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Ms. Peggy Smith
Maryland Department of the Environment (MDE)
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Subject: **Additional Soil and Sediment Sampling Letter Report**
Martin State Airport, Middle River, Maryland (MD-304)

On behalf of Lockheed Martin Corporation (LMC), Tetra Tech has prepared the following letter report summaring the results of the additional soil and sediment sampling conducted on May 24, 2005 at Martin State Airport located in Middle River, Maryland. The additional soil and sediement sampling was conducted in accordance with the *Additonal Soil and Sediment Sampling Letter Work Plan* dated April 19, 2005 with Figure 2 amended May 5, 2005. The Maryland Department of the Environment (MDE) approved the plan in their letter dated May 18, 2005. The objective of the additional sampling was to address MDE's comments (MDE, December 2004 and February 2005) on the human health and ecological risk assessments submitted to MDE on October 15, 2004. MDE's human health risk assessment comment #16 sent by e-mail dated December 17, 2004 was regarding the speciation of hexavalent chromium in the vicinity of areas where elevated total chromium concentrations were detected at former Excavation No. 2 in the Taxiway Tango Median Area. To address MDE's ecological risk assessment general comment #1 in their memorandum dated February 9, 2005, sediment sampling was conducted in Pond #1 to supplement sediment sample EP1-SD2 and further evaluate potential ecological risks associated with sediment chemical concentrations.

A summary of the sampling programs and results is presented below.

Site Description and Location

Martin State Airport is located at 701 Wilson Point Road in Middle River, Maryland, and is bounded by Frog Mortar Creek to the east and Stansbury Creek to the west. Both creeks join into Chesapeake Bay at the south side of the airport. The area under investigation is located at the southeast portion of the Martin State Airport and is bounded by Frog Mortar Creek to the east, and the main airport runway to the west. The boundaries of the Site location, as shown in Figure 1 in Appendix A, represent the investigation area. The proposed sampling locations at the former Excavation No. 2 in the Taxiway Tango Median Area and Pond #1 are located within the investigation area.

Soil Sampling Program

Background Information

As shown in Figure 2, elevated total chromium concentrations were detected in former Excavation No. 2 in the Taxiway Tango Median Area in previous samples TT-EX2-T11A-4, TT-EX2-T11C-4, and TT-EX2-T11D-4. The maximum total chromium concentration of 9,300 mg/kg was detected in previous sample TT-EX2-T11D-4 at a depth of 4 feet below ground surface (bgs). MDE's human health risk comment #16, and the discussion during the follow-up January 19, 2005 conference call recommended that total chromium concentrations represent hexavalent chromium concentrations in the human health risk assessment. This was recommended by MDE because samples in the immediate vicinity of the sample with the maximum total chromium concentration of 9,300 mg/kg were not analyzed for hexavalent chromium. It should be noted that a total of 19 samples were previously collected throughout the investigation area from December 2001 through January 2002 and analyzed for both total chromium and hexavalent chromium. The data demonstrated that hexavalent chromium was not present in any of the 19 samples that were collected and analyzed. Samples collected from boring TT-4 (i.e., two of the 19 samples), located approximately 100 feet southeast of sample TT-EX2-T11D-4 with the highest total chromium concentration of 9,300 mg/kg, were also analyzed for both total and hexavalent chromium. The results showed detectable levels of total chromium but did not show detectable concentrations of hexavalent chromium (Figure 2 in

Appendix A). Therefore, the speciated samples consistently showed that hexavalent chromium was not present. In order to address MDE's comment regarding hexavalent chromium speciation, Tetra Tech collected additional samples for analysis of both total and hexavalent chromium.

Field Activites

Prior to conducting soil sampling activities, a geophysical survey was conducted to clear all boring locations proposed in the Taxiway Tango Median Area. A geophysical survey was conducted by Enviroscan, Inc. to locate and mark all underground utility lines at the proposed soil boring locations. A combination of electromagnetic resistivity / conductivity and line locating, and ground penetrating radar (GPR) were used to assure that all proposed sampling locations did not encounter underground utilities, metallic objects, and other anomalies. Due to the presence of an electrical line and subsurface obstructions/ anomalies, all proposed boring locations required relocation. The borings were relocated as close as possilbe to their original location.

