ASSESSMENT OF PCBs AND DDTs IN FISH POPULATIONS OF THE COLVILLE RIVER NEAR THE FORMER UMIAT AIR FORCE STATION UMIAT, ALASKA

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Acronyms and Abbreviations

ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ATSDR	Agency for Toxic Substances and Disease Registry
BLM	Bureau of Land Management
CFS	Cubic Feet per Second
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DINAC	The Department of Indian and Northern Affairs Canada
DoD	Department of Defense
EPA	Environmental Protection Agency
Linc	Linc Energy Operations, Inc.
PCB	Polychlorinated Biphenyl
ppb	Parts per Billion
ppm	Parts per Million
QA/QC	Quality Assurance/Quality Control
SOP	Standard Operating Procedure
TPECI	Travis/Peterson Environmental Consulting, Inc.
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION

Linc Energy Operations, Inc. (Linc) contracted Travis/Peterson Environmental Consulting, Inc. (TPECI) and Fisheye Consulting (Fisheye) to investigate organochlorine contaminants, specifically polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichloroethane (DDTs), in the Colville River near the former Umiat Air Force Station in northern Alaska. This investigation included a literature review of all historical studies conducted at the facility and regarding these contaminants in fisheries populations in the Colville River and their potential impacts on subsistence harvests and use in the region. TPECI and Fisheye also conducted a field study at the Umiat facility to assess current PCB and DDT concentrations in various fish species. The field study was conducted in August, 2015.

2.0 SITE DESCRIPTION LOCATION AND DESCRIPTION

2.1 Former Umiat Air Force Station

The former Umiat Air Force Station is an approximately 8,000-acre facility located adjacent to the Colville River, 120 miles south of Prudhoe Bay in northern Alaska (Figure 1). The facility is located at 69.3706° North latitude, -152.1399° West longitude. The facility is located in Sections 9 and 10, Township 1 South, Range 1 West, Umiat Meridian, United States Geological Survey (USGS) Quadrangle.

Around 1944, the site was developed by the United States Department of Defense (DoD). It included the airstrip complex, the main gravel pad, and 11 historical oil well test sites. In 1960, the DoD transferred the site to the U.S. Bureau of Land Management (BLM). Currently, ownership of the developed facilities is divided amongst public entities including Alaska Department of Transportation and Public Facilities, BLM, as well as private ownership by UIC Umiaq.

The facility does not house any year-round residents. Temporary workers and site visitors are present at the property occasionally throughout the year. The camp facility is utilized as a staging area for oil and gas exploration and the airfield is often used as a base for hunting in the region.

DoD constructed a 13-acre landfill and closed it in 1973. It was located approximately one-half mile east of the main gravel pad, in a slough of the Colville River (Figure 2). Past activities at the facility, particularly those centered around the old landfill, have resulted in PCB and DDT contamination at the facility. Previous studies have located the source of this contamination at the “Unit C” slough, the location of the old landfill (Ecology & Environment, 2003). Unit C slough is roughly one-half mile long. The slough is fed by Sea Bee Creek and runs into the Colville River. Fish are present in the slough during non-freezing months (Ecology & Environment, 2003).

2.2 Colville River

The Colville River has its headwaters in the Brooks Range and flows for approximately 450 miles across the coastal plain of Alaska before emptying into the Beaufort Sea. The Colville River is the largest waterway on the North Slope of Alaska and discharges near the mouth of the river has been estimated to be 16,000 cubic feet per second (CFS) (Roguski et al., 1971, cited in Ecology & Environment, 2003). Fish species found within the Colville River include round whitefish, broad whitefish, arctic grayling, ciscos, char, stickleback, salmon, and burbot. Fish populations within the Colville River are a major food source of the local Inupiat Eskimo population in the downstream village of Nuiqsut, Alaska. In 1993, a 33.8% of the total Nuiqsut community resource harvest was fish from the Colville River watershed (ATSDR, 2003). Burbot, specifically their livers, are a favored species within the subsistence harvests for local populations.

3.0 FISH SPECIES OF CONCERN

Freshwater fishes make up more than one-third of all subsistence harvests for the community of Nuiqsut, Alaska, located on the Colville River (ATSDR, 2003). These harvests include salmon, smelt, burbot, char, grayling, and whitefish. Several species, including salmon, smelt, some char, and some whitefish are anadromous (ADF&G, 2015). These species will not be present within the Colville River watershed for the entirety of their life cycle, thus limiting their contact to potential contaminants and minimizing the effects of bioaccumulation of persistent organic contaminants.

Predatory species such as Arctic grayling (*Thymallus arcticus*) and burbot (*Lota lota*) are both high on the food chain and stay within a watershed for their entire lifecycle. These characteristics result in the strong potential for bioaccumulation of persistent organic contaminants and their suitability as indicators of the presence of these contaminants within an aquatic ecosystem. Additionally, these species are part of a regular subsistence diet for the regional population, with burbot livers considered to be a primary food source in Nuiqsut (ATSDR, 2003). Previous studies of the Umiat site and Colville River and the research conducted in 2015 focused on these two species as well as broad whitefish.

3.1 Broad Whitefish (*Coregonus nasus*)

Broad whitefish (*Coregonus nasus*) are an anadromous species. However, extended ocean migrations are not well studied or documented. The majority of adults remain in brackish waters in river delta regions (Morrow, 1980). An upstream spawning migration will occur in northern Alaska over a period of several months, typically August through October (ADF&G, 2015). Spawning typically takes place in small streams with gravel bottoms. Adults will move downstream after spawning and overwinter in deep pools or river delta estuaries (Morrow, 1980).

The species is the largest of the Alaskan whitefishes; mature fish weigh between two and five kilograms (four to 12 lbs) (ADF&G, 2015). The maximum age of fish collected during previous studies in the Umiat area is roughly 14 years old. Growth of this species in arctic regions is

particularly slow. The broad whitefish is primarily a bottom feeder and subsists mostly on chironomids, snails, small mollusks, mosquito larvae, and crustaceans (Morrow, 1980).

3.2 Arctic Grayling (*Thymallus arcticus*)

Arctic grayling (*Thymallus arcticus*) have the largest natural range of any sport fish within the State of Alaska, being found in nearly the entire state with the exception of Kodiak Island, the Aleutian Islands, and portions of Southeast Alaska. Arctic grayling are found throughout the northern latitudes of North America, though their range continues to move northward due to overfishing, competition from introduced species, and habitat loss (ADF&G, 2015).

In Alaska, Arctic grayling will typically reach a length of 10 to 20 inches. The largest recorded Arctic grayling in the State was recorded to be 24 inches (ADF&G, 2015). The fish are particularly long-lived and individuals have been found in Alaska over 32 years old. Grayling will first spawn between the ages of four and seven years old and will continue to spawn regularly throughout their life span.

During summer months, Arctic grayling are voracious feeders. They will strike and consume any potential food source. Their diet consists of primarily aquatic insects including blackflies, caddisflies, stoneflies, as well as small fish and the eggs of other fish species (ADF&G, 2015). Arctic grayling feed minimally during the winter months, conserving energy by occupying lakes or deep, slow moving river pools.

Arctic grayling are known to be highly migratory, utilizing different streams, rivers, and lakes for spawning, juvenile growth, summer feeding, and overwintering. Grayling typically undertake a spring, upstream migration for spawning. Then migrate again for summer feeding. Distances traveled during times of migration can be as little as one kilometer, or up to 100 miles. Arctic grayling populations are found in all reaches of the Colville River and its tributaries (ADF&G, 2015). Their abundance in addition to their aggressive feeding behaviors results in the grayling being a popular and accessible subsistence food source.

3.3 Burbot (*Lota lota*)

Burbot (*Lota lota*) can also be referred to as cusk, lingcod, eel pout, loache, ling, lawyer, lush, or mud shark. The burbot is the only member of the cod family (*Gadidae*) in North America that lives entirely in fresh water (ADF&G, 2015).

In Alaska, burbot will typically reach a length of 15 to 22 inches, but are known to grow as long as 46 inches (ADF&G, 2015). Burbot spawn under the late winter ice of February and March. They are a long-lived species, and burbot older than 20 years are not uncommon in Alaska (ADF&G, 2015). Burbot are extremely predatory, by the age of five years old, they will typically feed entirely on fish, including whitefish, sculpin, lamprey, and other burbot (ADF&G, 2015).

Burbot are a somewhat sedentary species, often resting near the bottom of the stream or river, in deep, slow moving pools or back eddies (Morrow, 1980). Despite the sedentary behavior, burbot

may travel significant distances, upwards of 78 miles, during spawning season (Breeser, et al., 1988). A 2003 study of the seasonal movements of burbot within the Colville River delta showed that burbot frequently moved in and out of shallow, ephemeral streams and backwater of larger rivers and streams, overwintering in deeper lakes or river channels (Morris, 2003). These seasonal migrations for both spawning and overwintering sites results in a changing population distribution and indicates the presence of burbot migration throughout the Colville River system.

4.0 CONTAMINANT CHARACTERISTICS

Polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT) and its breakdown products, dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE), are all persistent, lipophilic organochlorine compounds. The DDT compounds are naturally degraded into DDD and DDE in the environment. However, these chemicals do not fully deteriorate. PCBs, DDTs, as well as DDE and DDD do not break down readily within the environment and due to their lipophilic nature, they tend to bioaccumulate in aquatic food chains. Animals at the upper ends of the food chains, such as predatory fish, fish consuming birds and mammals, often contain the highest concentrations of these contaminants, when present. In fish, these organochlorine compounds are more likely to be found in predatory fish such as burbot or char than in fish whose diet is comprised of primary aquatic invertebrates, lower on the food chain. In an organism, the concentrations of the organochlorine compounds will likely be higher in fatty tissues, including adipose tissue or liver. The high specific gravity of the contaminants also results in their transport through sediments in aquatic environments.

5.0 POINT AND NON-POINT CONTAMINANT SOURCES

5.1 Unit C Slough at Umiat Point Source

The former landfill located at Unit C Slough at Umiat has been identified in previous studies as a point source for both PCB and DDT contamination. Specific information regarding the design, construction, and materials within the former landfill are not readily available. However, the United States Army Corps of Engineers (USACE) has been aware of the presence of these contaminants and the site since the early 1990s and has conducted numerous investigations and cleanup operations.

PCBs were utilized by the DoD for numerous applications until 1979, when their manufacture and use was banned in the United States. Uses included fire retardants, in transformers and capacitors, in motor oil and other lubricants, in caulking, sealants, and other coatings, in fluorescent light ballasts, and for many other industrial purposes. The U.S. Navy noted that PCB compounds, Aroclors 1254 and 1260, were among the most frequently produced and used (Battelle Memorial Institute et al., 2012). Therefore, it is logical that these compounds (1254 and 1260) have been noted in previous studies to have been the most prevalent in water, sediments, and fish tissues in the area of the Unit C Slough at Umiat.

Beginning during the second half of World War II, around the time that the Umiat facility was established, the DoD began using DDT as an insecticide for the control of malaria. Shortly

thereafter and until the early 1970s, it was used heavily as a commercial insecticide (Bates, 2007).

Mosquitoes are found in extreme abundance on the Alaska Coastal Plain and in the Umiat area due to optimal climatic conditions during the summer months (Gjullin, C.M. et al., 1961). To control the mosquito populations, the DoD and subsequent users of the facility likely used DDT extensively to control mosquito populations at the site. Previous studies have found varying concentrations of DDT and its breakdown products DDE and DDD in the soils, water, and fish tissues around Umiat.

5.2 Non-Point Sources

Many studies have documented the presence of persistent organic contaminants such as PCBs or organochloride pesticides in the surface waters, sediments and fish tissues in arctic ecosystems (Muir and Lockhart, 1994a, 1994b, 1997; Palmer, 1994; McCarthy et al., 1997; Ewald et al., 1998). Very few point sources for these persistent organic contaminants exist within these arctic ecosystems. As a result, many researches have sought to determine the source for this contamination or otherwise explain its continued presence. Prevailing theories indicate that the presence of the persistent organic contaminants in aquatic arctic ecosystems may be attributed to the deposition of pollutant through atmospheric transport (McCarthy et al., 1997; Ewald et al., 1998).

The mechanism for this deposition occurs when contaminants originating in warmer climates are volatilized and transported in water vapor form by upper atmospheric winds. The direction of contaminant transport is typically believed to be toward the Polar Regions. Contaminant laden vapors condense and are deposited in colder climates. Condensation temperatures vary for different contaminants and the condensation characteristics for contaminant species may result in a global fractioning of contaminant deposition. This process is referred to as global distillation. As these persistent organic contaminants are deposited in arctic aquatic or terrestrial ecosystems, they have the potential to bio-accumulate due to their lipophilic nature. The fractionation of contaminants into subspecies can alter the original contaminant's identifying signature, potentially allowing a foreign chemical or contaminant to be distinguished from a local, point source.

Theories into the biotransport of contaminants have been established within the past several decades as studies have sought to explain the process by which contaminants accumulate in fish tissues and how these contaminants move among different ecosystems (Ewald et al., 1998). Numerous species of anadromous fish potentially accumulate contaminants through their diet, contact with contaminated water, and contact with contaminated sediments during their time in the ocean as well as migratory periods within freshwater environments. These anadromous fishes accumulate lipid stores for energy needed during spawning migration. As a result, a concomitant accumulation of lipophilic pollutants occurs. When spawning fish die, their carcasses become a source of nutrients and organic matter to the freshwater ecosystem. It is evident then, that migrating fish can act as vectors of organic contaminants between ecosystems. As an example, organic pollutants have been transported to inland Alaska lakes by sockeye

salmon (Ewald et al., 1998). This biotransport process has also been documented in the Great Lakes with anadromous Steelhead and Atlantic Salmon.

The Unit C Slough at Umiat is a likely point source contributor of organic contaminants within the Colville River. However, it is equally likely that both atmospheric transport and biotransport also contribute PCBs and DDTs to the biota of the Colville River system. The Colville River watershed is located entirely within arctic latitudes. As such, atmospheric transported contaminants are more likely to condense and be deposited in this region. Additionally, the Colville River has numerous anadromous fish runs, including several species of whitefish (*Coregons* spp.), Chum salmon (*Oncorhynchus keta*), Pink salmon (*O. gorbuscha*), and Dolly Varden (*Salvelinus malma*) (Burr, 1999). Anecdotally, Inupiat Eskimo residents of the region have also reported a Chinook salmon (*O. tshawtytsha*) run in the Colville River. All of these species, with the exception of Pink Salmon, have been found upstream past Umiat (Burr, 1999).

The Department of Indian and Northern Affairs Canada (DINAC) published data on contaminant levels in biota, water, and sediments of freshwater and marine ecosystems in northern Canada (Muir and Lockhart, 1994, DINAC, 1997). In their research, whole fish, fish muscle, and fish livers were analyzed for 130 individual organochlorine compounds, including PCB congeners and DDT and its breakdown products.

A 1998 Ecology & Environment study for the USACE (described in detail in subsequent Sections) found that total PCB mean concentrations detected in burbot livers of fish collected from the upstream reaches of the Colville River (123.70 ppb) were similar to the lower ranges of total PCB concentrations found in the DINAC studies (26.9 ppb to 136 ppb). Burbot livers results from fish samples collected in the Unit C slough at Umiat and downstream reaches of the Colville were significantly higher (468.05 ppb and 665.00 ppb, respectively) and were similar to higher PCB concentrations found in the DINAC studies in Lake Laberge, Canada (836 ppb to 1,300 ppb). DINAC studies note Lake Laberge's proximity to Whitehorse, Yukon, and the potential for point source contributions in addition to both atmospheric depositions. Additionally, the burbot in Lake Laberge likely feed at a higher trophic level than top predator fish in other reference waters. Higher trophic levels would result in the potential for greater biomagnification and bioaccumulation of contaminants.

A similar comparison of the 1998 Ecology & Environment and the DINAC studies found that DDT concentration detected in burbot livers of fish collected in the main channel of the Colville River (86.47 ppb to 448.40 ppb) were similar to the lower values of DDT mean concentrations detected burbot from lakes and rivers in northern Canada. The DDT concentrations detected in burbot livers of fish collected from the Unit C Slough at Umiat (1,029.80 ppb) were more closely similar to the higher ranges in the DINAC study data from Lake Laberge (1,578 ppb to 4,000 ppb). Again, DDT concentrations in Lake Laberge were likely associated with nearby point sources.

Numerous studies have determined that atmospheric transport and biotransport of contaminants is likely impacting arctic ecosystems. The role that these transport mechanisms play in the total contaminant concentrations within the biota is not insignificant as shown in the 1998 Ecology & Environment study and the DINAC studies. These previous studies, as well as other published

research, find that atmospheric transport and biotransport are likely contributing to contaminant concentrations in fish populations in the Colville River. They also indicated that at one point in time, a point source of both PCB and organochlorine (DDT) contaminants were present in the Unit C Slough at Umiat.

6.0 PREVIOUS STUDIES

Numerous previous studies have been conducted regarding PCB and DDT contamination in the Colville River, the effects of point-source contamination from the Unit C Slough at Umiat, and the impact on the utilization of subsistence food sources by the regional population. These studies have been primarily funded by U.S. federal agencies including the USACE, The U.S. Department of Health and Human Services, and the National Science Foundation. The scope of the studies varies widely, but all focus on the impacts of these contaminants pointing towards the source at Umiat as a primary concern.

The first studies of the PCB and DDT contamination in fish tissues in the Colville River at the Umiat site were conducted in August, 1997 by the private consulting firm Ecology & Environment. This study was contracted by the USACE. A follow-up study was conducted in August, 1998, also by Ecology & Environment under contract again by the USACE. The initial focus of these studies was a broad assessment of contamination throughout the entire Former Air Force Station at Umiat and included soil, groundwater, sediment, fish tissue, and other investigations.

In 2001, The U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR) conducted a review of the 1997 and 1998 Ecology & Environment studies for the completion of a Health Consultation and evaluation of the impacts of these contaminants on subsistence food sources.

In August, 2001, Ecology & Environment conducted a third study, focusing exclusively on fish tissues and included multiple reaches of the Colville River system. This study was also contracted by the USACE and was more in depth than any previous investigation into PCBs and DDTs within the river biota. The study also compared the data from the Colville River to background data from northern Canada identifying both point and non-point source inputs.

ATSDR conducted a review of the 2001 Ecology & Environment study and prepared a Health Consultation in 2003. This Health Consultation, similar to the one published by ATSDR in 2001 looked at the findings of the Ecology & Environment study and determined potential impacts on subsistence food sources and risk to the regional population. During their 2001 and 2003 reviews and reports, ATSDR did not collect any original data, but relied solely on data available from the Ecology & Environment findings.

One additional study was conducted in July, 2004 by Dr. Jesse Ford of Oregon State University Department of Fisheries and Wildlife. The findings and data of this study were never published or made publicly available. No report or other information regarding the scope of this study, fish species collected, or any other data is available and as a result it has not been included within this assessment.

6.1 Study Sampling Ranges

6.1.1 1997 Ecology & Environment Study

The August, 1997 Ecology & Environment study was focused exclusively at the Former Umiat Air Force Station and the development within the immediate vicinity of the facility. The fish collected as part of this study were only obtained for the Unit C Slough and from the main channel of the Colville River nearby.

6.1.2 1998 Ecology & Environment Study

Based on the findings of the 1997 study, Ecology & Environment expanded the sample collection range for the 1998 investigation. Fish for this study were collected in the Unit C Slough at Umiat, approximately four miles downstream from the Former Umiat Air Force Station, and approximately four miles upstream of the facility.

6.1.3 2001 Ecology & Environment Study

The August, 2001 Ecology & Environment study was designed as a comprehensive assessment of PCBs and DDTs in burbot throughout a significant length of the Colville River system. A total of seven reaches were established to serve as sampling segments. The length of the individual reaches varied significantly.

Reaches one through five were located downstream of the Former Umiat Air Force Station. These reaches stretched a total downstream distance of approximately 90 miles. These reaches included areas of the river in close proximity to the Village of Nuiqsut, where subsistence use occurs. Many of these reaches were established in an effort to isolate potential impacts form major tributary rivers. Reach six was established entirely within the Unit C slough at Umiat to determine if drainage from the landfill site was contributing to contamination in the slough and the Colville River as a whole. The seventh and final reach was established approximately 20 miles upriver from the Former Umiat Air Force Station. This distance was selected as it was assumed that it would be far enough upriver to limit any direct impacts from the Umiat facility.

