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NSA CRANE
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REVIEW COMMENTS FROM U S EPA REGION V ON SOLID WASTE MANAGEMENT UNIT
16 DRAFT FINAL INTERIM MEASURES WORK PLAN NSA CRANE IN
6/18/2013
U S EPA REGION V

Review comments from Peter Ramanauskas and Dan Mazur (USEPA Region V) dated June 18, 2013 on the SWMU 16 Draft-Final Interim Measures Work Plan for NSA Crane, May 2013 are indicated in bold font.

Responses are shown in regular font. Edits/modifications to the SWMU 16 Interim Measures Work Plan are shown in the comment responses below in *italic font*.

Comment 1:

Page 1-3, last sentence, first paragraph typo: “visibly contaminated soil were removed xxx.”

Response: The indicated typo was initially inserted as a placeholder to state the timing for the removals for the incinerators, oil tanks, and ash/slag piles. The timing for the removal of the incinerators, ash piles, and visibly contaminated soil at Building 146 (SWMU 16) is somewhat uncertain, but the description of the scope of the Voluntary Interim Measures (VIM) performed at SWMU 16 during 1995 appears to correspond to the timeframe for those initial Interim Measures at SWMU 16. The cited last sentence has been deleted on page 1-3 and replaced with the discussion as shown below.

Constructed in 1943, Building 146 was an explosives fill and pressure washout facility and included three oil-fired, rotary kiln incinerators and associated aboveground No. 2 fuel oil tanks. Beginning in the 1960s, the kilns were used to demilitarize munitions through burning or detonation. Munitions placed in the kilns were exposed to flame combustion, which resulted in the destruction of the energetics (explosives, propellants, pyrotechnics) contained within the munitions. Initially, ash and slag residues were piled on the ground. Later, ash and other incineration residues were collected and transferred to the NSA Crane hazardous waste storage facility prior to off-site disposal. The incinerators were removed and underwent RCRA closure in the early 1990s. The fuel storage tanks, ash pile remnants and visibly contaminated soils were subsequently removed under a Voluntary Interim Measure (VIM) in 1995, as discussed in Section 2.0.

Comment 2:

Referring to the Dewatering section on page 3-7 typo: “sol dewatering”.

Response: The indicated typo has been modified to “soil dewatering”, so the sentence now reads: “*Otherwise there is no anticipated need for soil dewatering.*”

Comment 3:

Referring to the table at the bottom of page 3-7, is there the potential for TCE/explosives contamination in the debris of the three settling tanks?

Response: The presence of TCE/explosives contamination in the debris of the three settling tanks is unlikely. During the interim measures the sumps were thoroughly cleaned using a high-pressure, low-volume wash system. The decontaminating fluid was sampled for verification of the sumps walls and floor cleanliness. Prior to the cleaning, sludges were removed from the settling tanks and disposed. The sumps have been out of service since the 1995 interim measures.

Text changes have been made as discussed in the response to EPA Comment No. 1, and as shown below at the end of Section 2.2.1.

During the VIM, the settling tanks were thoroughly cleaned using a high-pressure, low-volume wash system. The decontaminating fluid was sampled for verification of the sumps walls and floor cleanliness. Prior to the cleaning, sludge residues were removed from the settling tanks and disposed.

Comment 4:

Referring to Section 2.1.4: Is it known whether the groundwater elevations of the Puz fluctuate such that TCE impacted groundwater may rise and reach the bedrock/overburden interface?

Response: The following text has been added as Section 2.1.4 new paragraph 3 to address this comment.

The Monitored Natural Attenuation (MNA) Final Report for SWMU 16 (Round No. 9) dated July 2010, presents the recorded groundwater elevations for SWMU 16 wells from nine different monitoring rounds beginning in May 2003 and continuing through April 2007. This SWMU 16 MNA report (Tetra Tech, 2010) includes groundwater elevation data for several shallow (Pennsylvanian upper zone or Puz) monitoring wells in the SWMU 16 area. Based on the recorded water table elevation data for the Puz groundwater monitoring wells at SWMU 16, most recorded groundwater elevations are below the recorded well-specific elevation for the top of bedrock. Two shallow monitoring wells on the western side of the SWMU 16 site (16MWT02 and 16MWT13) had recorded groundwater elevations above the local top of bedrock elevation. At this location, TCE-contaminated groundwater may reach the bedrock/overburden interface. These two Puz wells are both less than 20 feet deep, are located on the western margin of the Building 146 area (near the west settling tank), are located outside the limits of the planned excavation for TCE-contaminated soils, and appear to have been constructed with the top of the well screen extending above the top of bedrock elevation. The maximum observed groundwater

elevation was in these wells was 753.8 feet above mean sea level (amsl). The lowest bedrock elevation in the excavation area is 755.6 feet amsl. The other Puz wells at monitored at SWMU 16 for the MNA Report typically had depths of at least 20 to 24 feet and did not feature groundwater elevations above the top of bedrock. During the installation of multiple borings in the overburden at SWMU 16, especially within the proposed TCE soil excavation areas adjacent to Building 146, no groundwater was encountered in those soil borings, indicating that groundwater elevations were below the local bedrock elevation. Based on these data, it is not expected that groundwater will be present in the proposed TCE soil excavation areas above the local bedrock surface during excavation.

Comment 5:

Would it be clearer to remove the word “or” from the 5th sentence of #6 on page 3-11?

Response: The word “or” has been removed from the 5th sentence of #6 on Page 3-11, as shown below:

6. *Settling tank excavation and removal. Pump out settling tank water for staging and collect water samples for laboratory analysis and characterization. Laboratory results will support proper management of settling tank water for offsite disposal. Following the removal of settling tanks, restore the disturbed excavation areas as required. Verify piping is capped when left in place and remove piping within areas targeted for soil removal (settling tank piping north and west of Building 146 will be removed). Following loading operations, transport settling tanks and piping debris to the NSA Crane-approved off-site disposal facility.*

Comment 6:

Referring to Table 3-2, how do these nodes match with the sampling data points shown on Figures 2-X?

Response: The soil excavation perimeter lines indicated on Figure 3-1 are consistent with the indicated limits of clean soil (soil boring points with no TCE concentrations exceeding Media Cleanup Standards) as presented on Figures 2-2, 2-3, and 2-4 in the IMWP for SWMU 16. The specified nodes indicated on those lines on Figure 3-1 and as listed on Table 3-2 are to support reacquisition of these location points in the field and provide confirmation when identified soil areas impacted by TCE have been successfully excavated from the site.

