produce liver swelling, skin lesions, disturbed heart function, and neurological effects. The only non-carcinogenic effects in humans clearly attributable to chronic oral exposure to arsenic are dermal hyperpigmentation and keratosis, as revealed by studies of several hundred Chinese exposed to naturally occurring arsenic in well water (Tseng 1977; Tseng et al. 1968; EPA 1999b). Similar effects were observed in persons exposed to high levels of arsenic in water in Utah and the northern part of Mexico (Cebrian et al. 1983; Southwick et al. 1983). Occupational (predominantly inhalation) exposure is also associated with neurological deficits, anemia, and cardiovascular effects (Ishinishi et al. 1986), but concomitant exposure to other chemicals cannot be ruled out. EPA (1999b) derived an RfD of 3.00E-04 mg/kg/day for chronic oral exposure, based on an NOAEL of 0.0008 mg/kg/day for skin lesions from the Chinese data. An uncertainty of 3 is applied to account for both the lack of data to preclude reproductive toxicity as a critical effect and to account for some of the uncertainty in whether the NOAEL of the critical study accounts for all sensitive individuals. The principal target organ for arsenic appears to be the skin. The nervous system and cardiovascular systems appear to be less significant target organs. Inorganic arsenic may be an essential nutrient, exerting beneficial effects on growth, health, and feed conversion efficiency (Underwood 1977). EPA (1999b) has not published an RfC or Inhalation RfD for arsenic.

A.3.3 Carcinogenicity

Inorganic arsenic is clearly a carcinogen in humans. Inhalation exposure is associated with increased risk of lung cancer in persons employed as smelter workers, in arsenical pesticide applicators, and in a population residing near a pesticide manufacturing plant (EPA 1999b). Oral exposure to high levels in well water is associated with increased risk of skin cancer (Tseng 1977; EPA 1999b). Extensive animal testing with various forms of arsenic given by many routes of exposure to several species, however, has not demonstrated the carcinogenicity of arsenic (International Agency for Research on Cancer [IARC] 1980). EPA (1999b) classifies inorganic arsenic in cancer weight-of-evidence Group A (human carcinogen), and recommends an oral unit risk of 0.00005 ug/L in drinking water, based on the incidence of skin cancer in the Tseng (1977) study.. EPA (1999b) published an oral SF of 1.50E+00 per mg/kg/day. EPA (1999b) notes that the uncertainties associated with the oral unit risk are considerably less than those for most carcinogens, so that the unit risk might be reduced an order of magnitude. An inhalation unit risk of 0.0043 per ug/m3, equivalent to a inhalation RfD of 1.51E+01 per mg/kg/day, was derived for inorganic arsenic from the incidence of lung cancer in occupationally exposed men (EPA 1999b).

A.4 Barium

A.5.1 Non-carcinogenic Toxicity

Barium is a naturally occurring alkaline earth metal that comprises approximately 0.04 percent of the earth's crust (Reeves 1986a). Acute oral toxicity was manifested by GI upset, altered cardiac performance, and transient hypertension, convulsions, and muscular paralysis. Repeated oral exposures were associated with hypertension. Occupational exposure to insoluble barium sulfate induced benign pneumoconiosis (ACGIH 1991). EPA (1999b) published a verified chronic oral RfD of 7.00E-02 mg/kg/day, based on an NOAEL of 0.21 mg/kg/day in a ten-week study in humans exposed to barium in drinking water and an uncertainty factor of 3. The uncertainty factor of 3 is assigned to the oral RfD to account for a lack of potential differences between adults and children. The critical effects seen

were hypertension and the data suggested possible renal effects in animal and human studies. EPA (1997) presented a Inhalation RfD of 1.43E-04 mg/kg/day based on a fetotoxicity study in rats.

A.4.2 Carcinogenicity

EPA (1999b) considers barium as not likely to be a human carcinogen, however, the lack of adequate inhalation studies preclude EPA from classifying barium as a cancer weight-of-evidence Group D substance (not classifiable as to carcinogenicity in humans).

A.5 Benzene

A.5.1 Non-carcinogenic Toxicity

In humans, short-term inhalation exposure to benzene induced CNS effects such as drowsiness, dizziness, and headaches; long-term exposure induced anemia (ACGIH 1991). Oral dosing in animals induced hematopoietic effects (ATSDR 1995c). EPA (1999a) published an oral RfD of 3.00E-03 mg/kg/day (NCEA). EPA (1999a) presented an inhalation RfD of 1.70E-03 mg/kg/day (NCEA). The immune system, hematopoietic system, and CNS are the apparent target organs of benzene.

A.5.2 Carcinogenicity

EPA (1999b) classifies benzene in cancer weight-of-evidence Group A (human carcinogen) based on several studies of increased risk of non-lymphocytic leukemia associated with occupational exposure, supported by an increased incidence of neoplasia in rats and mice exposed by inhalation and gavage. A verified oral SF of 2.90E-02 per mg/kg/day (EPA 1999b) and an inhalation SF of 2.90E-02 per mg/kg/day are based on the increased incidence of leukemia in several occupational (inhalation exposure) studies.

A.6 Beryllium

A.6.1 Non-carcinogenic Toxicity

Beryllium has a low order of toxicity when ingested because it is poorly absorbed from the GI tract (Reeves 1986b). Occupational exposure was associated with dermatitis, acute pneumonitis, and chronic pulmonary granulomatosis (berylliosis). Berylliosis was also observed in humans living in the vicinity of a beryllium plant. Similar pulmonary effects were observed in laboratory animals subjected to inhalation exposure. A verified chronic oral RfD value of 2.00E-03 mg/kg/day (EPA 1999b) was based on small intestinal lesions in a dog dietary study and an uncertainty factor of 300 (EPA 1999b). EPA (1999a) presented an inhalation RfD of 5.70E-06 mg/kg/day (NCEA). The GI Tract, respiratory and immune system are the apparent target organs of beryllium.

A.6.2 Carcinogenicity

EPA (1999b) classifies beryllium in cancer weight-of-evidence Group B1 (probable human carcinogen) based on limited evidence of carcinogenicity in human exposed to airborne beryllium (lung cancer) and sufficient evidence of carcinogenicity in animals (lung cancer in rats and monkeys inhaling beryllium, lung tumors in rats exposed to beryllium via intratracheal instillation, and osteosarcomas in rabbits and possibly mice receiving intravenous or intramedullary injection), beryllium is reclassified from a B2 to a B1 using criteria of the 1986 Guidelines for Carcinogen Risk Assessment. The oral database is considered inadequate for the assessment of carcinogenicity. An inhalation unit risk of 0.0024 per µg/m3, equivalent to 8.4 per mg/kg/day (EPA 1997) (assuming an inhalation rate of 20 m3/day and body weight of 70 kg for humans), was derived from an occupational study.

A.7 Cadmium

A.7.1 Pharmacokinetics

Estimates of cadmium uptake by the respiratory tract range from 10 to 50 percent; uptake is greatest for fumes and small particles and least for large dust particles (Friberg et al., 1986; Goyer, 1991). GI absorption of ingested cadmium is ordinarily 5 to 8 percent, but may reach 20 percent in cases of serious dietary ion deficiency. Highest tissue levels are normally found in the kidneys followed by the liver, although levels in the liver may exceed those in the kidneys of persons suffering from cadmium-induced renal dysfunction. The half-life of cadmium in the kidneys and liver may be as long as 10-30 years. Fecal and urinary excretion of cadmium are approximately equivalent to normal humans exposed to small amounts. Urinary excretion increases markedly in humans with cadmium-induced renal disease.

A.7.2 Non-carcinogenic Toxicity

Acute inhalation exposure to fumes or particles of cadmium induces respiratory symptoms, general weakness, and, in severe cases, respiratory insufficiency, shock, and death (Friberg et al., 1986). Acute oral exposure induces GI disturbances. Chronic inhalation exposure induces pulmonary emphysema, and chronic exposure by either route consistently produces renal tubular disease in humans and laboratory animals. Proteinuria is a reliable early indicator of cadmium-induced kidney disease. The combination of pulmonary emphysema and renal tubular disease, if severe, may result in early mortality. Painful osteomalacia and osteoporosis may arise from altered metabolism of bone minerals secondary to renal damage. The combination of renal and skeletal damage is called itai-itai disease in Japan. Cadmium exposure ahs been associated with liver damage, but the liver appears to be less sensitive than the kidney. The kidney is the primary target organ of cadmium toxicity. EPA (1999b) derived chronic oral RfD values of 5.00E-04 mg/kg/day for cadmium ingested in water and 1.00E-03 g/kg/day for cadmium ingested in food (solid material), based on a

toxicokinetic model that predicted NOAELs from renal cortical concentration of cadmium. The different RfD values reflect assumed differences in GI absorption of cadmium from water (5 percent) and food (2.5 percent). EPA (1999b) has not published an RfC or Inhalation RfD for cadmium.

A.7.3 Carcinogenicity

Carcinogenicity data in humans consist of several occupational studies that associate cadmium exposure with lung cancer, but concomitant exposure to other carcinogenic chemicals and smoking were not adequately controlled. Other occupational studies reported significantly increased risk of prostatic cancer, but this effect was not observed in the largest occupational study of workers exposed to high levels (Thun et al., 1985). The animal data consist of an inhalation study in rats that showed a significant increase in lung tumors, and several parenteral injection studies that produced injection site tumors. No evidence of carcinogenicity, however, was observed in seven oral studies in rats and mice. EPA (1999b) classifies cadmium a cancer weight-of-evidence Group B1 substance for inhalation exposure on the basis of limited evidence of carcinogenicity in humans and sufficient evidence in animals. The data were insufficient to classify cadmium as carcinogenic to humans exposed by the oral route. An inhalation unit risk of 0.0018 mg/m3, equivalent to 6.30E+00 per mg/kg/day, was derived from the occupational exposure study by Thun et al. (1985) assuming an inhalation rate of 20 m3/day and a body weight of 70 kg for humans.

A.8 Chloroform

A.8.1 Non-carcinogenic Toxicity

Oral or inhalation exposure of animals to chloroform was associated with liver and kidney damage (ACGIH 1991; EPA 1999b). In humans, acute inhalation exposure to high levels induced narcosis, ventricular fibrillation, and death (ACGIH 1991). Limited occupational

data associated chronic exposure to chloroform with CNS depression, digestive disturbances, and enlarged livers. EPA (1999b) presented a verified chronic oral RfD of 1.00E-02 mg/kg/day based on an LOAEL for fatty cyst formation in the livers of dogs treated orally for 7.5 years and an uncertainty factor of 1,000. EPA (1999a) presented an inhalation RfD of 8.60E-05 mg/kg/day (NCEA). Target organs for the toxicity of chloroform include the liver and kidney for oral and inhalation exposure, and the blood for inhalation exposure.

A.8.2 Carcinogenicity

Chloroform is classified as a cancer weight-of-evidence Group B2 compound (probable human carcinogen), based on increased incidence of several tumor types in rats and liver tumors in mice (EPA 1999b). Human carcinogenicity data are inadequate. An oral SF of 8.10E-02 per mg/kg/day (EPA 1999b) was derived from the incidence of kidney tumors in rats treated with chloroform in drinking water for two years. An inhalation unit risk of 2.3E-05 per µg/m3, equivalent to 6.30E+00 per mg/kg/day, was based on the incidence of hepatocellular carcinomas in mice treated by gavage for 78 weeks (EPA 1999b).

A.9 Chromium

A.9.1 Non-carcinogenic Toxicity

In nature, chromium (III) predominates over chromium (VI) (Langård and Norseth 1986). Little chromium (VI) exists in biological materials, except shortly after exposure, because reduction to chromium (III) occurs rapidly. Chromium (III) is considered a nutritionally essential trace element and is considerably less toxic than chromium (VI).

No effects were observed in rats consuming 1800 mg chromium (III)/kg/day in the diet for over two years (EPA 1999b). The NOEL of 1800 mg/kg/day and an uncertainty factor of 1,000 was the basis for a verified chronic oral RfD of 1.5E+00 mg/kg/day (EPA 1999b).

A target organ was not identified for chromium (III).

Acute oral exposure of humans to high doses of chromium (VI) induced neurological effects, GI hemorrhage and fluid loss, and kidney and liver effects. Parenteral dosing of animals with chromium (VI) is selectively toxic to the kidney tubules. An NOAEL of 2.4 mg chromium (VI)/kg/day in a one-year drinking water study in rats was the basis of a verified RfD of 3.00E-03 mg/kg/day for chronic oral exposure (EPA 1999b). An uncertainty factor of 300 represents two 10-fold decreases in dose to account for both the expected interhuman and interspecies variability in the toxicity of the chemical in lieu of specific data and an additional factor of 3 to compensate for the less-than-lifetime exposure duration of the study (EPA 1999b). The kidney may be the principal target organ for repeated oral dosing with chromium (VI), but effects seen in the principal RfD study were increased levels of chromium (VI) in kidneys, livers, and femurs of test subjects.

EPA (1999b) published an inhalation RfC of 0.0004 mg/m3, equivalent to 2.86E-05 mg/kg/day, based on a BMD of 0.016 mg/m3 in a rat subchronic study. Critical effects seen were lactate dehydrogenase in bronchioalveolar lavage fluid. An uncertainty factor of 300 was also applied to the inhalation RfC based on a accounting for pharmacodyna differences not accounted for, and a 10-fold factor to account for the less than lifetime exposure and a 10-fold factor to account for variation in the human population (EPA 1988).

A.9.2 Carcinogenicity

Data were not located regarding the carcinogenicity of chromium (III). EPA (1999b) classifies chromium (VI) in cancer weight-of-evidence Group D (not classifiable regarding human carcinogenicity), via the oral route of exposure. EPA (1999b) classifies chromium (VI) in cancer weight-of-evidence Group A (human carcinogen), via inhalation exposure based on the consistent observation of increased risk of lung cancer in occupational studies of workers in chromate production or the chrome pigment industry. Parenteral dosing of animals with chromium (VI) compounds consistently induced injection-site tumors. inhalation unit risk of 0.012 per ug/m3, equivalent to 4.10E+01 per mg/kg/day (EPA 1999b), assuming humans inhale 20 m3/day and weigh 70 kg, was based on increased risk of lung cancer deaths in chromate production workers.

A.10 Cobalt

A.10.1 Non-carcinogenic Toxicity

Acute high oral or parenteral doses of cobalt in humans or animals induced myocardial degeneration often leading to mortality, erythropoiesis, enlarged thyroid, and, in animals, renal tubular degeneration (Elinder and Friberg 1986). Chronic ingestion from the consumption of beer containing high concentrations of cobalt was associated with "beer-drinkers cardiomyopathy," which includes polycythemia and goiter, as well as marked myocardial degeneration and mortality. The therapeutic use of 0.16 to 0.32 mg cobalt/kg/day in anemic, anephric dialysis patients for 12 to 32 weeks induced a significant, but reversible, rise in blood hemoglobin concentration (EPA 1992).

Occupational (inhalation and dermal) exposure was associated with allergic dermatitis, chronic interstitial pneumonitis, reversibly impaired lung function, occupational asthma, and

myocardial effects (ACGIH 1991). Cobalt was determined to be the etiologic factor in hard metal disease, the syndrome of respiratory symptoms, and pneumoconiosis associated with inhalation exposure to dusts containing tungsten carbide with cobalt powder as a binder (Elinder and Friberg 1986). The lowest occupational air concentration of cobalt associated with hard metal disease was 0.003 mg cobalt/m3 (Sprince et al. 1988). It should be noted that the workers were also exposed to tungsten and sometimes to titanium, tantalum, and niobium (Elinder and Friberg 1986). Similar lung effects were seen in animals exposed to cobalt by inhalation.

The developmental toxicity of cobalt was tested in rodents treated orally with cobalt chloride (EPA 1992). Maternal effects (unspecified) were reported in rats treated with 5.4 to 21.8 mg cobalt/kg/day from gestation day 14 through lactation day 21. Effects on the offspring included stunted growth at 5.4 mg cobalt/kg/day and reduced survival at 21.8 mg cobalt/kg/day. In rats treated with 6.2, 12.4, or 24.8 mg cobalt/kg/day on gestation days 6 through 15, maternal effects included reduced food consumption and body weight gain and altered hematologic parameters, although it is unclear at what dose level(s) these effects occurred. There were no effects on fetal survival, although a nonsignificant increase in fetal stunting was observed in rats treated with 12.4 mg cobalt/kg/day. Mice treated with 81.7 mg cobalt/kg/day had reduced maternal weight gain, but no fetal effects.

Several studies reported testicular degeneration and atrophy in rats treated with cobalt chloride in the diet or drinking water at concentrations equivalent to doses of 5.7 to 30.2 mg cobalt/kg/day (EPA 1992). Cobalt is nutritionally essential as a cofactor in cyanocobalamin (vitamin B12) (EPA 1992). Cobalt is universally present in the diet. Average daily adult dietary intakes of cobalt range from 0.16 to 0.58 mg/day (0.002 to 0.008 mg/kg/day, assuming adults weigh 70 kg) (Tipton et al. 1966; Schroeder et al. 1967). In 9- to 12-year-old children, dietary intakes of cobalt range from 0.3 to 1.77 mg/day (Murthy et al. 1971; National Research Council 1989). Assuming an average weight for children in this age

range of 28 kg (National Research Council, 1989), the dietary intakes are equivalent to 0.01 to 0.06 mg/kg/day.

EPA (1999a) presented an oral RfD for cobalt of 6.00E-02 mg/kg/day based on the upper range of dietary intake for children (NCEA). Important target organs in orally exposed humans are the heart and erythrocyte. EPA (1999b) has not published an RfC or Inhalation RfD for cobalt.

A.10.2 Carcinogenicity

Data regarding the carcinogenicity of cobalt were not available (EPA 1999b).

A.11 Cyanide

A.11.1 Non-carcinogenic Toxicity

EPA (1999b) published a oral RfD of 2.00E-02 mg/kg/day for cyanide based on a NOAEL in a rat chronic oral feeding study based on effects measured such as weight loss, thyroid effects, and myelin degeneration. EPA (1999b) has not published an RfC or Inhalation RfD for cyanide.

A.11.2 Carcinogenicity

EPA (1999b) classifies cyanide in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans).

A.12 2,4-Dimethylphenol

A.12.1 Non-carcinogenic Toxicity

EPA (1999b) published a oral RfD of 2.00E-02 mg/kg/day for 2,4-dimethylphenol based on a NOAEL in a ninety-day gavage study in Albino mice using 2,4-dimethylphenol. EPA (1999b) has not published an RfC or Inhalation RfD for 2,4-dimethylphenol.

A.1 2.2 Carcinogenicity

2,4-Dimethylphenol has not undergone a complete evaluation and determination under US EPA's IRIS program for evidence of human carcinogenic potential (EPA 1999b).

A.13 Iron

A.13.1 Non-carcinogenic Toxicity

Iron is potentially toxic in all forms and by all routes of exposure. Inorganic iron is a poison by the intraperitoneal route. The inhalation of large amounts of iron dust may result in iron pneumoconiosis or arc welders lung. Chronic exposure to excess levels of iron (>50-100 mg Iron/day) can result in pathological deposition of iron in tissues. The target organs are the pancreas and liver (Sax and Lewis 1989).

Iron compounds are of varying toxicity. Iron oxides are a potential risk in all industrial settings. In general, ferrous compounds are more toxic than ferric compounds. Acute exposure to excessive levels of ferrous compounds can cause liver and kidney damage, altered respiratory rates and convulsions (Sax and Lewis 1989). An oral RfD of 3.00E-01 mg/kg/day has been published for iron by EPA (ECAO). EPA (1999b) has not published an RfC or Inhalation RfD for iron.

A.13.2 Carcinogenicity

Some iron compounds are suspected human carcinogens. Iron dust is an experimental

neoplastigen and an increased incidence of lung cancer has been associated with exposure to iron dust. Iron oxide is an experimental tumorigen and a suspected human carcinogen. (Sax and Lewis 1989). EPA (1999b) has not published oral or inhalation SFs for iron.

A.14 Lead

A.14.1 Pharmacokinetics

Studies in humans indicate that an average of 10 percent of ingested lead is absorbed, but estimates as high as 40 percent were obtained in some individuals (Tsuchiya 1986). Nutritional factors have a profound effect on GI absorption efficiency. Children absorb ingested lead more efficiently than adults; absorption efficiencies up to 53 percent were recorded for children three months to eight years of age. Similar results were obtained for laboratory animals; absorption efficiencies of 5 to 10 percent were obtained for adults and 50 percent were obtained for young animals. The deposition rate of inhaled lead averages approximately 30 to 50 percent, depending on particle size. All lead deposited in the lungs is eventually absorbed.

Approximately 95 percent of the lead in the blood is located in the erythrocytes (EPA 1991a). Lead in the plasma exchanges with several body compartments, including the internal organs, bone, and several excretory pathways. In humans, lead concentrations in bone increase with age (Tsuchiya 1986). About 90 percent of the body burden of lead is located in the skeleton. Neonatal blood concentrations are about 85 percent of maternal concentrations. Excretion of absorbed lead is principally through the urine, although GI secretion, biliary excretion, and loss through hair, nails, and sweat are also significant.

A.14.2 Non-carcinogenic Toxicity

The non-carcinogenic toxicity of lead to humans has been well characterized through decades of medical observation and scientific research (EPA 1999b). The principal effects of acute oral exposure are colic with diffuse paroxysmal abdominal pain (probably due to vagal irritation), anemia, and, in severe cases, acute encephalopathy, particularly in children (Tsuchiya 1986). The primary effects of long-term exposure are neurological and hematological. Limited occupational data indicate that long-term exposure to lead may induce kidney damage. The principal target organs of lead toxicity are the erythrocyte and the nervous system. Some of the effects on the blood, particularly changes in levels of certain blood enzymes, and subtle neurologic behavioral changes in children, appear to occur at levels so low as to be considered non-threshold effects.

EPA (1999b) presents no inhalation RfC for lead, but referred to the National Ambient Air Quality Standard (NAAQS) for lead. The NAAQSs are based solely on human health considerations and are designed to protect the most sensitive subgroup of the human population. The NAAQS for lead is 1.5 ug/m3, averaged quarterly (EPA 1999b).

EPA (1991a, 1999b) determined that it is inappropriate to derive an RfD for oral exposure to lead for several reasons. First, the use of an RfD assumes that a threshold for toxicity exists, below which adverse effects are not expected to occur; however, the most sensitive effects of lead exposure, impaired neurologic behavioral development in children and altered blood enzyme levels associated with anemia, may occur at blood lead concentrations so low as to be considered practically non-threshold in nature. Second, RfD values are specific for the route of exposure for which they are derived. Lead, however, is ubiquitous, so that exposure occurs from virtually all media and by all pathways simultaneously, making it practically impossible to quantify the contribution to blood lead from any one route of exposure. Finally, the dose-response relationships common to many toxicants, and upon

which derivation of an RfD is based, do not hold true for lead. This is because the fate of lead within the body depends, in part, on the amount and rate of previous exposures, the age of the recipient, and the rate of exposure. There is, however, a reasonably good correlation between blood lead concentration and effect. Therefore, blood lead concentration is the appropriate parameter on which to base the regulation of lead.

EPA IEUBK lead model is an iterated set of equations that estimate blood lead concentration in children aged 0 to 7 years (EPA 1991a; 1991b). The biokinetic part of the model describes the movement of lead between the plasma and several body compartments and estimates the resultant blood lead concentration. The rate of the movement of lead between the plasma and each compartment is a function of the transition or residence time (i.e., the mean time for lead to leave the plasma and enter a given compartment, or the mean residence time for lead in that compartment). Compartments modeled include the erythrocytes, liver, kidneys, all the other soft tissue of the body, cortical bone, and trabecular bone. Excretory pathways and their rates are also modeled. These include the mean time for excretion from the plasma to the urine, from the liver to the bile, and from the other soft tissues to the hair, skin, sweat, etc. The model permits the user to adjust the transition and residence times.

EPA guidance establishes an interim soil cleanup level for lead of 400 parts per million (ppm) to be applied at Superfund sites. This value is considered by EPA to be protective for direct contact with lead-contaminated soils in residential settings. The guidance is to be followed when current or predicted land use is residential.

A.15.3 Carcinogenicity

EPA (1999b) classifies lead in cancer weight-of-evidence Group B2 (probable human carcinogen), based on inadequate evidence of cancer in humans and sufficient animal evidence. The human data consist of several epidemiological occupational studies that yielded confusing results. All of the studies lacked quantitative exposure data and failed to control for smoking and concomitant exposure to other possibly carcinogenic metals. Rat and mouse bioassays showed statistically significant increases in renal tumors following dietary and subcutaneous exposure to several soluble lead salts. Various lead compounds were observed to induce chromosomal alterations in vivo and in vitro, sister chromatid exchange in exposed workers, and cell transformation in Syrian hamster embryo cells; to enhance simian adenovirus induction; and to alter molecular processes that regulate gene expression. EPA (1999b) declined to estimate risk for oral exposure to lead because many factors (e.g., age, general health, nutritional status, existing body burden and duration of exposure) influence the bioavailability of ingested lead, introducing a great deal of uncertainty into any estimate of risk.

A.16 Manganese

A.16.1 Non-carcinogenic Toxicity

Manganese is nutritionally required in humans for normal growth and health (EPA 1999b). The elderly appeared to be more sensitive than children. Oral treatment of laboratory rodents induced biochemical changes in the brain, but rodents did not exhibit the neurological signs exhibited by humans. Occupational exposure to high concentrations in air induced a generally typical spectrum of neurological effects, and increased incidence of pneumonia (ACGIH 1986).

EPA (1999b) published an oral RfD for manganese of 0.024 mg/kg/day based on drinking

water and an oral RfD of 0.14 mg/kg/day based on food. EPA (1999b) presented a verified chronic inhalation RfC based on a LOAEL for impairment of neurobehavioral function in occupationally exposed humans. The inhalation RfC is equivalent to 1.43E-05 mg/kg/day, assuming humans inhale 20 m3 of air/day and weigh 70 kg. The CNS and respiratory tract are target organs of inhalation exposure to manganese.

A.16.2 Carcinogenicity

EPA (1999b) classifies manganese in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans).

A.17 2-Methylphenol

A.17.1 Non-carcinogenic Toxicity

EPA (1999b) published an oral RfD of 5.00E-02 mg/kg/day for 2-methylphenol based on a NOAEL in a ninety-day oral toxicity and neurotoxicity study in rats. EPA (1999b) has not published an RfC or Inhalation RfD for 2-methylphenol.

A.17.2 Carcinogenicity

EPA (1999b) classifies 2-methylphenol in cancer weight-of-evidence Group C (possible human carcinogen), based on inadequate human data and limited animal data. The animal data was based on an increased incidence of skin papillomas in mice in an initiation-promotion study. The three cresol isomers produced positive results in genetic toxicity studies both alone and in combination. EPA (1999b) did not establish an oral SF and/or an inhalation unit risk for 2-methylphenol.

A.18 4-Methylphenol

A.18.1 Non-carcinogenic Toxicity

EPA (1997) published a oral RfD of 5.00E-03 mg/kg/day for 4-methylphenol based on CNS, respiratory, and whole body effects in a rabbit gavage study. EPA (1999b) has not published an RfC or Inhalation RfD for 4-methylphenol.

A.18.2 Carcinogenicity

EPA (1999b) classifies 4-methylphenol in cancer weight-of-evidence Group C (possible human carcinogen), based on inadequate human data and limited animal data. The animal data was based on an increased incidence of skin papillomas in mice in an initiation-promotion study. The three cresol isomers produced positive results in genetic toxicity studies both alone and in combination. EPA (1999b) did not establish an oral SF and/or an inhalation unit risk for 4-methylphenol.

A.19 Mercury

Mercury occurs in three forms: elemental, organic, and inorganic. Although the toxicity of all forms is mediated by the mercury cation, the extent of absorption and pattern of distribution within the body, which determines the effects observed, depends on the form to which the organism is exposed (Goyer 1991). Bacterial activity in the environment converts inorganic mercury to methyl mercury (Berlin 1986). It is likely that either inorganic mercury or methyl mercury may be taken up by plants and enter the food chain, and this discussion will focus on inorganic and methyl mercury. Exposure to elemental mercury, which is more likely to occur in an occupational setting, is not discussed herein.

A.19.1 Pharmacokinetics

The GI absorption of inorganic mercury salts is about 2 to 10 percent in humans, and slightly higher in experimental animals (Berlin 1986; Goyer 1991). Inorganic mercury in the blood is roughly equally divided between the plasma and erythrocytes. Distribution is preferentially to the kidney, with somewhat lower concentrations found in the liver, and even lower levels found in the skin, spleen, testes, and brain (Berlin 1986). Inorganic mercury is excreted principally through the feces and urine, with minor pathways including the secretions of exocrine glands and exhalation of elemental mercury vapor.

Methyl mercury is nearly completely (90 to 95 percent) absorbed from the GI tract (Berlin 1986). The concentration of methyl mercury in the erythrocytes is about 10 times that in the plasma. Methyl mercury leaves the blood slowly, showing particular affinity for the brain, particularly in primates. In rats, 1 percent of the body burden of methyl mercury is found in the brain, but in humans, 10 percent of the body burden is found in the brain. Somewhat lower levels are found in the liver and kidney. During pregnancy, methyl mercury accumulates in the fetal brain, often at levels higher than in the maternal brain. Most tissues except the brain transform methyl mercury to inorganic mercury. Excretion of methyl mercury is principally via the bile, with a half-life of 70 days in humans not suffering from toxicity. Following exposure to methyl mercury, some of the mercury in the bile exists as methyl mercury and some as the inorganic form. The inorganic form is largely passed in the feces, but methyl mercury is subject to enterohepatic recirculation. Another important excretory pathway for methyl mercury is lactation.

G.19.2 Non-carcinogenic Toxicity

Target organs for inorganic or methyl mercury include the kidney, nervous system, fetus, and neonate. Acute oral exposure to high doses of inorganic mercury causes severe damage to the GI mucosa because of the corrosive nature of mercury salts, which may lead to bloody diarrhea, shock, circulatory collapse, and death (Berlin 1986a; Goyer 1991). Acute sublethal poisoning induces severe kidney damage. Chronic exposure induces an autoimmune glomerular disease and renal tubular injury. Acute or chronic exposure to methyl mercury leads to neurologic dysfunction (Berlin 1986a; Goyer 1991). The region of the nervous system affected is species-dependent. Methyl mercury poisoning in rats induces peripheral nerve damage and kidney effects. In humans, the sensory cortex appears to be the most sensitive. The brain of the fetus and the neonate may be unusually sensitive to methyl mercury; retarded neurologic development was observed in prenatally exposed children whose mothers showed no clinical signs of poisoning. EPA (1999b) published an oral RfD of 1.00E-04 mg/kg/day for exposure to methyl mercury based on neurological effects in environmentally exposed humans. An intake of 3 ug/kg/day was the LOAEL corresponding to a blood level of 200 ng/mL, which was associated with CNS effects. An uncertainty factor of 10 was used to estimate an NOAEL from an LOAEL. An inhalation RfC of 0.0003 mg/kg/day (uncertainty factor of 30) has been established for inorganic mercury based on neurotoxic effects in humans. This translates into a chronic RfD of 8.60E-05 mg/kg/day (EPA 1999b).

G.19.3 Carcinogenicity

EPA (1999b) classifies inorganic mercury in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans), based on no data regarding cancer in humans, and inadequate animal and supporting data. EPA (1999b) has not yet evaluated the carcinogenicity of organic mercury.

A.20 Nickel

A.20.1 Non-carcinogenic Toxicity

In a subchronic gavage study with nickel chloride in water, clinical signs of toxicity in rats included lethargy, ataxia, irregular breathing, reduced body temperature, salivation, and discolored extremities (EPA 1996). Inhalation exposure was associated with asthma and pulmonary fibrosis in welders using nickel alloys (ACGIH 1986). Lung effects were observed in laboratory animals exposed by inhalation. EPA (1999b) presented a verified RfD of 2.00E-02 for chronic oral exposure to nickel, based on an NOAEL for decreased organ and body weights in a two-year dietary study with nickel sulfate in rats and an uncertainty factor of 300. The nickel RfD is based on decreased organ wieght. The lung is clearly the target organ for inhalation exposure even though EPA (1999b) has not published an RfC or Inhalation RfD for nickel.

A.20.2 Carcinogenicity

Occupational exposure to nickel was associated with increased risk of nasal, laryngeal and lung cancer (ATSDR 1995a). Inhalation exposure of rats to nickel subsulfide increased the incidence of lung tumors. EPA (1999b) presents a cancer weight-of-evidence Group A classification (human carcinogen) for nickel refinery dust. No oral SF or inhalation unit risk was established for elemental nickel, therefore, carcinogenic exposures for nickel are not estimated at this site.

A.21 Phenol

A.21.1 Noncancer Toxicity

EPA (1999b) published a oral RfD of 6.00E-01 mg/kg/day based on a NOAEL of reduced fetal body weights in a teratologic evaluation of phenol in CD rats and mice. EPA (1999b) has not published an RfC or Inhalation RfD for phenol.

A.21.2 Carcinogenicity

Phenol was classified in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans) (EPA 1999b).

A.22 Polyaromatic Hydrocarbons (Carcinogenic)

A.22.1 Pharmacokinetics

Although quantitative absorption data for the PAHs were not located, benzo(a)pyrene was readily absorbed across the GI (Rees et al. 1971) and respiratory epithelia (Kotin et al. 1969; Vainich et al. 1976). The high lipophilicity of other compounds in this class suggests that other PAHs also would be readily absorbed across GI and respiratory epithelia.

Benzo(a)pyrene was distributed widely in the tissues of treated rats and mice, but primarily to tissues high in fat, such as adipose tissue and mammary gland (Kotin et al. 1969; Schlede et al. 1970a). Patterns of tissue distribution of other PAHs would be expected to be similar because of the high lipophilicity of the members of this class.

Studies of the metabolism of benzo(a)pyrene provide information relevant to other PAHs because of the structural similarities of all members of the class. Metabolism involves microsomal mixed function oxidase hydroxylation of one or more of the phenyl rings with the formation of phenols and dihydrodiols, probably via formation of arene oxide intermediates (EPA 1979a). The dihydrodiols may be further oxidized to diol epoxides,

which, for certain members of the class, are known to be the ultimate carcinogens (LaVoie et al. 1982). Conjugation with glutathione or glucuronic acid, and reduction to tetrahydrotetrols are important detoxification pathways. Metabolism of naphthalene resulted in the formation of 1,2-naphthoquinone, which induced cataract formation and retinal damage in rats and rabbits.

Excretion of benzo(a)pyrene or dibenz(a,h)anthracene residues was reported to be rapid, although quantitative data were not located (EPA 1979b). Excretion occurred mainly via the feces, probably largely due to biliary secretion (Schlede et al. 1970a, 1970b). EPA (1980) concluded that accumulation in the body tissues of PAHs from chronic low level exposure would be unlikely.

A.22.2 Non-carcinogenic Toxicity

Oral noncancer toxicity data are available for dibenzofuran, fluoranthene, fluorene, 2-methylnaphthalene, naphthalene, and pyrene. EPA (1997, 1999a, 1999b) has not established oral RfDs or inhalation RfCs for the carcinogenic PAHs including benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

EPA (1999a) presented a oral RfD of 4.00E-03 mg/kg/day for dibenzofuran (NCEA). The target organ dibenzofuran exposure is the kidney. EPA (1999b) has not published an RfC or Inhalation RfD for dibenzofuran.

Fluoranthene appears to be toxic to the liver, kidney, and blood. In a comprehensive 13-week gavage study in mice, 125 mg/kg/day was an NOAEL and 250 mg/kg/day was an LOAEL (EPA 1988). The verified chronic oral RfD for fluoranthene is 4.00E-02 mg/kg/day, based on the NOAEL in a comprehensive 13-week gavage study of 125

mg/kg/day in mice and an uncertainty factor of 3000 (EPA 1999b). The uncertainty factor of 3000 includes factors of 10 each for inter- and intraspecies variation, and a factor of 30 to expand from subchronic to chronic exposure and to reflect an incomplete database. The liver, kidney, and blood appear to be the target organs for the toxicity of fluoranthene. EPA (1999b) has not published an RfC or Inhalation RfD for fluoranthene.

The critical effects of oral exposure to fluorene appear to be hemolytic anemia and CNS effects. In mice treated by gavage for 13 weeks, 125 mg/kg/day was an NOAEL and 250 mg/kg/day was an LOAEL (EPA 1989b). A verified chronic oral RfD for fluorene of 4.00E-02 mg/kg/day was based on the NOAEL of 125 mg/kg/day for hemolytic anemia in mice (EPA 1999b). An uncertainty factor of 3000 was used with factors of 10 each for inter- and intraspecies variation and to expand from subchronic to chronic exposure, and a factor of 3 to reflect gaps in the database. The target organs of fluorene toxicity are the erythrocyte and the CNS. EPA (1999b) has not published an RfC or Inhalation RfD for fluorene.

Newborn infants, children, and adults exposed to naphthalene by ingestion, inhalation, or possibly by skin contact developed hemolytic anemia with jaundice and, occasionally, renal disease (EPA 1980). EPA (1999b) established a oral RfD of 2.00E-02 mg/kg/day for naphthalene based on a NOAEL in an unpublished subchronic toxicity study using Fischer 344 rats. The effects of the study included mean terminal body weights in male Fischer 344 rats. EPA (1999b) has published an Inhalation RfD of 9.00E-04 for naphthalene.

EPA (1999a) presented a oral RfD of 2.00E-02 mg/kg/day for 2-methylnaphthalene (NCEA). This is based on the likelihood that 2-methylnaphthalene is no more toxic than naphthalene. The target organ for 2-methylnaphthalene exposure is weight loss. EPA (1999b) has not published an RfC or Inhalation RfD for 2-methylnaphthalene.