6.2 Study Fish Species, Sample Methodology, and Sample Quantities

The sample size and speciation of the studies changed from 1997 through 2001 as each subsequent study became more focused on both impacts to fish and the broader concern of impacts to subsistent uses through consumption of preferred species.

6.2.1 1997 Ecology & Environment Study

The 1997 Ecology & Environment study collected a total of 20 Arctic grayling (*Thymallus arcticus*) for sampling analysis for PCBs. Fourteen fish were collected entirely within the Unit C slough at the Former Umiat Air Force Station. An additional six fish were collected approximately one mile upstream of the confluence of the Unit C slough and the Colville River.

These fish were intended to be collected as background samples. All Arctic grayling were collected by fly fishing. Despite the study design and intentions, no whitefish or burbot were caught or collected in 1997. This is likely because the fly fishing sample collection methods were not conducive to attracting whitefish or burbot.

6.2.2 1998 Ecology & Environment Study

The 1998 Ecology & Environment study was designed to expand on the 1997 research. As the 1997 results yielded indications of contaminants present in the fish populations, further work was necessary to determine if the point source at the Unit C slough at Umiat was a significant cause and whether other species were also impacted.

During this study, five broad whitefish (*Coregonus nasus*) and three burbot (*Lota lota*) were captured and submitted for laboratory analysis at the upstream site, approximately four miles upriver of the Former Umiat Air Force Station. Five broad whitefish and two burbot were captured in the Unit C slough at the Umiat facility. Five broad whitefish and two burbot were captured at the downstream site, approximately four miles downriver from the Former Umiat Air Force Station.

Ecology & Environment utilized baited hoop nets for the capture of burbot. Hoop nets were 10 feet in length with a two foot diameter opening. Hoops were held rigid with lengths of PVC piping. The nets were baited with locally caught Arctic grayling, char, and whitefish. Two hoop nets were fished at each of the three locations for eight days. Due to poor success rates, an additional hoop net was placed at the downstream site for six days.

Gill nets were used for the collection of broad whitefish. Gill nets were 125 feet in length, and six feet deep. One gill net was set at each sampling site and was fished until the required number of whitefish was collected. The gill nets were fished for five days at the upstream site, and two days each at the Unit C slough site and the downstream site. Due to the traveling distance between sites, the gill nets were not attended and were checked once daily.

Due to poor success rates of burbot capture, the use of a baited long line was also attempted for a five day period. However, no fish were captured using this method. While the original study planned for the collection of Arctic grayling, Ecology & Environment determined that it was not necessary based on the number of broad whitefish collected.

6.2.3 2001 Ecology & Environment Study

Based on the data from the 1998 study, Ecology & Environment determined that low sample numbers from captured burbot resulted in inconclusive research outcomes. However, it did indicate a possible trend of elevated PCB and DDT concentrations in burbot downstream of the Unit C slough at Umiat. Burbot are the most abundant resident predatory fish in the Colville River watershed, and as persistent organic contaminants such as PCBs and DDTs are known to bioaccumulate at higher trophic levels, the burbot was selected as the target species for evaluating risk factors to subsistence users.

Baited hoop nets were again used for the capture of burbot during this study. Hoop net construction was identical to those used in 1998, consisting of 10-foot long hoops with a two foot diameter opening. Hoop nets were baited with locally captured whitefish. Hoop nets were primarily set in pools that were formed on downstream ends of alder and willow lined embankments. The river currents tended to undercut these soil embankments, causing shoreline vegetation to collapse into the river channel, forming underwater habitat. Hoop nets were typically set by wading into the channel, but were deployed by boat and anchored to the river bank where depth limited access.

Baited long lines, both shore based and temporary buoy based, were also initially used. Hooks were baited using pieces of a locally captured whitefish. The long lines were found to not be successful for the capture of burbot and were phased out after five days with the capture of only a single burbot.

Three hoop nets were initially deployed in each of the seven reaches. Once 10 burbot were captured in a reach, the hoop nets were reallocated to the remaining reaches until 10 burbot were captured in all seven reaches. The total time (in days) of nets actively fishing each reach was not listed within the Ecology & Environment report. However, it is stated that a period of greater than 13 days was spent fishing some reaches.

Once preferred burbot habitat was identified, capture success of the hoop nets was found to be a function of river stage. Rising water levels led to greater catch rates (Ecology & Environment, 2001). Within one reach, after fishing for 13 days using up to eight hoop nets, only two fish had been captured. Heavy precipitation and flood conditions then occurred, forcing burbot to move towards vegetative shelter along the river banks, increasing catch rates significantly (up to 12 fish in a single net per day).

During the study, the majority of the fish captured within the hoop nets were burbot. No numbers or other information were recorded on incidentally captured fish, but species caught included (in order of abundance) Arctic grayling, longnose sucker (*Catostomus catostomus*), broad whitefish, arctic char (*Salvelinus alpinus*), sclupin (*Myoxocephalus quadricornis*), lake trout (*Salvenlinus namaycush*), and northern pike (*Esox Lucius*).

6.3 Study Results and Conclusions

6.3.1 1997 Ecology & Environment Study

The 1997 Ecology & Environment study focused on Arctic grayling captured within the Unit C slough at the Former Umiat Air Force Station. A total of 14 fish were collected at the site. All fish were submitted for laboratory analysis. Of these 14, seven fish were analyzed for PCBs looking at whole body content, and the other seven were analyzed for PCBs for just the fillets.

PCB Aroclor 1254 was detected in three of the seven whole body samples, ranging in concentrations from 48 µg/Kg to 1,400 µg/kg. Four of the seven analyzed fillets detected PCBs (Aroclor 1254) in concentrations ranging from 19 µg/Kg to 460 µg/kg. PCBs were not detected in the six Arctic grayling (three whole body samples and three fillets) collected approximately

one mile upriver of the confluence of the Unit C slough and the main channel of the Colville River. Mean concentrations for PCBs captured in the slough were calculated to be 25 µg-PCB/Kg and 18 µg-PCB/Kg for fillet and whole body tissues samples, respectively.

While the primary focus of the analysis was on PCBs, DDT and its breakdown products DDD and DDE were also identified, but not quantified in the fish tissues. The scope of the study did not originally intend to include an investigation of DDT or its breakdown products, and as such, detailed laboratory analysis was not conducted. The presence of DDT, DDD, and DDE within the grayling may indicate a point source of these contaminants within the Unit C slough at Umiat. However, the extent or probability of this source could not be determined, due to the lack of quantifiable data.

6.3.2 1998 Ecology & Environment Study

The 1998 Ecology & Environment study included PCB and DDT analysis for fish collected from the Unit C slough at the Former Umiat Air Force Station as well as sampling sites located four miles upstream and four miles downstream of the facility. A total of 15 broad whitefish and seven burbot were collected from the three sampling locations.

Five broad whitefish were collected from each of the three sampling sties. All 15 fish samples were found to have detectable levels of PCBs and DDTs. PCB compounds, Aroclors 1242/1016, 1254, and 1260 were all detected. Whitefish samples at the upstream location had PCB concentrations ranging from 2.2 to 8.3 µg/Kg. DDT concentrations in the whitefish at this site ranged from 0.5 to 1.3 µg/Kg. Whitefish collected from the Unit C slough were found to have PCB concentrations ranging from 4.1 to 39.1 µg/Kg and DDT concentrations from 0.5 to 2.2 µg/Kg. Whitefish collected from the downstream sampling site had PCB concentrations ranging from 2.4 to 6.0 µg/Kg and DD concentrations from 0.7 to 1.0 µg/Kg.

Seven whole body burbot samples were collected from the three sampling sites. Three samples were collected from the upstream location, two of which were found to have detectable concentrations of PCBs (1.2 to 1.3 µg/Kg). DDTs were detected in all three samples with concentrations ranging from 0.3 to 0.6 µg/Kg. Two whole body burbot samples were collected from the Unit C slough site. Both samples were found to contain detectable concentrations of PCBs and DDTs ranging from 3.3 to 18.2 µg/Kg and 4.1 to 34.9 µg/Kg, respectively. The two whole body burbot samples collected from the downstream site were found to have PCB concentrations ranging from 1.2 to 8.1 µg/Kg and DDT concentrations from 0.7 to 4.4 µg/Kg.

A total of seven burbot livers were collected for analysis from the three sampling sites. Three samples were collected from the upstream location, all were found to have PCB concentrations ranging from 119.1 to 126 µg/Kg. DDT concentrations in these samples ranged from 71.1 to 106.9 µg/Kg. The two burbot liver samples from the Unit C slough sampling location were found to have PCB concentrations of 270 µg/Kg and 1,060 µg/Kg and DDT concentrations of 704.6 µg/Kg and 1,355 µg/Kg. The two burbot liver samples collected from the downstream site were found to contain PCB concentrations ranging from 256.1 to 680 µg/Kg and DDTC concentrations from 174.3 to 722.5 µg/Kg.

During their investigation, Ecology & Environment reviewed both their data collected during August, 1998 as well as the findings of other investigators and determined that atmospheric transport and biotransport are likely contributing to persistent organic contaminant concentrations in the fish tissues of several species in the Colville River.

The findings note that a point source of contaminants, both PCBs and DDTs is likely located at the Unit C slough at Umiat. The Ecology & Environment statistical analysis found that the source does not appear to be significantly affecting the whitefish population in the remainder of the Colville River. However, despite weak supporting data due to small sample size, Ecology & Environment found that the burbot population of the Colville River downstream of the Unit C slough may have elevated concentrations of persistent organic contaminants including PCBs and DDTs. Ecology & Environment recommended that an additional study be conducted with larger burbot population sampling size to confirm these findings.

6.3.3 2001 Ecology & Environment Study

The 2001 Ecology & Environment study collected a total of 70 burbot from seven sampling reaches (10 burbot per reach) on the Colville River. The liver of each fish was removed by the laboratory prior to sample analysis. Both whole body fish and liver analysis was done for each fish collected. Samples were analyzed for PCBs, DDT, and its breakdown products.

The analytical data for PCBs, individual Aroclors, and DDTs were evaluated by Ecology & Environment for any potential flood bias as a portion of their sample collection period was divided by a river flood event. The data from all seven reaches were pooled for each of the analyte groups. Ecology & Environment determined that no statistically significant differences were found comparing results from fish collected before and after the flooding began. A similar assessment was made within the data for each individual reach. All burbot from Reaches 1, 2, and 7 were collected prior to flooding. Ecology & Environment found no statistical differences for the sample results from the remaining reaches (Reaches 3, 4, 5, and 6) where burbot were collected both before and during the flood event.

Ecology & Environment found that livers contained higher concentrations of persistent organic contaminants than whole body samples, as was anticipated. However, the results of both liver and whole body sampling displayed the same general trends throughout the various analyses.

Reviewing the data, the seven samples with the highest PCB concentrations within the study were all collected from Reach 6, contained fully within the Unit C slough at Umiat. Those sample concentrations ranged from 896 µg/Kg to 3,389 µg/Kg. Average concentrations for PCBs in each of the seven study reaches ranged from a maximum of 887 µg/Kg in Reach 6 to a minimum of 106 µg/Kg in Reach 5, near the village of Nuiqsut. While Reaches 1 and 2 are located closer to the Unit C slough, the upstream sampling reach (Reach 7) had the second highest average PCB concentrations (449 µg/Kg). Reach 4 (445 µg/Kg) also was found to have higher average concentrations than Reach 1 (200 µg/Kg) and 2 (297 µg/Kg), the reaches located immediately downstream of the slough.

Ecology & Environment analyzed downstream trends by developing correlation coefficients from PCBs for Reaches 1 through 6. The analysis yielded high negative correlations, indicating PCB concentrations are decreasing from upstream to downstream.

The patterns and concentrations of DDTs found in the 2001 Ecology & Environment were found to be very similar to those of the PCBs. Reach 6 (Unit C slough) had the five highest concentrations (liver samples) ranging from 1,833 to 10,673 µg/Kg. Excluding Reach 6, the highest concentrations for both liver and whole body samples were found in Reach 7 at 1.35 mg/Kg (liver) and 0.27 mg/kg (whole body). Reach 5 was found to have the lowest mean DDT concentrations (0.02 ppm for liver and 0.1 ppm for whole body). The reach concentration patterns vary slightly compared to PCBs as Reach 1, located immediately downstream of the slough had the next highest mean DDT concentrations, flowing by Reach 7.

In an analysis of the data, Ecology & Environment determined that some fish collected near the Unit C slough in Reaches 7 and 1 exhibited elevated concentrations of DDTs. Contaminants that originate in Reach 6 could not have migrated to Reach 7 in the water column, because Reach 7 is located approximately 20 miles upstream of the Unit C slough. It is therefore probably that persistent organic contaminants from the Unit C slough migrate to the Colville River via biotransport in burbot. Telemetry studies conducted in 2003 support this theory, showing that burbot may migrate distances of greater than 50 miles and periodically return to some locations (Breeser 1988, Morris, 2003).

Ecology & Environment found that concentrations of DDTs in fish tissues decrease with distance downstream from the Unit C slough at Reach 6. In general, an increased concentration of DDTs in an individual sample was associated with an increase in PCB concentrations as well. This may indicate that individual fish with elevation concentrations of PCBs and DDT are exposed to the same point source in the Colville River, rather than contacting multiple individual sources of these contaminants throughout the river. Ecology & Environment noted that whole the data does not explicitly prove that Reach 6 is the source of increased PCB and DDT concentrations in fish tissues, however, it generally supports that hypothesis.

The variability in PCB and DDT concentrations in the fish tissue results suggest that biotransport of these persistent organic contaminants out of the Unit C slough at Umiat by migratory fish is likely responsible for higher total concentrations within individual fish in the Colville River, both upstream and downstream of Umiat. The effects of biotransport are largely limited to the study reaches near Umiat, though a small number of burbot that may have been affected by PCBs and DDTs were collected in Reach 4, approximately 75 miles downstream of the Unit C slough. Burbot collected from Reach 5, near the Village of Nuiqsut, did not show any evidence that PCBs or DDTs from the Unit C slough at Umiat impacted them.

Ecology & Environment compared their sampling results to samples of burbot livers from 13 lakes and rivers located in the Canadian Yukon and presented in the DIAND report (Palmer, 1992, 1993, 1994). These Yukon lake and rivers samples were not associated with any point sources for PCBs or DDTs. Therefore, this data likely best represents a range of PCB and DDT concentrations in burbot liver resulting from atmospheric deposition. Ecology & Environment found that mean concentrations of PCBs and DDTs detected in burbot livers in 2001 from the

Colville River are very similar to those found in the Yukon lake and river samples from the DIAND report, indicating that the majority of the Colville River concentrations are the result atmospheric deposition. Ecology & Environment concluded then that only individual samples that are exposed to the Unit C slough at Umiat may contain concentrations higher than might be expected from typical atmospheric deposition of contaminants in arctic regions, and while these individuals may migrate, they likely do not reach the lower reaches of the Colville River near Nuiqsut.

6.4 Study Determinations of Consumption Risks

A primary focus of many of these studies was an assessment and determination of risk to subsistence users based on the presence of persistent organic contaminants in the Colville River ecosystem, specifically the tissues of target harvest species such as burbot.

6.4.1 1997 Ecology & Environment Study

In the 1997 study, Ecology & Environment determined that the potential excess lifetime cancer risks for current Umiat residents and subsistence users association with consumption of fish caught from the Colville River near Umiat were within acceptable regulatory criteria. They determined that there were no human health risks associated with eating fish from the Colville River for current Umiat residents and subsistence users. Any human health risks related to the consumption of fish contaminated with PCB Aroclor 1254 would be limited to the Unit C slough and do not extend to fish collected from the Colville River.

The study scope was limited to PCBs, so while DDT and its breakdown products were identified in fish tissue, the human health risks due to these contaminants in fish tissue were unknown.

6.4.2 1998 Ecology & Environment Study

The 1998 Ecology & Environment study did not make a determination of potential human health impacts of persistent organic contaminants on the consumption or subsistence harvests of fish in the Colville River watershed. Ecology & Environment recommend that a risk evaluation to determine these impacts be conducted in a future study.

6.4.3 2001 Ecology & Environment Study

The 2001 Ecology & Environment study did not make a determination of potential human health impacts of persistent organic contaminants on the consumption or subsistence harvests of fish in the Colville River watershed. Ecology & Environment made all raw data publicly available so that independent health professionals could evaluation potential risks to subsistence users.

6.4.4 2001 ATSDR Health Consultation

In 2001, ATSDR conducted its review of the 1997 and 1998 Ecology & Environment studies and produced its Health Consultation. The Consultation determined that there is a point source of

PCB and DDT contamination in the Unit C slough, and resident fish in the slough are exposed to the contaminants. However, any human exposure to contaminants in fish tissue at the site is likely limited, and as a result, it was not identified as a current public health problem. This is due to the small population of fish in the slough and lack of active harvesting of those fish.

ATSDR also determined that the current Colville River fish data did not indicate a need for a public health concern. Minimal data was available on PCBs and DDTs in burbot downstream in the Colville River. Broad whitefish sampled in the river near Umiat were not affected by persistent organic contaminants.

The extent of the downstream contamination of fish had not yet been well characterized. Some evidence suggested that PCB and DDT contamination were present in burbot collected four miles downstream of the Unit C slough at Umiat. The presence of these contaminants further downstream towards the village of Nuiqsut was unknown.

Minimal data was available regarding the dietary information, including fish consumption and harvest locations, was available at the time of the review. This data would be necessary to provide an accurate assessment of potential human health risks.

6.4.5 2003 ATSDR Health Consultation

In 2003, ATSDR conducted its review of the 2001 Ecology & Environment and produced its Health Consultation. The consultation made the following conclusions. PCBs and DDTs were detected in burbot collected during the August, 2001 Ecology & Environment study. However, contaminant concentrations observed were too low to cause harmful health effects for the subsistence users in Nuiqsut.

ATSDR evaluated whether eating up to almost one pound of fish from the river every day for 70 years would result in harmful health effects. This extremely conservative evaluation was based on the information available on the subsistence harvests for Nuiqsut and contaminant concentrations found in burbot in the Colville River. In this scenario, the estimated exposure doses for both adults and children were found to be well below health effect levels. ATSDR concluded that it was safe to consume fish from the river.

The address Nuiqsut community concerns, ATSDR evaluated whether eating large amounts of burbot during the seasonal subsistence harvest would result in harmful health effects. Based on harvest data, ATSDR assumed people at two pounds per week for four months. Again, the estimated exposure was found to be below health effect levels. ATSDR concluded that it was safe to eat large amounts of burbot during the harvest period.

Nuiqsut community members also expressed concerns regarding the consumption of burbot livers. In both scenarios where community members consumed six livers in one week and six livers in one day, exposure doses remained below health effect levels. ATSDR concluded that it is safe to eat several burbot livers in a short time period.

Based on these findings, ATSDR has determined that exposure to PCBs and DDTs in fish from the Colville River has "no apparent public health hazard."

7.0 2015 STUDY SCOPE AND OBJECTIVES

Linc contracted TPECI and Fisheye to conduct a follow-up investigation into the presence of presence of organochlorine contaminants (PCBs and DDTs) in fish tissues in the Unit C slough at Umiat and within the Colville River as a portion of their oil exploration activities in the greater Umiat area.

Despite the findings of the previous studies and the ATSDR Health Consultation determinations that subsistence harvests are not negatively impacted by these contaminants, there are lingering concerns regarding whether burbot can be safely consumed by the community of Nuiqsut. Linc desired to conduct a follow-up study as an outreach effort to provide the subsistence community further information regarding contaminant concentrations within the Colville River watershed. This information may also be potentially beneficial in determining what, if any impact continued oil exploration in the area may have on future disturbance of these contaminants or general attenuation trends.

