FINAL REPORT

ENVIRONMENTAL EVALUATION OF POLLUTANTS IN SITKA, ALASKA

BASED ON A RECONNAISSANCE SURVEY CONDUCTED AUGUST 26-31, 1990, BY

U.S.ENVIRONMENTAL PROTECTION AGENCY, REGION 10, IN COOPERATION WITH U.S. FISH AND WILDLIFE SERVICE AND ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

October 1991

Prepared by:

U.S. Environmental Protection Agency, Region 10
Health and Environmental Assessment Section
Environmental Services Division
1200-Sixth Avenue, ES-098
Seattle, WA 98101

ENVIRONMENTAL EVALUATION OF POLLUTANTS IN SITKA, ALASKA

EXECUTIVE SUMMARY

Sitka, Alaska is in the southeastern end of the state. Primary activities in the area are tourism, fishing and pulp and paper production. Local citizens are concerned about their exposure to toxic chemicals, specifically dioxin, which may be released as a result of pulp mill operations. In response to this concern, the U.S. Environmental Protection Agency (EPA), in cooperation with Alaska Department of Environmental Conservation (ADEC) and the U.S. Fish and Wildlife Service (USFWS). conducted a reconnaissance survey for chemical contaminants in Sitka and the surrounding areas during August 26-31, 1990.

During June, July and August 1990 the State of Alaska Department of Environmental Conservation (ADEC) completed an analysis of dioxins and furans in ash and sludge samples near the pulp mill. Their data are also included in this evaluation.

The results of the reconnaissance survey for chemical pollutants in the Sitka area are described in two parts. The first part (Section II) includes the results of the reconnaissance survey for approximately 250 inorganic and organic chemicals as well as a detailed discussion of sampling and analytical methods for dioxins and furans. Measurements of dioxins and furans in environmental media (ash, sludges and sediments) for which there is no direct human exposure are also described in the first part. A preliminary risk assessment for exposure to dioxins and furans by people living in Sitka is presented in the second part (Section III).

Very low concentrations of dioxins and furans were found in the Sitka area. At these low concentrations, using worst case exposure assumptions, the likelihood of health effects occurring is also very low. The analysis presented in this report is not intended to be considered a formal risk assessment. The results may be used to determine if additional sampling and analysis are warranted.

The conclusions reached in this report are based on limited sampling of the following environmental media for dioxins and furans:

1) ash from the APC mill,
2) floating residue in Silver Bay,
3) leachate and sludge from the city landfill,
4) sediment from Silver Bay and Blue Lake,
5) soil from Sitka and surrounding areas,
6) water from Blue Lake, and
7) seafood from Silver Bay, Thimbleberry Lake and Blue Lake.

Trace levels (0 to 22 parts per trillion) of dioxins and furans were found in floating residue, soils and sediments. These levels appear to be similar to background concentrations reported for the U.S. and other countries throughout the world. No dioxins or furans were found in leachate from the landfill and water from Blue Lake. The highest levels were found in ash from the pulp mill power boilers. High concentrations of dioxins and furans in ash from incinerators have been previously documented in other municipal and industrial settings.

Seafood from Silver Bay also contained trace levels of dioxins and furans. The range in concentration from (0 to 3 parts per trillion) is similar to other background levels measured in the U.S.

The results of the reconnaissance survey for other potential pollutants in the Sitka area are summarized below:

> The degradation of water quality, demonstrated in previous studies, continues. Dissolved oxygen at depth was below levels considered adequate to support marine life. pH was below normal levels in surface waters. Organic material on the seafloor was built up considerably over pre-discharge levels. This blanket of solids depletes oxygen in sediments and bottom water, greatly affecting benthic organisms. Suspended solids and color in the upper water column can reduce photosynthesis adding further stress to the marine ecosystem.
>
> Sediments, water and soils were sampled for the presence of more than 250 inorganic and organic chemicals. Several contaminants found in the sediments and water of Silver Bay may be a threat to the health of the aquatic organisms. Based on a comparison with values used to assess marine sediments in Puget Sound, Washington, 4-methylphenol, benzoic acid, and phenol may affect the aquatic organisms which live in the sediments. Copper and zinc in Silver Bay exceeded EPA's ambient water quality criteria for marine life.

II. RECONNAISSANCE SURVEY

A. Methods

1. Sampling

The sampling objectives were to: (1) evaluate the potential accumulation of dioxins and furans and metals in air emissions from the Alaska Pulp Corporation pulp mill (APC) into surface soils, Thimbleberry Lake fish, and Blue Lake water, fish, and sediment; (2) evaluate the presence of dioxins and furans, metals, and organic contaminants in the marine environment near the APC effluent discharge (for this study, marine sediments and biota were examined for dioxins and furans, but water column samples were not); and (3) evaluate the presence of dioxins and furans and metals in the City landfill and potential release of these contaminants from the landfill by sampling the ash at APC and sampling leachate and sludge at the City landfill. Table 1 summarizes details about the samples collected and lists the general types of contaminants that were evaluated.

Field Sampling

Marine sampling and freshwater sampling were conducted with the assistance of the USFWS. The vessel Curlew was used to occupy sampling stations and conduct the trawl as described below. A skiff was used to deploy and retrieve gill nets, set lines, and crab pots. An inflatable boat was used to collect samples at Blue Lake.

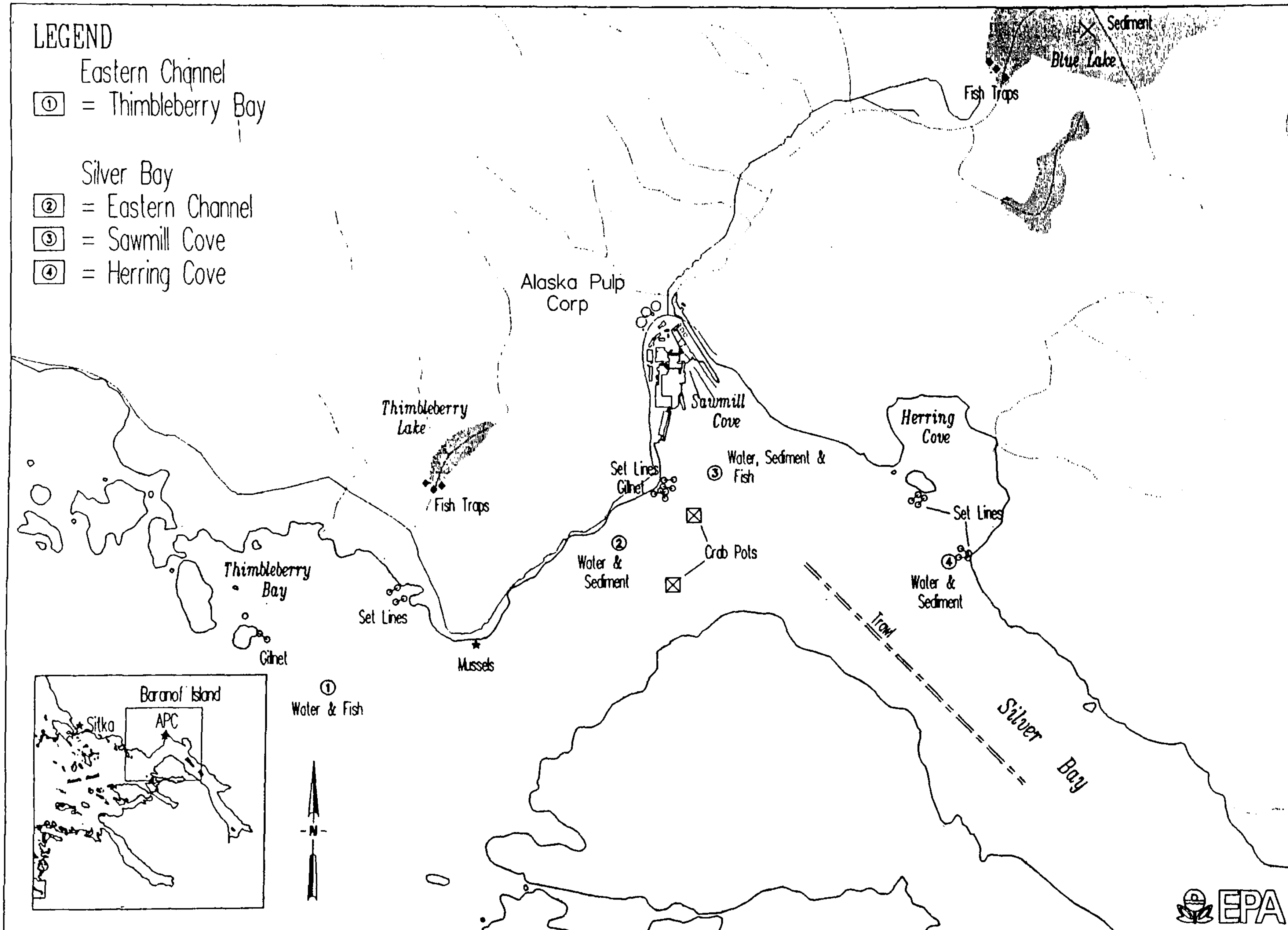
Marine Sampling

Water: Locations were chosen to (1) reflect increased distance from APC, (2) be within close proximity (less than 2.5 miles) to APC, (3) sample in Silver Bay as well as Eastern Channel, and (4) sample near or in Sawmill Cove. Based on vessel operation considerations, stations were occupied where water depth was approximately 60 meters. Four stations were occupied, one in Thimbleberry Bay (Station 1, off of Eastern Channel) and three in Silver Bay (Station 2, in the western arm of Silver Bay, between Sawmill Cove and Eastern Channel; Station 3, at the entrance to Sawmill Cove; and Station 4, near the southern point of the entrance to Herring Cove). The four stations are named for nearby water bodies; their locations are shown in Figure 1. Approximate station locations were plotted using distances and relative compass bearings indicated on the Curlew's radar. Sampling dates and times are in Appendix C-4, Table 1.

A Hydrolab unit was used to measure depth (m), temperature (°C), pH, and dissolved oxygen (mg/L-uncorrected). The unit was calibrated in the morning and evening each day it was used. Because this particular unit was not configured to measure conductivity in seawater, salinity was estimated based on surface, mid-depth, and bottom grab samples analyzed by use of a refractometer at the EPA Region 10 lab.

Table 1. Summary of information on sample collection and analysis. Matrix sampled, location of sample, collection method, contaminants measured, and laboratory where analyzed.

Matrix	Location	Sampling Method	Measurement	Analysis
SEDIMENT AND SLUDGE				
Marine Sediment	Silver Bay: 3 stations Eastern Channel (#2) Sawmill Cove (#3) Herring Cove (#4)	Van Veen grab composite of 4 grabs	Dioxins & furans Sediment particle size Total organic carbon Metals & organics	EPA Duluth Contract lab Contract lab EPA Region 10
Lake Sediment	Blue Lake: 1 station	Petite Ponar grab	Dioxins & furans Sediment particle size Total organic carbon Metals & organics	EPA Duluth Contract lab Contract lab EPA Region 10
Landfill Sludge	City Landfill: leachate collection sump	Grab, using stainless steel spoon	Dioxins & furans Sediment particle size Total organic carbon Metals & organics	EPA Duluth Contract lab Contract lab EPA Region 10
WATER AND LEACHATE				
Marine Water	Silver Bay: 3 stations Eastern Channel (#2) Sawmill Cove (#3) Herring Cove (#4) Thimbleberry Bay: 1 Sta.	Composite of top, mid, & bottom of water col. Brass Kemmerer for organics, plastic for metals	Metals & organics Salinity (separate anal. for for top, mid, & bot.)	EPA Region 10 EPA Region 10
		In situ measurements every 10 m water depth	T, DO, pH	Hydrolab
Lake Water	Water Treatment Plant	Grab at pressure relief valve	Dioxins & furans Metals & organics	EPA Region 7 EPA Region 10
Leachate	City Landfill: leachate collection sump	Grab, using large collection bottle	Dioxins & furans Metals & organics	EPA Duluth EPA Region 10
	Herring Cove: hogfuel storage area	Grab	Dioxins & furans Metals & organics	EPA Duluth EPA Region 10
SOIL AND ASH				
Soil	10 stations: Sitka City: N, central, S, Japonski Galankin I, Mill (APC) Jamestown Bay Thimbleberry Bay Blue Lake-launch ramp Deep Inlet (background)	Composite of 4 grabs (5 at Deep Inlet) Collected using stainless steel spoons	Metals Dioxins & furans	EPA Region 10 Contract lab (7) EPA Region 7 (5) (both labs analyzed samples from the Mill & Galankin I.)
Power Boiler	2 stations: Bottom ash Multiclone ash	Grabs, collected with spatulas (bottom ash) or jar (multiclone)	Dioxins & furans Metals	EPA Duluth EPA Region 10 (bottom ash only)
TISSUE				
Marine	Herring Cove	4 set lines		
		Quillback rockfish (2)	Dioxins & furans	EPA Duluth
	Thimbleberry Bay - E.end	2 set lines		
		Pacific sanddab (10)	Dioxins & furans	EPA Duluth
		Quillback rockfish (1)	Dioxins & furans	EPA Duluth
	- Entrance to Silver Bay	Grab-hand collection		
		Mussels (jar)	Dioxins & furans	EPA Duluth
	Sawmill Cove - SW side	Gill net & 3 set lines		
		Quillback rockfish (3)	Dioxins & furans	EPA Duluth
		Pac. stag. sculpin (5)	Dioxins & furans	EPA Duluth
		Crab pots		
		Dungeness crab (2)	Dioxins & furans	EPA Duluth
	Silver Bay - main channel	Trawl		
		Shrimp (150)	Dioxins & furans	EPA Duluth
		English sole (5)	Dioxins & furans	EPA Duluth
Lake	Blue Lake - near boat launch	Minnow traps		
		Rainbow trout (3)	Dioxins & furans	EPA Duluth
	Thimbleberry Lake - near trail end	Minnow traps		
		E. brook trout (4)	Dioxins & furans	EPA Duluth



LEGEND
Eastern Channel
① = Thimbleberry Bay
Silver Bay
② = Eastern Channel
③ = Sawmill Cove
④ = Herring Cove
Alaska Pulp Corp
Sediment
Blue Lake
Fish Traps
Thimbleberry Lake
Fish Traps
Sawmill Cove
Herring Cove
Set Lines
Gillnet
③ Water, Sediment & Fish
Set Lines
② Water & Sediment
Crab Pots
④ Water & Sediment
Thimbleberry Bay
Set Lines
Gillnet
Mussels
Trawl
Silver Bay
① Water & Fish
Baranof Island
Sitka
APC
N
EPA

At each station, surface, mid-depth, and bottom grab samples were composited. A brass Kemmerer sampler and a PVC Kemmerer sampler were used to collect samples for organics and metals analyses (respectively). Collection containers were filled one third from each grab, except for samples destined for volatile organics analysis (VOA). For VOAs, separate containers were filled from each grab. These were later combined at the EPA Region 10 lab to produce a composite sample prior to analysis. A few drops of acid were added to the VOA samples. Water samples were provided to USFWS for their use in conducting bioassays. Each Kemmerer sampler was rinsed with methylene chloride and then distilled water between uses.

Sediment: A stainless-steel, 0.1-m2 Van Veen sampler was used to collect marine sediments. A maximum of 10 attempts was made at each of the stations to obtain 4 acceptable grabs. Despite problems such as failure of the sampler to trip, washout due to wood, rocks, or trash in the jaws, canted sample, shallow penetration, etc., grabs were collected successfully at 3 of the stations (at Thimbleberry Bay, no successful samples were obtained within 10 attempts due to the rocky substrate). At these three stations a single sediment sample was obtained by compositing subsamples from separate grabs. The sediment VOA samples were collected from the first successful grab except for the Eastern Channel Sample in the western arm of Silver Bay, when a composite was used. All traces of sediment were rinsed from the Van Veen sampler using ambient seawater prior to each successive grab attempt. At each site, a new, cleaned (and previously foil-wrapped) stainless steel spoon was used to transfer and mix sediments.

Tissue: Set lines, gill nets, crab pots, pole and line, a bottom trawl, and collection by hand in the intertidal were used to obtain organisms for tissue analysis. The sampling sites (Figure 1) were located within the vicinity of APC and the water and sediment sampling stations. Organisms were identified, measured, weighed, and evaluated for external evidence of problems such as lesions or tumors. Next, in accordance with the protocols established for the National Bioaccumulation Study (USEPA 1989), they were wrapped in foil and frozen. Mussels were collected from the intertidal into a glass jar and then frozen.

A variety of marine organisms was caught. Shrimp (mixed), mussels and crabs were the shellfish selected for analysis. Crab hepatopancreas and the remainder of the crab body were analyzed separately. In consultation with NOAA personnel familiar with the effects of sediment contamination on fish as well as fish life histories (Long 1990), Pacific sanddab, English sole, and Pacific staghorn sculpin were selected for analysis. Quillback rockfish were collected from 3 of the 4 marine sampling stations; these were analyzed to investigate the variability in tissue contamination across stations.

Freshwater Sampling

Water: A water sample was obtained August 30, 1990, at the Water Treatment Plant northwest of APC. Water from Blue Lake is piped down to the plant. Sample jars were filled directly from the pressure relief valve.

Sediment: A sample of sediment at Blue Lake was collected on August 30, 1990, by compositing grab samples from two locations (approximately 150 ft water depth on the west side of the lake and 50 ft water depth on the east side), using a Petite Ponar grab sampler, deployed 100 ft from shore (Figure 1).

Tissue: Minnow traps were used to collect fish from Thimbleberry Lake and Blue Lake (Figure 1). Fish were identified, measured, weighed, and evaluated for external evidence of problems such as lesions or tumors. In accordance with the protocols established for the National Bioaccumulation Study (USEPA 1989), fish were wrapped in foil and frozen. Rainbow trout from Blue Lake and Eastern brook trout from Thimbleberry Lake were submitted for analysis.

Soil Sampling

Preliminary sampling locations that were identified included day care facilities, schools, playgrounds, residences, and areas potentially in the path of air emissions from APC, recognizing the possible confounding influence of the Sitka City incinerator. Final locations were chosen based on a survey, August 29, 1990, of Sitka, Japonski Island, and areas in vicinity of the road leading from town to APC. A reference location, assumed to be away from the influence of APC or City emissions was selected at the head of Deep Inlet. As shown in Appendix C-6 and Figures 2 and 3, at each of 10 locations, composite samples of four aliquots (5 at Deep Inlet) were collected for analysis. A field replicate was collected at APC. At each location, a new, cleaned (and previously wrapped) stainless steel spoon was used to transfer soils from the top 0.5 to 1 inch into collection jars. The field replicate was collected by spooning soil into two sets of jars.

Landfill Sampling

At the landfill (Figure 2), on August 31, 1990, samples of leachate and sludge were collected from the catch basin. A field transfer blank sample (transferring distilled water to containers while on site) was also collected.

The leachate water was collected by dipping a glass 1 gal jar into the catch basin then filling the sample jars from this grab. The "sludge" that had collected in the bottom of the basin was scooped out with a stainless steel spoon. Each scoop was apportioned among the sample jars. No acid was added to the sediment VOAs.

APC Ash Sampling

Ash samples were collected in the power house (Figure 3). Bottom ash was collected from the power boilers. The power boilers produce ash which remains at the bottom of the boiler on the first floor of the power house. This ash is raked into dumpsters. A composite, representative sample of power boiler bottom ash was scooped out of the hoppers using a wooden spatula. On the third floor of the power house, exhaust from the boilers passes through multiclones which connect the power boilers with the electrostatic

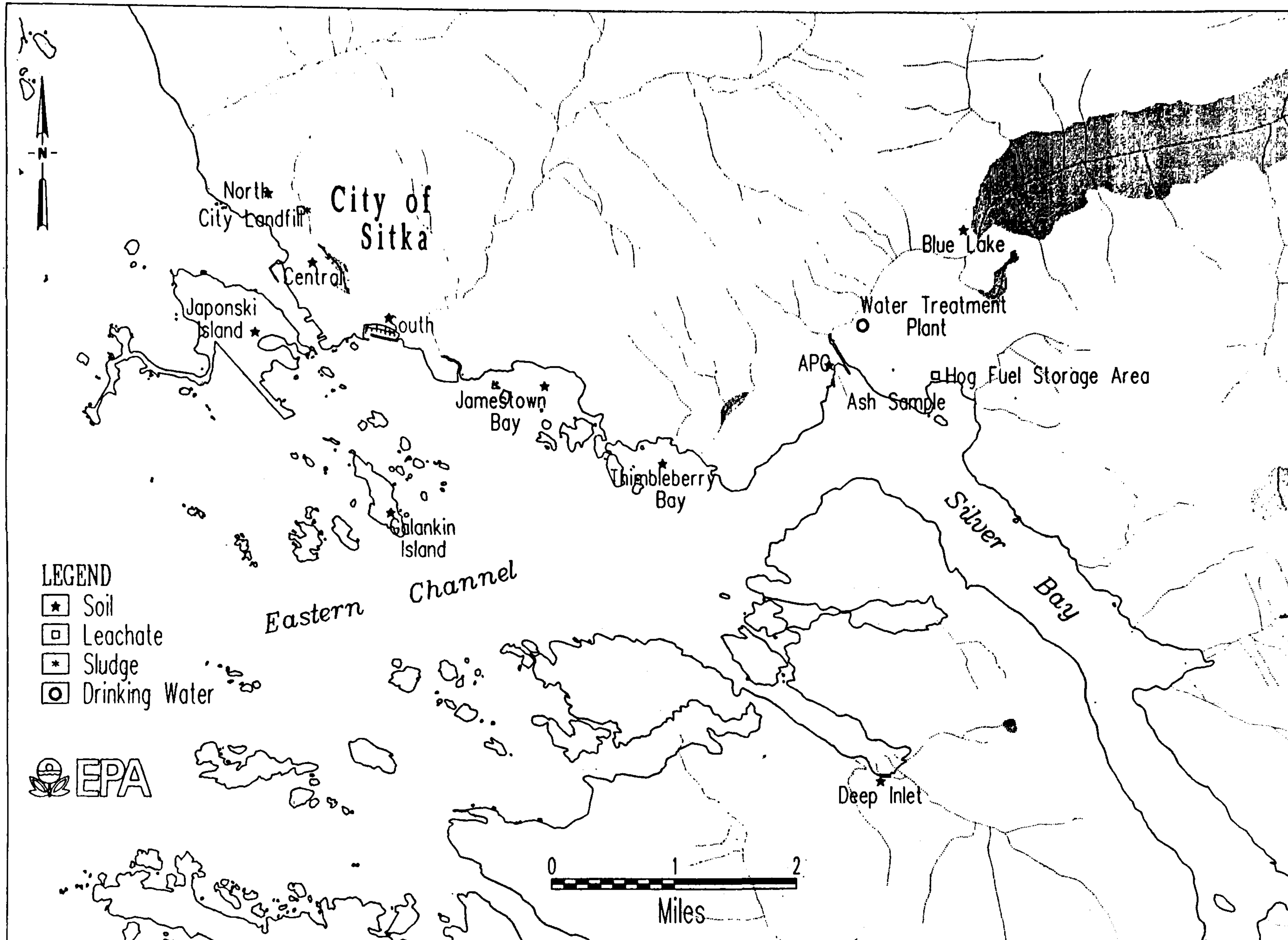


Figure 2. Location of soil, leachate, leachate-sludge, ash (from APC), and drinking water (from Blue Lake; at the water treatment plant) samples in and around Sitka, AK (August 26-31, 1990).

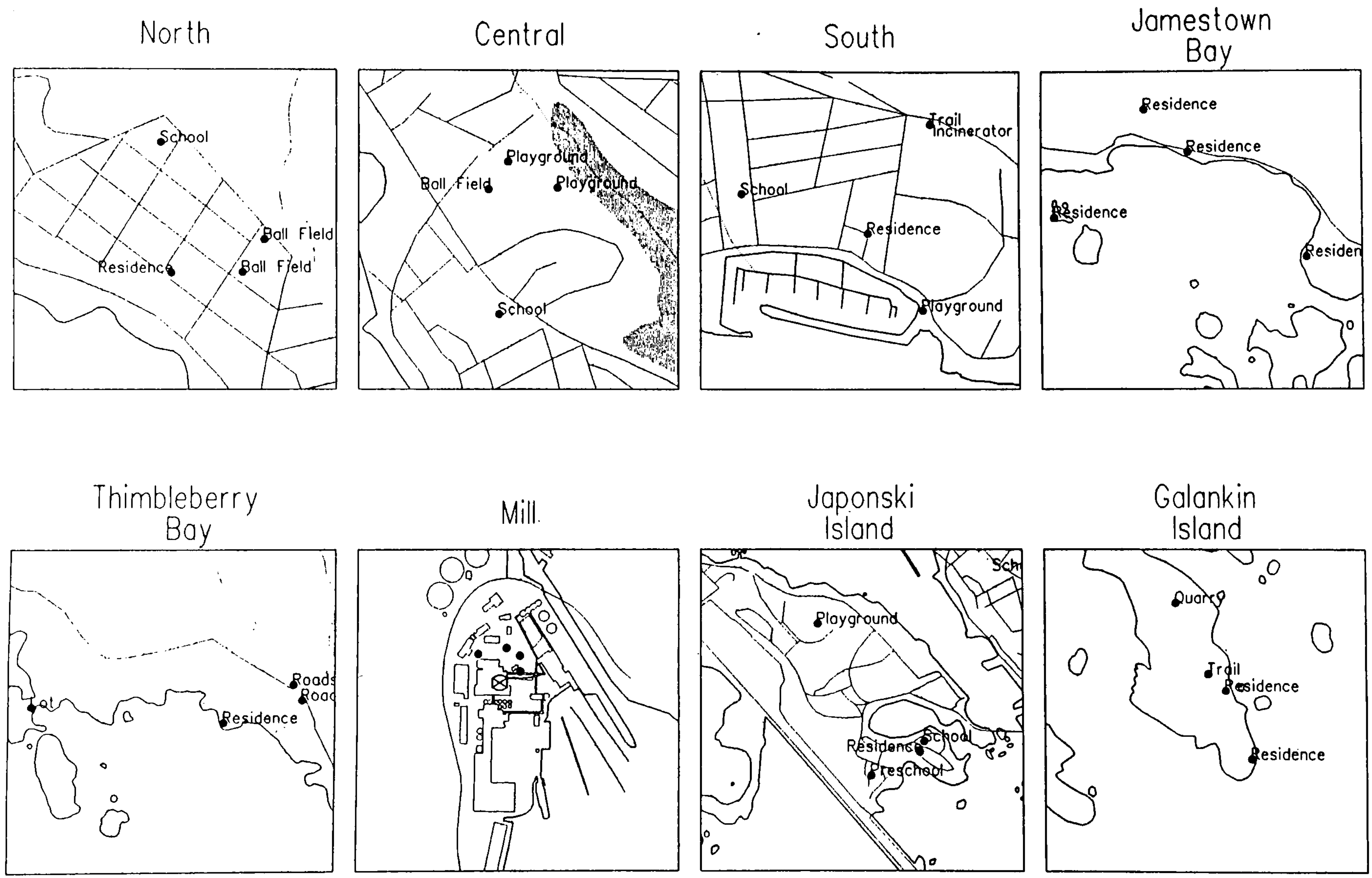


Figure 3. Location of individual subsamples used to produce the composite soil samples, for 8 of the 10 stations (Blue Lake and Deep Inlet samples are not shown). The X at the Mill indicates the location of the ash samples.

precipitator (ESP). The multiclones remove large particles of ash which drop down into a wet whirler. The remaining boiler exhaust continues to the ESP where fly ash is removed (fly ash was not sampled). A composite sample of the multiclone ash was obtained by APC personnel who held a jar through the observation ports and collected the ash as it fell down from the multiclone, before it reached the wet whirler.

Quality Assurance/Quality Control

A QA plan was developed for this sampling effort (Appendix D). In the field, two QA samples were collected: A field duplicate sample for the soil sampling conducted at APC; and a field transfer sample obtained when sampling at the City landfill catch basin.

