburden aquifer as well as the bedrock aquifer for its beneficial use; as a drinking water source.

4. Figures 4-6a to 4-6f: It would be very helpful to provide a horizontal scale and some reference points at the ground surface in order to interpret these figures. Reference points such as Area H limits and location of borings is requested to allow the reader to evaluate this stratigraphic interpretation.

5. Section 2.5.2: Have the surface water concentrations met the state requirements? Compare the results with the surface water criteria as was done for the groundwater well samples.

6. Section 2.6, p. 2-8, last Para.: Is there an estimated time frame this system will operate? What percentage is attributed to site shallow groundwater and what are the remaining sources of shallow groundwater contamination?

7. Sections 5.3.2 & 5.4.2: It would be very helpful to the reader to outline the source areas (Area F, Area H, and Former Evaporation Lagoon) on the figures depicting soil and groundwater contamination since they are specifically referenced in the text under the VOC results.

8. Section 5.4: Related to the previous comments, there is a need for better graphical presentation of the concentration of VOC's with depth, and their relationship to stratigraphy, groundwater elevation and bedrock surface. Specifically for shallow groundwater, there needs to be more detailed analysis and presentation of groundwater total VOC, methylene chloride, PCE, TCE and 1,1,1 TCA concentrations with depth within each of the three source areas. The discussion of this graphical presentation needs to more fully describe the higher methylene chloride concentrations at depth between Source Areas F and H, and conclusions regarding the source of the groundwater contamination. Although briefly discussed in 5.4.2.1 under Area F with regard to higher concentrations of methylene chloride with depth in G-39 compared to MW-3, no definitive conclusion was made to whether the source of this contamination was DNAPL in this area at the bedrock surface, residual DNAPL in the silty site soils, or from bedrock groundwater that has an upward gradient near the creek. Similarly, the source of the higher PCE, TCE, and 1,1,1 TCA in the shallow groundwater in the Former Lagoon Area and in Area H to the Bridge, needs to be discussed in greater detail with a graphical presentation of contamination with depth showing bedrock elevation and soil stratigraphy. Is the source of the contamination from DNAPL near B-1 in Area F? Is this indicated by higher concentrations close to the silty soil layer opposed to at deeper depths near the bedrock? Is the VOC contamination in Area H to the Bridge the result of residual soil contamination as stated on page 7-4, and where is the predominant source of this residual contamination. This discussion of variance in contamination concentration with depth is important in assessing potential remedial alternatives [illegible] By identifying *remaining* sources and *targeting these* shallow [illegible] tion

zones both aerial and vertically with applicable treatment technologies, the time that the creek remediation system and treatment unit is operated could be significantly reduced. These targeted treatment options may provide a more cost effective long-term solution by reducing long term operational and maintenance costs. This will depend on the treatment technology effectiveness in targeting sources of the shallow groundwater contamination and the shallow groundwater itself. To assess the effectiveness of such in-situ treatment options and develop cost for comparison to the long-term costs of the existing system, more discussion is needed in the RI as outlined in these comments.

9. Section 7.1, p7-2: The summary under the DNAPL header, although accurate does not provide the full picture of observed and potential residual DNAPL. Figure 2-3 that was presented in the Draft Focused Remedial Investigation Report (4 May 1994) provided a better picture of DNAPL occurrence at the site. In particular, borings B-5, B-6 and B-7 were all identified as having potential DNAPL based on portioning analysis. These locations correspond to the higher VOCs contamination in soils and are within identified source areas.

10. The report needs to include an Ecological Risk Assessment. A brief scoping meeting will be held via conference call to develop this part of the RI

11. The RI needs to identify Remedial Action Objectives (RAOs) and EPA exposure limits. This will help identify the scope of the operable unit.

13. Table 5-1: The RBCs for methylene chloride, 1,1,1-trichloroethane (111TCA), trichloroethene (TCE), and tetrachloroethene (PCE) should be 85000, 2200, 58000, and 12000 ug/kg, respectively. The SSLs should also be shown.

14. Table 5-2:

    a) The residential RBCs for 2-butanone, vinyl chloride, and xylene should be 4700000, 90, and 16000000 ug/kg, respectively. The industrial RBC for vinyl chloride should be 7900 ug/kg.

    b) The residential RBCs for anthracene, butylbenzyl phthalate, dibutyl phthalate, diethyl phthalate, dimethyl phthalate, nitrobenzene, dioctyl phthalate, and phenol should be 2.3E6, 1.6E6, 780000, 6.3E6, 7.8E7, 3.9E3, 160000, and 4.7E6 ug/kg, respectively. The industrial RBCs for dibutyl phthalate, dimethyl phthalate, fluoranthene, fluorene, nitrobenzene, and dioctyl phthalate should be 2E7, 2E9, 8176000, 8176000, 102200, and 4100000 ug/kg, respectively.

    c) The residential RBCs for Aroclor 1016, delta-BHC, alpha-chlordane, gamma-chlordane, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, endrin ketone, methoxychlor, and toxaphene should be 550, 350, 1800, 1800, 47000, 47000, 47000, 2300, 2300, 2300, 39110, and 580 ug/kg, respectively. The industrial RBCs for delta-BHC, alpha-chlordane, gamma-chlordane, DDT, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, endrin ketone, and toxaphene should be 3200, 16000, 16000, 17000, 1200000, 1200000, 1200000, 61000, 61000, 61000, and 5200 ug/kg, respectively.

    d) The residential RBCs for antimony, cadmium, chromium, lead, and mercury should be 3.1, 3.9 (or 7.8), 23, 400, and 0.78 mg/kg, respectively. The industrial RBCs for chromium and mercury should be 610 and 20 mg/kg, respectively.

15. Lead should be a soil COPC.

16. The soil concentrations should also be compared to SSLs for migration to groundwater. The following chemicals exceed SSLs: acetone, benzene, 2-butanone, carbon tetrachloride, chlorobenzene, chloroethane, chloroform, 1,1-dichloroethane (11DCA), 1,2-dichloroethane (12DCA), 1,1-dichloroethene (11DCE), total 1,2-dichloroethene (tot12DCE), ethylbenzene, methylene chloride, 4-methyl-2-pentanone, 1,1,2,2-tetrachloroethane (1122PCA), PCE, toluene, 111TCA, 112TCA, TCE, vinyl chloride, xylenes, benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, bis(2-chloroethyl)ether, carbazole, 4-chloroaniline, dibenz[a,h]anthracene, dibenzofuran, 1,2-dichlorobenzene (12DCB), 1,3-dichlorobenzene (13DCB), 1,4-dichlorobenzene (14DCB), 2,4-dimethylphenol (24DMP), hexachlorobenzene, hexachlorobutadiene, indeno[1,2,3-c,d]pyrene, isophorone, 2-methylnaphthalene, naphthalene, nitrobenzene, N,N-diphenylamine, 1,2,4-trichlorobenzene (124TCB), aldrin, beta-BHC, DDT, dieldrin, endosulfan II, endrin aldehyde, antimony, arsenic, barium, cadmium, chromium, copper, manganese, selenium, thallium, zinc.

17. Table 5-3: The RBC for 111TCA should be 320 ug/l.

Specific Comments on Remedial Investigation and Risk Assessment Report for Site Soils, Galaxy/Spectron Site, Elkton, Maryland, March 2001

1. Page ix, 4th paragraph; bottom of page ix to top of page x; page x, 3rd paragraph; page x, 5th paragraph; page 1-1, 5th paragraph; page 5-9, 4th paragraph; page 5-10, 2nd and 4th paragraphs; page 7-3, last bullet; page 7-4, 4th paragraph: While the creek liner has done a good deal to reduce releases of contaminates from the shallow soils, it is too conclusive to imply that the creek liner "isolates" or "captures" everything.

2. Page 2-7, 1st paragraph; page 2-8, 3rd paragraph: To support these assertions, please provide a table showing before-and-after concentrations.