The focus of the TPECI/Fisheye study was to investigate contaminant concentrations in fish within the Unit C slough at Umiat as well as fish in the Colville River at distances of approximately three miles upstream and downstream of Umiat. While not as extensive as the 2001 Ecology & Environment study, the 2015 work focused on the areas of previously identified elevated contaminant concentrations to assess any potential changed in the previous 15 year period.

TPECI and Fisheye selected burbot (*Lota lota*), Arctic grayling (*Thymallus arcticus*), and Broad whitefish (*Coregonus nasus)* as the target species for the 2015 study. These species are identical to those species selected by Ecology & Environment in their previous work and will allow for a comparison of data to observe potential changes and contaminant trends.

TPECI and Fisheye compared 2015 data to the data in the previous Ecology & Environment studies to determine contaminant concentration and migration trends. This assessment allowed for a determination on the status contamination present in fish tissues in the Colville River.

TPECI and Fisheye performed the 2015 field investigation under the stipulations of Alaska Department of Fish & Game (ADF&G) Fish Resource Permit (FRP) SF 2015-232.

8.0 METHODS

8.1 Sampling Site Selection

TPECI and Fisheye selected three sampling locations for the study using aerial imagery and maps. Each of the three stations was selected as an area of previously identified contamination and would allow for comparison to past data. Upstream (Station "U") and downstream (Station "D") locations were selected approximately three miles from the mouth of the Unit C slough on

the Colville River. The slough itself comprised the third sampling location (Station "S"). Figure 3 in Appendix A shows the specific locations of the sampling sites as well as those locations sampled in previous studies.

Unfortunately, low water levels resulted in river access issues and Station U was moved to approximately 1.5 miles upstream of the slough.

Station	*Description*	*Approximate River Miles From Slough*
U	Upstream of slough	1.5
S	Unit C slough	0
D	Downstream of slough	3.0

Sample collection was conducted in August, 2015. The sampling sites were accessed via the Colville River and flat-bottom jet-boat, traveling from the Umiat Camp. The summer of 2015 was unusually dry with river water levels being extremely low. As a result, the pools favored by burbot were unusually shallow or frequently non-existent. River travel by boat was not possible upstream of Station U at the time of sample collection due to low water levels and braided river channels.

8.2 Fish Collection

Fish collection and sampling was conducted utilizing hoop nets, set lines, gills nets, and hook and line angling. All sampling methodology and collection was in accordance with the ADF&G FRP. All sampling techniques were used at each of the three sampling locations with the exception of gill nets.

Weighted, varied-mesh monofilament gill nets were initially deployed from shore at the slough sampling location and continually monitored and observed during a period of several hours. Unfortunately the gill nets did not prove effective and were found to be difficult to manage and use in areas of woody debris. Their use was abandoned for the other sampling sites.

Two hoop nets were used at each sampling location. Each hoop net was 12-feet long and four feet in diameter, with two throats. The netting was heavy twine woven in 3-inch stretch mesh. The nets where held open using four, 12-foot long PVC pipes secured to the net hoops using zip ties. Due to the weight of the fiberglass hoops, no additional weights were required to sink the nets, so long as current velocity was not excessive. Each net was baited with fresh bait prior to deployment. TPECI and Fisheye used commercially frozen herring bait, in two fine-mesh bags. Bait bags were secured in the second (deeper) chamber of each net. The nets sunk to the riverbed, and were anchored to shore in deep pools and near shoreline vegetation (locations where Ecology & Environment successfully captured burbot).

The baited set lines (commonly referred to as trot lines) were anchored from shore and deployed into the river. The lines were weighted to sink. Each line had six hooks spaced approximately eight feet apart, attached to the set line by steel gangions (leaders). The hooks were single (not treble) circle-type hooks, of legal size for recreational burbot fishing with a gap between the point and shank larger than 20 mm (as required by ADFG regulation). Each hook was baited

using commercially frozen herring bait, as was used in the hoop nets. Fresh bait was used for each deployment.

At each sampling location, the passive gear (two hoop nets and three set lines) was allowed to soak overnight (for a period of approximately 16 hours). As required by the FRP, each piece of sampling gear (nets and lines) was tagged with the investigators contact information and the FRP number.

Hook and line angling was performed using spinning rods and reels, with a variety of terminal tackle. All personnel conducting hook and line angling were holders of valid State of Alaska sport fishing licenses. The total duration of hook and line angling at each sampling location varied based on fish landing frequency and study species requirements. Number and species of fish captured and released during hook and line angling was not recorded. Species caught by angling included Arctic grayling, northern pike, and lake trout.

8.3 Sample Processing

Captured fish retention at each site was based on individual species retention limits of the ADF&G FRP. All retained fishes were sacrificed and temporarily stored for transport back to the Umiat camp for processing.

Sampled fish were measured and weighed, noting the condition of the fish and any indicators of stress, disease, or trauma. Fish were subsequently photographed. No assessment of gender or age was made at the time of collection.

Each fish was rinsed in river water to remove any dirt or other potential inadvertent contaminants that they may have come in contact with during handling. Collected fish here handled in a manner to ensure no cross contamination occurred. Each retained fish was placed in a sealed zip-close plastic bag, which were individually labeled with a unique sample identification number. Collected fish were kept fully intact throughout the handling and storage process.

Collected samples were held for approximately two days at the Umiat Camp at a temperature less than 40 degrees Fahrenheit, but above freezing. Upon completion of field activities, all samples were packed in wax coated cardboard fish boxes with gel ice, and transported to Anchorage for further processing and shipment to the analytical laboratory. In Anchorage, samples were flash frozen by a commercial seafood processing company and shipped in insulated containers with dry ice to the analytical laboratory.

8.4 Laboratory Analysis

Laboratory analysis of the fish tissue samples was conducted by ALS Environmental laboratory located in Kelso, Washington. Arctic grayling samples were randomly apportioned into whole body and fillet subsets. The burbot was dissected to allow for analyses of the two edible tissues, body meat (fillet) and the liver. The results of the two were reported separately.

DDT, DDE, and DDD (pesticides) analysis was conducted using EPA Method 8081A. PCB analysis was conducted using EPA Method 8082A. Specific PCB Aroclors assessed include 1016, 1221, 1232, 1242, 1248, 1254, and 1260. The analytical methods differed from those used by Ecology & Environment in their previous studies. A discussion of these differences and potential impacts on results is included in Section 10.0.

9.0 RESULTS

Ten Arctic grayling and one burbot were collected during the 2015 study among the three sampling locations. Three Arctic grayling were captured at the upstream site, four Arctic grayling were captured at the Unit C slough, and three Arctic grayling, as well as a single (one) burbot were collected at the downstream site. Arctic grayling were captured primarily by hook and line angling, though several were captured within the hoop nets. The single burbot was captured within a hoop net. No Broad whitefish were captured during the study, despite their inclusion as a target species.

All grayling were adults, and generally similar in size (Table 1). While grayling were found to be similar in length, weights varied greatly.

Table 1 – Lengths and Weights of Fishes Captured in the Colville River Near Umiat

Species	Grayling										Burbot
Station	Upstream			Slough				Downstream			
ID	UG1	UG2	UG3	SG1	SG2	SG3	SG4	DG1	DG2	DG3	DB1
Length*	324	315	327	334	312	320	327	318	323	356	580
Weight+	320	300	300	340	280	320	360	390	290	400	420

*Grayling length reported in mm fork length; burbot length reported in mm total length.
+Weight reported as live weight in grams.

In general, DDT and its breakdown products DDE, and DDD (pesticides) were not detected in Arctic grayling captured upstream of the Unit C slough, with one exception as 2,4' – DDT was observed in sample UG3 at 0.17 µg/Kg (Table 2). The complete ALS Environmental Laboratory report is in Appendix C. Observable concentrations were noted in Arctic grayling collected from within the Unit C slough ranging from 0.83 to 11.0 µg/Kg. Pesticide concentrations in Arctic grayling collected at the downstream sampling location were higher than concentrations observed at the upstream sites, though less than those within the Unit C slough (Ranging from 0.58 to 5.4 µg/Kg). Pesticides were not detected in the burbot fillet (DB1F), but three compounds (4,4' – DDE, 4,4' – DDT, and 2,4' – DDT) were detected in the liver (DB1L) (16.0 µg/Kg, 13.0 µg/Kg, and 4.9 µg/Kg, respectively).

Table 2 – Organochlorine Pesticides in Fishes Captured in the Colville River Near Umiat (ppb, wet weight)

Species	Grayling										Burbot	
Station	Upstream			Slough				Downstream				
Sample ID	UG1	UG2	UG3	SG1	SG2	SG3	SG4	DG1	DG2	DG3	DB1F	DB1L
Tissue	Whole	Whole	Fillet	Whole	Whole	Fillet	Fillet	Whole	Whole	Fillet	Fillet	Liver
4,4'-DDE	ND	ND	ND	11	6.6	0.99	4.0	0.58	1.9	5.4	ND	16
4,4'-DDD	ND	ND	ND	5.2	3.6	1.4	1.3	ND	ND	3.4	ND	ND
4,4'-DDT	ND	ND	ND	3.0	3.5	0.83	0.64	ND	0.94	1.3	ND	13
2,4'-DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4'-DDD	ND	ND	ND	ND	0.83	ND	ND	ND	ND	ND	ND	ND
2,4'-DDT	ND	ND	0.17	1.3	2.4	ND	ND	ND	ND	ND	ND	4.9

ND – Analyte not detected in the sample.
All data in parts per billion (ppb), wet weight

PCB concentrations in all Arctic grayling captured at both the upstream and downstream sampling locations were found to be non-detect for all Aroclors (Table 3). A single sample, SG2, collected at the Unit C slough was found to have an (PCB) Aroclor 1254 concentration of 9.2 µg/Kg and an Aroclor 1260 concentration of 5.3 µg/Kg. No other PCBs were detected in any Arctic grayling from any of the three sampling locations.

PCBs were not detected in burbot fillet. PCB Aroclor 1260 was detected in the burbot liver from the downstream sampling location (Sample ID DB1L) at 15.0 µg/Kg. No other PCB Aroclors were detected in the burbot sample.

Table 3 – Polychlorinated Biphenyls (PCBs) in Fishes Captured in the Colville River Near Umiat (ppb, wet weight)

Species	Grayling										Burbot	
Station	Upstream			Slough				Downstream				
Sample ID	UG1	UG2	UG3	SG1	SG2	SG3	SG4	DG1	DG2	DG3	DB1 F	DB1 L
Tissue	Whole	Whole	Fillet	Whole	Whole	Fillet	Fillet	Whole	Whole	Fillet	Fillet	Liver
Aroclor 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND	9.2	ND	ND	ND	ND	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND	5.3	ND	ND	ND	ND	ND	ND	15

ND – Analyte not detected in the sample.
All data in parts per billion (ppb), wet weight

10.0 DISCUSSION

10.1 Analysis Methodology

DDT, DDE, and DDD (pesticides) analysis was conducted using EPA Method 8081A. PCB analysis was conducted using EPA Method 8082A. Specific PCB Aroclors assessed include 1016, 1221, 1232, 1242, 1248, 1254, and 1260. The analytical methods differed from those used by Ecology & Environment in their previous studies. Ecology & Environment used EPA Method 1668, Revision A for their analysis of PCBs and Isotope dilution analysis using the New York Department of Environmental Conservation Method HRMS-2 (a modified EPA Method 1668) for pesticide analysis (DDT, DDE, and DDD).

A comparison of the two separate methodologies (8082A and 8081A vs. 1668) finds that EPA Method 1668 is a more sensitive analysis capable of a greater degree of accuracy and generally lower detection limits. EPA Method 1668 also is capable of reducing potential interferences within the analyzed samples. At the concentration levels observed within this study and the observed detection limits, both methods were comparable and either would have been suitable for the analysis of these samples.

The ALS Environmental laboratory report case narrative makes use of several descriptive terms in regards to potential impacts to data usability and quality. Matrix interference, or the potential

impact to sample analysis based on a sample matrix other than pure water, was noted as a possible flag within the report. The matrix for the samples for this study was animal (fish) tissue, which is composed of numerous constituents in varying quantities including proteins, polypeptides, lipids, and other compounds. It is possible, although unlikely that these constituents could have interfered with the analyses for PCBs and DDTs. The potential matrix interference is noted for the lab's reference control samples, and is not considered to affect the analytical results of the collected samples or the interpretation of the results.

The case narrative also notes elevated detection limits for some samples. An elevated detection limits refers to a decrease in statistical precision when an analyte is detected at concentrations close to its lower detection limit. All samples analyzed for this study were detected at concentrations close to or below their lower detection limits. However, all results in which an analyte was reported as ND (Not Detected) can be confidently interpreted as having an extremely low (likely zero) concentration for the specific analyte.

10.2 Burbot Capture Success

The TPECI/Fisheye study deployed two hoop nets at each of the three sites for one day each. During this time, one burbot was captured at the downstream location, and no burbot were captured at the slough or at the upstream site. The 2015 TPECI/Fisheye study conducted fishing at each site for a short duration compared to the previous Ecology & Environment studies.

In the 1998 Ecology & Environment study, two hoop nets were fished at each of the three locations for eight days. Due to poor success rates, an additional hoop net was placed at the downstream site for six days. During the 14 days of fishing, a total of seven burbot were captured among the three sampling sites.

In the 2001 Ecology & Environment study, three hoop nets were initially deployed in each of the seven reaches. Once 10 burbot were captured in a reach, the hoop nets were reallocated to the remaining reaches until 10 burbot were captured in all seven reaches. The total time (in days) of nets actively fishing each reach was not listed within the Ecology & Environment report. However, it is stated that a period of greater than 13 days was spent fishing some reaches.

Ecology & Environment found that capture success of the hoop nets was largely a function of river stage. During their 2001 study, flooding conditions forced burbot to move towards vegetative shelter along the river banks, increasing their catch rates significantly. Water levels and the river stage during the 2015 study were extremely low, likely limiting potential for burbot capture.

Given the short duration of fishing and the low water levels of the Colville River at the time of sampling, the capture of one burbot during the 2015 TPECI/Fisheye study can be viewed as successful compared to the capture success rates of the previous studies. However, to allow for greater sampling populations, additional burbot, and therefore, longer fishing periods may have been beneficial.

10.3 Long-Term Trends

The 2015 TPECI/Fisheye data can be combined with data collected during the 1997, 1998, and 2001 Ecology & Environment studies to assess concentrations of persistent organic contaminants in fish tissue and determine if any long term trends are present. Direct comparisons of these data are difficult due to variability in sampling location, species sampled, and the contaminant analyzed among the four separate studies. Ideally, the more sampling years (studies) included in any comparison would yield greater potential for observable trends. However, limited data prevented detailed analysis for all analytes, all fish species, in all locations.

In the 1997 Ecology & Environment study, a total of 14 Arctic grayling were collected from the Unit C slough. Four Arctic grayling were collected in the slough during the 2015 TPECI/Fisheye study. PCBs were analyzed for whole body or fillet for grayling for both studies. The results of these analyses were plotted as shown in Figure 4 below. A decreasing trend in PCB concentrations in grayling tissue within the slough was observed. However, this trend is not significant ($P > 0.05$), likely due to the numerous "zero" concentration values during both the 1997 Ecology & Environment study and the 2015 TPECI/Fisheye study. However, in 1997, fewer than half of the total fish exhibited zero (0.0 µg/Kg) PCB concentrations. In 2015, three quarters of the sampled fish were found to be non-detect (0.0 µg/Kg) for PCBs. The only non-zero concentration from the 2015 study (14.5 µg/Kg) was lower than the lowest non-zero concentration from the 1997 study (19.0 µg/Kg). Based on this data, it is likely that PCB concentrations in grayling at the Unit slough are decreasing. Additional data would be necessary to prove that this trend is occurring.

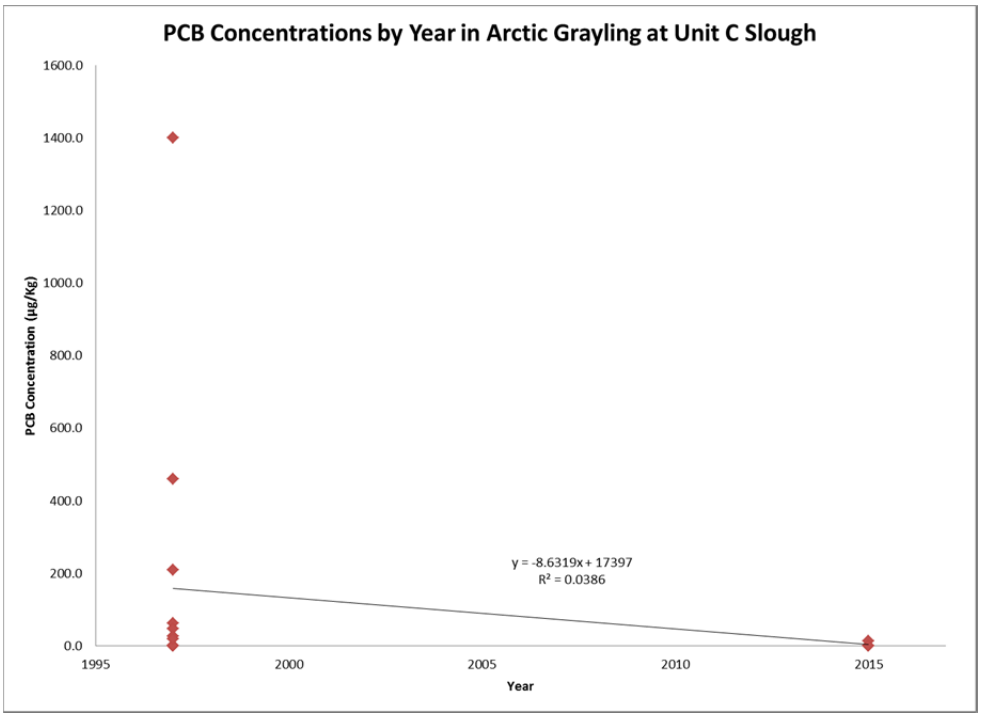

Figure 4. PCB Concentrations by Year in Arctic Grayling at Unit C Slough.

A single burbot was captured during the 2015 TPECI/Fisheye study. While the capture success rate was comparable with previous studies (on a catch-per-unit-effort basis), the single data point made analysis of long term trends challenging.

PCB concentrations in whole burbot were compared among the 1998 Ecology & Environment study, the 2001 Ecology & Environment study, and the 2015 TPECI/Fisheye study at the "downstream" location. The sampling locations varied only slightly among the three studies, all were located downstream of the Unit C slough at Umiat. The 1998 site was located approximately four miles downstream of Umiat, the 2001 site was referred to as Reach 1, and was began approximately two to three miles downstream of the slough, and the 2015 site was located approximately three miles downstream of the slough. Figures XX and XX all use data obtained from "this" location.

Figure 5 shows that a slight, decreasing trend in whole body PCB concentrations in burbot in the Colville River downstream of the Unit C slough may exist, though it is not statistically significant ($P > 0.05$). Data analysis and the presence of any statistically significant trend is limited by the single data point from 2015. Had additional burbot been collected at this site, identifiable, and proven trends may have been identified. Additional data would be required to make these determinations.

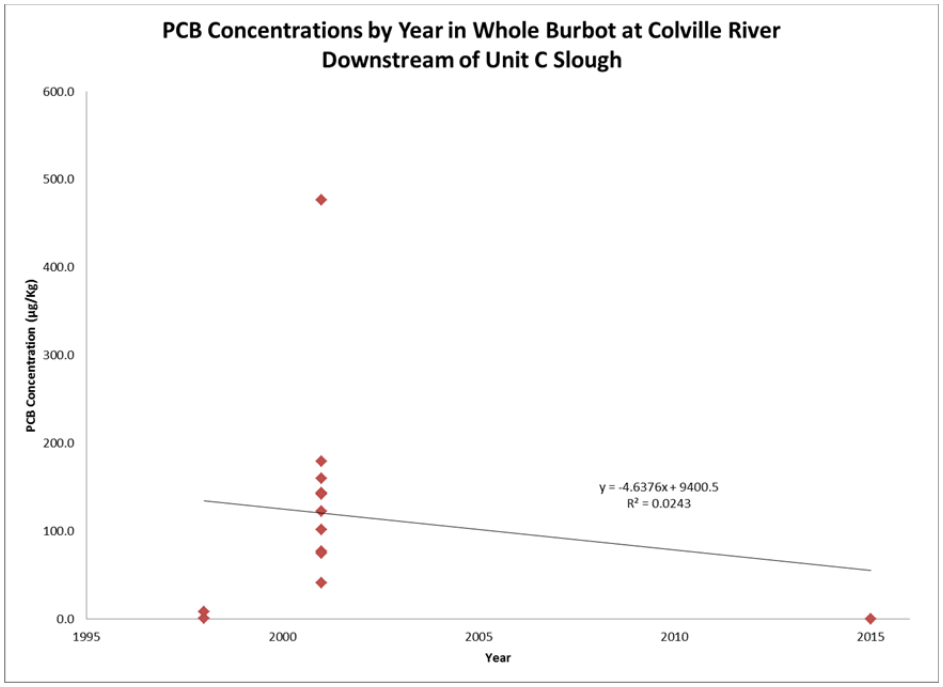

Figure 5. PCB Concentrations by Year in Whole Burbot at Colville River Downstream of Unit C Slough.