No text changes are required to address this comment.

Comment 7:

Table 2-4 presents MCS for metals contamination and, using lead as an example, identifies 652 mg/kg and 163 mg/kg as MCS with the 652 mg/kg noted as the “plant preliminary remediation goal, not to be exceeded at any given sample point.” Figure 2-6 identifies the proposed soil excavation areas, but a couple of locations with lead exceeding 652 mg/kg are not marked for excavation (e.g., 16SB020 and 16SB177). Please clarify how the areas proposed for excavation will meet your proposed MCS metals targets.

Response: The rationale why certain samples were not included in the area proposed for remediation is presented in Section 4.2.1 of the Revised Draft Soil Delineation Sampling Data Summary Report SWMU 16 - Cast High Explosive Fill/ Building 146 Incinerator (Tetra Tech, December 2012). To make the SWMU 16 Interim Measures Work Plan a more transparent document, Section 2.2.3.3 will be revised as follows:

“Table 2-4 presents the Metals Contamination Area soil data screened against the applicable MCSs. The MCSs were developed in the Technical Memorandum Ecological Media Cleanup Goals for SWMU 16 Surface Soil (Tetra Tech, 2013). Figure 2-6 presents the surface soil data for antimony, copper, lead and zinc, and the proposed soil removal areas. Both the table and figure utilize the entire dataset for all samples collected at SWMU 16 as part of the RFI, as well as the most recent soil delineation sampling event, with one exception. Samples from locations 16SS100-16SS113, which were collected specifically for the toxicity test that was used to develop the MCS values, are not presented on Table 2-4 or Figure 2-6. These samples were collected from different depth intervals than the other surface soil samples because the goal was to collect samples from the biologically active zone (i.e., the root zone) and to collect samples with metals concentrations over a concentration gradient. Therefore, most of these samples were collected from a shallower depth than the other surface soil samples that were collected from 0-2 feet based on the depth of the root zone. Also, samples 16SS100-16SS113 were collected at locations of existing soil samples so metals results samples from 0 to 2 feet in depth are already available at those 14 sample locations. That being said, even had those samples been used, no additional locations would have been included in the removal area for the following reasons:

- *16SS101, which had the greatest concentrations of metals, is located in the railroad bed where 16SS020 was collected so it would not have been recommended for removal.*
- *12SS104, the only other sample with concentrations that exceeded the PRGs, was collected near 16SS016. However, the lead concentration at this location (656 mg/kg), just slightly exceeded the plant PRG of 652 mg/kg. Similarly, the zinc concentration at this location (1,950 mg/kg), just slightly exceeded the plant PRG of 1,716 mg/kg. Therefore, because of the slight exceedences of the PRGs at 16SS104 and because of the much lower concentration in 16SS016, this location would not have been recommended for remediation.*

Several exceedances of all four metals were observed, with the majority of the highest exceedances co-located in the eastern and southeastern portions of the area. Based on the Round 2 data, the extent of metals concentrations above MCSs has been fully delineated in the surface soil horizontally in the Metals Contamination Area of SWMU 16. Also, as presented in the SWMU 16 Soil Delineation Sampling Data Summary Report (Tetra Tech, 2012), there are seven additional locations, in addition to the ones discussed that are not proposed for removal, even though the MCSs are exceeded for some of the metals. The rationales regarding why those locations are not proposed for removal are discussed below:

- 16SB020: The sample from this location was collected within the railroad bed so there is no ecological habitat in this area so it is not necessary to remove soil from this location.
- 16SB177 and 16SB179: These sample locations are within the wooded area in the south eastern portion of SWMU 16. The only MCSs that are exceeded there are based on plants; however, removing the soil would result in removing the trees and other vegetation. Also, because concentrations of metals just slightly exceed the plant MCSs and the area is wooded, it is not likely that significant impacts to plants are occurring. Therefore, the removal of soil would likely have a greater impact on the vegetation than is currently occurring, so a removal of soil around these sample locations is not warranted.
- 16SB009, 16SB010, and 16SB184: Soil from these sample locations only slightly exceeded the background concentration for antimony. No other metals exceeded a MCS at these locations. Also, as discussed in the Technical Memorandum (Tetra Tech, 2010), there is uncertainty in whether the impacts observed in the plant toxicity test was due to antimony. For these reasons, the soil around these sample locations is not proposed for removal.
- 16SB015: Soil from this sample location only slightly exceeded the plant MCS for copper. The plant MCS for copper is based on a NOEC so impacts to plants at this level cannot be determined, but it would be greater than 253 mg/kg. For that reason, it is not likely the copper from this location is significantly impacting plants so the soil around this sample location is not proposed for removal."

Also, Footnote 2 in Table 2-4 will be changed to:

"2 - Plant preliminary remediation goal, not to be exceeded at any given sample point except as discussed in Section 2.2.3.3."

Comment 8:

Navy's Response to Ecological Media Cleanup Goals Specific Comment 2:

The revised Table 7 was not updated with the bird LOAEL TRV of 128 mg/kg-d for zinc as stated in the Navy response to comments. Using this LOAEL TRV and both food and soil ingestion rates shown above the PRG is calculated below. The NOAEL PRG was also calculated using these ingestion values. The Navy food ingestion rate of 0.133 g/g-d (0.0253 kg/d ÷ 0.1895 kg) appears to be derived from two average food intake values 0.160 & 0.123 listed in the Eco-SSL report (see Eco-SSL Attachment 4-1, Table 1) and a value of 0.117 that is considered not significantly different from the other Eco-SSL value and not used in the Eco-SSL calculations.

$$HQ = \text{Fir} \times (\text{soil} \times \text{Ps} + \text{B}) / \text{TRV} \quad \text{Set } HQ = 1 \text{ and solve for soil (B} = 0.067 \times \text{soil} + 86.8)$$

NOAEL PRG	961.4 mg/kg	TRV	<u>NOAEL</u> 66.1 mg/kg-d	<u>LOAEL</u> 128 mg/kg-d
LOAEL PRG	6218 mg/kg	Fir	0.214 g/g-d	0.142 g/g-d
Geo-Mean	2444 mg/kg	Ps	0.164	.064

The revised PRGs do not change EPA's prior evaluation that only location SS 100 exceeds the Geo-Mean of 2444 mg/kg for zinc (see prior General Comment 2 from EPA Comments 12/21/2012).

