# APPENDIX M

# SUPPORTING INFORMATION FOR THE HUMAN HEALTH RISK ASSESSMENT AT THE FUZE AND BOOSTER QUARRY LANDFILL/PONDS

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# CONTENTS

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# TABLES

# ACRONYMS

| | |
|---|---|
| $BCF_{inv}$ | water-to-tissue bioconcentration factor |
| BSAF | sediment-to-tissue bioaccumulation factor |
| BTF | biotransfer factor |
| COPC | chemical of potential concern |
| EC | exposure concentration |
| EPA | U. S. Environmental Protection Agency |
| EPC | exposure point concentration |
| FBQ | Fuze and Booster Quarry |
| foc | fraction organic carbon |
| HAZWRAP | Hazardous Waste Remedial Actions Program |
| HHRA | human health risk assessment |
| $K_{ow}$ | octanol-water partitioning coefficient |
| RVAAP | Ravenna Army Ammunition Plant |

# M1.0 INTRODUCTION

This appendix includes supporting information for the human health risk assessment (HHRA) at the Fuze and Booster Quarry (FBQ). Section M2 provides tables that support Chapter 6.0 of the main text (HHRA) and Section M3 documents the process for determining exposure point concentrations (EPCs) that are used in the HHRA for waterfowl.

# M2.0 SUPPORTING TABLES FOR THE HUMAN HEALTH RISK ASSESSMENT

Tables M-1 to M-37 are provided in support of the HHRA for the FBQ (see Chapter 6.0 of the main text).

# M3.0 DETERMINING WATERFOWL CONCENTRATIONS

Numerous waterfowl are harvested and eaten by humans in northeast Ohio, where the Ravenna Army Ammunition Plant (RVAAP) is located. Ohio is in the Mississippi Flyway, and many species of waterfowl migrate through the RVAAP area in the spring and fall (ODNR 2003). Other species breed in the area and are summer residents. A 1993 census of waterfowl at Ravenna found bufflehead, Canada goose, wood duck, hooded merganser, mallard, blue-winged teal, ring-necked duck, American coot, red-breasted merganser, greater scaup, red-headed duck, common goldeneye, Northern shoveler, and American widgeon (ODNR 1993). Several of these species may be hunted at RVAAP.

## M3.1 METHODOLOGY FOR CALCULATING TISSUE CONCENTRATIONS IN WATERFOWL

The mallard is used as a representative species of dabbling-type ducks for the development of EPCs for the Hunter/Trapper scenario. According to Tim Morgan, Office of Species Conservation forester, the most likely species hunted at the Ravenna Training and Logistics Site are mallards, wood ducks, and Canadian Geese (Morgan 2003). The goose is primarily herbivorous, while the mallard and wood duck are omnivorous and dabble for seeds, rootlets, tubers of aquatic plants, and aquatic insects, such as snails, small clams, insects, worms, and crustaceans (Ducks Unlimited 2003; EPA 1993a).

To calculate the concentrations of chemicals of potential concern (COPCs) in duck whole-body tissue, biouptake and concentration factors are required for each transfer represented in the exposure model for the duck. The duck is exposed directly and indirectly via the food web to the measured concentrations of COPCs in sediment (Table M-5) and surface water (Table M-6) at FBQ at RVAAP. For calculating whole-body concentrations, ducks are assumed to be exposed by the following routes:

- ingestion of aquatic plants that are exposed to surface water, sediment, and sediment porewater;
- ingestion of sediment invertebrates that are exposed to surface water, sediment, and sediment porewater;

**Table M-1. COPC Screening for Groundwater at Fuze and Booster Quarry Ponds**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Tap Water PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Bedrock Groundwater*** | | | | | | | | | | | |
| *Inorganics* | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/L | 1 / 6 | 6.8E-02 | 2.7E-02 | 6.8E-02 | 4.4E-02 | 4.4E-02 | -- | 3.6E+01 | No |
| Barium | 7440-39-3 | mg/L | 6 / 6 | 2.0E-02 | 4.0E-02 | 8.7E-02 | 7.8E-02 | 7.8E-02 | 2.6E-01 | 2.6E+00 | No |
| Calcium | 7440-70-2 | mg/L | 6 / 6 | 8.9E+00 | 2.8E+01 | 8.7E+01 | 9.0E+01 | 8.7E+01 | 5.3E+01 | -- | No |
| Chromium, hexavalent | 18540-29-9 | mg/L | 1 / 6 | 1.0E-02 | 5.8E-03 | 1.0E-02 | 7.5E-03 | 7.5E-03 | -- | 1.1E-01 | No |
| Cobalt | 7440-48-4 | mg/L | 3 / 6 | 3.8E-03 | 3.2E-03 | 9.3E-03 | 6.2E-03 | 6.2E-03 | 0.0E+00 | 7.3E-01 | No |
| Iron | 7439-89-6 | mg/L | 2 / 6 | 3.9E+00 | 1.6E+00 | 5.6E+00 | 3.6E+00 | 3.6E+00 | 1.4E+00 | 1.1E+01 | No |
| Magnesium | 7439-95-4 | mg/L | 6 / 6 | 3.1E+00 | 1.1E+01 | 3.9E+01 | 4.8E+01 | 3.9E+01 | 1.5E+01 | -- | No |
| Manganese | 7439-96-5 | mg/L | 6 / 6 | 1.5E-02 | 1.0E+00 | 4.2E+00 | 1.3E+04 | 4.2E+00 | 1.3E+00 | 8.8E-01 | Yes |
| Nickel | 7440-02-0 | mg/L | 2 / 6 | 3.8E-02 | 5.0E-02 | 2.6E-01 | 1.3E-01 | 1.3E-01 | 8.3E-02 | 7.3E-01 | No |
| Potassium | 7440-09-7 | mg/L | 6 / 6 | 1.0E+00 | 1.4E+00 | 1.9E+00 | 1.8E+00 | 1.8E+00 | 5.8E+00 | -- | No |
| Sodium | 7440-23-5 | mg/L | 6 / 6 | 1.5E+00 | 6.5E+00 | 2.2E+01 | 3.8E+01 | 2.2E+01 | 5.1E+01 | -- | No |
| Zinc | 7440-66-6 | mg/L | 4 / 6 | 1.2E-02 | 1.1E-02 | 2.1E-02 | 1.6E-02 | 1.6E-02 | 5.2E-02 | 1.1E+01 | No |
| *Organic Explosives* | | | | | | | | | | | |
| 2,4,6-Trinitrotoluene | 118-96-7 | mg/L | 2 / 6 | 1.9E-03 | 3.4E-03 | 1.8E-02 | 9.3E-03 | 9.3E-03 | -- | 2.2E-03 | Yes |
| 2,4-Dinitrotoluene | 121-14-2 | mg/L | 1 / 6 | 3.1E-04 | 1.6E-04 | 3.1E-04 | 2.2E-04 | 2.2E-04 | -- | 9.9E-05 | Yes |
| 2-Amino-4,6-dinitrotoluene | 35572-78-2 | mg/L | 2 / 6 | 2.9E-03 | 5.2E-03 | 2.8E-02 | 1.5E-02 | 1.5E-02 | -- | -- | Yes |
| 4-Amino-2,6-dinitrotoluene | 19406-51-0 | mg/L | 2 / 6 | 2.7E-03 | 5.2E-03 | 2.8E-02 | 1.4E-02 | 1.4E-02 | -- | -- | Yes |
| Nitrobenzene | 98-95-3 | mg/L | 1 / 6 | 1.7E-04 | 1.4E-04 | 1.7E-04 | 1.5E-04 | 1.5E-04 | -- | 3.4E-03 | No |
| Nitrocellulose | 9004-70-0 | mg/L | 5 / 6 | 1.8E-01 | 2.5E-01 | 3.2E-01 | 3.2E-01 | 3.2E-01 | -- | -- | Yes |
| *Organic Semivolatiles* | | | | | | | | | | | |
| Bis(2-ethylhexyl)phthalate | 117-81-7 | mg/L | 1 / 6 | 2.4E-03 | 1.6E-03 | 2.4E-03 | 2.1E-03 | 2.1E-03 | -- | 4.8E-03 | No |
| Butyl benzyl phthalate | 85-68-7 | mg/L | 2 / 6 | 2.5E-03 | 6.3E-03 | 1.4E-02 | 9.6E-03 | 9.6E-03 | -- | 7.3E+00 | No |
| Caprolactam | 105-60-2 | mg/L | 6 / 6 | 3.1E-02 | 1.1E-01 | 3.9E-01 | 6.0E-01 | 3.9E-01 | -- | 1.8E+01 | No |
| Di-n-butyl phthalate | 84-74-2 | mg/L | 1 / 1 | 2.3E-03 | 2.3E-03 | 2.3E-03 | -- | 2.3E-03 | -- | 3.6E+00 | No |
| *Organic Volatiles* | | | | | | | | | | | |
| Acetone | 67-64-1 | mg/L | 2 / 3 | 5.9E-03 | 5.7E-03 | 6.2E-03 | 6.8E-03 | 6.2E-03 | -- | 5.5E+00 | No |
| Trichloroethene | 79-01-6 | mg/L | 2 / 6 | 7.1E-03 | 4.9E-03 | 1.2E-02 | 8.1E-03 | 8.1E-03 | -- | 2.8E-05 | Yes |
| ***Unconsolidated Groundwater*** | | | | | | | | | | | |
| *Inorganics* | | | | | | | | | | | |
| Barium | 7440-39-3 | mg/L | 6 / 6 | 2.0E-02 | 4.2E-02 | 6.2E-02 | 5.4E-02 | 5.4E-02 | 8.2E-02 | 2.6E+00 | No |
| Cadmium | 7440-43-9 | mg/L | 1 / 6 | 1.3E-03 | 3.4E-04 | 1.3E-03 | 7.3E-04 | 7.3E-04 | 0.0E+00 | 1.8E-02 | No |

**Table M-1. COPC Screening for Groundwater at Fuze and Booster Quarry Ponds (continued)**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Tap Water PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Calcium | 7440-70-2 | mg/L | 6 / 6 | 1.0E+01 | 4.5E+01 | 9.7E+01 | 1.5E+02 | 9.7E+01 | 1.2E+02 | -- | No |
| Cobalt | 7440-48-4 | mg/L | 2 / 6 | 7.3E-03 | 4.2E-03 | 1.4E-02 | 8.5E-03 | 8.5E-03 | 0.0E+00 | 7.3E-01 | No |
| Copper | 7440-50-8 | mg/L | 1 / 6 | 5.9E-03 | 2.1E-03 | 5.9E-03 | 3.6E-03 | 3.6E-03 | 0.0E+00 | 1.5E+00 | No |
| Iron | 7439-89-6 | mg/L | 3 / 6 | 1.2E-01 | 4.3E+00 | 1.6E+01 | 7.3E+09 | 1.6E+01 | 2.8E-01 | 1.1E+01 | No |
| Magnesium | 7439-95-4 | mg/L | 6 / 6 | 3.4E+00 | 1.6E+01 | 3.2E+01 | 5.9E+01 | 3.2E+01 | 4.3E+01 | -- | No |
| Manganese | 7439-96-5 | mg/L | 6 / 6 | 3.2E-02 | 2.1E+00 | 6.8E+00 | 2.6E+03 | 6.8E+00 | 1.0E+00 | 8.8E-01 | Yes |
| Nickel | 7440-02-0 | mg/L | 3 / 6 | 4.6E-03 | 5.4E-03 | 1.8E-02 | 9.4E-01 | 1.8E-02 | 0.0E+00 | 7.3E-01 | No |
| Potassium | 7440-09-7 | mg/L | 6 / 6 | 9.3E-01 | 2.0E+00 | 2.9E+00 | 2.5E+00 | 2.5E+00 | 2.9E+00 | -- | No |
| Sodium | 7440-23-5 | mg/L | 6 / 6 | 3.2E+00 | 1.4E+01 | 3.5E+01 | 1.5E+02 | 3.5E+01 | 4.6E+01 | -- | No |
| Zinc | 7440-66-6 | mg/L | 2 / 6 | 1.3E-02 | 6.5E-03 | 1.6E-02 | 1.2E-02 | 1.2E-02 | 6.1E-02 | 1.1E+01 | No |
| *Organic Explosives* | | | | | | | | | | | |
| 2-Amino-4,6-dinitrotoluene | 35572-78-2 | mg/L | 1 / 6 | 2.3E-04 | 1.5E-04 | 2.3E-04 | 1.8E-04 | 1.8E-04 | -- | -- | Yes |
| 4-Amino-2,6-dinitrotoluene | 19406-51-0 | mg/L | 1 / 6 | 3.3E-04 | 1.6E-04 | 3.3E-04 | 2.3E-04 | 2.3E-04 | -- | -- | Yes |
| Nitrocellulose | 9004-70-0 | mg/L | 5 / 6 | 2.3E-01 | 2.3E-01 | 3.5E-01 | 3.0E-01 | 3.0E-01 | -- | -- | Yes |
| *Organic Semivolatiles* | | | | | | | | | | | |
| Bis(2-ethylhexyl)phthalate | 117-81-7 | mg/L | 3 / 6 | 1.4E-03 | 1.5E-03 | 2.2E-03 | 2.0E-03 | 2.0E-03 | -- | 4.8E-03 | No |
| Caprolactam | 105-60-2 | mg/L | 3 / 6 | 1.4E-02 | 1.7E-02 | 3.6E-02 | 9.7E-02 | 3.6E-02 | -- | 1.8E+01 | No |
| *Organic Volatiles* | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | mg/L | 1 / 6 | 5.8E-03 | 3.1E-03 | 5.8E-03 | 4.2E-03 | 4.2E-03 | -- | 3.2E+00 | No |
| 1,1-Dichloroethene | 75-35-4 | mg/L | 2 / 6 | 2.5E-03 | 2.8E-03 | 4.2E-03 | 3.4E-03 | 3.4E-03 | -- | 3.4E-01 | No |
| Acetone | 67-64-1 | mg/L | 1 / 4 | 6.2E-03 | 5.3E-03 | 6.2E-03 | 6.0E-03 | 6.0E-03 | -- | 5.5E+00 | No |
| Carbon Disulfide | 75-15-0 | mg/L | 1 / 6 | 9.7E-04 | 2.3E-03 | 9.7E-04 | 2.8E-03 | 9.7E-04 | -- | 1.0E+00 | No |

CAS = Chemical Abstracts Service.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
PRG = Preliminary remediation goal.
UCL = Upper confidence limit on the mean.
-- Criteria not available or insufficient data to calculate the UCL.

**Table M-2. COPC Screening for Shallow Surface Soil at Fuze and Booster Quarry Ponds**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Inorganics*** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 60 / 60 | 7.2E+02 | 1.1E+04 | 1.7E+04 | 1.2E+04 | 1.2E+04 | 1.8E+04 | 7.6E+03 | No |
| Antimony | 7440-36-0 | mg/kg | 15 / 60 | 9.1E-01 | 2.0E+00 | 7.4E+01 | 4.1E+00 | 4.1E+00 | 9.6E-01 | 3.1E+00 | Yes |
| Arsenic | 7440-38-2 | mg/kg | 60 / 60 | 1.1E+00 | 1.1E+01 | 2.7E+01 | 1.2E+01 | 1.2E+01 | 1.5E+01 | 3.9E-01 | Yes |
| Barium | 7440-39-3 | mg/kg | 60 / 60 | 1.1E+01 | 8.7E+01 | 1.1E+03 | 1.2E+02 | 1.2E+02 | 8.8E+01 | 5.4E+02 | Yes |
| Beryllium | 7440-41-7 | mg/kg | 60 / 60 | 2.1E-01 | 7.1E-01 | 1.5E+00 | 7.5E-01 | 7.5E-01 | 8.8E-01 | 1.5E+01 | No |
| Cadmium | 7440-43-9 | mg/kg | 31 / 60 | 1.0E-01 | 2.2E-01 | 4.0E+00 | 3.4E-01 | 3.4E-01 | 0.0E+00 | 3.7E+00 | Yes |
| Calcium | 7440-70-2 | mg/kg | 60 / 60 | 1.1E+02 | 2.6E+03 | 4.0E+04 | 4.1E+03 | 4.1E+03 | 1.6E+04 | -- | No |
| Chromium | 7440-47-3 | mg/kg | 60 / 60 | 2.7E+00 | 1.8E+01 | 8.9E+01 | 2.0E+01 | 2.0E+01 | 1.7E+01 | 2.2E+01 | Yes |
| Chromium, hexavalent | 18540-29-9 | mg/kg | 7 / 8 | 1.3E+00 | 3.7E+00 | 6.8E+00 | 7.2E+00 | 6.8E+00 | -- | 2.2E+01 | No |
| Cobalt | 7440-48-4 | mg/kg | 60 / 60 | 1.1E+00 | 1.1E+01 | 3.7E+01 | 1.2E+01 | 1.2E+01 | 1.0E+01 | 1.4E+02 | No |
| Copper | 7440-50-8 | mg/kg | 60 / 60 | 2.1E+00 | 2.6E+01 | 5.6E+02 | 4.1E+01 | 4.1E+01 | 1.8E+01 | 3.1E+02 | Yes |
| Iron | 7439-89-6 | mg/kg | 60 / 60 | 4.3E+03 | 2.6E+04 | 1.1E+05 | 2.9E+04 | 2.9E+04 | 2.3E+04 | 2.3E+03 | No |
| Lead | 7439-92-1 | mg/kg | 60 / 60 | 5.8E+00 | 5.7E+01 | 8.9E+02 | 8.3E+01 | 8.3E+01 | 2.6E+01 | 4.0E+02 | Yes |
| Magnesium | 7439-95-4 | mg/kg | 60 / 60 | 1.4E+02 | 2.4E+03 | 9.9E+03 | 2.7E+03 | 2.7E+03 | 3.0E+03 | -- | No |
| Manganese | 7439-96-5 | mg/kg | 60 / 60 | 2.2E+02 | 6.6E+02 | 2.3E+03 | 7.4E+02 | 7.4E+02 | 1.5E+03 | 1.8E+02 | Yes |
| Mercury | 7439-97-6 | mg/kg | 12 / 60 | 5.4E-02 | 6.3E-02 | 1.2E+00 | 1.0E-01 | 1.0E-01 | 3.6E-02 | 2.3E+00 | No |
| Nickel | 7440-02-0 | mg/kg | 60 / 60 | 2.9E+00 | 1.8E+01 | 8.5E+01 | 2.1E+01 | 2.1E+01 | 2.1E+01 | 1.6E+02 | No |
| Potassium | 7440-09-7 | mg/kg | 60 / 60 | 1.2E+02 | 1.1E+03 | 2.7E+03 | 1.2E+03 | 1.2E+03 | 9.3E+02 | -- | No |
| Selenium | 7782-49-2 | mg/kg | 34 / 60 | 1.1E+00 | 1.2E+00 | 7.9E+00 | 1.4E+00 | 1.4E+00 | 1.4E+00 | 3.9E+01 | No |
| Silver | 7440-22-4 | mg/kg | 1 / 60 | 2.6E-01 | 6.3E-02 | 2.6E-01 | 7.6E-02 | 7.6E-02 | 0.0E+00 | 3.9E+01 | No |
| Sodium | 7440-23-5 | mg/kg | 55 / 60 | 6.1E+01 | 1.0E+02 | 6.9E+02 | 1.2E+02 | 1.2E+02 | 1.2E+02 | -- | No |
| Vanadium | 7440-62-2 | mg/kg | 60 / 60 | 3.0E+00 | 2.1E+01 | 3.6E+01 | 2.2E+01 | 2.2E+01 | 3.1E+01 | 7.8E+00 | Yes |
| Zinc | 7440-66-6 | mg/kg | 60 / 60 | 1.5E+01 | 9.9E+01 | 1.3E+03 | 1.4E+02 | 1.4E+02 | 6.2E+01 | 2.3E+03 | No |
| ***Organic Explosives*** | | | | | | | | | | | |
| 1,3,5-Trinitrobenzene | 99-35-4 | mg/kg | 6 / 60 | 6.2E-02 | 9.0E-02 | 1.7E+00 | 1.4E-01 | 1.4E-01 | -- | 1.8E+02 | No |
| 2,4,6-Trinitrotoluene | 118-96-7 | mg/kg | 11 / 60 | 2.7E-02 | 1.9E+00 | 9.9E+01 | 4.6E+00 | 4.6E+00 | -- | 3.1E+00 | Yes |
| 2,4-Dinitrotoluene | 121-14-2 | mg/kg | 4 / 60 | 3.8E-02 | 5.8E-02 | 4.0E-01 | 6.9E-02 | 6.9E-02 | -- | 7.2E-01 | No |
| 2,6-Dinitrotoluene | 606-20-2 | mg/kg | 2 / 60 | 7.0E-02 | 7.1E-02 | 1.3E+00 | 1.1E-01 | 1.1E-01 | -- | 7.2E-01 | Yes |
| 2-Amino-4,6-dinitrotoluene | 35572-78-2 | mg/kg | 9 / 60 | 1.4E-01 | 3.0E-01 | 1.2E+01 | 6.4E-01 | 6.4E-01 | -- | -- | Yes |
| 4-Amino-2,6-dinitrotoluene | 19406-51-0 | mg/kg | 9 / 60 | 1.1E-01 | 2.6E-01 | 9.7E+00 | 5.2E-01 | 5.2E-01 | -- | -- | Yes |
| Nitrobenzene | 98-95-3 | mg/kg | 4 / 60 | 4.0E-02 | 5.0E-02 | 8.3E-02 | 5.1E-02 | 5.1E-02 | -- | 2.0E+00 | No |

**Table M-2. COPC Screening for Shallow Surface Soil at Fuze and Booster Quarry Ponds (continued)**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nitrocellulose | 9004-70-0 | mg/kg | 6 / 8 | 2.5E+01 | 5.6E+01 | 1.5E+02 | 3.1E+02 | 1.5E+02 | -- | -- | Yes |
| RDX | 121-82-4 | mg/kg | 1 / 60 | 3.3E-01 | 1.0E-01 | 3.3E-01 | 1.1E-01 | 1.1E-01 | -- | 4.4E+00 | No |
| ***Organic Pesticides*** | | | | | | | | | | | |
| 4,4'-DDE | 72-55-9 | mg/kg | 2 / 8 | 1.8E-04 | 8.5E-04 | 3.7E-04 | 1.1E-03 | 3.7E-04 | -- | 1.7E+00 | No |
| ***Organic Semivolatiles*** | | | | | | | | | | | |
| Benz(*a*)anthracene | 56-55-3 | mg/kg | 1 / 8 | 1.9E-01 | 2.1E-01 | 1.9E-01 | 2.1E-01 | 1.9E-01 | -- | 6.2E-01 | No |
| Benzo(*a*)pyrene | 50-32-8 | mg/kg | 1 / 8 | 8.4E-02 | 1.9E-01 | 8.4E-02 | 2.2E-01 | 8.4E-02 | -- | 6.2E-02 | Yes |
| Benzo(*b*)fluoranthene | 205-99-2 | mg/kg | 1 / 8 | 2.6E-01 | 2.2E-01 | 2.6E-01 | 2.3E-01 | 2.3E-01 | -- | 6.2E-01 | No |
| Benzo(*k*)fluoranthene | 207-08-9 | mg/kg | 1 / 8 | 8.5E-02 | 1.9E-01 | 8.5E-02 | 2.2E-01 | 8.5E-02 | -- | 6.2E+00 | No |
| Chrysene | 218-01-9 | mg/kg | 1 / 8 | 3.7E-01 | 2.3E-01 | 3.7E-01 | 2.7E-01 | 2.7E-01 | -- | 6.2E+01 | No |
| Di-n-butyl phthalate | 84-74-2 | mg/kg | 1 / 5 | 2.4E-01 | 2.2E-01 | 2.4E-01 | 2.3E-01 | 2.3E-01 | -- | 6.1E+02 | No |
| Fluoranthene | 206-44-0 | mg/kg | 2 / 8 | 5.0E-02 | 2.7E-01 | 8.7E-01 | 4.4E-01 | 4.4E-01 | -- | 2.3E+02 | No |
| Pyrene | 129-00-0 | mg/kg | 1 / 8 | 6.4E-01 | 2.6E-01 | 6.4E-01 | 3.7E-01 | 3.7E-01 | -- | 2.3E+02 | No |
| ***Organic Volatiles*** | | | | | | | | | | | |
| Acetone | 67-64-1 | mg/kg | 1 / 4 | 5.1E-03 | 5.0E-03 | 5.1E-03 | 6.4E-03 | 5.1E-03 | -- | 1.4E+03 | No |
| Carbon Disulfide | 75-15-0 | mg/kg | 1 / 8 | 6.9E-02 | 1.1E-02 | 6.9E-02 | 2.7E-02 | 2.7E-02 | -- | 3.6E+01 | No |
| Methylene Chloride | 75-09-2 | mg/kg | 1 / 4 | 2.7E-02 | 9.8E-03 | 2.7E-02 | 2.3E-02 | 2.3E-02 | -- | 9.1E+00 | No |
| Trichloroethene | 79-01-6 | mg/kg | 2 / 8 | 3.2E-03 | 3.4E-03 | 4.9E-03 | 3.8E-03 | 3.8E-03 | -- | 5.3E-02 | No |

CAS = Chemical Abstracts Service.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
PRG = Preliminary remediation goal.
UCL = Upper confidence limit on the mean.
-- Criteria not available or insufficient data to calculate the UCL.

**Table M-3. COPC Screening for Deep Surface Soil at Fuze and Booster Quarry Ponds**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Inorganics*** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 97 / 97 | 5.6E+02 | 1.2E+04 | 2.1E+04 | 1.3E+04 | 1.3E+04 | 1.8E+04 | 7.6E+03 | Yes |
| Antimony | 7440-36-0 | mg/kg | 17 / 97 | 9.1E-01 | 1.4E+00 | 7.4E+01 | 2.7E+00 | 2.7E+00 | 9.6E-01 | 3.1E+00 | Yes |
| Arsenic | 7440-38-2 | mg/kg | 96 / 97 | 1.1E+00 | 1.3E+01 | 2.7E+01 | 1.3E+01 | 1.3E+01 | 1.5E+01 | 3.9E-01 | Yes |
| Barium | 7440-39-3 | mg/kg | 97 / 97 | 1.1E+01 | 8.3E+01 | 1.1E+03 | 1.0E+02 | 1.0E+02 | 8.8E+01 | 5.4E+02 | Yes |
| Beryllium | 7440-41-7 | mg/kg | 97 / 97 | 2.0E-01 | 7.3E-01 | 1.5E+00 | 7.7E-01 | 7.7E-01 | 8.8E-01 | 1.5E+01 | No |
| Cadmium | 7440-43-9 | mg/kg | 41 / 97 | 8.5E-02 | 1.6E-01 | 4.0E+00 | 2.3E-01 | 2.3E-01 | 0.0E+00 | 3.7E+00 | Yes |
| Calcium | 7440-70-2 | mg/kg | 97 / 97 | 9.1E+01 | 3.6E+03 | 4.0E+04 | 5.0E+03 | 5.0E+03 | 1.6E+04 | -- | No |
| Chromium | 7440-47-3 | mg/kg | 97 / 97 | 2.7E+00 | 2.1E+01 | 2.8E+02 | 2.6E+01 | 2.6E+01 | 1.7E+01 | 2.2E+01 | Yes |
| Chromium, hexavalent | 18540-29-9 | mg/kg | 9 / 13 | 1.3E+00 | 3.5E+00 | 7.9E+00 | 5.6E+00 | 5.6E+00 | -- | 2.2E+01 | No |
| Cobalt | 7440-48-4 | mg/kg | 97 / 97 | 9.7E-01 | 1.1E+01 | 3.7E+01 | 1.2E+01 | 1.2E+01 | 1.0E+01 | 1.4E+02 | No |
| Copper | 7440-50-8 | mg/kg | 97 / 97 | 8.5E-01 | 2.4E+01 | 5.6E+02 | 3.3E+01 | 3.3E+01 | 1.8E+01 | 3.1E+02 | Yes |
| Iron | 7439-89-6 | mg/kg | 97 / 97 | 4.3E+03 | 2.7E+04 | 1.1E+05 | 2.9E+04 | 2.9E+04 | 2.3E+04 | 2.3E+03 | No |
| Lead | 7439-92-1 | mg/kg | 97 / 97 | 2.2E+00 | 4.2E+01 | 8.9E+02 | 5.8E+01 | 5.8E+01 | 1.9E+01 | 4.0E+02 | Yes |
| Magnesium | 7439-95-4 | mg/kg | 97 / 97 | 9.6E+01 | 2.9E+03 | 9.9E+03 | 3.2E+03 | 3.2E+03 | 3.0E+03 | -- | No |
| Manganese | 7439-96-5 | mg/kg | 97 / 97 | 1.9E+02 | 5.8E+02 | 2.3E+03 | 6.3E+02 | 6.3E+02 | 1.5E+03 | 1.8E+02 | Yes |
| Mercury | 7439-97-6 | mg/kg | 13 / 97 | 5.4E-02 | 5.1E-02 | 1.2E+00 | 7.7E-02 | 7.7E-02 | 3.6E-02 | 2.3E+00 | No |
| Nickel | 7440-02-0 | mg/kg | 97 / 97 | 2.3E+00 | 2.0E+01 | 8.5E+01 | 2.2E+01 | 2.2E+01 | 2.1E+01 | 1.6E+02 | No |
| Potassium | 7440-09-7 | mg/kg | 97 / 97 | 1.2E+02 | 1.2E+03 | 3.1E+03 | 1.3E+03 | 1.3E+03 | 9.3E+02 | -- | No |
| Selenium | 7782-49-2 | mg/kg | 58 / 97 | 1.0E+00 | 1.2E+00 | 7.9E+00 | 1.4E+00 | 1.4E+00 | 1.4E+00 | 3.9E+01 | No |
| Silver | 7440-22-4 | mg/kg | 1 / 97 | 2.6E-01 | 5.4E-02 | 2.6E-01 | 6.2E-02 | 6.2E-02 | 0.0E+00 | 3.9E+01 | No |
| Sodium | 7440-23-5 | mg/kg | 91 / 97 | 6.1E+01 | 1.1E+02 | 6.9E+02 | 1.2E+02 | 1.2E+02 | 1.2E+02 | -- | No |
| Vanadium | 7440-62-2 | mg/kg | 97 / 97 | 2.7E+00 | 2.2E+01 | 4.0E+01 | 2.3E+01 | 2.3E+01 | 3.1E+01 | 7.8E+00 | Yes |
| Zinc | 7440-66-6 | mg/kg | 97 / 97 | 1.5E+01 | 8.6E+01 | 1.3E+03 | 1.1E+02 | 1.1E+02 | 6.2E+01 | 2.3E+03 | No |
| ***Organic Explosives*** | | | | | | | | | | | |
| 1,3,5-Trinitrobenzene | 99-35-4 | mg/kg | 6 / 97 | 6.2E-02 | 7.5E-02 | 1.7E+00 | 1.0E-01 | 1.0E-01 | -- | 1.8E+02 | No |
| 2,4,6-Trinitrotoluene | 118-96-7 | mg/kg | 11 / 97 | 2.7E-02 | 1.2E+00 | 9.9E+01 | 2.9E+00 | 2.9E+00 | -- | 3.1E+00 | Yes |
| 2,4-Dinitrotoluene | 121-14-2 | mg/kg | 4 / 97 | 3.8E-02 | 5.5E-02 | 4.0E-01 | 6.2E-02 | 6.2E-02 | -- | 7.2E-01 | No |
| 2,6-Dinitrotoluene | 606-20-2 | mg/kg | 2 / 97 | 7.0E-02 | 6.3E-02 | 1.3E+00 | 8.5E-02 | 8.5E-02 | -- | 7.2E-01 | Yes |
| 2-Amino-4,6-dinitrotoluene | 35572-78-2 | mg/kg | 9 / 97 | 1.4E-01 | 2.1E-01 | 1.2E+01 | 4.1E-01 | 4.1E-01 | -- | -- | Yes |
| 4-Amino-2,6-dinitrotoluene | 19406-51-0 | mg/kg | 9 / 97 | 1.1E-01 | 1.8E-01 | 9.7E+00 | 3.4E-01 | 3.4E-01 | -- | -- | Yes |
| Nitrobenzene | 98-95-3 | mg/kg | 12 / 97 | 3.9E-02 | 5.2E-02 | 1.0E-01 | 5.3E-02 | 5.3E-02 | -- | 2.0E+00 | No |

**Table M-3. COPC Screening for Deep Surface Soil at Fuze and Booster Quarry Ponds (continued)**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nitrocellulose | 9004-70-0 | mg/kg | 10 / 13 | 2.5E+01 | 5.4E+01 | 1.5E+02 | 1.3E+02 | 1.3E+02 | -- | -- | Yes |
| RDX | 121-82-4 | mg/kg | 1 / 97 | 3.3E-01 | 1.0E-01 | 3.3E-01 | 1.1E-01 | 1.1E-01 | -- | 4.4E+00 | No |
| ***Organic Pesticides*** | | | | | | | | | | | |
| 4,4'-DDE | 72-55-9 | mg/kg | 2 / 13 | 1.8E-04 | 9.1E-04 | 3.7E-04 | 1.1E-03 | 3.7E-04 | -- | 1.7E+00 | No |
| ***Organic Semivolatiles*** | | | | | | | | | | | |
| Benz(*a*)anthracene | 56-55-3 | mg/kg | 1 / 13 | 1.9E-01 | 2.0E-01 | 1.9E-01 | 2.1E-01 | 1.9E-01 | -- | 6.2E-01 | No |
| Benzo(*a*)pyrene | 50-32-8 | mg/kg | 1 / 13 | 8.4E-02 | 2.0E-01 | 8.4E-02 | 2.1E-01 | 8.4E-02 | -- | 6.2E-02 | Yes |
| Benzo(*b*)fluoranthene | 205-99-2 | mg/kg | 1 / 13 | 2.6E-01 | 2.1E-01 | 2.6E-01 | 2.2E-01 | 2.2E-01 | -- | 6.2E-01 | No |
| Benzo(*k*)fluoranthene | 207-08-9 | mg/kg | 1 / 13 | 8.5E-02 | 2.0E-01 | 8.5E-02 | 2.1E-01 | 8.5E-02 | -- | 6.2E+00 | No |
| Chrysene | 218-01-9 | mg/kg | 1 / 13 | 3.7E-01 | 2.2E-01 | 3.7E-01 | 2.4E-01 | 2.4E-01 | -- | 6.2E+01 | No |
| Di-n-butyl phthalate | 84-74-2 | mg/kg | 1 / 8 | 2.4E-01 | 2.1E-01 | 2.4E-01 | 2.2E-01 | 2.2E-01 | -- | 6.1E+02 | No |
| Fluoranthene | 206-44-0 | mg/kg | 2 / 13 | 5.0E-02 | 2.4E-01 | 8.7E-01 | 3.4E-01 | 3.4E-01 | -- | 2.3E+02 | No |
| Pyrene | 129-00-0 | mg/kg | 1 / 13 | 6.4E-01 | 2.4E-01 | 6.4E-01 | 3.0E-01 | 3.0E-01 | -- | 2.3E+02 | No |
| ***Organic Volatiles*** | | | | | | | | | | | |
| Acetone | 67-64-1 | mg/kg | 1 / 7 | 5.1E-03 | 4.4E-03 | 5.1E-03 | 5.2E-03 | 5.1E-03 | -- | 1.4E+03 | No |
| Carbon Disulfide | 75-15-0 | mg/kg | 3 / 13 | 1.3E-02 | 1.5E-02 | 8.7E-02 | 2.9E-02 | 2.9E-02 | -- | 3.6E+01 | No |
| Methylene Chloride | 75-09-2 | mg/kg | 3 / 7 | 1.7E-02 | 1.7E-02 | 2.7E-02 | 2.7E-02 | 2.7E-02 | -- | 9.1E+00 | No |
| Trichloroethene | 79-01-6 | mg/kg | 3 / 13 | 2.8E-03 | 3.2E-03 | 4.9E-03 | 3.5E-03 | 3.5E-03 | -- | 5.3E-02 | No |

CAS = Chemical Abstracts Service.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
PRG = Preliminary remediation goal.
UCL = Upper confidence limit on the mean.
-- Criteria not available or insufficient data to calculate the UCL.