Figure 6 shows a significant decrease in PCB concentrations in Burbot livers in the Colville River at the site downstream of the Unit C slough. A regression analysis found this decreasing trend to be significant ($P=0.049$). Had additional burbot been captured at this site during the 2015 study, a stronger correlation may have been produced. However, the available data does show that PCB concentrations in these tissues are generally on the decline in the area.

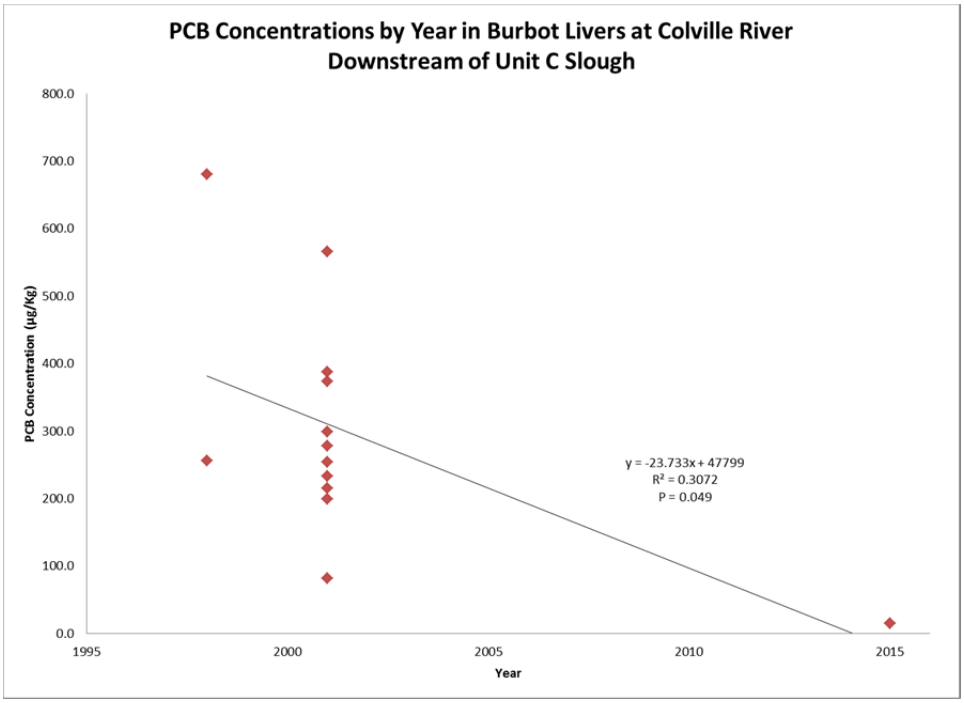

Figure 6. PCB Concentrations by Year in Burbot Livers at Colville River Downstream of Unit C Slough

DDT (including DDD, and DDE) concentrations in whole burbot at the downstream location were low in the 1998 Ecology & Environment Study, were generally low in the 2001 Ecology & Environment Study, and remained low in the 2015 TPECI/Fisheye study. No significant trend or decrease in contaminant concentrations was observed during this time period. Low sample numbers for burbot in the 2015 study may have impacted this analysis, or DDT concentrations are not a major issue in whole body burbot tissues at this site.

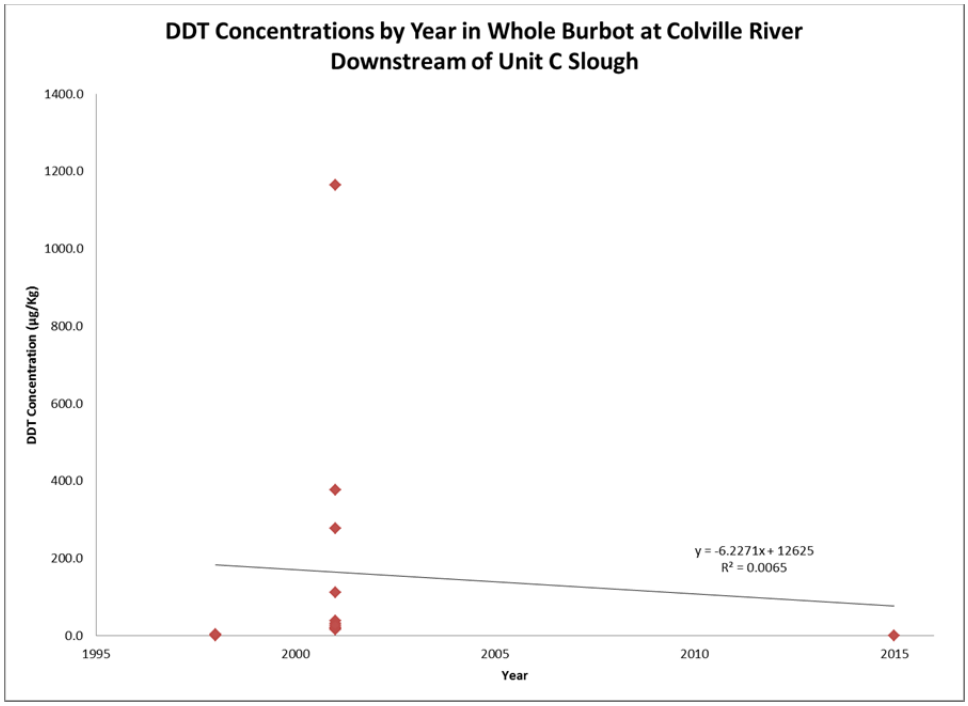

Figure 7. DDT Concentrations by Year in Whole Burbot at Colville River Downstream of Unit C Slough.

DDT (included DDD, and DDE) concentrations in burbot livers at the downstream location were found to have a slight decreasing trend (Figure 8). However, no significant decrease was noted from 1998 to 2015. As with DDT concentrations in whole burbot, low sample numbers for the species in 2015 may have impacted the analysis. A larger sample population likely would show stronger long term contaminant trends.

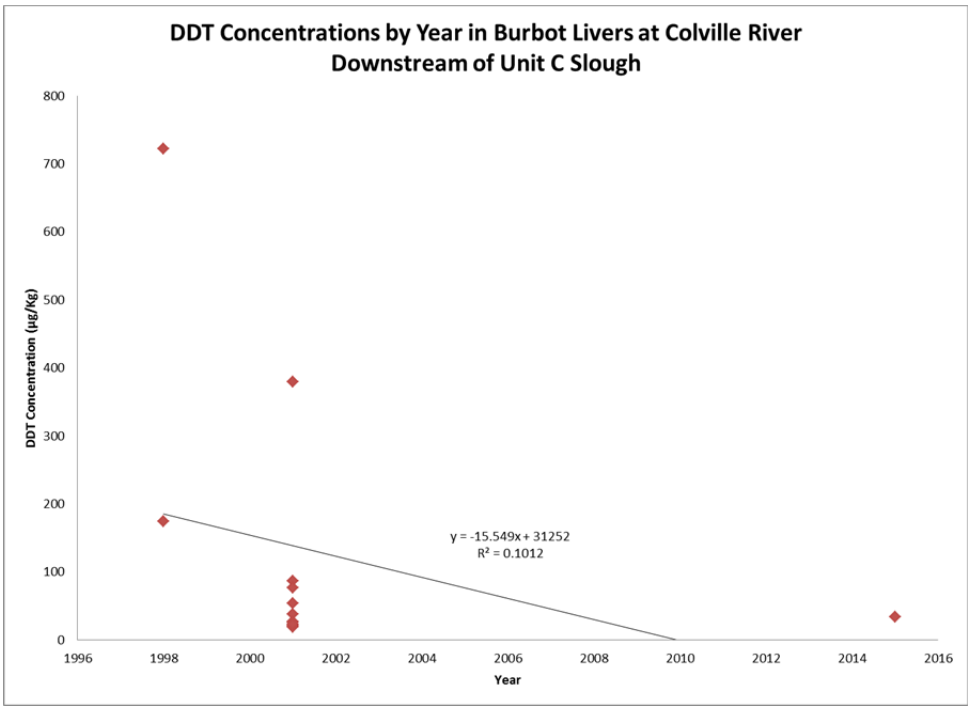

Figure 8. DDT Concentrations by Year in Whole Burbot at Colville River Downstream of Unit C Slough.

The migration of persistent organic contaminants, including PCBs downstream towards the village of Nuiqsut is a major concern of the regional communities and subsistence users. Specifically, PCB concentrations in burbot livers have been noted as an issue. Figure 8 shows a figure of both the 2001 Ecology & Environment data and the 2015 TPECI/Fisheye data for PCB concentrations in burbot livers relative to river location.

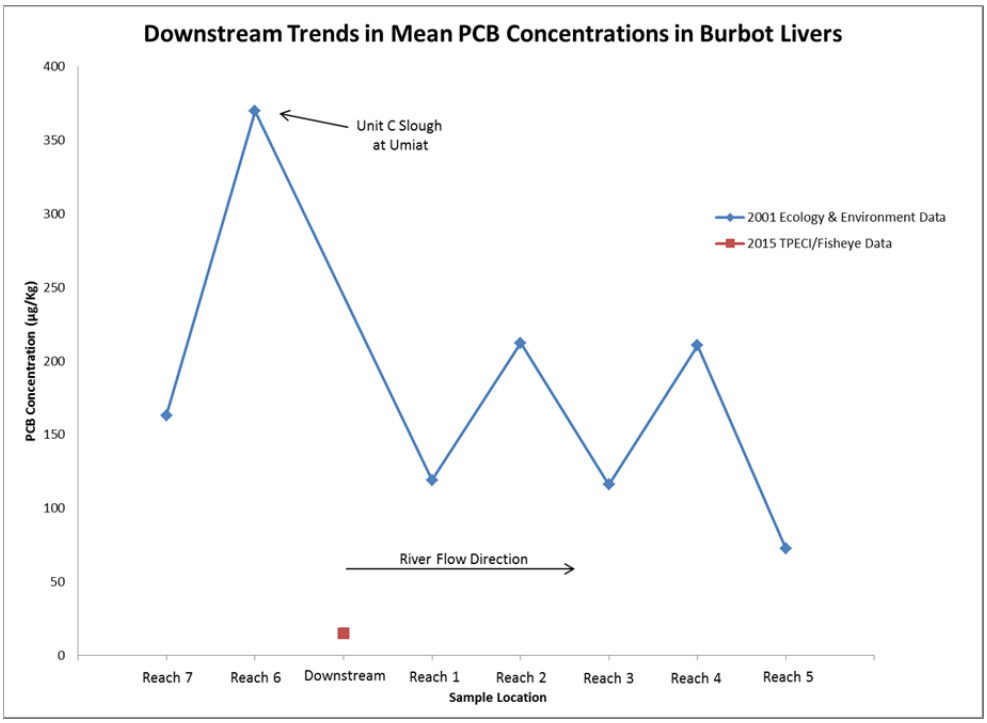

Figure 9. Downstream Trends in Mean PCB Concentrations in Burbot Livers.

The 2015 PCB concentrations in burbot livers are much lower than those from the 2001 study, especially compared to those of similar locations. Figure 9 shows that PCB concentrations in burbot livers decreased from upstream to downstream relative to distance from the Unit C slough at Umiat. While only one data point is available for the 2015 study, TPECI/Fisheye find that if additional downstream sampling were conducted, a similar trend, but at further decreased concentrations would be observed.

The significant decrease in PCB concentrations in burbot livers downstream of the Unit C slough can likely be attributed to the removal of the contaminant source and a generational change in the burbot population of the Colville River. The former landfill was mostly remediated during the early 1990s, though areas of PCB contamination within the soil are still noted as part of the Ecology & Environment studies. Given a lifespan nearing a maximum of 20 years, the generation of burbot exposed to the contaminant source at the landfill has largely died off and have been replaced by a new generation, lacking the contaminant source. Additionally, fish on lower trophic levels, which the burbot feed upon, have similarly undergone a generational shift.

10.4 Current Background Concentrations and Atmospheric Deposition

DINAC published data on contaminant levels in biota, water, and sediments of freshwater and marine ecosystems in northern Canada (Muir and Lockhart, 1994, DINAC, 1997). In their research, whole fish, fish muscle, and fish livers were analyzed for 130 individual organochlorine compounds, including PCB congeners and DDT and its breakdown products.

The 2015 TPECI/Fisheye study found that total PCB mean concentrations detected in burbot livers of fish collected from the downstream sampling site on the Colville River (15.0 ppb) were similar to the lower ranges of total PCB concentrations found in the DINAC studies (26.9 ppb to 136 ppb). In the previous Ecology & Environment studies, burbot livers results from fish samples collected in the Unit C slough at Umiat and downstream reaches of the Colville were significantly higher (468.05 ppb and 665.00 ppb, respectively) and were similar to higher PCB concentrations found in the DINAC studies in Lake Laberge, Canada (836 ppb to 1,300 ppb). DINAC studies note Lake Laberge's proximity to Whitehorse, Yukon, and the potential for point source contributions in addition to both atmospheric depositions.

The PCB concentrations observed in burbot liver in the 2015 TPECI/Fisheye study were similar to background levels observed in the DINAC studies. These observations may indicate that the primary current source of PCBs in the Colville River ecosystem may be from atmospheric deposition.

Numerous studies have determined that atmospheric transport and biotransport of contaminants is likely impacting arctic ecosystems. The role that these transport mechanisms play in the total contaminant concentrations within the biota is not insignificant as shown in the 1998 Ecology & Environment study and the DINAC studies. These previous studies, as well as other published research, find that atmospheric transport and biotransport are likely contributing to contaminant concentrations in fish populations in the Colville River. The findings of the 2015 TPECI/Fisheye study also indicate that the a point source of PCB contaminants at the Unit C Slough at Umiat may no longer be impacting burbot populations in the Colville River, as contaminant levels observed have decreased to within background ranges.

11.0 CONCLUSIONS

The weathering of the primary contaminant point source (Umiat landfill) and a new burbot population generation that no longer is exposed to a concentrated point source of persistent organic contaminants is likely the primary cause in the decreased concentrations seen during the 2015 sampling. Similar trends observed in other species, including Arctic grayling likely are due to these same circumstances. As burbot livers and fish in general comprise a significant portion of the subsistence harvests in the region, the decrease in persistent organic contaminant concentrations is beneficial to the human health of the region, despite findings of the previous studies that existing contaminant concentrations at the time did not pose any significant health risks.

Long-term trends in contaminant concentrations in both burbot and Arctic grayling were not generally statistically significant. Poor correlations were likely due to low numbers of fish

captured during the 2015 study. Additional data would be required to further define the findings of this study.

11.1 Recommendations for Future Work

The purpose of the TPECI/Fisheye study was to investigate contaminant concentrations in fish within the Unit C slough at Umiat as well as fish in the Colville River at distances of approximately three miles upstream and downstream of Umiat. Fish capture numbers and the relatively small study area, as compared to the 2001 Ecology & Environment study, resulted in few statistically significant findings.

To confirm the general trends observed during this study, and to make a complete assessment of the contaminant concentrations in burbot populations in downstream areas of the Colville River, near the village of Nuiqsut, TPECI/Fisheye recommend that additional field work be conducted allowing for a larger sample population and the addition of more sampling locations throughout the river system. Additionally, sediment sampling within the Unit C slough may aid in determining if a point source for persistent organic contaminants remains present at the site. Any future studies would allow for a more direct comparison to previous work and an ultimate determination in ecosystem health.

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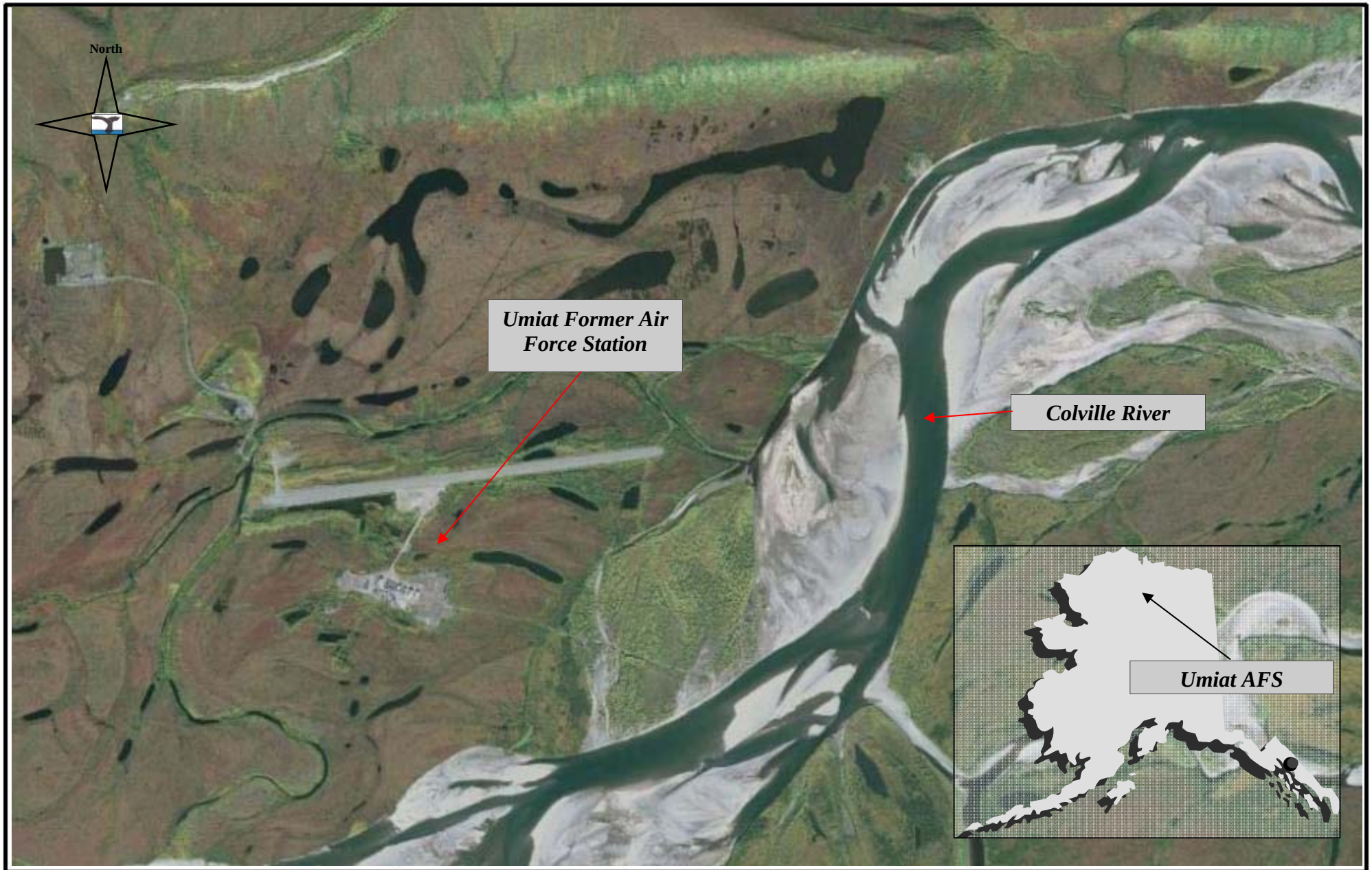
Appendix A:
Figures