Laboratory QA procedures involved matrix spikes, duplicates, and blanks. These were analyzed to provide information on analytical reliability and variability and to qualify data when necessary.

Other Contemporaneous Sampling

The Alaska Department of Environmental Conservation (ADEC) collected samples of floating residue from Silver Bay and Eastern Channel and fly ash samples from the mill (ENSECO 1990, 1991). The power boiler fly ash samples were collected June 21, 1990, from the location where the electrostatic precipitator conveyor screw drops the fly ash into collection bags. A 1 L grab sample was collected at the end of each of three 8 hr periods for a total of 3 samples.

Five grabs of floating residue were collected July 20, 1990 (3 samples within 100 ft of the log booms and 2 samples near the log pullout area in Sawmill Cove) and composited for a single analysis of residue in Sawmill Cove. Two additional residue samples were collected August 8, 1990, from Eastern Channel (one near the east end of Thimbleberry Bay and one from the midpoint of Eastern Channel, south of the west end of Jamestown Bay).

During the present survey, the US Fish and Wildlife Service (USFWS) obtained water samples from the four marine stations occupied in the present survey as well as floating residue from Sawmill Cove.

2. Analysis

Analyses were completed by US EPA Region 10, Region 7, and Duluth labs, as well as contract labs (Table 1). As indicated in Table 1, in addition to dioxins and furans, analyses for selected samples included metals, organics (volatiles, semivolatiles, base, neutral, acid compounds, etc.), organic carbon content, sediment particle size, and salinity. The methods used by each laboratory are listed or referenced in Appendix D.

B. Results and Discussion

Measured concentrations were compared with a variety of screening values. These screening values consisted of the EPA ambient water quality criteria (for freshwater, leachate, and marine water samples), apparent effects thresholds (for Puget Sound, WA, sediments), and New York Department of Environmental Conservation screening level (for dioxins in fish tissue).

The results of concern include: (1) Dioxins and furans were present in sediments, fish, and shellfish in Silver Bay. These contaminants appear to be at low levels, but their presence in the benthic food web is unknown; (2) Dioxins and furans were found in Blue Lake sediment in concentrations as high as in Sawmill Cove. Again, it is not known whether these contaminants are in the limnetic food web; (3) Four-methylphenol, benzoic acid, and phenol were present at high levels of concern in the sediments near the mill; (4) Copper and zinc were present at high levels of concern in the water column near the mill; (5) Copper was present at high levels in the Herring Cove hogfuel storage leachate; (6) Dissolved oxygen was depressed below levels considered to be adequate to support marine life; (7) pH was depressed in surface waters; and (8) Organic material has built up, possibly beyond levels measured in 1970.

In addition to those stresses listed above, suspended solids and color reduce photosynthesis in the upper water column and thereby impact the marine ecosystem.

1. Dioxins and Furans (Appendices A, C-1)

Marine Sediment: In general, the highest values were found in the Sawmill Cove sediment where more congeners were detected than at the other two stations. Without some screening value against which to compare the measured concentration, it can only be stressed here that these compounds are present in most of the organisms sampled in Silver Bay which is consistent with the known ability of dioxins and furans to bioaccumulate and enter the food web (see, for example, Rabert 1990).

Marine Tissue: Dioxins and furans were measured and detected in the tissues of a variety of fish and shellfish. The following discussion is based on the review of the effects of tetrachlorodibenzodioxin (TCDD) and tetrachloro-dibenzofuran (TCDF) releases from pulp and paper mills on aquatic organisms by Rabert (1990). Lethality has not been shown to be related to TCDD body burdens in fish. In fact, fish mortality can occur even after significant loss of TCDD from tissues. However, fish are very sensitive to TCDD and TCDF and delayed lethality can result from exposures as short as 6 hours. In addition, fish may develop lesions following exposure. In the present study, the only evidence of visible external abnormalities found was fin damage in of 4 of 6 total copper rockfish collected from Herring Cove and a growth in the lower eye of one arrowtooth flounder collected from Thimbleberry Bay. Further investigation is necessary to determine the cause of these abnormalities.

Because chlorinated dioxins and furans can bioconcentrate, piscivorous birds and mammals may be at risk. Rabert (1990) cites Newell, 1987, concerning the New York Department of Environmental Conservation's screening value. They (NYDEC) determined that wildlife are at risk when feeding on fish with body burdens greater than 3 pptr (ng/kg) TCDD. In the present study, the highest TCDD value in tissue was the analysis of English sole at 1.17 ng/kg which is below the NY screening value. The preliminary data collected during this survey suggest that wildlife may not be at risk from TCDD when feeding on fish from the Silver Bay and Eastern Channel areas, at least for those fish species which were evaluated.

Freshwater: Dioxins and furans were not detected in leachate or freshwater.

Lake Sediment: Dioxins and furans were found in the Blue Lake sediment sample. The levels of these contaminants were similar to those found in Sawmill Cove and, apart from the heptadioxins and tetrafurans, were higher than Sawmill Cove values. There is concern that dioxins and furans may be in the food web, although they were not in the rainbow trout in concentrations sufficient to be detected by the laboratory analysis.

Lake Tissue: Based on the laboratory detection limits, dioxin and furan congeners (containing chlorine at positions 2,3,7,8) were not detected in Blue Lake rainbow trout or in Thimbleberry Lake brook trout (whole body analyses). Detection limits, however, were higher than the NYDEC screening value so that risk to piscivorous wildlife could not be evaluated.

Soil, Ash, and Landfill Sludge Sampling: Because of the emphasis on human exposure (locations were playgrounds, ball fields, residences, catch basins, etc.), these sample results are not very useful in evaluating ecological effects. Dioxins and furans were detected in the ash samples, the landfill sludge sample, and many of the soil samples (see Section III). The sludge and soil levels were very low compared with the fly ash. At Deep Inlet, the background site, dioxins and furans were not detected. However, interference due to high levels of organic matter resulted in fairly high detection limits.

2. **Organics** (Appendix C-2)

Marine water: Analyses for organic compounds were made on composite water samples from the four marine stations. In general, only a few compounds were detected. For most of the organic compounds, especially those volatiles and semivolatiles detected, there are no water quality criteria to use as a screening tool to evaluate the potential risk to the ecosystem.

Marine Sediment: Because no contaminant-specific marine sediment standards are available for the state of Alaska, apparent effects threshold values (AETs), as described below, were used. Bioassays are often used to evaluate sediment toxicity relative to control or reference sediments. By measuring contaminant concentrations for the same sediments, it is possible to derive AETs. These values represent contaminant concentrations above which biological effects are always observed. An AET is developed for each effect; increased oyster larvae mortality, or decreased bacterial luminescence, for example. The range of AETs can be used then to determine a High AET (HAET) and a Low AET (LAET). AETs have been established for Puget Sound, WA, and these are used to evaluate the Silver Bay sediments. Although these two waterbodies cannot be considered to have exactly the same biota, they do share many genera and species (compare information in Barnes, et al. 1956 and Eldridge, et al. 1957 with Gotshall & Laurent 1980 and Kozloff 1983). Table 2 summarizes the exceedances based upon Puget Sound, WA, AETs.

At the Sawmill Cove station, six contaminants exceeded the AETs. In particular, 4-Methylphenol was 50 times the concentration set for the HAET and 270 that set for the LAET. Benzoic acid was 16 times the HAET. Phenol was 11 times the HAET and 31 times the LAET. For three other contaminants, the LAETs but not the HAETs were exceeded (fluoranthene, fluorene, and phenanthrene). The only other station to show exceedances was Eastern Channel, for 4-Methylphenol and benzoic acid.

Table 2. Exceedances of EPA ambient water quality criteria applied to water samples, and exceedances of Puget Sound, WA, apparent effects threshold values applied to marine sediment samples (Eastern Channel refers to station 2 within Silver Bay, see Figure 1).

Contaminant	Sample	Concentration	Ambient Water Quality Criterion: Acute Criterion	Ambient Water Quality Criterion: Chronic Criterion
MARINE WATER				
Copper	Sawmill Cove	181 ug/L	2.9 ug/L	2.9 ug/L
	Herring Cove	16.2 ug/L		
	Herring Cove-hogfuel storage leachate	13.5 ug/L		
Zinc	Sawmill Cove	267 ug/L	95 ug/L	86 ug/L
Mercury	Herring Cove	0.19 ug/L	2.1 ug/L	0.025 ug/L
	Eastern Channel	0.16 ug/L		
Lead	Herring Cove	18 ug/L	140 ug/L	5.6 ug/L
	Thimbleberry Bay	12 ug/L		
FRESHWATER				
Zinc	City Landfill leachate	81.3 ug/L	65.04 ug/L	58.91 ug/L
Iron	City Landfill leachate	76,500 ug/L	-- --	1000 ug/L
Lead	City Landfill	2 ug/L	33.78 ug/L	1.32 ug/L
MARINE SEDIMENT SAMPLES			Puget Sound Apparent Effects Threshold: High AET	Puget Sound Apparent Effects Threshold: Low AET
4-Methylphenol	Sawmill Cove	180,000 ug/kg	1,900 ug/kg	670 ug/kg
	Eastern Channel	4,400 ug/kg		
Benzoic acid	Sawmill Cove	12,000 ug/kg	760 ug/kg	650 ug/kg
	Eastern Channel	880 ug/kg		
Fluoranthene	Sawmill Cove	2,300 ug/kg	30,000 ug/kg	1,700 ug/kg
Flourene	Sawmill Cove	570 ug/kg	3,600 ug/kg	540 ug/kg
Phenanthrene	Sawmill Cove	2,600 ug/kg	6,900 ug/kg	1,500 ug/kg
Phenol	Sawmill Cove	13,000 ug/kg	1,200 ug/kg	420 ug/kg

Freshwater: Leachate from the City landfill and water from Blue Lake were evaluated against the EPA freshwater water quality criteria. Leachate from the hogfuel storage at Herring Cove was evaluated using EPA marine water quality criteria since it discharges into Silver Bay. In general, few organics were detected. For the volatiles and semivolatiles, few EPA freshwater criteria are available.

Lake Sediment: No standards (AETs or criteria) are available at present for screening analysis of freshwater sediments.

3. **Metals (Appendix C-3)**

Marine Water: Analyses for metals were made on composite water samples from the four marine stations. In general, only a few metals were detected. Some metals exceeded EPA water quality criteria for aquatic organisms, with the largest exceedances at the Sawmill Cove station (Table 2).

Copper. Copper was about 60 times the EPA acute (which is the same as the chronic or continuous exposure) criterion (181 ug/L compared to the criterion of 2.9 ug/L) at the Sawmill Cove station and about 6 times the EPA acute criterion at the Herring Cove station. Copper was 2.3 ug/L at the Eastern Channel station and not detected at the Thimbleberry Bay station.

Zinc. The concentration at the Sawmill Cove station (267 ug/L) was about 3 times the EPA acute criterion of 95 ug/L. Zinc was 25 ug/L at Herring Cove and not detected at the other two stations.

Other Metals. Mercury concentrations at the Herring Cove and East Channel stations exceeded the EPA chronic (continuous) criterion but not the acute criterion. Similarly, lead concentrations at Herring Cove and Thimbleberry Bay exceeded the EPA chronic criterion (Table 2).

Marine Sediment: No metals were detected at concentrations exceeding the Puget Sound AETs.

Freshwater: Blue Lake water had no exceedances of water quality criteria. The Sitka City landfill leachate, however, exceeded the freshwater acute criterion for zinc (by 1.25 x) and the chronic criterion for iron (77 x) and lead (just exceeded; Table 2). Because the leachate commingles with other waste streams prior to treatment and eventual discharge these results indicate the probable low toxicity of the leachate rather than a potential effect on biota. The leachate from the Herring Cove hogfuel storage area exceeded the marine chronic criterion for copper (4.7 x; Table 2). The volume of discharge and dilution of the leachate within Herring Cove is unknown, but the marine copper criterion was exceeded in Silver Bay at the Herring Cove station. This suggests that effects of copper in Silver Bay should be investigated further.

Lake Sediment: No freshwater sediment criteria are available at present for screening analysis.

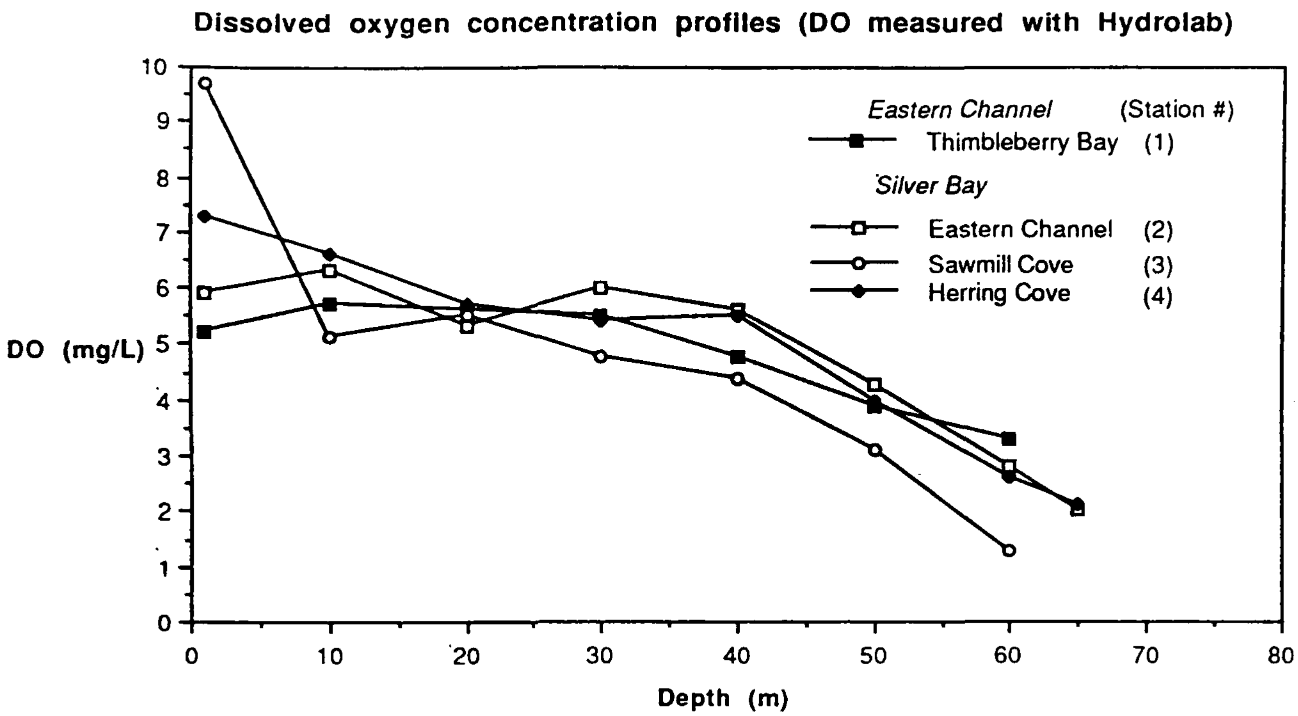
4. Conventionals: pH, DO, T, TOC, and Grain Size (Appendix C-4)

Marine Water: Figures 4-6 show the profiles of dissolved oxygen (DO), temperature (T, in °C), and pH. Salinities were lower in the surface grabs (approximately 20 to 26 °/oo, with mid and bottom grabs having similar values (approximately 32 °/oo; Appendix C4-Table 1). Salinity and temperature were used to evaluate percent oxygen saturation (Figure 4). The DO, T, and pH profiles show: (1) A reduction in DO from 5 - 9.5 mg/L in the surface to 1.5 3.5 mg/L at 60 m with most of the reduction occurring below 40 m water depth (changes in % saturation of DO follow a similar pattern); (2) A gradual decline of T with depth; and (3) A depression of pH in the surface 20 m (about 1.8 units below the fairly constant pH of 7.4 measured from 20 to 60 m water depth). The pH depression was most noticeable at the Herring Cove station.

pH. -- Near surface pH depressions in an August 26, 1965, survey by the US Dept of Interior (USDOI 1966) was attributed to "the combined result of biochemical waste decomposition, acid nature of the pulp mill wastes, and reduced photosynthetic production in the waste layer." However, during the 1965 survey, pH depressions did not fall below 7 units. In our study, pH below 7 was measured at the surface at 3 of the four stations, and did reach a low of 5.5 units (Figure 6). One anomalously high reading was noted at 50 m water depth for the Thimbleberry Bay station.

Dissolved Oxygen. Several previous studies in the Silver Bay area measured DO. Two studies that preceded the operation of the mill generally found DO to be above 6 mg/L from the surface to 60 m water depth. In May and July of 1956, a University of Washington study measured DO values from 6.37 to 11.20 mg/L at water depths of 50 to 75 m regardless of location (Barnes, et al. 1956). This same study did measure DO as low as 0.5 mg/L, but these values were in water deeper than 1,300 m. The Alaska Water Pollution Control Board measured DO in July, August, September, and October, 1956 (Eldridge 1957). At 30 m, the maximum depth sampled, the lowest DO measured at any location was 6.7 mg/L. In the surface 0.5 to 1.5 m, DO was always greater than 8.5 mg/L, apart from a single measurement of 2.6 mg/L measured at 5 ft water depth (in this instance, DO was 9.4 mg/L at the 2 ft water depth and 9.6 mg/L at 15 ft).

After the mill began operating, DO was again measured on August 26, 1965 (USDOI 1966). Low DO concentrations (4.4 to 7.1 mg/L) were measured in surface water. DO then increased rapidly to a maximum value at a depth between 2 and 10 m (maximum values ranges from 7.2 to 8.0 mg/L). Below this, DO gradually decreased with depth. At 60 m water depth, DO ranged from 3.9 to 5.8 mg/L. According to the U.S. Dept of Interior (USDOI 1966), up-welled oxygen-deficient ocean water is present in bays and inlets along the north Pacific coast in late summer. This water can have DO concentrations below 5 mg/L in the absence of any detectable mill discharges. Within Silver Bay, the extreme oxygen deficit at depth is attributable to oxygen depletion due to mill discharges exacerbating the low DO found in the up-welled oceanic water (USDOI 1966). This previous study also suggested that "Any reduction of dissolved oxygen beyond that observed ... in the surface waters of Silver Bay will definitely place the values below recommended minimum levels." The



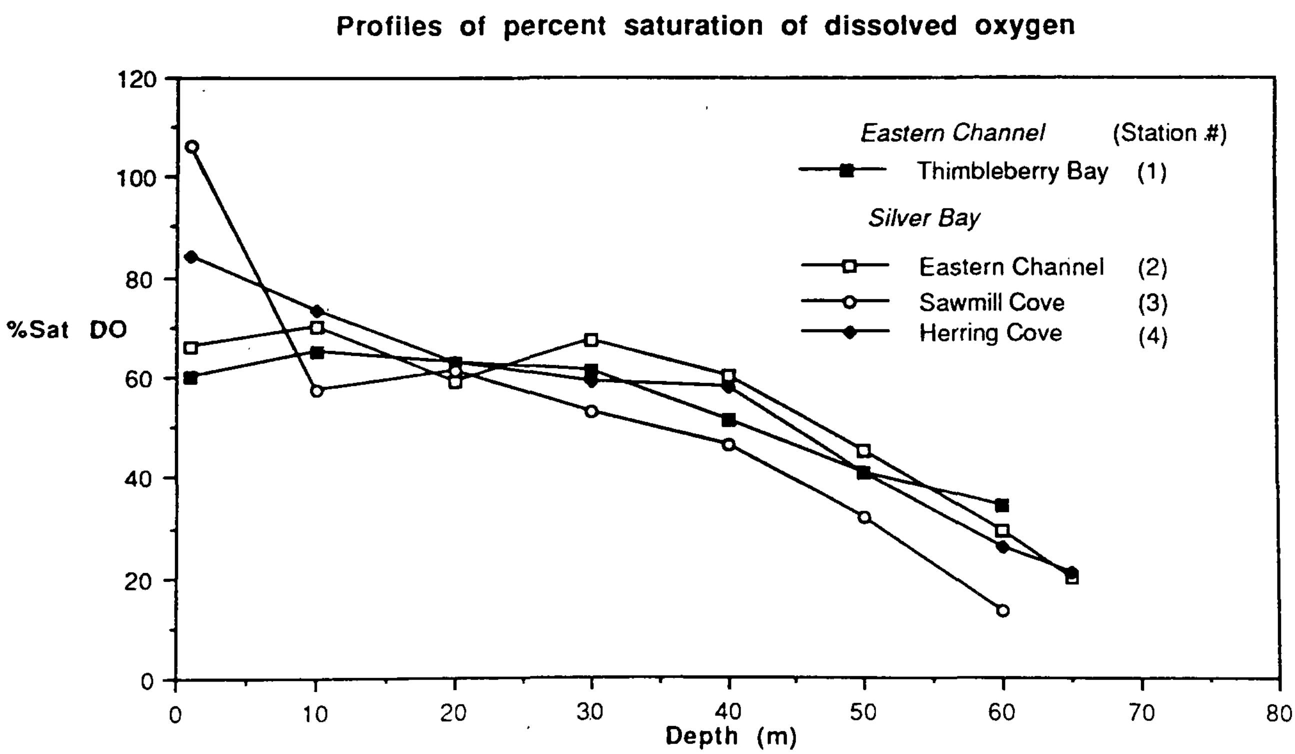


Figure 4. Dissolved oxygen concentration (mg/L) as a function of water depth (m) at the four marine sampling stations shown in Figure 1. Note the variability in the surface measurement, the relatively constant concentration between 10 m and 30 m, and the decline at all four stations below 40 m.

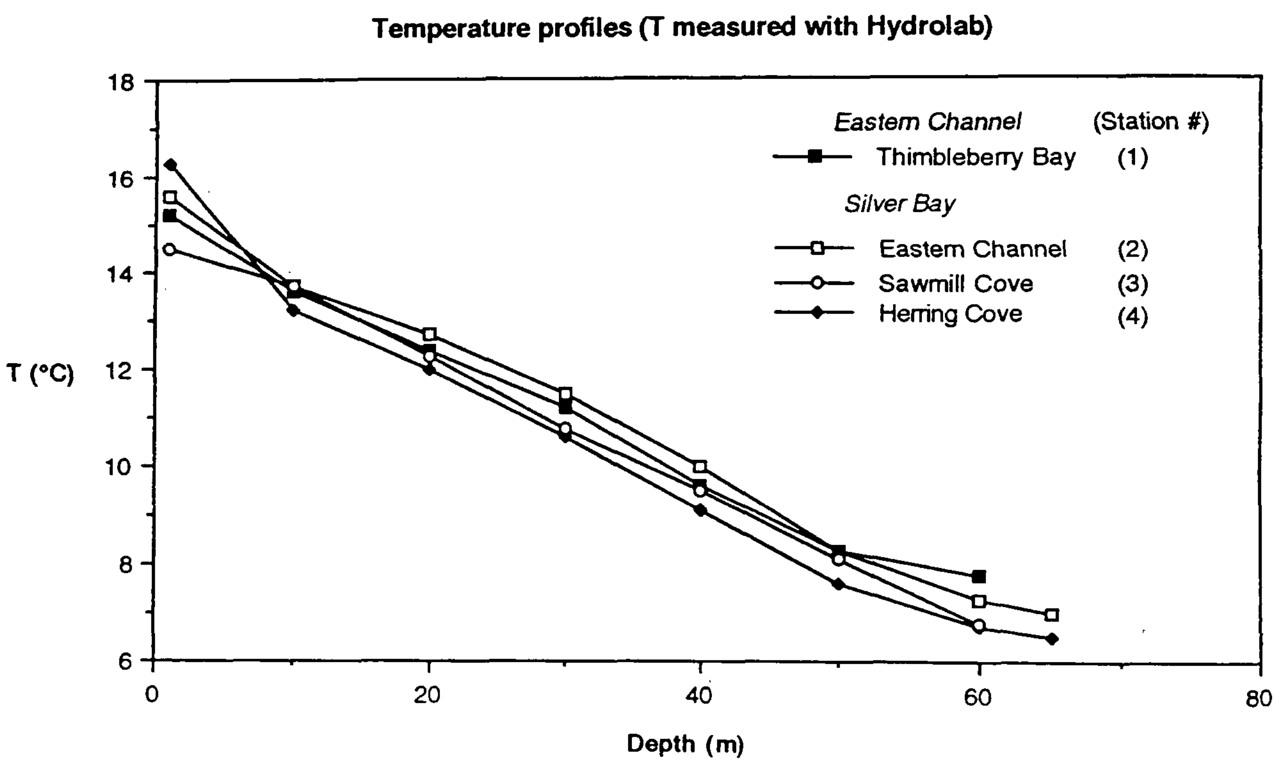


Figure 5. Water temperature (oC) as a function of water depth (m) at the four marine water sampling stations shown in Figure 1. Note the relatively constant decline with depth and the similarity in profiles among the stations.

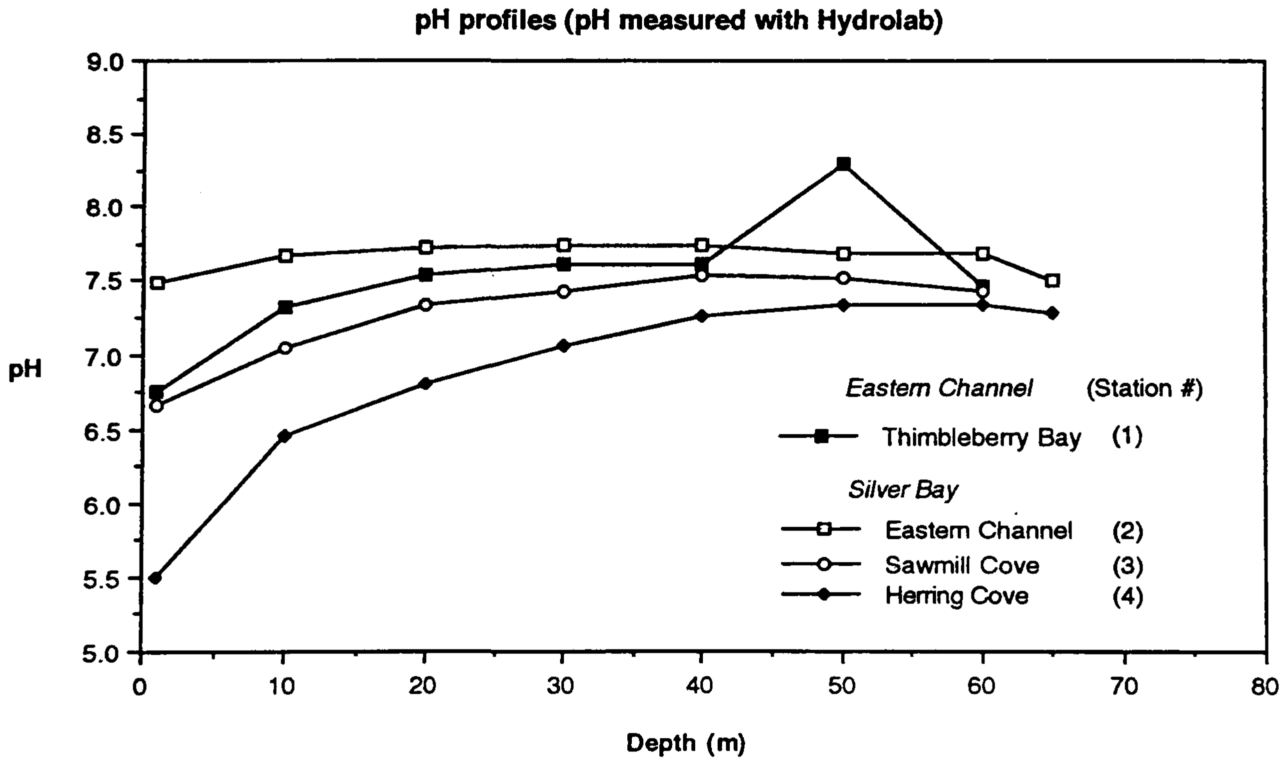


Figure 6. pH as a function of water depth (m) at the four marine water sampling stations shown in Figure 1. Note the general depression in surface waters, especially at the Herring Cove station.

present study did measure values below the 5 mg/L originally recommended in the 1956 studies as adequate to protect marine life.