**Table M-4. COPC Screening for Subsurface Soil at Fuze and Booster Quarry Ponds**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Inorganics*** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 37 / 37 | 5.6E+02 | 1.4E+04 | 2.1E+04 | 1.5E+04 | 1.5E+04 | 2.0E+04 | 7.6E+03 | Yes |
| Antimony | 7440-36-0 | mg/kg | 2 / 37 | 1.1E+00 | 3.0E-01 | 1.9E+00 | 3.8E-01 | 3.8E-01 | 9.6E-01 | 3.1E+00 | No |
| Arsenic | 7440-38-2 | mg/kg | 36 / 37 | 7.3E+00 | 1.5E+01 | 2.5E+01 | 1.6E+01 | 1.6E+01 | 2.0E+01 | 3.9E-01 | Yes |
| Barium | 7440-39-3 | mg/kg | 37 / 37 | 1.1E+01 | 7.6E+01 | 1.5E+02 | 8.4E+01 | 8.4E+01 | 1.2E+02 | 5.4E+02 | No |
| Beryllium | 7440-41-7 | mg/kg | 37 / 37 | 2.0E-01 | 7.8E-01 | 1.2E+00 | 8.3E-01 | 8.3E-01 | 8.8E-01 | 1.5E+01 | No |
| Cadmium | 7440-43-9 | mg/kg | 10 / 37 | 8.5E-02 | 6.1E-02 | 7.2E-01 | 9.6E-02 | 9.6E-02 | 0.0E+00 | 3.7E+00 | No |
| Calcium | 7440-70-2 | mg/kg | 37 / 37 | 9.1E+01 | 5.1E+03 | 3.5E+04 | 8.1E+03 | 8.1E+03 | 3.6E+04 | -- | No |
| Chromium | 7440-47-3 | mg/kg | 37 / 37 | 3.0E+00 | 2.7E+01 | 2.8E+02 | 3.9E+01 | 3.9E+01 | 2.7E+01 | 2.2E+01 | Yes |
| Chromium, hexavalent | 18540-29-9 | mg/kg | 2 / 5 | 3.7E+00 | 3.2E+00 | 7.9E+00 | 5.9E+00 | 5.9E+00 | -- | 2.2E+01 | No |
| Cobalt | 7440-48-4 | mg/kg | 37 / 37 | 9.7E-01 | 1.2E+01 | 2.3E+01 | 1.3E+01 | 1.3E+01 | 2.3E+01 | 1.4E+02 | No |
| Copper | 7440-50-8 | mg/kg | 37 / 37 | 8.5E-01 | 2.0E+01 | 2.8E+01 | 2.2E+01 | 2.2E+01 | 3.2E+01 | 3.1E+02 | No |
| Iron | 7439-89-6 | mg/kg | 37 / 37 | 1.4E+04 | 2.8E+04 | 4.1E+04 | 2.9E+04 | 2.9E+04 | 3.5E+04 | 2.3E+03 | No |
| Lead | 7439-92-1 | mg/kg | 37 / 37 | 2.2E+00 | 1.8E+01 | 1.2E+02 | 2.2E+01 | 2.2E+01 | 1.9E+01 | 4.0E+02 | No |
| Magnesium | 7439-95-4 | mg/kg | 37 / 37 | 9.6E+01 | 3.6E+03 | 9.1E+03 | 4.2E+03 | 4.2E+03 | 8.8E+03 | -- | No |
| Manganese | 7439-96-5 | mg/kg | 37 / 37 | 1.9E+02 | 4.5E+02 | 9.8E+02 | 5.0E+02 | 5.0E+02 | 3.0E+03 | 1.8E+02 | No |
| Mercury | 7439-97-6 | mg/kg | 1 / 37 | 7.6E-01 | 3.1E-02 | 7.6E-01 | 6.5E-02 | 6.5E-02 | 4.4E-02 | 2.3E+00 | No |
| Nickel | 7440-02-0 | mg/kg | 37 / 37 | 2.3E+00 | 2.3E+01 | 3.7E+01 | 2.5E+01 | 2.5E+01 | 6.1E+01 | 1.6E+02 | No |
| Potassium | 7440-09-7 | mg/kg | 37 / 37 | 1.2E+02 | 1.5E+03 | 3.1E+03 | 1.6E+03 | 1.6E+03 | 3.4E+03 | -- | No |
| Selenium | 7782-49-2 | mg/kg | 24 / 37 | 1.0E+00 | 1.2E+00 | 3.1E+00 | 1.4E+00 | 1.4E+00 | 1.5E+00 | 3.9E+01 | No |
| Sodium | 7440-23-5 | mg/kg | 36 / 37 | 6.8E+01 | 1.1E+02 | 1.8E+02 | 1.2E+02 | 1.2E+02 | 1.5E+02 | -- | No |
| Vanadium | 7440-62-2 | mg/kg | 37 / 37 | 2.7E+00 | 2.5E+01 | 4.0E+01 | 2.6E+01 | 2.6E+01 | 3.8E+01 | 7.8E+00 | Yes |
| Zinc | 7440-66-6 | mg/kg | 37 / 37 | 1.8E+01 | 6.3E+01 | 1.6E+02 | 6.9E+01 | 6.9E+01 | 9.3E+01 | 2.3E+03 | No |
| ***Organic Explosives*** | | | | | | | | | | | |
| Nitrobenzene | 98-95-3 | mg/kg | 8 / 37 | 3.9E-02 | 5.4E-02 | 1.0E-01 | 5.8E-02 | 5.8E-02 | -- | 2.0E+00 | No |
| Nitrocellulose | 9004-70-0 | mg/kg | 4 / 5 | 2.6E+01 | 4.9E+01 | 1.1E+02 | 5.6E+02 | 1.1E+02 | -- | -- | Yes |
| ***Organic Volatiles*** | | | | | | | | | | | |
| Carbon Disulfide | 75-15-0 | mg/kg | 2 / 5 | 1.3E-02 | 2.2E-02 | 8.7E-02 | 5.7E-02 | 5.7E-02 | -- | 3.6E+01 | No |
| Methylene Chloride | 75-09-2 | mg/kg | 2 / 3 | 1.7E-02 | 2.6E-02 | 1.8E-02 | 2.6E-01 | 1.8E-02 | -- | 9.1E+00 | No |
| Trichloroethene | 79-01-6 | mg/kg | 1 / 5 | 2.8E-03 | 3.0E-03 | 2.8E-03 | 3.1E-03 | 2.8E-03 | -- | 5.3E-02 | No |

CAS = Chemical Abstracts Service.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
PRG = Preliminary remediation goal.
UCL = Upper confidence limit on the mean.
-- Criteria not available or insufficient data to calculate the UCL.

**Table M-5. COPC Screening for Sediment at Fuze and Booster Quarry Ponds**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ditch*** | | | | | | | | | | | |
| *Inorganics* | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 7 / 7 | 7.6E+03 | 1.3E+04 | 1.7E+04 | 1.6E+04 | 1.6E+04 | 1.4E+04 | 7.6E+03 | Yes |
| Antimony | 7440-36-0 | mg/kg | 2 / 7 | 3.8E+00 | 2.4E+00 | 1.2E+01 | 5.5E+00 | 5.5E+00 | 0.0E+00 | 3.1E+00 | Yes |
| Arsenic | 7440-38-2 | mg/kg | 7 / 7 | 8.7E+00 | 1.4E+01 | 3.3E+01 | 2.1E+01 | 2.1E+01 | 2.0E+01 | 3.9E-01 | Yes |
| Barium | 7440-39-3 | mg/kg | 7 / 7 | 9.8E+01 | 1.9E+02 | 5.1E+02 | 3.5E+02 | 3.5E+02 | 1.2E+02 | 5.4E+02 | No |
| Beryllium | 7440-41-7 | mg/kg | 7 / 7 | 6.2E-01 | 8.5E-01 | 1.1E+00 | 9.6E-01 | 9.6E-01 | 3.8E-01 | 1.5E+01 | No |
| Cadmium | 7440-43-9 | mg/kg | 5 / 7 | 1.0E-01 | 5.7E-01 | 2.3E+00 | 1.6E+02 | 2.3E+00 | 0.0E+00 | 3.7E+00 | No |
| Calcium | 7440-70-2 | mg/kg | 7 / 7 | 1.4E+03 | 2.9E+03 | 7.8E+03 | 5.6E+03 | 5.6E+03 | 5.5E+03 | -- | No |
| Chromium | 7440-47-3 | mg/kg | 7 / 7 | 1.6E+01 | 1.9E+01 | 2.1E+01 | 2.0E+01 | 2.0E+01 | 1.8E+01 | 2.2E+01 | No |
| Chromium, hexavalent | 18540-29-9 | mg/kg | 2 / 7 | 1.9E+00 | 2.0E+00 | 1.9E+00 | 3.2E+00 | 1.9E+00 | -- | 2.2E+01 | No |
| Cobalt | 7440-48-4 | mg/kg | 7 / 7 | 7.7E+00 | 1.1E+01 | 1.6E+01 | 1.4E+01 | 1.4E+01 | 9.1E+00 | 1.4E+02 | No |
| Copper | 7440-50-8 | mg/kg | 7 / 7 | 1.5E+01 | 3.2E+01 | 6.3E+01 | 6.0E+01 | 6.0E+01 | 2.8E+01 | 3.1E+02 | No |
| Iron | 7439-89-6 | mg/kg | 7 / 7 | 2.0E+04 | 3.1E+04 | 5.5E+04 | 4.2E+04 | 4.2E+04 | 2.8E+04 | 2.3E+03 | No |
| Lead | 7439-92-1 | mg/kg | 7 / 7 | 2.5E+01 | 4.0E+01 | 8.0E+01 | 5.5E+01 | 5.5E+01 | 2.7E+01 | 4.0E+02 | No |
| Magnesium | 7439-95-4 | mg/kg | 7 / 7 | 1.6E+03 | 2.7E+03 | 3.6E+03 | 3.2E+03 | 3.2E+03 | 2.8E+03 | -- | No |
| Manganese | 7439-96-5 | mg/kg | 7 / 7 | 2.1E+02 | 1.2E+03 | 4.1E+03 | 8.4E+03 | 4.1E+03 | 2.0E+03 | 1.8E+02 | Yes |
| Mercury | 7439-97-6 | mg/kg | 6 / 7 | 8.7E-02 | 2.9E-01 | 8.0E-01 | 4.9E+00 | 8.0E-01 | 5.9E-02 | 2.3E+00 | No |
| Nickel | 7440-02-0 | mg/kg | 7 / 7 | 1.8E+01 | 2.3E+01 | 3.0E+01 | 2.7E+01 | 2.7E+01 | 1.8E+01 | 1.6E+02 | No |
| Potassium | 7440-09-7 | mg/kg | 7 / 7 | 1.1E+03 | 1.4E+03 | 1.9E+03 | 1.7E+03 | 1.7E+03 | 2.0E+03 | -- | No |
| Selenium | 7782-49-2 | mg/kg | 1 / 7 | 2.3E+00 | 8.3E-01 | 2.3E+00 | 1.3E+00 | 1.3E+00 | 1.7E+00 | 3.9E+01 | No |
| Silver | 7440-22-4 | mg/kg | 1 / 7 | 5.1E-01 | 2.4E-01 | 5.1E-01 | 4.2E-01 | 4.2E-01 | 0.0E+00 | 3.9E+01 | No |
| Sodium | 7440-23-5 | mg/kg | 7 / 7 | 1.2E+02 | 1.7E+02 | 2.9E+02 | 2.2E+02 | 2.2E+02 | 1.1E+02 | -- | No |
| Vanadium | 7440-62-2 | mg/kg | 7 / 7 | 1.6E+01 | 2.4E+01 | 3.1E+01 | 2.8E+01 | 2.8E+01 | 2.6E+01 | 7.8E+00 | Yes |
| Zinc | 7440-66-6 | mg/kg | 7 / 7 | 8.3E+01 | 2.2E+02 | 5.4E+02 | 5.9E+02 | 5.4E+02 | 5.3E+02 | 2.3E+03 | No |
| *Organic Explosives* | | | | | | | | | | | |
| 2,4,6-Trinitrotoluene | 118-96-7 | mg/kg | 3 / 7 | 3.3E-02 | 4.8E-02 | 6.0E-02 | 5.4E-02 | 5.4E-02 | -- | 3.1E+00 | No |
| 3-Nitrotoluene | 99-08-1 | mg/kg | 2 / 7 | 1.0E-01 | 1.1E-01 | 1.5E-01 | 1.2E-01 | 1.2E-01 | -- | 7.3E+01 | No |
| Nitrobenzene | 98-95-3 | mg/kg | 1 / 7 | 7.1E-02 | 4.5E-02 | 7.1E-02 | 5.8E-02 | 5.8E-02 | -- | 2.0E+00 | No |
| Nitrocellulose | 9004-70-0 | mg/kg | 5 / 7 | 3.2E+01 | 5.8E+01 | 1.0E+02 | 8.1E+01 | 8.1E+01 | -- | -- | Yes |

**Table M-5. COPC Screening for Sediment at Fuze and Booster Quarry Ponds (continued)**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organic Pesticides* | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | 2 / 7 | 1.5E-03 | 3.4E-03 | 1.3E-02 | 6.6E-03 | 6.6E-03 | -- | 2.4E+00 | No |
| 4,4'-DDE | 72-55-9 | mg/kg | 2 / 7 | 1.0E-03 | 1.4E-03 | 1.5E-03 | 1.7E-03 | 1.5E-03 | -- | 1.7E+00 | No |
| Methoxychlor | 72-43-5 | mg/kg | 1 / 7 | 2.3E-03 | 1.6E-03 | 2.3E-03 | 1.9E-03 | 1.9E-03 | -- | 3.1E+01 | No |
| *Organic Semivolatiles* | | | | | | | | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 2 / 7 | 1.9E-01 | 4.6E-01 | 1.6E+00 | 8.4E-01 | 8.4E-01 | -- | 5.6E+00 | No |
| Acenaphthylene | 208-96-8 | mg/kg | 1 / 7 | 1.1E-01 | 3.3E-01 | 1.1E-01 | 4.8E-01 | 1.1E-01 | -- | -- | Yes |
| Anthracene | 120-12-7 | mg/kg | 1 / 7 | 4.6E-01 | 3.8E-01 | 4.6E-01 | 5.2E-01 | 4.6E-01 | -- | 2.2E+03 | No |
| Benz(*a*)anthracene | 56-55-3 | mg/kg | 2 / 7 | 3.4E-01 | 4.1E-01 | 1.1E+00 | 6.4E-01 | 6.4E-01 | -- | 6.2E-01 | Yes |
| Benzo(*a*)pyrene | 50-32-8 | mg/kg | 2 / 7 | 3.0E-01 | 3.7E-01 | 8.4E-01 | 5.3E-01 | 5.3E-01 | -- | 6.2E-02 | Yes |
| Benzo(*b*)fluoranthene | 205-99-2 | mg/kg | 2 / 7 | 3.8E-01 | 4.0E-01 | 9.8E-01 | 6.0E-01 | 6.0E-01 | -- | 6.2E-01 | Yes |
| Benzo(*ghi*)perylene | 191-24-2 | mg/kg | 1 / 7 | 3.9E-01 | 3.7E-01 | 3.9E-01 | 5.0E-01 | 3.9E-01 | -- | -- | Yes |
| Benzo(*k*)fluoranthene | 207-08-9 | mg/kg | 1 / 7 | 2.5E-01 | 3.5E-01 | 2.5E-01 | 4.9E-01 | 2.5E-01 | -- | 6.2E+00 | No |
| Carbazole | 86-74-8 | mg/kg | 1 / 7 | 2.3E-01 | 3.5E-01 | 2.3E-01 | 4.9E-01 | 2.3E-01 | -- | 2.4E+01 | No |
| Chrysene | 218-01-9 | mg/kg | 2 / 7 | 3.2E-01 | 3.8E-01 | 8.9E-01 | 5.5E-01 | 5.5E-01 | -- | 6.2E+01 | No |
| Dibenzofuran | 132-64-9 | mg/kg | 2 / 7 | 1.1E-01 | 2.9E-01 | 4.3E-01 | 3.7E-01 | 3.7E-01 | -- | 1.5E+01 | No |
| Fluoranthene | 206-44-0 | mg/kg | 2 / 7 | 5.9E-01 | 6.4E-01 | 2.4E+00 | 1.2E+00 | 1.2E+00 | -- | 2.3E+02 | No |
| Fluorene | 86-73-7 | mg/kg | 1 / 7 | 1.2E-01 | 3.3E-01 | 1.2E-01 | 4.8E-01 | 1.2E-01 | -- | 2.7E+02 | No |
| Indeno(*1,2,3-cd*)pyrene | 193-39-5 | mg/kg | 2 / 7 | 1.5E-01 | 2.9E-01 | 4.0E-01 | 3.6E-01 | 3.6E-01 | -- | 6.2E-01 | No |
| Naphthalene | 91-20-3 | mg/kg | 2 / 7 | 1.4E-01 | 3.7E-01 | 9.7E-01 | 5.7E-01 | 5.7E-01 | -- | 5.6E+00 | No |
| Phenanthrene | 85-01-8 | mg/kg | 2 / 7 | 9.6E-01 | 5.9E-01 | 1.7E+00 | 9.9E-01 | 9.9E-01 | -- | -- | Yes |
| Pyrene | 129-00-0 | mg/kg | 2 / 7 | 4.7E-01 | 4.9E-01 | 1.5E+00 | 8.2E-01 | 8.2E-01 | -- | 2.3E+02 | No |
| *Organic Volatiles* | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/kg | 2 / 7 | 1.1E-02 | 1.1E-02 | 2.6E-02 | 1.6E-02 | 1.6E-02 | -- | 2.2E+03 | No |
| Carbon Disulfide | 75-15-0 | mg/kg | 2 / 7 | 2.3E-03 | 4.6E-03 | 3.6E-03 | 6.7E-03 | 3.6E-03 | -- | 3.6E+01 | No |
| Toluene | 108-88-3 | mg/kg | 1 / 7 | 2.8E-03 | 5.2E-03 | 2.8E-03 | 7.2E-03 | 2.8E-03 | -- | 6.6E+01 | No |
| Trichloroethene | 79-01-6 | mg/kg | 1 / 7 | 2.8E-03 | 4.8E-03 | 2.8E-03 | 6.9E-03 | 2.8E-03 | -- | 5.3E-02 | No |
| ***Quarry Ponds*** | | | | | | | | | | | |
| *Inorganics* | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 17 / 17 | 2.9E+03 | 1.2E+04 | 1.6E+04 | 1.3E+04 | 1.3E+04 | 1.4E+04 | 7.6E+03 | Yes |
| Antimony | 7440-36-0 | mg/kg | 14 / 17 | 1.0E+00 | 1.8E+01 | 1.3E+02 | 1.7E+02 | 1.3E+02 | 0.0E+00 | 3.1E+00 | Yes |
| Arsenic | 7440-38-2 | mg/kg | 17 / 17 | 3.3E+00 | 1.4E+01 | 3.2E+01 | 1.9E+01 | 1.9E+01 | 2.0E+01 | 3.9E-01 | Yes |

**Table M-5. COPC Screening for Sediment at Fuze and Booster Quarry Ponds (continued)**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Barium | 7440-39-3 | mg/kg | 17 / 17 | 2.7E+01 | 1.9E+02 | 9.8E+02 | 2.9E+02 | 2.9E+02 | 1.2E+02 | 5.4E+02 | Yes |
| Beryllium | 7440-41-7 | mg/kg | 16 / 17 | 2.1E-01 | 6.8E-01 | 1.1E+00 | 8.0E-01 | 8.0E-01 | 3.8E-01 | 1.5E+01 | No |
| Cadmium | 7440-43-9 | mg/kg | 14 / 17 | 8.5E-02 | 2.8E+00 | 1.9E+01 | 2.1E+02 | 1.9E+01 | 0.0E+00 | 3.7E+00 | Yes |
| Calcium | 7440-70-2 | mg/kg | 17 / 17 | 2.8E+02 | 9.9E+03 | 5.6E+04 | 3.9E+04 | 3.9E+04 | 5.5E+03 | -- | No |
| Chromium | 7440-47-3 | mg/kg | 17 / 17 | 5.5E+00 | 3.6E+01 | 1.1E+02 | 5.7E+01 | 5.7E+01 | 1.8E+01 | 2.2E+01 | Yes |
| Chromium, hexavalent | 18540-29-9 | mg/kg | 13 / 17 | 7.1E+00 | 1.5E+01 | 3.3E+01 | 2.0E+01 | 2.0E+01 | -- | 2.2E+01 | Yes |
| Cobalt | 7440-48-4 | mg/kg | 17 / 17 | 3.3E+00 | 1.1E+01 | 1.8E+01 | 1.3E+01 | 1.3E+01 | 9.1E+00 | 1.4E+02 | No |
| Copper | 7440-50-8 | mg/kg | 17 / 17 | 1.3E+01 | 1.3E+02 | 6.6E+02 | 2.0E+02 | 2.0E+02 | 2.8E+01 | 3.1E+02 | Yes |
| Iron | 7439-89-6 | mg/kg | 17 / 17 | 7.8E+03 | 4.0E+04 | 1.4E+05 | 6.2E+04 | 6.2E+04 | 2.8E+04 | 2.3E+03 | No |
| Lead | 7439-92-1 | mg/kg | 17 / 17 | 1.6E+01 | 3.9E+02 | 1.5E+03 | 6.2E+02 | 6.2E+02 | 2.7E+01 | 4.0E+02 | Yes |
| Magnesium | 7439-95-4 | mg/kg | 17 / 17 | 5.1E+02 | 3.2E+03 | 8.6E+03 | 4.0E+03 | 4.0E+03 | 2.8E+03 | -- | No |
| Manganese | 7439-96-5 | mg/kg | 17 / 17 | 7.0E+01 | 4.1E+02 | 8.7E+02 | 6.6E+02 | 6.6E+02 | 2.0E+03 | 1.8E+02 | No |
| Mercury | 7439-97-6 | mg/kg | 17 / 17 | 8.5E-02 | 3.7E+00 | 3.5E+01 | 3.0E+01 | 3.0E+01 | 5.9E-02 | 2.3E+00 | Yes |
| Nickel | 7440-02-0 | mg/kg | 17 / 17 | 7.2E+00 | 3.1E+01 | 8.1E+01 | 4.3E+01 | 4.3E+01 | 1.8E+01 | 1.6E+02 | No |
| Potassium | 7440-09-7 | mg/kg | 17 / 17 | 3.4E+02 | 1.2E+03 | 2.1E+03 | 1.4E+03 | 1.4E+03 | 2.0E+03 | -- | No |
| Selenium | 7782-49-2 | mg/kg | 12 / 17 | 1.1E+00 | 2.0E+00 | 8.2E+00 | 3.2E+00 | 3.2E+00 | 1.7E+00 | 3.9E+01 | No |
| Silver | 7440-22-4 | mg/kg | 6 / 17 | 2.7E-01 | 1.3E+00 | 1.2E+01 | 2.6E+00 | 2.6E+00 | 0.0E+00 | 3.9E+01 | No |
| Sodium | 7440-23-5 | mg/kg | 15 / 17 | 6.1E+01 | 2.3E+02 | 8.1E+02 | 3.7E+02 | 3.7E+02 | 1.1E+02 | -- | No |
| Vanadium | 7440-62-2 | mg/kg | 17 / 17 | 5.9E+00 | 2.1E+01 | 2.8E+01 | 2.4E+01 | 2.4E+01 | 2.6E+01 | 7.8E+00 | Yes |
| Zinc | 7440-66-6 | mg/kg | 17 / 17 | 6.0E+01 | 8.8E+02 | 3.6E+03 | 1.4E+03 | 1.4E+03 | 5.3E+02 | 2.3E+03 | Yes |
| *Organic Explosives* | | | | | | | | | | | |
| 2,4,6-Trinitrotoluene | 118-96-7 | mg/kg | 2 / 17 | 1.0E-01 | 6.8E-02 | 3.0E-01 | 9.4E-02 | 9.4E-02 | -- | 3.1E+00 | No |
| 2-Amino-4,6-Dinitrotoluene | 35572-78-2 | mg/kg | 1 / 17 | 7.3E-02 | 5.1E-02 | 7.3E-02 | 5.4E-02 | 5.4E-02 | -- | -- | Yes |
| 4-Amino-2,6-Dinitrotoluene | 19406-51-0 | mg/kg | 3 / 17 | 1.1E-01 | 7.8E-02 | 3.9E-01 | 1.1E-01 | 1.1E-01 | -- | -- | Yes |
| HMX | 2691-41-0 | mg/kg | 1 / 17 | 1.6E-01 | 1.0E-01 | 1.6E-01 | 1.1E-01 | 1.1E-01 | -- | 3.1E+02 | No |
| Nitrobenzene | 98-95-3 | mg/kg | 4 / 17 | 4.9E-02 | 5.5E-02 | 1.1E-01 | 6.1E-02 | 6.1E-02 | -- | 2.0E+00 | No |
| Nitrocellulose | 9004-70-0 | mg/kg | 10 / 17 | 2.3E+01 | 2.8E+01 | 5.5E+01 | 3.9E+01 | 3.9E+01 | -- | -- | Yes |
| Nitroglycerin | 55-63-0 | mg/kg | 1 / 15 | 4.9E+01 | 7.9E+00 | 4.9E+01 | 1.3E+01 | 1.3E+01 | -- | 3.5E+01 | Yes |
| *Organic Pesticides* | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | 2 / 17 | 5.3E-04 | 1.4E-03 | 2.7E-03 | 1.6E-03 | 1.6E-03 | -- | 2.4E+00 | No |
| 4,4'-DDE | 72-55-9 | mg/kg | 2 / 17 | 5.2E-04 | 1.3E-03 | 6.6E-04 | 1.4E-03 | 6.6E-04 | -- | 1.7E+00 | No |
| Dieldrin | 60-57-1 | mg/kg | 2 / 17 | 4.1E-04 | 1.3E-03 | 8.8E-04 | 1.4E-03 | 8.8E-04 | -- | 3.0E-02 | No |
| Endrin | 72-20-8 | mg/kg | 1 / 17 | 7.1E-04 | 1.3E-03 | 7.1E-04 | 1.5E-03 | 7.1E-04 | -- | 1.8E+00 | No |

**Table M-5. COPC Screening for Sediment at Fuze and Booster Quarry Ponds (continued)**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Endrin aldehyde | 7421-93-4 | mg/kg | 1 / 17 | 1.8E-03 | 1.4E-03 | 1.8E-03 | 1.5E-03 | 1.5E-03 | -- | 1.8E+00 | No |
| Methoxychlor | 72-43-5 | mg/kg | 2 / 17 | 1.1E-03 | 1.4E-03 | 3.0E-03 | 1.6E-03 | 1.6E-03 | -- | 3.1E+01 | No |
| *Organic Semivolatiles* | | | | | | | | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 2 / 17 | 3.2E-02 | 2.4E-01 | 5.1E-02 | 2.8E-01 | 5.1E-02 | -- | 5.6E+00 | No |
| Anthracene | 120-12-7 | mg/kg | 1 / 17 | 2.3E-01 | 2.7E-01 | 2.3E-01 | 2.9E-01 | 2.3E-01 | -- | 2.2E+03 | No |
| Benz(*a*)anthracene | 56-55-3 | mg/kg | 5 / 17 | 8.4E-02 | 3.4E-01 | 2.1E+00 | 5.4E-01 | 5.4E-01 | -- | 6.2E-01 | Yes |
| Benzo(*a*)pyrene | 50-32-8 | mg/kg | 5 / 17 | 8.6E-02 | 3.4E-01 | 2.0E+00 | 5.2E-01 | 5.2E-01 | -- | 6.2E-02 | Yes |
| Benzo(*b*)fluoranthene | 205-99-2 | mg/kg | 5 / 17 | 1.2E-01 | 3.7E-01 | 2.3E+00 | 5.8E-01 | 5.8E-01 | -- | 6.2E-01 | Yes |
| Benzo(*ghi*)perylene | 191-24-2 | mg/kg | 3 / 17 | 2.1E-01 | 3.1E-01 | 1.2E+00 | 4.1E-01 | 4.1E-01 | -- | -- | Yes |
| Benzo(*k*)fluoranthene | 207-08-9 | mg/kg | 2 / 17 | 1.6E-01 | 2.9E-01 | 9.5E-01 | 3.7E-01 | 3.7E-01 | -- | 6.2E+00 | No |
| Bis(2-ethylhexyl)phthalate | 117-81-7 | mg/kg | 2 / 17 | 7.7E-02 | 1.2E-01 | 1.0E-01 | 1.5E-01 | 1.0E-01 | -- | 3.5E+01 | No |
| Carbazole | 86-74-8 | mg/kg | 1 / 17 | 1.1E-01 | 2.6E-01 | 1.1E-01 | 2.9E-01 | 1.1E-01 | -- | 2.4E+01 | No |
| Chrysene | 218-01-9 | mg/kg | 5 / 17 | 7.9E-02 | 2.9E-01 | 1.3E+00 | 4.1E-01 | 4.1E-01 | -- | 6.2E+01 | No |
| Fluoranthene | 206-44-0 | mg/kg | 6 / 17 | 9.8E-02 | 4.2E-01 | 3.2E+00 | 7.2E-01 | 7.2E-01 | -- | 2.3E+02 | No |
| Indeno(*1,2,3-cd*)pyrene | 193-39-5 | mg/kg | 3 / 17 | 1.1E-01 | 2.9E-01 | 1.0E+00 | 3.7E-01 | 3.7E-01 | -- | 6.2E-01 | Yes |
| Naphthalene | 91-20-3 | mg/kg | 1 / 17 | 1.2E-01 | 2.6E-01 | 1.2E-01 | 2.9E-01 | 1.2E-01 | -- | 5.6E+00 | No |
| Phenanthrene | 85-01-8 | mg/kg | 5 / 17 | 9.2E-02 | 2.6E-01 | 6.8E-01 | 3.2E-01 | 3.2E-01 | -- | -- | Yes |
| Pyrene | 129-00-0 | mg/kg | 5 / 17 | 1.0E-01 | 3.8E-01 | 2.3E+00 | 6.0E-01 | 6.0E-01 | -- | 2.3E+02 | No |
| *Organic Volatiles* | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/kg | 9 / 17 | 4.2E-03 | 1.1E-02 | 4.3E-02 | 1.5E-02 | 1.5E-02 | -- | 2.2E+03 | No |
| Acetone | 67-64-1 | mg/kg | 3 / 17 | 1.6E-02 | 2.1E-02 | 6.4E-02 | 3.2E-02 | 3.2E-02 | -- | 1.4E+03 | No |
| Carbon Disulfide | 75-15-0 | mg/kg | 1 / 17 | 2.9E-03 | 3.9E-03 | 2.9E-03 | 4.6E-03 | 2.9E-03 | -- | 3.6E+01 | No |
| Methylene Chloride | 75-09-2 | mg/kg | 6 / 17 | 1.0E-02 | 1.3E-02 | 3.7E-02 | 1.6E-02 | 1.6E-02 | -- | 9.1E+00 | No |
| Toluene | 108-88-3 | mg/kg | 1 / 17 | 5.6E-03 | 4.3E-03 | 5.6E-03 | 5.0E-03 | 5.0E-03 | -- | 6.6E+01 | No |
| ***Settling Basins*** | | | | | | | | | | | |
| *Inorganics* | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 16 / 16 | 9.2E+03 | 1.7E+04 | 2.2E+04 | 1.9E+04 | 1.9E+04 | 1.4E+04 | 7.6E+03 | Yes |
| Arsenic | 7440-38-2 | mg/kg | 16 / 16 | 3.2E+00 | 9.6E+00 | 1.8E+01 | 1.2E+01 | 1.2E+01 | 2.0E+01 | 3.9E-01 | No |
| Barium | 7440-39-3 | mg/kg | 16 / 16 | 5.3E+01 | 1.0E+02 | 2.3E+02 | 1.3E+02 | 1.3E+02 | 1.2E+02 | 5.4E+02 | No |
| Beryllium | 7440-41-7 | mg/kg | 16 / 16 | 5.2E-01 | 8.5E-01 | 1.2E+00 | 9.5E-01 | 9.5E-01 | 3.8E-01 | 1.5E+01 | No |
| Cadmium | 7440-43-9 | mg/kg | 13 / 16 | 8.1E-02 | 2.8E-01 | 9.2E-01 | 4.0E-01 | 4.0E-01 | 0.0E+00 | 3.7E+00 | No |
| Calcium | 7440-70-2 | mg/kg | 16 / 16 | 8.2E+02 | 1.8E+03 | 3.7E+03 | 2.3E+03 | 2.3E+03 | 5.5E+03 | -- | No |
| Chromium | 7440-47-3 | mg/kg | 16 / 16 | 1.2E+01 | 9.2E+01 | 1.1E+03 | 2.1E+02 | 2.1E+02 | 1.8E+01 | 2.2E+01 | Yes |