3. Page x, 3rd paragraph; page 7-3, 5th bullet; page 7-4, 3rd paragraph: EPA is not convinced that the site is delineated. (E.G., See Appendix C, Boring log for PSB-12 showed that at a depth of 4 - 8 foot the OVA indicated a reading of 1000 PPM)

4. Page 5-4, 2nd paragraph; page 5-5, 3rd paragraph, last sentence: Please provide a typical cross section of the area being discussed.

5. Page 7-5: "Slightly" should be deleted. Residential wells have not been evaluated yet, and these conclusions also depend on whether groundwater migration has actually been prevented.

6. Page x, 3rd paragraph; Table 6-3; end of Table 6-5; Section 6.2.2; page 7-4, 5th paragraph: Residential wells could not yet be evaluated because the residential well data submitted to EPA is still incomplete. However, preliminary screening shows that there are site-related VOCs in residential wells at levels above RBCs. The residential well data should be submitted in full and should undergo a baseline risk assessment.

7. Page x, last paragraph: In the 2nd sentence of this paragraph, delete "slightly."

8. Page x, last paragraph: The assertion in the 3rd sentence cannot be confirmed without defining "contaminated" or "impacted" and describing the extent of the asphalt cover.

9. Page 1-1, 5th paragraph: It is the Agency's prerogative to determine the integral components of the final remedy.

10. Page 2-4, 7th bullet; Section 5.4.2; page 5-11, 3rd paragraph: It is not necessarily true that RDGP-10 is a false positive or unrepresentative of the eastern water. Note that RDGP-6 (also on the east side of the creek) had significant VOCs, and RDGP-8 had some VOCs also.

11. Section 2.5.1 will need to be reevaluated when all the residential well data have been compiled.

12. Page 5-1 refers to 5 overburden monitoring wells. Please list them by well number so it is clear which 5 wells are being discussed.

18. Page 5-5, 5th paragraph; page 7-2, last bullet: The RBC for chlorobenzene was not exceeded.

19. Section 5.3.2: A comparison to SSLs would also be useful.

20. Section 5.3.3: Six SVOCs exceed RBCs (benzo[b]fluoranthene is the other).

21. Page 5-6, 2nd paragraph: The action of the VOCs on the naturally occurring metals should be discussed. If the metals have been altered by site conditions, they are not background.

22. Page 5-6, 3rd paragraph: This is not the recommended background procedure. Statistical testing using local background samples should be performed. The last paragraph on this page should also be deleted.

23. Table 5-4:

    a) The RBCs for chlorobenzene, 1122PCA, and 111TCA should be 11, 0.05, and 320 ug/l, respectively.

    b) The 1996 results for MW-10 should be included on this table.

    c) For MW-11, 1992, the cis-12DCE result of 1400 ug/l does not appear on the laboratory data sheet.

    d) For MW-11, 1996, the methylene chloride lab result was 170 B and the field result was 1452 ug/l, according to the lab data sheets. The cis-12DCE lab result was 2500 ug/l.

    e) For G-39, the result of 26000 shown under cis-12DCE should be under trans-12DCE.

    f) The RBCs for 2-methylphenol (2MP), delta-BHC, endosulfan sulfate, endrin, endrin aldehyde, and endrin ketone, should be 180, 0.037, 22, 1.1, 1.1, and 1.1 ug/l, respectively.

    g) For MW-11, 1996, there should be a result of 480 ug/l for 12DCB.

    h) 12DCB results for RDGP-3, RDGP-17, RDGP-22, RDGP-41, and RDGP-46 should be 700, 320, 390, 25000, and 5400 ug/l, respectively.

    i) The 13DCB result for RDGP-22 should be 6.1 ug/l.

    j) 14DCB results for RDGP-17, RDGP-22, RDGP-41, and RDGP-46 should be 45, 65, 3300, and 700, respectively.

    k) The 1991 metals results shown in the table need to be replaced with the 3/92 validated results.

d) The metals should be redone, in accordance with the change to the 1991 inorganic data. The COPCs should be as follows: total, aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, manganese, lead, nickel, vanadium, zinc; dissolved, arsenic, barium, iron, manganese.

32. Table 6-4 should be adjusted in accordance with previous comments.

33. Table 6-5:

a) Soil:

Chloroethane was detected in soil (maximum 0.012).
4-Chlorophenyl-phenylether has no RBC.
124TCB exceeds the RBC and is a COPC.
Beryllium should be added to this list.

b) Groundwater:

Benzyl chloride, 14DCB, trans-12DCE, 13DCB, 2-methylnaphthalene, naphthalene, and 124TCB exceed the RBCs and are COPCs.
Chloromethane is below the RBC.
The metals should be redone, in accordance with the change to the 1991 inorganic data. The COPCs should be as follows: total, aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, manganese, lead, nickel, vanadium, zinc; dissolved, arsenic, barium, iron, manganese.

34. Table 6-8:

a) Benzyl chloride and 1,1,2-trichloro-1,2,2-trifluoroethane should be added to this table.

b) The Q/C that was used to derive the VFs should be identified.

c) VFs for acetone (1.2E4), benzene (2700), carbon disulfide (1200), chlorobenzene (6300), chloroform (2900), 11DCA (2800), 12DCA (4900), 11DCE (1400), cis-12DCE (2800), trans-12DCE (3000), ethylbenzene (4000), methylene chloride (2400), toluene (3500), 111TCA (2400), 112TCA (7500), TCE (2600), xylenes (5700), bis(2-chloroethyl)ether (1.3E4), 4-chloroaniline (2.8E5), 2-chlorophenol (3E4), 12DCB (1.1E4), and naphthalene (5.5E4) can be derived.

d) The molecular weight, t*, B, and tau should also be displayed.

e) 111TCA has a provisional RfDi of 6.3E-1 mg/kg/day.

f) The vinyl chloride CSFs should be applied as shown in the Toxicological Review (on IRIS).

g) 13DCB has a provisional oral RfD of 3E-2 mg/kg/day.

l) RBCs for chromium, lead, and mercury should be 11, 15, and 0.37 ug/l, respectively.

m) For MW-11, 1996, the total iron and manganese results should be 92300 and 1070 ug/l, respectively; the dissolved manganese result should be 13000 ug/l.

n) For B5, the dissolved iron result should be 40400 ug/l.

24. Page 5-7, 4th paragraph, 4th sentence: This sentence should be modified. Not all the methylene chloride lab data were B qualified; only the samples that were collocated with field data were flagged B.

25. Sections 5.4.3 and 5.4.4: The analysis did not look for SVOCs or pesticides on the east side of the creek; therefore the last sentence in each of these paragraphs should be qualified.

26. Page 5-12: Barium also exceeds the RBC, and a large number of metals exceed the RBC for total metals. Therefore, these statements should be modified.

27. Please indicate which samples collected during the RI investigation were not included in the risk assessment or shown in the data tables.

28. Geoprobe metals results for groundwater should not be used in the risk assessment.

29. Section 6.2 should specify: if lab or field data were used in the risk assessment (lab data are preferred), and if total or dissolved metals were used and why.

30. Table 6-1:

a) The residential screening values for lead, mercury,. and thallium should be 400, 0.78, and 0.55 mg/kg, respectively.

b) The industrial screening values for aluminum, chromium, mercury, and thallium should be 2E5, 610, 20, and 14 mg/kg, respectively.

c) Lead should be a COPC.

