

## **APPENDIX G**

### **Human Health Risk Assessment Tables**

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**Table G-1. SRC and COPC Screening for Surface Soil (0-1 ft bgs ISM Samples) at C Block Quarry  
Unrestricted Land use Receptor: Resident (Adult and Child)**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	Background Criteria <sup>a</sup>	SRC? (yes/no)	SRC Justification	Screening FWCUG <sup>b</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> )		Risk Screening Level	Screening Level Source <sup>c</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
									RA	RC						
<i>Inorganic Chemicals</i>																
Aluminum	7429-90-5	6/ 6	1800	12000	8520	17700	No	Below background	52923	7380	7380	RC	No	Below background	CBLss-003M	11/4/2004
<b>Arsenic</b>	<b>7440-38-2</b>	<b>6/ 6</b>	<b>6.7</b>	<b>19</b>	<b>13.1</b>	<b>15.4</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>0.425</b>	<b>0.524</b>	<b>0.425</b>	<b>RA</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLss-001M</b>	<b>11/4/2004</b>
Barium	7440-39-3	6/ 6	23	84	62.2	88.4	No	Below background	8966	1413	1413	RC	No	Below background	CBLss-005M	11/4/2004
Beryllium	7440-41-7	6/ 6	0.22	0.71	0.56	0.88	No	Below background	--	--	16	RSL	No	Below background	CBLss-003M	11/4/2004
Calcium	7440-70-2	6/ 6	350	1300	825	15800	No	Essential Nutrient	--	--	1000000	RDA	No	Essential Nutrient	CBLss-001M	11/4/2004
<b>Chromium (total)<sup>d</sup></b>	<b>7440-47-3</b>	<b>8/ 8</b>	<b>17</b>	<b>1000</b>	<b>412</b>	<b>17.4</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>90.4</b>	<b>19.9</b>	<b>19.9</b>	<b>RC</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLss-005M</b>	<b>8/10/2012</b>
Chromium (hexavalent)	18540-29-9	3/ 7	0.32	5.4	1.48	--	Yes	Exceeds background	90.4	19.9	19.9	RC	No	Below risk screening criteria	CBLss-003M	11/4/2004
Cobalt	7440-48-4	6/ 6	1.7	9.6	6.77	10.4	No	Below background	803	131	131	RC	No	Below background	CBLss-001M	11/4/2004
Copper	7440-50-8	6/ 6	15	78	32	17.7	Yes	Exceeds background	2714	311	311	RC	No	Below risk screening criteria	CBLss-005M	11/4/2004
Iron	7439-89-6	6/ 6	9900	22000	18500	23100	No	Essential Nutrient	19010	2313	180000	RDA	No	Essential Nutrient	CBLss-005M	11/4/2004
Lead	7439-92-1	6/ 6	17	43	24.5	26.1	Yes	Exceeds background	--	--	400	RSL	No	Below risk screening criteria	CBLss-002M	11/4/2004
Magnesium	7439-95-4	6/ 6	270	2100	1480	3030	No	Essential Nutrient	--	--	1000000	RDA	No	Essential Nutrient	CBLss-001M	11/4/2004
Manganese	7439-96-5	6/ 6	140	950	597	1450	No	Below background	1482	293	293	RC	No	Below background	CBLss-001M	11/4/2004
Mercury	7439-97-6	3/ 6	0.05	0.07	0.0425	0.036	Yes	Exceeds background	16.5	2.27	2.27	RC	No	Below risk screening criteria	CBLss-006M	11/4/2004
Nickel	7440-02-0	6/ 6	13	16	14.7	21.1	No	Below background	1346	155	155	RC	No	Below background	CBLss-001M	11/4/2004
Potassium	7440-09-7	6/ 6	360	960	773	927	No	Essential Nutrient	--	--	1000000	RDA	No	Essential Nutrient	CBLss-002M	11/4/2004
Selenium	7782-49-2	5/ 6	0.48	0.85	0.733	1.4	No	Below background	--	--	39	RSL	No	Below background	CBLss-003M	11/4/2004
Sodium	7440-23-5	6/ 6	130	310	255	123	No	Essential Nutrient	--	--	1000000	RDA	No	Essential Nutrient	CBLss-003M	11/4/2004
Thallium	7440-28-0	2/ 6	0.19	0.36	0.296	0	Yes	Exceeds background	4.76	0.612	0.612	RC	No	Below risk screening criteria	CBLss-002M	11/4/2004
Vanadium	7440-62-2	6/ 6	5.3	24	18.1	31.1	No	Below background	156	44.9	44.9	RC	No	Below background	CBLss-005M	11/4/2004
Zinc	7440-66-6	6/ 6	34	59	50.8	61.8	No	Below background	19659	2321	2321	RC	No	Below background	CBLss-005M	11/4/2004
<i>Explosives</i>																
<b>2,4,6-Trinitrotoluene</b>	<b>118-96-7</b>	<b>3/ 6</b>	<b>0.09</b>	<b>22</b>	<b>3.73</b>	<b>--</b>	<b>Yes</b>	<b>Detected organic</b>	<b>21.1</b>	<b>3.65</b>	<b>3.65</b>	<b>RC</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLss-004M</b>	<b>11/4/2004</b>
2-Amino-4,6-Dinitrotoluene	35572-78-2	2/ 6	0.19	0.54	0.188	--	Yes	Detected organic	12.8	1.54	1.54	RC	No	Below risk screening criteria	CBLss-004M	11/4/2004
4-Amino-2,6-Dinitrotoluene	19406-51-0	2/ 6	0.12	0.64	0.225	--	Yes	Detected organic	12.8	1.54	1.54	RC	No	Below risk screening criteria	CBLss-004M	11/4/2004
Nitrocellulose	9004-70-0	1/ 1	1.3	1.3	1.3	--	Yes	Detected organic	--	--	19000000	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004

**Table G-1. SRC and COPC Screening for Surface Soil (0-1 ft bgs ISM Samples) at C Block Quarry  
Unrestricted Land use Receptor: Resident (Adult and Child) (continued)**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	Background Criteria <sup>a</sup>	SRC? (yes/no)	SRC Justification	Screening FWCUG <sup>b</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> )		Risk Screening Level	Screening Level Source <sup>c</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
									RA	RC						
<i>Semi-volatile Organic Compounds</i>																
Benz(a)anthracene	56-55-3	1/ 1	0.017	0.017	0.017	--	Yes	Detected organic	0.221	0.65	0.221	RA	No	Below risk screening criteria	CBLss-005M	11/4/2004
Benzo(b)fluoranthene	205-99-2	1/ 1	0.036	0.036	0.036	--	Yes	Detected organic	0.221	0.65	0.221	RA	No	Below risk screening criteria	CBLss-005M	11/4/2004
Benzo(g,h,i)perylenee	191-24-2	1/ 1	0.019	0.019	0.019	--	Yes	Detected organic	--	--	180	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Benzo(k)fluoranthene	207-08-9	1/ 1	0.019	0.019	0.019	--	Yes	Detected organic	2.21	6.5	2.21	RA	No	Below risk screening criteria	CBLss-005M	11/4/2004
Bis(2-ethylhexyl)phthalate	117-81-7	1/ 1	0.054	0.054	0.054	--	Yes	Detected organic	--	--	39	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Chrysene	218-01-9	1/ 1	0.028	0.028	0.028	--	Yes	Detected organic	22.1	65	22.1	RA	No	Below risk screening criteria	CBLss-005M	11/4/2004
Fluoranthene	206-44-0	1/ 1	0.036	0.036	0.036	--	Yes	Detected organic	276	163	163	RC	No	Below risk screening criteria	CBLss-005M	11/4/2004
Phenanthrene <sup>e</sup>	85-01-8	1/ 1	0.017	0.017	0.017	--	Yes	Detected organic	--	--	180	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Pyrene	129-00-0	1/ 1	0.027	0.027	0.027	--	Yes	Detected organic	207	122	122	RC	No	Below risk screening criteria	CBLss-005M	11/4/2004

<sup>a</sup>Background criteria for soil 0-1 ft bgs from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>b</sup>Facility-Wide Cleanup Goals (FWCUG) for Resident Adult (RA) and Resident Child (RC) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>c</sup>Screening Level Source:

RDA = Concentration associated with recommended daily allowance of essential nutrient

RA = FWCUG for Resident Adult

RC = FWCUG for Resident Child

RSL = USEPA Residential Regional Screening Level

<sup>d</sup>FWCUG is the most conservative (smallest) of the FWCUGs for hexavalent and trivalent chromium.

