Final Release

PUBLIC HEALTH ASSESSMENT

Callahan Mining Corporation
Brooksville (Cape Rosier), Hancock County, Maine
EPA Facility ID: MED980524128

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U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Superfund Site Assessment Branch
Atlanta, Georgia 30333

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104(i)(6) (42 U.S.C.9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E60), Atlanta, GA 30333.

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Summary

Callahan Mining Corporation site is on the Cape Rosier peninsula, near Harborside Village in the town of Brooksville, Maine. The site is a former zinc/copper open-pit mine operated adjacent to and beneath Goose Pond (also known as Goose Pond Estuary), on the Cape Rosier peninsula. Goose Pond was dammed and drained during operations to allow the mining to take place. The site was contaminated by metals from the open-pit mining operation and residual chemicals from mining separations processes. Since the mine ceased operations in 1972, dams preventing water from entering Goose Pond have been removed, and the pit is currently under water. Elevated levels of heavy metals, including cadmium, copper, lead, and zinc, have been measured in surface water, sediments, biota, soil, and waste piles on site.

On the basis of available information, the Agency for Toxic Substances and Disease Registry (ATSDR) has made the following conclusions about the Callahan Mining Corporation site:

- The site contains physical hazards and elevated levels of heavy metals. Physical hazards could cause injury to people visiting the site.
- Because of the low frequency and duration of likely exposures, people exposed to heavy metals and other contaminants in the soil, tailings, waste rock, surface water, and sediments are not expected to experience adverse health effects. We might modify this conclusion based on further environmental data collected during the remedial investigation process.
- Several contaminants found at the site are known to accumulate in biota. Currently, not enough information exists on potential contaminant levels in Goose Pond and Goose Cove biota to fully determine whether adverse health effects are possible from eating fish or shellfish collected from these areas. The very limited available mussels data have been evaluated in this document. People who occasionally eat mussels from Goose Cove are not likely to experience health effects due to contaminants associated with the Callahan Mining Corporation site. However, collecting or eating shellfish (including clams, mussels, and oysters) from Goose Pond, Goose Cove, and other nearby areas is banned because of elevated levels of metals and other pollution.

ATSDR has made the following recommendations about the Callahan Mining Corporation site:

- ATSDR recommends that property owners discourage access to the site by using signage and barriers until physical hazards are removed and cleanup activities are complete.
- ATSDR recommends that the US. Environmental Protection Agency (EPA), Maine Department of Environmental Protection (DEP), or other relevant agencies conduct more extensive biota sampling to determine concentrations of heavy metals in fish and shellfish tissues in Goose Pond, Goose Cove and, if determined to be appropriate, in waters adjacent to Goose Cove. Adequate background sampling should be conducted to determine the naturally occurring concentrations of heavy metals in the Brooksville area.
- ATSDR recommends that the Holbrook Island Sanctuary ranger and Brooksville and Maine State police increase vigilance to ensure that people follow the shellfish ban and to other fish advisories applicable near the site.

Purpose and Health Issues

The Callahan Mining Corporation was proposed for the National Priorities List (NPL) on September 13, 2001, and listed on September 5, 2002. ATSDR is required by Congress to conduct public health assessments on all sites proposed for the NPL. In this public health assessment, ATSDR evaluates the public health significance of the Callahan Mining Corporation site. ATSDR reviewed available environmental data, potential exposure scenarios, and community health concerns to determine whether adverse health effects are possible. In addition, this public health assessment recommends actions to prevent, reduce, or further identify the possibility for site-related adverse health effects.

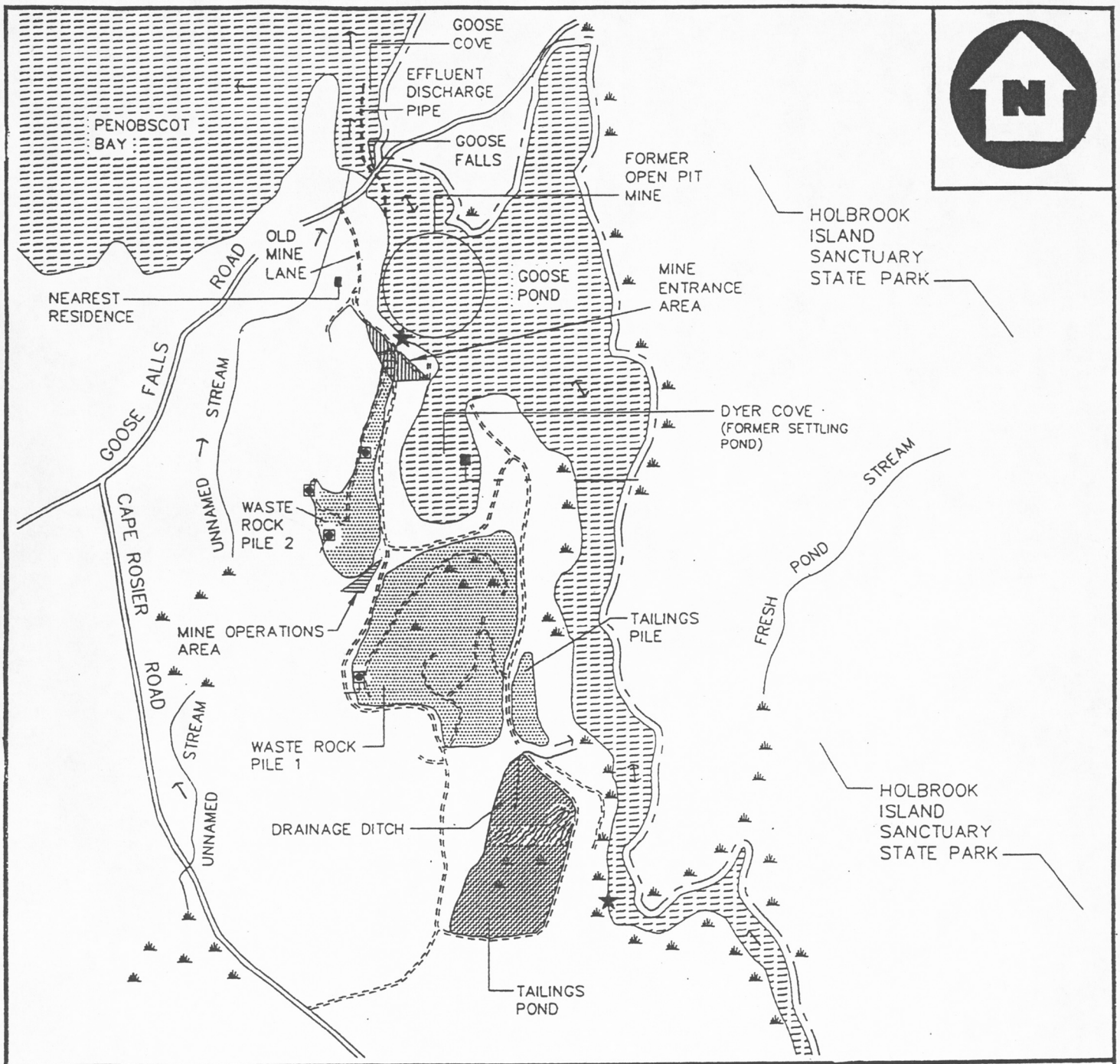
Background

Site Description

This site description includes information from various site documents [1,2,3,4]. The Callahan Mining Corporation site comprises approximately 150 acres and is on the Cape Rosier peninsula, near Harborside Village in the town of Brooksville, Maine. The site extends into Goose Pond (also known as Goose Pond Estuary) to the east, and is adjacent to private properties to the south, west, and north.

Limited underground mining occurred at the site from the late 1800s through the 1900s. The Callahan Mining Corporation operated the site as a zinc and copper open-pit mine from 1968 through 1972. Goose Pond was drained to mine the ore deposit with an open pit by damming Goose Falls, the seawater entrance on the north end of the site. The freshwater entrance to the pond on the south end of the site was also dammed. Goose Falls separates Goose Pond and Goose Cove at the north end of the site. Goose Cove is a cove off of the southern portion of Penobscot Bay. Figure 1 is a site sketch that includes the Callahan Mining Corporation site, Goose Pond, Goose Cove, and Goose Falls [5]. The fresh water that would normally flow into Goose Pond was diverted through a drainage ditch into Weir Cove, and the remaining water was pumped from Goose Pond.

A number of areas involved in the mining operations exist in the developed portion of the site. Each of these areas is briefly discussed in the following text. The developed portion of the site includes a tailings pond of approximately 11 acres that received waste rock materials and chemical products used during the ore-milling process (removal of the metals from the rock). Two waste rock dumps, containing approximately 5 million tons of waste rock removed during mining activities, are also present at the site. During mining activities, a circular open pit measuring 600 feet in diameter and 320 feet deep was created on the site. This pit has been covered with water since the site was re-flooded in the 1970s. Dyer Cove, in the central-west portion of Goose Pond, was used as a settling pond and received water pumped from the open-pit mine during active mining operations. A number of buildings and a building foundation are present at the site. These buildings were previously used for milling operations. Four abandoned



LEGEND

- SURFACE WATER
- WASTE ROCK PILES (SOURCE 1)
- TAILINGS POND (SOURCE 2)
- FLOW DIRECTION
- PROBABLE POINT OF ENTRY TO SURFACE WATER PATHWAY
- SOURCE SAMPLE
- UNPAVED ROAD
- PAVED ROAD
- MINE ENTRANCE AREA
- HOLBROOK ISLAND SANCTUARY STATE PARK BOUNDRY
- BACKGROUND SOIL SAMPLE
- MINE OPERATIONS AREA
- SEDIMENT SAMPLE
- WETLAND

SITE SKETCH

CALLAHAN MINE
HARBORSIDE
BROOKSVILLE, MAINE

WESTON®
MANAGERS DESIGNERS/CONSULTANTS
REGION I SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM

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FIGURE 1

underground storage tanks near the metals building were removed in 1987. Figure 1 shows a sketch of the Callahan Mining Corporation site [5].

Demographics

The Callahan Mining Corporation site is in a sparsely populated area of coastal Maine. Figure 2 shows the demographic information for the population within a 1-mile radius of the site. About 73 year-round residents, including 3 children under 6 years of age, live within a 1-mile radius of the site. The population is white except for one Asian/Pacific Islander. According to EPA officials, the local population doubles during the summer months.

Land and Natural Resource Use

The Callahan Mining Corporation site is in a rural, coastal setting and contains large rock and debris piles. Overall, only sparse vegetation is present along the surface of the site. The site is a groundwater discharge area and borders the west shore of Goose Pond. The east shore of Goose Pond is bordered by the Holbrook Island Sanctuary State Park, which is managed by Maine's Bureau of Parks and Lands and overseen by the Holbrook Island Sanctuary Corporation trust. Private property makes up the west, north, and south boundaries of the Callahan Mining Corporation site. More than 100 sensitive environments are located within 15 miles of the site. Most of these areas have been designated as sensitive environments because of seabird nesting and feeding. Available data show that surface water and sediment in Goose Pond have been impacted by heavy metals contamination associated with mining activities at the Callahan Mining Corporation site.

