SITE VISIT REPORT:

VALDEZ CREEK MINE

CAMBIOR ALASKA INCORPORATED

3.0 SITE VISIT REPORT: VALDEZ CREEK MINE CAMBIOR ALASKA INCORPORATED

3.1 INTRODUCTION

3.1.1 Background

The U.S. Environmental Protection Agency (EPA) is currently developing a mining program under the Resource Conservation and Recovery Act (RCRA). To date, EPA has initiated several information gathering activities to characterize mining wastes and mining waste management practices. EPA has also chartered a Policy Dialogue Committee under the Federal Advisory Committee Act to encourage discussion of mining-related issues by representatives of EPA and other Federal agencies, States, industry, and public interest groups. As part of these ongoing efforts, EPA is gathering data related to waste generation and management practices by conducting visits to mine sites. As one of several site visits, EPA visited the Valdez Creek Mine on July 13, 1992.

Sites to be visited were selected by EPA to represent both an array of mining industry sectors and different regional geographies. All site visits have been conducted pursuant to RCRA Sections 3001 and 3007 information collection authorities. When sites have been on Federal land, EPA has invited representatives of the land management agencies (Forest Service/Bureau of Land Management). State agency representatives and EPA regional personnel have also been invited to participate in each site visit.

For each site, EPA has collected information using a three-step approach: (1) contacting the facility by telephone to get initial information, (2) contacting state regulatory agencies by telephone to get further information, and (3) conducting the actual site visit. Information collection prior to the site visit is then reviewed and confirmed at the site.

In preparing this report, EPA collected information from a variety of sources including Cambior Inc., and the State of Alaska. The following individuals participated in the Valdez Creek Mine site visit on July 13, 1992:

<u>Cambior Alaska, Incorporated</u>

Bob Walish, General Manager
907-694-4653

<u>U.S. Environmental Protection Agency</u>

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3.1.1.1 General Description

The Valdez Creek Mine was the largest placer gold mine in North America in 1992 and is operated by Cambior Alaska, Incorporated. The operation is owned by Camindex Mines (25 percent share holder)

and Cambior Alaska, Incorporated (75 percent share holder). The operation is located near Cantwell, Alaska, 110 miles south of Fairbanks, along the Denali Highway (Figure 3-1).

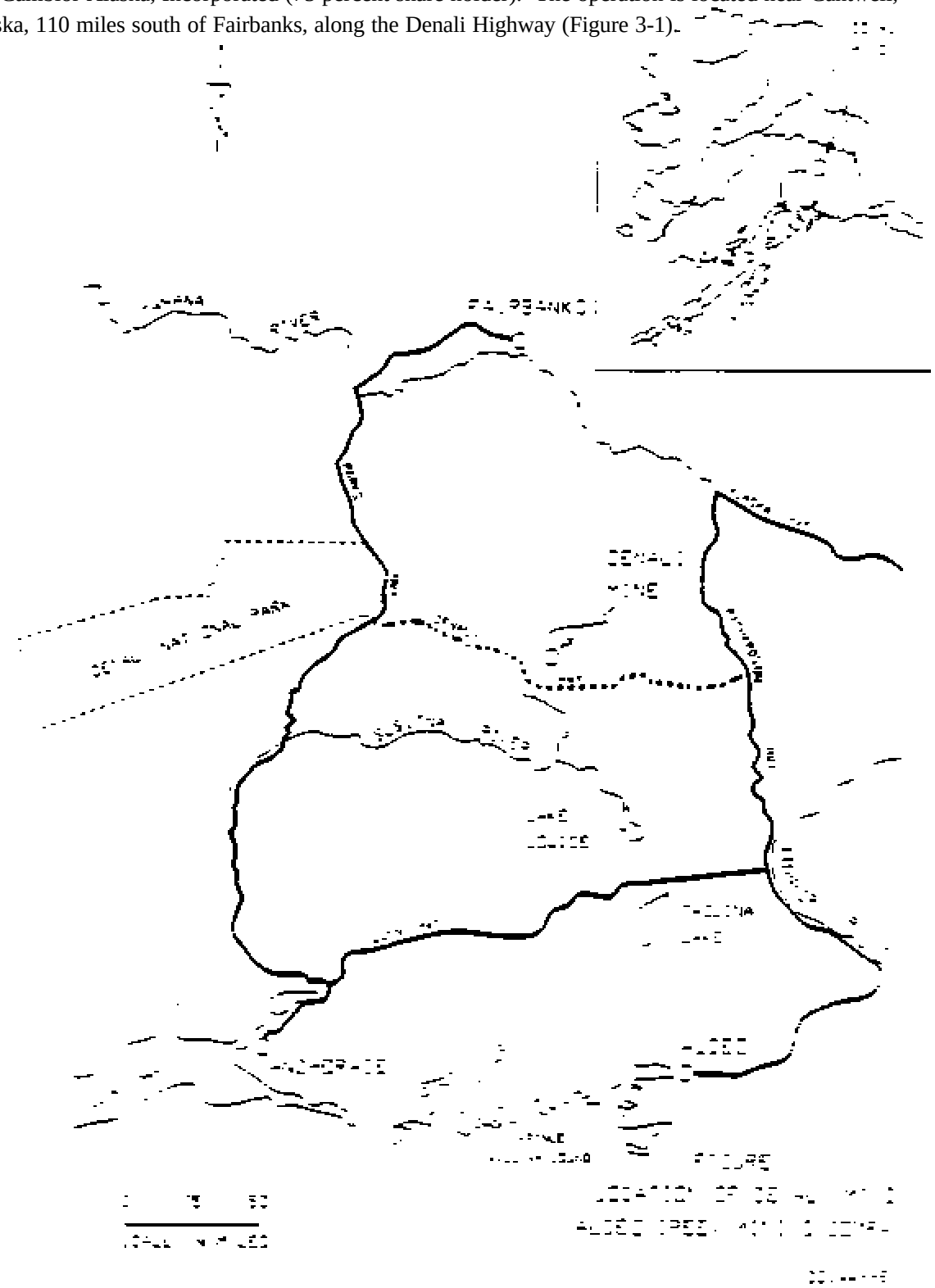

Figure 3-1. Facility Location Map

(Source: Environmental Assessment 1990)

The mine extracted loosely consolidated alluvial material from the valley bottom to a depth of 180 to 200 feet. Gold bearing pay-gravel is passed through a wash plant (a sluice system) to gravity concentrate the gold. Additional gold concentration is conducted using a jig, Knudsen bowl and magnetic separation.

Typically, pay-gravels have been located in deeply-buried paleochannels north of the active channel of Valdez Creek. However, in the area where mining was taking place, the active channel of Valdez Creek converges with the area to be mined, overlying the paleochannels. In order to access portions of the mine, the facility had diverted Valdez Creek around the mine. Diversion structures include a diversion dam, spillway and ditch.

