Exhibit 2

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Mr. Pete Stevenson
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U.S. Environmental Protection Agency, Region VIII
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Subject: START2, EPA Region VIII, Contract No. 68-W-00-118, TDD No. 0101-0008. Imminent and Substantial Endangerment to Human Health and Environment Due to Metals Contamination at American Fork Canyon Sites, Uinta National Forest, Utah County, Utah

Dear Mr. Stevenson:

This endangerment assessment describes human health and environmental risks associated with metals contamination at two mine sites in American Fork Canyon, Uinta National Forest in Utah County, Utah. Health and environmental risks at the site include impacts to human health through recreational use of the mine sites and resulting inhalation, dermal and ingestion exposure to metals-contaminated tailings and soils. In addition, a potential for human exposure to metals exists through the consumption of locally caught contaminated fish. Environmental impacts include the potential effects of contaminated soil and mine runoff on terrestrial and aquatic ecological receptors.

BACKGROUND

The Dutchman Flats site is located adjacent to the North Fork of the American Fork River in Utah County, Utah, and consists of a mill site, mine waste dump, and tailings pond. The Pacific Mine site is also located adjacent to the North Fork of the American Fork River, just north of its confluence with the Dry Fork. It consists of the Pacific Mine waste pile, the Pacific Mill, and the Pacific Mill tailings pond.

Both the Dutchman Flats and Pacific Mines are historical lead mines and have extensive piles of mine and mill tailings containing high levels of lead (up to 99,999 parts per million [ppm]) and arsenic (up to 3,700 ppm). About 46,000 tons of tailings are present at the Pacific Mine site alone. In addition to high levels of lead and arsenic in tailings, elevated levels of lead, arsenic, and zinc have been found in fish collected downstream of the Pacific Mine site, indicating that runoff from the Pacific Mine site is contaminating the American Fork River.

Human exposure to these metals is currently occurring, because both the Dutchman Flats and Pacific Mine areas are used extensively for recreation, including camping, hiking, picnicking, mine exploration, hunting, fishing, and all-terrain vehicle (ATV) and four-wheel drive vehicle use. Many of these activities can be expected to generate high levels of airborne contaminated dust, resulting in a likelihood for significant inhalation exposure to the recreational user.

Conceptual Site Model

A conceptual site model (CSM) was prepared for the American Fork Canyon sites (Figure 1). The CSM graphically illustrates the relationship between contaminant sources, release mechanisms, exposure pathways, and human population receptors. Figure 1 shows that metal contaminants at the sites derive from tailings piles, waste rock piles, and mill sites. Contaminants are released from these sources into the surrounding soils by wind erosion, surface runoff and infiltration. The primary human population receptor is considered to be the recreational user who is exposed to metal contaminants primarily through inhalation of airborne dust, incidental soil ingestion, and dermal contact with soil. Because the present analysis is only a screening evaluation, and as a result of limitations in the available data, a quantitative analysis of all potential exposure pathways was not conducted.

Human Exposure to Lead in Soil and Tailings Material

Health risks posed by lead in soil are evaluated using mathematical models to predict blood lead concentrations in children or adults. For residential exposure scenarios, the child is the relevant receptor and the *Integrated Exposure Uptake Biokinetic Model for Lead in Children* (IEUBK) is used (EPA 1994). For nonresidential exposure scenarios, as would be applicable for these mine sites, the adult is the direct receptor and the interim *Adult Lead Methodology* (ALM) is used to evaluate lead risks (EPA 1996). Both models use site-specific exposure parameters to derive a residual soil level of lead considered to be protective of human health.

According to the ALM, the pregnant woman is the direct receptor. However, lead exposure to the fetus of a pregnant woman is actually the receptor upon which the predicted protective soil lead concentration, the PRG, is based. Since the fetus is considered the more sensitive to the effects of lead than are adults or older children, protection of the fetus is considered to result in protection of adults and children as well. The ALM model is used to predict a lead concentration in soil such that less than 5 percent of pregnant women exposed to that soil concentration would experience a fetal blood lead level of greater than 10 micrograms per deciliter (µg/dl).