<sup>e</sup>No reference dose or cancer potency factors are available for these PAHs, therefore, the RSL value for pyrene was used (NDEP 2006).

bgs = Below ground surface

CAS = Chemical Abstract Service

COPC = Chemical of Potential Concern

HQ = Hazard Quotient

ISM = Incremental Sampling Method

PAH = Polycyclic Aromatic Hydrocarbon

SRC = Site-related Contaminant

USEPA = United States Environmental Protection Agency

--=No value available

**Bold** = Chemical is a COPC

**Table G-2. SRC and COPC Screening for Subsurface Soil (1-7 ft bgs Discrete Samples) at C Block Quarry  
Unrestricted Land Use Receptor: Resident (Adult and Child)**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result <sup>a</sup>	Background Criteria <sup>b</sup>	SRC? (yes/no)	SRC Justification	Screening FWCUG <sup>c</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> )		Risk Screening Level	Screening Level Source <sup>d</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
									RA	RC						
<i>Inorganic Chemicals</i>																
Aluminum	7429-90-5	7/ 7	8470	11800	10200	19500	No	Below background	52923	7380	7380	RC	No	Below background	CBLsb-007	3/22/2010
Antimony	7440-36-0	6/ 7	0.08	0.15	0.133	0.96	No	Below background	13.6	2.82	2.82	RC	No	Below background	CBLsb-010	3/22/2010
Arsenic	7440-38-2	7/ 7	11.9	14.7	13.5	19.8	No	Below background	0.425	0.524	0.425	RA	No	Below background	CBLsb-007	3/22/2010
Barium	7440-39-3	7/ 7	56.6	74.7	68.2	124	No	Below background	8966	1413	1413	RC	No	Below background	CBLsb-011	3/23/2010
Beryllium	7440-41-7	7/ 7	0.45	0.53	0.489	0.88	No	Below background	--	--	16	RSL	No	Below background	CBLsb-007	3/22/2010
Cadmium	7440-43-9	7/ 7	0.044	0.11	0.0707	0	Yes	Exceeds background	22.3	6.41	6.41	RC	No	Below risk screening criteria	CBLsb-011	3/23/2010
Calcium	7440-70-2	7/ 7	260	1760	710	35500	No	Essential Nutrient	--	--	1000000	RDA	No	Essential Nutrient	CBLsb-011	3/23/2010
<b>Chromium<sup>e</sup></b>	<b>7440-47-3</b>	<b>9/ 9</b>	<b>12.1</b>	<b>930</b>	<b>293</b>	<b>27.2</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>90.4</b>	<b>19.9</b>	<b>19.9</b>	<b>RC</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLsb-025</b>	<b>8/10/2012</b>
<b>Chromium (hexavalent)</b>	<b>18540-29-9</b>	<b>2/ 2</b>	<b>6.4</b>	<b>39</b>	<b>22.7</b>	<b>--</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>90.4</b>	<b>19.9</b>	<b>19.9</b>	<b>RC</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLsb-025</b>	<b>8/10/2012</b>
Cobalt	7440-48-4	7/ 7	8.2	9.9	9.14	23.2	No	Below background	803	131	131	RC	No	Below background	CBLsb-011	3/23/2010
Copper	7440-50-8	7/ 7	14	218	45.6	32.3	Yes	Exceeds background	2714	311	311	RC	No	Below risk screening criteria	CBLsb-010	3/22/2010
Iron	7439-89-6	7/ 7	20500	26400	23500	35200	No	Essential Nutrient	19010	2313	180000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Lead	7439-92-1	7/ 7	12.5	25.6	15.6	19.1	Yes	Exceeds background	--	--	400	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Magnesium	7439-95-4	7/ 7	1660	2480	2050	8790	No	Essential Nutrient	--	--	1000000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Manganese	7439-96-5	7/ 7	476	896	621	3030	No	Below background	1482	293	293	RC	No	Below background	CBLsb-011	3/23/2010
Mercury	7439-97-6	7/ 7	0.022	0.067	0.0451	0.044	Yes	Exceeds background	16.5	2.27	2.27	RC	No	Below risk screening criteria	CBLsb-012	3/22/2010
Nickel	7440-02-0	7/ 7	15.6	17.4	16.5	60.7	No	Below background	1346	155	155	RC	No	Below background	CBLsb-007	3/22/2010
Potassium	7440-09-7	7/ 7	539	795	668	3350	No	Essential Nutrient	--	--	1000000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Selenium	7782-49-2	7/ 7	1	1.3	1.17	1.5	No	Below background	--	--	39	RSL	No	Below background	CBLsb-011	3/23/2010
Sodium	7440-23-5	7/ 7	27.5	31.7	29.2	145	No	Essential Nutrient	--	--	1000000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Thallium	7440-28-0	7/ 7	0.13	0.16	0.146	0.91	No	Below background	4.76	0.612	0.612	RC	No	Below background	CBLsb-007	3/22/2010
Vanadium	7440-62-2	6/ 7	16	21.4	16.6	37.6	No	Below background	156	44.9	44.9	RC	No	Below background	CBLsb-007	3/22/2010
Zinc	7440-66-6	7/ 7	45	57.6	49.9	93.3	No	Below background	19659	2321	2321	RC	No	Below background	CBLsb-010	3/22/2010
<i>Explosives</i>																
Dinitrotoluene	35572-78-2	1/ 7	0.073	0.073	0.116	--	Yes	Detected organic	12.8	1.54	1.54	RC	No	Below risk screening criteria	CBLsb-010	3/22/2010
Dinitrotoluene	19406-51-0	1/ 7	0.051	0.051	0.113	--	Yes	Detected organic	12.8	1.54	1.54	RC	No	Below risk screening criteria	CBLsb-010	3/22/2010
<i>Semi-volatile Organic Compounds</i>																
Anthracene	120-12-7	1/ 2	0.021	0.021	0.026	--	Yes	Detected organic	--	--	1800	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Benz(a)anthracene	56-55-3	1/ 2	0.048	0.048	0.0395	--	Yes	Detected organic	0.221	0.65	0.221	RA	No	Below risk screening criteria	CBLsb-011	3/23/2010
<b>Benzo(a)pyrene</b>	<b>50-32-8</b>	<b>1/ 2</b>	<b>0.049</b>	<b>0.049</b>	<b>0.04</b>	<b>--</b>	<b>Yes</b>	<b>Detected organic</b>	<b>0.022</b>	<b>0.065</b>	<b>0.022</b>	<b>RA</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLsb-011</b>	<b>3/23/2010</b>
Benzo(b)fluoranthene	205-99-2	2/ 2	0.01	0.062	0.036	--	Yes	Detected organic	0.221	0.65	0.221	RA	No	Below risk screening criteria	CBLsb-011	3/23/2010
Benzo(ghi)perylene <sup>f</sup>	191-24-2	1/ 2	0.037	0.037	0.034	--	Yes	Detected organic	--	--	180	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Benzo(k)fluoranthene	207-08-9	1/ 2	0.028	0.028	0.0295	--	Yes	Detected organic	2.21	6.5	2.21	RA	No	Below risk screening criteria	CBLsb-011	3/23/2010

**Table G-2. SRC and COPC Screening for Subsurface Soil (1-7 ft bgs Discrete Samples) at C Block Quarry  
Unrestricted Land Use Receptor: Resident (Adult and Child) (continued)**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result <sup>a</sup>	Background Criteria <sup>b</sup>	SRC? (yes/no)	SRC Justification	Screening FWCUG <sup>c</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> )		Risk Screening Level	Screening Level Source <sup>d</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
									RA	RC						
Chrysene	218-01-9	1/ 2	0.05	0.05	0.0405	--	Yes	Detected organic	22.1	65	22.1	RA	No	Below risk screening criteria	CBLsb-011	3/23/2010
Fluoranthene	206-44-0	2/ 2	0.012	0.13	0.071	--	Yes	Detected organic	276	163	163	RC	No	Below risk screening criteria	CBLsb-011	3/23/2010
Fluorene	86-73-7	1/ 2	0.0094	0.0094	0.0202	--	Yes	Detected organic	737	243	243	RC	No	Below risk screening criteria	CBLsb-011	3/23/2010
Indeno(1,2,3-cd)pyrene	193-39-5	1/ 2	0.03	0.03	0.0305	--	Yes	Detected organic	0.221	0.65	0.221	RA	No	Below risk screening criteria	CBLsb-011	3/23/2010
Phenanthrene <sup>f</sup>	85-01-8	1/ 2	0.087	0.087	0.059	--	Yes	Detected organic	--	--	180	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Pyrene	129-00-0	2/ 2	0.01	0.097	0.0535	--	Yes	Detected organic	207	122	122	RC	No	Below risk screening criteria	CBLsb-011	3/23/2010

<sup>a</sup>Bedrock is present at C Block Quarry at 7 ft bgs. Therefore, discrete soil data from 1-7 ft bgs were used to evaluate subsurface soil for the Resident (Adult and Child).

<sup>b</sup>Background criteria for soil >1 ft bgs from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>Facility-Wide Cleanup Goals (FWCUGs) for Resident Adult (RA) and Resident Child (RC) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>d</sup>Screening Level Source:

RDA = Concentration associated with recommended daily allowance of essential nutrient

RA = FWCUG for Resident Adult

RC = FWCUG for Resident Child

RSL = USEPA Residential Regional Screening Level

<sup>e</sup>FWCUG is the most conservative (smallest) of the FWCUGs for hexavalent and trivalent chromium.

<sup>f</sup>No reference dose or cancer potency factors are available for these PAHs, therefore, the RSL value for pyrene was used (NDEP 2006).