Mild kidney lesions appear to be the critical effects of pyrene. In mice treated by gavage for 13 weeks, 75 mg/kg/day was an NOAEL and 125 mg/kg/day was an LOAEL (EPA 1989c). Even in mice treated with 250 mg/kg/day the lesions were considered minimal to mild. EPA (1999b) verified a chronic oral RfD for pyrene of 3.00E-02 mg/kg/day based on the NOAEL in mice and an uncertainty factor of 3000 (10 each for inter- and intraspecies variation and to expand from subchronic to chronic exposure, and a factor of 3 to reflect gaps in the database). The kidney is the target organ for the toxicity of pyrene. EPA (1999b) has not published an RfC or Inhalation RfD for pyrene.

A.22.3 Carcinogenicity

The PAHs are ubiquitous, being released to the environment from anthropogenic as well as from natural sources (ATSDR 1987). Benzo(a)pyrene is the most extensively studied member of the class, inducing tumors in multiple tissues of virtually all laboratory species tested by all routes of exposure. Although epidemiology studies suggested that complex mixtures that contain PAHs (coal tar, soot's, coke oven emissions, cigarette smoke) are carcinogenic to humans, the carcinogenicity cannot be attributed to PAHs alone because of the presence of other potentially carcinogenic substances in these mixtures (ATSDR 1987). In addition, recent investigations showed that the PAH fraction of roofing tar, cigarette smoke, and coke oven emissions accounted for only 0.1 to 8 percent of the total mutagenic activity of the unfractionated complex mixture in Salmonella (Lewtas 1988). Aromatic amines, nitrogen heterocyclic compounds, highly oxygenated quinones, diones, and nitrooxygenated compounds, none of which would be expected to arise from in vivo metabolism of PAHs, probably accounted for the majority of the mutagenicity of coke oven emissions and cigarette smoke. Furthermore, coal tar, which contains a mixture of many PAHs, has a long history of use in the clinical treatment of a variety of skin disorders in humans (ATSDR 1987).

Because of the lack of human cancer data, assignment of individual PAHs to EPA cancer weight-of-evidence groups was based largely on the results of animal studies with large doses of purified compound. Frequently, unnatural routes of exposure, including implants of the test chemical in beeswax and trioctanoin in the lungs of female Osborne-Mendel rats, intratracheal instillation, and subcutaneous or intraperitoneal injection, were used. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were classified in Group B2 (probable human carcinogens) (EPA 1997, 1999b).

EPA (1999b) verified a SF for oral exposure to benzo(a)pyrene of 7.3 per mg/kg/day, based on several dietary studies in mice and rats. Neither verified nor provisional quantitative risk estimates were available for the other PAHs in Group B2. EPA (1980) promulgated an ambient water quality criterion for "total carcinogenic PAHs," based on an oral SF derived from a study with benzo(a)pyrene, as being sufficiently protective for the class. Largely because of this precedent, the quantitative risk estimates for the other carcinogenic PAHs were based on benzo(a)pyrene when quantitative estimates were needed.

Recent reevaluations of the carcinogenicity and mutagenicity of the Group B2 PAHs suggest that there are large differences between individual PAHs in cancer potency (Krewski et al., 1989). Based on the available cancer and mutagenicity data, and assuming that there is a constant relative potency between different carcinogens across different bioassay systems and that the PAHs under consideration have similar dose-response curves, Thorslund and Charnley (1988) derived relative potency values for several PAHs. A more recent Relative Potency Factor (RPF) scheme for the Group B2 PAHs was based only on the induction of lung epidermoid carcinomas in female Osborne-Mendel rats in the lung-implantation experiments (Clement International 1990).

Carcinogenic PAHs are related by chemical structure. All other carcinogenic PAHs except

carbazole have SFs based on their potency relative to benzo(a)pyrene. These factors are published by EPA (Clement International 1990). The relative potency factors are as follows for the carcinogenic PAHs:

Constituent	Relative Potency Factor
Benzo(a)pyrene	1.0
Benz(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.01
Chrysene	0.001
Dibenz(a,h)anthracene	1.0
Indeno(1,2,3-cd)pyrene)	0.1

Carbazole had an EPA (1999b) listed oral SF of 2E-02 per mg/kg/day. The SF was based on a observations of liver tumors in mice.

EPA (1999a) presented an inhalation SF of 3.1E-01 per mg/kg/day (NCEA) for benzo(a)pyrene. The other carcinogenic PAHs do not have established inhalation SFs and are not subjected to toxicity equivalency factors regarding inhalation criteria.

A.23 Selenium

A.23.1 Noncancer Toxicity

Selenium is a nutritionally essential trace element that is an integral part of the enzyme glutathione peroxidase and other proteins (Högberg and Alexander 1986). The National Research Council (1989) recommended dietary allowances (RDAs) for humans range from 10 to 75 mg/day. Chronic ingestion of 5 mg/day (0.071 mg/kg/day, assuming humans weigh 70 kg) induced selenosis in humans, characterized by abnormal hair and nail

formation (Högberg and Alexander 1986). Effects in domestic grazing animals exposed to high levels of selenium included emaciation, lameness, and loss of hair and hooves. Occupational exposure to selenium fume or various selenium compounds was associated with intense ocular and respiratory tract irritation, chemical pneumonia, skin rashes, garlic odor to the breath, metallic taste in the mouth, and various socio-psychological effects (ACGIH 1986). EPA (1999b) presented a verified RfD of 5.00E-03 mg/kg/day for chronic oral exposure to selenourea, based on effects in humans exposed to selenium in high selenium areas. An uncertainty factor of 3 was used. The principal target organs for oral exposure to selenium are the skin, including the nails and hair, and, in animals, the hooves and joints. Targets for inhalation or dermal exposure include the skin and mucous membranes of the eyes and respiratory tract, and possibly the CNS. EPA (1999b) has not published an RfC or Inhalation RfD for selenium.

A.23.2 Carcinogenicity

An impressive body of data indicates that selenium exerts an anticarcinogenic effect (Högberg and Alexander 1986). In laboratory animals, selenium supplementation decreased the incidence of chemical-induced cancers. In humans, the incidence of lymphomas and cancers of the breast, digestive tract, and lung were lower in geographic areas with high soil selenium levels. Occupational data suggest that selenium may protect against lung cancer. Several animal tests with various deficiencies in design and conduct equivocally associated exposure to selenium with cancer induction. In a well controlled oral experiment, selenium sulfide was associated with an increase in the incidence of liver tumors in rats, and with liver and lung tumors in mice. On the basis of this study, EPA (1999b) classified selenium sulfide a cancer weight-of-evidence Group B2 compound (probable human carcinogen), but declined to derive quantitative risk estimates. Selenium and other selenium compounds were classified in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans) (EPA 1999b).

A.24 Thallium

A.24.1 Non-carcinogenic Toxicity

Thallium is highly toxic; acute ingestion by humans or laboratory animals induced gastroenteritis, neurological dysfunction, and renal and liver damage (Kazantis, 1986). Chronic ingestion of more moderate doses characteristically caused alopecia. Thallium was used medicinally to induce alopecia in cases of ringworm of the scalp, sometimes with disastrous results. Ininudstrial (inhlation, oral, dermal) exposure, neurologic signs preceded alopecia, suggesting that the nervous system is more sensitive than the hair follicle. EPA (1999b) presented verified chronic oral RfD values for several thallium compounds (thallium acetate, thallium carbonate, thallium chloride, thallium nitrate, thallium sulfate, and thallic oxide) based on increased incidence of alopecia and increased serum levels of liver enzymes indicative of hepatocellular damage in rats treated with thallium sulfate for 90 days. EPA (1999a) presented a chronic oral RfD for thallium of 7.00E-05 mg/kg/day (NCEA). This is based on adjusting the IRIS RfDs for thallium compounds by the weight of thallium. EPA (1999b) has not published an RfC or Inhalation RfD for thallium.

A.24.2 Carcinogenicity

Several thallium compounds (thallium oxide, thallium acetate, thallium carbonate, thallium chloride, thallium nitrate, thallium sulfate) were classified as cancer weight-of-evidence Group D substances (not classifiable as to carcinogenicity to humans) (EPA 1994, 1999b). No weight-of-evidence classification was located for thallium alone.

A.25 Vanadium

A.25.1 Non-carcinogenic Toxicity

In a chronic study, an unspecified number of rats were exposed to dietary levels of 10 or 100 ppm vanadium (about 17.9 or 179 ppm vanadium pentoxide) for 2.5 years. The results of this unpublished study were summarized by Stokinger et al. (1981). The criteria used to evaluate vanadium toxicity were growth rate, survival, and hair cystine content. The only significant change reported was a decrease in the amount of cystine in the hair of animals ingesting vanadium. EPA (1997) presented an oral RfD of 7.00E-03 mg/kg/day based on a NOAEL in a lifetime rat drinking water study. EPA (1999b) has not published an RfC or Inhalation RfD for vanadium.

A.25.2 Carcinogenicity

EPA (1999b) classifies vanadium in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans).

A.26 Zinc

A.26.1 Pharmacokinetics

Zinc is a nutritionally required trace element. Estimates of the efficiency of GI absorption of zinc in animals range from <10 to 90 percent (Elinder 1986c). Estimates in normal humans range from approximately 20 to 77 percent (Elinder 1986c; Goyer 1991). The net absorption of zinc appears to be homeostatically controlled, but it is unclear whether GI absorption, intestinal secretion, or both are regulated. Distribution of absorbed zinc is primarily to the liver (Goyer 1991), with subsequent redistribution to bone, muscle, and kidney (Elinder 1986c). Highest tissue concentrations are found in the prostate. Excretion

appears to be principally through the feces, in part from biliary secretion, but the relative importance of fecal and urinary excretion is species-dependent. The half-life of zinc absorbed from the GI tracts of humans in normal zinc homeostasis is approximately 162 to 500 days.

A.26.2 Non-carcinogenic Toxicity

Humans exposed to high concentrations of aerosols of zinc compounds may experience severe pulmonary damage and death (Elinder 1986c). The usual occupational exposure is to freshly formed fumes of zinc, which can induce a reversible syndrome known as metal fume fever. Orally, zinc exhibits a low order of acute toxicity. Animals dosed with 100 times dietary requirement showed no evidence of toxicity (Goyer 1991). In humans, acute poisoning from foods or beverages prepared in galvanized containers is characterized by GI upset (Elinder 1986c). Chronic oral toxicity in animals is associated with poor growth, GI inflammation, arthritis, lameness, and a microcytic, hypochromic anemia (Elinder 1986c), possibly secondary to copper deficiency (Underwood 1977). EPA (1999b) presented a verified RfD of 3.00E-01 mg/kg/day for chronic oral exposure to zinc, based on anemia in humans. EPA (1999b) has not published an RfC or Inhalation RfD for zinc.

A.26.3 Carcinogenicity

EPA (1999b) classifies zinc in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans) based on inadequate evidence for carcinogenicity in humans and animals. The human data consist largely of occupational exposure studies not designed to detect a carcinogenic response, and of reports that prostatic zinc concentrations were lower in cancerous than in noncancerous tissue. The animal data consist of several dietary, drinking water, and zinc injection studies, none of which provided convincing data for a carcinogenic response.

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FIGURES

Figure 1 - Site Location Map

Figure 2 - Topographic Map

Figure 3 - Regional Geology Map

Figure 4 - Quarry 1 Soil Boring Locations

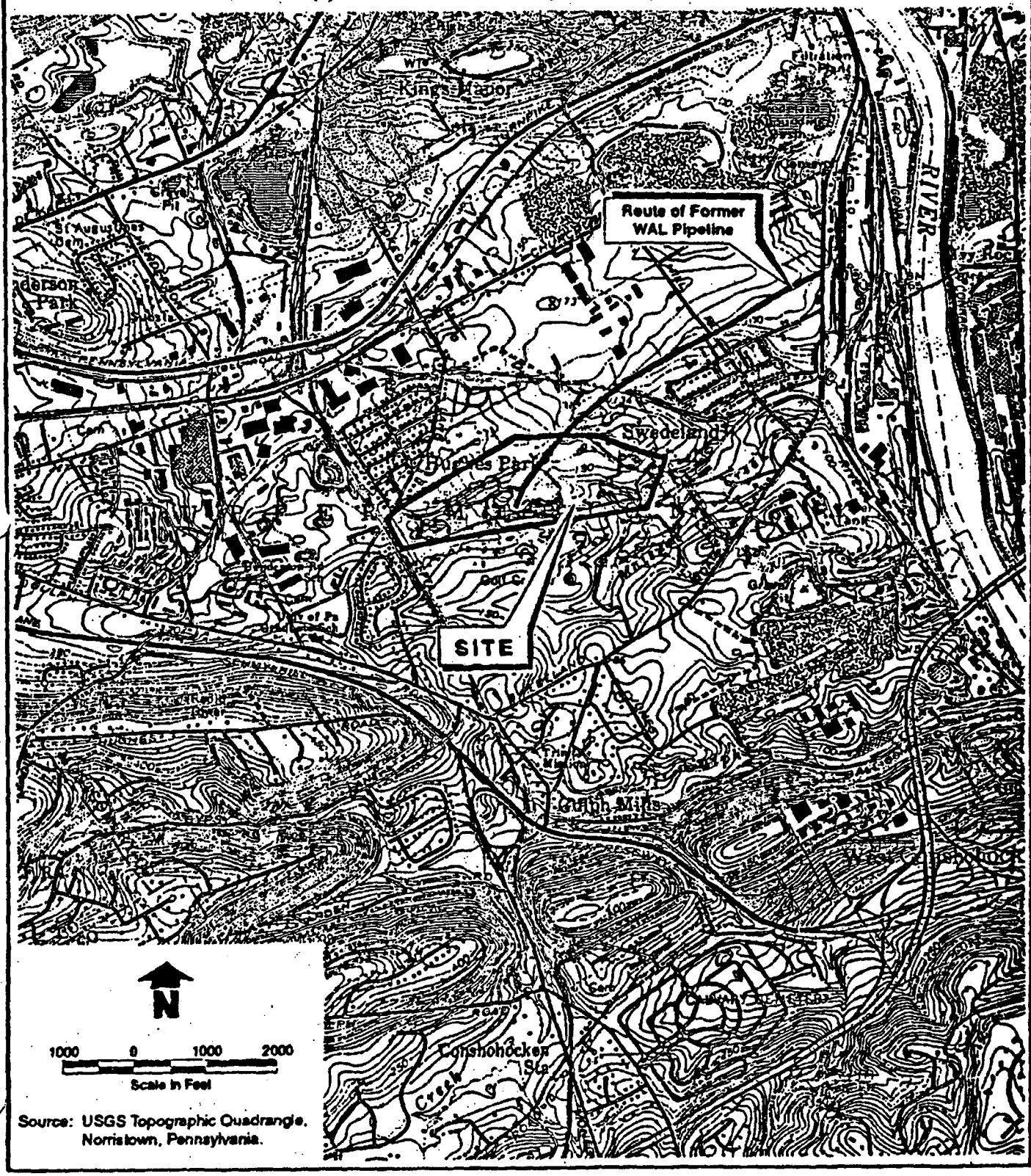
Figure 5 - Quarry 2 and Quarry 3 Sample Locations

Figure 6 - Quarry 4, Area 5 and Area 6 Soil Sample Locations

Figure 7 - Off-Site Well Location Map

Figure 8 - Well Location Map

Figure 1
Site Location Map
Crater Resources Site
Upper Merion Township, Pennsylvania



Source: USGS Topographic Quadrangle, Norristown, Pennsylvania.

ERM

H4902.08.01 AF/9.4.98

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Figure 2
Site Topographic Map
Crater Resources Site
Upper Merion Twp., Pennsylvania

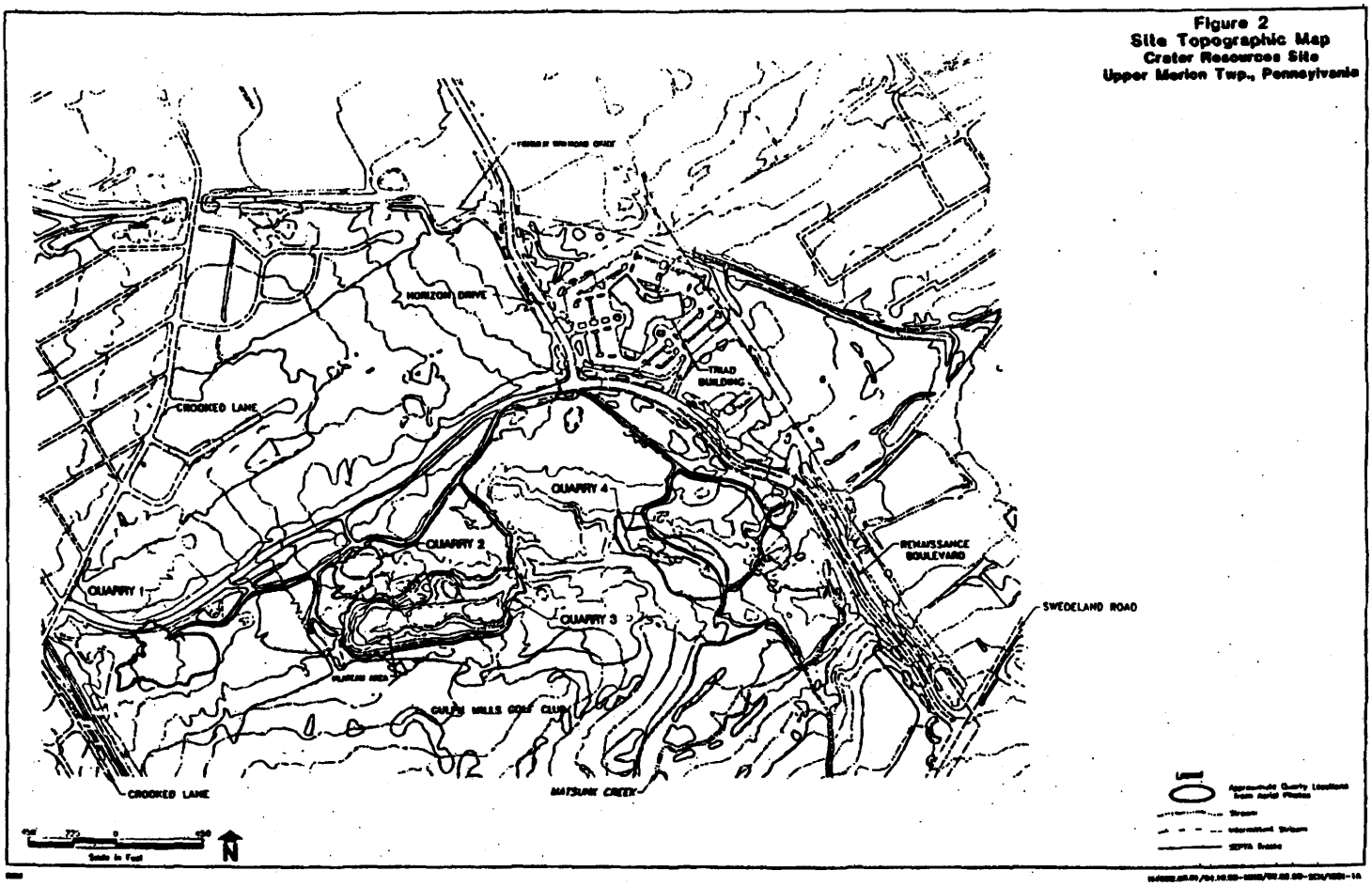

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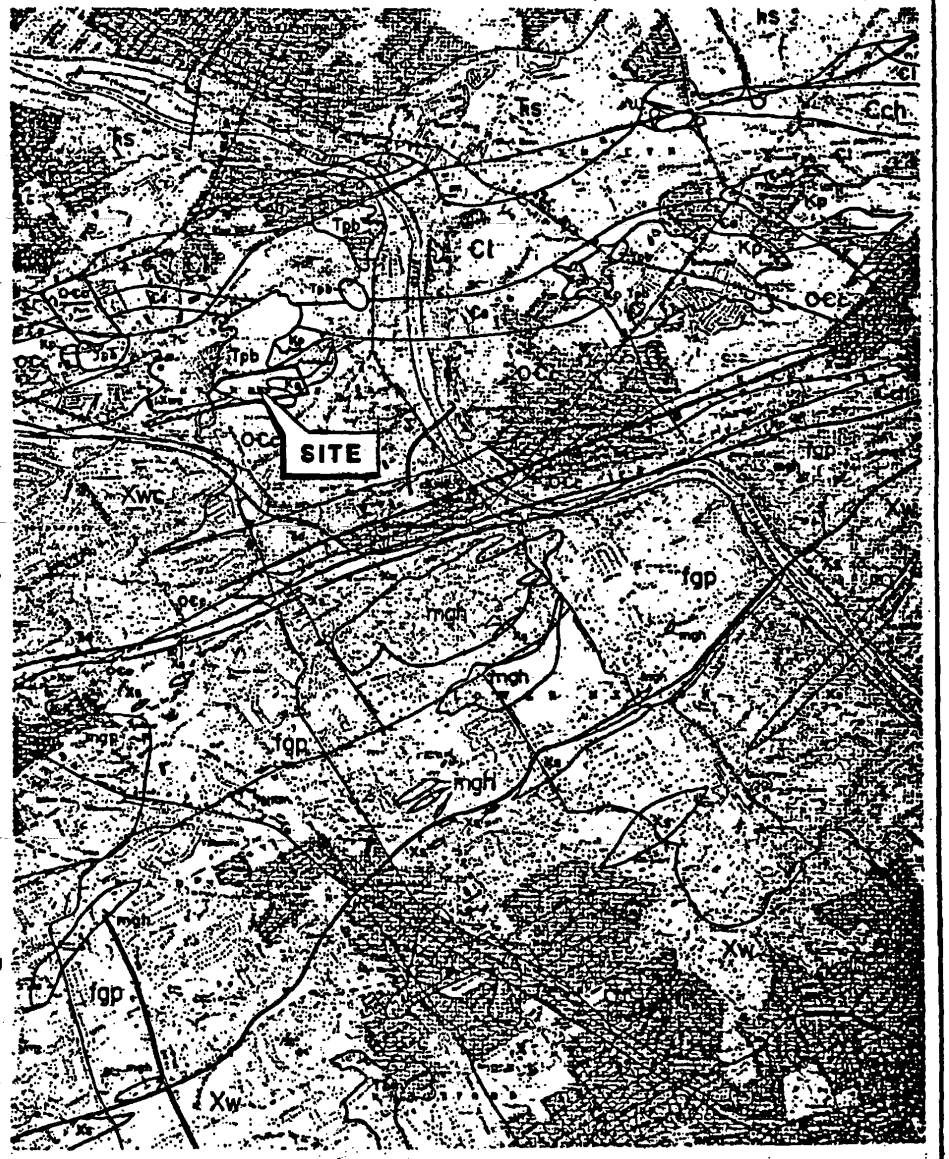
Figure 3
Regional Geology Map
Crater Resources Site
Upper Merion Township, Pennsylvania

LEGEND

- Tpb — Pensauken and Bridgeton Fms., undif.
- Tbm — Bryn Mawr Fm.
- Kp — Patapsco (?) Fm.
- Ꞓd — Diabase
- Ꞓs — Stockton Fm.
- OꞒc — Conestoga Fm.
- Ꞓe — Elbrook Fm.
- Ꞓl — Ledger Fm
- Ꞓah — Antietam and Harpers Fms., undiv
- Ꞓch — Chickies Fm.
- Xgr — Granitic gneiss and granite
- Xs — Serpentinite
- Xwc — Wissahickon Fm., albite - chlorite schist
- Xw — Wissahickon Fm., oligoclase - mica schist
- fgp — Felsic gneiss pyroxene - bearing
- mgh — Mafic gneiss, hornblende - bearing
- mgp — Mafic gneiss, pyroxene - bearing



Source: Pennsylvania Geological Survey, Map 61, Norristown Quadrangle

N

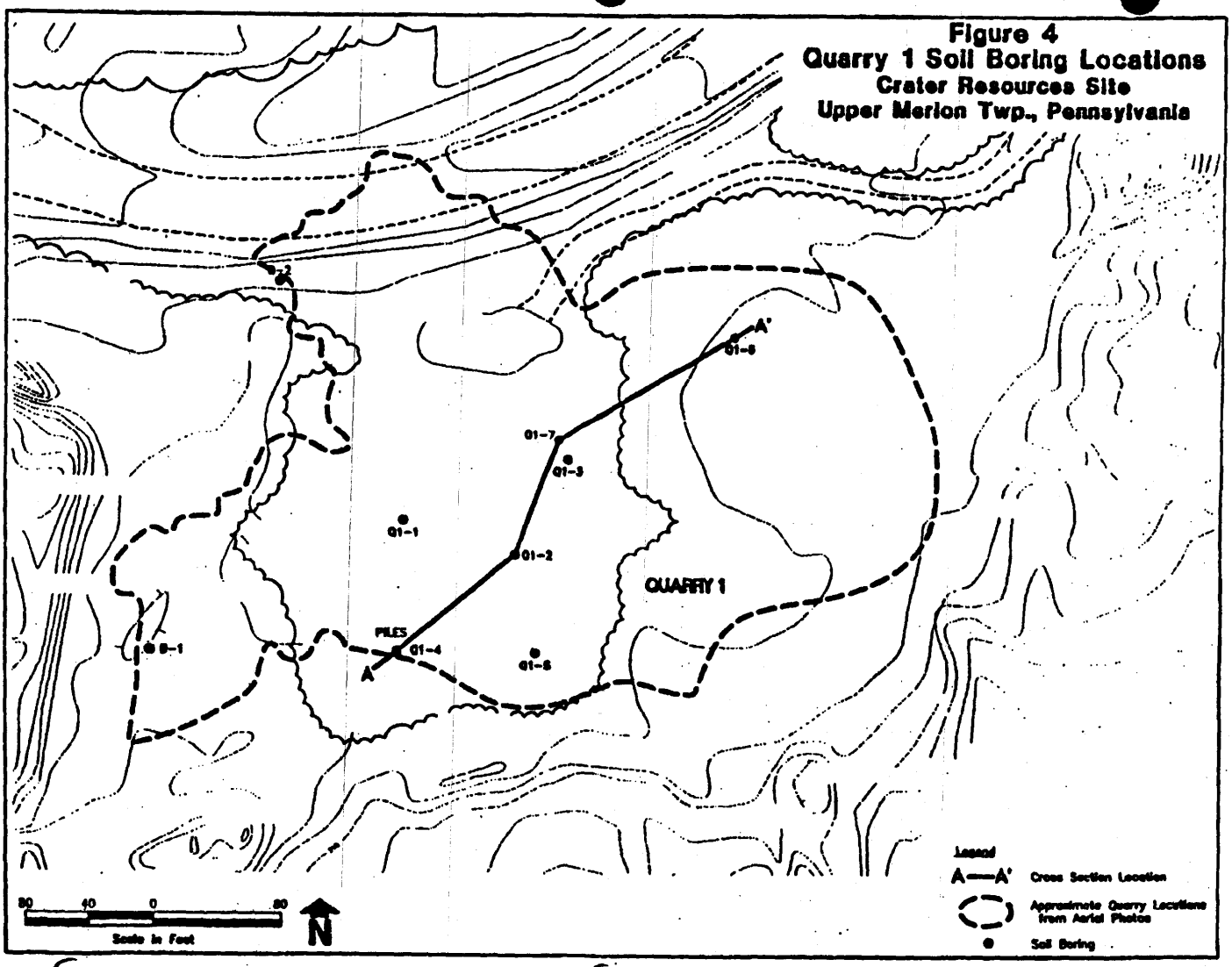


Figure 4
Quarry 1 Soil Boring Locations
Crater Resources Site
Upper Merion Twp., Pennsylvania
A'
Q1-6
Q1-7
Q1-3
Q1-1
Q1-2
QUARRY 1
PILES
Q1-4
A
Q1-5
B-1
80
40
0
80
Scale in Feet
N
Legend
A—A' Cross Section Location
Approximate Quarry Locations from Aerial Photos
Soil Boring

AR306414

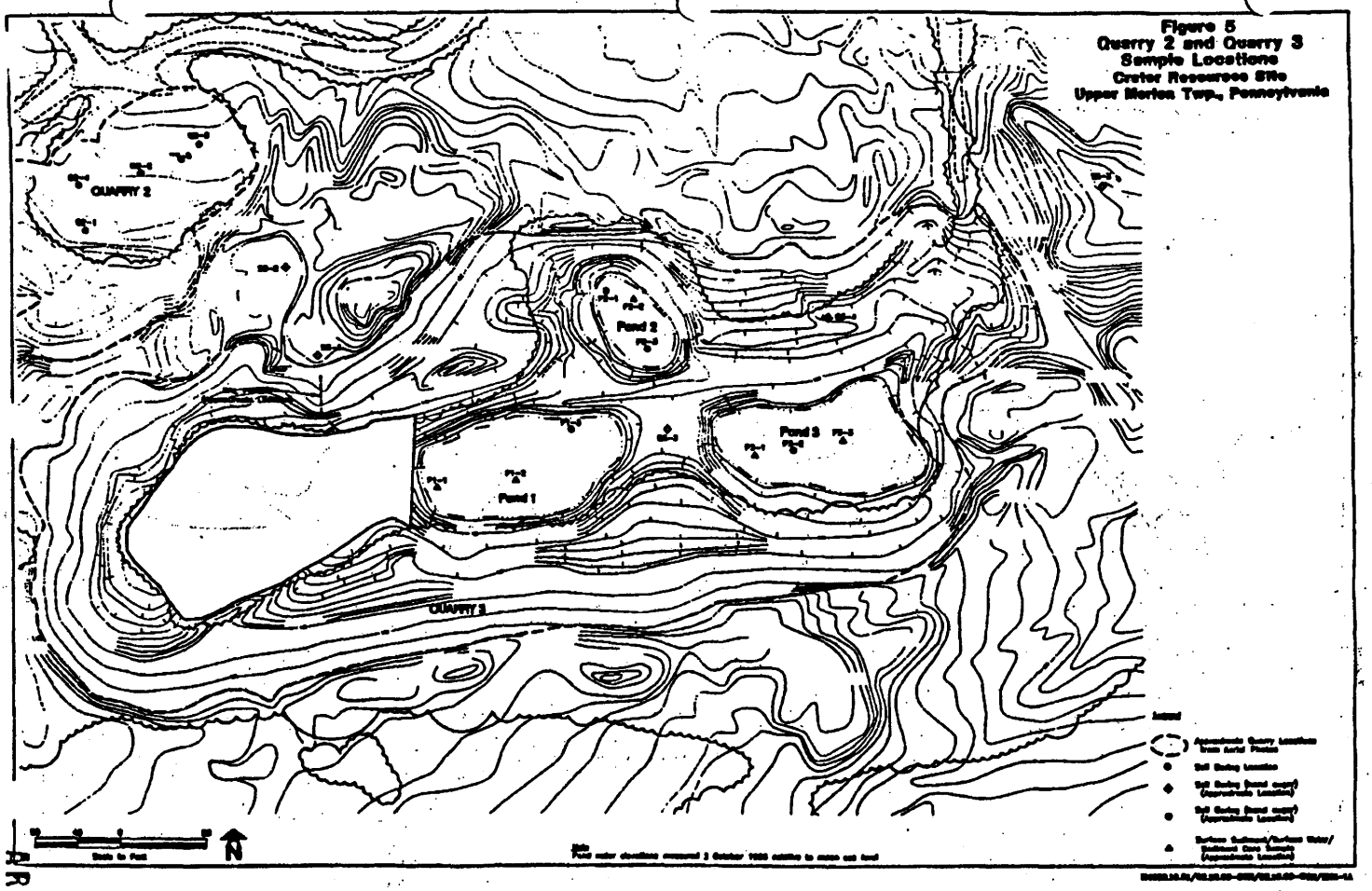
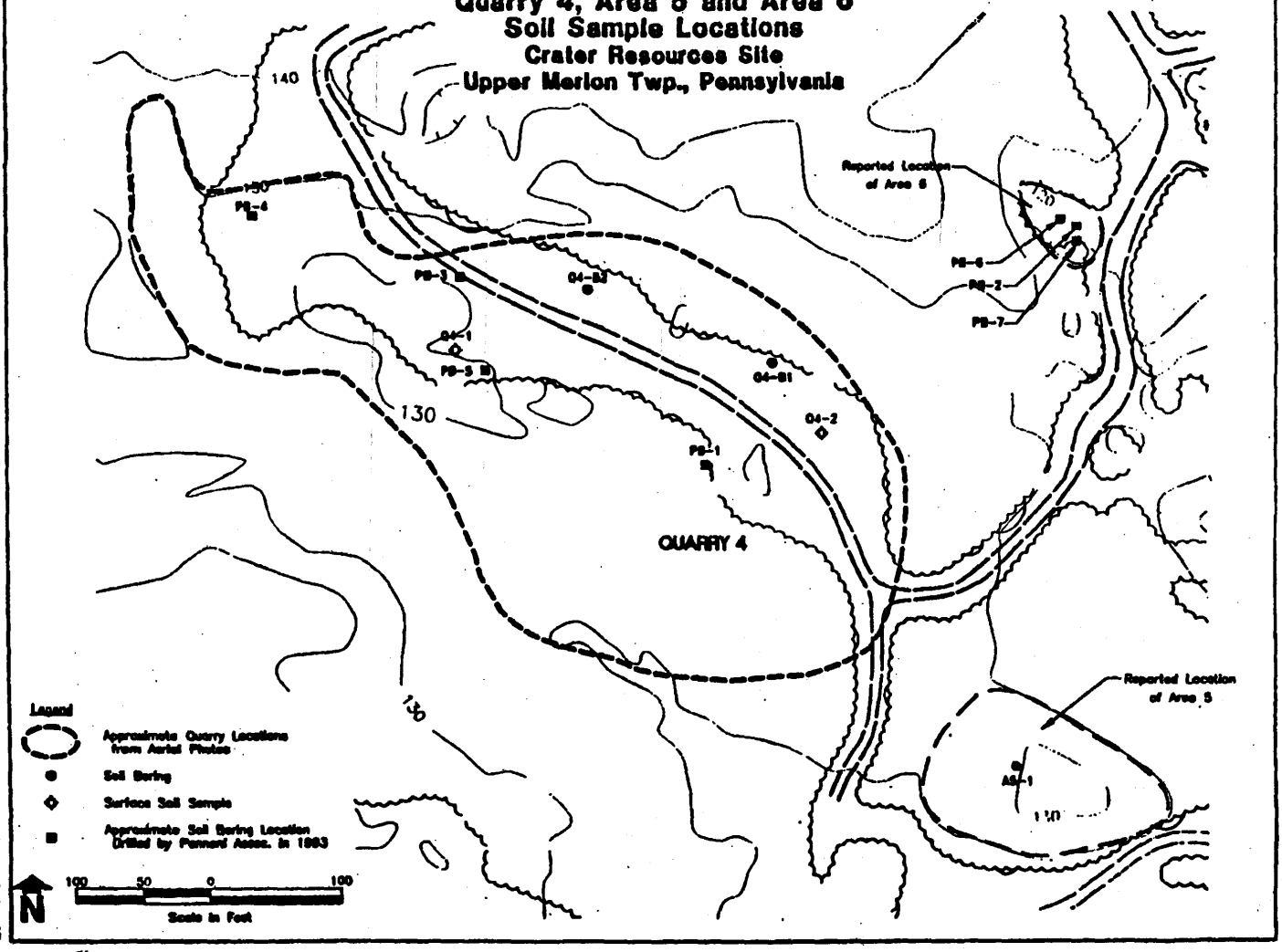


Figure 5
Quarry 2 and Quarry 3
Sample Locations
Crater Resources Site
Upper Merion Twp., Pennsylvania

AR306415

Figure 6
Quarry 4, Area 5 and Area 6
Soil Sample Locations
Crater Resources Site
Upper Merion Twp., Pennsylvania



AR306416

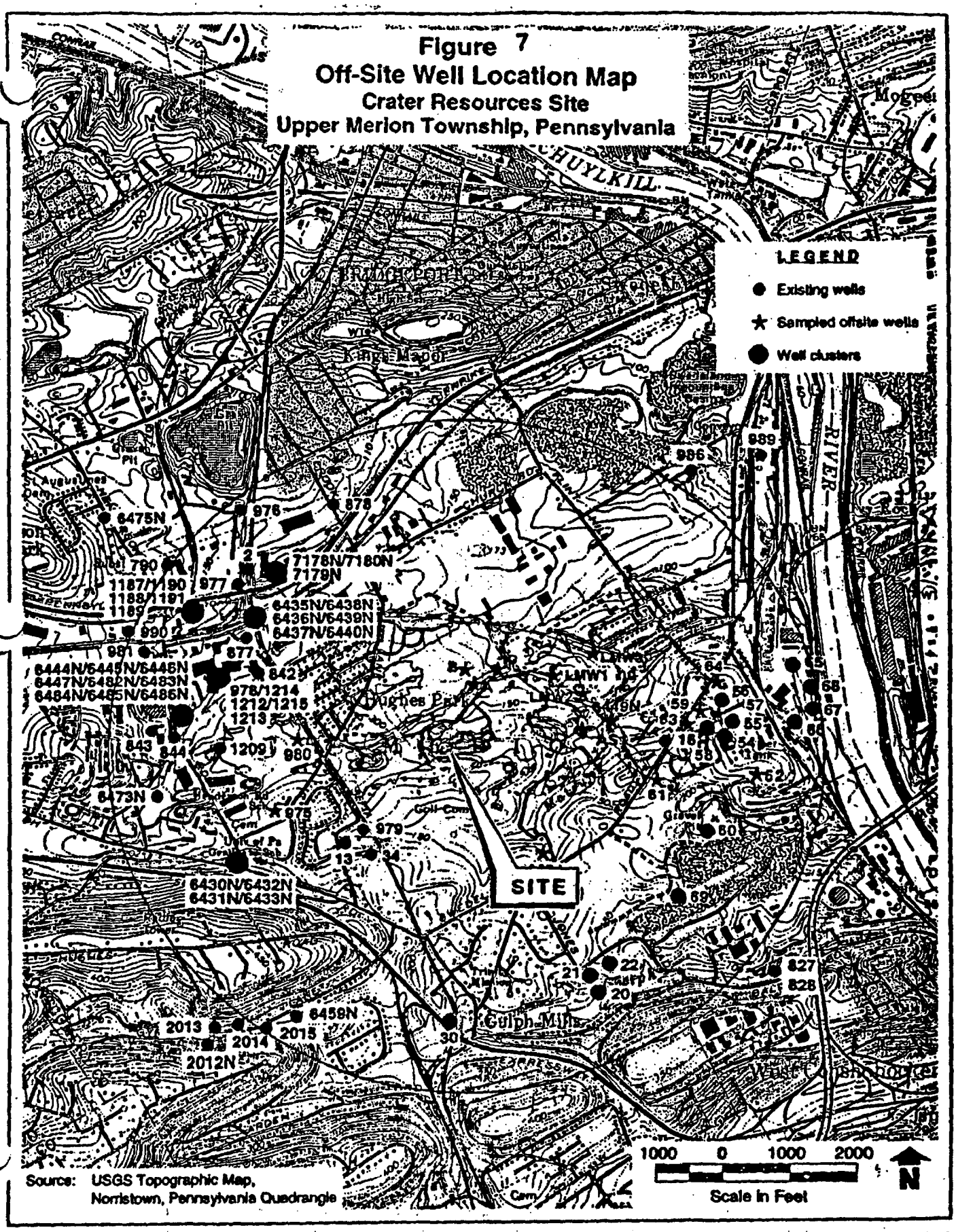


Figure 7
Off-Site Well Location Map
Crater Resources Site
Upper Merion Township, Pennsylvania