Response: The Table 7 that was included in the Navy's responses to EPA Comments dated December 21, 2012 on the Draft Final Technical Memorandum Ecological Media Cleanup Goals SWMU 16 Surface Soil (January 2011) had two worksheets. The first worksheet was a summary while the second worksheet presented the calculation of the PRG. The LOAEL TRV listed as 171 mg/kg on the first worksheet was incorrect, it should have been listed as 128 mg/kg (a revised Table 7 is attached). As can be seen in the second worksheet, the LOAEL TRV of 128 mg/kg-d was actually used to calculate the NOAEL PRG of 3,134 mg/kg and the LOAEL PRG of 6,694 mg/kg. These PRGs are the same ones presented in the Navy's responses to comments cited above. Because the MCS for zinc is 1,716 mg/kg, which is based on risks to plants, the MCS is not affected by the change in the zinc TRV.

The Navy does not agree that conservative exposure factors should be used to develop the NOAEL PRG because that is what is typically done in a screening level ERA, not at the cleanup step. That is why EPA's NOAEL PRG is about one-third of the Navy's NOAEL PRG, which was calculated using average exposure factors. Also, during the conference call on July 9, 2013, EPA indicated that in future ERAs, the Navy should consider eliminating the lower ingestion rate of 0.73 g/g-day) for the American woodcock from Stickel et al. (1965).because EPA only used the higher value of 0.77 g/g-day) from that reference for developing the Eco SSL. The Navy will consider making that change in future risk assessments. However, note that the change would only results in a very slight increase in risks.

Sample 16SS100 was collected in the railroad bed at the same location as 16SB-020. Because there is no ecological habitat in that area, that sample is not included in the excavation area.

No text changes are required to address this comment. However, the Draft Final Technical Memorandum Ecological Media Cleanup Goals for SWMU 16 Surface Soil will be updated with these changes and in accordance with the Navy's responses to EPA December 21, 2012 comments on that document.

Comment 9:

The "Interim Measures Work Plan" (May 2013) calculates an average lead concentration of 212 mg/kg shown in Table 2-4. Table 2-4 does not contain site sample data (16SS100 - 16SS113) reported in Table 2 for the January 2011 report noted above. The zinc data for sample 16SS100 - 16SS113 are also missing for Table 2-4. How are samples 16SS100 - 16SS113 incorporated into the analysis?

Response: The results from Samples 16SS100 – 16SS113 were only used to help develop the ecological PRGs. They were not used to delineate the contamination for the following reasons:

- 1) Samples 16SS100-16SS113 were collected from different depth intervals than the other surface soil samples because the goal was to collect samples from the biologically active zone (i.e., the root zone) and to collect samples with metals concentrations over a concentration gradient. Therefore, most of these samples were collected from a shallower depth than the other surface soil samples that were collected from 0-2 feet based on the depth of the root zone. Table 1 in the Draft Final Technical Memorandum Ecological Media Cleanup Goals SWMU 16 Surface Soil presents the depths of each sample.
- 2) Samples 16SS100-16SS113 were collected at locations of existing soil samples because the metals data from those existing samples were the basis of the sample locations. Therefore, metals results samples from 0 to 2 feet in depth are already available at those 14 sample locations.

That being said, based on the results from Samples 16SS100-16SS113, no additional locations would be proposed for removal other than what is already proposed in the IMWP for SWMU 16. Table 4-1 from the Soil Delineation Report was modified to include the metals results for Samples 16SS100-16SS113 and is attached to this response to comment document. As indicated in the table, 16SS101, which had the greatest concentrations of metals, is located in the railroad bed where 16SS020 was collected so it would not have been recommended for removal. The only other sample with concentrations that exceeded the PRGs was 16SS104, which was collected near 16SS016. However, the lead concentration in this sample (656 mg/kg), just slightly exceeded the plant PRG of 652 mg/kg. Similarly, the zinc concentration in this sample (1,950 mg/kg), just slightly exceeded the plant PRG of 1,716 mg/kg. Therefore, because of the slight exceedences of the PRGs at 16SS104 and because of the much lower concentration in 16SS016, this location would not be recommended for remediation.

See the Navy's response to Comment 7 for changes that will be made to the text to address this comment.

Comment 10:

Although Table 7 from the "Ecological Media Cleanup Goals" report lists a home range of 61.3 acres, the EPA "Wildlife Exposure Factors Handbook" lists the home range of an adult female with brood as 4.5 hectares (11.1 acres). EPA estimated the area for samples 16SS100 - 16SS113 to be approximately 650ft by 470ft, about 7 acres which is 63% of the 11.1 acre home range. Average lead concentration is 681 mg/kg (9532.4 mg/kg/ 14 samples) for this same area. Estimated lead exposure corrected for percent home range is 429 mg/kg (681 mg/kg x 0.63), which exceeds the Navy cleanup goal of 163 mg/kg and the default EPA LOAEL PRG of 192 mg/kg. Samples 16SB020 and 16SB117 are within this group of 16SS100 - 16SS113, so it is unclear why these two samples are not considered for remediation (in addition to 16SS100 - 16SS113). Also note several samples adjacent to 16SB117 were not analyzed.

Response: A blue outline was added to Figure 2-6 IMWP (attached to this response to comment document) to show the approximate area that encompasses Samples 16SS100 through 16SS113. The area around the 14 samples is approximately 94,000 ft², which is a little more than 2 acres. Therefore, the area only encompasses approximately 18 percent of the 11.1 acre home range for the female woodcock with brood. However, those 14 samples do not adequately represent the entire 2 acre area, because many samples within that area have metal concentrations lower than their respective PRGs. Also, within that area, the majority of the samples with the greatest metal concentrations will be removed. In the Revised Draft Soil Delineation Sampling Data Summary Report SWMU 16 - Cast High Explosive Fill/ Building 146 Incinerator (Tetra Tech, December 2012), the average concentrations of metals over the entire site were recalculated after removing the samples that would be excavated [Note that the recalculated average metals concentrations in Table 4-1 of that report are actually lower than the values listed in that table. That is because the replacement concentrations were inadvertently not included in the average calculation because they had superscripts and were thus not treated as numerical values in Excel.] A revised Table 4-1 is attached to this response to comment document. If the lead data from all 14 samples were included in Table 4-1, except for the data from 16SS100 which was collected in the railroad bed, the average lead concentrations would still be less than the PRG of 163 mg/kg.