**Table M-5. COPC Screening for Sediment at Fuze and Booster Quarry Ponds (continued)**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chromium, hexavalent | 18540-29-9 | mg/kg | 8 / 16 | 4.1E+00 | 4.8E+00 | 1.8E+01 | 1.1E+01 | 1.1E+01 | -- | 2.2E+01 | No |
| Cobalt | 7440-48-4 | mg/kg | 16 / 16 | 5.1E+00 | 9.4E+00 | 1.8E+01 | 1.1E+01 | 1.1E+01 | 9.1E+00 | 1.4E+02 | No |
| Copper | 7440-50-8 | mg/kg | 16 / 16 | 1.1E+01 | 2.3E+01 | 4.1E+01 | 2.7E+01 | 2.7E+01 | 2.8E+01 | 3.1E+02 | No |
| Iron | 7439-89-6 | mg/kg | 16 / 16 | 1.3E+04 | 2.4E+04 | 4.7E+04 | 2.9E+04 | 2.9E+04 | 2.8E+04 | 2.3E+03 | No |
| Lead | 7439-92-1 | mg/kg | 16 / 16 | 1.5E+01 | 6.7E+01 | 4.6E+02 | 1.1E+02 | 1.1E+02 | 2.7E+01 | 4.0E+02 | Yes |
| Magnesium | 7439-95-4 | mg/kg | 16 / 16 | 1.7E+03 | 3.6E+03 | 5.5E+03 | 4.0E+03 | 4.0E+03 | 2.8E+03 | -- | No |
| Manganese | 7439-96-5 | mg/kg | 16 / 16 | 9.5E+01 | 3.8E+02 | 2.6E+03 | 6.5E+02 | 6.5E+02 | 2.0E+03 | 1.8E+02 | Yes |
| Mercury | 7439-97-6 | mg/kg | 8 / 16 | 6.6E-02 | 7.6E-02 | 1.9E-01 | 1.4E-01 | 1.4E-01 | 5.9E-02 | 2.3E+00 | No |
| Nickel | 7440-02-0 | mg/kg | 16 / 16 | 1.2E+01 | 2.2E+01 | 3.3E+01 | 2.6E+01 | 2.6E+01 | 1.8E+01 | 1.6E+02 | No |
| Potassium | 7440-09-7 | mg/kg | 16 / 16 | 9.2E+02 | 1.9E+03 | 3.7E+03 | 2.2E+03 | 2.2E+03 | 2.0E+03 | -- | No |
| Selenium | 7782-49-2 | mg/kg | 2 / 16 | 1.4E+00 | 6.7E-01 | 2.2E+00 | 9.1E-01 | 9.1E-01 | 1.7E+00 | 3.9E+01 | No |
| Sodium | 7440-23-5 | mg/kg | 15 / 16 | 9.1E+01 | 1.2E+02 | 1.9E+02 | 1.4E+02 | 1.4E+02 | 1.1E+02 | -- | No |
| Vanadium | 7440-62-2 | mg/kg | 16 / 16 | 1.9E+01 | 2.9E+01 | 4.2E+01 | 3.2E+01 | 3.2E+01 | 2.6E+01 | 7.8E+00 | Yes |
| Zinc | 7440-66-6 | mg/kg | 16 / 16 | 5.9E+01 | 1.0E+02 | 2.1E+02 | 1.3E+02 | 1.3E+02 | 5.3E+02 | 2.3E+03 | No |
| *Organic Explosives* | | | | | | | | | | | |
| 1,3,5-Trinitrobenzene | 99-35-4 | mg/kg | 1 / 16 | 9.8E-02 | 5.3E-02 | 9.8E-02 | 5.8E-02 | 5.8E-02 | -- | 1.8E+02 | No |
| 1,3-Dinitrobenzene | 99-65-0 | mg/kg | 1 / 16 | 1.1E-01 | 5.4E-02 | 1.1E-01 | 6.0E-02 | 6.0E-02 | -- | 6.1E-01 | No |
| 2,6-Dinitrotoluene | 606-20-2 | mg/kg | 1 / 16 | 8.5E-02 | 5.2E-02 | 8.5E-02 | 5.6E-02 | 5.6E-02 | -- | 7.2E-01 | No |
| 3-Nitrotoluene | 99-08-1 | mg/kg | 1 / 16 | 7.8E-02 | 9.9E-02 | 7.8E-02 | 1.0E-01 | 7.8E-02 | -- | 7.3E+01 | No |
| HMX | 2691-41-0 | mg/kg | 1 / 16 | 1.1E-01 | 1.0E-01 | 1.1E-01 | 1.0E-01 | 1.0E-01 | -- | 3.1E+02 | No |
| Nitrocellulose | 9004-70-0 | mg/kg | 8 / 16 | 3.9E+01 | 4.2E+01 | 1.1E+02 | 7.4E+01 | 7.4E+01 | -- | -- | Yes |
| *Organic Pesticides* | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | 1 / 16 | 8.5E-04 | 1.5E-03 | 8.5E-04 | 1.6E-03 | 8.5E-04 | -- | 2.4E+00 | No |
| 4,4'-DDE | 72-55-9 | mg/kg | 2 / 16 | 7.6E-04 | 1.4E-03 | 7.9E-04 | 1.6E-03 | 7.9E-04 | -- | 1.7E+00 | No |
| 4,4'-DDT | 50-29-3 | mg/kg | 1 / 16 | 1.6E-03 | 1.5E-03 | 1.6E-03 | 1.6E-03 | 1.6E-03 | -- | 1.7E+00 | No |
| Dieldrin | 60-57-1 | mg/kg | 1 / 16 | 5.5E-04 | 1.5E-03 | 5.5E-04 | 1.6E-03 | 5.5E-04 | -- | 3.0E-02 | No |
| Endosulfan I | 959-98-8 | mg/kg | 1 / 16 | 5.2E-04 | 1.5E-03 | 5.2E-04 | 1.6E-03 | 5.2E-04 | -- | 3.7E+01 | No |
| Endrin | 72-20-8 | mg/kg | 1 / 16 | 5.5E-04 | 1.5E-03 | 5.5E-04 | 1.6E-03 | 5.5E-04 | -- | 1.8E+00 | No |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | 1 / 16 | 5.7E-04 | 1.5E-03 | 5.7E-04 | 1.6E-03 | 5.7E-04 | -- | 5.3E-02 | No |
| Lindane | 58-89-9 | mg/kg | 1 / 16 | 8.6E-04 | 1.5E-03 | 8.6E-04 | 1.6E-03 | 8.6E-04 | -- | 4.4E-01 | No |
| Methoxychlor | 72-43-5 | mg/kg | 1 / 16 | 2.2E-03 | 1.6E-03 | 2.2E-03 | 1.7E-03 | 1.7E-03 | -- | 3.1E+01 | No |
| beta-BHC | 319-85-7 | mg/kg | 1 / 16 | 6.6E-04 | 1.5E-03 | 6.6E-04 | 1.6E-03 | 6.6E-04 | -- | 3.2E-01 | No |

**Table M-5. COPC Screening for Sediment at Fuze and Booster Quarry Ponds (continued)**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Residential PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organic Semivolatiles* | | | | | | | | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 1 / 16 | 1.1E-01 | 2.9E-01 | 1.1E-01 | 3.2E-01 | 1.1E-01 | -- | 5.6E+00 | No |
| 4-Methylphenol | 106-44-5 | mg/kg | 2 / 16 | 2.6E-01 | 3.1E-01 | 5.1E-01 | 3.5E-01 | 3.5E-01 | -- | 3.1E+01 | No |
| Benz(*a*)anthracene | 56-55-3 | mg/kg | 5 / 16 | 7.4E-02 | 2.4E-01 | 1.2E-01 | 2.9E-01 | 1.2E-01 | -- | 6.2E-01 | No |
| Benzo(*a*)pyrene | 50-32-8 | mg/kg | 9 / 16 | 5.3E-02 | 1.8E-01 | 1.1E-01 | 2.8E-01 | 1.1E-01 | -- | 6.2E-02 | Yes |
| Benzo(*b*)fluoranthene | 205-99-2 | mg/kg | 9 / 16 | 8.3E-02 | 2.0E-01 | 1.6E-01 | 2.7E-01 | 1.6E-01 | -- | 6.2E-01 | No |
| Bis(2-ethylhexyl)phthalate | 117-81-7 | mg/kg | 2 / 16 | 6.1E-02 | 2.0E-01 | 7.6E-02 | 2.5E-01 | 7.6E-02 | -- | 3.5E+01 | No |
| Chrysene | 218-01-9 | mg/kg | 8 / 16 | 6.1E-02 | 1.9E-01 | 1.1E-01 | 2.4E-01 | 1.1E-01 | -- | 6.2E+01 | No |
| Fluoranthene | 206-44-0 | mg/kg | 10 / 16 | 7.3E-02 | 2.1E-01 | 1.9E-01 | 2.7E-01 | 1.9E-01 | -- | 2.3E+02 | No |
| Indeno(1,2,3-*cd*)pyrene | 193-39-5 | mg/kg | 1 / 16 | 6.6E-02 | 2.9E-01 | 6.6E-02 | 3.2E-01 | 6.6E-02 | -- | 6.2E-01 | No |
| Naphthalene | 91-20-3 | mg/kg | 1 / 16 | 8.3E-02 | 2.9E-01 | 8.3E-02 | 3.2E-01 | 8.3E-02 | -- | 5.6E+00 | No |
| Phenanthrene | 85-01-8 | mg/kg | 4 / 16 | 9.7E-02 | 2.6E-01 | 1.4E-01 | 3.0E-01 | 1.4E-01 | -- | -- | Yes |
| Pyrene | 129-00-0 | mg/kg | 7 / 16 | 1.1E-01 | 2.3E-01 | 2.0E-01 | 2.7E-01 | 2.0E-01 | -- | 2.3E+02 | No |
| *Organic Volatiles* | | | | | | | | | | | |
| Acetone | 67-64-1 | mg/kg | 2 / 16 | 2.0E-02 | 9.4E-03 | 3.6E-02 | 1.3E-02 | 1.3E-02 | -- | 1.4E+03 | No |
| Toluene | 108-88-3 | mg/kg | 4 / 16 | 2.0E-03 | 1.1E-02 | 9.0E-02 | 2.0E-02 | 2.0E-02 | -- | 6.6E+01 | No |

CAS = Chemical Abstracts Service.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
PRG = Preliminary remediation goal.
UCL = Upper confidence limit on the mean.
-- Criteria not available or insufficient data to calculate the UCL.

**Table M-6. COPC Screening for Surface Water at Fuze and Booster Quarry Ponds**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Tap Water PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ditch*** | | | | | | | | | | | |
| *Inorganics* | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/L | 1 / 1 | 2.3E+00 | 2.3E+00 | 2.3E+00 | -- | 2.3E+00 | 3.4E+00 | 3.6E+01 | No |
| Barium | 7440-39-3 | mg/L | 1 / 1 | 1.0E+00 | 1.0E+00 | 1.0E+00 | -- | 1.0E+00 | 4.8E-02 | 2.6E+00 | No |
| Calcium | 7440-70-2 | mg/L | 1 / 1 | 3.8E+01 | 3.8E+01 | 3.8E+01 | -- | 3.8E+01 | 4.1E+01 | -- | No |
| Chromium | 7440-47-3 | mg/L | 1 / 1 | 3.7E-03 | 3.7E-03 | 3.7E-03 | -- | 3.7E-03 | 0.0E+00 | 1.1E-01 | No |
| Cobalt | 7440-48-4 | mg/L | 1 / 1 | 2.1E-03 | 2.1E-03 | 2.1E-03 | -- | 2.1E-03 | 0.0E+00 | 7.3E-01 | No |
| Copper | 7440-50-8 | mg/L | 1 / 1 | 4.2E-03 | 4.2E-03 | 4.2E-03 | -- | 4.2E-03 | 7.9E-03 | 1.5E+00 | No |
| Iron | 7439-89-6 | mg/L | 1 / 1 | 1.9E+01 | 1.9E+01 | 1.9E+01 | -- | 1.9E+01 | 2.6E+00 | 1.1E+01 | No |
| Magnesium | 7439-95-4 | mg/L | 1 / 1 | 7.3E+00 | 7.3E+00 | 7.3E+00 | -- | 7.3E+00 | 1.1E+01 | -- | No |
| Manganese | 7439-96-5 | mg/L | 1 / 1 | 1.1E+01 | 1.1E+01 | 1.1E+01 | -- | 1.1E+01 | 3.9E-01 | 8.8E-01 | Yes |
| Potassium | 7440-09-7 | mg/L | 1 / 1 | 2.6E+00 | 2.6E+00 | 2.6E+00 | -- | 2.6E+00 | 3.2E+00 | -- | No |
| Sodium | 7440-23-5 | mg/L | 1 / 1 | 3.7E+00 | 3.7E+00 | 3.7E+00 | -- | 3.7E+00 | 2.1E+01 | -- | No |
| Vanadium | 7440-62-2 | mg/L | 1 / 1 | 4.3E-03 | 4.3E-03 | 4.3E-03 | -- | 4.3E-03 | 0.0E+00 | 3.6E-02 | No |
| Zinc | 7440-66-6 | mg/L | 1 / 1 | 3.6E-02 | 3.6E-02 | 3.6E-02 | -- | 3.6E-02 | 4.2E-02 | 1.1E+01 | No |
| *Organic Explosives* | | | | | | | | | | | |
| Nitrocellulose | 9004-70-0 | mg/L | 1 / 1 | 6.1E-01 | 6.1E-01 | 6.1E-01 | -- | 6.1E-01 | -- | -- | Yes |
| *Organic Semivolatiles* | | | | | | | | | | | |
| Bis(2-ethylhexyl)phthalate | 117-81-7 | mg/L | 1 / 1 | 1.7E-03 | 1.7E-03 | 1.7E-03 | -- | 1.7E-03 | -- | 4.8E-03 | No |
| *Organic Volatiles* | | | | | | | | | | | |
| Carbon Disulfide | 75-15-0 | mg/L | 1 / 1 | 1.8E-03 | 1.8E-03 | 1.8E-03 | -- | 1.8E-03 | -- | 1.0E+00 | No |
| ***Quarry Ponds*** | | | | | | | | | | | |
| *Inorganics* | | | | | | | | | | | |
| Barium | 7440-39-3 | mg/L | 4 / 4 | 3.1E-02 | 4.9E-02 | 6.8E-02 | 6.7E-02 | 6.7E-02 | 4.8E-02 | 2.6E+00 | No |
| Calcium | 7440-70-2 | mg/L | 4 / 4 | 1.1E+01 | 2.1E+01 | 4.5E+01 | 1.4E+02 | 4.5E+01 | 4.1E+01 | -- | No |
| Copper | 7440-50-8 | mg/L | 2 / 4 | 5.3E-03 | 3.2E-03 | 6.2E-03 | 1.6E+00 | 6.2E-03 | 7.9E-03 | 1.5E+00 | No |
| Iron | 7439-89-6 | mg/L | 4 / 4 | 1.1E-01 | 1.5E-01 | 2.0E-01 | 2.5E-01 | 2.0E-01 | 2.6E+00 | 1.1E+01 | No |
| Magnesium | 7439-95-4 | mg/L | 4 / 4 | 2.6E+00 | 3.2E+00 | 3.9E+00 | 4.0E+00 | 3.9E+00 | 1.1E+01 | -- | No |
| Manganese | 7439-96-5 | mg/L | 4 / 4 | 1.2E-02 | 1.4E-02 | 1.6E-02 | 1.7E-02 | 1.6E-02 | 3.9E-01 | 8.8E-01 | No |
| Potassium | 7440-09-7 | mg/L | 4 / 4 | 1.2E+00 | 1.7E+00 | 2.5E+00 | 3.3E+00 | 2.5E+00 | 3.2E+00 | -- | No |
| Sodium | 7440-23-5 | mg/L | 4 / 4 | 1.8E+00 | 2.0E+00 | 2.2E+00 | 2.2E+00 | 2.2E+00 | 2.1E+01 | -- | No |
| Zinc | 7440-66-6 | mg/L | 2 / 4 | 2.4E-02 | 1.3E-02 | 2.5E-02 | 2.8E-02 | 2.5E-02 | 4.2E-02 | 1.1E+01 | No |

**Table M-6. COPC Screening for Surface Water at Fuze and Booster Quarry Ponds (continued)**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Tap Water PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organic Explosives* | | | | | | | | | | | |
| Nitrocellulose | 9004-70-0 | mg/L | 4 / 4 | 3.7E-01 | 7.4E-01 | 1.1E+00 | 2.8E+00 | 1.1E+00 | -- | -- | Yes |
| *Organic Semivolatiles* | | | | | | | | | | | |
| Bis(2-ethylhexyl)phthalate | 117-81-7 | mg/L | 1 / 4 | 2.9E-03 | 2.6E-03 | 2.9E-03 | 5.1E-03 | 2.9E-03 | -- | 4.8E-03 | No |
| *Organic Volatiles* | | | | | | | | | | | |
| Methylene Chloride | 75-09-2 | mg/L | 2 / 4 | 4.5E-03 | 4.1E-03 | 4.7E-03 | 4.8E-03 | 4.7E-03 | -- | 4.3E-03 | Yes |
| ***Settling Basins*** | | | | | | | | | | | |
| *Inorganics* | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/L | 10 / 10 | 1.7E-01 | 1.1E+00 | 7.0E+00 | 2.3E+00 | 2.3E+00 | 3.4E+00 | 3.6E+01 | No |
| Arsenic | 7440-38-2 | mg/L | 1 / 10 | 2.0E-02 | 6.0E-03 | 2.0E-02 | 9.0E-03 | 9.0E-03 | 3.2E-03 | 4.5E-05 | Yes |
| Barium | 7440-39-3 | mg/L | 10 / 10 | 1.9E-02 | 5.0E-02 | 9.9E-02 | 7.8E-02 | 7.8E-02 | 4.8E-02 | 2.6E+00 | No |
| Beryllium | 7440-41-7 | mg/L | 1 / 10 | 7.7E-04 | 1.9E-04 | 7.7E-04 | 3.1E-04 | 3.1E-04 | 0.0E+00 | 7.3E-02 | No |
| Calcium | 7440-70-2 | mg/L | 10 / 10 | 6.1E+00 | 1.5E+01 | 2.8E+01 | 2.4E+01 | 2.4E+01 | 4.1E+01 | -- | No |
| Chromium | 7440-47-3 | mg/L | 3 / 10 | 1.8E-03 | 2.0E-03 | 1.2E-02 | 4.1E-03 | 4.1E-03 | 0.0E+00 | 1.1E-01 | No |
| Chromium, hexavalent | 18540-29-9 | mg/L | 5 / 10 | 1.0E-02 | 1.8E-02 | 5.0E-02 | 2.7E-02 | 2.7E-02 | -- | 1.1E-01 | No |
| Cobalt | 7440-48-4 | mg/L | 8 / 10 | 4.6E-03 | 6.9E-03 | 1.7E-02 | 9.7E-03 | 9.7E-03 | 0.0E+00 | 7.3E-01 | No |
| Copper | 7440-50-8 | mg/L | 5 / 10 | 3.6E-03 | 6.6E-03 | 4.2E-02 | 3.9E-02 | 3.9E-02 | 7.9E-03 | 1.5E+00 | No |
| Iron | 7439-89-6 | mg/L | 10 / 10 | 3.3E+00 | 1.4E+01 | 2.5E+01 | 1.8E+01 | 1.8E+01 | 2.6E+00 | 1.1E+01 | No |
| Lead | 7439-92-1 | mg/L | 3 / 10 | 3.3E-03 | 4.3E-03 | 2.5E-02 | 8.6E-03 | 8.6E-03 | 0.0E+00 | -- | Yes |
| Magnesium | 7439-95-4 | mg/L | 10 / 10 | 2.3E+00 | 5.4E+00 | 9.2E+00 | 7.5E+00 | 7.5E+00 | 1.1E+01 | -- | No |
| Manganese | 7439-96-5 | mg/L | 10 / 10 | 6.3E-01 | 1.4E+00 | 4.4E+00 | 2.0E+00 | 2.0E+00 | 3.9E-01 | 8.8E-01 | Yes |
| Nickel | 7440-02-0 | mg/L | 1 / 10 | 2.6E-02 | 3.3E-03 | 2.6E-02 | 7.9E-03 | 7.9E-03 | 0.0E+00 | 7.3E-01 | No |
| Potassium | 7440-09-7 | mg/L | 10 / 10 | 3.1E+00 | 7.0E+00 | 1.4E+01 | 1.1E+01 | 1.1E+01 | 3.2E+00 | -- | No |
| Sodium | 7440-23-5 | mg/L | 10 / 10 | 9.5E-01 | 1.9E+00 | 4.1E+00 | 2.9E+00 | 2.9E+00 | 2.1E+01 | -- | No |
| Vanadium | 7440-62-2 | mg/L | 4 / 10 | 2.0E-03 | 3.0E-03 | 1.9E-02 | 6.3E-03 | 6.3E-03 | 0.0E+00 | 3.6E-02 | No |
| Zinc | 7440-66-6 | mg/L | 5 / 10 | 1.2E-02 | 1.8E-02 | 1.1E-01 | 6.8E-02 | 6.8E-02 | 4.2E-02 | 1.1E+01 | No |
| Perchlorate | 7601-90-3 | mg/L | 2 / 7 | 7.5E-03 | 5.0E-03 | 2.5E-02 | 1.2E-02 | 1.2E-02 | -- | 3.6E-03 | Yes |
| *Organic Explosives* | | | | | | | | | | | |
| 2-Amino-4,6-dinitrotoluene | 35572-78-2 | mg/L | 1 / 10 | 6.8E-04 | 1.9E-04 | 6.8E-04 | 2.9E-04 | 2.9E-04 | -- | -- | Yes |
| 4-Amino-2,6-dinitrotoluene | 19406-51-0 | mg/L | 1 / 10 | 2.0E-02 | 2.1E-03 | 2.0E-02 | 5.8E-03 | 5.8E-03 | -- | -- | Yes |
| Nitrocellulose | 9004-70-0 | mg/L | 7 / 10 | 2.5E-01 | 3.0E-01 | 7.5E-01 | 6.2E-01 | 6.2E-01 | -- | -- | Yes |

**Table M-6. COPC Screening for Surface Water at Fuze and Booster Quarry Ponds (continued)**

| Chemical | CAS Number | Units | Frequency of Detection | Minimum Detect | Average Result | Maximum Detect | 95% UCL of Mean | EPC | Site Background Criteria | Region 9 Tap Water PRG | COPC? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organic Semivolatiles* | | | | | | | | | | | |
| 4-Methylphenol | 106-44-5 | mg/L | 4 / 10 | 2.0E-03 | 4.1E-02 | 1.7E-01 | 7.9E-02 | 7.9E-02 | -- | 1.8E-01 | No |
| Bis(2-ethylhexyl)phthalate | 117-81-7 | mg/L | 9 / 10 | 1.4E-03 | 2.8E-03 | 1.1E-02 | 4.5E-03 | 4.5E-03 | -- | 4.8E-03 | Yes |
| Phenol | 108-95-2 | mg/L | 3 / 10 | 3.4E-02 | 2.4E-02 | 1.2E-01 | 4.5E-02 | 4.5E-02 | -- | 1.1E+01 | No |
| *Organic Volatiles* | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/L | 3 / 10 | 3.4E-03 | 4.9E-03 | 5.1E-03 | 5.2E-03 | 5.1E-03 | -- | 7.0E+00 | No |
| Carbon Disulfide | 75-15-0 | mg/L | 2 / 10 | 9.4E-04 | 2.3E-03 | 1.7E-03 | 2.6E-03 | 1.7E-03 | -- | 1.0E+00 | No |
| Styrene | 100-42-5 | mg/L | 1 / 10 | 1.1E-03 | 2.4E-03 | 1.1E-03 | 2.6E-03 | 1.1E-03 | -- | 1.6E+00 | No |
| Toluene | 108-88-3 | mg/L | 10 / 10 | 2.2E-03 | 1.0E-02 | 2.0E-02 | 2.3E-02 | 2.0E-02 | -- | 7.2E-01 | No |

CAS = Chemical Abstracts Service.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
PRG = Preliminary remediation goal.
UCL = Upper confidence limit on the mean.
-- Criteria not available or insufficient data to calculate the UCL.

**Table M-7. Chemical-specific Exposure Parameters for Fuze and Booster Quarry Ponds COPCs**

| COPC | Dermal Absorption Factor[a] (unitless) | Permeability Constant[b] (cm/hr) | Volatilization Factor[c] ($m^3$/kg) | Soil-to-Plant Uptake Factor[d] Dry Weight (days/kg) | Soil-to-Plant Uptake Factor[d] Wet Weight (days/kg) | Beef Transfer Coefficient[d] (kg/kg) | Milk Transfer Coefficient[d] (kg/kg) | Fish Transfer Coefficient[d] (L/kg) |
|---|---|---|---|---|---|---|---|---|
| ***Inorganics*** | | | | | | | | |
| Aluminum | 1.0E-03 | 2.1E-03 | -- | 4.0E-03 | 1.0E-03 | 1.5E-03 | 2.0E-04 | 3.2E+00 |
| Antimony | 1.0E-03 | 1.1E-03 | -- | 5.0E-02 | 1.0E-02 | 4.0E-05 | 2.5E-05 | 3.2E+00 |
| Arsenic | 3.0E-02 | 1.9E-03 | -- | 4.0E-02 | 1.0E-02 | 2.0E-03 | 6.0E-05 | 3.2E+00 |
| Barium | 1.0E-03 | 4.0E-04 | -- | 1.0E-01 | 3.0E-03 | 2.0E-04 | 4.8E-04 | 3.2E+00 |
| Cadmium | 1.0E-03 | 3.5E-04 | -- | 5.5E-01 | 1.4E-01 | 4.0E-04 | 1.0E-03 | 3.2E+00 |
| Chromium (as Chromium III) | 1.0E-03 | 1.0E-03 | -- | 4.0E-02 | 1.0E-04 | 9.0E-03 | 1.0E-05 | 2.0E+02 |
| Chromium, hexavalent | 1.0E-03 | 1.0E-03 | -- | 4.0E-02 | 1.0E-04 | 9.0E-03 | 1.0E-05 | 2.0E+02 |
| Copper | 1.0E-03 | 3.1E-04 | -- | 8.0E-01 | 8.0E-02 | 9.0E-03 | 1.5E-03 | 3.2E+00 |
| Manganese | 1.0E-03 | 1.3E-03 | -- | 6.8E-01 | 6.9E-02 | 5.0E-04 | 3.0E-05 | 3.2E+00 |
| Mercury | 1.0E-03 | 2.9E-05 | -- | 1.0E+00 | 1.0E-03 | 1.0E-02 | 4.7E-04 | 1.0E+02 |
| Vanadium | 1.0E-03 | 1.4E-03 | -- | 5.5E-03 | 1.4E-03 | 2.5E-03 | 2.0E-05 | 3.2E+00 |
| Zinc | 1.0E-03 | 3.4E-04 | -- | 9.9E-01 | 2.6E-01 | 1.0E-01 | 1.0E-02 | 3.2E+00 |
| ***Organics*** | | | | | | | | |
| 2,4,6-Trinitrotoluene | 1.0E-01 | 1.1E-03 | -- | 1.8E+00 | 3.6E-01 | 5.0E-06 | 1.6E-06 | 3.4E+00 |
| 2,4-Dinitrotoluene | 1.0E-02 | 3.8E-03 | -- | 2.6E+00 | 5.3E-01 | 2.5E-06 | 7.9E-07 | 6.7E+00 |
| 2,6-Dinitrotoluene | 1.0E-01 | 4.6E-03 | -- | 3.9E+00 | 8.0E-01 | 1.3E-06 | 4.0E-07 | 8.3E+00 |
| Benz(*a*)anthracene | 1.3E-01 | 9.5E-01 | -- | 1.9E-02 | 3.8E-03 | 1.3E-02 | 4.0E-03 | 5.4E+03 |
| Benzo(*a*)pyrene | 1.3E-01 | 1.2E+00 | -- | 1.1E-02 | 2.2E-03 | 3.1E-02 | 9.9E-03 | 1.1E+04 |
| Benzo(*b*)fluoranthene | 1.3E-01 | 7.0E-01 | -- | 1.1E-02 | 2.2E-03 | 3.1E-02 | 9.9E-03 | 5.6E+03 |
| Bis(2-ethylhexyl)phthalate | 1.0E-02 | 2.0E+00 | -- | 5.5E-02 | 1.1E-02 | 2.0E-03 | 6.3E-04 | 3.1E+02 |
| Indeno(*1,2,3-cd*)pyrene | 1.3E-01 | 2.2E+00 | -- | 5.6E-03 | 1.1E-03 | 1.0E-01 | 3.1E-02 | 2.9E+04 |
| Methylene Chloride | 1.0E-02 | 4.5E-03 | 3.5E+03 | 6.7E+00 | 1.4E+00 | 5.0E-07 | 1.6E-07 | 1.8E+00 |
| Perchlorate | 1.0E-03 | 3.8E-07 | -- | -- | -- | -- | -- | 3.2E+00 |
| Trichloroethene | 1.0E-02 | 1.6E-02 | 2.5E+03 | 1.5E+00 | 3.1E-01 | 6.3E-06 | 2.0E-06 | 1.5E+01 |

[a] Chemical-specific absorption factor values from the U. S. Environmental Protection Agency (EPA) Region 5 (EPA 2000). When chemical-specific values are not available, the following default values are used for soil and sediment only: Semivolatile organic compounds = 0.1, volatile organic compounds (VOCs) = 0.01, and inorganics = 0.001, per EPA Region 4 Supplemental Guidance to Risk Assessment Guidance for Superfund.

[b] From Risk Assessment Information System (RAIS) *http://risk.lsd.ornl.gov/tox/tox_values.shtml* for groundwater and surface water.

[c] Volatilization factors calculated using the 1996 EPA Soil Screening Guidance Methodology, using site-specific parameter values for Cleveland, Ohio. Only used for soil and sediment VOCs.

[d] Parameter used to evaluate food pathways.

COPC = Chemical of potential concern.

-- = No value available.

**Table M-8. Non-carcinogenic Reference Doses for Fuze and Booster Quarry Ponds COPCs**

| COPC | Oral Chronic RfD (mg/kg-day) | Confidence Level | % GI Absorption[a] | Dermal Chronic RfD (mg/kg-day) | Inhalation Chronic RfD (mg/kg-day) | RfD Basis (vehicle) | Critical Effect | Uncertainty/ Modifying Factor |
|---|---|---|---|---|---|---|---|---|
| ***Inorganics*** | | | | | | | | |
| Aluminum | 1.0E+00 | NA | 1 | 1.0E+00 | 1.4E-03 | NA | NA | (O) UF=10 |
| Antimony | 4.0E-04 | Low | 0.15 | 6.0E-05 | -- | Oral, oral-water | Gastrointestinal, liver, cardiovascular, and developmental toxicity | (O) UF=1,000 |
| Arsenic | 3.0E-04 | Medium (O) | 0.95 | 3.0E-04 | -- | Oral, oral-water | Hyperpigmentation and keritosis and possible vascular complication | (O) UF=3 |
| Barium | 7.0E-02 | Medium (O) | 0.07 | 4.9E-03 | 1.4E-04 | Oral, oral-water, and inhalation | (O) increased blood pressure (human) (I) baritosis (human) | (O) UF=3 (I) UF=1,000 |
| Cadmium (soil/food) | 1.0E-03 | High | 0.025 | 2.5E-05 | -- | Oral, oral-water | Renal toxicity, osteomalacia, osteoporosis, and significant proteinuria | (O) UF=1,000 |
| Chromium (as Chromium III) | 1.5E+00 | Low (O) | 0.013 | 2.0E-02 | -- | Oral (rat) | Reduced liver/spleen weight | (O) UF=100 |
| Chromium, hexavalent | 3.0E-03 | Low | 0.025 | 7.5E-05 | 2.9E-05 | NA | NA | (O) MF=3 (O) UF=300 |
| Copper | 4.0E-02 | NA | 1 | 4.0E-02 | -- | NA | NA | NA |
| Manganese (food) | 1.4E-01 | Medium (O) | 0.04 | 5.6E-03 | 1.4E-05 | Oral | (O) lethargy, tremors, mental disturbance, muscle tonus, and central nervous system effects | (O) UF=1 (O) MF=1 |
| Manganese (soil/water) | 4.6E-02 | Medium (O) | 0.04 | 1.8E-03 | 1.4E-05 | Oral, water, and inhalation | (O) lethargy, tremors, mental disturbance, muscle tonus, and central nervous system effects | (O) UF=1 (O) MF=1 (I) UF=1,000 |
| Mercury | 3.0E-04 | Medium (I) | 0.07 | 2.1E-05 | -- | Human occupational inhalation studies | Hand tremor, increases in memory disturbance; slight subjective and objective evidence of autonomic dysfunction | (I) UF=30 |
| Vanadium | 7.0E-03 | NA | 0.026 | 1.8E-04 | -- | Inhalation | (I) respiratory system | (O) MF=1 (O) UF=100 |

**Table M-8. Non-carcinogenic Reference Doses for Fuze and Booster Quarry Ponds COPCs (continued)**

| COPC | Oral Chronic RfD (mg/kg-day) | Confidence Level | % GI Absorption[a] | Dermal Chronic RfD (mg/kg-day) | Inhalation Chronic RfD (mg/kg-day) | RfD Basis (vehicle) | Critical Effect | Uncertainty/ Modifying Factor |
|---|---|---|---|---|---|---|---|---|
| Zinc | 3.0E-01 | Medium | 0.3 | 9.0E-02 | -- | Oral | (O) copper deficiency and hypochromic microcytic anemia (human) (I) pulmonary and gastrointestinal effects (human) | UF=3 |
| ***Organics*** | | | | | | | | |
| 2,4,6-Trinitrotoluene | 5.0E-04 | Medium | 1 | 5.0E-04 | -- | Oral (dog) | Liver effects | UF=1,000 |
| 2,4-Dinitrotoluene | 2.0E-03 | High | 1 | 2.0E-03 | -- | Oral | Neurotoxicity, heinz bodies, and biliary tract hyperplasia | (O) MF=1 (O) UF=100 |
| 2,6-Dinitrotoluene | 1.0E-03 | Medium | 1 | 1.0E-03 | -- | Oral (dog) | Neurological, hematological, and liver histopathology | UF=3,000 |
| Bis(2-ethylhexyl)phthalate | 2.0E-02 | Medium | 1 | 2.0E-02 | -- | Oral | Liver effects with increased relative weight | (O) MF=1 (O) UF=1,000 |
| Methylene Chloride | 6.0E-02 | Medium | 1 | 6.0E-02 | 8.6E-01 | Oral (mice), inhalation (mice) | Adenomas, carcinomas, and nodules | UF=100 |
| Perchlorate | 7.0E-04 | NA | 1 | 7.0E-04 | -- | NA | NA | NA |
| Trichloroethene | -- | NA | 1 | -- | 1.7E-01 | Oral | Liver, kidney, and developing fetus | NA |

[a] % Gastrointestinal (GI) absorption values from EPA 2004a.
(O) indicates oral, (I) indicates inhalation.
COPC = Chemical of potential concern.
MF = Modifying factor (the default modifying factor is 1).
NA = Not available.
RfD = Reference dose.
UF = Uncertainty factor.
-- = No value available.