bgs = Below ground surface

CAS = Chemical Abstract Service

COPC = Chemical of Potential Concern

HQ = Hazard Quotient

PAH = Polycyclic Aromatic Hydrocarbon

SRC = Site-related Contaminant

USEPA = United States Environmental Protection Agency

--=No value available

**Bold** = Chemical is a COPC



**Table G-3. SRC and COPC Screening for Surface Soil (0-1 ft bgs ISM Samples) at C Block Quarry  
Commercial/Industrial Land Use: Industrial Receptor**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	Background Criteria <sup>a</sup>	SRC? (yes/no)	SRC Justification	Screening RSL <sup>b</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> ) Industrial	Risk Screening Level	Screening Level Source <sup>c</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
<i>Inorganic Chemicals</i>															
Aluminum	7429-90-5	6/ 6	1800	12000	8520	17700	No	Below background	110000	110000	RSL	No	Below background	CBLss-003M	11/4/2004
<b>Arsenic</b>	<b>7440-38-2</b>	<b>6/ 6</b>	<b>6.7</b>	<b>19</b>	<b>13.1</b>	<b>15.4</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>3</b>	<b>3</b>	<b>RSL</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLss-001M</b>	<b>11/4/2004</b>
Barium	7440-39-3	6/ 6	23	84	62.2	88.4	No	Below background	22000	22000	RSL	No	Below background	CBLss-005M	11/4/2004
Beryllium	7440-41-7	6/ 6	0.22	0.71	0.56	0.88	No	Below background	230	230	RSL	No	Below background	CBLss-003M	11/4/2004
Calcium	7440-70-2	6/ 6	350	1300	825	15800	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLss-001M	11/4/2004
<b>Chromium (total)<sup>d</sup></b>	<b>7440-47-3</b>	<b>8/ 8</b>	<b>17</b>	<b>1000</b>	<b>412</b>	<b>17.4</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>6.3</b>	<b>6.3</b>	<b>RSL</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLss-005M</b>	<b>8/10/2012</b>
Chromium (hexavalent)	18540-29-9	3/ 7	0.32	5.4	1.48	--	Yes	Exceeds background	6.3	6.3	RSL	No	Below risk screening criteria	CBLss-003M	11/4/2004
Cobalt	7440-48-4	6/ 6	1.7	9.6	6.77	10.4	No	Below background	35	35	RSL	No	Below background	CBLss-001M	11/4/2004
Copper	7440-50-8	6/ 6	15	78	32	17.7	Yes	Exceeds background	4700	4700	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Iron	7439-89-6	6/ 6	9900	22000	18500	23100	No	Essential Nutrient	82000	180000	RDA	No	Essential Nutrient	CBLss-005M	11/4/2004
Lead	7439-92-1	6/ 6	17	43	24.5	26.1	Yes	Exceeds background	800	800	RSL	No	Below risk screening criteria	CBLss-002M	11/4/2004
Magnesium	7439-95-4	6/ 6	270	2100	1480	3030	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLss-001M	11/4/2004
Manganese	7439-96-5	6/ 6	140	950	597	1450	No	Below background	2600	2600	RSL	No	Below background	CBLss-001M	11/4/2004
Mercury	7439-97-6	3/ 6	0.05	0.07	0.0425	0.036	Yes	Exceeds background	4	4	RSL	No	Below risk screening criteria	CBLss-006M	11/4/2004
Nickel	7440-02-0	6/ 6	13	16	14.7	21.1	No	Below background	2200	2200	RSL	No	Below background	CBLss-001M	11/4/2004
Potassium	7440-09-7	6/ 6	360	960	773	927	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLss-002M	11/4/2004
Selenium	7782-49-2	5/ 6	0.48	0.85	0.733	1.4	No	Below background	580	580	RSL	No	Below background	CBLss-003M	11/4/2004
Sodium	7440-23-5	6/ 6	130	310	255	123	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLss-003M	11/4/2004
Thallium	7440-28-0	2/ 6	0.19	0.36	0.296	0	Yes	Exceeds background	1.2	1.2	RSL	No	Below risk screening criteria	CBLss-002M	11/4/2004
Vanadium	7440-62-2	6/ 6	5.3	24	18.1	31.1	No	Below background	580	580	RSL	No	Below background	CBLss-005M	11/4/2004
Zinc	7440-66-6	6/ 6	34	59	50.8	61.8	No	Below background	35000	35000	RSL	No	Below background	CBLss-005M	11/4/2004
<i>Explosives</i>															
2,4,6-Trinitrotoluene	118-96-7	3/ 6	0.09	22	3.73	--	Yes	Detected organic	51	51	RSL	No	Below risk screening criteria	CBLss-004M	11/4/2004
2-Amino-4,6-Dinitrotoluene	35572-78-2	2/ 6	0.19	0.54	0.188	--	Yes	Detected organic	230	230	RSL	No	Below risk screening criteria	CBLss-004M	11/4/2004
4-Amino-2,6-Dinitrotoluene	19406-51-0	2/ 6	0.12	0.64	0.225	--	Yes	Detected organic	230	230	RSL	No	Below risk screening criteria	CBLss-004M	11/4/2004
Nitrocellulose	9004-70-0	1/ 1	1.3	1.3	1.3	--	Yes	Detected organic	250000000	250000000	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004

**Table G-3. SRC and COPC Screening for Surface Soil (0-1 ft bgs ISM Samples) at C Block Quarry  
Commercial/Industrial Land Use: Industrial Receptor (continued)**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	Background Criteria <sup>a</sup>	SRC? (yes/no)	SRC Justification	Screening RSL <sup>b</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> ) Industrial	Risk Screening Level	Screening Level Source <sup>c</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
<i>Semi-volatile Organic Compounds</i>															
Benz(a)anthracene	56-55-3	1/ 1	0.017	0.017	0.017	--	Yes	Detected organic	2.9	2.9	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Benzo(b)fluoranthene	205-99-2	1/ 1	0.036	0.036	0.036	--	Yes	Detected organic	2.9	2.9	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Benzo(g,h,i)perylene <sup>e</sup>	191-24-2	1/ 1	0.019	0.019	0.019	--	Yes	Detected organic	--	2300	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Benzo(k)fluoranthene	207-08-9	1/ 1	0.019	0.019	0.019	--	Yes	Detected organic	29	29	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Bis(2-ethylhexyl)phthalate	117-81-7	1/ 1	0.054	0.054	0.054	--	Yes	Detected organic	160	160	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Chrysene	218-01-9	1/ 1	0.028	0.028	0.028	--	Yes	Detected organic	290	290	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Fluoranthene	206-44-0	1/ 1	0.036	0.036	0.036	--	Yes	Detected organic	3000	3000	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Phenanthrene <sup>c</sup>	85-01-8	1/ 1	0.017	0.017	0.017	--	Yes	Detected organic	--	2300	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Pyrene	129-00-0	1/ 1	0.027	0.027	0.027	--	Yes	Detected organic	2300	2300	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004

<sup>a</sup>Background criteria for soil 0-1 ft bgs from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>b</sup>USEPA Industrial Regional Screening Level from table dated June 2015.

<sup>c</sup>Screening Level Source:

RDA = Concentration associated with recommended daily allowance of essential nutrient  
RSL = USEPA Industrial Regional Screening Level

<sup>d</sup>RSL is the most conservative (smallest) of the FWCUGs for hexavalent and trivalent chromium.

<sup>e</sup>No reference dose or cancer potency factors are available for these PAHs, therefore, the RSL value for pyrene was used (NDEP 2006).

bgs = Below ground surface

CAS = Chemical Abstract Service

COPC = Chemical of Potential Concern

HQ = Hazard Quotient

ISM = Incremental Sampling Method

PAH = Polycyclic Aromatic Hydrocarbon

SRC = Site-related Contaminant

USEPA = United States Environmental Protection Agency

--=No value available

**Bold** = Chemical is a COPC

**Table G-4. SRC and COPC Screening for Subsurface Soil (1-7 ft bgs Discrete Samples) at C Block Quarry  
Commercial/Industrial Land Use: Industrial Receptor**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result <sup>a</sup>	Background Criteria <sup>b</sup>	SRC? (yes/no)	SRC Justification	Screening RSL <sup>b</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> ) Industrial	Risk Screening Level	Screening Level Source <sup>d</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
Aluminum	7429-90-5	7/ 7	8470	11800	10200	19500	No	Below background	110000	110000	RSL	No	Below background	CBLsb-007	3/22/2010
Antimony	7440-36-0	6/ 7	0.08	0.15	0.133	0.96	No	Below background	47	47	RSL	No	Below background	CBLsb-010	3/22/2010
Arsenic	7440-38-2	7/ 7	11.9	14.7	13.5	19.8	No	Below background	3	3	RSL	No	Below background	CBLsb-007	3/22/2010
Barium	7440-39-3	7/ 7	56.6	74.7	68.2	124	No	Below background	22000	22000	RSL	No	Below background	CBLsb-011	3/23/2010
Beryllium	7440-41-7	7/ 7	0.45	0.53	0.489	0.88	No	Below background	230	230	RSL	No	Below background	CBLsb-007	3/22/2010
Cadmium	7440-43-9	7/ 7	0.044	0.11	0.0707	0	Yes	Exceeds background	98	98	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
<b>Chromium<sup>e</sup></b>	<b>7440-47-3</b>	<b>9/ 9</b>	<b>12.1</b>	<b>930</b>	<b>293</b>	<b>27.2</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>6.3</b>	<b>6.3</b>	<b>RSL</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLsb-025</b>	<b>8/10/2012</b>
<b>Chromium (hexavalent)</b>	<b>18540-29-9</b>	<b>2/ 2</b>	<b>6.4</b>	<b>39</b>	<b>22.7</b>	<b>--</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>6.3</b>	<b>6.3</b>	<b>RSL</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLsb-025</b>	<b>8/10/2012</b>
Cobalt	7440-48-4	7/ 7	8.2	9.9	9.14	23.2	No	Below background	35	35	RSL	No	Below background	CBLsb-011	3/23/2010
Copper	7440-50-8	7/ 7	14	218	45.6	32.3	Yes	Exceeds background	4700	4700	RSL	No	Below risk screening criteria	CBLsb-010	3/22/2010
Lead	7439-92-1	7/ 7	12.5	25.6	15.6	19.1	Yes	Exceeds background	800	800	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Manganese	7439-96-5	7/ 7	476	896	621	3030	No	Below background	2600	2600	RSL	No	Below background	CBLsb-011	3/23/2010
Mercury	7439-97-6	7/ 7	0.022	0.067	0.0451	0.044	Yes	Exceeds background	4	4	RSL	No	Below risk screening criteria	CBLsb-012	3/22/2010
Nickel	7440-02-0	7/ 7	15.6	17.4	16.5	60.7	No	Below background	2200	2200	RSL	No	Below background	CBLsb-007	3/22/2010
Selenium	7782-49-2	7/ 7	1	1.3	1.17	1.5	No	Below background	580	580	RSL	No	Below background	CBLsb-011	3/23/2010
Thallium	7440-28-0	7/ 7	0.13	0.16	0.146	0.91	No	Below background	1.2	1.2	RSL	No	Below background	CBLsb-007	3/22/2010
Vanadium	7440-62-2	6/ 7	16	21.4	16.6	37.6	No	Below background	580	580	RSL	No	Below background	CBLsb-007	3/22/2010
Zinc	7440-66-6	7/ 7	45	57.6	49.9	93.3	No	Below background	35000	35000	RSL	No	Below background	CBLsb-010	3/22/2010
Dinitrotoluene	35572-78-2	1/ 7	0.073	0.073	0.116	--	Yes	Detected organic	230	230	RSL	No	Below risk screening criteria	CBLsb-010	3/22/2010
Dinitrotoluene	19406-51-0	1/ 7	0.051	0.051	0.113	--	Yes	Detected organic	230	230	RSL	No	Below risk screening criteria	CBLsb-010	3/22/2010
Anthracene	120-12-7	1/ 2	0.021	0.021	0.026	--	Yes	Detected organic	23000	23000	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Benzo(a)anthracene	56-55-3	1/ 2	0.048	0.048	0.0395	--	Yes	Detected organic	2.9	2.9	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Benzo(a)pyrene	50-32-8	1/ 2	0.049	0.049	0.04	--	Yes	Detected organic	0.29	0.29	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Benzo(b)fluoranthene	205-99-2	2/ 2	0.01	0.062	0.036	--	Yes	Detected organic	2.9	2.9	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Benzo(ghi)perylene <sup>f</sup>	191-24-2	1/ 2	0.037	0.037	0.034	--	Yes	Detected organic	--	2300	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Benzo(k)fluoranthene	207-08-9	1/ 2	0.028	0.028	0.0295	--	Yes	Detected organic	29	29	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010