The reason that 16SB020 was not included in the excavation area is discussed above in the Navy response to Comment 7. The Navy believes that EPA is referring to Sample 16SB177 not 16SS117 because sample 16SS117 was a reference sample with very low concentrations of metals. The reason that 16SB177 was not included in the excavation area is discussed above in the Navy response to Comment 7.

TABLE 2-4

METALS CONTAMINATION AREA SOIL SCREENING

SWMU 16
NSA CRANE
CRANE, INDIANA
PAGE 1 OF 3

SAMPLE LOCATION	SAMPLE DATE	PRE-REMEDIATION CONCENTRATIONS			
		ANTIMONY	COPPER	LEAD	ZINC
<i>SWMU 16 MCS</i>		<i>6.9⁽¹⁾ / 6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾ / 163⁽³⁾</i>	<i>1716</i>
16SB181	8/26/2011	6.9	450	1800	4000
16SB014	3/27/2003	27.2	231	1240	575
16SB188	8/26/2011	21	290	1100	3200
16SB186	8/26/2011	18	250	830	2600
16SB020	3/28/2003	7.7	65.4	765	132
16SB177	8/26/2011	7.3	150	760	2000
16SB184	8/26/2011	7.8	170	640	1400
16SB190	8/26/2011	15	190	600	2000
16SB179	8/26/2011	4.9	190	590	2200
16SB013	3/28/2003	13	122	405	1560
16SB157	8/25/2011	4.5	110	390	850
16SB180	8/26/2011	4.7	96	370	1100
16SB183	8/26/2011	4.9	95	360	1200
16SB010	3/27/2003	7.3	127	345	972
16SB009	3/27/2003	8.9	84	311	552
16SB178	8/26/2011	6	88	290	1500
16SB012	3/28/2003	3.6	62.6	258	603
16SB044	12/5/2003	3.3	72.9	240	967
16SB021	3/28/2003	14.8	391	211	2510
16SB015	3/27/2003	4.4	413	211	1150
16SB182	8/26/2011	3.2	63	210	630
16SB008	3/27/2003	2.9	52.5	195	271
16SB176	8/26/2011	5	52	170	550
16SB016	3/27/2003	6.6	66.9	154	563
16SB031	3/28/2003	1.6	42.5	150	633
16SB017	3/27/2003	1.4	39.5	140	438
16SB045	12/5/2003	3.1	32.2	127	455
16SB033	4/9/2003	1.1	33.5	123	193
16SB187	8/26/2011	2.6	41	120	390
16SB159	8/25/2011	1.8	52	120	380
16SB162	8/25/2011	1.7	38	120	170
16SB155	8/25/2011	1.2	36	120	470
16SB089	8/14/2004	5.2	43.5	112	683
16SB086	10/16/2004	3	38.5	110	368
16SB172	8/25/2011	2.9	38	110	330
16SB163	8/25/2011	0.51	34	94	210
16SB165	8/25/2011	0.27	35	94	190
16SB029	3/28/2003	2.8	35	85.7	401
16SB189	8/26/2011	1.6	27	85	320
16SB088	8/14/2004	1.9	36.8	82.6	280
16SB171	8/25/2011	1.6	41	79	340
16SB185	8/26/2011	1.5	27	78	390
16SB022	3/28/2003	2	28.3	69.9	197
16SB154	8/25/2011	1.7	24	69	200
16SB167	8/25/2011	0.61	28	55	140
16SB023	3/28/2003	1.3	23	43	102
16SB166	8/25/2011	0.49	33	42	280
16SB164	8/25/2011	0.63	24	39	160
16SB161	8/25/2011	0.7	100	38	1400

TABLE 2-4

METALS CONTAMINATION AREA SOIL SCREENING
SWMU 16
NSA CRANE
CRANE, INDIANA
PAGE 2 OF 3

SAMPLE LOCATION	SAMPLE DATE	PRE-REMEDIATION CONCENTRATIONS			
		ANTIMONY	COPPER	LEAD	ZINC
SWMU 16 MCS		6.9⁽¹⁾/6.3⁽²⁾	253	652⁽²⁾/163⁽³⁾	1716
16SB168	8/25/2011	0.53	17	36	97
16SB175	8/25/2011	0.42	24	32	84
16SB028	3/28/2003	0.66	19.8	31.8	144
16SB043	12/5/2003	1.2	19.2	31.5	144
16SB169	8/25/2011	0.58	17	31	91
16SB170	8/25/2011	0.69	17	29	130
16SB174	8/25/2011	1.1	25	28	85
16SB085	8/14/2004	0.96	19.2	26	135
16SB025	3/28/2003	1.5	19	24.9	97.2
16SB156	8/25/2011	0.57	16	24	76
16SB158	8/25/2011	0.33	11	23	42
16SB087	8/14/2004	0.94	14.6	21.4	88.6
16SB160	8/25/2011	0.081	21	19	130
16SB024	3/28/2003	2	15.3	18	174
16SB032	4/9/2003	0.79	15.9	17.2	40.6
16SB173	8/25/2011	0.34	13	17	59
16SB030	3/28/2003	1.2	18.8	16.9	68.2
16SB007	3/27/2003	0.29	13.8	16	48.1
16SB011	3/27/2003	3.4	16.9	15.2	55.9
16SB026	4/9/2003	0.19	13	14.8	49
16SB018	3/28/2003	0.59	12.8	9.8	47.8
16SB027	3/28/2003	0.27	5.1	8.3	24.3
16SB019	3/28/2003	0.29	6.9	8.1	17.6
16SB221	10/5/2012	--	--	--	--
16SB222	10/5/2012	--	--	--	--
16SB223	10/5/2012	--	--	--	--
16SB224	10/5/2012	--	--	--	--
16SB225	10/5/2012	--	--	--	--
16SB226	10/5/2012	--	--	--	--
16SB227	10/5/2012	--	--	--	--
16SB228	10/5/2012	--	--	--	--
16SB229	10/5/2012	--	--	--	--
16SB230	10/5/2012	--	--	--	--
16SB231	10/5/2012	--	--	--	--
16SB232	10/5/2012	--	--	--	--
16SB233	10/5/2012	--	--	--	--
16SB234	10/5/2012	--	--	--	--
16SB235	10/5/2012	--	--	--	--
Average Concentration		4	74	212	632

Notes:

- 1 - Basewide background concentration for soil.
- 2 - Plant preliminary remediation goal, not to be exceeded at any given sample point except as discussed in Section 2.2.3.3.
- 3 - Preliminary remediation goal for invertivorous birds - applied as an average lead concentration across the site.