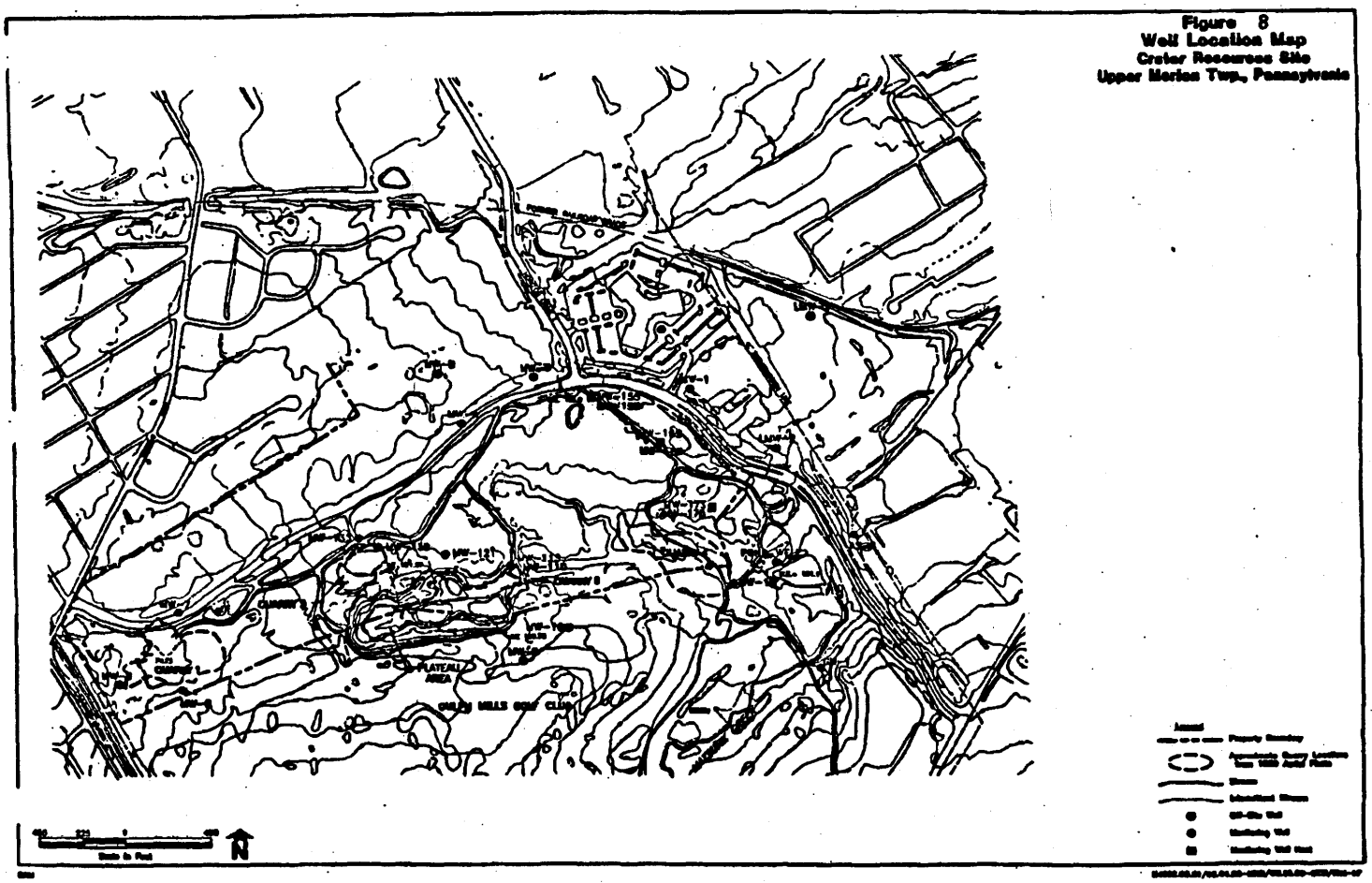


Figure 8
Well Location Map
Crater Resources Site
Upper Merion Twp., Pennsylvania

AR306418

TABLES

Table 1	Selection of Exposure Pathways
Table 2	Chemicals of Concern and Medium-Specific Exposure Point Concentrations
Table 3	Cancer Toxicity Data
Table 4	Summary of Receptor Risks and Hazards for COPCs
Table 5	Summary of Site Risks
Table 6	Sediment and Soil EEQs for On-Site Constituents of Potential Concern
Table 7	EEQs for On-Site Surface Water Constituents of Potential Concern
Table 8	Potential Constituents of Concern in Soil Samples
Table 9	Potential Constituents of Concern in Sediments and Surface Water
Table 10	Estimated Cost of Alternatives
Table 11	Present Worth and Capital Costs for the Selected Remedy
Table 12	Soil and Sediment Cleanup Standards
Table 13	Groundwater Cleanup Standards
Table 14	ARARs and TBCs

TABLE 1
SELECTION OF EXPOSURE PATHWAYS - QUARRY 1
CRATER RESOURCES

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Populations	Receptor Age	Exposure Routes	On Site/ Off Site	Type of Analysis	Rationale
Current	Surface Soil	Surface Soil	Contact with Quarry 1 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 1 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 1 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 1 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Quarry 1 surface soil.
Future	Surface Soil	Surface Soil	Contact with Quarry 1 Surface Soil; Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 1 Surface Soil; Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 1 Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 1 Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	None	No significant VOCs were detected in Quarry 1 surface soil.
		Surface Soil	Contact with Quarry 1 Surface Soil; Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 1 Surface Soil; Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 1 Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 1 Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 1 surface soil.
		Surface Soil	Contact with Quarry 1 Surface Soil; Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 1 Surface Soil; Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 1 Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 1 Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 1 surface soil.
		Surface Soil	Contact with Quarry 1 Surface Soil; Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 1 Surface Soil; Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 1 Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 1 Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 1 surface soil.
	Soil	Soil	Contact with Quarry 1 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Soil	Contact with Quarry 1 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 1 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 1 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.

AR306420

TABLE 1

SELECTION OF EXPO[illegible] PATHWAYS - QUARRY 2

CRATE[illegible] SOURCES

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Populations	Receptor Age	Exposure Routes	On Site/ Off Site	Type of Analysis	Rationale
Current	Surface Soil	Surface Soil	Contact with Quarry 2 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 2 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 2 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 2 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Quarry 2 surface soil.
Future	Surface Soil	Surface Soil	Contact with Quarry 2 Surface Soil; Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 2 Surface Soil; Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 2 Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 2 Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	None	No significant VOCs were detected in Quarry 2 surface soil.
		Surface Soil	Contact with Quarry 2 Surface Soil; Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 2 Surface Soil; Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 2 Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 2 Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 2 surface soil.
		Surface Soil	Contact with Quarry 2 Surface Soil; Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 2 Surface Soil; Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 2 Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 2 Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 2 surface soil.
		Surface Soil	Contact with Quarry 2 Surface Soil; Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 2 Surface Soil; Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 2 Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 2 Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 2 surface soil.
	Soil	Soil	Contact with Quarry 2 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Soil	Contact with Quarry 2 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 2 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 2 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 2 soil.

AR306421

TABLE 1
SELECTION OF EXPOSURE PATHWAYS - QUARRY 3
CRATER REBOURCES

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Populations	Receptor Age	Exposure Routes	On Site/ Off Site	Type of Analysis	Rationale
Current	Surface Soil	Surface Soil	Contact with Quarry 3 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 3 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 3 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 3 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 surface soil.
	Sediment	Sediment	Contact with Quarry 3 Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescent (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Quarry 3 Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescent (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure
		Particulates	Inhalation of Particulates in Quarry 3 Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescent (Teens)	Inhalation	On Site	None	Quarry 3 sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Quarry 3 Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescent (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 sediment.
	Surface Water	Surface Water	Contact with Quarry 3 Surface Water; Adolescent Trespasser	Trespasser/Visitor	Adolescent (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Water	Contact with Quarry 3 Surface Water; Adolescent Trespasser	Trespasser/Visitor	Adolescent (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Water	Inhalation of Volatiles in Quarry 3 Surface Water; Adolescent Trespasser	Trespasser/Visitor	Adolescent (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 surface water.
Future	Surface Soil	Surface Soil	Contact with Quarry 3 Surface Soil; Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 3 Surface Soil; Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 3 Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 3 Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 surface soil.
		Surface Soil	Contact with Quarry 3 Surface Soil; Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 3 Surface Soil; Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 3 Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 3 Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 surface soil.
		Surface Soil	Contact with Quarry 3 Surface Soil; Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 3 Surface Soil; Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 3 Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 3 Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 surface soil.
		Surface Soil	Contact with Quarry 3 Surface Soil; Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 3 Surface Soil; Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 3 Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 3 Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 surface soil.
	Soil	Soil	Contact with Quarry 3 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Soil	Contact with Quarry 3 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 3 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 3 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
	Sediment	Sediment	Contact with Quarry 3 Sediment; Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Quarry 3 Sediment; Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 3 Sediment; Residential Child	Resident	Child	Inhalation	On Site	None	Quarry 3 sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Quarry 3 Sediment; Residential Child	Resident	Child	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 sediment.
		Sediment	Contact with Quarry 3 Sediment; Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Quarry 3 Sediment; Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 3 Sediment; Residential Adult	Resident	Adult	Inhalation	On Site	None	Quarry 3 sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Quarry 3 Sediment; Residential Adult	Resident	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 sediment.
		Sediment	Contact with Quarry 3 Sediment; Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Quarry 3 Sediment; Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 3 Sediment; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	Quarry 3 sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Quarry 3 Sediment; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 sediment.
		Sediment	Contact with Quarry 3 Sediment; Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Quarry 3 Sediment; Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 3 Sediment; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	Quarry 3 sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Quarry 3 Sediment; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 sediment.
	Surface Water	Surface Water	Contact with Quarry 3 Surface Water; Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Water	Contact with Quarry 3 Surface Water; Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 3 Surface Water; Residential Child	Resident	Child	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 surface water.
		Surface Water	Contact with Quarry 3 Surface Water; Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Water	Contact with Quarry 3 Surface Water; Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 3 Surface Water; Residential Adult	Resident	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 surface water.
		Surface Water	Contact with Quarry 3 Surface Water; Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Water	Contact with Quarry 3 Surface Water; Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 3 Surface Water; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 surface water.
		Surface Water	Contact with Quarry 3 Surface Water; Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Water	Contact with Quarry 3 Surface Water; Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 3 Surface Water; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 3 surface water.

SELECTION OF EXPO[illegible]ATHWAYS - QUARRY 4
CRATER [illegible]OURCES

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Populations	Receptor Age	Exposure Route	On Site/ Off Site	Type of Analysis	Rationale
Current	Surface Soil	Surface Soil	Contact with Quarry 4 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 4 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 4 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 4 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Quarry 4 surface soil.
		Surface Soil	Contact with Quarry 4 Surface Soil; Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 4 Surface Soil; Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 4 Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 4 Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 4 surface soil.
Future	Surface Soil	Surface Soil	Contact with Quarry 4 Surface Soil; Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 4 Surface Soil; Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 4 Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 4 Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	None	No significant VOCs were detected in Quarry 4 surface soil.
		Surface Soil	Contact with Quarry 4 Surface Soil; Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 4 Surface Soil; Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 4 Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 4 Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 4 surface soil.
		Surface Soil	Contact with Quarry 4 Surface Soil; Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 4 Surface Soil; Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 4 Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 4 Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 4 surface soil.
	Soil	Soil	Contact with Quarry 4 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Soil	Contact with Quarry 4 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 4 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 4 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.

AR306423

TABLE 1
SELECTION OF EXPOSURE PATHWAYS - AREA 6
CRATER RESOURCES

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Populations	Receptor Age	Exposure Routes	On Site/ Off Site	Type of Analysis	Rationale
Current	Surface Soil	Surface Soil	Contact with Quarry 5 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 5 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 5 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 5 Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Quarry 5 surface soil.
		Surface Soil	Contact with Quarry 5 Surface Soil; Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 5 Surface Soil; Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 5 Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 5 Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 5 surface soil.
Future	Surface Soil	Surface Soil	Contact with Quarry 5 Surface Soil; Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 5 Surface Soil; Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 5 Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 5 Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	None	No significant VOCs were detected in Quarry 5 surface soil.
		Surface Soil	Contact with Quarry 5 Surface Soil; Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 5 Surface Soil; Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 5 Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 5 Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 5 surface soil.
		Surface Soil	Contact with Quarry 5 Surface Soil; Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Quarry 5 Surface Soil; Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 5 Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 5 Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 5 surface soil.
	Soil	Soil	Contact with Quarry 5 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Soil	Contact with Quarry 5 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 5 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 5 Soil (Surface and Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Quarry 5 soil.

AR306424

TABLE 1
SELECTION OF EXPOSURE PATHWAYS - AREA 6
CRATER JURCES

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Populations	Receptor Age	Exposure Routes	On Site/ Off Site	Type of Analysis	Rationale
Future	Soil	Soil	Contact with Quarry 6 Soil (Subsurface); Construction Worker	Construction Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Soil	Contact with Quarry 6 Soil (Subsurface); Construction Worker	Construction Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Quarry 6 Soil (Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Quarry 6 Soil (Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.

AR306425

TABLE 1
SELECTION OF EXPOSURE PATHWAYS - YELLOW TRACT PIPELINE AREA
CRATER RESOURCES

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Populations	Receptor Age	Exposure Routes	On Site/ Off Site	Type of Analysis	Rationale
Current	Surface Soil	Surface Soil	Contact with Yellow Tract Pipeline Area Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Yellow Tract Pipeline Area Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Pipeline Area Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Yellow Tract Pipeline Area Surface Soil; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract PA surface soil.
	Sediment	Sediment	Contact with Yellow Tract Pipeline Area Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Yellow Tract Pipeline Area Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Pipeline Area Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	Yellow Tract PA sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Yellow Tract Pipeline Area Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract PA sediment.
Current/Future	Surface Soil	Surface Soil	Contact with Yellow Tract Pipeline Area Surface Soil; Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Yellow Tract Pipeline Area Surface Soil; Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Pipeline Area Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Yellow Tract Pipeline Area Surface Soil; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract PA surface soil.
	Sediment	Sediment	Contact with Yellow Tract Sediment; Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Yellow Tract Sediment; Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Sediment; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	Yellow Tract PA sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Yellow Tract Sediment; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract PA sediment.
Future	Surface Soil	Surface Soil	Contact with Yellow Tract Pipeline Area Surface Soil; Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Yellow Tract Pipeline Area Surface Soil; Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Pipeline Area Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Yellow Tract Pipeline Area Surface Soil; Residential Child	Resident	Child	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Yellow Tract Pipeline Area Surface Soil; Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Yellow Tract Pipeline Area Surface Soil; Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Pipeline Area Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Yellow Tract Pipeline Area Surface Soil; Residential Adult	Resident	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Yellow Tract Pipeline Area Surface Soil; Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Yellow Tract Pipeline Area Surface Soil; Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Pipeline Area Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Yellow Tract Pipeline Area Surface Soil; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
	Sediment	Sediment	Contact with Yellow Tract Pipeline Area Sediment; Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Yellow Tract Pipeline Area Sediment; Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Pipeline Area Sediment; Residential Child	Resident	Child	Inhalation	On Site	None	Yellow Tract PA sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Yellow Tract Pipeline Area Sediment; Residential Child	Resident	Child	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract PA sediment.
		Sediment	Contact with Yellow Tract Pipeline Area Sediment; Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Yellow Tract Pipeline Area Sediment; Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Pipeline Area Sediment; Residential Adult	Resident	Adult	Inhalation	On Site	None	Yellow Tract PA sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Yellow Tract Pipeline Area Sediment; Residential Adult	Resident	Adult	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract PA sediment.
		Sediment	Contact with Yellow Tract Pipeline Area Sediment; Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Yellow Tract Sediment; Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Pipeline Area Sediment; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	Yellow Tract PA sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Yellow Tract Pipeline Area Sediment; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract PA sediment.

AR306426

TABLE 1

SELECTION OF EXPOSURE P[illegible] 8 - YELLOW TRACT QUARRY 4

CRATE[illegible] JURCES

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On Site/ Off Site	Type of Analysis	Rationale
Current	Sediment	Sediment	Contact with Yellow Tract Quarry 4 Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Yellow Tract Quarry 4 Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Quarry 4 Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	Yellow Tract Q4 sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Yellow Tract Quarry 4 Sediment; Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract PA sediment.
Current/Future	Sediment	Sediment	Contact with Yellow Tract Sediment; Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Yellow Tract Sediment; Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Sediment; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	Yellow Tract Q4 sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Yellow Tract Sediment; Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract Q4 sediment.
Future	Soil	Soil	Contact with Yellow Tract Quarry 4 Soil (Subsurface); Construction Worker	Construction Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Soil	Contact with Yellow Tract Quarry 4 Soil (Subsurface); Construction Worker	Construction Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Quarry 4 Soil (Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Yellow Tract Quarry 4 Soil (Subsurface); Construction Worker	Construction Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
	Sediment	Sediment	Contact with Yellow Tract Quarry 4 Sediment; Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Yellow Tract Quarry 4 Sediment; Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Quarry 4 Sediment; Residential Child	Resident	Child	Inhalation	On Site	None	Yellow Tract Q4 sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Yellow Tract Quarry 4 Sediment; Residential Child	Resident	Child	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract Q4 sediment.
		Sediment	Contact with Yellow Tract Quarry 4 Sediment; Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Yellow Tract Quarry 4 Sediment; Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Quarry 4 Sediment; Residential Adult	Resident	Adult	Inhalation	On Site	None	Yellow Tract Q4 sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Yellow Tract Quarry 4 Sediment; Residential Adult	Resident	Adult	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract Q4 sediment.
		Sediment	Contact with Yellow Tract Quarry 4 Sediment; Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Sediment	Contact with Yellow Tract Sediment; Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Yellow Tract Quarry 4 Sediment; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	Yellow Tract Q4 sediment is expected to be wet, resulting in no exposure
		Air	Inhalation of Volatiles in Yellow Tract Quarry 4 Sediment; Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	No significant VOCs were detected in Yellow Tract Q4 sediment.

AR306427

TABLE 1

SELECTION OF EXPOSURE PATHWAYS - GROUNDWATER (3 PLUMES; CENTER, AREAL, AND BIG WELLS) AND MISCELLANEOUS EXPOSURE MEDIA (SS1 + SS2 & SS3)

CRATER REBOURCES

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Populations	Receptor Age	Exposure Routes	On Site/ Off Site	Type of Analysis	Rationale
Current	Surface Soil	Surface Soil	Contact with Surface Soil (SS-1 & SS-2; and SS-3); Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Surface Soil (SS-1 & SS-2; and SS-3); Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Surface Soil (SS-1 & SS-2; and SS-3); Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Surface Soil (SS-1 & SS-2; and SS-3); Adolescent Trespasser	Trespasser/Visitor	Adolescents (Teens)	Inhalation	On Site	None	No significant VOCs were detected in Surface Soil (SS-1 & SS-2, and SS-3).
		Surface Soil	Contact with Surface Soil (SS-1 & SS-2; and SS-3); Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Surface Soil (SS-1 & SS-2; and SS-3); Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Surface Soil (SS-1 & SS-2; and SS-3); Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Surface Soil (SS-1 & SS-2; and SS-3); Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	No significant VOCs were detected in Surface Soil (SS-1 & SS-2; and SS-3).
Future	Surface Soil	Surface Soil	Contact with Surface Soil (SS-1 & SS-2; and SS-3); Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Surface Soil (SS-1 & SS-2; and SS-3); Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Surface Soil (SS-1 & SS-2; and SS-3); Residential Child	Resident	Child	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Surface Soil (SS-1 & SS-2; and SS-3); Residential Child	Resident	Child	Inhalation	On Site	None	No significant VOCs were detected in Surface Soil (SS-1 & SS-2; and SS-3).
		Surface Soil	Contact with Surface Soil (SS-1 & SS-2; and SS-3); Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Surface Soil (SS-1 & SS-2; and SS-3); Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Surface Soil (SS-1 & SS-2; and SS-3); Residential Adult	Resident	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Surface Soil (SS-1 & SS-2; and SS-3); Residential Adult	Resident	Adult	Inhalation	On Site	None	No significant VOCs were detected in Surface Soil (SS-1 & SS-2; and SS-3).
		Surface Soil	Contact with Surface Soil (SS-1 & SS-2; and SS-3); Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Surface Soil	Contact with Surface Soil (SS-1 & SS-2; and SS-3); Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Particulates	Inhalation of Particulates in Surface Soil (SS-1 & SS-2; and SS-3); Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Surface Soil (SS-1 & SS-2; and SS-3); Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	None	No significant VOCs were detected in Surface Soil (SS-1 & SS-2; and SS-3).
	Groundwater	Groundwater	Contact with Area Groundwater (3 Plumes); Residential Child	Resident	Child	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Groundwater	Contact with Area Groundwater (3 Plumes); Residential Child	Resident	Child	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Area Groundwater (3 Plumes); Residential Child	Resident	Child	Inhalation	On Site	None	Receptor activity patterns are not expected to result in significant exposure.
		Groundwater	Contact with Area Groundwater (3 Plumes); Residential Adult	Resident	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Groundwater	Contact with Area Groundwater (3 Plumes); Residential Adult	Resident	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Area Groundwater (3 Plumes); Residential Adult	Resident	Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Groundwater	Contact with Area Groundwater (3 Plumes); Lifetime Resident	Resident	Child/Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Groundwater	Contact with Area Groundwater (3 Plumes); Lifetime Resident	Resident	Child/Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Area Groundwater (3 Plumes); Lifetime Resident	Resident	Child/Adult	Inhalation	On Site	Quant	Receptor activity patterns could result in exposure.
		Groundwater	Contact with Area Groundwater (3 Plumes); Industrial Worker	Industrial Worker	Adult	Ingestion	On Site	Quant	Receptor activity patterns could result in exposure.
		Groundwater	Contact with Area Groundwater (3 Plumes); Industrial Worker	Industrial Worker	Adult	Dermal Absorption	On Site	Quant	Receptor activity patterns could result in exposure.
		Air	Inhalation of Volatiles in Area Groundwater (3 Plumes); Industrial Worker	Industrial Worker	Adult	Inhalation	On Site	None	Receptor activity patterns are not expected to result in exposure.
		Groundwater	Contact with Area Groundwater (3 Plumes); Construction Worker	Construction Worker	Adult	Ingestion	On Site	None	Groundwater (3 Plumes) is at a depth that is not expected to result in exposure.
		Groundwater	Contact with Area Groundwater (3 Plumes); Construction Worker	Construction Worker	Adult	Dermal Absorption	On Site	None	Groundwater (3 Plumes) is at a depth that is not expected to result in exposure.
		Air	Inhalation of Area Volatiles in Groundwater (3 Plumes); Construction Worker	Construction Worker	Adult	Inhalation	On Site	None	Groundwater (3 Plumes) is at a depth that is not expected to result in exposure.

AR306428

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Contact (Ing. & Der.) with Groundwater (Center of Plume); Residential Child

Chemical	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Arsenic	23.9	50.6	ug/L	MW-11S	2/6	30.1	ug/l	95% UCL-N
Barium	14.2	713	ug/l	MW-13S	6/6	713	ug/l	Max.
Beryllium	9.6	24.8	ug/L	MW-6	2/2	24.8	ug/l	Max.
Chromium	6.7	89.4	ug/L	MW-13S	4/6	89.4	ug/l	Max.
Cyanide	52.7	1120	ug/L	MW-13D	5/5	1120	ug/l	Max.
Iron	2570	65200	ug/L	MW-6	6/6	65200	ug/l	Max.
Lead	15.8	68	ug/L	MW-6	3/4	26.3	ug/l	Mean-N
Manganese	130	33600	ug/L	MW-13D	6/6	33600	ug/l	Max.
Selenium	10.5	97.7	ug/L	MW-6	5/6	97.7	ug/l	Max.
2,4-Dimethylphenol	20	580	ug/L	MW-11D	4/6	580	ug/l	Max.
2-Methylphenol	89	6300	ug/L	MW-13S	4/6	6300	ug/l	Max.
4-Methylphenol	2100	24000	ug/L	MW-13S	3/6	24000	ug/l	Max.
Dibenzofuran	1	16	ug/L	MW-11D	3/6	16	ug/l	Max.
Naphthalene	12	1300	ug/L	MW-11D	5/6	1300	ug/l	Max.
Phenol	10	19000	ug/L	MW-13S	5/6	19000	ug/l	Max.
Acetone	110	420	ug/L	MW-7	2/6	420	ug/l	Max.
Benzene	4	250	ug/L	MW-13S	5/6	250	ug/l	Max.
Chloroform	2.6	3.9	ug/L	MW-7	2/5	3.08	ug/l	95% UCL-N

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N)

AR306429

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Contact (Ing. & Der.) with Groundwater (Extent of Plume); Residential Child

Chemical	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Arsenic	15.5	50.6	ug/L	MW-11S	6/18	33.1	ug/l	95%UCL-T
Barium	2.6	713	ug/L	MW-13S	22/22	498	ug/l	95%UCL-T
Beryllium	0.36	245	ug/L	MW-17D	9/17	245	ug/l	Max.
Cadmium	0.84	29.4	ug/L	MW-17D	5/17	5.08	ug/l	95%UCL-T
Chromium	5.3	205	ug/L	MW-16S	12/22	205	ug/l	Max.
Cobalt	5.6	1010	ug/L	MW-17D	12/12	384	ug/l	95%UCL-T
Cyanide	2.6	1120	ug/L	MW-13D	11/22	1120	ug/l	Max.
Iron	547	65200	ug/L	MW-6	23/23	56500	ug/l	95%UCL-T
Lead	6.5	499	ug/L	MW-17D	17/18	65.2	ug/l	Mean-T
Manganese	42.4	33600	ug/L	MW-13D	23/23	13300	ug/l	95%UCL-T
Mercury	0.11	4.3	ug/L	MW-17D	7/20	0.4	ug/l	95%UCL-T
Nickel	5.6	2380	ug/L	MW-17D	17/21	2380	ug/l	Max.
Selenium	4.9	152	ug/L	MW-8	7/19	42.6	ug/l	95%UCL-T
Thallium	11.3	11.3	ug/L	MW-17D	1/19	3.06	ug/l	95%UCL-T
Vanadium	1.6	41.8	ug/L	MW-16S	15/17	41.8	ug/l	Max.
Zinc	19.4	8110	ug/L	MW-17D	19/22	2950	ug/l	95%UCL-T
2-Methylphenol	0.6	6300	ug/L	MW-13S	6/23	1370	ug/l	95%UCL-T
4-Methylphenol	1	24000	ug/L	MW-13S	4/23	3470	ug/l	95%UCL-T
2,4-Dimethylphenol	20	580	ug/L	MW-11D	4/23	90.1	ug/l	95%UCL-T
Dibenzofuran	1	16	ug/L	MW-11D	3/23	7.07	ug/l	95%UCL-T
Naphthalene	4	1300	ug/L	MW-11D	6/23	81.2	ug/l	95%UCL-T
Acetone	5	420	ug/L	MW-7	4/13	420	ug/l	Max.
Benzene	0.23	250	ug/L	MW-13S	10/23	53.3	ug/l	95%UCL-T
Chloroform	0.12	3.9	ug/L	MW-7	9/22	1.94	ug/l	95%UCL-T

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

AR306430

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil/Air/Particulates
Exposure Point: Contact (Ing., Der. & Inhal.) with Soil (Quarry 1); Construction Worker

Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency	Location of Maximum Concentration	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
				Soil				
Aluminum	7120	30500	mg/kg	12-Dec	Q1-1 (6-8)	21700	mg/kg	95% UCL-N
				Particulates				
Manganese	229	2480	mg/kg	12/12	Q1-7 (79-79.4)	1080	mg/kg	95% UCL-N
				Air				
Naphthalene	11000	3100000	ug/kg	2/8	Q1-6 (18-20)	3100000	ug/kg	Max.

AR306431

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Contact (Ing. & Der.) with Soil and Particulates (Quarry 2); Construction Worker

Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Arsenic	1.2	18	mg/kg	11/11	18	mg/kg	Max.
Chromium	2.6	288	mg/kg	11/11	288	mg/kg	Max.
Iron	1240	143000	mg/kg	11/11	143000	mg/kg	Max.
Manganese	6.8	1530	mg/kg	11/11	1020	mg/kg	95% UCL-N

AR306432

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Medium: Soil
Exposure Medium: Soil
Exposure Point: Contact (Ing. & Der.) with Soil, Paticulates (Inh.) and Air (inh.) (Quarry 3); Construction Worker

Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Arsenic	11.7	660	mg/kg	13/13	660	mg/kg	Max.
Manganese	169	1140	mg/kg	13/13	756	mg/kg	95 % UCL-T
Mercury	0.23	49	mg/kg	11/11	49	mg/kg	Max.
Benzo(a)pyrene	540	470000	ug/kg	13/13	470000	ug/kg	Max.
Dibenz(a,h)anthracene	150	100000	ug/kg	11/13	100000	ug/kg	Max.
Naphthalene	3200	270000000	ug/kg	13/13	270000000	ug/kg	Max.

AR306433

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Contact (Ing. & Der.) and particualts (inh.) with Surface Soil (Quarry 3); Residential Child*

Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Aluminum	4570	26700	mg/kg	4/4	26700	mg/kg	Max.
Arsenic	17.7	302	mg/kg	4/4	302	mg/kg	Max.
Iron	21700	52500	mg/kg	4/4	52500	mg/kg	Max.
Mercury	0.23	22.5	mg/kg	4/4	22.5	mg/kg	Max.
Benz(a)anthracene	27000	400000	ug/kg	4/4	400000	ug/kg	Max.
Benzo(a)pyrene	38000	460000	ug/kg	4/4	460000	ug/kg	Max.
Benzo(b)fluoranthene	44000	630000	ug/kg	4/4	630000	ug/kg	Max.
Dibenz(a,h)anthracene	1800	100000	ug/kg	4/4	100000	ug/kg	Max.
Indeno(1,2,3-cd)pyrene	20000	330000	ug/kg	4/4	330000	ug/kg	Max.

* This screening is also valid for Future/Surface Soil/Particulates/Contact (Inhalation) with Particulates from Surface Soil (Quarry 3) Residential Child.
* This screening is also valid for Future/Surface Soil/Surface Soil/Contact (Ing. & Der.) with Surface Soil (Quarry 3) Residential Adult.
* This screening is also valid for Future/Surface Soil/Particulates/Contact (Inhalation) with Particulates from Surface Soil (Quarry 3) Residential Adult.
* This screening is also valid for Future/Surface Soil/Surface Soil/Contact (Ing. & Der.) with Surface Soil (Quarry 3) Lifetime Resident.
* This screening is also valid for Future/Surface Soil/Particulates/Contact (Inhalation) with Particulates from Surface Soil (Quarry 3) Lifetime Resident.
* This screening is also valid for Current/Surface Soil/Surface Soil/Contact (Ing. & Der.) with Surface Soil (Quarry 3) Adolescent Trespasser.
* This screening is also valid for Current/Surface Soil/Particulates/Contact (Inhalation) with Particulates from Surface Soil (Quarry 3) Adolescent Trespasser.
* This screening is also valid for Future/Surface Soil/Surface Soil/Contact (Ing. & Der.) with Surface Soil (Quarry 3) Industrial Adult.
* This screening is also valid for Future/Surface Soil/Particulates/Contact (Inhalation) with Particulates from Surface Soil (Quarry 3) Industrial Adult.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

AR306434

TABLE 2
Summary of Chemicals of Concern and Media-Specific Exposure Point Concentrations

Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Contact (Ing. & Der.) with Sediment (Query 3); Residential Child*

Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Benz(a)anthracene	14000	2100000	ug/kg	13/14	2100000	ug/kg	Max.
Benzo(a)pyrene	16000	2500000	ug/kg	14/14	2500000	ug/kg	Max.
Benzo(b)fluoranthene	28000	3800000	ug/kg	14/14	3800000	ug/kg	Max.

* This screening is also valid for Future/Sediment/Sediment/Contact (Ing. & Der.) with Sediment (Query 3) Residential Adult.
* This screening is also valid for Future/Sediment/Sediment/Contact (Ing. & Der.) with Sediment (Query 3) Lifetime Resident.
* This screening is also valid for Current/Sediment/Sediment/Contact (Ing. & Der.) with Sediment (Query 3) Adolescent Trespasser.
* This screening is also valid for Future/Sediment/Sediment/Contact (Ing. & Der.) with Sediment (Query 3) Industrial Worker.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

AR306435

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Contact (Ing. & Der.) with Surface Soil and Particulates (inh.) (Quarry 4); Residential Child*

Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Aluminum	8240	11600	mg/kg	2/2	11600	mg/kg	Max.
Arsenic	7	12.2	mg/kg	2/2	12.2	mg/kg	Max.
Chromium	20.8	331	mg/kg	2/2	331	mg/kg	Max.
Iron	23000	113000	mg/kg	2/2	113000	mg/kg	Max.
Manganese	678	6200	mg/kg	2/2	6200	mg/kg	Max.

* This screening is also valid for Future/Surface Soil/Particulates/Contact (Inhalation) with Particualtes from Surface Soil (Quarry 4) Residential Child.
* This screening is also valid for Future/Surface Soil/Surface Soil/Contact (Ing. & Der.) with Surface Soil (Quarry 4) Residential Adult.
* This screening is also valid for Future/Surface Soil/Particulates/Contact (Inhalation) with Particulates from Surface Soil (Quarry 4) Residential Adult.
* This screening is also valid for Future/Surface Soil/Surface Soil/Contact (Ing. & Der.) with Surface Soil (Quarry 4) Lifetime Resident.
* This screening is also valid for Future/Surface Soil/Particulates/Contact (Inhalation) with Particualtes from Surface Soil (Quarry 4) Lifetime Resident.
* This screening is also valid for Current/Surface Soil/Surface Soil/Contact (Ing. & Der.) with Surface Soil (Quarry 4) Adolescent Trespasser.
* This screening is also valid for Current/Surface Soil/Particulates/Contact (Inhalation) with Particulates from Surface Soil (Quarry 4) Adolescent Trespasser.
* This screening is also valid for Current/Surface Soil/Surface Soil/Contact (Ing. & Der.) with Surface Soil (Quarry 4) Industrial Adult.
* This screening is also valid for Current/Surface Soil/Particulates/Contact (Inhalation) with Particulates from Surface Soil (Quarry 4) Industrial Adult.

(1) Represents the 95% UCL of normal data for normal distributions; Represents the log-transformed 95% UCL for lognormal distributions.
Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

AR306436

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Contact (Ing. & Der.) with Surface Soil and Particulates (Inh.) (Quarry 4); Construction Worker

Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Aluminum	310	22600	mg/kg	8/8	22600	mg/kg	Max.
Manganese	5.4	6200	mg/kg	10/10	6200	mg/kg	Max.
Vanadium	10.5	2140	mg/kg	9/9	2140	mg/kg	Max.

AR306437

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Contact (Ing. & Der.) with Soil, Particulates (inh.) and Air (inh.) (Quarry 6); Construction Worker

Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Aluminum	1360	8170	ug/kg	2/2	8170	ug/kg	Max.
Iron	24900	31100	ug/kg	2/2	31100	ug/kg	Max.
Manganese	89.7	185	ug/kg	2/2	185	ug/kg	Max.
2-Methylnaphthalene	5000	5000	ug/kg	1/2	5000	ug/kg	Max.
4-Methylphenol	620	620	ug/kg	1/2	620	ug/kg	Max.
Benz(a)anthracene	520	8800000	ug/kg	2/2	8800000	ug/kg	Max.
Benzo(a)pyrene	470	8100000	ug/kg	2/2	8100000	ug/kg	Max.
Benzo(b)fluoranthene	5700000	5700000	ug/kg	1/2	5700000	ug/kg	Max.
Benzo(k)fluoranthene	5500000	5500000	ug/kg	1/2	5500000	ug/kg	Max.
Dibenz(a,h)anthracene	1600000	1600000	ug/kg	1/2	1600000	ug/kg	Max.
Dibenzofuran	7200000	7200000	ug/kg	1/2	7200000	ug/kg	Max.
Fluoranthene	1300	22000000	ug/kg	2/2	22000000	ug/kg	Max.
Fluorene	0.51	9600	ug/kg	2/2	9600	ug/kg	Max.
Indeno(1,2,3-cd)pyrene	4600000	4600000	ug/kg	1/2	4600000	ug/kg	Max.
Naphthalene	870	29000000	ug/kg	2/2	29000000	ug/kg	Max.
Pyrene	1500	23000000	ug/kg	2/2	23000000	ug/kg	Max.