Another study in 1968-70 (USEPA 1971) reported considerable reductions in DO in the surface layers of Silver Bay and Eastern Channel compared with the level measured prior to operation of the mill. The 1971 EPA report generally found DO to be above 5 mg/L (apart from some measurements in August, 1970, when DO varied between 4.6 and 6.7 mg/L at a depth of 1 m). The present study found DO in surface waters was reduced by approximately 2.5 to 11 mg/L below pre-mill measurements reported by Eldridge et al. (1957) and Barnes et al. (1956).

Marine Sediment: Total Organic Carbon (TOC) and Particle Size Analysis (Appendix C-4 - Table 2). TOC was 30% at the Sawmill Cove station, decreasing both in Herring Cove (17.5%) and Eastern Channel (8.2%). The 1956 studies measured organic carbon in Sawmill Cove at 3%, near Herring Cove at approximately 6.6%, and near our Eastern Channel station at 8.4%. In August, 1970, at three stations in Sawmill Cove, organic carbon was measured at 40%, 30%, and 27%, with increasing distance from the mill (USEPA 1971). Such a change in organic carbon in Sawmill Cove as noted in 1970 and 1990 indicates a major deposition of organic matter since the mill began discharging. The present Sawmill Cove station had an average of 28% TOC. Because it was located farther from the mill than the 1970 stations, this may indicate an increase in organic content of bottom sediments or an increase in the area affected. Comparison of the particle sizes further demonstrates the large difference in bottom type among the stations. Approximately 53% of the total weight of the sediment at Sawmill Cove was in the silt-clay fraction, while 69% was silt-clay at Herring Cove with just 11% at Eastern Channel.

Lake Sediment: The particle size and organic carbon analyses (95% silt-clay and 2.7% TOC; Appendix C-4 - Table 2) were consistent with a fine sediment lake bed.

5. Other Contemporaneous Studies

The results of dioxin and furan analysis of the ADEC ash and floating residue samples were reviewed by EPA Region 10, for quality assurance. These data are discussed in Section III (see Table 4 and Appendix A for summary data). In general, the fly ash samples had the greatest concentrations of dioxins and furans of all samples analyzed by EPA or ADEC. The floating residue samples had lower concentrations, but did contain TCDD, which was not detected in any of the EPA sediment samples. No consistent pattern was seen in relative proportions of the different dioxin and furan congeners when comparing sediment and sludge samples. How fish and wildlife come in contact with floating residue is unknown.

Effects of the residue on biota in Silver Bay and Eastern Channel should be assessed further. In addition to the dioxins and furans, the ADEC found metals in the residue. Furthermore, the results of the bioassay conducted by USFWS using marine bacteria indicated that filtrate from one of two floating residue samples was highly toxic (USDOI 1990).

III. SCREENING HUMAN HEALTH RISK ASSESSMENT FOR EXPOSURE TO DIOXINS AND FURANS

Introduction

The screening risk assessment for exposure to dioxins and furans in surface soils, floating residue, fish, shellfish and crabs is presented in this section. Section II includes the results of the reconnaissance survey for all contaminants as well as a more detailed discussion of sampling and analytical methods for dioxins and furans. Measurements of dioxins and furans in environmental media (ash, sludges and sediments) for which there is no direct human exposure are also described in Section II.

The risk analysis presented in this report is not intended to be considered as a formal risk assessment. Extremely conservative exposure assumptions were chosen as screening tools. These do not reflect actual exposures which may occur in Sitka. The results of this analysis should be used to determine what further studies or actions could be taken to protect public health in Sitka. Before additional sampling or analysis is done, the assumptions (seafood consumption rate, etc) used in screening assessment should be revised to reflect actual exposures which may occur in Sitka.

Exposure to dioxins and furans may result in cancer, reproductive and developmental effects. The chance of developing disease is dependent upon the concentration of the chemical and the likelihood of coming into contact with material contaminated with these chemicals. Risks for individuals (children and adults) who live in Sitka for 30 years in contact with surface soils, water, floating residue and consuming fish, shellfish and crabs (for 75 years) is a concern because of potential health effects.

There are a number of uncertainties which may cause the risk estimates to be too high or too low. Some of these uncertainties are listed below.

- only dioxins and furans were measured in seafood, thus the overall risks are not addressed

- samples were collected during the summer; concentrations may vary over time.

- dioxin levels being discharged have been and continue to be reduced, thus the concentrations in the environment should be diminishing over time

- the toxicity of dioxins and furans is being re-evaluated

- a limited number of samples in presumably worst case areas were sampled; these may not be representative of the whole community

- the seafood (bottom fish, crabs and mussels) collected in Silver Bay may not be part of the regular sport fishing catch

- there are no data regarding what happens to the chemicals when seafood is cooked

- exposures are assumed to occur over a lifetime (30-75 years)

- the toxic equivalent concentrations reported here include measured values as well as a correction for chemical analytical error; 1/2 the detection limit for some of the 12 toxic dioxins and furans was assumed to be present

In order to be protective of public health, EPA uses conservative assumptions for risk assessment. Given these conservative assumptions, the risks may range from the upper bound estimates given in this report to zero.

Toxicity of Dioxins and Furans

Polychlorinated dibenzo-p-dioxins and -furans are a group of 210 synthetic compounds commonly referred to as dioxins and furans. This complex group of chemicals are subdivided into homologous groups which are identified by the degree of chlorination:

(4 Chlorines) tetrachlorodibenzodioxin - TCDD, and
tetrachlorodibenzofuran - TCDF
(5 Chlorines) pentachlorodibenzodioxin PCDD, and
pentachlorodibenzofuran - PCDF
(6 Chlorines) hexachlorodibenzodioxin - HxCDD, and
hexachlorodibenzofuran - HxCDF
(7 Chlorines) heptachlorodibenzodioxin - HpCDD, and
heptachlorodibenzofuran - HpCDF
(8 Chlorines) octachlorodibenzodioxin - OCDD, and
octachlorodibenzofuran - OCDF

Within the groups of homologues there are individual isomers which are identified according to the location of the chlorine atom on the dioxin or furan molecule, e.g. 2,3,7,8 tetrachlorodibenzo dioxin (2,3,7,8 TCDD). The most toxic dioxin or furan compound is 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD). In order to simplify the estimates of risks to human health, a relative ranking of 12 individual congeners (homologues with chlorine atoms at the 2,3,7,8 positions) which constitute the class dioxins and furans was completed. In this ranking system, (Table 3), TCDD is given a rank of one; the other 11 in these classes are ranked from 0.5 to 0.001 relative to TCDD.

Table 3. Dioxin and Furan toxic equivalency procedure. Dioxin and furan isomer concentrations are converted into a toxic equivalent concentration (TEC) using the appropriate toxic equivalent factor (TEF).

	TEF	CONC ng/Kg	TEC ng/Kg		TEF	CONC ng/Kg	TEC ng/Kg
DIOXIN				FURAN			
2378 TCDD	1	1	1	2378 TCDF	0.100	1	0.100
2378 PeCDD	0.5	1	0.5	12378 PeCDF	0.050	1	0.050
2378 HxCDD	0.1	1	0.1	23478 PeCDF	0.500	1	0.500
2378 HpCDD	0.01	1	0.01	2378 HxCDF	0.100	1	0.100
OCDD	0.001	1	0.001	2378 HpCDF	0.010	1	0.010
				OCDF	0.001	1	0.001
TOTAL DIOXINS		5	1.611	TOTAL FURANS		6	0.761

TOTAL TEF = 1.611 + 0.761 = 2.372

Dioxin and furans can produce a variety of effects including cancer and reproductive effects in laboratory animals at very low doses (USEPA 1989a). Based on the results in animal studies EPA has classified 2,3,7,8 TCDD as a B2 carcinogen or probable human carcinogen. It is the most potent animal carcinogen (cancer slope factor of 1.56 x 10^5 per milligram of dioxins and furans per kilogram body weight per day) evaluated to date by EPA. Recent reports (Fingerhut et al. 1991) suggest that while cancer has been observed in humans exposed to relatively high doses of dioxin, dioxins and furans are less potent in humans than in animals.

In addition to causing cancer, exposures to dioxins and furans may also result in developmental and reproductive effects. Based on laboratory studies with animals a one day and lifetime health advisories have been established through the EPA Drinking Water Program (USEPA, 1988) for these non-cancer health effects. In order to be absolutely sure of protecting public health, these advisories are set well above the level which has resulted in adverse health effects in laboratory animals. Although these health advisories were primarily developed for the protection of public drinking water, the same advisories may be used for other environmental media (soils, seafood, etc). The one day health advisory is: 100 picograms per kilogram-body weight per day. For a 14 kg (31 pounds) child, a concentration of 7 picograms of dioxins or furans would be equivalent to the one day advisory. The lifetime health advisory is 1 picogram per kilgram-body weight per day.

EPA as well as other world-wide health agencies are reviewing the toxicity data for dioxins and furans. This may result in a change in the cancer potency estimates and the drinking water health advisories. However, until this evaluation is complete, risk estimates completed by EPA will continue to rely on the existing cancer potency factor and non- cancer health advisories.

Dioxin and Furan Sampling and Analysis

The sampling objectives were to evaluate the potential accumulation of dioxins and furans in surface soils, fish, shellfish and crabs to which people may be exposed. The absolute levels of dioxins and furans are presented in Appendix C-1 in this report. For the purpose of discussing risks to human health, the absolute dioxin and furan concentrations found in all media are converted to toxic equivalent concentrations.

<u>Soil, Ash, and Landfill Sludge and Leachate.</u> Dioxins and furans were detected in the ash samples, the landfill sludge sample, and many of the soil samples. The sludge and soil levels were very low compared with the fly ash (Tables 4 and 5). No dioxins or furans were detected in the leachate samples (Appendix A). Detailed discussion of sampling and analysis is provided in Section II. The high ash level is within the range found in other incinerator residues (Table 4). Since, people are not expected to encounter ash from Alaska Pulp Corporation incinerator operations, landfill sludge, landfill leachate or sediments during regular activities at work, at home or during recreation, risk estimates are therefore not calculated for direct contact with these media.

Table 4. Toxic equivalent concentration (TEC) of dioxins and furans measured in ash, sludge, sediment and floating residue from Sitka Alaska. The TEC is calculated with 1/2 the detection limit included with the measured values.

APC Power Boiler	TEC (ng/Kg)	SITKA LANDFILL[2]	TEC (ng/Kg)
Fly Ash[1]	1752	Sludge	6
Hog Fuel Bottom Ash[2]	17	Leachate	ND
Multi Clone Ash[2]	10		
NATIONAL DIOXIN STUDY[3]		EPA Sludge Regulations[4]	10
Fly Ash	5000-80		

[1] ADEC, 1990
[2] This Study - U.S. EPA 1991
[3] U.S. EPA, 1989
[4] U.S. EPA, 1991a; TEC for only 2,3,7,8 TCDD and 2,3,7,8 TCDF
TEC of 1/2 Detection Limit - 119 pg/L

<u>Soils.</u> Composites of 4 to 5 soil samples were collected on August 29, 1990 in Sitka and surrounding areas (Japonski Island, Deep Inlet, and Blue Lake, Figure 2). Sample locations were selected to represent the most likely areas where people may come into contact with soils: day care facilities, schools, playgrounds, public walkways, and private residences (Figure 3).

The toxic equivalent concentrations shown in Table 5 represent not only what was measured in the soil, but they also include an additional amount to correct for uncertainty in chemical analytical methods. The measured concentrations of toxic dioxins and furans ranged from 0.2 parts per trillion at to 2.6 parts per trillion. When the correction (1/2 detection limit) for analytical error is included trace concentrations (non-detect to 14 parts per trillion) of dioxins and furans were found in surface soils in Sitka (Table 5). At Deep Inlet, which was chosen as the local background soil site, dioxins and furans were not detected. However, interference due to high organic matter in the sample resulted in fairly high detection limits. There was no significant difference in concentrations at the various locations sampled. The levels found in Sitka and surrounding areas were similar to background levels.

Table 5. Toxic equivalent concentration (TEC) of dioxins and furans measured in soils from Sitka, Alaska. The TEC is calculated with 1/2 the detection limit included with the measured values.

	TEC (ng/Kg)		TEC (ng/Kg)
City North	3	Galankin Island*	ND
City Center	3	Blue Lake	12
City South	5	Jamestown	13
City Japonski	6	Thimbleberry	14
APC	9	Deep Inlet*	ND
BACKGROUND			
Urban soils[1]	ND - 11		

*ND = ALL DIOXIN ISOMERS WERE AT DETECTION LIMIT (at 1/2 DL = 12 - 22 ng/Kg)
[1]U.S. EPA, 1987; ND = 0 - 8

Sediment. Marine and freshwater sediment levels were generally low (Table 6) ranging from 4 to 12 ng/Kg. While there were not enough samples taken to establish any significant difference between sites, Sawmill Cove sediment levels appeared to be higher than other sediments in Silver Bay or Blue Lake.

Floating residue. Floating residue (fibers, organic matter) was sampled by ADEC in July and October 1990. The levels of dioxins and furans were relatively high when compared to concentrations found in soils in Sitka or in sediments in Silver Bay (Table 6). The measured concentrations (10, 12 and 25 parts per trillion) were similar to the corrected (1/2 detection limit) values presented in Table 6. The levels of dioxins and furans were primarily due to the presence of Octachlorodibenzodioxins (Appendix A, Table A-1) and furans. Since these compounds are relatively non-toxic (0.001 x 2,3,7,8 TCDD), the toxic equivalent concentrations in the floating residue were similar to that found in the soils in Sitka.

Table 6. Dioxins and furans reported as toxic equivalent concentrations, measured in sediments, floating residue from Sitka, Alaska and other areas in the U.S. The TEC is calculated with 1/2 the detection limit included with the measured values.

SEDIMENT[1]	TEC(ng/Kg)	FLOATING RESIDUE[2]	TEC (ng/Kg)
SITKA, ALASKA		SITKA, ALASKA	
Sawmill Cove	12	Sawmill Cove	26
Eastern Channel	4	Eastern Channel	12
Herring Cove	4		
Blue Lake	9		
WASHINGTON[3]			
Industrialized area			
Grays Harbor, WA	1 - 15		
Reference area			
Sequim Bay, WA	4		
West Beach, WA	2		

[1]This study - U.S. EPA, 1991
[2]ADEC - July, October 1990
[3]U.S. COE, 1990

Water. Dioxins and furans were not detected in the water from Blue Lake (Appendices A and C-1) but may be present at concentrations below the method detection limits which is 100 pg/l (parts per quadrillion) for both chemical groups.

Fish, shellfish and crabs. Fish and shellfish concentrate dioxins and furans through ingestion of contaminated microorganisms, sediments or water. Therefore, they are a good indicator of general contamination in the environment. Measurements of tissue concentrations are used to estimate risk to human health from consumption of these aquatic organisms.

The types of seafood (Table 7), such as bottom fish, were selected because they tend to concentrate chemicals which may be found in the sediments at the bottom of the bay. They should therefore be worst case examples of dioxin and furan contamination. These organisms are part of commerical catches nor are they the types of seafood which may be actually caught during sport fishing in Sitka.

Mussels, crabs, and a variety of shrimp (mixed), were caught and selected for analysis. Crab internal organs and the remainder of the crab body were analyzed separately. In consultation with NOAA personnel familiar with the effects of sediment contamination on fish as well as fish life histories (Long 1990), Pacific sanddab, English sole, and Pacific staghorn sculpin were selected for analysis. Quillback rockfish were analyzed to investigate the variability in tissue contamination across marine sampling stations. Eastern brook trout and rainbow trout were collected from Thimbleberry Lake and Blue Lake. The whole fish (muscle, skin and internal organs) from each species was analysed.

Trace levels (0.1 parts per trillion to 1.3 parts per trillion before correction -1/2 detection limit- for analytical error) of dioxins and furans were found in the tissue samples for Sitka. Since, dioxins and furans tend to concentrate in organs which are high in lipids (fat) such as the liver, the whole fish samples will be higher than what may be measured if only the meat (muscle) were sampled. There was little difference in the levels of dioxins and furans found in all the aquatic organisms sampled during this study. The levels were also very close to the limits of detection (1 part per trillion). The range from the detection limit to 3 parts per trillion is similar to the background levels in the U.S. and the lowest levels measured in urban (Puget Sound) environments (Table 7).

Table 7. Toxic equivalent concentration (TEC) of dioxins and furans measured in fish and shellfish from various bodies of water in the U.S. The TEC is calculated with 1/2 the detection limit included with the measured values.

FISH	TEC (ng/Kg)
1991 Sitka	
Blue Lake Trout*	ND
Thimbleberry Lake Trout*	ND
Thimbleberry Bay Sanddab	2
Herring Cove Quillback	2
Thimbleberry Bay Quillback	2
Sawmill Cove Quillback	2
Silver Bay Sculpin	2
Silver Bay English Sole	2
1985/87 Sitka	
Flathead Sole	2
Sitka Halibut	1
Red Striped Rockfish	2

CRABS, MUSSELS, SHRIMP	TEC (ng/Kg)
1991 Sitka	
Crab Muscle	2
Crab Hepatopancreas	3
Silver Bay Shrimp	2
Thimbleberry Bay Mussels	2
1991 Puget Sound[1]	
Crab Muscle	3 - 0.4
Crab Hepatopancreas	62 2
NATIONAL BIOACCUMULATION STUDY[2]	
Bearce Lake, Maine	
Chain Pickerel	0.3
Androscoggin R., Maine	
Sucker	68

*ND = ALL ISOMERS WERE AT THEIR DETECTION LIMIT
TEC for 1/2 Detection limit = 1 ng/Kg
[1]U.S.EPA, 1991b [2]U.S.EPA, 1989

Exposure Assessment

To assess the effects of chemicals on people, exposure must be demonstrated. In the case of the Sitka evaluation exposure to dioxins and furans could occur through ingestion, inhalation and skin absorption of soils and dust in the community, ingestion, inhalation and skin absorption of the floating residue in Silver Bay, and ingestion of fish, crabs and shellfish.

For this screening assessment conservative assumptions were used to estimate risk from exposure to soils and dust in Sitka and floating residues in Silver Bay. These assumptions were used:

Body weight:
Child - 10 Kg
Adult - 70 Kg

Exposure Duration for soils:
Child - 6 years
Adult - 24 years

Quantity of SOIL ingested:
Child - 200 mg per day
Adult - 100 mg per day
Absorption from SOIL - 100%

Area of SKIN contact:
Child - 3900 cm²
Adult - 5000 cm² summer
1900 cm² winter

SKIN Contact Rate:
Child and Adult - 1 mg/cm²
Amount Absorbed through SKIN:
Child and Adult - ~~20%~~ 2 %

Fish and shellfish consumption is based on the amount of fish, crab, mussels, and shrimp that a recreational harvester might ingest over a lifetime (75 years). A consumption rate of 54 grams per day (one quarter pound every other day) was used as a screening level to estimate fish and shellfish consumption in this report. This is an average value for recreational harvesters in the U.S. (Pao, et al., 1982). Since consumption rates may vary depending on individual preferences, risks are also presented for a range of consumption rates (Figures 7-9). In addition to the amount and frequency of fish consumed, it is also important to consider what portions of the fish may be eaten. Most people would only eat fish fillets and they would discard the internal organs. Another conservative assumption used in this assessment, is that someone catches all their fish from Silver Bay.

For crabs, consumption data are presented for two types of tissue: the hepatopancreas commonly referred to as "crab butter" and muscle tissue. For the hepatopancreas there are survey data from Puget Sound (DSHS 1986) which suggest that 14% of the individuals who harvest crabs also eat the hepatopancreas commonly referred to as "crab butter". In this study the crabs weighed about 1.5 lbs (1020.58 grams); the muscle represents 30% of the whole crab (0.45 lbs or 202 grams); and, the hepatopancreas represents 0.5 % (0.01 lbs or 5 grams). For this screening assessment risk estimates are based on an individual consuming one crab (muscle and/or hepatopancreas) per week over a lifetime. Figures 7-9 illustrate how the risk estimates would change depending on individual consumption rates.

Risk Estimates

Risk assessment for carcinogens includes an estimate of carcinogenicity (carcinogenic slope factor) as well as an estimate of human exposure. The carcinogenic slope factor is generally based on laboratory studies of animals, although in some cases there are data from human exposures.

The risk of developing cancer is obtained from carcinogenic slope factor by multiplying the latter by the actual number of units of human exposure. For a given exposure, the higher the slope factor, the higher the risk.

Risk = Carcinogenic Slope Factor multiplied times human exposure
Dioxin Carcinogenic Slope Factor = 15600 per mg per kg-body weight per day

Human exposure may be estimated from the following equation:

Human exposure from soil, water or food consumption = tissue or soil concentration multiplied times the quantity ingested multiplied times the duration of exposure divided by the body weight multiplied by average lifetime

Human exposure for skin contact = soil or floating residue concentration multiplied times skin surface area multiplied times contact rate multiplied times the duration of exposure divided by the body weight multiplied by average lifetime

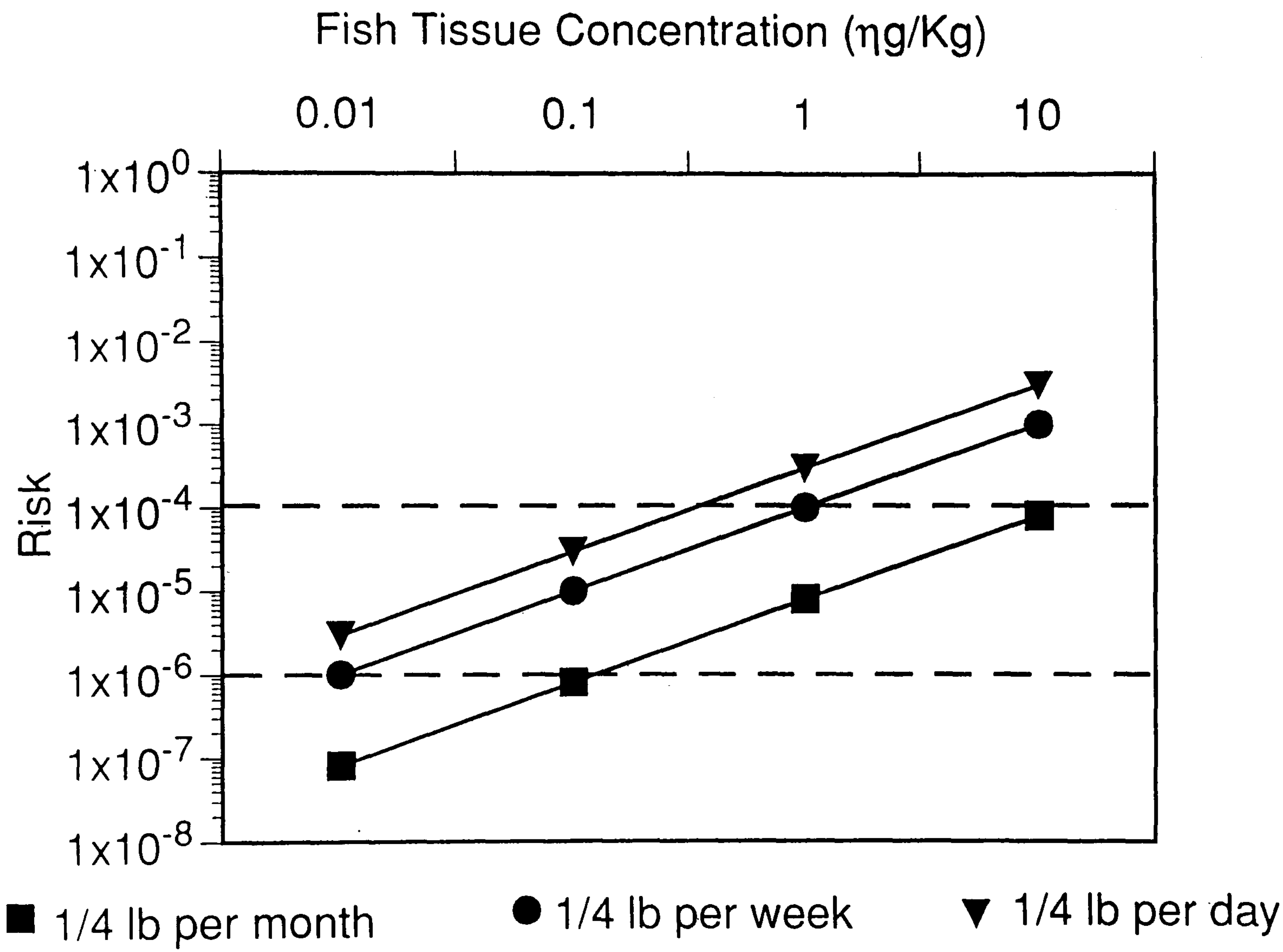


Figure 7. Relationship between dioxin and furan concentration in fish tissue and risk (probability of excess cancer) as a function of the amount of fish consumed.

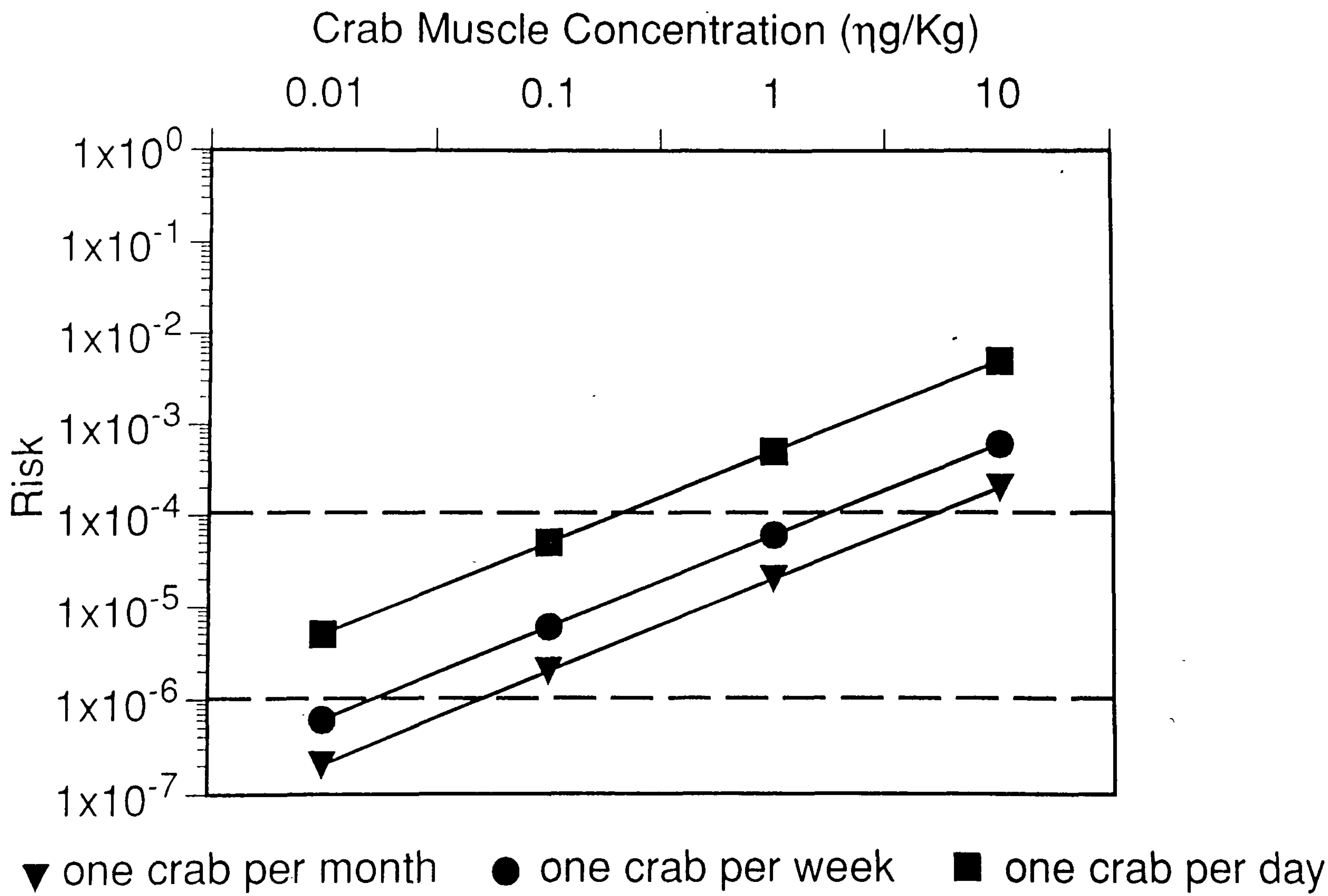


Figure 8. Relationship between dioxin and furan concentration in crab muscle and risk (probability of excess cancer) as a function of the amount of crab consumed.