Cells are shaded if the chemical concentration exceeds the greater of the basewide background concentration or the preliminary remediation goal.

Because the lead PRG for invertivorous birds is an average across the site, the lead concentrations are shaded if they exceed the PRG for plants.

MCS - media cleanup standard

PRG - preliminary remediation goal

-- - not analyzed

TABLE 2-4

METALS CONTAMINATION AREA SOIL SCREENING
 SWMU 16
 NSA CRANE
 CRANE, INDIANA
 PAGE 3 OF 3

SAMPLE LOCATION	SAMPLE DATE	PRE-REMEDICATION CONCENTRATIONS			
		ANTIMONY	COPPER	LEAD	ZINC
<i>SWMU 16 MCS</i>		<i>6.9⁽¹⁾ / 6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾ / 163⁽³⁾</i>	<i>1716</i>

TABLE 7

CALCULATION OF PRGs FOR INVERTIVOROUS BIRDS REPRESENTED BY THE AMERICAN WOODCOCK
SWMU 16 TOXICITY TESTING
NSA CRANE, INDIANA

Chemical	BAF ⁽¹⁾	Bird TRVs		PRGs		Geometric Mean (mg/kg)
		NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL PRG (mg/kg)	LOAEL PRG (mg/kg)	
Lead (Maximum BAF)	0.6	1.63	9.7	18.4	110	45
Lead (Average BAF)	0.17	1.63	9.7	52.3	311	128
Lead (Median BAF)	0.12	1.63	9.7	66.6	396	163
Zinc	0.067 × Cs + 86.8	66.1	128	3134	6694	4580

1 - See Table 6 for derivation of lead BAFs and Attachment 4 for derivation of zinc BAFs.

2 - The PRG for lead was calculated using the below equation. The PRG for zinc was calculated by reversing the equation and plugging in a soil concentration until the EEQ was 1.0.

$$PRG = \frac{BW \cdot TRV \cdot EEQ}{[(BAF \cdot If) + (Is)] \cdot AUF}$$

American Woodcock Exposure Inputs	Average Values	Units
Body Weight = BW	0.1895	kg
Food Ingestion Rate = If	0.0253	kg/day
Soil Ingestion Rate - Is	0.0016	kg/day
Home Range = HR	61.3	acres

AUF - Area Use Factor (assumed 100%) = Site Acreage/HR

BAF - Soil-to-earthworm bioaccumulation factor

BW - Body Weight

Cs - Chemical concentration in soil

EEQ - Ecological Effects Quotient (equals 1.0)

If - Food Ingestion Rate

Is - Incidental Surface Soil Ingestion Rate

LOAEL - Lowest Observed Adverse Effects Level

NOAEL - No Observed Adverse Effects Level

PRG - Preliminary Remediation Goal

TRV - Toxicity Reference Value (i.e., NOAEL or LOAEL)

TABLE 4-1

SOIL SAMPLES PROPOSED FOR REMOVAL
SWMU 16
NSA CRANE
CRANE, INDIANA
PAGE 1 OF 6

SAMPLE LOCATION	SAMPLE DATE	PRE-REMEDATION CONCENTRATIONS				POST-REMEDATION CONCENTRATIONS				Sample Removed or Rationale for Not Removing a Sample
		ANTIMONY	COPPER	LEAD	ZINC	ANTIMONY	COPPER	LEAD	ZINC	
SWMU 16 MCS		6.9⁽¹⁾/6.3⁽²⁾	253	652⁽²⁾/163⁽³⁾	1716	6.9⁽¹⁾/6.3⁽²⁾	253	652⁽²⁾/163⁽³⁾	1716	
Samples Collected for Toxicity Test Memorandum										
SS100	6/9/2010	42.3	1880	5480	5800	42.3	1880	5480	5800	Sample is located in railroad line. No ecological habitat.
FD ⁽⁴⁾	6/9/2010	44.2	2130	6390	5650	44.2	2130	6390	5650	
SS101	6/9/2010	4.2	132	452	576	6.9 ⁽⁴⁾	17.6 ⁽⁴⁾	27 ⁽⁴⁾	65.6 ⁽⁴⁾	To be removed - Co-located with 16SB014
SS102	6/9/2010	6.1	253	648	1270	6.1	253	648	1270	No Issue
SS103	6/9/2010	4.3	170	422	1510	4.3	170	422	1510	No Issue
SS104	6/9/2010	6.5	216	656	1950	6.5	216	656	1950	Sample co-located by 16SS016. Average concentrations between these samples much lower than the PRG.
SS105	6/9/2010	4.5	141	403	1360	4.5	141	403	1360	No Issue
SS106	6/10/2010	1.9	112	318	932	1.9	112	318	932	No Issue
SS107	6/9/2010	3.1	117	444	996	3.1	117	444	996	No Issue
SS108	6/10/2010	0.76	27	32.7	144	0.76	27	32.7	144	No Issue
SS109	6/10/2010	3	135	277	1130	3	135	277	1130	No Issue
SS110	6/10/2010	2.9	27.2	51.9	168	2.9	27.2	51.9	168	No Issue
SS111	6/10/2010	0.92	28.3	58.8	223	0.92	28.3	58.8	223	Co-located with 16SB186
SS112	6/10/2010	0.88	57.9	175	706	0.88	57.9	175	706	No Issue
SS113	6/11/2010	0.74	36.4	114	410	0.74	36.4	114	410	No Issue
Samples Used for Delineation of Contamination										
16SB181	8/26/2011	6.9	450	1800	4000	6.9 ⁽⁴⁾	17.6 ⁽⁴⁾	27 ⁽⁴⁾	65.6 ⁽⁴⁾	To Be Removed
16SB014	3/27/2003	27.2	231	1240	575	6.9 ⁽⁴⁾	17.6 ⁽⁴⁾	27 ⁽⁴⁾	65.6 ⁽⁴⁾	To Be Removed
16SB188	8/26/2011	21	290	1100	3200	6.9 ⁽⁴⁾	17.6 ⁽⁴⁾	27 ⁽⁴⁾	65.6 ⁽⁴⁾	To Be Removed
16SB186	8/26/2011	18	250	830	2600	6.9 ⁽⁴⁾	17.6 ⁽⁴⁾	27 ⁽⁴⁾	65.6 ⁽⁴⁾	To Be Removed
16SB020	3/28/2003	7.7	65.4	765	132	7.7	65.4	765	132	Sample is located in railroad line. No ecological habitat.
16SB177	8/26/2011	7.3	150	760	2000	7.3	150	760	2000	Slightly greater than plant PRG in wooded area. Removal would impact plants while trying to protect plants.
16SB184	8/26/2011	7.8	170	640	1400	6.9 ⁽⁴⁾	17.6 ⁽⁴⁾	27 ⁽⁴⁾	65.6 ⁽⁴⁾	To Be Removed
16SB190	8/26/2011	15	190	600	2000	6.9 ⁽⁴⁾	17.6 ⁽⁴⁾	27 ⁽⁴⁾	65.6 ⁽⁴⁾	To Be Removed