**Table G-4. SRC and COPC Screening for Subsurface Soil (1-7 ft bgs Discrete Samples) at C Block Quarry  
Commercial/Industrial Land Use: Industrial Receptor (continued)**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result <sup>a</sup>	Background Criteria <sup>b</sup>	SRC? (yes/no)	SRC Justification		Risk Screening Level	Screening Level Source <sup>d</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
Chrysene	218-01-9	1/ 2	0.05	0.05	0.0405	--	Yes	Detected organic	290	290	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Fluoranthene	206-44-0	2/ 2	0.012	0.13	0.071	--	Yes	Detected organic	3000	3000	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Fluorene	86-73-7	1/ 2	0.0094	0.0094	0.0202	--	Yes	Detected organic	3000	3000	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Indeno(1,2,3-cd)pyrene	193-39-5	1/ 2	0.03	0.03	0.0305	--	Yes	Detected organic	2.9	2.9	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Phenanthrene <sup>f</sup>	85-01-8	1/ 2	0.087	0.087	0.059	--	Yes	Detected organic	--	2300	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Pyrene	129-00-0	2/ 2	0.01	0.097	0.0535	--	Yes	Detected organic	2300	2300	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010

<sup>a</sup>Bedrock is present at C Block Quarry at 7 ft bgs. Therefore, discrete soil data from 1-7 ft bgs were used to evaluate subsurface soil for the Resident (Adult and Child).

<sup>b</sup>Background criteria for soil >1 ft bgs from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>USEPA Industrial Regional Screening Level from table dated June 2015.

<sup>d</sup>Screening Level Source:

RDA = Concentration associated with recommended daily allowance of essential nutrient

RSL = USEPA Industrial Regional Screening Level

<sup>e</sup>RSL is the most conservative (smallest) of the FWCUGs for hexavalent and trivalent chromium.

<sup>f</sup>No reference dose or cancer potency factors are available for these PAHs, therefore, the RSL value for pyrene was used (NDEP 2006).

bgs = Below ground surface

CAS = Chemical Abstract Service

COPC = Chemical of Potential Concern

HQ = Hazard Quotient

PAH = Polycyclic Aromatic Hydrocarbon

SRC = Site-related Contaminant

USEPA = United States Environmental Protection Agency

--=No value available

**Bold** = Chemical is a COPC

**Table G-5. SRC and COPC Screening for Surface Soil (0-1 ft bgs ISM Samples) at C Block Quarry  
Military Training Land Use Receptor: National Guard Trainee**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	Background Criteria <sup>a</sup>	SRC? (yes/no)	SRC Justification	Screening FWCUG <sup>b</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> )	Risk Screening Level	Screening Level Source <sup>c</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
									NGT						
<i>Inorganic Chemicals</i>															
Aluminum	7429-90-5	6/ 6	1800	12000	8520	17700	No	Below background	3496	3496	NGT	No	Below background	CBLss-003M	11/4/2004
<b>Arsenic</b>	<b>7440-38-2</b>	<b>6/ 6</b>	<b>6.7</b>	<b>19</b>	<b>13.1</b>	<b>15.4</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>2.78</b>	<b>2.78</b>	<b>NGT</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLss-001M</b>	<b>11/4/2004</b>
Barium	7440-39-3	6/ 6	23	84	62.2	88.4	No	Below background	351	351	NGT	No	Below background	CBLss-005M	11/4/2004
Beryllium	7440-41-7	6/ 6	0.22	0.71	0.56	0.88	No	Below background	--	230	RSL	No	Below background	CBLss-003M	11/4/2004
Calcium	7440-70-2	6/ 6	350	1300	825	15800	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLss-001M	11/4/2004
<b>Chromium (total)<sup>d</sup></b>	<b>7440-47-3</b>	<b>8/ 8</b>	<b>17</b>	<b>1000</b>	<b>412</b>	<b>17.4</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>1.64</b>	<b>1.64</b>	<b>NGT</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLss-005M</b>	<b>8/10/2012</b>
<b>Chromium (hexavalent)</b>	<b>18540-29-9</b>	<b>3/ 7</b>	<b>0.32</b>	<b>5.4</b>	<b>1.48</b>	<b>--</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>1.64</b>	<b>1.64</b>	<b>NGT</b>	<b>Yes</b>	Exceeds screening level	<b>CBLss-003M</b>	<b>11/4/2004</b>
Cobalt	7440-48-4	6/ 6	1.7	9.6	6.77	10.4	No	Below background	7.03	7.03	NGT	No	Below background	CBLss-001M	11/4/2004
Copper	7440-50-8	6/ 6	15	78	32	17.7	Yes	Exceeds background	25368	25368	NGT	No	Below risk screening criteria	CBLss-005M	11/4/2004
Iron	7439-89-6	6/ 6	9900	22000	18500	23100	No	Essential Nutrient	184370	180000	RDA	No	Essential Nutrient	CBLss-005M	11/4/2004
Lead	7439-92-1	6/ 6	17	43	24.5	26.1	Yes	Exceeds background	--	800	RSL	No	Below risk screening criteria	CBLss-002M	11/4/2004
Magnesium	7439-95-4	6/ 6	270	2100	1480	3030	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLss-001M	11/4/2004
Manganese	7439-96-5	6/ 6	140	950	597	1450	No	Below background	35.1	35.1	NGT	No	Below background	CBLss-001M	11/4/2004
Mercury	7439-97-6	3/ 6	0.05	0.07	0.0425	0.036	Yes	Exceeds background	172	172	NGT	No	Below risk screening criteria	CBLss-006M	11/4/2004
Nickel	7440-02-0	6/ 6	13	16	14.7	21.1	No	Below background	12639	12639	NGT	No	Below background	CBLss-001M	11/4/2004
Potassium	7440-09-7	6/ 6	360	960	773	927	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLss-002M	11/4/2004
Selenium	7782-49-2	5/ 6	0.48	0.85	0.733	1.4	No	Below background	--	580	RSL	No	Below background	CBLss-003M	11/4/2004
Sodium	7440-23-5	6/ 6	130	310	255	123	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLss-003M	11/4/2004
Thallium	7440-28-0	2/ 6	0.19	0.36	0.296	0	Yes	Exceeds background	47.7	47.7	NGT	No	Below risk screening criteria	CBLss-002M	11/4/2004
Vanadium	7440-62-2	6/ 6	5.3	24	18.1	31.1	No	Below background	2304	2304	NGT	No	Below background	CBLss-005M	11/4/2004
Zinc	7440-66-6	6/ 6	34	59	50.8	61.8	No	Below background	187269	187269	NGT	No	Below background	CBLss-005M	11/4/2004
<i>Explosives</i>															
2,4,6-Trinitrotoluene	118-96-7	3/ 6	0.09	22	3.73	--	Yes	Detected organic	249	249	NGT	No	Below risk screening criteria	CBLss-004M	11/4/2004
2-Amino-4,6-Dinitrotoluene	35572-78-2	2/ 6	0.19	0.54	0.188	--	Yes	Detected organic	124	124	NGT	No	Below risk screening criteria	CBLss-004M	11/4/2004
4-Amino-2,6-Dinitrotoluene	19406-51-0	2/ 6	0.12	0.64	0.225	--	Yes	Detected organic	124	124	NGT	No	Below risk screening criteria	CBLss-004M	11/4/2004
Nitrocellulose	9004-70-0	1/ 1	1.3	1.3	1.3	--	Yes	Detected organic	--	250000000	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004

**Table G-5. SRC and COPC Screening for Surface Soil (0-1 ft bgs ISM Samples) at C Block Quarry  
Military Training Land Use Receptor: National Guard Trainee (continued)**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	Background Criteria <sup>a</sup>	SRC? (yes/no)	SRC Justification	Screening FWCUG <sup>b</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> )	Risk Screening Level	Screening Level Source <sup>c</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
									NGT						
<i>Semi-volatile Organic Compounds</i>															
Benz(a)anthracene	56-55-3	1/ 1	0.017	0.017	0.017	--	Yes	Detected organic	4.77	4.77	NGT	No	Below risk screening criteria	CBLss-005M	11/4/2004
Benzo(b)fluoranthene	205-99-2	1/ 1	0.036	0.036	0.036	--	Yes	Detected organic	4.77	4.77	NGT	No	Below risk screening criteria	CBLss-005M	11/4/2004
Benzo(g,h,i)perylene <sup>c</sup>	191-24-2	1/ 1	0.019	0.019	0.019	--	Yes	Detected organic	--	2300	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Benzo(k)fluoranthene	207-08-9	1/ 1	0.019	0.019	0.019	--	Yes	Detected organic	47.7	47.7	NGT	No	Below risk screening criteria	CBLss-005M	11/4/2004
Bis(2-ethylhexyl)phthalate	117-81-7	1/ 1	0.054	0.054	0.054	--	Yes	Detected organic	--	160	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Chrysene	218-01-9	1/ 1	0.028	0.028	0.028	--	Yes	Detected organic	477	477	NGT	No	Below risk screening criteria	CBLss-005M	11/4/2004
Fluoranthene	206-44-0	1/ 1	0.036	0.036	0.036	--	Yes	Detected organic	5087	5087	NGT	No	Below risk screening criteria	CBLss-005M	11/4/2004
Phenanthrene <sup>c</sup>	85-01-8	1/ 1	0.017	0.017	0.017	--	Yes	Detected organic	--	2300	RSL	No	Below risk screening criteria	CBLss-005M	11/4/2004
Pyrene	129-00-0	1/ 1	0.027	0.027	0.027	--	Yes	Detected organic	3815	3815	NGT	No	Below risk screening criteria	CBLss-005M	11/4/2004

<sup>a</sup>Background criteria for soil 0-1 ft bgs from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>b</sup>Facility-Wide Cleanup Goals (FWCUG) for National Guard Trainee (NGT) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>c</sup>Screening Level Source:

NGT = FWCUG for National Guard Trainee

RDA = Concentration associated with recommended daily allowance of essential nutrient

RSL = USEPA Industrial Regional Screening Level

<sup>d</sup>FWCUG is the most conservative (smallest) of the FWCUGs for hexavalent and trivalent chromium.

