

N00639.AR.002415
NSA MID SOUTH
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TECHNICAL MEMORANDUM SUPPLEMENTARY SCREENING LEVEL ECOLOGICAL RISK
ASSESSMENT SOLID WASTE MANAGEMENT UNIT 65 BUILDING S-362 TRAINING MOCK
UP SITE MILLINGTON SUPPACT TN

12/13/2005
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TECHNICAL MEMORANDUM

To: Bill Hill, NAVFAC EFD SOUTH
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Roger Donovan, TDEC
Rob Williamson, NSA Mid-South
Jim Heide, NSA Mid-South
Jack Carmichael, USGS

From: Brian Mulhearn, EnSafe Inc.

Date: December 13, 2005

Re: Supplementary Screening Level Ecological Risk Assessment
SWMU 65 — Building S-362 Training Mock-Up Site
NSA Mid-South

INTRODUCTION

This report provides a supplementary screening level ecological risk assessment (SLERA) for the Statement of Basis for SWMU 65 — Building S-362 Training Mock-Up Site. A Human Health Risk Assessment (HHRA) was completed as part of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) to evaluate human health risk. Since a quantitative ecological risk assessment was not completed as part of the RFI, a SLERA has been completed to evaluate ecological risks to the grassy areas of SWMU 65. Information in this memorandum is provided as part of the administrative record to help clarify the decision-making process for SWMU 65.

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

Data Sources

The source of data for the SWMU 65 SLERA can be found in the following documents:

- *RCRA Facility Investigation Report; Assembly E – SWMUs 2, 9, 14, 38, 59, and 65. NSA Mid-South – Millington, Tennessee. Revision 2. October 6, 2000. EnSafe Inc., Memphis, Tennessee.*
- *Voluntary Corrective Action Report, RCRA Facility Investigation, Naval Support Activity Mid-South, Petroleum-Contaminated Soil Removal Buildings S-362/SWMU 65, S-235, S3-94, N-114/SWMU 24, N-1211, N-105, N-108, S-203, SWMU 41, SWMU 43, SWMU 47, SWMU 48, and SWMU 49; Revision 1. June 29, 2001. EnSafe Inc., Memphis, Tennessee.*

Groundwater samples were collected during the RFI; however, a connection between surface water and groundwater was not identified. Therefore, only soil detections are applicable to the SLERA. Field duplicate samples were excluded from the SLERA to be consistent with the HHRA completed as part of the RFI.

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

The maximum detected concentration for any chemical found at SWMU 65 during the RFI and Voluntary Corrective Action (VCA) was compared to the U.S. Environmental Protection Agency (USEPA) Region 4's 2001 ecological screening values (ESVs) to derive screening hazard quotients for each chemical. Chemicals with hazard quotients greater than 1 were carried forward as chemicals of potential concern (COPC), unless the reported concentration was below the NSA Mid-South reference background concentration for that chemical. Tables 1 and 2 list the hazard quotients for each chemical and indicate concentrations exceeding corresponding reference concentrations.

USEPA Region 5 ESVs were used for chemicals not found in USEPA Region 4's ecological screening table. Soil samples were separated by depth to assess ecological risk. Soil from 0-2 feet was compared to surface soil ESVs, while soil greater than the 2 feet interval was assessed against subsurface ESVs. Tables 1 and 2 show maximum detected concentrations, screening comparisons, and hazard quotients calculated based on the screening values for the surface and subsurface intervals.

After this initial COPC screening, the SLERA process was used to refine the COPC list. Contaminants with hazard quotients greater than 1 and that exceeded the background reference concentration were compared to the food chain models derived from the *Toxicological Benchmarks for Wildlife* from Oak Ridge National Laboratory (Sample et al., 1996). Tables 3 and 4 provide the detected concentrations and food chain screening values used for the SLERA for the surface and subsurface intervals, respectively.

No food-chain hazards quotients are available for polycyclic aromatic hydrocarbons (PAHs). A screening value of 1 milligram per kilogram was used as a background threshold for total carcinogenic PAHs based on Tennessee Department of Environmental Conservation (TDEC) policies. Carcinogenic PAH concentrations do not approach TDEC's threshold. PAHs are often naturally occurring, and most PAHs initially identified as COPCs are not carcinogenic. Consequently, any risks posed by PAHs would be expected to be consistent with other, similar areas in Tennessee, so PAHs were not identified as chemicals of concern.

Based on the food-chain model hazard quotients in Tables 3 and 4, there are no unacceptable ecological risks associated with SWMU 65. It should be noted that ecological features at SWMU 65 are minimal. The site is a long, paved area with several buildings surrounded by a grassy field and several small stands of trees. The grassy field south of the concrete has a dimension of approximately 900 feet by 50 feet and would likely represent the only area with potential for exposure to most upper-level predatory species.