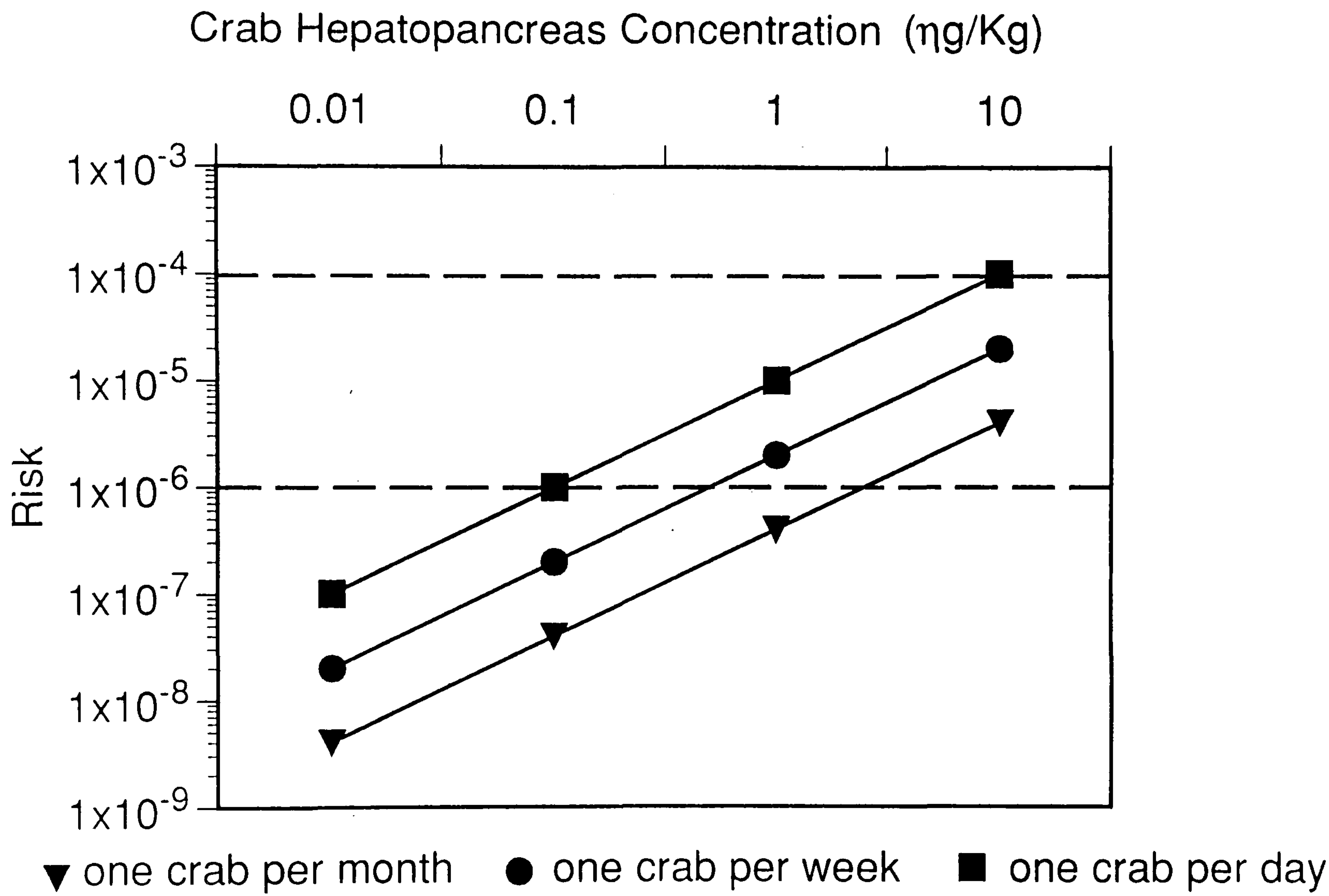


Figure 9. Relationship between dioxin and furan concentration in crab hepatopancreas and risk (probability of excess cancer) as a function of the amount of hepatopancreas consumed.

To estimate the potential for other health effects to occur the following equation is used:

Ratio = Human exposure divided by the one day health advisory or lifetime health advisory
one day health advisory = 100 pg/kg-body weight/day
lifetime health advisory = 1 pg/kg-body weight/day

Soils. Risk estimates for exposure to soils assumes people ingest soil, inhale dust and absorb dioxins and furans through skin contact. The cumulative risks for developing cancer range from one in one million to twenty in one million (Table 8; Appendix B, Table B-1). There are a number of uncertainties in deriving this risk estimate for soils. It is assumed that an individual spends 30 years in direct contact with soils only from the locations presented in this study. It is also assumed that large amounts of chemical are absorbed through the skin. More information about the chemicals as well as individuals in the community would need to be understood in order to reduce some of the uncertainty. In addition to the exposure and toxicity questions, the concentrations found in the soil are also in question. Since the levels in the soil were very close to the detection limit, the risk at the detection limit (8 in one million to 20 in one million) is equivalent to the measured values. When exposures are that close to the detection limit, the accuracy of the risk estimates is not very good.

Exposures to levels of dioxins and furans measured in soils from Sitka and surrounding areas does not exceed the one day or lifetime health advisories for children and adults. Therefore it is not expected that the soils measured in this study present a health threat for non-cancer effects (Appendix B).

Floating residue. Contact with floating residues may occur through recreational activities such as swimming, playing on the beach or fishing. Exposure may be incidental ingestion of the material, inhalation or skin absorption. Since, these routes of exposure are similar to those for soil, the same assumptions as were used to derive the risk assessments for soil were used for the floating residue. The risks range from 2 in 100,000 to 4 in 100,000 (Table 8). It should be noted that these risks are based on an assumption that a child is exposed for 6 years every day to this material and an adult for 24 years, every day. The likelihood of encounters with floating residue occurring daily over a 30 year period are probably quite low. Therefore, the risks for individuals who live in or visit Sitka are more likely to be lower than this estimate.

Table 8. Carcinogenic risk from exposure (ingestion, dust inhalation and skin absorption) to dioxin and furans measured in surface soils and floating residue in Sitka, Alaska

SOIL

SITKA	RISK	SITKA	RISK
City North	5 in 10,000,000	Galankin Island	*
City Center	4 in 10,000,000	Galankin Island(dup)	1 in 1,000,000
City South	1 in 1,000,000	Jamestown	2 in 1,000,000
City Japonski	1 in 1,000,000	Thimbleberry	2 in 1,000,000
APC	1 in 1,000,000	Deep Inlet	*

FLOATING RESIDUE
4 in 1,000,000 to 9 in 1,000,000

----

*NO DIOXINS OR FURANS DETECTED; 1/2 DETECTION LIMIT = 12 - 22 ng/Kg)
RISK AT 1/2 DETECTION LIMIT (1 in 1,000,000 to 2 in 1,000,000)

Fish, Shellfish and Crabs. While risk estimates may be calculated for the aquatic organisms collected during this study, there is a great deal of uncertainty in the levels of dioxins and furans which were reported for the fish tissue. The concentrations of dioxins and furans measured in seafood were at the limits of the laboratories chemical analytical capability. When tissue concentrations are close to the detection limit the accuracy of the risk estimate is questionable. Therefore, the risk estimates are clearly a maximum worst case estimate and may in fact be zero. Using the screening consumption of one 1/4 pound of seafood every other day, the data from this study indicate that the maximum risk of developing cancer could be two in ten thousand (Table 9; Appendix B). This estimate will vary depending on individual consumptions rates (Figures 7-9). In estimating risks for consumption of fish it is also assumed that all seafood which an individual ingests are caught in Silver Bay. Since, the projected risks for consumption fish are at levels which may cause some health concerns, it should be understood that these risks are projected for only the worst case exposures. The assumptions used to derive these estimates need to be refined in order to better approximate the actual risk which may result from fish consumption in Sitka.

Consumption of whole fish, shellfish or crabs collected during this study does not result in a daily intake which exceeds the one day health advisory. Upper bound exposures may exceed the lifetime health advisory (Appendix B).

Table 9. Risk of developing cancer from consumption of dioxins and furans in fish, shellfish and crabs.

FISH	RISK\1	SHELLFISH	RISK\1
Blue Lake Trout	*	Silver Bay Shrimp	2 in 10,000
Thimbleberry Lake Trout	*	Thimbleberry Bay Mussels	2 in 10,000
Thimbleberry Lake Sanddab	2 in 10,000		
Herring Cove Quillback	2 in 10,000		
Thimbleberry Bay Quillback	2 in 10,000		
Sawmill Cove Quillback	2 in 10,000		
Silver Bay Sculpin	2 in 10,000		
Silver Bay English Sole	2 in 10,000		
CRAB			
Sawmill Cove	RISK\2		RISK
Hepatopancreas	2 in 1,000,000		
Muscle	8 in 100,000		
Whole Crab	8 in 100,000		

*DIOXINS AND FURANS WERE NOT DETECTED
RISK AT 1/2 DETECTION LIMIT = 2 in 10,000.
\1 Risk assumes one meal every other day for a lifetime (75 years)
\2 Risk estimate assumes one crab per week over a lifetime (75 years)

IV. BIBLIOGRAPHY

Barnes, C.A., T.F. Budinger, E.E. Collias, W.B. McAlister, P.N. Sund, and M.P. Wennekens 1956 Oceanography of Silver Bay, Preliminary report. U. of Washington, Dept. of Oceanography. Special Report No. 24, 85 pp.

DSHS 1985 Washington State Department of Social and Health Services. Seafood Catch and Consumption in Urban Bays of Puget Sound.

Eldridge, E.F. and R.O. Sylvester 1957 Silver Bay water pollution control studies near Sitka, Alaska. Alaska Water Pollution Control Board. Report No. 10, 121 pp.

ENSECO 1990 Laboratory report for dioxin and furan analyses of ash samples. September 27, 1990., report from M.J. Miille to A. Viteri, ADEC.

ENSECO 1991 Laboratory report for dioxin and furan analyses of floating residue samples. February 21, 1991, report from M.J. Miille to R. Grabbe, ADEC

Fingerhut, M.A., W.E. Halperin, D.A. Marlow, L.A. Placitelli, P.A. Honchar, M.H. Sweeney, A.L. Greife, P.A. Dill, K. Steenland and A.J. Suruda. 1991. Cancer Mortality in Workers exposed to 2,3,7,8-Tetrachlorodibenzo-p-dioxin. New England Journal of Medicine. January 24, 1991. 212- 218.

Gotshall, D.W. and L.L. Laurent 1980 Pacific coast subtidal marine invertebrates. Sea Challengers. Monterey, CA. 112 pp.

Kozloff, E.N. 1983 Seashore life of the northern Pacific coast. University of Washington Press. Seattle, WA. 370 pp.

Long, E. 1990 Personal communication, September 13, 1990. Telephone call between B.Duncan, USEPA Region 10, and E.Long, NOAA, Seattle, WA.

Pao, E. M., K.H. Fleming, P.A. Guenther, and S.J. Mickle. 1982. Foods commonly eated by individuals; Amounts per day and per eating occasion. USDA, Human Nutrition Information Service. Home Economics Report No. 44

Rabert, W.S. 1990 An update on the environmental effects of TCDD and TCDF releases from pulp and paper mills on aquatic and terrestrial animals. In: USEPA, 1990, Assessment of risks from exposure of humans, terrestrial and avian wildlife, and aquatic life to dioxins and furans from disposal and use of sludge from bleached kraft and sulfite pulp and paper mills. EPA 560/5-90-013. Appendix F.

USCOE 1991 Human Health Risk Assessment of Seafood Consumption Related to Disposal of Federal Channel Maintenance Dredged Material at Point Chehalis/South Jetty, Grays Harbor, Washington.

USDOI 1966 Oceanographic and related water quality studies in southeastern Alaska, August 1965. Federal Water Pollution Control Administration.

USDOI 1990 An analysis of water and sludge samples from four coves near Sitka, Alaska, using the Microtox bioassay technique. Memo from K.A. Mueller, Northern Alaska Ecological Services to D.Rudis. October 2.

USEPA 1971 Effects of pulp mill wastes on receiving waters at Silver Bay, Alaska. 64 pp.

USEPA 1987 National Dioxin Study. EPA/530-SW-87-025.

USEPA 1989 Bioaccumulative Pollutants in Fish. A National Study. Draft Report. December 1989.

USEPA 1991a Sludge regulations, in preparation.

USEPA 1991b Puget Sound Estuary Program. Dioxin and Furan Concentrations in Puget Sound Crabs. EPA 910/9-91-040.

APPENDIX A. SUMMARY TABLES OF DIOXINS AND FURANS

Table A . Dioxins and furans measured in Sitka Alaska.
DL=Detection limit. TEC = Toxic equivalent concentration.

Descrip	TOTAL	TOTAL	TOTAL	TEC	TEC	TEC
TEF-factor	DIOXINS	FURANS	D&F	DL=0	DL=1	DL=.5
	SOIL (ng/Kg dry weight)					
APC	625	30	655	2.4	10	6
APC dup	210	ND	210	0.2	24	12
THIMBLEBERRY	730	65	795	2.6	26	14
JAMESTOWN	580	43	623	0.9	26	13
GALANKIN I	ND	ND	ND	ND	12	6
GALANKIN dup	ND	ND	ND	ND	24	12
CITY-SOUTH	305	74	378	2.0	5	7
CITY-JAPONSKI	1066	125	1191	2.6	10	6
CITY-CENTER	80	ND	80	0.2	6	3
CITY-NORTH	166	ND	166	0.4	7	3
BLUE LAKE	ND	ND	ND	ND	24	12
DEEP INLET	ND	ND	ND	ND	44	22
	WATER (pg/L)					
FIELD BLANK	ND	ND	ND	ND	237	119
BLUE LAKE	ND	ND	ND	ND	237	119
BLUE L. dup	ND	ND	ND	ND	237	119
	TISSUE (ng/Kg wet weight)					
BLUE L-R TROUT	ND	ND	ND	ND	3	1
THIMBLE L-Br TRT	ND	ND	ND	ND	3	1
HERRING C-QUIL	ND	2	2	0.2	3	2
SAWMILL C-QUIL	ND	3	3	0.3	3	2
THIMBLE B-QUIL	ND	2	2	0.2	3	2
SILVER B-SCULP	ND	4	4	0.4	3	2
SILVER B-E SOLE	1	2	3	1.3	3	2
THIMBLE B-SANDDAB	ND	1	1	0.1	3	2
SAW C-CRAB HEP	ND	11	11	1.1	4	3
SAW C-CRAB GHS	ND	8	8	0.8	4	2
SAW C-CRAB MUS	ND	3	3	0.3	3	2
THIMB B-MUSSELS	ND	3	3	0.3	3	2
SILVER B-SHRIMP	ND	1	1	0.1	3	2
	FLOATING RESIDUE (ng/Kg)					
SAWMILL COVE	417	171	588	25	26	26
EASTERN CHANNEL	254	79	333	10	12	11
EASTERN CHANNEL	261	84	345	12	15	13
	SEDIMENT (ng/Kg)					
HERRING COVE	54	24	78	1	4	7
EASTERN CHANNEL	25	17	42	1	4	7
SAWMILL COVE	185	109	294	10	12	13
BLUE LAKE	48	78	126	8	9	11
	ASH (ng/Kg)					
BOTTOM	54	86	139			
BOTTOM dup	ND	38	38			
MULTI CLONE	6	47	52			
FLY ASH - ESP	21099	2930	24029			
FLY ASH ESP	47400	5392	52792			
FLY ASH ESP	25480	3859	29339			
	LEACHATE (pg/L)					
HOGFUEL STORAGE	ND	ND	ND			
HOGF STOR-dup	ND	ND	ND			
SITKA LANDFILL	ND	ND	ND			
	SLUDGE (ng/Kg)					
SITKA LANDFILL	103	107	210			

Table A . Dioxins and furans measured in samples collected in Sitka, Alaska August 1990.

Descrip	2378 TCDD	2378 PeCDD	2378 HxCDD	2378 HpCDD	OCDD	2378 TCDF	12378 PeCDF	23478 PeCDF	2378 HxCDF	2378 HpCDF	OCDF
TEF-factor	1.000	0.500	0.100	0.010	0.001	0.100	0.050	0.500	0.100	0.010	0.001
SOIL (ng/Kg)											
APC			11	84	531						30
APC dup					210						
THIMBLEBERRY				170	560					29	36
JAMESTOWN					580					31	12
GALANKIN I											
GALANKIN dup											
CITY-SOUTH				58	247				8	33	33
CITY-JAPONSKI				120	946					36	89
CITY-CENTER				11	69						
CITY-NORTH				23	143						
BLUE LAKE											
DEEP INLET											
FLOATING RESIDUE (ng/Kg)											
SAWMILL COVE	4	4	23	57	330	140	3	4	7	4	13
EASTERN CHANNEL	3			31	220	61				5	13
EASTERN CHANNEL	3			28	230	84					
SEDIMENT (ng/Kg)											
HERRING COVE				54		4				20	
EASTERN CHANNEL				25		8				9	
SAWMILL COVE			11	174		46	3	3	3	53	
BLUE LAKE		4	16	28		4		4	15	55	
ASH (ng/Kg)											
BOTTOM			6	18	29	55	9	7		14	
BOTTOM dup							26	12			
MULTI CLONE	2	3				32	6	4		6	
FLY ASH - ESP	99	600	6500	12000	1900	1500	320	230	803	77	
FLY ASH - ESP		2000	16400	17000	12000	3100	700	540	569	413	70
FLY ASH - ESP		780	6800	12000	5900	2100	420	330	831	78	100
SITKA LANDFILL											
SLUDGE ng/Kg			7	96		1			7	99	
LEACHATE (pg/L)											
HOGFUEL STORAGE											
HOGF STOR-dup											
SITKA LANDFILL											
WATER (pg/L)											
FIELD BLANK											
BLUE LAKE											
BLUE L. dup											

Table A . Dioxins and furans measured in samples collected in Sitka, Alaska August 1990.

Descrip	2378 TCDD	2378 PeCDD	2378 HxCDD	2378 HpCDD	OCDD	2378 TCDF	12378 PeCDF	23478 PeCDF	2378 HxCDF	2378 HpCDF	OCDF
TEF-factor	1.000	0.500	0.100	0.010	0.001	0.100	0.050	0.500	0.100	0.010	0.001
BLUE L-R TROUT											
THIMBLE L-Br TRT											
HERRING C-QUIL						2					
SAWMILL C-QUIL						3					
THIMBLE B-QUIL						2					
SILVER B-SCULP						4					
SILVER B-E SOLE	1					2					
THIMBLE B-SANDDAB						1					
SAW C-CRAB HEP						11					
SAW C-CRAB GHS						8					
SAW C-CRAB MUS						3					
THIMB B-MUSSELS						3					
SILVER B-SHRIMP						1					

APPENDIX B. RISK CALCULATIONS

AVISO 1E-09
ADVISO 1E-07 one day
SLOPE 156000

Duration	Days	Body weight	Kg
75 yrs	27375	Adult	70
30 yrs	10950	Child	10
6 year	2190		

CANCER RISK

TISSUE CONCENTR 3
NG/KG

ADULT 75 years			ADULT 30 years			CHILD 6 years		
ING	DOSE	RISK	conc	DOSE	RISK	conc	DOSE	RISK
G/Day	mg/kg/day		ng/Kg	mg/kg/day		ng/Kg	mg/kg/day	
0.17	7E-12	1E-06	0.17	3E-12	5E-07	0.17	4E-12	6E-07
0.71	3E-11	5E-06	0.71	1E-11	2E-06	0.71	2E-11	3E-06
5	2E-10	3E-05	5	9E-11	1E-05	5	1E-10	2E-05
6.5	3E-10	4E-05	6.5	1E-10	2E-05	6.5	2E-10	2E-05
25	1E-09	2E-04	25	4E-10	7E-05	25	6E-10	9E-05
28.9	1E-09	2E-04	28.9	5E-10	8E-05	28.9	7E-10	1E-04
54	2E-09	4E-04	54	9E-10	1E-04	54	1E-09	2E-04
95.1	4E-09	6E-04	95.1	2E-09	3E-04	95.1	2E-09	4E-04
202	9E-09	1E-03	202	3E-09	5E-04	202	5E-09	8E-04

NONCANCER RISK

TISSUE CONCENTR 3 LIFETIME
NG/KG

ADULT 75 years			ADULT 30 years		
ING	DOSE	RATIO	conc	DOSE	RATIO
G/Day	mg/kg/day		ng/Kg	mg/kg/day	
0.17	7E-12	7E-03	0.17	3E-12	3E-03
0.71	3E-11	3E-02	0.71	1E-11	1E-02
5	2E-10	2E-01	5	9E-11	9E-02
6.5	3E-10	3E-01	6.5	1E-10	1E-01
25	1E-09	1E+00	25	4E-10	4E-01
28.9	1E-09	1E+00	28.9	5E-10	5E-01
54	2E-09	2E+00	54	9E-10	9E-01
95.1	4E-09	4E+00	95.1	2E-09	2E+00
202	9E-09	9E+00	202	3E-09	3E+00

ONE DAY NONCANCER RISK

TISSUE CONCENTR 3
NG/KG

ADULT 75 years			CHILD 6 years		
	DOSE	RATIO	conc	DOSE	RATIO
G/Day	mg/kg/day		G/Day	mg/kg/day	
0.17	7E-12	7E-05	0.17	5E-11	5E-04
0.71	3E-11	3E-04	0.71	2E-10	2E-03
5	2E-10	2E-03	5	2E-09	2E-02
6.5	3E-10	3E-03	6.5	2E-09	2E-02
25	1E-09	1E-02	25	8E-09	8E-02
28.9	1E-09	1E-02	28.9	9E-09	9E-02
54	2E-09	2E-02	54	2E-08	2E-01
95.1	4E-09	4E-02	95.1	3E-08	3E-01
202	9E-09	9E-02	202	6E-08	6E-01

AVISO 1E-09
ADVISO 1E-07 one day
SLOPE 156000

Duration	Days	Body weight	Kg
75 yrs	27375	Adult	70
30 yrs	10950	Child	10
6 year	2190		

CANCER RISK

TISSUE CONCENTR 0.4
NG/KG

ADULT 75 years			ADULT 30 years			CHILD 6 years		
ING	DOSE	RISK	conc	DOSE	RISK	conc	DOSE	RISK
G/Day	mg/kg/day		ng/Kg	mg/kg/day		ng/Kg	mg/kg/day	
0.17	1E-12	2E-07	0.17	4E-13	6E-08	0.17	5E-13	8E-08
0.71	4E-12	6E-07	0.71	2E-12	3E-07	0.71	2E-12	4E-07
5	3E-11	4E-06	5	1E-11	2E-06	5	2E-11	2E-06
6.5	4E-11	6E-06	6.5	1E-11	2E-06	6.5	2E-11	3E-06
25	1E-10	2E-05	25	6E-11	9E-06	25	8E-11	1E-05
28.9	2E-10	3E-05	28.9	7E-11	1E-05	28.9	9E-11	1E-05
54	3E-10	5E-05	54	1E-10	2E-05	54	2E-10	3E-05
95.1	5E-10	8E-05	95.1	2E-10	3E-05	95.1	3E-10	5E-05
202	1E-09	2E-04	202	5E-10	7E-05	202	6E-10	1E-04

NONCANCER RISK

TISSUE CONCENTR 0.4 LIFETIME
NG/KG

ADULT 75 years			ADULT 30 years		
ING	DOSE	RATIO	conc	DOSE	RATIO
G/Day	mg/kg/day		ng/Kg	mg/kg/day	
0.17	1E-12	1E-03	0.17	1E-12	1E-03
0.71	4E-12	4E-03	0.71	4E-12	4E-03
5	3E-11	3E-02	5	3E-11	3E-02
6.5	4E-11	4E-02	6.5	4E-11	4E-02
25	1E-10	1E-01	25	1E-10	1E-01
28.9	2E-10	2E-01	28.9	2E-10	2E-01
54	3E-10	3E-01	54	3E-10	3E-01
95.1	5E-10	5E-01	95.1	5E-10	5E-01
202	1E-09	1E+00	202	1E-09	1E+00

ONE DAY NONCANCER RISK

TISSUE CONCENTR 0.4
NG/KG

ADULT 75 years			CHILD 6 years		
	DOSE	RATIO	conc	DOSE	RATIO
G/Day	mg/kg/day		G/Day	mg/kg/day	
0.17	4E-12	4E-05	0.17	7E-12	7E-05
0.71	3E-11	3E-04	0.71	3E-11	3E-04
5	4E-11	4E-04	5	2E-10	2E-03
6.5	1E-10	1E-03	6.5	3E-10	3E-03
25	2E-10	2E-03	25	1E-09	1E-02
28.9	3E-10	3E-03	28.9	1E-09	1E-02
54	5E-10	5E-03	54	2E-09	2E-02
95.1	1E-09	1E-02	95.1	4E-09	4E-02
202	0E+00	0E+00	202	8E-09	8E-02

AVISO 1E-09
ADVISO 1E-07 one day
SLOPE 156000

Duration	Days	Body weight	Kg
75 yrs	27375	Adult	70
30 yrs	10950	Child	10
6 year	2190		

CANCER RISK

TISSUE CONCENTR 1
NG/KG

ADULT 75 years			ADULT 30 years			CHILD 6 years		
ING G/Day	DOSE mg/kg/day	RISK	conc ng/Kg	DOSE mg/kg/day	RISK	conc ng/Kg	DOSE mg/kg/day	RISK
0.17	2E-12	4E-07	0.17	1E-12	2E-07	0.17	1E-12	2E-07
0.71	1E-11	2E-06	0.71	4E-12	6E-07	0.71	6E-12	9E-07
5	7E-11	1E-05	5	3E-11	4E-06	5	4E-11	6E-06
6.5	9E-11	1E-05	6.5	4E-11	6E-06	6.5	5E-11	8E-06
25	4E-10	6E-05	25	1E-10	2E-05	25	2E-10	3E-05
28.9	4E-10	6E-05	28.9	2E-10	3E-05	28.9	2E-10	4E-05
54	8E-10	1E-04	54	3E-10	5E-05	54	4E-10	7E-05
95.1	1E-09	2E-04	95.1	5E-10	8E-05	95.1	8E-10	1E-04
202	3E-09	5E-04	202	1E-09	2E-04	202	2E-09	3E-04

NONCANCER RISK

TISSUE CONCENTR 1 LIFETIME
NG/KG

ADULT 75 years			ADULT 30 years		
ING G/Day	DOSE mg/kg/day	RATIO	conc ng/Kg	DOSE mg/kg/day	RATIO
0.17	2E-12	2E-03	0.17	1E-12	1E-03
0.71	1E-11	1E-02	0.71	4E-12	4E-03
5	7E-11	7E-02	5	3E-11	3E-02
6.5	9E-11	9E-02	6.5	4E-11	4E-02
25	4E-10	4E-01	25	1E-10	1E-01
28.9	4E-10	4E-01	28.9	2E-10	2E-01
54	8E-10	8E-01	54	3E-10	3E-01
95.1	1E-09	1E+00	95.1	5E-10	5E-01
202	3E-09	3E+00	202	1E-09	1E+00