Travis/Peterson Environmental Consulting, Inc.
3305 Arctic Boulevard, Suite 102
Anchorage, AK 99503
907-522-4337

Assessment of PCBs and DDTs in Fish Populations of the Colville River Near the Former Umiat Air Force Station
Umiat, Alaska

General Location Map

Figure #1

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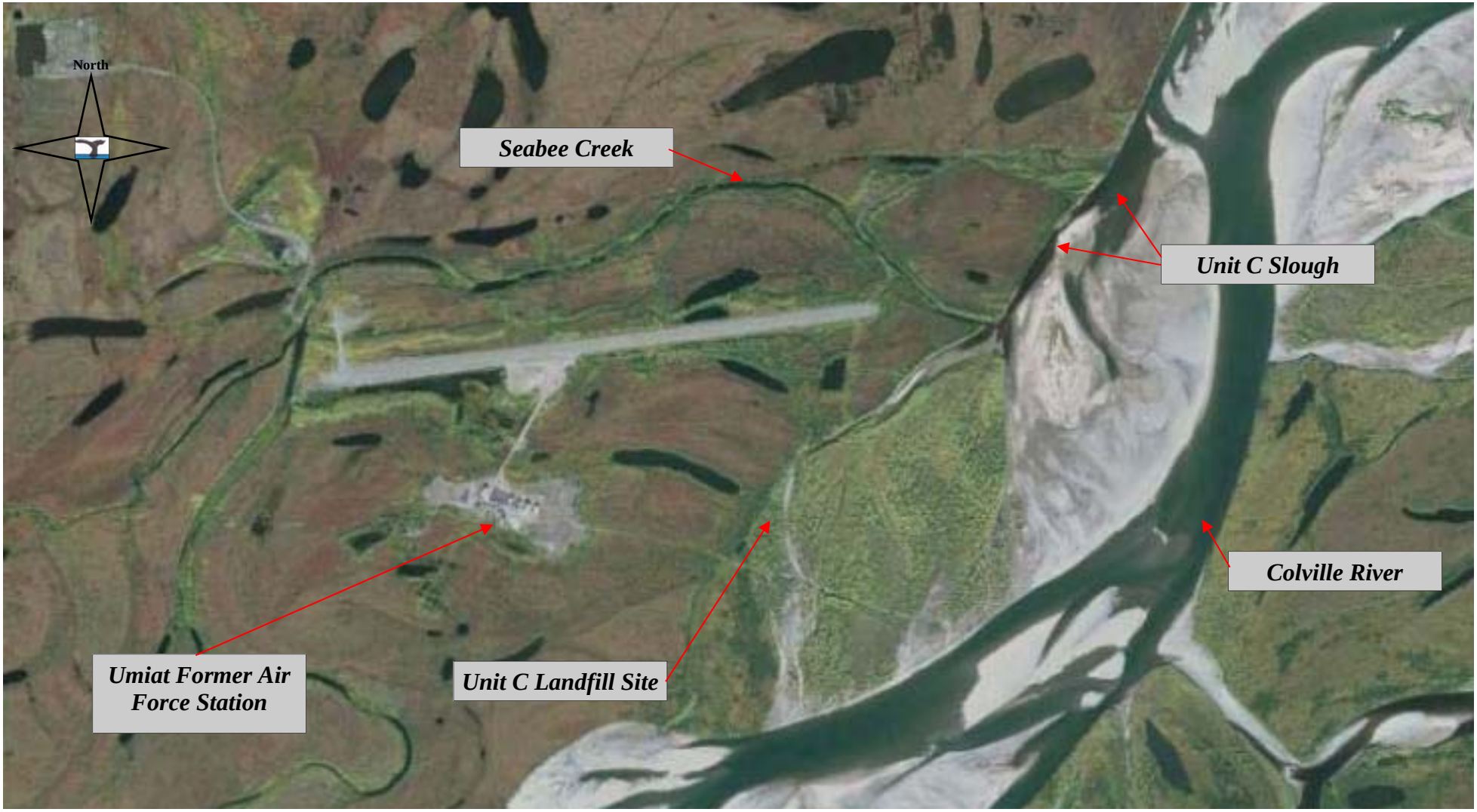

Travis/Peterson Environmental Consulting, Inc. 3305 Arctic Boulevard, Suite 102 Anchorage, AK 99503 907-522-4337	**Assessment of PCBs and DDTs in Fish Populations of the Colville River Near the Former Umiat Air Force Station** **Umiat, Alaska**	**Umiat Map** **Figure #1**

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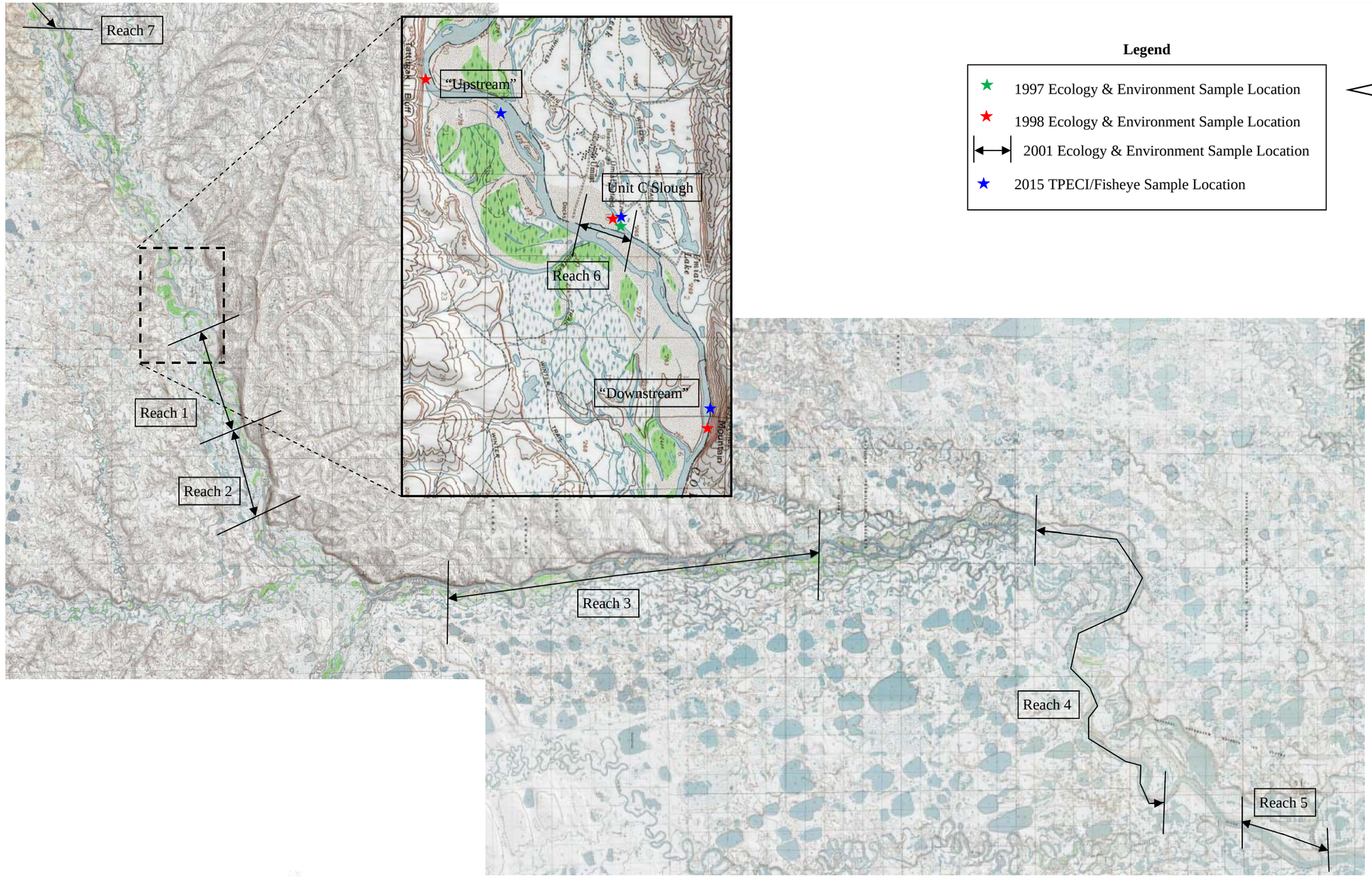

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Assessment of PCBs and DDTs in Fish Populations of the Colville River Near the Former Umiat Air Force Station
Umiat, Alaska

Figure #3
1997, 1998, 2001 Ecology & Environment, and 2015 TPECI/Fisheye Fish Sampling Locations

Project No: 1554-01	**File: Jupiter\backup\Erik\1554-01\Figures**	**Date: 11/10/15**	**Scale: None**

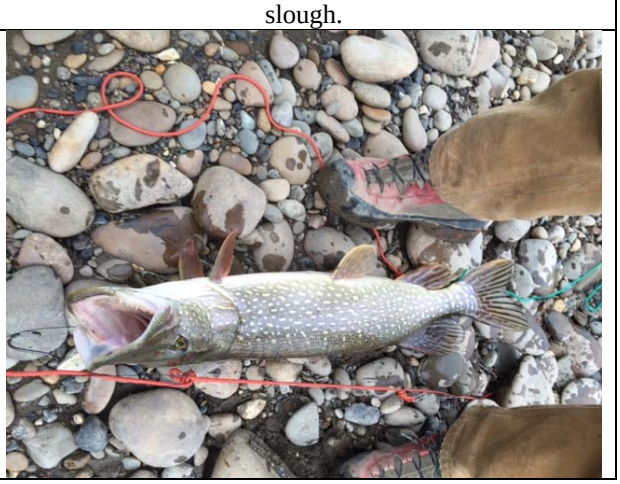
Appendix B:
Photographic Log

Travis/Peterson
Environmental Consulting, Inc.

Assessment of PCBs and DDTs in Fish Populations of the Colville River Near the Former Umiat Air Force Station: Photo Log – August, 2015

Upper end of Unit C slough near former landfill site.	Unit C slough at Umiat.

Entrance of Seabee Creek into Unit C slough	Unit C slough.

Outlet of Unit C slough into Colville River.	Northern Pike captured (and released) in Unit C slough.
	

Downstream site on Colville River.	Downstream site on Colville River.

Downstream site on Colville River.	Collected Arctic grayling from downstream site on Colville River.

Burbot captured at downstream site on Colville River being measured.	Upstream site on Colville River.

Upstream site on Colville River.	Transportation via jet boat on the Colville River.

Upstream site on Colville River.	Upstream site on Colville River looking west towards Umiat.

Hoop net deployed at Unit C slough	Hoop net deployed.

Appendix C:
ALS Environmental Laboratory Report

ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

September 28, 2015

Analytical Report for Service Request No: K1509159

Stephen Grabacki
GRAYSTAR Pacific Seafood, Ltd.
P.O. Box 100506
Anchorage, AK 99510-0506

RE: Umiat Fish / 30118-001

Dear Stephen,

Enclosed are the results of the sample(s) submitted to our laboratory August 20, 2015
For your reference, these analyses have been assigned our service request number **K1509159.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3293. You may also contact me via email at Shar.Samy@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Shar Samy, Ph.D.
Project Manager

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Organochlorine Pesticides
Polychlorinated Biphenyls (PCBs)

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
ISO 17025	http://www.pjlabs.com/	L14-50
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Case Narrative

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ALS ENVIRONMENTAL

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request No.:**	K1509159
Project:	Umiat Fish/ 30118-001	**Date Received:**	08/20/15
Sample Matrix:	Animal Tissue		

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Laboratory Control Sample (LCS), and Laboratory/Duplicate Laboratory Control Sample (LCS/DLCS).

Sample Receipt

Twelve animal tissue samples were received for analysis at ALS Environmental on 08/20/15. The samples were received in good condition and consistent with the accompanying chain of custody form, except where noted on the cooler receipt and preservation form included in this report. The samples were stored frozen at –20ºC upon receipt at the laboratory.

Lipids

No anomalies associated with the analysis of these samples were observed.

Organochlorine Pesticides by EPA Method 8081

Calibration Verification Exceptions:
The upper control criterion was exceeded for the following analytes in Continuing Calibration Verification (CCV) KWG1508959-3: 4,4'-DDD and 4,4'-DDT. The field samples analyzed in this sequence did not contain the analytes in question above the reporting limit. Since the apparent problem equates to a potential high bias, the data quality is not affected. No further corrective action was required.

The analysis of Chlorinated Pesticides by EPA 8081 requires the use of dual column confirmation. When the Continuing Calibration Verification (CCV) criterion is met for both columns, the lower of the two sample results is generally reported. The primary evaluation criteria were not met on the confirmation column for Tetrachloro-m-xylene. The results were reported from the column with an acceptable CCV. The data quality was not affected. No further corrective action was necessary.

Second Source Exceptions:
The analysis of Chlorinated Pesticides by EPA 8081 requires the use of dual column confirmation. When the Initial Calibration Verification (ICV) criteria are met for both columns, the lower of the two sample results is generally reported. The criteria were not met for 4,4'-DDE and 2,4'-DDD in CAL 14272. The data quality was not affected. No further corrective action was necessary.

Approved by_____

Sample Confirmation Notes:
The confirmation comparison criterion of 40% difference for 2,4'-DDT was exceeded in DB1-Liver. The lower of the two values was reported when both peaks were within the expected retention time window for this analysis and Gaussian in shape or the higher of the two values was reported when there was an apparent interference on the alternate column that produced the lower value.

Elevated Detection Limits:
The reporting limit is elevated for 2,4;-DDT in samples DG1 and DG3. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compound at the reporting limit. The results are flagged to indicate the matrix interference.

The reporting limit is elevated for all analytes in sample DB1-Liver. The sample extract was diluted prior to instrumental analysis due to sample matrix. The extract contained visible lipids and was viscous, which indicated the need to perform a dilution prior to injection into the instrument. Clean-up of the extract was performed within the scope of the method, but did not eliminate enough of the background components to prevent dilution. The results are flagged to indicate the matrix interference.

Sample Notes and Discussion:
Organochlorine Pesticides (O-C Pesticides) determined by EPA Method 8081B or equivalent gas chromatography-electron capture detector (GC/ECD) procedures are subject to interference from polychlorinated biphenyls (PCBs). The interference stems from the inability of the GC/ECD to differentiate selected PCB congeners from certain O-C Pesticides. This method limitation can result in false positive detections and/or high bias to pesticide values.

The magnitude of the interference is directly proportional to the concentration of PCBs in the sample. In addition, the affect on selected O-C Pesticides is complicated by the type PCB Aroclor(s) present in the sample. The presence of multiple Aroclors can result in contribution to the apparent concentration of O-C Pesticides by PCB congeners common to two or more Aroclors.

DB1_Liver and SG2 in this delivery group contained PCB Aroclors at concentrations high enough to impact the O-C Pesticide results. Note that the results for the O-C Pesticides were reported as per the protocol defined in SW-846 regarding dual column confirmation. In some instances, certain PCB congeners were suspected of being detected on both columns simultaneously within the retention time window of the target pesticide. When the resulting chromatographic peaks met the criteria of a detection as defined in the method, the values were reported.

Results for 4,4-DDT have contribution from confirmed PCB interferences on both columns within the established retention time window, resulting in reported values with a significant high bias.

Matrix Spike Recovery Exceptions:
The matrix spike recovery of a few analytes for sample UG1 was outside control criteria. Recoveries in the Laboratory Control Sample (LCS) and Duplicate Matrix Spike were acceptable, which indicated the analytical batch was in control. The matrix spike outlier suggested a potential low bias in this matrix. No further corrective action was appropriate.

No other anomalies associated with the analysis of these samples were observed.

<u>PCB Aroclors by EPA Method 8082</u>

Second Source Exceptions:
The analysis of PCB Aroclors by EPA 8082A requires the use of dual column confirmation. The Initial Calibration Verification (ICV) evaluation criteria were not met on the confirmation column for Aroclor 1260 in CAL13624. The ICV criteria were met on the alternate column. The data quality was not affected. No further corrective action was necessary.

Approved by_____

Elevated Detection Limits:
The detection limit was elevated for at least a few Aroclors in samples SG2 and DB1-Liver. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compounds at the normal limit. The results were flagged to indicate the matrix interference.

Sample Notes and Discussion:
Two Aroclors were identified in SG2: Aroclor 1254 and Aroclor 1260. When mixtures of PCB Aroclors are present in a sample, correct identification and quantitative analysis of the individual Aroclors can be subjective.

When Aroclor mixtures are present in a sample, care is taken to minimize the possibility of double-counting PCBs. Analytical peaks are selected based on the best resolution possible for that particular sample. However, when a mixture of Aroclors 1254 and 1260 are present in a sample, the potential exists for a high bias from contribution of one Aroclor to another due to common peaks or peaks that cannot be completely resolved.

Sample Confirmation Notes:
The confirmation comparison criteria of 40% difference for Aroclor 1260 was exceeded in sample DB1_Liver. The lower of the two values was reported because no evidence of a matrix interference was observed.

No other anomalies associated with the analysis of these samples were observed.

Approved by_____

Chain of Custody

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Chain of Custody

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Columbia Analytical Services, Inc.
Part of the ALS Group A Campbell Brothers Limited Company

Work Order No.: K1509159

Project Manager:	Stephen Grabacki		**Bill to:**	Michael Travis	
Client Name:	GRAYSTAR Pacific Seafood, Ltd.		**Company:**	Travis Peterson Environmental Consulting	
Address:	P.O.Box 100506		**Address:**	3305 Arctic Blvd, Suite 102	
City, State ZIP:	Anchorage, Alaska 99510-0506		**City, State ZIP:**	Anchorage, Alaska 99503	
Email:	graystarpacific@gmail.com	**Phone:** 907-272-5600	**Email:**	mtravis@tpeci.com	**Phone:** 907-522-4337
Project Name:	Umiat Fish				
Project Number:	30118-001				
P.O. Number:					
Sampler's Name:	Stephen Grabacki				

SAMPLE RECEIPT

Temperature (°C):		Temp Blank Present		
Received Intact:	Yes	No	N/A	Dry Ice
Cooler Custody Seals:	Yes	No	N/A	Total Containers:
Sample Custody Seals:	Yes	No	N/A	11

REQUESTED ANALYSIS

TAT
- [x] Routine
- [ ] Same Day ***
- [ ] Next Day ***
- [ ] 5 Day
- [ ] 7 Day

*** Please call for availability

Due Date:

Sample Identification	Matrix	Date Sampled	Time Sampled	Lab ID	No. of Containers	PCBs 8082A	pesticides 8081B	Comments
UG1	fish	8/8/2015		1	1	X	X	whole body
UG2	fish	8/8/2015		2	1	X	X	whole body
UG3	fish	8/8/2015		3	1	X	X	fillet only
SG1	fish	8/8/2015		4	1	X	X	whole body
SG2	fish	8/8/2015		5	1	X	X	whole body
SG3	fish	8/8/2015		6	1	X	X	fillet only
SG4	fish	8/8/2015		7	1	X	X	fillet only
DG1	fish	8/8/2015		8	1	X	X	whole body
DG2	fish	8/8/2015		9	1	X	X	whole body
DG3	fish	8/8/2015		10	1	X	X	fillet only
DB1	fish	8/8/2015		11	1	X	X	fillet & liver (2)

Dissolved	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Se, Si, Sn, Sr, Tl, V, Zn, Zr
Total	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Se, Si, Sn, Sr, Tl, V, Zn, Zr

Additional Methods Available Upon Request

RELINQUISHED BY			RECEIVED BY		
Print Name	Signature	Date/Time	Print Name	Signature	Date/Time
Stephen Grabacki		18 AUG 2015 @ 17:0	SWOLF		8/20/15 0920

PC Shar

Cooler Receipt and Preservation Form

Client / Project: Favco Inc. Service Request *K15* 09159

Received: 8/20/15 Opened: 8/20/15 By: [illegible] Unloaded: 8/20/15 By: [illegible]

1. Samples were received via? *Mail* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? _____

   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA	Tracking Number NA	Filed
-4.0	-0.5	—	—	-0.1	354		1Z E2R 227 13 4263 2628	

4. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* _____
5. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
12. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions:

No COC rec'd.