**Table M-9. Cancer Slope Factors for Fuze and Booster Quarry Ponds COPCs**

| COPC | Oral Slope Factor $(mg/kg\text{-}day)^{-1}$ | % GI Absorption[a] | Dermal Slope Factor $(mg/kg\text{-}day)^{-1}$ | Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$ | EPA Class | TEF | Type of Cancer |
|---|---|---|---|---|---|---|---|
| ***Inorganics*** | | | | | | | |
| Arsenic | 1.5E+00 | 0.95 | 1.5E+00 | 1.5E+01 | A | -- | Respiratory system tumors |
| Cadmium (diet) | -- | 0.025 | -- | 6.3E+00 | B1 | -- | Respiratory tract and lung tumors |
| Chromium, hexavalent | -- | 0.025 | -- | 4.2E+01 | A | -- | Lung tumors |
| ***Organics*** | | | | | | | |
| 2,4,6-Trinitrotoluene | 3.0E-02 | 1 | 3.0E-02 | -- | C | -- | Bladder transitional cell papilloma |
| 2,4-Dinitrotoluene | 6.8E-01 | 1 | 6.8E-01 | -- | B2 | -- | Liver carcinoma, mammary adenomas, and fibromas (mouse) |
| 2,6-Dinitrotoluene | 6.8E-01 | 1 | 6.8E-01 | -- | B2 | -- | Liver carcinoma, mammary adenomas, and fibromas (mouse) |
| Benz(*a*)anthracene | 7.3E-01 | 0.58 | 7.3E-01 | 3.1E-01 | B2 | 0.1 | Stomach tumors (mouse) |
| Benzo(*a*)pyrene | 7.3E+00 | 0.58 | 7.3E+00 | 3.1E+00 | B2 | 1 | Stomach, nasal cavity, larynx, tracheak, and pharnyx |
| Benzo(*b*)fluoranthene | 7.3E-01 | 0.58 | 7.3E-01 | 3.1E-01 | B2 | 0.1 | Tumors |
| Bis(2-ethylhexyl)phthalate | 1.4E-02 | 1 | 1.4E-02 | -- | B2 | -- | Liver neoplastic nodule and nepatocellular carcinoma (mouse) |
| Indeno(1,2,3-*cd*)pyrene | 7.3E-01 | 0.58 | 7.3E-01 | 3.1E-01 | B2 | 0.1 | Tumors |
| Methylene Chloride | 7.5E-03 | 1 | 7.5E-03 | 1.7E-03 | B2 | -- | Hepatocellular carcinoma and adinomas (mouse) |
| Trichloroethene | 1.3E-02 | 1 | 1.3E-02 | 7.0E-03 | NA | -- | Liver and kidney |

[a] % Gastrointestinal (GI) absorption values from EPA 2004a.
COPC = Chemical of potential concern.
EPA = U. S. Environmental Protection Agency.
TEF = Toxicity equivalency factor is based on the relative potency of each carcinogenic polycyclic aromatic hydrocarbon relative to that of benzo(*a*)pyrene.
-- = No value available.

**Table M-10. Fuze and Booster Quarry Ponds Surface Soil Calculations of Blood Lead Concentrations for the Security Guard/Maintenance Worker**

| Exposure Variable | PbB Equation[a] | | Description of Exposure Variable | Units | Security Guard/ Maintenance Worker | |
|---|---|---|---|---|---|---|
| | 1* | 2* | | | GSDi = 1.8 | GSDi = 2.1 |
| PbS | X | X | Soil lead concentration | µg/g or mg/kg | 82.7 | 82.7 |
| $R_{fetal/maternal}$ | X | X | Fetal/maternal PbB ratio | -- | 0.9 | 0.9 |
| BKSF | X | X | Biokinetic slope factor | µg/dL per µg/day | 0.4 | 0.4 |
| $GSD_i$ | X | X | Geometric standard deviation PbB | -- | 1.8 | 2.1 |
| $PbB_0$ | X | X | Baseline PbB | µg/dL | 2.2 | 1.7 |
| $IR_S$ | X | | Soil ingestion rate (including soil-derived indoor dust) | g/day | 0.1 | 0.1 |
| $IR_{S+D}$ | | X | Total ingestion rate of outdoor soil and indoor dust | g/day | 0.1 | 0.1 |
| $W_S$ | | X | Weighting factor; fraction of $IR_{S+D}$ ingested as outdoor soil | -- | -- | -- |
| $K_{SD}$ | | X | Mass fraction of soil in dust | -- | -- | -- |
| $AF_{S, D}$ | X | X | Absorption fraction (same for soil and dust) | -- | 0.12 | 0.12 |
| $EF_{S, D}$ | X | X | Exposure frequency (same for soil and dust) | days/year | 250 | 250 |
| $AT_{S, D}$ | X | X | Averaging time (same for soil and dust) | days/year | 365 | 365 |
| **$PbB_{adult}$** | **PbB of adult receptor, geometric mean** | | | **µg/dL** | **2.5** | **2.0** |
| **$PbB_{fetal, 0.95}$** | **95th percentile PbB among fetuses of adult workers** | | | **µg/dL** | **5.9** | **6.0** |
| **$PbB_t$** | **Target PbB level of concern (e.g., 10 µg/dL)** | | | **µg/dL** | **10.0** | **10.0** |
| **$P(PbB > PbB_t)$** | **Probability that $PbB > PbB_t$, assuming lognormal distribution** | | | **%** | **0.5%** | **1.0%** |

[a] Equation 1 does not apportion exposure between soil and dust ingestion (excludes $W_S$, $K_{SD}$). When IRS = $IR_{S+D}$ and WS = 1.0, the equations yield the same $PbB_{fetal,0.95}$.

* Equation 1, based on Equations 1 and 2 in EPA (1996). U.S. Environmental Protection Agency Technical Review Workgroup for Lead, Adult Lead Committee.

PbB = Blood lead concentration.

| | |
|---|---|
| $PbB_{adult}$ = | $(PbS * BKSF * IR_{S+D} * AF_{S,D} * EF_{S,D} / AT_{S,D}) + PbB_0$ |
| $PbB_{fetal, 0.95}$ = | $PbB_{adult} * (GSD_i^{1.645} * R)$ |

**Table M-11. Fuze and Booster Quarry Ponds Surface Soil Calculations of Blood Lead Concentrations for the Adult Resident Subsistence Farmer**

| Exposure Variable | PbB Equation[a] | | Description of Exposure Variable | Units | Security Guard/ Maintenance Worker | |
|---|---|---|---|---|---|---|
| | 1* | 2* | | | GSDi = 1.8 | GSDi = 2.1 |
| PbS | X | X | Soil lead concentration | µg/g or mg/kg | 82.7 | 82.7 |
| $R_{fetal/maternal}$ | X | X | Fetal/maternal PbB ratio | -- | 0.9 | 0.9 |
| BKSF | X | X | Biokinetic slope factor | µg/dL per µg/day | 0.4 | 0.4 |
| $GSD_i$ | X | X | Geometric standard deviation PbB | -- | 1.8 | 2.1 |
| $PbB_0$ | X | X | Baseline PbB | µg/dL | 2.2 | 1.7 |
| $IR_S$ | X | | Soil ingestion rate (including soil-derived indoor dust) | g/day | 0.1 | 0.1 |
| $IR_{S+D}$ | | X | Total ingestion rate of outdoor soil and indoor dust | g/day | 0.1 | 0.1 |
| $W_S$ | | X | Weighting factor; fraction of $IR_{S+D}$ ingested as outdoor soil | -- | -- | -- |
| $K_{SD}$ | | X | Mass fraction of soil in dust | -- | -- | -- |
| $AF_{S, D}$ | X | X | Absorption fraction (same for soil and dust) | -- | 0.12 | 0.12 |
| $EF_{S, D}$ | X | X | Exposure frequency (same for soil and dust) | days/year | 350 | 350 |
| $AT_{S, D}$ | X | X | Averaging time (same for soil and dust) | days/year | 365 | 365 |
| **$PbB_{adult}$** | **PbB of adult receptor, geometric mean** | | | **µg/dL** | **2.6** | **2.1** |
| **$PbB_{fetal, 0.95}$** | **95th percentile PbB among fetuses of adult workers** | | | **µg/dL** | **6.1** | **6.3** |
| **$PbB_t$** | **Target PbB level of concern (e.g., 10 µg/dL)** | | | **µg/dL** | **10.0** | **10.0** |
| **P(PbB > $PbB_t$)** | **Probability that PbB > $PbB_t$, assuming lognormal distribution** | | | **%** | **0.7%** | **1.2%** |

[a] Equation 1 does not apportion exposure between soil and dust ingestion (excludes $W_S$, $K_{SD}$). When IRS = $IR_{S+D}$ and WS = 1.0, the equations yield the same $PbB_{fetal,0.95}$.

* Equation 1, based on Equations 1 and 2 in EPA (1996). U.S. Environmental Protection Agency Technical Review Workgroup for Lead, Adult Lead Committee.

PbB = Blood lead concentration.

| | |
|---|---|
| $PbB_{adult}$ = | $(PbS * BKSF * IR_{S+D} * AF_{S,D} * EF_{S,D} / AT_{S,D}) + PbB_0$ |
| $PbB_{fetal, 0.95}$ = | $PbB_{adult} * (GSD_i^{1.645} * R)$ |

**Table M-12. Fuze and Booster Quarry Ponds Surface Soil Calculations of Blood Lead Concentrations for the Child Resident Subsistence Farmer**

| Exposure Variable | Description of Exposure Variable | Units | Child Resident Subsistence Farmer |
|---|---|---|---|
| PbS | Soil lead concentration | µg/g or mg/kg | 82.7 |
| $GSD_i$ | Geometric standard deviation PbB | -- | 1.6 |
| **PbB** | **PbB geometric mean** | **µg/dL** | **3.2** |
| **$PbB_t$** | **Target PbB level of concern (e.g., 10 µg/dL)** | **µg/dL** | **10.0** |
| **$P(PbB > PbB_t)$** | **Probability that PbB > $PbB_t$, assuming lognormal distribution** | **%** | **0.7%** |

Child receptor uses the IEUBK win 32 Lead Model Version 1.0 (Build 252) to calculate the PbB concentration and the probability that PbB > PbBt assuming a soil/dust ingestion weighting factor of 100%.
PbB = Blood lead concentration.

**Table M-13. Fuze and Booster Quarry Ponds Sediment Calculations of Blood Lead Concentrations for the Adult Resident Subsistence Farmer**

| Exposure Variable | PbB Equation[a] | | Description of Exposure Variable | Units | Adult Resident Subsistence Farmer | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Quarry Ponds | | Settling Basins | |
| | 1* | 2* | | | GSDi = 1.8 | GSDi = 2.1 | GSDi = 1.8 | GSDi = 2.1 |
| PbS | X | X | Soil lead concentration | µg/g or mg/kg | 621 | 621 | 114 | 114 |
| $R_{fetal/maternal}$ | X | X | Fetal/maternal PbB ratio | -- | 0.9 | 0.9 | 0.9 | 0.9 |
| BKSF | X | X | Biokinetic slope factor | µg/dL per µg/day | 0.4 | 0.4 | 0.4 | 0.4 |
| $GSD_i$ | X | X | Geometric standard deviation PbB | -- | 1.8 | 2.1 | 1.8 | 2.1 |
| $PbB_0$ | X | X | Baseline PbB | µg/dL | 2.2 | 1.7 | 2.2 | 1.7 |
| $IR_S$ | X | | Soil ingestion rate (including soil-derived indoor dust) | g/day | 0.1 | 0.1 | 0.1 | 0.1 |
| $IR_{S+D}$ | | X | Total ingestion rate of outdoor soil and indoor dust | g/day | 0.1 | 0.1 | 0.1 | 0.1 |
| $W_S$ | | X | Weighting factor; fraction of $IR_{S+D}$ ingested as outdoor soil | -- | -- | -- | -- | -- |
| $K_{SD}$ | | X | Mass fraction of soil in dust | -- | -- | -- | -- | -- |
| $AF_{S, D}$ | X | X | Absorption fraction (same for soil and dust) | -- | 0.12 | 0.12 | 0.12 | 0.12 |
| $EF_{S, D}$ | X | X | Exposure frequency (same for soil and dust) | days/year | 350 | 350 | 350 | 350 |
| $AT_{S, D}$ | X | X | Averaging time (same for soil and dust) | days/year | 365 | 365 | 365 | 365 |
| **$PbB_{adult}$** | **PbB of adult receptor, geometric mean** | | | **µg/dL** | **5.1** | **4.6** | **2.7** | **2.2** |
| **$PbB_{fetal, 0.95}$** | **95th percentile PbB among fetuses of adult workers** | | | **µg/dL** | **12.0** | **13.9** | **6.4** | **6.8** |
| **$PbB_t$** | **Target PbB level of concern (e.g., 10 µg/dL)** | | | **µg/dL** | **10.0** | **10.0** | **10.0** | **10.0** |
| **P(PbB > $PbB_t$)** | **Probability that PbB > $PbB_t$, assuming lognormal distribution** | | | **%** | **9.0%** | **11.5%** | **0.8%** | **1.5%** |

[a] Equation 1 does not apportion exposure between soil and dust ingestion (excludes $W_S$, $K_{SD}$). When IRS = $IR_{S+D}$ and WS = 1.0, the equations yield the same $PbB_{fetal,0.95}$.
* Equation 1, based on Equations 1 and 2 in EPA (1996). U.S. Environmental Protection Agency Technical Review Workgroup for Lead, Adult Lead Committee.
PbB = Blood lead concentration.

| | |
|---|---|
| $PbB_{adult}$ = | $(PbS * BKSF * IR_{S+D} * AF_{S,D} * EF_{S,D} / AT_{S,D}) + PbB_0$ |
| $PbB_{fetal, 0.95}$ = | $PbB_{adult} * (GSD_i^{1.645} * R)$ |

**Table M-14. Fuze and Booster Quarry Ponds Sediment Calculations of Blood Lead Concentrations for the Child Resident Subsistence Farmer**

| Exposure Variable | Description of Exposure Variable | Units | Child Resident Subsistence Farmer | |
|---|---|---|---|---|
| | | | Quarry Ponds | Settling Basins |
| PbS | Soil lead concentration | µg/g or mg/kg | 621 | 114 |
| $GSD_i$ | Geometric standard deviation PbB | -- | 1.6 | 1.6 |
| **PbB** | **PbB geometric mean** | **µg/dL** | **11.6** | **3.8** |
| **$PbB_t$** | **Target PbB level of concern (e.g., 10 µg/dL)** | **µg/dL** | **10.0** | **10.0** |
| **P(PbB > $PbB_t$)** | **Probability that PbB > $PbB_t$, assuming lognormal distribution** | **%** | **62.5%** | **1.9%** |

Child receptor uses the IEUBK win 32 Lead Model Version 1.0 (Build 252) to calculate the PbB concentration and the probability that PbB > PbBt assuming a soil/dust ingestion weighting factor of 100%.
PbB = Blood lead concentration.

**Table M-15. Fuze and Booster Quarry Ponds Surface Water Calculations of Blood Lead Concentrations for the Adult Resident Subsistence Farmer**

| Exposure Variable | PbB Equation[a] 1* | PbB Equation[a] 2* | Description of Exposure Variable | Units | Adult Resident Subsistence Farmer Settling Basins GSDi = 1.8 | Adult Resident Subsistence Farmer Settling Basins GSDi = 2.1 |
|---|---|---|---|---|---|---|
| PbW | X | X | Water lead concentration | µg/L | 8.57 | 8.57 |
| $R_{fetal/maternal}$ | X | X | Fetal/maternal PbB ratio | -- | 0.9 | 0.9 |
| BKSF | X | X | Biokinetic slope factor | µg/dL per µg/day | 0.4 | 0.4 |
| $GSD_i$ | X | X | Geometric standard deviation PbB | -- | 1.8 | 2.1 |
| $PbB_0$ | X | X | Baseline PbB | µg/dL | 2.2 | 1.7 |
| $IR_W$ | X | | Water ingestion rate | L/day | 0.1 | 0.1 |
| $AF_W$ | X | X | Absorption fraction | -- | 0.12 | 0.12 |
| $EF_W$ | X | X | Exposure frequency | days/year | 350 | 350 |
| $AT_W$ | X | X | Averaging time | days/year | 365 | 365 |
| **$PbB_{adult}$** | **PbB of adult receptor, geometric mean** | | | **µg/dL** | **2.2** | **1.7** |
| **$PbB_{fetal, 0.95}$** | **95th percentile PbB among fetuses of adult workers** | | | **µg/dL** | **5.3** | **5.3** |
| **$PbB_t$** | **Target PbB level of concern (e.g., 10 µg/dL)** | | | **µg/dL** | **10.0** | **10.0** |
| **$P(PbB > PbB_t)$** | **Probability that $PbB > PbB_t$, assuming lognormal distribution** | | | **%** | **0.3%** | **0.6%** |

* Equation 1, based on Equations 1 and 2 in EPA (1996). U.S. Environmental Protection Agency Technical Review Workgroup for Lead, Adult Lead Committee.
PbB = Blood lead concentration.

| | |
|---|---|
| $PbB_{adult}$ = | $(PbS * BKSF * IR_{S+D} * AF_{S,D} * EF_{S,D} / AT_{S,D}) + PbB_0$ |
| $PbB_{fetal, 0.95}$ = | $PbB_{adult} * (GSD_i^{1.645} * R)$ |

**Table M-16. Fuze and Booster Quarry Ponds Surface Water Calculations of Blood Lead Concentrations for the Child Resident Subsistence Farmer**

| Exposure Variable | Description of Exposure Variable | Units | Child Resident Subsistence Farmer Settling Basins |
|---|---|---|---|
| PbW | Water lead concentration | µg/L | 8.57 |
| $GSD_i$ | Geometric standard deviation PbB | -- | 1.6 |
| **PbB** | **PbB geometric mean** | **µg/dL** | **3.6** |
| **$PbB_t$** | **Target PbB level of concern (e.g., 10 µg/dL)** | **µg/dL** | **10.0** |
| **P(PbB > $PbB_t$)** | **Probability that PbB > $PbB_t$, assuming lognormal distribution** | **%** | **1.5%** |

Child receptor uses the IEUBK win 32 Lead Model Version 1.0 (Build 252) to calculate the PbB concentration and the probability that PbB > PbBt.
PbB = Blood lead concentration.

**Table M-17. Fuze and Booster Quarry Ponds Shallow Surface Soil Non-carcinogenic Hazards - Direct Contact**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Maintained Industrial/Managed Recreational - Security Guard/Maintenance Worker*** | | | | | | | | | |
| Antimony | 4.1E+00 | 1.7E-07 | 9.3E-08 | 3.6E-11 | 4.2E-04 | 1.5E-03 | | 2.0E-03 | |
| Arsenic | 1.2E+01 | 5.0E-07 | 8.3E-06 | 1.1E-10 | 1.7E-03 | 2.8E-02 | | 2.9E-02 | |
| Barium | 1.2E+02 | 4.7E-06 | 2.6E-06 | 1.0E-09 | 6.8E-05 | 5.4E-04 | 7.2E-06 | 6.1E-04 | |
| Cadmium | 3.4E-01 | 1.4E-08 | 7.7E-09 | 3.0E-12 | 1.4E-05 | 3.1E-04 | | 3.2E-04 | |
| Chromium | 2.0E+01 | 8.2E-07 | 4.5E-07 | 1.8E-10 | 5.4E-07 | 2.3E-05 | | 2.4E-05 | |
| Copper | 4.1E+01 | 1.7E-06 | 9.3E-07 | 3.6E-10 | 4.2E-05 | 2.3E-05 | | 6.5E-05 | |
| Manganese | 7.4E+02 | 3.0E-05 | 1.7E-05 | 6.5E-09 | 6.5E-04 | 9.1E-03 | 4.6E-04 | 1.0E-02 | |
| Vanadium | 2.2E+01 | 9.1E-07 | 5.0E-07 | 2.0E-10 | 1.3E-04 | 2.8E-03 | | 2.9E-03 | |
| *Inorganics Pathway Total* | | | | | 3.0E-03 | 4.2E-02 | 4.6E-04 | 4.5E-02 | |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 1.9E-07 | 1.0E-05 | 4.1E-11 | 3.8E-04 | 2.1E-02 | | 2.1E-02 | |
| 2,6-Dinitrotoluene | 1.1E-01 | 4.3E-09 | 2.4E-07 | 9.4E-13 | 4.3E-06 | 2.4E-04 | | 2.4E-04 | |
| Benzo(*a*)pyrene | 8.4E-02 | 3.4E-09 | 2.5E-07 | 7.4E-13 | | | | | |
| *Organics Pathway Total* | | | | | 3.8E-04 | 2.1E-02 | | 2.1E-02 | |
| *Pathway Total - Chemicals* | | | | | 3.4E-03 | 6.3E-02 | 4.6E-04 | 6.7E-02 | |
| ***National Guard - National Guard Fire Suppression Worker*** | | | | | | | | | |
| Antimony | 4.1E+00 | 4.0E-08 | 2.4E-09 | 1.9E-11 | 1.0E-04 | 4.0E-05 | | 1.4E-04 | |
| Arsenic | 1.2E+01 | 1.2E-07 | 2.1E-07 | 5.7E-11 | 4.0E-04 | 7.1E-04 | | 1.1E-03 | |
| Barium | 1.2E+02 | 1.1E-06 | 6.7E-08 | 5.5E-10 | 1.6E-05 | 1.4E-05 | 3.8E-06 | 3.4E-05 | |
| Cadmium | 3.4E-01 | 3.3E-09 | 2.0E-10 | 1.6E-12 | 3.3E-06 | 7.9E-06 | | 1.1E-05 | |
| Chromium | 2.0E+01 | 2.0E-07 | 1.2E-08 | 9.4E-11 | 1.3E-07 | 6.0E-07 | | 7.3E-07 | |
| Copper | 4.1E+01 | 4.0E-07 | 2.4E-08 | 1.9E-10 | 1.0E-05 | 6.0E-07 | | 1.1E-05 | |
| Manganese | 7.4E+02 | 7.2E-06 | 4.3E-07 | 3.5E-09 | 1.6E-04 | 2.3E-04 | 2.4E-04 | 6.3E-04 | |
| Vanadium | 2.2E+01 | 2.2E-07 | 1.3E-08 | 1.0E-10 | 3.1E-05 | 7.1E-05 | | 1.0E-04 | |
| *Inorganics Pathway Total* | | | | | 7.2E-04 | 1.1E-03 | 2.5E-04 | 2.0E-03 | |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 4.5E-08 | 2.7E-07 | 2.2E-11 | 9.0E-05 | 5.4E-04 | | 6.3E-04 | |
| 2,6-Dinitrotoluene | 1.1E-01 | 1.0E-09 | 6.2E-09 | 5.0E-13 | 1.0E-06 | 6.2E-06 | | 7.2E-06 | |
| Benzo(*a*)pyrene | 8.4E-02 | 8.2E-10 | 6.3E-09 | 4.0E-13 | | | | | |
| *Organics Pathway Total* | | | | | 9.1E-05 | 5.4E-04 | | 6.3E-04 | |
| *Pathway Total - Chemicals* | | | | | 8.1E-04 | 1.6E-03 | 2.5E-04 | 2.7E-03 | |

**Table M-17. Fuze and Booster Quarry Ponds Shallow Surface Soil Non-carcinogenic Hazards - Direct Contact (continued)**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | |
| Antimony | 4.1E+00 | 5.6E-06 | 1.3E-07 | 1.2E-09 | 1.4E-02 | 2.1E-03 | | 1.6E-02 | |
| Arsenic | 1.2E+01 | 1.7E-05 | 1.1E-05 | 3.6E-09 | 5.6E-02 | 3.8E-02 | | 9.4E-02 | |
| Barium | 1.2E+02 | 1.6E-04 | 3.6E-06 | 3.4E-08 | 2.3E-03 | 7.4E-04 | 2.4E-04 | 3.3E-03 | |
| Cadmium | 3.4E-01 | 4.6E-07 | 1.1E-08 | 1.0E-10 | 4.6E-04 | 4.2E-04 | | 8.9E-04 | |
| Chromium | 2.0E+01 | 2.7E-05 | 6.2E-07 | 5.9E-09 | 1.8E-05 | 3.2E-05 | | 5.0E-05 | |
| Copper | 4.1E+01 | 5.7E-05 | 1.3E-06 | 1.2E-08 | 1.4E-03 | 3.2E-05 | | 1.4E-03 | |
| Manganese | 7.4E+02 | 1.0E-03 | 2.3E-05 | 2.2E-07 | 2.2E-02 | 1.3E-02 | 1.5E-02 | 5.0E-02 | |
| Vanadium | 2.2E+01 | 3.0E-05 | 6.9E-07 | 6.6E-09 | 4.3E-03 | 3.8E-03 | | 8.2E-03 | |
| *Inorganics Pathway Total* | | | | | 1.0E-01 | 5.8E-02 | 1.6E-02 | 1.7E-01 | |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 6.3E-06 | 1.4E-05 | 1.4E-09 | 1.3E-02 | 2.9E-02 | | 4.1E-02 | |
| 2,6-Dinitrotoluene | 1.1E-01 | 1.5E-07 | 3.3E-07 | 3.1E-11 | 1.5E-04 | 3.3E-04 | | 4.8E-04 | |
| Benzo(*a*)pyrene | 8.4E-02 | 1.2E-07 | 3.4E-07 | 2.5E-11 | | | | | |
| *Organics Pathway Total* | | | | | 1.3E-02 | 2.9E-02 | | 4.2E-02 | |
| *Pathway Total - Chemicals* | | | | | 1.1E-01 | 8.7E-02 | 1.6E-02 | 2.2E-01 | |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | |
| Antimony | 4.1E+00 | 5.3E-05 | 1.2E-07 | 2.8E-09 | 1.3E-01 | 1.9E-03 | | 1.3E-01 | |
| Arsenic | 1.2E+01 | 1.6E-04 | 1.0E-05 | 8.4E-09 | 5.2E-01 | 3.4E-02 | | 5.5E-01 | |
| Barium | 1.2E+02 | 1.5E-03 | 3.3E-06 | 8.0E-08 | 2.1E-02 | 6.7E-04 | 5.6E-04 | 2.2E-02 | |
| Cadmium | 3.4E-01 | 4.3E-06 | 9.5E-09 | 2.3E-10 | 4.3E-03 | 3.8E-04 | | 4.7E-03 | |
| Chromium | 2.0E+01 | 2.6E-04 | 5.6E-07 | 1.4E-08 | 1.7E-04 | 2.9E-05 | | 2.0E-04 | |
| Copper | 4.1E+01 | 5.3E-04 | 1.2E-06 | 2.9E-08 | 1.3E-02 | 2.9E-05 | | 1.3E-02 | |
| Manganese | 7.4E+02 | 9.4E-03 | 2.1E-05 | 5.1E-07 | 2.1E-01 | 1.1E-02 | 3.6E-02 | 2.5E-01 | |
| Vanadium | 2.2E+01 | 2.8E-04 | 6.2E-07 | 1.5E-08 | 4.1E-02 | 3.4E-03 | | 4.4E-02 | |
| *Inorganics Pathway Total* | | | | | 9.4E-01 | 5.2E-02 | 3.6E-02 | 1.0E+00 | H |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 5.9E-05 | 1.3E-05 | 3.2E-09 | 1.2E-01 | 2.6E-02 | | 1.4E-01 | |
| 2,6-Dinitrotoluene | 1.1E-01 | 1.4E-06 | 3.0E-07 | 7.3E-11 | 1.4E-03 | 3.0E-04 | | 1.7E-03 | |
| Benzo(*a*)pyrene | 8.4E-02 | 1.1E-06 | 3.1E-07 | 5.8E-11 | | | | | |
| *Organics Pathway Total* | | | | | 1.2E-01 | 2.6E-02 | | 1.5E-01 | |
| *Pathway Total - Chemicals* | | | | | 1.1E+00 | 7.8E-02 | 3.6E-02 | 1.2E+00 | H |
| ***Recreational - Hunter/Trapper/Fisher*** | | | | | | | | | |
| Antimony | 4.1E+00 | 2.1E-08 | 1.8E-09 | 4.6E-12 | 5.4E-05 | 2.9E-05 | | 8.3E-05 | |
| Arsenic | 1.2E+01 | 6.4E-08 | 1.6E-07 | 1.4E-11 | 2.1E-04 | 5.2E-04 | | 7.3E-04 | |
| Barium | 1.2E+02 | 6.1E-07 | 5.0E-08 | 1.3E-10 | 8.6E-06 | 1.0E-05 | 9.2E-07 | 2.0E-05 | |
| Cadmium | 3.4E-01 | 1.8E-09 | 1.4E-10 | 3.8E-13 | 1.8E-06 | 5.8E-06 | | 7.6E-06 | |
| Chromium | 2.0E+01 | 1.0E-07 | 8.5E-09 | 2.3E-11 | 7.0E-08 | 4.4E-07 | | 5.1E-07 | |
| Copper | 4.1E+01 | 2.2E-07 | 1.8E-08 | 4.7E-11 | 5.4E-06 | 4.4E-07 | | 5.8E-06 | |
| Manganese | 7.4E+02 | 3.9E-06 | 3.2E-07 | 8.3E-10 | 8.4E-05 | 1.7E-04 | 5.8E-05 | 3.1E-04 | |
| Vanadium | 2.2E+01 | 1.2E-07 | 9.5E-09 | 2.5E-11 | 1.7E-05 | 5.2E-05 | | 6.9E-05 | |
| *Inorganics Pathway Total* | | | | | 3.8E-04 | 7.9E-04 | 5.9E-05 | 1.2E-03 | |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 2.4E-08 | 2.0E-07 | 5.2E-12 | 4.8E-05 | 3.9E-04 | | 4.4E-04 | |
| 2,6-Dinitrotoluene | 1.1E-01 | 5.5E-10 | 4.5E-09 | 1.2E-13 | 5.5E-07 | 4.5E-06 | | 5.1E-06 | |
| Benzo(*a*)pyrene | 8.4E-02 | 4.4E-10 | 4.7E-09 | 9.5E-14 | | | | | |
| *Organics Pathway Total* | | | | | 4.9E-05 | 4.0E-04 | | 4.5E-04 | |
| *Pathway Total - Chemicals* | | | | | 4.3E-04 | 1.2E-03 | 5.9E-05 | 1.7E-03 | |

[a] COPCs are identified as COCs if the total HI across all pathways is > 1 (H).

COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
HI = Hazard index.
HQ = Hazard quotient.

**Table M-18. Fuze and Booster Quarry Ponds Shallow Surface Soil Carcinogenic Risks - Direct Contact**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Maintained Industrial/Managed Recreational - Security Guard/Maintenance Worker*** | | | | | | | | | |
| Antimony | 4.1E+00 | 6.0E-08 | 3.3E-08 | 1.3E-11 | | | | | |
| Arsenic | 1.2E+01 | 1.8E-07 | 3.0E-06 | 3.8E-11 | 2.7E-07 | 4.4E-06 | 5.8E-10 | 4.7E-06 | R |
| Barium | 1.2E+02 | 1.7E-06 | 9.4E-07 | 3.7E-10 | | | | | |
| Cadmium | 3.4E-01 | 4.9E-09 | 2.7E-09 | 1.1E-12 | | | 6.7E-12 | 6.7E-12 | |
| Chromium | 2.0E+01 | 2.9E-07 | 1.6E-07 | 6.3E-11 | | | | | |
| Copper | 4.1E+01 | 6.0E-07 | 3.3E-07 | 1.3E-10 | | | | | |
| Manganese | 7.4E+02 | 1.1E-05 | 6.0E-06 | 2.3E-09 | | | | | |
| Vanadium | 2.2E+01 | 3.2E-07 | 1.8E-07 | 7.0E-11 | | | | | |
| *Inorganics Pathway Total* | | | | | 2.7E-07 | 4.4E-06 | 5.9E-10 | 4.7E-06 | R |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 6.7E-08 | 3.7E-06 | 1.5E-11 | 2.0E-09 | 1.1E-07 | | 1.1E-07 | |
| 2,6-Dinitrotoluene | 1.1E-01 | 1.5E-09 | 8.6E-08 | 3.3E-13 | 1.0E-09 | 5.8E-08 | | 5.9E-08 | |
| Benzo(*a*)pyrene | 8.4E-02 | 1.2E-09 | 8.8E-08 | 2.6E-13 | 8.9E-09 | 6.4E-07 | 8.2E-13 | 6.5E-07 | |
| *Organics Pathway Total* | | | | | 1.2E-08 | 8.1E-07 | 8.2E-13 | 8.3E-07 | |
| *Pathway Total - Chemicals* | | | | | 2.8E-07 | 5.2E-06 | 5.9E-10 | 5.5E-06 | R |
| ***National Guard - National Guard Fire Suppression Worker*** | | | | | | | | | |
| Antimony | 4.1E+00 | 1.4E-08 | 8.5E-10 | 6.9E-12 | | | | | |
| Arsenic | 1.2E+01 | 4.3E-08 | 7.6E-08 | 2.0E-11 | 6.4E-08 | 1.1E-07 | 3.1E-10 | 1.8E-07 | |
| Barium | 1.2E+02 | 4.1E-07 | 2.4E-08 | 1.9E-10 | | | | | |
| Cadmium | 3.4E-01 | 1.2E-09 | 7.0E-11 | 5.7E-13 | | | 3.6E-12 | 3.6E-12 | |
| Chromium | 2.0E+01 | 7.0E-08 | 4.2E-09 | 3.4E-11 | | | | | |
| Copper | 4.1E+01 | 1.4E-07 | 8.6E-09 | 6.9E-11 | | | | | |
| Manganese | 7.4E+02 | 2.6E-06 | 1.5E-07 | 1.2E-09 | | | | | |
| Vanadium | 2.2E+01 | 7.8E-08 | 4.6E-09 | 3.7E-11 | | | | | |
| *Inorganics Pathway Total* | | | | | 6.4E-08 | 1.1E-07 | 3.1E-10 | 1.8E-07 | |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 1.6E-08 | 9.6E-08 | 7.7E-12 | 4.8E-10 | 2.9E-09 | | 3.4E-09 | |
| 2,6-Dinitrotoluene | 1.1E-01 | 3.7E-10 | 2.2E-09 | 1.8E-13 | 2.5E-10 | 1.5E-09 | | 1.7E-09 | |
| Benzo(*a*)pyrene | 8.4E-02 | 2.9E-10 | 2.3E-09 | 1.4E-13 | 2.1E-09 | 1.7E-08 | 4.4E-13 | 1.9E-08 | |
| *Organics Pathway Total* | | | | | 2.9E-09 | 2.1E-08 | 4.4E-13 | 2.4E-08 | |
| *Pathway Total - Chemicals* | | | | | 6.7E-08 | 1.3E-07 | 3.1E-10 | 2.0E-07 | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | |
| Antimony | 4.1E+00 | 2.4E-06 | 5.5E-08 | 5.2E-10 | | | | | |
| Arsenic | 1.2E+01 | 7.2E-06 | 4.9E-06 | 1.6E-09 | 1.1E-05 | 7.3E-06 | 2.3E-08 | 1.8E-05 | R |
| Barium | 1.2E+02 | 6.8E-05 | 1.6E-06 | 1.5E-08 | | | | | |
| Cadmium | 3.4E-01 | 2.0E-07 | 4.5E-09 | 4.3E-11 | | | 2.7E-10 | 2.7E-10 | |
| Chromium | 2.0E+01 | 1.2E-05 | 2.7E-07 | 2.5E-09 | | | | | |
| Copper | 4.1E+01 | 2.4E-05 | 5.5E-07 | 5.3E-09 | | | | | |
| Manganese | 7.4E+02 | 4.3E-04 | 9.9E-06 | 9.4E-08 | | | | | |
| Vanadium | 2.2E+01 | 1.3E-05 | 3.0E-07 | 2.8E-09 | | | | | |
| Inorganics Pathway Total | | | | | 1.1E-05 | 7.3E-06 | 2.4E-08 | 1.8E-05 | R |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 2.7E-06 | 6.2E-06 | 5.9E-10 | 8.1E-08 | 1.9E-07 | | 2.7E-07 | |
| 2,6-Dinitrotoluene | 1.1E-01 | 6.2E-08 | 1.4E-07 | 1.3E-11 | 4.2E-08 | 9.6E-08 | | 1.4E-07 | |
| Benzo(a)pyrene | 8.4E-02 | 4.9E-08 | 1.5E-07 | 1.1E-11 | 3.6E-07 | 1.1E-06 | 3.3E-11 | 1.4E-06 | R |
| Organics Pathway Total | | | | | 4.8E-07 | 1.3E-06 | 3.3E-11 | 1.8E-06 | R |
| Pathway Total - Chemicals | | | | | 1.1E-05 | 8.7E-06 | 2.4E-08 | 2.0E-05 | R |

**Table M-18. Fuze and Booster Quarry Ponds Shallow Surface Soil Carcinogenic Risks - Direct Contact (continued)**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | |
| Antimony | 4.1E+00 | 4.5E-06 | 9.9E-09 | 2.4E-10 | | | | | |
| Arsenic | 1.2E+01 | 1.3E-05 | 8.8E-07 | 7.2E-10 | 2.0E-05 | 1.3E-06 | 1.1E-08 | 2.1E-05 | R |
| Barium | 1.2E+02 | 1.3E-04 | 2.8E-07 | 6.9E-09 | | | | | |
| Cadmium | 3.4E-01 | 3.7E-07 | 8.2E-10 | 2.0E-11 | | | 1.3E-10 | 1.3E-10 | |
| Chromium | 2.0E+01 | 2.2E-05 | 4.8E-08 | 1.2E-09 | | | | | |
| Copper | 4.1E+01 | 4.5E-05 | 1.0E-07 | 2.5E-09 | | | | | |
| Manganese | 7.4E+02 | 8.1E-04 | 1.8E-06 | 4.4E-08 | | | | | |
| Vanadium | 2.2E+01 | 2.4E-05 | 5.4E-08 | 1.3E-09 | | | | | |
| *Inorganics Pathway Total* | | | | | 2.0E-05 | 1.3E-06 | 1.1E-08 | 2.1E-05 | R |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 5.1E-06 | 1.1E-06 | 2.7E-10 | 1.5E-07 | 3.3E-08 | | 1.8E-07 | |
| 2,6-Dinitrotoluene | 1.1E-01 | 1.2E-07 | 2.6E-08 | 6.3E-12 | 7.9E-08 | 1.7E-08 | | 9.6E-08 | |
| Benzo(*a*)pyrene | 8.4E-02 | 9.2E-08 | 2.6E-08 | 5.0E-12 | 6.7E-07 | 1.9E-07 | 1.5E-11 | 8.6E-07 | |
| *Organics Pathway Total* | | | | | 9.0E-07 | 2.4E-07 | 1.5E-11 | 1.1E-06 | R |
| *Pathway Total - Chemicals* | | | | | 2.1E-05 | 1.6E-06 | 1.1E-08 | 2.3E-05 | R |
| ***Recreational - Hunter/Trapper/Fisher*** | | | | | | | | | |
| Antimony | 4.1E+00 | 9.2E-09 | 7.5E-10 | 2.0E-12 | | | | | |
| Arsenic | 1.2E+01 | 2.7E-08 | 6.7E-08 | 5.9E-12 | 4.1E-08 | 1.0E-07 | 8.9E-11 | 1.4E-07 | |
| Barium | 1.2E+02 | 2.6E-07 | 2.1E-08 | 5.6E-11 | | | | | |
| Cadmium | 3.4E-01 | 7.6E-10 | 6.2E-11 | 1.6E-13 | | | 1.0E-12 | 1.0E-12 | |
| Chromium | 2.0E+01 | 4.5E-08 | 3.7E-09 | 9.7E-12 | | | | | |
| Copper | 4.1E+01 | 9.2E-08 | 7.6E-09 | 2.0E-11 | | | | | |
| Manganese | 7.4E+02 | 1.7E-06 | 1.4E-07 | 3.6E-10 | | | | | |
| Vanadium | 2.2E+01 | 5.0E-08 | 4.1E-09 | 1.1E-11 | | | | | |
| *Inorganics Pathway Total* | | | | | 4.1E-08 | 1.0E-07 | 9.0E-11 | 1.4E-07 | |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 1.0E-08 | 8.4E-08 | 2.2E-12 | 3.1E-10 | 2.5E-09 | | 2.8E-09 | |
| 2,6-Dinitrotoluene | 1.1E-01 | 2.4E-10 | 1.9E-09 | 5.1E-14 | 1.6E-10 | 1.3E-09 | | 1.5E-09 | |
| Benzo(*a*)pyrene | 8.4E-02 | 1.9E-10 | 2.0E-09 | 4.1E-14 | 1.4E-09 | 1.5E-08 | 1.3E-13 | 1.6E-08 | |
| *Organics Pathway Total* | | | | | 1.8E-09 | 1.8E-08 | 1.3E-13 | 2.0E-08 | |
| *Pathway Total - Chemicals* | | | | | 4.3E-08 | 1.2E-07 | 9.0E-11 | 1.6E-07 | |

[a] COPCs are identified as COCs if the total incremental lifetime cancer risk across all pathways is > 1E-06 (R).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.