This sampling event was coordinated with the Maryland Aviation Administration. A total of six soil borings (TT-EX2-SB1 through TT-EX2-SB6) were conducted in the vicinity of previous samples (TT-EX2-T11A-4, TT-EX2-T11C-4, and TT-EX2-T11D-4) containing high total chromium concentrations at former Excavation No. 2 in the Taxiway Tango Median Area – *see Figure 2 in Appendix A*. The sampling was conducted using a Geoprobe. A total of two samples were collected from each boring at a depth of 1 foot and 4 feet bgs. The samples from the 1-foot depth were used to represent the surface soil concentrations. The samples from the 4-foot depth correspond to the depth where high total chromium concentrations were previously detected. Therefore, a total of twelve samples were collected and analyzed for total chromium using EPA Method 6010B and for hexavalent chromium using EPA Method 7196A. Lithological information for each soil boring was recorded on a boring log – *see Appendix B*.

Soil Analyical Data Results

The concentrations of chromium that were detected in the 12 additional soil samples are presented in Table 1 with laboratory analytical data reports included in Appendix C. Total chromium was analyzed using EPA Method 6010B, and hexavalent chromium was analyzed usiing EPA Method 7196A. The analytical data from the 12 samples will be incorporated into the revised human health risk assessment, and data from the six surface samples will be incorporated into the revised ecological risk assessment. Among the six surface soil (i.e., 1-foot depth) samples that were collected, TT-EX2-SB1 to TT-EX2-SB-6, hexavalent chromium was detected in five locations whereas total chromium was detected in all of the locations. The results also show that hexavalent chromiuim was generally limited to the 1-foot depth. The step-out boring TT-EX2-SB3 (in the vicinity of the previous highest total chromium of 9,300 mg/kg at TT-EX2-11D-4) resulted in a total chromium concentration of 1,300 mg/kg and no detection of hexavalent chromium at a depth of 4 feet bgs.

Table 1
Results of Total Hexavalent and Total Chromium Soil Concentrations

Sample ID	Sample Depth (feet)	Hexavalent Chromium (mg/kg)	Total Chromium (mg/kg)	Cr^{+6}/Total Chromium Ratio*
TT-EX2-SB1-1	1	1.1	39.7	1:36
TT-EX2-SB1-4	4	<0.35	132	<0.35:132
TT-EX2-SB2-1	1	0.36	24.4	1:68
TT-EX2-SB2-4	4	1.3	300	1:231
TT-EX2-SB3-1	1	0.72	32.3	1:45
TT-EX2-SB3-4	4	<0.37	1300	<0.37:1300
TT-EX2-SB4-1	1	1.4	31.8	1:23
TT-EX2-SB4-4	4	<0.45	346	<0.45:346
TT-EX2-SB5-1	1	<0.34	25.4	<0.34:25.4
TT-EX2-SB5-4	4	<0.36	224	<0.36:224
TT-EX2-SB6-1	1	1	48.3	1:48
TT-EX2-SB6-4	4	<0.35	102	<0.35:102

The results of the additional sampling demonstrate that hexavalent chromium is present at a much lower level relative to total chromium. Since the ratios between hexavalent chromium and total chromium as shown in Table 1 do not show a consistent trend, Tetra Tech would like to

propose that hexavalent chromium and total chromium be evaluated separately in the revised human health risk assessment. In cases where speciated data are not available, Tetra Tech would like to propose that the detected concentrations be evaluated as total chromium in the revised human health risk assessment.

Sediment Sampling Program

To address MDE's ecological risk assessment general comment #1, sediment sampling was conducted in Pond #1 to supplement sediment sample EP1-SD2 and further evaluate potential ecological risks associated with sediment chemical concentrations. MDE did not require additional sediment or surface water sampling at Pond #2 or Frog Mortar Creek.

Field Activities

A total of four sediment samples (EP1-SD3 through EP1-SD6) were collected from Pond #1 – *see Figure 2 in Appendix A*. The sampling was conducted using a boat. Sediment samples were collected from the water-sediment interface using a stainless steel mini-ponar dredge. All reusable equipment was decontaminated between sample locations following appropriate QA/QC protocols. Upon sample retrieval, the initial sample volume was placed within the volatile organic compound (VOC) sample container until no headspace remained. The remaining sample volume was homogenized and placed within the other sample containers supplied by the analytical laboratory. The sediment samples were analyzed for VOCs using EPA Method 8260B, semi-volatile organic compounds (SVOCs) using EPA Method 8270C, total priority pollutant metals using EPA Method 6010B/7471, polychlorinated biphenyls (PCBs) using EPA Method 8082, and hexavalent chromium using EPA Method 7196A. In addition, analysis of sediment samples for simultaneously extracted metals / acid volatile sulfides (SEM/AVS) was also conducted to measure potential sediment toxicity based on the recommendation by the Maryland Department of the Environment (MDE) in their e-mail dated May 16, 2005. Approximate water depths were measured at each sediment sample location. The top of the surface water to the depth of the sediment ranged from 4.5 feet to 6.5 feet.