<sup>e</sup>No reference dose or cancer potency factors are available for these PAHs, therefore, the RSL value for pyrene was used (NDEP 2006).

bgs = Below ground surface

CAS = Chemical Abstract Service

COPC = Chemical of Potential Concern

HQ = Hazard Quotient

ISM = Incremental Sampling Method

PAH = Polycyclic Aromatic Hydrocarbon

SRC = Site-related Contaminant

USEPA = United States Environmental Protection Agency

--=No value available

**Bold** = Chemical is a COPC

**Table G-6. SRC and COPC Screening for Deep Surface Soil (1-4 ft bgs Discrete Samples) at C Block Quarry  
Military Training Land Use Receptor: National Guard Trainee**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	Background Criteria <sup>a</sup>	SRC? (yes/no)	SRC Justification	Screening FWCUG <sup>b</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> ) NGT	Risk Screening Level	Screening Level Source <sup>c</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
<i>Inorganic Chemicals</i>															
Aluminum	7429-90-5	5/ 5	8470	11600	10200	19500	No	Below background	3496	3496	NGT	No	Below background	CBLsb-007	3/22/2010
Antimony	7440-36-0	4/ 5	0.082	0.15	0.142	0.96	No	Below background	175	175	NGT	No	Below background	CBLsb-010	3/22/2010
Arsenic	7440-38-2	5/ 5	11.9	14.4	13.2	19.8	No	Below background	2.78	2.78	NGT	No	Below background	CBLsb-012	3/22/2010
Barium	7440-39-3	5/ 5	56.6	74.7	68.3	124	No	Below background	351	351	NGT	No	Below background	CBLsb-011	3/23/2010
Beryllium	7440-41-7	5/ 5	0.45	0.53	0.49	0.88	No	Below background	--	230	RSL	No	Below background	CBLsb-007	3/22/2010
Cadmium	7440-43-9	5/ 5	0.044	0.086	0.0674	0	Yes	Exceeds background	10.9	10.9	NGT	No	criteria	CBLsb-011	3/23/2010
Calcium	7440-70-2	5/ 5	260	1760	782	35500	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLsb-011	3/23/2010
<b>Chromium<sup>d</sup></b>	<b>7440-47-3</b>	<b>7/ 7</b>	<b>13.15</b>	<b>930</b>	<b>372</b>	<b>27.2</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>1.64</b>	<b>1.64</b>	<b>NGT</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLsb-010</b>	<b>3/22/2010</b>
<b>Chromium (hexavalent)</b>	<b>18540-29-9</b>	<b>2/ 2</b>	<b>6.4</b>	<b>39</b>	<b>22.7</b>	<b>--</b>	<b>Yes</b>	<b>Exceeds background</b>	<b>1.64</b>	<b>1.64</b>	<b>NGT</b>	<b>Yes</b>	<b>Exceeds screening level</b>	<b>CBLsb-025</b>	<b>8/10/2012</b>
Cobalt	7440-48-4	5/ 5	8.2	9.9	9.28	23.2	No	Below background	7.03	7.03	NGT	No	Below background	CBLsb-011	3/23/2010
Copper	7440-50-8	5/ 5	14.9	218	57.6	32.3	Yes	Exceeds background	25368	25368	NGT	No	criteria	CBLsb-010	3/22/2010
Iron	7439-89-6	5/ 5	20500	24800	23100	35200	No	Essential Nutrient	184370	180000	RDA	No	Essential Nutrient	CBLsb-012	3/22/2010
Lead	7439-92-1	5/ 5	12.5	17.4	14.2	19.1	No	Below background	--	800	RSL	No	Below background	CBLsb-010	3/22/2010
Magnesium	7439-95-4	5/ 5	1800	2270	2040	8790	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Manganese	7439-96-5	5/ 5	476	797	587	3030	No	Below background	35.1	35.1	NGT	No	Below background	CBLsb-011	3/23/2010
Mercury	7439-97-6	5/ 5	0.022	0.067	0.0474	0.044	Yes	Exceeds background	172	172	NGT	No	criteria	CBLsb-012	3/22/2010
Nickel	7440-02-0	5/ 5	15.6	17.4	16.6	60.7	No	Below background	12639	12639	NGT	No	Below background	CBLsb-007	3/22/2010
Potassium	7440-09-7	5/ 5	539	795	680	3350	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Selenium	7782-49-2	5/ 5	1	1.3	1.18	1.5	No	Below background	--	580	RSL	No	Below background	CBLsb-011	3/23/2010
Sodium	7440-23-5	5/ 5	27.6	31.7	29	145	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Thallium	7440-28-0	5/ 5	0.13	0.16	0.142	0.91	No	Below background	47.7	47.7	NGT	No	Below background	CBLsb-007	3/22/2010
Vanadium	7440-62-2	4/ 5	18.2	20.6	15.8	37.6	No	Below background	2304	2304	NGT	No	Below background	CBLsb-007	3/22/2010
Zinc	7440-66-6	5/ 5	45	57.6	49.8	93.3	No	Below background	187269	187269	NGT	No	Below background	CBLsb-010	3/22/2010
<i>Explosives</i>															
Dinitrotoluene	35572-78-2	1/ 5	0.073	0.073	0.114	--	Yes	Detected organic	124	124	NGT	No	criteria	CBLsb-010	3/22/2010
Dinitrotoluene	19406-51-0	1/ 5	0.051	0.051	0.109	--	Yes	Detected organic	124	124	NGT	No	criteria	CBLsb-010	3/22/2010
<i>Semi-volatile Organic Compounds</i>															
Anthracene	120-12-7	1/ 1	0.021	0.021	0.021	--	Yes	Detected organic	--	2300	RSL	No	criteria	CBLsb-011	3/23/2010
Benz(a)anthracene	56-55-3	1/ 1	0.048	0.048	0.048	--	Yes	Detected organic	4.77	4.77	NGT	No	criteria	CBLsb-011	3/23/2010
Benzo(a)pyrene	50-32-8	1/ 1	0.049	0.049	0.049	--	Yes	Detected organic	0.477	0.477	NGT	No	criteria	CBLsb-011	3/23/2010
Benzo(b)fluoranthene	205-99-2	1/ 1	0.062	0.062	0.062	--	Yes	Detected organic	4.77	4.77	NGT	No	criteria	CBLsb-011	3/23/2010

**Table G-6. SRC and COPC Screening for Deep Surface Soil (1-4 ft bgs Discrete Samples) at C Block Quarry  
Military Training Land Use Receptor: National Guard Trainee (continued)**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	Background Criteria <sup>a</sup>	SRC? (yes/no)	SRC Justification	Screening FWCUG <sup>b</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> ) NGT	Risk Screening Level	Screening Level Source <sup>c</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
Benzo(g,h,i)perylene <sup>c</sup>	191-24-2	1/ 1	0.037	0.037	0.037	--	Yes	Detected organic	--	2300	RSL	No	criteria	CBLsb-011	3/23/2010
Benzo(k)fluoranthene	207-08-9	1/ 1	0.028	0.028	0.028	--	Yes	Detected organic	47.7	47.7	NGT	No	criteria	CBLsb-011	3/23/2010
Chrysene	218-01-9	1/ 1	0.05	0.05	0.05	--	Yes	Detected organic	477	477	NGT	No	criteria	CBLsb-011	3/23/2010
Fluoranthene	206-44-0	1/ 1	0.13	0.13	0.13	--	Yes	Detected organic	5087	5087	NGT	No	criteria	CBLsb-011	3/23/2010
Fluorene	86-73-7	1/ 1	0.0094	0.0094	0.0094	--	Yes	Detected organic	11458	11458	NGT	No	criteria	CBLsb-011	3/23/2010
Indeno(1,2,3-cd)pyrene	193-39-5	1/ 1	0.03	0.03	0.03	--	Yes	Detected organic	4.77	4.77	NGT	No	criteria	CBLsb-011	3/23/2010
Phenanthrene <sup>c</sup>	85-01-8	1/ 1	0.087	0.087	0.087	--	Yes	Detected organic	--	2300	RSL	No	criteria	CBLsb-011	3/23/2010
Pyrene	129-00-0	1/ 1	0.097	0.097	0.097	--	Yes	Detected organic	3815	3815	NGT	No	criteria	CBLsb-011	3/23/2010

<sup>a</sup>Background criteria for soil >1 ft bgs from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>b</sup>Facility-Wide Cleanup Goals (FWCUGs) for National Guard Trainee (NGT) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>c</sup>Screening Level Source:

NGT = FWCUG for National Guard Trainee

RDA = Concentration associated with recommended daily allowance of essential nutrient

RSL = USEPA Industrial Regional Screening Level

<sup>d</sup>FWCUG is the most conservative (smallest) of the FWCUGs for hexavalent and trivalent chromium.