The towns of Brooksville, Castine, and Isleboro are within 4 miles of the site. All residents within 3 miles of the site, including those in Brooksville and Isleboro, get their drinking water from private groundwater wells. In 1995, approximately 38 people were drinking groundwater from private wells within a half-mile radius of the site; within a 3-mile radius 769 people were drinking from private wells. A public water district uses both groundwater and surface water to supply drinking water to a population of about 1,100 in the town of Castine, approximately 4 miles from the site [1].

Discussion

Data Used

The data evaluated in this document came from the following sources:

- sampling of soil, tailings and waste rock piles, surface water, and sediment by the Maine DEP in 1999 [6];
- sampling of surface water, seeps, and drinking water wells by the Maine DEP from 1986 to 1994 [1];
- sampling of soil and sediment by the Maine DEP in 1994 [1]; and
- sampling of mussels from Goose Cove for heavy metals analysis by the Maine DEP (L. Doggett, unpublished data).

Callahan Mining Corp.

Figure 2

Brooksville (Cape Rosier), Maine

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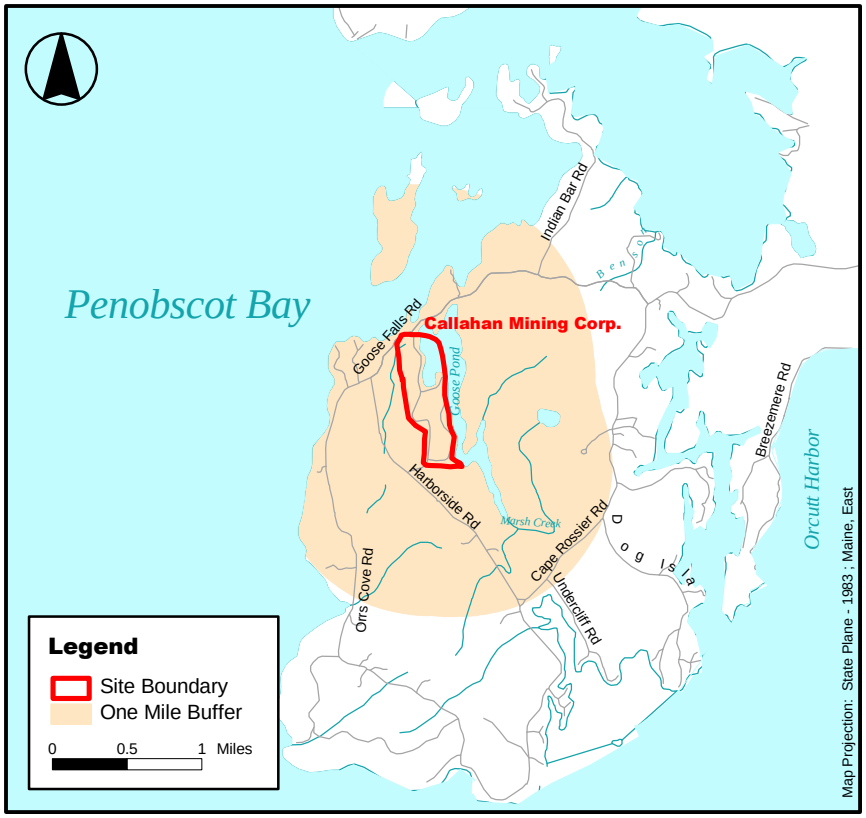
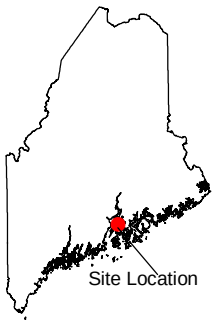


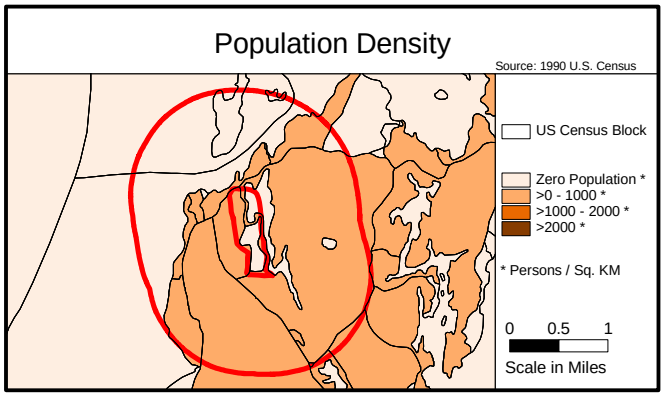
Base Map Source: 1995 TIGER/Line Files

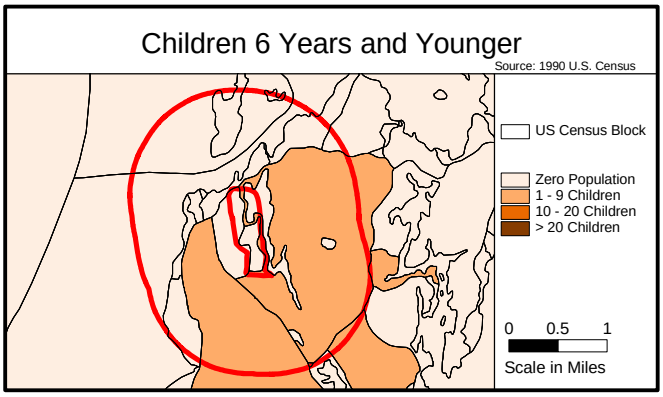


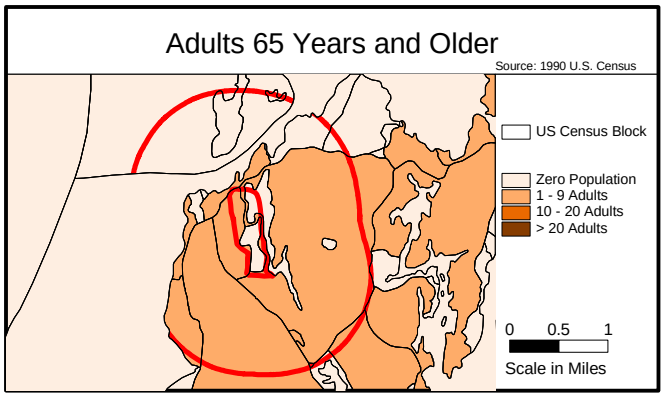
Hancock County, Maine

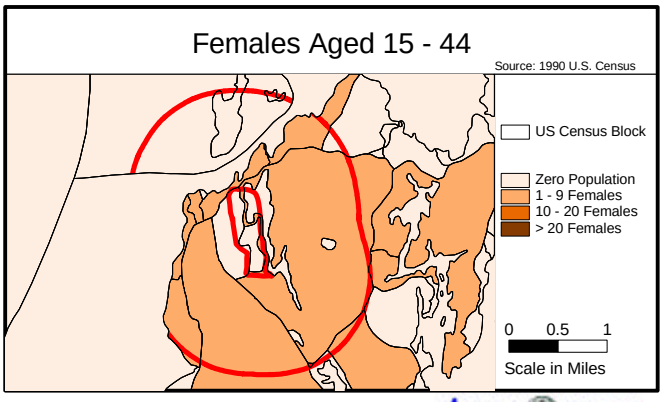
Demographic Statistics Within One Mile of Site*	
Total Population	73
White	72
Black	0
American Indian, Eskimo, Aleut	0
Asian or Pacific Islander	1
Other Race	0
Hispanic Origin	0
Children Aged 6 and Younger	3
Adults Aged 65 and Older	17
Females Aged 15 - 44	14
Total Housing Units	91

Demographics Statistics Source: 1990 US Census
*Calculated using an area-proportion spatial analysis technique









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The conclusions reached in this document are based on the data available at the time and might be modified based on the results of additional samples that will be collected during the remedial investigation process.

ATSDR visited the site to better understand the physical setting of the site and its relationship to the people living and working nearby.[1] The visit included a tour of Goose Pond (open-pit and settling basin areas), abandoned buildings, the waste rock pile, and the tailings pond. During the site visit, the following observations were made:

- The site was accessible to the public; no fence was present.
- The nearest residence was adjacent to the site and approximately 1,000 feet from the waste piles.
- Roads led up to the main waste rock pile and around the tailings pond.
- Evidence of trespassing was apparent at several locations throughout the site (e.g., campfire debris, cigarette boxes, beverage cans and bottles, shotgun shells, and clay pigeons).
- A number of physical hazards were apparent, including large concrete piles and metal rods from abandoned buildings and large, steep piles of sharp rocks.
- The tailings pond was not covered with water. Cattails and short grasses were growing on the tailings pond. The tailings were very fine, suggesting they might produce dust in dry conditions.
- The particle size of waste rock was relatively large.
- During the rainy conditions of the site visit, water ran off the tailings pile and tailings pond and entered Goose Pond.
- A fishing net seen near the water on the northern side of the site indicated that some fishing or shellfish collecting might occur at the site.

ATSDR met with residents during a public meeting about the site.[2] The residents expressed many health concerns, which are discussed in the Community Health Concerns section of this document. In addition, community members provided the following information about community use of the site:

- People swim and boat in the waters of the site.
- Young adults access the site to meet/gather with friends. Since the landowner and local police have started watching the site more closely, this might occur less often.
- The community occasionally gathers on the top of the waste rock piles for events such as July 4th fireworks. Some residents said they went to the site once every couple of years.

[1] The site visit was held on June 12, 2002 and included staff from ATSDR (Jill Dyken, Annmarie DePasquale, Dawn O'Connor, and Bill Sweet), EPA (Mary Jane O'Donnell, Leslie McVickar, and Pam Harting-Barrat), and Maine DEP(Naji Akladiss).

[2] The public meeting was held in the Brooksville Community Center on June 11, 2002 and included staff from ATSDR (Jill Dyken, Annmarie DePasquale, Dawn O'Connor, and Bill Sweet), EPA (Mary Jane O'Donnell, Leslie McVickar, and Pam Harting-Barrat), and Maine DEP(Naji Akladiss). Approximately 140 community members attended the meeting.

- Residents said that people would not bring very small children to the site, except maybe to the "sand dune" [possibly referring to the waste rock pile].
- Fish and shellfish are collected on and near the site. Residents said that shellfish are eaten from Goose Pond despite the shellfish advisory.
- There were reports of commercial soft shell clam harvesting and scallop dragging taking place in Goose Pond.
- Mine shafts are on the properties of homes near the site.