Sediment Analyical Data Results

The concentrations of VOCs, SVOCs, priority pollutant metals, hexavalent chromium, and PCBs that were detected in the four additional sediment samples are presented in Table 2 with laboratory analytical data reports included in Appendix C. The analytical data from these four samples will be incorporated into the revised ecological and human health risk assessments.

Table 2
Results of Chemical Analyses for Sediment Samples Collected in Pond #1

Sample ID	Results of Chemical Analyses				
	VOCs (ug/kg)	SVOCs (ug/kg)	Metals (mg/kg)	Cr^{+6} (mg/kg)	PCBs (mg/kg)
EP1-SD3	Acetone: 1,230 2-Butanone: 180 tert. – Butyl Alcohol: 47J sec-Butylbenzene: 8.7J Carbon disulfide: 92.3 Chlorobenzene: 176 1,2-Dichlorobenzene: 7.9J Isopropylbenzene: 23.7 Naphthalene: 10.3J n-Propylbenzene: 32.3 Total xylenes:19.7J 1,2,4-Trimethlybenzene: 7.5J 1,3,5-Trimethylbenzene: 6.7J o-Xylene: 5.0J m/p-Xylene: 15.0J	Anthracene: 319J Benzo(a)anthracene: 1,960 Benzo(a)pyrene: 2,230 Benzo(b)fluoranthene: 2,030 Benzo(g,h,i)perylene: 1,210 Benzoic acid: 1,150J Benzo(k)fluoranthene: 2,080 Carbazole: 178J Chrysene: 2,210 Dibenzo(a.h)anthracene: 342J Fluoranthene: 3,650 Fluorene: 129J Ideno(1,2,3-cd)pyrene: 1,150 Phenanthrene: 1,330 Pyrene 3,100	As: 20 Be: 1.4 Cd: 123 Cr: 957 Cu: 108 Pb: 140 Hg: 0.08 Ni: 53 Se: 8 Ag: 1.8 Zn: 562	ND	Aroclor-1254: 0.543 Aroclor-1260: 0.775
EP1-SD4	Acetone: 1,260 Benzene: 3.8J 2-Butanone: 182 tert. – Butyl Alcohol: 37J n-Butylbenzene: 31.8 sec-Butylbenzene: 32.4 tert-Butylbenzene: 5.2J Carbon disulfide: 78.1 Chlorobenzene: 231 1,2-Dichlorobenzene: 10.4J Ethylbenzene:229 Isopropylbenzene: 57.9 p-Isopropyltoluene: 16.2 Naphthalene: 25.5 n-Propylbenzene: 89.7 Tetrachloroethene: 8.1J Toluene: 619 Total xylenes: 1,090 Trichloroethene: 11.0J 1,2,4-Trimethlybenzene: 207 1,3,5-Trimethylbenzene: 70.0 o-Xylene: 319 m/p-Xylene: 769	Benzo(a)anthracene: 648 Benzo(a)pyrene: 660 Benzo(b)fluoranthene: 636 Benzo(g,h,i)perylene: 752 Benzo(k)fluoranthene: 700 Chrysene: 868 bis(2-Ethylhexyl)phthalate: 3,430 Fluoranthene: 1,110 Fluorene: 321J Ideno(1,2,3-cd)pyrene: 660 1-Methylnaphthalene: 483 Phenanthrene: 1,390 Pyrene: 1,930	As: 12 Be: 1.5 Cd: 929 Cr: 7,660 Cu: 279 Pb: 158 Hg: 0.09 Ni: 79 Ag: 1.2 Zn: 1,110	22.1	Aroclor-1254: 0.557 Aroclor-1260: 0.671

Table 2 - Continued
Results of Chemical Analyses for Sediment Samples Collected in Pond #1