REFERENCES

- EnSafe/Allen & Hoshall. (1996, August 27). *Reference Concentration Technical Memorandum, Naval Support Activity Memphis*. Memphis, Tennessee.
- (1997, June 3). *Surface Soil (0 to 1 foot) Background Dieldrin Concentrations at NSA Memphis*. Memphis, Tennessee.
- (1996, December 11). *Addendum to the September 18, 1996 Assemblies A through D Background Reference Concentrations Technical Memorandum*. Memphis, Tennessee.
- EnSafe Inc. (2000, October 6). *RCRA Facility Investigation Report; Assembly E – SWMUs 2, 9, 14, 38, 59, and 65. NSA Mid-South— Millington, Tennessee*. Revision 2. Memphis, Tennessee.
- EnSafe Inc. (2001, June 29). *Voluntary Corrective Action Report, RCRA Facility Investigation, Naval Support Activity Mid-South, Petroleum-Contaminated Soil Removal Buildings S-362/ SWMU 65, S-235, S3-94, N-114/SWMU 24, N-1211, N-105, N-108, S-203, SWMU 41, SWMU 43, SWMU 47, SWMU 48, and SWMU 49*. Revision 1. Memphis, Tennessee.
- Sample, B.E., Opresko D.M., Sutter G.W. II. (1996, June). *Toxicological Benchmarks for Wildlife: 1996 Revision*. Department of Energy. Oak Ridge National Laboratory. Oak Ridge, Tennessee.
- U.S. Environmental Protection Agency. (2001). *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*. Retrieved at <http://www.epa.gov/region4/waste/ots/ecolbul.htm>
- U.S. Environmental Protection Agency. (2003). *RCRA Ecological Screening Levels*. USEPA Region 5. Retrieved at <http://www.epa.gov/reg5rcra/ca/edql.htm>

Tables

Table 1
SWMU 65 NSA Mid-South
Ecological Chemicals of Potential Concern (COPCs) — Surface Soil

Parameter	Maximum	ESV ^a	Source	Screening	Reference	Reference	Max Conc. >	Ref. Conc.
	Detection				Conc.	Conc.		
	(mg/kg)	(mg/kg)		HQ ^b	(mg/kg)	Source	HQ > 1	
Arsenic	5.7	10	Reg 4	0.57	14.58	c	No	No
Barium	258	165	Reg 4	1.6	223.46	c	Yes	Yes
Beryllium	0.93	1.1	Reg 4	0.85	1	c	No	No
Cadmium	1.8	1.6	Reg 4	1.1	1.54	c	Yes	Yes
Chromium	17.3	0.4	Reg 4	43.3	23.89	c	Yes	No
Cobalt	6.9	20	Reg 4	0.3	15.98	c	No	No
Copper	18.6	40	Reg 4	0.5	24.19	c	No	No
Lead	24.8	50	Reg 4	0.5	26.03	c	No	No
Nickel	15.6	30	Reg 4	0.5	20.62	c	No	No
Selenium	0.55	0.81	Reg 4	0.68	—	—	No	NC
Tin	33.4	53	Reg 4	0.6	33.56	c	No	No
Vanadium	30.7	2	Reg 4	15.4	45.11	c	Yes	No
Zinc	59.7	50	Reg 4	1.2	98	c	Yes	No
alpha-Chlordane	0.0054	0.224	Reg 5	0.024	—	—	No	NC
4,4'-DDT	0.0062	0.0025	Reg 4	2.480	—	—	Yes	NC
Dieldrin	0.34	0.0005	Reg 4	680	0.262	d	Yes	Yes
Pesticides (Total)	0.35	0.1	Reg 4	3.52	—	—	Yes	NC
gamma-Chlordane	0.0011	0.224	Reg 5	0.0049	—	—	No	NC
Benzo(a)anthracene	0.12	5.21	Reg 5	0.023	—	—	No	NC
Benzo(a)pyrene	0.21	0.1	Reg 4	2.10	—	—	Yes	NC
Benzo(b)fluoranthene	0.23	59.8	Reg 5	0.004	—	—	No	NC
Benzo(g,h,i)perylene	0.18	119	Reg 5	0.002	—	—	No	NC
Benzo(k)fluoranthene	0.16	148	Reg 5	0.001	—	—	No	NC
Chrysene	0.16	4.73	Reg 5	0.034	—	—	No	NC
Dibenz(a,h)anthracene	0.057	18	Reg 5	0.003	—	—	No	NC
Fluoranthene	0.094	0.1	Reg 4	0.9	—	—	No	NC
Indeno(1,2,3-cd)pyrene	0.14	109	Reg 5	0.0013	—	—	No	NC
Pyrene	0.12	0.1	Reg 4	1.2	—	—	Yes	NC
Total PAHs	1.47	1.0	Reg 4	1.5	—	—	Yes	NC
Acetone	0.013	2.5	Reg 5	0.005	—	—	No	NC
Ethylbenzene	0.001	0.05	Reg 4	0.02	—	—	No	NC
Toluene	0.014	0.05	Reg 4	0.3	—	—	No	NC
Xylene (Total)	0.007	0.05	Reg 4	0.1	—	—	No	NC