AR306438

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Contact (Ing. & Der.) with Surface Soil (SS-1 + SS-2); Residential Child*

Chemical	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Aluminum	8060	9690	mg/kg	SS-2	2/2	9690	mg/kg	Max
Iron	36400	51700	mg/kg	SS-1	2/2	51700	mg/kg	Max
Manganese	482	1940	mg/kg	SS-1	2/2	1940	mg/kg	Max

* This screening also valid for Residential Adult, Lifetime Resident, Adolescent Trespasser, and Industrial Adult

AR306439

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Contact (Ing. & Der.) with Surface Soil (SS-3); Residential Child*

Chemical	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Arsenic	8.8	8.8	mg/kg	SS-3	1/1	8.8	mg/kg	Max
Iron	64900	64900	mg/kg	SS-3	1/1	64900	mg/kg	Max
Manganese	517	517	mg/kg	SS-3	1/1	517	mg/kg	Max
Benzo(a)pyrene	6600	6600	ug/kg	SS-3	1/1	6600	ug/kg	Max

* This screening also valid for Residential Adult, Lifetime Resident, Adolescent Trespasser, and Industrial Adult

AR306440

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Contact (Ing. & Der.) with Surface Soil (YP-Pipeline Area); Residential Child*

Chemical	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Aluminum	3390	27700	mg/kg	YUP-04	20/20	14700	mg/kg	95%UCL-T
Arsenic	4.5	146	mg/kg	YUP-04	20/20	28.8	mg/kg	95%UCL-T
Chromium	7.7	43.9	mg/kg	YUP-01	20/20	25.8	mg/kg	95%UCL-N
Cyanide	1.77	185	mg/kg	YUP-10	8/20	14.1	mg/kg	95%UCL-T
Iron	6070	54400	mg/kg	YSS-10	20/20	29,500	mg/kg	95%UCL-T
Benz(a)anthracene	68	430000	ug/kg	YUP-10	17/20	220,000	ug/kg	95%UCL-T
Benzo(a)pyrene	84	390000	ug/kg	YUP-10	18/20	25,700	ug/kg	95%UCL-T
Benzo(b)fluoranthene	52	420000	ug/kg	YUP-10	19/20	420,000	ug/kg	Max.
Dibenz(a,h)anthracene	48	48000	ug/kg	YUP-10	14/20	8720	ug/kg	95%UCL-T
Dibenzofuran	420000	420000	ug/kg	YUP-10	1/1	420000	ug/kg	Max.
Indeno(1,2,3-cd)pyrene	120	180000	ug/kg	YUP-10	18/20	62500	ug/kg	95%UCL-T

* This screening also valid for Residential Adult, Lifetime Resident, Adolescent Trespasser, and Industrial Adult

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

AR306441

TABLE 2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Contact (Ing. & Der.) with Soil (YP Quarry4); Construction Worker

Chemical	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Iron	20500	160000	mg/kg	SB-2-10-12	12/12	60000	mg/kg	95%UCL-T
Manganese	336	5280	mg/kg	Q4-T6-15	12/12	764	mg/kg	95%UCL-T

Statistics: 95% UCL of Log-transformed Data (95% UCL-T);

AR306442

TABLE 3a
CANCER TOXICITY DATA -- ORAL/DERMAL

Chemical of Potential Concern	Oral Cancer Slope Factor	Adjusted Dermal Cancer Slope Factor (2)	Units	Weight of Evidence/ Cancer Guideline Description (4)	Source Target Organ	Date (3)
Aluminum	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	1.50E+00	1.58E+00	1/(mg/kg-day)	A	IRIS	04/15/99
Barium	N/A	N/A	N/A	N/A	N/A	N/A
Beryllium	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	N/A	N/A	N/A	N/A	N/A	N/A
Chromium	N/A	N/A	N/A	N/A	N/A	N/A
Cobalt	N/A	N/A	N/A	N/A	N/A	N/A
Cyanide	N/A	N/A	N/A	N/A	N/A	N/A
Iron	N/A	N/A	N/A	N/A	N/A	N/A
Lead	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	N/A	N/A	N/A	N/A	N/A	N/A
Mercury	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dimethylphenol	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A
4-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A
Benz(a)anthracene	7.30E-01	N/A	1/(mg/kg-day)	B2	NCEA	03/01/93
Benzo(a)pyrene	7.30E+00	N/A	1/(mg/kg-day)	B2	IRIS	04/15/99
Benzo(b)fluoranthene	7.30E-01	N/A	1/(mg/kg-day)	B2	NCEA	03/01/93
Dibenz(a,h)anthracene	7.30E+00	N/A	1/(mg/kg-day)	B2	NCEA	03/01/93

AR306443

TABLE 3a
CANCER TOXICITY DATA -- ORAL/DERMAL

Chemical of Potential Concern	Oral Cancer Slope Factor	Adjusted Dermal Cancer Slope Factor (2)	Units	Weight of Evidence/ Cancer Guideline Description (4)	Source Target Organ	Date (3)
Dibenzofuran	N/A	N/A	N/A	N/A	N/A	N/A
Fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A
Fluorene	N/A	N/A	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	7.30E-01	N/A	1/(mg/kg-day)	B2	NCEA	03/01/93
2-Methynaphthalene	N/A	N/A	N/A	N/A	N/A	N/A
Naphthalene	N/A	N/A	N/A	N/A	N/A	N/A
Phenol	N/A	N/A	N/A	N/A	N/A	N/A
Pyrene	N/A	N/A	N/A	N/A	N/A	N/A
Acetone	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	2.90E-02	2.90E-02	1/(mg/kg-day)	A	IRIS	05/10/99
Chloroform	6.10E-03	6.10E-03	1/(mg/kg-day)	B2	IRIS	05/10/99

N/A = Not Applicable
(2) Adjusted SF dermal = oral SF/GI absorption value in toxicity study upon which the SF is based. To be used for dermal pathway only.
(3) IRIS - Integrated Risk Information System (EPA, 1999)
HEAST - Health Effects Assessment Summary Tables (EPA, 1997)
(4) EPA Group (Weight of Evidence); Weight of Evidence is only shown for those chemicals that have numerical cancer slope factors.
EPA Group:

A -	Human carcinogen
B1 -	Probable human carcinogen - Indicates that limited human data are available
B2 -	Probable human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans
C -	Possible human carcinogen
D -	Not classifiable as a human carcinogen
E -	Evidence of noncarcinogenicity

AR306444

TABLE 3b
CANCER TOXICITY DATA – INHALATION

Chemical of Potential Concern	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description (2)	Source	Date (1)
Aluminum	N/A	N/A	N/A	N/A	N/A
Arsenic	1.51E+01	1/(mg/kg-day)	A	IRIS	04/15/99
Beryllium	8.40E+00	1/(mg/kg-day)	B1	IRIS	05/18/99
Cadmium	6.3	1/(mg/kg-day)	B1	IRIS	05/10/99
Chromium	4.10E+01	1/(mg/kg-day)	A	IRIS	04/15/99
Cobalt	N/A	N/A	N/A	N/A	N/A
Cyanide	N/A	N/A	N/A	N/A	N/A
Iron	N/A	N/A	N/A	N/A	N/A
Lead	N/A	N/A	N/A	N/A	N/A
Manganese	N/A	N/A	N/A	N/A	N/A
Mercury	N/A	N/A	N/A	N/A	N/A
Nickel	N/A	N/A	N/A	N/A	N/A
Selenium	N/A	N/A	N/A	N/A	N/A
Thallium	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A
Zinc	N/A	N/A	N/A	N/A	N/A
2,4-Dimethylphenol	N/A	N/A	N/A	N/A	N/A
2-Methylphenol	N/A	N/A	N/A	N/A	N/A
4-Methylphenol	N/A	N/A	N/A	N/A	N/A
Benz(a)anthracene	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	3.10E+00	1/(mg/kg-day)	B2	NCEA	11/18/97
Benzo(b)fluoranthene	N/A	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	N/A	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	1.40E-02	1/(mg/kg-day)	B2	NCEA	08/02/93
Carbazole	N/A	N/A	N/A	N/A	N/A
Chrysene	N/A	N/A	N/A	N/A	N/A
Dibenz(a,h)anthracene	N/A	N/A	N/A	N/A	N/A

AR306445

TABLE 3b
CANCER TOXICITY DATA -- INHALATION

Chemical of Potential Concern	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description (2)	Source	Date (1)
Dibenzofuran	N/A	N/A	N/A	N/A	N/A
Fluoranthene	N/A	N/A	N/A	N/A	N/A
Fluorene	N/A	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	N/A	N/A
2-Methylnaphthalene	N/A	N/A	N/A	N/A	N/A
Naphthalene	N/A	N/A	N/A	N/A	N/A
Phenol	N/A	N/A	N/A	N/A	N/A
Pyrene	N/A	N/A	N/A	N/A	N/A
Acetone	N/A	N/A	N/A	N/A	N/A
Benzene	2.90E-02	1/(mg/kg-day)	A	IRIS	05/10/99
Chloroform	8.10E-02	1/(mg/kg-day)	B2	IRIS	05/10/99
Tetrachloroethene	2.03E-03	1/(mg/kg-day)	B2-C	NCEA, Other	04/01/87

N/A = Not Applicable
(1) IRIS - Integrated Risk Information System (EPA, 1999)
HEAST - Health Effects Assessment Summary Tables (EPA, 1997)
(2) EPA Group (Weight of Evidence); Weight of Evidence is only shown for those chemicals that have numerical cancer slope factors.
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C- Possilbe human carcinogen

AR306446

TABLE 3c
NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3)
Aluminum	Chronic	1.00E+00	mg/kg-day	2.70E-01	mg/kg-day	CNS (Developmental)	100	NCEA	08/26/96
Arsenic	Chronic	3.00E-04	mg/kg-day	2.85E-04	mg/kg-day	Skin/Vascular	3	IRIS	04/15/99
Barium	Chronic	7.00E-02	mg/kg-day	7.00E-02	mg/kg-day	Kidney	3	IRIS	09/29/98
Beryllium	Chronic	2.00E-03	mg/kg-day	2.00E-05	mg/kg-day	GI Tract	300	IRIS	05/10/99
Cadmium (Soil/Sediment)	Chronic	1.00E-03	mg/kg-day	2.50E-05	mg/kg-day	Kidney	10	IRIS	05/10/99
Cadmium (Water)	Chronic	5.00E-04	mg/kg-day	2.50E-05	mg/kg-day	Kidney	10	IRIS	05/10/99
Chromium	Chronic	3.00E-03	mg/kg-day	3.00E-05	mg/kg-day	Kidney	900	IRIS:Other	04/15/99
Cobalt	Chronic	6.00E-02	mg/kg-day	1.80E-02	mg/kg-day	Blood	1	NCEA	12/01/97
Cyanide	Chronic	2.00E-02	mg/kg-day	2.00E-02	mg/kg-day	Thyroid/Nervous System/Weight Loss	500	IRIS	05/10/99
Iron	Chronic	3.00E-01	mg/kg-day	3.00E-01	mg/kg-day	Liver/Blood/GI	1	NCEA	01/05/99
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	2.40E-02	mg/kg-day	2.40E-02	mg/kg-day	CNS	3	IRIS	05/10/99
Mercury (4)	Chronic	1.00E-04	mg/kg-day	1.00E-04	mg/kg-day	CNS	10	IRIS	05/10/99
Nickel	Chronic	2.00E-02	mg/kg-day	2.00E-03	mg/kg-day	Decr. Org. Wt.	300	IRIS	05/10/99
Selenium	Chronic	5.00E-03	mg/kg-day	4.50E-03	mg/kg-day	Blood/Skin/CNS	3	IRIS	05/10/99
Thallium (5)	Chronic	7.00E-05	mg/kg-day	7.00E-05	mg/kg-day	Liver	3000	Other	04/12/99
Vanadium	Chronic	7.00E-03	mg/kg-day	1.40E-04	mg/kg-day	NOAEL	100	HEAST	07/01/97
Zinc	Chronic	3.00E-01	mg/kg-day	7.50E-02	mg/kg-day	Blood	3	IRIS	05/10/99
2,4-Dimethylphenol	Chronic	2.00E-02	mg/kg-day	2.00E-02	mg/kg-day	Blood/CNS	3000	IRIS	05/10/99
2-Methylphenol	Chronic	5.00E-02	mg/kg-day	5.00E-02	mg/kg-day	CNS/Weight Loss	1000	IRIS	05/10/99
4-Methylphenol	Chronic	5.00E-03	mg/kg-day	3.25E-03	mg/kg-day	CNS/Lung/Weight Loss	1000	HEAST	07/01/97
Benz(a)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenz(a,h)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

AR306447

TABLE 3c
NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3)
Dibenzofuran	Chronic	4.00E-03	mg/kg-day	2.80E-03	mg/kg-day	CNS/Weight Loss	3000	NCEA	04/12/93
Fluoranthene	Chronic	4.00E-02	mg/kg-day	2.80E-02	mg/kg-day	Kidney/Liver/Blood	3000	IRIS	05/10/99
Fluorene	Chronic	4.00E-02	mg/kg-day	2.80E-02	mg/kg-day	Blood	3000	IRIS	05/10/99
Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylnaphthalene	Chronic	2.00E-02	mg/kg-day	1.60E-02	mg/kg-day	Weight Loss	3000	NCEA	10/21/98
Naphthalene	Chronic	2.00E-02	mg/kg-day	1.60E-02	mg/kg-day	Weight Loss	3000	IRIS	05/10/99
Phenol	Chronic	6.00E-01	mg/kg-day	6.00E-01	mg/kg-day	Fetal Weight	100	IRIS	05/10/99
Pyrene	Chronic	3.00E-02	mg/kg-day	2.40E-02	mg/kg-day	Kidney	3000	IRIS	05/10/99
Acetone	Chronic	1.00E-01	mg/kg-day	8.30E-02	mg/kg-day	Liver/Kidney	1000	IRIS	05/10/99
Benzene	Chronic	3.00E-03	mg/kg-day	3.00E-03	mg/kg-day	Blood/Immune	3000	NCEA	07/02/96
Chloroform	Chronic	1.00E-02	mg/kg-day	1.00E-02	mg/kg-day	Liver	1000	IRIS	05/10/99
Tetrachloroethene	Chronic	1.00E-02	mg/kg-day	1.00E-02	mg/kg-day	Liver	1000	IRIS	05/10/99

N/A = Not Applicable
Acronyms: CNS = Central Nervous System; GI = Gastrointestinal Tract; and NOAEL = No Observed Adverse Effect Level.
(2) Adjusted RfD = oral RfD x GI absorption value in toxicity study upon which the RfD is based. To be used for dermal pathway only.
(3) IRIS - Integrated Risk Information System (EPA, 1999)
HEAST - Health Effects Assessment Summary Tables (EPA, 1997)
(4) Oral RfD for mercury is based on that for methyl mercury, the most conservative RfD for mercury compounds, because the actual form of mercury is not known.
(5) Oral RfD for thallium is based on that for thallic oxide, the most conservative RfD for thallium compounds, because the actual form of thallium is not known.

AR306448

TABLE 3d
NON-CANCER TOXICITY DATA – INHALATION

Chemical of Potential Concern	Chronic/ Subchronic	Adjusted Inhalation RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (1)
Aluminum	Chronic	1.00E-03	mg/kg-day	CNS	300	NCEA	06/20/97
Arsenic	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Barium	Chronic	1.43E-04	mg/kg-day	Fetotoxicity	1000	HEAST	07/01/97
Beryllium	Chronic	5.70E-06	mg/kg-day	Respiratory/Immune	10	IRIS	05/18/99
Cadmium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium	Chronic	2.86E-05	mg/kg-day	Lung	300	IRIS	04/15/99
Cobalt	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cyanide	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	1.43E-05	mg/kg-day	CNS	1000	IRIS	05/10/99
Mercury	Chronic	8.60E-05	mg/kg-day	CNS	30	IRIS	05/10/99
Nickel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dimethylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benz(a)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenz(a,h)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A

AR306449

TABLE 3d
NON-CANCER TOXICITY DATA -- INHALATION

Chemical of Potential Concern	Chronic/ Subchronic	Adjusted Inhalation RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (1)
Dibenzofuran	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fluorene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylnaphthalene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Naphthalene	Chronic	9.00E-04	mg/kg-day	Respiratory	3000	IRIS	05/10/99
Phenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acetone	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	Chronic	1.70E-03	mg/kg-day	Blood	1000	NCEA	07/02/96
Chloroform	Chronic	8.60E-05	mg/kg-day	Respiratory	1000	NCEA	12/01/97

N/A = Not Applicable
Acronyms: CNS = Central Nervous System
(1) IRIS - Integrated Risk Information System (EPA, 1999)
HEAST - Health Effects Assessment Summary Tables (EPA, 1997)

AR306450

TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CHILD RESIDENT EXPOSURE QUARRY 1 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	2.88E-04	–	4.34E-07	2.88E-04	Arsenic	Skin/Vascular	7.48E+00	–	1.10E-02	7.48E+00
			Barium	–	–	–	–	Barium	Kidney	7.50E-01	–	1.08E-03	7.50E-01
			Beryllium	–	–	–	–	Beryllium	GI Tract	9.24E-01	–	1.29E-01	1.05E+00
			Chromium	–	–	–	–	Chromium	Kidney	2.22E+00	–	3.10E-01	2.53E+00
			Cyanide	–	–	–	–	Cyanide	Thyroid/Nervous System/Weight Loss	4.17E+00	–	5.83E-03	4.18E+00
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	1.62E+01	–	2.28E-02	1.62E+01
			Lead	–	–	–	–	Lead	N/A	–	–	–	–
			Manganese	–	–	–	–	Manganese	CNS	1.04E+02	–	1.46E-01	1.04E+02
			Selenium	–	–	–	–	Selenium	Blood/Skin/CNS	1.46E+00	–	2.28E-03	1.46E+00
			2,4-Dimethylphenol	–	–	–	–	2,4-Dimethylphenol	Blood/CNS	2.16E+00	–	1.52E-01	2.31E+00
			2-Methylphenol	–	–	–	–	2-Methylphenol	CNS/Weight Loss	9.36E+00	–	4.59E-01	9.85E+00
			4-Methylphenol	–	–	–	–	4-Methylphenol	CNS/Lung/Weight Loss	3.68E+02	–	2.68E+01	3.95E+02
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	2.08E-01	–	4.70E-01	7.74E-01
			Naphthalene	–	–	–	–	Naphthalene	Weight Loss	4.84E+00	–	2.36E+00	7.19E+00
			Phenol	–	–	–	–	Phenol	Fetal Weight	2.38E+00	–	8.70E-02	2.42E+00
			Acetone	–	–	–	–	Acetone	Liver/Kidney	3.13E-01	–	7.38E-04	3.14E-01
			Benzene	4.69E-05	–	3.65E-08	5.01E-05	Benzene	Blood/Immune	6.21E+00	–	5.14E-01	6.72E+00
			Chloroform	1.29E-07	–	9.66E-09	1.39E-07	Chloroform	Liver	2.30E-02	–	1.09E-03	2.40E-02
			(Total)	3.36E-04	–	4.38E-06	3.39E-04	(Total)		5.21E+02	–	3.15E+01	5.52E+02
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Quarry 1)											
			Iron*	–	–	–	–	Iron*	Liver/Blood/GI Tract	1.86E+00	–	7.31E-03	1.86E+00
			(Total)	–	–	–	–	(Total)		1.86E+00	–	7.31E-03	1.86E+00
	Particulates	Contact (Inh.) with Particulates from Surface Soil (Quarry 1)											
			Iron*	–	–	–	–	Iron*	N/A	–	–	–	–
			(Total)	–	–	–	–	(Total)		–	–	–	–

Total Risk Across Groundwater	3.39E-04
Total Risk Across Surface Soil	–
Total Risk Across All Media and All Exposure Routes	3.39E-04

Total Hazard Index Across Groundwater	5.52E+02
Total Hazard Index Across Surface Soil	1.86E+00
Total Hazard Index Across All Media and All Exposure Routes	5.54E+02

Notes
* = Only the T-test for Iron indicates a background exceedance.

Total Blood HI =	2.83E+01
Total CNS HI =	5.03E+02
Total Fetal Weight HI =	2.42E+00
Total GI Tract HI =	1.88E+01
Total Immune HI =	6.72E+00
Total Kidney HI =	4.38E+00
Total Liver HI =	1.81E+01
Total Lung HI =	3.95E+02
Total Nervous System HI =	4.18E+00
Total Skin HI =	9.95E+00
Total Thyroid HI =	4.18E+00
Total Vascular HI =	7.48E+00
Total Weight Loss HI =	4.88E+02

AR306451

TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT CONSTRUCTION WORKER EXPOSURE TO QUARRY 1 SOIL
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Contact (Ing. & Der.) with Soil (Quarry 1)											
			Aluminum	--	--	--	--	Aluminum	CNS (Developmental)	6.38E-02	--	1.57E-03	6.52E-02
			Manganese	--	--	--	--	Manganese	CNS	1.32E-01	--	8.76E-04	1.33E-01
			Naphthalene	--	--	--	--	Naphthalene	Weight Loss	4.64E-01	--	3.77E-02	4.92E-01
			(Total)	--	--	--	--	(Total)		6.50E-01	--	4.02E-02	6.90E-01
	Air	Contact (Inh.) with Airborne Vapors from Soil (Quarry 1)											
			Naphthalene	--	--	--	--	Naphthalene	Respiratory	--	1.45E+00	--	1.45E+00
			(Total)	--	--	--	--	(Total)		--	1.45E+00	--	1.45E+00
	Particulates	Contact (Inh.) with Particulates from Soil (Quarry 1)											
			Aluminum	--	--	--	--	Aluminum	CNS	--	9.11E-01	--	9.11E-01
			Manganese	--	--	--	--	Manganese	CNS	--	3.17E+00	--	3.17E+00
			Naphthalene	--	--	--	--	Naphthalene	Respiratory	--	1.45E-01	--	1.45E-01
			(Total)	--	--	--	--	(Total)		--	4.23E+00	--	4.23E+00
						Total Risk Across Soil	--					Total Hazard Index Across Soil	6.35E+00
						Total Risk Across All Media and All Exposure Routes	--					Total Hazard Index Across All Media and All Exposure Routes	6.35E+00

Total CNS HI =	4.26E+00
Total CNS (Developmental) HI =	6.52E-02
Total Respiratory HI =	1.59E+00
Total Weight Loss HI =	4.92E-01

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TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT CONSTRUCTION WORKER EXPOSURE TO QUARRY 2 SOIL
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Contact (Ing. & Der.) with Soil (Quarry 2)											
			Iron*	–	–	–	–	Iron*	Liver/Blood/GI Tract	1.40E+00	–	9.28E-03	1.41E+00
			Manganese*	–	–	–	–	Manganese*	CNS	1.25E-01	–	8.28E-04	1.25E-01
			(Total)	–	–	–	–	(Total)		1.52E+00	–	1.01E-02	1.53E+00
	Particulates	Contact (Inh.) with Particulates from Soil (Quarry 2)											
			Iron*	–	–	–	–	Iron*	N/A	–	–	–	–
			Manganese*	–	–	–	–	Manganese*	CNS	–	2.99E+00	–	2.99E+00
			(Total)	–	–	–	–	(Total)		–	2.99E+00	–	2.99E+00
						Total Risk Across Soil	–					Total Hazard Index Across Soil	4.53E+00
						Total Risk Across All Media and All Exposure Routes	–					Total Hazard Index Across All Media and All Exposure Routes	4.53E+00

Total Blood HI = 1.41E+00
Total CNS HI = 3.12E+00
Total Liver HI = 1.41E+00

Notes
* = Only the UTL test for iron and manganese indicates a background exceedance.

AR306453

TABLE 4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CHILD RESIDENT EXPOSURE TO QUARRY 3 SURFACE SOIL, SEDIMENT, SURFACE WATER AND GROUNDWATER (CENTER OF PLUME)

REASONABLE MAXIMUM EXPOSURE

CRATER REBOURCES

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Central (Avg. 5 Dev.) with Groundwater (Center of Plume)											
			Arsenic	2.00E-04	-	4.24E-07	2.00E-04	Arsenic	Skin/Arsenicosis	7.40E+00	-	1.10E-02	7.40E+00
			Barium	-	-	-	-	Barium	Kidney	7.00E-01	-	1.00E-00	7.00E-01
			Beryllium	-	-	-	-	Beryllium	GI Tract	8.34E-01	-	1.20E-01	1.00E+00
			Chromium	-	-	-	-	Chromium	Kidney	2.22E+00	-	3.18E-01	2.66E+00
			Cyanide	-	-	-	-	Cyanide	Thyroid/Nervous System/Weight Loss	4.17E+00	-	6.00E-00	4.17E+00
			Iron	-	-	-	-	Iron	Liver/Blood/GI Tract	1.00E+01	-	2.20E-00	1.00E+01
			Lead	-	-	-	-	Lead	NA	-	-	-	-
			Manganese	-	-	-	-	Manganese	CNS	1.04E+00	-	1.40E-01	1.04E+00
			Selenium	-	-	-	-	Selenium	Blood/Skin/CNS	1.40E+00	-	2.20E-00	1.40E+00
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	Blood/CNS	2.14E+00	-	1.02E-01	2.31E+00
			2-Methylphenol	-	-	-	-	2-Methylphenol	CNS/Weight Loss	5.30E+00	-	4.00E-01	5.80E+00
			4-Methylphenol	-	-	-	-	4-Methylphenol	CNS/Long/Weight Loss	3.00E+00	-	2.00E+01	3.00E+00
			Chlorobenzene	-	-	-	-	Chlorobenzene	Kidney	2.00E-01	-	4.70E-01	7.70E-01
			Naphthalene	-	-	-	-	Naphthalene	Weight Loss	4.00E+00	-	2.30E+00	7.10E+00
			Phenol	-	-	-	-	Phenol	Fetal Weight	2.30E+00	-	6.70E-00	2.63E+00
			Aniline	-	-	-	-	Aniline	Liver/Kidney	3.13E-01	-	7.30E-01	3.14E-01
			Benzene	4.00E-00	-	3.00E-00	8.01E-00	Benzene	Blood/Immune	6.34E+00	-	6.14E-01	6.72E+00
			Chloroform	1.30E-07	-	5.00E-00	1.20E-07	Chloroform	Liver	2.30E+00	-	1.00E-00	2.40E+00
			(Total)	3.30E-04	-	4.30E-00	3.30E-04	(Total)		6.30E+00	-	3.10E+01	9.60E+00
Sediment	Sediment	Central (Avg. 5 Dev.) with Sediment (Quarry 3)											
			Benzo(a)anthracene	6.07E-00	-	-	6.07E-00	Benzo(a)anthracene	NA	-	-	-	-
			Benzo(a)pyrene	1.00E-00	-	-	1.00E-00	Benzo(a)pyrene	NA	-	-	-	-
			Dibenzo(a,h)anthracene	1.97E-04	-	-	1.97E-04	Dibenzo(a,h)anthracene	NA	-	-	-	-
			Chlorobenzene	-	-	-	-	Chlorobenzene	Kidney	7.30E-01	-	3.73E-01	1.10E+00
			Naphthalene	-	-	-	-	Naphthalene	Weight Loss	1.23E+00	-	5.00E-01	1.77E+00
			(Total)	1.20E-00	-	-	1.20E-00	(Total)		1.60E+00	-	9.20E-01	2.57E+00
Surface Soil	Surface Soil	Central (Avg. 5 Dev.) with Surface Soil (Quarry 3)											
			Aluminum*	-	-	-	-	Aluminum*	CNS (Developmental)	3.60E-01	-	6.37E-00	3.14E-01
			Arsenic	4.40E-04	-	7.10E-00	4.60E-04	Arsenic	Skin/Arsenicosis	1.10E+01	-	1.04E-01	1.10E+01
			Iron*	-	-	-	-	Iron*	Liver/Blood/GI Tract	2.00E+00	-	6.00E-00	2.00E+00
			Mercury*	-	-	-	-	Mercury	CNS	2.00E+00	-	1.23E-02	2.01E+00
			Benzo(a)anthracene	7.00E-04	-	-	2.00E-04	Benzo(a)anthracene	NA	-	-	-	-
			Benzo(a)pyrene	3.30E-03	-	-	3.30E-00	Benzo(a)pyrene	NA	-	-	-	-
			Benzo(b)fluoranthene	4.00E-04	-	-	4.00E-04	Benzo(b)fluoranthene	NA	-	-	-	-
			Dibenzo(a,h)anthracene	7.20E-04	-	-	7.20E-04	Dibenzo(a,h)anthracene	NA	-	-	-	-
			Indeno(1,2,3-cd)pyrene	2.00E-00	-	-	2.00E-04	Indeno(1,2,3-cd)pyrene	NA	-	-	-	-
			(Total)	6.40E-00	-	7.10E-00	6.40E-00	(Total)		1.00E+00	-	2.11E-01	1.00E+01
	Particulates	Central (Ind.) with Particulates from Surface Soil (Quarry 3)											
			Aluminum*	-	-	-	-	Aluminum*	CNS	-	6.70E+00	-	6.70E+00
			Arsenic	-	6.47E-00	-	6.47E-00	Arsenic	NA	-	-	-	-
			Iron*	-	-	-	-	Iron*	NA	-	-	-	-
			Mercury*	-	-	-	-	Mercury	CNS	-	6.00E-00	-	6.00E-00
			Benzo(a)anthracene	-	-	-	-	Benzo(a)anthracene	NA	-	-	-	-
			Benzo(a)pyrene	-	2.00E-00	-	2.00E-00	Benzo(a)pyrene	NA	-	-	-	-
			Benzo(b)fluoranthene	-	-	-	-	Benzo(b)fluoranthene	NA	-	-	-	-
			Dibenzo(a,h)anthracene	-	-	-	-	Dibenzo(a,h)anthracene	NA	-	-	-	-
			Indeno(1,2,3-cd)pyrene	-	-	-	-	Indeno(1,2,3-cd)pyrene	NA	-	-	-	-
			(Total)	-	1.11E-04	-	1.11E-04	(Total)		-	6.04E+00	-	6.04E+00

Total Risk Across Groundwater	3.30E-04
Total Risk Across Sediment	1.20E-00
Total Risk Across Surface Soil	6.60E-00
Total Risk Across Surface Water	-
Total Risk Across All Media and All Exposure Routes	7.90E-00

Total Hazard Index Across Groundwater	9.30E+00
Total Hazard Index Across Sediment	2.57E+00
Total Hazard Index Across Surface Soil	2.26E+01
Total Hazard Index Across Surface Water	-
Total Hazard Index Across All Media and All Exposure Routes	3.79E+00

Total Blood HI =	2.97E+01
Total CNS HI =	6.11E+00
Total CNS (Developmental) HI =	3.14E-01
Total Fetal Weight HI =	2.43E+00
Total GI Tract HI =	1.00E+01
Total Immune HI =	6.72E+00
Total Kidney HI =	6.40E+00
Total Liver HI =	1.00E+01
Total Lung HI =	3.00E+00
Total Nervous System HI =	4.11E+00
Total Skin HI =	2.00E+01
Total Thyroid HI =	4.11E+00
Total Vascular HI =	1.30E+01
Total Weight Loss HI =	4.00E+00

Notes
* = Only the UTL half for aluminum and iron indicates a background concentration.

AR306454

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RESIDENT EXPOSURE [illegible] BY 3 SURFACE SOIL, SEDIMENT, SURFACE WATER AND GROUNDWATER (CENTER OF PLUME)
RESIDENTIAL [illegible] AIR EXPOSURE
CRATER RESIDENCES

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Total												
	Air	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Total												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Total												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Total												
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Total												
Total Risk Across Ingestion							[illegible]	Total Hazard Index Across Ingestion					[illegible]
Total Risk Across Inhalation							[illegible]	Total Hazard Index Across Inhalation					[illegible]
Total Risk Across Dermal							[illegible]	Total Hazard Index Across Dermal					[illegible]
Total Risk Across Surface Water							-	Total Hazard Index Across Surface Water					-
Total Risk Across All Media and All Exposure Routes							[illegible]	Total Hazard Index Across All Media and All Exposure Routes					[illegible]

Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	-
Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	[illegible]
Total [illegible]	[illegible]

Notes
* [illegible]

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TABLE 4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - LIFETIME RESIDENT EXPOSURE TO QUARRY 1 SURFACE SOIL, SEDIMENT, SURFACE WATER AND GROUNDWATER (CENTER OF PLUME

REASONABLE MAXIMUM EXPOSURE

CRATER RESOURCES

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	7.11E-04	-	1.44E-04	7.11E-04	Arsenic	NA	NA	-	NA	-
			Barium	-	-	-	-	Barium	NA	NA	-	NA	-
			Beryllium	-	-	-	-	Beryllium	NA	NA	-	NA	-
			Chromium	-	-	-	-	Chromium	NA	NA	-	NA	-
			Cyanide	-	-	-	-	Cyanide	NA	NA	-	NA	-
			Iron	-	-	-	-	Iron	NA	NA	-	NA	-
			Lead	-	-	-	-	Lead	NA	NA	-	NA	-
			Manganese	-	-	-	-	Manganese	NA	NA	-	NA	-
			Selenium	-	-	-	-	Selenium	NA	NA	-	NA	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	NA	NA	-	NA	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	NA	NA	-	NA	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	NA	-	NA	-
			Chlorobenzene	-	-	-	-	Chlorobenzene	NA	NA	-	NA	-
			Naphthalene	-	-	-	-	Naphthalene	NA	NA	-	NA	-
			Phenol	-	-	-	-	Phenol	NA	NA	-	NA	-
			Aniline	-	-	-	-	Aniline	NA	NA	-	NA	-
			Benzene	1.14E-04	-	0.00E-00	1.20E-04	Benzene	NA	NA	-	NA	-
			Chloroform	2.00E-07	-	1.37E-00	2.00E-07	Chloroform	NA	NA	-	NA	-
			Total	8.27E-04	-	1.00E-00	8.27E-04	Total	-	-	-	-	-
	Air	Contact (Inh.) with Atlanta Water (Groundwater (Center of Plume)											
			Arsenic	-	-	-	-	Arsenic	NA	-	NA	-	-
			Barium	-	-	-	-	Barium	NA	-	NA	-	-
			Beryllium	-	-	-	-	Beryllium	NA	-	NA	-	-
			Chromium	-	-	-	-	Chromium	NA	-	NA	-	-
			Cyanide	-	-	-	-	Cyanide	NA	-	NA	-	-
			Iron	-	-	-	-	Iron	NA	-	NA	-	-
			Lead	-	-	-	-	Lead	NA	-	NA	-	-
			Manganese	-	-	-	-	Manganese	NA	-	NA	-	-
			Selenium	-	-	-	-	Selenium	NA	-	NA	-	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	NA	-	NA	-	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	NA	-	NA	-	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	-	NA	-	-
			Chlorobenzene	-	-	-	-	Chlorobenzene	NA	-	NA	-	-
			Naphthalene	-	-	-	-	Naphthalene	NA	-	NA	-	-
			Phenol	-	-	-	-	Phenol	NA	-	NA	-	-
			Aniline	-	-	-	-	Aniline	NA	-	NA	-	-
			Benzene	-	1.20E-04	-	1.20E-04	Benzene	NA	-	NA	-	-
			Chloroform	-	2.00E-07	-	2.00E-07	Chloroform	NA	-	NA	-	-
			Total	-	1.20E-04	-	1.20E-04	Total	-	-	-	-	-
Sediment	Sediment	Contact (Ing. & Der.) with Sediment (Quarry 1)											
			Benzo(a)anthracene	1.07E-04	-	-	1.07E-04	Benzo(a)anthracene	NA	NA	-	NA	-
			Benzo(b)fluoranthene	1.30E-04	-	-	1.30E-04	Benzo(b)fluoranthene	NA	NA	-	NA	-
			Benzo(k)fluoranthene	1.00E-04	-	-	1.00E-04	Benzo(k)fluoranthene	NA	NA	-	NA	-
			Chrysene	-	-	-	-	Chrysene	NA	NA	-	NA	-
			Dibenzofuran	-	-	-	-	Dibenzofuran	NA	NA	-	NA	-
			Total	1.00E-03	-	-	1.00E-03	Total	-	-	-	-	-
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Quarry 1)											
			Aluminum*	-	-	-	-	Aluminum*	NA	NA	-	NA	-
			Arsenic	0.00E-04	-	1.00E-00	0.70E-04	Arsenic	NA	NA	-	NA	-
			Iron*	-	-	-	-	Iron*	NA	NA	-	NA	-
			Mercury*	-	-	-	-	Mercury	NA	NA	-	NA	-
			Benzo(a)anthracene	4.30E-04	-	-	4.30E-04	Benzo(a)anthracene	NA	NA	-	NA	-
			Benzo(b)fluoranthene	4.00E-04	-	-	4.00E-04	Benzo(b)fluoranthene	NA	NA	-	NA	-
			Benzo(k)fluoranthene	0.70E-04	-	-	0.70E-04	Benzo(k)fluoranthene	NA	NA	-	NA	-
			Chrysene	1.07E-04	-	-	1.07E-04	Chrysene	NA	NA	-	NA	-
			Indeno(1,2,3-cd)pyrene	3.00E-04	-	-	3.00E-04	Indeno(1,2,3-cd)pyrene	NA	NA	-	NA	-
			Total	2.00E-03	-	1.00E-00	2.00E-03	Total	-	-	-	-	-
	Production	Contact (Ing.) with Production Area Surface Soil (Quarry 1)											
			Aluminum*	-	-	-	-	Aluminum*	NA	-	NA	-	-
			Arsenic	-	1.00E-04	-	1.00E-04	Arsenic	NA	-	NA	-	-
			Iron*	-	-	-	-	Iron*	NA	-	NA	-	-
			Mercury*	-	-	-	-	Mercury	NA	-	NA	-	-
			Benzo(a)anthracene	-	-	-	-	Benzo(a)anthracene	NA	-	NA	-	-
			Benzo(b)fluoranthene	-	0.10E-04	-	0.10E-04	Benzo(b)fluoranthene	NA	-	NA	-	-
			Benzo(k)fluoranthene	-	-	-	-	Benzo(k)fluoranthene	NA	-	NA	-	-
			Chrysene	-	-	-	-	Chrysene	NA	-	NA	-	-
			Indeno(1,2,3-cd)pyrene	-	-	-	-	Indeno(1,2,3-cd)pyrene	NA	-	NA	-	-
			Total	-	2.00E-04	-	2.00E-04	Total	-	-	-	-	-

Total Risk Across Groundwater	2.00E-04
Total Risk Across Sediment	1.00E-03
Total Risk Across Surface Soil	2.00E-03
Total Risk Across Surface Water	-
Total Risk Across All Media and All Exposure Routes	3.00E-03

Total Hazard Index Across Groundwater	-
Total Hazard Index Across Sediment	-
Total Hazard Index Across Surface Soil	-
Total Hazard Index Across Surface Water	-
Total Hazard Index Across All Media and All Exposure Routes	-

Notes

* = Only the UTL test for aluminum and iron indicates a background contribution.