ONE DAY NONCANCER RISK

TISSUE CONCENTR 1
NG/KG

ADULT 75 years			CHILD 6 years		
G/Day	DOSE mg/kg/day	RATIO	conc G/Day	DOSE mg/kg/day	RATIO
0.17	2E-12	2E-05	0.17	2E-11	2E-04
0.71	1E-11	1E-04	0.71	7E-11	7E-04
5	7E-11	7E-04	5	5E-10	5E-03
6.5	9E-11	9E-04	6.5	7E-10	7E-03
25	4E-10	4E-03	25	3E-09	3E-02
28.9	4E-10	4E-03	28.9	3E-09	3E-02
54	8E-10	8E-03	54	5E-09	5E-02
95.1	1E-09	1E-02	95.1	1E-08	1E-01
202	3E-09	3E-02	202	2E-08	2E-01

Table B   Soil Risk Calculations

DOSE	noncancer derm	7.9E-05 kg/kgday	Conc X ADI X abs X 1E-06 mg/ng
DOSE	cancer dermal	3.4E-05 kg/kgday	ng/kg kg/kgday mg/ng
	sloper factor	156000 \mg/kg/day	
			slope factor X ADI
	one day Hlth	1.0E-07 mg/kg/day	ADI/RFD
DOSE	noncancer soil	3.7E-06 kg/kgday	
DOSE	cancer soil	1.6E-06 kg/kgday	

DERMAL CANCER RISK ESTIMATE

TEF-factor	ng/Kg TEC	ng/Kg TEC	ng/Kg TEC	DOSE TEC	DOSE TEC	DOSE TEC	RISK TEC	RISK TEC	RISK TEC
LOCATION	DL=0.00	DL=0.50	DL=1.00	DL=0.00	DL=0.50	DL=1.00	DL=0.00	DL=0.50	DL=1.00
APC-DUP	0.21	12.07	23.92	1.4E-12	8.2E-11	1.6E-10	2E-08	1E-06	3E-06
APC	2.45	6.04	9.62	1.7E-11	4.1E-11	6.5E-11	3E-07	6E-07	1E-06
GALANKIN I		11.86	23.72	0	8.1E-11	1.6E-10	0E+00	1E-06	3E-06
GALANKIN I	0.03	6.20	12.37	2.4E-13	4.2E-11	8.4E-11	4E-09	7E-07	1E-06
BLUE LAKE		11.86	23.72	0	8.1E-11	1.6E-10	0E+00	1E-06	3E-06
JAMESTOWN	0.90	13.40	25.90	6.1E-12	9.1E-11	1.8E-10	1E-07	1E-06	3E-06
THIMBLEBERRY	2.59	14.34	26.09	1.8E-11	9.7E-11	1.8E-10	3E-07	2E-06	3E-06
DEEP INLET		21.87	43.74	0	1.5E-10	3.0E-10	0E+00	2E-06	5E-06
CITY-N	0.37	3.44	6.51	2.5E-12	2.3E-11	4.4E-11	4E-08	4E-07	7E-07
CITY-C	0.18	3.11	6.05	1.2E-12	2.1E-11	4.1E-11	2E-08	3E-07	6E-07
CITY-JAPO	2.59	6.19	9.78	1.8E-11	4.2E-11	6.7E-11	3E-07	7E-07	1E-06
CITY-S	1.98	4.65	7.33	1.3E-11	3.2E-11	5.0E-11	2E-07	5E-07	8E-07
F. RESIDUE	25	26	26	1.7E-10	1.8E-10	1.8E-10	3E-06	3E-06	3E-06
F. RESIDUE	10	11	12	6.8E-11	7.5E-11	8.2E-11	1E-06	1E-06	1E-06
F. RESIDUE	12	13	15	8.2E-11	8.8E-11	1.0E-10	1E-06	1E-06	2E-06

SOIL INGESTION CANCER RISK

TEF-factor	ng/Kg TEC	ng/Kg TEC	ng/Kg TEC	DOSE	DOSE	DOSE	RISK	RISK	RISK
LOCATION	DL=0.00	DL=0.50	DL=1.00	DL=0.00	DL=0.50	DL=1.00	DL=0.00	DL=0.50	DL=1.00
APC-DUP	0.21	12.07	23.92	3.4E-13	2.0E-11	3.9E-11	5E-08	3E-06	6E-06
APC	2.45	6.04	9.62	4.0E-12	9.8E-12	1.6E-11	6E-07	2E-06	2E-06
GALANKIN I		11.86	23.72	0	1.9E-11	3.9E-11	0E+00	3E-06	6E-06
GALANKIN I	0.03	6.20	12.37	5.7E-14	1.0E-11	2.0E-11	9E-09	2E-06	3E-06
BLUE LAKE		11.86	23.72	0	1.9E-11	3.9E-11	0E+00	3E-06	6E-06
JAMESTOWN	0.90	13.40	25.90	1.5E-12	2.2E-11	4.2E-11	2E-07	3E-06	7E-06
THIMBLEBERRY	2.59	14.34	26.09	4.2E-12	2.3E-11	4.3E-11	7E-07	4E-06	7E-06
DEEP INLET		21.87	43.74	0	3.6E-11	7.1E-11	0E+00	6E-06	1E-05
CITY-N	0.37	3.44	6.51	6.0E-13	5.6E-12	1.1E-11	9E-08	9E-07	2E-06
CITY-C	0.18	3.11	6.05	3.0E-13	5.1E-12	9.9E-12	5E-08	8E-07	2E-06
CITY-JAPO	2.59	6.19	9.78	4.2E-12	1.0E-11	1.6E-11	7E-07	2E-06	2E-06
CITY-S	1.98	4.65	7.33	3.2E-12	7.6E-12	1.2E-11	5E-07	1E-06	2E-06
F. RESIDUE	25	26	26	4.1E-11	4.2E-11	4.2E-11	6E-06	7E-06	7E-06
F. RESIDUE	10	11	12	1.6E-11	1.8E-11	2.0E-11	3E-06	3E-06	3E-06
F. RESIDUE	12	13	15	2.0E-11	2.1E-11	2.4E-11	3E-06	3E-06	4E-06

TABLE B   SOIL CUMULATIVE RISK CALCULATIONS

	DL=0.00			DL=0.50			DL=1.0		
LOCATION	DERMAL	INGEST	SUM	DERMAL	INGEST	SUM	DERMAL	INGEST	SUM
APC-DUP	2E-08	5E-08	8E-08	1E-06	5E-08	1E-06	3E-06	6E-06	9E-06
APC	3E-07	6E-07	9E-07	6E-07	6E-07	1E-06	1E-06	2E-06	3E-06
GALANKIN I	0E+00	0E+00	0E+00	1E-06	0E+00	1E-06	3E-06	6E-06	9E-06
GALANKIN I	4E-09	9E-09	1E-08	7E-07	9E-09	7E-07	1E-06	3E-06	4E-06
BLUE LAKE	0E+00	0E+00	0E+00	1E-06	0E+00	1E-06	3E-06	6E-06	9E-06
JAMESTOWN	1E-07	2E-07	3E-07	1E-06	2E-07	2E-06	3E-06	7E-06	9E-06
THIMBLEBERRY	3E-07	7E-07	9E-07	2E-06	7E-07	2E-06	3E-06	7E-06	9E-06
DEEP INLET	0E+00	0E+00	0E+00	2E-06	0E+00	2E-06	5E-06	1E-05	2E-05
CITY-N	4E-08	9E-08	1E-07	4E-07	9E-08	5E-07	7E-07	2E-06	2E-06
CITY-C	2E-08	5E-08	7E-08	3E-07	5E-08	4E-07	6E-07	2E-06	2E-06
CITY-JAPO	3E-07	7E-07	9E-07	7E-07	7E-07	1E-06	1E-06	2E-06	4E-06
CITY-S	2E-07	5E-07	7E-07	5E-07	5E-07	1E-06	8E-07	2E-06	3E-06
F RESIDUE	3E-06	6E-06	9E-06	3E-06	6E-06	9E-06	3E-06	7E-06	9E-06
F RESIDUE	1E-06	3E-06	4E-06	1E-06	3E-06	4E-06	1E-06	3E-06	4E-06
F RESIDUE	1E-06	3E-06	4E-06	1E-06	3E-06	4E-06	2E-06	4E-06	5E-06

TABLE 5. SOIl NON-CANCER LIFETIME RISK ESTIMATES

DOSE	noncancer derm	7.9E-05 kg/kgday	Conc X ADI X abs X 1E-06 mg/ng
DOSE	cancer dermal	3.4E-05 kg/kgday	ng/kg kg/kgday mg/ng
	sloper factor	156000 \mg/kg/day	
	lifetime	1.0E-09 mg/kg/day	slope factor X ADI
	one day Hlth	1.0E-07 mg/kg/day	ADI/RFD
DOSE	noncancer soil	3.7E-06 kg/kgday	
DOSE	cancer soil	1.6E-06 kg/kgday	

DERMAL NON-CANCER RISK ESTIMATE

TEF- LOCATION	ng/Kg TEC DL=0.00	ng/Kg TEC DL=0.50	ng/Kg TEC DL=1.00	DOSE TEC DL=0.00	DOSE TEC DL=0.50	DOSE TEC DL=1.00	RATIO TEC DL=0.00	RATIO TEC DL=0.50	RATIO TEC DL=1.00
APC-DUP	0.21	12.07	23.92	1.4E-12	8.2E-11	1.6E-10	1E-04	8E-03	2E-02
APC	2.45	6.04	9.62	1.7E-11	4.1E-11	6.5E-11	2E-03	4E-03	7E-03
GALANKIN I		11.86	23.72	0	8.1E-11	1.6E-10	0E+00	8E-03	2E-02
GALANKIN	0.03	6.20	12.37	2.4E-13	4.2E-11	8.4E-11	2E-05	4E-03	8E-03
BLUE LAKE		11.86	23.72	0	8.1E-11	1.6E-10	0E+00	8E-03	2E-02
JAMESTOWN	0.90	13.40	25.90	6.1E-12	9.1E-11	1.8E-10	6E-04	9E-03	2E-02
THIMBLEBE	2.59	14.34	26.09	1.8E-11	9.7E-11	1.8E-10	2E-03	1E-02	2E-02
DEEP INLET		21.87	43.74	0	1.5E-10	3.0E-10	0E+00	1E-02	3E-02
CITY-N	0.37	3.44	6.51	2.5E-12	2.3E-11	4.4E-11	3E-04	2E-03	4E-03
CITY-C	0.18	3.11	6.05	1.2E-12	2.1E-11	4.1E-11	1E-04	2E-03	4E-03
CITY-JAPO	2.59	6.19	9.78	1.8E-11	4.2E-11	6.7E-11	2E-03	4E-03	7E-03
CITY-S	1.98	4.65	7.33	1.3E-11	3.2E-11	5.0E-11	1E-03	3E-03	5E-03
F. RESIDU	25	26	26	1.7E-10	1.8E-10	1.8E-10	2E-02	2E-02	2E-02
F. RESIDU	10	11	12	6.8E-11	7.5E-11	8.2E-11	7E-03	7E-03	8E-03
F. RESIDU	12	13	15	8.2E-11	8.8E-11	1.0E-10	8E-03	9E-03	1E-02

SOIL INGESTION NON-CANCER RISK

TEF- LOCATION	ng/Kg TEC DL=0.00	ng/Kg TEC DL=0.50	ng/Kg TEC DL=1.00	DOSE DL=0.00	DOSE DL=0.50	DOSE DL=1.00	RATIO DL=0.00	RATIO DL=0.50	RATIO DL=1
APC-DUP	0.21	12.07	23.92	7.8E-13	4.5E-11	8.9E-11	0.00	0.04	0.09
APC	2.45	6.04	9.62	9.1E-12	2.2E-11	3.6E-11	0.01	0.02	0.04
GALANKIN I		11.86	23.72	0	4.4E-11	8.8E-11	0.00	0.04	0.09
GALANKIN	0.03	6.20	12.37	1.3E-13	2.3E-11	4.6E-11	0.00	0.02	0.05
BLUE LAKE		11.86	23.72	0	4.4E-11	8.8E-11	0.00	0.04	0.09
JAMESTOWN	0.90	13.40	25.90	3.3E-12	5.0E-11	9.6E-11	0.00	0.05	0.10
THIMBLEBE	2.59	14.34	26.09	9.6E-12	5.3E-11	9.7E-11	0.01	0.05	0.10
DEEP INLET		21.87	43.74	0	8.1E-11	1.6E-10	0.00	0.08	0.16
CITY-N	0.37	3.44	6.51	1.4E-12	1.3E-11	2.4E-11	0.00	0.01	0.02
CITY-C	0.18	3.11	6.05	6.7E-13	1.2E-11	2.2E-11	0.00	0.01	0.02
CITY-JAPO	2.59	6.19	9.78	9.6E-12	2.3E-11	3.6E-11	0.01	0.02	0.04
CITY-S	1.98	4.65	7.33	7.3E-12	1.7E-11	2.7E-11	0.01	0.02	0.03
F. RESIDU	25	26	26	9.3E-11	9.6E-11	9.6E-11	0.09	0.10	0.10
F. RESIDU	10	11	12	3.7E-11	4.1E-11	4.4E-11	0.04	0.04	0.04
F. RESIDU	12	13	15	4.4E-11	4.8E-11	5.6E-11	0.04	0.05	0.06

	DL=0			DL=.5			DL=1		
LOCATION	DERMAL	INGEST	SUM	DERMAL	INGEST	SUM	DERMAL	INGEST	SUM
APC-DUP	0.00	0.00	0.00	0.01	0.04	0.05	0.02	0.09	0.10
APC	0.00	0.01	0.01	0.00	0.02	0.03	0.01	0.04	0.04
GALANKIN I	0.00	0.00	0.00	0.01	0.04	0.05	0.02	0.09	0.10
GALANKIN I	0.00	0.00	0.00	0.00	0.02	0.03	0.01	0.05	0.05
BLUE LAKE	0.00	0.00	0.00	0.01	0.04	0.05	0.02	0.09	0.10
JAMESTOWN	0.00	0.00	0.00	0.01	0.05	0.06	0.02	0.10	0.11
THIMBLEBERRY	0.00	0.01	0.01	0.01	0.05	0.06	0.02	0.10	0.11
DEEP INLET	0.00	0.00	0.00	0.01	0.08	0.10	0.03	0.16	0.19
CITY-N	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.02	0.03
CITY-C	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.02	0.03
CITY-JAPO	0.00	0.01	0.01	0.00	0.02	0.03	0.01	0.04	0.04
CITY-S	0.00	0.01	0.01	0.00	0.02	0.02	0.00	0.03	0.03
F. RESIDUE	0.02	0.09	0.11	0.02	0.10	0.11	0.02	0.10	0.11
F. RESIDUE	0.01	0.04	0.04	0.01	0.04	0.05	0.01	0.04	0.05
F. RESIDUE	0.01	0.04	0.05	0.01	0.05	0.06	0.01	0.06	0.07

Table B Soil Risk Calculations

DOSE	cancer dermal	3.4E-05	kg/kgday	ng/kg kg/kgday mg/ng
	sloper factor	156000	\mg/kg/day	
	lifetime	1.0E-09	mg/kg/day	slope factor X ADI
	one day Hlth	1.0E-07	mg/kg/day	ADI/RFD
DOSE	noncancer soil	3.7E-06	kg/kgday	
DOSE	cancer soil	1.6E-06	kg/kgday	

CHILD ADI 200 mg/day x 1e-12kg/ng /15 KG

1.3E-11 mg/ng/day

					INGESTION			NON-CANCER	
	ng/Kg	ng/Kg	ng/Kg	DOSE	DOSE	DOSE	RATIO	RATIO	RATIO
TEF-factor	TEC	TEC	TEC	TEC	TEC	TEC	TEC	TEC	TEC
LOCATION	DL=0.00	DL=0.50	DL=1.00	DL=0.00	DL=0.50	DL=1.00	DL=0.00	DL=0.50	DL=1.00
APC-DUP	0.21	12.07	23.92	2.8E-12	1.6E-10	3.2E-10	0.00	0.00	0.00
APC	2.45	6.04	9.62	3.3E-11	8.0E-11	1.3E-10	0.00	0.00	0.00
GALANKIN I		11.86	23.72	0.0E+00	1.6E-10	3.2E-10	0.00	0.00	0.00
GALANKIN I	0.03	6.20	12.37	4.6E-13	8.3E-11	1.6E-10	0.00	0.00	0.00
BLUE LAKE		11.86	23.72	0.0E+00	1.6E-10	3.2E-10	0.00	0.00	0.00
JAMESTOWN	0.90	13.40	25.90	1.2E-11	1.8E-10	3.5E-10	0.00	0.00	0.00
THIMBLEBERRY	2.59	14.34	26.09	3.4E-11	1.9E-10	3.5E-10	0.00	0.00	0.00
DEEP INLET		21.87	43.74	0.0E+00	2.9E-10	5.8E-10	0.00	0.00	0.01
CITY-N	0.37	3.44	6.51	4.9E-12	4.6E-11	8.7E-11	0.00	0.00	0.00
CITY-C	0.18	3.11	6.05	2.4E-12	4.2E-11	8.1E-11	0.00	0.00	0.00
CITY-JAPO	2.59	6.19	9.78	3.5E-11	8.3E-11	1.3E-10	0.00	0.00	0.00
CITY-S	1.98	4.65	7.33	2.6E-11	6.2E-11	9.8E-11	0.00	0.00	0.00
F. RESIDUE	25	26	26	3.3E-10	3.5E-10	3.5E-10	0.00	0.00	0.00
F. RESIDUE	10	11	12	1.3E-10	1.5E-10	1.6E-10	0.00	0.00	0.00
F. RESIDUE	12	13	15	1.6E-10	1.7E-10	2.0E-10	0.00	0.00	0.00

CHILD (3900cm2 x 1mg/cm2 x 1e-12 kg/ng)/15Kg

2.6E-10 mg/ng/day

	ng/Kg	ng/Kg	ng/Kg		DERMAL			NON CANCER	
TEF-factor	TEC	TEC	TEC	DOSE	DOSE	DOSE	RATIO	RATIO	RATIO
LOCATION	DL=0.00	DL=0.50	DL=1.00	DL=0.00	DL=0.50	DL=1.00	DL=0.00	DL=0.50	DL=1.00
APC-DUP	0.21	12.07	23.92	5.5E-11	3.1E-09	6.2E-09	0.00	0.00	0.01
APC	2.45	6.04	9.62	6.4E-10	1.6E-09	2.5E-09	0.00	0.00	0.00
GALANKIN I		11.86	23.72	0.0E+00	3.1E-09	6.2E-09	0.00	0.00	0.01
GALANKIN I	0.03	6.20	12.37	9.0E-12	1.6E-09	3.2E-09	0.00	0.00	0.00
BLUE LAKE		11.86	23.72	0.0E+00	3.1E-09	6.2E-09	0.00	0.00	0.01
JAMESTOWN	0.90	13.40	25.90	2.3E-10	3.5E-09	6.7E-09	0.00	0.00	0.01
THIMBLEBERRY	2.59	14.34	26.09	6.7E-10	3.7E-09	6.8E-09	0.00	0.00	0.01
DEEP INLET		21.87	43.74	0.0E+00	5.7E-09	1.1E-08	0.00	0.01	0.01
CITY-N	0.37	3.44	6.51	9.6E-11	8.9E-10	1.7E-09	0.00	0.00	0.00
CITY-C	0.18	3.11	6.05	4.7E-11	8.1E-10	1.6E-09	0.00	0.00	0.00
CITY-JAPO	2.59	6.19	9.78	6.7E-10	1.6E-09	2.5E-09	0.00	0.00	0.00
CITY-S	1.98	4.65	7.33	5.1E-10	1.2E-09	1.9E-09	0.00	0.00	0.00
F. RESIDUE	25	26	26	6.5E-09	6.8E-09	6.8E-09	0.01	0.01	0.01
F. RESIDUE	10	11	12	2.6E-09	2.9E-09	3.1E-09	0.00	0.00	0.00
F. RESIDUE	12	13	15	3.1E-09	3.4E-09	3.9E-09	0.00	0.00	0.00

ONE DAY CHILD HEALTH ADVISORY

		DL=0			DL=.5		DL=1		
LOCATION	DERMAL	INGEST	SUM	DERMAL	INGEST	SUM	DERMAL	INGEST	SUM
APC-DUP	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
APC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GALANKIN I	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
GALANKIN I	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BLUE LAKE	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
JAMESTOWN	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01
THIMBLEBERRY	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01
DEEP INLET	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.02
CITY-N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CITY-C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CITY-JAPO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CITY-S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. RESIDUE	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
F. RESIDUE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F RESIDUE	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01

APPENDIX C. RAW DATA

C-1. DIOXINS AND FURANS

EPA August 1990 investigation

Description of Data qualifiers is attached.

Lab	Type	Sample No.	Descrip	Units	2378 TCDD	2378 PeCDD	2378 HxCDD	2378 HpCDD	OCDD	2378 TCDF	12378 PeCDF	23478 PeCDF	2378 HxCDF	2378 HpCDF	OCDF
			TEF-factor		1.000	0.500	0.100	0.010	0.001	0.100	0.050	0.500	0.100	0.010	0.001
CL	Ash	4269	HOGF-BOTTOM	ng/Kg	2.17 U	3.90 U	6.42	18.30	28.80	54.70	9.48	7.12	6.34 U	14.20	9.50
CL	Ash	4270	MULTI CLON	ng/Kg	2.32	3.22	5.36 U	4.42 U	9.90 U	31.50	5.72	4.08	6.49 U	5.62 U	9.90
CL	Soil	4721	DEEP INLET	ng/Kg	17.90 UJ3	14.40 UJ3	39.80 UJ3	40.80 UJ3	99.10 UJ3	16.30 UJ3	14.60 UJ3	14.60 UJ3	40.00 UJ3	39.10 UJ3	99.10
CL	Soil	4730	GALANKIN I	ng/Kg	3.89 U	2.97 U	35.80 U	8.37 U	34.70	3.86 U	3.16 U	3.16 U	10.60 U	9.25 U	18.20
CL	Soil	4731	APC	ng/Kg	3.06 U	2.32 U	10.50	83.70	531.00	5.40 U	2.77 U	2.77 U	7.67 U	12.50 UJ	30.20
CL	Leachate	4740	SITKA LAND	pg/L	24.20 UJ3	18.40 UJ3	57.30 UJ3	44.30 UJ3	92.70 UJ3	19.10 UJ3	20.20 UJ3	20.20 UJ3	61.40 UJ3	58.10 UJ3	92.70
CL	Soil	4741	CITY-N	ng/Kg	2.53 U	2.06 U	6.07 U	22.50	143.00	2.52 U	1.97 U	1.97 U	5.69 U	5.97 U	14.10
CL	Soil	4742	CITY-C	ng/Kg	2.48 U	1.79 U	5.45 U	11.20	69.00	2.26 U	1.97 U	1.97 U	5.79 U	4.92 U	9.41
CL	Soil	4743	CITY-JAPO	ng/Kg	2.76 U	2.29 U	7.06 U	120.00	946.00	2.41 U	2.71 U	2.71 U	8.46 U	35.90	89.00
CL	Soil	4749	CITY-S	ng/Kg	2.53 U	1.86 U	5.37 U	57.60	247.00	1.98 U	2.11 U	2.11 U	7.92	32.80	33.10

U=practical quantitation limit

Lab	Type	Sample No.	Descrip	Units	2378 TCDD	2378 PeCDD	2378 HxCDD	2378 HpCDD	OCDD	2378 TCDF	12378 PeCDF	23478 PeCDF	2378 HxCDF	2378 HpCDF	OCDF
R7	Water	4744	FIELD BLANK	pg/L	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100
R7	Water	4746	BLUE LAKE	pg/L	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100
R7	Water	4746	BLUE LAKE-DUP	pg/L	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100
R7	Leachate	4267	HOGF STOR	pg/L	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100
R7	Leachate	4267	HOGF STOR-DUP	pg/L	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100
R7	Ash	4269	HOGF-BOTTOM	ng/Kg	10 U	10 U	10 U	10 U	10 U	79 U	26	12	20 U	20 U	10
R7	Soil	4730	GALANKIN I	ng/Kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
R7	Soil	4732	APC-DUP	ng/Kg	10 U	10 U	10 U	10 U	210	10 U	10 U	10 U	10 U	10 U	10
R7	Soil	4733	BLUE LAKE	ng/Kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
R7	Soil	4747	JAMESTOWN	ng/Kg	10 U	10 U	10 U	150 U	580	10 U	10 U	10 U	10 U	31	12
R7	Soil	4748	THIMBLEBERRY	ng/Kg	10 U	10 U	10 U	170	560	10 U	10 U	10 U	10 U	29	36

U=Detection Limit

Lab	Type	Sample No.	Descrip	Units	2378 TCDD	2378 PeCDD	2378 HxCDD	2378 HpCDD	OCDD	2378 TCDF	12378 PeCDF	23478 PeCDF	2378 HxCDF	2378 HpCDF	OCDF
															Few Oct
DU	Tissue	0179	BL LK-R TROUT	ng/Kg	0.67 U	1.27 U	1.66 U	7.12 U	No data	0.47 U	1.68 U	1.68 U	2.75 U	5.3 U	No data
DU	Tissue	0181	H COVE-QUILLB	ng/Kg	0.67 U	1.27 U	1.67 U	7.12 U	No data	2.36	1.68 U	1.68 U	2.77 U	5.32 U	No data
DU	Tissue	0183	SAW B-QUILLB	ng/Kg	0.67 U	1.27 U	1.66 U	7.12 U	No data	3.48	1.68 U	1.68 U	2.75 U	5.3 U	No data
DU	Tissue	0176	SILV B-SCULP	ng/Kg	0.67 U	1.27 U	1.66 U	7.29 U	No data	3.83	1.68 U	1.68 U	2.75 U	5.3 U	No data
DU	Tissue	0185	SILV B-E SOLE	ng/Kg	1.17	1.27 U	1.66 U	0 U	No data	1.76	1.68 U	1.68 U	2.75 U	5.3 U	No data
DU	Tissue	0175	SILV B-SHRIMP	ng/Kg	0.67 U	1.27 U	1.67 U	7.12 U	No data	1.10	1.68 U	1.68 U	2.76 U	5.31 U	No data
DU	Tissue	0184	TH B-SANDDAB	ng/Kg	0.68 U	1.27 U	1.67 U	7.14 U	No data	1.37	1.68 U	1.68 U	2.76 U	5.32 U	No data
DU	Tissue	0182	TH B-QUILLB	ng/Kg	0.67 U	1.27 U	1.67 U	7.12 U	No data	2.16	1.68 U	1.68 U	2.76 U	5.31 U	No data
DU	Tissue	0180	TH L-E BR TRT	ng/Kg	0.67 U	1.27 U	1.66 U	7.12 U	No data	0.47 U	1.67 U	1.67 U	2.75 U	5.29 U	No data
DU	Tissue	0178	SAW B-CRB HEP	ng/Kg	0.76 U	1.27 U	2.03 U	8.15 U	9.6 U	11.38	1.68 U	1.68 U	2.76 U	5.31 U	6.41
DU	Tissue	0178	SAW B-CRB GHS	ng/Kg	0.68 U	1.28 U	1.67 U	7.7 U	9.6 U	7.51	1.69 U	1.69 U	2.77 U	5.33 U	6.41
DU	Tissue	0178	SAW B-CRB MUS	ng/Kg	0.67 U	1.27 U	1.88 U	7.37 U	9.6 U	2.73	1.68 U	1.68 U	2.76 U	5.31 U	6.41
DU	Tissue	0177	TH B-MUSSELS	ng/Kg	0.68 U	1.27 U	1.67 U	7.71 U	2.4	3.22	1.68 U	1.68 U	2.76 U	5.31 U	6.41
DU	Sediment	4711	H COVE	ng/Kg	1.35 U	3.09 U	6.42 U	54 QR	No data	4.14	3.77 U	3.38 U	5.54 U	20 QR	No data
DU	Sediment	4704	E CHANNEL	ng/Kg	1.35 U	3.15 U	4.12 U	25 QR	No data	8.13	3.39 U	3.44 U	6.23 U	9 QR	No data
DU	Sediment	4710	SAWMILL COVE	ng/Kg	1.35 U	3.39 U	11 QR	174 QR	No data	46.1	2.88	3.43	3.13	53 QR	No data
DU	Sediment	4712	BLUE LAKE	ng/Kg	2.09 U	3.85	16.31	28 QR	No data	3.98	4.59 U	4.06	14.54	55 QR	No data
DU	Sediment	4745	LANDF-LEACH	ng/Kg	1.35 U	2.61 U	6.58 UQR	96 QR	No data	1.34	3.38 U	4.27 U	7 QR	99 QR	No data

