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SECTION 2
SOIL MANAGEMENT PROCEDURES

This section describes the sequence of activities to be followed to ensure appropriate handling of soils and groundwater at the Middle River Complex (MRC). This plan pertains to Blocks E and I as depicted on Figure 2-1. The site contact list is attached as Appendix A.

2.1 CONTACT CEESH FOR HISTORICAL DATA REVIEW

Once an area requiring excavation has been identified, data from the relational database for that location and associated data from investigations conducted by Lockheed Martin Corporate Energy, Environment, Safety, and Health (CEESH) must be consulted to determine if known contamination is present in the excavation area(s). The excavation process should be started as follows:

1. Submit a drawing showing the location and approximate dimensions of the excavation to CEESH
2. CEESH will consult the list of Recognized Environmental Conditions (RECs), records of historical investigations, and the database, then provide a summary of existing data either within the excavation or nearby the excavation (i.e., within 25 feet of planned excavation)

A preliminary understanding of site conditions in Blocks E and I, based on current investigation data, is provided in Figures 2-2 and 2-3 (respectively). These graphics, in relative terms, provide an understanding of where contaminated soil or groundwater is more likely to be encountered. Use of this information is limited by the degree of investigation conducted in any specific area of the

characterized as hazardous based on the toxicity characteristic leaching procedure (TCLP). A preliminary determination of listed waste (F001) was determined for the southeastern corner of Block E due to the discovery in 2013 of an underground storage tank containing high concentrations of trichloroethene (at former Building D), not far from the existing firewater storage tank. Therefore, groundwater and soil encountered in this area must be appropriately categorized for proper handling and disposal in consultation with CEESH.

As stated earlier, some areas of Block E soil contain PCB concentrations above the TSCA and Maryland Hazardous Waste limit (both at 50 mg/kg). Regulations governing the management of investigation-derived waste (IDW) containing PCBs, which are generally based on in situ concentrations, are included in 40 CFR 761. Therefore, Block E soil sampling must be conducted in accordance with the applicable TSCA regulations including in situ pre-characterization sampling. PCB-contaminated material with concentrations less than 50 mg/kg are generally not regulated under TSCA and may be disposed in approved Subtitle D facilities per their discretion and permitted limits. Acceptance concentrations for PCB-contaminated waste vary with each facility and must be verified with each disposal facility used. Subsurface piping (and soil) associated with the former Building D in Block E may also contain radiological constituents that require special handling, transportation, and disposal. Due to these unique conditions specific to Block E, any excavation there must be coordinated through CEESH.

Chemical data required by the selected disposal or recycling facilities must be used to develop a waste profile. The selected receiving facility may also require that the waste profile includes an estimate of the type and quantity of non-soil materials suciaETSuctriiaE40.0(300.0o(on)-260.0(t)-2.9(ne

X

SECTION 3
SOIL MANAGEMENT REPORTING REQUIREMENTS

3.1 ENVIRONMENTAL COVENANTS

Neither Tax Block E nor Tax Block I have been closed in accordance with the requirements of Administrative Consent Order ACO-SAR-MDE0746-2015-1-01. At the time this plan was published, there are no established environmental covenants recorded on the property deed.

3.2 SOIL MANAGEMENT REPORTING REQUIREMENTS

Excavation activities in Blocks E and I require monthly reporting via electronic mail to the Maryland Department of the Environment Land Management Administration. This reporting will be completed by Lockheed Martin Corporate Energy, Environment, Safety, and Health (CEESH), as defined in the administrative consent order. This notification is not specifically required for environmental restoration conducted under Maryland Department of the Environment-approved planning documents in accordance with the order.

The information required to be submitted by LMC Properties, Inc., (LMCPI) or any site tenants to CEESH within three days following completion of the excavations in Blocks E and I, and includes the following:

1. Copy(ies) of facility-approved dig permit
2. Figure(s) depicting excavation area
3. Excavation date(s)
4. Brief summaries of the work completed

FIGURES

TABLES

Table 2-1 – Analytical Summary Table

APPENDICES

APPENDIX A
SITE CONTACT LIST

Lockheed Martin Project Lead	Tom Blackman
Office Telephone	301-548-2209
Cell Number	240-460-7508
Email	tom.d.blackman@lmco.com
LMCPI ESH/Projects	Mike Musheno
Office Telephone	484-875-2819
Cell Number	610-656-4012
Email	mike.musheno@lmco.com
LMCPI ESH/Projects	Scott Heinlein
Cell Number	240-888-6581
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LMCPI ESH/Projects	Glen Harriel (facility manager)
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Remediation Technical Operations Coordinator	CDM Smith: Cannon Silver
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Lockheed Martin Communications Lead	Meghan Macdonald
Office Number	301-897-6195
Email	meghan.o.macdonald@lmco.com
Lockheed Martin Head of Security	Chief Philip Johnston
Office Telephone	410-682-1050
EMCOR Facilities Supervisor	Tom Ambrose

Office Telephone	410-682-1308
Cell Number	856-842-2590
Email	tambrose@emcor.net
EMCOR Safety /Permits	Scott Lapp

IDW Tracking Form
Middle River Complex
Middle River, Maryland

Drum	Contents	Project	First generation date	Waste characterization sample collected (date)	Profile (non haz or haz)	Date removed from the site	75 day deadline for removal	90 day deadline for removal (only applies to haz waste)	Field inspection date	Field inspector	Action/Repairs from inspection

fact sheet.

