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PROPOSED REMEDIATION OBJECTIVES FORT SHERIDAN IL  
2/27/2001  
DEPARTMENT OF THE NAVY

**Proposed Remediation Objectives  
Department of Defense Operable Unit  
Feasibility Study Sites, Fort Sheridan, IL  
February 27, 2001**

**Objective:**

*Identify cleanup goals for carcinogenic chemicals at the Fort Sheridan Department of Defense Operable Unit (DOD OU) that are both health protective and achievable.*

**Method:**

The above stated objective can be met by adopting a method which defines cancer risk targets for individual carcinogenic contaminants that fall within the cancer risk management range, such that the cumulative cancer risks at all study areas do not exceed the upper limit of the range  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$  defined in the National Contingency Plan (NCP).

**Discussion:**

When determining remediation objectives, the NCP states that "for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between  $10^{-4}$  and  $10^{-6}$  using information on the relationship between dose and response. The  $10^{-6}$  risk level shall be used as the point of departure for determining remediation goals for alternatives when ARARs are not available or sufficiently protective..." Therefore, using  $10^{-6}$  as the starting point, calculated preliminary remediation objectives for the DOD OU FS study areas are listed in Table 1, Column III. For comparison sake, Table 1 also contains Illinois Environmental Protection Agency's (IEPA) Tiered Approach to Corrective Action Objectives (TACO) Tier 1 Residential Cleanup Objectives, US Environmental Protection Agency (EPA) Region 9 Preliminary Remediation Goals (PRGs), and established surface soil background values. The chemicals of concern (COCs) are arsenic, lead, and seven carcinogenic polynuclear aromatic hydrocarbons (PAHs). Background surface soil screening levels for 6 of the 7 PAH COCs are reported in the *Final Background Sampling and Data Evaluation Report* (ESE, 1997); there is no background screening value for dibenzo(a,h)anthracene. The background level for arsenic in soil in counties within metropolitan statistical areas is 13 mg/kg, and is adopted from IEPA TACO Appendix A, Table G.

The  $10^{-6}$  calculated objectives listed in Column III are highly conservative, and while the Army's preference is to select remedial goals that are at the more protective end of the risk range, we also need to be able to consider remedial technologies that can actually achieve these remedial goals. EPA recognized this as evidenced by the following discussion from the Preamble to the Final NCP:

*Preliminary remediation goals for carcinogens are set at a  $10^{-6}$  excess cancer risk as a point of departure, but may be revised to a different risk level within the acceptable risk range based on the consideration of appropriate factors, including but not limited to: exposure factors, uncertainty factors, and technical factors... Technical factors may include:... background levels of contaminants... EPA's approach allows a pragmatic and flexible evaluation of potential remedies at a site while still protecting human health and the environment. This approach emphasizes the use of  $10^{-6}$  as the point of departure while allowing site- or remedy-specific factors... As risks increase*

above  $10^{-6}$ , they become less desirable, and the risk to individuals generally should not exceed  $10^{-4}$ .

To determine how achievable these  $10^{-6}$  remediation objectives are in surface soils, a comparison of the calculated  $10^{-6}$  remediation objectives, the TACO cleanup objectives, and the Region 9 PRGs to surface soil background levels of PAHs and arsenic is provided. While PAH and/or arsenic contamination at several study areas is primarily associated with the subsurface soil/waste, contamination is limited to the surface soils at three sites: Coal Storage Area 4, Landfill 6-South/Vehicle and Equipment Storage Area 8 (VES 8), and Building 70. Given the background PAH and arsenic concentrations in Column VI of Table 1, defining the horizontal limits of contamination in these study area surface soils using the  $10^{-6}$  remediation objectives will be extremely difficult, if not impossible. Based on this, it is clear a different approach is needed, one that is both protective and practical.

We looked to the NCP for guidance on how best to determine remediation objectives other than the  $10^{-6}$  point of departure. There are no specific guidelines besides the following:

*"First, EPA will use an individual lifetime excess cancer risk of  $10^{-6}$  as a point of departure for establishing remediation goals for the risks from contaminants at specific sites. While the  $10^{-6}$  starting point expresses EPA's preference for setting cleanup levels at the more protective end of the risk range, it is not a presumption that the final Superfund cleanup will attain that risk level. The second step involves consideration of a variety of site-specific or remedy-specific factors. Such factors will enter into the determination of where within the risk range of  $10^{-4}$  to  $10^{-6}$  the cleanup standard for a given contaminant will be established."*

Our first attempt to arrive at practical, yet protective, remediation objectives (as documented in the *Draft Feasibility Study* (SAIC, 1999)) developed remediation objectives explicitly considering the additivity effects of multiple collocated carcinogens with an upper limit on cancer risk of  $1 \times 10^{-4}$ . These objectives are listed in Table 1, Column II. Using this method, final residual risks ended up in the middle of the risk management range (i.e. around  $10^{-5}$ ) for most study areas. However, a simpler approach, and one more consistent with IEPA's policy to adopt cleanup objectives based on a  $10^{-6}$  risk level (when practical), involves the use of the TACO Tier 1 Residential cleanup objectives (which are based on a  $10^{-6}$  risk level using TACO equations) and the background levels listed in Table 1. The resulting list of remediation objectives is in Table 1, Column VII.