The facility held placer mining claims in the area that cover 19,880 non-contiguous acres of Federal Land under jurisdiction of the Bureau of Land Management. According to facility personnel, the most recent

active operations are currently disturbing approximately 67 new acres of BLM land, not including land previously disturbed. As shown in Figure 3-2, the total area of land disturbed at the mine, including past

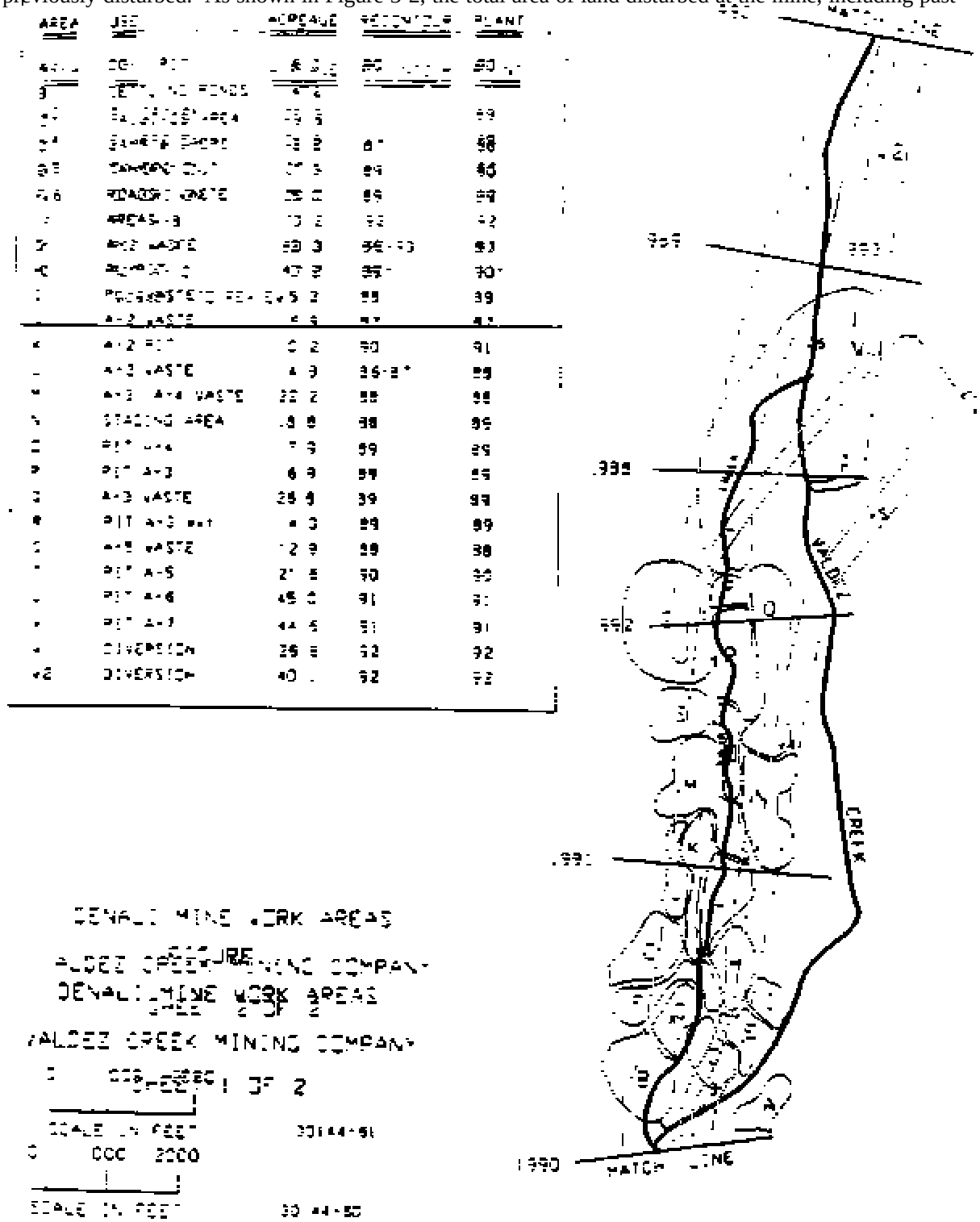

Figure 3-2 Denali Mine Work Areas (continued)

(Source: Valdez Creek Mining Company, Plan of Operations)

mining activity, is on the order of 807 acres (BLM 1990). In addition to Valdez Creek Mine, there are other smaller mines further up the Valdez Creek valley.

Open pit mining began at the site in 1984. Cambior Incorporated purchased the existing mining operations in November 1989 and shut down the operation in November 1990 to construct a new wash plant and settling/tailings impoundments (Cambior, 1991). According to facility personnel, the operation reopened in August 1990, with mining in the A7 pit beginning in March 1991.

Mining began in the area in 1903, with the discovery of placer deposits. After a small "rush" in 1904 and 1905, mining activity in the area was variable with techniques such as drift mining, booming and hydraulicking used to access and excavate the pay dirt. According to the Environmental Assessment, three different mining companies held the Valdez Creek property from 1913 to 1949 and conducted a considerable amount of mining. Mining in the area was substantially reduced until open pit mining began in 1984.

3.1.2 Environmental Setting

The mine is located in the Clearwater Mountains area, part of the Alaska Range. Valleys in the region were occupied by the Susitna, West Fork, and Valdez Creek glaciers during past periods of glaciation. Glacial features in the valley include medial, lateral, end, and ground moraines. Valdez Creek is a tributary to the Susitna River; the Susitna River flows into the Cook inlet on the south coast of Alaska. The mine is located at approximately 3,000 above sea level. The climate is harsh during most of the year, with extreme cold conditions from October through April or May. Temperatures range from summers highs in the 50's to winter lows in the -40's range (Valdez Creek Mining Co. 1988) Mean annual precipitation is estimated to be between 10 and 12 inches per year. Most of this falls as snow from February through May. The Environmental Assessment (BLM 1990) estimated that up to 9 inches of the annual precipitation budget (12 inches) is lost by sublimation and evapotransporation, and that 2.4 inches run off via Valdez Creek, the remainder recharges ground water.

Vegetation is typical of cold climate species. In the valley bottom, conifers (scattered black spruce) are mixed with grasses and alder. Further up the valley slopes, the vegetation grades into tundra species including dwarf birch, mountain avens, dwarf willows, cranberry, and other species. There are no threatened or endangered plant species in the area. (BLM 1990)

Wildlife in the area include caribou, moose, wolf, black and brown bear, fox, and beaver. None of these species occur in large numbers and according to site personnel, no threatened or endangered species occur in the area. Valdez Creek supports populations of grayling and lake trout. The stream diversion required to conduct mining activity in pits A-7 through A-10 resulted in the operator having to transport the fish around the diversion. Grayling migrate upstream in the spring, following breakup, for spawning. The fish are captured in a pool located below the mine and are trucked a short distance up stream. (BLM 1990)

3.1.2.1 Geology

The geology at the site consists of poorly-sorted glacial and fluvial material deposited above bedrock. The sedimentary deposits consist of glacially worked alluvial and fluvial sediments deposited by the Susitna, West Fork and Valdez glaciers during past glaciation (Valdez Creek Mining Co. 1988). Material from volcanic ash outfalls are also present in the area.

The site contains paleochannels cut during interglacial periods by the ancestral Valdez Creek. These channels contain the sediments (fluvial deposits) where placer gold material has been naturally concentrated (Figure 3-3). This material is sometimes referred to as pay-gravel or pay-dirt. Overlying