Notes:

- Reg 4 — USEPA Region 4. 2001. *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*. Originally published November, 1995. Website version last updated November 30, 2001: <http://www.epa.gov/region4/waste/ots/ecolbul.htm>.
- Reg 5 — USEPA Region 5. *RCRA Ecological Screening Levels*, August 22, 2003.
- a — Ecological Screening Value
- b — Hazard Quotient
- c — EnSafe/Allen & Hoshall. *Reference Concentration Technical Memorandum, Naval Support Activity Memphis*, August, 27 1996.
- d — EnSafe/Allen & Hoshall. *Surface Soil (0 to 1 foot) Background Dieldrin Concentrations at NSA Memphis*, June 3, 1997.
- — Denotes constituents for which no EPA Region 4 ESV or reference concentration is available.
- NC — Denotes contaminants for which there is not sufficient information to calculate a value (primarily used when a constituent was not detected in any background sample).

Table 2
SWMU 65 NSA Mid-South
Ecological Chemicals of Potential Concern (COPCs) — Subsurface Soi

Parameter	Maximum Detection (mg/kg)	ESV ^a (mg/kg)	Source	Screening HQ ^b	Reference Conc. (mg/kg)	Reference Conc. Source	HQ > 1	Max Conc. > Ref. Conc.
Arsenic	8.1	10	Reg 4	0.8	20.32	c	No	No
Barium	272	165	Reg 4	1.6	265.12	c	Yes	Yes
Beryllium	0.75	1.1	Reg 4	0.68	1.004	c	No	No
Cadmium	2.8	1.6	Reg 4	1.8	3.24	c	Yes	No
Chromium	19.6	0.4	Reg 4	49	28.28	c	Yes	No
Cobalt	19.2	20	Reg 4	1.0	14.36	c	No	Yes
Copper	23.6	40	Reg 4	0.6	32.52	c	No	No
Lead	15.9	50	Reg 4	0.3	19.8	c	No	No
Nickel	41.6	30	Reg 4	1.4	24.5	d	Yes	Yes
Selenium	0.51	0.81	Reg 4	0.63	—	—	No	NC
Silver	5.4	2	Reg 4	2.7	—	—	Yes	NC
Tin	36.6	53	Reg 4	0.7	—	—	No	NC
Vanadium	36.0	2	Reg 4	18	43.68	c	Yes	No
Zinc	85.9	50	Reg 4	1.7	109	c	Yes	No
2,4,5-TP (Silvex)	0.0048	0.109	Reg 5	0.044	—	—	No	NC
2,4-DB	0.012	—	—	NC	—	—	Yes	NC
Dinoseb	0.007	0.0218	Reg 5	0.3	—	—	No	NC
MCPA	17	—	—	NC	—	—	Yes	NC
Pesticides (Total)	17.024	0.1	Reg 4	170.2380	—	—	Yes	NC
Acetone	0.009	2.5	Reg 5	0.004	—	—	No	NC
Xylene (Total)	0.003	0.05	Reg 4	0.06	—	—	No	NC

Notes:

- Reg 4 — USEPA Region 4. 2001. *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*. Originally published November 1995. Website version last updated November 30, 2001: <http://www.epa.gov/region4/waste/ots/ecolbul.htm>.
- Reg 5 — USEPA Region 5. *RCRA Ecological Screening Levels*, August 22, 2003.
- a — Ecological Screening Value
- b — Hazard Quotient
- c — EnSafe/Allen & Hoshall. *Reference Concentration Technical Memorandum, Naval Support Activity Memphis*, August, 27 1996.
- d — EnSafe/Allen & Hoshall. *Addendum to the September 18, 1996 Assemblies A through D Background Reference Concentrations Technical Memorandum*, December 11, 1996.
- — Denotes constituents for which no EPA Region 4 ESV or reference concentration is available.
- NC — Denotes contaminants for which there is not sufficient information to calculate a value (primarily used when a constituent was not detected in any background sample).