Background Level means the level of a substance occurring naturally at the site prior to any manmade spill or release, as defined by § 7-501 of the Environment Article, Annotated Code of Maryland.

Category 1- Residential Unrestricted Use Soil and Fill Material means a soil or fill material that is impacted by a hazardous substance or oil at concentrations less than or equal to the current residential EPA soil

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Soil and Fill Material Management Guidelines

The following guidelines apply to management of soil and fill material received at eligible properties. These guidelines are also illustrated in Figure 1.

Soil or fill material may not be placed where it is subject to intrusion by groundwater or surface water. It must be placed at least three (3) feet above the maximum expected groundwater elevations at all locations of placement or other sufficient protective measures must be implemented to ensure soil and fill material do not adversely impact groundwater or surface water resources;

Soil and fill material placed in groundwater use areas may be subject to additional environmental measures and evaluations to ensure placement of soil or fill material will not adversely impact groundwater or surface water resources.

Soil or fill material shall conform with all appropriate sediment and erosion control regulations during placement and construction.

Impervious surfaces placed over soil or fill material shall be continuous in all areas that overlie the soil or fill material.

Land use controls may include, but are not limited to, engineering controls and institutional controls.

Residential Unrestricted Use Soil and Fill Material (Category 1)

Soil or fill material with concentrations of hazardous substances or oil less than or equal to the residential unrestricted use screening criteria may be innovatively reused at all sites without restriction. If potential contaminant concentrations in soil or fill material exceed the Category 1 screening criteria, then a more detailed soil or fill material residential risk assessment (considering factors such as magnitude and frequency of detections, land use, exposure parameters and factors, and toxicity values) may be performed that meets a HQ of 1 for non-carcinogens and a lifetime cancer risk of $1x10^{-5}$ for carcinogens. When the residential risk assessment is performed and meets a HQ of 1 for non-carcinogens and a lifetime cancer risk of $1x10^{-5}$ for carcinogens the soil or fill material may be innovatively reused at all sites without soil exposure restrictions and will be considered Category 1 soil and fill material. For soil or fill material that meets the Residential Unrestricted Use Soil and Fill Material definition, a person may send such soil or fill material to any offsite location. The owner or operator of the receiving site may be required to

program for additional details. The receiving site may also be required to encumber the property with land use controls to ensure that exp osure to the soil or fill material meeting the Non -Residential Restricted Use Soil and Fill Material definition is appropriately managed. The land use controls may include a recorded environmental covenant that complies with the Maryland Uniform Environme ntal Covenants Act (UECA). The environmental covenant shall include a map drawn to scale identifying where the soil or fill material has been placed and copies of the manifests, bill of lading, or other documentation demonstrating the transport and accept ance of soil or fill material. The Department may sign on to the environmental covenant as agency and holder of the environmental covenant.

Restricted Use Soil and Fill Material, Cap Required (Category 3)

If the soil or fill material concentrations of

APPENDIX D—MDE CLEANUP STANDARDS FOR SOIL AND GROUNDWATER

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3

State of Maryland

Department of the Environment

Cleanup Standards for Soil and Groundwater

1.0 INTRODUCTION

This document presents the approach and supporting documentation used to develop numeric Cleanup Standards for hazardous substances in the soil and groundwater media, and remedial action categories fo the State of Maryland. The Cleanup Standards are screening levels developed to represent concentratior levels at which no further remedial action or land use controls would be required at a property based upon the harm posed by these substances to human health within the constraints of current knowledge (i.e., applicable only to the soil media Residential Cleanup Standard and the groundwater media Cleanup Standard). The Cleanup Standards have been developed by incorporating applicable land uses and the current or projected use of the groundwater media for potable use. Tables 1 and 2 lists the hazardous substances included in the Cleanup Standards.

The Cleanup Standards for hazardous substances in soil and groundwater media are to be considered as guidance.

2.0 PURPOSE AND APPLICABILITY

The intent of this guidance is to:

a)

(11) "Free Product" means a hazardous substance which occurs as an immiscible (i.e., either Dense Non-Aqueous Phase Liquid (DNAPL) or a Non-Aqueous Phase Liquid (NAPL) liquid in surface water, groundwater, the vadose zone, or the ground surface.

(12) "Grab Sample" means a discrete sample that is representative of a specific location at a specific point in time.

(13) "Groundwater" means water below the land surface in the zone of saturation.

(14) "Groundwater Standard" means either the Maximum Contaminant Level (MCL) value for a chemical, the Secondary Drinking Water Regulation value for a chemical, or the highest value from the criteria identified in section 4.0 (B) 1 –2.

(15) “Groundwater use area” means a property located within ½ mile of a potable use well, or an area not served by a public water distribution system and reliant on groundwater for potable consumption, or an area where there is a potential for future groundwater use as a

intermediate and final products, including but not limited to: administration of business activities, research and development, warehousing, shipping, transport, remanufacturing, stockpiling of raw materials, storage, repair and maintenance of commercial machinery and equipment, and solid waste management.

associated with the propagation of vegetation or livestock under certain conditions. The Residential exposure scenario for the soil media is applicable from 15' Below Ground Surface (BGS) or to the zone of saturation.

(31) "Residential land use" typically means land that has a zoning designation by either the county or local government that exclusively requires that the land shall be used as a place in which a person resides.