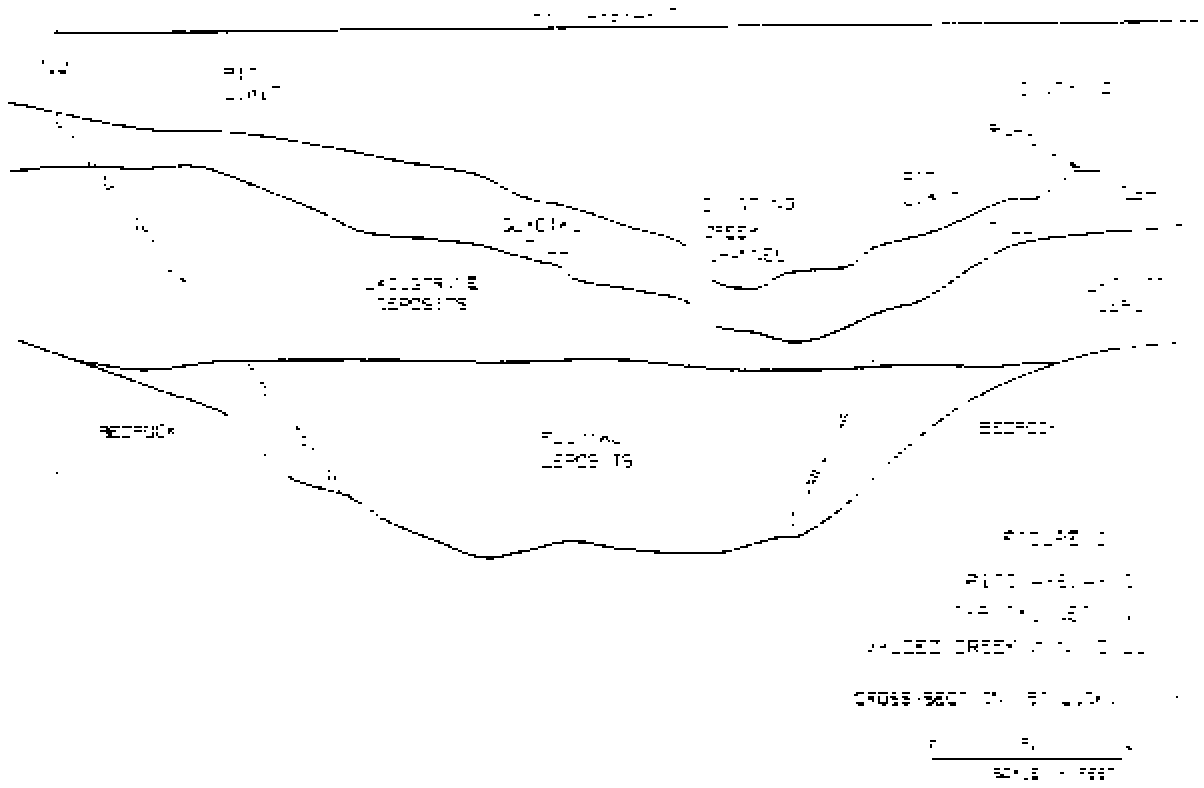

Figure 3-3. Typical Cross Section of Pits A-6 Through A-10

(Source: Valdez Creek Mining Company, Plan of Operations)

these are the lacustrine and outwash features characteristic of a glacial environment. Height of the section above bedrock averages 200 feet.

There are two pay gravel deposits mined at the site. The main deposit conforms to the bedrock floor and is approximately 20 feet thick, while a second newer deposit is in a canyon incised in the main deposit that reaches an additional depth of 40 feet. Where possible, both deposits are mined; however, the difficulty of delineating the newer deposit because of its irregular channel path often results in leaving the deposit unmined.

Soils are typical of cold climates at high altitudes and latitudes. Dominant soils are Histic and Pergelic Cryaquepts that are wet during the summer. Soils are prone to high runoff and erosion because they have a low permeability and slopes in the Valdez Creek valley are high. Topsoil in the area is very shallow and generally nutrient deficient. Although permafrost does occur in the area, none has been encountered at the Denali Mine (BLM 1990).

3.1.2.2 Surface Water

The Valdez Creek valley watershed covers an area of 60 square miles. The Creek flows 17 miles from Grogg Lake to the Susitna River. Mining operations are concentrated on the lower portion of the valley, two miles upstream from the Susitna River. In this area, Valdez Creek has been diverted by the mining company in order to access to ore beneath the active stream channel (see Section 3.2). A diversion dam has been constructed upstream of the active pit. The dam impounds water, which then flows through the diversion channel approximately one mile until rejoining with the stream. The diversion channel is lined and covered with rip-rap. The Creek is then returned to its original channel below the mine, before entering the Susitna River. In addition to the Creek diversion system, the facility has two small diversion ditches on either side of the valley to intercept runoff before it reaches the pit. Water from these diversion ditches flows to two settling ponds.

Over most of its course, Valdez Creek flows as a single, confined channel. The channel is braided above the diversion dam and then from below the mine to its confluence with the Susitna River. Background water quality tests in the stream show a turbidity of 0.4 nephelometric turbidity units (NTU), with settleable solids of less than 0.1 ml/l. Storm runoff can increase these levels to 1,500 NTU, with settleable solids reaching 10.3 ml/l. (BLM 1990)

Discharge from the Creek is estimated to be 300 cubic feet per second (cfs) in late March and up to 900 cfs in late May and early June. The 25-year flood is estimated to flow at 2,700 cfs. All of the facilities are within the 100-year floodplain. (BLM 1990)

3.1.2.3 Ground Water

As discussed above in the geology section, the site is underlain by unconsolidated glacial and fluvial material above bedrock. Till is interbedded with lenses of gravel in the upper portions of the profile that discharge an estimated 10 to 30 gallons per minute (gpm) of ground water. In the area just above the bedrock, a 10 foot zone of gravel, cobbles, and boulders discharge up to 50 gpm. (BLM 1990) Transmissivity in the till is estimated to be approximately 10^{-5} cm/sec (Valdez Creek Mining Co. 1988). According to the facility's Solid Waste Permit Application, the regional water table is a ten or more feet into the bedrock, 170 to 200 feet below the surface and water production is limited. Additional information concerning the hydrologic regime at the site was not obtained.

The facility operated eight dewatering wells that pump ground water from the area prior to and during mining. According to facility personnel, five wells are located above the diversion dam, which is upstream of the active pit, and 3 wells are located below the dam in the mine area. The water was discharged to the diversion system directly below the diversion dam. Additional information on these 8 dewatering wells was not obtained.

The facility operated three drinking water wells onsite. Wells A and B provided less than 10 gallons per minute and were used during normal operations. Well C was only used during winter operations. Well water was tested monthly for coliform, quarterly for volatile organics and once every 4 years for gross α. Depths of these wells and results of the testing were not obtained.

3.2 FACILITY OPERATION

3.2.1 General Overview

Cambior's Valdez Creek Mine recovered over 75,000 ounces of gold annually, making it the largest placer operation in North America in 1992. Reserves are estimated to be 216,843 raw ounces with grades that average 0.1 ounces per cubic yard. Typically, mining progressed up the valley, with ore hauled by truck to a wash plant for gravity concentration and waste rock trucked to backfill previously excavated pits. The Plan of Operations for the period from 1990 to 1994 called for moving 35,590,000 cubic yards of overburden to access 4,450,000 cubic yards of pay gravel.

According to Cambior personnel, the Company employed 155 people onsite and operated 365 days each year. Two shifts ran each day for 10.5 hours. Three crews cycle in and out: 14 days on, one week off. Accommodations for the crews are ATCO trailers purchased from the Alyeska Company, where they were used along the Trans-Alaska Pipeline. Some employees prefer to live offsite in a camp on BLM land close to the facility referred to as Little Idaho. Water, sewage, and electricity is supplied by the facility.

3.2.2 Extraction

As discussed above, open pit mining of paleochannels north of Valdez Creek began in 1984. Camindex Mines has been a partial owner since the start of the project (at various percentages). Cambior acquired a 26 percent share of the mine in 1989, 49 percent in May 1990, and, effective January 1991, the ownership is: Cambior 75 percent, Camindex 25 percent. In August 1990 the operators shut down the operation to make operational changes. Until then, pay-gravels had been located in deeply-buried paleochannels separate from the active channel of Valdez Creek. However, as mining progressed up-valley, the paleochannels converged with the active channel of Valdez Creek. In order to access the ore, the facility constructed a diversion system for Valdez Creek. During this same inactive period, the facility also constructed a new wash plant and settling impoundments. Upon completion of construction in March 1991, mining began again with excavation from Pit A7.

3.2.2.1 Excavation

The Operating Plan for 1990 through 1994 laid out the progression of mining activities. Figure 3-2 is a plan view of pit, waste, tailing, and facility building locations. The acreage for each use is identified, total area for all the activities identified is 807 acres. The operation was mining in the area A-7 (labeled area V and located at the top of the figure), and continuing upstream through A-10. Table 3-1

Table 3-1. Estimated Volumes of Overburden and Pay-Gravel
(Source: Valdez Creek Mining Company, Plan of Operations)

MASS BALANCE

DENALI MINE 1990-94

PIT NAME	DC-7	A-7	A-8	A-9	A-10	Totals
Acreage	6	67.3	70.2	80.2	22.3	246
Overburden Cu. Yd.*	640	9100	9100	8250	8500	35590
Pay Gravels Cu. Yd.*	110	700	740	1600	1300	4450

* In thousands

provides the estimated volume of overburden and pay gravels in each of these areas.