Evaluation Process

The process by which ATSDR evaluates the possible health impact of contaminants is summarized here and described in more detail in Appendix A. The first step involves screening the available data for contaminants of concern (COCs). ATSDR uses comparison values (CVs) to determine which chemicals to examine more closely. CVs are concentrations of chemicals in the environment (air, water, or soil) below which no adverse human health effects should occur. Exceeding a CV does not mean that health effects will occur, just that more evaluation is needed. ATSDR also considers sampling location and data quality; exposure probability, frequency, and duration; and community health concerns in determining which chemicals to evaluate further.

If a chemical contaminant is selected for further evaluation, the next step is to identify which chemicals and exposure situations could be a health hazard. Child and adult exposure doses are calculated for COCs in site media (e.g., soil, groundwater, surface water, sediment, fish or shellfish). Exposure doses are the estimated amounts of a contaminant that people come in contact with under specified exposure situations. These exposure doses are compared to appropriate health guidelines for that chemical. Health guideline values are considered safe doses; that is, health effects are unlikely below this level. If the exposure dose for a chemical is greater than the health guideline, then the exposure dose is compared to known health effect levels identified in ATSDR's toxicological profiles. If the COC is a carcinogen, the cancer risk is also estimated. These comparisons are the basis for stating whether the exposure is a health hazard.

Exposure Pathways and Contaminants of Concern

The following sections describe the various ways people could come into contact with contaminants at the site. Each of these ways is called an exposure pathway. Appendix B summarizes the possible exposure pathways for the Callahan Mining Corporation site. If people are unlikely to be exposed to contaminants in a given pathway, then that pathway will not be evaluated further for human health risks.

Soil / Waste Ingestion Pathway

People trespassing on the site could come into contact with tailings or waste rock in the waste piles or soil contaminated by these wastes. People could get particles of waste or soil on their skin, or they might accidentally eat or breathe in the particles. Soil, tailings, and waste rock from the site have all been sampled and analyzed for contaminants. In our initial screening, we conservatively assumed that people would contact the tailings and waste rock as much as they

would the soil. Because the maximum levels of contaminants were similar for these materials, we combined soil, tailings, and waste rock into one exposure pathway. Table 1 lists the contaminants found in on-site soil and waste materials at levels above soil CVs.

Table 1. Soil, Tailings, and Waste Rock Contaminants Above Soil Comparison Values

Contaminant	Concentration Range in parts per million (ppm)	Frequency of Detection / Total	Comparison Value (CV) in ppm	CV Source[1]
Arsenic	54 - 100	3 / 3	20 / 0.5 [2]	EMEG[3] / CREG[4]
Cadmium	ND[5] - 150	21 / 28	10	EMEG
Copper	80 - 110,000	28 / 28	2,900	R9 PRG[6]
Lead	120 - 9,100	28 / 28	400	SSL[7]
Mercury	0.1 - 7	24 / 24	5	RMEG[8]

Source: [1]
[1] These comparison values are described in Appendix B.
[2] The first number is the EMEG and the second is the CREG.
[3] EMEG = environmental media evaluation guide.
[4] CREG = cancer risk evaluation guide.
[5] ND = not detected.
[6] R9 PRG = EPA Region 9 preliminary remediation goal.
[7] SSL = EPA soil screening level.
[8] RMEG = reference media evaluation guide.

We then calculated exposure doses for the COCs in Table 1. The worst case was assumed to be a 10-year-old child (36.3 kilogram (kg) average weight [7]) contacting the average concentration of each contaminant 104 days a year (twice a week). This assumption will likely overestimate the calculated exposure doses because of the climate of coastal Maine. Standard default values and professional judgment were used to estimate the amount of contaminant taken in through incidental ingestion (accidental swallowing), inhalation (breathing), and dermal (skin) contact for each day. The exposure dose estimated through this procedure was compared with health guideline values and toxicologic information for the COC. To evaluate the risk for cancer, we assumed adults weighing 70 kg would be exposed to the average concentration of each contaminant for 104 days a year for 30 years. The following sections describe this evaluation for the COCs from Table 1.

Arsenic

A review of the available data shows that exposure of children or adults to arsenic in soil, tailings, or waste rock at the site is not likely to result in adverse health effects. This conclusion is based on available toxicologic data and conservative assumptions about exposure, as described below.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause skin changes (such as the appearance of small "corns" or "warts" on the palms, soles, and torso), as well as

changes in blood chemistry and neurologic and cardiovascular effects [8]. ATSDR's minimal risk level (MRL) of 0.0003 milligrams per kilogram per day (mg/kg/day) was developed on the basis of a human study that did not report any health effects at an arsenic dose of 0.0008 mg/kg/day [8]. This concentration is known as the no observed adverse effect level (NOAEL). The lowest observed adverse effect level (LOAEL) for chronic arsenic exposure by ingestion was 0.014 mg/kg/day; at this concentration, skin changes were observed [8]. Compared with incidental ingestion, breathing in arsenic in contaminated dust does not appreciably contribute to total exposure. Uptake of arsenic through skin contact increases the dose by about 25% over incidental ingestion alone. Direct skin effects from dermal exposure to arsenic have been observed only at levels hundreds of times greater than those for ingestion [8].

Estimated exposure doses were calculated for exposure of adults and children to the average arsenic concentration in soil, tailings, or waste rock. The estimated dose included exposure from ingestion, inhalation of dust, and dermal contact. For adults, the estimated dose of 0.0002 mg/kg/day was lower than ATSDR's MRL of 0.0003 mg/kg/day, indicating that no adverse health effects are expected [8]. For children, the dose estimate of 0.0005 mg/kg/day for children exceeds the MRL. However, the child dose is lower than the NOAEL of 0.0008 mg/kg/day for humans, so no adverse health effects are expected [8].

Arsenic is a known carcinogen, and it has been associated with liver, kidney, lung, and especially skin cancer [8]. Most studies on ingestion of arsenic and cancer have shown effects at exposure doses at or above 0.01 mg/kg/day [8]. The exception is one human study that reported an increase in lung cancer at an exposure dose of approximately 0.001 mg/kg/day [8]. These effect levels are two to three orders of magnitude greater than the estimated long-term arsenic exposure dose at the site. No increase in the incidence of cancer is expected among people exposed for many years to arsenic in soil, tailings, or waste rock at the site.

Cadmium

A review of the available data shows that exposure of children or adults to cadmium in soil, tailings, or waste rock at the site is not likely to result in adverse health effects. This conclusion is based on available toxicological data and conservative assumptions about exposure, as described below.

The primary target organ for cadmium toxicity is the kidney [9]. Other noncancer health effects associated with exposure to cadmium include gastrointestinal irritation and musculoskeletal effects such as osteoporosis [9]. ATSDR's MRL of 0.0002 mg/kg/day is based on a human study with a NOAEL of 0.0021 mg/kg/day, and animal studies have shown effect levels ranging from 0.01-1 mg/kg/day [9]. There are no studies demonstrating direct health effects from dermal contact with cadmium [9].

Estimated exposure doses were calculated for exposure of adults and children to the average cadmium concentration in soil, tailings, or waste rock. The estimated dose included exposure from ingestion, inhalation of dust, and dermal contact. However, inhalation of fugitive dust did not contribute significantly to the total cadmium exposure dose. For adults, the estimated dose of 0.00008 mg/kg/day was lower than ATSDR's MRL of 0.0002 mg/kg/day, indicating that no

adverse health effects are expected [9]. For children, the dose estimate of 0.00024 mg/kg/day slightly exceeds the MRL. However, the child dose is much lower than the NOAEL of 0.0021 mg/kg/day, so no adverse health effects are expected [9].

Long-term inhalation exposure to cadmium, particularly as a fume, is associated with an increased incidence of lung cancer. Cadmium is considered a probable human carcinogen for inhalation [9]. However, the calculated inhalation exposure doses for cadmium at the site were thousands of times smaller than the effect levels observed in animal studies, indicating that the increased risk of cancer is not appreciable [9]. Studies have not indicated whether ingestion or dermal exposure to cadmium causes cancer [9].

Copper

A review of the available data shows that exposure of children or adults to copper in soil, tailings, or waste rock at the site is not likely to result in adverse health effects. Significant exposures of copper can cause nausea and other gastrointestinal problems [10]. However, the average concentration of copper at the site would result in an intake less than half the tolerable upper intake level, defined as the highest level of daily nutrient intake that is likely to pose no risks of adverse health effects to almost all persons in the general population [11]. In addition, copper is not classified as a cancer-causing agent [10]. Therefore, no adverse health effects are expected from exposure to copper in soil, tailings, or waste rock at the site.

Lead

Exposure to lead in soil, tailings, or waste rock on this site is unlikely to result in health effects. This is based on the average levels of lead detected and the assumption that older children only occasionally contact soil materials on the site. If young children (less than 6 years old) had daily contact with the waste piles, the lead could pose a health hazard. However, it is unlikely that a small child would be playing on the site long enough to ingest appreciable amounts of dirt. Older children (and adults) are less vulnerable to lead in the soil than small children because they generally ingest less soil and less lead is absorbed into their bodies [12].

In general, the level of lead in a person's blood, typically measured in micrograms per deciliter (μg/dL), gives a good indication of recent exposure to lead and also correlates well with health effects. If we use the most protective correlation between blood lead levels and soil concentration found in epidemiologic studies (a 0.0068-μg/dL increase in blood lead level per parts per million [ppm] of lead in soil) and the average lead concentration measured in soil, then children exposed daily to this soil could increase their blood lead levels by 13 μg/dL [12]. The Centers for Disease Control and Prevention (CDC) considers children to have elevated lead levels if the amount of lead in the blood is 10 μg/dL or above. Some studies have indicated that lead levels less than 10 μg/dL in children's blood might be associated with small decreases in IQ and slightly impaired hearing and growth. Any increase in blood lead level from exposure to soil, tailings, or waste rock at the site is likely to be much smaller than 13 μg/dL. This is because the exposure of children, if any, to contaminated soils at the site is likely to be very infrequent and of short duration, and the correlation used to calculate the 13 μg/dL value is based on studies where children were exposed to lead regularly and frequently in a residential setting.

Animal data indicate that lead is a probable human carcinogen [12]. However, the animal studies were based on very high doses of lead and are difficult to compare to low-level environmental exposures, such as at those present at the site. Because no cancer slope factor (a value used to predict the increased risk of cancer for low chemical exposures) exists for lead, it is impossible to quantitatively evaluate carcinogenic risk.

Mercury

No health effects are expected from exposure to mercury in soil, tailings, or waste rock at the site. Exposure doses calculated for children and adults were below the health guideline [13].

Surface Water Pathway

Water from surface runoff on-site comes in contact with the waste material and might contribute contaminants to Goose Pond and Goose Cove. No use of this water for drinking water purposes was identified, but people who wade or swim in surface waters on the site will get surface water on their skin and might accidentally ingest some of the surface water. Table 2 lists the contaminants found in surface water and seeps onsite at levels above drinking water CVs.