31. Table 6-2:

a) The maximum result for carbon disulfide shown here (675 ug/l) does not appear on Table 5-4.

b) Benzyl chloride (maximum 7.6 ug/l, RBC 0.06 ug/l, COPC), 1,1,2-trichloro-1,2,2-trifluoroethane (maximum 11000 ug/l, RBC 5900 ug/l, COPC), chloromethane (RBC 2.1 ug/l, not COPC), bis(2-ethylhexyl) phthalate (RBC 4.8 ug/l, not COPC), DDE (RBC 0.2 ug/l, not COPC), and alpha-chlordane (RBC 0.19 ug/l, not COPC) should be added to this table.

c) The new vinyl chloride RBC is 0.015 ug/l.

h) Cadmium has an oral-food RfD of 1E-3 mg/kg/day.

i) The non-food RfD for manganese is 2E-2 mg/kgday; the mercury RfD shoudl be 1E-4 mg/kg/day.

j) The cobalt provisional RfD is now 2E-2 mg/kg/day.

k) PAHs typically do not receive oral-to-dermal adjustment for the CSF because they can act locally on the skin.

l) For Aroclors, the dermal CSF that is recommended for use with dermal exposure when an absorption factor has been applied (as it has here) is 2 per mg/kg/day, not 4.

m) According to the ATSDR Toxicological Profile, the oral absorption factor for dieldrin could be 0.9.

n) According to the ATSDR Toxicological Profile, the oral absorption factor for aluminum should be 0.005.

o) According to IRIS, the absorbed (e.g., dermal) RfD for cadmium should be 2.5E-5 mg/kg/day.

p) The oral absorption factors for iron, manganese, and mercury should be 1.

q) The following permeability coefficients should be corrected: acetone, 6E-4; 4-methyl-2-pentanone, 4E-3; 4-chloroaniline, 6E-3; 2-methylnaphthalene, 0.14; Aroclor 1242, 0.7; BHCs, 0.018. The metal permeability coefficients that are currently shown as 1.55E-3 should be 1E-3 (from the 1992 Dermal Guidance).

35. Section 6.5.1: The cancer equation for risks above 1E-2 (1 - exp(-Dose x CSF)) should also be shown.

36. Table 6-6:

a) If B data are excluded from the data set, the n for arsenic would be 10.

b) The mercury UCL and EPC should be 1.3 mg/kg.

c) For lead, the average concentration is used in the blood-lead models.

37. Table 6-7:

a) Carbon disulfide does not appear to be a COPC.

b) Benzyl chloride (EPC maximum, 0.0076 mg/l) and 1,1,2-trichloro-1,2,2-trifluoroethane (EPC maximum, 11 mg/l) should be added.

c) If B data are excluded from the data set and the data are changed as noted in Comment #23 (referring to Table 5-4), the following n would be derived: acetone, 18; benzene, 27; chloroform, 27; cis-12DCE, 15; trans-12DCE, 15; tot12DCE, 12; methylene chloride, 6; 12DCB, 14; 13DCB, 9; 14DCB, 12; 2-methylnaphthalene, 8; naphthalene, 8; 124TCB, 8.

d) The following organic EPCs should be changed: tot12DCE, 28 mg/l (normal); 112TCA (0.18 mg/l, maximum); bis(2-chloroethyl ether), 0.159 mg/l (normal); 14DCB, 2.8 mg/l (lognormal); alpha-BHC, 0.000037 (normal); beta-BHC, 0.00013 (lognormal); delta-BHC, 0.00126 (lognormal).

e) The inorganic data need to be recalculated in light of the new 1991 metals results. The EPCs for these metals should be as follows:

Total: aluminum, 178 mg/l (maximum); antimony, 0.142 mg/l (maximum); arsenic, 0.0102 mg/l (lognormal); barium, 0.852 mg/l (lognormal); cadmium, 0.0314 mg/l (lognormal); chromium, 0.39 mg/l (maximum); lead, 0.2 mg/l (average); nickel, 0.648 mg/l (lognormal); vanadium, 0.438 mg/l (maximum); zinc, 2.4 mg/l (lognormal); cobalt, 0.319 mg/l (lognormal); copper, 1.28 mg/l (maximum), beryllium, 0.0036 mg/l (lognormal). Iron and manganese remain with the EPCs currently shown on the table.

Dissolved: arsenic, 0.007 mg/l (normal); barium, 0.392 mg/l (normal); iron, 74.7 mg/l (normal); manganese, 10.45 mg/l (lognormal).

38. Table 6-9: Children are assumed not to shower, but rather to take baths (therefore, exposure would be dermal and ingestion only). The mechanism of construction worker's inhalation exposure to groundwater is not clear. (Table 6-37 should be deleted.)

39. Tables 6-10, 6-11, 6-12, 6-16, 6-17, 6-18, 6-21, 6-22, 6-23, 6-24, 6-25, 6-26, 6-27, 6-28, 6-29, 6-33, 6-34, and 6-35: The units for the intake factors should be (kg chemical/kg body weight-day).

40. Tables 6-12, 6-18, 6-23, 6-26, 6-29, and 6-35: The soil adherence factor units are rather high (this would correspond to muddy soil), but do not need to be changed for the RME assessment. The absorption factor for VOCs (0.0005 to 0.03) should be shown.

41. Tables 6-13, 6-30, and 6-36: The units for the intake factors should be (L/kg-day).

42. Tables 6-14 and 6-31: Instead of this model (which is usually used only for screening because it assumes all chemicals volatilize equally), the Foster and Chrostowski model should have been used.

43. Tables 6-15, 6-20, 6-32, and 6-38: For organics, the non-steady-state model should also be used.

44. Table 6-19: The mechanism of construction worker's inhalation exposure to groundwater is not clear.

45. Table 6-26: The title of this table should refer to "Dermal" rather than "Inhalation."

46. Tables 6-27, 6-28, 6-29, 6-33, 6-34, and 6-35: The exposure frequency should be 350 days/yr.

47. Table 6-29: The skin surface area should be 5000 cm^2.

48. Tables 6-12, 6-15, 6-18, 6-20, 6-23, 6-26, 6-29, 6-32, 6-35, and 6-38: The Exposure Handbook date should be 1997.

49. Table 6-38: The duration of the child's bath is typically 0.33 hr.

50. Table 6-39, Soil:

It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA	4.9E-7	1.6E-5	1.5E-10	5.5E-7
PCE	2.4E-7	1.6E-6	2.8E-12	2.1E-7
vinyl chloride	5.3E-8	4.8E-7	3.3E-13	7.9E-10
benz[a]anthracene	5.5E-8			
benzo[a]pyrene		4.1E-9	6.6E-11	NA
benzo[b]fluoranthene	8.9E-8			
dibenz[a,h]anthracene	2.3E-7			
14DCB	1.8E-7	6.2E-6	5.1E-11	1.1E-6
Aroclor 1242	5.6E-7		1.7E-10	1.7E-6
Cadmium			2.7E-8	
Chromium			3.6E-7	
Total	1.3E-5	2.5E-5	4E-7	

51. Table 6-39, Groundwater:

The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation	Dermal
benzene		4.7E-4	3E-5
chloroform		1.9E-3	4E-6
12DCA		0.03	5E-4

Chemical	Ingestion	Inhalation	Dermal
11DCE		1.6E-2	2.6E-3
methylene chloride		1.3E-2	7E-4
1122PCA		1.9E-3	2E-4
PCE		4.7E-4	3E-3
112TCA	3.6E-5	8E-5	
TCE		4.6E-4	6E-5
vinyl chloride	3.5E-2	2.7E-3	1.3E-3
bis(2-chloroethyl ether)	6.1E-4	1.4E-4	4.5E-5
14DCB	2.3E-4	5E-4	3.5E-4
benzyl chloride	4.5E-6		9.4E-7
alpha-BHC	8.1E-7	5E-8	1.5E-6
beta-BHC	8E-7	6E-9	1.5E-6
delta-BHC	8E-6	5E-8	1.5E-5
dieldrin		3E-7	1.3E-5
heptachlor epoxide	9.5E-7	7E-8	1.9E-6
Total As	5.3E-5		2E-7
Dissolved As	3.7E-5		1.4E-7
Total (incl. either total or dissolved metals)	9E-2	6.8E-2	8.9E-3

The oral cancer risks for beryllium, cadmium, and chromium should be deleted.
It is not clear why total metals were used for ingestion and dissolved metals for inhalation and dermal. One form should be used consistently for all exposure routes.