AR306456

TABLE 4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADOLESCENT (TEENS) TRESPASSER/VISITOR EXPOSURE TO QUARRY 3 SURFACE SOIL, SEDIMENT, AND SURFACE WATER

REASONABLE MAXIMUM EXPOSURE

CRATER RESOURCES

Scenario Timeframe: Current
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescent (Teens)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Contact (Ing. & Der.) with Sediment (Quarry 3)											
			Benz(a)anthracene	1.27E-05	–	–	1.27E-05	Benz(a)anthracene	NA	–	–	–	–
			Benzo(a)pyrene	1.91E-04	–	–	1.91E-04	Benzo(a)pyrene	NA	–	–	–	–
			Benzo(b)fluoranthene	2.30E-05	–	–	2.30E-05	Benzo(b)fluoranthene	NA	–	–	–	–
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	6.38E-02	–	1.32E-01	1.95E-01
			Naphthalene	–	–	–	–	Naphthalene	Weight Loss	1.07E-01	–	1.94E-01	3.01E-01
			(Total)	1.67E-04	–	–	1.67E-04	(Total)		1.71E-01	–	3.26E-01	4.97E-01
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Quarry 3)											
			Aluminum*	–	–	–	–	Aluminum*	CNS (Developmental)	1.24E-02	–	6.60E-04	1.31E-02
			Arsenic	3.01E-05	–	1.47E-03	3.16E-05	Arsenic	Skin/Vascular	4.67E-01	–	2.23E-02	4.90E-01
			Iron*	–	–	–	–	Iron*	Liver/Blood/GI Tract	6.12E-02	–	1.16E-03	6.24E-02
			Mercury	–	–	–	–	Mercury	CNS	1.04E-01	–	1.51E-03	1.06E-01
			Benz(a)anthracene	1.94E-05	–	–	1.94E-05	Benz(a)anthracene	NA	–	–	–	–
			Benzo(a)pyrene	2.22E-04	–	–	2.22E-04	Benzo(a)pyrene	NA	–	–	–	–
			Benzo(b)fluoranthene	3.60E-05	–	–	3.60E-05	Benzo(b)fluoranthene	NA	–	–	–	–
			Dibenz(a,h)anthracene	4.84E-05	–	–	4.84E-05	Dibenz(a,h)anthracene	NA	–	–	–	–
			Indeno(1,2,3-cd)pyrene	1.60E-05	–	–	1.60E-05	Indeno(1,2,3-cd)pyrene	NA	–	–	–	–
			(Total)	3.67E-04	–	1.47E-03	3.66E-04	(Total)		6.66E-01	–	2.62E-02	6.92E-01
	Particulates	Contact (Inh.) with Particulates from Surface Soil (Quarry 3)											
			Aluminum*	–	–	–	–	Aluminum*	CNS	–	1.56E-01	–	1.56E-01
			Arsenic	–	3.76E-09	–	3.76E-09	Arsenic	NA	–	–	–	–
			Iron*	–	–	–	–	Iron*	NA	–	–	–	–
			Mercury	–	–	–	–	Mercury	CNS	–	1.62E-03	–	1.62E-03
			Benz(a)anthracene	–	–	–	–	Benz(a)anthracene	NA	–	–	–	–
			Benzo(a)pyrene	–	1.16E-09	–	1.16E-09	Benzo(a)pyrene	NA	–	–	–	–
			Benzo(b)fluoranthene	–	–	–	–	Benzo(b)fluoranthene	NA	–	–	–	–
			Dibenz(a,h)anthracene	–	–	–	–	Dibenz(a,h)anthracene	NA	–	–	–	–
			Indeno(1,2,3-cd)pyrene	–	–	–	–	Indeno(1,2,3-cd)pyrene	NA	–	–	–	–
			(Total)	–	4.92E-09	–	4.92E-09	(Total)		–	1.57E-01	–	1.57E-01

Total Risk Across Sediment	1.67E-04
Total Risk Across Surface Soil	3.74E-04
Total Risk Across Surface Water	–
Total Risk Across All Media and All Exposure Routes	5.61E-04

Total Hazard Index Across Sediment	4.97E-01
Total Hazard Index Across Surface Soil	8.46E-01
Total Hazard Index Across Surface Water	–
Total Hazard Index Across All Media and All Exposure Routes	1.34E+00

Total Blood HI =	6.24E-02
Total CNS HI =	2.76E-01
Total CNS (Developmental) HI =	1.31E-02
Total GI Tract HI =	6.24E-02
Total Kidney HI =	1.95E-01
Total Liver HI =	6.24E-02
Total Skin HI =	4.90E-01
Total Vascular HI =	4.90E-01
Total Weight Loss HI =	3.01E-01

Notes

* = Only the UTL test for aluminum and iron indicates a background exceedance.

AR306457

TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT CONSTRUCTION WORKER EXPOSURE TO QUARRY 3 SOIL
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Contact (Ing. & Der.) with Soil (Quarry 3)											
			Arsenic	4.14E-05	–	9.28E-07	4.24E-05	Arsenic	Skin/Vascular	6.45E+00	–	1.44E-01	6.59E+00
			Manganese	–	–	–	–	Manganese	CNS	9.23E-02	–	6.14E-04	9.29E-02
			Mercury	–	–	–	–	Mercury	CNS	1.44E+00	–	9.54E-03	1.45E+00
			2-Methylnaphthalene	–	–	–	–	2-Methylnaphthalene	Weight Loss	5.13E-01	–	4.28E-02	5.55E-01
			Benzo(a)pyrene	1.44E-04	–	–	1.44E-04	Benzo(a)pyrene	N/A	–	–	–	–
			Dibenz(a,h)anthracene	3.08E-05	–	–	3.08E-05	Dibenz(a,h)anthracene	N/A	–	–	–	–
			Naphthalene	–	–	–	–	Naphthalene	Weight Loss	3.98E+01	–	3.29E+00	4.29E+01
			(Total)	2.18E-04	–	9.28E-07	2.17E-04	(Total)		4.61E+01	–	3.48E+00	5.15E+01
	Air	Contact (Inh.) with Airborne Vapors from Soil (Quarry 3)											
			2-Methylnaphthalene	–	–	–	–	2-Methylnaphthalene	N/A	–	–	–	–
			Naphthalene	–	–	–	–	Naphthalene	Respiratory	–	1.62E+02	–	1.62E+02
			(Total)	–	–	–	–	(Total)		–	1.62E+02	–	1.62E+02
	Particulates	Contact (Inh.) with Particulates from Soil (Quarry 3)											
			Arsenic	–	5.99E-08	–	5.99E-08	Arsenic	N/A	–	–	–	–
			Manganese	–	–	–	–	Manganese	CNS	–	2.22E+00	–	2.22E+00
			Mercury	–	–	–	–	Mercury	CNS	–	2.40E-02	–	2.40E-02
			2-Methylnaphthalene	–	–	–	–	2-Methylnaphthalene	N/A	–	–	–	–
			Benzo(a)pyrene	–	8.74E-07	–	8.74E-07	Benzo(a)pyrene	N/A	–	–	–	–
			Dibenz(a,h)anthracene	–	–	–	–	Dibenz(a,h)anthracene	N/A	–	–	–	–
			Naphthalene	–	–	–	–	Naphthalene	Respiratory	–	1.26E+01	–	1.26E+01
			(Total)	–	8.85E-06	–	8.85E-06	(Total)		–	1.46E+01	–	1.46E+01
						Total Risk Across Soil	2.23E-04					Total Hazard Index Across Soil	2.29E+02
						Total Risk Across All Media and All Exposure Routes	2.23E-04					Total Hazard Index Across All Media and All Exposure Routes	2.29E+02

Total CNS HI =	3.76E+00
Total Respiratory HI =	1.75E+02
Total Skin HI =	6.59E+00
Total Vascular HI =	6.59E+00
Total Weight Loss HI =	4.34E+01

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RY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT INDUSTRIAL WORKER EXPOSU QUARRY 3 SURFACE SOIL, SEDIMENT, SURFACE WATER AND GROUNDWATER (CENTER OF P
REASONABLE M UM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Central Reg. 4 Rec.) wells Groundwater (Center of Plume)											
			Arsenic	1.[illegible]E-04	-	3.[illegible]E-05	1.[illegible]E-04	Arsenic	Skin/vascular	8.[illegible]E-01	-	2.[illegible]E-01	9.[illegible]E-01
			Barium	-	-	-	-	Barium	Kidney	8.[illegible]E-02	-	1.[illegible]E-02	9.[illegible]E-02
			Beryllium	-	-	-	-	Beryllium	GI Tract	1.[illegible]E-01	-	2.[illegible]E-02	1.[illegible]E-01
			Chromium	-	-	-	-	Chromium	Kidney	2.[illegible]E-01	-	5.[illegible]E-02	2.[illegible]E-01
			Cyanide	-	-	-	-	Cyanide	Thyroid/Adrenal System/Weight Loss	5.[illegible]E-02	-	1.[illegible]E-01	6.[illegible]E-01
			Iron	-	-	-	-	Iron	Liver/Blood/GI Tract	2.[illegible]E-00	-	4.[illegible]E-01	2.[illegible]E-00
			Lead	-	-	-	-	Lead	NA	-	-	-	-
			Manganese	-	-	-	-	Manganese	CNS	1.[illegible]E-01	-	2.[illegible]E-02	1.[illegible]E-01
			Selenium	-	-	-	-	Selenium	Blood/Skin/CNS	1.[illegible]E-01	-	4.[illegible]E-02	1.[illegible]E-01
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	Blood/CNS	2.[illegible]E-01	-	2.[illegible]E-02	2.[illegible]E-01
			2-Methylphenol	-	-	-	-	2-Methylphenol	CNS/Weight Loss	1.[illegible]E-00	-	8.[illegible]E-02	1.[illegible]E-00
			4-Methylphenol	-	-	-	-	4-Methylphenol	CNS/Liver/Weight Loss	4.[illegible]E-00	-	5.[illegible]E-01	4.[illegible]E-01
			Dibenzofuran	-	-	-	-	Dibenzofuran	Kidney	3.[illegible]E-00	-	6.[illegible]E-02	4.[illegible]E-00
			Naphthalene	-	-	-	-	Naphthalene	Weight Loss	6.[illegible]E-01	-	4.[illegible]E-02	6.[illegible]E-01
			Phenol	-	-	-	-	Phenol	Pituitary Weight	3.[illegible]E-01	-	1.[illegible]E-01	3.[illegible]E-01
			Pyrene	-	-	-	-	Pyrene	Liver/Kidney	4.[illegible]E-02	-	1.[illegible]E-02	4.[illegible]E-02
			Benzene	2.[illegible]E-05	-	2.[illegible]E-07	2.[illegible]E-05	Benzene	Blood/Immune	6.[illegible]E-01	-	5.[illegible]E-01	9.[illegible]E-01
			Chloroform	6.[illegible]E-05	-	4.[illegible]E-10	6.[illegible]E-05	Chloroform	Liver	3.[illegible]E-00	-	2.[illegible]E-05	3.[illegible]E-00
			Total	1.[illegible]E-04	-	3.[illegible]E-07	1.[illegible]E-04	Total		8.[illegible]E-01	-	3.[illegible]E-01	8.[illegible]E-01
Sediment	Sediment	Central Reg. 4 Rec.) wells Sediment (Quarry 3)											
			Benzo(a)anthracene	7.[illegible]E-05	-	-	7.[illegible]E-05	Benzo(a)anthracene	NA	-	-	-	-
			Benzo(a)pyrene	6.[illegible]E-05	-	-	6.[illegible]E-05	Benzo(a)pyrene	NA	-	-	-	-
			Benzo(b)fluoranthene	1.[illegible]E-05	-	-	1.[illegible]E-05	Benzo(b)fluoranthene	NA	-	-	-	-
			Dibenzofuran	-	-	-	-	Dibenzofuran	Kidney	1.[illegible]E-02	-	1.[illegible]E-02	3.[illegible]E-02
			Naphthalene	-	-	-	-	Naphthalene	Weight Loss	3.[illegible]E-02	-	3.[illegible]E-02	6.[illegible]E-02
			Total	1.[illegible]E-04	-	-	1.[illegible]E-04	Total		4.[illegible]E-02	-	3.[illegible]E-02	7.[illegible]E-02
Surface Soil	Surface Soil	Central Reg. 4 Rec.) wells Surface Soil (Quarry 3)											
			Aluminum*	-	-	-	-	Aluminum*	CNS (Developmental)	1.[illegible]E-02	-	6.[illegible]E-03	1.[illegible]E-02
			Arsenic	7.[illegible]E-05	-	3.[illegible]E-05	1.[illegible]E-04	Arsenic	Skin/vascular	4.[illegible]E-01	-	2.[illegible]E-01	6.[illegible]E-01
			Iron*	-	-	-	-	Iron*	Liver/Blood/GI Tract	6.[illegible]E-02	-	1.[illegible]E-02	6.[illegible]E-02
			Mercury	-	-	-	-	Mercury	CNS	1.[illegible]E-01	-	1.[illegible]E-03	1.[illegible]E-01
			Benzo(a)anthracene	8.[illegible]E-05	-	-	8.[illegible]E-05	Benzo(a)anthracene	NA	-	-	-	-
			Benzo(a)pyrene	8.[illegible]E-04	-	-	8.[illegible]E-04	Benzo(a)pyrene	NA	-	-	-	-
			Benzo(b)fluoranthene	6.[illegible]E-05	-	-	6.[illegible]E-05	Benzo(b)fluoranthene	NA	-	-	-	-
			Dibenzo(a,h)anthracene	1.[illegible]E-04	-	-	1.[illegible]E-04	Dibenzo(a,h)anthracene	NA	-	-	-	-
			Indeno(1,2,3-cd)pyrene	4.[illegible]E-05	-	-	4.[illegible]E-05	Indeno(1,2,3-cd)pyrene	NA	-	-	-	-
			Total	8.[illegible]E-04	-	3.[illegible]E-05	9.[illegible]E-04	Total		7.[illegible]E-01	-	2.[illegible]E-01	7.[illegible]E-01
	Particulates	Central Reg. 4 Rec.) wells Particulates from Surface Soil (Quarry 3)											
			Aluminum*	-	-	-	-	Aluminum*	CNS	-	1.[illegible]E-03	-	1.[illegible]E-03
			Arsenic	-	1.[illegible]E-01	-	1.[illegible]E-01	Arsenic	Skin	-	-	-	-
			Iron*	-	-	-	-	Iron*	Skin	-	-	-	-
			Mercury	-	-	-	-	Mercury	CNS	-	1.[illegible]E-02	-	1.[illegible]E-02
			Benzo(a)anthracene*	-	-	-	-	Benzo(a)anthracene*	Skin	-	-	-	-
			Benzo(a)pyrene	-	3.[illegible]E-03	-	3.[illegible]E-03	Benzo(a)pyrene	Skin	-	-	-	-
			Benzo(b)fluoranthene	-	-	-	-	Benzo(b)fluoranthene	Skin	-	-	-	-
			Dibenzo(a,h)anthracene	-	-	-	-	Dibenzo(a,h)anthracene	Skin	-	-	-	-
			Indeno(1,2,3-cd)pyrene	-	-	-	-	Indeno(1,2,3-cd)pyrene	Skin	-	-	-	-
			Total	-	1.[illegible]E-01	-	1.[illegible]E-01	Total		-	1.[illegible]E-02	-	1.[illegible]E-02

Total Risk Across Groundwater	1.[illegible]E-04
Total Risk Across Sediment	1.[illegible]E-04
Total Risk Across Surface Soil	1.[illegible]E-03
Total Risk Across Surface Water	-
Total Risk Across All Media and All Exposure Routes	1.[illegible]E-03

Total Hazard Index Across Groundwater	8.[illegible]E+01
Total Hazard Index Across Sediment	7.[illegible]E-02
Total Hazard Index Across Surface Soil	2.[illegible]E+00
Total Hazard Index Across Surface Water	-
Total Hazard Index Across All Media and All Exposure Routes	7.[illegible]E+01

Total Hazard HI =	2.[illegible]E+00
Total CNS HI =	8.[illegible]E+01
Total CNS (Developmental) HI =	1.[illegible]E-02
Total Pituitary Weight HI =	3.[illegible]E-01
Total GI Tract HI =	2.[illegible]E+00
Total Immune HI =	9.[illegible]E-01
Total Kidney HI =	5.[illegible]E-01
Total Liver HI =	2.[illegible]E+00
Total Lung HI =	4.[illegible]E+01
Total Nervous System HI =	5.[illegible]E-01
Total Skin HI =	1.[illegible]E+00
Total Thyroid HI =	5.[illegible]E-01
Total Vascular HI =	1.[illegible]E+00
Total Weight Loss HI =	3.[illegible]E+01

Notes
* = Only the UTL not for aluminum and iron indicates a background exceedance

AR306459

TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CHILD RESIDENT EXPOSURE TO QUARRY 4 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	2.88E-04	--	4.34E-07	2.88E-04	Arsenic	Skin/Vascular	7.48E+00	--	1.10E-02	7.49E+00
			Barium	--	--	--	--	Barium	Kidney	7.58E-01	--	1.08E-03	7.60E-01
			Beryllium	--	--	--	--	Beryllium	GI Tract	8.24E-01	--	1.29E-01	1.05E+00
			Chromium	--	--	--	--	Chromium	Kidney	2.22E+00	--	3.10E-01	2.53E+00
			Cyanide	--	--	--	--	Cyanide	Thyroid/Nervous System/Weight Loss	4.17E+00	--	5.83E-03	4.18E+00
			Iron	--	--	--	--	Iron	Liver/Blood/GI Tract	1.62E+01	--	2.28E-02	1.62E+01
			Lead	--	--	--	--	Lead	N/A	--	--	--	--
			Manganese	--	--	--	--	Manganese	CNS	1.04E+02	--	1.46E-01	1.04E+02
			Selenium	--	--	--	--	Selenium	Blood/Skin/CNS	1.46E+00	--	2.28E-03	1.46E+00
			2,4-Dimethylphenol	--	--	--	--	2,4-Dimethylphenol	Blood/CNS	2.16E+00	--	1.52E-01	2.31E+00
			2-Methylphenol	--	--	--	--	2-Methylphenol	CNS/Weight Loss	8.38E+00	--	4.59E-01	8.85E+00
			4-Methylphenol	--	--	--	--	4-Methylphenol	CNS/Lung/Weight Loss	3.58E+02	--	2.69E+01	3.85E+02
			Dibenzofuran	--	--	--	--	Dibenzofuran	Kidney	2.98E-01	--	4.76E-01	7.74E-01
			Naphthalene	--	--	--	--	Naphthalene	Weight Loss	4.84E+00	--	2.35E+00	7.19E+00
			Phenol	--	--	--	--	Phenol	Fetal Weight	2.36E+00	--	5.76E-02	2.42E+00
			Acetone	--	--	--	--	Acetone	Liver/Kidney	3.13E-01	--	7.39E-04	3.14E-01
			Benzene	4.63E-06	--	3.63E-08	5.01E-06	Benzene	Blood/Immune	6.21E+00	--	5.14E-01	6.72E+00
			Chloroform	1.20E-07	--	5.86E-09	1.26E-07	Chloroform	Liver	2.30E-02	--	1.08E-03	2.40E-02
			(Total)	3.36E-04	--	4.28E-06	3.36E-04	(Total)		6.21E+02	--	3.16E+01	6.62E+02
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Quarry 4)											
			Aluminum*	--	--	--	--	Aluminum*	CNS (Developmental)	1.34E-01	--	2.33E-03	1.36E-01
			Chromium**	--	--	--	--	Chromium**	Kidney	1.27E+00	--	6.99E-01	1.87E+00
			Iron**	--	--	--	--	Iron**	Liver/Blood/GI Tract	4.35E+00	--	2.05E-02	4.37E+00
			Manganese**	--	--	--	--	Manganese**	CNS	2.98E+00	--	1.40E-02	3.00E+00
			(Total)	--	--	--	--	(Total)		8.74E+00	--	6.36E-01	9.38E+00
	Particulates	Contact (Inh.) with Particulates from Surface Soil (Quarry 4)											
			Aluminum*	--	--	--	--	Aluminum*	CNS	--	2.51E+00	--	2.51E+00
			Chromium**	--	2.52E-04	--	2.52E-04	Chromium**	Lung	--	2.51E+00	--	2.51E+00
			Iron**	--	--	--	--	Iron**	N/A	--	--	--	--
			Manganese**	--	--	--	--	Manganese**	CNS	--	9.39E+01	--	9.39E+01
			(Total)	--	2.52E-04	--	2.52E-04	(Total)		--	9.89E+01	--	9.89E+01

Total Risk Across Groundwater	3.36E-04	Total Hazard Index Across Groundwater	6.62E+02
Total Risk Across Surface Soil	2.52E-04	Total Hazard Index Across Surface Soil	1.08E+02
Total Risk Across All Media and All Exposure Routes	5.91E-04	Total Hazard Index Across All Media and All Exposure Routes	6.81E+02

Notes
* = Only the UTL test for aluminum indicates a background exceedance.
** = Chromium, iron, and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

Total Blood HI =	3.11E+01
Total CNS HI =	6.02E+02
Total CNS (Developmental) HI =	1.36E-01
Total Fetal Weight HI =	2.42E+00
Total GI Tract HI =	2.16E+01
Total Immune HI =	6.72E+00
Total Kidney HI =	6.25E+00
Total Liver HI =	2.09E+01
Total Lung HI =	3.87E+02
Total Nervous System HI =	4.18E+00
Total Skin HI =	8.95E+00
Total Thyroid HI =	4.18E+00
Total Vascular HI =	[illegible]E+00
Total Weight Loss HI =	[illegible]E+02

ro+fouse+cp_tan_rwo.xls

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SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RESIDENT[illegible]URE TO QUARRY 4 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)
REASONABLE M[illegible]M EXPOSURE
CRAYER RESOURCES

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Central (Eq. 4 Bor.) wells Groundwater (Center of Plume)											
			Arsenic*	4.2E-04	-	1.0E-03	4.0E-04	Arsenic	Skin/vascular	2.7E+02	-	0.0E+00	2.7E+02
			Barium	-	-	-	-	Barium	Kidney	2.7E-01	-	0.0E+00	2.0E-01
			Beryllium	-	-	-	-	Beryllium	GI Tract	3.0E-02	-	7.7E-02	4.1E-01
			Cadmium	-	-	-	-	Cadmium	Kidney	5.1E-01	-	1.0E-01	1.0E+00
			Chromium	-	-	-	-	Chromium	Thymus/Immune System/Weight Loss	1.0E+00	-	3.0E-02	1.0E+00
			Iron	-	-	-	-	Iron	Blood/Blood/GI Tract	0.0E+00	-	1.3E-02	0.0E+00
			Lead	-	-	-	-	Lead	NA	-	-	-	-
			Manganese	-	-	-	-	Manganese	CNS	3.0E+00	-	0.7E-02	3.0E+00
			Mercury	-	-	-	-	Mercury	Blood/Kidney/CNS	5.3E-01	-	1.3E-02	5.3E-01
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	Blood/CNS	7.0E-01	-	0.0E+00	0.0E-01
			2-Methylphenol	-	-	-	-	2-Methylphenol	CNS/Weight Loss	3.4E+00	-	2.7E-02	3.7E+00
			4-Methylphenol	-	-	-	-	4-Methylphenol	CNS/Liver/Weight Loss	1.3E+00	-	1.0E+00	1.4E+02
			Phenol	-	-	-	-	Phenol	Kidney	1.1E-01	-	2.0E-01	3.0E-01
			Benzoic Acid	-	-	-	-	Benzoic Acid	Weight Loss	1.7E+00	-	0.0E+00	2.7E+00
			Benzyl Alcohol	-	-	-	-	Benzyl Alcohol	Fetal Weight	0.0E+00	-	3.4E-02	0.0E+00
			Benzene	0.0E+00	-	4.7E+00	7.3E+00	Benzene	Liver/Kidney	1.1E-01	-	4.1E-02	1.1E-01
			Chlorobenzene	1.1E-07	-	0.0E+00	1.0E-07	Chlorobenzene	Blood/Immune	2.3E+00	-	1.0E-01	2.4E+00
			(Total)	4.0E-04	-	5.0E-03	4.0E-04	(Total)	Liver	1.0E+00	-	1.0E+01	1.0E+02
	Air	Central (Eq.) wells Volatiles Vapors from Groundwater (Center of Plume)											
			Arsenic	-	NA	-	-	Arsenic	NA	-	-	-	-
			Barium	-	-	-	-	Barium	Pulmonary	-	NA	-	-
			Beryllium	-	NA	-	-	Beryllium	Bronchiolitis	-	NA	-	-
			Cadmium	-	NA	-	-	Cadmium	Lung	-	NA	-	-
			Chromium	-	-	-	-	Chromium	NA	-	-	-	-
			Iron	-	-	-	-	Iron	NA	-	-	-	-
			Lead	-	-	-	-	Lead	NA	-	-	-	-
			Manganese	-	-	-	-	Manganese	CNS	-	NA	-	-
			Mercury	-	-	-	-	Mercury	NA	-	-	-	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	NA	-	-	-	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	NA	-	-	-	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	-	-	-	-
			Phenol	-	-	-	-	Phenol	NA	-	-	-	-
			Benzoic Acid	-	-	-	-	Benzoic Acid	NA	-	-	-	-
			Benzyl Alcohol	-	-	-	-	Benzyl Alcohol	NA	-	-	-	-
			Benzene	-	1.3E-04	-	1.3E-04	Benzene	Blood	-	7.0E-02	-	7.0E-02
			Chlorobenzene	-	3.0E-02	-	3.0E-02	Chlorobenzene	Respiratory	-	1.0E-02	-	1.0E-02
			(Total)	-	1.3E-04	-	1.3E-04	(Total)		-	0.3E-02	-	0.3E-01
Surface Soil	Surface Soil	Central (Eq. 4 Bor.) wells Surface Soil (Quarry 4)											
			Aluminum*	-	-	-	-	Aluminum*	CNS (Development)	1.3E-02	-	4.1E-01	1.0E-02
			Chromium*	-	-	-	-	Chromium*	Kidney	1.0E-01	-	1.0E-01	2.0E-01
			Iron*	-	-	-	-	Iron*	Blood/Blood/GI Tract	0.1E-01	-	3.0E-02	0.3E-01
			Manganese*	-	-	-	-	Manganese*	CNS	3.0E-01	-	3.0E-02	3.0E-01
			(Total)	-	-	-	-	(Total)		1.0E-02	-	1.1E-01	1.1E-02
	Pesticides	Central (Eq.) wells Pesticides from Surface Soil (Quarry 4)											
			Aluminum*	-	-	-	-	Aluminum*	CNS	-	0.3E-01	-	0.3E-01
			Chromium*	-	3.0E-01	-	3.0E-01	Chromium*	Lung	-	0.3E-01	-	0.3E-01
			Iron*	-	-	-	-	Iron*	NA	-	-	-	-
			Manganese*	-	-	-	-	Manganese*	CNS	-	3.0E-01	-	3.0E-01
			(Total)	-	3.3E-01	-	3.3E-01	(Total)		-	3.3E-01	-	3.3E-01

Total Risk Across Groundwater: 6.2E-04
Total Risk Across Surface Soil: 3.3E-01
Total Risk Across All Media and All Exposure Routes: 3.3E-01

Total Hazard Index Across Groundwater: 2.0E+02
Total Hazard Index Across Surface Soil: 3.3E+01
Total Hazard Index Across All Media and All Exposure Routes: 2.3E+02

Total Blood HI =	1.1E+01
Total CNS HI =	2.2E+02
Total CNS (Development) HI =	1.0E-02
Total Fetal Weight HI =	0.0E-01
Total Pulmonary HI =	-
Total GI Tract HI =	0.0E+00
Total Immune HI =	2.0E+00
Total Kidney HI =	2.0E+00
Total Liver HI =	0.01E+00
Total Lung HI =	1.0E+02
Total Thymus System HI =	1.0E+00
Total Respiratory HI =	4.0E+01
Total Skin HI =	3.3E+00
Total Thyroid HI =	1.0E+00
Total Vascular HI =	2.7E+00
Total Weight Loss HI =	3.3E+02

Notes:
* = Only the UTL had for aluminum indicates a background exceedance.
** = Chromium, iron, and manganese appear to be below background, however, the sample size is small and the background comparison further may this point.

TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - LIFETIME RESIDENT EXPOSURE TO QUARRY 4 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	7.12E-04	-	1.44E-03	7.14E-04	Arsenic	NA	NA	-	NA	-
			Barium	-	-	-	-	Barium	NA	NA	-	NA	-
			Beryllium	-	-	-	-	Beryllium	NA	NA	-	NA	-
			Chromium	-	-	-	-	Chromium	NA	NA	-	NA	-
			Cyanide	-	-	-	-	Cyanide	NA	NA	-	NA	-
			Iron	-	-	-	-	Iron	NA	NA	-	NA	-
			Lead	-	-	-	-	Lead	NA	NA	-	NA	-
			Manganese	-	-	-	-	Manganese	NA	NA	-	NA	-
			Selenium	-	-	-	-	Selenium	NA	NA	-	NA	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	NA	NA	-	NA	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	NA	NA	-	NA	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	NA	-	NA	-
			Dibenzofuran	-	-	-	-	Dibenzofuran	NA	NA	-	NA	-
			Naphthalene	-	-	-	-	Naphthalene	NA	NA	-	NA	-
			Phenol	-	-	-	-	Phenol	NA	NA	-	NA	-
			Aniline	-	-	-	-	Aniline	NA	NA	-	NA	-
			Benzene	1.14E-04	-	8.63E-08	1.23E-04	Benzene	NA	NA	-	NA	-
			Chloroform	2.98E-07	-	1.37E-08	3.14E-07	Chloroform	NA	NA	-	NA	-
			(Total)	8.27E-04	-	1.01E-03	8.37E-04	(Total)		-	-	-	-
	Air	Contact (Inh.) with Airborne Vapors from Groundwater (Center of Plume)											
			Arsenic	-	-	-	-	Arsenic	NA	-	NA	-	-
			Barium	-	-	-	-	Barium	NA	-	NA	-	-
			Beryllium	-	-	-	-	Beryllium	NA	-	NA	-	-
			Chromium	-	-	-	-	Chromium	NA	-	NA	-	-
			Cyanide	-	-	-	-	Cyanide	NA	-	NA	-	-
			Iron	-	-	-	-	Iron	NA	-	NA	-	-
			Lead	-	-	-	-	Lead	NA	-	NA	-	-
			Manganese	-	-	-	-	Manganese	NA	-	NA	-	-
			Selenium	-	-	-	-	Selenium	NA	-	NA	-	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	NA	-	NA	-	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	NA	-	NA	-	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	-	NA	-	-
			Dibenzofuran	-	-	-	-	Dibenzofuran	NA	-	NA	-	-
			Naphthalene	-	-	-	-	Naphthalene	NA	-	NA	-	-
			Phenol	-	-	-	-	Phenol	NA	-	NA	-	-
			Aniline	-	-	-	-	Aniline	NA	-	NA	-	-
			Benzene	-	1.28E-04	-	1.28E-04	Benzene	NA	-	NA	-	-
			Chloroform	-	3.69E-08	-	3.69E-08	Chloroform	NA	-	NA	-	-
			(Total)	-	1.28E-04	-	1.28E-04	(Total)		-	-	-	-
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Quarry 4)											
			Aluminum*	-	-	-	-	Aluminum*	NA	NA	-	NA	-
			Chromium*	-	-	-	-	Chromium*	NA	NA	-	NA	-
			Iron*	-	-	-	-	Iron*	NA	NA	-	NA	-
			Manganese**	-	-	-	-	Manganese**	NA	NA	-	NA	-
			(Total)	-	-	-	-	(Total)		-	-	-	-
	Particulates	Contact (Inh.) with Particulates from Surface Soil (Quarry 4)											
			Aluminum*	-	-	-	-	Aluminum*	NA	-	NA	-	-
			Chromium*	-	5.04E-04	-	5.04E-04	Chromium*	NA	-	NA	-	-
			Iron*	-	-	-	-	Iron*	NA	-	NA	-	-
			Manganese**	-	-	-	-	Manganese**	NA	-	NA	-	-
			(Total)	-	5.04E-04	-	5.04E-04	(Total)		-	-	-	-

Total Risk Across Groundwater	9.09E-04
Total Risk Across Surface Soil	5.04E-04
Total Risk Across All Media and All Exposure Routes	1.39E-03

Total Hazard Index Across Groundwater	-
Total Hazard Index Across Surface Soil	-
Total Hazard Index Across All Media and All Exposure Routes	-

Notes:
* = Only the UTL test for aluminum indicates a background exceedance.
** = Chromium, iron, and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

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TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADOLESCENT (TEENS) TRESPASSER/VISITOR EXPOSURE TO QUARRY 4 SURFACE SOIL
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Current
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescent (Teens)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Quarry 4)											
			Aluminum*	–	–	–	–	Aluminum*	CNS (Developmental)	5.39E-03	–	2.66E-04	5.66E-03
			Chromium**	–	–	–	–	Chromium**	Kidney	5.12E-02	–	7.43E-02	1.26E-01
			Iron**	–	–	–	–	Iron**	Liver/Blood/GI Tract	1.75E-01	–	2.54E-03	1.77E-01
			Manganese**	–	–	–	–	Manganese**	CNS	1.20E-01	–	1.74E-03	1.22E-01
			(Total)	–	–	–	–	(Total)		3.51E-01	–	7.89E-02	4.30E-01
	Particulates	Contact (Inh.) with Particulates from Surface Soil (Quarry 4)											
			Aluminum*	–	–	–	–	Aluminum*	CNS	–	6.73E-02	–	6.73E-02
			Chromium**	–	1.13E-05	–	1.13E-05	Chromium**	Lung	–	6.72E-02	–	6.72E-02
			Iron**	–	–	–	–	Iron**	NIA	–	–	–	–
			Manganese**	–	–	–	–	Manganese**	CNS	–	2.52E+00	–	2.52E+00
			(Total)	–	1.13E-05	–	1.13E-05	(Total)		–	2.65E+00	–	2.65E+00
						Total Risk Across Surface Soil	1.13E-05					Total Hazard Index Across Surface Soil	3.08E+00
						Total Risk Across All Media and All Exposure Routes	1.13E-05					Total Hazard Index Across All Media and All Exposure Routes	3.08E+00

Notes
* = Only the UTL test for aluminum indicates a background exceedance.
** = Chromium, iron, and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

Total Blood HI =	1.77E-01
Total CNS HI =	2.71E+00
Total CNS (Developmental) HI =	5.66E-03
Total GI Tract HI =	1.77E-01
Total Kidney HI =	1.26E-01
Total Liver HI =	1.77E-01
Total Lung HI =	6.72E-02

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TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT CONSTRUCTION WORKER EXPOSURE TO QUARRY 4 SOIL
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Contact (Ing. & Der.) with Soil (Quarry 4)											
			Aluminum*	–	–	–	–	Aluminum*	CNS (Developmental)	6.62E-02	–	1.63E-03	6.79E-02
			Manganese*	–	–	–	–	Manganese*	CNS	7.57E-01	–	6.03E-03	7.62E-01
			Vanadium	–	–	–	–	Vanadium	NOAEL	9.96E-01	–	2.98E-01	1.19E+00
			(Total)	–	–	–	–	(Total)		1.72E+00	–	3.04E-01	2.02E+00
	Particulates	Contact (Inh.) with Particulates from Soil (Quarry 4)											
			Aluminum*	–	–	–	–	Aluminum*	CNS	–	9.49E-01	–	9.49E-01
			Manganese*	–	–	–	–	Manganese*	CNS	–	1.82E+01	–	1.82E+01
			Vanadium	–	–	–	–	Vanadium	N/A	–	–	–	–
			(Total)	–	–	–	–	(Total)		–	1.91E+01	–	1.91E+01
						Total Risk Across Soil	–					Total Hazard Index Across Soil	2.12E+01
						Total Risk Across All Media and All Exposure Routes	–					Total Hazard Index Across All Media and All Exposure Routes	2.12E+01

Notes
* = Only the UTL test for aluminum and manganese indicates a background exceedance.