<sup>e</sup>No reference dose or cancer potency factors are available for these PAHs, therefore, the RSL value for pyrene was used (NDEP 2006).

bgs = Below ground surface

CAS = Chemical Abstract Service

COPC = Chemical of Potential Concern

HQ = Hazard Quotient

PAH = Polycyclic Aromatic Hydrocarbon

SRC = Site-related Contaminant

USEPA = United States Environmental Protection Agency

--=No value available

**Bold** = Chemical is a COPC



**Table G-7. SRC and COPC Screening for Subsurface Soil (4-7 ft bgs Discrete Samples) at C Block Quarry  
Military Training Land Use Receptor: National Guard Trainee**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	Background Criteria <sup>a</sup>	SRC? (yes/no)	SRC Justification	Screening FWCUG <sup>b</sup> (HQ= 0.1 or Risk=10 <sup>-6</sup> ) NGT	Risk Screening Level	Screening Level Source <sup>c</sup>	COPC? (yes/no)	COPC Justification	Station at Max Detect	Date Collected at Max Detect
<i>Inorganic Chemicals</i>															
Aluminum	7429-90-5	2/ 2	8590	11800	10200	19500	No	Below background	3496	3496	NGT	No	Below background	CBLsb-007	3/22/2010
Antimony	7440-36-0	2/ 2	0.08	0.14	0.11	0.96	No	Below background	175	175	NGT	No	Below background	CBLsb-011	3/23/2010
Arsenic	7440-38-2	2/ 2	13.6	14.7	14.2	19.8	No	Below background	2.78	2.78	NGT	No	Below background	CBLsb-007	3/22/2010
Barium	7440-39-3	2/ 2	61.5	74.3	67.9	124	No	Below background	351	351	NGT	No	Below background	CBLsb-011	3/23/2010
Beryllium	7440-41-7	2/ 2	0.47	0.5	0.485	0.88	No	Below background	--	230	RSL	No	Below background	CBLsb-007	3/22/2010
Cadmium	7440-43-9	2/ 2	0.048	0.11	0.079	0	Yes	Exceeds background	10.9	10.9	NGT	No	Below risk screening criteria	CBLsb-011	3/23/2010
Calcium	7440-70-2	2/ 2	463	597	530	35500	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLsb-011	3/23/2010
Chromium <sup>d</sup>	7440-47-3	2/ 2	12.6	14.6	13.6	27.2	No	Below background	1.64	1.64	NGT	No	Below background	CBLsb-007	3/22/2010
Cobalt	7440-48-4	2/ 2	8.3	9.3	8.8	23.2	No	Below background	7.03	7.03	NGT	No	Below background	CBLsb-011	3/23/2010
Copper	7440-50-8	2/ 2	14	16.9	15.5	32.3	No	Below background	25368	25368	NGT	No	Below background	CBLsb-007	3/22/2010
Iron	7439-89-6	2/ 2	22500	26400	24500	35200	No	Essential Nutrient	184370	180000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Lead	7439-92-1	2/ 2	12.6	25.6	19.1	19.1	Yes	Exceeds background	--	800	RSL	No	Below risk screening criteria	CBLsb-011	3/23/2010
Magnesium	7439-95-4	2/ 2	1660	2480	2070	8790	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Manganese	7439-96-5	2/ 2	513	896	705	3030	No	Below background	35.1	35.1	NGT	No	Below background	CBLsb-011	3/23/2010
Mercury	7439-97-6	2/ 2	0.032	0.047	0.0395	0.044	Yes	Exceeds background	172	172	NGT	No	Below risk screening criteria	CBLsb-011	3/23/2010
Nickel	7440-02-0	2/ 2	15.7	17.2	16.5	60.7	No	Below background	12639	12639	NGT	No	Below background	CBLsb-007	3/22/2010
Potassium	7440-09-7	2/ 2	546	729	638	3350	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Selenium	7782-49-2	2/ 2	1.1	1.2	1.15	1.5	No	Below background	--	580	RSL	No	Below background	CBLsb-011	3/23/2010
Sodium	7440-23-5	2/ 2	27.5	31.5	29.5	145	No	Essential Nutrient	--	1000000	RDA	No	Essential Nutrient	CBLsb-007	3/22/2010
Thallium	7440-28-0	2/ 2	0.15	0.16	0.155	0.91	No	Below background	47.7	47.7	NGT	No	Below background	CBLsb-011	3/23/2010
Vanadium	7440-62-2	2/ 2	16	21.4	18.7	37.6	No	Below background	2304	2304	NGT	No	Below background	CBLsb-007	3/22/2010
Zinc	7440-66-6	2/ 2	48.7	51.8	50.3	93.3	No	Below background	187269	187269	NGT	No	Below background	CBLsb-011	3/23/2010
<i>Semi-volatile Organic Compounds</i>															
Benzo(b)fluoranthene	205-99-2	1/ 1	0.01	0.01	0.01	--	Yes	Detected organic	4.77	4.77	NGT	No	Below risk screening criteria	CBLsb-011	3/23/2010
Fluoranthene	206-44-0	1/ 1	0.012	0.012	0.012	--	Yes	Detected organic	5087	5087	NGT	No	Below risk screening criteria	CBLsb-011	3/23/2010
Pyrene	129-00-0	1/ 1	0.01	0.01	0.01	--	Yes	Detected organic	3815	3815	NGT	No	Below risk screening criteria	CBLsb-011	3/23/2010

<sup>a</sup>Background criteria for soil >1 ft bgs from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>b</sup>Facility-Wide Cleanup Goals (FWCUGs) for National Guard Trainee (NGT) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>c</sup>Screening Level Source:

NGT = FWCUG for National Guard Trainee

RDA = Concentration associated with recommended daily allowance of essential nutrient

RSL = USEPA Industrial Regional Screening Level

<sup>d</sup>FWCUG is the most conservative (smallest) of the FWCUGs for hexavalent and trivalent chromium.

bgs = Below ground surface

CAS = Chemical Abstract Service

COPC = Chemical of Potential Concern

HQ = Hazard Quotient

SRC = Site-related Contaminant

USEPA = United States Environmental Protection Agency

--=No value available

**Bold** = Chemical is a COPC

**Table G-8. COC Screening for Surface Soil (0-1 ft bgs ISM Samples) at C Block Quarry  
Unrestricted Land Use Receptor: Resident (Adult and Child)**

Sample ID	Date	COPC		Arsenic <sup>c</sup>	Total Chromium	2,4,6-Trinitrotoluene
		CAS Number		7440-38-2	7440-47-3	118-96-7
Resident FWCUG <sup>a</sup> :						
		HQ=1		20.2	81,473	36.5
		Risk=10 <sup>-5</sup>		4.25	--	284
		Background Criteria <sup>b</sup>		15.4 (19.8)	17.4 (27.2)	--
		Depth (ft)	Station	Result Exceeds FWCUG?	Result Exceeds FWCUG?	Result Exceeds FWCUG?
CBLss-001M-SO	11/4/2004	0.0 - 1.0	CBLss-001M	19 No	17 No	<0.1U No
CBLss-002M-SO	11/4/2004	0.0 - 1.0	CBLss-002M	14 No	430 No	<0.1U No
CBLss-003M-SO	11/4/2004	0.0 - 1.0	CBLss-003M	13 No	240 No	0.09J No
CBLss-004M-SO	11/4/2004	0.0 - 0.5	CBLss-004M	6.7 No	150 No	22 No
CBLss-005M-SO	11/4/2004	0.0 - 1.0	CBLss-005M	14 No	920 No <sup>d</sup>	0.15 No
CBLss-006M-SO	11/4/2004	0.0 - 1.0	CBLss-006M	12 No	19 No	<0.1U No
CBLss-003M-5876-SO	8/10/2012	0.0 - 1.0	CBLss-003M	NR	520 No	NR
CBLss-005M-5877-SO	8/10/2012	0.0 - 1.0	CBLss-005M	NR	1000 No	NR

All units in mg/kg.

<sup>a</sup>Facility-Wide Cleanup Goals (FWCUG) for Resident Adult (RA) and Resident Child (RC) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>b</sup>Background criteria for soil 0-1 ft bgs and >1 ft bgs from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>Since the Resident (Adult and Child) FWCUG for arsenic is less than the surface soil background screening value (15.4 mg/kg) and the subsurface soil screening value (19.8 mg/kg), the background level is used as the cleanup goal (CUG) for comparison. As ground disturbance has occurred at the site with the use of the quarry, the subsurface background value was used as the CUG for comparison.

<sup>d</sup>FWCUG values are for trivalent chromium. Based on the lines of evidence presented in Section 7.2.5.1, total chromium concentrations are screened against the trivalent chromium FWCUGs. Although no hexavalent chromium result is available for sample CBLss-005M-SO this sample was screened against the trivalent chromium FWCUG based on the hexavalent chromium results in CBLss-005M-5877-SO collected from the same ISM area in August 2012.

Data Qualifiers:

J=indicates that the analyte was positively identified, but the associated numerical value is an approximate concentration of the analyte in the sample.