52. Table 6-40, Soil:

It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA	9.4E-8	3.3E-7	3E-12	1.1E-8
PCE	4.5E-8	3.2E-8	6E-14	4.3E-9
vinyl chloride	1E-8	9.7E-9	6.7E-15	1.6E-11

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
benz[a]anthracene	1E-8			
benzo[a]pyrene	9.8E-8	8.3E-11	1.3E-12	NA
benzo[b]fluoranthene	1.7E-8			
dibenz[a,h]anthracene	4.5E-8			
14DCB	3.5E-8	1.2E-7	1E-12	2.2E-8
Aroclor 1242	1.1E-7		3.4E-12	3.4E-8
Arsenic	2E-6		6.4E-10	2.1E-7
Cadmium			5.4E-10	
Chromium			7.1E-9	
Total	2.5E-6	5E-7	8.3E-9	2.8E-7

53. Table 6-40, Groundwater:

The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table). The inhalation risk was not included because it is not clear what kind of exposure that was.

Chemical	Dermal
chloroform	1E-7
12DCA	1.6E-5
11DCE	9E-5
methylene chloride	2.6E-5
1122PCA	4.8E-6
PCE	6.5E-5
112TCA	1E-7
TCE	1.7E-6
vinyl chloride	5E-5
bis(2-chloroethyl ether)	1.2E-6
14DCB	8E-6
benzyl chloride	2.6E-8
alpha-BHC	2.6E-8

Chemical	Dermal
beta-BHC	2.6E-8
delta-BHC	2.5E-7
dieldrin	2.2E-7
heptachlor epoxide	3.3E-8
Total As	2E-8
Dissolved As	1.5E-8
Total (incl. either total or dissolved metals)	2.6E-4

54. Table 6-41, Soil:

It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA	6.3E-9	2.6E-8	2E-13	8.8E-10
PCE	3E-9	2.5E-9	4E-15	3.4E-10
vinyl chloride	6.8E-10	7.7E-10	5.6E-16	1.3E-12
benz[a]anthracene	7E-10			
benzo[a]pyrene		6.6E-12	1E-13	NA
benzo[b]fluoranthene	1.1E-9			
dibenz[a,h]anthracene	3E-9			
14DCB	2.4E-9	9.8E-9	8E-14	1.8E-9
Aroclor 1242	7.2E-9		3E-13	2.7E-9
Cadmium			4.3E-11	
Chromium			5.7E-10	
Total	1.7E-7	3.9E-8	6.6E-10	2.3E-8

55. Table 6-42, Soil:

It is preferable to separate the soil risks for VF and PEF.

The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA		1.9E-6	2E-11	1.5E-7
PCE		1.8E-7	3E-13	6E-8
vinyl chloride	1.2E-8	5.6E-8	4E-14	2E-10
benz[a]anthracene	7E-10			
benzo[a]pyrene		4.8E-10	7.6E-12	NA
benzo[b]fluoranthene				
dibenz[a,h]anthracene				
14DCB		7.2E-7	6E-12	
Aroclor 1242			2E-11	5E-7
Cadmium				
Chromium				
Total		3E-6	5E-8	4E-6

56. Table 6-43, Soil:

It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA	1.3E-6	2E-5	2E-10	1.5E-6
PCE	6.3E-7	2E-6	4E-12	5.7E-7
vinyl chloride	1.4E-7	6.5E-7	4.5E-13	2.1E-9
benz[a]anthracene	1.5E-7			
benzo[a]pyrene	1.4E-6	5.5E-9	9E-11	NA
benzo[b]fluoranthene	2.4E-7			
dibenz[a,h]anthracene	6.3E-7			
14DCB	5E-7	8.3E-6	7E-11	3E-6
Aroclor 1242	1.5E-6		2E-10	4.5E-6
Arsenic	2.8E-5		4E-8	2.8E-5
Cadmium			4E-8	

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
Chromium			4.8E-7	
Total	3.5E-5	3E-5	5.6E-7	3.8E-5

57. Table 6-43, Groundwater:

The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation	Dermal
benzene		6E-4	4.5E-5
chloroethane			3E-6
chloroform		2.5E-3	5.6E-6
12DCA		0.04	
11DCE		2E-2	
methylene chloride		2E-2	1E-3
1122PCA		2.5E-3	3E-4
PCE		6E-4	4E-3
112TCA	9.6E-5	1E-4	6E-6
TCE		6E-4	8E-5
vinyl chloride	9E-2	4E-3	2E-3
bis(2-chloroethyl ether)	1.6E-3	2E-4	6E-5
14DCB	6E-4	7E-4	
benzyl chloride	1.2E-5		1.3E-6
alpha-BHC	2E-6	7E-8	2E-6
beta-BHC	2E-6	7E-9	2E-6
delta-BHC	2E-5	7E-8	2E-5
dieldrin		5E-7	2E-5
heptachlor epoxide		1E-7	3E-6
Total As	1E-4		3E-7
Dissolved As	1E-4		2E-7

Chemical	Ingestion	Inhalation	Dermal
• Total (incl. either total or dissolved metals)	2.4E-1	9E-2	1.2E-2

The oral cancer risks for beryllium, cadmium, and chromium should be deleted.
It is not clear why total metals were used for ingestion and dissolved metals for inhalation and dermal. One form should be used consistently for all exposure routes.

58. Table 6-44, Soil:

It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA	3E-6	1.5E-5	1E-10	9.7E-7
PCE	1.5E-6	1.5E-6	2.6E-12	4E-7
vinyl chloride	4.4E-6	6E-6	4E-12	1.8E-8
benz[a]anthracene	3.4E-7			
benzo[a]pyrene	3.2E-6	3.9E-9	6E-11	NA
benzo[b]fluoranthene	5.6E-7			
dibenz[a,h]anthracene	1.5E-6			
14DCB	1.2E-6	5.8E-6	5E-11	1.9E-6
Aroclor 1242	3.5E-6		1.6E-10	2.9E-6
Arsenic	6.6E-5		3E-8	1.9E-5
Cadmium			2.5E-8	
Chromium			3.3E-7	
Total	8.1E-5	3E-5	3.9E-7	2.5E-5

59. Table 6-44, Groundwater:

The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table). Inhalation should be deleted (children are assumed to take baths.):

Chemical	Ingestion	Dermal
benzene		5.2E-5
chloroethane		3.6E-6

Chemical	Ingestion	Dermal
chloroform		5.6E-6
12DCA		6.5E-4
11DCE		3.8E-3
methylene chloride		1E-3
1122PCA		2.2E-4
PCE		4E-3
112TCA	5.6E-5	5.1E-6
TCE		8.2E-5
vinyl chloride	5.4E-2	2.1E-3
bis(2-chloroethyl ether)	9.6E-4	3.7E-5
14DCB	3.7E-4	4.3E-4
benzyl chloride	7.1E-6	1E-6
alpha-BHC	1.3E-6	1.2E-6
beta-BHC	1.3E-6	1.2E-6
delta-BHC	1.2E-5	1.2E-5
dieldrin		1E-5
heptachlor epoxide	1.5E-6	1.6E-6
Total As	8.4E-5	2E-7
Dissolved As	5.8E-5	1.4E-7
Total (incl. either total or dissolved metals)	1.4E-1	1.2E-2

The oral cancer risks for beryllium, cadmium, and chromium should be deleted.

It is not clear why total metals were used for ingestion and dissolved metals for inhalation and dermal. One form should be used consistently for all exposure routes.

