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MEMORANDUM REGARDING DRAFT INTERIM MEASURES REPORTS SOLID WASTE  
MANAGEMENT UNIT 12 (SWMU 12) REVIEW OF APPENDIX G ECOLOGICAL RISK  
EVALUATION NSA CRANE IN  
3/23/2015  
U S NAVY

March 23, 2015

**MEMORANDUM**

**TO:** Peter Ramanauskas, Project Manager

**FROM:** Daniel Mazur, Ecologist

**SUBJECT:** Draft Interim Measures Report, November 2010 – Crane SWMU 12  
Review of Appendix G: Ecological Risk Evaluation

Review of the above ecological risk evaluation was focused on post-excavation analysis of residual lead in surface soil. Attachment A (2<sup>nd</sup> paragraph, 3<sup>rd</sup> sentence) states "... ecological scenarios only included backfill results, RFI surface samples, and verification samples ...", but a data table used for this evaluation was not presented. I was unable to confirm the exposures presented in the three scenarios (Tables 2-1, 2-2 and 2-3), since Appendix G did not contain surface soil data.

A protective risk goal typically uses both lower and upper thresholds of adverse impacts commonly represented by measures of no adverse effect level (NOAEL) and lowest adverse effect level (LOAEL). LOAEL values need to limit the upper level of effect (some LOAELs represent 50% or greater adverse effects). EPA prefers using studies that contain both NOAEL and LOAEL (i.e., bounded) values and limits LOAEL adverse effects to 20% or less. Although EPA guidance does not require the PRG or cleanup criteria to be a geometric mean of the NOAEL and LOAEL values, a geometric mean can refine exposure when increased food ingestion or soil uptake is expected.

For other Crane SWMU's, EPA did not agree with Navy selection of all lead LOAEL values (i.e., unbounded and >20% adverse effects) from the EPA Ecological Soil Screening Levels for Lead report (OSWER Directive 9285.7-70, March 2005) to develop a protective risk goal. A default LOAEL soil cleanup goal of 192 mg/kg for lead was recommended by EPA to be protective of the American woodcock. If the area weighted average lead concentrations for the three scenarios (32.77 mg/kg, 50.74 mg/kg and 49.45 mg/kg as shown in Tables 2-1, 2-2 and 2-3) are correct, these lead concentrations are less than the LOAEL PRG of 192 mg/kg and protective of the American woodcock (sensitive ecological receptor). This LOAEL PRG of 192 mg/kg is expected to be lower than a mammal LOAEL PRG for lead.

The food chain analysis did not provide data and equations used to estimate receptor exposure or LOAEL PRG values for generating the ecological effects quotient (EEQ) presented in Tables 3-1, 3-2 and 3-3. For mammals, exposure to a shrew is expected to be greater than a vole and for birds exposure is expected to be greater for a woodcock than a quail. Tables 3-1 and 3-2 shows a greater exposure (higher EEQ) to a vole than a shrew for lead and tin, respectively. These two vole EEQ values are in question as the data and equations are not available to confirm the EEQ values. Since chromium, copper and zinc exceeded screening values, LOAEL PRGs were calculated and compared to the area weighted concentrations. These LOAEL PRGs used the lowest bounded LOAELs from the EPA Eco-SSL reports for the American woodcock and short-tailed shrew along with an average food ingestion rate and median soil uptake (same approach used for the LOAEL PRG for lead).

The soil LOAEL PRG was calculated using the following equation and criteria from the EPA Guidance for Developing Ecological Soil Screening Levels (OSWER Directive 9285.7-55, February 2005).

$$HQ = \text{Fir} \times (\text{soil} \times \text{Ps} + \text{B}) / \text{TRV}$$

Set HQ = 1 and solve for soil

Use the following Fir, Ps & TRV

	<u>Woodcock</u>	<u>Shrew</u>
Food ingestion rate (Fir)	0.142 g/g-day	0.167 g/g-day
Soil ingestion, proportion of diet (Ps)	0.064 (6.4%)	0.009 (0.9%)

	<u>LOAEL TRV (mg/kg-day)</u>		<u>Concentration in Soil Invertebrates</u>
	<u>Avian</u>	<u>Mammal</u>	
Chromium <sup>+3</sup>	2.78	2.82	B = 0.306 x soil
Copper	4.69	6.79	B = 0.515 X soil
Zinc	66.5	75.9	ln(B) = 0.328 x ln(soil) + 4.449

Solving for soil in the above equation provides the following soil LOAEL PRGs for the American woodcock and short-tailed shrew (sensitive bird and mammal receptors)

	<u>Soil LOAEL PRG (mg/kg)</u>	
	<u>Woodcock</u>	<u>Shrew</u>
Chromium <sup>+3</sup>	52.9	53.6
Copper	57.04	77.59
Zinc	166.2	161.1

A comparison of the area weighted average concentrations for chromium<sup>+3</sup>, copper and zinc in Tables 2-1, 2-2 and 2-3 against the above soil LOAEL PRGs shows all values are lower (except zinc in scenarios 2 and 3). For SWMU 16 (Media Cleanup Goals, surface soils) an avian LOAEL TRV of 128 mg/kg-day for zinc was recommended (twice the value used above) and was based on bounded studies with adverse effects ≤ 20% (same approach as lead). Although a mammal LOAEL TRV for zinc was not developed, data is available from studies listed in the Eco-SSL report.

The Navy needs to present data used to derive area weighted values in Tables 2-1, 2-2 and 2-3. Also data, equations and effect values used to derive the EEQ values in Tables 3-1, 3-2 and 3-3 need to be presented.