U=not detected

bgs = below ground surface

CAS = Chemical Abstract Service

COC = Chemical of Concern

HQ = Hazard Quotient

ISM = Incremental Sampling Method

NR = No result

-- = No value available

**Bold** = Concentration exceeds FWCUG for this sample

**Table G-9. Sum-of-Ratios for Non-Carcinogens for Surface Soil (0-1 ft bgs ISM Samples) at C Block Quarry  
Unrestricted Land Use Receptor: Resident (Adult and Child)**

Sample ID	Date	COPC		Total Chromium <sup>c</sup>		2,4,6-Trinitrotoluene		SOR	
		CAS Number		7440-47-3		118-96-7			
		Resident FWCUG <sup>a</sup> :							
		HQ=1		81,473		36.5			
		Critical Effect or Target Organ		NOAEL		Liver			
		Background Criteria <sup>b</sup>		17.4 (27.2)		--			
		Depth (ft bgs)	Station	Result	Ratio	Result	Ratio		
CBLss-001M-SO	11/4/2004	0.0 - 1.0	CBLss-001M	17	NA	<0.1U	--	--	
CBLss-002M-SO	11/4/2004	0.0 - 1.0	CBLss-002M	430	0.005	<0.1U	--	--	
CBLss-003M-SO	11/4/2004	0.0 - 1.0	CBLss-003M	240	0.003	0.09	0.002	0.005	
CBLss-004M-SO	11/4/2004	0.0 - 0.5	CBLss-004M	150	0.002	22	0.6	0.6	
CBLss-005M-SO	11/4/2004	0.0 - 1.0	CBLss-005M	920	0.01	0.15	0.004	0.02	
CBLss-006M-SO	11/4/2004	0.0 - 1.0	CBLss-006M	19	NA	<0.1U	--	--	
CBLss-003M-5876-SO	8/10/2012	0.0 - 1.0	CBLss-003M	520	0.01	NR	--	0.006	
CBLss-005M-5877-SO	8/10/2012	0.0 - 1.0	CBLss-005M	1000	0.01	NR	--	0.01	

All units in mg/kg.

<sup>a</sup>Facility-Wide Cleanup Goals (FWCUG) for Resident Adult (RA) and Resident Child (RC) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>b</sup>Background criteria for soil 0-1 ft bgs and >1 ft bgs from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>FWCUG values are for trivalent chromium. Based on the lines of evidence presented in Section 7.2.5.1, total chromium concentrations are screened against the trivalent chromium FWCUGs. Although no hexavalent chromium result is available for sample CBLss-005M-SO this sample was screened against the trivalent chromium FWCUG based on the hexavalent chromium results in CBLss-005M-5877-SO collected from the same ISM area in August 2012.

Data Qualifiers:

U= not detected

bgs = below ground surface

CAS = Chemical Abstract Service

COC = Chemical of Concern

ISM = Incremental Sampling Method

NA = The total chromium concentration is below background criteria.

NR = No result

SOR = Sum-of-Ratios

**Bold** = SOR greater than 1

-- = No value available

**Table G-10. COC Screening for Subsurface Soil (1-7 ft bgs Discrete Samples) at C Block Quarry  
Unrestricted Land Use Receptor: Resident (Adult and Child)**

COPC	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	UCL 95	Dist.	EPC	Resident FWCUG <sup>a</sup>		Background Criteria <sup>b</sup>	EPC Exceeds FWCUG?
									HQ=1	Risk=10 <sup>-5</sup>		
<i>Inorganic Chemicals</i>												
Chromium <sup>c</sup>	7440-47-3	9/ 9	12.1	930	293	555	X	555	81,473	--	27.2	No
Chromium, hexavalent	18540-29-9	2/ 2	6.4	39	22.7	126	D	39	199	268	--	No
<i>Semi-volatile Organic Compounds</i>												
Benzo(a)pyrene	50-32-8	1/ 2	0.049	0.049	0.04	0.0968	D	0.049	--	0.221	--	No

All units in mg/kg.

<sup>a</sup>Facility-Wide Cleanup Goals (FWCUGs) for Resident (RA) and Resident Child (RC) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>b</sup>Background criteria for subsurface soil (>1 ft bgs) from the final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>FWCUG values are for trivalent chromium. Based on the lines of evidence presented in Section 7.2.5.1, total chromium concentrations are screened against the trivalent chromium FWCUG.

Dist.: N=normal distribution, t statistic used for UCL 95 calculation

L=lognormal distribution, Land statistic used for UCL 95 calculation

D=fewer than 5 or 50% detects, t statistic used for UCL 95 calculation

X=distribution neither normal nor lognormal, t statistic used for UCL 95 calculation

bgs = below ground surface

CAS= Chemical Abstract Service

COC = Chemical of Concern

EPC = Exposure Point Concentration

HQ = Hazard Quotient

UCL = 95% Upper Confidence Limit of the mean

-- = No value available

**Bold** = EPC exceeds FWCUG

**Table G-11. Sum-of-Ratios for Non-Carcinogens: COC Screening for Subsurface Soil (1-7 ft bgs Discrete Samples) at C Block Quarry  
Unrestricted Land Use Receptor: Resident (Adult and Child)**

Analyte (mg/kg)	CAS Number	EPC	Resident FWCUG <sup>a</sup> : HQ = 1	Background Criteria <sup>b</sup>	Critical Effect or Target Organ	Ratio
Chromium <sup>c</sup>	7440-47-3	555	81,473	27.2	NOAEL	0.007
Chromium, hexavalent	18540-29-9	39	199	--	Stomach, Liver/Kidney	0.2
Sum-of-Ratios						0.2

All units in mg/kg.

<sup>a</sup>Facility-Wide Cleanup Goals (FWCUGs) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>b</sup>Background criteria for subsurface soil (>1 ft bgs) from the final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>FWCUG values are for trivalent chromium. Based on the lines of evidence presented in Section 7.2.5.1, total chromium concentrations are screened against the trivalent chromium FWCUG.

bgs = below ground surface

CAS = Chemical Abstract Service

COC= Chemical of Concern

EPC = Exposure Point Concentration

SOR = Sum-of-Ratios

-- = No value available

**Bold** = SOR greater than 1

**Table G-12. Sum-of-Ratios for Carcinogens: COC Screening for Subsurface Soil (1-7 ft bgs Discrete Samples) at C Block Quarry  
Unrestricted Land Use Receptor: Resident (Adult and Child)**

<b>Analyte (mg/kg)</b>	<b>CAS Number</b>	<b>EPC</b>	<b>Resident FWCUG<sup>a</sup>: Risk=10<sup>-5</sup></b>	<b>Background Criteria<sup>b</sup></b>	<b>Ratio</b>
Chromium, hexavalent	18540-29-9	39	268 <sup>c</sup>	--	0.1
Benzo(a)pyrene	50-32-8	0.049	0.221	--	0.2
<b>Sum-of-Ratios</b>					0.4

All units in mg/kg.

<sup>a</sup>Facility-Wide Cleanup Goals (FWCUGs) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>b</sup>Background criteria for subsurface soil (>1 ft bgs) from the final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>Hexavalent chromium results evaluated using 1/7th of the hexavalent chromium FWCUG for the cancer endpoint. For further explanation see Section 7.2.5.1.

bgs = below ground surface

CAS = Chemical Abstract Service

COC= Chemical of Concern

EPC = Exposure Point Concentration

SOR = Sum-of-Ratios

-- = No value available

**Bold** = SOR greater than 1

**Table G-13. COC Screening for Surface Soil (0-1 ft bgs ISM Samples) at C Block Quarry  
Commercial/Industrial Land Use: Industrial Receptor**

Sample ID	Date	COPC		Arsenic <sup>c</sup>	Total Chromium <sup>d</sup>
		CAS Number		7440-38-2	7440-47-3
Industrial RSL <sup>a</sup> :					
		HQ=1		480	1,800,000
		Risk=10 <sup>-5</sup>		30	--
		Background Criteria <sup>b</sup>		15.4 (19.8)	17.4 (27.2)
		Depth (ft)	Station	Result Exceeds FWCUG?	Result Exceeds FWCUG?
CBLss-001M-SO	11/4/2004	0.0 - 1.0	CBLss-001M	19 No	17 No
CBLss-002M-SO	11/4/2004	0.0 - 1.0	CBLss-002M	14 No	430 No
CBLss-003M-SO	11/4/2004	0.0 - 1.0	CBLss-003M	13 No	240 No
CBLss-004M-SO	11/4/2004	0.0 - 0.5	CBLss-004M	6.7 No	150 No
CBLss-005M-SO	11/4/2004	0.0 - 1.0	CBLss-005M	14 No	920 No
CBLss-006M-SO	11/4/2004	0.0 - 1.0	CBLss-006M	12 No	19 No
CBLss-003M-5876-SO	8/10/2012	0.0 - 1.0	CBLss-003M	NR	520 No
CBLss-005M-5877-SO	8/10/2012	0.0 - 1.0	CBLss-005M	NR	1000 No

All units in mg/kg.

<sup>a</sup>Regional Screening Levels (RSLs) for Industrial Land Use (USEPA's Composite Worker) from RSL Table dated June 2015 (<http://epa.gov/region9/superfund/prg>) and adjusted to target risks of HQ =1 for non-carcinogens and 1E-05 for carcinogens.

<sup>b</sup>Background criteria for soil 0-1 ft bgs and >1 ft bgs from final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>Since the Resident (Adult and Child) FWCUG for arsenic is less than the surface soil background screening value (15.4 mg/kg) and the subsurface soil screening value (19.8 mg/kg), the background level is used as the cleanup goal (CUG) for comparison. As ground disturbance has occurred at the site by nature of the operations at the quarry, the subsurface background value was used as the CUG for comparison.

<sup>d</sup>Based on the lines of evidence presented in Section 7.2.5.1, where results indicate most or all of the chromium present is not in the hexavalent form, total chromium concentrations are screened against the trivalent chromium FWCUGs. Although no hexavalent chromium result is available for sample CBLss-005M-SO, the hexavalent chromium result in CBLss-005M-5877-SO, collected from the same ISM area in 2012, supports the use of the trivalent chromium FWCUG.

bgs = below ground surface

CAS = Chemical Abstract Service

COC = Chemical of Concern

HQ = Hazard Quotient

ISM = Incremental Sampling Method

NR = No result

-- = No value available

**Bold** = Concentration exceeds FWCUG for this sample

**Table G-14. COC Screening for Subsurface Soil (1-7 ft bgs Discrete Samples) at C Block Quarry  
Commercial/Industrial Land Use: Industrial Receptor**

COPC	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	UCL 95	Dist.	EPC	Industrial RSL <sup>a</sup>		Background Criteria <sup>b</sup>	EPC Exceeds FWCUG?
									HQ=1	Risk=10 <sup>-5</sup>		
<i>Inorganic Chemicals</i>												
Chromium <sup>c</sup>	7440-47-3	9/ 9	12.1	930	293	555	X	555	1800000	--	27.2	No
Chromium, hexavalent	18540-29-9	2/ 2	6.4	39	22.7	126	D	39	3500	63	--	No

All units in mg/kg.