Lab	Type	Sample No.	Descrip TEF-factor	Units	123478 HxCDD	123789 HxCDD	1234678 HpCDD	123478 HxCDF	123678 HxCDF	123789 HxCDF	234678 HxCDF	1234678 HpCDF	1234789 HpCDF
CL	Ash	4269	HOGF-BOTTOM	ng/Kg	5.57U	6.42*	18.3*	6.34U	6.34U	6.34U	6.34U	14.2*	5.8U
CL	Ash	4270	MULTI CLON	ng/Kg	5.36U	5.36U	4.42U	6.49U	6.49U	6.49U	6.49U	5.62U	5.62U
CL	Soil	4721	DEEP INLET	ng/Kg	39.8UJ3	39.8UJ3	40.8UJ3	40UJ3	40UJ3	40UJ3	40UJ3	39.1UJ3	39.1UJ3
CL	Soil	4730	GALANKIN I	ng/Kg	35.8U	8.61U	8.37U	10.6U	10.6U	10.6U	10.6U	9.25U	9.25U
CL	Soil	4731	APC	ng/Kg	7.61U	10.5	83.7	7.67U	7.67U	7.67U	7.67U	12.5UJ	12.5UJ
CL	Leach	4740	SITKA LAND	pg/L	57.3UJ3	57.3UJ3	44.3UJ3	61.4UJ3	61.4UJ3	61.4UJ3	61.4UJ3	58.1UJ3	58.1UJ3
CL	Soil	4741	CITY-N	ng/Kg	6.07U	6.07U	22.5	5.69U	5.69U	5.69U	5.69U	5.97U	5.97U
CL	Soil	4742	CITY-C	ng/Kg	5.45U	5.45U	11.2	5.79U	5.79U	5.79U	5.79U	4.92U	4.92U
CL	Soil	4743	CITY-JAPO	ng/Kg	7.06U	7.06U	120	8.46U	8.46U	8.46U	8.46U	35.9	6.89U
CL	Soil	4749	CITY-S	ng/Kg	5.37U	5.37U	57.6	6.67U	6.67U	6.67U	7.92	32.8	6.21U

ADEC investigation

L a b	Type	Sample No.	Descrip	Units	2378 TCDD	2378 PeCDD	2378 HxCDD	2378 HpCDD	OCDD	2378 TCDF	12378 PeCDF	23478 PeCDF	2378 HxCDF	2378 HpCDF	OCDF
			TEF-factor		1.000	0.500	0.100	0.010	0.001	0.100	0.050	0.500	0.100	0.010	0.001
U=Detection Limit															
AD	Ash	JR190	FLY ASH - ESP	ng/Kg	99	600	6500	12000	1900	1500	320	230	803	77	290
AD	Solid	JR290	FIELD BLANK	ng/Kg	2.2 U	2.9 U	6.4 U	12	45	1.5 U	0.97 U	0.78 U	1.1 U	4.5 U	2.6
AD	Ash	JR390	FLY ASH - ESP	ng/Kg	42 U	2000	16400	17000	12000	3100	700	540	569	413	70
AD	Ash	JR590	FLY ASH - ESP	ng/Kg	80 U	780	6800	12000	5900	2100	420	330	831	78	100
Sample Collected July 15, 1990															
AD	Sludge	DEC05	SAWMILL COVE	ng/Kg	3.8	3.5	22.7	57	330	140	2.7	3.9	6.7	4.4 U	13
Sample Collected October 15,1990;															
AD	Sludge	0004	EASTERN CHAN	ng/Kg	3	1.8 U	4.8 U	31	220	61	1.5 U	2 U	3.3 U	5	13
AD	Sludge	0009	EASTERN CHAN	ng/Kg	2.6	1.6 U	7.6 U	28	230	84	1.5 U	2.1 U	2.8 U	2.5 U	10

C-2. ORGANICS

Below are the definitions for qualifiers used in the GC/MS Organics area when qualifying Semivolatile, Volatile, PAH, Resin Acids, and Guaiacol/Catechol/Phenolics analysis results.

Data Qualifiers

U	-	The analyte was analyzed for, but not detected. the associated numerical value is the sample quantitation limit.
J	-	The analyte was analyzed for, and was positively identified. However, the associated numerical value is an estimate only.
REJ	-	The data are unusable for all purposes. The analyte was analyzed for, but the presence or absence of the analyte has not been verified.
N	-	There is presumptive evidence the analyte is present.
NJ	-	A combination of "N" and "J" qualifiers. There is presumptive evidence that the analyte is present. The associated numerical value is an estimate of the concentration of the analyte in this sample.
UJ	-	A combination of "U" and "J" qualifiers. The analyte was analyzed for, and was not present above the level of the associated value. The associated numerical value is an estimate of the quantitation limit of the analyte in this sample.
NAR	-	There is no analysis result for this analyte.
*	-	The analyte was present in the sample.

Sample #:	90354267	90354704	90354710	90354711	90354712	90354744	90354746	90354700	90354701	90354702	90354709
MEDIA	Leachate	Sediment	Sediment	Sediment	Sediment	Water	Water-DW	Water-Mar	Water-Mar	Water-Mar	Water-Mar
Descrip:	HOG FUEL S	EAST CHANN	SAWMILL CO	HERRING CO	BLUE LAKE	SITKA CATC	BLUE LAKE	HERRING CO	THIMLEBERR	EAST CHANN	SAWMILL CO
Matrix:	Water-To	Sediment	Sediment	Sediment	Sediment	Water-To	Water-To	Water-To	Water-To	Water-To	Water-To
Units:	ug/l	ug/kg	ug/kg	ug/kg	ug/kg	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
TENTATIVELY IDENTIFIED VOLATILES											
RX 52 1,1,2 Trichlorotrifluoro		2.8NJ*									
RX 52 1H-INDENE, 1-ETHYLIDENE-						0.083NJ*					
RX 52 BENZENE, 1-ETHYL-2-METHY						0.084NJ*					
RX 52 BICYCLO[4.1.0]HEPTANE, 3	0.72NJ*										
RX 52 CAMPHOR (ACN)	2.4NJ*										
RX 52 CINEOLE (VAN)	0.51NJ*										
RX 52 DECANE, 2,5,6-TRIMETHYL-			75NJ*								
RX 52 Decane, 2,6,6-Trimethyl-			58NJ*								
RX 52 DECANE, 2,6,7-TRIMETHYL-			97NJ*								
RX 52 DISULFIDE, DIMETHYL		0.89NJ*	6.4NJ*								
RX 52 FORMAMIDE, N,N-DIBUTYL-											
RX 52 METHANE, THIOBIS		59NJ*	150NJ*								
RX 52 NAPHTHALENE, 1,4-DIMETHY						0.21NJ*					
BASE/NEUTRALS/ACIDS											
RX 68 1,2,4-Trichlorobenzene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 1,2-Dichlorobenzene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 1,3-Dichlorobenzene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 1,4-Dichlorobenzene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 2,4,5-Trichlorophenol	18UJ	3100U	12000U	14000U	5000U	42UJ	42UJ	9UJ	12UJ	10UJ	15UJ
RX 68 2,4,6-Trichlorophenol	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 2,4-Dichlorophenol	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 2,4-Dimethylphenol	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 2,4-Dinitrophenol	18UJ	3100UJ	12000UJ	14000UJ	5000UJ	42UJ	42UJ	9UJ	12UJ	10UJ	15UJ
RX 68 2,4-Dinitrotoluene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	REJ	REJ	REJ
RX 68 2,6-Dinitrotoluene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 2-Chloronaphthalene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 2-Methylnaphthalene	4UJ	30J*	610J*	83J*	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 2-Methylphenol	52J*	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 2-Nitroaniline	18UJ	3100U	12000U	14000U	5000U	42UJ	42UJ	9UJ	12UJ	10UJ	15UJ
RX 68 2-Nitrophenol	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 3,3'-Dichlorobenzidine	REJ	REJ	REJ	REJ	REJ	REJ	REJ	2UJ	REJ	REJ	REJ
RX 68 3-Nitroaniline	18UJ	3100UJ	12000UJ	14000UJ	5000UJ	42UJ	42UJ	9UJ	12UJ	10UJ	15UJ
RX 68 4,6-Dinitro-2-methylphen	18UJ	3100U	12000U	14000U	5000U	42UJ	42UJ	9UJ	12UJ	10UJ	15UJ
RX 68 4-Bromophenyl-phenylethe	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 4-Chloroaniline	REJ	REJ	REJ	REJ	REJ	REJ	REJ	REJ	REJ	REJ	REJ
RX 68 4-Chlorophenyl-phenyleth	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 4-Chloro-3-Methylphenol	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 4-Methylphenol	340J*	4400*	180000*	540J*	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 4-Nitroaniline	18UJ	3100U	12000U	14000U	5000U	42UJ	42UJ	9UJ	12UJ	10UJ	15UJ
RX 68 4-Nitrophenol	18UJ	3100U	12000U	14000U	5000U	42UJ	42UJ	9UJ	12UJ	10UJ	15UJ
RX 68 Acenaphthene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Acenaphthylene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Anthracene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Benzoic acid	18UJ	880J*	12000J*	14000UJ	100J*	42UJ	42UJ	9UJ	12UJ	10UJ	15UJ
RX 68 Benzo(a)anthracene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Benzo(a)pyrene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ

Sample #:	90354267	90354704	90354710	90354711	90354712	90354744	90354746	90354700	90354701	90354702	90354709
MEDIA	Leachate	Sediment	Sediment	Sediment	Sediment	Water	Water-DW	Water-Mar	Water-Mar	Water-Mar	Water-Mar
Descrip:	HOG FUEL S	EAST CHANN	SAWMILL CO	HERRING CO	BLUE LAKE	SITKA CATC	BLUE LAKE	HERRING CO	THIMLEBERR	EAST CHANN	SAWMILL CO
Matrix:	Water-To	Sediment	Sediment	Sediment	Sediment	Water-To	Water-To	Water-To	Water-To	Water-To	Water-To
Units:	ug/l	ug/kg	ug/kg	ug/kg	ug/kg	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
RX 68 Benzo(b)fluoranthene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Benzo(ghi)perylene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Benzo(k)fluoranthene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Benzyl Alcohol	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	REJ	REJ	REJ	REJ
RX 68 bis(2-Chloroethoxy)Metha	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 bis(2-Chloroethyl)Ether	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 bis(2-Chloroisopropyl)Et	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 BIS(2-ETHYLHEXYL) PHTHAL	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	0.4J*	0.2J*	0.4J*	0.1J*
RX 68 Butylbenzylphthalate	4U	650U	2500U	2900U	1000U	8UJ	0.7J*	2UJ	2UJ	2UJ	3UJ
RX 68 Carbazole	4UJ	650UJ	2500UJ	2900UJ	1000UJ	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Chrysene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Dibenzofuran	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Dibenzo(a,h)anthracene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Diethylphthalate	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Dimethylphthalate	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Di-n-Butylphthalate	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Di-n-Octyl Phthalate	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Fluoranthene	4UJ	650U	2300J*	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Fluorene	4UJ	650U	570J*	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Hexachlorobenzene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Hexachlorobutadiene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Hexachlorocyclopentadien	7UJ	1300U	5000U	5700U	2100U	17UJ	17UJ	4UJ	5UJ	4UJ	6UJ
RX 68 Hexachloroethane	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Indeno(1,2,3-cd)pyrene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Isophorone	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Naphthalene	4UJ	27J*	790J*	76J*	1000U	8UJ	8UJ	2UJ	0.09J*	2UJ	0.1J*
RX 68 Naphthalene, 1-Methyl-	4UJ	33J*	800J*	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Nitrobenzene	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 N-Nitrosodiphenylamine	4UJ	650U	2500U	2900U	1000U	8UJ	2J*	2UJ	2UJ	2UJ	3UJ
RX 68 N-Nitroso-di-n-Propylami	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 o-Chlorophenol	4UJ	650U	2500U	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Pentachlorophenol	3J*	3100U	12000U	14000U	5000U	42UJ	42UJ	9UJ	12UJ	10UJ	15UJ
RX 68 Phenanthrene	4UJ	650U	2600*	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Phenol	58J*	310J*	13000*	2900U	1000U	2J*	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Pyrene	4UJ	650U	1600J*	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 Retene	4UJ	170J*	2500J*	2900U	1000U	8UJ	8UJ	2UJ	2UJ	2UJ	3UJ
RX 68 %RECOV:PYRENE-D10 (SS)	92	83	70	96	101	148	122	131	109	115	126
RX 68 %RECOV:Surrog: 2-Fluorobiphenyl	78	68	72	78	67	54	80	27	19	46	48
RX 68 %RECOV:Surrog: 2-Fluorophenol	54	54	70	73	68	103	93	69	85	68	85
RX 68 %RECOV:Surrog: D14-Terphenyl	61	89	76	101	106	158	130	140	122	125	138
RX 68 %RECOV:Surrog: D5-Nitrobenzene	91	50	84	68	68	78	112	60	59	56	78
RX 68 %RECOV:Surrog: D5-Phenol	44	40	55	40	50	45	55	26	24	21	27
TENTATIVELY IDENTIFIED BASE/NEUTRALS/ACIDS											
RX 6A 1H-INDOLE-2,3-DIONE			6400NJ*								
RX 6A 1-PHENANTHRENECARBOXALDE	9.2NJ*										
RX 6A 2,4-PENTANEDIONE, 3-METH											
RX 6A 2H-1-BENZOPYRAN, 3,4-DIH	78NJ*										

Sample #:	90354267	90354704	90354710	90354711	90354712	90354744	90354746	90354700	90354701	90354702	90354709
MEDIA	Leachate	Sediment	Sediment	Sediment	Sediment	Water	Water-DW	Water-Mar	Water-Mar	Water-Mar	Water-Mar
Descrip:	HOG FUEL S	EAST CHANN	SAWMILL CO	HERRING CO	BLUE LAKE	SITKA CATC	BLUE LAKE	HERRING CO	THIMLEBERR	EAST CHANN	SAWMILL CO
Matrix:	Water-To	Sediment	Sediment	Sediment	Sediment	Water-To	Water-To	Water-To	Water-To	Water-To	Water-To
Units:	ug/l	ug/kg	ug/kg	ug/kg	ug/kg	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
RX 6A 2H-1-BENZOPYRAN-2-ONE, 3	2.2J*										
RX 6A 2-CYCLOHEXEN-1-ONE, 3,5-		1000NJ*	7400NJ*	2400NJ*							
RX 6A 4-Propenylguaiacol			720NJ*								
RX 6A 5,6-DECADIEN-3-YNE, 5,7-	22NJ*										
RX 6A 7-OXABICYCLO[2.2.1]HEPTA	4.9NJ*										
RX 6A 9,10-ANTHRACENEDIONE, 1,	110NJ*										
RX 6A 9-HEXADECENOIC ACID, MET		2400NJ*									
RX 6A 9-OCTADECENE, (E)-		5300NJ*									
RX 6A 9-OCTADECENOIC ACID, MET		3200NJ*									
RX 6A BENZENE, 1-METHYL-3-(1-M	2.2NJ*	2600NJ*									
RX 6A BENZENEACETIC ACID, 4-HY			4700NJ*								
RX 6A BENZENEACETIC ACID, .ALP	110NJ*										
RX 6A BENZENEPROPANOIC ACID			19000NJ*								
RX 6A BENZOIC ACID, 4-(1-METHY	20NJ*										
RX 6A BICYCLO[2.2.1]HEPTAN-2-O	55NJ*										
RX 6A BICYCLO[3.1.1]HEPTAN-2-O	34NJ*										
RX 6A CAMPHOR (ACN)	140NJ*										
RX 6A CINEOLE (VAN)	5.2NJ*										
RX 6A CYCLOHEXANECARBOXYLIC AC	2.6J*										
RX 6A CYCLOHEXANEMETHANOL, .AL	80NJ*										
RX 6A DECANOIC ACID, 8-METHYL-		2400NJ*		4700NJ*							
RX 6A ETHANONE, 1-PHENYL-		400NJ*									
RX 6A HEPTADECANE, 2,6-DIMETHY		200NJ*									
RX 6A HEXADECANOIC ACID											
RX 6A HEXADECANOIC ACID, METHY					120NJ*						
RX 6A HEXANEDIOIC ACID, BIS(2-											
RX 6A HEXANOIC ACID, 2-METHYL-	47NJ*										
RX 6A INDOLIZINE, 7-METHYL-			5800NJ*								
RX 6A NAPHTHALENE, 1,2,3,4,4A,				910NJ*							
RX 6A NAPHTHALENE, 1,2,3,5,6,8				2000NJ*							
RX 6A NAPHTHALENE, 1,2,4A,5,6,				3500NJ*							
RX 6A NAPHTHALENE, 1,2,4A,5,8,				1100NJ*							
RX 6A NAPHTHALENE, DECAHYDRO-1		3800NJ*									
RX 6A OCTANOIC ACID			8500NJ*								
RX 6A Perylene					340NJ*						
RX 6A PHENANTHRENE, 1,2,3,4,4A		820NJ*									
RX 6A PHENANTHRENE, 7-ETHENYL-		1600NJ*									
RX 6A PHENOL, 2-PROPYL-				4100NJ*							
RX 6A PHENOL, 3-PROPYL-	46NJ*										
RX 6A PHENOL, 4-PROPYL-			2400NJ*								
RX 6A Phenylacetic Acid			7000NJ*								
RX 6A p-Isopropyltoluene			73000NJ*	740NJ*							
RX 6A TETRACOSANOIC ACID, METH		840NJ*									
RX 6A TETRADECANOIC ACID		410NJ*	9500NJ*								
RX 6A TETRADECANOIC ACID, 12-M			11000NJ*								
RX 6A TETRADECANOIC ACID, METH		110NJ*									
RX 6A UNKNOWN HYDROCARBONS (TO					5600NJ*						
RX 6A .BETA.-SITOSTEROL		8200NJ*									

Sample #:	90354267	90354704	90354710	90354711	90354712	90354744	90354746	90354700	90354701	90354702	90354709
MEDIA	Leachate	Sediment	Sediment	Sediment	Sediment	Water	Water-DW	Water-Mar	Water-Mar	Water-Mar	Water-Mar
Descrip:	HOG FUEL S	EAST CHANN	SAWMILL CO	HERRING CO	BLUE LAKE	SITKA CATC	BLUE LAKE	HERRING CO	THIMLEBERR	EAST CHANN	SAWMILL CO
Matrix:	Water-To	Sediment	Sediment	Sediment	Sediment	Water-To	Water-To	Water-To	Water-To	Water-To	Water-To
Units:	ug/l	ug/kg	ug/kg	ug/kg	ug/kg	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
PESTICIDES/PCBs											
RX 71 4,4'-DDD	0.008UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 4,4'-DDE	0.008UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 4,4'-DDT	0.016UJ	6U	60UJ	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Aldrin	0.008UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 alpha-BHC	0.016UJ	6U	20U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 beta-BHC	0.016UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Chlordane (Tech)	0.08UJ	60U	400U	250U	90U	0.2U	0.11U	0.08U	0.1U	0.08U	0.12U
RX 71 delta-BHC	0.016UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Dieldrin	0.008UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Endosulfan I	0.016UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Endosulfan II	0.008UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Endosulfan sulfate	0.016UJ	6U	80U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Endrin	0.016UJ	6U	20U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Endrin aldehyde	0.008UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Endrin Ketone	0.016UJ	12U	80U	50U	18U						
RX 71 gamma-BHC (Lindane)	0.008UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Heptachlor	0.016UJ	6U	40U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Heptachlor Epoxide	0.016UJ	6U	20U	25U	9U	0.02U	0.011U	0.008U	0.01U	0.008U	0.012U
RX 71 Methoxychlor	0.016UJ	12U	80U	50U	18U	0.04U	0.022U	0.015U	0.02U	0.016U	0.024U
RX 71 PCB - 1016	0.3UJ	60U	820U	250U	90U	0.2U	0.11U	0.08U	0.1U	0.08U	0.12U
RX 71 PCB - 1221	0.3UJ	60U	820UJ	250U	90U	0.2U	0.11U	0.08U	0.1U	0.08U	0.12U
RX 71 PCB - 1232	0.3UJ	60U	820U	250U	90U	0.2U	0.11U	0.08U	0.1U	0.08U	0.12U
RX 71 PCB - 1242	0.3UJ	60U	820U	250U	90U	0.2U	0.11U	0.08U	0.1U	0.08U	0.12U
RX 71 PCB - 1248	0.3UJ	60U	820U	250U	90U	0.2U	0.11U	0.08U	0.1U	0.08U	0.12U
RX 71 PCB - 1254	0.3UJ	60U	820U	250U	90U	0.2U	0.11U	0.08U	0.1U	0.08U	0.12U
RX 71 PCB - 1260	0.5UJ	60U	820U	250U	90U	0.2U	0.11U	0.08U	0.1U	0.08U	0.12U
RX 71 Toxaphene	0.45UJ	160U	2000U	700U	250U	0.5U	0.33U	0.25U	0.3U	0.25U	0.35U
RX 71 %RECOV:4,4-Dibromooctafluorobip	42	66	78	44	39	41	53	37	46	48	51
RX 71 %RECOV:DIBUTYLCHLORENDATE (SS)	17J	80	69	58	62	79	88	77	79	73	64
RX 71 %RECOV:OCTACHLORONAPHTHALENE (S	24	8J	7J	2U	15	71	77	75	85	70	68
VOLATILES											
RX 51 1,1,1-Trichloroethane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,1,2-Trichloroethane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,1-Dichloroethane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,1-Dichloroethene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,1-Dichloropropene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,2,3-Trichlorobenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,2,3-Trichloropropane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,2,4-Trichlorobenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,2,4-Trimethylbenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,2-Dibromoethane (EDB)	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,2-Dichlorobenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,2-Dichloroethane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,2-Dichloropropane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,3,5-Trimethylbenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			

Sample #:	90354267	90354704	90354710	90354711	90354712	90354744	90354746	90354700	90354701	90354702	90354709
MEDIA	Leachate	Sediment	Sediment	Sediment	Sediment	Water	Water-DW	Water-Mar	Water-Mar	Water-Mar	Water-Mar
Descrip:	HOG FUEL S	EAST CHANN	SAWMILL CO	HERRING CO	BLUE LAKE	SITKA CATC	BLUE LAKE	HERRING CO	THIMLEBERR	EAST CHANN	SAWMILL CO
Matrix:	Water-To	Sediment	Sediment	Sediment	Sediment	Water-To	Water-To	Water-To	Water-To	Water-To	Water-To
Units:	ug/l	ug/kg	ug/kg	ug/kg	ug/kg	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
RX 51 1,3-Dichlorobenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,3-Dichloropropane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 1,4-Dichlorobenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 2,2-Dichloropropane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 2-Butanone	9J*	4UJ	18J*	31UJ	64J*	2U	1U	1UJ			
RX 51 2-Chlorotoluene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 2-Hexanone	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 4-Chlorotoluene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 4-Methyl-2-Pentanone	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Acetone	10J*	9UJ	52UJ	550J*	320J*	6*	1U	1UJ			
RX 51 Benzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Benzene, 1,2-Dimethyl		4UJ	17UJ	11UJ	6UJ						
RX 51 BENZENE, ETHENYL-(STYREN	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 BENZENE, ETHYL-	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 BENZENE, PROPYL-	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Bromobenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Bromochloromethane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Bromodichloromethane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Bromoform	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Bromomethane	1UJ	4U	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Butylbenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Carbon Disulfide	1UJ	4UJ	70J*	11J*	1J*	1U	1U	1UJ			
RX 51 Carbon Tetrachloride	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Chlorobenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Chloroethane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Chloroform	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Chloromethane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Cis-1,2-Dichloroethene	0.5J*	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 cis-1,3-Dichloropropene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 d8-Toluene											
RX 51 DBCP	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Dibromochloromethane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Dibromomethane	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Ethane, 1,1,1,2-Tetrachl	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 ETHANE, 1,1,2,2-TETRACHL	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Hexachlorobutadiene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Isopropylbenzene (Cumene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Methane, Dichlorodifluor	1UJ	REJ	REJ	REJ	REJ	1U	1U	1UJ			
RX 51 Methylene Chloride	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Naphthalene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 p-Isopropyltoluene	4UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Sec-Butylbenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Tert-Butylbenzene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Tetrachloroethene	0.03J*	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Toluene	670J*	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Total Xylenes	1UJ					1U	1U	1UJ			
RX 51 trans-1,2-Dichloroethene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 trans-1,3-Dichloropropen	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			

Sample #:	90354267	90354704	90354710	90354711	90354712	90354744	90354746	90354700	90354701	90354702	90354709
MEDIA	Leachate	Sediment	Sediment	Sediment	Sediment	Water	Water-DW	Water-Mar	Water-Mar	Water-Mar	Water-Mar
Descrip:	HOG FUEL S	EAST CHANN	SAWMILL CO	HERRING CO	BLUE LAKE	SITKA CATC	BLUE LAKE	HERRING CO	THIMLEBERR	EAST CHANN	SAWMILL CO
Matrix:	Water-To	Sediment	Sediment	Sediment	Sediment	Water-To	Water-To	Water-To	Water-To	Water-To	Water-To
Units:	ug/l	ug/kg	ug/kg	ug/kg	ug/kg	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
RX 51 Trichloroethene	1UJ	4UJ	17UJ	11UJ	6UJ	1U	1U	1UJ			
RX 51 Trichlorofluoromethane	1UJ	4UJ	17UJ	11UJ	6UJ	0.5J*	1U	1UJ			
RX 51 Vinyl Acetate	REJ	REJ	REJ	REJ	REJ	REJ	REJ	REJ			
RX 51 Vinyl Chloride	1UJ	4UJ	17UJ	11UJ	6UJ	0.1J*	1U	1UJ			
RX 51 %RECOV:1,2-Dichloroethane-d4 (	80	99	97	124	93	96	88	124			
RX 51 %RECOV:d8-Toluene	94	101	104	104	96	104	94	103			
RX 51 %RECOV:p-Bromofluorobenzene	92	77	75	79	92	106	96	99			
RX 51 %RECOV:Surrog: 1-Bromo-2-Fluoro	82	122	119	109	104	96	92	107			

