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TECHNICAL MEMORANDUM SUPPLEMENTARY SCREENING LEVEL ECOLOGICAL RISK  
ASSESSMENT SOLID WASTE MANAGEMENT UNIT 5 (SWMU 5) AIRCRAFT FIRE  
FIGHTING TRAINING FACILITY MILLINGTON SUPPACT TN  
12/13/2005  
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## TECHNICAL MEMORANDUM

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**From:** Brian Mulhearn, EnSafe Inc.

**Date:** December 13, 2005

**Re:** Supplementary Screening Level Ecological Risk Assessment  
SWMU 5 — Aircraft Fire Fighting Training Facility NSA Mid-South

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## INTRODUCTION

This memorandum provides a supplementary screening level ecological risk assessment (SLERA) for the SWMU 5 — Aircraft Fire Fighting Training Facility (AFFTF) Statement of Basis. A 1990 RCRA Facility Assessment reported spills, overflows, leaking tanks, and mixing of waste fuel with waste solvents such as naphtha, xylenes, methyl ethyl ketone, toluene, and benzene. Consequently, a recommendation was made to characterize the site using a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) (ERC/EDGE, 1990).

As a result of the 1990 Base Realignment and Closure Act, SWMU 5 and other naval property north of Navy Road was transferred to the City of Millington, and in 1999, EnSafe Inc. developed a risk assessment as part of the RFI to evaluate environmental risks (EnSafe, 1999a). Several areas were identified where both soil and groundwater were impacted and could pose a human health risk in the absence of corrective action, which led to two voluntary corrective removal actions (VCAs). Tanks, piping, and structures that could pose a source to contamination were removed from the site. The first VCA was implemented in August 1997, where the site's oil-water separator was removed by the U.S. Army Corps of Engineers (EnSafe, 1999b), and the second VCA was implemented to remove a fire mat and the fire extinguisher pits (EnSafe, 1998). The RFI concluded that no quality habitat was available at SWMU 5, limiting the exposure of potential ecological receptors, and the extensive soil removals associated with the site would limit any potential ecological exposure to clean fill material instead of hot spot contamination. Therefore, no quantitative ecological assessment was performed (EnSafe, 1999a).

Since a quantitative ecological risk assessment was not completed as part of the RFI and site soil was not removed from all locations, this SLERA has been developed for SWMU 5 soil to evaluate ecological risks to terrestrial receptors at SWMU 5 based on soil data from locations that were not removed during SWMU removal actions, as well as confirmatory sample results from the SWMU 5 VCA reports. Information in this memorandum is provided to clarify the decision-making process for SWMU 5.

## SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

SWMU 5 is a large open field that contained two large concrete mats used for fire fighting training. To the east of the site is a small wooded area and the north and southern boundaries are roadways. The area west of the site is a grass field that is maintained and mowed. Some SWMU 5 soil was excavated and replaced with clean fill material, so pre-removal surface soil data from the filled area would be obsolete and unusable for assessing ecological risk from site-related constituents. SWMU 5 could be used by terrestrial receptors, such as passerine birds and/or small mammals using them as transient or opportunistic foraging areas rather than home range habitat. However, this SLERA was developed to document potential future risks assuming the area will not be maintained as a mowed field in the future.

### **Data Sources**

Data sources for the SWMU 5 SLERA are:

- *RCRA Facility Investigation Report -Aircraft Fire Fighting Training Facility; SWMU 5 (Revision 3), June 3, 1999a.* EnSafe Inc., Memphis, Tennessee.
- *UST Closure Report, Oil/Water Separator (Revision 2).* May 11, 1998. EnSafe Inc., Memphis, Tennessee.
- *Voluntary Corrective Action Report (Revision 1) for SWMU 5, SWMU 60, North Fuel Farm, and Former Building N-6 at NSA Mid-South,* May 13, 1999b; 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 risk assessments completed as part of the RFI for SWMU 5 and other NSA Mid-South sites.

## SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

The maximum detected concentration for any chemical found at SWMU 5 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 from 0-2 feet was compared to surface soil ESVs. Table 1 shows maximum detected concentrations, screening comparisons, and hazard quotients calculated based on the screening values.

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). Table 2 provides the detected concentrations and food chain screening values used for the SLERA.

The food-chain hazard quotient for benzo(a)pyrene was calculated using the ecological benchmark for PAHs, and the estimated hazard quotient was below 1.0. Consequently, benzo(a)pyrene were not identified as a chemical of concern.