(32) “Risk assessment” means a scientific process used to estimate the probability of adverse effects from chemicals present at a property.

(33) "Regional Screening Levels” (RSLs) means the EPA Regional Screening Levels dated May, 2018. The concentration levels for individual chemicals that correspond to a specific cancer risk level of 1E-6 or an HQ of 0.1. The HQ values have been adjusted from 1.0 to 0.1 to account for potential additivity.

(34) "Secondary Drinking Water Regulation" means a non-mandatory water quality st .0(, 2A24(s2(a)4

more protective than the remedial action standard established by the Department. This safety factor allows for potential additive risk factors from multiple hazardous substances at a property.

C. When a change to an EPA RSL occurs for a specific Cleanup Standard or when updates occur to

At a minimum, 10 grab samples are recommended to be taken from a property in order to demonstrate attainment of an applicable soil Cleanup Standard. The spatial distribution, sample depth and number of samples required to demonstrate attainment of an applicable Cleanup Standard is dependent on property specific conditions. In general, the 10 minimum soil sampling requirement is restricted to chemicals known or suspected to be used, stored or manufactured at the property, either currently or in the past. However, sampling work plans should adequately address the variables identified in section 7.0 (i.e., size of the property, historical use, chemical use, extent of previous environmental assessments) to satisfactorily address this requirement.

For properties that are two acres in size or larger, sampling approaches that should be considered include

a) Grid Sampling
b) Biased Sampling, or
c) Phased Sampling.

b) Where a risk assessment demonstrates no risk is posed by the current or intended property use. In this case, a restriction may need to be placed on the deed of a property with a current non-residential use or other approved use that is protective of public health and the environment that prohibits the use of the property under a residential exposure scenario; and

c) Where the Department determines that it is technically impracticable to reach the standard and a risk assessment demonstrates that a risk is posed by the current or intended use. In this case, an appropriate containment or isolation remedy is required to prevent exposure potential receptors. In addition, a restriction and LUCs may need to be placed on the deed of a property with a current non-residential use or other approved use that is protective of public health and the environment that prohibits the use of the property under a residential exposure scenario and maintains the LUCs.

8.0 USE OF FIELD SCREENING TECHNOLOGY FOR ENVIRONMENTAL MEDIA

Field Screening Technology (i.e., Mobile Gas Chromatograph/Mass Spectrometer Laboratory, Immunoassay Technology and X-Ray Fluorescence equipment) for the soil media may be used in combination with a Fixed Laboratory sampling and chemical analysis program to reduce the total number of samples sent to a Fixed Laboratory for analysis in order to demonstrate attainment of a cleanup standard or to completely characterize the presence of hazardous substances at a property. Field Screening Technology may also be used to reduce/eliminate possible hazardous substances of concern from further evaluation at a property following an acceptable demonstration of positive correlation for accuracy and precision of analytical results between a Fixed Laboratory and Field Screening Technology results.

Generally, a 30% Fixed Laboratory confirmation is required for 20 or more samples tested using Field Screening Technologies. A 50% Fixed Laboratory confirmation is required for 10-19 samples tested using Field Screening Technologies. A 100% Fixed Laboratory confirmation is required for 1-9 samples tested using Field Screening Technologies.

A positive correlation between the Immunoassay Technology result and the fixed laboratory result is demo

c) Controlled Hazardous Substances in drums, tanks, bulk storage containers, or any other container that pose an imminent threat of release as function of the poor integrity of the storage vessel, or

d) Free Product, or

e) Actual or potential exposure to nearby human populations, animals or the food chain from controlled hazardous substances that exceed the criteria identified in 9.a. Examples of direct exposure scenarios include but are not limited to dust generation/migration to residential areas, playgrounds, sensitive populations nearby, or

f) Threat of fire or explosion

All identified Hot Spots have to be addressed in accordance with a Department approved Remedial Action Plan. The Department's expectation is that treatment shall be used to remediate Hot Spot contamination, wherever practicable. Engineering controls, such as containment, may be used when the applicant has demonstrated to the satisfaction of the Department that treatment or removal is technically impracticable. Land Use Control remedial actions may be used in conjunction with treatment or containment of Hot Spots, but may not solely be used as an acceptable method to remedy Hot Spot contamination.

10.0 GROUNDWATER ASSESSMENT/REMEDIAL ACTION REQUIREMENTS

A.

2) a groundwater cleanup standard will occur and the surface water is either used for drinking water, or may be used for drinking water in the future.

C. Groundwater Cleanup Standards are generally applicable to groundwater from Type I and II aquifers. Exceptions to this are:

1) It is technically impractical to complete a remedial action to a groundwater cleanup standard. The standard for determining Technical Impracticability shall adhere to the EPA Guidance Documents: 1) OSWER Directive 9234.2-25 (September 1993) "Interim Final Guidance for Evaluating the Technical Impracticability of Groundwater Restoration" and OSWER Directive 9200.4-14 (January 1995) "Consistent Implementation of the FY 1993 Guidance on Technical Impracticability of Groundwater Restoration at Superfund Sites.", and "Clarification of the Consultation Process for Evaluating the Technical Impracticability of Groundwater Restoration at CERCLA Sites", December 28, 2016, OLEM Directive 9200.3-117.