Table 2. Surface Water / Seep Contaminants Detected Above Drinking Water Comparison Values

Contaminant	Concentration Range in parts per billion (ppb)	Frequency of Detection / Total	Comparison Value (CV) in ppb	CV Source[1]
Cadmium	ND[2] - 65	22 / 25	2	EMEG[3]
Lead	ND - 104	15 / 25	15	AL[4]
Zinc	ND - 16,300	20 / 21	3,000	EMEG[3]
Dioctyl adipate	ND - 260	1 / 13	6,000 / 30[5]	RMEG[6] / CREG[7]
Dioctyl phthalate	ND - 100	1 / 13	100 / 3[8]	EMEG[3] / CREG[7]
Butane thiol	ND - 5	1 / 13	None[9]	-
o,o-Diethyl-s-ethyl phosphorothioate	ND - 14	7 / 13	None[9]	-
o,o-Diethyl-s-methyl phosphorothioate	ND - 18	5 / 12	None[9]	-
o,o-Diethyl phosphorodithioic acid	ND - 10	1 / 11	None[9]	-
o,o-s-Triethyl dithiophosphate	ND - 13	1 / 13	None[9]	-

Source: [1]
[1] These comparison values are described in Appendix A.
[2] ND = not detected.
[3] EMEG = environmental media evaluation guide.
[4] AL = EPA action level.
[5] The first number is the RMEG and the second is the CREG.
[6] RMEG = reference media evaluation guide.
[7] CREG = cancer risk evaluation guide.
[8] The first number is the EMEG and the second is the CREG.
[9] No comparison value available.

We then calculated exposure doses for the COCs in Table 2. The worst case was assumed to be a 1-year-old (10 kg average weight [7]) contacting the average concentration of each contaminant 60 days out of the year (5 days a week for the 3 summer months). Standard default values and professional judgment were used to estimate the amount of contaminant taken in through incidental ingestion (accidental swallowing) and dermal (skin) contact during wading and swimming. The exposure dose estimated through this procedure was compared with health guideline values and toxicologic information for the COC. To evaluate the risk for cancer, we assumed adults weighing 70 kg would be exposed to the average concentration of each contaminant for 60 days a year for 30 years. The following sections describe this evaluation for the COCs listed in Table 2.

Cadmium

A review of the available information shows that adverse noncancer or cancer health effects are not expected to a result from exposure of children or adults to cadmium while wading or

swimming in surface water at the site. The estimated doses are 0.00014 and 0.00066 mg/kg/day for adults and children, respectively. Only the child dose is slightly higher than ATSDR's MRL of 0.0002 mg/kg/day. However, the child dose is much lower than the NOAEL of 0.0021 mg/kg/day, so no adverse health effects are expected [9]. Also, cadmium is not considered a carcinogen through the ingestion or dermal routes of exposure. Therefore, no adverse cancer or noncancer health effects are expected through exposure to cadmium via the surface water pathway.

Lead

The average concentration of lead in surface water at the site (10 parts per billion (ppb)) is lower than the EPA action level of 15 ppb. Therefore, no adverse health effects are expected from exposure to lead via the surface water pathway.

Zinc

A review of the available information shows that adverse non-cancer or cancer health effects are not expected to result from exposure of children or adults to zinc while wading or swimming in surface water at the site. The estimated doses are 0.034 and 0.17 mg/kg/day for adults and children, respectively. Both doses are lower than ATSDR's MRL of 0.3 mg/kg/day [14]. Also, zinc is not considered a carcinogen. Therefore, no adverse cancer or noncancer health effects are expected through exposure to zinc via the surface water pathway.

Dioctyl adipate

Dioctyl adipate, also known as di(2-ethylhexyl) adipate, is commonly used as a plasticizer and solvent [15]. Dioctyl adipate was detected in only 1 of 13 samples. Estimated doses for exposure to the average concentration through wading or swimming were lower than EPA's oral reference dose (RfD) of 0.6 mg/kg/day. Dioctyl adipate is classified as a possible human carcinogen on the basis of an increased incidence of liver tumors in female mice. However, the average concentration of dioctyl adipate measured in surface water at the site is too low to cause a significantly increased risk of cancer [16]. Because of the low detection frequency combined with the low frequency of exposure, exposure to dioctyl adipate in surface water is not considered to be of concern at the site.

Dioctyl phthalate

Dioctyl phthalate, also known as di(2-ethylhexyl) phthalate, is a colorless, oily liquid commonly used as a plasticizer and in cosmetics and pesticides [17]. Dioctyl phthalate was detected in only 1 of 13 samples. For exposure to the average concentration through wading or swimming, the estimated doses are 0.018 and 0.12 mg/kg/day for adults and children, respectively. These doses are higher than the MRL of 0.01 mg/kg/day; however, they are much smaller than the LOAEL of 3.3 mg/kg/day identified in animal studies [17]. At the LOAEL, testicular alterations were observed in rat pups [17]. Dioctyl phthalate is classified as a probable human carcinogen on the basis of animal studies; however, the average concentration measured in surface water at the site is too low to cause a significantly increased risk of cancer [16]. Because of the low detection

frequency combined with the low frequency of exposure, exposure to dioctyl phthalate in surface water is not considered to be of concern at the site.

Butane Thiol

Butane thiol, also known as butyl mercaptan, is a colorless, flammable liquid with a strong odor. It is used as an odorant for natural gas and as a solvent and chemical intermediate [18]. Butane thiol was detected in only 1 of 13 samples. The available studies focus on acute effects of inhalation of butane thiol; no health effects of ingesting or contacting butane thiol in water were found. Because of the low detection frequency combined with the low frequency of exposure, exposure to butane thiol in surface water is not considered to be of concern at the site.

Remaining COCs

The remaining contaminants of concern from Table 2 (O,O-diethyl-S-ethyl phosphorothioate; O,O-diethyl-S-methyl phosphorothioate; O,O-diethyl phosphorodithioic acid; and O,O-S-triethyl dithiophosphate) have no comparison values, and no toxicological information about them was found. These contaminants are likely to be process chemicals or the breakdown products of process chemicals formerly used at the site. No information on potential health effects of these possible breakdown products was found.

Sediment Pathway

People who trespass on the site might accidentally ingest some of the sediments from the ponds or bay on the site or get the sediments on their skin. To be conservative, our initial screening assumed sediments would be contacted like soil particles. Table 3 lists the contaminants found at levels above soil CVs in the sediments on site.

Table 3. Sediment Contaminants Detected Above Soil Comparison Values

Contaminant	Concentration Range in parts per million (ppm)	Frequency of Detection / Total	Comparison Value (CV) in ppm	CV Source[1]
Arsenic	8 – 270	7 / 7	20 / 0.5[2]	EMEG[3] / CREG[4]
Cadmium	ND[5] – 170	13 / 14	10	EMEG[3]
Lead	10 - 1,500	14 / 14	400	SSL[6]
Zinc	41 - 58,000	14 / 14	20,000	EMEG[3]
1,1-Thiobisethane	ND[5] – 2	1 / 1	None[7]	-

Source: [1]
[1] These comparison values are described in Appendix A.
[2] The first number is the EMEG and the second is the CREG.
[3] EMEG = environmental media evaluation guide.
[4] CREG = cancer risk evaluation guide.
[5] ND = not detected.
[6] SSL = EPA soil screening level.
[7] No CV available.

We then calculated exposure doses for the COCs in Table 3. The worst case was assumed to be a 1-year-old contacting the average concentration of each contaminant for about 60 days out of the

year. Child and adult exposure doses for arsenic, cadmium, lead, and zinc were well below health guideline values. The compound 1,1-thiobisethane is used in pesticides; however, no recognized or suspected human health hazards are associated with it [19]. Therefore, no health effects are expected from exposure to the sediment.

Biota Pathway

People might eat mussels, other shellfish, or fish collected from Goose Pond or Goose Cove. According to the EPA Fact Sheet on the site, a 1975 study by the Maine Department of Marine Resources found elevated levels of cadmium, copper, lead, and zinc in biota and sediments from Goose Cove compared to other Maine midcoastal and river locations [20].

Few fish and shellfish data are available to fully evaluate potential exposure to persons who consume fish and shellfish collected from Goose Pond or Goose Cove. However, periodic mussels sampling has been conducted in Goose Cove by the Maine DEP to evaluate the potential for ecologic impacts from the Callahan Mining Corporation. The available mussels data were used to evaluate potential exposure to contaminants as a result of human consumption. Table 4 lists the contaminants detected in mussels at levels above fish consumption CVs.

Table 4. Biota (Mussels) Contaminants Detected Above Comparison Values

Contaminant	Concentration Range in parts per million (ppm)	Frequency of Detection / Total	Comparison Value (CV) in ppm	CV Source[1]
Arsenic	11.9 – 16.5	4 / 4	0.002	RBC[2]
Cadmium	6.5 – 7.3	4 / 4	1.4	RBC[2]
Iron	388.4 – 456.2	4 / 4	410	RBC[2]

Source: [1]
[1] These comparison values are described in Appendix A.
[2] RBC = EPA Region 3 risk-based concentration.
Note: Chromium appeared in Table 4 in the public comment version of the PHA in error. Chromium concentrations in mussels were below the EPA RBC. Therefore, chromium has been removed from Table 4 and is not considered a contaminant of concern for mussels samples. A discussion of chromium toxicity has also been removed from the text of this section.

The latest mussels data consist of only 4 samples, each of which was a composite sample of 20 mussels. We do not feel that this is enough data to make a definitive health call. However, to get a general idea of potential health impacts from eating mussels, we evaluated the limited available data. Because concentrations of the contaminants listed in Table 4 exceed established CVs, exposure doses were calculated for each of the contaminants. Conservative assumptions for human consumption of mussels caught during recreational activities were incorporated into the dose calculations. Potential exposure to children (average body weight of 16 kg) and adults (70 kg) was considered. Standard default assumptions and professional judgment were used to estimate the amount of recreationally harvested mussels that people are likely to ingest. Adults were assumed to consume, on average, 11 grams of mussels per day (or approximately two mussel meals per month with a serving size of about a third of a pound). Children were assumed to consume about half of the estimated amount of mussels consumed by adults, or about 5.6 grams of mussels per day. For a conservative estimate, we assumed that 100% of a person's fish

and shellfish consumption is based on ingestion of mussels from Goose Cove. However, it is very likely that persons consume mussels from other, nonimpacted areas, and that they consume other species besides mussels. A discussion of the results of the limited evaluation for each contaminant is given in the following sections. It is important to note, however, that any findings related to the biota pathway in this document are based on an insufficient number of samples and types of species. Additional shellfish and finfish samples should be collected as part of future site investigations.