60. Table 6-45:

Using the above adjustments, this table would be as follows:

	Ind worker	Cons worker	Util worker	Tresp	Ad Res	Ch Res
Soil Ing	1.3E-5	2.5E-6	1.7E-7	3E-6	3.5E-5	8.1E-5
Soil Inh	2.5E-5	5E-7	4E-8	2.9E-6	3.3E-5	3E-5
Soil Derm	1.4E-5	2.8E-7	2.2E-8	4E-6	3.8E-5	2.5E-5
Total Soil	5.2E-5	3.3E-6	2.3E-7	2E-5	1E-4	1.4E-4
GW Ing	9E-2	--	--	--	2.4E-1	1.4E-1
GW Inh	6.8E-2	--	--	--	9E-2	--
GW Derm	8.9E-3	2.6E-4	--	--	1.2E-2	1.2E-2
Total GW	1.7E-1	2.6E-4	--	--	3.4E-1	1.4E-1
Total	1.7E-1	2.6E-4	2.3E-7	2E-5	3.4E-1	1.4E-1

61. Table 6-46, Soil:

It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA	1.1E-4			1.3E-4
PCE	1.3E-3	1.6E-2	2.8E-8	1.1E-3
vinyl chloride	6.8E-5	3E-3	2.2E-9	1E-6
14DCB	7.2E-4	3E-3	2.9E-8	4.3E-3
124TCB	7.8E-3	1.4E-2	4E-8	4.7E-2
Aluminum	5.9E-3		2E-3	0.35
Antimony	1.4E-2			4E-2
Barium	2E-3		3E-4	6.1E-4
Cadmium	3.9E-2		2E-4	0.47

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
Chromium	2.7E-2		8E-4	0.8
Iron	4.6E-2			1.4E-2
Manganese	6.8E-3		3E-3	2E-3
Mercury	6.4E-3		2E-6	1.9E-3
Nickel	2.4E-3			7.3E-3
Total	0.22	0.04	6E-3	1.8

62. Table 6-46, Groundwater:

The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table). Dissolved metals, other than the four shown below, should be deleted.

Chemical	Ingestion	Inhalation	Dermal
acetone			0.16
benzene		27	0.7
2-butanone		0.5	3.5E-3
chlorobenzene		34	4.6
chloroethane		0.05	5E-3
chloroform		760	0.2
11DCA		8	0.3
12DCA		660	0.5
11DCE			1.3
cis-12DCE			2.8
trans-12DCE			2E-3
tot12DCE	30		2.2
ethylbenzene		0.4	0.27
4-methyl-2-pentanone		12	0.1
methylene chloride		26	4.6
1122PCA			0.05
PCE		4.7	17

Chemical	Ingestion	Inhalation	Dermal
toluene		9.7	0.55
111TCA		3.6	0.6
112TCA	0.4		0.05
TCE			2.6
vinyl chloride		18	1.6
xylene			0.06
4-chloroaniline			4.7
2-chlorophenol			0.02
12DCB			4
13DCB	9E-3		0.03
14DCB	0.9	0.3	1.4
2-methylnaphthalene			0.04
4-methylphenol			0.4
naphthalene		0.6	0.01
124TCB		0.04	0.3
1,1,2-trichloro-1,2,2-trifluoroethane	3.6E-3	0.03	2.6E-4
dieldrin			0.04
heptachlor epoxide			0.045
Total Al	1.7		1.3
Total Sb	3.5		
Total As	0.3		1E-3
Total Ba	0.1		4E-4
Total Cd	0.6		0.04
Total Cr	1.3		0.9
Total Fe	16		0.06
Total Mn	3.7		0.01
Total Ni	0.3		1E-3

Chemical	Ingestion	Inhalation	Dermal
Total V	0.6		0.1
Total Zn	0.08		7E-4
Total Be	0.02		6E-3
Total Co	0.16		2E-3
Total Cu	0.3		2E-3
Dissolved As	0.2		8.7E-4
Dissolved Ba	0.06		2E-4
Dissolved Fe	2.4		8.8E-3
Dissolved Mn	5.1		0.02
Total (12DCE as cis and trans; dissolved metals)	340	1600	49
Total (12DCE as cis and trans; total metals)	370	1600	52
Total (12DCE as total; dissolved metals)	330	1600	48
Total (12DCE as total; total metals)	360	1600	51

It is not clear why total metals were used for ingestion and dissolved metals for inhalation and dermal. One form should be used consistently for all exposure routes.

63. Table 6-47, Soil:
It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA	5.5E-4			6.4E-5
PCE	6.1E-3	8E-3	1.4E-8	5.7E-4
vinyl chloride	3.3E-4	1.6E-3	1.1E-9	5E-7
14DCB	3.4E-3	1.7E-3	1.4E-8	2.2E-3
124TCB	3.8E-2	7E-3	2E-7	2.3E-2
Aluminum	2.8E-2		8.9E-4	0.18

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
Antimony	6.6E-2			2E-2
Arsenic	0.3			3E-2
Barium	9.7E-3		1.5E-4	3E-4
Cadmium	0.19		1E-4	0.24
Chromium	0.13		4E-4	0.4
Iron	0.22			6.9E-3
Manganese	3E-2		1.4E-3	1E-3
Mercury	3E-2		1E-6	9.5E-4
Nickel	1E-2			3.7E-3
Total	1.1	0.018	3E-3	0.9

64. Table 6-47, Groundwater:

The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table). Dissolved metals, other than the four shown below, should be deleted. Inhalation was deleted because the scenario was not clear.

Chemical	Dermal
acetone	0.09
benzene	0.7
2-butanone	3E-3
chlorobenzene	3.3
12DCA	0.4
11DCE	1.1
trans-12DCE	2E-3
tot12DCE	1.8
ethylbenzene	0.19
4-methyl-2-pentanone	0.1
methylene chloride	4
1122PCA	0.03
PCE	8.8

Chemical	Dermal
toluene	0.45
111TCA	0.4
112TCA	0.03
TCE	1.8
xylene	0.045
4-chloroaniline	3.3
2-chlorophenol	0.01
12DCB	2.2
14DCB	0.8
4-methylphenol	8E-3
naphthalene	0.01
124TCB	0.1
1,1,2-trichloro-1,2,2-trifluoroethane	1.4E-4
dieldrin	0.02
heptachlor epoxide	0.02
Total Al	3.5
Total Sb	0.35
Total As	4E-3
Total Ba	1E-3
Total Cd	0.1
Total Cr	2.5
Total Fe	0.2
Total Mn	0.04
Total Ni	3E-3
Total V	0.3
Total Zn	2E-3
Total Be	0.02
Total Co	5E-3

Chemical	Dermal
Total Cu	5E-3
Dissolved As	2E-3
Dissolved Ba	6E-4
Dissolved Fe	0.02
Dissolved Mn	0.05
Total (12DCE as cis and trans; dissolved metals)	32
Total (12DCE as cis and trans; total metals)	39
Total (12DCE as total; dissolved metals)	32
Total (12DCE as total; total metals)	39

65. Table 6-48, Soil:

It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA	3.7E-5			5.1E-6
PCE	4E-4	6.3E-4	1.1E-9	4.6E-5
vinyl chloride	2.2E-5	1.3E-4	8.9E-11	4.1E-8
14DCB	2.3E-4	1.4E-4	1.1E-9	1.7E-4
124TCB	2.5E-3	5.8E-4	1.7E-8	1.9E-3
Aluminum	1.9E-3		7E-5	1.4E-2
Antimony	4.4E-3			1.7E-3
Barium	6.5E-4		1E-5	2.4E-5
Cadmium	0.013		8.3E-6	1.9E-2
Chromium	8.6E-3		3.2E-5	3E-2
Iron	0.015			5.5E-4

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
Manganese	2.2E-3		1.1E-4	8.2E-5
Mercury	2E-3		9E-8	7.6E-5
Nickel	7.8E-4			2.9E-4
Total	0.07	1.5E-3	2.4E-4	0.07

66. Table 6-49, Soil:

It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA				9E-5
PCE		4.7E-3	8E-9	8E-4
vinyl chloride		9.3E-4	6.5E-10	7E-7
14DCB		9.6E-4	8.3E-9	
124TCB		4E-3	1E-7	
Aluminum				0.25
Cadmium				0.33
Iron				9.7E-3
Manganese				1.4E-3
Mercury	3.7E-3		7E-7	1.3E-3
Total		0.01	1.7E-3	1.3

67. Table 6-50, Soil:

It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA	3.2E-4			3.6E-4
PCE	3.6E-3	2.3E-2	4E-8	3E-3
vinyl chloride	1.9E-4	4.5E-3	3E-9	2.9E-6
14DCB	2E-3	5E-3	4E-8	1.2E-2

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
124TCB	2E-2	0.02	6E-7	0.13
Aluminum	1.6E-2		2E-3	1
Antimony	3.9E-2			0.12
Arsenic	0.18			0.18
Barium	6E-3		4.3E-4	1.7E-3
Cadmium	0.1		3E-4	1.3
Chromium	7.5E-2		1E-3	2.2
Iron	0.13			0.04
Manganese	1.9E-2		4E-3	5.7E-3
Mercury	1.8E-2		3E-6	5.3E-3
Nickel	6.8E-3			0.02
Total	0.63	0.05	8E-3	5.1

68. Table 6-50, Groundwater:

The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table). Dissolved metals, other than the four shown below, should be deleted.