The ALM model incorporates several exposure parameters that can be modified on a site-specific basis to develop a site-specific PRG. In particular, the ALM model was not specifically developed to address a recreational exposure scenario as would be applicable in this case. Therefore, this model must be adjusted using exposure parameters relevant to recreational use rather than the default commercial exposure scenario. The two parameters that must be modified to accommodate a recreational exposure scenario include the soil ingestion rate and the number of days per year an individual would be exposed. The default value used in the ALM model for the soil ingestion rate is 50 milligrams per day (mg/day). This value, however, is based on the limited soil exposure that would normally occur for an office or retail worker. For recreationists involved in hiking, camping, and riding vehicles over the tailings piles, however, it can be expected that the incidental soil ingestion rate would be much higher. EPA recommends use of 100 mg/day as an "appropriate default value for contact intensive scenarios" (EPA 1999). Therefore, this value was used in the ALM model for the daily rate of incidental soil ingestion. The exposure frequency, or number of days per year (days/yr) an individual would be exposed to the mine site soils, was assumed to be 45 days/yr. This value is based on the conservative assumption that a recreationist might access these areas every other day during the three primary summer months of June, July, and August.

Large single doses of lead produce fatigue, sleep disturbances, and constipation, followed by colic, anemia, and neuritis. Chronic lead poisoning produces loss of appetite, metallic taste, constipation and obstipation, anemia, pallor, malaise, weakness, insomnia, headache, nervous irritability, muscle and joint pains, fine tremors, damage to kidney tubules and in cases of high, long-term exposure, chronic nephritis. Other effects include certain muscular weaknesses ("wrist drop") and lead encephalopathy.

The most commonly used indicator of lead exposure is the whole blood lead level. Toxic effects of lead may occur at levels so low that a threshold is effectively nonexistent. In other words, there may be no completely safe exposure to lead for children. Other signs of low-dose lead toxicity include learning deficits and growth retardation in children and hypertension in middle-aged men. Exposure to low doses of lead in childhood causes long-lasting effects that are thought to be irreversible. Sensitivity to the adverse effects of lead extends from fetal development to the cessation of growth after puberty. At very high exposure levels, lead may produce severe reproductive toxicity, inducing premature deliveries and spontaneous abortions in women and sterility in men.

Human Exposure to Arsenic in Soil and Tailings

Elevated levels of arsenic were also found in tailings at both mine sites. In order to evaluate the significance of these elevated levels, a PRG was developed for a hypothetical adult recreationist receptor using the following equation:

$$PRG = \frac{TR \times BW \times AT}{EF \times ED \left[\left(\frac{IRS \times BA \times CSF_o}{10^6\ mg/kg} \right) + \left(\frac{SA \times AF \times ABS \times CSF}{10^6\ mg/kg} \right) + \left(\frac{IRA \times CSF_i}{PEF} \right) \right]}$$

where:

TR	=	target cancer risk (1E-06)
BW	=	body weight (kilograms [kg])
AT	=	averaging time (days)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BA	=	bioavailability (unitless)
IRS	=	soil ingestion rate (mg/day)
CSF_o	=	cancer slope factor for arsenic (oral exposure route) $((mg/kg/day)^{-1})$
CSF_i	=	cancer slope factor for arsenic (inhalation exposure route) $((mg/kg/day)^{-1})$
SA	=	skin surface area for an adult (square centimeters [cm^2])
AF	=	soil adherence factor (mg/cm^2)
ABS	=	dermal absorption efficiency of arsenic (unitless)
IRA	=	inhalation rate (cubic meters [m^3]/day)
PEF	=	particulate emission factor (m^3/kg)

Human exposure to arsenic occurs primarily through chronic oral ingestion of a variety of organic and inorganic forms of arsenic. Food constitutes the largest source of daily exposure to arsenic. Humans consume an average of 25 to 50 µg/day arsenic from this source. The particular form of arsenic ingested is a critical factor. Trivalent arsenic compounds are more toxic than pentavalent forms. However, the pentavalent form is most commonly found in the environment because natural oxidation processes in the environment favor it.