Page ____ *of* ____

Total Solids

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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/8/15
Sample Matrix:	Animal Tissue	**Date Received:**	08/20/15
Analysis Method:	Calculation	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Moisture

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
UG1	K1509159-001	**76.9**	-	-	1	09/04/15 14:45	
UG2	K1509159-002	**76.3**	-	-	1	09/04/15 14:45	
UG3	K1509159-003	**79.2**	-	-	1	09/04/15 14:45	
SG1	K1509159-004	**77.9**	-	-	1	09/04/15 14:45	
SG2	K1509159-005	**76.3**	-	-	1	09/04/15 14:45	
SG3	K1509159-006	**79.5**	-	-	1	09/04/15 14:45	
SG4	K1509159-007	**79.3**	-	-	1	09/04/15 14:45	
DG1	K1509159-008	**75.0**	-	-	1	09/04/15 00:00	
DG2	K1509159-009	**75.6**	-	-	1	09/04/15 14:45	
DG3	K1509159-010	**80.1**	-	-	1	09/04/15 14:45	
DB1_Fillet	K1509159-011	**80.6**	-	-	1	09/04/15 14:45	
DB1_Liver	K1509159-012	**58.3**	-	-	1	09/04/15 14:45	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/8/15
Sample Matrix:	Animal Tissue	**Date Received:**	08/20/15
Analysis Method:	Freeze Dry	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Total Solids

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
UG1	K1509159-001	**23.1**	-	-	1	09/04/15 14:45	
UG2	K1509159-002	**23.7**	-	-	1	09/04/15 14:45	
UG3	K1509159-003	**20.8**	-	-	1	09/04/15 14:45	
SG1	K1509159-004	**22.1**	-	-	1	09/04/15 14:45	
SG2	K1509159-005	**23.7**	-	-	1	09/04/15 14:45	
SG3	K1509159-006	**20.5**	-	-	1	09/04/15 14:45	
SG4	K1509159-007	**20.7**	-	-	1	09/04/15 14:45	
DG1	K1509159-008	**25.0**	-	-	1	09/04/15 00:00	?
DG2	K1509159-009	**24.4**	-	-	1	09/04/15 14:45	
DG3	K1509159-010	**19.9**	-	-	1	09/04/15 14:45	
DB1_Fillet	K1509159-011	**19.4**	-	-	1	09/04/15 14:45	
DB1_Liver	K1509159-012	**41.7**	-	-	1	09/04/15 14:45	

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project	Umiat Fish/30118-001	**Date Collected:**	08/08/15
Sample Matrix:	Animal Tissue	**Date Received:**	08/20/15
		Date Analyzed:	09/04/15

Replicate Sample Summary
Inorganic Parameters

Sample Name:	UG1	**Units:**	Percent
Lab Code:	K1509159-001	**Basis:**	Wet

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample K1509159-001DUP Result	Average	RPD	RPD Limit
Total Solids	Freeze Dry	-	-	23.1	23.1	23.1	<1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

LIPIDS

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ALS ENVIRONMENTAL

Analytical Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	8/8/2015
Sample Matrix:	Animal tissue	**Date Received:**	8/20/2015

Lipids, Total

Prep Method:	EPA 3541	Units:	PERCENT
Analysis Method:	NOAA	Basis:	Wet Weight
Test Notes:			

Sample Name	Lab Code	MRL	Date Extracted	Date Analyzed	Result	Result Notes
UG1	K1509159-001	0.004	9/4/2015	9/9/2015	1.6	
UG2	K1509159-002	0.005	9/4/2015	9/9/2015	1.9	
UG3	K1509159-003	0.005	9/4/2015	9/9/2015	1.2	
SG1	K1509159-004	0.005	9/4/2015	9/9/2015	1.3	
SG2	K1509159-005	0.005	9/4/2015	9/9/2015	1.5	
SG3	K1509159-006	0.005	9/4/2015	9/9/2015	1.0	
SG4	K1509159-007	0.005	9/4/2015	9/9/2015	1.0	
DG1	K1509159-008	0.005	9/4/2015	9/9/2015	2.3	
DG2	K1509159-009	0.005	9/4/2015	9/9/2015	0.97	
DG3	K1509159-010	0.005	9/4/2015	9/9/2015	1.4	
DB1_Fillet	K1509159-011	0.005	9/4/2015	9/9/2015	0.46	
DB1_Liver	K1509159-012	0.008	9/4/2015	9/9/2015	25	
Method Blank	KWG1508474-8 MB	0.004	9/4/2015	9/9/2015	0.004	U

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QA/QC Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	8/8/2015
Sample Matrix:	Animal tissue	**Date Received:**	8/20/2015
		Date Extracted:	9/4/2015
		Date Analyzed:	9/9/2015

Triplicate Summary
Lipids, Total

Sample Name:	KWG1508474-9 LCS	Units:	PERCENT
Lab Code:	K1509459-001 TRP	Basis:	Wet Weight
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Triplicate Sample Result	Average	Percent Relative Standard Deviation	Result Notes
Lipids, Total	EPA 3541	NOAA	0.005	1.6	1.3	1.4	1.5	9	

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QA/QC Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	NA
Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	9/4/2015
		Date Analyzed:	9/9/2015

Laboratory Control Sample
Lipids, Total

Sample Name: KWG1508474-9 LCS

Units: PERCENT
Basis: Wet Weight

Test Notes:

Analyte	Prep Method	Analysis Method	Spike Level Percent	Result	CAS Advisory Limits	Result Notes
Lipids, Total	EPA 3541	NOAA	100	108	70-130	

Organochlorine Pesticides

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Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	UG1	**Units:**	ug/Kg
Lab Code:	K1509159-001	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	ND	U	0.89	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	ND	U	0.89	0.55	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDT	ND	U	0.89	0.49	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	ND	U	0.89	0.16	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	77	29-117	09/17/15	Acceptable
Decachlorobiphenyl	78	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	UG2	**Units:**	ug/Kg
Lab Code:	K1509159-002	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	ND	U	1.0	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	ND	U	1.0	0.55	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDT	ND	U	1.0	0.49	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	ND	U	1.0	0.16	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	73	29-117	09/17/15	Acceptable
Decachlorobiphenyl	72	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	UG3	**Units:**	ug/Kg
Lab Code:	K1509159-003	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	ND	U	0.96	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	ND	U	0.96	0.55	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDT	ND	U	0.96	0.49	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	**0.17**	JP	0.96	0.16	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	68	29-117	09/17/15	Acceptable
Decachlorobiphenyl	70	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	SG1	**Units:**	ug/Kg
Lab Code:	K1509159-004	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	**11**		0.96	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	**5.2**		0.96	0.55	1	09/04/15	09/22/15	KWG1508474	
4,4'-DDT	**3.0**		0.96	0.49	1	09/04/15	09/22/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	**1.3**		0.96	0.16	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	66	29-117	09/17/15	Acceptable
Decachlorobiphenyl	66	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	SG2	**Units:**	ug/Kg
Lab Code:	K1509159-005	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	**6.6**		0.98	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	**3.6**		0.98	0.55	1	09/04/15	09/22/15	KWG1508474	
4,4'-DDT	**3.5**		0.98	0.49	1	09/04/15	09/22/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	**0.83**	JP	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	**2.4**		0.98	0.16	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	65	29-117	09/17/15	Acceptable
Decachlorobiphenyl	67	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	SG3	**Units:**	ug/Kg
Lab Code:	K1509159-006	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	**0.99**		0.98	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	**1.4**		0.98	0.55	1	09/04/15	09/22/15	KWG1508474	
4,4'-DDT	**0.83**	JP	0.98	0.49	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	ND	U	0.98	0.16	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	71	29-117	09/17/15	Acceptable
Decachlorobiphenyl	73	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	SG4	**Units:**	ug/Kg
Lab Code:	K1509159-007	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	**4.0**		0.97	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	**1.3**		0.97	0.55	1	09/04/15	09/22/15	KWG1508474	
4,4'-DDT	**0.64**	JP	0.97	0.49	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	ND	U	0.97	0.16	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	77	29-117	09/17/15	Acceptable
Decachlorobiphenyl	83	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	DG1	**Units:**	ug/Kg
Lab Code:	K1509159-008	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	**0.58**	JP	0.97	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	ND	U	0.97	0.55	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDT	ND	U	0.97	0.49	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	ND	Ui	0.97	0.24	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	54	29-117	09/17/15	Acceptable
Decachlorobiphenyl	58	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	DG2	**Units:**	ug/Kg
Lab Code:	K1509159-009	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	**1.9**		0.99	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	ND	U	0.99	0.55	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDT	**0.94**	J	0.99	0.49	1	09/04/15	09/22/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	ND	U	0.99	0.16	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	68	29-117	09/17/15	Acceptable
Decachlorobiphenyl	69	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	DG3	**Units:**	ug/Kg
Lab Code:	K1509159-010	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	**5.4**		0.98	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	**3.4**		0.98	0.55	1	09/04/15	09/22/15	KWG1508474	
4,4'-DDT	**1.3**		0.98	0.49	1	09/04/15	09/22/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	ND	Ui	0.98	0.23	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	62	29-117	09/17/15	Acceptable
Decachlorobiphenyl	65	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	DB1_Fillet	**Units:**	ug/Kg
Lab Code:	K1509159-011	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	ND	U	0.97	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	ND	U	0.97	0.55	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDT	ND	U	0.97	0.49	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	ND	U	0.97	0.16	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	65	29-117	09/17/15	Acceptable
Decachlorobiphenyl	69	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Organochlorine Pesticides

Sample Name:	DB1_Liver	**Units:**	ug/Kg
Lab Code:	K1509159-012	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	**16**	D	4.0	2.3	5	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	ND	U	4.0	2.8	5	09/04/15	09/17/15	KWG1508474	
4,4'-DDT	**13**	D	4.0	2.5	5	09/04/15	09/22/15	KWG1508474	
2,4'-DDE	ND	U	5.0	1.9	5	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	5.0	3.7	5	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	**4.9**	PD	4.0	0.80	5	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	60	29-117	09/17/15	Acceptable
Decachlorobiphenyl	68	22-121	09/17/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	NA

Organochlorine Pesticides

Sample Name:	Method Blank	**Units:**	ug/Kg
Lab Code:	KWG1508474-8	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
4,4'-DDE	ND	U	0.85	0.45	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDD	ND	U	0.85	0.55	1	09/04/15	09/17/15	KWG1508474	
4,4'-DDT	ND	U	0.85	0.49	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDE	ND	U	1.0	0.37	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDD	ND	U	1.0	0.73	1	09/04/15	09/17/15	KWG1508474	
2,4'-DDT	ND	U	0.85	0.16	1	09/04/15	09/17/15	KWG1508474	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	76	29-117	09/17/15	Acceptable
Decachlorobiphenyl	88	22-121	09/17/15	Acceptable

Comments:

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001
Sample Matrix: Animal tissue

Surrogate Recovery Summary
Organochlorine Pesticides

Extraction Method: EPA 3541 **Units:** Percent
Analysis Method: 8081B **Level:** Low

Sample Name	Lab Code	Sur1	Sur2
UG1	K1509159-001	77	78
UG2	K1509159-002	73	72
UG3	K1509159-003	68	70
SG1	K1509159-004	66	66
SG2	K1509159-005	65	67
SG3	K1509159-006	71	73
SG4	K1509159-007	77	83
DG1	K1509159-008	54	58
DG2	K1509159-009	68	69
DG3	K1509159-010	62	65
DB1_Fillet	K1509159-011	65	69
DB1_Liver	K1509159-012	60 D	68 D
Method Blank	KWG1508474-8	76	88
UG1MS	KWG1508474-5	36	35
UG1DMS	KWG1508474-6	40	40
Lab Control Sample	KWG1508474-7	65	68

Surrogate Recovery Control Limits (%)

Sur1	=	Tetrachloro-m-xylene	29-117
Sur2	=	Decachlorobiphenyl	22-121

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

QA/QC Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Extracted:**	09/04/2015
Sample Matrix:	Animal tissue	**Date Analyzed:**	09/19/2015

Matrix Spike/Duplicate Matrix Spike Summary
Organochlorine Pesticides

Sample Name:	UG1	**Units:**	ug/Kg
Lab Code:	K1509159-001	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B	**Extraction Lot:**	KWG1508474

		UG1MS KWG1508474-5 Matrix Spike				UG1DMS KWG1508474-6 Duplicate Matrix Spike					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**		**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
4,4'-DDE	ND	7.80	18.8	41		8.09	16.8	48	33-134	4	40
4,4'-DDD	ND	8.27	18.8	44		8.48	16.8	50	35-126	2	40
4,4'-DDT	ND	8.67	18.8	46		8.85	16.8	53	26-133	2	40
2,4'-DDE	ND	7.02	18.8	37	*	7.49	16.8	44	44-115	6	40
2,4'-DDD	ND	7.37	18.8	39	*	7.70	16.8	46	43-117	4	40
2,4'-DDT	ND	7.69	18.8	41	*	8.12	16.8	48	42-118	5	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Extracted:**	09/04/2015
Sample Matrix:	Animal tissue	**Date Analyzed:**	09/19/2015

Lab Control Spike Summary
Organochlorine Pesticides

Extraction Method:	EPA 3541	**Units:**	ug/Kg
Analysis Method:	8081B	**Basis:**	Wet
		Level:	Low
		Extraction Lot:	KWG1508474

	Lab Control Sample KWG1508474-7 Lab Control Spike			
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
4,4'-DDE	14.3	20.0	71	36-139
4,4'-DDD	15.3	20.0	77	33-138
4,4'-DDT	17.4	20.0	87	49-136
2,4'-DDE	13.1	20.0	65	44-115
2,4'-DDD	13.5	20.0	68	43-117
2,4'-DDT	13.9	20.0	69	42-118

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Polychlorinated Biphenyls (PCBs)

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001

Cover Page - Organic Analysis Data Package
Polychlorinated Biphenyls (PCBs)

Sample Name	Lab Code	Date Collected	Date Received
UG1	K1509159-001	08/08/2015	08/20/2015
UG2	K1509159-002	08/08/2015	08/20/2015
UG3	K1509159-003	08/08/2015	08/20/2015
SG1	K1509159-004	08/08/2015	08/20/2015
SG2	K1509159-005	08/08/2015	08/20/2015
SG3	K1509159-006	08/08/2015	08/20/2015
SG4	K1509159-007	08/08/2015	08/20/2015
DG1	K1509159-008	08/08/2015	08/20/2015
DG2	K1509159-009	08/08/2015	08/20/2015
DG3	K1509159-010	08/08/2015	08/20/2015
DB1_Fillet	K1509159-011	08/08/2015	08/20/2015
DB1_Liver	K1509159-012	08/08/2015	08/20/2015
UG1MS	KWG1508475-4	08/08/2015	08/20/2015
UG1DMS	KWG1508475-5	08/08/2015	08/20/2015

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	UG1	**Units:**	ug/Kg
Lab Code:	K1509159-001	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	8.9	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1221	ND	U	18	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1232	ND	U	8.9	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1242	ND	U	8.9	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1248	ND	U	8.9	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1254	ND	U	8.9	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1260	ND	U	8.9	2.8	1	09/04/15	09/15/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	83	37-139	09/15/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	UG2	**Units:**	ug/Kg
Lab Code:	K1509159-002	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	10	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1221	ND	U	20	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1232	ND	U	10	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1242	ND	U	10	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1248	ND	U	10	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1254	ND	U	10	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1260	ND	U	10	2.8	1	09/04/15	09/15/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	79	37-139	09/15/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	UG3	**Units:**	ug/Kg
Lab Code:	K1509159-003	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1221	ND	U	20	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1232	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1242	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1248	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1254	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1260	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	76	37-139	09/15/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	SG1	**Units:**	ug/Kg
Lab Code:	K1509159-004	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1221	ND	U	20	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1232	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1242	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1248	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1254	ND	Ui	9.6	5.0	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1260	ND	Ui	9.6	3.3	1	09/04/15	09/15/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	71	37-139	09/15/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	SG2	**Units:**	ug/Kg
Lab Code:	K1509159-005	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1221	ND	U	20	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1232	ND	U	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1242	ND	U	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1248	ND	U	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1254	**9.2**	J	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1260	**5.3**	J	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	70	37-139	09/15/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	SG3	**Units:**	ug/Kg
Lab Code:	K1509159-006	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1221	ND	U	20	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1232	ND	U	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1242	ND	U	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1248	ND	U	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1254	ND	U	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1260	ND	U	9.8	2.8	1	09/04/15	09/15/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	79	37-139	09/15/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	SG4	**Units:**	ug/Kg
Lab Code:	K1509159-007	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1221	ND	U	20	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1232	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1242	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1248	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1254	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1260	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	83	37-139	09/15/15	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	DG1	**Units:**	ug/Kg
Lab Code:	K1509159-008	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1221	ND	U	20	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1232	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1242	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1248	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1254	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1260	ND	U	9.7	2.8	1	09/04/15	09/15/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	59	37-139	09/15/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	DG2	**Units:**	ug/Kg
Lab Code:	K1509159-009	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.9	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1221	ND	U	20	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1232	ND	U	9.9	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1242	ND	U	9.9	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1248	ND	U	9.9	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1254	ND	U	9.9	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1260	ND	U	9.9	2.8	1	09/04/15	09/15/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	73	37-139	09/15/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	DG3	**Units:**	ug/Kg
Lab Code:	K1509159-010	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1221	ND	U	20	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1232	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1242	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1248	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1254	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	
Aroclor 1260	ND	U	9.6	2.8	1	09/04/15	09/15/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	71	37-139	09/15/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	DB1_Fillet	**Units:**	ug/Kg
Lab Code:	K1509159-011	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.7	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1221	ND	U	20	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1232	ND	U	9.7	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1242	ND	U	9.7	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1248	ND	U	9.7	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1254	ND	U	9.7	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1260	ND	U	9.7	2.8	1	09/04/15	09/16/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	77	37-139	09/16/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	DB1_Liver	**Units:**	ug/Kg
Lab Code:	K1509159-012	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	8.0	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1221	ND	U	16	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1232	ND	Ui	8.0	5.9	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1242	ND	Ui	8.0	7.7	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1248	ND	U	8.0	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1254	ND	Ui	28	28	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1260	**15**	P	8.0	2.8	1	09/04/15	09/16/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	50	37-139	09/16/15	Acceptable

Comments:

Analytical Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	NA

Polychlorinated Biphenyls (PCBs)

Sample Name:	Method Blank	**Units:**	ug/Kg
Lab Code:	KWG1508475-7	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	8.5	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1221	ND	U	17	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1232	ND	U	8.5	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1242	ND	U	8.5	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1248	ND	U	8.5	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1254	ND	U	8.5	2.8	1	09/04/15	09/16/15	KWG1508475	
Aroclor 1260	ND	U	8.5	2.8	1	09/04/15	09/16/15	KWG1508475	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	89	37-139	09/16/15	Acceptable

Comments:

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001
Sample Matrix: Animal tissue

Surrogate Recovery Summary
Polychlorinated Biphenyls (PCBs)

Extraction Method: EPA 3541 **Units:** Percent
Analysis Method: 8082A **Level:** Low

Sample Name	Lab Code	Sur1
UG1	K1509159-001	83
UG2	K1509159-002	79
UG3	K1509159-003	76
SG1	K1509159-004	71
SG2	K1509159-005	70
SG3	K1509159-006	79
SG4	K1509159-007	83
DG1	K1509159-008	59
DG2	K1509159-009	73
DG3	K1509159-010	71
DB1_Fillet	K1509159-011	77
DB1_Liver	K1509159-012	50
Method Blank	KWG1508475-7	89
UG1MS	KWG1508475-4	58
UG1DMS	KWG1508475-5	58
Lab Control Sample	KWG1508475-6	80

Surrogate Recovery Control Limits (%)

Sur1 = Decachlorobiphenyl 37-139

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

QA/QC Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Extracted:**	09/04/2015
Sample Matrix:	Animal tissue	**Date Analyzed:**	09/15/2015

Matrix Spike/Duplicate Matrix Spike Summary
Polychlorinated Biphenyls (PCBs)