**Table M-19. Fuze and Booster Quarry Ponds Deep Surface Soil Non-carcinogenic Hazards - Direct Contact**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***National Guard - National Guard Trainee*** | | | | | | | | | |
| Aluminum | 1.3E+04 | 2.0E-03 | 1.9E-05 | 5.2E-04 | 2.0E-03 | 1.9E-05 | 3.6E-01 | 3.7E-01 | |
| Antimony | 2.7E+00 | 4.0E-07 | 4.0E-09 | 1.1E-07 | 1.0E-03 | 6.7E-05 | | 1.1E-03 | |
| Arsenic | 1.3E+01 | 2.0E-06 | 6.0E-07 | 5.4E-07 | 6.8E-03 | 2.0E-03 | | 8.8E-03 | |
| Barium | 1.0E+02 | 1.5E-05 | 1.5E-07 | 4.1E-06 | 2.2E-04 | 3.1E-05 | 2.9E-02 | 2.9E-02 | |
| Cadmium | 2.3E-01 | 3.6E-08 | 3.5E-10 | 9.5E-09 | 3.6E-05 | 1.4E-05 | | 5.0E-05 | |
| Chromium | 2.6E+01 | 4.0E-06 | 3.9E-08 | 1.1E-06 | 2.6E-06 | 2.0E-06 | | 4.6E-06 | |
| Copper | 3.3E+01 | 5.1E-06 | 5.0E-08 | 1.3E-06 | 1.3E-04 | 1.3E-06 | | 1.3E-04 | |
| Manganese | 6.3E+02 | 9.6E-05 | 9.5E-07 | 2.5E-05 | 2.1E-03 | 5.1E-04 | 1.8E+00 | 1.8E+00 | H |
| Vanadium | 2.3E+01 | 3.6E-06 | 3.5E-08 | 9.5E-07 | 5.1E-04 | 1.9E-04 | | 7.0E-04 | |
| *Inorganics Pathway Total* | | | | | 1.3E-02 | 2.9E-03 | 2.2E+00 | 2.2E+00 | H |
| 2,4,6-Trinitrotoluene | 2.9E+00 | 4.4E-07 | 4.3E-07 | 1.2E-07 | 8.7E-04 | 8.6E-04 | | 1.7E-03 | |
| 2,6-Dinitrotoluene | 8.5E-02 | 1.3E-08 | 1.3E-08 | 3.4E-09 | 1.3E-05 | 1.3E-05 | | 2.6E-05 | |
| Benzo(*a*)pyrene | 8.4E-02 | 1.3E-08 | 1.7E-08 | 3.4E-09 | | | | | |
| *Organics Pathway Total* | | | | | 8.9E-04 | 8.8E-04 | | 1.8E-03 | |
| *Pathway Total - Chemicals* | | | | | 1.4E-02 | 3.7E-03 | 2.2E+00 | 2.2E+00 | H |

[a] COPCs are identified as COCs if the total HI across all pathways is > 1 (H).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
HI = Hazard index.
HQ = Hazard quotient.

**Table M-20. Fuze and Booster Quarry Ponds Deep Surface Soil Carcinogenic Risks - Direct Contact**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***National Guard - National Guard Trainee*** | | | | | | | | | |
| Aluminum | 1.3E+04 | 7.0E-04 | 6.9E-06 | 1.9E-04 | | | | | |
| Antimony | 2.7E+00 | 1.4E-07 | 1.4E-09 | 3.8E-08 | | | | | |
| Arsenic | 1.3E+01 | 7.3E-07 | 2.2E-07 | 1.9E-07 | 1.1E-06 | 3.2E-07 | 2.9E-06 | 4.3E-06 | R |
| Barium | 1.0E+02 | 5.5E-06 | 5.5E-08 | 1.5E-06 | | | | | |
| Cadmium | 2.3E-01 | 1.3E-08 | 1.3E-10 | 3.4E-09 | | | 2.1E-08 | 2.1E-08 | |
| Chromium | 2.6E+01 | 1.4E-06 | 1.4E-08 | 3.8E-07 | | | | | |
| Copper | 3.3E+01 | 1.8E-06 | 1.8E-08 | 4.8E-07 | | | | | |
| Manganese | 6.3E+02 | 3.4E-05 | 3.4E-07 | 9.1E-06 | | | | | |
| Vanadium | 2.3E+01 | 1.3E-06 | 1.3E-08 | 3.4E-07 | | | | | |
| *Inorganics Pathway Total* | | | | | 1.1E-06 | 3.2E-07 | 2.9E-06 | 4.3E-06 | R |
| 2,4,6-Trinitrotoluene | 2.9E+00 | 1.6E-07 | 1.5E-07 | 4.2E-08 | 4.7E-09 | 4.6E-09 | | 9.3E-09 | |
| 2,6-Dinitrotoluene | 8.5E-02 | 4.6E-09 | 4.6E-09 | 1.2E-09 | 3.1E-09 | 3.1E-09 | | 6.2E-09 | |
| Benzo(*a*)pyrene | 8.4E-02 | 4.6E-09 | 5.9E-09 | 1.2E-09 | 3.3E-08 | 4.3E-08 | 3.8E-09 | 8.0E-08 | |
| *Organics Pathway Total* | | | | | 4.1E-08 | 5.1E-08 | 3.8E-09 | 9.6E-08 | |
| *Pathway Total - Chemicals* | | | | | 1.1E-06 | 3.7E-07 | 2.9E-06 | 4.4E-06 | R |

[a] COPCs are identified as COCs if the total incremental lifetime cancer risk across all pathways is > 1E-06 (R).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.

## Table M-21. Fuze and Booster Quarry Ponds Surface Soil Non-carcinogenic Hazards - Ingestion of Foodstuffs

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | | HQ | | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Milk | Beef | Vegetables | Venison | Milk | Beef | Vegetables | Venison | | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | | | |
| Antimony | 4.1E+00 | 1.7E-06 | 3.0E-07 | 1.3E-03 | 3.0E-10 | 4.4E-03 | 7.6E-04 | 3.2E+00 | 7.6E-07 | 3.2E+00 | H |
| Arsenic | 1.2E+01 | 1.2E-05 | 4.4E-05 | 3.8E-03 | 3.6E-08 | 4.0E-02 | 1.5E-01 | 1.3E+01 | 1.2E-04 | 1.3E+01 | H |
| Barium | 1.2E+02 | 1.1E-03 | 4.8E-05 | 3.5E-02 | 8.5E-08 | 1.5E-02 | 6.8E-04 | 5.0E-01 | 1.2E-06 | 5.1E-01 | |
| Cadmium | 3.4E-01 | 1.3E-05 | 5.3E-07 | 1.5E-04 | 2.7E-09 | 1.3E-02 | 5.3E-04 | 1.5E-01 | 2.7E-06 | 1.7E-01 | |
| Chromium | 2.0E+01 | 3.3E-06 | 3.3E-04 | 5.9E-03 | 2.7E-07 | 2.2E-06 | 2.2E-04 | 4.0E-03 | 1.8E-07 | 4.2E-03 | |
| Copper | 4.1E+01 | 3.0E-03 | 1.8E-03 | 1.6E-02 | 1.1E-05 | 7.5E-02 | 4.6E-02 | 4.0E-01 | 2.7E-04 | 5.2E-01 | |
| Manganese | 7.4E+02 | 9.6E-04 | 1.6E-03 | 2.8E-01 | 9.2E-06 | 6.9E-03 | 1.2E-02 | 2.0E+00 | 6.6E-05 | 2.0E+00 | H |
| Vanadium | 2.2E+01 | 6.7E-06 | 9.3E-05 | 6.6E-03 | 1.1E-08 | 9.6E-04 | 1.3E-02 | 9.5E-01 | 1.6E-06 | 9.6E-01 | |
| *Inorganics Pathway Total* | | | | | | 1.6E-01 | 2.2E-01 | 2.0E+01 | 4.7E-04 | 2.0E+01 | H |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 6.7E-07 | 2.1E-07 | 3.3E-03 | 3.1E-10 | 1.3E-03 | 4.1E-04 | 6.5E+00 | 6.2E-07 | 6.5E+00 | H |
| 2,6-Dinitrotoluene | 1.1E-01 | 7.6E-09 | 2.4E-09 | 1.3E-04 | 4.0E-12 | 7.6E-06 | 2.4E-06 | 1.3E-01 | 4.0E-09 | 1.3E-01 | |
| Benzo(*a*)pyrene | 8.4E-02 | 1.3E-05 | 4.4E-06 | 2.5E-05 | 2.1E-10 | | | | | | |
| *Organics Pathway Total* | | | | | | 1.3E-03 | 4.2E-04 | 6.7E+00 | 6.2E-07 | 6.7E+00 | H |
| *Pathway Total* | | | | | | 1.6E-01 | 2.2E-01 | 2.6E+01 | 4.7E-04 | 2.7E+01 | H |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | | | |
| Antimony | 4.1E+00 | 1.4E-05 | 1.4E-06 | 5.9E-03 | 1.4E-09 | 3.4E-02 | 3.5E-03 | 1.5E+01 | 3.5E-06 | 1.5E+01 | H |
| Arsenic | 1.2E+01 | 9.4E-05 | 2.1E-04 | 1.8E-02 | 1.7E-07 | 3.1E-01 | 6.9E-01 | 5.9E+01 | 5.6E-04 | 6.0E+01 | H |
| Barium | 1.2E+02 | 8.3E-03 | 2.2E-04 | 1.6E-01 | 4.0E-07 | 1.2E-01 | 3.2E-03 | 2.3E+00 | 5.7E-06 | 2.4E+00 | H |
| Cadmium | 3.4E-01 | 1.0E-04 | 2.5E-06 | 7.2E-04 | 1.3E-08 | 1.0E-01 | 2.5E-03 | 7.2E-01 | 1.3E-05 | 8.3E-01 | |
| Chromium | 2.0E+01 | 2.6E-05 | 1.5E-03 | 2.8E-02 | 1.2E-06 | 1.7E-05 | 1.0E-03 | 1.8E-02 | 8.2E-07 | 2.0E-02 | |
| Copper | 4.1E+01 | 2.3E-02 | 8.5E-03 | 7.5E-02 | 5.1E-05 | 5.9E-01 | 2.1E-01 | 1.9E+00 | 1.3E-03 | 2.7E+00 | H |
| Manganese | 7.4E+02 | 7.5E-03 | 7.6E-03 | 1.3E+00 | 4.3E-05 | 5.4E-02 | 5.4E-02 | 9.2E+00 | 3.1E-04 | 9.4E+00 | H |
| Vanadium | 2.2E+01 | 5.2E-05 | 4.3E-04 | 3.1E-02 | 5.2E-08 | 7.5E-03 | 6.2E-02 | 4.4E+00 | 7.5E-06 | 4.5E+00 | H |
| *Inorganics Pathway Total* | | | | | | 1.2E+00 | 1.0E+00 | 9.2E+01 | 2.2E-03 | 9.4E+01 | H |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 5.2E-06 | 9.7E-07 | 1.5E-02 | 1.4E-09 | 1.0E-02 | 1.9E-03 | 3.0E+01 | 2.9E-06 | 3.0E+01 | H |
| 2,6-Dinitrotoluene | 1.1E-01 | 5.9E-08 | 1.1E-08 | 6.0E-04 | 1.9E-11 | 5.9E-05 | 1.1E-05 | 6.0E-01 | 1.9E-08 | 6.0E-01 | |
| Benzo(*a*)pyrene | 8.4E-02 | 9.9E-05 | 2.1E-05 | 1.2E-04 | 9.9E-10 | | | | | | |
| *Organics Pathway Total* | | | | | | 1.0E-02 | 1.9E-03 | 3.1E+01 | 2.9E-06 | 3.1E+01 | H |
| *Pathway Total* | | | | | | 1.2E+00 | 1.0E+00 | 1.2E+02 | 2.2E-03 | 1.3E+02 | H |

[a] COPCs are identified as COCs if the total HI across all pathways is > 1 (H).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
HI = Hazard index.
HQ = Hazard quotient.

## Table M-22. Fuze and Booster Quarry Ponds Surface Soil Carcinogenic Risks - Ingestion of Foodstuffs

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | | Risk | | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Milk | Beef | Vegetables | Venison | Milk | Beef | Vegetables | Venison | | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | | | |
| Antimony | 4.1E+00 | 7.5E-07 | 1.3E-07 | 5.4E-04 | 1.3E-10 | | | | | | |
| Arsenic | 1.2E+01 | 5.2E-06 | 1.9E-05 | 1.6E-03 | 1.5E-08 | 7.8E-06 | 2.8E-05 | 2.4E-03 | 2.3E-08 | 2.5E-03 | R |
| Barium | 1.2E+02 | 4.6E-04 | 2.0E-05 | 1.5E-02 | 3.7E-08 | | | | | | |
| Cadmium | 3.4E-01 | 5.5E-06 | 2.3E-07 | 6.6E-05 | 1.2E-09 | | | | | | |
| Chromium | 2.0E+01 | 1.4E-06 | 1.4E-04 | 2.5E-03 | 1.1E-07 | | | | | | |
| Copper | 4.1E+01 | 1.3E-03 | 7.8E-04 | 6.9E-03 | 4.7E-06 | | | | | | |
| Manganese | 7.4E+02 | 4.1E-04 | 7.0E-04 | 1.2E-01 | 4.0E-06 | | | | | | |
| Vanadium | 2.2E+01 | 2.9E-06 | 4.0E-05 | 2.8E-03 | 4.8E-09 | | | | | | |
| *Inorganics Pathway Total* | | | | | | 7.8E-06 | 2.8E-05 | 2.4E-03 | 2.3E-08 | 2.5E-03 | R |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 2.9E-07 | 8.9E-08 | 1.4E-03 | 1.3E-10 | 8.6E-09 | 2.7E-09 | 4.2E-05 | 4.0E-12 | 4.2E-05 | R |
| 2,6-Dinitrotoluene | 1.1E-01 | 3.3E-09 | 1.0E-09 | 5.5E-05 | 1.7E-12 | 2.2E-09 | 7.0E-10 | 3.7E-05 | 1.2E-12 | 3.7E-05 | R |
| Benzo(*a*)pyrene | 8.4E-02 | 5.5E-06 | 1.9E-06 | 1.1E-05 | 9.1E-11 | 4.0E-05 | 1.4E-05 | 7.9E-05 | 6.6E-10 | 1.3E-04 | R |
| *Organics Pathway Total* | | | | | | 4.0E-05 | 1.4E-05 | 1.6E-04 | 6.7E-10 | 2.1E-04 | R |
| *Pathway Total* | | | | | | 4.8E-05 | 4.2E-05 | 2.6E-03 | 2.4E-08 | 2.7E-03 | R |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | | | |
| Antimony | 4.1E+00 | 1.2E-06 | 1.2E-07 | 5.1E-04 | 1.2E-10 | | | | | | |
| Arsenic | 1.2E+01 | 8.1E-06 | 1.8E-05 | 1.5E-03 | 1.4E-08 | 1.2E-05 | 2.6E-05 | 2.3E-03 | 2.2E-08 | 2.3E-03 | R |
| Barium | 1.2E+02 | 7.1E-04 | 1.9E-05 | 1.4E-02 | 3.4E-08 | | | | | | |
| Cadmium | 3.4E-01 | 8.6E-06 | 2.1E-07 | 6.2E-05 | 1.1E-09 | | | | | | |
| Chromium | 2.0E+01 | 2.2E-06 | 1.3E-04 | 2.4E-03 | 1.1E-07 | | | | | | |
| Copper | 4.1E+01 | 2.0E-03 | 7.3E-04 | 6.4E-03 | 4.4E-06 | | | | | | |
| Manganese | 7.4E+02 | 6.4E-04 | 6.5E-04 | 1.1E-01 | 3.7E-06 | | | | | | |
| Vanadium | 2.2E+01 | 4.5E-06 | 3.7E-05 | 2.7E-03 | 4.5E-09 | | | | | | |
| *Inorganics Pathway Total* | | | | | | 1.2E-05 | 2.6E-05 | 2.3E-03 | 2.2E-08 | 2.3E-03 | R |
| 2,4,6-Trinitrotoluene | 4.6E+00 | 4.5E-07 | 8.3E-08 | 1.3E-03 | 1.2E-10 | 1.3E-08 | 2.5E-09 | 3.9E-05 | 3.7E-12 | 3.9E-05 | R |
| 2,6-Dinitrotoluene | 1.1E-01 | 5.1E-09 | 9.7E-10 | 5.1E-05 | 1.6E-12 | 3.4E-09 | 6.6E-10 | 3.5E-05 | 1.1E-12 | 3.5E-05 | R |
| Benzo(*a*)pyrene | 8.4E-02 | 8.5E-06 | 1.8E-06 | 1.0E-05 | 8.5E-11 | 6.2E-05 | 1.3E-05 | 7.3E-05 | 6.2E-10 | 1.5E-04 | R |
| *Organics Pathway Total* | | | | | | 6.2E-05 | 1.3E-05 | 1.5E-04 | 6.2E-10 | 2.2E-04 | R |
| *Pathway Total* | | | | | | 7.4E-05 | 3.9E-05 | 2.4E-03 | 2.2E-08 | 2.5E-03 | R |

[a] COPCs are identified as COCs if the total incremental lifetime cancer risk across all pathways is > 1E-06 (R).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.

**Table M-23. Fuze and Booster Quarry Ponds Subsurface Soil Non-carcinogenic Hazards**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | |
| Aluminum | 1.5E+04 | 2.1E-02 | 4.7E-04 | 4.5E-06 | 2.1E-02 | 4.7E-04 | 3.2E-03 | 2.4E-02 | |
| Arsenic | 1.6E+01 | 2.2E-05 | 1.5E-05 | 4.7E-09 | 7.3E-02 | 5.0E-02 | | 1.2E-01 | |
| Chromium | 3.9E+01 | 5.3E-05 | 1.2E-06 | 1.1E-08 | 3.5E-05 | 6.2E-05 | | 9.7E-05 | |
| Vanadium | 2.6E+01 | 3.6E-05 | 8.2E-07 | 7.8E-09 | 5.2E-03 | 4.5E-03 | | 9.7E-03 | |
| *Inorganics Pathway Total* | | | | | 9.9E-02 | 5.5E-02 | 3.2E-03 | 1.6E-01 | |
| *Pathway Total - Chemicals* | | | | | 9.9E-02 | 5.5E-02 | 3.2E-03 | 1.6E-01 | |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | |
| Aluminum | 1.5E+04 | 1.9E-01 | 4.3E-04 | 1.1E-05 | 1.9E-01 | 4.3E-04 | 7.4E-03 | 2.0E-01 | |
| Arsenic | 1.6E+01 | 2.0E-04 | 1.3E-05 | 1.1E-08 | 6.8E-01 | 4.5E-02 | | 7.2E-01 | |
| Chromium | 3.9E+01 | 4.9E-04 | 1.1E-06 | 2.7E-08 | 3.3E-04 | 5.6E-05 | | 3.9E-04 | |
| Vanadium | 2.6E+01 | 3.4E-04 | 7.4E-07 | 1.8E-08 | 4.8E-02 | 4.1E-03 | | 5.2E-02 | |
| *Inorganics Pathway Total* | | | | | 9.2E-01 | 4.9E-02 | 7.4E-03 | 9.8E-01 | |
| *Pathway Total - Chemicals* | | | | | 9.2E-01 | 4.9E-02 | 7.4E-03 | 9.8E-01 | |

[a] COPCs are identified as COCs if the total HI across all pathways is > 1 (H).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
HI = Hazard index.
HQ = Hazard quotient.

**Table M-24. Fuze and Booster Quarry Ponds Subsurface Soil Carcinogenic Risks**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | |
| Aluminum | 1.5E+04 | 8.9E-03 | 2.0E-04 | 1.9E-06 | | | | | |
| Arsenic | 1.6E+01 | 9.3E-06 | 6.4E-06 | 2.0E-09 | 1.4E-05 | 9.6E-06 | 3.0E-08 | 2.4E-05 | R |
| Chromium | 3.9E+01 | 2.3E-05 | 5.2E-07 | 4.9E-09 | | | | | |
| Vanadium | 2.6E+01 | 1.5E-05 | 3.5E-07 | 3.4E-09 | | | | | |
| *Inorganics Pathway Total* | | | | | 1.4E-05 | 9.6E-06 | 3.0E-08 | 2.4E-05 | R |
| *Pathway Total - Chemicals* | | | | | 1.4E-05 | 9.6E-06 | 3.0E-08 | 2.4E-05 | R |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | |
| Aluminum | 1.5E+04 | 1.7E-02 | 3.7E-05 | 9.0E-07 | | | | | |
| Arsenic | 1.6E+01 | 1.7E-05 | 1.2E-06 | 9.4E-10 | 2.6E-05 | 1.7E-06 | 1.4E-08 | 2.8E-05 | R |
| Chromium | 3.9E+01 | 4.2E-05 | 9.3E-08 | 2.3E-09 | | | | | |
| Vanadium | 2.6E+01 | 2.9E-05 | 6.4E-08 | 1.6E-09 | | | | | |
| *Inorganics Pathway Total* | | | | | 2.6E-05 | 1.7E-06 | 1.4E-08 | 2.8E-05 | R |
| *Pathway Total - Chemicals* | | | | | 2.6E-05 | 1.7E-06 | 1.4E-08 | 2.8E-05 | R |

[a] COPCs are identified as COCs if the total incremental lifetime cancer risk across all pathways is > 1E-06 (R).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.

**Table M-25. Fuze and Booster Quarry Ponds Groundwater Non-carcinogenic Hazards**

| COPC | EPC (mg/L) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***National Guard - National Guard Trainee*** | | | | | | | | | |
| *Bedrock Groundwater* | | | | | | | | | |
| Manganese | 4.2E+00 | 1.3E-02 | 3.9E-05 | | 2.8E-01 | 2.1E-02 | | 3.0E-01 | |
| *Inorganics Pathway Total* | | | | | 2.8E-01 | 2.1E-02 | | 3.0E-01 | |
| 2,4,6-Trinitrotoluene | 9.3E-03 | 2.8E-05 | 7.4E-08 | | 5.7E-02 | 1.5E-04 | | 5.7E-02 | |
| 2,4-Dinitrotoluene | 2.2E-04 | 6.7E-07 | 6.1E-09 | | 3.4E-04 | 3.1E-06 | | 3.4E-04 | |
| Trichloroethene | 8.1E-03 | 2.5E-05 | 9.4E-07 | 1.2E-04 | | | 7.3E-04 | 7.3E-04 | |
| *Organics Pathway Total* | | | | | 5.7E-02 | 1.5E-04 | 7.3E-04 | 5.8E-02 | |
| *Pathway Total - Chemicals* | | | | | 3.3E-01 | 2.2E-02 | 7.3E-04 | 3.5E-01 | |
| *Unconsolidated Groundwater* | | | | | | | | | |
| Manganese | 6.8E+00 | 2.1E-02 | 6.4E-05 | | 4.5E-01 | 3.5E-02 | | 4.8E-01 | |
| *Inorganics Pathway Total* | | | | | 4.5E-01 | 3.5E-02 | | 4.8E-01 | |
| *Pathway Total - Chemicals* | | | | | 4.5E-01 | 3.5E-02 | | 4.8E-01 | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | |
| *Bedrock Groundwater* | | | | | | | | | |
| Manganese | 4.2E+00 | 1.1E-01 | 3.5E-04 | | 2.5E+00 | 1.9E-01 | | 2.7E+00 | H |
| *Inorganics Pathway Total* | | | | | 2.5E+00 | 1.9E-01 | | 2.7E+00 | H |
| 2,4,6-Trinitrotoluene | 9.3E-03 | 2.6E-04 | 6.6E-07 | | 5.1E-01 | 1.3E-03 | | 5.1E-01 | |
| 2,4-Dinitrotoluene | 2.2E-04 | 6.0E-06 | 5.5E-08 | | 3.0E-03 | 2.7E-05 | | 3.0E-03 | |
| Trichloroethene | 8.1E-03 | 2.2E-04 | 8.4E-06 | 1.1E-03 | | | 6.5E-03 | 6.5E-03 | |
| *Organics Pathway Total* | | | | | 5.1E-01 | 1.4E-03 | 6.5E-03 | 5.2E-01 | |
| *Pathway Total - Chemicals* | | | | | 3.0E+00 | 1.9E-01 | 6.5E-03 | 3.2E+00 | H |
| *Unconsolidated Groundwater* | | | | | | | | | |
| Manganese | 6.8E+00 | 1.9E-01 | 5.8E-04 | | 4.0E+00 | 3.1E-01 | | 4.3E+00 | H |
| *Inorganics Pathway Total* | | | | | 4.0E+00 | 3.1E-01 | | 4.3E+00 | H |
| *Pathway Total - Chemicals* | | | | | 4.0E+00 | 3.1E-01 | | 4.3E+00 | H |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | |
| *Bedrock Groundwater* | | | | | | | | | |
| Manganese | 4.2E+00 | 4.0E-01 | 7.4E-04 | | 8.7E+00 | 4.0E-01 | | 9.1E+00 | H |
| *Inorganics Pathway Total* | | | | | 8.7E+00 | 4.0E-01 | | 9.1E+00 | H |
| 2,4,6-Trinitrotoluene | 9.3E-03 | 8.9E-04 | 1.4E-06 | | 1.8E+00 | 2.8E-03 | | 1.8E+00 | H |
| 2,4-Dinitrotoluene | 2.2E-04 | 2.1E-05 | 1.1E-07 | | 1.1E-02 | 5.7E-05 | | 1.1E-02 | |
| Trichloroethene | 8.1E-03 | 7.8E-04 | 1.8E-05 | 2.6E-03 | | | 1.5E-02 | 1.5E-02 | |
| *Organics Pathway Total* | | | | | 1.8E+00 | 2.8E-03 | 1.5E-02 | 1.8E+00 | H |
| *Pathway Total - Chemicals* | | | | | 1.0E+01 | 4.0E-01 | 1.5E-02 | 1.1E+01 | H |
| *Unconsolidated Groundwater* | | | | | | | | | |
| Manganese | 6.8E+00 | 6.5E-01 | 1.2E-03 | | 1.4E+01 | 6.5E-01 | | 1.5E+01 | H |
| *Inorganics Pathway Total* | | | | | 1.4E+01 | 6.5E-01 | | 1.5E+01 | H |
| *Pathway Total - Chemicals* | | | | | 1.4E+01 | 6.5E-01 | | 1.5E+01 | H |

[a] COPCs are identified as COCs if the total HI across all pathways is > 1 (H).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
HI = Hazard index.
HQ = Hazard quotient.

**Table M-26. Fuze and Booster Quarry Ponds Groundwater Carcinogenic Risks**

| COPC | EPC (mg/L) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***National Guard - National Guard Trainee*** | | | | | | | | | |
| *Bedrock Groundwater* | | | | | | | | | |
| Manganese | 4.2E+00 | 4.5E-03 | 1.4E-05 | | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| 2,4,6-Trinitrotoluene | 9.3E-03 | 1.0E-05 | 2.6E-08 | | 3.0E-07 | 7.9E-10 | | 3.1E-07 | |
| 2,4-Dinitrotoluene | 2.2E-04 | 2.4E-07 | 2.2E-09 | | 1.6E-07 | 1.5E-09 | | 1.6E-07 | |
| Trichloroethene | 8.1E-03 | 8.8E-06 | 3.4E-07 | 4.4E-05 | 1.1E-07 | 4.4E-09 | 3.1E-07 | 4.3E-07 | |
| *Organics Pathway Total* | | | | | 5.8E-07 | 6.6E-09 | 3.1E-07 | 9.0E-07 | |
| *Pathway Total - Chemicals* | | | | | 5.8E-07 | 6.6E-09 | 3.1E-07 | 9.0E-07 | |
| *Unconsolidated Groundwater* | | | | | | | | | |
| Manganese | 6.8E+00 | 7.4E-03 | 2.3E-05 | | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | | | | | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | |
| *Bedrock Groundwater* | | | | | | | | | |
| Manganese | 4.2E+00 | 4.9E-02 | 1.5E-04 | | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| 2,4,6-Trinitrotoluene | 9.3E-03 | 1.1E-04 | 2.8E-07 | | 3.3E-06 | 8.5E-09 | | 3.3E-06 | R |
| 2,4-Dinitrotoluene | 2.2E-04 | 2.6E-06 | 2.4E-08 | | 1.8E-06 | 1.6E-08 | | 1.8E-06 | R |
| Trichloroethene | 8.1E-03 | 9.5E-05 | 3.6E-06 | 4.8E-04 | 1.2E-06 | 4.7E-08 | 3.3E-06 | 4.6E-06 | R |
| *Organics Pathway Total* | | | | | 6.3E-06 | 7.2E-08 | 3.3E-06 | 9.7E-06 | R |
| *Pathway Total - Chemicals* | | | | | 6.3E-06 | 7.2E-08 | 3.3E-06 | 9.7E-06 | R |
| *Unconsolidated Groundwater* | | | | | | | | | |
| Manganese | 6.8E+00 | 7.9E-02 | 2.5E-04 | | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | | | | | |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | |
| *Bedrock Groundwater* | | | | | | | | | |
| Manganese | 4.2E+00 | 3.4E-02 | 6.3E-05 | | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| 2,4,6-Trinitrotoluene | 9.3E-03 | 7.7E-05 | 1.2E-07 | | 2.3E-06 | 3.5E-09 | | 2.3E-06 | R |
| 2,4-Dinitrotoluene | 2.2E-04 | 1.8E-06 | 9.8E-09 | | 1.2E-06 | 6.7E-09 | | 1.2E-06 | R |
| Trichloroethene | 8.1E-03 | 6.7E-05 | 1.5E-06 | 2.2E-04 | 8.7E-07 | 2.0E-08 | 1.6E-06 | 2.4E-06 | R |
| *Organics Pathway Total* | | | | | 4.4E-06 | 3.0E-08 | 1.6E-06 | 6.0E-06 | R |
| *Pathway Total - Chemicals* | | | | | 4.4E-06 | 3.0E-08 | 1.6E-06 | 6.0E-06 | R |
| *Unconsolidated Groundwater* | | | | | | | | | |
| Manganese | 6.8E+00 | 5.6E-02 | 1.0E-04 | | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | | | | | |

[a] COPCs are identified as COCs if the total incremental lifetime cancer risk across all pathways is > 1E-06 (R).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.