Water-soluble arsenic is efficiently absorbed from the gastrointestinal tract. Reaching the systemic circulation, trivalent arsenic is detoxified in the liver by conversion to methylarsenic acid and dimethylarsenic acid, which are the principal forms excreted in the urine. The body burden of arsenic can reach considerable levels since it can be sequestered in nails, hair, bones, teeth, skin, liver, kidneys, and lungs.

The adverse health effects produced by arsenic are highly dose dependent. For example, at low concentrations, arsenic may be an essential nutrient and substitute for phosphorus in key biochemical reactions. At high levels, however, arsenic has been recognized as an effective human poison. At toxic levels, it produces severe gastrointestinal irritation, including hemorrhage, and a form of peripheral arteriosclerosis known as blackfoot disease.

Exposure to low levels of arsenic can produce malaise and fatigue, gastrointestinal distress, anemia and basophilic stippling, and neuropathy. The most characteristic pathological effects of chronic arsenic poisoning, however, are skin lesions, particularly plantar and palmar hyperpigmentation and hyperkeratotic lesions. Although these lesions in themselves do not pose a significant health concern, they may ultimately develop into malignant skin cancers and metastasize to other parts of the body.

Health Risks Due to Contaminated Fish Consumption

In addition to the health risks posed by contaminated soil and tailings, fish collected at sites downstream of the Pacific Mine site in the American Fork River show elevated concentrations of lead, arsenic, and zinc. Fish were not analyzed for mercury. The Food and Drug Administration (FDA) has not established safe levels (action or guidance levels) for detected metals in fish per se, but has established them for lead and arsenic in crustaceans and shellfish. The guidance levels for arsenic are 76 in crustaceans and 86 ppm in shellfish. The corresponding guidance levels for lead are 1.5 in crustaceans and 1.7 ppm in shellfish. By comparison, maximum levels of lead and arsenic detected in locally caught fish, although significantly elevated downstream of the mine sites, are still less than 1 ppm.

ECOLOGICAL RISKS

In addition to the screening assessment of human health risks associated with lead and arsenic in tailings material at these sites, a preliminary evaluation of ecological impacts was conducted for arsenic, cadmium, copper, lead, mercury, and zinc. This screening evaluation was based on results of sampling of surface water, soil, and macroinvertebrates, and also included consideration of potential effects on soil invertebrates, soil microbes, terrestrial plants, and fish. No sediment samples were collected; therefore impacts related to potential sediment exposure could not be evaluated and may be underestimated.

candidate for endangered species listing. Note that the presence of the spotted frog at these mine sites has not been verified. No studies of possible effects on the abundance of the Bonneville cutthroat trout or other native fish species have been conducted.

That the above adverse effects on stream fauna are being caused by mine runoff contamination is supported by the fact that lead and zinc concentrations in runoff from these sites are significantly above EPA ambient water quality criteria (AWQC) for the protection of aquatic life. The EPA AWQC for arsenic, cadmium, copper, lead, mercury, and zinc are shown in Table 2. Table 2 shows the criteria maximum concentration (CMC), which is "an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect" and the criterion continuous concentration (CCC), which is "an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect."

Concentrations of metals were below detection limits in most reaches of the American Fork proper, and average concentrations were below the corresponding AWQC. However, metals concentrations did exceed AWQC in tributaries to the American Fork and in surface runoff. For example, zinc levels considerably in excess of 120 µg/liter(L) (total zinc) (CCC/CMC) were detected at 5 of 20 locations sampled in tributaries of the American Fork River downstream of these mine sites. Lead and cadmium also exceed their corresponding CCC at 4 of 20 and 5 of 20 locations, respectively, in American Fork tributaries. Surface runoff concentrations of metals also significantly exceed corresponding AWQC at many locations. Zinc concentrations found in Pacific Mine runoff range up to 2,520 micrograms per liter (µg/L) (total zinc) while lead and cadmium concentrations range up to 130 µg/L lead and 27.1 µg/L cadmium respectively (as total metal).