Total CNS HI = 2.00E+01
Total CNS (Developmental) HI = 6.79E-02
Total NOAEL HI = 1.19E+00

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[illegible]MMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT INDUSTRIAL WOR[illegible] EXPOSURE TO QUARRY 4 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)

REASONABLE MAXIMUM EXPOSURE

CRATER RESOURCES

Scenario Timeframe: Current
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	1.98E-04	–	9.29E-09	1.98E-04	Arsenic	Skin/Vascular	9.62E-01	–	2.09E-04	9.62E-01
			Barium	–	–	–	–	Barium	Kidney	9.97E-02	–	1.99E-05	9.97E-02
			Beryllium	–	–	–	–	Beryllium	GI Tract	1.21E-01	–	2.41E-03	1.24E-01
			Chromium	–	–	–	–	Chromium	Kidney	2.92E-01	–	5.79E-03	2.97E-01
			Cyanide	–	–	–	–	Cyanide	Thyroid/Nervous System/Weight Loss	5.48E-01	–	1.09E-04	5.48E-01
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	2.13E+00	–	4.22E-04	2.13E+00
			Lead	–	–	–	–	Lead	NA	–	–	–	–
			Manganese	–	–	–	–	Manganese	CNS	1.37E+01	–	2.72E-03	1.37E+01
			Selenium	–	–	–	–	Selenium	Blood/Skin/CNS	1.91E-01	–	4.21E-05	1.91E-01
			2,4-Dimethylphenol	–	–	–	–	2,4-Dimethylphenol	Blood/CNS	2.84E-01	–	2.83E-03	2.87E-01
			2-Methylphenol	–	–	–	–	2-Methylphenol	CNS/Weight Loss	1.23E+00	–	8.55E-03	1.24E+00
			4-Methylphenol	–	–	–	–	4-Methylphenol	CNS/Lung/Weight Loss	4.70E+01	–	5.01E-01	4.75E+01
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	3.91E-02	–	8.88E-03	4.80E-02
			Naphthalene	–	–	–	–	Naphthalene	Weight Loss	6.38E-01	–	4.38E-02	6.80E-01
			Phenol	–	–	–	–	Phenol	Fetal Weight	3.10E-01	–	1.07E-03	3.11E-01
			Acetone	–	–	–	–	Acetone	Liver/Kidney	4.11E-02	–	1.38E-05	4.11E-02
			Benzene	2.53E-05	–	2.97E-07	2.56E-05	Benzene	Blood/Immune	8.19E-01	–	9.57E-03	8.25E-01
			Chloroform	6.57E-08	–	4.39E-10	6.61E-08	Chloroform	Liver	3.01E-03	–	2.02E-05	3.03E-03
			(Total)	1.83E-04	–	3.31E-07	1.84E-04	(Total)		6.84E+01	–	5.87E-01	6.90E+01
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Quarry 4)											
			Aluminum*	–	–	–	–	Aluminum*	CNS (Developmental)	5.88E-03	–	2.00E-04	5.97E-03
			Chromium**	–	–	–	–	Chromium**	Kidney	5.40E-02	–	7.45E-02	1.28E-01
			Iron**	–	–	–	–	Iron**	Liver/Blood/GI Tract	1.94E-01	–	2.54E-03	1.97E-01
			Manganese**	–	–	–	–	Manganese**	CNS	1.28E-01	–	1.74E-03	1.29E-01
			(Total)	–	–	–	–	(Total)		3.70E-01	–	7.91E-02	4.49E-01
	Particulates	Contact (Inh.) with Particulates from Surface Soil (Quarry 4)											
			Aluminum*	–	–	–	–	Aluminum*	CNS	–	7.60E-01	–	7.60E-01
			Chromium**	–	3.28E-04	–	3.28E-04	Chromium**	Lung	–	7.79E-01	–	7.79E-01
			Iron**	–	–	–	–	Iron**	NA	–	–	–	–
			Manganese**	–	–	–	–	Manganese**	CNS	–	2.92E+01	–	2.92E+01
			(Total)	–	3.28E-04	–	3.28E-04	(Total)		–	3.07E+01	–	3.07E+01

Total Risk Across Groundwater	1.84E-04
Total Risk Across Surface Soil	3.28E-04
Total Risk Across All Media and All Exposure Routes	5.10E-04

Total Hazard Index Across Groundwater	6.90E+01
Total Hazard Index Across Surface Soil	3.12E+01
Total Hazard Index Across All Media and All Exposure Routes	1.00E+02

Notes
* = Only the UTL test for aluminum indicates a background exceedance.
** = Chromium, iron, and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

Total Blood HI =	3.62E+00
Total CNS HI =	9.30E+01
Total CNS (Developmental) HI =	5.97E-03
Total Fetal Weight HI =	3.11E-01
Total GI Tract HI =	2.44E+00
Total Immune HI =	8.25E-01
Total Kidney HI =	6.15E-01
Total Liver HI =	2.36E+00
Total Lung HI =	4.82E+01
Total Nervous System HI =	5.48E-01
Total Skin HI =	1.17E+00
Total Thyroid HI =	5.48E-01
Total Vascular HI =	9.62E-01
Total Weight Loss HI =	4.99E+01

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TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT CONSTRUCTION WORKER EXPOSURE TO QUARRY 6 SOIL
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Contact (Ing. & Der.) with Soil (Quarry 6)											
			Aluminum*	-	-	-	-	Aluminum*	CNS (Developmental)	2.36E-02	-	5.88E-04	2.46E-02
			Iron*	-	-	-	-	Iron*	Liver/Blood/GI Tract	3.94E-01	-	2.83E-03	3.98E-01
			Manganese*	-	-	-	-	Manganese*	CNS	2.36E-02	-	1.88E-04	2.27E-02
			2-Methylnaphthalene	-	-	-	-	2-Methylnaphthalene	Weight Loss	7.33E-01	-	6.88E-02	7.94E-01
			4-Methylphenol	-	-	-	-	4-Methylphenol	CNS/Lung/Weight Loss	3.63E-01	-	3.72E-02	4.01E-01
			Benzo(a)anthracene	2.88E-04	-	-	2.88E-04	Benzo(a)anthracene	NA	-	-	-	-
			Benzo(a)pyrene	2.40E-03	-	-	2.40E-03	Benzo(a)pyrene	NA	-	-	-	-
			Benzo(b)fluoranthene	1.74E-04	-	-	1.74E-04	Benzo(b)fluoranthene	NA	-	-	-	-
			Dibenzo(a,h)anthracene	4.88E-04	-	-	4.88E-04	Dibenzo(a,h)anthracene	NA	-	-	-	-
			Dibenzofuran	-	-	-	-	Dibenzofuran	Kidney	5.28E+00	-	5.01E-01	5.78E+00
			Fluoranthene	-	-	-	-	Fluoranthene	Kidney/Liver/Blood	1.91E+00	-	1.50E-01	1.76E+00
			Fluorene	-	-	-	-	Fluorene	Blood	7.63E-01	-	6.88E-02	7.70E-01
			Indeno(1,2,3-cd)pyrene	1.41E-04	-	-	1.41E-04	Indeno(1,2,3-cd)pyrene	NA	-	-	-	-
			Naphthalene	-	-	-	-	Naphthalene	Weight Loss	4.25E+00	-	3.53E-01	4.60E+00
			Pyrene	-	-	-	-	Pyrene	Kidney	2.25E+00	-	1.87E-01	2.43E+00
			(Total)	3.88E-03	-	-	3.88E-03	(Total)		1.88E+01	-	1.38E+00	1.88E+01
	Air	Contact (Inh.) with Airborne Vapors from Soil (Quarry 6)											
			2-Methylnaphthalene	-	-	-	-	2-Methylnaphthalene	NA	-	-	-	-
			Naphthalene	-	-	-	-	Naphthalene	Respiratory	-	1.88E+01	-	1.88E+01
			(Total)	-	-	-	-	(Total)		-	1.88E+01	-	1.88E+01
	Particulates	Contact (Inh.) with Particulates from Soil (Quarry 6)											
			Aluminum*	-	-	-	-	Aluminum*	CNS	-	3.43E-01	-	3.43E-01
			Iron*	-	-	-	-	Iron*	NA	-	-	-	-
			Manganese*	-	-	-	-	Manganese*	CNS	-	6.43E-01	-	6.43E-01
			2-Methylnaphthalene	-	-	-	-	2-Methylnaphthalene	NA	-	-	-	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	-	-	-	-
			Benzo(a)anthracene	-	-	-	-	Benzo(a)anthracene	NA	-	-	-	-
			Benzo(a)pyrene	-	1.51E-06	-	1.51E-06	Benzo(a)pyrene	NA	-	-	-	-
			Benzo(b)fluoranthene	-	-	-	-	Benzo(b)fluoranthene	NA	-	-	-	-
			Dibenzo(a,h)anthracene	-	-	-	-	Dibenzo(a,h)anthracene	NA	-	-	-	-
			Dibenzofuran	-	-	-	-	Dibenzofuran	NA	-	-	-	-
			Fluoranthene	-	-	-	-	Fluoranthene	NA	-	-	-	-
			Fluorene	-	-	-	-	Fluorene	NA	-	-	-	-
			Indeno(1,2,3-cd)pyrene	-	-	-	-	Indeno(1,2,3-cd)pyrene	NA	-	-	-	-
			Naphthalene	-	-	-	-	Naphthalene	Respiratory	-	1.38E+00	-	1.38E+00
			Pyrene	-	-	-	-	Pyrene	NA	-	-	-	-
			(Total)	-	1.51E-06	-	1.51E-06	(Total)		-	2.24E+00	-	2.24E+00
						Total Risk Across Soil	3.54E-03					Total Hazard Index Across Soil	2.97E+01
			Total Risk Across All Media and All Exposure Routes				3.54E-03	Total Hazard Index Across All Media and All Exposure Routes					2.97E+01

Notes
* = Aluminum, iron, and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

Total Blood HI =	2.84E+00
Total CNS HI =	1.53E+00
Total CNS (Developmental) HI =	2.46E-02
Total GI Tract HI =	3.98E-01
Total Kidney HI =	9.97E+00
Total Liver HI =	2.07E+00
Total Lung HI =	4.01E-01
Total Respiratory HI =	1.19E+01
Total Weight Loss HI =	5.88E+00

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TABLE 4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CHILD RESIDENT EXPOSURE TO SS-1 + SS-2 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)

REASONABLE MAXIMUM EXPOSURE

CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	2.88E-04	–	4.34E-07	2.88E-04	Arsenic	Skin/Vascular	7.40E+00	–	1.10E-02	7.40E+00
			Barium	–	–	–	–	Barium	Kidney	7.98E-01	–	1.00E-03	7.80E-01
			Beryllium	–	–	–	–	Beryllium	GI Tract	9.24E-01	–	1.29E-01	1.00E+00
			Chloride	–	–	–	–	Chloride	Kidney	2.22E+00	–	3.10E-01	2.53E+00
			Cyanide	–	–	–	–	Cyanide	Thyroid/Nervous System/Weight Loss	4.17E+00	–	5.83E-02	4.18E+00
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	1.63E+01	–	2.28E-02	1.63E+01
			Lead	–	–	–	–	Lead	NA	–	–	–	–
			Manganese	–	–	–	–	Manganese	CNS	1.64E+02	–	1.40E-01	1.64E+02
			Selenium	–	–	–	–	Selenium	Blood/Skin/CNS	1.40E+00	–	2.20E-03	1.40E+00
			2,4-Dimethylphenol	–	–	–	–	2,4-Dimethylphenol	Blood/CNS	2.16E+00	–	1.52E-01	2.31E+00
			2-Methylphenol	–	–	–	–	2-Methylphenol	CNS/Weight Loss	9.30E+00	–	4.60E-01	9.80E+00
			4-Methylphenol	–	–	–	–	4-Methylphenol	CNS/Lung/Weight Loss	3.00E+02	–	2.60E+01	3.00E+02
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	2.00E-01	–	4.70E-01	7.70E-01
			Naphthalene	–	–	–	–	Naphthalene	Weight Loss	4.84E+00	–	2.30E+00	7.10E+00
			Phenol	–	–	–	–	Phenol	Fetal Weight	2.30E+00	–	3.70E-02	2.42E+00
			Aroclors	–	–	–	–	Aroclors	Liver/Kidney	3.13E-01	–	7.30E-04	3.14E-01
			Benzene	4.83E-06	–	2.03E-08	4.91E-06	Benzene	Blood/Immune	6.31E+00	–	6.14E-01	6.72E+00
			Chloroform	1.39E-07	–	8.00E-09	1.39E-07	Chloroform	Liver	2.90E-02	–	1.00E-03	2.40E-02
			(Total)	3.39E-04	–	4.38E-06	3.39E-04	(Total)		6.21E+02	–	3.11E+01	6.52E+02
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (SS-1 + SS-2)											
			Aluminum*	–	–	–	–	Aluminum*	CNS (Developmental)	1.12E-01	–	1.80E-03	1.14E-01
			Iron*	–	–	–	–	Iron*	Liver/Blood/GI Tract	1.00E+00	–	9.30E-03	2.00E+00
			Manganese*	–	–	–	–	Manganese*	CNS	9.34E-01	–	4.30E-03	9.38E-01
			(Total)	–	–	–	–	(Total)		3.04E+00	–	1.57E-02	3.06E+00
	Particulates	Contact (Inh.) with Particulates from Surface Soil (SS-1 + SS-2)											
			Aluminum*	–	–	–	–	Aluminum*	CNS	–	2.10E+00	–	2.10E+00
			Iron*	–	–	–	–	Iron*	NA	–	–	–	–
			Manganese*	–	–	–	–	Manganese*	CNS	–	2.94E+01	–	2.94E+01
			(Total)	–	–	–	–	(Total)		–	3.15E+01	–	3.15E+01

Total Risk Across Groundwater	3.39E-04
Total Risk Across Surface Soil	–
Total Risk Across All Media and All Exposure Routes	3.39E-04

Total Hazard Index Across Groundwater	6.52E+02
Total Hazard Index Across Surface Soil	3.45E+01
Total Hazard Index Across All Media and All Exposure Routes	6.87E+02

Notes

* = Aluminum, iron, and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

Total Blood HI =	2.07E+01
Total CNS HI =	5.35E+02
Total CNS (Developmental) HI =	1.14E-01
Total Fetal Weight HI =	2.42E+00
Total GI Tract HI =	1.93E+01
Total Immune HI =	6.72E+00
Total Kidney HI =	4.30E+00
Total Liver HI =	1.80E+01
Total Lung HI =	3.85E+02
Total Nervous System HI =	4.18E+00
Total Skin HI =	8.95E+00
Total Thyroid HI =	4.18E+00
Total Vascular HI =	7.40E+00
Total Weight Loss HI =	4.88E+02

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TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RESIDENT EXPOSURE TO 99-01 + 99-02 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	4.24E-04	-	1.04E-03	4.38E-04	Arsenic	skin/vascular	2.70E+00	-	6.66E-02	2.70E+00
			Barium	-	-	-	-	Barium	Kidney	2.70E-01	-	6.38E-04	2.80E-01
			Beryllium	-	-	-	-	Beryllium	GI Tract	3.40E-01	-	7.74E-02	4.17E-01
			Chromium	-	-	-	-	Chromium	Kidney	6.10E-01	-	1.00E-02	1.00E+00
			Cyanide	-	-	-	-	Cyanide	Thyroid/Endocrine System/Weight Loss	1.00E+00	-	2.40E-02	1.04E+00
			Iron	-	-	-	-	Iron	Liver/Blood/GI Tract	6.00E+00	-	1.30E-02	6.01E+00
			Lead	-	-	-	-	Lead	NA	-	-	-	-
			Manganese	-	-	-	-	Manganese	CNS	3.04E+01	-	6.70E-02	3.04E+01
			Selenium	-	-	-	-	Selenium	Blood/Skin/CNS	6.30E-01	-	1.30E-03	6.37E-01
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	Blood/CNS	7.60E-01	-	9.60E-02	8.56E-01
			2-Methylphenol	-	-	-	-	2-Methylphenol	Cell/Weight Loss	2.40E+00	-	2.74E-01	2.72E+00
			4-Methylphenol	-	-	-	-	4-Methylphenol	CNS/Lung/Weight Loss	1.30E+00	-	1.60E+01	1.60E+00
			Phenanthrene	-	-	-	-	Phenanthrene	Kidney	1.10E-01	-	2.50E-03	3.04E-01
			Naphthalene	-	-	-	-	Naphthalene	Weight Loss	1.70E+00	-	6.60E-01	2.37E+00
			Phenol	-	-	-	-	Phenol	Fetal Weight	6.60E-01	-	3.40E-02	6.60E-01
			Acetone	-	-	-	-	Acetone	Liver/Kidney	1.10E-01	-	4.10E-01	1.10E-01
			Benzene	6.91E-05	-	4.76E-03	7.38E-03	Benzene	Blood/Immune	2.30E+00	-	1.01E-01	2.40E+00
			Chloroform	1.70E-07	-	8.07E-03	1.00E-07	Chloroform	Liver	9.00E-03	-	3.00E-01	6.00E-03
			Total	4.66E-04	-	6.04E-03	4.90E-03	Total		1.00E+00	-	1.00E+01	2.10E+00
	Air	Contact (Inh.) with Volatiles from Groundwater (Center of Plume)											
			Arsenic	-	NA	-	-	Arsenic	NA	-	-	-	-
			Barium	-	-	-	-	Barium	Pulmonary	-	NA	-	-
			Beryllium	-	NA	-	-	Beryllium	Respiratory/Immune	-	NA	-	-
			Chromium	-	NA	-	-	Chromium	Lung	-	NA	-	-
			Cyanide	-	-	-	-	Cyanide	NA	-	-	-	-
			Iron	-	-	-	-	Iron	NA	-	-	-	-
			Lead	-	-	-	-	Lead	NA	-	-	-	-
			Manganese	-	-	-	-	Manganese	CNS	-	NA	-	-
			Selenium	-	-	-	-	Selenium	NA	-	-	-	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	NA	-	-	-	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	NA	-	-	-	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	-	-	-	-
			Phenanthrene	-	-	-	-	Phenanthrene	NA	-	-	-	-
			Naphthalene	-	-	-	-	Naphthalene	Respiratory	-	4.40E+01	-	4.40E+01
			Phenol	-	-	-	-	Phenol	NA	-	-	-	-
			Acetone	-	-	-	-	Acetone	NA	-	-	-	-
			Benzene	-	1.30E-04	-	1.30E-04	Benzene	Blood	-	7.40E+00	-	7.40E+00
			Chloroform	-	3.00E-09	-	3.00E-09	Chloroform	Respiratory	-	1.00E+00	-	1.00E+00
			Total	-	1.30E-04	-	1.30E-04	Total		-	5.50E+01	-	5.50E+01
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (99-1 + 99-2)											
			Aluminum*	-	-	-	-	Aluminum*	CNS (Developmental)	1.30E-02	-	3.40E-01	1.30E-02
			Iron*	-	-	-	-	Iron*	Liver/Blood/GI Tract	2.30E-01	-	1.00E-03	2.30E-01
			Manganese*	-	-	-	-	Manganese*	CNS	1.17E-01	-	7.90E-04	1.17E-01
			Total	-	-	-	-	Total		3.60E-01	-	3.84E-01	3.60E-01
	Perchlorate	Contact (Inh.) with Perchlorate from Surface Soil (99-1 + 99-2)											
			Aluminum*	-	-	-	-	Aluminum*	CNS	-	6.04E-01	-	6.04E-01
			Iron*	-	-	-	-	Iron*	NA	-	-	-	-
			Manganese*	-	-	-	-	Manganese*	CNS	-	9.00E+00	-	9.00E+00
			Total	-	-	-	-	Total		-	1.04E+01	-	1.04E+01

Total Risk Across Groundwater: 6.27E-04
Total Risk Across Surface Soil: -
Total Risk Across All Media and All Exposure Routes: 6.27E-04

Total Hazard Index Across Groundwater: 2.04E+02
Total Hazard Index Across Surface Soil: 1.07E+01
Total Hazard Index Across All Media and All Exposure Routes: 2.14E+02

Notes
* If Aluminum, Iron, and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

Total Blood HI =	1.79E+01
Total CNS HI =	3.02E+02
Total CNS (Developmental) HI =	1.30E-02
Total Fetal Weight HI =	6.60E-01
Total Pulmonary HI =	-
Total GI Tract HI =	6.60E-01
Total Immune HI =	2.44E+00
Total Kidney HI =	1.79E+00
Total Liver HI =	6.30E+00
Total Lung HI =	1.40E+02
Total Nervous System HI =	1.54E+00
Total Respiratory HI =	4.64E+01
Total Skin HI =	3.20E+00
Total Thyroid HI =	1.54E+00
Total Vascular HI =	2.70E+00
Total Weight Loss HI =	1.00E+00

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SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - LIFETIME RESIDENT[illegible]SURE TO SS-01 + SS-02 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	7.12E-04	–	1.44E-05	7.14E-04	Arsenic	NA	NA	–	NA	–
			Barium	–	–	–	–	Barium	NA	NA	–	NA	–
			Beryllium	–	–	–	–	Beryllium	NA	NA	–	NA	–
			Chromium	–	–	–	–	Chromium	NA	NA	–	NA	–
			Cyanide	–	–	–	–	Cyanide	NA	NA	–	NA	–
			Iron	–	–	–	–	Iron	NA	NA	–	NA	–
			Lead	–	–	–	–	Lead	NA	NA	–	NA	–
			Manganese	–	–	–	–	Manganese	NA	NA	–	NA	–
			Selenium	–	–	–	–	Selenium	NA	NA	–	NA	–
			2,4-Dimethylphenol	–	–	–	–	2,4-Dimethylphenol	NA	NA	–	NA	–
			2-Methylphenol	–	–	–	–	2-Methylphenol	NA	NA	–	NA	–
			4-Methylphenol	–	–	–	–	4-Methylphenol	NA	NA	–	NA	–
			Chlorobenzene	–	–	–	–	Chlorobenzene	NA	NA	–	NA	–
			Naphthalene	–	–	–	–	Naphthalene	NA	NA	–	NA	–
			Phenol	–	–	–	–	Phenol	NA	NA	–	NA	–
			Acetone	–	–	–	–	Acetone	NA	NA	–	NA	–
			Benzene	1.14E-04	–	8.63E-06	1.23E-04	Benzene	NA	NA	–	NA	–
			Chloroform	2.14E-07	–	1.27E-06	3.14E-07	Chloroform	NA	NA	–	NA	–
			(Total)	8.27E-04	–	1.51E-05	8.32E-04	(Total)		–	–	–	–
	Air	Contact (Inh.) with Airborne Vapors from Groundwater (Center of Plume)											
			Arsenic	–	–	–	–	Arsenic	NA	–	NA	–	–
			Barium	–	–	–	–	Barium	NA	–	NA	–	–
			Beryllium	–	–	–	–	Beryllium	NA	–	NA	–	–
			Chromium	–	–	–	–	Chromium	NA	–	NA	–	–
			Cyanide	–	–	–	–	Cyanide	NA	–	NA	–	–
			Iron	–	–	–	–	Iron	NA	–	NA	–	–
			Lead	–	–	–	–	Lead	NA	–	NA	–	–
			Manganese	–	–	–	–	Manganese	NA	–	NA	–	–
			Selenium	–	–	–	–	Selenium	NA	–	NA	–	–
			2,4-Dimethylphenol	–	–	–	–	2,4-Dimethylphenol	NA	–	NA	–	–
			2-Methylphenol	–	–	–	–	2-Methylphenol	NA	–	NA	–	–
			4-Methylphenol	–	–	–	–	4-Methylphenol	NA	–	NA	–	–
			Chlorobenzene	–	–	–	–	Chlorobenzene	NA	–	NA	–	–
			Naphthalene	–	–	–	–	Naphthalene	NA	–	NA	–	–
			Phenol	–	–	–	–	Phenol	NA	–	NA	–	–
			Acetone	–	–	–	–	Acetone	NA	–	NA	–	–
			Benzene	–	1.28E-04	–	1.28E-04	Benzene	NA	–	NA	–	–
			Chloroform	–	3.00E-06	–	3.00E-06	Chloroform	NA	–	NA	–	–
			(Total)	–	1.28E-04	–	1.28E-04	(Total)		–	–	–	–
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (SS-1 + SS-2)											
			Aluminum*	–	–	–	–	Aluminum*	NA	NA	–	NA	–
			Iron*	–	–	–	–	Iron*	NA	NA	–	NA	–
			Manganese*	–	–	–	–	Manganese*	NA	NA	–	NA	–
			(Total)	–	–	–	–	(Total)		–	–	–	–
	Particulates	Contact (Inh.) with Particulates from Surface Soil (SS-1 + SS-2)											
			Aluminum*	–	–	–	–	Aluminum*	NA	–	NA	–	–
			Iron*	–	–	–	–	Iron*	NA	–	NA	–	–
			Manganese*	–	–	–	–	Manganese*	NA	–	NA	–	–
			(Total)	–	–	–	–	(Total)		–	–	–	–

Total Risk Across Groundwater	9.00E-04	Total Hazard Index Across Groundwater	–
Total Risk Across Surface Soil	–	Total Hazard Index Across Surface Soil	–
Total Risk Across All Media and All Exposure Routes	9.00E-04	Total Hazard Index Across All Media and All Exposure Routes	–

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[1] = Aluminum, iron, and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

TABLE 4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT INDUSTRIAL WORKER EXPOSURE TO SS-01 + SS-02 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)

REASONABLE MAXIMUM EXPOSURE

CRATER RESOURCES

Scenario Timeframe: Current
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	1.54E-04	–	3.28E-05	1.88E-04	Arsenic	Skin/Vascular	9.02E-01	–	2.08E-04	9.02E-01
			Barium	–	–	–	–	Barium	Kidney	9.07E-02	–	1.08E-05	9.07E-02
			Beryllium	–	–	–	–	Beryllium	GI Tract	1.21E-01	–	2.41E-03	1.24E-01
			Chromium	–	–	–	–	Chromium	Kidney	2.93E-01	–	5.78E-03	2.97E-01
			Cyanide	–	–	–	–	Cyanide	Thyroid/Nervous System/Weight Loss	5.46E-01	–	1.06E-04	5.46E-01
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	2.13E+00	–	4.22E-04	2.13E+00
			Lead	–	–	–	–	Lead	NA	–	–	–	–
			Manganese	–	–	–	–	Manganese	CNS	1.37E+01	–	2.72E-03	1.37E+01
			Selenium	–	–	–	–	Selenium	Blood/Skin/CNS	1.91E-01	–	4.21E-05	1.91E-01
			2,4-Dimethylphenol	–	–	–	–	2,4-Dimethylphenol	Blood/CNS	2.64E-01	–	2.81E-05	2.67E-01
			2-Methylphenol	–	–	–	–	2-Methylphenol	CNS/Weight Loss	1.23E+00	–	8.88E-03	1.24E+00
			4-Methylphenol	–	–	–	–	4-Methylphenol	CNS/Lung/Weight Loss	4.70E+01	–	5.01E-01	4.75E+01
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	3.01E-02	–	8.88E-03	4.00E-02
			Naphthalene	–	–	–	–	Naphthalene	Weight Loss	6.38E-01	–	4.36E-02	6.82E-01
			Phenol	–	–	–	–	Phenol	Fetal Weight	3.10E-01	–	1.07E-03	3.11E-01
			Acetone	–	–	–	–	Acetone	Liver/Kidney	4.11E-02	–	1.36E-05	4.11E-02
			Benzene	2.53E-05	–	2.07E-07	2.56E-05	Benzene	Blood/Immune	8.15E-01	–	9.57E-03	8.25E-01
			Chloroform	6.97E-05	–	4.39E-10	6.91E-05	Chloroform	Liver	3.91E-03	–	2.02E-05	3.93E-03
			(Total)	1.83E-04	–	3.31E-07	1.84E-04	(Total)		8.84E+01	–	5.07E-01	8.90E+01
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (SS-1 + SS-2)											
			Aluminum*	–	–	–	–	Aluminum*	CNS (Developmental)	4.74E-03	–	2.42E-04	4.94E-03
			Iron*	–	–	–	–	Iron*	Liver/Blood/GI Tract	9.43E-02	–	1.18E-03	9.55E-02
			Manganese*	–	–	–	–	Manganese*	CNS	3.84E-02	–	5.48E-04	4.01E-02
			(Total)	–	–	–	–	(Total)		1.38E-01	–	1.88E-03	1.31E-01
	Particulates	Contact (Inh.) with Particulates from Surface Soil (SS-1 + SS-2)											
			Aluminum*	–	–	–	–	Aluminum*	CNS	–	6.53E-01	–	6.53E-01
			Iron*	–	–	–	–	Iron*	NA	–	–	–	–
			Manganese*	–	–	–	–	Manganese*	CNS	–	9.13E+00	–	9.13E+00
			(Total)	–	–	–	–	(Total)		–	9.78E+00	–	9.78E+00

Total Risk Across Groundwater: 1.84E-04
Total Risk Across Surface Soil: –
Total Risk Across All Media and All Exposure Routes: 1.84E-04

Total Hazard Index Across Groundwater: 8.90E+01
Total Hazard Index Across Surface Soil: 9.91E+00
Total Hazard Index Across All Media and All Exposure Routes: 7.88E+01

Notes
* = Aluminum, iron, and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

Total Blood HI =	3.52E+00
Total CNS HI =	7.27E+01
Total CNS (Developmental) HI =	4.94E-03
Total Fetal Weight HI =	3.11E-01
Total GI Tract HI =	2.34E+00
Total Immune HI =	8.25E-01
Total Kidney HI =	4.00E-01
Total Liver HI =	2.30E+00
Total Lung HI =	4.75E+01
Total Nervous System HI =	5.46E-01
Total Skin HI =	1.17E+00
Total Thyroid HI =	5.46E-01
Total Vascular HI =	9.02E-01
Total Weight Loss HI =	4.88E+01

TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CHILD RESIDENT EXPOSURE TO SS-03 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)
REASONABLE MAXIMUM EXPOSURE
CRATER REBOURCES

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	2.88E-04	–	4.34E-07	2.88E-04	Arsenic	Skin/Vascular	7.49E+00	–	1.10E-02	7.49E+00
			Barium	–	–	–	–	Barium	Kidney	7.90E-01	–	1.08E-03	7.90E-01
			Beryllium	–	–	–	–	Beryllium	GI Tract	9.34E-01	–	1.28E-01	1.06E+00
			Chromium	–	–	–	–	Chromium	Kidney	2.22E+00	–	3.10E-01	2.53E+00
			Cyanide	–	–	–	–	Cyanide	Thyroid/Nervous System/Weight Loss	4.17E+00	–	5.83E-03	4.19E+00
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	1.62E+01	–	2.28E-02	1.62E+01
			Lead	–	–	–	–	Lead	NA	–	–	–	–
			Manganese	–	–	–	–	Manganese	CNS	1.94E+02	–	1.48E-01	1.94E+02
			Selenium	–	–	–	–	Selenium	Blood/Skin/CNS	1.40E+00	–	2.20E-03	1.40E+00
			2,4-Dimethylphenol	–	–	–	–	2,4-Dimethylphenol	Blood/CNS	2.19E+00	–	1.53E-01	2.31E+00
			2-Methylphenol	–	–	–	–	2-Methylphenol	CNS/Weight Loss	5.30E+00	–	4.59E-01	5.80E+00
			4-Methylphenol	–	–	–	–	4-Methylphenol	CNS/Lung/Weight Loss	3.59E+02	–	2.99E+01	3.89E+02
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	2.66E-01	–	4.76E-01	7.74E-01
			Naphthalene	–	–	–	–	Naphthalene	Weight Loss	4.84E+00	–	2.32E+00	7.16E+00
			Phenol	–	–	–	–	Phenol	Petal Weight	2.32E+00	–	5.76E-02	2.42E+00
			Acetone	–	–	–	–	Acetone	Liver/Kidney	3.13E-01	–	7.34E-04	3.14E-01
			Benzene	4.68E-06	–	3.83E-08	5.04E-06	Benzene	Blood/Immune	6.21E+00	–	5.14E-01	6.72E+00
			Chloroform	1.28E-07	–	5.68E-09	1.33E-07	Chloroform	Liver	2.34E-02	–	1.66E-03	2.49E-02
			(Total)	3.16E-04	–	4.38E-06	3.20E-04	(Total)		5.21E+00	–	3.10E+01	5.63E+02
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (SS-3)											
			Arsenic*	1.31E-05	–	2.07E-07	1.33E-05	Arsenic*	Skin/Vascular	3.39E-01	–	5.37E-03	3.44E-01
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	2.91E+00	–	1.17E-02	2.91E+00
			Manganese*	–	–	–	–	Manganese*	CNS	2.46E-01	–	1.17E-03	2.58E-01
			Benzo(a)pyrene	4.77E-06	–	–	4.77E-06	Benzo(a)pyrene	NA	–	–	–	–
			(Total)	8.08E-05	–	2.07E-07	8.10E-05	(Total)		3.53E+00	–	1.83E-02	3.11E+00
	Perforation	Contact (Inh.) with Perforation from Surface Soil (SS-3)											
			Arsenic*	–	2.07E-09	–	2.07E-09	Arsenic*	NA	–	–	–	–
			Iron	–	–	–	–	Iron	NA	–	–	–	–
			Manganese*	–	–	–	–	Manganese*	CNS	–	7.83E+00	–	7.83E+00
			Benzo(a)pyrene	–	1.98E-07	–	1.98E-07	Benzo(a)pyrene	NA	–	–	–	–
			(Total)	–	2.03E-06	–	2.03E-06	(Total)		–	7.83E+00	–	7.83E+00

Total Risk Across Groundwater 3.39E-04
Total Risk Across Surface Soil 8.30E-05
Total Risk Across All Media and All Exposure Routes 4.22E-04

Total Hazard Index Across Groundwater 5.52E+02
Total Hazard Index Across Surface Soil 1.09E+01
Total Hazard Index Across All Media and All Exposure Routes 5.63E+02

Notes
* = Arsenic and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

Total Blood HI = 2.92E+01
Total CNS HI = 5.11E+02
Total Petal Weight HI = 2.42E+00
Total GI Tract HI = 1.08E+01
Total Immune HI = 6.72E+00
Total Kidney HI = 4.30E+00
Total Liver HI = 1.91E+01
Total Lung HI = 3.85E+02
Total Nervous System HI = 4.19E+00
Total Skin HI = 9.25E+00
Total Thyroid HI = 4.19E+00
Total Vascular HI = 7.83E+00
Total Weight Loss HI = 4.88E+02

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TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RESIDENT EXPOSURE TO SB-08 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)
REASONABLE MAXIMUM EXPOSURE
CRATER REBOUNCER

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	4.30E-04	-	1.04E-03	4.32E-03	Arsenic	Skin/Vascular	2.70E+00	-	6.60E-02	2.76E+00
			Barium	-	-	-	-	Barium	Kidney	2.70E-01	-	6.90E-04	2.80E-01
			Beryllium	-	-	-	-	Beryllium	GI Tract	5.40E-04	-	7.71E-02	4.17E-01
			Chromium	-	-	-	-	Chromium	Kidney	5.10E-01	-	1.20E-03	1.20E+00
			Cyanide	-	-	-	-	Cyanide	Thyroid/Immune System/Weight Loss	1.00E+00	-	3.40E-03	1.04E+00
			Iron	-	-	-	-	Iron	Liver/Blood/GI Tract	6.00E+00	-	1.20E-02	6.07E+00
			Lead	-	-	-	-	Lead	N/A	-	-	-	-
			Manganese	-	-	-	-	Manganese	CNS	3.04E+01	-	8.70E-02	3.04E+01
			Selenium	-	-	-	-	Selenium	Blood/Liver/CNS	6.30E-01	-	1.20E-03	6.37E-01
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	Blood/CNS	7.20E-01	-	6.00E-02	8.00E-01
			2-Methylphenol	-	-	-	-	2-Methylphenol	CNS/Weight Loss	3.40E+00	-	2.74E-01	3.72E+00
			4-Methylphenol	-	-	-	-	4-Methylphenol	CNS/Longevity/Weight Loss	1.30E+00	-	1.00E+01	1.40E+00
			Dibenzofuran	-	-	-	-	Dibenzofuran	Kidney	1.10E-01	-	2.00E-02	2.00E-01
			Naphthalene	-	-	-	-	Naphthalene	Weight Loss	1.70E+00	-	8.00E-01	2.70E+00
			Phenol	-	-	-	-	Phenol	Fetal Weight	6.00E-01	-	3.40E-02	6.00E-01
			Pyrene	-	-	-	-	Pyrene	Liver/Kidney	1.10E-02	-	4.10E-03	1.10E-01
			Benzene	6.01E-05	-	4.70E-03	7.30E-03	Benzene	Blood/Immune	2.30E+00	-	1.00E-01	2.44E+00
			Chloroform	1.70E-07	-	8.00E-03	1.00E-07	Chloroform	Liver	6.40E-02	-	1.00E-01	6.60E-01
			(Total)	4.00E-04	-	5.00E-03	4.60E-03	(Total)		1.00E+00	-	1.00E+01	1.10E+00
	Air	Contact (Inh.) with Volatiles from Groundwater (Center of Plume)											
			Arsenic	-	NA	-	-	Arsenic	N/A	-	-	-	-
			Barium	-	-	-	-	Barium	Pulmonary	-	NA	-	-
			Beryllium	-	NA	-	-	Beryllium	Respiratory/Immune	-	NA	-	-
			Chromium	-	NA	-	-	Chromium	Lung	-	NA	-	-
			Cyanide	-	-	-	-	Cyanide	N/A	-	-	-	-
			Iron	-	-	-	-	Iron	N/A	-	-	-	-
			Lead	-	-	-	-	Lead	N/A	-	-	-	-
			Manganese	-	-	-	-	Manganese	CNS	-	NA	-	-
			Selenium	-	-	-	-	Selenium	N/A	-	-	-	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	N/A	-	-	-	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	N/A	-	-	-	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	N/A	-	-	-	-
			Dibenzofuran	-	-	-	-	Dibenzofuran	N/A	-	-	-	-
			Naphthalene	-	-	-	-	Naphthalene	Respiratory	-	4.40E+01	-	4.40E+01
			Phenol	-	-	-	-	Phenol	N/A	-	-	-	-
			Pyrene	-	-	-	-	Pyrene	N/A	-	-	-	-
			Benzene	-	1.20E-04	-	1.20E-04	Benzene	Blood	-	7.00E+00	-	7.00E+00
			Chloroform	-	3.00E-09	-	3.00E-09	Chloroform	Respiratory	-	1.30E+00	-	1.30E+00
			(Total)	-	1.20E-03	-	1.20E-03	(Total)		-	6.00E+01	-	6.00E+01
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (SB-8)											
			Arsenic*	6.20E-03	-	1.40E-07	6.30E-03	Arsenic*	Skin/Vascular	4.00E-02	-	9.01E-04	4.11E-02
			Iron	-	-	-	-	Iron	Liver/Blood/GI Tract	3.00E-01	-	2.10E-03	3.00E-01
			Manganese*	-	-	-	-	Manganese*	CNS	2.00E-02	-	2.10E-04	2.07E-02
			Benzo(a)pyrene	3.20E-05	-	-	3.20E-05	Benzo(a)pyrene	N/A	-	-	-	-
			(Total)	2.00E-02	-	1.40E-07	2.00E-02	(Total)		3.00E-01	-	3.21E-03	3.00E-01
	Perchlorate	Contact (Inh.) with Perchlorate from Surface Soil (SB-8)											
			Arsenic*	-	3.30E-09	-	3.30E-09	Arsenic*	N/A	-	-	-	-
			Iron	-	-	-	-	Iron	N/A	-	-	-	-
			Manganese*	-	-	-	-	Manganese*	CNS	-	2.00E-09	-	2.00E-09
			Benzo(a)pyrene	-	6.00E-07	-	6.00E-07	Benzo(a)pyrene	N/A	-	-	-	-
			(Total)	-	3.70E-08	-	3.70E-08	(Total)		-	2.00E-09	-	2.00E-09

Total Risk Across Groundwater 6.27E-04
Total Risk Across Surface Soil 3.27E-08
Total Risk Across All Media and All Exposure Routes 6.60E-04

Total Hazard Index Across Groundwater 2.04E+03
Total Hazard Index Across Surface Soil 2.00E+03
Total Hazard Index Across All Media and All Exposure Routes 2.00E+03

Notes
* = Arsenic and manganese appear to be below background. However, the sample size is small and the background comparison test has very little power.