**Table M-27. Fuze and Booster Quarry Ponds Sediment Non-carcinogenic Hazards - Direct Contact**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***National Guard - National Guard Fire Suppression Worker*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Aluminum | 1.6E+04 | 1.5E-04 | 9.1E-06 | 7.3E-08 | 1.5E-04 | 9.1E-06 | 5.1E-05 | 2.1E-04 | |
| Antimony | 5.5E+00 | 5.4E-08 | 3.2E-09 | 2.6E-11 | 1.3E-04 | 5.3E-05 | | 1.9E-04 | |
| Arsenic | 2.1E+01 | 2.0E-07 | 3.6E-07 | 9.7E-11 | 6.7E-04 | 1.2E-03 | | 1.9E-03 | |
| Manganese | 4.1E+03 | 4.0E-05 | 2.4E-06 | 1.9E-08 | 8.7E-04 | 1.3E-03 | 1.4E-03 | 3.5E-03 | |
| Vanadium | 2.8E+01 | 2.7E-07 | 1.6E-08 | 1.3E-10 | 3.9E-05 | 9.0E-05 | | 1.3E-04 | |
| Inorganics Pathway Total | | | | | 1.9E-03 | 2.6E-03 | 1.4E-03 | 5.9E-03 | |
| Benz(a)anthracene | 6.4E-01 | 6.3E-09 | 4.8E-08 | 3.0E-12 | | | | | |
| Benzo(a)pyrene | 5.3E-01 | 5.2E-09 | 4.0E-08 | 2.5E-12 | | | | | |
| Benzo(b)fluoranthene | 6.0E-01 | 5.8E-09 | 4.5E-08 | 2.8E-12 | | | | | |
| Organics Pathway Total | | | | | | | | | |
| Pathway Total - Chemicals | | | | | 1.9E-03 | 2.6E-03 | 1.4E-03 | 5.9E-03 | |
| *Quarry Ponds* | | | | | | | | | |
| Aluminum | 1.3E+04 | 1.3E-04 | 7.6E-06 | 6.1E-08 | 1.3E-04 | 7.6E-06 | 4.3E-05 | 1.8E-04 | |
| Antimony | 1.3E+02 | 1.3E-06 | 7.4E-08 | 6.0E-10 | 3.1E-03 | 1.2E-03 | | 4.4E-03 | |
| Arsenic | 1.9E+01 | 1.9E-07 | 3.3E-07 | 9.0E-11 | 6.3E-04 | 1.1E-03 | | 1.7E-03 | |
| Barium | 2.9E+02 | 2.8E-06 | 1.7E-07 | 1.4E-09 | 4.0E-05 | 3.4E-05 | 9.5E-06 | 8.4E-05 | |
| Cadmium | 1.9E+01 | 1.8E-07 | 1.1E-08 | 8.9E-11 | 1.8E-04 | 4.4E-04 | | 6.2E-04 | |
| Chromium | 5.7E+01 | 5.6E-07 | 3.3E-08 | 2.7E-10 | 3.7E-07 | 1.7E-06 | | 2.1E-06 | |
| Chromium, hexavalent | 2.0E+01 | 1.9E-07 | 1.1E-08 | 9.2E-11 | 6.4E-05 | 1.5E-04 | 3.2E-06 | 2.2E-04 | |
| Copper | 2.0E+02 | 2.0E-06 | 1.2E-07 | 9.5E-10 | 4.9E-05 | 2.9E-06 | | 5.2E-05 | |
| Mercury | 3.0E+01 | 2.9E-07 | 1.7E-08 | 1.4E-10 | 9.8E-04 | 8.3E-04 | | 1.8E-03 | |
| Vanadium | 2.4E+01 | 2.3E-07 | 1.4E-08 | 1.1E-10 | 3.3E-05 | 7.5E-05 | | 1.1E-04 | |
| Zinc | 1.4E+03 | 1.4E-05 | 8.2E-07 | 6.6E-09 | 4.6E-05 | 9.1E-06 | | 5.5E-05 | |
| *Inorganics Pathway Total* | | | | | 5.3E-03 | 3.9E-03 | 5.5E-05 | 9.2E-03 | |
| Benz(*a*)anthracene | 5.4E-01 | 5.2E-09 | 4.0E-08 | 2.5E-12 | | | | | |
| Benzo(*a*)pyrene | 5.2E-01 | 5.1E-09 | 3.9E-08 | 2.5E-12 | | | | | |
| Benzo(*b*)fluoranthene | 5.8E-01 | 5.7E-09 | 4.4E-08 | 2.7E-12 | | | | | |
| Indeno(1,2,3-*cd*)pyrene | 3.7E-01 | 3.6E-09 | 2.8E-08 | 1.7E-12 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 5.3E-03 | 3.9E-03 | 5.5E-05 | 9.2E-03 | |
| *Settling Basins* | | | | | | | | | |
| Aluminum | 1.9E+04 | 1.8E-04 | 1.1E-05 | 8.7E-08 | 1.8E-04 | 1.1E-05 | 6.1E-05 | 2.5E-04 | |
| Chromium | 2.1E+02 | 2.1E-06 | 1.2E-07 | 1.0E-09 | 1.4E-06 | 6.4E-06 | | 7.8E-06 | |
| Manganese | 6.5E+02 | 6.3E-06 | 3.8E-07 | 3.0E-09 | 1.4E-04 | 2.0E-04 | 2.1E-04 | 5.5E-04 | |
| Vanadium | 3.2E+01 | 3.1E-07 | 1.9E-08 | 1.5E-10 | 4.5E-05 | 1.0E-04 | | 1.5E-04 | |
| *Inorganics Pathway Total* | | | | | 3.6E-04 | 3.2E-04 | 2.7E-04 | 9.6E-04 | |
| Benzo(*a*)pyrene | 1.1E-01 | 1.1E-09 | 8.3E-09 | 5.2E-13 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 3.6E-04 | 3.2E-04 | 2.7E-04 | 9.6E-04 | |

**Table M-27. Fuze and Booster Quarry Ponds Sediment Non-carcinogenic Hazards - Direct Contact (continued)**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***National Guard - National Guard Trainee*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Aluminum | 1.6E+04 | 2.4E-03 | 2.4E-05 | 6.3E-04 | 2.4E-03 | 2.4E-05 | 4.4E-01 | 4.5E-01 | |
| Antimony | 5.5E+00 | 8.4E-07 | 8.3E-09 | 2.2E-07 | 2.1E-03 | 1.4E-04 | | 2.2E-03 | |
| Arsenic | 2.1E+01 | 3.1E-06 | 9.3E-07 | 8.4E-07 | 1.0E-02 | 3.1E-03 | | 1.4E-02 | |
| Manganese | 4.1E+03 | 6.3E-04 | 6.2E-06 | 1.7E-04 | 1.4E-02 | 3.4E-03 | 1.2E+01 | 1.2E+01 | H |
| Vanadium | 2.8E+01 | 4.3E-06 | 4.2E-08 | 1.1E-06 | 6.1E-04 | 2.3E-04 | | 8.5E-04 | |
| *Inorganics Pathway Total* | | | | | 2.9E-02 | 6.9E-03 | 1.2E+01 | 1.2E+01 | H |
| Benz(*a*)anthracene | 6.4E-01 | 9.8E-08 | 1.3E-07 | 2.6E-08 | | | | | |
| Benzo(*a*)pyrene | 5.3E-01 | 8.1E-08 | 1.0E-07 | 2.2E-08 | | | | | |
| Benzo(*b*)fluoranthene | 6.0E-01 | 9.1E-08 | 1.2E-07 | 2.4E-08 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 2.9E-02 | 6.9E-03 | 1.2E+01 | 1.2E+01 | H |
| *Quarry Ponds* | | | | | | | | | |
| Aluminum | 1.3E+04 | 2.0E-03 | 2.0E-05 | 5.3E-04 | 2.0E-03 | 2.0E-05 | 3.7E-01 | 3.7E-01 | |
| Antimony | 1.3E+02 | 2.0E-05 | 1.9E-07 | 5.2E-06 | 4.9E-02 | 3.2E-03 | | 5.2E-02 | |
| Arsenic | 1.9E+01 | 2.9E-06 | 8.7E-07 | 7.8E-07 | 9.8E-03 | 2.9E-03 | | 1.3E-02 | |
| Barium | 2.9E+02 | 4.4E-05 | 4.4E-07 | 1.2E-05 | 6.3E-04 | 8.9E-05 | 8.2E-02 | 8.3E-02 | |
| Cadmium | 1.9E+01 | 2.9E-06 | 2.9E-08 | 7.7E-07 | 2.9E-03 | 1.1E-03 | | 4.0E-03 | |
| Chromium | 5.7E+01 | 8.7E-06 | 8.6E-08 | 2.3E-06 | 5.8E-06 | 4.4E-06 | | 1.0E-05 | |
| Chromium, hexavalent | 2.0E+01 | 3.0E-06 | 2.9E-08 | 7.9E-07 | 9.9E-04 | 3.9E-04 | 2.8E-02 | 2.9E-02 | |
| Copper | 2.0E+02 | 3.1E-05 | 3.1E-07 | 8.2E-06 | 7.7E-04 | 7.6E-06 | | 7.8E-04 | |
| Mercury | 3.0E+01 | 4.6E-06 | 4.5E-08 | 1.2E-06 | 1.5E-02 | 2.2E-03 | | 1.7E-02 | |
| Vanadium | 2.4E+01 | 3.6E-06 | 3.6E-08 | 9.6E-07 | 5.1E-04 | 2.0E-04 | | 7.1E-04 | |
| Zinc | 1.4E+03 | 2.2E-04 | 2.1E-06 | 5.7E-05 | 7.2E-04 | 2.4E-05 | | 7.4E-04 | |
| *Inorganics Pathway Total* | | | | | 8.2E-02 | 1.0E-02 | 4.8E-01 | 5.7E-01 | |
| Benz(*a*)anthracene | 5.4E-01 | 8.2E-08 | 1.1E-07 | 2.2E-08 | | | | | |
| Benzo(*a*)pyrene | 5.2E-01 | 8.0E-08 | 1.0E-07 | 2.1E-08 | | | | | |
| Benzo(*b*)fluoranthene | 5.8E-01 | 8.8E-08 | 1.1E-07 | 2.4E-08 | | | | | |
| Indeno(1,2,3-*cd*)pyrene | 3.7E-01 | 5.7E-08 | 7.3E-08 | 1.5E-08 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 8.2E-02 | 1.0E-02 | 4.8E-01 | 5.7E-01 | |
| *Settling Basins* | | | | | | | | | |
| Aluminum | 1.9E+04 | 2.8E-03 | 2.8E-05 | 7.5E-04 | 2.8E-03 | 2.8E-05 | 5.3E-01 | 5.3E-01 | |
| Chromium | 2.1E+02 | 3.3E-05 | 3.2E-07 | 8.7E-06 | 2.2E-05 | 1.7E-05 | | 3.8E-05 | |
| Manganese | 6.5E+02 | 9.9E-05 | 9.8E-07 | 2.6E-05 | 2.1E-03 | 5.3E-04 | 1.8E+00 | 1.8E+00 | H |
| Vanadium | 3.2E+01 | 4.9E-06 | 4.8E-08 | 1.3E-06 | 7.0E-04 | 2.6E-04 | | 9.6E-04 | |
| *Inorganics Pathway Total* | | | | | 5.7E-03 | 8.4E-04 | 2.4E+00 | 2.4E+00 | H |
| Benzo(*a*)pyrene | 1.1E-01 | 1.7E-08 | 2.2E-08 | 4.5E-09 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 5.7E-03 | 8.4E-04 | 2.4E+00 | 2.4E+00 | H |

**Table M-27. Fuze and Booster Quarry Ponds Sediment Non-carcinogenic Hazards - Direct Contact (continued)**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Aluminum | 1.6E+04 | 2.1E-02 | 4.9E-04 | 4.6E-06 | 2.1E-02 | 4.9E-04 | 3.2E-03 | 2.5E-02 | |
| Antimony | 5.5E+00 | 7.5E-06 | 1.7E-07 | 1.6E-09 | 1.9E-02 | 2.9E-03 | | 2.2E-02 | |
| Arsenic | 2.1E+01 | 2.8E-05 | 1.9E-05 | 6.1E-09 | 9.4E-02 | 6.4E-02 | | 1.6E-01 | |
| Manganese | 4.1E+03 | 5.6E-03 | 1.3E-04 | 1.2E-06 | 1.2E-01 | 7.0E-02 | 8.5E-02 | 2.8E-01 | |
| Vanadium | 2.8E+01 | 3.8E-05 | 8.8E-07 | 8.3E-09 | 5.5E-03 | 4.8E-03 | | 1.0E-02 | |
| *Inorganics Pathway Total* | | | | | 2.6E-01 | 1.4E-01 | 8.8E-02 | 4.9E-01 | |
| Benz(*a*)anthracene | 6.4E-01 | 8.8E-07 | 2.6E-06 | 1.9E-10 | | | | | |
| Benzo(*a*)pyrene | 5.3E-01 | 7.2E-07 | 2.1E-06 | 1.6E-10 | | | | | |
| Benzo(*b*)fluoranthene | 6.0E-01 | 8.2E-07 | 2.4E-06 | 1.8E-10 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 2.6E-01 | 1.4E-01 | 8.8E-02 | 4.9E-01 | |
| *Quarry Ponds* | | | | | | | | | |
| Aluminum | 1.3E+04 | 1.8E-02 | 4.1E-04 | 3.9E-06 | 1.8E-02 | 4.1E-04 | 2.7E-03 | 2.1E-02 | |
| Antimony | 1.3E+02 | 1.8E-04 | 4.0E-06 | 3.8E-08 | 4.4E-01 | 6.7E-02 | | 5.0E-01 | |
| Arsenic | 1.9E+01 | 2.6E-05 | 1.8E-05 | 5.7E-09 | 8.8E-02 | 6.0E-02 | | 1.5E-01 | |
| Barium | 2.9E+02 | 3.9E-04 | 9.0E-06 | 8.5E-08 | 5.6E-03 | 1.8E-03 | 6.0E-04 | 8.1E-03 | |
| Cadmium | 1.9E+01 | 2.6E-05 | 5.9E-07 | 5.6E-09 | 2.6E-02 | 2.4E-02 | | 5.0E-02 | |
| Chromium | 5.7E+01 | 7.8E-05 | 1.8E-06 | 1.7E-08 | 5.2E-05 | 9.1E-05 | | 1.4E-04 | |
| Chromium, hexavalent | 2.0E+01 | 2.7E-05 | 6.1E-07 | 5.8E-09 | 8.9E-03 | 8.1E-03 | 2.0E-04 | 1.7E-02 | |
| Copper | 2.0E+02 | 2.8E-04 | 6.3E-06 | 6.0E-08 | 6.9E-03 | 1.6E-04 | | 7.1E-03 | |
| Mercury | 3.0E+01 | 4.1E-05 | 9.3E-07 | 8.9E-09 | 1.4E-01 | 4.4E-02 | | 1.8E-01 | |
| Vanadium | 2.4E+01 | 3.2E-05 | 7.3E-07 | 7.0E-09 | 4.6E-03 | 4.0E-03 | | 8.6E-03 | |
| Zinc | 1.4E+03 | 1.9E-03 | 4.4E-05 | 4.2E-07 | 6.4E-03 | 4.9E-04 | | 6.9E-03 | |
| *Inorganics Pathway Total* | | | | | 7.4E-01 | 2.1E-01 | 3.5E-03 | 9.5E-01 | |
| Benz(*a*)anthracene | 5.4E-01 | 7.3E-07 | 2.2E-06 | 1.6E-10 | | | | | |
| Benzo(*a*)pyrene | 5.2E-01 | 7.2E-07 | 2.1E-06 | 1.5E-10 | | | | | |
| Benzo(*b*)fluoranthene | 5.8E-01 | 7.9E-07 | 2.4E-06 | 1.7E-10 | | | | | |
| Indeno(1,2,3-*cd*)pyrene | 3.7E-01 | 5.1E-07 | 1.5E-06 | 1.1E-10 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 7.4E-01 | 2.1E-01 | 3.5E-03 | 9.5E-01 | |
| *Settling Basins* | | | | | | | | | |
| Aluminum | 1.9E+04 | 2.5E-02 | 5.8E-04 | 5.5E-06 | 2.5E-02 | 5.8E-04 | 3.8E-03 | 3.0E-02 | |
| Chromium | 2.1E+02 | 2.9E-04 | 6.7E-06 | 6.3E-08 | 2.0E-04 | 3.4E-04 | | 5.4E-04 | |
| Manganese | 6.5E+02 | 8.8E-04 | 2.0E-05 | 1.9E-07 | 1.9E-02 | 1.1E-02 | 1.3E-02 | 4.4E-02 | |
| Vanadium | 3.2E+01 | 4.4E-05 | 1.0E-06 | 9.5E-09 | 6.2E-03 | 5.5E-03 | | 1.2E-02 | |
| *Inorganics Pathway Total* | | | | | 5.1E-02 | 1.7E-02 | 1.7E-02 | 8.6E-02 | |
| Benzo(*a*)pyrene | 1.1E-01 | 1.5E-07 | 4.5E-07 | 3.3E-11 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 5.1E-02 | 1.7E-02 | 1.7E-02 | 8.6E-02 | |

**Table M-27. Fuze and Booster Quarry Ponds Sediment Non-carcinogenic Hazards - Direct Contact (continued)**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Aluminum | 1.6E+04 | 2.0E-01 | 4.4E-04 | 1.1E-05 | 2.0E-01 | 4.4E-04 | 7.6E-03 | 2.1E-01 | |
| Antimony | 5.5E+00 | 7.0E-05 | 1.5E-07 | 3.8E-09 | 1.8E-01 | 2.6E-03 | | 1.8E-01 | |
| Arsenic | 2.1E+01 | 2.6E-04 | 1.7E-05 | 1.4E-08 | 8.8E-01 | 5.8E-02 | | 9.4E-01 | |
| Manganese | 4.1E+03 | 5.2E-02 | 1.2E-04 | 2.8E-06 | 1.1E+00 | 6.3E-02 | 2.0E-01 | 1.4E+00 | H |
| Vanadium | 2.8E+01 | 3.6E-04 | 7.9E-07 | 1.9E-08 | 5.1E-02 | 4.3E-03 | | 5.6E-02 | |
| *Inorganics Pathway Total* | | | | | 2.4E+00 | 1.3E-01 | 2.1E-01 | 2.8E+00 | H |
| Benz(*a*)anthracene | 6.4E-01 | 8.2E-06 | 2.3E-06 | 4.4E-10 | | | | | |
| Benzo(*a*)pyrene | 5.3E-01 | 6.8E-06 | 1.9E-06 | 3.7E-10 | | | | | |
| Benzo(*b*)fluoranthene | 6.0E-01 | 7.6E-06 | 2.2E-06 | 4.1E-10 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 2.4E+00 | 1.3E-01 | 2.1E-01 | 2.8E+00 | H |
| *Quarry Ponds* | | | | | | | | | |
| Aluminum | 1.3E+04 | 1.7E-01 | 3.7E-04 | 9.0E-06 | 1.7E-01 | 3.7E-04 | 6.3E-03 | 1.7E-01 | |
| Antimony | 1.3E+02 | 1.6E-03 | 3.6E-06 | 8.9E-08 | 4.1E+00 | 6.0E-02 | | 4.2E+00 | H |
| Arsenic | 1.9E+01 | 2.5E-04 | 1.6E-05 | 1.3E-08 | 8.2E-01 | 5.4E-02 | | 8.7E-01 | |
| Barium | 2.9E+02 | 3.7E-03 | 8.1E-06 | 2.0E-07 | 5.3E-02 | 1.7E-03 | 1.4E-03 | 5.6E-02 | |
| Cadmium | 1.9E+01 | 2.4E-04 | 5.3E-07 | 1.3E-08 | 2.4E-01 | 2.1E-02 | | 2.6E-01 | |
| Chromium | 5.7E+01 | 7.3E-04 | 1.6E-06 | 4.0E-08 | 4.9E-04 | 8.2E-05 | | 5.7E-04 | |
| Chromium, hexavalent | 2.0E+01 | 2.5E-04 | 5.5E-07 | 1.3E-08 | 8.3E-02 | 7.3E-03 | 4.7E-04 | 9.1E-02 | |
| Copper | 2.0E+02 | 2.6E-03 | 5.7E-06 | 1.4E-07 | 6.5E-02 | 1.4E-04 | | 6.5E-02 | |
| Mercury | 3.0E+01 | 3.8E-04 | 8.4E-07 | 2.1E-08 | 1.3E+00 | 4.0E-02 | | 1.3E+00 | H |
| Vanadium | 2.4E+01 | 3.0E-04 | 6.6E-07 | 1.6E-08 | 4.3E-02 | 3.6E-03 | | 4.7E-02 | |
| Zinc | 1.4E+03 | 1.8E-02 | 4.0E-05 | 9.8E-07 | 6.0E-02 | 4.4E-04 | | 6.1E-02 | |
| *Inorganics Pathway Total* | | | | | 6.9E+00 | 1.9E-01 | 8.2E-03 | 7.1E+00 | H |
| Benz(*a*)anthracene | 5.4E-01 | 6.9E-06 | 2.0E-06 | 3.7E-10 | | | | | |
| Benzo(*a*)pyrene | 5.2E-01 | 6.7E-06 | 1.9E-06 | 3.6E-10 | | | | | |
| Benzo(*b*)fluoranthene | 5.8E-01 | 7.4E-06 | 2.1E-06 | 4.0E-10 | | | | | |
| Indeno(1,2,3-*cd*)pyrene | 3.7E-01 | 4.7E-06 | 1.4E-06 | 2.6E-10 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 6.9E+00 | 1.9E-01 | 8.2E-03 | 7.1E+00 | H |
| *Settling Basins* | | | | | | | | | |
| Aluminum | 1.9E+04 | 2.4E-01 | 5.2E-04 | 1.3E-05 | 2.4E-01 | 5.2E-04 | 9.0E-03 | 2.5E-01 | |
| Chromium | 2.1E+02 | 2.7E-03 | 6.0E-06 | 1.5E-07 | 1.8E-03 | 3.1E-04 | | 2.1E-03 | |
| Manganese | 6.5E+02 | 8.3E-03 | 1.8E-05 | 4.5E-07 | 1.8E-01 | 9.9E-03 | 3.1E-02 | 2.2E-01 | |
| Vanadium | 3.2E+01 | 4.1E-04 | 9.0E-07 | 2.2E-08 | 5.8E-02 | 4.9E-03 | | 6.3E-02 | |
| *Inorganics Pathway Total* | | | | | 4.8E-01 | 1.6E-02 | 4.0E-02 | 5.3E-01 | |
| Benzo(*a*)pyrene | 1.1E-01 | 1.4E-06 | 4.0E-07 | 7.6E-11 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 4.8E-01 | 1.6E-02 | 4.0E-02 | 5.3E-01 | |

**Table M-27. Fuze and Booster Quarry Ponds Sediment Non-carcinogenic Hazards - Direct Contact (continued)**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Recreational - Hunter/Trapper/Fisher*** | | | | | | | | | |
| *Quarry Ponds* | | | | | | | | | |
| Aluminum | 1.3E+04 | 6.8E-05 | 5.6E-06 | 1.5E-08 | 6.8E-05 | 5.6E-06 | 1.0E-05 | 8.4E-05 | |
| Antimony | 1.3E+02 | 6.7E-07 | 5.5E-08 | 1.4E-10 | 1.7E-03 | 9.1E-04 | | 2.6E-03 | |
| Arsenic | 1.9E+01 | 1.0E-07 | 2.5E-07 | 2.2E-11 | 3.3E-04 | 8.2E-04 | | 1.2E-03 | |
| Barium | 2.9E+02 | 1.5E-06 | 1.2E-07 | 3.3E-10 | 2.1E-05 | 2.5E-05 | 2.3E-06 | 4.9E-05 | |
| Cadmium | 1.9E+01 | 9.9E-08 | 8.1E-09 | 2.1E-11 | 9.9E-05 | 3.2E-04 | | 4.2E-04 | |
| Chromium | 5.7E+01 | 3.0E-07 | 2.4E-08 | 6.5E-11 | 2.0E-07 | 1.3E-06 | | 1.5E-06 | |
| Chromium, hexavalent | 2.0E+01 | 1.0E-07 | 8.3E-09 | 2.2E-11 | 3.4E-05 | 1.1E-04 | 7.7E-07 | 1.5E-04 | |
| Copper | 2.0E+02 | 1.1E-06 | 8.6E-08 | 2.3E-10 | 2.6E-05 | 2.2E-06 | | 2.9E-05 | |
| Mercury | 3.0E+01 | 1.6E-07 | 1.3E-08 | 3.4E-11 | 5.2E-04 | 6.1E-04 | | 1.1E-03 | |
| Vanadium | 2.4E+01 | 1.2E-07 | 1.0E-08 | 2.7E-11 | 1.8E-05 | 5.5E-05 | | 7.3E-05 | |
| Zinc | 1.4E+03 | 7.4E-06 | 6.0E-07 | 1.6E-09 | 2.5E-05 | 6.7E-06 | | 3.1E-05 | |
| *Inorganics Pathway Total* | | | | | 2.8E-03 | 2.9E-03 | 1.3E-05 | 5.7E-03 | |
| Benz(*a*)anthracene | 5.4E-01 | 2.8E-09 | 3.0E-08 | 6.1E-13 | | | | | |
| Benzo(*a*)pyrene | 5.2E-01 | 2.7E-09 | 2.9E-08 | 5.9E-13 | | | | | |
| Benzo(*b*)fluoranthene | 5.8E-01 | 3.0E-09 | 3.2E-08 | 6.5E-13 | | | | | |
| Indeno(1,2,3-*cd*)pyrene | 3.7E-01 | 1.9E-09 | 2.1E-08 | 4.2E-13 | | | | | |
| *Organics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | 2.8E-03 | 2.9E-03 | 1.3E-05 | 5.7E-03 | |

[a] COPCs are identified as COCs if the total HI across all pathways is > 1 (H).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
HI = Hazard index.
HQ = Hazard quotient.

**Table M-28. Fuze and Booster Quarry Ponds Sediment Carcinogenic Risks - Direct Contact**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***National Guard - National Guard Fire Suppression Worker*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Aluminum | 1.6E+04 | 5.5E-05 | 3.2E-06 | 2.6E-08 | | | | | |
| Antimony | 5.5E+00 | 1.9E-08 | 1.1E-09 | 9.3E-12 | | | | | |
| Arsenic | 2.1E+01 | 7.2E-08 | 1.3E-07 | 3.5E-11 | 1.1E-07 | 1.9E-07 | 5.2E-10 | 3.0E-07 | |
| Manganese | 4.1E+03 | 1.4E-05 | 8.5E-07 | 6.9E-09 | | | | | |
| Vanadium | 2.8E+01 | 9.8E-08 | 5.8E-09 | 4.7E-11 | | | | | |
| Inorganics Pathway Total | | | | | 1.1E-07 | 1.9E-07 | 5.2E-10 | 3.0E-07 | |
| Benz(a)anthracene | 6.4E-01 | 2.2E-09 | 1.7E-08 | 1.1E-12 | 1.6E-09 | 1.3E-08 | 3.3E-13 | 1.4E-08 | |
| Benzo(a)pyrene | 5.3E-01 | 1.8E-09 | 1.4E-08 | 8.9E-13 | 1.3E-08 | 1.0E-07 | 2.8E-12 | 1.2E-07 | |
| Benzo(b)fluoranthene | 6.0E-01 | 2.1E-09 | 1.6E-08 | 1.0E-12 | 1.5E-09 | 1.2E-08 | 3.1E-13 | 1.3E-08 | |
| Organics Pathway Total | | | | | 1.7E-08 | 1.3E-07 | 3.4E-12 | 1.5E-07 | |
| Pathway Total - Chemicals | | | | | 1.2E-07 | 3.2E-07 | 5.2E-10 | 4.5E-07 | |
| *Quarry Ponds* | | | | | | | | | |
| Aluminum | 1.3E+04 | 4.5E-05 | 2.7E-06 | 2.2E-08 | | | | | |
| Antimony | 1.3E+02 | 4.5E-07 | 2.7E-08 | 2.2E-10 | | | | | |
| Arsenic | 1.9E+01 | 6.7E-08 | 1.2E-07 | 3.2E-11 | 1.0E-07 | 1.8E-07 | 4.9E-10 | 2.8E-07 | |
| Barium | 2.9E+02 | 1.0E-06 | 6.0E-08 | 4.8E-10 | | | | | |
| Cadmium | 1.9E+01 | 6.6E-08 | 3.9E-09 | 3.2E-11 | | | 2.0E-10 | 2.0E-10 | |
| Chromium | 5.7E+01 | 2.0E-07 | 1.2E-08 | 9.6E-11 | | | | | |
| Chromium, hexavalent | 2.0E+01 | 6.8E-08 | 4.0E-09 | 3.3E-11 | | | 1.4E-09 | 1.4E-09 | |
| Copper | 2.0E+02 | 7.1E-07 | 4.2E-08 | 3.4E-10 | | | | | |
| Mercury | 3.0E+01 | 1.0E-07 | 6.2E-09 | 5.0E-11 | | | | | |
| Vanadium | 2.4E+01 | 8.2E-08 | 4.9E-09 | 3.9E-11 | | | | | |
| Zinc | 1.4E+03 | 4.9E-06 | 2.9E-07 | 2.4E-09 | | | | | |
| *Inorganics Pathway Total* | | | | | 1.0E-07 | 1.8E-07 | 2.1E-09 | 2.8E-07 | |
| Benz(*a*)anthracene | 5.4E-01 | 1.9E-09 | 1.4E-08 | 9.0E-13 | 1.4E-09 | 1.1E-08 | 2.8E-13 | 1.2E-08 | |
| Benzo(*a*)pyrene | 5.2E-01 | 1.8E-09 | 1.4E-08 | 8.8E-13 | 1.3E-08 | 1.0E-07 | 2.7E-12 | 1.2E-07 | |
| Benzo(*b*)fluoranthene | 5.8E-01 | 2.0E-09 | 1.6E-08 | 9.7E-13 | 1.5E-09 | 1.1E-08 | 3.0E-13 | 1.3E-08 | |
| Indeno(*1,2,3-cd*)pyrene | 3.7E-01 | 1.3E-09 | 1.0E-08 | 6.2E-13 | 9.5E-10 | 7.3E-09 | 1.9E-13 | 8.3E-09 | |
| *Organics Pathway Total* | | | | | 1.7E-08 | 1.3E-07 | 3.5E-12 | 1.5E-07 | |
| *Pathway Total - Chemicals* | | | | | 1.2E-07 | 3.1E-07 | 2.1E-09 | 4.3E-07 | |
| *Settling Basins* | | | | | | | | | |
| Aluminum | 1.9E+04 | 6.5E-05 | 3.8E-06 | 3.1E-08 | | | | | |
| Chromium | 2.1E+02 | 7.5E-07 | 4.4E-08 | 3.6E-10 | | | | | |
| Manganese | 6.5E+02 | 2.3E-06 | 1.3E-07 | 1.1E-09 | | | | | |
| Vanadium | 3.2E+01 | 1.1E-07 | 6.6E-09 | 5.4E-11 | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| Benzo(*a*)pyrene | 1.1E-01 | 3.8E-10 | 3.0E-09 | 1.8E-13 | 2.8E-09 | 2.2E-08 | 5.7E-13 | 2.4E-08 | |
| *Organics Pathway Total* | | | | | 2.8E-09 | 2.2E-08 | 5.7E-13 | 2.4E-08 | |
| *Pathway Total - Chemicals* | | | | | 2.8E-09 | 2.2E-08 | 5.7E-13 | 2.4E-08 | |

**Table M-28. Fuze and Booster Quarry Ponds Sediment Carcinogenic Risks - Direct Contact (continued)**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***National Guard - National Guard Trainee*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Aluminum | 1.6E+04 | 8.5E-04 | 8.4E-06 | 2.3E-04 | | | | | |
| Antimony | 5.5E+00 | 3.0E-07 | 3.0E-09 | 8.0E-08 | | | | | |
| Arsenic | 2.1E+01 | 1.1E-06 | 3.3E-07 | 3.0E-07 | 1.7E-06 | 5.0E-07 | 4.5E-06 | 6.7E-06 | R |
| Manganese | 4.1E+03 | 2.2E-04 | 2.2E-06 | 6.0E-05 | | | | | |
| Vanadium | 2.8E+01 | 1.5E-06 | 1.5E-08 | 4.1E-07 | | | | | |
| *Inorganics Pathway Total* | | | | | 1.7E-06 | 5.0E-07 | 4.5E-06 | 6.7E-06 | R |
| Benz(*a*)anthracene | 6.4E-01 | 3.5E-08 | 4.5E-08 | 9.3E-09 | 2.5E-08 | 3.3E-08 | 2.9E-09 | 6.1E-08 | |
| Benzo(*a*)pyrene | 5.3E-01 | 2.9E-08 | 3.7E-08 | 7.7E-09 | 2.1E-07 | 2.7E-07 | 2.4E-08 | 5.1E-07 | |
| Benzo(*b*)fluoranthene | 6.0E-01 | 3.2E-08 | 4.2E-08 | 8.7E-09 | 2.4E-08 | 3.1E-08 | 2.7E-09 | 5.7E-08 | |
| *Organics Pathway Total* | | | | | 2.6E-07 | 3.3E-07 | 2.9E-08 | 6.2E-07 | |
| *Pathway Total - Chemicals* | | | | | 1.9E-06 | 8.3E-07 | 4.5E-06 | 7.3E-06 | R |
| *Quarry Ponds* | | | | | | | | | |
| Aluminum | 1.3E+04 | 7.1E-04 | 7.0E-06 | 1.9E-04 | | | | | |
| Antimony | 1.3E+02 | 7.0E-06 | 6.9E-08 | 1.9E-06 | | | | | |
| Arsenic | 1.9E+01 | 1.0E-06 | 3.1E-07 | 2.8E-07 | 1.6E-06 | 4.7E-07 | 4.2E-06 | 6.2E-06 | R |
| Barium | 2.9E+02 | 1.6E-05 | 1.6E-07 | 4.2E-06 | | | | | |
| Cadmium | 1.9E+01 | 1.0E-06 | 1.0E-08 | 2.7E-07 | | | 1.7E-06 | 1.7E-06 | R |
| Chromium | 5.7E+01 | 3.1E-06 | 3.1E-08 | 8.3E-07 | | | | | |
| Chromium, hexavalent | 2.0E+01 | 1.1E-06 | 1.1E-08 | 2.8E-07 | | | 1.2E-05 | 1.2E-05 | R |
| Copper | 2.0E+02 | 1.1E-05 | 1.1E-07 | 2.9E-06 | | | | | |
| Mercury | 3.0E+01 | 1.6E-06 | 1.6E-08 | 4.3E-07 | | | | | |
| Vanadium | 2.4E+01 | 1.3E-06 | 1.3E-08 | 3.4E-07 | | | | | |
| Zinc | 1.4E+03 | 7.7E-05 | 7.6E-07 | 2.0E-05 | | | | | |
| *Inorganics Pathway Total* | | | | | 1.6E-06 | 4.7E-07 | 1.8E-05 | 2.0E-05 | R |
| Benz(*a*)anthracene | 5.4E-01 | 2.9E-08 | 3.8E-08 | 7.8E-09 | 2.1E-08 | 2.7E-08 | 2.4E-09 | 5.1E-08 | |
| Benzo(*a*)pyrene | 5.2E-01 | 2.8E-08 | 3.7E-08 | 7.6E-09 | 2.1E-07 | 2.7E-07 | 2.4E-08 | 5.0E-07 | |
| Benzo(*b*)fluoranthene | 5.8E-01 | 3.2E-08 | 4.1E-08 | 8.4E-09 | 2.3E-08 | 3.0E-08 | 2.6E-09 | 5.5E-08 | |
| Indeno(1,2,3-*cd*)pyrene | 3.7E-01 | 2.0E-08 | 2.6E-08 | 5.4E-09 | 1.5E-08 | 1.9E-08 | 1.7E-09 | 3.5E-08 | |
| *Organics Pathway Total* | | | | | 2.7E-07 | 3.4E-07 | 3.0E-08 | 6.4E-07 | |
| *Pathway Total - Chemicals* | | | | | 1.8E-06 | 8.1E-07 | 1.8E-05 | 2.0E-05 | R |
| *Settling Basins* | | | | | | | | | |
| Aluminum | 1.9E+04 | 1.0E-03 | 1.0E-05 | 2.7E-04 | | | | | |
| Chromium | 2.1E+02 | 1.2E-05 | 1.2E-07 | 3.1E-06 | | | | | |
| Manganese | 6.5E+02 | 3.5E-05 | 3.5E-07 | 9.4E-06 | | | | | |
| Vanadium | 3.2E+01 | 1.7E-06 | 1.7E-08 | 4.6E-07 | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| Benzo(*a*)pyrene | 1.1E-01 | 6.0E-09 | 7.7E-09 | 1.6E-09 | 4.4E-08 | 5.6E-08 | 5.0E-09 | 1.1E-07 | |
| *Organics Pathway Total* | | | | | 4.4E-08 | 5.6E-08 | 5.0E-09 | 1.1E-07 | |
| *Pathway Total - Chemicals* | | | | | 4.4E-08 | 5.6E-08 | 5.0E-09 | 1.1E-07 | |