Based on the food-chain model hazard quotients in Table 2, there are no unacceptable ecological risks associated with SWMU 5. It should be noted that ecological features at SWMU 5 are minimal. The site is a large, mowed field where fire fighting training was performed on two concrete pads. The pads and some soils have been removed and replaced with clean fill material. The remaining grassy area and clean fill material would likely represent the only areas 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.
- EnSafe/Allen & Hoshall. (1997, June 3). *Surface Soil (0 to 1 foot) Background Dieldrin Concentrations at NSA Memphis*. Memphis, Tennessee.
- EnSafe/Allen & Hoshall. (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>

**Table 1**  
**SWMU 5 NSA Mid-South**  
**Ecological Chemicals of Potential Concern (COPCs) — Surface Soil**

Parameter	Maximum	ESV <sup>a</sup> (mg/kg)	Source	Screening	Reference	Reference	HQ > 1	Max Conc. >
	Detection (mg/kg)			HQ <sup>b</sup>	Conc. (mg/kg)	Conc. Source		Ref. Conc.
Arsenic	12.0	10	Reg 4	1.2	20.32	c	Yes	No
Barium	273	165	Reg 4	1.7	265.12	c	Yes	Yes
Beryllium	0.86	1.1	Reg 4	0.78	1.004	c	No	No
Cadmium	3.4	1.6	Reg 4	2.1	3.24	c	Yes	Yes
Chromium	19.2	0.4	Reg 4	48.0	28.28	c	Yes	No
Cobalt	13.3	20	Reg 4	0.7	14.36	c	No	No
Copper	17.9	40	Reg 4	0.4	32.52	c	No	No
Lead	30.7	50	Reg 4	0.6	19.8	c	No	Yes
Mercury	0.14	0.1	Reg 4	1.4	—	—	Yes	NC
Nickel	22.5	30	Reg 4	0.8	20.62	c	No	Yes
Selenium	0.51	0.81	Reg 4	0.63	—	—	No	NC
Silver	1.20	2	Reg 4	0.6	—	—	No	No
Thallium	0.28	1	Reg 4	0.3	—	—	No	No
Tin	7.7	53	Reg 4	0.1	—	c	No	No
Vanadium	36.4	2	Reg 4	18.2	43.68	c	Yes	No
Zinc	75.6	50	Reg 4	1.5	109	c	Yes	No
Aroclor-1260	0.0470	0.020	Reg 4	2.4	—	—	Yes	No
4,4'-DDT	0.0053	0.0025	Reg 4	2.120	—	—	Yes	NC
Dieldrin	0.00029	0.0005	Reg 4	0.58	0.262	d	No	No
heptachlor epoxide	0.00280	0.152	Reg 5	0.0184211	—	—	No	No
MCPA	0.01900	NA	—	NA	—	—	NA	NA
Pesticides (Total)	0.03	0.1	Reg 4	0.27	—	—	No	NC
Benzo(a)anthracene	0.12	5.21	Reg 5	0.023	—	—	No	NC
Benzo(a)pyrene	0.15	0.1	Reg 4	1.50	—	—	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	0.00	4.73	Reg 5	0.000	—	—	No	NC
Fluoranthene	0.00018	0.1	Reg 4	0.0	—	—	No	NC
Indeno(1,2,3-cd)pyrene	0.00007	109	Reg 5	0.0000	—	—	No	NC
Phenanthrene	0.00005	0.1	Reg 4	0.0	—	—	No	NC
Pyrene	0.00017	0.1	Reg 4	0.0017	—	—	No	NC
Total PAHs	0.84	1.0	Reg 4	0.8	—	—	No	NC
bis(2-Ethylhexyl)phthalate (BEHP)	0.00007	0.925	Reg 5	0.0	—	—	No	NC
Acetone	0.0046	2.5	Reg 5	0.002	—	—	No	NC
Benzene	2.5	0.05	Reg 4	50.0	—	—	Yes	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 5 NSA Mid-South  
 Screening Level COPCs and Relative Risk to Simple Food Chain Models – Surface Soil

Parameter	Maximum Detection (mg/kg)	ESV <sup>a</sup> (mg/kg)	Screening	Screening HQ <sup>b</sup>	HQ > 1	Reference Conc. (mg/kg)	Conc. > Ref. Conc.	Refined HQ <sup>c</sup>	BAF <sup>d</sup> mammal	BAF <sup>d</sup> avian	TRV	TRV	TRV	TRV	NOAEL MAM		NOAEL BIRD		Max Food Chain
											mammal NOAEL	mammal LOAEL	avian NOAEL	avian LOAEL	SSL <sup>e</sup> (mg/kg)	SSL <sup>e</sup> (mg/kg)	LOAEL MAM (mg/kg)	LOAEL BIRD (mg/kg)	
Barium	0.0	773	Reg 4	0.0	No	223.46	No	0.8	0.22	—	11.60	—	20.85	41.7	75.9	NA	NA	345.258	0.791
Cadmium	0.0	3.4	Reg 4	0.0	No	1.54	No	0.5	0.98	—	2.12	21.20	1.45	20.0	3.67	NA	56.729	165.591	0.0305
4,4'-DDT	0.0000	0.0053	Reg 4	0.0000	No	—	NC	—	1.26	1.26	1.76	8.79	0.003	0.028	2.35	0.902	11.748	0.019	0.0005
Benzene	0.0000	2.5	Reg 4	0	No	—	NC	—	—	—	26.36	263.60	—	—	879	NA	NA	NA	0.00005
Benzophenone	0.0	0.73	Reg 4	0.0	No	—	NC	—	—	—	1.82	0.80	—	—	200	NA	NA	NA	0.00003

- Notes:**
- Reg 4 — USEPA Region 4. 2001. *Supplemental Guidance to RAGS: Region 4 Bulletin, Ecological Risk Assessment*. Originally published November 1995. Website version last updated November 30, 2001. <http://www.epa.gov/region4/westa/ats/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.
  - 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