TABLE 4-1

SOIL SAMPLES PROPOSED FOR REMOVAL

SWMU 16
NSA CRANE
CRANE, INDIANA
PAGE 2 OF 6

SAMPLE LOCATION	SAMPLE DATE	PRE-REMEDATION CONCENTRATIONS				POST-REMEDATION CONCENTRATIONS				Sample Removed or Rationale for Not Removing a Sample
		ANTIMONY	COPPER	LEAD	ZINC	ANTIMONY	COPPER	LEAD	ZINC	
<i>SWMU 16 MCS</i>		<i>6.9⁽¹⁾/6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾/163⁽³⁾</i>	<i>1716</i>	<i>6.9⁽¹⁾/6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾/163⁽³⁾</i>	<i>1716</i>	
16SB179	8/26/2011	4.9	190	590	2200	4.9	190	590	2200	Slightly greater than plant PRG in wooded area. Removal would impact plants while trying to protect plants.
16SB013	3/28/2003	13	122	405	1560	6.9 ⁽⁴⁾	17.6 ⁽⁴⁾	27 ⁽⁴⁾	65.6 ⁽⁴⁾	To Be Removed
16SB157	8/25/2011	4.5	110	390	850	4.5	110	390	850	No Issue
16SB180	8/26/2011	4.7	96	370	1100	4.7	96	370	1100	No Issue
16SB183	8/26/2011	4.9	95	360	1200	4.9	95	360	1200	No Issue
16SB010	3/27/2003	7.3	127	345	972	7.3	127	345	972	Isolated detection above plant PRG and background.
16SB009	3/27/2003	8.9	84	311	552	8.9	84	311	552	Isolated detection above plant PRG and background.
16SB178	8/26/2011	6	88	290	1500	6	88	290	1500	No Issue
16SB012	3/28/2003	3.6	62.6	258	603	3.6	62.6	258	603	No Issue
16SB044	12/5/2003	3.3	72.9	240	967	3.3	72.9	240	967	No Issue
16SB021	3/28/2003	14.8	391	211	2510	6.9 ⁽⁴⁾	17.6 ⁽⁴⁾	27 ⁽⁴⁾	65.6 ⁽⁴⁾	To Be Removed
16SB015	3/27/2003	4.4	413	211	1150	4.4	413	211	1150	The PRG for copper is very conservative because no impacts to plants or invertebrates were observed at 253 mg/kg.
16SB182	8/26/2011	3.2	63	210	630	3.2	63	210	630	No Issue
16SB008	3/27/2003	2.9	52.5	195	271	2.9	52.5	195	271	No Issue
16SB176	8/26/2011	5	52	170	550	5	52	170	550	No Issue
16SB016	3/27/2003	6.6	66.9	154	563	6.6	66.9	154	563	No Issue
16SB031	3/28/2003	1.6	42.5	150	633	1.6	42.5	150	633	No Issue
16SB017	3/27/2003	1.4	39.5	140	438	1.4	39.5	140	438	No Issue
16SB045	12/5/2003	3.1	32.2	127	455	3.1	32.2	127	455	No Issue

TABLE 4-1

SOIL SAMPLES PROPOSED FOR REMOVAL

SWMU 16
NSA CRANE
CRANE, INDIANA
PAGE 3 OF 6

SAMPLE LOCATION	SAMPLE DATE	PRE-REMEDATION CONCENTRATIONS				POST-REMEDATION CONCENTRATIONS				Sample Removed or Rationale for Not Removing a Sample
		ANTIMONY	COPPER	LEAD	ZINC	ANTIMONY	COPPER	LEAD	ZINC	
	<i>SWMU 16 MCS</i>	<i>6.9⁽¹⁾/6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾/163⁽³⁾</i>	<i>1716</i>	<i>6.9⁽¹⁾/6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾/163⁽³⁾</i>	<i>1716</i>	
16SB033	4/9/2003	1.1	33.5	123	193	1.1	33.5	123	193	No Issue
16SB187	8/26/2011	2.6	41	120	390	2.6	41	120	390	No Issue
16SB159	8/25/2011	1.8	52	120	380	1.8	52	120	380	No Issue
16SB162	8/25/2011	1.7	38	120	170	1.7	38	120	170	No Issue
16SB155	8/25/2011	1.2	36	120	470	1.2	36	120	470	No Issue
16SB089	8/14/2004	5.2	43.5	112	683	5.2	43.5	112	683	No Issue
16SB086	10/16/2004	3	38.5	110	368	3	38.5	110	368	No Issue
16SB172	8/25/2011	2.9	38	110	330	2.9	38	110	330	No Issue
16SB163	8/25/2011	0.51	34	94	210	0.51	34	94	210	No Issue
16SB165	8/25/2011	0.27	35	94	190	0.27	35	94	190	No Issue
16SB029	3/28/2003	2.8	35	85.7	401	2.8	35	85.7	401	No Issue
16SB189	8/26/2011	1.6	27	85	320	1.6	27	85	320	No Issue
16SB088	8/14/2004	1.9	36.8	82.6	280	1.9	36.8	82.6	280	No Issue
16SB171	8/25/2011	1.6	41	79	340	1.6	41	79	340	No Issue
16SB185	8/26/2011	1.5	27	78	390	1.5	27	78	390	No Issue
16SB022	3/28/2003	2	28.3	69.9	197	2	28.3	69.9	197	No Issue
16SB154	8/25/2011	1.7	24	69	200	1.7	24	69	200	No Issue
16SB167	8/25/2011	0.61	28	55	140	0.61	28	55	140	No Issue
16SB023	3/28/2003	1.3	23	43	102	1.3	23	43	102	No Issue