2) Where the person can demonstrate that there is no current use or projected future use of groundwater within one half miace--10(r)pmbe-3(va)-4(l)(i)-,T224

The Department has developed presumptive remedial actions for hazardous substances in the soils under restricted use residential scenarios, mixed-use commercial/residential scenarios, recreational scenarios and commercial and industrial scenarios. Presumptive remedial actions are intended to provide the applicant with readily understood requirements in order to facilitate an expedited remedial action of the property

1) Utilize a treatment technology or perform a removal action for contaminant of concentrations that exceed an EPA RSL target cancer risk threshold value of 1e-4 for cancer and/or the Hazard Quotient threshold = 100 or,

2) Remove hazardous substances that exceed the standards identified in 11.1 and place under a Department-approved cap. Department approval of this remedial action is contingent on the applicant demonstrating that the placement of soil hazardous substances under the cap will not result in an unacceptable risk to a human receptor from the inhalation of contaminant vapors, and

b) Options a) 1 and 2 must also consider the Groundwater use area scenario and adhere to the Hot Spots/Remedial Action Criteria.

c) Open Space areas of the properties (i.e. not park land, but including land between buildings, etc.) with identified hazardous substance above the residential cleanup standard for soil are required to have a minimum placement of a clean fill soil cap cover that is a minimum of 30 inches thick over a Department-approved Geotextile Marker Fabric Material or an equivalent engineering control that is protective of public health and the environment. This provision is applicable under an engineering control – containment remedy.

d) Areas identified for paving that have identified hazardous substances above the residential cleanup standard for soil are required to have a minimum placement of a clean fill soil cap cover that is a minimum of 30 inches thick or a combination of clean fill/road base and asphalt/cement over a Department approved Geotextile Marker Fabric Material or an equivalent engineering control that is protective of public health and the environment. This provision is applicable under an engineering control – containment remedy.

e) With respect to the criteria identified in 11.4.a.1, the applicant will be required to have a LUC restriction placed on the Deed that restricts excavation activities below the ground surface. With respect to the criteria identified in 11.4.a.2, the restriction would be at the ground surface. This provision is applicable under an engintective of Mic184(n e)4r an e4(pp

TABLE 1 - GENERIC NUMERIC CLEANUP STANDARDS FOR GROUNDWATER AND SOIL

Chemical (RSL Name)		CAS Number	Groundwater Standards Type I and II Aquifers (ug/L)	Soil Standards Residential Clean-up Standard (mg/Kg)	Soil Standards Non-Residential Clean-up Standard (mg/Kg)	Protection of Groundwater (a) (mg/Kg)
Inorganic Compounds						
Aluminum		7429-90-5	2000	7700	110000	60000
Antimony (metallic)		7440-36-0	6.0	3.1	47000	0.07
Arsenic, Inorganic		7440-38-2	10	0.68	3	0.03
Barium		7440-39-3	2000	15000	22000	320
Beryllium and compounds		7440-41-7	4.0	16	230	38
Cadmium (Water& diet)		7440-43-9	5.0	7.11	98	1.4
Chromium(III), Insoluble Salts		16065-83-1	2200	12000	180000	80000000
Chromium(VI)	(e)	18540-29-9	0.035	0.3	6.3	0.013
Chromium, Total		7440-47-3	100			
Copper		7440-50-8	1300	310	4700	56
Cyanide (CN-)		57-12-5	200	2	15	0.030
		Copp5(Rn) Tj 417 -0.4 Td (700) Tj 90 0 Td (5 0 Td (0.6C6Td (310) Tje S22000) Tj 102.4PTd (0.035) Tj 94 0 T5.				
[illegible]		[illegible] 0 T9 (16) Tj 0.356 -19.6 ThaBeryll(o Insoluble S(3.1)Barium3101.46.01656				

Chemical (RSL Name)	CAS Number	Groundwater Standards Type I and II Aquifers (ug/L)	Soil Standards Residential Clean-up Standard (mg/Kg)	Soil Standards Non-Residential Clean-up Standard (mg/Kg)	Protection of Groundwater (a) (mg/Kg)
Polychlorinated Biphenyl					
Alachlor	15972-60-8	2.0	9.7	41	0.017
Aldrin	309-00-2	0.00092	0.039	0.18	0.003
Aroclor 1016	12674-11-2	0.14	0.41	5.1	0.26
Aroclor 1221	11104-28-2	0.0047	0.20	0.83	0.0016
Aroclor 1232	11141-16-5	0.0047	0.17	0.72	0.0016
Aroclor 1242	53469-21-9	0.0078	0.23	0.95	0.024
Aroclor 1248	12672-29-6	0.0078	0.23	0.95	0.024
Aroclor 1254	11097-69-1	0.0078	0.12	0.97	0.04
Aroclor 1260	11096-82-5	0.0078	0.24	0.99	0.11
Atrazine	1912-24-9	3.0	2.4	10	0.004
Chlordane	12789-03-6	2.0	1.7	7.7	0.054
Dalapon	75-99-0	200	190	2500	0.24
DDD	72-54-8	0.0063	0.19	2.5	0.03
DDE, p,p'-	72-55-9	0.046	2.0	9.3	0.22
DDT	50-29-3	0.23	1.9	8.5	1.5
Dichlorophenoxy Acetic Acid, 2,4-	94-75-7	70	70	960	0.09
Dieldrin	60-57-1	0.0018	0.034	0.14	0.0014
Dinoseb	88-85-7	7.0	6.3	82	0.26
Endosulfan	115-29-7	10	47	700	2.8
Endrin	72-20-8	2.0	1.9	25	0.184
Glyphosate	1071-83-6	700	630	8200	18
Heptachlor	76-44-8	0.40	0.13	0.63	0.0024
Heptachlor Epoxide	1024-57-3	0.20	0.07	0.33	0.00056
Hexachlorocyclohexane, Alpha-	319-84-6	0.0072	0.086	0.36	0.00084
Hexachlorocyclohexane, Beta-	319-85-7	0.025	0.30	1.3	0.003
Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	.20	.57	2.5	0.0048
Methoxychlor	72-43-5	40	32	410	4
Oxamyl	23135-22-0	200	160	2100	0.22
Polychlorinated Biphenyls (low risk) (PCB Total)	1336-36-3	0.50	0.23	0.94	0.024
Simazine	122-34-9	4.0	4.5	19	0.006
Toxaphene	8001-35-2	3.0	0.49	2.1	0.22