	Sample #:	90354269	90354740
	MEDIA	Ash	Leachate
	Descrip:	BOTTOM ASH	SITKA LAND
	Matrix:	Sediment	Water-To
	Units:	ug/kg	ug/l
TENTATIVELY IDENTIFIED VOLATILES			
RX 52	1,1,2 Trichlorotrifluoro	9.0NJ*	
RX 52	1H-INDENE, 1-ETHYLIDENE-		3.0NJ*
RX 52	1H-INDENE, 2,3-DIHYDRO-1		0.38NJ*
RX 52	1H-INDENE, 2,3-DIHYDRO-1		0.64NJ*
RX 52	1H-INDENE, 2,3-DIHYDRO-1		0.67NJ*
RX 52	1H-INDENE, 2,3-DIHYDRO-4		1.1NJ*
RX 52	1-PROPANOL, 2,2-DIMETHYL		
RX 52	2-PENTANONE, 3-METHYL-		
RX 52	3-PENTANONE, 2,4-DIMETHY		1.5NJ*
RX 52	ACETIC ACID, 1-METHYLETH		
RX 52	ACETIC ACID, PROPYL ESTE		
RX 52	BENZENE, 1,2,3-TRIMETHYL		5.6NJ*
RX 52	BENZENE, 1-ETHENYL-2-MET		4.6NJ*
RX 52	BENZENE, 1-ETHYL-2,3-DIM		0.64NJ*
RX 52	BENZENE, 1-ETHYL-2-METHY		5.6NJ*
RX 52	BENZENE, 1-ETHYL-4-METHY		4.2NJ*
RX 52	BENZENE, 1-PROPYNYL-		1.8NJ*
RX 52	BENZENE, 2-ETHYL-1,4-DIM		1.8NJ*
RX 52	BENZENE, PENTAMETHYL-		0.17NJ*
RX 52	BENZENE, (1-METHYL-1-PRO		2.8NJ*
RX 52	BUTANOIC ACID, 1-METHYLE		
RX 52	CARBON OXIDE SULFIDE (CO		
RX 52	Methane, Dimethoxy-		0.79NJ*
RX 52	NAPHTHALENE, 1,2,3,4-TET		0.94NJ*
RX 52	Naphthalene, 1-Methyl-		2.1NJ*
RX 52	p-Isopropyltoluene		1.7NJ*
RX 52	Tert-Butylbenzene	4.1NJ*	
RX 52	Tetrahydrofuran		3.5NJ*
RX 52	Thiophene, Benzo[b]-		0.47NJ*
BASE/NEUTRALS/ACIDS			
RX 68	1,2,4-Trichlorobenzene	490U	4UJ
RX 68	1,2-Dichlorobenzene	490U	0.3J*
RX 68	1,3-Dichlorobenzene	490U	4UJ
RX 68	1,4-Dichlorobenzene	490U	2J*
RX 68	2,4,5-Trichlorophenol	2400U	18UJ
RX 68	2,4,6-Trichlorophenol	490U	4UJ
RX 68	2,4-Dichlorophenol	490U	4UJ
RX 68	2,4-Dimethylphenol	490U	4UJ
RX 68	2,4-Dinitrophenol	2400UJ	18UJ
RX 68	2,4-Dinitrotoluene	490U	4UJ
RX 68	2,6-Dinitrotoluene	490U	4UJ
RX 68	2-Chloronaphthalene	490U	4UJ
RX 68	2-Methylnaphthalene	490U	1J*
RX 68	2-Methylphenol	490U	4UJ
RX 68	2-Nitroaniline	2400U	18UJ
RX 68	2-Nitrophenol	490U	4UJ
RX 68	3,3'-Dichlorobenzidine	REJ	REJ
RX 68	3-Nitroaniline	2400UJ	18UJ
RX 68	4,6-Dinitro-2-methylphen	2400U	18UJ
RX 68	4-Bromophenyl-phenylethe	490U	4UJ
RX 68	4-Chloroaniline	REJ	REJ
RX 68	4-Chlorophenyl-phenyleth	490U	4UJ
RX 68	4-Chloro-3-Methylphenol	490U	4UJ
RX 68	4-Methylphenol	10J*	4UJ
RX 68	4-Nitroaniline	2400U	18UJ
RX 68	4-Nitrophenol	2400U	18UJ
RX 68	Acenaphthene	490U	2J*
RX 68	Acenaphthylene	490U	4UJ
RX 68	Anthracene	490U	4UJ
RX 68	Benzoic acid	51J*	18UJ
RX 68	Benzo(a)anthracene	490U	4UJ
RX 68	Benzo(a)pyrene	490U	4UJ
RX 68	Benzo(b)fluoranthene	25J*	0.1J*
RX 68	Benzo(ghi)perylene	490U	4UJ

		Sample #:	90354269	90354740
		MEDIA	Ash	Leachate
		Descrip:	BOTTOM ASH	SITKA LAND
		Matrix:	Sediment	Water-To
		Units:	ug/kg	ug/l
RX	68	Benzo(k)fluoranthene	490U	0.2J*
RX	68	Benzyl Alcohol	490U	4UJ
RX	68	bis(2-Chloroethoxy)Metha	490U	4UJ
RX	68	bis(2-Chloroethyl)Ether	490U	4UJ
RX	68	bis(2-Chloroisopropyl)Et	490U	4UJ
RX	68	BIS(2-ETHYLHEXYL) PHTHAL	490U	0.5J*
RX	68	Butylbenzylphthalate	490U	0.7J*
RX	68	Carbazole	490UJ	1J*
RX	68	Chrysene	17J*	0.3J*
RX	68	Dibenzofuran	490U	1J*
RX	68	Dibenzo(a,h)anthracene	490U	4UJ
RX	68	Diethylphthalate	490U	2J*
RX	68	Dimethylphthalate	490U	4UJ
RX	68	Di-n-Butylphthalate	800U	0.2J*
RX	68	Di-n-Octyl Phthalate	490U	0.2J*
RX	68	Fluoranthene	490U	0.2J*
RX	68	Fluorene	490U	1J*
RX	68	Hexachlorobenzene	490U	4UJ
RX	68	Hexachlorobutadiene	490U	4UJ
RX	68	Hexachlorocyclopentadien	980U	7UJ
RX	68	Hexachloroethane	490U	4UJ
RX	68	Indeno(1,2,3-cd)pyrene	490U	4UJ
RX	68	Isophorone	490U	4UJ
RX	68	m-Cresol		
RX	68	Naphthalene	490U	6J*
RX	68	Naphthalene, 1-Methyl-	490U	3J*
RX	68	Nitrobenzene	490U	4UJ
RX	68	N-Nitrosodiphenylamine	490U	4UJ
RX	68	N-Nitroso-di-n-Propylami	490U	4UJ
RX	68	o-Chlorophenol	490U	4UJ
RX	68	Pentachlorophenol	2400U	18UJ
RX	68	Phenanthrene	490U	1J*
RX	68	Phenol	490U	4UJ
RX	68	Pyrene	490U	0.3J*
RX	68	Retene	490U	0.3J*
RX	68	%RECOV:PYRENE-D10 (SS)	80	97
RX	68	%RECOV:Surrog: 2-Fluorobiphenyl	60	67
RX	68	%RECOV:Surrog: 2-Fluorophenol	55	68
RX	68	%RECOV:Surrog: D14-Terphenyl	85	108
RX	68	%RECOV:Surrog: D5-Nitrobenzene	55	79
RX	68	%RECOV:Surrog: D5-Phenol	50	35

TENTATIVELY IDENTIFIED BASE/NEUTRALS/ACIDS

RX	6A	1,1'-BIPHENYL		0.54NJ*
RX	6A	1,2,4-Trimethylbenzene		3.6NJ*
RX	6A	1,3,5-Trimethylbenzene		1.8NJ*
RX	6A	1H-INDENE, 2,3-DIHYDRO-4		0.95NJ*
RX	6A	BENZAMIDE, N,N-DIETHYL-3		9.9NJ*
RX	6A	Benzene, 1,2,3,4-Tetrame		0.64NJ*
RX	6A	BENZENE, 1,2,3-TRIMETHYL		5.6NJ*
RX	6A	BENZENE, 1,2,4,5-TETRAME		0.48NJ*
RX	6A	Benzene, 1,2-Dimethyl		5.2NJ*
RX	6A	BENZENE, 1-ETHENYL-2-MET		2.2NJ*
RX	6A	BENZENE, 1-ETHYL-2-METHY		3.2NJ*
RX	6A	BENZENE, ETHYL-		13NJ*
RX	6A	Benzoic acid		
RX	6A	CAMPHOR (ACN)		1.4NJ*
RX	6A	Chlorobenzene		4.6NJ*
RX	6A	ETHANOL, 2-BUTOXY-, PHOS		2.7NJ*
RX	6A	ETHANONE, 1-(METHYLPHENY		0.68NJ*
RX	6A	m-Xylene		13NJ*
RX	6A	PHOSPHORIC ACID TRIBUTYL		2.6NJ*

PESTICIDES/PCBs

RX	71	4,4'-DDD	5U	0.008U
RX	71	4,4'-DDE	5U	0.008U

		Sample #:	90354269	90354740
		MEDIA	Ash	Leachate
		Descrip:	BOTTOM ASH	SITKA LAND
		Matrix:	Sediment	Water-To
		Units:	ug/kg	ug/l
RX	71	4,4'-DDT	5U	0.008U
RX	71	Aldrin	5U	0.008U
RX	71	alpha-BHC	5U	0.008U
RX	71	beta-BHC	5U	0.008U
RX	71	Chlordane (Tech)	50U	0.08U
RX	71	delta-BHC	5U	0.008U
RX	71	Dieldrin	5U	0.0185*
RX	71	Endosulfan I	5U	0.008U
RX	71	Endosulfan II	5U	0.008U
RX	71	Endosulfan sulfate	8U	0.008U
RX	71	Endrin	5U	0.008U
RX	71	Endrin aldehyde	5U	0.008U
RX	71	Endrin Ketone	8U	
RX	71	gamma-BHC (Lindane)	5U	0.008U
RX	71	Heptachlor	5U	0.008U
RX	71	Heptachlor Epoxide	5U	0.008U
RX	71	Methoxychlor	8U	0.016U
RX	71	PCB - 1016	50U	0.08U
RX	71	PCB 1221	50U	0.08U
RX	71	PCB - 1232	50U	0.08U
RX	71	PCB - 1242	50U	0.08U
RX	71	PCB - 1248	50U	0.08U
RX	71	PCB 1254	50U	0.08U
RX	71	PCB - 1260	50U	0.08U
RX	71	Toxaphene	150U	0.25U
RX	71	%RECOV:4,4-Dibromooctafluorobip	54	60
RX	71	%RECOV:DIBUTYLCHLORENDATE (SS)	86	68
RX	71	%RECOV:OCTACHLORONAPHTHALENE (S	31	69
PESTICIDES				
RX	72	4,4-Dibromooctafluorobip		
RX	72	Chlordane (Tech)		
RX	72	DECACHLOROBIPHENYL		
RX	72	DIBUTYLCHLORENDATE (SS)		
RX	72	Endrin		
RX	72	gamma-BHC (Lindane)		
RX	72	Heptachlor		
RX	72	Heptachlor Epoxide		
RX	72	Methoxychlor		
RX	72	OCTACHLORONAPHTHALENE (S		
RX	72	Toxaphene		
RX	72	TRANS-CHLORDANE (GAMMA)		
HERBICIDES				
RX	73	2,4,5-TP (Silvex)		
RX	73	2,4-D		
RX	73	Surrog: 2,4,6-Tribromoph		
VOLATILES				
RX	51	1,1,1-Trichloroethane	4J*	1U
RX	51	1,1,2-Trichloroethane	4UJ	1U
RX	51	1,1-Dichloroethane	4UJ	1*
RX	51	1,1-Dichloroethene	3J*	1U
RX	51	1,1-Dichloropropene	4UJ	1U
RX	51	1,2,3-Trichlorobenzene	4UJ	1U
RX	51	1,2,3-Trichloropropane	4UJ	1U
RX	51	1,2,4-Trichlorobenzene	4UJ	1U
RX	51	1,2,4-Trimethylbenzene	2J*	10*
RX	51	1,2-Dibromoethane (EDB)	4UJ	1U
RX	51	1,2-Dichlorobenzene	4UJ	0.5J*
RX	51	1,2-Dichloroethane	4UJ	1U
RX	51	1,2-Dichloropropane	4UJ	1U
RX	51	1,3,5-Trimethylbenzene	24J*	3*
RX	51	1,3-Dichlorobenzene	4UJ	1U
RX	51	1,3-Dichloropropane	4UJ	1U
RX	51	1,4-Dichlorobenzene	4UJ	3*

		Sample #:	90354269	90354740
		MEDIA	Ash	Leachate
		Descrip:	BOTTOM ASH	SITKA LAND
		Matrix:	Sediment	Water-To
		Units:	ug/kg	ug/l
RX	51	2,2-Dichloropropane	4UJ	1U
RX	51	2-Butanone	10UJ	1U
RX	51	2-Chlorotoluene	4UJ	1U
RX	51	2-Hexanone	4UJ	1U
RX	51	4-Chlorotoluene	4UJ	1U
RX	51	4-Methyl-2-Pentanone	4UJ	1U
RX	51	Acetone	88J*	2*
RX	51	Benzene	40J*	10*
RX	51	Benzene, 1,2-Dimethyl		25*
RX	51	BENZENE, ETHENYL-(STYREN	4UJ	1*
RX	51	BENZENE, ETHYL-	4UJ	25*
RX	51	BENZENE, PROPYL-	4UJ	2*
RX	51	Bromobenzene	4UJ	1U
RX	51	Bromochloromethane	4UJ	1U
RX	51	Bromodichloromethane	4UJ	1U
RX	51	Bromoform	4UJ	1U
RX	51	Bromomethane	4UJ	1U
RX	51	Butylbenzene	4UJ	1U
RX	51	Carbon Disulfide	10J*	1U
RX	51	Carbon Tetrachloride	4UJ	1U
RX	51	Chlorobenzene	4UJ	7*
RX	51	Chloroethane	2J*	5*
RX	51	Chloroform	4UJ	1U
RX	51	Chloromethane	4J*	1U
RX	51	Cis-1,2-Dichloroethene	4UJ	2*
RX	51	cis-1,3-Dichloropropene	4UJ	1U
RX	51	d8-Toluene		
RX	51	DBCP	4UJ	1U
RX	51	Dibromochloromethane	4UJ	1U
RX	51	Dibromomethane	4UJ	1U
RX	51	Ethane, 1,1,1,2-Tetrachl	4UJ	1U
RX	51	ETHANE, 1,1,2,2-TETRACHL	4UJ	1U
RX	51	Hexachlorobutadiene	4UJ	1U
RX	51	Isopropylbenzene (Cumene	4UJ	2*
RX	51	Methane, Dichlorodifluor	1700J*	5*
RX	51	Methylene Chloride	140J*	1U
RX	51	Naphthalene	4UJ	26*
RX	51	p-Isopropyltoluene	4UJ	1U
RX	51	Sec-Butylbenzene	4UJ	1U
RX	51	Tert-Butylbenzene	4UJ	1U
RX	51	Tetrachloroethene	4UJ	0.09J*
RX	51	Toluene	6J*	2*
RX	51	Total Xylenes	7J*	
RX	51	trans-1,2-Dichloroethene	4UJ	0.08J*
RX	51	trans-1,3-Dichloropropen	4UJ	1U
RX	51	Trichloroethene	4UJ	0.3J*
RX	51	Trichlorofluoromethane	38J*	1U
RX	51	Vinyl Acetate	REJ	REJ
RX	51	Vinyl Chloride	4UJ	1U
RX	51	%RECOV:1,2-Dichloroethane-d4 (	136	92
RX	51	%RECOV:d8-Toluene	131	91
RX	51	%RECOV:p-Bromofluorobenzene	62	105
RX	51	%RECOV:Surrog: 1-Bromo-2-Fluoro	320	87

C-3. METALS

Below are the definitions for qualifiers used in the Metals area when qualifying data from metals analysis.

<u>Data Qualifiers</u>

U	-	Element was analyzed for but not detected. The associated numerical value is the instrument detection limit/method detection limit.
J	-	The analyte was detected above the instrument detection limit but not quantified within expected limits of precision. The laboratory has established minimum quantitation limits having a relative standard deviation of no more than 10%.
E	-	The reported value is an estimate because of the presence of interference.
B	-	Analyte found in the analytical blank as well as the sample, indicating possible/probable contamination. "B" accompanies those analytical results within 10 (10x) times the instrument detection limit for the analyte of interest.
N	-	Spike sample recovery not within control limits.
NAR	-	There is <u>no analysis result</u> for this analyte.
NA	-	Not Applicable/Not Required.
*	-	The analyte was present in the sample.

Type	Ash-Boiler	Ash-Boiler	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Request	Metals	Metals	Metals	Metals	Metals	Metals	Metals	Metals	Metals	Metals	Metals
SampleNo	90354269	90354269	90354731	90354732	90354733	90354742	90354743	90354741	90354749	90354721	90354730
Description	BOTTOM ASH	BOTTOM ASH Lab duplicate	APC-1	APC-2 Field duplicate	BLUE LAKE	CITY-C Central	CITY-JAPO Japonski I.	CITY-N North	CITY-S South	DEEP INLET Background	GALANKIN I
Station											
Taken	900828	900828	900830	900830	900830	900831	900831	900831	900831	900829	900830
QA_Code		LDP1									
Matrix	Ash	Ash	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Units	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr
Ag	.20U	.20U	0.20J*	0.20U	0.20U	0.20U	0.20U	0.20U	0.20U	0.20U	0.20U
Al	18800.*	19400.*	10900.*	12800*	25500*	11100.*	18000.*	9620.*	13500.*	4680.*	34900*
As	29.8*	28.4*	146.*	118*	18.7*	6.7J*	24.1*	5.1J*	23.9*	9.3J*	14J*
Ba	305E*	164.E*	174.*	196*	110*	73.6*	43.0*	100.*	77.2*	7.08*	23.6*
Be	.504*	.48J*	0.15J*	0.13J*	0.10U	0.10U	0.18J*	0.10U	0.26J*	0.10U	0.40J*
Ca	112000.*	95500.*	12300.*	12700*	4360*	21900.*	5190.*	20100.*	4920.*	5890.*	4050*
Cd	.20U	.20U	0.20U	0.20U	0.20U	0.20U	0.20U	0.20U	0.20U	0.51J*	0.20U
Co	11.8*	11.0*	12.8*	13.2*	17.6*	5.84*	8.53*	4.25*	9.33*	7.8*	9.31*
Cr	122.*	108.*	88.3*	94.2*	63.3*	24.6*	33.7*	18.1*	28.8*	19.3*	11.2*
Cu	191.*	180.*	400.*	340*	55.2*	13.5*	26.9*	11.4*	22.3*	18.0*	19.0*
Fe	30700.*	29700.*	65200.*	58000*	42300*	17200.*	29900.*	12700.*	27500.*	5890.*	25900*
Hg	0.004U		.021J*	.027J*	.028J*	.018J*	.051*	.024J*	.039J*	.033J*	.029J*
K	8940.*	8740.*	1040.*	1010*	1740*	1010.*	775.*	1270.*	775.*	1250*	199*
Mg	65300.*	60600.*	7830.*	9460*	13600*	7330.*	9430.*	4750.*	6650.*	5650*	5290*
Mn	4020.*	3450.*	640.*	576*	943*	279.*	470.*	190.*	358.*	123.*	325*
Mo	29.6*	23.5*	22.9*	30.5*	0.20U	0.20U	0.20U	0.20U	0.20U	1.2J*	0.20U
Na	63900.*	56100.*	484.*	358*	59.3*	302.*	170.*	281.*	170.*	4310*	854*
Ni	216.*	180.*	57.0*	56.5*	36.7*	12.2*	20.1*	8.30*	18.1*	109.*	10.9*
Pb	18.8E*	31.1E*	144.*	260*	12.2*	3.6J*	52.8*	3.2J*	8.5J*	8.1J*	2.7J*
Sb	9.9J*	9.1J*	27.4*	22.4*	3.0U	3.0U	3.0U	3.0U	3.0U	3.0U	3.0U
Se	1.0U	1.0U	0.20U	0.20U	0.20U	0.20U	0.20U	0.20U	3.42*	0.63J*	0.20U
Tl	5.0U	5.0U	0.25UN	0.25UN	0.25UN	0.25UN	0.25UN	0.25UN	3.71N*	0.25UN	0.25UN
V	350.*	296.*	56.9*	56.3*	89.0*	41.5*	51.3*	34.2*	40.6*	14.3*	64.0*
Zn	196.*	190*	1447.*	1150*	72.8*	56.2*	241.*	31.3*	172.*	20.1*	24.4*

Type	Soil	Soil	Leach-Sed	Sediment	Sediment	Sediment	Sediment	Sediment	Leachate	Leachate	Leachate	Water
Request	Metals	Metals	TCL	TCL	TCL	TCL	TCL	TCL	TCL	TCL	TCL	TCL
SampleNo	90354747	90354748	90354745	90354710	90354710	90354711	90354712	90354704	90354267	90354740	90354744	90354746
Description	JAMESTOWN Bay	THIMBLEBER Bay	SITKA LAND Sludge in catch basin	SAWMILL CO Cove	SAWMILL CO Lab duplicate	HERRING CO Cove	BLUE LAKE	EAST CHANN' Eastern Channel	HOG FUEL S Storage at Herring Cove	SITKA LAND	SITKA CATC Field blank (QA)	BLUE LAKE
Station												
Taken	900831	900831	900831	900829	900829	900827	900830	900828	900829	900831	900831	900830
QA_Code					LDP1							
Matrix	Soil	Soil	Sludge	Sediment	Sediment	Sediment	Sediment	Sediment	Leachate	Leachate	Blank	Water
Units	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	mg/kg-dr	ug/l	ug/l	ug/l	ug/l
Ag	0.20U	0.20U	4.0U	0.28J*	0.34J*	0.21J*	0.20U	0.20U	2.0U	2.0U	2.0U	2.0U
Al	23100*	18500*	4060*	8270*	7990*	11700*	38700*	11800*	810.*	150*	10U	24J*
As	21.3*	20.0*	87.9*	31.8*	36.7*	27.1*	46.5*	20.8*	15.8*	1.5U	1.5U	3.0U
Ba	32.5*	32.2*	224*	64.5*	61.6*	57.7*	204*	50.8*	109.*	155*	1.0U	10.5*
Be	0.22J*	0.22J*	0.703*	0.10U	0.10U	0.10*	0.16J*	0.10U	1.0U	1.0U	1.0U	1.0U
Ca	5520*	4980*	6780*	6800*	6600*	7130*	9140*	5170*	132000.*	112000.*	30.0*	3910.*
Cd	0.20U	0.20U	15U	3.73*	4.09*	1.2J*	0.20U	1.4JB*	2.0U	2.0U	2.0U	2.0U
Co	10.1*	10.4*	40.6*	6.65*	5.86*	5.69*	40.5*	7.82*	5.0U	5.0U	5.0U	5.0U
Cr	54.7*	51.5*	21.7*	56.6*	55.7*	41.8*	105*	55.2*	5.0U	5.0U	5.0U	5.0U
Cu	43.2*	24.3*	308*	64.9E*	61.6E*	32.3E*	134E*	58.0E*	13.5*	3.7J*	2.0U	2.0U
Fe	31600*	29400*	444000*	10600*	10300*	16900*	64000*	18900*	5640.*	76500*	2.8J*	30.9*
Hg	.029J*	.021J*	.024J*	.016J*		.004U	.022J*	.017J*	0.08U	.013J*	.04U	.04U
K	674*	657*	346*	3390*	3280*	3190*	2400*	2240*	62100.*	50300.*	300U	640J*
Mg	10400*	10200*	2000*	12800*	12600*	12900*	24400*	11300*	249000.*	28800*	3.5J*	290.*
Mn	582*	522*	633*	149E*	140E*	196E*	2010E*	322E*	6600.*	891.*	1.0U	11.0*
Mo	0.20U	0.20U	60U	26.0*	26.6*	20.9*	0.20U	11.1*	2.0U	2.0U	2.0U	2.0U
Na	167*	209*	1390*	47200*	46700*	45500*	463E*	18300*	503000.*	249000*	425.*	1360.*
Ni	25.5*	24.7*	39.9*	43.9*	44.1*	23.2*	73.0*	30.4*	43J*	10U	10U	10U
Pb	87.8*	24.3*	21.8*	10.9*	12.3*	7.9J*	6.6J*	5.7J*	3.0J*	2.0J*	1.0U	10U
Sb	3.0U	3.0U	19.3*	3.0U	3.0U	3.0U	3.0U	3.0U	30U	30U	30U	30U
Se	0.20U	0.20U	48.8*	1.61*	1.77*	1.71*	0.36J*	0.66J*	2.0U	2.0U	2.0U	8.0U
Tl	0.25UN	0.25UN	0.25UN	0.28J*	0.25U	0.25U	0.25U	0.25U	2.5U	2.5U	2.5U	5.0UE
V	64.5*	59.8*	100U	96.0*	92.9*	63.5*	190*	61.2*	4.9J*	2.0U	2.0U	2.0U
Zn	118*	86.9*	7200*	93.8E*	96.1E*	245E*	364E*	68.9E*	34.6*	81.3*	5.8J*	16J*

Type	Water-Mar	Water-Mar	Water-Mar	Water-Mar
Request	TCL(mtls)	TCL(mtls)	TCL(mtls)	TCL(mtls)
SampleNo	90354705	90354706	90354707	90354708
Description	HERRING CO Cove	THIMBLEBER Bay	E. CHANNEL	SAWMILL CO Cove
Station				
Taken	900827	900828	900828	900829
QA_Code				
Matrix	Water	Water	Water	Water
Units	ug/l	ug/l	ug/l	ug/l
Ag	2.0U	10U	2.0U	2.0U
Al	635.*	672.*	592.*	761E*
As	3.0U	3.0U	3.0U	3.0U
Ba	6.5*	5.06*	5.73*	5.6*
Be	1.0U	1.0U	1.0U	1.0U
Ca	316000*	336000.*	336000*	375000*
Cd	10U	20U	20U	2.0U
Co	25U	25.U	25U	25.U
Cr	5.0U	5.0U	5.0U	5.0U
Cu	16.2*	2.0U	2.3J*	181*
Fe	98.8*	56.9*	32.8*	200J*
Hg	.19J*	.04U	.16J*	0.15U
K	293000*	314000.*	314000*	352000*
Mg	966000*	1030000.*	1030000*	1150000*
Mn	50U	50U	40U	50U
Mo	20U	40U	20U	40U
Na	8010000*	7690000*	8060000*	6960000*
Ni	50U	50U	50U	50U
Pb	18J*	12J*	10U	10U
Sb	30U	30U	30U	30U
Se	8.0U	8.0U	8.0U	8.0U
Tl	5.0UE	5.0UE	5.0UE	5.0UE
V	2.0U	2.0U	2.0U	22J*
Zn	25J*	10U	10U	267.*

C-4. CONVENTIONALS

1. T, Salinity, DO, pH
2. TOC, particle size

APPENDIX C-4. Table 1.

Hydrolab data

Station	Date	Time	Depth (m)	Temp (C)	Salinity (o/oo)	DO (mg/L)	%Sat-DO	pH
1-Thimbleberry	28-Aug-90	10:21	1.0	15.5	26	5.0	58	6.00
1-Thimbleberry	28-Aug-90	11:21	1.0	15.2		5.3	61	7.50
1-Thimbleberry	28-Aug-90	10:45	1.0	15.3		5.3	61	6.75
1-Thimbleberry	28-Aug-90	10:48	10.0	13.6		5.7	65	7.33
1-Thimbleberry	28-Aug-90	10:54	19.9	12.4		5.6	63	7.54
1-Thimbleberry	28-Aug-90	10:57	29.9	11.2	32	5.5	61	7.61
1-Thimbleberry	28-Aug-90	11:00	40.1	9.6		4.8	51	7.61
1-Thimbleberry	28-Aug-90	11:05	50.0	8.3		3.9	40	8.30
1-Thimbleberry	28-Aug-90	11:12	57.8	7.8	32	3.3	34	7.47
2-E.Channel	28-Aug-90	16:22	1.0	15.6	22	6.9	79	7.53
2-E.Channel	28-Aug-90	15:54	1.0	15.6		4.8	55	7.44
2-E.Channel	28-Aug-90	15:57	10.0	13.7		6.3	70	7.67
2-E.Channel	28-Aug-90	16:01	20.0	12.7		5.3	59	7.72
2-E.Channel	28-Aug-90	16:04	30.0	11.5	32	6.0	67	7.75
2-E.Channel	28-Aug-90	16:07	40.0	10.0		5.6	60	7.75
2-E.Channel	28-Aug-90	16:10	50.0	8.3		4.3	44	7.70
2-E.Channel	28-Aug-90	16:13	60.0	7.3		2.8	28	7.70
2-E.Channel	28-Aug-90	16:17	66.4	7.0	32	2.0	20	7.50
3-Sawmill Cove	29-Aug-90	10:07	1	15.1	20	9.07	101	5.49
3-Sawmill Cove	29-Aug-90	10:49	1	13.9		10.26	111	7.81
3-Sawmill Cove	29-Aug-90	10:46	10	13.6		5.39	60	7.68
3-Sawmill Cove	29-Aug-90	10:12	10	13.8		4.84	54	6.4
3-Sawmill Cove	29-Aug-90	10:16	20	12.4		5.43	60	7.15
3-Sawmill Cove	29-Aug-90	10:43	20	12.2		5.52	61	7.55
3-Sawmill Cove	29-Aug-90	10:20	30	11		4.29	47	7.47
3-Sawmill Cove	29-Aug-90	10:39	30	10.5	32	5.32	58	7.41
3-Sawmill Cove	29-Aug-90	10:24	40	9.5		4.35	46	7.54
3-Sawmill Cove	29-Aug-90	10:27	50.1	8.1		3.07	32	7.52
3-Sawmill Cove	29-Aug-90	10:35	59.4	6.7		1.26	13	7.41
3-Sawmill Cove	29-Aug-90	10:31	60	6.9	32	1.34	13	7.47
4-Herring Cove	27-Aug-90	15:28	0.9	16.3	22	7.3	84	5.50
4-Herring Cove	27-Aug-90	15:30	10.2	13.2		6.6	73	6.46
4-Herring Cove	27-Aug-90	15:32	19.9	12.0		5.7	63	6.81
4-Herring Cove	27-Aug-90	15:34	30.1	10.6	32	5.4	59	7.06
4-Herring Cove	27-Aug-90	15:38	40.0	9.1		5.5	58	7.26
4-Herring Cove	27-Aug-90	15:41	50.0	7.6		4.0	41	7.34
4-Herring Cove	27-Aug-90	15:45	60.1	6.7		2.6	26	7.34
4-Herring Cove	27-Aug-90	15:49	63.3	6.5	32	2.1	21	7.28

APPENDIX C-4. Table 2. Results from Total Organic Carbon and grain size analysis of sediment samples.