Pit A7 was being mined in 10 phases, with 2 or 3 phases in operation at any one time. Each phase of the current pit is 400 to 650 feet wide (in the direction perpendicular to the stream channel), 180 to 200 feet deep, and 400 to 600 feet long.

At any one time, there was approximately 1,200 feet of open cut (e.g., a 1,200 foot length of valley bottom, 400-650 foot wide) being mined and backfilled. The top 180 feet of material is waste rock with pay gravel reaching a depth of 20 feet below the waste rock. The facility was extracting an average of approximately 34,000 cubic yards of material each day. Of this, 3,000 cubic yards pass through the wash plant when it is operating, leaving approximately 90 percent of the material moved as waste.

There were two pay gravel deposits in the area of Pit A7. The main deposit conforms to the bedrock floor, while a second newer deposit is in a canyon incised in the main deposit that reaches an additional depth of 40 feet. Where possible, both deposits are mined; however, the difficulty of delineating the newer deposit because of its irregular channel path often results in leaving the deposit unmined.

Initially the area was dewatered by pumping from withdrawal wells located near the diversion dam. Before excavating, a new section is drilled and blasted using ANFO to loosen or "fluff up" the unconsolidated material thereby making it easier to load and haul. The Company purchased ammonium nitrate and mixes it with fuel oil onsite. Waste rock is then mucked up and trucked to previously mined pits for disposal. The company used two front shovels, one with a 13-yard^3 bucket and one with a 11-yard^3 bucket and a Caterpillar front-end loader with a 12-yard^3 bucket to muck waste rock, and eight 85-ton Caterpillar trucks to haul the waste rock. Pay gravel was mucked with a backhoe having either a six-yard^3 or nine-yard^3 bucket and trucked to the wash plant. Usually smaller 50 ton trucks are used to haul pay dirt. The facility also used four dozers to work the dumps and the roadways.

3.2.2.2 Water Management

During the site visit, EPA observed water in the bottom of the pit and noted the plasticity of the soils as trucks traveled in the area. According to facility personnel this is due to characteristics of the glacial till overburden. To help with water management in the active area of the pit, the facility maintained two small diversion ditches on either side of the valley above the mined area to intercept runoff before it reaches the pit. In addition, the area to be mined was dewatered by eight ground water wells. Water from these wells is pumped to the diversion channel. According to facility personnel, five wells are located above the diversion dam above the mine and three wells are located below the dam. The water was discharged to the diversion system directly below the dam. Additional information on these eight dewatering wells was not obtained.

To access pay-gravels in pits A-7 through A-10 a temporary stream diversion was built. According to facility personnel, the diversion dam, is approximately 200 feet wide and over 25 feet tall with a crest width of approximately 50 feet (the dam was observed during the site visit). The area impounded during breakup reaches a maximum of approximately 100 acres, two to three times the normal impoundment size of 25 acres. Typically, the water is only a few feet deep; however at breakup it may reach 10 feet in depth. The diversion ditch leads approximately 5,000 feet downhill, from the diversion dam to where it discharges to the creek. The entire diversion ditch is lined with a synthetic liner and rip-rap to prevent erosion and downcutting.

Peratrovich, Nottingham & Drage, Inc. were retained to prepare an engineering study for the diversion. The final design allowed a two stage implementation. Stream flow would be diverted to a channel 500 feet south and parallel to the natural stream. The stage I channel would be 5,385 feet long and the stage II channel would be 5,385 feet long for a total length of 10,755 feet. The channel invert was planned to be 20 feet wide at the base and 30 feet wide to the top and 2 to 2.5 feet deep. The diversion channel was

to be designed to accommodate flow up to 2,700 cfs, equivalent to the 25 year flood event. Average flow is expected to be 700 cfs.

3.2.3 Beneficiation

The wash plant that concentrates the gold is strictly a mechanical system, no chemical additives were used. Additional gold concentration is conducted in a guarded and secured room using a jig, Knudsen bowl, table, and magnetic separation.

Pay-gravel was delivered to the wash plant by truck and dumped into a vibrating grizzly feeder. Water is added to the grizzly through pipe-mounted sprayer heads at the rate of 1,500 gallons per minute. The grizzly discards material larger than six inches in diameter. Material less than six inches in diameter passes to double-deck vibrating screens. Additional water is added to the screens at the rate of approximately 1,500 gallons per minute. The screens reject material larger than 3/4 inches in diameter. This material is carried by conveyor to a pile and is used by the facility for road repair. The facility does not have nugget trays to separate nuggets from the waste rock; they are assessing whether it would be economical to install them.

Fine material passing the screens is passed to a make-up tank where water may be added to make a slurry of 14 to 20 percent solids. According to facility personnel, the wash plant operation used approximately 3,000 gpm of water; most of this is added by spray bars at the grizzly and vibrating screen. From the make-up tank, a Warman slurry pump transfers the slurry to a series of sluices. The wash plant is operating with seven sluice boxes. Two types of sluices are used: five are 34 feet long, sloping 1.25 inches per foot. Four of these are running at any one time. Hungarian riffles are 1.5 inches high and are spaced two inches apart. Below the riffles, the lower 20 percent of the sluices are fitted with expanded metal over astroturf. Two newer sluices use a modified Hungarian riffle one inch high spaced one inch apart. The slope is two inches per foot in the riffle portion and 1.25 inches per foot in the expanded metal portion. A Nomad matting is used under the expanded metal section.

The sluices serve to allow the gravity concentration of gold from other less dense particles. No chemicals are added; the operation is entirely mechanical. The relatively more dense gold accumulates in the lee of the riffles and in the matting, with the remainder of the slurry (water and less dense gangue) flowing over the riffles to become tailings. Tailings from the sluice boxes empty into a pump box where they are pumped to one of three settling ponds (also called tailings ponds).

The sluices were shut down and cleaned of gold every one or two days. Matting is picked and washed. The material is put in buckets and carried to the gold room. In the gold room, magnetic separation is used to separate heavy minerals such as magnetite from the gold. Following this, a jig, a table, and a Knudsen bowl are used to further separate gold from gangue. In a jig, slurry flows horizontally through a box with a screen top through which water is pulsed, separating more dense from less dense material. A table is an inclined table with small channels. The quantities of waste generated in this operation were not obtained; however quantities are minimal compared to the amount of tailings generated.

As discussed above, tailings were sent to settling ponds. There are three settling ponds in this system; the system is designed to allow settling of tailings and recycling of the water to the wash plant. Two ponds are unlined and the dam on the remaining pond is lined at one end of the pond. The operation discharged a low solids slurry from the wash plant into the primary sluice pond, which discharged to the secondary

sluice pond and then to the tertiary sluice pond, where water is reclaimed and pumped back to the wash plant operation. These ponds are actually old mining pits A4 and A5 and are called the E4 and E5 wash plant ponds by the facility. According to facility personnel, each was approximately five acres in size with the deepest being 20 feet and the others ranging in depth from five to 10 feet. The ponds had a total capacity of 340 acre-feet (Cambior 1990). This pond system is intended to totally recycle all wash plant water. In addition to wash plant water, effluent from dewatering the pit was also discharged to these ponds (Cambior 1990).

Cambior had structural integrity problems with the first pond. This pond has failed twice, in 1991 and 1992. At the time of the site visit, the pond had been reconstructed and lined and Cambior was refilling the pond with water to test its integrity. Cambior expects a final permit for this pond when the construction is finished. These pond failures are discussed in more detail in Section 4.