Chemical	Ingestion	Inhalation	Dermal
acetone			0.2
benzene		37	0.1
2-butanone		0.7	5E-3
chlorobenzene		48	6.4
chloroethane		0.07	7E-3
chloroform		1100	0.3
11DCA		11	0.4
12DCA		930	0.7
11DCE			1.9
cis-12DCE			3.9
trans-12DCE			3E-3

Chemical	Ingestion	Inhalation	Dermal
tot12DCE	85		3
ethylbenzene		0.6	0.4
4-methyl-2-pentanone		17	0.2
methylene chloride		36	6.4
1122PCA			0.07
PCE		6.6	23
toluene		14	0.8
111TCA		5	0.9
112TCA	1.2		0.07
TCE			3.7
vinyl chloride		25	2.3
xylene			0.09
4-chloroaniline			6.6
2-chlorophenol			0.02
12DCB			5.6
13DCB	0.03		0.04
14DCB		0.4	1.9
2-methylnaphthalene	0.05		0.06
4-methylphenol			0.5
naphthalene	0.04	0.9	0.02
124TCB	0.2	0.05	0.36
1,1,2-trichloro-1,2,2-trifluoroethane	1E-2	0.04	4E-4
dieldrin			0.06
heptachlor epoxide			0.06
Total Al	5		1.8
Total Sb	9.7		0.18
Total As	0.9		2E-3

Chemical	Ingestion	Inhalation	Dermal
Total Ba	0.3		6E-4
Total Cd	1.7		0.06
Total Cr	3.6		1.3
Total Fe	45		0.08
Total Mn	10		0.02
Total Ni	0.9		2E-3
Total V	1.7		0.16
Total Zn	0.2		1E-3
Total Be	0.05		9E-3
Total Co	0.4		3E-3
Total Cu	0.9		3E-3
Dissolved As	0.6		1E-3
Dissolved Ba	0.15		3E-4
Dissolved Fe	6.8		0.01
Dissolved Mn	14		0.026
Total (12DCE as cis and trans; dissolved metals)	900	2200	68
Total (12DCE as cis and trans; total metals)	980	2200	72
Total (12DCE as total; dissolved metals)	915	2200	67
Total (12DCE as total; total metals)	995	2200	71

It is not clear why total metals were used for ingestion and dissolved metals for inhalation and dermal. One form should be used consistently for all exposure routes.

69. Table 6-51, Soil:

It is preferable to separate the soil risks for VF and PEF.
The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table):

Chemical	Ingestion	Inhalation/Vol	Inhalation/Part	Dermal
1122PCA	3E-3			9E-4
PCE	3.3E-2	6E-2	1E-7	8E-3
vinyl chloride	1.8E-3	0.01	8.7E-9	8E-6
14DCB	1.9E-2	1E-2	1E-7	3E-2
124TCB	0.2	0.06	1.6E-6	0.34
Aluminum	0.15		6.9E-3	2.6
Antimony	0.36			0.3
Arsenic	1.7			0.5
Barium	5E-2		9.4E-4	4.4E-3
Cadmium	1		8E-4	3.4
Chromium	0.7		3E-3	5.9
Iron	1.2			0.1
Manganese	0.18		1E-2	1.5E-2
Mercury	0.17		9E-6	1.4E-2
Nickel	6E-2			0.054
Total	6	0.13	0.02	13

70. Table 6-51, Groundwater:

The following corrections are recommended (if a risk is not specifically shown here, it is considered correct on the original table). Dissolved metals, other than the four shown below, should be deleted. Inhalation was deleted because young children are assumed to take baths.

Chemical	Ingestion	Dermal
acetone		0.5
benzene		4.6
2-butanone		1.3E-2
chlorobenzene		26
chloroethane		3.6E-2
chloroform		1.1
11DCA		1.8

Chemical	Ingestion	Dermal
12DCA		2.8
11DCE		8.2
cis-12DCE		17
trans-12DCE		1.5E-2
tot12DCE	200	13
ethylbenzene		1.6
4-methyl-2-pentanone		0.49
methylene chloride		27
1122PCA		0.22
PCE		88
toluene		3.4
111TCA		3.5
112TCA	2.9	0.26
TCE		14
vinyl chloride		11
xylene		0.37
4-chloroaniline		16
2-chlorophenol		0.08
12DCB		21
13DCB	5.8E-2	0.095
14DCB	6	7
2-methylnaphthalene		0.18
4-methylphenol		1.2
naphthalene		0.06
124TCB		1.3
1,1,2-trichloro-1,2,2-trifluoroethane	2.3E-2	1.3E-3
dieldrin		0.15

Chemical	Ingestion	Dermal
heptachlor epoxide	0.15	0.15
Total Al	11	5.4
Total Sb	23	0.54
Total As	2.2	5.5E-3
Total Ba	0.78	1.9E-3
Total Cd	4	0.19
Total Cr	8.3	4
Total Fe	100	0.25
Total Mn	24	0.058
Total Ni	2.1	5E-3
Total V	4	0.48
Total Zn	0.5	2.9E-3
Total Be	0.12	2.7E-2
Total Co	1	8E-3
Total Cu	2	8E-3
Dissolved As	1.5	3.7E-3
Dissolved Ba	0.36	8.5E-4
Dissolved Fe	16	0.038
Dissolved Mn	33	0.08
Total (12DCE as cis and trans; dissolved metals)	2200	257
Total (12DCE as cis and trans; total metals)	2340	268
Total (12DCE as total; dissolved metals)	2150	253
Total (12DCE as total; total metals)	2290	264

It is not clear why total metals were used for ingestion and dissolved metals for inhalation and dermal. One form should be used consistently for all exposure routes.

71. Table 6-52:

Using the above adjustments, this table would be as follows:

	Ind worker	Cons worker	Util worker	Tresp	Ad Res	Ch Res
Soil Ing	0.2	1.1	0.07	0.1	0.6	6
Soil Inh	0.05	0.02	2E-3	0.01	0.06	0.16
Soil Derm	1.8	0.9	0.07	1.3	5.1	13
Total Soil	2*	2*	0.1	1.4*	5.8	19
GW Ing	330-370	--	--	--	900-995	2150-2340
GW Inh	1600	--	--	--	2200	--
GW Derm	48-52	32-39	--	--	67-72	253-268
Total GW	1978-2022	32-39	--	--	3167-3267	2403-2608
Total	1980-2024	34-41	0.14	1.4*	3173-3273	2422-2627

*When separated by target organ, HIs do not exceed 1.

72. Page 6-13, 2nd paragraph: In the 3rd line, the extra "hypothetical" should be deleted. In the 6th line, the respective risks should be 1.7E-1, 2.6E-4, 3.4E-1, and 1.2E-2. In the last line, the utility worker risk should be 2.3E-7.

73. Page 6-13, 3rd paragraph: The last line should be modified; the future residential risk (adult plus child) would be 2E-4, exceeding the risk range.

74. Page 6-14, 3rd paragraph: In the 2nd line, the extra "hypothetical" should be deleted. In the 5th line, the respective HIs should be 1980-2024, 34-41, 3173-3272, and 2422-2627. (The ranges occur because there are options to use either cis- and trans-12DCE, or tot12DCE; and to use either total or dissolved metals.) In the last sentence of this paragraph, the trespasser HI should be 1.4 and the utility worker HI should be 0.14, so the risks are "at or below" 1.