TABLE 4-1

SOIL SAMPLES PROPOSED FOR REMOVAL
 SWMU 16
 NSA CRANE
 CRANE, INDIANA
 PAGE 4 OF 6

SAMPLE LOCATION	SAMPLE DATE	PRE-REMEDICATION CONCENTRATIONS				POST-REMEDICATION CONCENTRATIONS				Sample Removed or Rationale for Not Removing a Sample
		ANTIMONY	COPPER	LEAD	ZINC	ANTIMONY	COPPER	LEAD	ZINC	
	<i>SWMU 16 MCS</i>	<i>6.9⁽¹⁾/6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾/163⁽³⁾</i>	<i>1716</i>	<i>6.9⁽¹⁾/6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾/163⁽³⁾</i>	<i>1716</i>	
16SB166	8/25/2011	0.49	33	42	280	0.49	33	42	280	No Issue
16SB164	8/25/2011	0.63	24	39	160	0.63	24	39	160	No Issue
16SB161	8/25/2011	0.7	100	38	1400	0.7	100	38	1400	No Issue
16SB168	8/25/2011	0.53	17	36	97	0.53	17	36	97	No Issue
16SB175	8/25/2011	0.42	24	32	84	0.42	24	32	84	No Issue
16SB028	3/28/2003	0.66	19.8	31.8	144	0.66	19.8	31.8	144	No Issue
16SB043	12/5/2003	1.2	19.2	31.5	144	1.2	19.2	31.5	144	No Issue
16SB169	8/25/2011	0.58	17	31	91	0.58	17	31	91	No Issue
16SB170	8/25/2011	0.69	17	29	130	0.69	17	29	130	No Issue
16SB174	8/25/2011	1.1	25	28	85	1.1	25	28	85	No Issue
16SB085	8/14/2004	0.96	19.2	26	135	0.96	19.2	26	135	No Issue
16SB025	3/28/2003	1.5	19	24.9	97.2	1.5	19	24.9	97.2	No Issue
16SB156	8/25/2011	0.57	16	24	76	0.57	16	24	76	No Issue
16SB158	8/25/2011	0.33	11	23	42	0.33	11	23	42	No Issue
16SB087	8/14/2004	0.94	14.6	21.4	88.6	0.94	14.6	21.4	88.6	No Issue
16SB160	8/25/2011	0.081	21	19	130	0.081	21	19	130	No Issue
16SB024	3/28/2003	2	15.3	18	174	2	15.3	18	174	No Issue
16SB032	4/9/2003	0.79	15.9	17.2	40.6	0.79	15.9	17.2	40.6	No Issue
16SB173	8/25/2011	0.34	13	17	59	0.34	13	17	59	No Issue

TABLE 4-1

SOIL SAMPLES PROPOSED FOR REMOVAL
SWMU 16
NSA CRANE
CRANE, INDIANA
PAGE 5 OF 6

SAMPLE LOCATION	SAMPLE DATE	PRE-REMEDICATION CONCENTRATIONS				POST-REMEDICATION CONCENTRATIONS				Sample Removed or Rationale for Not Removing a Sample
		ANTIMONY	COPPER	LEAD	ZINC	ANTIMONY	COPPER	LEAD	ZINC	
<i>SWMU 16 MCS</i>		<i>6.9⁽¹⁾ / 6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾ / 163⁽³⁾</i>	<i>1716</i>	<i>6.9⁽¹⁾ / 6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾ / 163⁽³⁾</i>	<i>1716</i>	
16SB030	3/28/2003	1.2	18.8	16.9	68.2	1.2	18.8	16.9	68.2	No Issue
16SB007	3/27/2003	0.29	13.8	16	48.1	0.29	13.8	16	48.1	No Issue
16SB011	3/27/2003	3.4	16.9	15.2	55.9	3.4	16.9	15.2	55.9	No Issue
16SB026	4/9/2003	0.19	13	14.8	49	0.19	13	14.8	49	No Issue
16SB018	3/28/2003	0.59	12.8	9.8	47.8	0.59	12.8	9.8	47.8	No Issue
16SB027	3/28/2003	0.27	5.1	8.3	24.3	0.27	5.1	8.3	24.3	No Issue
16SB019	3/28/2003	0.29	6.9	8.1	17.6	0.29	6.9	8.1	17.6	No Issue
16SB221	10/5/2012	--	--	--	--	--	--	101	902	No Issue
16SB222	10/5/2012	--	--	--	--	--	--	76.9	991	No Issue
16SB223	10/5/2012	--	--	--	--	--	--	175	883	No Issue
16SB224	10/5/2012	--	--	--	--	--	--	50.9	504	No Issue
16SB225	10/5/2012	--	--	--	--	--	--	125	525	No Issue
16SB226	10/5/2012	--	--	--	--	--	--	101	288	No Issue
16SB227	10/5/2012	--	--	--	--	--	--	92.4	750	No Issue
16SB228	10/5/2012	--	--	--	--	--	--	244	671	No Issue
16SB229	10/5/2012	--	--	--	--	--	--	155	527	No Issue
16SB230	10/5/2012	--	--	--	--	--	--	358	1060	No Issue
16SB231	10/5/2012	--	--	--	--	--	--	28	155	No Issue
16SB232	10/5/2012	--	--	--	--	--	--	168	735	No Issue
16SB233	10/5/2012	--	--	--	--	--	--	114	741	No Issue
16SB234	10/5/2012	--	--	--	--	--	--	59.8	214	No Issue
16SB235	10/5/2012	--	--	--	--	--	--	339	930	No Issue
Average Concentration⁽⁵⁾		4	72	212	613	3	45	124	422	Only includes samples used for delineation of contamination ⁽⁵⁾
Average Concentration⁽⁶⁾		4	78	227	653	3	54	143	476	All samples except 16SS100 ⁽⁶⁾

Notes:

Cells are shaded in black if the chemical concentration exceeds the greater of the basewide background concentration or the preliminary remediation goal.

Because the lead PRG for invertovorous birds is an average across the site, the lead concentrations are shaded if they exceed the PRG for plants.

Cells shaded in yellow are sample locations that will be removed as part of the soil excavation.