Advisories on fish and shellfish consumption already exist in the area. A shellfish ban is currently in effect for Goose Pond, Goose Cove, and other nearby areas. This advisory was placed because elevated metals and other contamination were detected in the area of Goose Cove. The ban states that no shellfish (including clams, mussels, and oysters) should be collected or consumed from designated areas[4]. In addition, the Maine Bureau of Health has issued warnings about consumption of freshwater and saltwater fish because of poly-chlorinated biphenyl, mercury, and pesticide contamination. These warnings recommend that pregnant and nursing women, women who might get pregnant, and children under age 8 not eat any freshwater fish from Maine's inland waters, including the Penobscot River (with the exception of 1 meal per month of brook trout or landlocked salmon). Other adults and children age 8 and older are advised to eat no more than 2 freshwater fish meals per month according to the fish advisory (with the exception of 1 meal per week of brook trout or landlocked salmon). Consumption guidelines for saltwater species for the general population include no more than 2 meals per month of striped bass and bluefish and no meals of lobster tomalley. Lobster tomalley is the soft, green substance in the body cavity of the lobster. Tomalley accumulates contaminants from the environment. Lobster meat is generally safe (i.e., no advisories related to eating lobster meat are in place). Other fish consumption guidelines exist for pregnant women, women who are nursing, and women who might become pregnant. For more information on specific advisories, contact the Maine Bureau of Health at (886) 292-3474 or visit http://www.state.me.us/dhs/bohetp/index.html [21].

ATSDR recommends that persons follow the existing shellfish ban and fish advisories. Following the shellfish ban and fish advisories will reduce people's chance of being exposed to contaminants from the site, as well as protecting them from other sources of contamination. We did a limited evaluation of health impacts of eating mussels because we learned that some people did not follow the shellfish ban. It is important to realize that the following conclusions are based on a very limited set of data and that further sampling of shellfish and finfish near the site is warranted.

Arsenic

Arsenic is found naturally in the environment and exists in a number of different forms. Fish and shellfish normally contain high concentrations of arsenic because of their ability to accumulate arsenic naturally present in seawater. An important consideration in the evaluation of arsenic exposure via fish consumption is that arsenic present in fish and shellfish typically exists in the

[4] Based on information posted throughout the community by the Maine Department of Marine Resources. For more information, contact the South Portland Office (207) 799-3380 or the Lamoine Office (207) 667-3373.

organic arsenic form, which does not appear to be harmful to humans. Organic arsenic compounds are excreted in the urine very quickly after absorption and are not associated with adverse health effects in humans. In addition, shellfish tend to accumulate arsenic from the environment mostly in their shells, which are not consumed by humans [7].

The mussels data available for Goose Cove are reported as "total arsenic" and do not indicate whether arsenic is present in mussels as organic arsenic or as inorganic arsenic. Although it is ideal to have arsenic data that distinguish between the presence of organic and inorganic arsenic, an evaluation was completed using the available data for total arsenic. Studies of arsenic in shellfish indicate that between 3% and 20% of total arsenic in shellfish is present in the form of inorganic arsenic [8]. Therefore, we conservatively assumed that 80% of the arsenic in the mussels collected from Goose Cove is present in the form of organic arsenic, which is not expected to be harmful to humans.

The calculated exposure doses for exposure to inorganic arsenic via consumption of mussels are 0.00052 and 0.0012 mg/kg/day for adults and children, respectively. The calculated doses exceed the MRL and EPA RfD for arsenic ingestion of 0.00030 mg/kg/day [8]. As previously discussed in this public health assessment, the MRL and RfD of 0.00030 mg/kg/day was developed based on a human study of exposure, via an arsenic-contaminated water supply, that did not report any health effects (or the NOAEL) at an arsenic dose of 0.00080 mg/kg/day [8]. At the LOAEL of 0.014 mg/kg/day, skin changes were observed [8]. Because the calculated doses are at least an order of magnitude smaller than the LOAEL, and because conservative assumptions were made in calculating doses, it is unlikely that adverse health effects would be observed at these doses. However, the scarcity of biota data and data about consumption patterns in the area make this conclusion uncertain. More biota tissue data are needed.

Arsenic is a known carcinogen, and it has been associated with liver, kidney, lung, and particularly skin cancer [8]. Most studies on ingestion of arsenic and cancer have shown effects at exposure doses at or above 0.010 mg/kg/day [8]. The concentrations of arsenic associated with these effect levels are significantly greater than the estimated arsenic exposure dose resulting from mussel consumption. On the basis of the available data and the protectiveness of exposure assumptions, exposure to arsenic by eating mussels from Goose Cove does not pose a significant increased risk for cancer.

Cadmium

The estimated doses for cadmium are 0.0011 and 0.0026 mg/kg/day for adults and children, respectively. The calculated doses for adults and children exceed ATSDR's MRL of 0.00020 mg/kg/day. Toxicologic studies have indicated health effects at exposure doses of 0.010 mg/kg/day, which is 10 to 20 times greater than the exposure estimated from consumption of mussels from Goose Cove [8]. Additionally, exposure to cadmium as a result of ingestion has not been associated with cancer. Therefore, the available data indicate that no adverse health effects are expected among persons exposed to cadmium as a result of consumption of mussels from Goose Cove.

Iron

The calculated doses for iron exposure to adults and children who consume mussels from Goose Cove are 0.072 and 0.16 mg/kg/day, respectively. The calculated doses do not exceed the EPA RfD of 0.30 mg/kg/day for ingestion of iron. In addition, ingestion exposure to iron has not been associated with cancer. Therefore, the available data indicates that no adverse health effects are expected among persons exposed to iron as a result of consuming mussels from Goose Cove.

Potential Exposure Pathways

Drinking Water Pathway

Contaminants from the waste piles or other source areas could infiltrate into the groundwater beneath the site. If people used this groundwater for drinking, they could be exposed to contaminants. A few private drinking water wells are near the site. All samples of these wells to date show that no contaminants are present above drinking water CVs. Therefore, this pathway is not expected to lead to any adverse health effects and has been dropped from further consideration. Additional sampling of private drinking water wells has been proposed by EPA as part of the Remedial Investigation for the site. ATSDR will evaluate newly collected private well data and will prepare an update to this PHA should the conclusions for the drinking water exposure pathway change.

Air Pathway

Contaminants could volatilize from the source area. People could breathe in these contaminants or absorb them through their skin. No data exists on air contaminants from the site. On the basis of the soil, tailings, waste rock, surface water, and sediment sampling, none of the COCs are very volatile, so this pathway is considered incomplete and has been dropped from further consideration. Inhalation of contaminants as dust is considered above in the section on soil, tailings, and waste rock.

Children's Health Considerations

ATSDR recognizes that infants and children might be more vulnerable to exposures than adults in communities faced with contamination of their air, water, soil, or food. This vulnerability is a result of the following factors:

- Children are more likely to play outdoors and bring food into contaminated areas.
- Children are shorter, so they are more likely to breathe dust, soil, and heavy vapors close to the ground.
- Children are smaller, resulting in higher doses of chemical exposure per body weight.
- The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

Because children depend completely on adults for risk identification and management decisions, ATSDR is committed to evaluating their special interests at the site as part of the ATSDR Child Health Initiative.

The major exposure routes for children who might access the Callahan Mining Corporation site are ingestion of soil and waste rock and tailings. Other exposure routes include dermal (or skin) contact with surface water and sediment and ingestion of surface water. Refer to the appropriate section for discussion of the possible health effects for children to contaminants associated with the site.

Health Outcome Data

The Superfund law requires that health outcome data be considered in a public health assessment. Health outcome data might include mortality information (e.g., the number of people dying from a certain disease) or morbidity information (e.g., the number of people in an area getting a certain disease or illness). To thoroughly evaluate health outcome data as it relates to a hazardous waste site, four elements are necessary: (1) the presence of a completed human exposure pathway, (2) sufficiently high contaminant levels to result in measurable health effects, (3) sufficient number of people in the completed pathway for the health effect to be measured, and (4) a health outcome database in which disease rates for populations of concern can be identified.

The Callahan Mining Corporation site does not meet the requirements for including an evaluation of health outcome data in a public health assessment. Although completed human exposure pathways exist at this site, the contaminant levels, exposures, and exposed population are not great enough to result in a meaningful evaluation of health outcome data.

Community Health Concerns

ATSDR staff attended a public meeting in Brooksville, Maine, on June 11, 2002. The meeting was organized by EPA to discuss the Callahan Mining Corporation site. Approximately 140 community members and 7 local, state, and federal officials attended the meeting. During the meeting, ATSDR discussed the public health assessment process and asked community members to share their health concerns related to contaminants at the site. Many people provided information about how people in the area use the site; this information was listed in the Data Used section of this document. Following are concerns expressed by members of the audience:

Concern: *Are site contaminants responsible for cancer, including prostate cancer and leukemia, in people who lived or worked at the site?*

Response: Based on the current use and contaminant concentrations at the site, an increased risk for cancer is not expected. We do not have any information on past contaminant levels and exposures, so we cannot predict what the increased cancer risk was to workers in the past. The population around the site is not large enough to determine whether cancer rates are higher there compared to other areas.

Concern: *What is the surface film or sheen I have seen on the water of Goose Pond and the source of the yellow, dirty-looking water in Dyer Cove?*

Response: We did not see these conditions during our June visit to the site, perhaps because it was raining. It is impossible to speculate what the source of the sheen or dirty water might be. EPA will be sampling surface water as part of the remedial investigation.

Concern: *Are seals, lobsters, fish, and shellfish living in Goose Cove affected by site contaminants?*

Response: Limited biota data are available for Goose Cove. The available mussels data indicates the presence of arsenic, cadmium, chromium, and iron. Consumption of recreationally-caught mussels from Goose Cove has been evaluated in this public health assessment using the limited data available (four composite mussels samples from Goose Cove). Our analysis did not indicate a significant health risk from eating mussels; however, more information is needed to determine unequivocally that the risk is minimal. It should be noted that a shellfish ban currently exists for Goose Pond, Goose Cove, and other nearby areas because of the presence of metals and other contamination. ATSDR recommends that persons follow local fish and shellfish advisories. Currently, no information exists on levels of contaminants in seals, lobsters, or finfish in Goose Pond and Goose Cove. ATSDR has recommended that additional fish and shellfish be collected from Goose Pond, Goose Cove, and, if determined to be appropriate, waters adjacent to Goose Cove to enable a full evaluation of fish and shellfish consumption pathway.

Concern: *Is it safe to swim in Goose Pond? Who has the authority to determine whether swimming is safe?*

Response: ATSDR determined in this document that incidental exposure to contaminants in surface water in Goose Pond would not pose a health concern, assuming only occasional use. However, physical, biological, or other hazards might make it inappropriate for swimming. We suggest you check with your county government or the Maine Department of Environmental Protection to find out who determines the safety of surface waters for swimming.

Concern: *I am concerned that ATSDR will make recommendations that will not be carried out because of a lack of funding.*

Response: It is possible that a lack of funds might prevent some of ATSDR's recommendations (e.g., regarding biota sampling) from being carried out. However, alternative actions exist that will also protect public health. For example, if the site cannot be cleaned up, restricting access will also prevent exposures to site contaminants. If no funds for sampling shellfish exist, enforcing the shellfish ban will be protective.