75. Page 6-14, 4th paragraph: The last line should be modified; the future residential HIs exceed 1 (adult 6, child 19).

76. Page 6-16, 6th paragraph: The last sentence should be modified to, "This can also result in a conservative estimate of risk, but it does not always (e.g., TCE can degrade to the more potent carcinogen vinyl chloride)."

77. Page 6-17, 3rd paragraph: The mean soil lead concentration is 687 mg/kg, which exceeds 400 mg/kg.

78. Page 6-17, 4th paragraph: This paragraph should be revised to read, "Lead was detected in total groundwater samples at concentrations up to 1320 ug/l, with a mean of approximately 200 ug/l. Dissolved concentrations, however, were much lower. If child residents were exposed to the average amount of lead in soil and total groundwater at this site, their geometric mean blood level would be approximately 17 ug/dL, with 83.6% exceeding a blood level of 10 ug/dL. EPA's goal is for no more than 5% of a population to exceed 10 ug/dL."

79. Page 6-17: The last paragraph on this page will need to be rewritten when all the residential well results have been compiled.

80. Page 6-18, 3rd bullet: It is not clear why or how "status of local public water supplies" contributes to the uncertainty of the risk estimates.

81. Section 6.6.4: In this section, the results of the split samples should be assessed.

82. Page 7-3, 2nd bullet; page 7-4, 2nd paragraph; page 7-5: Define "impacted." Also, describe the extent of the asphalt.

83. Page 7-4, 2nd paragraph: SSLs are also exceeded.

84. Page 7-4, 6th paragraph: The description of the creek liner is unclear. Is it preventing groundwater discharge or groundwater exposure?

MARYLAND DEPARTMENT OF THE ENVIRONMENT
WASTE MANAGEMENT ADMINISTRATION
ENVIRONMENTAL RESTORATION AND REDEVELOPMENT PROGRAM

Comments on:
Galaxy/Spectron Superfund Site
Feasibility Study Report for Site Soils and Overburden Groundwater
Elkton, Maryland, June 2001

GENERAL COMMENTS

1. This report presents the Remedial Action alternatives for addressing contaminated soils and overburden groundwater at the site. The preferred Remedial Action alternative selected in this report does not include an impermeable cap, or equivalent technology, to cover highly contaminated shallow soils that will, according to this scenario, remain in place. However, installing an impermeable cap would minimize the infiltration of precipitation through highly contaminated soils, thereby reducing the migration of hazardous substances to underlying groundwater. This type of cap would also reduce the amount of groundwater entering the groundwater collection system, thereby relieving some of the load that is placed on the collection system during high groundwater flows associated with episodic heavy precipitation events. In addition to an impermeable cap, other engineered controls such as a slurry wall or run-off and run-on controls may be necessary to prevent the collection system from being overwhelmed during these heavy precipitation events.

   At this time, there has been no demonstrated benefit to the remediation of soils or overburden groundwater by installing an engineered vegetative soil cover, rather than an impermeable cap, over highly contaminated shallow soils. In fact, an engineered vegetative soil cover, which may reduce infiltration during part of the year (growing season), may still generate a greater volume of contaminated groundwater to be treated by the groundwater treatment plant over the entire year than an impermeable cap. Installing an engineered vegetative soil cover may also increase the future risk of excavation into underlying contaminated soils.

   The Maryland Department of the Environment (MDE) recommends that an impermeable cap, or equivalent technology, be further evaluated as being part of the remedy for addressing contaminated soils and overburden groundwater, if highly contaminated soils will remain in place. The MDE also recommends that the revised Feasibility Study report include a discussion of the capability of the collection system during periods of high groundwater flows associated with episodic heavy precipitation events. Included with this discussion should be the remedial contractor's estimates of the amount of groundwater that is expected to enter the collection system during the type of rainfall event (5-year rainfall event) that resulted in floating the creek liner back in March 2000. It is imperative that the remedy that is ultimately approved for Operable Unit 1 not result in the collection system being overwhelmed during high groundwater discharge periods.

2. All of the remedial alternatives presented in this report, with the exception of the "No Action" alternative, include a deed restriction being placed on the site. A discussion should be included in the text explaining how the Potentially Responsible Party (PRP) group plans to implement these restrictions in light of the fact that the owner of the site is not part of the PRP group.

SPECIFIC COMMENTS

1. Page 2. Executive Summary. This section indicates that there are "no current threats to human health and the environment at the site." MDE does not believe that this statement is accurate. The lateral and vertical extent of contamination in the bedrock aquifer is still being investigated, and therefore, the risks posed by this pathway have not yet been fully evaluated. Furthermore, surface water data from the Little Elk Creek immediately downgradient of the creek liner indicates that U.S. Environmental Protection Agency's Ambient Water Quality Criteria (AWQC) were exceeded for two site-related contaminants (1,1,2,2 tetrachloroethane and tetrachloroethene) during the last creek sampling event (see February 2001 Residential Well and Creek Surface Water Sampling Results Report). Until these sampling data are further evaluated and this exceedance explained, the ecological risks posed to the Little Elk Creek also require further evaluation at this time. The text should be revised to indicate that the threats to human health and the environment posed by bedrock groundwater contamination have not been fully evaluated at this time. The text should also be revised to include an explanation of the possible threats to the Little Elk Creek posed by the above-mentioned exceedances in AWQCs.

2. Page 16. Section 1.3.6 Groundwater Isolation and Collection System. This section indicates that the as-built drawings for the Removal Action groundwater collection system are included in the January 24, 2000 Removal Action Construction Certification Report prepared by Advanced GeoServices Corporation. While the Removal Action Construction Certification Report does include the most recent as-built drawings of the collection system, MDE is concerned that some of the actual operational parameters are apparently different than the 100% approved design parameters. Discrepancies have been found between some of the information included on these drawings and other groundwater collection system design information contained in the site files. For example, the elevation of the invert pipe in Sump 2 recorded in the as-built drawings is 193 feet. However, O'Brien & Gere's June 18, 2001 e-mail to MDE indicates that this pipe is set at an elevation of 190.42 feet.

   The MDE recommends that the design information on the as-built drawings included in the January 24, 2000 Removal Action Construction Certification Report be checked as soon as possible to confirm that the information included on these drawings is correct. Until these drawings are verified to be consistent with current operational parameters, MDE recommends that they be considered draft. The text should be revised to indicate that the most recent as-built drawings of the Removal Action groundwater collection/treatment system, which are included in the Removal Action Construction Certification Report, are currently under review.

3. Page 17. Section 1.3.7 Groundwater Treatment System. This section describes the permanent groundwater treatment system that is currently operating at the site. However, there is no mention of the temporary groundwater treatment system that went on-line in June 2001 to help handle episodic high groundwater flows into the groundwater collection system associated with heavy precipitation events. The temporary system consists of two granular activated carbon treatment units that are designed to treat as much as 100 gallons per minute contaminated groundwater entering the collection system. The temporary system will continue to operate until a permanent solution can be implemented to handle episodic high groundwater flows into the collection system. This section should be revised to include a discussion of the temporary groundwater treatment system.

4. Page 25. Section 2.1.2 Identification of Potential ARARs and TBCs. Identified in this section are the potential State applicable or relevant and appropriate requirements (ARARs) that apply to the cleanup of contaminated soils and overburden groundwater. Not all potential State ARARs are mentioned in this section. MDE is including with these comments tables of the potential State ARARs that apply to the cleanup of contaminated soils and overburden groundwater. This report should be revised to identify all of the potential State ARARs that MDE has identified on the above-mentioned tables.