Sample Name:	UG1	**Units:**	ug/Kg
Lab Code:	K1509159-001	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A	**Extraction Lot:**	KWG1508475

		UG1MS KWG1508475-4 Matrix Spike			UG1DMS KWG1508475-5 Duplicate Matrix Spike					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Aroclor 1016	ND	99.4	195	51	98.5	192	51	46-128	1	40
Aroclor 1260	ND	108	195	55	113	192	59	46-128	4	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Extracted:**	09/04/2015
Sample Matrix:	Animal tissue	**Date Analyzed:**	09/16/2015

Lab Control Spike Summary
Polychlorinated Biphenyls (PCBs)

Extraction Method:	EPA 3541	**Units:**	ug/Kg
Analysis Method:	8082A	**Basis:**	Wet
		Level:	Low
		Extraction Lot:	KWG1508475

	Lab Control Sample KWG1508475-6 Lab Control Spike			
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
Aroclor 1016	125	200	62	46-128
Aroclor 1260	167	200	84	46-128

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Extracted:**	09/04/2015
Sample Matrix:	Animal tissue	**Date Analyzed:**	09/16/2015
		Time Analyzed:	00:52

Method Blank Summary
Polychlorinated Biphenyls (PCBs)

Sample Name:	Method Blank	**Instrument ID:**	GC27.i
Lab Code:	KWG1508475-7	**File ID:**	J:\GC27\DATA\091515.B\0915F027.D
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A	**Extraction Lot:**	KWG1508475

This Method Blank applies to the following analyses:

Sample Name	Lab Code	File ID	Date Analyzed	Time Analyzed
UG1	K1509159-001	J:\GC27\DATA\091515.B\0915F011.D	09/15/15	18:36
UG1MS	KWG1508475-4	J:\GC27\DATA\091515.B\0915F012.D	09/15/15	18:59
UG1DMS	KWG1508475-5	J:\GC27\DATA\091515.B\0915F013.D	09/15/15	19:23
UG2	K1509159-002	J:\GC27\DATA\091515.B\0915F014.D	09/15/15	19:46
UG3	K1509159-003	J:\GC27\DATA\091515.B\0915F015.D	09/15/15	20:10
SG1	K1509159-004	J:\GC27\DATA\091515.B\0915F016.D	09/15/15	20:33
SG2	K1509159-005	J:\GC27\DATA\091515.B\0915F017.D	09/15/15	20:57
SG3	K1509159-006	J:\GC27\DATA\091515.B\0915F018.D	09/15/15	21:20
SG4	K1509159-007	J:\GC27\DATA\091515.B\0915F019.D	09/15/15	21:44
DG1	K1509159-008	J:\GC27\DATA\091515.B\0915F020.D	09/15/15	22:07
DG2	K1509159-009	J:\GC27\DATA\091515.B\0915F023.D	09/15/15	23:18
DG3	K1509159-010	J:\GC27\DATA\091515.B\0915F024.D	09/15/15	23:41
DB1_Fillet	K1509159-011	J:\GC27\DATA\091515.B\0915F025.D	09/16/15	00:05
Lab Control Sample	KWG1508475-6	J:\GC27\DATA\091515.B\0915F026.D	09/16/15	00:28
DB1_Liver	K1509159-012	J:\GC27\DATA\091515.B\0915F030.D	09/16/15	02:02

QA/QC Report

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Extracted:**	09/04/2015
Sample Matrix:	Animal tissue	**Date Analyzed:**	09/16/2015
		Time Analyzed:	00:28

Lab Control Sample Summary
Polychlorinated Biphenyls (PCBs)

Sample Name:	Lab Control Sample	**Instrument ID:**	GC27.i
Lab Code:	KWG1508475-6	**File ID:**	J:\GC27\DATA\091515.B\0915F026.D
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A	**Extraction Lot:**	KWG1508475

This Lab Control Sample applies to the following analyses:

Sample Name	Lab Code	File ID	Date Analyzed	Time Analyzed
UG1	K1509159-001	J:\GC27\DATA\091515.B\0915F011.D	09/15/15	18:36
UG1MS	KWG1508475-4	J:\GC27\DATA\091515.B\0915F012.D	09/15/15	18:59
UG1DMS	KWG1508475-5	J:\GC27\DATA\091515.B\0915F013.D	09/15/15	19:23
UG2	K1509159-002	J:\GC27\DATA\091515.B\0915F014.D	09/15/15	19:46
UG3	K1509159-003	J:\GC27\DATA\091515.B\0915F015.D	09/15/15	20:10
SG1	K1509159-004	J:\GC27\DATA\091515.B\0915F016.D	09/15/15	20:33
SG2	K1509159-005	J:\GC27\DATA\091515.B\0915F017.D	09/15/15	20:57
SG3	K1509159-006	J:\GC27\DATA\091515.B\0915F018.D	09/15/15	21:20
SG4	K1509159-007	J:\GC27\DATA\091515.B\0915F019.D	09/15/15	21:44
DG1	K1509159-008	J:\GC27\DATA\091515.B\0915F020.D	09/15/15	22:07
DG2	K1509159-009	J:\GC27\DATA\091515.B\0915F023.D	09/15/15	23:18
DG3	K1509159-010	J:\GC27\DATA\091515.B\0915F024.D	09/15/15	23:41
DB1_Fillet	K1509159-011	J:\GC27\DATA\091515.B\0915F025.D	09/16/15	00:05
Method Blank	KWG1508475-7	J:\GC27\DATA\091515.B\0915F027.D	09/16/15	00:52
DB1_Liver	K1509159-012	J:\GC27\DATA\091515.B\0915F030.D	09/16/15	02:02

QA/QC Results

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Calibration Date:** 10/18/2014

Initial Calibration Summary
Polychlorinated Biphenyls (PCBs)

Calibration ID: CAL13624 **Column:** DB-35MS
Instrument ID: GC27.i

Level ID	File ID	Level ID	File ID
A	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F011.D	Q	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F027.D
B	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F012.D	R	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F028.D
C	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F013.D	S	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F029.D
D	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F014.D	T	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F030.D
E	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F015.D	U	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F031.D
F	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F016.D	V	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F032.D
G	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F017.D	W	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F033.D
H	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F018.D	X	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F034.D
I	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F019.D	Y	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F046.D
J	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F020.D	Z	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F047.D
K	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F021.D	AA	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F048.D
L	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F022.D	AB	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F049.D
M	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F023.D	AC	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F050.D
N	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F024.D	AD	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F052.D
O	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F025.D		
P	\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F026.D		

Analyte Name	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF
Decachlorobiphenyl													Y	5.0	1.74E+5
	Z	50	1.80E+5	AA	100	1.55E+5	AB	200	1.37E+5	AC	500	1.37E+5	AD	2.5	1.65E+5
Aroclor 1016 {1}													Y	50	4000
	Z	500	4060	AA	1000	3530	AB	2000	3160	AC	5000	2890	AD	25	3890
Aroclor 1016 {2}													Y	50	3180
	Z	500	3510	AA	1000	3090	AB	2000	2640	AC	5000	2480	AD	25	3080
Aroclor 1016 {3}													Y	50	11100
	Z	500	11000	AA	1000	9830	AB	2000	8070	AC	5000	9210	AD	25	10100
Aroclor 1016 {4}													Y	50	5730
	Z	500	5650	AA	1000	4880	AB	2000	4330	AC	5000	4070	AD	25	5110
Aroclor 1016 {5}													Y	50	5740
	Z	500	5900	AA	1000	5120	AB	2000	4550	AC	5000	4370	AD	25	5370
Aroclor 1260 {1}													Y	50	11600
	Z	500	11100	AA	1000	9570	AB	2000	8330	AC	5000	8190	AD	25	10400
Aroclor 1260 {2}													Y	50	8920
	Z	500	9340	AA	1000	8030	AB	2000	6990	AC	5000	6900	AD	25	8500
Aroclor 1260 {3}													Y	50	9200
	Z	500	9530	AA	1000	8190	AB	2000	7130	AC	5000	7020	AD	25	8320
Aroclor 1260 {4}													Y	50	20700
	Z	500	21000	AA	1000	18200	AB	2000	16300	AC	5000	16800	AD	25	19800

Results flagged with an asterisk (*) indicate values outside control criteria.

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Calibration Date:** 10/18/2014

Initial Calibration Summary
Polychlorinated Biphenyls (PCBs)

Calibration ID: CAL13624 **Column:** DB-35MS
Instrument ID: GC27.i

Analyte Name	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF
Aroclor 1260 {5}													Y	50	15700
	Z	500	16200	AA	1000	14000	AB	2000	12400	AC	5000	12600	AD	25	14300

Results flagged with an asterisk (*) indicate values outside control criteria.

QA/QC Results

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Calibration Date:** 10/18/2014

Initial Calibration Summary
Polychlorinated Biphenyls (PCBs)

Calibration ID: CAL13624 **Column:** DB-35MS
Instrument ID: GC27.i

		Calibration Evaluation				
Analyte Name	**Compound Type**	**Fit Type**	**Eval.**	**Eval. Result**	**Q**	**Control Criteria**
Decachlorobiphenyl	SURR	AverageRF	% RSD	11.7		≤ 20
Aroclor 1016 {1}	MULTI	AverageRF	% RSD	13.4		≤ 20
Aroclor 1016 {2}	MULTI	AverageRF	% RSD	12.5		≤ 20
Aroclor 1016 {3}	MULTI	AverageRF	% RSD	11.5		≤ 20
Aroclor 1016 {4}	MULTI	AverageRF	% RSD	13.6		≤ 20
Aroclor 1016 {5}	MULTI	AverageRF	% RSD	12.0		≤ 20
Aroclor 1260 {1}	MULTI	AverageRF	% RSD	14.3		≤ 20
Aroclor 1260 {2}	MULTI	AverageRF	% RSD	12.4		≤ 20
Aroclor 1260 {3}	MULTI	AverageRF	% RSD	12.5		≤ 20
Aroclor 1260 {4}	MULTI	AverageRF	% RSD	10.6		≤ 20
Aroclor 1260 {5}	MULTI	AverageRF	% RSD	11.0		≤ 20

Results flagged with an asterisk (*) indicate values outside control criteria.

QA/QC Results

Client: GRAYSTAR Pacific Seafood, Ltd.
Project: Umiat Fish/30118-001

Service Request: K1509159
Calibration Date: 10/18/2014
Date Analyzed: 10/19/2014

Second Source Calibration Verification
Polychlorinated Biphenyls (PCBs)

Calibration Type: External Standard
Analysis Method: 8082A

Calibration ID: CAL13624
Units: ng/mL

File ID: \\alklsws002\instdata\GC27\Data\101714CAL.b\1017F036.D
\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F037.D
\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F038.D
\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F039.D
\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F040.D
\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F042.D
\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F043.D
\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F053.D
\\alklsws002\instdata\GC27\Data\101714CAL.b\1017F054.D

Column ID: DB-35MS

Analyte Name	Expected	Result	Average RF	SSV RF	%D	%Drift		Criteria	Curve Fit
Aroclor 1016 {1}	1000	1300	3590	4530	26	NA		± 100 %	AverageRF
Aroclor 1016 {2}	1000	1200	3000	3720	24	NA		± 100 %	AverageRF
Aroclor 1016 {3}	1000	1200	9890	11900	20	NA		± 100 %	AverageRF
Aroclor 1016 {4}	1000	1100	4960	5570	12	NA		± 100 %	AverageRF
Aroclor 1016 {5}	1000	1200	5180	6170	19	NA		± 100 %	AverageRF
Aroclor 1016	1000	1200	NA	NA	NA	20	*	± 20 %	NA
Aroclor 1260 {1}	1000	1100	9850	10300	5	NA		± 100 %	AverageRF
Aroclor 1260 {2}	1000	1300	8110	10300	27	NA		± 100 %	AverageRF
Aroclor 1260 {3}	1000	1200	8230	10200	24	NA		± 100 %	AverageRF
Aroclor 1260 {4}	1000	1200	18800	22900	22	NA		± 100 %	AverageRF
Aroclor 1260 {5}	1000	1200	14200	17200	21	NA		± 100 %	AverageRF
Aroclor 1260	1000	1200	NA	NA	NA	20		± 20 %	NA

Results flagged with an asterisk (*) indicate values outside control criteria.

† SPCC Compound **‡ CCC Compound**

QA/QC Results

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Calibration Date:** 10/18/2014

Initial Calibration Summary
Polychlorinated Biphenyls (PCBs)

Calibration ID: CAL13624 **Column:** DB-XLB
Instrument ID: GC27.i

Level ID	File ID	Level ID	File ID
A	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F011.D	Q	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F027.D
B	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F012.D	R	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F028.D
C	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F013.D	S	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F029.D
D	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F014.D	T	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F030.D
E	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F015.D	U	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F031.D
F	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F016.D	V	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F032.D
G	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F017.D	W	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F033.D
H	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F018.D	X	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F034.D
I	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F019.D	Y	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F046.D
J	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F020.D	Z	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F047.D
K	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F021.D	AA	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F048.D
L	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F022.D	AB	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F049.D
M	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F023.D	AC	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F050.D
N	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F024.D	AD	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F052.D
O	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F025.D		
P	\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F026.D		

Analyte Name	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF
Decachlorobiphenyl													Y	5.0	97700
	Z	50	81000	AA	100	79500	AB	200	74900	AC	500	66600	AD	2.5	94400
Aroclor 1016 {1}													Y	50	2030
	Z	500	1810	AA	1000	1770	AB	2000	1610				AD	25	1960
Aroclor 1016 {2}													Y	50	2670
	Z	500	2380	AA	1000	2310	AB	2000	2120				AD	25	2700
Aroclor 1016 {3}													Y	50	3400
	Z	500	2970	AA	1000	2890	AB	2000	2620				AD	25	3100
Aroclor 1016 {4}													Y	50	2520
	Z	500	2160	AA	1000	2110	AB	2000	1930				AD	25	2260
Aroclor 1016 {5}													Y	50	2500
	Z	500	2130	AA	1000	2080	AB	2000	1930				AD	25	2140
Aroclor 1260 {1}													Y	50	2520
	Z	500	2230	AA	1000	2200	AB	2000	2070	AC	5000	1760	AD	25	2450
Aroclor 1260 {2}													Y	50	4610
	Z	500	3740	AA	1000	3690	AB	2000	3490	AC	5000	3090	AD	25	4050
Aroclor 1260 {3}													Y	50	4460
	Z	500	3540	AA	1000	3470	AB	2000	3290	AC	5000	2920	AD	25	3960
Aroclor 1260 {4}													Y	50	10300
	Z	500	8380	AA	1000	8380	AB	2000	8090	AC	5000	7460	AD	25	9170

Results flagged with an asterisk (*) indicate values outside control criteria.

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Calibration Date:** 10/18/2014

Initial Calibration Summary
Polychlorinated Biphenyls (PCBs)

Calibration ID: CAL13624 **Column:** DB-XLB
Instrument ID: GC27.i

Analyte Name	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF	Level ID	Amt	RF
Aroclor 1260 {5}													Y	50	6810
	Z	500	5490	AA	1000	5410	AB	2000	5150	AC	5000	4630	AD	25	6020

Results flagged with an asterisk (*) indicate values outside control criteria.

QA/QC Results

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Calibration Date:** 10/18/2014

Initial Calibration Summary
Polychlorinated Biphenyls (PCBs)

Calibration ID: CAL13624 **Column:** DB-XLB
Instrument ID: GC27.i

		Calibration Evaluation				
Analyte Name	**Compound Type**	**Fit Type**	**Eval.**	**Eval. Result**	**Q**	**Control Criteria**
Decachlorobiphenyl	SURR	AverageRF	% RSD	14.3		≤ 20
Aroclor 1016 {1}	MULTI	AverageRF	% RSD	9.0		≤ 20
Aroclor 1016 {2}	MULTI	AverageRF	% RSD	10.1		≤ 20
Aroclor 1016 {3}	MULTI	AverageRF	% RSD	9.5		≤ 20
Aroclor 1016 {4}	MULTI	AverageRF	% RSD	9.8		≤ 20
Aroclor 1016 {5}	MULTI	AverageRF	% RSD	9.8		≤ 20
Aroclor 1260 {1}	MULTI	AverageRF	% RSD	12.5		≤ 20
Aroclor 1260 {2}	MULTI	AverageRF	% RSD	13.6		≤ 20
Aroclor 1260 {3}	MULTI	AverageRF	% RSD	14.9		≤ 20
Aroclor 1260 {4}	MULTI	AverageRF	% RSD	11.6		≤ 20
Aroclor 1260 {5}	MULTI	AverageRF	% RSD	13.5		≤ 20

Results flagged with an asterisk (*) indicate values outside control criteria.

QA/QC Results

Client: GRAYSTAR Pacific Seafood, Ltd.
Project: Umiat Fish/30118-001

Service Request: K1509159
Calibration Date: 10/18/2014
Date Analyzed: 10/19/2014

Second Source Calibration Verification
Polychlorinated Biphenyls (PCBs)

Calibration Type: External Standard
Analysis Method: 8082A

Calibration ID: CAL13624
Units: ng/mL

File ID: \\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F036.D
\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F037.D
\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F038.D
\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F039.D
\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F040.D
\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F042.D
\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F043.D
\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F053.D
\\alklsws002\instdata\GC27\Data\101714CAL_r.b\1017F054.D

Column ID: DB-XLB

Analyte Name	Expected	Result	Average RF	SSV RF	%D	%Drift		Criteria	Curve Fit
Aroclor 1016 {1}	1000	1100	1840	1970	7	NA		± 100 %	AverageRF
Aroclor 1016 {2}	1000	1000	2430	2530	4	NA		± 100 %	AverageRF
Aroclor 1016 {3}	1000	1100	3000	3170	6	NA		± 100 %	AverageRF
Aroclor 1016 {4}	1000	1000	2200	2290	4	NA		± 100 %	AverageRF
Aroclor 1016 {5}	1000	1100	2160	2300	6	NA		± 100 %	AverageRF
Aroclor 1016	1000	1100	NA	NA	NA	5		± 20 %	NA
Aroclor 1260 {1}	1000	1200	2210	2590	17	NA		± 100 %	AverageRF
Aroclor 1260 {2}	1000	1300	3780	4910	30	NA		± 100 %	AverageRF
Aroclor 1260 {3}	1000	1200	3610	4410	22	NA		± 100 %	AverageRF
Aroclor 1260 {4}	1000	1200	8630	10700	24	NA		± 100 %	AverageRF
Aroclor 1260 {5}	1000	1200	5590	6680	20	NA		± 100 %	AverageRF
Aroclor 1260	1000	1200	NA	NA	NA	23	*	± 20 %	NA

Results flagged with an asterisk (*) indicate values outside control criteria.

† **SPCC Compound** ‡ **CCC Compound**

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Date Analyzed:** 09/15/2015

Continuing Calibration Verification Summary
Polychlorinated Biphenyls (PCBs)

Calibration Type: External Standard **Calibration Date:** 10/18/2014
Analysis Method: 8082A **Calibration ID:** CAL13624
Analysis Lot: KWG1509033
Units: ng/mL
File ID: \\ALKLSWS002\INSTDATA\GC27\DATA\091515.B\0915F009.D **Column ID:** DB-35MS

Analyte Name	Expected	Result	Average RF	CCV RF	%D	%Drift	Criteria	Curve Fit
Decachlorobiphenyl	50	51	158000	161000	2	NA	± 20	AverageRF
Aroclor 1016 {1}	500	480	3590	3430	-5	NA	± 100	AverageRF
Aroclor 1016 {2}	500	470	3000	2810	-6	NA	± 100	AverageRF
Aroclor 1016 {3}	500	450	9890	8810	-11	NA	± 100	AverageRF
Aroclor 1016 {4}	500	440	4960	4380	-12	NA	± 100	AverageRF
Aroclor 1016 {5}	500	430	5180	4490	-13	NA	± 100	AverageRF
Aroclor 1016	500	450	NA	NA	NA	-9	± 20	NA
Aroclor 1260 {1}	500	440	9850	8740	-11	NA	± 100	AverageRF
Aroclor 1260 {2}	500	480	8110	7750	-5	NA	± 100	AverageRF
Aroclor 1260 {3}	500	480	8230	7880	-4	NA	± 100	AverageRF
Aroclor 1260 {4}	500	480	18800	18200	-3	NA	± 100	AverageRF
Aroclor 1260 {5}	500	500	14200	14200	0	NA	± 100	AverageRF
Aroclor 1260	500	480	NA	NA	NA	-5	± 20	NA

Results flagged with an asterisk (*) indicate values outside control criteria.