Table 1 indicates that the proposed remediation objective for arsenic in soil is 13 mg/kg, which, as previously noted, is a background concentration that is approved by IEPA. For lead in soil, the remediation objective is the conventionally applied screening level of 400 mg/kg. For each carcinogenic PAH in soil, the recommended remediation goal is either the IEPA TACO Tier 1 residential value or the background level, whichever is higher. The PAH background level is higher than the TACO Tier 1 value only for benzo(a)pyrene.

Anthropogenic and natural sources of PAHs are widely known, especially in metropolitan areas. This fact cannot be ignored, especially for remediation of surface soils. At Fort Sheridan, background levels of PAHs are reported in the *Final Background Sampling and Data Evaluation Report* (ESE, 1997). The 5 different areas for collection of the 10 background soil samples were selected because they were believed to be unaffected by mission related activities. These sample locations were also used to develop the approved background screening values for inorganics. As stated in the approved Final Background Report, "the occurrence of PAHs in the background soil

samples collected at Fort Sheridan is not considered to be indicative of mission related releases to the environment...PAH values in the background samples were treated as ubiquitous and/or naturally occurring.”

Although background levels of organics were not used to screen out organics from the risk assessment process, they do provide weight of evidence indicating that the observed concentrations of PAHs and the associated risk estimates are of minimal significance in the context of a metropolitan locale. IEPA and EPA has agreed with such weight of evidence discussions at many Fort Sheridan study areas as reported in the *Final Decision Document for Landfills 3 and 4 Operable Unit* (QST, 1997); *Final Decision Document for the Ravines and Beach Area Study Areas of the Surplus Operable Unit* (QST, 1998); *Final Technical Memorandum for Miscellaneous Surplus OU Study Areas* (Fort Sheridan, 1997); *No Further Response Action Decision Paper, Building 42, Building 43, Building 77, and Coal Storage Area 3, Fort Sheridan* (Fort Sheridan BRAC Cleanup Team, 1999); and the *Draft Decision Document for the No Action Study Areas, DOD Operable Unit* (SAIC, 2000) .

Significant portions of the DOD OU are paved with asphalt, representing a source of PAHs that should be recognized. PAH levels in samples collected below and next to paved areas were evaluated during RI field work on the Surplus OU. As reported in the *Final Remedial Investigation /Baseline Risk Assessment Report for the Landfills 3 and 4 OU, Fort Sheridan* (QST, 1997), PAH levels of up to 8 parts per million (ppm or mg/kg in soil) were detected, exclusive of outliers. Table 2 lists the concentration ranges detected in the asphaltic baseline soil samples for the 7 DOD OU PAH COCs. For comparison, Table 2 also contains the background screening values.

**Table 2. Background Screening Levels and Asphaltic Baseline, PAH COCs**

PAH COCs	Background Screening level (0-1' bgs) (mg/kg)	Asphaltic Baseline Range (mg/kg)
Benzo(a)anthracene	0.33	<0.001 – 1.05
Benzo(a)pyrene	0.32	<0.0007 – 8.09
Benzo(b)fluoranthene	0.30	<0.001 – 1.15
Benzo(k)flouranthene	0.33	<0.0007 – 3.74
Chrysene	0.39	<0.007 – 1.70
Dibenzo(a,h)anthracene	N/A	<0.003 – 0.062
Indeno(1,2,3-cd)pyrene	0.24	<0.003 – 1.30

While we recognize that potentially higher “baseline” PAH levels, up to 8 mg/kg in soil, may be present on the DOD OU because of the asphalt, study area sampling data indicates that the background UTL of 0.32 for benzo(a)pyrene is a reasonable goal that should be achievable at most sites. This is a more conservative remediation goal targeting background levels obtained from relatively undeveloped areas of the Fort.

Table 3 contains the residual cancer risk for each DOD OU FS study area that would result using TACO risk equations with the proposed remediation objectives (listed in Table 1, column 8). Table 3 confirms that the proposed remediation objectives are within the risk range and, thus, protective of human health.

**Table 3. Cumulative Residual Cancer Risk at Study Areas**

<b>Study Area</b>	<b>Arsenic a COC? (PRG of 13 ug/g)</b>	<b>Number of Carcinogenic PAH COCs</b>	<b>Resulting Cumulative Residual Cancer Risk using TACO Equations</b>
Landfill #6 South/VES 8	No	4	6.65E-06
Landfill #1	Yes	1	3.41E-05
Landfill #5	No	2	4.65E-06
Coal Storage Area #3	No	7	9.65E-06
Coal Storage Area #4	No	2	4.65E-06
Building 70	Yes	0	3.05E-05