Table 4
 SWMU 65 NSA Mid-South
 Screening Level COPCs and Relative Risk to Simple Food Chain Models — Subsurface Soil

Parameter	Maximum Detection (mg/kg)	ESV ^a (mg/kg)	Source	Screening HQ ^b	HQ > 1	Reference Conc. (mg/kg)	Max Conc. > Ref. Conc.	Refined HI ^c	BAF mammal	BAF avian	TRV mammal NOAEL	TRV mammal LOAEL	TRV avian NOAEL	TRV avian LOAEL	NOAEL MAM SSL ^d (mg/kg)	NOAEL Bird SSL ^e (mg/kg)	LOAEL MAM SSL ^f (mg/kg)	LOAEL Bird SSL ^g (mg/kg)	Max Food Chain Model HQ ^h	
Barium	272	165	Reg 4	1.6	Yes	265.12	c	Yes	1.6	0.22	—	11.80	—	20.80	41.70	75.933	NA	NA	345.258	0.4779
Nickel	41.6	30	Reg 4	1.4	Yes	24.5	d	Yes	0.8	0.02	—	87.91	175.8	77.40	107.0	2,123.430	NA	4,247.101	885.914	0.0071
Silver	5.4	2	Reg 4	2.7	Yes	—	—	NC	—	0.22	—	—	—	—	—	NA	NA	NA	NA	—
Vanadium	36.0	2	Reg 4	18	Yes	43.68	c	No	21.8	0.22	0.22	0.428	4.285	11.40	2.754	31.674	27.574	NA	NA	0.0631
Zinc	85.9	50	Reg 4	1.7	Yes	109	c	No	2.2	—	—	351.7	703.3	14.50	131.0	NA	NA	1,084.624	0.0461	
2,4-DB	0.012	—	—	NC	Yes	—	—	NC	—	—	—	—	—	—	—	—	—	—	—	—
MCPA	17	—	—	NC	Yes	—	—	NC	—	—	—	—	—	—	—	—	—	—	—	—
Pesticides (total)	17.024	0.1	Reg 4	170.2380	Yes	—	—	NC	—	—	—	—	—	—	—	3.220	0.002	5.191	2.091	0.0193

Notes.

- Reg 4 — USEPA Region 4 2001 *Supplemental Guidance to RAGS Region 4 Bulletins, Ecological Risk Assessment* Originally published November 1995. Website version last updated November 30, 2001: <http://www.epa.gov/region4/waste/ots/ecolbul.htm>
- Reg 5 — USEPA Region 5 *RCRA Ecological Screening Levels*, August 22, 2003
- a — Ecological Screening Value
- b — Hazard Quotient
- c — EnSafe/Allen & Hoshall *Reference Concentration Technical Memorandum, Naval Support Activity Memphis, August, 27 1996*
- d — EnSafe/Allen & Hoshall *Surface Soil (0 to 1 foot) Background Dieleinn Concentrations at NSA Memphis, June 3, 1997*
- e — Hazard Index
- f — No Observed Adverse Effect Level (NOAEL) for mammals soil screening level
- g — No Observed Adverse Effect Level (NOAEL) for birds soil screening level
- h — Lowest Observed Adverse Effect Level (LOAEL) for mammals soil screening level
- i — Lowest Observed Adverse Effect Level (LOAEL) for birds soil screening level
- j — Maximum Food Chain Model Hazard Quotient
- Information is not available to calculate food chain HQ (e.g., no EPA Region 4 ESV or TRV is available).
- NC — Insufficient information to calculate a background value.

Equation used to calculate soil screening level (SSL).

$$SSL = \frac{TRV \times BW}{AUF \times AF \times [BAF \times (FIR - f_{soil} \times FIR) + f_{soil} \times FIR]}$$

- TRV — Toxicity Reference Value (species-specific NOAEL or LOAEL endpoint)
- BW — Body weight
- AUF — Area use factor = 1.0
- AF — Absorbed fraction of contaminant = 1.0
- BAF — Bioaccumulation factor
- FIR — Total food ingestion rate
- fsoil — Fraction soil ingested

	Mammal	Avian
FIR:	0.009 kg/d	0.093 kg/d
fsoil:	0.05	0.10
BW:	0.015 kg	0.077 kg

Contaminant exposure for terrestrial wildlife is expressed as an Exposure Dose in milligram (mg) contaminant per kilogram (kg) body weight (BW) per day or mg/kg BW/day and the Effect Dose is represented by a toxicity reference value (TRV) expressed in the same units

The SSL is the soil concentration that results in an ecological HQ=1, that is when the Effect Dose (TRV) and the Exposure Dose are equal

BAF x (FIR - fsoil x FIR) describes accumulation via the food web

fsoil x FIR describes direct soil ingestion only