Concern: *If the site is not cleaned up, how long will it take before the contaminants go away and the site is safe?*

Response: The main contaminants at the site are heavy metals, which are expected to persist in the environment for a long time. However, the safety of the site depends on how and how much

people are exposed to the contaminants. In the absence of cleanup, ATSDR would make recommendations for safe use of the site.

Concern: *Can ATSDR provide health education activities to the Brooksville Elementary School about the potential risks associated with exposure at the site?*

Response: We informed ATSDR's Division of Health Education and Promotion of this request. The division is working with the community to determine whether health education activities are desired at the site.

Concern: *How do I find out about Technical Assistance Grants for the Callahan Mining Corporation site?*

Response: Technical Assistance Grants (TAGs) are administered by EPA. Information on TAGs and other community resources is available on-line at http://www.epa.gov/superfund/resources/assistance/index.htm.

The Callahan Mining Corporation Public Health Assessment was available for public review and comment from December 16, 2002 until March 15, 2003, on the Internet and at the Brooksville Community Center in Brooksville, Maine. The public comment period was announced in local newspapers, and fact sheets announcing the availability of the public health assessment were mailed to residents near the site. The PHA was also sent to federal, state, and local officials. The findings of the PHA were presented by ATSDR staff at a public meeting held April 1, 2003 in Brooksville, Maine, and public comments were accepted for 1 week after the meeting. The written public comments received are listed and addressed in Appendix C.

Additional community concerns voiced at the April meeting are summarized below:

Concern: *When I was a child, I played every day on the flats at the site. We raced and kicked up dust.*

Response: We estimated the exposure of a child weighing 36 kilograms who was exposed to soil on the site for 300 days a year for 7 years. The estimated exposure doses were lower than those expected to result in adverse health effects. This use of the site did not likely result in an increased risk of adverse health effects.

Comment: *Former workers at the mine site may have silicosis.*

Response: Not enough information on past mine practices is available to evaluate risks to former workers at the mine.

Health Hazard Category

The contaminant levels in soil, tailings, waste rock, surface water, and sediments at the site are too low to cause health effects for the low frequency and duration of current exposures. Therefore, ATSDR concludes that for direct contact pathways the site poses *no apparent public*

health hazard. Additional environmental sampling data or changing exposure scenarios could alter this conclusion.

Not enough information exists to fully evaluate whether exposure to site contaminants through eating contaminated shellfish or fish from Callahan Mining Corporation NPL site could result in health effects. This pathway poses an *indeterminate public health hazard*.

Conclusions

1. The site contains physical hazards and elevated levels of heavy metals. Physical hazards could cause injury to people visiting the site.

2. Because of the low frequency and duration of likely exposures, people exposed to heavy metals and other contaminants in the soil, tailings, waste rock, surface water, and sediments are not expected to experience adverse health effects. We might modify this conclusion based on further environmental data collected during the remedial investigation process.

3. Several contaminants found at the site are known to accumulate in biota. Currently, not enough information exists on potential contaminant levels in Goose Pond and Goose Cove biota to fully determine whether adverse health effects are possible from eating fish or shellfish collected from these areas. The very limited available mussels data have been evaluated in this document. People who occasionally eat mussels from Goose Cove are not likely to experience health effects due to contaminants associated with the Callahan Mining Corporation site. However, collecting or eating shellfish (including clams, mussels, and oysters) from Goose Pond, Goose Cove, and other nearby areas is banned because of elevated levels of metals and other pollution.

Recommendations

1. ATSDR recommends that the property owners discourage access to the site by using signage and barriers until physical hazards are removed and cleanup activities are complete.

2. ATSDR recommends that EPA, Maine DEP, or other relevant agencies conduct more extensive biota sampling to determine concentrations of heavy metals in fish and shellfish tissues in Goose Pond, Goose Cove and, if determined to be appropriate, in waters adjacent to Goose Cove. Adequate background sampling should be conducted to determine the naturally occurring concentrations of heavy metals in the Brooksville area.

3. ATSDR recommends that the Holbrook Island Sanctuary ranger and Brooksville and Maine State police increase vigilance to ensure that people follow the shellfish ban and other fish advisories applicable near the site.

Public Health Action Plan

The public health action plan for the Callahan Mining Corporation site contains a description of actions that have been or will be taken at the site by ATSDR and/or other government agencies. The purpose of the plan is to ensure that this public health assessment not only identifies public health hazards at the site, but also outlines a plan of action to prevent or minimize the potential for adverse human health effects from exposure to site-related hazardous substances. ATSDR will follow up on this plan to ensure that it is implemented.

Actions Completed

- ATSDR conducted a site visit to verify site conditions and to gather pertinent information and data for the site.
- ATSDR attended a public meeting to inform the community about the public health assessment process and to gather health concerns from the site community.

Planned Actions

- EPA will complete remedial investigation activities for the site.
- If requested, ATSDR will work with EPA and/or Maine DEP to develop an appropriate biota sampling plan for the site.

ATSDR will reevaluate and expand the public health action plan if needed. New environmental, toxicologic, or health outcome data or the results of implementing the above proposed actions might determine the need for additional actions at this site.

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Appendix A. Explanation of Evaluation Process

Screening Process

In evaluating these data, ATSDR used comparison values (CVs) to determine which chemicals to examine more closely. CVs are the contaminant concentrations found in a specific media (air, soil, or water) and are used to select contaminants for further evaluation. CVs incorporate assumptions of daily exposure to the chemical and a standard amount of air, water, and soil that someone might inhale or ingest each day.

As health-based thresholds, CVs are set at a concentration below which no known or anticipated adverse human health effects are expected to occur. Different CVs are developed for cancer and noncancer health effects. Noncancer levels are based on valid toxicologic studies for a chemical, with appropriate safety factors included, and the assumption that small children (22 pounds) and adults are exposed every day. Cancer levels are based on a one-in-a -million excess cancer risk for an adult eating contaminated soil or drinking contaminated water every day for 70 years. For chemicals for which both cancer and noncancer levels exist, we use the lower level to be protective. Exceeding a CV does not mean that health effects will occur, just that more evaluation is needed.

CVs used in this document are listed below:

Environmental Media Evaluation Guides (EMEGs) are estimated contaminant concentrations in a media where noncarcinogenic health effects are unlikely. EMEGs are derived from the Agency for Toxic Substances and Disease Registry's (ATSDR) minimal risk level (MRL).

Cancer Risk Evaluation Guides (CREGs) are estimated contaminant concentrations that would be expected to cause no more than one additional excess cancer in one million persons exposed over a lifetime. CREGs are calculated from the U.S. Environmental Protection Agency's (EPA) cancer slope factors (CSFs).

Reference Media Evaluation Guides (RMEGs) are estimated contaminant concentrations in a media where noncarcinogenic health effects are unlikely. RMEGs are derived from EPA's reference dose (RfD).

Preliminary Remediation Goals (PRGs) are the estimated contaminant concentrations in a media where carcinogenic or noncarcinogenic health effects are unlikely. The PRGs used in this public health assessment were derived using provisional reference doses or CSFs calculated by EPA's Region 9 toxicologists.

Risk-Based Concentrations (RBCs) are the estimated contaminant concentrations at which carcinogenic and noncarcinogenic health effects are not expected to occur as a result of exposure. The RBCs used in this public health assessment were derived using provisional reference doses or CSFs calculated by EPA's Region 3 toxicologists.

EPA Action Levels (ALs) are the estimated contaminant concentrations in water of which additional evaluation is needed to determine whether action is required to eliminate or reduce exposure. Action levels can be based on mathematical models.

EPA Soil Screening Levels (SSLs) are estimated contaminant concentrations in soil at which additional evaluation is needed to determine if action is required to eliminate or reduce exposure.

Determination of Exposure Pathways

ATSDR identifies human exposure pathways by examining environmental and human components that might lead to contact with COCs. A pathway analysis considers five principal elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and an exposed population. Completed exposure pathways are those for which the five elements are evident, and indicate that exposure to a contaminant has occurred in the past, is now occurring, or will occur in the future. Potential exposure pathways are those for which exposure seems possible, but one or more of the elements is not clearly defined. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. It should be noted that the identification of an exposure pathway does not imply that health effects will occur. Exposures might be, or might not be, substantive. Therefore, even if exposure has occurred, is now occurring, or is likely to occur in the future, human health effects might not result.

ATSDR reviewed site history, information on site activities, and the available sampling data. On the basis of this review, ATSDR identified numerous exposure pathways that warranted consideration. Additional information regarding the completed and potential exposure pathways identified for the Callahan Mining Corporation site is provided in Appendix B of this public health assessment. Summaries of these pathways are discussed below.

Evaluation of Public Health Implications

The next step is to take those contaminants present at levels above the CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Child and adult exposure doses are calculated for the site-specific exposure scenario, using our assumptions of who goes on the site and how often they contact the site contaminants. The exposure dose is the amount of a contaminant that gets into a person's body. Following is a brief explanation of how we calculated the estimated exposure doses for the site.

Soil, Tailings, and Waste Rock Contaminant Ingestion

Exposure doses for ingestion of contaminants present in soil from the source areas were calculated using the average concentration measured in the source areas, in milligrams per kilogram (mg/kg), or parts per million (ppm), multiplied by the soil ingestion rate for adults (100 mg/day) or children (200 mg/day).

The multiplication product was divided by the average weight for an adult, 70 kg (154 pounds) or a 10-year old child, 36.3 kg (80 pounds). The resulting dose was then multiplied by a factor of

104/365, because the exposure was assumed to occur on average of twice per week throughout the year.

Soil, Tailings, and Waste Rock Contaminant Inhalation of Fugitive Dust

For exposure to contaminants in source soil via inhalation of fugitive dust from source area soil, the average detected soil concentrations was multiplied by an inhalation rate and an exposure time of 2 hours per day. An inhalation rate of 2.3 cubic meters per hour (m^3/hour) for adults and 1.74 m^3/hour for children was assumed, based on moderate activity. The multiplication product was divided by the average weight for an adult, 70 kg (154 pounds) or a 10-year old child, 36.3 kg (80 pounds). The resulting dose was then multiplied by a factor of 104/365, because the exposure was assumed to occur on average of twice per week throughout the year, as in the soil ingestion calculation.

Surface Water Ingestion

Exposure doses for surface water ingestion were calculated using the average concentration for a surface water contaminant, in milligrams per liter (mg/L), multiplied by an incidental surface water ingestion rate of 0.02 liter/day for adults or 0.01 liter/day for children. These ingestion rates are 1/100th of the EPA default drinking water rates. The multiplication product was divided by the average weight for an adult (70 kg or 154 pounds), or for a 1-year old child (10 kg or 22 pounds). The resulting dose was then multiplied by a factor of 60/365, because the exposure was assumed to occur 5 days per week during 3 summer months of the year.