As discussed above, water use in the wash plant was estimated by facility personnel to be approximately 3,000 gpm. Water sources for the operation include recycled water from the sluice ponds, which

constitutes about 90 percent of the total flow. The remaining flow is make-up water from Valdez Creek (BLM 1990). Figure 3-4 is a diagram showing the 1990 through 1991 water balance according to the

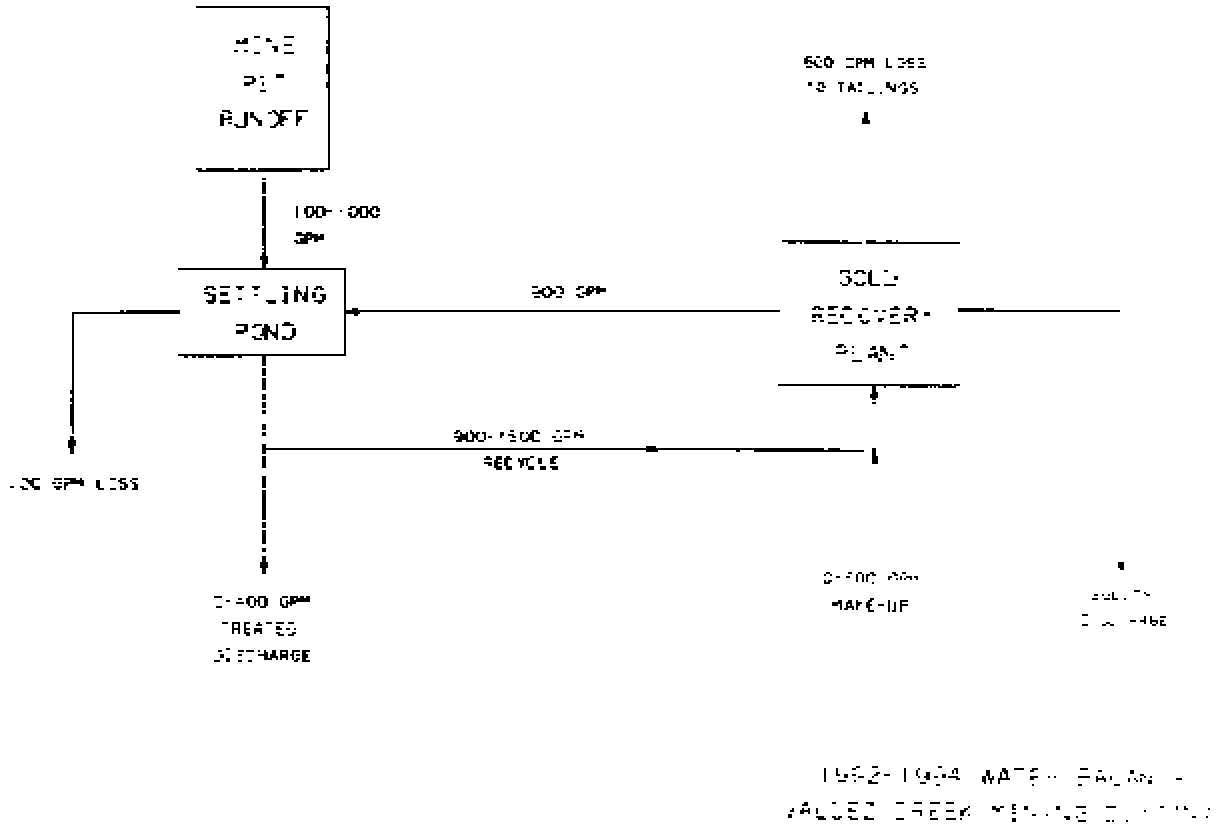

Figure 3-4. Water Balance for 1990 Through 1991

(Source: EA 1990)

Environmental Assessment. Note that the total volume used at the wash plant estimated in the Environmental Assessment differs from the estimate provided for current usage.

3.2.3.1 Ancillary Facilities

If the plant is shut down or if there is excessive runoff, the settling ponds discharge to a system of older settling ponds (called the Willow Creek Ponds). These ponds are old settling ponds that were constructed during previous operations.

Any discharge from the new settling pond system is routed through a series of ditches to the uppermost pond of the old pond system, which consists of six ponds. Discharge to the Creek from the old system is through an outlet from the Willow Creek Number 1 dam, the NPDES discharge point. (Cambior 1990)

A pump station has the capacity to supply 4,400 gpm to the plant. More detailed information on the pump station was not obtained. The facility operates three diesel boilers to provide steam during winter operations. There are steam lines under the ore pile keep the ore pile from freezing.

3.3 MATERIALS AND WASTE MANAGEMENT

Wastes and materials managed onsite at the Valdez Creek placer mine include large volumes of waste rock and tailings, as well as used or spilled material not uniquely related to mining. In addition other materials, such as mine water are generated onsite. Because these material ultimately become wastes when intended for disposal, they are also addressed here.

3.3.1 Waste Rock

Waste rock was generated during excavation of the pit and consists of overburden removed to access the ore. Waste rock typically consists of poorly sorted glacial material with some lenses of well sorted gravels and cobbles. As discussed previously, according to the Environmental Assessment, the facility extracted approximately 34,000 cubic yards of material each day. During operation, approximately 3,000 cubic yards passed through the wash plant per day. According to facility personnel, the waste to ore ratio is about 11 to 1. Table 3-1 provides the estimated volume of overburden and pay gravels in each of the planned areas. Based on Table 3-1, the stripping ratio for Pit A7 is approximately 13:1 (waste to ore).

Most waste rock is used to backfill older pits, however, there is always an amount remaining to be disposed of elsewhere due to swelling caused by the excavation. The swell factor or ratio for materials at this site was not obtained. The excess waste rock is piled onsite. As discussed later in this section, a solid waste landfill is located on one of the waste rock piles. Chemical analysis of the waste rock was not obtained.

3.3.2 Tailings

Tailings generated at the Valdez Creek Mine can be categorized into three types: one type consist of oversize material generated during the initial stages of washing; a second type consists of a low solids slurry generated as discharge from the wash plant; the third type is generated during final concentration of the gold in the gold room. The volume of tailings generated from each different part of the operation varies greatly, with discharge from the wash plant at a rate of 3,000 gpm, while tailings from the final concentration may be measures in terms of buckets per day.

Tailings separated during initial stages of washing include anything larger than 3/4 inches. This material is generated at both the grizzly (material greater than 6 inch) and the vibrating screens (material greater than 3/4 inch) of the wash plant. Tailings may also contain gold nuggets, discarded from the washplant due to size. According to the facility this material was stored in piles and used to maintain roads onsite. Tailings from the final stages of concentration, where gold concentrate is further separated from gangue using magnetic separation, a jig, a table, and a Knudsen bowl, consist of fine gangue minerals. This material was poured back into the system at the top of the sluice.

The highest volume of tailings generated was the low solids slurry discharged from the wash plant to the sluice ponds. The slurry consists of the less dense gangue minerals (all material less than 3/4 inch that was introduced to the wash plant) and water. Because no chemical additives are used in the wash plant, none are expected in the tailings. Constituent analysis of the water was not obtained.

As discussed previously, these tailings were discharged to a settling pond system. After settling, process water is then reused in the wash plant. The settling pond system is made of three settling ponds in a series with water pumped back to the wash plant from the third pond; only the dam between the first and

second pond is lined. According to facility personnel, the ponds were constructed in two old mining pits; each is approximately five acres in size with the deepest being 20 feet and the other two ranging in depth from five to 10 feet. The ponds have a total capacity of 340 acre-feet (Cambior 1990). Dam and other construction-related details were not obtained. This pond system is intended to totally recycle all wash plant water. In addition to wash plant water, an unspecified volume of effluent from dewatering the pit is also discharged to these ponds (Cambior 1990). Information was not obtained on the estimated amount of water lost to seepage from this pond system.