**Table M-28. Fuze and Booster Quarry Ponds Sediment Carcinogenic Risks - Direct Contact (continued)**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Aluminum | 1.6E+04 | 9.2E-03 | 2.1E-04 | 2.0E-06 | | | | | |
| Antimony | 5.5E+00 | 3.2E-06 | 7.4E-08 | 7.0E-10 | | | | | |
| Arsenic | 2.1E+01 | 1.2E-05 | 8.3E-06 | 2.6E-09 | 1.8E-05 | 1.2E-05 | 3.9E-08 | 3.1E-05 | R |
| Manganese | 4.1E+03 | 2.4E-03 | 5.5E-05 | 5.2E-07 | | | | | |
| Vanadium | 2.8E+01 | 1.6E-05 | 3.8E-07 | 3.6E-09 | | | | | |
| *Inorganics Pathway Total* | | | | | 1.8E-05 | 1.2E-05 | 3.9E-08 | 3.1E-05 | R |
| Benz(*a*)anthracene | 6.4E-01 | 3.8E-07 | 1.1E-06 | 8.1E-11 | 2.7E-07 | 8.1E-07 | 2.5E-11 | 1.1E-06 | R |
| Benzo(*a*)pyrene | 5.3E-01 | 3.1E-07 | 9.2E-07 | 6.7E-11 | 2.3E-06 | 6.7E-06 | 2.1E-10 | 9.0E-06 | R |
| Benzo(*b*)fluoranthene | 6.0E-01 | 3.5E-07 | 1.0E-06 | 7.6E-11 | 2.6E-07 | 7.6E-07 | 2.3E-11 | 1.0E-06 | R |
| *Organics Pathway Total* | | | | | 2.8E-06 | 8.3E-06 | 2.6E-10 | 1.1E-05 | R |
| *Pathway Total - Chemicals* | | | | | 2.1E-05 | 2.1E-05 | 4.0E-08 | 4.2E-05 | R |
| *Quarry Ponds* | | | | | | | | | |
| Aluminum | 1.3E+04 | 7.6E-03 | 1.7E-04 | 1.7E-06 | | | | | |
| Antimony | 1.3E+02 | 7.5E-05 | 1.7E-06 | 1.6E-08 | | | | | |
| Arsenic | 1.9E+01 | 1.1E-05 | 7.7E-06 | 2.4E-09 | 1.7E-05 | 1.2E-05 | 3.7E-08 | 2.9E-05 | R |
| Barium | 2.9E+02 | 1.7E-04 | 3.9E-06 | 3.7E-08 | | | | | |
| Cadmium | 1.9E+01 | 1.1E-05 | 2.5E-07 | 2.4E-09 | | | 1.5E-08 | 1.5E-08 | |
| Chromium | 5.7E+01 | 3.4E-05 | 7.6E-07 | 7.3E-09 | | | | | |
| Chromium, hexavalent | 2.0E+01 | 1.1E-05 | 2.6E-07 | 2.5E-09 | | | 1.0E-07 | 1.0E-07 | |
| Copper | 2.0E+02 | 1.2E-04 | 2.7E-06 | 2.6E-08 | | | | | |
| Mercury | 3.0E+01 | 1.8E-05 | 4.0E-07 | 3.8E-09 | | | | | |
| Vanadium | 2.4E+01 | 1.4E-05 | 3.1E-07 | 3.0E-09 | | | | | |
| Zinc | 1.4E+03 | 8.3E-04 | 1.9E-05 | 1.8E-07 | | | | | |
| *Inorganics Pathway Total* | | | | | 1.7E-05 | 1.2E-05 | 1.6E-07 | 2.9E-05 | R |
| Benz(*a*)anthracene | 5.4E-01 | 3.1E-07 | 9.3E-07 | 6.8E-11 | 2.3E-07 | 6.8E-07 | 2.1E-11 | 9.1E-07 | |
| Benzo(*a*)pyrene | 5.2E-01 | 3.1E-07 | 9.1E-07 | 6.6E-11 | 2.2E-06 | 6.6E-06 | 2.1E-10 | 8.9E-06 | R |
| Benzo(*b*)fluoranthene | 5.8E-01 | 3.4E-07 | 1.0E-06 | 7.4E-11 | 2.5E-07 | 7.4E-07 | 2.3E-11 | 9.8E-07 | |
| Indeno(1,2,3-*cd*)pyrene | 3.7E-01 | 2.2E-07 | 6.5E-07 | 4.7E-11 | 1.6E-07 | 4.7E-07 | 1.5E-11 | 6.3E-07 | |
| *Organics Pathway Total* | | | | | 2.9E-06 | 8.5E-06 | 2.6E-10 | 1.1E-05 | R |
| *Pathway Total - Chemicals* | | | | | 2.0E-05 | 2.0E-05 | 1.6E-07 | 4.0E-05 | R |
| *Settling Basins* | | | | | | | | | |
| Aluminum | 1.9E+04 | 1.1E-02 | 2.5E-04 | 2.4E-06 | | | | | |
| Chromium | 2.1E+02 | 1.3E-04 | 2.9E-06 | 2.7E-08 | | | | | |
| Manganese | 6.5E+02 | 3.8E-04 | 8.6E-06 | 8.2E-08 | | | | | |
| Vanadium | 3.2E+01 | 1.9E-05 | 4.3E-07 | 4.1E-09 | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| Benzo(*a*)pyrene | 1.1E-01 | 6.5E-08 | 1.9E-07 | 1.4E-11 | 4.7E-07 | 1.4E-06 | 4.3E-11 | 1.9E-06 | R |
| *Organics Pathway Total* | | | | | 4.7E-07 | 1.4E-06 | 4.3E-11 | 1.9E-06 | R |
| *Pathway Total - Chemicals* | | | | | 4.7E-07 | 1.4E-06 | 4.3E-11 | 1.9E-06 | R |

**Table M-28. Fuze and Booster Quarry Ponds Sediment Carcinogenic Risks - Direct Contact (continued)**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Aluminum | 1.6E+04 | 1.7E-02 | 3.8E-05 | 9.3E-07 | | | | | |
| Antimony | 5.5E+00 | 6.0E-06 | 1.3E-08 | 3.3E-10 | | | | | |
| Arsenic | 2.1E+01 | 2.3E-05 | 1.5E-06 | 1.2E-09 | 3.4E-05 | 2.2E-06 | 1.8E-08 | 3.6E-05 | R |
| Manganese | 4.1E+03 | 4.5E-03 | 9.9E-06 | 2.4E-07 | | | | | |
| Vanadium | 2.8E+01 | 3.1E-05 | 6.8E-08 | 1.7E-09 | | | | | |
| *Inorganics Pathway Total* | | | | | 3.4E-05 | 2.2E-06 | 1.8E-08 | 3.6E-05 | R |
| Benz(*a*)anthracene | 6.4E-01 | 7.0E-07 | 2.0E-07 | 3.8E-11 | 5.1E-07 | 1.5E-07 | 1.2E-11 | 6.6E-07 | |
| Benzo(*a*)pyrene | 5.3E-01 | 5.8E-07 | 1.7E-07 | 3.1E-11 | 4.2E-06 | 1.2E-06 | 9.7E-11 | 5.4E-06 | R |
| Benzo(*b*)fluoranthene | 6.0E-01 | 6.5E-07 | 1.9E-07 | 3.5E-11 | 4.8E-07 | 1.4E-07 | 1.1E-11 | 6.1E-07 | |
| *Organics Pathway Total* | | | | | 5.2E-06 | 1.5E-06 | 1.2E-10 | 6.7E-06 | R |
| *Pathway Total - Chemicals* | | | | | 3.9E-05 | 3.7E-06 | 1.9E-08 | 4.3E-05 | R |
| *Quarry Ponds* | | | | | | | | | |
| Aluminum | 1.3E+04 | 1.4E-02 | 3.1E-05 | 7.7E-07 | | | | | |
| Antimony | 1.3E+02 | 1.4E-04 | 3.1E-07 | 7.6E-09 | | | | | |
| Arsenic | 1.9E+01 | 2.1E-05 | 1.4E-06 | 1.1E-09 | 3.2E-05 | 2.1E-06 | 1.7E-08 | 3.4E-05 | R |
| Barium | 2.9E+02 | 3.2E-04 | 6.9E-07 | 1.7E-08 | | | | | |
| Cadmium | 1.9E+01 | 2.1E-05 | 4.6E-08 | 1.1E-09 | | | 7.1E-09 | 7.1E-09 | |
| Chromium | 5.7E+01 | 6.3E-05 | 1.4E-07 | 3.4E-09 | | | | | |
| Chromium, hexavalent | 2.0E+01 | 2.1E-05 | 4.7E-08 | 1.2E-09 | | | 4.9E-08 | 4.9E-08 | |
| Copper | 2.0E+02 | 2.2E-04 | 4.9E-07 | 1.2E-08 | | | | | |
| Mercury | 3.0E+01 | 3.3E-05 | 7.2E-08 | 1.8E-09 | | | | | |
| Vanadium | 2.4E+01 | 2.6E-05 | 5.7E-08 | 1.4E-09 | | | | | |
| Zinc | 1.4E+03 | 1.5E-03 | 3.4E-06 | 8.4E-08 | | | | | |
| *Inorganics Pathway Total* | | | | | 3.2E-05 | 2.1E-06 | 7.3E-08 | 3.4E-05 | R |
| Benz(*a*)anthracene | 5.4E-01 | 5.9E-07 | 1.7E-07 | 3.2E-11 | 4.3E-07 | 1.2E-07 | 9.9E-12 | 5.5E-07 | |
| Benzo(*a*)pyrene | 5.2E-01 | 5.7E-07 | 1.6E-07 | 3.1E-11 | 4.2E-06 | 1.2E-06 | 9.6E-11 | 5.4E-06 | R |
| Benzo(*b*)fluoranthene | 5.8E-01 | 6.3E-07 | 1.8E-07 | 3.4E-11 | 4.6E-07 | 1.3E-07 | 1.1E-11 | 6.0E-07 | |
| Indeno(1,2,3-*cd*)pyrene | 3.7E-01 | 4.1E-07 | 1.2E-07 | 2.2E-11 | 3.0E-07 | 8.5E-08 | 6.8E-12 | 3.8E-07 | |
| *Organics Pathway Total* | | | | | 5.4E-06 | 1.5E-06 | 1.2E-10 | 6.9E-06 | R |
| *Pathway Total - Chemicals* | | | | | 3.7E-05 | 3.6E-06 | 7.3E-08 | 4.1E-05 | R |
| *Settling Basins* | | | | | | | | | |
| Aluminum | 1.9E+04 | 2.0E-02 | 4.5E-05 | 1.1E-06 | | | | | |
| Chromium | 2.1E+02 | 2.3E-04 | 5.2E-07 | 1.3E-08 | | | | | |
| Manganese | 6.5E+02 | 7.1E-04 | 1.6E-06 | 3.8E-08 | | | | | |
| Vanadium | 3.2E+01 | 3.5E-05 | 7.7E-08 | 1.9E-09 | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| Benzo(*a*)pyrene | 1.1E-01 | 1.2E-07 | 3.4E-08 | 6.5E-12 | 8.8E-07 | 2.5E-07 | 2.0E-11 | 1.1E-06 | R |
| *Organics Pathway Total* | | | | | 8.8E-07 | 2.5E-07 | 2.0E-11 | 1.1E-06 | R |
| *Pathway Total - Chemicals* | | | | | 8.8E-07 | 2.5E-07 | 2.0E-11 | 1.1E-06 | R |

**Table M-28. Fuze and Booster Quarry Ponds Sediment Carcinogenic Risks - Direct Contact (continued)**

| COPC | EPC (mg/kg) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Recreational - Hunter/Trapper/Fisher*** | | | | | | | | | |
| *Quarry Ponds* | | | | | | | | | |
| Aluminum | 1.3E+04 | 2.9E-05 | 2.4E-06 | 6.3E-09 | | | | | |
| Antimony | 1.3E+02 | 2.9E-07 | 2.3E-08 | 6.2E-11 | | | | | |
| Arsenic | 1.9E+01 | 4.3E-08 | 1.1E-07 | 9.3E-12 | 6.4E-08 | 1.6E-07 | 1.4E-10 | 2.2E-07 | |
| Barium | 2.9E+02 | 6.4E-07 | 5.3E-08 | 1.4E-10 | | | | | |
| Cadmium | 1.9E+01 | 4.2E-08 | 3.5E-09 | 9.2E-12 | | | 5.8E-11 | 5.8E-11 | |
| Chromium | 5.7E+01 | 1.3E-07 | 1.0E-08 | 2.8E-11 | | | | | |
| Chromium, hexavalent | 2.0E+01 | 4.4E-08 | 3.6E-09 | 9.4E-12 | | | 4.0E-10 | 4.0E-10 | |
| Copper | 2.0E+02 | 4.5E-07 | 3.7E-08 | 9.8E-11 | | | | | |
| Mercury | 3.0E+01 | 6.7E-08 | 5.5E-09 | 1.4E-11 | | | | | |
| Vanadium | 2.4E+01 | 5.3E-08 | 4.3E-09 | 1.1E-11 | | | | | |
| Zinc | 1.4E+03 | 3.2E-06 | 2.6E-07 | 6.8E-10 | | | | | |
| *Inorganics Pathway Total* | | | | | 6.4E-08 | 1.6E-07 | 5.9E-10 | 2.2E-07 | |
| Benz(*a*)anthracene | 5.4E-01 | 1.2E-09 | 1.3E-08 | 2.6E-13 | 8.7E-10 | 9.3E-09 | 8.0E-14 | 1.0E-08 | |
| Benzo(*a*)pyrene | 5.2E-01 | 1.2E-09 | 1.2E-08 | 2.5E-13 | 8.5E-09 | 9.1E-08 | 7.8E-13 | 9.9E-08 | |
| Benzo(*b*)fluoranthene | 5.8E-01 | 1.3E-09 | 1.4E-08 | 2.8E-13 | 9.5E-10 | 1.0E-08 | 8.7E-14 | 1.1E-08 | |
| Indeno(1,2,3-*cd*)pyrene | 3.7E-01 | 8.3E-10 | 8.8E-09 | 1.8E-13 | 6.1E-10 | 6.4E-09 | 5.6E-14 | 7.1E-09 | |
| *Organics Pathway Total* | | | | | 1.1E-08 | 1.2E-07 | 1.0E-12 | 1.3E-07 | |
| *Pathway Total - Chemicals* | | | | | 7.5E-08 | 2.7E-07 | 6.0E-10 | 3.5E-07 | |

[a] COPCs are identified as COCs if the total incremental lifetime cancer risk across all pathways is > 1E-06 (R).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.

**Table M-29. Fuze and Booster Quarry Ponds Surface Water Non-carcinogenic Hazards - Direct Contact**

| COPC | EPC (mg/L) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***National Guard - National Guard Fire Suppression Worker*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Manganese | 1.1E+01 | 6.5E-04 | 1.1E-04 | | 1.4E-02 | 5.9E-02 | | 7.3E-02 | |
| *Inorganics Pathway Total* | | | | | 1.4E-02 | 5.9E-02 | | 7.3E-02 | |
| *Pathway Total - Chemicals* | | | | | 1.4E-02 | 5.9E-02 | | 7.3E-02 | |
| *Quarry Ponds* | | | | | | | | | |
| Methylene Chloride | 4.7E-03 | 2.8E-07 | 1.6E-07 | | 4.6E-06 | 2.7E-06 | | 7.3E-06 | |
| *Organics Pathway Total* | | | | | 4.6E-06 | 2.7E-06 | | 7.3E-06 | |
| *Pathway Total - Chemicals* | | | | | 4.6E-06 | 2.7E-06 | | 7.3E-06 | |
| *Settling Basins* | | | | | | | | | |
| Arsenic | 9.0E-03 | 5.3E-07 | 1.3E-07 | | 1.8E-03 | 4.5E-04 | | 2.2E-03 | |
| Manganese | 2.0E+00 | 1.2E-04 | 2.0E-05 | | 2.6E-03 | 1.1E-02 | | 1.3E-02 | |
| *Inorganics Pathway Total* | | | | | 4.3E-03 | 1.1E-02 | | 1.6E-02 | |
| Bis(2-ethylhexyl)phthalate | 4.5E-03 | 2.7E-07 | 6.9E-05 | | 1.3E-05 | 3.5E-03 | | 3.5E-03 | |
| Perchlorate | 1.2E-02 | 6.9E-07 | 3.5E-11 | | 9.9E-04 | 5.0E-08 | | 9.9E-04 | |
| *Organics Pathway Total* | | | | | 1.0E-03 | 3.5E-03 | | 4.5E-03 | |
| *Pathway Total - Chemicals* | | | | | 5.3E-03 | 1.5E-02 | | 2.0E-02 | |
| ***National Guard - National Guard Trainee*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Manganese | 1.1E+01 | 1.7E-03 | 1.7E-03 | | 3.7E-02 | 9.3E-01 | | 9.6E-01 | |
| *Inorganics Pathway Total* | | | | | 3.7E-02 | 9.3E-01 | | 9.6E-01 | |
| *Pathway Total - Chemicals* | | | | | 3.7E-02 | 9.3E-01 | | 9.6E-01 | |
| *Quarry Ponds* | | | | | | | | | |
| Methylene Chloride | 4.7E-03 | 7.2E-07 | 2.5E-06 | | 1.2E-05 | 4.2E-05 | | 5.4E-05 | |
| *Organics Pathway Total* | | | | | 1.2E-05 | 4.2E-05 | | 5.4E-05 | |
| *Pathway Total - Chemicals* | | | | | 1.2E-05 | 4.2E-05 | | 5.4E-05 | |
| *Settling Basins* | | | | | | | | | |
| Arsenic | 9.0E-03 | 1.4E-06 | 2.1E-06 | | 4.6E-03 | 7.0E-03 | | 1.2E-02 | |
| Manganese | 2.0E+00 | 3.1E-04 | 3.1E-04 | | 6.6E-03 | 1.7E-01 | | 1.7E-01 | |
| *Inorganics Pathway Total* | | | | | 1.1E-02 | 1.8E-01 | | 1.9E-01 | |
| Bis(2-ethylhexyl)phthalate | 4.5E-03 | 6.9E-07 | 1.1E-03 | | 3.5E-05 | 5.4E-02 | | 5.4E-02 | |
| Perchlorate | 1.2E-02 | 1.8E-06 | 5.4E-10 | | 2.6E-03 | 7.8E-07 | | 2.6E-03 | |
| Organics Pathway Total | | | | | 2.6E-03 | 5.4E-02 | | 5.7E-02 | |
| Pathway Total - Chemicals | | | | | 1.4E-02 | 2.3E-01 | | 2.4E-01 | |

**Table M-29. Fuze and Booster Quarry Ponds Surface Water Non-carcinogenic Hazards - Direct Contact (continued)**

| COPC | EPC (mg/L) | Daily Intake (mg/kg-day) | | | HQ | | | Total HI Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Manganese | 1.1E+01 | 1.5E-02 | 2.7E-03 | | 3.3E-01 | 1.5E+00 | | 1.8E+00 | H |
| *Inorganics Pathway Total* | | | | | 3.3E-01 | 1.5E+00 | | 1.8E+00 | H |
| *Pathway Total - Chemicals* | | | | | 3.3E-01 | 1.5E+00 | | 1.8E+00 | H |
| *Quarry Ponds* | | | | | | | | | |
| Methylene Chloride | 4.7E-03 | 6.4E-06 | 4.1E-06 | | 1.1E-04 | 6.8E-05 | | 1.8E-04 | |
| *Organics Pathway Total* | | | | | 1.1E-04 | 6.8E-05 | | 1.8E-04 | |
| *Pathway Total - Chemicals* | | | | | 1.1E-04 | 6.8E-05 | | 1.8E-04 | |
| *Settling Basins* | | | | | | | | | |
| Arsenic | 9.0E-03 | 1.2E-05 | 3.4E-06 | | 4.1E-02 | 1.1E-02 | | 5.3E-02 | |
| Manganese | 2.0E+00 | 2.7E-03 | 5.0E-04 | | 6.0E-02 | 2.7E-01 | | 3.3E-01 | |
| *Inorganics Pathway Total* | | | | | 1.0E-01 | 2.8E-01 | | 3.8E-01 | |
| Bis(2-ethylhexyl)phthalate | 4.5E-03 | 6.2E-06 | 1.7E-03 | | 3.1E-04 | 8.7E-02 | | 8.7E-02 | |
| Perchlorate | 1.2E-02 | 1.6E-05 | 8.8E-10 | | 2.3E-02 | 1.3E-06 | | 2.3E-02 | |
| *Organics Pathway Total* | | | | | 2.3E-02 | 8.7E-02 | | 1.1E-01 | |
| *Pathway Total - Chemicals* | | | | | 1.2E-01 | 3.7E-01 | | 4.9E-01 | |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Manganese | 1.1E+01 | 7.0E-02 | 5.0E-03 | | 1.5E+00 | 2.7E+00 | | 4.2E+00 | H |
| *Inorganics Pathway Total* | | | | | 1.5E+00 | 2.7E+00 | | 4.2E+00 | H |
| *Pathway Total - Chemicals* | | | | | 1.5E+00 | 2.7E+00 | | 4.2E+00 | H |
| *Quarry Ponds* | | | | | | | | | |
| Methylene Chloride | 4.7E-03 | 3.0E-05 | 7.4E-06 | | 5.0E-04 | 1.2E-04 | | 6.2E-04 | |
| *Organics Pathway Total* | | | | | 5.0E-04 | 1.2E-04 | | 6.2E-04 | |
| *Pathway Total - Chemicals* | | | | | 5.0E-04 | 1.2E-04 | | 6.2E-04 | |
| *Settling Basins* | | | | | | | | | |
| Arsenic | 9.0E-03 | 5.8E-05 | 6.1E-06 | | 1.9E-01 | 2.0E-02 | | 2.1E-01 | |
| Manganese | 2.0E+00 | 1.3E-02 | 9.0E-04 | | 2.8E-01 | 4.9E-01 | | 7.7E-01 | |
| *Inorganics Pathway Total* | | | | | 4.7E-01 | 5.1E-01 | | 9.8E-01 | |
| Bis(2-ethylhexyl)phthalate | 4.5E-03 | 2.9E-05 | 3.1E-03 | | 1.4E-03 | 1.6E-01 | | 1.6E-01 | |
| Perchlorate | 1.2E-02 | 7.5E-05 | 1.6E-09 | | 1.1E-01 | 2.3E-06 | | 1.1E-01 | |
| *Organics Pathway Total* | | | | | 1.1E-01 | 1.6E-01 | | 2.7E-01 | |
| *Pathway Total - Chemicals* | | | | | 5.8E-01 | 6.7E-01 | | 1.2E+00 | H |
| ***Recreational - Hunter/Trapper/Fisher*** | | | | | | | | | |
| *Quarry Ponds* | | | | | | | | | |
| Methylene Chloride | 4.7E-03 | 6.4E-08 | 1.4E-07 | | 1.1E-06 | 2.3E-06 | | 3.3E-06 | |
| *Organics Pathway Total* | | | | | 1.1E-06 | 2.3E-06 | | 3.3E-06 | |
| *Pathway Total - Chemicals* | | | | | 1.1E-06 | 2.3E-06 | | 3.3E-06 | |

[a] COPCs are identified as COCs if the total HI across all pathways is > 1 (H).

COC = Chemical of concern. HI = Hazard index.

COPC = Chemical of potential concern. HQ = Hazard quotient.

EPC = Exposure point concentration.

**Table M-30. Fuze and Booster Quarry Ponds Surface Water Carcinogenic Risks - Direct Contact**

| COPC | EPC (mg/L) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***National Guard - National Guard Fire Suppression Worker*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Manganese | 1.1E+01 | 2.3E-04 | 3.9E-05 | | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | | | | | |
| *Quarry Ponds* | | | | | | | | | |
| Methylene Chloride | 4.7E-03 | 9.9E-08 | 5.8E-08 | | 7.4E-10 | 4.4E-10 | | 1.2E-09 | |
| *Organics Pathway Total* | | | | | 7.4E-10 | 4.4E-10 | | 1.2E-09 | |
| *Pathway Total - Chemicals* | | | | | 7.4E-10 | 4.4E-10 | | 1.2E-09 | |
| *Settling Basins* | | | | | | | | | |
| Arsenic | 9.0E-03 | 1.9E-07 | 4.8E-08 | | 2.8E-07 | 7.2E-08 | | 3.6E-07 | |
| Manganese | 2.0E+00 | 4.2E-05 | 7.1E-06 | | | | | | |
| *Inorganics Pathway Total* | | | | | 2.8E-07 | 7.2E-08 | | 3.6E-07 | |
| Bis(2-ethylhexyl)phthalate | 4.5E-03 | 9.5E-08 | 2.5E-05 | | 1.3E-09 | 3.5E-07 | | 3.5E-07 | |
| Perchlorate | 1.2E-02 | 2.5E-07 | 1.2E-11 | | | | | | |
| *Organics Pathway Total* | | | | | 1.3E-09 | 3.5E-07 | | 3.5E-07 | |
| *Pathway Total - Chemicals* | | | | | 2.9E-07 | 4.2E-07 | | 7.0E-07 | |
| ***National Guard - National Guard Trainee*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Manganese | 1.1E+01 | 6.0E-04 | 6.1E-04 | | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | | | | | |
| *Quarry Ponds* | | | | | | | | | |
| Methylene Chloride | 4.7E-03 | 2.6E-07 | 9.1E-07 | | 1.9E-09 | 6.8E-09 | | 8.7E-09 | |
| *Organics Pathway Total* | | | | | 1.9E-09 | 6.8E-09 | | 8.7E-09 | |
| *Pathway Total - Chemicals* | | | | | 1.9E-09 | 6.8E-09 | | 8.7E-09 | |
| *Settling Basins* | | | | | | | | | |
| Arsenic | 9.0E-03 | 4.9E-07 | 7.5E-07 | | 7.4E-07 | 1.1E-06 | | 1.9E-06 | R |
| Manganese | 2.0E+00 | 1.1E-04 | 1.1E-04 | | | | | | |
| *Inorganics Pathway Total* | | | | | 7.4E-07 | 1.1E-06 | | 1.9E-06 | R |
| Bis(2-ethylhexyl)phthalate | 4.5E-03 | 2.5E-07 | 3.9E-04 | | 3.5E-09 | 5.4E-06 | | 5.4E-06 | R |
| Perchlorate | 1.2E-02 | 6.4E-07 | 1.9E-10 | | | | | | |
| Organics Pathway Total | | | | | 3.5E-09 | 5.4E-06 | | 5.4E-06 | R |
| Pathway Total - Chemicals | | | | | 7.4E-07 | 6.5E-06 | | 7.3E-06 | R |

**Table M-30. Fuze and Booster Quarry Ponds Surface Water Carcinogenic Risks - Direct Contact (continued)**

| COPC | EPC (mg/L) | Daily Intake (mg/kg-day) | | | Risk | | | Total Risk Across all Pathways | COC[a] |
|---|---|---|---|---|---|---|---|---|---|
| | | Ingestion | Dermal | Inhalation | Ingestion | Dermal | Inhalation | | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Manganese | 1.1E+01 | 6.5E-03 | 1.2E-03 | | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | | | | | |
| *Quarry Ponds* | | | | | | | | | |
| Methylene Chloride | 4.7E-03 | 2.8E-06 | 1.8E-06 | | 2.1E-08 | 1.3E-08 | | 3.4E-08 | |
| *Organics Pathway Total* | | | | | 2.1E-08 | 1.3E-08 | | 3.4E-08 | |
| *Pathway Total - Chemicals* | | | | | 2.1E-08 | 1.3E-08 | | 3.4E-08 | |
| *Settling Basins* | | | | | | | | | |
| Arsenic | 9.0E-03 | 5.3E-06 | 1.5E-06 | | 7.9E-06 | 2.2E-06 | | 1.0E-05 | R |
| Manganese | 2.0E+00 | 1.2E-03 | 2.1E-04 | | | | | | |
| *Inorganics Pathway Total* | | | | | 7.9E-06 | 2.2E-06 | | 1.0E-05 | R |
| Bis(2-ethylhexyl)phthalate | 4.5E-03 | 2.7E-06 | 7.5E-04 | | 3.7E-08 | 1.0E-05 | | 1.0E-05 | R |
| Perchlorate | 1.2E-02 | 6.9E-06 | 3.8E-10 | | | | | | |
| *Organics Pathway Total* | | | | | 3.7E-08 | 1.0E-05 | | 1.0E-05 | R |
| *Pathway Total - Chemicals* | | | | | 8.0E-06 | 1.3E-05 | | 2.1E-05 | R |
| ***Open Residential - Resident Farmer Child*** | | | | | | | | | |
| *Ditch* | | | | | | | | | |
| Manganese | 1.1E+01 | 6.0E-03 | 4.2E-04 | | | | | | |
| *Inorganics Pathway Total* | | | | | | | | | |
| *Pathway Total - Chemicals* | | | | | | | | | |
| *Quarry Ponds* | | | | | | | | | |
| Methylene Chloride | 4.7E-03 | 2.6E-06 | 6.3E-07 | | 1.9E-08 | 4.7E-09 | | 2.4E-08 | |
| *Organics Pathway Total* | | | | | 1.9E-08 | 4.7E-09 | | 2.4E-08 | |
| *Pathway Total - Chemicals* | | | | | 1.9E-08 | 4.7E-09 | | 2.4E-08 | |
| *Settling Basins* | | | | | | | | | |
| Arsenic | 9.0E-03 | 4.9E-06 | 5.2E-07 | | 7.4E-06 | 7.9E-07 | | 8.2E-06 | R |
| Manganese | 2.0E+00 | 1.1E-03 | 7.7E-05 | | | | | | |
| *Inorganics Pathway Total* | | | | | 7.4E-06 | 7.9E-07 | | 8.2E-06 | R |
| Bis(2-ethylhexyl)phthalate | 4.5E-03 | 2.5E-06 | 2.7E-04 | | 3.5E-08 | 3.8E-06 | | 3.8E-06 | R |
| Perchlorate | 1.2E-02 | 6.5E-06 | 1.4E-10 | | | | | | |
| *Organics Pathway Total* | | | | | 3.5E-08 | 3.8E-06 | | 3.8E-06 | R |
| *Pathway Total - Chemicals* | | | | | 7.4E-06 | 4.6E-06 | | 1.2E-05 | R |
| ***Recreational - Hunter/Trapper/Fisher*** | | | | | | | | | |
| *Quarry Ponds* | | | | | | | | | |
| Methylene Chloride | 4.7E-03 | 2.8E-08 | 5.8E-08 | | 2.1E-10 | 4.4E-10 | | 6.5E-10 | |
| *Organics Pathway Total* | | | | | 2.1E-10 | 4.4E-10 | | 6.5E-10 | |
| *Pathway Total - Chemicals* | | | | | 2.1E-10 | 4.4E-10 | | 6.5E-10 | |

[a] COPCs are identified as COCs if the total incremental lifetime cancer risk across all pathways is > 1E-06 (R).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.

**Table M-31. Fuze and Booster Quarry Ponds Risks and Hazards for the Ingestion of Fish Pathway**

| COPC | EPC (mg/L) | Non-carcinogenic | | Carcinogenic | | COC[a] |
|---|---|---|---|---|---|---|
| | | Daily Intake (mg/kg-day) | Total HI | Daily Intake (mg/kg-day) | Total Risk | |
| ***Open Residential - Resident Farmer Adult*** | | | | | | |
| *Quarry Ponds* | | | | | | |
| Methylene Chloride | 4.7E-03 | 6.5E-06 | 1.1E-04 | 2.8E-06 | 2.1E-08 | |
| *Organics Pathway Total* | | | 1.1E-04 | | 2.1E-08 | |
| *Pathway Total* | | | 1.1E-04 | | 2.1E-08 | |
| ***Open Residential - Resident Farmer Child*** | | | | | | |
| *Quarry Ponds* | | | | | | |
| Methylene Chloride | 4.7E-03 | 3.0E-05 | 5.1E-04 | 2.6E-06 | 2.0E-08 | |
| *Organics Pathway Total* | | | 5.1E-04 | | 2.0E-08 | |
| *Pathway Total* | | | 5.1E-04 | | 2.0E-08 | |
| ***Recreational - Hunter/Trapper/Fisher*** | | | | | | |
| *Quarry Ponds* | | | | | | |
| Methylene Chloride | 4.7E-03 | 6.5E-06 | 1.1E-04 | 2.8E-06 | 2.1E-08 | |
| *Organics Pathway Total* | | | 1.1E-04 | | 2.1E-08 | |
| *Pathway Total* | | | 1.1E-04 | | 2.1E-08 | |

[a] COPCs are identified as COCs if the total incremental lifetime cancer risk is > 1E-06 (R) or total HI is > 1 (H).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
HI = Hazard index.