Total Blood HI =	1.70E+01
Total CNS HI =	1.04E+02
Total Fetal Weight HI =	6.60E-01
Total Pulmonary HI =	
Total GI Tract HI =	6.00E+00
Total Immune HI =	2.44E+00
Total Kidney HI =	1.70E+00
Total Liver HI =	6.30E+00
Total Lung HI =	1.40E+00
Total Musculoskeletal HI =	1.50E+00
Total Respiratory HI =	4.40E+01
Total Skin HI =	3.30E+00
Total Thyroid HI =	1.50E+00
Total Vascular HI =	2.00E+00
Total Weight Loss HI =	1.00E+00

AR306472

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - LIFETIME RESIDENT EXPOSURE TO SS-03 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	7.12E-04	-	1.44E-05	7.14E-04	Arsenic	NA	NA	-	NA	-
			Barium	-	-	-	-	Barium	NA	NA	-	NA	-
			Beryllium	-	-	-	-	Beryllium	NA	NA	-	NA	-
			Chromium	-	-	-	-	Chromium	NA	NA	-	NA	-
			Cyanide	-	-	-	-	Cyanide	NA	NA	-	NA	-
			Iron	-	-	-	-	Iron	NA	NA	-	NA	-
			Lead	-	-	-	-	Lead	NA	NA	-	NA	-
			Manganese	-	-	-	-	Manganese	NA	NA	-	NA	-
			Selenium	-	-	-	-	Selenium	NA	NA	-	NA	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	NA	NA	-	NA	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	NA	NA	-	NA	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	NA	-	NA	-
			Chlorobenzene	-	-	-	-	Chlorobenzene	NA	NA	-	NA	-
			Naphthalene	-	-	-	-	Naphthalene	NA	NA	-	NA	-
			Phenol	-	-	-	-	Phenol	NA	NA	-	NA	-
			Acetone	-	-	-	-	Acetone	NA	NA	-	NA	-
			Benzene	1.14E-04	-	8.60E-06	1.23E-04	Benzene	NA	NA	-	NA	-
			Chloroform	2.00E-07	-	1.37E-09	2.14E-07	Chloroform	NA	NA	-	NA	-
			(Total)	8.27E-04	-	1.44E-05	8.37E-04	(Total)		-	-	-	-
	Air	Contact (Inh.) with Volatiles from Groundwater (Center of Plume)											
			Arsenic	-	-	-	-	Arsenic	NA	-	NA	-	-
			Barium	-	-	-	-	Barium	NA	-	NA	-	-
			Beryllium	-	-	-	-	Beryllium	NA	-	NA	-	-
			Chromium	-	-	-	-	Chromium	NA	-	NA	-	-
			Cyanide	-	-	-	-	Cyanide	NA	-	NA	-	-
			Iron	-	-	-	-	Iron	NA	-	NA	-	-
			Lead	-	-	-	-	Lead	NA	-	NA	-	-
			Manganese	-	-	-	-	Manganese	NA	-	NA	-	-
			Selenium	-	-	-	-	Selenium	NA	-	NA	-	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	NA	-	NA	-	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	NA	-	NA	-	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	-	NA	-	-
			Chlorobenzene	-	-	-	-	Chlorobenzene	NA	-	NA	-	-
			Naphthalene	-	-	-	-	Naphthalene	NA	-	NA	-	-
			Phenol	-	-	-	-	Phenol	NA	-	NA	-	-
			Acetone	-	-	-	-	Acetone	NA	-	NA	-	-
			Benzene	-	1.20E-04	-	1.20E-04	Benzene	NA	-	NA	-	-
			Chloroform	-	3.00E-08	-	3.00E-08	Chloroform	NA	-	NA	-	-
			(Total)	-	1.20E-04	-	1.20E-04	(Total)		-	-	-	-
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (SS-3)											
			Arsenic*	1.00E-05	-	3.00E-07	1.03E-05	Arsenic*	NA	NA	-	NA	-
			Iron	-	-	-	-	Iron	NA	NA	-	NA	-
			Manganese*	-	-	-	-	Manganese*	NA	NA	-	NA	-
			Benzo(a)pyrene	7.00E-06	-	-	7.00E-06	Benzo(a)pyrene	NA	NA	-	NA	-
			(Total)	8.00E-05	-	3.00E-07	8.03E-05	(Total)		-	-	-	-
	Particulates	Contact (Inh.) with Particulates from Surface Soil (SS-3)											
			Arsenic*	-	6.72E-08	-	6.72E-08	Arsenic*	NA	-	NA	-	-
			Iron	-	-	-	-	Iron	NA	-	NA	-	-
			Manganese*	-	-	-	-	Manganese*	NA	-	NA	-	-
			Benzo(a)pyrene	-	8.44E-07	-	8.44E-07	Benzo(a)pyrene	NA	-	NA	-	-
			(Total)	-	8.44E-06	-	8.44E-06	(Total)		-	-	-	-

Total Risk Across Groundwater	8.37E-04	Total Hazard Index Across Groundwater*	-
Total Risk Across Surface Soil	9.10E-05	Total Hazard Index Across Surface Soil	-
Total Risk Across All Media and All Exposure Routes	1.00E-03	Total Hazard Index Across All Media and All Exposure Routes	-

Notes
* Arsenic and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT INDUSTRIAL WORKER EXPOSURE TO SS-03 SURFACE SOIL AND GROUNDWATER (CENTER OF PLUME)
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Current
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	1.88E-04	--	5.88E-08	1.88E-04	Arsenic	Skin/Vascular	9.82E-01	--	2.06E-04	9.82E-01
			Barium	--	--	--	--	Barium	Kidney	9.97E-02	--	1.08E-06	9.97E-02
			Beryllium	--	--	--	--	Beryllium	GI Tract	1.21E-01	--	2.41E-03	1.24E-01
			Chromium	--	--	--	--	Chromium	Kidney	2.92E-01	--	5.70E-03	2.97E-01
			Cyanide	--	--	--	--	Cyanide	Thyroid/Nervous System/Weight Loss	6.48E-01	--	1.68E-04	6.48E-01
			Iron	--	--	--	--	Iron	Liver/Blood/GI Tract	2.12E+00	--	4.22E-04	2.12E+00
			Lead	--	--	--	--	Lead	N/A	--	--	--	--
			Manganese	--	--	--	--	Manganese	CNS	1.37E+01	--	2.72E-03	1.37E+01
			Selenium	--	--	--	--	Selenium	Skin/Liver/CNS	1.91E-01	--	4.21E-03	1.91E-01
			2,4-Dimethylphenol	--	--	--	--	2,4-Dimethylphenol	Blood/CNS	2.94E-01	--	2.83E-03	2.97E-01
			2-Methylphenol	--	--	--	--	2-Methylphenol	CNS/Weight Loss	1.23E+00	--	8.58E-03	1.24E+00
			4-Methylphenol	--	--	--	--	4-Methylphenol	CNS/Lung/Weight Loss	4.70E+01	--	5.91E-01	4.75E+01
			Chlorobenzene	--	--	--	--	Chlorobenzene	Kidney	3.91E-02	--	8.98E-03	4.80E-02
			Naphthalene	--	--	--	--	Naphthalene	Weight Loss	6.38E-01	--	4.38E-02	6.80E-01
			Phenol	--	--	--	--	Phenol	Fetal Weight	3.10E-01	--	1.07E-03	3.11E-01
			Aniline	--	--	--	--	Aniline	Liver/Kidney	4.11E-02	--	1.38E-03	4.11E-02
			Benzene	2.53E-05	--	2.07E-07	2.55E-05	Benzene	Blood/Immune	6.16E-01	--	9.57E-03	6.25E-01
			Chloroform	6.07E-01	--	4.96E-10	6.01E-01	Chloroform	Liver	3.01E-03	--	2.92E-05	3.03E-03
			(Total)	1.03E-04	--	3.31E-07	1.04E-04	(Total)		6.84E+01	--	5.67E-01	6.90E+01
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (SS-3)											
			Arsenic*	2.31E-08	--	1.67E-07	2.41E-08	Arsenic*	Skin/Vascular	1.44E-02	--	6.67E-04	1.50E-02
			Iron	--	--	--	--	Iron	Liver/Blood/GI Tract	1.03E-01	--	1.48E-03	1.07E-01
			Manganese*	--	--	--	--	Manganese*	CNS	1.88E-02	--	1.48E-04	1.97E-02
			Benzo(a)pyrene	8.42E-08	--	--	8.42E-08	Benzo(a)pyrene	N/A	--	--	--	--
			(Total)	1.07E-08	--	1.67E-07	1.68E-08	(Total)		1.21E-01	--	2.77E-03	1.23E-01
	Particulates	Contact (Inh.) with Particulates from Surface Soil (SS-3)											
			Arsenic*	--	3.19E-08	--	3.19E-08	Arsenic*	N/A	--	--	--	--
			Iron	--	--	--	--	Iron	N/A	--	--	--	--
			Manganese*	--	--	--	--	Manganese*	CNS	--	2.43E+00	--	2.43E+00
			Benzo(a)pyrene	--	4.92E-07	--	4.92E-07	Benzo(a)pyrene	N/A	--	--	--	--
			(Total)	--	3.44E-06	--	3.50E-06	(Total)		--	2.43E+00	--	2.43E+00

Total Risk Across Groundwater	1.04E-04
Total Risk Across Surface Soil	1.45E-06
Total Risk Across All Media and All Exposure Routes	1.06E-04

Total Hazard Index Across Groundwater	6.90E+01
Total Hazard Index Across Surface Soil	2.57E+00
Total Hazard Index Across All Media and All Exposure Routes	7.15E+01

Notes
* = Arsenic and manganese appear to be below background, however, the sample size is small and the background comparison test has very little power.

Total Blood HI =	3.54E+00
Total CNS HI =	6.53E+01
Total Fetal Weight HI =	3.11E-01
Total GI Tract HI =	2.36E+00
Total Immune HI =	9.75E-01
Total Kidney HI =	4.86E-01
Total Liver HI =	2.26E+00
Total Lung HI =	4.75E+01
Total Nervous System HI =	6.48E-01
Total Skin HI =	1.19E+00
Total Thyroid HI =	6.48E-01
Total Vascular HI =	9.97E-01
Total Weight Loss HI =	4.98E+01

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SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CHILD RESIDENT EXPOSURE TO YE[illegible] PARCEL (PIPELINE AREA) SURFACE SOIL, SEDIMENT, AND GROUNDWATER (CENTER OF PLUM
REASONABLE MAXIMUM EXPOSURE
CRATER REBOURCES

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	2.88E-04	–	4.24E-07	2.88E-04	Arsenic	Skin/Vascular	7.40E+00	–	1.10E-02	7.40E+00
			Barium	–	–	–	–	Barium	Kidney	7.50E-01	–	1.88E-03	7.68E-01
			Beryllium	–	–	–	–	Beryllium	GI Tract	9.24E-01	–	1.28E-01	1.05E+00
			Chromium	–	–	–	–	Chromium	Kidney	2.22E+00	–	3.10E-01	2.53E+00
			Cyanide	–	–	–	–	Cyanide	Thyroid/Immune System/Weight Loss	4.17E+00	–	5.83E-03	4.18E+00
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	1.63E+01	–	2.28E-02	1.63E+01
			Lead	–	–	–	–	Lead	NA	–	–	–	–
			Manganese	–	–	–	–	Manganese	CNS	1.04E+02	–	1.46E-01	1.04E+02
			Selenium	–	–	–	–	Selenium	Blood/Skin/CNS	1.65E+00	–	2.30E-03	1.65E+00
			2,4-Dimethylphenol	–	–	–	–	2,4-Dimethylphenol	Blood/CNS	2.16E+00	–	1.52E-01	2.31E+00
			2-Methylphenol	–	–	–	–	2-Methylphenol	CNS/Weight Loss	5.35E+00	–	4.56E-01	5.80E+00
			4-Methylphenol	–	–	–	–	4-Methylphenol	CNS/Lung/Weight Loss	3.56E+02	–	2.50E+01	3.81E+02
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	2.56E-01	–	4.70E-01	7.26E-01
			Naphthalene	–	–	–	–	Naphthalene	Weight Loss	4.84E+00	–	2.35E+00	7.19E+00
			Phenol	–	–	–	–	Phenol	Fetal Weight	2.30E+00	–	1.70E-02	2.42E+00
			Aniline	–	–	–	–	Aniline	Liver/Kidney	3.13E-01	–	7.38E-04	3.14E-01
			Benzene	4.83E-05	–	3.53E-08	5.01E-05	Benzene	Blood/Immune	6.21E+00	–	5.14E-01	6.72E+00
			Chloroform	1.30E-07	–	6.08E-09	1.36E-07	Chloroform	Liver	2.30E-02	–	1.08E-03	2.40E-02
			(Total)	3.35E-04	–	4.28E-06	3.39E-04	(Total)		5.21E+02	–	3.10E+01	5.52E+02
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Yellow Parcel - Pipeline Area)											
			Aluminum	–	–	–	–	Aluminum	CNS (Developmental)	1.70E-01	–	2.80E-03	1.73E-01
			Arsenic	4.20E-05	–	0.77E-07	4.28E-05	Arsenic	Skin/Vascular	1.11E+00	–	1.70E-02	1.13E+00
			Chromium	–	–	–	–	Chromium	Kidney	0.84E-02	–	4.67E-02	1.46E-01
			Iron*	–	–	–	–	Iron*	Liver/Blood/GI Tract	1.14E+00	–	5.24E-03	1.14E+00
			Bis(2-ethylhexyl)phthalate	1.50E-04	–	–	1.50E-04	Bis(2-ethylhexyl)phthalate	NA	–	–	–	–
			Benzo(a)pyrene	1.60E-03	–	–	1.60E-03	Benzo(a)pyrene	NA	–	–	–	–
			Benzo(b)fluoranthene	3.04E-04	–	–	3.04E-04	Benzo(b)fluoranthene	NA	–	–	–	–
			Dibenzo(a,h)anthracene	6.50E-05	–	–	6.50E-05	Dibenzo(a,h)anthracene	NA	–	–	–	–
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	1.21E+00	–	0.14E-02	1.20E+00
			Indeno(1,2,3-cd)pyrene	4.40E-05	–	–	4.40E-05	Indeno(1,2,3-cd)pyrene	NA	–	–	–	–
			(Total)	2.47E-03	–	0.77E-07	2.47E-03	(Total)		3.72E+00	–	1.54E-01	3.88E+00
	Particulates	Contact (Inh.) with Particulates from Surface Soil (Yellow Parcel - Pipeline Area)											
			Aluminum	–	–	–	–	Aluminum	CNS	–	3.10E+00	–	3.10E+00
			Arsenic	–	0.07E-05	–	0.07E-05	Arsenic	NA	–	–	–	–
			Chromium	–	1.00E-05	–	1.00E-05	Chromium	Lung	–	1.00E-01	–	1.00E-01
			Iron*	–	–	–	–	Iron*	NA	–	–	–	–
			Bis(2-ethylhexyl)phthalate	–	–	–	–	Bis(2-ethylhexyl)phthalate	NA	–	–	–	–
			Benzo(a)pyrene	–	1.40E-05	–	1.40E-05	Benzo(a)pyrene	NA	–	–	–	–
			Benzo(b)fluoranthene	–	–	–	–	Benzo(b)fluoranthene	NA	–	–	–	–
			Dibenzo(a,h)anthracene	–	–	–	–	Dibenzo(a,h)anthracene	NA	–	–	–	–
			Dibenzofuran	–	–	–	–	Dibenzofuran	NA	–	–	–	–
			Indeno(1,2,3-cd)pyrene	–	–	–	–	Indeno(1,2,3-cd)pyrene	NA	–	–	–	–
			(Total)	–	4.29E-05	–	4.29E-05	(Total)		–	3.30E+00	–	3.30E+00

Total Risk Across Groundwater	3.39E-04
Total Risk Across Sediment	–
Total Risk Across Surface Soil	2.51E-03
Total Risk Across All Media and All Exposure Routes	2.85E-03

Total Hazard Index Across Groundwater	5.52E+02
Total Hazard Index Across Sediment	–
Total Hazard Index Across Surface Soil	7.28E+00
Total Hazard Index Across All Media and All Exposure Routes	5.60E+02

Notes
* = Only the UTL test for iron indicates a background exceedance.

Total Blood HI =	2.79E+01
Total CNS HI =	5.66E+02
Total CNS (Developmental) HI =	1.73E-01
Total Fetal Weight HI =	2.42E+00
Total GI Tract HI =	1.84E+01
Total Immune HI =	6.72E+00
Total Kidney HI =	5.82E+00
Total Liver HI =	1.77E+01
Total Lung HI =	3.85E+02
Total Nervous System HI =	4.18E+00
Total Skin HI =	1.91E+01
Total Thyroid HI =	4.18E+00
Total Vascular HI =	9.01E+00
Total Weight Loss HI =	4.80E+00

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TABLE 4

MARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - LIFETIME RESIDENT EXPOSURE TO YELLOW PARCEL (PIPELINE AREA) SURFACE SOIL, SEDIMENT AND GROUNDWATER (CENTER OF PL

REASONABLE MAXIMUM EXPOSURE

CRATER RESOURCES

Receptor Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Pumps)											
			Arsenic	7.12E-04	-	1.44E-03	7.14E-04	Arsenic	NA	NA	-	NA	-
			Barium	-	-	-	-	Barium	NA	NA	-	NA	-
			Beryllium	-	-	-	-	Beryllium	NA	NA	-	NA	-
			Chromium	-	-	-	-	Chromium	NA	NA	-	NA	-
			Copper	-	-	-	-	Copper	NA	NA	-	NA	-
			Iron	-	-	-	-	Iron	NA	NA	-	NA	-
			Lead	-	-	-	-	Lead	NA	NA	-	NA	-
			Molybdenum	-	-	-	-	Molybdenum	NA	NA	-	NA	-
			Selenium	-	-	-	-	Selenium	NA	NA	-	NA	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	NA	NA	-	NA	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	NA	NA	-	NA	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	NA	-	NA	-
			Dibenzofuran	-	-	-	-	Dibenzofuran	NA	NA	-	NA	-
			Naphthalene	-	-	-	-	Naphthalene	NA	NA	-	NA	-
			Phenol	-	-	-	-	Phenol	NA	NA	-	NA	-
			Aniline	-	-	-	-	Aniline	NA	NA	-	NA	-
			Benzene	1.1E-06	-	0.0E-00	1.2E-06	Benzene	NA	NA	-	NA	-
			Chloroform	2.0E-07	-	1.3E-06	2.1E-07	Chloroform	NA	NA	-	NA	-
			Total	0.3E-04	-	1.0E-03	0.3E-04	Total		-	-	-	-
	Air	Contact (Inh.) with Airborne Vapors from Groundwater (Center of Pumps)											
			Arsenic	-	-	-	-	Arsenic	NA	-	NA	-	-
			Barium	-	-	-	-	Barium	NA	-	NA	-	-
			Beryllium	-	-	-	-	Beryllium	NA	-	NA	-	-
			Chromium	-	-	-	-	Chromium	NA	-	NA	-	-
			Copper	-	-	-	-	Copper	NA	-	NA	-	-
			Iron	-	-	-	-	Iron	NA	-	NA	-	-
			Lead	-	-	-	-	Lead	NA	-	NA	-	-
			Molybdenum	-	-	-	-	Molybdenum	NA	-	NA	-	-
			Selenium	-	-	-	-	Selenium	NA	-	NA	-	-
			2,4-Dimethylphenol	-	-	-	-	2,4-Dimethylphenol	NA	-	NA	-	-
			2-Methylphenol	-	-	-	-	2-Methylphenol	NA	-	NA	-	-
			4-Methylphenol	-	-	-	-	4-Methylphenol	NA	-	NA	-	-
			Dibenzofuran	-	-	-	-	Dibenzofuran	NA	-	NA	-	-
			Naphthalene	-	-	-	-	Naphthalene	NA	-	NA	-	-
			Phenol	-	-	-	-	Phenol	NA	-	NA	-	-
			Aniline	-	-	-	-	Aniline	NA	-	NA	-	-
			Benzene	-	1.3E-04	-	1.3E-04	Benzene	NA	-	NA	-	-
			Chloroform	-	2.0E-05	-	2.0E-05	Chloroform	NA	-	NA	-	-
			Total	-	1.3E-04	-	1.3E-04	Total		-	-	-	-
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Yellow Parcel - Pipeline Area)											
			Arsenic	-	-	-	-	Arsenic	NA	NA	-	NA	-
			Barium	0.3E-05	-	1.1E-05	0.4E-05	Barium	NA	NA	-	NA	-
			Chromium	-	-	-	-	Chromium	NA	NA	-	NA	-
			Iron	-	-	-	-	Iron	NA	NA	-	NA	-
			Benzo(a)anthracene	2.3E-04	-	-	2.3E-04	Benzo(a)anthracene	NA	NA	-	NA	-
			Benzo(b)pyrene	2.7E-05	-	-	2.7E-05	Benzo(b)pyrene	NA	NA	-	NA	-
			Dibenzo(a,h)anthracene	4.0E-04	-	-	4.0E-04	Dibenzo(a,h)anthracene	NA	NA	-	NA	-
			Dibenzo(a,h)phenanthrene	0.3E-05	-	-	0.3E-05	Dibenzo(a,h)phenanthrene	NA	NA	-	NA	-
			Phenanthrene	-	-	-	-	Phenanthrene	NA	NA	-	NA	-
			Indeno(1,2,3-cd)pyrene	0.0E-00	-	-	0.0E-00	Indeno(1,2,3-cd)pyrene	NA	NA	-	NA	-
			Total	3.0E-03	-	1.1E-05	3.0E-03	Total		-	-	-	-
	Particulates	Contact (Inh.) with Particulates from Surface Soil (Yellow Parcel - Pipeline Area)											
			Arsenic	-	-	-	-	Arsenic	NA	-	NA	-	-
			Barium	-	1.0E-05	-	1.0E-05	Barium	NA	-	NA	-	-
			Chromium	-	4.0E-05	-	4.0E-05	Chromium	NA	-	NA	-	-
			Iron	-	-	-	-	Iron	NA	-	NA	-	-
			Benzo(a)anthracene	-	-	-	-	Benzo(a)anthracene	NA	-	NA	-	-
			Benzo(b)pyrene	-	2.4E-05	-	2.4E-05	Benzo(b)pyrene	NA	-	NA	-	-
			Dibenzo(a,h)anthracene	-	-	-	-	Dibenzo(a,h)anthracene	NA	-	NA	-	-
			Dibenzo(a,h)phenanthrene	-	-	-	-	Dibenzo(a,h)phenanthrene	NA	-	NA	-	-
			Phenanthrene	-	-	-	-	Phenanthrene	NA	-	NA	-	-
			Indeno(1,2,3-cd)pyrene	-	-	-	-	Indeno(1,2,3-cd)pyrene	NA	-	NA	-	-
			Total	-	0.0E-05	-	0.0E-05	Total		-	-	-	-

Total Risk Across Groundwater	0.0E-04	Total Hazard Index Across Groundwater	-
Total Risk Across Surface Soil	-	Total Hazard Index Across Surface Soil	-
Total Risk Across Surface Soil	3.1E-03	Total Hazard Index Across Surface Soil	-
Total Risk Across All Media and All Exposure Routes	4.7E-03	Total Hazard Index Across All Media and All Exposure Routes	-

Notes
* = Only the VOL test for iron indicates a background concentration.

AR306476

TABLE 4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADOLESCENT (TEENS) TRESPASSER/VISITOR EXPOSURE TO YELLOW PARCEL (PIPELINE AREA) SURFACE SOIL AND SEDIMENT

REASONABLE MAXIMUM EXPOSURE

CRATER RESOURCES

Scenario Timeframe: Current
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescent (Teens)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Yellow Parcel - Pipeline Area)											
			Aluminum	–	–	–	–	Aluminum	CNS (Developmental)	6.93E-03	–	3.67E-04	7.19E-03
			Arsenic	2.97E-06	–	1.40E-07	3.01E-06	Arsenic	Skin/Vascular	4.48E-02	–	2.18E-03	4.69E-02
			Chromium	–	–	–	–	Chromium	Kidney	3.98E-03	–	5.78E-03	9.76E-03
			Iron*	–	–	–	–	Iron*	Liver/Blood/GI Tract	4.57E-02	–	6.62E-04	4.63E-02
			Benz(a)anthracene	1.07E-05	–	–	1.07E-05	Benz(a)anthracene	NA	–	–	–	–
			Benzo(a)pyrene	1.24E-04	–	–	1.24E-04	Benzo(a)pyrene	NA	–	–	–	–
			Benzo(b)fluoranthene	2.03E-05	–	–	2.03E-05	Benzo(b)fluoranthene	NA	–	–	–	–
			Dibenz(a,h)anthracene	4.22E-06	–	–	4.22E-06	Dibenz(a,h)anthracene	NA	–	–	–	–
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	4.88E-02	–	1.01E-02	5.89E-02
			Indeno(1,2,3-cd)pyrene	3.01E-06	–	–	3.01E-06	Indeno(1,2,3-cd)pyrene	NA	–	–	–	–
			(Total)	1.88E-04	–	1.40E-07	1.88E-04	(Total)		1.80E-01	–	1.91E-02	1.88E-01
	Particulates	Contact (Inh.) with Particulates from Surface Soil (Yellow Parcel - Pipeline Area)											
			Aluminum	–	–	–	–	Aluminum	CNS	–	8.93E-02	–	8.93E-02
			Arsenic	–	3.61E-07	–	3.61E-07	Arsenic	NA	–	–	–	–
			Chromium	–	8.77E-07	–	8.77E-07	Chromium	Lung	–	5.24E-03	–	5.24E-03
			Iron*	–	–	–	–	Iron*	NA	–	–	–	–
			Benz(a)anthracene	–	–	–	–	Benz(a)anthracene	NA	–	–	–	–
			Benzo(a)pyrene	–	6.61E-07	–	6.61E-07	Benzo(a)pyrene	NA	–	–	–	–
			Benzo(b)fluoranthene	–	–	–	–	Benzo(b)fluoranthene	NA	–	–	–	–
			Dibenz(a,h)anthracene	–	–	–	–	Dibenz(a,h)anthracene	NA	–	–	–	–
			Dibenzofuran	–	–	–	–	Dibenzofuran	NA	–	–	–	–
			Indeno(1,2,3-cd)pyrene	–	–	–	–	Indeno(1,2,3-cd)pyrene	NA	–	–	–	–
			(Total)	–	1.90E-06	–	1.90E-06	(Total)		–	9.08E-02	–	9.08E-02

Total Risk Across Sediment	–
Total Risk Across Surface Soil	1.88E-04
Total Risk Across All Media and All Exposure Routes	1.88E-04

Total Hazard Index Across Sediment	–
Total Hazard Index Across Surface Soil	2.50E-01
Total Hazard Index Across All Media and All Exposure Routes	2.50E-01

Notes
* = Only the UTL test for iron indicates a background exceedance.

Total Blood HI =	4.63E-02
Total CNS HI =	9.25E-02
Total CNS (Developmental) HI =	7.19E-03
Total GI Tract HI =	4.63E-02
Total Kidney HI =	6.86E-02
Total Liver HI =	4.63E-02
Total Lung HI =	5.24E-03
Total Skin HI =	4.68E-02
Total Vascular HI =	4.68E-02

AR306477

TABLE 4

Y OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT INDUSTRIAL WORKER EXPOSURE TO YELLOW PARCEL (PIPELINE AREA) SURFACE SOIL, SEDIMENT AND GROUNDWATER (CENTER OF REASONABLE MAXIMUM EXPOSURE

CRATER RESOURCES

Scenario Timeframe: Current/Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Contact (Ing. & Der.) with Groundwater (Center of Plume)											
			Arsenic	1.66E-04	–	3.38E-08	1.66E-04	Arsenic	Skin/Vascular	9.82E-01	–	2.00E-04	9.82E-01
			Barium	–	–	–	–	Barium	Kidney	8.97E-02	–	1.66E-05	8.97E-02
			Beryllium	–	–	–	–	Beryllium	GI Tract	1.21E-01	–	2.41E-03	1.24E-01
			Chromium	–	–	–	–	Chromium	Kidney	2.92E-01	–	6.76E-03	2.97E-01
			Cyanide	–	–	–	–	Cyanide	Thyroid/Nervous System/Weight Loss	5.46E-01	–	1.09E-04	5.46E-01
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	2.12E+00	–	4.23E-04	2.12E+00
			Lead	–	–	–	–	Lead	NA	–	–	–	–
			Manganese	–	–	–	–	Manganese	CNS	1.37E+01	–	2.72E-03	1.37E+01
			Selenium	–	–	–	–	Selenium	Blood/Skin/CNS	1.91E-01	–	4.21E-03	1.91E-01
			2,4-Dimethylphenol	–	–	–	–	2,4-Dimethylphenol	Blood/CNS	2.04E-01	–	2.03E-03	2.07E-01
			3-Methylphenol	–	–	–	–	3-Methylphenol	CNS/Weight Loss	1.23E+00	–	8.98E-03	1.24E+00
			4-Methylphenol	–	–	–	–	4-Methylphenol	CNS/Lung/Weight Loss	4.78E+01	–	9.01E-01	4.78E+01
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	3.91E-02	–	8.92E-00	4.00E-02
			Naphthalene	–	–	–	–	Naphthalene	Weight Loss	8.92E-01	–	4.98E-02	8.98E-01
			Phenol	–	–	–	–	Phenol	Total Weight	3.16E-01	–	1.07E-03	3.11E-01
			Acetone	–	–	–	–	Acetone	Liver/Kidney	4.11E-02	–	1.36E-05	4.11E-02
			Benzene	2.53E-06	–	2.07E-07	2.60E-06	Benzene	Blood/Immune	8.18E-01	–	8.67E-05	8.28E-01
			Chloroform	8.57E-06	–	4.38E-10	8.61E-06	Chloroform	Liver	3.01E-05	–	2.02E-05	3.03E-05
			(Total)	1.83E-04	–	3.21E-07	1.84E-04	(Total)		8.04E+01	–	8.07E-01	8.05E+01
Surface Soil	Surface Soil	Contact (Ing. & Der.) with Surface Soil (Yellow Parcel - Pipeline Area)											
			Aluminum	–	–	–	–	Aluminum	CNS (Developmental)	7.19E-03	–	3.00E-04	7.56E-03
			Arsenic	7.66E-08	–	3.51E-07	7.66E-08	Arsenic	Skin/Vascular	4.76E-02	–	2.11E-03	4.91E-02
			Chromium	–	–	–	–	Chromium	Kidney	4.27E-03	–	5.01E-03	1.08E-02
			Iron*	–	–	–	–	Iron*	Liver/Blood/GI Tract	4.01E-02	–	8.04E-04	4.08E-02
			Benzo(a)anthracene	2.01E-08	–	–	2.01E-08	Benzo(a)anthracene	NA	–	–	–	–
			Benzo(a)pyrene	3.30E-04	–	–	3.30E-04	Benzo(a)pyrene	NA	–	–	–	–
			Benzo(b)fluoranthene	6.30E-08	–	–	6.30E-08	Benzo(b)fluoranthene	NA	–	–	–	–
			Dibenz(a,h)anthracene	1.11E-08	–	–	1.11E-08	Dibenz(a,h)anthracene	NA	–	–	–	–
			Dibenzofuran	–	–	–	–	Dibenzofuran	Kidney	6.14E-02	–	1.01E-02	6.16E-02
			Indeno(1,2,3-cd)pyrene	7.60E-08	–	–	7.60E-08	Indeno(1,2,3-cd)pyrene	NA	–	–	–	–
			(Total)	4.38E-04	–	3.51E-07	4.38E-04	(Total)		1.04E-01	–	1.01E-02	1.17E-01
	Particulates	Contact (Inh.) with Particulates from Surface Soil (Yellow Parcel - Pipeline Area)											
			Aluminum	–	–	–	–	Aluminum	CNS	–	9.00E-01	–	9.00E-01
			Arsenic	–	1.04E-05	–	1.04E-05	Arsenic	NA	–	–	–	–
			Chromium	–	2.94E-05	–	2.94E-05	Chromium	Lung	–	6.07E-02	–	6.07E-02
			Iron*	–	–	–	–	Iron*	NA	–	–	–	–
			Benzo(a)anthracene	–	–	–	–	Benzo(a)anthracene	NA	–	–	–	–
			Benzo(a)pyrene	–	1.91E-05	–	1.91E-05	Benzo(a)pyrene	NA	–	–	–	–
			Benzo(b)fluoranthene	–	–	–	–	Benzo(b)fluoranthene	NA	–	–	–	–
			Dibenz(a,h)anthracene	–	–	–	–	Dibenz(a,h)anthracene	NA	–	–	–	–
			Dibenzofuran	–	–	–	–	Dibenzofuran	NA	–	–	–	–
			Indeno(1,2,3-cd)pyrene	–	–	–	–	Indeno(1,2,3-cd)pyrene	NA	–	–	–	–
			(Total)	–	5.50E-05	–	5.50E-05	(Total)		–	1.00E+00	–	1.00E+00

Total Risk Across Groundwater	1.14E-04
Total Risk Across Sediment	–
Total Risk Across Surface Soil	4.91E-04
Total Risk Across All Media and All Exposure Routes	6.70E-04

Total Hazard Index Across Groundwater	8.05E+01
Total Hazard Index Across Sediment	–
Total Hazard Index Across Surface Soil	1.23E+00
Total Hazard Index Across All Media and All Exposure Routes	7.82E+01

Notes

* = Only the UTL tool for iron indicates a background concentration.