Chemical (RSL Name)	CAS Number	Groundwater Standards Type I and II Aquifers (ug/L)	Soil Standards Residential Clean-up Standard (mg/Kg)	Soil Standards Non-Residential Clean-up Standard (mg/Kg)	Protection of Groundwater (a) (mg/Kg)
Polychlorinated Biphenyl					
Trichlorophenoxypropionic acid, -2,4,5(2,4,5-TP)(Silvex)	93-72-1	50	51	660	0.12

Chemical (RSL Name)		CAS Number	Groundwater Standards Type I and II Aquifers (ug/L)	Soil Standards Residential Clean-up Standard (mg/Kg)	Soil Standards Non-Residential Clean-up Standard (mg/Kg)	Protection of Groundwater (a) (mg/Kg)
Semivolatile Organic Compounds						
Acenaphthene		83-32-9	53	360	4500	11
Anthracene		120-12-7	180	1800	23000	116
Benz[a]anthracene	(e)	56-55-3	0.03	1.1	21	0.22
Benzo[a]pyrene	(e)	50-32-8	0.2	0.11	2.1	0.58
Benzo[b]fluoranthene	(e)	205-99-2	0.25	1.1	21	6
Benzo[k]fluoranthene	(e)	207-08-9	2.5	11	210	58
Bis(2-chloroethyl)ether		111-44-4	0.014	0.23	1	0.28
Bis(2-ethylhexyl)phthalate		117-81-7	6	39	160	26
Chloroaniline, p-		106-47-8	0.37	2.7	11	0.0032
Chloronaphthalene, Beta-		91-58-7	75	480	6000	7.8
Chlorophenol, 2-		95-57-8	9.1	39	580	0.18
Chrysene	(e)	218-01-9	25	110	2100	230
Cresol, o-		95-48-7	93	320	4100	1.5
Cresol, p-		106-44-5	190	63	8200	3
Di(2-ethylhexyl)adipate		103-23-1	65	450	1900	94
Dibenz[a,h]anthracene	(e)	53-70-3	0.025	0.11	2.1	1.9
Dibenzofuran		132-64-9	0.79	7.3	100	0.30
Dibutyl Phthalate		84-74-2	90			4.6
Dichlorobenzene, 1,2-		95-50-1	600	180	930	0.6
Dichlorobenzene, 1,4-		106-46-7	75	2.6	11	0.0092
Dichlorobenzidine, 3,3'-		91-94-1	0.13	1.2	5.1	0.016
Dichlorophenol, 2,4-		120-83-2	4.6	19	250	0.046
Diethyl Phthalate		84-66-2	1500	5100	66000	10.2
Dimethylphenol, 2,4-		105-67-9	36	130	1600	0.84
Dinitrophenol, 2,4-		51-28-5	3.9	13	160	0.088
Dinitrotoluene, 2,4-		121-14-2	0.24	1.7	7.4	0.0064
Dinitrotoluene, 2,6-		606-20-2	0.049	0.36	1.5	0.0013
Fluoranthene		206-44-0	80	240	3000	178
Fluorene		86-73-7	29	240	3000	10.8
Hexachlorobenzene		118-74-1	1	0.21	0.96	0.0024
Hexachlorobutadiene		87-68-3	0.14	1.2	5.3	0.054

Chemical (RSL Name)	CAS Number	Groundwater Standards Type I and II Aquifers (ug/L)	Soil Standards Residential Clean-up Standard (mg/Kg)	Soil Standards Non-Residential Clean-up Standard (mg/Kg)	Protection of Groundwater (a) (mg/Kg)
Volatile Organic Compounds					
Acetone	67-64-1	1400	6100	61000	5.8
Benzene	71-43-2			5.1	0.0046

Chemical (RSL Name)		CAS Number	Groundwater Standards Type I and II Aquifers (ug/L)	Soil Standards Residential Clean-up Standard (mg/Kg)	Soil Standards Non-Residential Clean-up Standard (mg/Kg)	Protection of Groundwater (a) (mg/Kg)
Volatile Organic Compounds						
Trichloroethane, 1,1,2-		79-00-5	5.0	0.15	0.63	0.00026
Trichloroethylene	(e)	79-01-6	5.0	0.41	1.9	0.0020
Trimethylbenzene, 1,2,4-		95-63-6	5.6	30	180	0.16
Trimethylbenzene, 1,3,5-		108-67-8	6.0	27	150	0.17
Vinyl Chloride (adult)	(e)	75-01-4	2.0	0.059	1.7	0.00013
Xylenes		1330-20-7	1000	58	250	0.38

Note: When updated toxicity information on a contaminant is identified in the RSL table the updated toxicity information must be utilized to assess the contaminant.

a. Standard based on EPA RSLs May 2018 SSLs for protection of groundwater migration using a dilution attenuation factor (DAF) of 20. (10/31/2007)

b. THM (trihalomethanes) Contaminants within this group are disinfection byproducts sometimes added to drinking water.

c. MTBE action level in Maryland is 20 ug/L.