Location	TOC	% Sand	% Silt	%Clay	%Silt+Clay
Silver Bay					
Eastern Channel	8.2%	27.0%	6.3%	4.8%	11.1%
Sawmill Cove	30.1%	30.9%	28.5%	24.8%	53.3%
(duplicate)	26.2%	34.6%	29.7%	23.7%	53.4%
Herring Cove	17.5%	25.1%	36.7%	31.8%	68.5%
Blue Lake	2.7%	5.2%	46.9%	47.5%	94.4%
City Landfill-sludge	3.8%	29.8%	16.5%	52.7%	69.2%

C-5. AQUATIC ORGANISMS

TISS-SEND.WK1 09/11/90 02:58 PM

SAMPLE#	FISH ID #	LOCATION	DATE COLLECTED	GEAR	SPECIES	LENGTH(mm)	WEIGHT(g)	ABNORMAL-ITIES
1	82	Blue Lake	30-Aug-90	Trap	Trout-Rainbow	217	124	
1	81	Blue Lake	30-Aug-90	Trap	Trout-Rainbow	161	50	
1	83	Blue Lake	30-Aug-90	Trap	Trout-Rainbow	208	108	
2	2	Herring Cove	27-Aug-90	Set line	Rockfish-quillback	261	310	
2	5	Herring Cove	27-Aug-90	Set line	Rockfish-quillback	392	1065	
3	77	Sawmill Bay	30-Aug-90	Pot-tanner	Crab-Dungeness-2	178		
4	64	Sawmill Bay	29-Aug-90	Set line	Rockfish-quillback	331	665	
4	62	Sawmill Bay	29-Aug-90	Set line	Rockfish-quillback	407	1310	
4	65	Sawmill Bay	29-Aug-90	Set line	Rockfish-quillback	264	360	
5	67	Sawmill Bay	29-Aug-90	Set line	Sculpin-Pacific staghorn	247	190	
5	66	Sawmill Bay	29-Aug-90	Set line	Sculpin-Pacific staghorn	278	335	
5	34	Sawmill Bay	29-Aug-90	Set line	Sculpin-Pacific staghorn	314	430	
5	29	Sawmill Bay	29-Aug-90	Gill net	Sculpin-Pacific staghorn	255	245	
5	30	Sawmill Bay	29-Aug-90	Gill net	Sculpin-Pacific staghorn	300	389	
6	55	Sawmill/Herring	29-Aug-90	Trawl	Flatfish-Sole-english	426	790	
6	57	Sawmill/Herring	29-Aug-90	Trawl	Flatfish-Sole-english	438	755	
6	56	Sawmill/Herring	29-Aug-90	Trawl	Flatfish-Sole-english	479	1095	
6	54	Sawmill/Herring	29-Aug-90	Trawl	Flatfish-Sole-english	406	835	
6	58	Sawmill/Herring	29-Aug-90	Trawl	Flatfish-Sole-english	324	345	
7	59	Sawmill/Herring	29-Aug-90	Trawl	Shrimp-mixed (pinks)	#=~150	735	
8	24	Thimbleberry Bay	28-Aug-90	Set line	Flatfish-Pacific sanddab	250	126	
8	17	Thimbleberry Bay	28-Aug-90	Set line	Flatfish-Pacific sanddab	258	165	
8	20	Thimbleberry Bay	28-Aug-90	Set line	Flatfish-Pacific sanddab	240	130	
8	19	Thimbleberry Bay	28-Aug-90	Set line	Flatfish-Pacific sanddab	267	170	
8	15	Thimbleberry Bay	28-Aug-90	Set line	Flatfish-Pacific sanddab	306	230	
8	16	Thimbleberry Bay	28-Aug-90	Set line	Flatfish-Pacific sanddab	250	68	
8	23	Thimbleberry Bay	28-Aug-90	Set line	Flatfish-Pacific sanddab	245	98	
8	21	Thimbleberry Bay	28-Aug-90	Set line	Flatfish-Pacific sanddab	309	265	
8	18	Thimbleberry Bay	28-Aug-90	Set line	Flatfish-Pacific sanddab	311	110	
8	22	Thimbleberry Bay	28-Aug-90	Set line	Flatfish-Pacific sanddab	290	215	
9	14	Thimbleberry Bay	28-Aug-90	Set line	Rockfish-quillback	378	1055	
10	80	Thimbleberry Bay	30-Aug-90	Hand	Shellfish-mussels		1/2 gal jar	
11	F-3	Thimbleberry Lake	28-Aug-90	Trap	Trout-Eastern brook	186	70	
11	60	Thimbleberry Lake	29-Aug-90	Trap	Trout-Eastern brook	187	76	
11	F-2	Thimbleberry Lake	28-Aug-90	Trap	Trout-Eastern brook	214	118	
11	F-1	Thimbleberry Lake	28-Aug-90	Trap	Trout-Eastern brook.	188	78	

C-6. LOCATION OF SOIL SAMPLES

APPENDIX C-6. Locations of soil samples.

Sample Name	Date	Subsamples and their Locations
Sitka City		
-North	8/31/90	1. Women's ball field, home plate. 2. Men's ball field, home plate. 3. Verstovia school ball field, home plate. 4. Residence at the southeast corner of Kostrometinoff and Edgecumbe Streets; garden soil just above the sidewalk.
-Central	8/31/90	1. Moller Park, northern playground, middle of the swingset. 2. Moller Park, southeast playground, middle of the swingset. 3. Moller Park, ball field, home plate. 4. Blatchley school, ball field, home plate.
-South	8/31/90	1. Etolin street school ballfield, home plate. 2. Sheldon Jackson Harbor park, swingset on south side of tennis courts. 3. Residence (# 106, end of Barlow Road), soil near roadside. 4. South side of jogging trail near the City incinerator.
-Japonski Island	8/31/90	1. Coast Guard housing playground, swingset. 2. Mt. Edgecumbe preschool (430 Fairway) playground, near base of tree, away from beauty bark. 3. Mt. Edgecumbe elementary school (Charcoal & Alice Loop Roads), bus loading area. 4. Residence one block west of the elementary school (house # 480A), soil near sidewalk.
Galankin Island	8/30/90	1. Back yard of residence in middle of northeast side. 2. North side of side yard of residence at southeast end. 3. Side of trail between the middle residence and the quarry. 4. Bare patch of soil on the northeast side of the quarry pit.
Jamestown Bay	8/31/90	1. Residence (1320 Raven Island) west end of the Bay (Price Street exit off of Sawmill Road), soils at edge of driveway. 2. Residence (107 Wolff Drive), soil at edge of driveway. 3. Residence (1618 Sawmill Road), soil near edge of sidewalk. 4. Residence (# 3 at a Trailer park) at east end of the Bay, soil between back door and driveway.
Thimbleberry Bay	8/31/90	1. Residential lot at west end (off of Shotgun Alley at approximately 2103 Sawmill Road), soil near side of road. 2. Residence (205 Blueberry Lane, at approximately 2507 Sawmill Road), soil from south part of yard. 3. Thimbleberry Lake trailhead, soil from base of tree to the east of the sign. 4. Roadside near Thimbleberry Creek, soil near west end of guardrail on south side of road.
Deep Inlet	8/29/90	1-5. Bare patches of soil on trail near the south shoreline at the head of the inlet
Alaska Pulp Corp	8/30/90	1. About 5 ft southeast of the east leg of the pylon supporting the chip conveyor (near the weak red liquor tank). 2. Between the tracks and the curb near the SO_2 solution tank and the nearby drain. 3. Near the base of the pylon supporting cables and hoses (around the corner from the location of subsample #2). 4. Across from the toe of the concrete near the 3B absorption tower; between the tracks and the nearby drain.
Blue Lake	8/30/90	1-4. Two from the northwest edge of the launching area. Two from the southeast edge of the launch/parking area.

APPENDIX D. QUALITY ASSURANCE REPORTS

1. Quality assurance reports are available from EPA, Region 10, for analyses completed by the following laboratories:

   EPA, Region 10, laboratory
   Contract Laboratory Program
   ADEC ash and floating residue samples
   (completed by ENSECO)

2. Table of laboratory methods used including details on TOC, particle size, and salinity

3. Quality assurance plan for the survey

D-2. Laboratory methods used
including details on TOC, particle size, and salinity

LABORATORY METHODS

Laboratory	Analyte	Method	Comment
USEPA Region 7	Dioxin/furan	EPA 8290	Without recovery standard
USEPA Duluth	Dioxin/furan	EPA 8290	EPA 600-3-90-022, Analytical procedures and quality assurance plan for determination of PCDD and PCDF in fish.
Contract Lab Program	Dioxin/furan	EPA 8290	
	TOC	PS Protocol	Puget Sound Protocol for sediment TOC (EPA 910/9-88-200)
	Particle size	ASTM D422-63	(See attached)
USEPA Region 10	VOAs (volatiles)	EPA 8260	Region 10 lab modifications
	B/N/Acid (semis)	EPA 8270	Region 10 lab modifications
	Pesticides/PCBs	EPA 608	
	Salinity		See attached
	Metals-ICP scan	EPA 200.7	(Total Recoverable)
	Specified Metals:		
	Arsenic	EPA 206.2	
	Lead	EPA 239.2	
	Mercury (water)	EPA 245.1	
	Mercury (sed/soil)	EPA 245.5	
	Selenium	EPA 270.2	
	Thallium	EPA 279.2	

Scope of Work for TOC and Particle Size Analyses

1. **General description of analytical service requested:**

   Total Organic Carbon (TOC) analysis in sediment by combustion, using the attached method, dated March 1986.

   The samples will also be analyzed for particle size using method ASTM D422.

2. **Definition <u>and</u> number of work units:**

   There will be 6 low level sediment samples submitted for TOC and particle size analyses.

3. **Estimated date(s) of collection/shipping:**

   The samples have already been collected.

   The samples will be shipped via Federal Express as soon as laboratory arrangements can be made.

4. **Number of days analysis and data required after laboratory receipt of samples:**

   The complete data package is required 35 days from receipt of the samples. The samples will be analyzed for TOC within 7 days of Validated Time of Sample Receipt and are to be stored at < 4 degrees Celsius.

5. **Analytical protocol required:**

   The attached method, dated March 1986, will be used for the TOC analyses. Follow Method ASTM D422-63, Particle Size Analysis of Soils for the particle size analyses.

6. **Special technical instructions:**

   Priority of analyses:

   Sample size may be limited for some or all of the samples. Therefore, TOC shall be analyzed before particle size.

   For TOC analyses:

   * An infrared CO_2 analyzer should be used if available, rather than a gravimetric method.

   * Dried samples shall be weighed prior to acidification.

* Report organic carbon results as a percentage of the dry weight of the unacidified sample to the nearest 0.1 units.

* An initial five point calibration curve that covers the dynamic range of the detector will be performed at the beginning of each analytical batch or whenever a calibration check exceeds specifications. The low calibration standard shall be at the Quantitation Limit specified in section 9 of this scope of work. In additiion, the initial calibration will also include a blank. The percent relative standard deviation (RSD) of each calibration factor is not to exceed 25% RSD.

* Matrix Spike and Matrix Spike Duplicate analyses are to be performed on 10% of the field samples utilizing potassium hydrogen phthalate as the spiking compound. Spiking concentrations should be approximately half the instrument calibration range.

* Matrix Spike and Matrix Spike Duplicate results target is RPD < 35% and the target mean recovery is 75 - 125% .

* Corrective action is required when method blank results exceed target detection limits.

* Triplicate sample analysis will be performed on sample 90354710. The %RPD for the sample triplicates shall be reported and shall be ≤ 35%.

* A calibration check standard will be analyzed after every ten field or QC samples analyzed. The calibration check standard will have a concentration equal to the mid-range standard of the established calibration curve. The response factor percent differences (%D) between the calibration check standard and the initial calibration standard will be ≤ 25% .

For particle size analyses:

Analyze one sample in duplicate. Follow method ASTM D422. Initially weigh each sample aliquot prior to analysis and determine % recovery relative to the cumulative weights after fractionating. Note: both sieve and hydrometer analyses are required.

7. **Analytical results required:**

The data package for TOC analyses shall include the following:

1. Chain-of-Custody sheets.

2. The bench sheets for sample preparation indicating dates, times and methods of preparation, standard information, spike volumes/amounts added,instrument run time/date, etc.

3. All sample and blank results reported as percentage on the dry weight and all supporting raw data including: run logs, computer printouts, calibration factors and QC results. All computer printouts will be labeled with a minimum of the sample number, and date/time of analysis.

4. All standard data including: preparation logs, traceability of standards, calibration factors (and RSD where applicable) for all standards analyzed.

5. All QC data including: summary forms, raw data and calculations.

6. An example calculation with the formula and all definitions of parameters in the formula in sufficient detail to allow an independent third party reconstruction of the results from the raw data.

The data package for particle size analyses shall include the following:

1. All Method D422-63 data reporting and documentation requirements.

2. The final results for each sample and it's duplicate.

3. All information used in calculating sample results.

4. Chain-of-Custody sheets.

4. Data on balance calibration checks for each day that samples are weighed.

8. Send the data packages to:

Laura Castrilli
USEPA Region 10
1200 Sixth Ave. MS/ES-095
Seattle, WA 98101

(Specify 9th. Floor if an express delivery service is used)

Phone: (206) 553-4323

9. **Data Requirements**

Parameter	Quantitation Limit	Precision Desired (percent or Concentration)
Particle size as per method ASTM D422-63	0.001 mm	≤ 35% RPD
TOC	5.0 mg/Kg	75-125% R

10. **QC Requirements**

Audits required	Frequency of Audits	Limits (percent or Concentration)
Particle size Analyses:		
Per method ASTM D422-63		
Duplicate	one	≤ 35% RPD
TOC analyses:		
Method Blanks	10 % Field Samples	< Detection Limit
MS/MSD	10 % Field Samples	RPD ≤ 35 %, R=75-125%
Calibration Check Standard	1 per 10 samples analyzed	% Difference ≤ 25%
Triplicate Analyses	on sample 90354711	RPD ≤ 35 %

11. **Action Required if Limits are Exceeded**

Call Bruce Woods, QA chemist, at 206-553-1193, immediately, for problem resolution.

III -D-1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10 LABORATORY
MANCHESTER, WASHINGTON 98353

REPLY TO ATTN OF: M/S LAB September 19, 1990

MEMORANDUM

SUBJECT: APC Salinity Analysis

FROM: Katherine York, CSC KY
Phil Davis P. Davis

TO: Leigh Woodruff
Bruce Duncan
Dan Tangarone

At the request of Bruce Duncan, four APC samples were analyzed for salinity on 9/11/90 by Phil Davis. These sample numbers are 90354700, 4701, 4702, and 4709. The request was for the analysis to be done on the top, middle, and bottom of the sample, which Phil did. Unfortunately, there is no simple way to report three values for each sample number with the data management system we presently use.

Rather than assign new sample numbers to the middle and bottom results, for example, we decided it would be best to report the results in the form of a memo.

		Results in ppt	
Sample number	Top	Middle	Bottom
90354700	22.	32.	32.
90353701	26.	32.	32.
90354702	22.	32.	32.
90354709	20.	32.	32.
90354701-Duplicate	26.	32.	32.
Blank #1-BK0254		0.0	
Blank #2+HCl-BK0254A		0.0	
Standard #1-34.995 ppt		35.	
Standard #2-20.ppt		20.	
Standard #3+HCl-34.995 ppt		35.	

Phil Davis used a Refractometric method to do his analysis. Please contact him or myself if you have any questions.

cc: Carolyn Wilson, RSCC
Arthur Dan Baker, RSCC

D-3. Quality assurance plan for the survey

•

QUALITY ASSURANCE PROJECT PLAN AND SAMPLING PLAN

Project Name: Alaska Pulp Corporation Multimedia & Risk Assessment Study, Sitka, Alaska

Project Manager: Dan Tangarone, Multimedia Inspection
Bruce Duncan, Risk Assessment Study

Field Operations: Dan Tangarone, ESD, EPA & ADEC Inspectors
Bruce Duncan, ESD • Dave Terpening, ESD • Andy Hess, ESD
Fish & Wildlife Service (2)

QA Office Concurrence: [signature] Date 22 Aug 90

Peer Review: ____________________ Date__________

Account Number: Sample Numbers:

PROJECT DESCRIPTION, OBJECTIVES, AND SITE LOCATION

APC has been selected for a multimedia compliance inspection which will involve EPA and ADEC program inspectors (Attachment A) during the week of August 27, 1990.

Previous studies of APC air emissions, wastewater discharges, and fly–ash disposal practices have raised concerns about dioxin contamination in soil, sediment, air, water, and biota in the vicinity of APC. Because of this, additional sampling (Attachment B) will be conducted during the same week to obtain data for a preliminary human health risk assessment study. Proposed sampling locations associated with this risk assessment phase are also listed in general terms in Attachment B.

The primary objectives of the August 27–31, 1990 APC survey are:

- Media program compliance inspections
- Human health risk assessment. The details of the toxicity and exposure assessments are shown on Attachment A.

SCHEDULE OF TASKS:

Sample Collection: August 27-31, 1990

Analysis Completion: Variable depending upon analysis type and laboratory. Dioxin sample results are estimated to require 45 days after receipt by the laboratory. Analyses to be performed by the Region 10 EPA Laboratory involving the Target Compound

	List (TCL) will take approximately 45 days. Final results should be available by October 31, 1990.
Data Summarization	October 31, 1990
Report Preparation	All compliance inspection / program reports will be generated by the program inspectors and will be submitted to the ESD APC multimedia coordinator (Dan Tangarone) for compilation and summary. Reports associated with the risk assessment will be generated by the risk assessment group of ESD.

DATA USAGE:

Data will be used to determine: (1) program compliance and (2) initial evaluation of risks to human health via various media and exposure routes.

QA OBJECTIVES FOR MEASUREMENT DATA

Precision and Accuracy Protocols / Limits:

Lab: Accuracy will be monitored by matrix /matrix spike duplicates, and laboratory control samples.

Laboratory replicate samples will be analyzed at a frequency of five percent for each sample matrix received for all parameters.

Rinsate blanks used for the final rinse of sampling equipment (Van Veen dredge and Automatic samplers) and are analyzed for all parameters of interest..

DATA REPRESENTATIVENESS

Sample selection will be based primarily on biased and composite sampling.

DATA COMPARABILITY:

These data are collected as a stand alone investigation and will not be compared to any other data set.

DATA COMPLETENESS:

The target goal for completeness is 100 percent.

DETECTION LIMITS:

Method detection limits required are based on human health risk assessment criteria, best available technology criteria, matrix type, and location. Where detection limits required for risk assessment are lower than attainable by current technology, SAS will be employed when appropriate to reduce the uncertainty in the risk assessment. Detection limits for CLP RAS will employ contract required quantitation limits specified in the CLP Statements of Work for organic and inorganic analyses.

Soil Dioxin and Furans

tcdd and tcdf 2.0 ng/kg

ocdd and ocdf 20 ng/kg

others 10.0 ng/kg

Water Dioxin and Furans

tcdd and tcdf 0.02 ng/l

ocdd and ocdf 0.2 ng/l

others . 0.1 ng/l

Tissue Dioxin and Furans

1 pg/kg for all 2,3,7,8 isomers

For all other parameters see attachment C.

SAMPLING PROGRAM

Samples to be obtained for the risk assessment phase and some NPDES related samples are shown in Attachment B. Other samples may be obtained during the conduct of the various media inspections. The programs which will involve the collection of samples are NPDES, Air, and Drinking Water. Samples may be obtained during the TSCA and RCRA inspections.

SAMPLE TYPES: See attachment B for sample types.

SAMPLE COLLECTION PROCEDURES:

Wastewater: One 24-Hour composite final effluent sample will be obtained by automatic sampler. In addition,12-hour manual composite samples will be taken from the bleach plant discharges, the treatment plant influent and effluent and the final effluent. .

Other water samples from Silver Bay and Blue Lake will be as shown on Attachment B and will also include TOC, pH, Conductivity, TSS, and TCL.

Water The marine water composite samples will be made up of approximately equal aliquots from the surface (5 Ft depth), mid point and bottom locations at each station using a Kemmerer sampler (Stainless or Teflon) or similar sampling device. The same sampler will be used at each location following a thorough ambient water rinse. A Hydrolab will be used for field analytical measurements.

Leachate Leachate samples will be obtained manually from the APC and city landfills.

Ash: Bottom ash from the APC and KPC hog fuel boilers will be collected using a stainless steel scoop or other appropriate sampling device as determined on location.

Sediment: Open water and near shore sediment samples will be collected from 4 areas in marine waters and from Thimbleberry Lake, Beaver Lake.

Debris or other objects larger than 0.5 inch diameter will be removed before placing the sample in the container.

Marine sediments will be collected using a stainless steel Van Veen grab sampler or other appropriate device. The upper 5 cm will be sampled from the center of each grab using clean stainless steel spoons. Two 8-oz wide mouth glass jar will be collected at each site for archiving. In addition, approximately equal portions of sediment from each of the four area locations will be composited into a half-gallon wide mouth glass jar or stainless steel pan. Sediments in this jar or pan will be mixed using a stainless spoon and a portion of this sample will be placed into 3, 8-oz and 1, 120 ml glass jars. One of the 8-oz jars will be archived, one will be sent the the appropriate laboratory for dioxin analysis, and the third will be sent to Region 10 lab along with the 120 ml jar for TCL analysis. Sample suitability will be judged according to the Puget Sound Protocols.

Freshwater lake sediment samples will be collected at the shoreline directly into appropriate containers using stainless steel spoons.

Soil: Surface soils will be sampled using a stainless steel scoop or other appropriate sampling device. Compositing of discrete samples will be done in stainless steel bowls. The depth of the sample will not exceed 2 inches below the ground surface. Objects larger than 0.5 inch diameter will be removed before placing the sample in the sample jar. If the sampling location is covered by vegetation, the turf will be separated from the soil and discarded. The thickness of the discarded turf will not be included in the 2–inch depth determination.

Tissue: Whole organisms - bottomfish, crab, clams, trout - will be obtained by normal methods and will be frozen aboard the boat, identified and wrapped in aluminum foil for shipment to the laboratory.

Following the procedures used in the National Bioaccumulation Study (1986), whole fish, crab, clams and mussel samples will be wrapped in aluminum foil and frozen ASAP for shipment to the analytical laboratory.

Tissue compositing will be done at the lab as part of the analytical procedure. The composite sample should not exceed 20 pounds. The weight, length, and species will be included on the sample data sheet. For sport or high utilization fish, the lab will analyze fillets. For bottom feeder fish, the whole fish will be analyzed.

Air: Certain air streams within APC will be sampled using evacuated canisters during the air compliance inspection. Sources to be sampled and analyzed for chloroform will be determined on site during the inspection but are thought to be from the vent system from the bleaching operation. Approximately ten in-plant air samples will be obtained.

DECONTAMINATION PROCEDURES

Sampling equipment will be thoroughly cleaned with alconox , carbon free water and methanol when appropriate.

SAMPLE CUSTODY PROCEDURES:

Region 10 chain-of-custody procedures will be used in the field and during sample shipment to the laboratory. Laboratory custody and sample control procedures will be in accordance with procedures described in the CLP SOWs for organics (EPA 1988a) and inorganics (EPA 1988b).

SAMPLE PRESERVATION AND HOLDING TIMES

Samples will be preserved as required according to procedures presented in the CLP organic (EPA 1988a) and inorganic (EPA 1988b) statements of work, SW-846 (EPA 1986a), Methods for the Chemical Analysis of Water and Wastes (EPA 1983). The sample preservation and holding time requirements for this study are summarized in the attached table.

SAMPLE CONTAINERS

Type and number of sample containers required for the sampling program are shown in the attached tables.

SHIPPING REQUIREMENTS

Packaging, marking, labelling, and shipping of samples will comply with all regulations promulgated by the U. S. Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171 – 177 and International Air Transport Association (IATA) regulations. Detailed requirements are discussed in the CLP User's Guide (EPA 1986b).

CALIBRATION PROCEDURES:

All field instruments will be operated, calibrated and maintained according to manufacturer's guidelines and recommendations by qualified personnel. Field maintenance and calibration records will be recorded in the field notebook.

ANALYTICAL METHODS:

See Attachment B.

DOCUMENTATION:

Samples will be documented by use of the Region 10 Field Sample Data Sheet, a log book, photographs, traffic reports and shipping documents.

Each sample will be assigned a unique identifying number. and documentation will include the following information:

- Name of sampler
- Date and time of sample collection
- Sample number
- Sample matrix and how collected (i.e., grab, composite)
- Preservation method
- Analyses required

DATA REDUCTION, VALIDATION, AND REPORTING:

All data generated by the laboratory will undergo a comprehensive quality assurance data validation. Data validation will assess laboratory performance in meeting the quality control specifications.

The project officer will oversee field measurements and data recording. Reduction and transfer of raw data from field notebooks to data tables will be independently checked and verified.

Data validation will assess laboratory performance in meeting the quality control specifications.

PERFORMANCE/SYSTEM AUDITS:

No additional audits are planned for this project.

CORRECTIVE ACTION:

The laboratory QA Officer will be responsible for ensuring that analytical results meet quality control criteria described in the CLP SOWs for organics (EPA 1988a) and inorganics (EPA 1988b) analyses or the appropriate EPA analytical method for SAS analyses and for implementing corrective actions as specified in the analytical methods and SOWs.

Appropriate corrective actions will be determined when and if required.

REPORTS:

Report development will be the responsibility of the Project Managers and/or program compliance inspectors.

Parameter	Media	Method	Samples	QA Samples	Parameters
Chloroform	Air	TO-14	10		
Dioxin/Furans	Soil	8290	8	1-Blank	
Metals		CLP SOW	8	1-Blank	
Particle Size		ASTM D422-63	8	1-Blank	
Target Compound	Ash	CLP SOW	1		BNA,Pest/PCB,Metals
Dioxin/Furans		8290	3		
TCLP		FR 3/29/90	1		BNA,Pest/PCB,Metals
Dioxin/Furans	Leachate	8290	2		
Target Compound		CLP SOW	2		BNA,Pest/PCB,Metals,VOA
Dioxin/Furans	Wastewater	8290	4	1-Blank	
Chloroform		CLP SOW	4	1-Blank	
TOX		9020	4	1-Blank	
BOD		405.1	2	1-Blank	
TSS		160.3	2	1-Blank	
Free Chlorine		330.3	1		
Fecal Coliform		9132	1		
ioxin/Furans	Sediment	8290	9		
Target Compound		CLP SOW	13		BNA,Pest/PCB,Metals,VOA
Particle Size		ASTM D422-63	6		
TOC		9060	5		
ioxin/Furans	Water	8290	1		
arget Compound		CLP SOW	5		BNA,Pest/PCB,Metals,VOA
ioxin/Furans	Tissue	8290	7		
ipids		??	7		