STATE OF MARYLAND ARARS
TITLE 26
DEPARTMENT OF THE ENVIRONMENT

CITATION (COMAR)	TYPE OF ARAR	TITLE	REQUIREMENT SYNOPSIS	EVIDENCE OF ENFORCEABILITY
26.02	Action	Occupational, Industrial, and Residential Hazards	Provides limits on the maximum allowable levels of noise at the site boundaries during site remediation work to protect the health, general welfare, and property of the people of the State.	State regulation
26.04	Action/Chemical	Regulation of Water Supply, Sewage Disposal, and Solid Waste	Provides for maximum contaminant levels (MCLs) of contaminants in drinking water. Provides specifications for well construction and abandonment. Provides for proper closure and post closure monitoring and maintenance of landfills.	State regulation
26.05	Action	Board of Well Drillers	Provides licensing requirements for persons drilling and installing wells in the State. Assures that monitoring wells are installed by qualified well drillers.	State regulation
26.06	Action	Waterworks and Waste Systems Operators	Provides certification requirements for persons operating facilities used to collect, store, pump, treat, or discharge any liquid or waterborne waste.	State regulation
26.08	Action/Chemical	Water Pollution	Protects and maintains the quality of surface water in the State. Establishes criteria and standards for discharge limitations and policy for anti-degradation of waters of the State. Discharge of treated groundwater must meet State treatment requirements. Requires permit to construct injection wells in the State.	State regulation
26.10	Action/Chemical	Oil Pollution and Tank Management	Provides that oil or other matter containing oil may not be pumped, discharged, spilled, thrown, drained, deposited, or caused to be deposited into, near, or in an area likely to pollute waters of the State. Procedures for the removal of oil must be authorized by the Department.	State regulation
26.11	Action/Chemical	Air Quality	Provides ambient air quality standards, general emissions standards, and restrictions for air emissions from construction activities, vents, and treatment technologies such as incinerators. Also includes nuisance and odor control. Construction activities will emit particulate matter into the ambient air. Remedial activities must follow regulations.	State regulation
26.13	Action/Chemical	Disposal of Controlled Hazardous Substances	Provides criteria to identify hazardous waste and listed waste, including maximum concentration of contaminants for the toxicity characteristic. Establishes standards for generators of hazardous waste. Provides regulations for the transport, treatment, storage and disposal of hazardous waste, including thermal treatment and incineration.	State regulation

26.14	Action/Chemical	Hazardous Substance Response Plan	Provides for the investigation, evaluation, and response under State authority to hazardous substance releases.	State regulation
26.15	Action/Chemical	Disposal of Controlled Hazardous Substances-Radioactive Hazardous Substances	Provides for disposal and transport of radioactive hazardous substances (low-level nuclear waste and low-level radioactive waste) in an appropriate manner.	State regulation
26.17	Action/Location	Water Management	Provides for the conservation and protection of the water resources of the State by requiring that any land-clearing, grading, other earth disturbances require an erosion and sediment control plan. Provides that stormwater must be managed to prevent off-site sedimentation and maintain current site conditions. Establishes criteria to govern construction, reconstruction, repair, or alteration of a dam, reservoir, or waterway obstruction or any change of the course, current, or cross section of a stream or body of water within the State including any changes to the 100-year frequency floodplain or free-flowing waters.	State regulation
26.23	Action/Location	Nontidal Wetlands	Provides that certain regulated activities may not be conducted in a nontidal wetland, or within a buffer or an expanded buffer unless the State has issued a permit.	State regulation
26.24	Action/Location	Tidal Wetlands	Provides that certain regulated activities conducted in tidal wetlands must be permitted by the State, These activities include constructing, reconstruction, dredging, filling, removing, or otherwise altering tidal wetlands.	State regulation

STATE OF MARYLAND ARARS
ANNOTATED CODE OF MARYLAND
ENVIRONMENT ARTICLES

CITATION	TYPE OF ARAR	TITLE	REQUIREMENT SYNOPSIS	EVIDENCE OF ENFORCEABILITY
Title 2	Action/Chemical/ Location	Ambient Air Quality Control	To maintain the degree of purity of the air necessary to protect the health, the general welfare, and property of the people of this State.	State Law
Title 3	Action/Location	Noise Control	To adopt environmental noise standards, sound level limits, and noise control rules and regulations as necessary to protect the public health, the general welfare, and property of the people of this State.	State Law
Title 4	Action/Location	Water Management	To adopt criteria and procedures in order to protect the lands and waters comprising the watersheds of the State.	State Law
Title 5	Action	Water Resources	To provide regulation and control over water resources of the state within the boundaries of tidal waters provided by this article, to protect and restore non-tidal wetlands, and to establish prohibitions on dumping spoils and used oil.	State Law
Title 7	Action/Chemical	Hazardous Materials and Hazardous Substances	To provide additional and cumulative remedies to prevent, abate, and control pollution of the waters of this State[1] by supervising and controlling the storage, treatment, transportation and disposal of hazardous material, controlled hazardous substances and low-level nuclear waste.	State Law
Title 9	Action/Chemical/ Location	Water, Ice, and Sanitary Facilities	To protect the waters of this State, including drinking water, from any contamination or other alteration of its physical, chemical, or biological properties, including a change in temperature, taste, color, turbidity, or odor of the waters or the discharge or deposit of any organic matter, harmful organism, or liquid, gaseous, solid, radioactive, or other substance that will render the waters of the State harmful or detrimental to: 1) public health, safety, and welfare; 2) domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; 3) livestock, wild animals, or birds; and 4) fish or other aquatic life. To provide for the adoption of water quality and effluent standards.	State Law
Title 12	Action	Waterworks and Waste Systems Operators	To establish a certification program for superintendents, operators, and industrial operators of waterworks, wastewater works, and industrial wastewater works: 1) to protect the quality of water in which wastes are placed; 2) to protect the public health; and 3) to prevent pollution.	State Law
Title 13	Action	Well Drillers	To provide for licensing of any person who practices well[2] drilling in the State.	State Law
Title 16	Location	Wetlands and Riparian Rights	To preserve wetlands and prevent their despoliation and destruction; to require a license for dredging or filling of wetlands.	State Law

[1] - "Waters of the State" are defined to include (1) both surface and underground waters within the boundaries of this State subject to its jurisdiction, including that part of the Atlantic Ocean within the boundaries of this State, the Chesapeake Bay and its tributaries, and all ponds, lakes, rivers, streams, public ditches, tax ditches, and public drainage systems within this State, other than those designed and used to collect, convey, or dispose of sanitary sewer, and (2) the flood plain of free-flowing waters determined by the Department of Natural Resources on the basis of the 100-year flood frequency.

2 - "Well" is defined to include any hole made in the ground to (1) explore for groundwater, (2) obtain or monitor groundwater, (3) inject water into any underground formation from which groundwater may be produced, or (4) to transfer heat to or from the ground or groundwater.

STATE OF MARYLAND ARARS
ANNOTATED CODE OF MARYLAND
NATURAL RESOURCES ARTICLES

CITATION	TYPE OF ARAR	TITLE	REQUIREMENT SYNOPSIS	EVIDENCE OF ENFORCEABILITY
Title 4	Action/Location/ Chemical	Fish and Fisheries	To conserve species of fish for human enjoyment, for scientific purposes and to ensure their perpetuation as viable components of their ecosystems.	State Law
Title 8	Action/Location/ Chemical	Water and Water Resources	To conserve, protect, and use water resources of the state by controlling appropriation or use of surface waters and groundwaters of the State.	State Law
Title 10	Action/Chemical/ Location	Wildlife	To conserve species of wildlife for human enjoyment, for scientific purposes, and to ensure their perpetuation as viable components of their ecosystems.	State Law

STATE OF MARYLAND ARARS
TITLE 08
DEPARTMENT OF NATURAL RESOURCES

CITATION (COMAR)	TYPE OF ARAR	TITLE	REQUIREMENT SYNOPSIS	EVIDENCE OF ENFORCEABILITY
08.01	Location/Action	Office of the Secretary	Wildlands shall be protected from erosion in a manner which has minimal adverse effects on the wildlands ecosystem. Roads, structures, installations, motorized equipment and vehicular transport are restricted.	State regulation
08.02	Action	Tidewater Administration	Permits are required to fish in nontidal waters in the State. If obtaining fish for study in a risk assessment, a permit would be required.	State regulation
08.03	Action/Chemical	Wildlife	Provides that threatened and endangered species in the State must be protected. May not reduce the likelihood of either the survival or recovery of a listed species in the wild by reducing the reproduction, numbers or distribution of a listed species or otherwise adversely affect the species.	State regulation