Figure 1. Flowchart for the Application of MDE Soil Cleanup Standards

Figure 2. Flowchart for the Application of MDE Groundwater Cleanup Standards

Appendix 2

REFERENCE LEVELS OF METALS AND TRACE ELEMENTS IN SOILS OF MARYLAND

As Indicated by Background Soil Samples
Collected As Part of National Priorities List, Federal Facility,
And CERCLA Investigations Conducted
Throughout Maryland

INTRODUCTION

The 1980 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) established a national process for investigating and remediating sites contaminated with hazardous substances. Since that time the environmental industry and government sectors have labored to establish cleanup standards that are practical and protective of human health and the environment.

One remediation approach commonly considered is clean up to “background.” Many regulatory agencies define “background” as the concentration of a hazardous substance, if any, existing in the environment at the site prior to the release of a hazardous substance. The establishment of “background” as a cleanup standard results in the necessity of determining the concentration of a chemical prior to any releases. This approach is particularly significant when cleanup standards are being developed for naturally occurring metals and trace elements that are present in the soil.

The soil media is of particular concern during site investigations since it is commonly the first media that is impacted by a release of hazardous material. Soils also serve as the pathway to other environmental media, such as air (via dust), or groundwater (via seepage), or surface water (via runoff). As a result, establishing the “background” concentration for metals and trace elements in soils is one of the most critical components of a site investigation.

OBJECTIVE

The Annotated Code of Maryland § 7

STATISTICAL ANALYSIS

Statistical analyses were conducted on data for each analyte included in the investigation. The statistical analyses included the mean, standard deviation, and maximum and minimum values. Since each particular site investigation has specific sampling objectives, not all samples were analyzed for all metals included in this study. Analytes that were not analyzed were not included in the statistical analysis. If an

STUDY LIMITATIONS

This investigation does not constitute a rigorous scientific analysis conducted in a controlled experimental setting. However, ATC reference levels can serve as general indicators of background levels of metals and trace elements in soil until a more rigorous and thorough background investigation can be completed.

REFERENCES

1) Shacklett, H.T. and Boerngenm, J.G., 1984: Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States; USGS Professional Paper 1270.

APPENDIX 2 - ATTACHMENT 1

BACKGROUND SOIL METAL DATA FROM

MDE SITE INVESTIGATIONS USED IN THIS STUDY

EASTERN

Site Name	Province	Designation	Aluminum	Antimony	Arsenic	Barium
Aberdeen Proving Ground	EMBG	S-1	3.7E+03	3.5E+00	2.8E+00	1.8E+01
Aberdeen Proving Ground	EMBG	S-1 DUP	3.3E+03	3.5E+00	2.4E+00	2.1E+01

EASTERN

Site Name	Province	Designation	Copper	Iron	Lead	Magnesium	Manganese
Aberdeen Proving Ground	EMBG	S-1	8.4E+00	5.1E+03	5.0E+01	2.0E+02	5.9E+01
Aberdeen Proving Ground	EMBG	S-1 DUP	8.6E+00	4.7E+03	5.0E+01	2.1E+02	5.0E+01
Aberdeen Proving Ground	EMBG	S-2	5.1E+00	5.4E+03	1.0E+01	3.6E+02	1.9E+02
Aberdeen Proving Ground	EMBG	S-3	2.8E+01	1.8E+04	1.2E+02	2.1E+03	3.0E+02
Aberdeen Proving Ground	EMBG	S-4	1.3E+01	8.9E+03	3.0E+01	1.5E+03	1.8E+02
Aberdeen Proving Ground	EMBG	S-5	4.8E+00	2.6E+03	1.4E+01	9.5E+01	6.9E+00
Aberdeen Proving Ground	EMBG	S-6	3.3E+00	3.6E+03	8.0E+00	2.0E+02	1.2E+01
Aberdeen Proving Ground	EMBG	S-6 DUP	3.4E+00	3.6E+03	9.8E+00	2.2E+02	9.2E+00
Aberdeen Proving Ground	EMBG	S-7	5.9E+00	1.0E+04	1.1E+01	1.1E+03	4.0E+02
Aberdeen Proving Ground	EMBG	S-8	1.4E+01	1.2E+04	3.0E+01	7.1E+02	2.6E+02
Aberdeen Proving Ground	EMBG	S-9	7.7E+00	1.5E+04	1.3E+01	1.2E+03	1.1E+02
Aberdeen Proving Ground							