Although the settling pond system is generally operated as a zero discharge system, during periods of high runoff or plant shutdown, excess water is routed through ditches to the uppermost of six additional settling ponds (Cambior Mining 1990). The lowest of the ponds discharges wastewater to Valdez Creek through a NPDES discharge point. These ponds, called the Willow Creek Ponds, allow additional settling of suspended solids prior to discharge to the Creek. Originally, the ponds were used as settling ponds during previous operations. According to facility personnel, the Willow Creek Ponds are constructed on native compacted soil. At the time of the site visit, the facility was not using the wash plant so mine water and other process water was being discharged to these ponds rather than being pumped back to the wash plant.

The size and theoretical efficiency of these settling ponds is presented in Table 3-2

Table 3-2. Theoretical Efficiency of Settling Ponds
(Source: BLM 1990)

Theoretical Efficiency of Settling Ponds
at Denali Mine (existing)

Structure	Surface Area (acres)	*Water Flow (gpm)	**Overflow (gpm/A)
Settling Pond #1	3.90	5000	1282
		1000	256
		4400	1128
Settling Pond #2	3.80	5000	1316
		1000	263
		4400	1157
Settling Pond #3	4.20	5000	1191
		1000	238
		4400	1047
Settling Pond #4	16.9	5000	295
		1000	59
		4400	260
Settling Pond #5	8.50	5000	588
		1000	118
		4400	517

* Process water rate through system. Maximum flow 5000 gpm, minimum probable 1000 gpm, design flow 4400 gpm.

** To obtain adequate sedimentation, the settling pond is recommended to have an overflow rate of not more than 3700 gal/min/acre. (The overflow rate is the flow rate divided by the surface area of the settling pond.) To obtain maximum sedimentation, the overflow rate should not be more than 860 gal/min/acre.

. The Environmental Assessment and Facility personnel identify five ponds while a letter from Cambior to EPA Region 10 identifies six ponds. According to facility personnel, the additional pond is a small mining pit that water flows through before it reaches the willow creek ponds. Information on the quantity and frequency of settling pond discharge to these settling ponds was not obtained. However, discharge from the lowest pond in the Willow Ponds system through the NPDES discharge point is presented in Table 3-3

Table 3-3. NPDES Discharge Rates
(Source: Cambior 1990)

INSTANTANEOUS DAILY FLOW MEASURMENTS[1]

WILLOW CREEK MINE NO. 1 DISCHARGE PIPE
(GPM)

MONTHS OF:

DATE	SEPTEMBER	OCTOBER	NOVEMBER
1		63	848
2		N.R.	1058
3		N.R.	351
4		N.R.	230
5		17	N.R.
6		5	N.R.
7		17	230
8		17	351
9	2268	17	230
10	2213	17	351
11	2258	17	N.R.
12	1290	N.R.	230
13	1172	N.R.	134
14	574	17	N.R.
15	179	N.R.	N.R.
16	134	37	OUTLET FROZEN
17	N.R.[2]	N.R.	OUTLET FROZEN
18	17	17	OUTLET FROZEN
19	17	17	OUTLET FROZEN
20	17	5	OUTLET FROZEN
21	17	5	OUTLET FROZEN
22	134	0	OUTLET FROZEN

[1] California Pipe Method.

[2] N.R. = No Reading.

Table 3-3. NPDES Discharge Rates (continued)

DATE	SEPTEMBER	OCTOBER	NOVEMBER
23	5	0	OUTLET FROZEN
24	134	0	OUTLET FROZEN
25	63	0	OUTLET FROZEN
26	134	N.R.	OUTLET FROZEN
27	63	N.R.	OUTLET FROZEN
28	37	N.R.	OUTLET FROZEN
29	63	134	OUTLET FROZEN
30	63	1058	OUTLET FROZEN
30	----	494	OUTLET FROZEN

. This discharge is monitored for arsenic, settleable solids and turbidity. According to a single sample taken (date of sampling not obtained), both turbidity and arsenic were slightly above background levels but well below NPDES limits. (Cambior 1990) See Section 3.4 for more information on NPDES compliance.

3.3.3 Other Materials

In addition to mining wastes and materials, the facility generated wastes and materials from routine operations that are not uniquely related to mining. These activities include equipment maintenance, spill clean-up, etc. The facility operated a permitted landfill for disposal of solid waste generated onsite. The main purpose of this landfill is to contain incinerator ash and residue and oil spill material from routine activities at the site. The cell for oil spill material, which is to contain approximately 3500 cubic yards of waste, was located on an old waste rock pile. The cell had a single liner and a leak detection system installed below the liner. During the site visit, facility personnel reported that the containment cell is being re-sealed as the original seams were not sufficiently sealed. As of the date of EPA's site visit, no material had been disposed of in the lined cell. Disposal was expected to begin once the seams have been effectively sealed. According to the Solid Waste Permit Application, the landfill is located away from surface water and is over 200 feet above the regional water table. (Valdez Creek Mining Company 1988) Additional construction details and current usage were not obtained. The oil spill material was generated by previous operators. According to facility personnel, prior to 1988, previous operators disposed of used oil by dumping it into a pit for burning and tires were added to keep the flame burning.

The facility had two methods of trash disposal, a putrescible waste incinerator, and an "air curtain burn box." The incinerator was used for disposal of domestic waste. (Valdez Creek Mining Company 1988) According to facility personnel, wood and other large debris are burned in the burn box, a large steel container. Ash from these operations was disposed of in the landfill. (Valdez Creek Mining Company 1988)

Waste oil was blended with diesel fuel and burned in waste oil furnaces. Wash water was directed to a sump where a skimmer removes grease and oil, which are also burned in the waste oil furnaces. Spent solvents from parts washing were also mixed with the waste oil and burned. The facility has a State permit for the waste oil furnaces. The furnaces were made by Clean Energy Inc. and have a 500,000 BTU capacity. Approximately 8,800 gallons of used oil was generated and burned in June of 1992.

Antifreeze was recycled on site. The facility designed and constructed an antifreeze distillation unit in order to recycle antifreeze. Because of the quantities of antifreeze used, and the difficulty and expense of transporting antifreeze to such a remote site, the facility found recycling of the antifreeze to be cost effective. The quantity of antifreeze recycled was not obtained.

Most of the facility's tires were hauled to a dump in Glenellen. Some tires are also used for lightpole anchors. The facility stored scrap iron and steel, such as worn undercarriages, bucket teeth, chain, plate steel, and pipe, in a forty foot hopper and sent it to a recycler in Anchorage. Approximately 120 tons per quarter is been recycled in this manner. Aluminum is also sent to a recycler at an approximate rate of 20 cubic yards a quarter.

The facility operated two septic systems, one for the main site and one for campers. An additional septic system is located at the Little Idaho camping area.