<sup>a</sup>Regional Screening Levels (RSLs) for Industrial Land Use (USEPA's Composite Worker) from RSL Table dated June 2015 (<http://epa.gov/region9/superfund/prg>) and adjusted to a 1E-05 target risk for carcinogens and an HQ of 1 for non-carcinogens.

<sup>b</sup>Background criteria for subsurface soil (>1 ft bgs) from the final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>FWCUG value is for trivalent chromium. Based on the lines of evidence presented in Section 7.2.5.1, total chromium concentrations are screened against the trivalent chromium FWCUG.

Dist.: N=normal distribution, t statistic used for UCL 95 calculation

L=lognormal distribution, Land statistic used for UCL 95 calculation

D=fewer than 5 or 50% detects, t statistic used for UCL 95 calculation

X=distribution neither normal nor lognormal, t statistic used for UCL 95 calculation

bgs = below ground surface

CAS= Chemical Abstract Service

COC = Chemical of Concern

EPC = Exposure Point Concentration

HQ = Hazard Quotient

UCL = 95% Upper Confidence Limit of the mean

-- = No value available

**Bold** = EPC exceeds FWCUG



**Table G-15. Sum-of-Ratios for Non-carcinogens: COC Screening for Subsurface Soil (1-7 ft bgs Discrete Samples) at C Block Quarry  
Commercial/Industrial Land Use: Industrial Receptor**

<b>COPC</b>	<b>CAS Number</b>	<b>EPC</b>	<b>Critical Effect or Target Organ</b>	<b>Industrial RSL<sup>a</sup>: HQ = 1</b>	<b>Background Criteria<sup>b</sup></b>	<b>Ratio</b>
Chromium <sup>c</sup>	7440-47-3	555	NOAEL	1800000	27.2	0.0003
Chromium, hexavalent	18540-29-9	39	Stomach, Liver/Kidney	3500	--	0.01
<b>Sum-of-Ratios</b>						0.01

All units in mg/kg.

<sup>a</sup>Regional Screening Levels (RSLs) for Industrial Land Use (USEPA's Composite Worker) from RSL Table dated June 2015 (<http://epa.gov/region9/superfund/prg>) and adjusted to an HQ = 1 for non-carcinogens.

<sup>b</sup>Background criteria for subsurface soil (>1 ft bgs) from the final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>FWCUG value is for trivalent chromium. Based on the lines of evidence presented in Section 7.2.5.1, total chromium concentrations are screened against the trivalent chromium FWCUG.

bgs = below ground surface

CAS = Chemical Abstract Service

COC= Chemical of Concern

EPC = Exposure Point Concentration

SOR = Sum-of-Ratios

-- = No value available

**Bold** = SOR greater than 1

**Table G-16. COC Screening for Surface Soil (0-1 ft bgs ISM Samples) at C Block Quarry  
Military Training Land Use Receptor: National Guard Trainee**

Sample ID	Date	COPC		Arsenic	Total Chromium <sup>c</sup>	Hexavalent Chromium <sup>d</sup>
		CAS Number		7440-38-2	7440-47-3	18540-29-9
National Guard Trainee FWCUG <sup>a</sup> :						
		HQ=1	1140	1,000,000	56.1	
		Risk=10 <sup>-5</sup>	27.8	--	2.3	
		Background Criteria <sup>b</sup>	15.4	17.4 (27.2)	--	
		Depth (ft)	Station	Result Exceeds FWCUG?	Result Exceeds FWCUG?	Result Exceeds FWCUG?
CBLss-001M-SO	11/4/2004	0.0 - 1.0	CBLss-001M	19 No	17 No	<2.2U No
CBLss-002M-SO	11/4/2004	0.0 - 1.0	CBLss-002M	14 No	430 No	<2.2U No
CBLss-003M-SO	11/4/2004	0.0 - 1.0	CBLss-003M	13 No	240 No	<b>5.4 Yes</b>
CBLss-004M-SO	11/4/2004	0.0 - 0.5	CBLss-004M	6.7 No	150 No	<2U No
CBLss-005M-SO	11/4/2004	0.0 - 1.0	CBLss-005M	14 No	920 No	NR
CBLss-006M-SO	11/4/2004	0.0 - 1.0	CBLss-006M	12 No	19 No	<2U No
CBLss-003M-5876-SO	8/10/2012	0.0 - 1.0	CBLss-003M	NR	520 No	0.46 No
CBLss-005M-5877-SO	8/10/2012	0.0 - 1.0	CBLss-005M	NR	1000 No	0.32 No

All units are mg/kg.

<sup>a</sup>Facility-Wide Cleanup Goals (FWCUGs) for National Guard Trainee from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>b</sup>Background criteria for surface soil (0-1 ft bgs) from the final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>FWCUG values are for trivalent chromium. Based on the lines of evidence presented in Section 7.2.5.1, total chromium concentrations are screened against the trivalent chromium FWCUGs. Although no hexavalent chromium result is available for sample CBLss-005M-SO this sample was screened against the trivalent chromium FWCUG based on the hexavalent chromium results in CBLss-005M-5877-SO collected from the same ISM area in August 2012.

<sup>d</sup>Hexavalent chromium results evaluated using 1/7th of the cancer risk-based hexavalent chromium FWCUG. For further explanation see Section 7.2.4.1.

Data Qualifiers:

J=indicates that the analyte was positively identified, but the associated numerical value is an approximate concentration of the analyte in the sample.

U=not detected

UJ=not detected and reporting limit estimated

bgs = below ground surface

CAS = Chemical Abstract Service

COC = Chemical of Concern

CUG = Cleanup Goal

HQ = Hazard Quotient

ISM = Incremental Sampling Method

NR = No result

-- = No value available

**Bold** = Concentration exceeds FWCUG for this sample

**Table G-17. COC Screening for Deep Surface Soil (1-4 ft bgs Discrete Samples) at C Block Quarry  
Military Training Land Use Receptor: National Guard Trainee**

Analyte (mg/kg)	CAS Number	Freq of Detect	Minimum Detect	Maximum Detect	Average Result	UCL 95	Dist.	EPC	National Guard Trainee FWCUG <sup>a</sup>		Background Criteria <sup>b</sup>	EPC Exceeds FWCUG?
									HQ=1	Risk=10 <sup>-5</sup>		
<i>Inorganic Chemicals</i>												
Chromium <sup>c</sup>	7440-47-3	7/ 7	12.1	930	372	705	X	705	1,000,000	--	27.2	No
<b>Chromium, hexavalent</b>	<b>18540-29-9</b>	<b>2/ 2</b>	<b>6.4</b>	<b>39</b>	<b>22.7</b>	<b>126</b>	<b>D</b>	<b>39</b>	<b>56.1</b>	<b>2.3<sup>d</sup></b>	--	<b>Yes</b>

<sup>a</sup>Facility-Wide Cleanup Goals (FWCUGs) for National Guard Trainee from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>b</sup>Background criteria for subsurface soil (>1 ft bgs) from the final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>FWCUG values are for trivalent chromium. Based on the lines of evidence presented in Section 7.2.5.1, total chromium concentrations are screened against the trivalent chromium FWCUG.

<sup>d</sup>Hexavalent chromium results evaluated using 1/7th of the hexavalent chromium FWCUG for the cancer endpoint. For further explanation see Section 7.2.5.1.

Dist.: N=normal distribution, t statistic used for UCL 95 calculation

D=fewer than 5 or 50% detects, t statistic used for UCL 95 calculation

X=distribution neither normal nor lognormal, t statistic used for UCL 95 calculation

bgs = below ground surface

CAS = Chemical Abstract Service

COC = Chemical of Concern

CUG = Cleanup Goal

EPC = Exposure Point Concentration

HQ = Hazard Quotient

UCL 95 = 95% Upper Confidence Limit of the mean

-- = No value available

**Bold** = EPC exceeds FWCUG

**Table G-18. Sum-of-Ratios for Non-Carcinogens: COC Screening for Deep Surface Soil (1-4 ft bgs Discrete Samples) at C Block Quarry  
Military Training Land Use Receptor: National Guard Trainee**

<b>COPC</b>	<b>CAS Number</b>	<b>EPC</b>	<b>Critical Effect or Target Organ</b>	<b>National Guard Trainee FWCUG<sup>a</sup>: HQ = 1</b>	<b>Background Criteria<sup>b</sup></b>	<b>Ratio</b>
Chromium <sup>c</sup>	7440-47-3	705	NOAEL	1,000,000	27.2	<0.01
Chromium, hexavalent <sup>d</sup>	18540-29-9	39	Liver/Kidney	56.1	--	0.7
<b>Sum-of-Ratios</b>						0.7

All units in mg/kg.

<sup>a</sup>Facility-Wide Cleanup Goals (FWCUGs) from *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (USACE 2010).

<sup>b</sup>Background criteria for subsurface soil (>1 ft bgs) from the final facility-wide background values for RVAAP, published in the *Final Phase II Remedial Investigation Report for Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001).

<sup>c</sup>FWCUG value is for trivalent chromium. Based on the lines of evidence presented in Section 7.2.5.1, total chromium concentrations are screened against the trivalent chromium FWCUG.

<sup>d</sup>Hexavalent chromium results evaluated using 1/7th of the hexavalent chromium FWCUG for the cancer endpoint. For further explanation see Section 7.2.5.1.

bgs = below ground surface

CAS = Chemical Abstract Service

COC= Chemical of Concern

EPC = Exposure Point Concentration

SOR = Sum-of-Ratios

-- = No value available

**Bold** = SOR greater than 1