Indian Head	EMBG	BGDSS0060101	2.1E+00	7.3E+03	6.7E+00	3.5E+02	1.1E+02
Indian Head	EMBG	BGDSS0070101	5.3E+00	1.0E+04	9.8E+00	6.7E+02	4.7E+01
Indian Head	EMBG	BGDSS0080101	1.7E+01	1.3E+04	1.5E+02	1.1E+03	8.1E+01
Indian Head	EMBG	BGDSS0090101	3.1E+00	4.4E+03	5.5E+00	4.5E+02	2.3E+01
Indian Head	EMBG	BGDSS0100101	3.3E+00	6.5E+03	7.8E+00	4.0E+02	2.0E+02
Indian Head	EMBG	S25-MW03-001	2.5E+00	7.9E+03	1.0E+01	2.4E+02	1.2E+02
Indian Head	EMBG	S26-MW03-001	4.4E+00	2.5E+04	9.9E+00	1.1E+03	8.8E+02
Fort Meade	EMBG	SSB-1	8.[illegible]E+00	1.2E+04	1.4E+01	1.2E+03	1.2E+02
Fort Meade	EMBG	SSB-2	4.6E+00	7.7E+03	1.6E+01	8.4E+02	1.5E+02

EASTERN

Site Name	Province	Designation	Mercury	Nickel	Potassium	Selenium	Silver
Aberdeen Proving Ground	EMBG	S-1	NA	4.3E+00	1.6E+02	4.6E-01	3.5E-01
Aberdeen Proving Ground	EMBG	S-1 DUP	NA	4.8E+00	1.8E+02	4.8E-01	3.5E-01
Aberdeen Proving Ground	EMBG	S-2	6.2E-02	6.1E+00	1.8E+02	1.6E-01	3.0E-01
Aberdeen Proving Ground	EMBG	S-3	3.5E-02	1.7E+01	3.2E+02	4.4E-01	3.5E-01
Aberdeen Proving Ground	EMBG	S-4	NA	2.0E+01	5.4E+02	3.0E+00	4.9E-01
Aberdeen Proving Ground	EMBG	S-5	5.0E-02	2.6E+00	7.1E+01	1.3E-01	2.7E-01
Aberdeen Proving Ground	EMBG	S-6	5.5E-02	1.4E+00	1.0E+02	1.4E-01	[redacted]
Aberdeen Proving Ground	EMBG	S-6 DUP	4.6E-02	2.6E+00	1.6E+02	1.4E-01	2.8E-01
Aberdeen Proving Ground	EMBG	S-7	5.8E-02	8.0E+00	3.5E+02	1.5E-01	

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

EASTERN

Site Name	Province	Designation	Sodium	Thallium	Vanadium	Zinc
Aberdeen Pr						

CENTRAL

Site Name	Province	Designation	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium

CENTRAL

Site Name	Province	Designation	Silver	Sodium	Thallium	Vanadium	Zinc
Ordnance Products (7/99)	CMBG	BG-01 (0 - 0.5 feet)	3.6E-01	1.7E+02	1.3E+00	2.6E+01	1.8E+01
Ordnance Products (7/99)	CMBG	BG-02 (0 - 0.5 feet)	5.6E-01	2.5E+02	1.7E+00	2.6E+01	2.5E+01
Ordnance Products (7/99)	CMBG	BG-03 (0 - 0.5 feet)	6.9E-01	2.3E+02	2.9E+00	3.2E+01	3.1E+01
Ordnance Products (7/99)	CMBG	BG-04 (0 - 0.5 feet)	1.0E+00	2.3E+02	1.0E+00	2.0E+01	2.3E+01
Bush Valley Landfill	CMBG	SUS1 (8/92, 0-6")	7.5E-01	7.9E+01	2.5E-01	2.6E+01	3.9E+01
Bush Valley Landfill	CMBG	SUS2 (8/92, 0-6")	8.0E-01	7.0E+01	2.7E-01	3.3E+01	5.1E+01
Bush Valley Landfill	CMBG	SUS3 (8/92, 0-6")	8.0E-01	1.0E+02	2.6E-01	3.4E+01	5.9E+01
Mullinex Farms	CMBG	Background Soil	5.0E-01	1.1E+02	NA	3.3E+01	7.2E+01
MullinexF[redacted]	CMBG	Background Soil	5.0E-01	8.0E+01	NA	[redacted]	[redacted]

WESTERN

Site Name	Province	Designation	Aluminum	Antimony	Arsenic	Barium

WESTERN

Site Name	Province	Designation	Calcium	Chromium (Total)	Cobalt	Copper	Iron	Lead

WESTERN

Site Name	[redacted]	Designation	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium

WESTERN

Fort Ritchie	WMBG	BKSS25	1.3E+04	8.0E+02	7.0E-02	4.8E+01	1.5E+02	1.7E+00	

WESTERN

Site Name	Province	Designation	Silver	Sodium	Thallium	Vanadium	Zinc
Ft. Detrick	WMBG	BORMWA1-A	NA	NA	NA	1.9E+02	7.9E+01

WESTERN

Fort Ritchie	WMBG	BKSS25	1.8E+01	8.1E+01	1.5E-01	8.5E+01	8.7E+01
Fort Ritchie	WMBG	BKSS26	1.8E+01	8.0E+01	1.3E-01	1.1E+02	9.9E+01
Fort Ritchie	WMBG	BKSS27	2.1E+01	9.5E+01	7.5E-02	9.7E+01	1.0E+02
Fort Ritchie	WMBG	BKSS28	1.9E+01	1.0E+02	1.4E-01	1.1E+02	7.2E+01
Fort Ritchie	WMBG	BKSS29	1.9E+01	1.2E+02	1.4E-01	9.6E+01	7.2E+01
Fort Ritchie	WMBG	BKSS30	2.1E-01	1.3E+02	6.5E-02		