There are four 15,000 gallon diesel tanks and two 10,000 gallon diesel tanks on site, and this storage area is lined and bermed. Other items stored onsite include antifreeze, solvents, gear lubricant, ANFO, and propane. According to facility personnel, all tanks are above ground. Table 3-4

Table 3-4. Storage Tank Summary

Tank Description	Location	Contents	Capacity (Gal.)	Containment (Gal.)	Factor of Safety
Gasoline Storage	Main Camp	Unleaded Gasoline	6,000	35,000	5.8
Diesel Storage	Main Camp	No. 1 Diesel	15,000	21,000	1.4
Diesel Storage	Main Generator Installation	No. 1 Diesel	500	600	1.2
Lubricant and Waste Oil Storage	Cold Storage Building	Motor Oil Hydraulic Fluid Ethylene Glycol Transmission Fluid Petroleum Naphtha Grease Waste Oil Blending Tank Blending Oil	3,000 3,000 1,000 3,000 3,000 550[1] 275[1] 400lbs 16,000[2] 6,000 10,000	14,500[3]	1.3
Miscellaneous Drum Storage	Maintenance Shops	Transmission Fluid Petroleum Naphtha	220[1] 110[1]	Operating Controls [4]	N/A
Diesel Storage	Wash Plant Generator	No. 1 Diesel	500	6,000	12.0
Diesel Storage	Sample Laboratory Generator	No. 1 Diesel	250	300	1.2
Diesel Storage	Operations Staging Area	No. 1 Diesel Transmission Fluid Petroleum Naphtha and Lubricants	15,000 15,000 15,000 27,50[1]	350,000	23.3
Diesel Storage	ANFO Mix Truck	No. 1 Diesel	230	Operating Controls [4]	N/A
Aviation Fuel Storage	Airstrip	Aviation Fuel	275		
Diesel Storage	Pump Installation	No. 1 Diesel	120[5]		
Diesel/Lubricant Storage	Mobile Fueling and Lubrication Equipment	No. 1 Diesel Fuel/ Lubricants	3,000 1,300	Operating Controls4	N/A

Notes: [1] Drum Storage (Capped 55 gallon drums on pallets).
[2] Waste Oil Storage Tank active level is less than or equal to 2/3 capacity (10,700) gallons).
[3] Containment capacity for Lubricant and Waste Oil Storage includes 5,000 gallons existing curb capacity, 7,000 gallon existing sump capacity, and 2,500 gallon proposed additional curb capacity.
[4] Operating controls include temporary berms, regular inspections and specific operating practices as appropriate.
[5] Fuel storage at any given pump installation does not exceed 120 gallons.

Source: Spill Prevention Control and Countermeasures Plan and Oil Discharge Prevention and Contingency Plan, January, 1992.

provides a list of tanks onsite.

3.4 REGULATORY REQUIREMENTS AND COMPLIANCE

The Valdez Creek Mine was subject to both State and Federal regulatory requirements and their attendant permits. Because the operation is located on Federal land under the jurisdiction of the Bureau of Land Management, the facility has prepared a Plan of Operations to satisfy BLM requirements. The facility has an NPDES permit issued by the EPA Region X, as well as several dredge and fill permits from the Army Corp of Engineers. State permits include dam safety and solid waste disposal. The State of Alaska has an optional annual placer mining permit; according to facility personnel, Cambior has not applied because the permit is optional. The State has no reclamation requirements; however, BLM has requirements for reclamation with a schedule of acreage in the Plan of Operations.

3.4.1 Federal Permits

3.4.1.1 Bureau of Land Management

Because the facility is located on Federal lands, BLM requires a Plan of Operations. BLM approved the Valdez Creek Plan of Operations on June 19, 1990; the Plan is effective for five years.

Reclamation requirements include a schedule for reclamation of acreage, as specified in the Plan of Operations. The Plan addresses smoothing of the pit walls, creek beds, old ponds and old roads. The facility is working on areas U and V this year, and is using aerial seeding as a method as hydroseeding has not worked well in the past (see Figure 3-2). The facility recontours slopes to 3:1 or shallower. Grass, clover and willow have been seeded. According to the facility, the total acreage reclaimed in 1992 is approximately 180 acres; the facility plans to reclaim 135 new acres and 45 old (previously reclaimed) acres each year. Specific details describing any problems that may arise with reclamation, other than access to areas with the hydroseeding equipment, were not obtained. According to facility personnel, immediate plans for reclamation include the A6 Pit this year (see Figure 3-2).

3.4.1.2 Army Corp of Engineers

The facility has an Army Corp of Engineers CWA Section 404 permit for construction of the diversion dam. It was issued on August 11, 1990 and expires in 1995. The Corps. has also issued smaller permits for culverts and other smaller disturbances. These permits were not obtained.

3.4.1.3 Environmental Protection Agency

NPDES Permit

The Environmental Protection Agency's Region X Office has issued an NPDES permit to the facility. The permit, number AK002497-0, was issued on July 10, 1989 and is effective for five years. Effluent limitations set in the permit include: Turbidity 398 NTU's above background; settleable solids 0.2 ml/l; and total arsenic 0.05 mg/l. As discussed previously, discharge is from the Willow Ponds system through a pipe in Willow Creek dam. Table 3-3 shows discharge rates for a season. Discharges may be exempt from the numeric limits if the facility qualifies for the "Storm exemption" in part I.D. of the permit. They apparently availed themselves of this exemption three times from December 1990 to November 1991, when storm events exceeded the 5-year 6-hour storm (the quantity required to be stored to qualify for the storm exemption). The facility is required to monitor their discharge once per season for arsenic and turbidity and once per day (during discharge) for settleable solids.

According to a single sample taken (date of sampling not obtained), both turbidity and arsenic were slightly above background levels but well below permit limits. In addition, there were three exceedances of the settleable solids, two in May and one in August 1991. According to the facility, these exceedances reflect natural events. (Cambior 1990) Additional compliance data was not obtained.

Hazardous Waste

Cambior generates hazardous waste at the Valdez Creek mine in the laboratory and is considered a conditionally exempt small quantity generator. The waste, mercuric nitrate, is generated in a solution from washing of the amalgam bead used in analysis of drill cores in the lab. The SIC code is 1041. The facility has a generator ID Number, AKD982656761.

3.4.2 State Permits

3.4.2.1 Dam Safety

The facility has State Dam Safety Permits, which are divided into 3 sections: the settling ponds (also called Willow Creek ponds); the diversion dam (also called the Aspen 4 Dam); and the sluice ponds. There are 5 Willow Creek Ponds, each is approximately 10 acres each. They were constructed of native compacted soils with no liner or grout and have decants and spillways.

The diversion dam, as described previously, is approximately 200 feet wide and over 25 feet tall with a crest width of approximately 50 feet. The area impounded during breakup is two to three times the normal impoundment size of 25 acres and reaches a maximum of approximately 100 acres. Typically, the water is only a few feet deep; but at breakup it may reach 10 feet in depth. The diversion ditch leads approximately 5,000 feet downhill, from the diversion dam to the point where it discharges to the creek. The diversion ditch is lined with a synthetic liner and rip-rap to prevent erosion and downcutting.

The sluice ponds are actually old mining pits A4 and A5 and are called the E4 and E5 wash plant ponds. There are actually three ponds in this system, each approximately five acres in size with the deepest being 20 feet and the others ranging from five to 10 feet deep. The dam between the first and second ponds is lined with a synthetic liner due to seepage problems. The ponds are used to recycle water from the wash plant. Tailings are discharged from the wash plant into the primary settling pond, which discharges to the secondary settling pond and then to the tertiary settling pond, where water is reclaimed and pumped back to the wash plant. Cambior has had several problems with pond 2, which has failed twice. At the time of the site visit, the dam had been reconstructed and lined and Cambior was refilling the pond with water to test its integrity. Cambior expects a final permit for this pond when the construction is finished.

3.4.2.2 Diversion Channel

On November 2, 1992, the Alaska Department of Environmental Conservation issued a Certificate of Reasonable Assurance, in accordance with Section 401 of the Clean Water Act of 1977, for the placement of fill material into wetland areas. Approximately 30,229,400 cubic yards of fill will be discharged into 317 acres of waters of the U.S. (wetlands) for the construction of the 4800 foot long Stage II lined diversion channel. The existing one mile long Stage I diversion channel has been designated, by this Department, as a mixing zone for the flushing of the new lined channel. As a condition of the Department's issuance of the Certificate of Reasonable Assurance, Cambior is required to have a

third party conduct water quality monitoring, for turbidity and settleable solids, during the actual flushing of the new channel.

3.4.2.3 Alaska Fish and Game

Alaska Fish and Game has issued a permit to move fish from below the facility to above the diversion dam during spawning. Cambior has retained the services of Potterville Specialties Service and Northern Alaska Fisheries Services to move the fish each year. The activities take place several days each week over a period of about a month and a half in the spring. According to Cambior personnel, the facility appears to be dealing with two distinct fish populations.