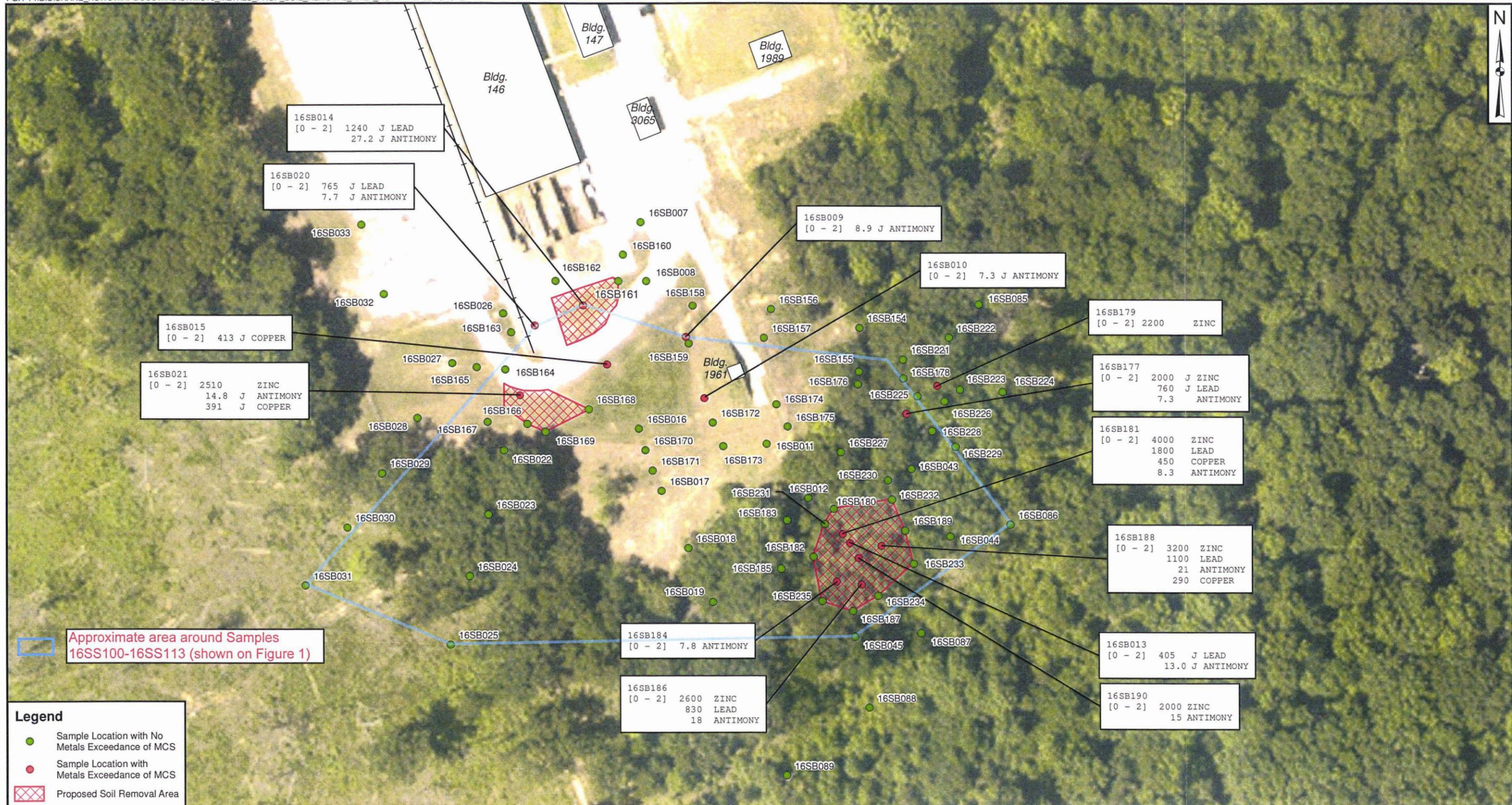
TABLE 4-1

SOIL SAMPLES PROPOSED FOR REMOVAL
 SWMU 16
 NSA CRANE
 CRANE, INDIANA
 PAGE 6 OF 6

SAMPLE LOCATION	SAMPLE DATE	PRE-REMEDICATION CONCENTRATIONS				POST-REMEDICATION CONCENTRATIONS				Sample Removed or Rationale for Not Removing a Sample
		ANTIMONY	COPPER	LEAD	ZINC	ANTIMONY	COPPER	LEAD	ZINC	
	<i>SWMU 16 MCS</i>	<i>6.9⁽¹⁾ / 6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾ / 163⁽³⁾</i>	<i>1716</i>	<i>6.9⁽¹⁾ / 6.3⁽²⁾</i>	<i>253</i>	<i>652⁽²⁾ / 163⁽³⁾</i>	<i>1716</i>	

- 1 - Basewide background concentration for soil
- 2 - Plant preliminary remediation goal, not to be exceeded at any given sample point
- 3 - Preliminary remediation goal for invertivorous birds - applied as an average lead concentration across the site.
- 4 - Concentration is based on backfill material assuming the 95% UTL for Soil Category 3 from the Crane Basewide Soil Investigation Report (Tetra Tech, 2001).
- 5 - Average concentration only includes the samples used for delineation of contamination
- 6 - Average concentration includes all of the samples except the results from 16SS100 because the sample was collected in the railroad bed where there is no viable ecological habitat.

PRG - Preliminary Remediation Goal
 MCS - Media Cleanup Standard
 Highlighted samples are proposed for removal
 -- - Not analyzed



Legend

- Sample Location with No Metals Exceedance of MCS
- Sample Location with Metals Exceedance of MCS
- ▨ Proposed Soil Removal Area
- +— Railroad
- Structure

MCS = Media Cleanup Standard
J = Estimated value.
Concentrations are in mg/kg.



DRAWN BY	DATE
C. TULLEY	01/30/12
CHECKED BY	DATE
J. DUCAR	02/13/13
REVISED BY	DATE
S. PAXTON	02/13/13
SCALE AS NOTED	



METALS CONTAMINATION AREA SOIL SAMPLING RESULTS AND PROPOSED SOILS REMOVAL AREAS
 SWMU 16 - CAST HIGH EXPLOSIVES FILL/B146 INCINERATOR
 NSA CRANE
 CRANE, INDIANA

CONTRACT NUMBER	CTO NUMBER
112G02127	F277
APPROVED BY	DATE
---	---
APPROVED BY	DATE
---	---
FIGURE NO.	REV
2-6	0