Sediment Ingestion

Exposure doses for ingestion of contaminants from the sediment were calculated using the average concentration measured in the sediment, in mg/kg or ppm, multiplied by 1/10th of the soil ingestion rate, 10 mg/day for adults or 20 mg/day for children. The multiplication product was divided by the average weight for an adult (70 kg or 154 pounds) or a 10-year-old child (36.3 kg or 80 pounds). The resulting dose was then multiplied by a factor of 60/365, because the exposure was assumed to occur 5 days per week during 3 summer months of the year.

Dermal (Skin) Exposure

In this public health assessment, we evaluated dermal exposure to source area soil, surface water, and sediment. Dermal absorption depends on numerous factors including the area of exposed skin, anatomic location of exposed skin, length of contact, concentration of chemical on skin, chemical-specific permeability, soil adherence, medium in which the chemical is applied, and skin condition and integrity. Because chemicals differ greatly in their potential to be absorbed through the skin, each chemical needs to be evaluated separately and is discussed as needed in the main body of the public health assessment. The assumed receptor body weights, exposure frequency, and exposure duration are the same as described in the above calculations of the ingestion route. The skin surface area and soil-to-skin adherence factors used in this public

health assessment were taken from EPA's *Exposure Factor Handbook*.[1] Absorption factors and other chemical-specific factors were taken from the ATSDR *Toxicological Profile* for each specific chemical.

Ingestion of Biota (Mussels) from Goose Cove

Exposure doses for ingestion of mussels from Goose Cove were calculated using the maximum detected concentration measured in mussel samples, in mg/kg or ppm, multiplied by average ingestion rates of 11.0 grams per day (g/day) and 5.6 g/day for adults and children, respectively. The calculated value was also multiplied by a conversion factor of 0.001 kilograms per gram. The multiplication product was divided by the average weight for an adult (70 kg or 154 pounds) or a child less than two years of age (16 kg or 35 pounds).

Noncancer Health Effects

The calculated exposure doses are then compared to an appropriate health guideline for that chemical. Health guideline values are considered safe doses; that is, health effects are unlikely below this level. The health guideline value is based on valid toxicological studies for a chemical, with appropriate safety factors built-in to account for human variation, animal-to-human differences, and/or the use of the lowest adverse effect level. For noncancer health effects, the following health guideline values are used.

Minimal Risk Level (MRLs) - Developed by ATSDR

An MRL is an estimate of daily human exposure – by a specified route and length of time – to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects. A list of MRLs can be found at http://www.atsdr.cdc.gov/mrls.html.

Reference Dose (RfD) - Developed by EPA

An RfD is an estimate, with safety factors built in, of the daily, life-time exposure of human populations to a possible hazard that is not likely to cause noncancerous health effects. RfDs can be found at http://www.epa.gov/iris.

If the estimated exposure dose for a chemical is less than the health guideline value, then the exposure is unlikely to cause a noncarcinogenic health effect in that specific situation. If the exposure dose for a chemical is greater than the health guideline, then the exposure dose is compared to known toxicologic values for that chemical and is discussed in more detail in the public health assessment (see Discussion section). These toxicologic values are doses derived from human and animal studies that are summarized in the ATSDR *Toxicological Profiles*. A direct comparison of site-specific exposure and doses to study-derived exposures and doses that cause adverse health effects is the basis for deciding whether health effects are likely or not.

[1] Environmental Protection Agency (EPA). Exposure factors handbook. Washington (DC): US Environmental Protection Agency, Office of Research and Development; 1999. Rpt. No.: EPA/600/C-99/001.

Calculation of Risk of Carcinogenic Effects

The estimated risk of developing cancer resulting from exposure to the contaminants was calculated by multiplying the site-specific adult exposure dose by EPA's corresponding CSF (which can be found at http://www.epa.gov/iris). The results estimate the maximum increase in risk of developing cancer after 70 years of exposure to the contaminant.

The actual risk of cancer is probably lower than the calculated number, which gives a worst-case excess cancer risk. The method used to calculate EPA's CSF assumes that high-dose animal data can be used to estimate the risk for low dose exposures in humans. The method also assumes that no safe level exists for exposure. Little experimental evidence exists to confirm or refute those two assumptions. Lastly, the method computes the 95% upper bound for the risk, rather than the average risk, suggesting that the cancer risk is actually lower, perhaps by several orders of magnitude.[2]

Because of uncertainties involved in estimating carcinogenic risk, ATSDR employs a weight-of-evidence approach in evaluating all relevant data.[3] Therefore, the carcinogenic risk is described in words (qualitatively) rather than giving a numerical risk estimate only. The numerical risk estimate must be considered in the context of the variables and assumptions involved in their derivation and in the broader context of biomedical opinion, host factors, and actual exposure conditions. The actual parameters of environmental exposures must be given careful consideration in evaluating the assumptions and variables relating to both toxicity and exposure.

[2] US Environmental Protection Agency (EPA), Office of Emergency and Remedial Response. Risk assessment guidance for Superfund, volume 1, human health evaluation manual. Washington (DC): US Environmental Protection Agency; 1989.

[3] Agency for Toxic Substances and Disease Registry (ATSDR). Cancer policy framework. Atlanta (GA): US Department of Health and Human Services; 1993.

Appendix B. Exposure Pathways for Callahan Mining Corporation Site

PATHWAY NAME	ENVIRONMENTAL MEDIA & TRANSPORT MECHANISMS	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSURE POPULATION	TIME	NOTES	COMPLETE?
Soil	Erosion of waste to surface soils; redeposition of fugitive dust	Site soils, residences nearby	Incidental ingestion, inhalation, dermal exposure	Nearby residents, fishers and shellfish collectors, trespassing teenagers and adults	Past, present, future	Population might include children 10 years and older.	Y
Waste rock and tailings	Waste rock and tailings piles on site; erosion dispersed	Waste piles on site	Incidental ingestion, inhalation, dermal exposure	Site workers, trespassing teenagers and adults	Past, present, future	Population might include children 10 years and older.	Y
Surface water	Surface water runoff over wastes to bay; dissolution from underwater mine pit	Water in Goose Pond and Goose Cove	Incidental ingestion, inhalation, dermal exposure	Fishers and shellfish collectors, recreational users of bay (children and adults)	Past, present, future	Population might include young children.	Y
Sediments	Deposition from surface water runoff into bay; underwater tailings	Along shoreline in Goose Pond	Incidental ingestion, dermal exposure	Fishers and shellfish collectors, recreational users of bay (children and adults)	Past, present, future	Population might include young children.	Y
Biota	Bioaccumulation of contaminants from surface water and sediments into shellfish and fish	Meal prepared using fish or shellfish from site	Ingestion	Fishers and shellfish collectors and their families; purchasers of local seafood	Past, present, future	Population might include young children	Y
Well water	Infiltration to groundwater	Groundwater wells supplying drinking water taps	Ingestion, inhalation, dermal exposure	Residents and workers near the site	Past, present, future	Population might include young children	N
Air	Volatilization of contaminants; fugitive dust	Groundwater wells supplying drinking water taps	Inhalation, dermal exposure	Residents and workers near the site	Past, present, future	Population might include young children	N

Appendix C. Public Comments Received

The Callahan Mining Corporation Public Health Assessment was available for public review and comment from December 16, 2002 until March 15, 2003, on the Internet and at the Brooksville Community Center in Brooksville, Maine. The public comment period was announced in local newspapers, and fact sheets announcing the availability of the public health assessment were mailed to residents near the site. The PHA was also sent to federal, state, and local officials. The findings of the PHA were presented by ATSDR staff at a public meeting held April 1, 2003 in Brooksville, Maine, and public comments were accepted for an additional 2 weeks after the meeting. The written public comments received are listed and addressed below.

Comments from Albert E. Sandecki, Chairman of the Holbrook Island Sanctuary Corporation:

Comment A1: *By way of a minor correction on page 4. The Easterly shore of Goose Pond is bordered by the Holbrook Island Sanctuary State Park. Now managed by the State of Maine's Bureau of Parks and Lands, which in turn is overseen by our trust the Holbrook Island Sanctuary Corporation.*

Response: Thank you for the clarification. The document has been modified accordingly.

Comment A2: *The ATSDR listing of Community Health Concerns on page 6 might consider adding that commercial soft shell clam harvesting has been done within Goose Pond, and scallop dragging also has been observed for the past two seasons within Goose Cove. Ref: Notice of this was given to Leslie McVickar, EPA's Remedial Project Manager at the Boston offices of EPA.*

Response: This concern has been added to the referenced section of the document.

Comments from Debbie Weeks, Ph.D., of the Maine Maritime Academy:

Comment B1: *Most of the samples were soil samples from waste rock pile 2 - this does not seem to be representative sampling. The lack of dissolved contaminant measurements makes it difficult to interpret the mobilization and distribution of these contaminants. A case for episodic dissolution, re-suspension and mobilization of these contaminants can be made, as rainfall (especially acid rain) will continue to leach metals. Tidal fluxes introduce saline, low-contaminant water which will further aid in the mobilization of the contaminants. These issues should be addressed.*

Response: Based on the available data considered in this PHA, a total of twelve soil samples were collected from the tailings pond (2 samples), separation mill (one sample), site entrance (4 samples), and operational areas (5 samples). Additionally, samples were collected from tailings pond (5 samples), tailings pile (3 samples), and waste rock pile (8 samples). Because maximum levels of contaminants were similar for these materials, soil, tailings, and waste rock were considered to be one exposure pathway for the purpose of this PHA.

At the current time, data is not available to completely characterize contamination at the site. EPA has proposed the collection of additional data to adequately address this exposure pathway, as part of the Remedial Investigation. Additional data will also be evaluated by ATSDR, and the conclusions of the PHA will be modified if necessary.

Comment B2: *Only blue mussels were sampled, and it is unclear from where they were taken. Of those taken, all were far above the EPA screening levels for all toxic metals tested, and the values for copper, iron, lead and zinc show a significant increase in concentration compared to data from the 70's and 90's. This seems to indicate an INCREASE in release of these elements since the mine closed, as these mussels typically live only 10-15 years.*

Response:

While ATSDR concludes that not enough mussels data was available to make a definitive health call regarding fish and shellfish consumption, limited mussels data was evaluated to provide general information for potential health impacts from consumption of mussels from Goose Cove. The most current mussels data, collected from Goose Cove in 2001, were evaluated as part of this PHA. Historical data were not considered in this evaluation due to data quality concerns.

As part of this PHA, ATSDR focuses on the evaluation of human health effects associated with exposure and does not consider potential ecological impacts. Therefore, concentrations of metals in the mussels samples were compared with EPA Region III Risk-Based Concentrations (RBCs) developed for human consumption of fish and shellfish. Based on the data, only three metals (arsenic, cadmium, and iron) were found to exceed the EPA Region III RBCs. No other metals were found to be elevated above the screening level. This limited evaluation indicated that health effects would not likely result for individuals who occasionally consume (2 meals per month) mussels from Goose Cove that contain similar concentrations of metals.