CONCLUSIONS

Metals-contaminated soil and mine waste (tailings) present imminent health risks to the public and the environment at the Dutchman Flats and Pacific Mine sites. In particular, inhalation, dermal, and ingestion exposure of recreationists accessing these areas is expected to result in unsafe exposure to lead and arsenic. PRGs were developed for arsenic and lead using standard EPA methods. Comparison of these PRGs to levels of lead and arsenic detected in site soils and tailings materials indicates that many areas of these sites must be considered unsafe for recreational use. Levels of lead, arsenic, and zinc are elevated in fish collected downstream of these sites. However, these levels are still less than available safe levels (guidance levels) established by FDA for metals in seafood. Metals-contaminated mine runoff is adversely affecting stream fauna as indicated by 1) reduced macroinvertebrate populations downstream of these sites, and 2) by significant exceedances of AWQC for zinc, lead, and cadmium in mine runoff, the American Fork River, and tributaries of the American Fork River. The lack of sediment data and data regarding concentrations of contaminants in forage is likely to result in an underestimate of wildlife exposure to site contaminants.

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profiles on CD-ROM. Version 3:1. CRC Press. Boca Raton.

Department of Interior (DOI). American Fork Canyon Watershed Reclamation Project: A Preliminary Investigation Report. Bureau of Reclamation. Provo Area Office.

Environmental Protection Agency (EPA). 1983. Hazardous Waste Land Treatment. Office of Solid Waste and Emergency Response, SW-74.

EPA. 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. EPA/540/R-93/081. Office of Emergency and Remedial Response. Washington, DC.

EPA. 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. Technical Review Workgroup for Lead.

EPA. 1999. Frequently Asked Questions on the Adult Lead Model.

EPA. 2000a. EPA Region 9 Preliminary Remediation Goals.

EPA. 2000b. Memorandum from Susan Griffin to Al Lange. Region 8. Denver.

EPA. 2000c. Integrated Risk Information System (IRIS). (accessed via the EPA website: www.epa.gov\iris).

Efroymson, R.A., Will, M.E. and Suter, G.W. 1997. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter: Invertebrates and Heterotrophic Process, 1997 Revision. ES/ER/TM-126/R2. Oak Ridge National Laboratory.

ISSI Consulting Group (ISSI).1999. Clark Fork River Ecological Risk Assessment.

United States Department of Agriculture (USDA). 2000. Action Memorandum: Dutchman Flat, Wild Dutchman, New Idea, Security and First Northerly Extension of Wild Dutchman Claims. MS 5890, Lot 68, and MS 5866. Forest Service.