APPENDIX 2 - ATTACHMENT 2

ANTICIPATED TYPICAL CONCENTRATIONS (ATC)/REFERENCE LEVELS OF METALS IN THE STATE OF MARYLAND

Region		Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium (Total)	Cobalt	Copper	Iron	Lead
CMBG	Number Samples	28	22	28	28	27	28	28	28	27	28	28	28
CMBG	Mean	1.2E+04	3.4E+00	3.3E+00	6.5E+01	6.4E-01	5.9E-01	3.3E+03	2.0E+01	1.5E+01	2.1E+01	1.8E+04	2.9E+01
CMBG	Std(n-1)	6.6E+03	3.5E+00	1.6E+00	3.4E+01	9.8E-01	5.0E-01	8.6E+03	1.0E+01	1.9E+01	2.2E+01	8.2E+03	3.1E+01
CMBG	Min	1.2E+03	5.0E-01	7.5E-01	2.0E+01	1.0E-02	3.0E-02	8.3E+01	6.0E+00	7.9E-01	3.4E+00	2.6E+03	3.4E+00
CMBG	Max	3.7E+04	1.1E+01	6.7E+00	2.0E+02	5.1E+00	1.8E+00	3.7E+04	5.6E+01	7.7E+01	1.2E+02	3.7E+04	1.8E+02
CMBG	ATC(n-1)	1.9E+04	6.8E+00	4.9E+00	9.9E+01	1.6E+00	1.1E+00	1.2E+04	3.0E+01	3.3E+01	4.2E+01	2.6E+04	6.1E+01
	USGS Concentrations (average)	7.2E+04	6.6E-01	7.2E+00	5.8E+02	9.2E-01	NA	2.4E+04	5.4E+01	9.1E+00	2.5E+01	2.6E+04	1.9E+01

Region		Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
CMBG	Number Samples	28	27	26	28	28	26	27	28	25	28	28
CMBG	Mean	1.8E+03										

APPENDIX 3

GUIDANCE ON THE CONTENT OF ENVIRONMENTAL INVESTIGATION WORK PLANS AND QUALITY ASSURANCE PROJECT PLANS INCLUDING DATA VERIFICATION AND VALIDATION

(D) Requirements for fieldwork record keeping should include a specific description of the content and style of geologic logs of all borings and well constructions, well construction diagrams, and sample data sheets. (See Attachment A for examples.)

(E) A statement that describes the methods for handling investigation derived media (IDM) that conforms to the Land and Materials

(2) Sampling method requirements describing the equipment and procedures for collection, identification, and preservation of samples (see Attachment C for examples). Methods including QC protocols should be identified by the appropriate regulatory citation and the specific performance requirements should be described).

With respect to laboratory QC samples, the following general protocols shall be required unless it can be demonstrated on a site-specific basis that one or more protocols are not necessary. Such a modification must be approved by MDE prior to initiation of the work.

(a) Method reagent blanks, which are samples of laboratory reagent water processed through the same analytical procedure as the sample, must be prepared and analyzed for each individual procedure every day that a sample is prepared. The method blank must contain less than or equal to three times the method detection limit (MDL) for compounds of interest. If this criterion is not met, then samplrennaion

(b) Electronic data files should be maintained for all current and past activities related to the project on a diskette. All files should be organized within directories and sub-directories that consist of a combination of appropriate project and/or client names.

(c) Project files will be established and maintained by the laboratory project manager (or the PRP) for each project. The project file will contain all correspondence associated with the project. All materials must be dated. Project files should include references to the location of raw analytical data for easy retrieval if necessary.

(d) Notebooks to be maintained include standards preparation log, instrument calibration log, instrument run log, sample preparation log, weighing log, and instrument maintenance log. Copies of all or some of these are to be included in the final data package.

(i) Standards Preparation Log shall be maintained and include the following information, as a minimum, for each sample prepared:

Unique sample ID #
Sample description
ID # of source or starting material
Weight/Volume of starting material
Volume and ID # of dilution solvent used
Final concentration
Date of preparation
Expiration date
Storage conditions and location
Signature of analyst preparing the solution
Initials and date of second level reviewer

(ii) Instrument Calibration Log shall be maintained for each instrument and should include the date, time, and results of each calibration and should be cross referenced with the standards preparation log, which documents the date and batch number (unique sample identification) of the standard preparation for the standards used for each calibration. This can be incorporated into the instrument run log where appropriate.

(iii) Instrument Run Log must be maintained for each instrument used to analyze samples for any parameter. The analyst performing the task must complete the run log concurrently with the specific analysis. At a minimum, the following information must be contained in the instrument run log:

Sample number/ID
Preparation date (cross reference with sample preparation log)
Analysis date
Injected volume of analyte (µl or ml)
Total run time
File name

(C) Data Validation and Usability

The criteria used to review and validate data should be provided. These criteria will be submitted to MDE for review and shall address the following topics:

(1) Data review, validation, and verification requirements that clearly state the criteria used to review and validate (i.e. accept, reject, or quantify) data (see USEPA Contract Laboratory Program National Functional Guidelines for