In order to make a definitive health call, ATSDR recommends that additional biota data be collected in an attempt to gain more information on the potential impact to mussels, as well as other shellfish and finfish. An update to this PHA will evaluate the newly collected data to determine whether ingestion of fish and shellfish is associated with adverse health effects. At the current time, ATSDR recommends that individuals continue to adhere to the fish and shellfish consumption advisories that already exist in the area. The ban states that no shellfish (including clams, mussels, and oysters) should be collected or consumed from Goose Pond, Goose Cove, and other nearby areas.

Comment B3: *The dismissal of potential ground-water contamination is disconcerting, as that has the potential to be the largest health-hazard risk to people who do not visit the site. Given the irregular strata in the area and the reliance of the community on delocalized ground water sources, a more thorough study of well-water, especially at low water, is warranted.*

Response: ATSDR reviewed data from drinking water wells sampled near the site from 1986-1994. Data indicates that no contaminants were present at concentrations that exceed human health comparison values. Therefore, no further evaluation of the drinking water exposure pathways was conducted as part of this PHA. However, additional sampling of private drinking water wells has been proposed by EPA as part of the Remedial Investigation for the site. ATSDR will evaluate newly collected private well data to determine whether exposure may be associated with adverse human health effects. The conclusions of this PHA will be modified if necessary. Comments from a contractor for EPA:

Comment C1: *The settling basin consists of fine, powdery particles left from grinding the rock for the concentrative extraction of ore. Much of the rock surrounding the ore body is siliceous, and the contents of the settling basin could be 50% silica. Silicosis in trespassers /recreators could be an endpoint. [The commenter provided particle size data from the settling basin for review by ATSDR].*

Response: Silicosis has been observed among individuals occupationally exposed to respirable (or fine, easily inhaled) crystalline silica over ten or more years (or chronic silicosis) or exposed to massive quantities of respirable silica over one to three years (or acute silicosis). In general, silicosis occurs among workers who engage in activities that generate very large quantities of respirable silica, such as sandblasting, rock crushing, grinding stone, highway construction, or building demolition. Respirable particle size is less than or equal to about 10 micrometers, or 10 one-thousandths of a centimeter.

The data provided by the commenter on particle size was reviewed by ATSDR in an attempt to gain information on the amount of respirable silica in the settling basin at the Callahan Mine Site. It was not possible to determine the amount of respirable particles present in the settling basin because the data provided did not differentiate any particles smaller than 74 micrometers. Exposure to silica from the settling basin, that may be associated with trespassing or recreational activities at the Callahan Mine Site, is expected to be short-term and infrequent and is not likely to be associated with silicosis. However, in the interest of health protectiveness, ATSDR recommends that access to the site be restricted in order to limit the potential for exposure by individuals who may access the site.

Comment from a private citizen:

Comment D1: *I wandered around the mine site, including the flat composed of fine, powdery residue, for several years doing natural studies. I measured and took impressions of animal tracks and collected rocks and bones.*

Response: This use of the site is not likely to result in a significantly increased risk of adverse health effects. In the public health assessment, we considered occasional use of the site (twice a week for thirty years) and concluded that there was not an increased risk of adverse health effects from such exposures.

Appendix D. ATSDR Plain Language Glossary of Environmental Health Terms

Absorption	How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed in.
Acute Exposure	Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.
Additive Effect	A response to a chemical mixture, or combination of substances, that might be expected if the known effects of individual chemicals, seen at specific doses, were added together.
Adverse Health Effect	A change in body function or the structures of cells that can lead to disease or health problems.
Antagonistic Effect	A response to a mixture of chemicals or combination of substances that is **less** than might be expected if the known effects of individual chemicals, seen at specific doses, were added together.
ATSDR	The **A**gency for **T**oxic **S**ubstances and **D**isease **R**egistry. ATSDR is a federal health agency in Atlanta, Georgia that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.
Background Level	An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment.
Bioavailability	See Relative Bioavailability.
Biota	Used in public health, things that humans would eat – including animals, fish and plants.
Cancer	A group of diseases which occur when cells in the body become abnormal and grow, or multiply, out of control
Cancer Slope Factor (CSF)	The slope of the dose-response curve for cancer. Multiplying the CSF by the dose gives a prediction of excess cancer risk for a contaminant.
Carcinogen	Any substance shown to cause tumors or cancer in experimental studies.

Chronic Exposure	A contact with a substance or chemical that happens over a long period of time. ATSDR considers exposures of more than one year to be *chronic*.
Completed Exposure Pathway	See Exposure Pathway.
Community Assistance Panel (CAP)	A group of people from the community and health and environmental agencies who work together on issues and problems at hazardous waste sites.
Comparison Value (CV)	Concentrations of substances in air, water, food, and soil that are unlikely, upon exposure, to cause adverse health effects. Comparison values are used by health assessors to select which substances and environmental media (air, water, food and soil) need additional evaluation while health concerns or effects are investigated.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	**CERCLA** was put into place in 1980. It is also known as **Superfund**. This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. This act created ATSDR and gave it the responsibility to look into health issues related to hazardous waste sites.
Concentration	How much or the amount of a substance present in a certain amount of soil, water, air, or food.
Contaminant	See Environmental Contaminant.
Delayed Health Effect	A disease or injury that happens as a result of exposures that may have occurred far in the past.
Dermal Contact	A chemical getting onto your skin (see **Route of Exposure**).
Dose	The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as “amount of substance(s) per body weight per day”.
Dose / Response	The relationship between the amount of exposure (dose) and the change in body function or health that results.
Duration	The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant	A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than the **Background Level**, or what would be expected.
Environmental Media	Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. **Environmental Media** is the second part of an **Exposure Pathway**.
US Environmental Protection Agency (EPA)	The federal agency that develops and enforces environmental laws to protect the environment and the public's health.
Epidemiology	The study of the different factors that determine how often, in how many people, and in which people will disease occur.
Exposure	Coming into contact with a chemical substance. (For the three ways people can come in contact with substances, see **Route of Exposure**.)
Exposure Assessment	The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.
Exposure Pathway	A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical. ATSDR defines an exposure pathway as having 5 parts: 1. Source of Contamination, 2. Environmental Media and Transport Mechanism, 3. Point of Exposure, 4. Route of Exposure, and 5. Receptor Population. When all 5 parts of an exposure pathway are present, it is called a **Completed Exposure Pathway**. Each of these 5 terms is defined in this Glossary.
Frequency	How often a person is exposed to a chemical over time; for example, every day, once a week, twice a month.
Hazardous Waste	Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Health Effect	ATSDR deals only with **Adverse Health Effects** (see definition in this Glossary).
Indeterminate Public Health Hazard	The category is used in Public Health Assessment documents for sites where important information is lacking (missing or has not yet been gathered) about site-related chemical exposures.
Ingestion	Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (see **Route of Exposure**).
Inhalation	Breathing. It is a way a chemical can enter your body (see **Route of Exposure**).
LOAEL	**L**owest **O**bserved **A**dverse **E**ffect **L**evel. The lowest dose of a chemical in a study, or group of studies, that has caused harmful health effects in people or animals.
Malignancy	See Cancer.
MRL	**M**inimal **R**isk **L**evel. An estimate of daily human exposure – by a specified route and length of time -- to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects.
NPL	**N**ational **P**riorities **L**ist. (Which is part of **Superfund**.) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.
NOAEL	**N**o **O**bserved **A**dverse **E**ffect **L**evel. The highest dose of a chemical in a study, or group of studies, that did not cause harmful health effects in people or animals.
No Apparent Public Health Hazard	The category is used in ATSDR's Public Health Assessment documents for sites where exposure to site-related chemicals may have occurred in the past or is still occurring but the exposures are not at levels expected to cause adverse health effects.
No Public Health Hazard	The category is used in ATSDR's Public Health Assessment documents for sites where there is evidence of an absence of exposure to site-related chemicals.
PHA	**P**ublic **H**ealth **A**ssessment. A report or document that looks at

	chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.
Plume	A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).
Point of Exposure	The place where someone can come into contact with a contaminated environmental medium (air, water, food or soil). Some examples include: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, or the backyard area where someone might breathe contaminated air.
Population	A group of people living in a certain area; or the number of people in a certain area.
PRP	**P**otentially **R**esponsible **P**arty. A company, government or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.
Public Health Assessment(s)	See **PHA**.
Public Health Hazard	The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.
Public Health Hazard Criteria	PHA categories given to a site which tell whether people could be harmed by conditions present at the site. Each are defined in the Glossary. The categories are: – Urgent Public Health Hazard – Public Health Hazard – Indeterminate Public Health Hazard – No Apparent Public Health Hazard – No Public Health Hazard
Receptor Population	People who live or work in the path of one or more chemicals, and who could come into contact with them (See **Exposure Pathway**).
Reference Dose (RfD)	An estimate, with safety factors (see **safety factor**) built in, of the daily, life-time exposure of human populations to a possible hazard that is <u>not</u> likely to cause harm to the person.

Relative Bioavailability	The amount of a compound that can be absorbed from a particular medium (such as soil) compared to the amount absorbed from a reference material (such as water). Expressed in percentage form.
Route of Exposure	The way a chemical can get into a person's body. There are three exposure routes: – breathing (also called inhalation), – eating or drinking (also called ingestion), and – getting something on the skin (also called dermal contact).
Safety Factor	Also called **Uncertainty Factor**. When scientists don't have enough information to decide if an exposure will cause harm to people, they use "safety factors" and formulas in place of the information that is not known. These factors and formulas can help determine the amount of a chemical that is not likely to cause harm to people.
SARA	The **S**uperfund **A**mendments and **R**eauthorization **A**ct in 1986 amended CERCLA (see **CERCLA**) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects resulting from chemical exposures at hazardous waste sites.
Sample Size	The number of people that are needed for a health study.
Sample	A small number of people chosen from a larger population (see **Population**).
Source (of Contamination)	The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an **Exposure Pathway**.
Special Populations	People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.
Statistics	A branch of the math process of collecting, looking at, and summarizing data or information.
Superfund Site	See **NPL**.
Survey	A way to collect information or data from a group of people (**population**). Surveys can be done by phone, mail, or in person.

	ATSDR cannot do surveys of more than nine people without approval from the U.S. Department of Health and Human Services.
Synergistic Effect	A health effect from an exposure to more than one chemical, where one of the chemicals worsens the effect of another chemical. The combined effect of the chemicals acting together is greater than the effects of the chemicals acting by themselves.
Toxic	Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.
Toxicology	The study of the harmful effects of chemicals on humans or animals.
Tumor	Abnormal growth of tissue or cells that have formed a lump or mass.
Uncertainty Factor	See Safety Factor.
Urgent Public Health Hazard	This category is used in ATSDR's Public Health Assessment documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.