Sample ID	Results of Chemical Analyses				
	VOCs (ug/kg)	SVOCs (ug/kg)	Metals (mg/kg)	Cr^{+6} (mg/kg)	PCBs (mg/kg)
EP1-SD5	Benzene: 215 n-Butylbenzene: 831 Chlorobenzene: 5,250 1,2-Dichlorobenzene:153 1,4-Dichlorobenzene: 40.1J cis-1,2-Dichloroethene: 28,200 trans-1,2-Dichloroethene: 125 Ethylbenzene: 30,400 Isopropylbenzene: 814 p-Isopropyltoluene: 625 Methylene Chloride: 282 Naphthalene: 6,610 n-Propylbenzene: 1,400 Tetrachloroethene: 5,160 Toluene: 350,000 Total xylenes: 86,500 Trichloroethene: 270,000 1,2,4-Trimethlybenzene: 12,600 1,3,5-Trimethylbenzene: 3,790 o-Xylene: 25,800 m/p-Xylene: 60,800	Anthracene: 165J Benzo(a)anthracene: 374 Benzo(a)pyrene: 196 Benzo(g,h,i)perylene: 243 Butylbenzylphthalate: 301J Carbazole: 89J Chrysene: 554 Di-n-butylphthalate:2,480 Dibenzofuran: 518 bis(2-Ethylhexyl)phthalate: 4,620 Fluoranthene: 700 Fluorene: 566 Ideno(1,2,3-cd)pyrene: 242 1-Methylnaphthalene: 6,080 2-Methylnaphthalene: 9,040 Naphthalene: 4,740 Phenanthrene: 1,850 Pyrene: 892	As: 2 Be: 0.3 Cd: 691 Cr: 4,690 Cu: 255 Pb: 131 Hg: 0.04 Ni: 60 Ag: 0.5 Zn: 632	14.1	Aroclor-1254: 0.413 Aroclor-1260: 0.175
EP1-SD6	Acetone: 1,560 2-Butanone: 266 tert. – Butyl Alcohol: 46J Carbon disulfide: 78.6 Naphthalene: 6.3J Total xylenes: 7.4J 1,2,4-Trimethlybenzene: 3.7J m/p-Xylene: 7.4J	Anthracene: 264J Benzo(a)anthracene: 950 Benzo(a)pyrene:911 Benzo(b)fluoranthene: 880 Benzo(g,h,i)perylene: 638 Chrysene: 1,130 Dibenzofuran: 247J bis(2-Ethylhexyl)phthalate:4,840 Fluoranthene: 1,520 Fluorene: 437J Ideno(1,2,3-cd)pyrene: 718 1-Methylnaphthalene: 741 Phenanthrene: 1,780 Pyrene: 2,200	As: 15 Be: 1.4 Cd: 289 Cr: 1,830 Cu: 129 Pb: 142 Hg: 0.07 Ni: 71 Ag: 0.8 Zn: 1,030	10.2	Aroclor-1254: 0.431 Aroclor-1260: 0.538

ND = Not Detected at a concentration greater than or equal to the practical quantitation limit (PQL).
J = Estimated value, less than the practical quantitation limit.
As = Arsenic; Be = Beryllium; Cd = Cadmium; Cr = Chromium; Cu = Copper; Pb = Lead; Hg = Mercury; Ni = Nickel; Se = Selenium; Ag = Silver; Zn = Zinc.

A summary of the SEM/AVS analytical results is presented in Table 3 with laboratory analtyical data reports included in Appendix C. The evaluation of the SEM/AVS data will be included in the revised ecological risk assesment.

Table 3
Results of SEM/AVS for Sediment Samples Collected in Pond #1

Sample ID	Chemical	SEM (umol/kg)	AVS (umol/g)
EP1-SD3	Cadmium	1,360	NA
	Copper	974	NA
	Lead	611	NA
	Nickel	286	NA
	Zinc	8,920	NA
	Sulfide	NA	28
EP1-SD4	Cadmium	9,030	NA
	Copper	2,800	NA
	Lead	816	NA
	Nickel	446	NA
	Zinc	22,700	NA
	Sulfide	NA	9.2
EP1-SD5	Cadmium	9,190	NA
	Copper	4,010	NA
	Lead	1,160	NA
	Nickel	728	NA
	Zinc	22,100	NA
	Sulfide	NA	13
EP1-SD6	Cadmium	3,250	NA
	Copper	1,280	NA
	Lead	667	NA
	Nickel	594	NA
	Zinc	20,500	NA
	Sulfide	NA	11

NA = Not Applicable

If you have any questions regarding this letter work plan, please contact me at (916) 276-7846.

Sincerely,

Nisha Bansal

Nisha Bansal
Project Manager
Tetra Tech, Inc.

Attachments: Attachment A - Figures
Attachment B - Boring Logs
Attachment C - Laboratory Analytical Data Reports

cc: M. Mank, MDE
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