3.4.2.4 Solid Waste Permit

The facility has permits for two landfills, a putrescible waste incinerator, and an "air curtain burn box." (Valdez Creek Company 1990). According to facility personnel, the facility also has a permit to operate used oil furnaces; this permit was not obtained during EPA's site visit. According to facility personnel, oil filters are no longer burned in the burn box as specified in the permit by direction of a DEC inspector.

According to the Alaska Department of Environmental Conservation (DEC), the facility has one Solid Waste Disposal Permit, which expires in November 1993. The permit allows for the seasonal disposal of oily soil, incinerated camp waste, and non-combustible residue into lined containment cells at the mine site. There is no limit as to the number of individual cells that can be developed under this permit.

Used oil filters were previously being burned in the burn box. State regulations concerning open burning, prohibit the burning of oily wastes or other materials that give off black smoke, without written permission from the Department. Due to a potential air quality violation, Cambior personnel were instructed by a Department inspector to dispose of used oil filters in the lined containment cells.

Currently, new State Solid Waste Management Regulations are being developed in preparation of the new EPA Solid Waste Regulations that will become effective no later than October 1993. At this time, it is uncertain how these new regulations will affect the renewal of Cambior's solid waste disposal permit.

3.4.3 Inspections and Compliance Incidents

3.4.3.1 Inspections

Department of Environmental Conservation

According to Cambior personnel, DEC inspects the facility once per year to review waste management, including the incinerator and burn box, the septic system, trash and other solid waste disposal, as well as water quality. According to the Alaska DEC, there were three inspections during 1991 and one inspection in 1992 (as of November 1992). The most recent unannounced inspection occurred approximately three weeks prior to EPA's site visit. According to Cambior, the inspector verbally noted erosion on the side of the diversion channel caused by breakup but did not send a report to the facility in writing. According to Cambior, the State typically does not send inspection reports to the facility unless there is a serious problem.

The Little Idaho campground is located on land within the claim block that Cambior Ak leases from BLM. Little Idaho is not a public campground and is restricted by Cambior to employee use only. The drinking

water and wastewater disposal systems at the camp serve a bath/toilet house and RV dump station available to campers. There are no individual water or sewer hookups to the camping spaces. The campground is used seasonally during summer months only.

Construction approval, for both water and sewer systems, was issued by this Department in the Summer of 1992. The sewer system, after construction, was put into use by Cambior without a final operating approval from this Department. A 30-day interim operational approval was issued for the water system only, which expired September 6, 1992. Final operational approvals for these systems have not yet been issued, and are pending submittal and approval of engineers as-builts of the installed sewer system and satisfactory water sample analysis results on the water system.

Bureau of Land Management

Representatives from the BLM visited the site one week prior to EPA's site visit. BLM voiced concern about uncontrolled camping. Little Idaho is a permitted camping area for employees provided by Cambior. The BLM expressed concern over camping outside of designated areas by others visiting the area. The number of visitors increases especially during hunting season. According to Cambior personnel, Little Idaho is outside of the active mining area on public land.

Mine Safety and Health Administration

The Mine Safety and Health Administration inspects the facility twice a year. The most recent inspection prior to EPA's site visit was in March of 1992. There were a number of violations cited with the most serious addressing a ladder in a culvert with no safety loops and "dumpover," where a truck backs to the very edge of a pit and dumps its load. The preferred method is to dump and then use a dozer to push material to the edge of the pit. Noise and dust at the washer plant, and at drills and dozers were also reviewed with no citations issued. The fines for this inspection totalled approximately $600.

3.4.3.2 Compliance Incidents

Waste Oil

According to facility personnel, an oil spill was identified in the area surrounding the generator shack. The facility attributed the release to drips over several years of operation. Approximately 75 cubic yards of contaminated soil were excavated and will be disposed on site in a containment cell permitted by the State. According to facility personnel, prior to 1988, previous operators disposed of used oil by dumping it into a pit for burning and tires were added to keep the flame burning. According to Alaska DEC, some, but not all, of the contaminated soil has been excavated and disposed of in a containment cell covered by the Solid Waste Disposal Permit. In addition, in 1991, extensive oil spill contamination was discovered in an outside area known as the "dead line," which is used for heavy equipment storage and repairs. The Department required that a third party consultant conduct a site assessment and corrective action plan for these two contaminated areas. To date, these two contamination issues are still unresolved.

During this Department's June 1992 inspection, it was noted that Cambior had improved maintenance practices and preventative procedures to help prevent soil contamination. Small quantity releases occur fairly often at the mine site from such things as equipment hydraulic line breakage, and outside equipment maintenance, including oil and fluid changes, and leakage of fluids from equipment awaiting repairs.

A contaminated waste management plan, submitted by Cambior on September 9, 1992 was found to be unacceptable to the Department. The plan included a spring cleanup of contamination occurring during the winter months, periodic cleanup during the summer months, and "reportable" spills to be cleaned up immediately. The plan did not include how a determination would be made to insure adequate cleanup or how appropriate minimum target cleanup levels would be met. State regulations require all spills to be cleaned up immediately. Cambior is revising their waste management plan to meet state regulations and the concerns of the Department.

Fuel Spill

According to facility personnel, approximately three to four years ago a truck dumped fuel on the ground. No additional details concerning this spill were obtained.

Dam Failure

October 27, 1991, the first pond of the three sluice ponds used by the facility failed and released approximately 50 million gallons of tailings water into Valdez Creek. As required by the Alaska DEC, the facility conducted TCLP testing on the sediments and found no toxic contamination. The Department further required the deposited sediments to be pulled back from the creek to prevent spring breakup high water flows from eroding the sediments and creating a water quality violation of turbidity and settleable solids. Stabilization of the slope, and silt fences to protect the quality of the creek, were also required by the Department. During the actual releases, it is highly suspected that water quality standards were drastically exceeded downstream within Valdez Creek. On May 25, 1992, the same pond failed during testing and approximately 15 million gallons of water were released into the creek. At the time of the site visit, the dam had been reconstructed, with a liner and piezometers, and facility personnel were preparing to fill and retest it. No other details on these failures were obtained. It is unclear whether the releases of water caused exceedance of arsenic and other water quality standards downstream on Valdez Creek. According to the DEC, water quality monitoring was not conducted by Cambior during the two dam failure events.

3.5 REFERENCES

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APPENDIX 3-A

COMMENTS SUBMITTED BY CAMBIOR ALASKA INC., ON DRAFT SITE VISIT REPORT

The letter reproduced in this appendix accompanied a copy of the draft site visit report on which Cambior Alaska Inc., had made comments and corrections. A copy of the marked-up draft is not reproduced here for brevity's sake. In general, Cambior's comments were clarifying in nature, providing information that the draft report indicated had not been obtained during the site visit or correcting minor factual errors in the draft. EPA's response to Cambior's comments are provided in Appendix B.

APPENDIX 3-B

EPA RESPONSE TO COMMENTS SUBMITTED BY CAMBIOR ALASKA INCORPORATED ON DRAFT SITE VISIT REPORT

EPA Response to Comments Submitted by
Cambior Alaska Incorporated
on Draft Site Visit Report

EPA has revised the report to incorporate all of the comments and suggestions made by Cambior Alaska Incorporated. In some cases, EPA made minor changes to wording suggested by Cambior in order to attribute the changes to Cambior or to enhance clarity.

APPENDIX 3-C

COMMENTS SUBMITTED BY THE STATE OF ALASKA ON DRAFT SITE VISIT REPORT

APPENDIX 3-D

EPA RESPONSE TO COMMENTS SUBMITTED BY THE STATE OF ALASKA ON DRAFT SITE VISIT REPORT

EPA Response to Comments Submitted by
The State of Alaska
On Draft Site Visit Report

EPA has revised the report to incorporate all of the comments and suggestions made by the State of Alaska. In some cases, EPA made minor changes to wording suggested by the State.