Table 2

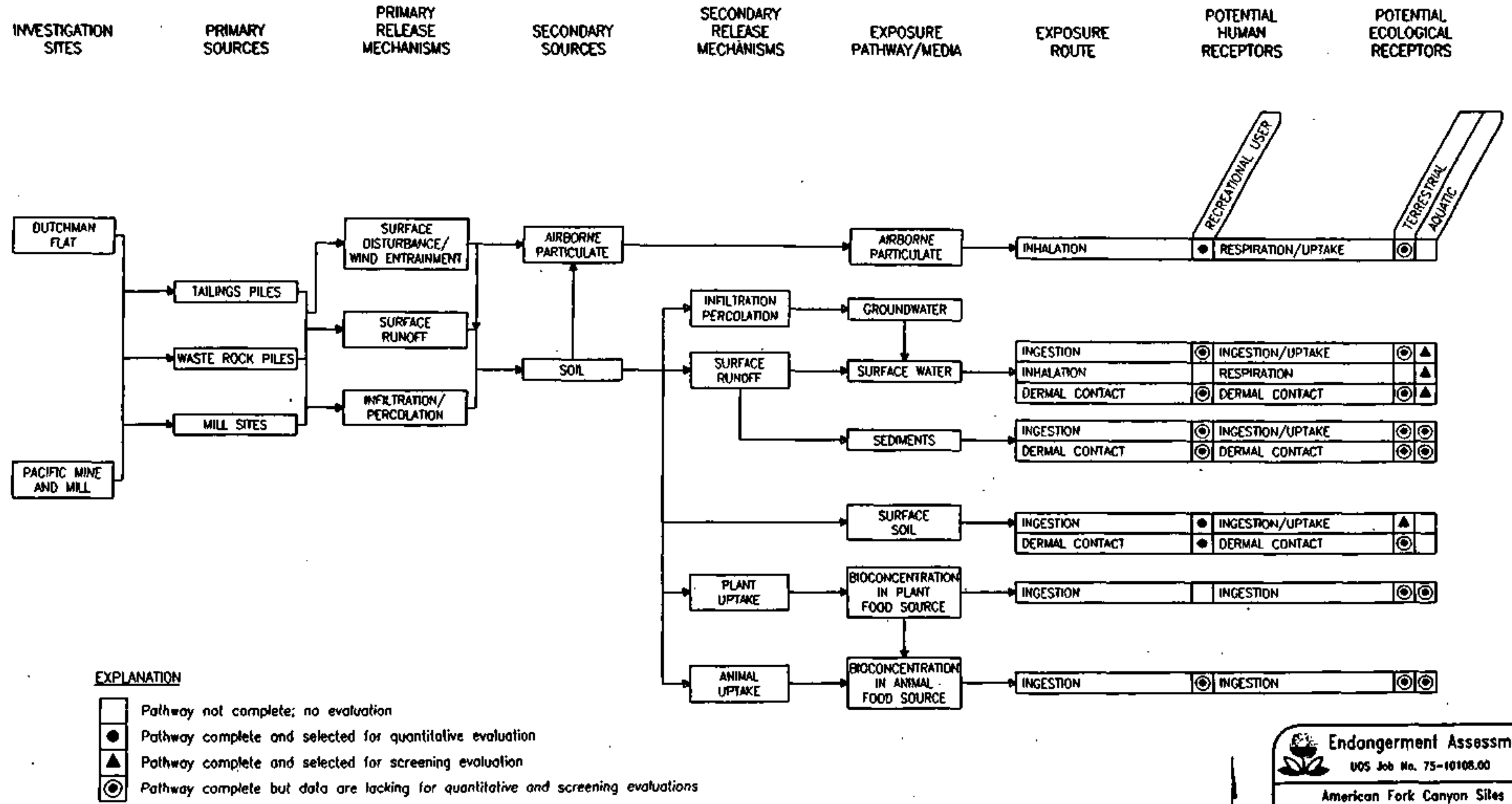
Toxicological Benchmarks for Metals at Dutchman Flats

Metal	Terrestrial Plants[1] (mg/kg soil dw)[2]	Soil Invertebrates[3] (earthworm) (mg/kg soil dw)	Soil Microbes[4] (mg/kg soil dw)	AWQC[5] (ug/L)	
				CMC[6]	CCC[7]
Arsenic	10 to 315	60	100	340	150
Cadmium	3 to 100	20	20	4.3	2.2
Copper	60 to 125	50	100	13	9
Lead	50 to 1,000	500	900	65	25
Mercury	5 to 35	0.1	30	1.4	0.77
Zinc	50 to 500	200	100	120	120

[1]From ISSI (1999).
[2]soil dw = soil dry weight basis
[3]From Efroymson et al. (1997).
[4]From Efroymson et al. (1997).
[5]AWQC = ambient water quality critiera (from Federal Register, Vol. 63, No. 237, December 10, 1998).
[6]CMC = criteria maximum concentration (an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect).
[7]CCC = criterion continuous concentration (an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect).
ug/L = micrograms per liter
mg/kg = milligrams per kilogram

ATTACHMENT A

PRG CALCULATION FOR ARSENIC



Endangerment Assessment
UOS Job No. 75-10108.00

American Fork Canyon Sites
Utah County, Utah

Human Health and Ecological Conceptual Site Model

Figure 1

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