Total Blood HI =	3.46E+00
Total CNS HI =	9.38E+01
Total CNS (Developmental) HI =	7.56E-03
Total Total Weight HI =	3.11E-01
Total GI Tract HI =	2.30E+00
Total Immune HI =	9.72E-01
Total Kidney HI =	5.54E-01
Total Liver HI =	2.22E+00
Total Lung HI =	4.78E+01
Total Nervous System HI =	5.46E-01
Total Skin HI =	1.72E+00
Total Thyroid HI =	5.46E-01
Total Vascular HI =	1.00E+00
Total Weight Loss HI =	4.98E-01

AR306478

TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT CONSTRUCTION WORKER EXPOSURE TO YELLOW PARCEL (QUARRY 4 AREA) SOIL
REASONABLE MAXIMUM EXPOSURE
CRATER RESOURCES

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Contact (Ing. & Der.) with Soil (Yellow Parcel Quarry 4 Area)											
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	1.25E+00	–	8.31E-03	1.26E+00
			Manganese	–	–	–	–	Manganese	CNS	4.90E-01	–	3.25E-03	4.93E+01
			(Total)	–	–	–	–	(Total)		1.74E+00	–	1.16E-02	1.75E+00
	Particulates	Contact (Inh.) with Particulates from Soil (Yellow Parcel Quarry 4 Area)											
			Iron	–	–	–	–	Iron	N/A	–	–	–	–
			Manganese	–	–	–	–	Manganese	CNS	–	1.18E+01	–	1.18E+01
			(Total)	–	–	–	–	(Total)		–	1.18E+01	–	1.18E+01
						Total Risk Across Soil	–					Total Hazard Index Across Soil	1.35E+01
						Total Risk Across All Media and All Exposure Routes	–					Total Hazard Index Across All Media and All Exposure Routes	1.35E+01

Total GI Tract HI = 1.26E+00
Total Liver HI = 1.26E+00

AR306479

TABLE 5
SIGNIFICANT RISKS (HI>1.0; CANCER RISK >1E-04)

Area	Child Resident HI	Adult Resident HI	Child/Adult resident CR	Tresspasser/vistor		Construction		Industrial	
				HI	CR	HI	CR	HI	CR
Groundwater center of plume	550	260	1E-03	--	--	--	--	69	2E-04
Groundwater extent of plume	160	66	8E-04	--	--	--	--	20	2E-04
Quarry 1 soil	1.6*	--	--	--	--	6	--	--	--
Quarry 2 soil	--	--	--	--	--	4*	--	--	--
Quarry 3 sediment	3	--	2E-03	--	2E-04	--	--	--	1E-04
Quarry 3 soil	23**	4**	8E-03**	--	4E-04**	230	2E-04	2**	1E-03**
Quarry 4 soil	108**	34*	6E-04**	3*	--	21*	--	31*	3E-04**
Quarry 6 soil	--	--	--	--	--	30**	4E-03**	--	--
SS1, SS2 soil	34*	11*	--	--	--	--	--	10*	--
SS3 soil	11**	3*	1E-04**					3*	--
Yellow Parcel Pipeline	7*	--	4E-03	--	2E-04	--	--	--	5E-04
Yellow Parcel - Quary 4 soil	--	--	--	--	--	14	--	--	--

* At least one statistical test indicates that the chemicals driving this risk may be attributable to backgroud.
** Some, but not, of the chemicals contributing to this risk may be attributable to background

Table 6 ***Sediment and Soil EEQs for On-Site Constituents of Potential Concern***
Crater Resources Site
Upper Merion Township, Pennsylvania

Constituent	Sediment Screening Level (mg/Kg)		Sediment Maximum † Concentration (mg/Kg)	Sediment EEQ*	Sediment Frequency of Detection**	Sediment Frequency of Exceedance***	Soil Screening Level (mg/Kg)		Soil Maximum † Concentration (mg/Kg) †	Soil EEQ* †	Soil Frequency of Detection**	Soil Frequency of Exceedance***
Methylene Chloride	-		-	-	-	-	0.30	b	9.00E-03	3.00E-02	10/16	0/10
Benzene	0.052	o	2.70E+00	5.19E+01	1/9	1/1	-		-	-	-	-
Toluene	0.79	o	3.40E+01	4.30E+01	1/9	1/1	-		-	-	-	-
Styrene	-		2.70E+01	-	1/9	-	-		-	-	-	-
Phenol	0.42	b	1.80E+02	4.29E+02	1/9	1/1	0.10	b	4.40E+00	4.40E+01	4/16	4/4
2-Methyl Phenol	0.063	b	1.40E+02	2.22E+03	4/9	4/4	0.10	b	1.10E+00	1.10E+01	4/16	2/4
4-Methyl Phenol	0.67	b	3.30E+02	4.93E+02	5/9	5/5	0.10	b	4.30E+00	4.30E+01	5/16	5/5
2,4-Dimethylphenol	0.029	b	1.60E+02	5.52E+03	3/9	3/3	0.10	b	2.30E+00	2.30E+01	4/16	3/4
Naphthalene	0.16	b	3.70E+04	2.31E+05	9/9	9/9	0.10	b	5.00E+02	5.00E+03	6/16	5/6
2-Methylnaphthalene	0.07	b	5.20E+03	7.43E+04	6/9	6/6	0.10	b	1.60E+01	1.60E+02	5/16	4/5
Acenaphthylene	0.044	b	9.00E+03	2.05E+05	9/9	9/9	0.10	b	1.20E+02	1.20E+03	8/16	6/8
Acenaphthene	0.016	b	9.30E+02	5.81E+04	6/9	6/6	0.10	b	4.20E+00	4.20E+01	7/16	5/7
Dibenzofuran	0.54	b	4.40E+03	8.15E+03	7/9	7/7	0.10	b	1.90E+01	1.90E+02	6/16	5/6
Fluorene	0.019	b	5.40E+03	2.84E+05	7/9	7/7	0.10	b	2.40E+01	2.40E+02	7/16	6/7
Phenanthrene	0.24	b	1.70E+04	7.08E+04	9/9	9/9	0.10	b	2.80E+02	2.80E+03	12/16	11/12
Anthracene	0.085	b	4.80E+03	5.63E+04	9/9	9/9	0.10	b	1.00E+02	1.00E+03	10/16	8/10
Fluoranthene	0.6	b	1.20E+04	2.00E+04	9/9	9/9	0.10	b	7.40E+02	7.40E+03	13/16	12/13
Pyrene	0.67	b	8.70E+03	1.31E+04	9/9	9/9	0.10	b	5.50E+02	5.50E+03	12/16	12/12
Benzo(a)anthracene	0.26	b	1.00E+02	3.83E+02	8/9	8/8	0.10	b	4.00E+02	4.00E+03	12/16	10/12
Chrysene	0.38	b	1.50E+02	3.91E+02	8/9	8/8	0.10	b	3.60E+02	3.60E+03	13/16	11/13
Bis(2-ethylhexyl)phthalate	-		-	-	-	-	1.15	o	6.10E-02	5.30E-02	1/16	0/1
Benzo(b)flouranthene	3.2	b	3.80E+03	1.19E+03	9/9	9/9	0.10	b	6.30E+02	6.30E+03	13/16	13/13
Benzo(k)fluoranthene	3.2	n	1.50E+03	4.69E+02	9/9	9/9	0.10	b	1.80E+02	1.80E+03	12/16	10/12
Benzo(a)pyrene	0.43	b	2.50E+03	5.81E+03	9/9	9/9	0.10	b	4.60E+02	4.60E+03	13/16	11/13
Indeno(1,2,3-cd)pyrene	0.60	b	3.40E+02	5.67E+02	9/9	9/9	0.10	b	3.30E+02	3.30E+03	12/16	10/12
Benzo(g,h,i)perylene	0.67	b	2.20E+02	3.28E+02	8/9	8/8	0.10	b	1.70E+02	1.70E+03	12/16	9/12
Dibenz(a,h)anthracene	0.06	b	2.80E+01	4.42E+02	1/9	1/1	0.10	b	1.00E+02	1.00E+03	8/16	6/8
Carbazole	-		3.20E+03	-	9/9	-	0.10	b	5.70E+01	5.70E+02	8/16	6/8
2-Butanone	0.27	o	1.60E-02	5.93E-02	1/9	0/1	-		-	-	-	-
Aroclor-1254	-		-	-	-	-	0.10	b	7.00E-02	7.00E-01	2/16	0/12

AR306481

Table 6 ***Sediment and Soil EEQs for On-Site Constituents of Potential Concern***
Crater Resources Site
Upper Merion Township, Pennsylvania

Constituent	Sediment Screening Level (mg/Kg)		Sediment Maximum † Concentration (mg/Kg)	Sediment EEQ*	Sediment Frequency of Detection**	Sediment Frequency of Exceedance***	Soil Screening Level (mg/Kg)		Soil Maximum † Concentration (mg/Kg)	Soil EEQ*	Soil Frequency of Detection**	Soil Frequency of Exceedance***
Cyanide(total)	0.10	o	5.28E+03	5.28E+04	9/9	9/9	0.005	b	1.75E+02	3.50E+04	6/16	6/6
Aluminum	-		1.31E+04	-	9/9	-	1	b	2.67E+04	2.67E+04	16/16	16/16
Antimony	2	n	1.20E+00	6.00E-01	1/9	0/1	0.48	b	1.80E+00	3.75E+00	1/16	1/1
Arsenic (total)	8.20	b	1.42E+02	1.73E+01	9/9	6/9	328	b	3.02E+02	9.21E-01	15/16	0/15
Barium	-		1.05E+02	-	9/9	-	440	b	2.87E+02	6.52E-01	16/16	0/16
Beryllium	-		5.60E+00	-	1/9	-	0.02	b	4.50E+00	2.25E+02	8/16	8/8
Cadmium	-		-	-	-	-	2.5	b	2.60E+00	1.04E+00	2/16	1/2
Calcium	-		1.75E+05	-	9/9	-	-		1.33E+05	-	16/16	-
Chromium (total)	0.01	b	2.09E+01	2.09E+03	9/9	9/9	0.005	b	3.31E+02	6.62E+04	16/16	16/16
Cobalt	-		3.79E+01	-	9/9	-	100	b	4.58E+01	4.58E-01	16/16	0/16
Copper	34	b	1.37E+02	4.03E+00	9/9	9/9	15	b	1.08E+02	7.20E+00	16/16	16/16
Iron	120	b	5.02E+04	4.18E+02	9/9	9/9	12	b	1.13E+05	9.42E+03	16/16	16/16
Lead	46.7	b	1.91E+02	4.09E+00	9/9	9/9	0.01	b	3.33E+02	3.33E+04	16/16	16/16
Magnesium	-		7.62E+03	-	9/9	-	-		2.24E+04	-	16/16	-
Manganese	460	o	7.74E+02	1.68E+00	9/9	6/9	330	b	6.20E+03	1.88E+01	16/16	14/16
Mercury	0.15	b	2.33E+01	1.55E+02	9/9	9/9	0.06	b	2.25E+01	3.88E+02	7/16	7/7
Nickel	20.9	b	7.67E+01	3.67E+00	9/9	9/9	2.00	b	6.75E+01	3.38E+01	16/16	16/16
Potassium	-		2.00E+03	-	6/9	-	-		1.70E+03	-	15/16	-
Selenium	0.92	n	1.05E+02	1.14E+02	9/9	9/9	1.8	b	1.09E+02	6.06E+01	6/16	6/6
Vanadium	-		2.11E+01	-	7/9	-	0.50	b	7.05E+01	1.41E+02	16/16	16/16
Zinc	150	b	5.37E+02	3.58E+00	9/9	9/9	10	b	1.15E+03	1.15E+02	16/16	16/16

b = USEPA Region III BTAG Screening Level (0.1 mg/kg used as a default soil screening level when a constituent-specific value was not available).
n = NOAA Screening Guideline.
o = Oak Ridge National Laboratory: Screening Benchmarks for Ecological Risk Assessment.

† = Maximum concentration is based on samples collected by ERM in April and May 1997.
* = Ecological Effects Quotient: maximum site concentration/screening level.
** = "6/9" represents 6 positive detections out of 9 samples in which the constituent was analyzed.
*** = "6/9" represents 6 exceedances of the screening levels out of 9 positive detections.

AR306482

Table 7 ***EEQs for On-Site Surface Water Constituents of Potential Concern***
Crater Resources Site
Upper Merion Township, Pennsylvania

Constituent	Screening Level (µg/L)		Surface Water Maximum † Concentration (µg/L)	EEQ*	Frequency of Detection**	Frequency of Exceedance***
2-Methylnaphthalene	300	n	2	6.67E-03	1/3	0/1
Anthracene	0.1	b	1	1.00E+01	1/3	1/1
Carbon Disulfide	2	b	0.88	4.40E-01	1/5	0/1
Cyanide(total)	5.2	b	1940	3.73E+02	3/3	3/3
Barium (dissolved)	4	o	91.1	2.28E+01	3/3	3/3
Calcium (dissolved)	116,000	o	85,200	7.34E-01	3/3	0/3
Copper (dissolved)	12	o	12.3	1.03E+00	3/3	1/3
Iron (dissolved)	320	b	989	3.09E+00	3/3	1/3
Magnesium (dissolved)	82,000	o	9140	1.11E-01	3/3	0/3
Manganese (dissolved)	14,500	b	228	1.57E-02	2/3	0/3
Potassium (dissolved)	53,000	o	1650	3.11E-02	3/3	0/3
Selenium (dissolved)	5	b	30.8	6.16E+00	3/3	3/3
Sodium (dissolved)	680,000	o	3400	5.00E-03	2/3	0/2
Zinc (dissolved)	30	b	78.9	2.63E+00	3/3	3/3

b = USEPA Region III BTAG Screening Level.
n = NOAA Screening Guideline.
o = Oak Ridge National Laboratory: Screening Benchmarks for Ecological Risk Assessment.

† = Maximum concentration is based on samples collected by ERM in April and May 1997.
* = Ecological Effects Quotient: maximum site concentration/screening level.
** = "2/3" represents 2 positive detections out of 3 samples in which the consitituent was analyzed.
*** = "0/2" represents 0 exceedances of the screening levels out of 2 positive detections.

AR306483

Table 8 ***Potential Constituents of Concern in Soil Samples***
Crater Resources Site
Upper Merion Township, Pennsylvania

	EEQ 1 - 9	EEQ 10 - 100	EEQ > 100
Phenol		4.40E+01	
2-Methyl Phenol		1.10E+01	
4-Methyl Phenol		4.30E+01	
2,4-Dimethylphenol		2.30E+01	
Naphthalene			5.00E+03
2-Methylnaphthalene			1.60E+02
Acenaphthylene			1.20E+03
Acenaphthene		4.20E+01	
Dibenzofuran			1.90E+02
Fluorene			2.40E+02
Phenanthrene			2.80E+03
Anthracene			1.00E+03
Fluoranthene			7.40E+03
Pyrene			5.50E+03
Chrysene			3.60E+03
Benzo(a)anthracene			4.00E+03
Benzo(b)fluoranthene			6.30E+03
Benzo(k)fluoranthene			1.80E+03
Benzo(a)pyrene			4.60E+03
Indeno(1,2,3-cd)pyrene			3.30E+03
Benzo(g,h,i)perylene			1.70E+03
Dibenz(a,h)anthracene			1.00E+03
Carbazole			5.70E+02
Cyanide(total)			3.50E+04
Aluminum			2.67E+04
Antimony	3.75E+00		
Beryllium			2.25E+02
Cadmium	1.04E+00		
Chromium			6.62E+04
Copper	7.20E+00		
Iron			9.42E+03
Lead			3.33E+04
Manganese		1.88E+01	
Mercury			3.88E+02
Nickel		3.38E+01	
Selenium		6.06E+01	
Vanadium			1.41E+02
Zinc			1.15E+02

Table 9 *Potential Constituents of Concern in Sediments and Surface Water*
Crater Resources Site
Upper Merion Township, Pennsylvania

	EEQ 1 - 9	EEQ 10 - 99	EEQ > 100
Sediment Constituents			
Benzene		5.19E+01	
Toluene		4.30E+01	
Phenol			4.29E+02
2-Methyl Phenol			2.22E+03
4-Methyl Phenol			4.93E+02
2,4-Dimethylphenol			5.52E+03
Naphthalene			2.31E+05
2-Methylnaphthalene			7.43E+04
Acenaphthylene			2.05E+05
Acenaphthene			5.81E+04
Dibenzofuran			8.15E+03
Fluorene			2.84E+05
Phenanthrene			7.08E+04
Anthracene			5.63E+04
Fluoranthene			2.00E+04
Pyrene			1.31E+04
Benzo(a)anthracene			3.83E+02
Chrysene			3.91E+02
Benzo(b)fluoranthene			1.19E+03
Benzo(k)fluoranthene			4.69E+02
Benzo(a)pyrene			5.81E+03
Indeno(1,2,3-cd)pyrene			5.67E+02
Benzo(g,h,i)perylene			3.28E+02
Dibenz(a,h)anthracene			4.42E+02
Cyanide (total)			5.28E+04
Arsenic		1.73E+01	
Chromium			2.09E+03
Copper	4.03E+00		
Iron			4.18E+02
Lead	4.09E+00		
Manganese	1.68E+00		
Mercury			1.55E+02
Nickel	3.67E+00		
Selenium			1.14E+02
Zinc	3.58E+00		
Surface Water Constituents			
Anthracene		1.00E+01	
Cyanide (total)			3.73E+02
Barium (dissolved)		2.88E+01	
Copper (dissolved)	1.03E+00		
Iron (dissolved)	3.09E+00		
Selenium (dissolved)	6.16E+00		
Zinc (dissolved)	2.63E+00		

Table 10
Crater Resources Superfund Site
Estimated Cost of Alternatives

Alternative	Capital Cost	Annual Operation and Maintenance Cost	Total Present Worth Cost
SW-1: No Action	$ 0	$ 0	$ 0
SW-2: Institutional Controls	$ 145,000	$ 2,000	$ 230,000
SW-3: WAL Pipeline Investigation	—	—	$ 148,000
S-3: Soil Cover	$ 5,295,000	$ 9,900	$ 5,407,000
S-4: Low Permeability Cap	$ 7,353,000	$ 11,900	$ 7,501,000
S-4A: Quarry 3 Sediment Removal, Low Permeability Cap	$ 9,064,000	$ 11,900	$ 9,211,000
S-4B: Quarry 3 Sediment Stabilization, Low Permeability Cap	$ 10,342,000	$ 11,900	$ 10,489,000
S-5: Quarry 3 Removal, Low-Permeability Cap	$ 8,855,000	$ 11,900	$ 9,002,000
S-6: Complete Removal	$ 69,103,000	$ 0	$ 69,103,000
S-7: Stabilization	$ 79,873,000	$ 9,900	$ 104,030,000
GW-3: Monitored Natural Attenuation	$ 50,000	$ 26,600	$ 600,000
GW-4: Perimeter Groundwater Recovery	$ 1,607,000	$ 64,800	$ 3,380,000
GW-5: Groundwater Recovery, Treatment, and Discharge	$ 2,184,000	$ 221,700	$ 7,270,000

Table 11

Alternative S-5: Quarry 3 Removal/Off-Site Disposal and Low-Permeability Capping
Present Worth Analysis

Year	Capital Cost	Annual Cost (1)	Total Year Cost	Annual Discount Rate at 7% (2)	Present Worth
0	$8,854,522		$8,854,522	1.000	$8,854,522
1		$11,900	$11,900	0.935	$11,127
2		$11,900	$11,900	0.873	$10,389
3		$11,900	$11,900	0.816	$9,710
4		$11,900	$11,900	0.763	$9,080
5		$11,900	$11,900	0.713	$8,485
6		$11,900	$11,900	0.666	$7,925
7		$11,900	$11,900	0.623	$7,414
8		$11,900	$11,900	0.582	$6,926
9		$11,900	$11,900	0.544	$6,474
10		$11,900	$11,900	0.508	$6,045
11		$11,900	$11,900	0.475	$5,653
12		$11,900	$11,900	0.444	$5,284
13		$11,900	$11,900	0.415	$4,939
14		$11,900	$11,900	0.388	$4,617
15		$11,900	$11,900	0.362	$4,308
16		$11,900	$11,900	0.339	$4,034
17		$11,900	$11,900	0.317	$3,772
18		$11,900	$11,900	0.296	$3,522
19		$11,900	$11,900	0.277	$3,296
20		$11,900	$11,900	0.258	$3,070
21		$11,900	$11,900	0.242	$2,880
22		$11,900	$11,900	0.226	$2,689
23		$11,900	$11,900	0.211	$2,511
24		$11,900	$11,900	0.197	$2,344
25		$11,900	$11,900	0.184	$2,190
26		$11,900	$11,900	0.172	$2,047
27		$11,900	$11,900	0.161	$1,916
28		$11,900	$11,900	0.150	$1,785
29		$11,900	$11,900	0.141	$1,678
30		$11,900	$11,900	0.131	$1,559
				TOTAL PRESENT WORTH	**$9,002,190**

Note:
(1) ERM's Annual O&M Cost
(2) ERM's Discount Rate at 5% vs TetNUS's Discount Rate at 7% (EPA OSWER #9355.3-20)

AR306487

Table 11

Alternative S-5: Quarry 3 Removal/Off-Site Disposal and Low-Permeability Capping

Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Total Cost Subcontract	Total Cost Material	Total Cost Labor	Total Cost Equipment	Total Direct Cost	Note
1 PROJECT DOCUMENTS/INSTITUTIONAL CONTROLS												
1.1 Prepare Documents & Plans including Permits	500	hr			$40.00		$0	$0	$20,000	$0	$20,000	(1)
1.2 Property Use Restrictions	750	hr			$40.00		$0	$0	$30,000	$0	$30,000	(1)
2 SITE PREPARATION												
2.1 E & S Controls (includes retention basin)	1	ls		$12,500.00	$20,000.00	$17,500.00	$0	$12,500	$20,000	$17,500	$50,000	(2)
2.2 Clear & Grub Area for Soil Cover	10	ac			$1,125.00	$1,100.00	$0	$0	$11,250	$11,000	$22,250	(3)
2.3 Site Grading for Stormwater Runoff	67,780	sy			$0.20	$0.28	$0	$0	$13,552	$17,618	$31,170	(3)
2.4 Construction of Roadway	1	ls		$8,250.00	$10,000.00	$8,750.00	$0	$8,250	$10,000	$8,750	$25,000	(2)
3 DEWATERING, TREATMENT & DISPOSAL OF SURFACE WATER												
3.1 Dewatering Ponds 1, 2 & 3	4,600,000	gal			$0.03	$0.02	$0	$0	$138,000	$92,000	$230,000	(2)
3.2 Hauling Surface Water, 10 miles	4,600,000	gal			$0.04	$0.03	$0	$0	$161,000	$138,000	$299,000	(2)
4 PARTIAL REMOVAL AND ASSOCIATED BACKFILL												
4.1 Excavate Plateau Area	11,960	cy			$2.66	$3.28	$0	$0	$31,867	$39,294	$71,161	(3)
4.2 Surface Soil Removal - Remaining Areas	6,065	cy			$2.66	$3.28	$0	$0	$16,133	$19,893	$36,026	(3)
4.3 Sediment Removal	10,110	cy			$5.46	$6.56	$0	$0	$55,201	$66,524	$121,724	(3)
4.4 General Fill - Delivered (backfill to original grade)	42,233	ton		$8.00			$0	$337,864	$0	$0	$337,864	(4)
4.5 General Fill - Spread with Dozer	28,155	cy			$0.53	$1.85	$0	$0	$14,922	$52,087	$67,009	(3)
4.6 General Fill - Compaction	28,155	cy			$0.21	$0.62	$0	$0	$5,913	$17,456	$23,369	(3)
5 OFF-SITE REMOVAL AND DISPOSAL OF CONTAMINATED SOILS												
5.1 Containment Area for Processing	1	ls		$5,000.00	$5,000.00	$5,000.00	$0	$5,000	$5,000	$5,000	$15,000	(2)
5.2 Soil/Sediment Loading	28,155	cy			$0.20	$0.25	$0	$0	$5,631	$7,039	$12,670	(3)
5.3 Transport & Disposal for Contaminated Soils	42,233	ton	$46.00				$1,942,718	$0	$0	$0	$1,942,718	(4)
6 MULTI-MEDIA CAP AT QUARRY 3 WITH TOPSOIL COVER												
6.1 Soil Excavation & Relocation (300' haul)	10,430	cy			$2.66	$3.28	$0	$0	$27,744	$34,210	$61,954	(3)
6.2 General Fill - Delivered	15,645	ton		$8.00			$0	$125,160	$0	$0	$125,160	(4)
6.3 General Fill - Spread with Dozer	10,430	cy			$0.53	$1.85	$0	$0	$5,528	$19,298	$24,823	(3)
6.4 General Fill - Compaction	10,430	cy			$0.21	$0.62	$0	$0	$2,190	$6,467	$8,657	(3)
6.5 Soil Cover, 6"	2,712	cy		$5.06	$0.86	$1.98	$0	$13,723	$2,332	$5,370	$21,425	(5)
6.6 Topsoil - Loading	2,712	cy		$13.10	$0.52	$0.77	$0	$35,527	$1,410	$2,088	$39,026	(3)
6.7 Topsoil - Hauling (10 mile)	2,712	cy			$1.86	$5.10	$0	$0	$4,502	$13,831	$18,333	(3)
6.8 Topsoil, 6" - Spread with Dozer	2,712	cy			$0.53	$1.85	$0	$0	$1,437	$5,017	$6,455	(3)
6.9 Seed & Mulch	146	msf		$46.00	$7.40	$7.86	$0	$6,736	$1,084	$1,149	$8,969	(3)
6.10 Drainage Trench	2,500	lf			$1.42	$1.02	$0	$0	$3,550	$2,550	$6,100	(3)
6.11 Channel Lining (riprap)	75	cy		$17.05	$7.05	$8.50	$0	$1,279	$529	$638	$2,445	(3)

AR306488

Table 11

Alternative S-5: Quarry 3 Removal/Off-Site Disposal and Low-Permeability Capping

Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Total Cost Subcontract	Total Cost Material	Total Cost Labor	Total Cost Equipment	Total Direct Cost	Note
7 MULTI-MEDIA CAP WITH ASPHALT COVER REMAINING AREA												
7.1 General Fill - Delivered	30,900	ton		$8.00			$0	$247,200	$0	$0	$247,200	(4)
7.2 General Fill - Spread with Dozer	20,600	cy			$0.53	$1.85	$0	$0	$10,918	$38,110	$49,028	(3)
7.3 General Fill - Compaction	20,600	cy			$0.21	$0.62	$0	$0	$4,326	$12,772	$17,098	(3)
7.4 Low Perm Clay	11,044	cy		$5.99	$2.56	$4.65	$0	$66,154	$28,273	$51,355	$145,781	(5)
7.5 HDPE liner, 40 mil	298,179	sf		$0.26	$0.77	$0.17	$0	$77,527	$229,598	$50,690	$357,815	(5)
7.6 Sand Drainage Layer	3,644	cy		$7.83	$0.86	$1.76	$0	$28,533	$3,134	$6,413	$38,080	(5)
7.7 Aggregate Sub-base, 6"	33,133	sy		$5.95	$0.33	$0.63	$0	$197,141	$10,934	$20,874	$228,949	(3)
7.8 Binder Course, 2"	33,131	sy		$2.49	$0.34	$0.28	$0	$82,496	$11,265	$9,277	$103,037	(3)
7.9 Wearing Course, 1 1/2"	33,131	sy		$2.23	$0.31	$0.26	$0	$73,882	$10,271	$8,614	$92,767	(3)
7.10 Drainage Improvements	1	ls		$6,250.00	$10,000.00	$8,750.00	$0	$6,250	$10,000	$8,750	$25,000	(2)
Subtotal							$1,942,718	$1,323,221	$907,492	$789,631	$4,963,062	
Local Area Adjustments							100.0%	105.0%	95.0%	95.0%		(3)
Subtotal							$1,942,718	$1,389,382	$862,117	$750,150	$4,944,367	
Burden on Labor Cost @ 30%									$258,635		$258,635	
G & A on Labor Cost @ 10%									$86,212		$86,212	
G & A on Material Cost @ 10%								$138,938			$138,938	
Tax on Material Cost @ 6%								$83,363			$83,363	
G & A on Subcontract Cost @ 5%							$97,136				$97,136	
Total Direct Cost							$2,039,854	$1,611,683	$1,206,964	$750,150	$5,608,850	
Indirects on Total Direct Cost @ 25%											$1,402,163	
Profit on Total Direct Cost @ 5%											$280,433	
Total Field Cost											$7,291,246	
Contingency on Total Field Cost @ 20%											$1,458,249	
Engineering Cost @ 2%			(Total Field Cost minus Subcontractor's Total Direct Cost)								$105,028	
TOTAL COST											$8,854,522	

AR306489

Table 11

Alternative S-5: Quarry 3 Removal/Off-Site Disposal and Low-Permeability Capping

Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Total Cost Subcontract	Total Cost Material	Total Cost Labor	Total Cost Equipment	Total Direct Cost	Note

NOTES: Source of costs

(1) Past Costing Experience

(2) ERM Cost

(3) Means 2000 Cost

(4) Vendor Quote

(5) ECHOS 2000 Cost

Assume density of general fill equal to 1.5 tons per cubic yard

Disposal cost of soil/sediments assumes materials are non-hazardous with disposal at a local Subtitle D Landfill.

Indirects include:

Construction Management, Legal, Travel, Medical, Supplies, Data Process, Bond Premium Insurance, Security, Testing & Analysis, Maintenance, Timekeeper, Photos, Pre and Post Documents (as-builts, reports), Pollution Insurance, Normal Trash Disposal, and Site Clean up.

AR306490

Table 12 Soil and Sediment Cleanup Standards (mg/kg) (Risk-based cleanup levels except where noted)						
Contaminant	Quarry 3 Surface	Quarry 3 Sediment	Quarry 3 Sub-surface	SS-1 and 2	SS-3	Yellow Parcel Pipeline
Benzo(a)anthracene	3.59	110[2]	-	-	-	4.48
Benzo(b)fluoranthene	5.65	110[2]	-	-	-	8.55
Benzo(a)pyrene	4.13	11[2]	11[2]	-	4.55	5.23
Dibenz(a,h)anthracene	0.897	-	4.48	-	-	0.177
Dibenzofuran	-	.66	-	-	-	3.180
Indeno(1,2,3-c,d)pyrene	2.96	-	-	-	-	1.26
2-Methylnaphthalene	-	-	16	-	-	-
Naphthalene	-	0.2[1]	0.20[1]	-	-	-
Aluminum	13,800	-	-	986	-	14,800
Arsenic	0.2[1]	-	0.2[1]	-	6.06	0.586
Chromium	-	-	-	-	-	0.525
Iron	40[1]	-	-	190,000[2]	190,000[2]	190,000[2]
Manganese	-	-	200	197	212	-
Mercury	11.6	-	13	-	-	-

[1] Based on Soil Screening Level
[2] Based on PADEP's Act 2 Standards

Table 13 Groundwater Cleanup Standards (µg/l) (Risk-based cleanup levels)		
Contaminant	**Center of Plume**	**Extent of Plume**
Acetone	95.9	24
Benzene	5	0.04
Chloroform	1	0.015
Dibenzofuran	12	0.86
2,4-Dimethylphenol	1.15	1
2-Methylphenol	12.5	1
4-Methylphenol	47.7	1
Naphthalene	5	1
Phenol	7,860	-
Cyanide	10	13
Arsenic	1	0.04
Barium	40	450
Beryllium	4	4
Cadmium	-	0.62
Chromium	8	12
Cobalt	-	22
Iron	250	2,300
Lead	15	15
Manganese	66.8	310
Mercury	-	0.004
Nickel	-	260
Selenium	0.4	0.006
Thallium	-	0.17
Vanadium	-	0.41
Zinc	-	170

TABLE 14
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)
AND TO BE CONSIDERED MATERIAL (TBCs) FOR THE
CRATER RESOURCES SITE

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Detail Regarding ARARs in the Context of the Remedy
I. CHEMICAL SPECIFIC				
A. Water				
1. Safe Drinking Water Act	42 U.S.C.§§300g-1			
a. Maximum Contaminant Levels (MCLs)	40 C.F.R. §§141.11-12 and 141.61-62	Relevant and Appropriate	MCLs are enforceable standards for public drinking water supply systems which have at least 15 service connections or are used by at least 25 persons. These requirements are not directly applicable since ground water in the vicinity of the Site is not used as a private drinking water supply. However, under the circumstances of this Site, MCLs are relevant and appropriate requirements which were considered in establishing ground water cleanup levels.	The groundwater will meet these requirements. The ground water cleanup standards listed on Table 13 will meet or exceed the MCLs.
b. Maximum Contaminant Level Goals (MCLGs)	40 C.F.R. §141.50-.51	Relevant and Appropriate	MCLGs are non-enforceable health goals for public water supplies which have at least 15 service connections or are used by 25 persons. Under the circumstances of this Site, MCLGs are relevant and appropriate requirements which were considered in establishing ground water cleanup levels.	The groundwater will meet these requirements. The ground water cleanup standards listed on Table 13 will meet or exceed the MCLGs.
2. Pennsylvania Water Quality Standards	25 PA Code Chapters 93.4a, 93.5-93.7, and 93.8a	Relevant and Appropriate	These are guidelines established pursuant to Section 304 of the Clean Water Act that set the concentrations of pollutants that are allowable at levels which preserve human health based on water and fish ingestion and to preserve aquatic life. Ambient water quality criteria may be relevant and appropriate to CERCLA cleanups based on the uses of a water body.	These requirements will be an ARAR if the discharge associated with Alternative GW-3, if any, is to an on-site surface water. Such on-site discharge would meet the guidelines established for protection of aquatic life.
3. Integrated Risk Information System (IRIS)	EPA Office of Research and Development	To Be Considered	IRIS is an EPA data base containing up-to-date health risk and EPA regulatory information for numerous chemicals. IRIS is the preferred source of toxicity information as it contains only those reference doses (RfDs) and cancer slope factors that have been verified by the RfD or Carcinogen Risk Assessment Verification Endeavor Workgroups.	These non-enforceable toxicity values have been considered while developing site-specific cleanup standards for each remedial alternative.

AR306493

TABLE 14
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED MATERIAL (TBCs) FOR THE CRATER RESOURCES SITE

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Detail Regarding ARARs in the Context of the Remedy
B. Soil				
1. Risk Assessment Guidance for Superfund - Volume 1 Human Health Manual Part A, December 1989	EPA Office of Emergency and Remedial Response EPA/540/1-89/002	To be Considered	EPA guidance for calculating baseline human health risk and establishing risk-based performance standards for Superfund clean-ups. Section 7.4 sets forth method for identifying appropriate toxicity values for contaminants of concern.	There are currently no ARARs establishing acceptable concentrations for contaminants in soil or sediment at the Site. This guidance document was considered when establishing risk based cleanup standards.
2. Pennsylvania Act 2 Program - Statewide Health Standards for soils	PA Code Chapter 250.305	Applicable	This regulation establishes requirements for voluntary cleanup activities.	Where Act 2's statewide health standards for soils provide more stringent requirements than the risk-based cleanup standards for the site, EPA has incorporated these more stringent requirements as cleanup standards in Table 12.
II. LOCATION SPECIFIC				
1. Pennsylvania Wetlands Regulations	25 PA Code Chapter 105.18a	Applicable	Protects wetlands of the Commonwealth from dredging, filling, removal, or other alteration and requires Commonwealth oversight and approval.	The substantive requirements of these regulations shall be applicable if construction of the cap, or discharge to surface water impacts regulated wetlands, if any.
2. Preservation of Historical & Archaeological Data Act	16 U.S.C. § 469	Applicable	Requires actions to avoid potential loss or destruction of significant scientific, historical, or archaeological data.	Actions shall be taken to mitigate any adverse effects on identified off-site historic resources that might result from implementation of the remedial action.
III. ACTION SPECIFIC				
A. Water				
1. Clean Water Act (CWA); Pennsylvania National Pollutant Discharge Elimination System Requirements;	40 CFR Part 125.3 40 CFR Part 122.44-.45 25 PA Code Chapters 95.1 - 95.3	Applicable	Establishes substantive requirements and limits for discharges to waters of Pennsylvania and the United States.	These requirements will be an ARAR if the discharge associated with Alternative GW-3, if at all, is to an on-site surface water source. Such on-site discharge would comply with these discharge standards.
2. Storm Water Management Act	32 P.S.§ 680.13	Applicable	Requires implementation of stormwater control measures to prevent injury to health, safety, or property.	Stormwater shall be managed to control stormwater during construction of the remedy.

AR306494

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APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED MATERIAL (TBCs) FOR THE CRATER RESOURCES SITE

	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Detail Regarding ARARs in the Context of the Remedy
3.	Erosion and Sediment Control	25 PA Code 102.4(b)(1), 102.11, 102.22	Applicable	Identifies erosion and sediment control requirements and criteria for activities involving land clearing, grading and other earth disturbances and establishes erosion and sediment control criteria.	These regulations apply to construction activities at the Site which disturb the ground surface, including clearing, grading, excavation and cap installation.
4.	Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites, April 1999	OSWER Directive 9200.4-17R	To Be Considered	This policy provides guidance for evaluating and approving monitored natural attenuation remedies.	This policy shall be considered during the implementation of the monitored natural attenuation remedy.
B. Air					
1.	Air Emission Standards for Process Vents	40 C.F.R. Part 264.1030 through 264.1034 and 40 CFR Part 264.1053 - 264.1063	Relevant and Appropriate	Establishes requirements for process vents and equipment leaks.	Emissions due to potential leaks from the contingent treatment plant would comply with this requirement.
2.	Federal Regulations Governing Hazardous Air Pollutants (NESHAPS)	40 CFR 61.242-1 through 61.244	Relevant and Appropriate	Requires emissions of Hazardous Air Pollutants (HAPs) from new and existing sources to be quantified; establishes ambient air quality standards and emissions limitations for HAP emissions from new sources.	The excavation of the PAH - contaminated materials in Quarry 3 will comply with the HAP Standards.
3.	Control of Air Emissions from Air Strippers at Superfund Groundwater Sites, June 15, 1989	OSWER Directive 9355.0-28	To Be Considered	This policy relates to the selection of control for air strippers at ground water sites according to the air quality status of the area of the site (i.e., whether it is an attainment or non-attainment area).	This policy shall be considered in determining if air emission controls are necessary for the air stripper. Sources most in need of the controls are those with emissions rates in excess of 3 lbs./hour or 15 lbs./day or a potential rate of 10 tons/year of total VOCs.
4.	Fugitive Air Emissions	25 PA Code Chapter 123.1 - 123.2 40 CFR § 50.6 - 50.7	Applicable	Establishes the fugitive dust regulation for particulate matter.	The capping and excavation activities will comply with these regulations.
5.	Malodorous Air Emissions	25 PA Code 123.31	Applicable	Prohibits malodors detectable beyond the site property line.	Emissions from the excavation and construction will comply with this requirement.
6.	Visible Air Emissions	25 PA Code 123.41	Applicable	Establishes opacity limits for visible air emissions.	Emissions from the excavation and construction will comply with this requirement.
7.	Pennsylvania Standards for New Stationary Sources	25 PA Code Chapters 121.7 and 127.1	Applicable	Requires all new air emission sources to achieve minimum attainable emissions using best available technology.	Emissions for the contingent groundwater treatment plant would comply with this requirement.

AR306495

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ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Detail Regarding ARARs in the Context of the Remedy
C. Solid Waste				
1. Residual Waste Landfill	25 PA Code 288.234, 288.236 and 288.237, 288.241-244	Relevant and Appropriate	Establishes minimum requirements for closure of residual waste landfills in the Commonwealth, including minimum cap specifications.	The specifications of the cap shall, at a minimum, comply with the Commonwealth of PA closure requirements.
D. Hazardous Waste				
1. Standards applicable to Generators.	25 PA Code 75.262 or 25 PA Code 262a	Applicable	Hazardous waste determination requirements applicable to generators who treat, store, or dispose of hazardous waste.	Any treatment, storage or disposal of soils that are considered hazardous waste shall comply with the more stringent substantive requirements of either 25 PA Code 75.262 or 25 PA Code 262a.[1]
2. Standards for Owners and Operators of Hazardous Waste TSDs	25 PA Code 75.264 or 25 PA Code 264a (Subchapters I, J, and L)	Applicable	Establishes standards for storing hazardous waste on-site.	In the event that excavated soil or sediments are hazardous waste, the material shall be stored in accordance with the more stringent substantive requirements of either 25 Pa. Code 75.264 or 25 Pa. Code 264a (Subchapters I, J, and L) concerning the manner of storage.[2]
E. Residual Waste				
1. Residual Waste Regulations	25 PA Code 299.101-.133 25 PA Code 299.211-215	Applicable	Establishes the criteria for storing residual waste.	In the event the soils and sediments are not considered hazardous waste, the substantive requirements for storage and transportation of residual waste apply.

[1]25 PA Code 75.262 is part of Pennsylvania's EPA-authorized hazardous waste program. 25 PA Code 262a represents Pennsylvania's new regulation, which is pending authorization from EPA, and will supercede 25 PA Code 75.262.

[2]25 PA Code 75.264 is part of Pennsylvania's EPA-authorized hazardous waste program. 25 PA Code 262a represents Pennsylvania's new regulation, which is pending authorization from EPA, and will supercede 25 PA Code 75.264.

AR306496