**Table M-32. Fuze and Booster Quarry Ponds Risks and Hazards for the Ingestion of Waterfowl Pathway**

| COPC | EPC (mg/kg) | Non-carcinogenic | | Carcinogenic | | COC[a] |
|---|---|---|---|---|---|---|
| | | Daily Intake (mg/kg-day) | Total HI | Daily Intake (mg/kg-day) | Total Risk | |
| ***Recreational - Hunter/Trapper/Fisher*** | | | | | | |
| *Quarry Ponds* | | | | | | |
| Aluminum | 8.8E+02 | 1.7E-01 | 1.7E-01 | 7.1E-02 | | |
| Antimony | 5.6E+00 | 1.0E-03 | 2.6E+00 | 4.5E-04 | | H |
| Arsenic | 1.7E+00 | 3.2E-04 | 1.1E+00 | 1.4E-04 | 2.1E-04 | R,H |
| Barium | 1.9E+00 | 3.6E-04 | 5.1E-03 | 1.5E-04 | | |
| Cadmium | 1.7E+00 | 3.3E-04 | 3.3E-01 | 1.4E-04 | | |
| Chromium | 7.0E+00 | 1.3E-03 | 4.4E-01 | 5.6E-04 | | |
| Copper | 3.3E+01 | 6.2E-03 | 1.5E-01 | 2.7E-03 | | |
| Mercury | 1.4E+02 | 2.7E-02 | 9.1E+01 | 1.2E-02 | | H |
| Vanadium | 2.7E+00 | 5.0E-04 | 7.1E-02 | 2.1E-04 | | |
| Zinc | 4.2E+03 | 8.0E-01 | 2.7E+00 | 3.4E-01 | | H |
| *Inorganics Pathway Total* | | | 9.8E+01 | | 2.1E-04 | R,H |
| Benz(*a*)anthracene | 4.6E-01 | 8.7E-05 | | 3.7E-05 | 2.7E-05 | R |
| Benzo(*a*)pyrene | 1.4E+00 | 2.6E-04 | | 1.1E-04 | 8.2E-04 | R |
| Benzo(*b*)fluoranthene | 1.8E+00 | 3.5E-04 | | 1.5E-04 | 1.1E-04 | R |
| Indeno(*1,2,3-cd*)pyrene | 6.1E+00 | 1.2E-03 | | 4.9E-04 | 3.6E-04 | R |
| Methylene Chloride | 6.6E-07 | 1.2E-10 | 2.1E-09 | 5.3E-11 | 4.0E-13 | |
| *Organics Pathway Total* | | | 2.1E-09 | | 1.3E-03 | R |
| *Pathway Total* | | | 9.8E+01 | | 1.5E-03 | R,H |

[a] COPCs are identified as COCs if the total incremental lifetime cancer risk is > 1E-06 (R) or total HI is > 1 (H).
COC = Chemical of concern.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
HI = Hazard index.

## Table M-33. Bioaccumulation Factors for Estimating Dabbling Duck Tissue Concentrations for COPCs in Sediment and Surface Water at Fuze and Booster Quarry Ponds

| COPC | Koc (L/kg) | | log Kow | | BCFinv | | Bv | | BSAF | | BAFv | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Value | Source | Value | Source | Value | Source | Value | Source | Value | Source | Value | Source |
| ***Inorganics*** | | | | | | | | | | | | |
| Aluminum | NA | | NA | | 4.07E+03 | EPA (1999)[a] | 8.00E-04 | EPA (1999)[b] | 9.00E-01 | Average[c] | 7.50E-02 | Baes et al. (1984)[d] |
| Antimony | NA | | NA | | 7.00E+00 | EPA (1999)[a] | 4.00E-02 | EPA (1999)[b] | 9.00E-01 | Average[c] | 5.00E-02 | Baes et al. (1984)[d] |
| Arsenic | NA | | NA | | 7.30E+01 | EPA (1999)[a] | 7.20E-03 | EPA (1999)[b] | 9.00E-01 | Average[c] | 1.00E-01 | Baes et al. (1984)[d] |
| Barium | NA | | NA | | 2.00E+02 | EPA (1999)[a] | 3.00E-02 | EPA (1999)[b] | 9.00E-01 | Average[c] | 7.50E-03 | Baes et al. (1984)[d] |
| Cadmium | NA | | NA | | 3.46E+03 | EPA (1999)[a] | 7.30E-02 | EPA (1999)[b] | 3.40E+00 | EPA (1999)[e] | 2.80E-02 | Baes et al. (1984)[d] |
| Chromium (total)[f] | NA | | NA | | 3.00E+03 | EPA (1999)[a] | 1.50E-03 | EPA (1999)[b] | 3.90E-01 | EPA (1999)[e] | 2.75E-01 | Baes et al. (1984)[d] |
| Copper | NA | | NA | | 3.72E+03 | EPA (1999)[a] | 8.00E-02 | EPA (1999)[b] | 3.00E-01 | EPA (1999)[e] | 5.00E-01 | Baes et al. (1984)[d] |
| Lead | NA | | NA | | 5.06E+03 | EPA (1999)[a] | 9.00E-03 | EPA (1999)[b] | 6.30E-01 | EPA (1999)[e] | 1.50E-02 | Baes et al. (1984)[d] |
| Mercury | NA | | NA | | 2.02E+04 | EPA (1999)[a] | 7.50E-03 | EPA (1999)[b] | 6.80E-02 | EPA (1999)[e] | 1.25E+01 | Baes et al. (1984)[d] |
| Vanadium | NA | | NA | | 4.07E+03 | Average[g] | 1.10E-03 | Baes et al. (1984)[h] | 9.00E-01 | Average[c] | 1.25E-01 | Baes et al. (1984)[d] |
| Zinc | NA | | NA | | 4.58E+03 | EPA (1999)[a] | 2.50E-13 | EPA (1999)[b] | 5.70E-01 | EPA (1999)[e] | 5.00E+00 | Baes et al. (1984)[d] |
| ***Organics-Explosives*** | | | | | | | | | | | | |
| 2-Amino-4,6-Dinitrotoluene | 1.01E+02 | EPI Suite[i] | 1.84E+00 | EPI Suite[i] | 2.30E+00 | Allometric[j] | 6.69E-01 | Allometric[k] | 3.37E-01 | Allometric[l] | 8.69E-05 | Allometric[m] |
| 4-Amino-2,6-Dinitrotoluene | 1.01E+02 | EPI Suite[i] | 1.84E+00 | EPI Suite[i] | 2.30E+00 | Allometric[j] | 6.69E-01 | Allometric[k] | 3.37E-01 | Allometric[l] | 8.69E-05 | Allometric[m] |
| Nitrocellulose | 1.00E+01 | EPI Suite[i] | -4.56E+00 | EPI Suite[i] | 1.32E-05 | Allometric[j] | 3.35E+03 | Allometric[k] | 1.95E-05 | Allometric[l] | 3.46E-11 | Allometric[m] |
| Nitroglycerin | 1.31E+02 | EPI Suite[i] | 1.51E+00 | EPI Suite[i] | 1.23E+00 | Allometric[j] | 1.04E+00 | Allometric[k] | 1.39E-01 | Allometric[l] | 4.06E-05 | Allometric[m] |
| ***Organics-Semivolatiles*** | | | | | | | | | | | | |
| Benz(*a*)anthracene | 2.60E+05 | EPA (1998)[n] | 5.68E+00 | EPA (1998)[n] | 1.23E+04 | EPA (1999)[a] | 4.04E-03 | EPA (1999)[b] | 1.45E+00 | EPA (1999)[e] | 5.99E-01 | Allometric[m] |
| Benzo(*a*)pyrene | 9.69E+05 | EPA (1998)[n] | 6.13E+00 | EPA (1998)[n] | 4.70E+03 | EPA (1999)[a] | 2.02E-03 | EPA (1999)[b] | 1.59E+00 | EPA (1999)[e] | 1.69E+00 | Allometric[m] |
| Benzo(*b*)fluoranthene | 8.36E+05 | EPA (1998)[n] | 6.20E+00 | EPA (1998)[n] | 4.70E+03 | EPA (1999)[a] | 2.02E-03 | EPA (1999)[b] | 1.61E+00 | EPA (1999)[e] | 1.99E+00 | Allometric[m] |
| Benzo(*ghi*)perylene | 2.68E+06 | EPI Suite[i] | 6.70E+00 | EPI Suite[i] | 4.70E+03 | Surrogate[o] | 1.04E-03 | Allometric[k] | 1.59E+00 | Surrogate[o] | 6.29E+00 | Allometric[m] |
| Indeno(*1,2,3-cd*)pyrene | 4.11E+06 | EPA (1998)[n] | 6.91E+00 | EPA (1998)[n] | 4.70E+03 | Surrogate[o] | 7.80E-04 | EPA (1999)[b] | 1.61E+00 | EPA (1999)[e] | 1.03E+01 | Allometric[m] |
| Phenanthrene | 5.01E+04 | EPA (1998)[n] | 4.55E+00 | EPA (1998)[n] | 4.70E+03 | Surrogate[o] | 1.82E-02 | Allometric[k] | 1.59E+00 | Surrogate[o] | 4.46E-02 | Allometric[m] |
| ***Organics-Volatiles*** | | | | | | | | | | | | |
| Methylene Chloride | 1.00E+01 | EPA (1998)[n] | 1.26E+00 | EPA (1998)[n] | 7.62E-01 | Allometric[j] | 1.46E+00 | Allometric[k] | 1.13E+00 | Allometric[l] | 2.26E-05 | Allometric[m] |

[a] EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Peer Review Draft, EPA 530 D 99 001A, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D.C. Available at http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm. Table C-3.

[b] EPA. 1999. Values in Table C-2 multiplied by 0.2 to adjust from dry weight to 80% moisture wet weight.

[c] Arithmetic mean of recommended values in Table C-6 in EPA (1999) for six inorganics with measured values.

[d] Baes, C.F., III, Sharp, R.D., Sjoreen, A.L., and Shor, R.W. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*, ORNL 5786, Oak Ridge National Laboratory, Oak Ridge, Tennessee. Figure 2.25 (F*f*) multiplied by cattle ingestion rate of 50 kg/day.

[e] EPA 1999, Table C-6.

[f] Arithmetic mean of recommended values in Table C-3 in EPA (1999) for 14 inorganics with measured values.

[g] Total chromium includes hexavalent chromium.

[h] Baes, C.F., III, Sharp, R.D., Sjoreen, A.L., and Shor, R.W. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*, ORNL 5786, Oak Ridge National Laboratory, Oak Ridge, Tennessee. Figure 2.1 (Bv) multiplied by 0.2 to adjust from dry weight to 80% moisture wet weight.

**Table M-33. Bioaccumulation Factors for Estimating Dabbling Duck Tissue Concentrations for COPCs in Sediment and Surface Water at Fuze and Booster Quarry Ponds (continued)**

[i] Software to calculate chemical properties by quantitative structure-activity relationships. EPI Suite was developed by the EPA's Office of Pollution, Prevention and Toxics and Syracuse Research Corporation. URL http://www.epa.gov/oppt/exposure/docs/episuitedl.htm.
[j] Empirically developed equation for uptake of organics by aquatic invertebrates: BCFinv = $10^{[0.819 \times \text{Log(Kow)}-1.146]}$ (Southworth, G.R., Beauchamp, J.J., and Schmieder, P.K. 1978. "Bioaccumulation Potential of Polycyclic Aromatic Hydrocarbons in Daphnia pulex," *Water Res*. 12:973–977).
[k] Empirically developed equation for uptake of organics by plants (Travis, C.C., and Arms, A.D. 1988. "Bioconcentration of Organics in Beef, Milk, and Vegetation," *Environ. Sci. Technol.* 22:271-274) multiplied by 0.2 to adjust from dry weight to 80% moisture wet weight: Bv = 0.2 x $10^{[1.588-0.578 \times \log(\text{Kow})]}$.
[l] Calculated by equilibrium partitioning (EPA 1999). BSAF = BCFinv/(foc x Koc) = $10^{[0.819 \times \text{Log(Kow)}-1.146]}/(f_{oc} \times \text{Koc})$. $f_{oc}$ is the site-specific value of 0.0675.
[m] Empirically developed equation for uptake of organics into animal tissue: BTF =$10^{[\log(\text{Kow})-7.6]}$ (Travis and Arms 1988). BAFv = BTF multiplied by cattle ingestion rate of 50 kg/day.
[n] EPA. 1998. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Peer Review Draft, EPA/530/D 98/001B, U. S. Environmental Protection Agency, Washington, D.C., available at http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm. Appendix A-3.
[o] Values for benzo(*a*)pyrene used by Science Applications International Corporation as surrogates.
BAFv = Ingestion-to-tissue uptake factor for ducks.
BCFinv = Water-to-aquatic invertebrate bioconcentration factor.
BSAF = Sediment-to-benthic invertebrate bioaccumulation factor.
Bv = Soil-to-plant bioconcentration factor.
COPC - Chemical of potential concern.
Koc = Organic carbon partitioning coefficient.
Kow = Octanol-water partitioning coefficient.
NA = Not applicable.

**Table M-34. Receptor Parameters for Mallard Ducks[a]**

| | | Receptor: | Mallard duck |
|---|---|---|---|
| | | | *(Anas platyrhynchos)* |
| **Parameter** | **Definition** | **Value** | **Reference / Notes** |
| BW | Body weight (kg) | 1.134 | Arithmetic mean adult males and females, throughout North America (EPA 1993) |
| HR | Home range (ha) | 111 | Adult females, spring, laying, North Dakota prairie potholes (EPA 1993) |
| TUF | Temporal use factor | 1 | Assumes ducks are present continuously at Ramsdell Quarry and do not migrate |
| $IR_F$ | Food ingestion rate (g/g-day = kg/kgBW/day)[a] | 0.09 | Estimated by dividing free-living metabolic rate (203 kcal/kgBW/day) by the product of the energy composition of seeds (4.26 kcal/g wet wt.) and leaves/stems (0.64 kcal/g wet wt.) times their assimilation efficiencies (0.59 and 0.23, respectively), per Table 4 in EPA 1993 |
| PF | Plant fraction | 0.5 | Assumed by SAIC to be average for harvested ducks based on interpretation of diets for males and females at different seasons |
| AF | Animal fraction | 0.5 | Assumed by SAIC to be average for harvested ducks based on interpretation of diets for males and females at different seasons |
| SF | Sediment fraction | 0.02 | Less than 2% (EPA 1993), assume 2% |
| $IR_w$ | Water ingestion rate (g/g-day = L/kgBW/day) | 0.057 | Adult, arithmetic mean, both sexes (EPA 1993) |

[a] Food ingestion rate (g/g-day) re-expressed as kg/kgBW/d is assumed not to include ingested soil; therefore, PF + AF = 1.0.
SAIC = Science Applications International Corporation.

**Table M-35. Exposure Parameters and Abiotic Media Concentrations Used to Calculate Dabbling Duck Tissue Concentrations for Human Health COPCs at Fuze and Booster Quarry Ponds**

| COPC | $K_{oc}$ (L/kg) | log ($K_{ow}$) | Aquatic Plant Bv (kg/kg) | Sediment Invertebrate BCFinv (L/kg) | Sediment Invertebrate BSAF (kg/kg) | Bird BAFv (kg/kg) | Sediment EC (mg/kg) | Surface Water EC (mg/L) | Sediment Pore Water EC (mg/L) | Aquatic Plant EC (mg/kg) | Sediment Invertebrate EC (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Inorganics*** | | | | | | | | | | | |
| Aluminum | NA | NA | 8.00E-04 | 4.07E+03 | 9.00E-01 | 7.50E-02 | 1.30E+04 | 0.00E+00 | NA | 1.04E+01 | 1.17E+04 |
| Antimony | NA | NA | 4.00E-02 | 7.00E+00 | 9.00E-01 | 5.00E-02 | 1.28E+02 | 0.00E+00 | NA | 5.12E+00 | 1.15E+02 |
| Arsenic | NA | NA | 7.20E-03 | 7.30E+01 | 9.00E-01 | 1.00E-01 | 1.92E+01 | 0.00E+00 | NA | 1.38E-01 | 1.73E+01 |
| Barium | NA | NA | 3.00E-02 | 2.00E+02 | 9.00E-01 | 7.50E-03 | 2.88E+02 | 0.00E+00 | NA | 8.64E+00 | 2.59E+02 |
| Cadmium | NA | NA | 7.30E-02 | 3.46E+03 | 3.40E+00 | 2.80E-02 | 1.89E+01 | 0.00E+00 | NA | 1.38E+00 | 6.43E+01 |
| Chromium (total) | NA | NA | 1.50E-03 | 3.00E+03 | 3.90E-01 | 2.75E-01 | 5.71E+01 | 0.00E+00 | NA | 8.57E-02 | 2.23E+01 |
| Copper | NA | NA | 8.00E-02 | 3.72E+03 | 3.00E-01 | 5.00E-01 | 2.02E+02 | 0.00E+00 | NA | 1.62E+01 | 6.06E+01 |
| Lead | NA | NA | 9.00E-03 | 5.06E+03 | 6.30E-01 | 1.50E-02 | 6.21E+02 | 0.00E+00 | NA | 5.59E+00 | 3.91E+02 |
| Mercury | NA | NA | 7.50E-03 | 2.02E+04 | 6.80E-02 | 1.25E+01 | 2.99E+01 | 0.00E+00 | NA | 2.24E-01 | 2.03E+00 |
| Vanadium | NA | NA | 1.10E-03 | 4.07E+03 | 9.00E-01 | 1.25E-01 | 2.35E+01 | 0.00E+00 | NA | 2.59E-02 | 2.12E+01 |
| Zinc | NA | NA | 2.50E-13 | 4.58E+03 | 5.70E-01 | 5.00E+00 | 1.41E+03 | 0.00E+00 | NA | 3.53E-10 | 8.04E+02 |
| ***Organics-Explosives*** | | | | | | | | | | | |
| 2-Amino-4,6-Dinitrotoluene | 1.01E+02 | 1.84E+00 | 6.69E-01 | 2.30E+00 | 3.37E-01 | 8.69E-05 | 5.37E-02 | 0.00E+00 | 7.88E-03 | 5.27E-03 | 1.81E-02 |
| 4-Amino-2,6-Dinitrotoluene | 1.01E+02 | 1.84E+00 | 6.69E-01 | 2.30E+00 | 3.37E-01 | 8.69E-05 | 1.14E-01 | 0.00E+00 | 1.67E-02 | 1.12E-02 | 3.84E-02 |
| Nitrocellulose | 1.00E+01 | -4.56E+00 | 3.35E+03 | 1.32E-05 | 1.95E-05 | 3.46E-11 | 3.94E+01 | 1.10E+00 | 5.84E+01 | 1.95E+05 | 7.68E-04 |
| Nitroglycerin | 1.31E+02 | 1.51E+00 | 1.04E+00 | 1.23E+00 | 1.39E-01 | 4.06E-05 | 1.31E+01 | 0.00E+00 | 1.48E+00 | 1.54E+00 | 1.83E+00 |
| ***Organics-Semivolatiles*** | | | | | | | | | | | |
| Benz(*a*)anthracene | 2.60E+05 | 5.68E+00 | 4.04E-03 | 1.23E+04 | 1.45E+00 | 5.99E-01 | 5.36E-01 | 0.00E+00 | 3.05E-05 | 1.23E-07 | 7.77E-01 |
| Benzo(*a*)pyrene | 9.69E+05 | 6.13E+00 | 2.02E-03 | 4.70E+03 | 1.59E+00 | 1.69E+00 | 5.22E-01 | 0.00E+00 | 7.98E-06 | 1.61E-08 | 8.30E-01 |
| Benzo(*b*)fluoranthene | 8.36E+05 | 6.20E+00 | 2.02E-03 | 4.70E+03 | 1.61E+00 | 1.99E+00 | 5.79E-01 | 0.00E+00 | 1.03E-05 | 2.07E-08 | 9.32E-01 |
| Benzo(*g,h,i*)perylene | 2.68E+06 | 6.70E+00 | 1.04E-03 | 4.70E+03 | 1.59E+00 | 6.29E+00 | 4.09E-01 | 0.00E+00 | 2.26E-06 | 2.35E-09 | 6.50E-01 |
| Indeno(1,2,3-*cd*)pyrene | 4.11E+06 | 6.91E+00 | 7.80E-04 | 4.70E+03 | 1.61E+00 | 1.03E+01 | 3.71E-01 | 0.00E+00 | 1.34E-06 | 1.04E-09 | 5.97E-01 |
| Phenanthrene | 5.01E+04 | 4.55E+00 | 1.82E-02 | 4.70E+03 | 1.59E+00 | 4.46E-02 | 3.18E-01 | 0.00E+00 | 9.40E-05 | 1.71E-06 | 4.42E-01 |
| ***Organics-Volatiles*** | | | | | | | | | | | |
| Methylene Chloride | 1.00E+01 | 1.26E+00 | 1.46E+00 | 7.62E-01 | 1.13E+00 | 2.26E-05 | 1.62E-02 | 4.70E-03 | 2.40E-02 | 3.50E-02 | 1.83E-02 |

**Notes**
BAFv = Ingested material-to-bird bioconcentration factor (kg-ingest/kg-tissue) (Table M-33).
BCFinv = Water-to-invertebrate bioconcentration factor (L/kg) from EPA (1999) (Table M-33).
BSAF = Sediment-to-invertebrate bioconcentration factor (kg-sediment/kg-tissue) from EPA (1999) (Table M-33).
Bv = Aquatic plant uptake factor; soil-to-plant uptake factor (kg-sediment/kg tissue) (Table M-33).
COPC = Chemical of potential concern (for human health).
EC = Exposure concentration. Sediment EC and surface water EC are measured values; sediment pore water EC = sediment EC/(Koc x foc).
foc = Fraction organic carbon in sediment (site-specific value of 0.0675).
Aquatic Plant EC = Larger of surface water EC x Bv and sediment pore water EC x Bv for organic COPCs; = sediment EC x Bv for metals.
Sediment Invertebrate EC = Sediment EC x BSAF for metals and organic COPCs with log Kow > 5; = sediment pore water EC x BCFinv for organic COPCs with log(Kow)<=5.
Kow = Octanol-water partitioning coefficient (for organic compounds) (Table M-33).
NA = Not applicable.

**Table M-36. Calculation of Dabbling Duck Tissue Concentrations for Human Health COPCs in Sediment and Surface Water at Fuze and Booster Quarry Ponds**

| COPC | Sediment Intake[a] (mg/kg/day) | Water Intake[b] (mg/kg/day) | Aquatic Plant Intake[c] (mg/kg/day) | Sediment Invertebrate Intake[d] (mg/kg/day) | Duck Tissue Concentration[e] (mg/kg) |
|---|---|---|---|---|---|
| ***Inorganics*** | | | | | |
| Aluminum | 2.34E+01 | 0.00E+00 | 4.68E-01 | 5.27E+02 | 8.81E+02 |
| Antimony | 2.30E-01 | 0.00E+00 | 2.30E-01 | 5.18E+00 | 5.56E+00 |
| Arsenic | 3.46E-02 | 0.00E+00 | 6.22E-03 | 7.78E-01 | 1.72E+00 |
| Barium | 5.18E-01 | 0.00E+00 | 3.89E-01 | 1.17E+01 | 1.89E+00 |
| Cadmium | 3.40E-02 | 0.00E+00 | 6.21E-02 | 2.89E+00 | 1.75E+00 |
| Chromium (total) | 1.03E-01 | 0.00E+00 | 3.85E-03 | 1.00E+00 | 6.99E+00 |
| Copper | 3.64E-01 | 0.00E+00 | 7.27E-01 | 2.73E+00 | 3.28E+01 |
| Lead | 1.12E+00 | 0.00E+00 | 2.52E-01 | 1.76E+01 | 5.99E+00 |
| Mercury | 5.38E-02 | 0.00E+00 | 1.01E-02 | 9.15E-02 | 1.45E+02 |
| Vanadium | 4.23E-02 | 0.00E+00 | 1.16E-03 | 9.52E-01 | 2.65E+00 |
| Zinc | 2.54E+00 | 0.00E+00 | 1.59E-11 | 3.62E+01 | 4.22E+03 |
| ***Organics-Explosives*** | | | | | |
| 2-Amino-4,6-Dinitrotoluene | 9.67E-05 | 0.00E+00 | 2.37E-04 | 8.14E-04 | 1.60E-06 |
| 4-Amino-2,6-Dinitrotoluene | 2.05E-04 | 0.00E+00 | 5.04E-04 | 1.73E-03 | 3.40E-06 |
| Nitrocellulose | 7.09E-02 | 6.27E-02 | 8.79E+03 | 3.46E-05 | 6.76E-06 |
| Nitroglycerin | 2.36E-02 | 0.00E+00 | 6.92E-02 | 8.21E-02 | 1.31E-04 |
| ***Organics-Semivolatiles*** | | | | | |
| Benz(*a*)anthracene | 9.65E-04 | 0.00E+00 | 5.55E-09 | 3.50E-02 | 4.62E-01 |
| Benzo(*a*)pyrene | 9.40E-04 | 0.00E+00 | 7.25E-10 | 3.73E-02 | 1.39E+00 |
| Benzo(*b*)fluoranthene | 1.04E-03 | 0.00E+00 | 9.33E-10 | 4.19E-02 | 1.84E+00 |
| Benzo(*g,h,i*)perylene | 7.36E-04 | 0.00E+00 | 1.06E-10 | 2.93E-02 | 4.06E+00 |
| Indeno(1,2,3-*cd*)pyrene | 6.68E-04 | 0.00E+00 | 4.69E-11 | 2.69E-02 | 6.11E+00 |
| Phenanthrene | 5.72E-04 | 0.00E+00 | 7.68E-08 | 1.99E-02 | 1.95E-02 |
| ***Organics-Volatiles*** | | | | | |
| Methylene Chloride | 2.92E-05 | 2.68E-04 | 1.57E-03 | 8.23E-04 | 6.57E-07 |

**Notes**

[a] Sediment Intake (mg/kg/d) = Sediment EC x $IR_S$. $IR_S$ = Sediment ingestion rate (kg/kg/d) = $IR_F$ x SF = 0.0018. SF = Incidental ingested sediment as fraction of food diet = 0.02 (Table M-34).

[b] Water Intake = Surface Water EC x $IR_W$. IRW = Water ingestion rate (L/kg/d) = 0.057 (Table M-34). Aquatic Plant Intake (mg/kg/d) = Aquatic Plant EC x $IR_P$. $IR_P$ = Plant ingestion rate (kg/kg/d) = $IR_F$ x PF = 0.045. IRF = Food ingestion rate (kg/kg/d) = 0.09 (Table M-34). PF = Plant fraction of diet = 0.5 (Table M-34).

[d] Sediment Invertebrate Intake (mg/kg/d) = Sediment Invertebrate EC x $IR_A$. $IR_A$ = Animal food ingestion rate (kg/kg/d) = $IR_F$ x AF = 0.045. AF = Animal fraction of diet = 0.5 (Table M-34).

*e* Duck Tissue Concentration (mg/kg) = BAFv x (Sediment EC x FS + Surface Water EC x FW + Aquatic Plant EC x FP + Sediment Invertebrate EC x FA). FS = Sediment EC x $IR_S$/(Sediment EC x $IR_S$ + Surface Water EC x $IR_W$ + Aquatic Plant EC x $IR_P$ + Sediment Invertebrate EC x $IR_A$). FW = Surface Water EC x $IR_W$/(Sediment EC x $IR_S$ + Surface Water EC x $IR_W$ + Aquatic Plant EC x $IR_P$ + Sediment Invertebrate EC x $IR_A$). FP = Aquatic Plant EC x $IR_P$/(Sediment EC x $IR_S$ + Surface Water EC x $IR_W$ + Aquatic Plant EC x $IR_P$ + Sediment Invertebrate EC x $IR_A$). FA = Sediment Invertebrate EC x $IR_A$/(Sediment EC x $IR_S$ + Surface Water EC x $IR_W$ + Aquatic Plant EC x $IR_P$ + Sediment Invertebrate EC x $IR_A$).

COPC = Chemical of potential concern (for human health).

**Table M-37. Dabbling Duck Tissue Concentrations for COPCs in Sediment and Surface Water at Fuze and Booster Quarry Ponds**

| COPC | Duck Tissue Concentration (mg/kg) |
|---|---|
| ***Inorganics*** | |
| Aluminum | 8.8E+02 |
| Antimony | 5.6E+00 |
| Arsenic | 1.7E+00 |
| Barium | 1.9E+00 |
| Cadmium | 1.7E+00 |
| Chromium (total) | 7.0E+00 |
| Copper | 3.3E+01 |
| Lead | 6.0E+00 |
| Mercury | 1.4E+02 |
| Vanadium | 2.7E+00 |
| Zinc | 4.2E+03 |
| ***Organics-Explosives*** | |
| 2-Amino-4,6-Dinitrotoluene | 1.6E-06 |
| 4-Amino-2,6-Dinitrotoluene | 3.4E-06 |
| Nitrocellulose | 6.8E-06 |
| Nitroglycerin | 1.3E-04 |
| ***Organics-Semivolatiles*** | |
| Benz(*a*)anthracene | 4.6E-01 |
| Benzo(*a*)pyrene | 1.4E+00 |
| Benzo(*b*)fluoranthene | 1.8E+00 |
| Benzo(*g*,*h*,*i*)perylene | 4.1E+00 |
| Indeno(1,2,3-*cd*)pyrene | 6.1E+00 |
| Phenanthrene | 2.0E-02 |
| ***Organics-Volatiles*** | |
| Methylene Chloride | 6.6E-07 |

COPC = Chemical of potential concern (for human health).

- ingestion of surface water; and
- incidental ingestion of sediment.

The values and sources of all biouptake and concentration factors used in the calculation of duck tissue concentrations are given in Table M-33.

### M3.1.1 Estimating Aquatic Plant Tissue Concentrations

The exposure concentrations (ECs) of inorganic COPCs (metals) in aquatic plant tissues eaten by dabbling ducks are assumed to result primarily from uptake from sediment by rooted aquatic plants. The resulting concentrations are estimated using soil-to-plant uptake factors (soil-to-plant Bv) reported by Hazardous Waste Remedial Actions Program (HAZWRAP) (1994), because it is assumed that the root uptake into plants of inorganics in sediment and soil is similar. That is, for inorganic COPCs in sediment,

$$\text{Aquatic Plant EC} = \text{soil-to-plant Bv} \times \text{Sediment EC}.$$

For organic COPCs, plant tissue concentrations are estimated from water-to-algae uptake factors (water-to-algae Bv) recommended in U. S. Environmental Protection Agency (EPA) guidance for screening level risk assessments at hazardous waste combustion facilities (EPA 1999). For organic COPCs, the Bv is multiplied by the larger of the measured surface water EC and estimated sediment porewater ECs, representing floating plants and rooted plants, respectively. That is, for organic COPCs,

$$\text{Aquatic Plant EC} = \text{water-to-algae Bv} \times \text{Surface Water EC}$$

or

$$\text{Aquatic Plant EC} = \text{water-to-algae Bv} \times \text{Sediment Porewater EC}.$$

The method of estimating sediment porewater ECs is described in Section M3.1.3, following the method for estimating sediment invertebrate tissue ECs.

### M3.1.2 Estimating Sediment Invertebrate Tissue Concentrations

Water-to-tissue bioconcentration factors ($BCF_{inv}$) and sediment-to-tissue bioaccumulation factors (BSAFs) are required to predict the tissue concentration in sediment invertebrates exposed to COPCs in sediment. The values used are those recommended in EPA (1999). For organic COPCs with log octanol-water partitioning coefficient ($K_{ow}$) $\leq 5$ (i.e., nitrocellulose and phenanthrene), the sediment porewater EC and $BCF_{inv}$ are used to estimate the tissue concentration in sediment invertebrates. For inorganic COPCs and organic COPCs with log $K_{ow} > 5$ [i.e., 2,4,6-trinitrotoluene and benzo(*b*)fluoranthene], the sediment EC and BSAF are used. That is, for inorganic COPCs and organic COPCs with log $K_{ow} > 5$,

$$\text{Sediment Invertebrate EC} = \text{BSAF} \times \text{Sediment EC},$$

and for organic COPCs with log $K_{ow} \leq 5$,

$$\text{Sediment Invertebrate EC} = BCF_{inv} \times \text{Sediment Porewater EC}.$$

This approach, modeled after the method of calculating fish tissue concentrations for an HHRA (EPA 1998), assumes that sediment invertebrates primarily take up COPCs either from bulk sediment or

sediment porewater as a function of the COPCs' different affinities for sediment. Inorganic COPCs (metals) and organic COPCs with log $K_{ow} > 5$ are assumed to be strongly associated with sediment. The BSAF is assumed to capture the relationship between sediment invertebrate tissue concentration and bulk sediment concentration of these COPCs resulting primarily from ingestion of sediment. The organic COPCs with log $K_{ow} \leq 5$ are assumed to be less strongly associated with sediment and, thus, reach an equilibrium with sediment porewater. The $BCF_{inv}$ for these COPCs is assumed to capture the relationship between the concentration in sediment porewater and sediment invertebrate tissue concentration resulting from direct contact and ingestion of sediment porewater.

### M3.1.3 Estimating Sediment Porewater Concentrations

Sediment porewater concentrations for organic COPCs are estimated from sediment concentrations using the product of the $K_{oc}$ and fraction organic carbon (foc) assuming equilibrium partitioning (EPA 1993b), that is,

$$\text{Sediment Porewater EC} = \text{Sediment EC}/(K_{oc} \times \text{foc}).$$

The foc is equal to the average total organic carbon concentration measured in sediment at FBQ. The $K_{oc}$ values for organic COPCs are from the EPA's *Estimation Program Interface (EPI) Suite* software (EPA 2003).

### M3.1.4 Estimating Duck Whole-body Tissue Concentrations

Bioaccumulation in the duck from the plant and animal food, water, and sediment it ingests is estimated using the bioaccumulation factors ($BAF_v$s) for small birds reported in HAZWRAP (1994). The small bird $BAF_v$s come from Baes et al. (1984) biotransfer factors (BTFs) [i.e., ingestion-to-beef transfer (Ff) values] for cattle for inorganics and BTFs for cattle for organics, calculated from log $K_{ow}$, using equations in Travis and Arms (1988).

A diet of 50% plant matter and 50% animal matter is used in the calculation of dabbling ducks' (as represented by the mallard) whole-body tissue concentrations. According to EPA (1993a), female mallards, during the breeding season, consume large amounts of animals dwelling in or on the sediment of lakes and streams, while the information for males in the Louisiana coastal marsh-prairie indicates they are primarily herbivorous during the winter. Thus, the ratio of animal-to-plant food differs by sex and by time of year. The 1:1 ratio is assumed to be representative of the diet of harvested ducks. Mallards and other dabbling ducks drink water and are likely to ingest small amounts of sediment incidentally while feeding; the calculations use a conservative value of 2% of food eaten daily for the amount of sediment ingested (EPA 1993a). The food and water ingestion rates for the mallard are given in Table M-34.

For the purposes of estimating duck tissue concentrations for human health COPCs, it is assumed that ducks spend enough time at FBQ prior to harvesting to achieve the predicted tissue concentration of COPCs via the different pathways.

The calculation of duck tissue concentrations for human health COPCs at the FBQ exposure unit is shown in Tables M-35 and M-36.

## M3.2 EXPOSURE POINT CONCENTRATIONS IN WATERFOWL TISSUE

The estimated concentrations in ducks of human health COPCs in sediment and surface water at FBQ are presented in Table M-37.

## M3.3 UNCERTAINTIES IN ESTIMATING WATERFOWL CONCENTRATIONS

Published data on whole-body tissue concentrations for ducks are not available – published data are for organs – so it is difficult to compare estimated duck tissue concentrations to published measurement data. Duck $BAF_v$ values are not for specific organs. Duck tissue concentrations of metals (e.g., chromium, lead, and zinc) may be overestimated due to the use of conservative sediment-to-sediment invertebrate bioaccumulation factors, duck biouptake factors ($BAF_v$), and duck diet (50% sediment invertebrate and 50% plant). In fact, the calculated concentration of lead in duck tissue (2.3 mg/kg) is comparable to the concentrations of lead in the liver and kidney of ducks with lead poisoning (Guitart et al. 1994). Comparisons of other COPCs are fraught with similar limitations. The predicted values are assumed to be conservative.

## M3.4 REFERENCES


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