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Date Analyzed:** 09/15/2015

Continuing Calibration Verification Summary
Polychlorinated Biphenyls (PCBs)

Calibration Type: External Standard **Calibration Date:** 10/18/2014
Analysis Method: 8082A **Calibration ID:** CAL13624
Analysis Lot: KWG1509033
Units: ng/mL

File ID: \\ALKLSWS002\INSTDATA\GC27\DATA\091515_R.B\0915F009.D **Column ID:** DB-XLB

Analyte Name	Expected	Result	Average RF	CCV RF	%D	%Drift	Criteria	Curve Fit
Decachlorobiphenyl	50	50	82400	82700	0	NA	± 20	AverageRF
Aroclor 1016 {1}	500	430	1840	1590	-14	NA	± 100	AverageRF
Aroclor 1016 {2}	500	430	2430	2110	-13	NA	± 100	AverageRF
Aroclor 1016 {3}	500	400	3000	2410	-20	NA	± 100	AverageRF
Aroclor 1016 {4}	500	410	2200	1800	-18	NA	± 100	AverageRF
Aroclor 1016 {5}	500	410	2160	1770	-18	NA	± 100	AverageRF
Aroclor 1016	500	420	NA	NA	NA	-17	± 20	NA
Aroclor 1260 {1}	500	450	2210	2000	-10	NA	± 100	AverageRF
Aroclor 1260 {2}	500	480	3780	3630	-4	NA	± 100	AverageRF
Aroclor 1260 {3}	500	480	3610	3470	-4	NA	± 100	AverageRF
Aroclor 1260 {4}	500	490	8630	8390	-3	NA	± 100	AverageRF
Aroclor 1260 {5}	500	500	5590	5550	-1	NA	± 100	AverageRF
Aroclor 1260	500	480	NA	NA	NA	-4	± 20	NA

Results flagged with an asterisk (*) indicate values outside control criteria.

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Date Analyzed:** 09/15/2015

Continuing Calibration Verification Summary
Polychlorinated Biphenyls (PCBs)

Calibration Type: External Standard **Calibration Date:** 10/18/2014
Analysis Method: 8082A **Calibration ID:** CAL13624
Analysis Lot: KWG1509033
Units: ng/mL
File ID: \\ALKLSWS002\INSTDATA\GC27\DATA\091515.B\0915F021.D **Column ID:** DB-35MS

Analyte Name	Expected	Result	Average RF	CCV RF	%D	%Drift	Criteria	Curve Fit
Decachlorobiphenyl	50	53	158000	168000	6	NA	± 20	AverageRF
Aroclor 1016 {1}	500	490	3590	3540	-1	NA	± 100	AverageRF
Aroclor 1016 {2}	500	500	3000	3020	1	NA	± 100	AverageRF
Aroclor 1016 {3}	500	500	9890	9820	-1	NA	± 100	AverageRF
Aroclor 1016 {4}	500	470	4960	4640	-6	NA	± 100	AverageRF
Aroclor 1016 {5}	500	460	5180	4800	-7	NA	± 100	AverageRF
Aroclor 1016	500	480	NA	NA	NA	-3	± 20	NA
Aroclor 1260 {1}	500	470	9850	9300	-6	NA	± 100	AverageRF
Aroclor 1260 {2}	500	500	8110	8160	1	NA	± 100	AverageRF
Aroclor 1260 {3}	500	510	8230	8370	2	NA	± 100	AverageRF
Aroclor 1260 {4}	500	510	18800	19100	2	NA	± 100	AverageRF
Aroclor 1260 {5}	500	520	14200	14800	4	NA	± 100	AverageRF
Aroclor 1260	500	500	NA	NA	NA	1	± 20	NA

Results flagged with an asterisk (*) indicate values outside control criteria.

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Date Analyzed:** 09/15/2015

Continuing Calibration Verification Summary
Polychlorinated Biphenyls (PCBs)

Calibration Type: External Standard **Calibration Date:** 10/18/2014
Analysis Method: 8082A **Calibration ID:** CAL13624
Analysis Lot: KWG1509033
Units: ng/mL

File ID: \\ALKLSWS002\INSTDATA\GC27\DATA\091515_R.B\0915F021.D **Column ID:** DB-XLB

Analyte Name	Expected	Result	Average RF	CCV RF	%D	%Drift	Criteria	Curve Fit
Decachlorobiphenyl	50	51	82400	84500	3	NA	± 20	AverageRF
Aroclor 1016 {1}	500	430	1840	1580	-14	NA	± 100	AverageRF
Aroclor 1016 {2}	500	430	2430	2080	-14	NA	± 100	AverageRF
Aroclor 1016 {3}	500	420	3000	2520	-16	NA	± 100	AverageRF
Aroclor 1016 {4}	500	420	2200	1840	-16	NA	± 100	AverageRF
Aroclor 1016 {5}	500	420	2160	1810	-16	NA	± 100	AverageRF
Aroclor 1016	500	420	NA	NA	NA	-15	± 20	NA
Aroclor 1260 {1}	500	460	2210	2040	-8	NA	± 100	AverageRF
Aroclor 1260 {2}	500	500	3780	3750	-1	NA	± 100	AverageRF
Aroclor 1260 {3}	500	500	3610	3620	0	NA	± 100	AverageRF
Aroclor 1260 {4}	500	500	8630	8710	1	NA	± 100	AverageRF
Aroclor 1260 {5}	500	510	5590	5750	3	NA	± 100	AverageRF
Aroclor 1260	500	500	NA	NA	NA	-1	± 20	NA

Results flagged with an asterisk (*) indicate values outside control criteria.

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Date Analyzed:** 09/16/2015

Continuing Calibration Verification Summary
Polychlorinated Biphenyls (PCBs)

Calibration Type: External Standard **Calibration Date:** 10/18/2014
Analysis Method: 8082A **Calibration ID:** CAL13624
Analysis Lot: KWG1509033
Units: ng/mL
File ID: \\ALKLSWS002\INSTDATA\GC27\DATA\091515.B\0915F028.D **Column ID:** DB-35MS

Analyte Name	Expected	Result	Average RF	CCV RF	%D	%Drift	Criteria	Curve Fit
Decachlorobiphenyl	50	54	158000	172000	9	NA	± 20	AverageRF
Aroclor 1016 {1}	500	540	3590	3890	8	NA	± 100	AverageRF
Aroclor 1016 {2}	500	510	3000	3060	2	NA	± 100	AverageRF
Aroclor 1016 {3}	500	440	9890	8650	-13	NA	± 100	AverageRF
Aroclor 1016 {4}	500	480	4960	4780	-4	NA	± 100	AverageRF
Aroclor 1016 {5}	500	470	5180	4880	-6	NA	± 100	AverageRF
Aroclor 1016	500	490	NA	NA	NA	-2	± 20	NA
Aroclor 1260 {1}	500	480	9850	9470	-4	NA	± 100	AverageRF
Aroclor 1260 {2}	500	510	8110	8300	2	NA	± 100	AverageRF
Aroclor 1260 {3}	500	520	8230	8530	4	NA	± 100	AverageRF
Aroclor 1260 {4}	500	520	18800	19500	4	NA	± 100	AverageRF
Aroclor 1260 {5}	500	530	14200	15200	7	NA	± 100	AverageRF
Aroclor 1260	500	510	NA	NA	NA	3	± 20	NA

Results flagged with an asterisk (*) indicate values outside control criteria.

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Date Analyzed:** 09/16/2015

Continuing Calibration Verification Summary
Polychlorinated Biphenyls (PCBs)

Calibration Type: External Standard **Calibration Date:** 10/18/2014
Analysis Method: 8082A **Calibration ID:** CAL13624
Analysis Lot: KWG1509033
Units: ng/mL
File ID: \\ALKLSWS002\INSTDATA\GC27\DATA\091515_R.B\0915F028.D **Column ID:** DB-XLB

Analyte Name	Expected	Result	Average RF	CCV RF	%D	%Drift	Criteria	Curve Fit
Decachlorobiphenyl	50	52	82400	85800	4	NA	± 20	AverageRF
Aroclor 1016 {1}	500	430	1840	1590	-14	NA	± 100	AverageRF
Aroclor 1016 {2}	500	430	2430	2100	-14	NA	± 100	AverageRF
Aroclor 1016 {3}	500	420	3000	2530	-16	NA	± 100	AverageRF
Aroclor 1016 {4}	500	430	2200	1870	-15	NA	± 100	AverageRF
Aroclor 1016 {5}	500	430	2160	1830	-15	NA	± 100	AverageRF
Aroclor 1016	500	430	NA	NA	NA	-15	± 20	NA
Aroclor 1260 {1}	500	470	2210	2090	-5	NA	± 100	AverageRF
Aroclor 1260 {2}	500	500	3780	3820	1	NA	± 100	AverageRF
Aroclor 1260 {3}	500	510	3610	3690	2	NA	± 100	AverageRF
Aroclor 1260 {4}	500	510	8630	8870	3	NA	± 100	AverageRF
Aroclor 1260 {5}	500	520	5590	5840	5	NA	± 100	AverageRF
Aroclor 1260	500	510	NA	NA	NA	1	± 20	NA

Results flagged with an asterisk (*) indicate values outside control criteria.

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Date Analyzed:** 09/16/2015

Continuing Calibration Verification Summary
Polychlorinated Biphenyls (PCBs)

Calibration Type: External Standard **Calibration Date:** 10/18/2014
Analysis Method: 8082A **Calibration ID:** CAL13624
Analysis Lot: KWG1509033
Units: ng/mL
File ID: \\ALKLSWS002\INSTDATA\GC27\DATA\091515.B\0915F031.D **Column ID:** DB-35MS

Analyte Name	Expected	Result	Average RF	CCV RF	%D	%Drift	Criteria	Curve Fit
Decachlorobiphenyl	50	55	158000	174000	10	NA	± 20	AverageRF
Aroclor 1016 {1}	500	500	3590	3570	-1	NA	± 100	AverageRF
Aroclor 1016 {2}	500	480	3000	2900	-3	NA	± 100	AverageRF
Aroclor 1016 {3}	500	430	9890	8490	-14	NA	± 100	AverageRF
Aroclor 1016 {4}	500	460	4960	4530	-9	NA	± 100	AverageRF
Aroclor 1016 {5}	500	450	5180	4620	-11	NA	± 100	AverageRF
Aroclor 1016	500	460	NA	NA	NA	-7	± 20	NA
Aroclor 1260 {1}	500	460	9850	9160	-7	NA	± 100	AverageRF
Aroclor 1260 {2}	500	500	8110	8150	0	NA	± 100	AverageRF
Aroclor 1260 {3}	500	500	8230	8300	1	NA	± 100	AverageRF
Aroclor 1260 {4}	500	510	18800	19000	1	NA	± 100	AverageRF
Aroclor 1260 {5}	500	520	14200	14800	4	NA	± 100	AverageRF
Aroclor 1260	500	500	NA	NA	NA	0	± 20	NA

Results flagged with an asterisk (*) indicate values outside control criteria.

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001 **Date Analyzed:** 09/16/2015

Continuing Calibration Verification Summary
Polychlorinated Biphenyls (PCBs)

Calibration Type: External Standard **Calibration Date:** 10/18/2014
Analysis Method: 8082A **Calibration ID:** CAL13624
Analysis Lot: KWG1509033
Units: ng/mL

File ID: \\ALKLSWS002\INSTDATA\GC27\DATA\091515_R.B\0915F031.D **Column ID:** DB-XLB

Analyte Name	Expected	Result	Average RF	CCV RF	%D	%Drift	Criteria	Curve Fit
Decachlorobiphenyl	50	52	82400	85700	4	NA	± 20	AverageRF
Aroclor 1016 {1}	500	450	1840	1650	-10	NA	± 100	AverageRF
Aroclor 1016 {2}	500	460	2430	2220	-9	NA	± 100	AverageRF
Aroclor 1016 {3}	500	420	3000	2540	-15	NA	± 100	AverageRF
Aroclor 1016 {4}	500	440	2200	1930	-12	NA	± 100	AverageRF
Aroclor 1016 {5}	500	440	2160	1890	-13	NA	± 100	AverageRF
Aroclor 1016	500	440	NA	NA	NA	-12	± 20	NA
Aroclor 1260 {1}	500	490	2210	2150	-3	NA	± 100	AverageRF
Aroclor 1260 {2}	500	510	3780	3880	3	NA	± 100	AverageRF
Aroclor 1260 {3}	500	510	3610	3700	2	NA	± 100	AverageRF
Aroclor 1260 {4}	500	510	8630	8860	3	NA	± 100	AverageRF
Aroclor 1260 {5}	500	500	5590	5630	1	NA	± 100	AverageRF
Aroclor 1260	500	510	NA	NA	NA	1	± 20	NA

Results flagged with an asterisk (*) indicate values outside control criteria.

ALS Group USA, Corp. dba ALS Environmental

QA/QC Results

Client: GRAYSTAR Pacific Seafood, Ltd. **Service Request:** K1509159
Project: Umiat Fish/30118-001

Analysis Run Log
Polychlorinated Biphenyls (PCBs)

Analysis Method: 8082A **Analysis Lot:** KWG1509033
Instrument ID: GC27.i
Column: DB-35MS

File ID	Sample Name	Lab Code	Date Analysis Started	Start Time	Q	Date Analysis Finished	Finish Time
0915F003.D	Continuing Calibration Verification	KWG1509033-1	9/15/2015	15:25		9/15/2015	15:25
0915F004.D	Instrument Blank	KWG1509033-2	9/15/2015	15:49		9/15/2015	15:49
0915F005.D	ZZZZZZ	ZZZZZZ	9/15/2015	16:13		9/15/2015	16:13
0915F006.D	ZZZZZZ	ZZZZZZ	9/15/2015	16:37		9/15/2015	16:37
0915F007.D	ZZZZZZ	ZZZZZZ	9/15/2015	17:01		9/15/2015	17:01
0915F008.D	ZZZZZZ	ZZZZZZ	9/15/2015	17:24		9/15/2015	17:24
0915F009.D	Continuing Calibration Verification	KWG1509033-3	9/15/2015	17:48		9/15/2015	17:48
0915F010.D	Instrument Blank	KWG1509033-4	9/15/2015	18:12		9/15/2015	18:12
0915F011.D	UG1	K1509159-001	9/15/2015	18:36		9/15/2015	18:36
0915F012.D	UG1MS	KWG1508475-4	9/15/2015	18:59		9/15/2015	18:59
0915F013.D	UG1DMS	KWG1508475-5	9/15/2015	19:23		9/15/2015	19:23
0915F014.D	UG2	K1509159-002	9/15/2015	19:46		9/15/2015	19:46
0915F015.D	UG3	K1509159-003	9/15/2015	20:10		9/15/2015	20:10
0915F016.D	SG1	K1509159-004	9/15/2015	20:33		9/15/2015	20:33
0915F017.D	SG2	K1509159-005	9/15/2015	20:57		9/15/2015	20:57
0915F018.D	SG3	K1509159-006	9/15/2015	21:20		9/15/2015	21:20
0915F019.D	SG4	K1509159-007	9/15/2015	21:44		9/15/2015	21:44
0915F020.D	DG1	K1509159-008	9/15/2015	22:07		9/15/2015	22:07
0915F021.D	Continuing Calibration Verification	KWG1509033-5	9/15/2015	22:31		9/15/2015	22:31
0915F022.D	Instrument Blank	KWG1509033-6	9/15/2015	22:54		9/15/2015	22:54
0915F023.D	DG2	K1509159-009	9/15/2015	23:18		9/15/2015	23:18
0915F024.D	DG3	K1509159-010	9/15/2015	23:41		9/15/2015	23:41
0915F025.D	DB1_Fillet	K1509159-011	9/16/2015	00:05		9/16/2015	00:05
0915F026.D	Lab Control Sample	KWG1508475-6	9/16/2015	00:28		9/16/2015	00:28
0915F027.D	Method Blank	KWG1508475-7	9/16/2015	00:52		9/16/2015	00:52
0915F028.D	Continuing Calibration Verification	KWG1509033-7	9/16/2015	01:15		9/16/2015	01:15
0915F029.D	Instrument Blank	KWG1509033-8	9/16/2015	01:39		9/16/2015	01:39
0915F030.D	DB1_Liver	K1509159-012	9/16/2015	02:02		9/16/2015	02:02
0915F031.D	Continuing Calibration Verification	KWG1509033-9	9/16/2015	02:26		9/16/2015	02:26
0915F032.D	Instrument Blank	KWG1509033-10	9/16/2015	02:49		9/16/2015	02:49

Results flagged with an asterisk (*) indicate the holding time was exceeded for the analysis

QA/QC Results

Client: GRAYSTAR Pacific Seafood, Ltd.
Project: Umiat Fish/30118-001
Sample Matrix: Animal tissue

Service Request: K1509159
Date Extracted: 09/04/2015

Extraction Prep Log
Polychlorinated Biphenyls (PCBs)

Extraction Method: EPA 3541
Analysis Method: 8082A

Extraction Lot: KWG1508475
Level: Low

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Volume	% Solids	Note
UG1	K1509159-001	08/08/15	08/20/15	22.714g	4ml	NA	
UG2	K1509159-002	08/08/15	08/20/15	20.011g	4ml	NA	
UG3	K1509159-003	08/08/15	08/20/15	20.991g	4ml	NA	
SG1	K1509159-004	08/08/15	08/20/15	20.976g	4ml	NA	
SG2	K1509159-005	08/08/15	08/20/15	20.547g	4ml	NA	
SG3	K1509159-006	08/08/15	08/20/15	20.587g	4ml	NA	
SG4	K1509159-007	08/08/15	08/20/15	20.755g	4ml	NA	
DG1	K1509159-008	08/08/15	08/20/15	20.641g	4ml	NA	
DG2	K1509159-009	08/08/15	08/20/15	20.357g	4ml	NA	
DG3	K1509159-010	08/08/15	08/20/15	20.956g	4ml	NA	
DB1_Fillet	K1509159-011	08/08/15	08/20/15	20.694g	4ml	NA	
DB1_Liver	K1509159-012	08/08/15	08/20/15	12.577g	2ml	NA	
Method Blank	KWG1508475-7	NA	NA	23.745g	4ml	NA	
UG1MS	KWG1508475-4	08/08/15	08/20/15	20.486g	4ml	NA	
UG1DMS	KWG1508475-5	08/08/15	08/20/15	20.843g	4ml	NA	
Lab Control Sample	KWG1508475-6	NA	NA	20.000g	4ml	NA	

Results flagged with an asterisk (*) indicate the holding time was exceeded for the analysis

Confirmation Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015
		Date Extracted:	09/04/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	SG2	**Units:**	ug/Kg
Lab Code:	K1509159-005	**Basis:**	Wet
		Level:	Low
Extraction Method:	EPA 3541		
Analysis Method:	8082A		

Analyte Name	MRL	MDL	Primary Result	Confirmation Result	RPD	Q	Dilution Factor	Date Analyzed
Aroclor 1254	9.8	2.8	9.2	11	17.8	J	1	09/15/15
Aroclor 1260	9.8	2.8	5.3	6.2	15.7	J	1	09/15/15

Confirmation Results

Client:	GRAYSTAR Pacific Seafood, Ltd.	**Service Request:**	K1509159
Project:	Umiat Fish/30118-001	**Date Collected:**	08/08/2015
Sample Matrix:	Animal tissue	**Date Received:**	08/20/2015
		Date Extracted:	09/04/2015

Polychlorinated Biphenyls (PCBs)

Sample Name:	DB1_Liver	**Units:**	ug/Kg
Lab Code:	K1509159-012	**Basis:**	Wet
		Level:	Low
Extraction Method:	EPA 3541		
Analysis Method:	8082A		

Analyte Name	MRL	MDL	Primary Result	Confirmation Result	RPD	Q	Dilution Factor	Date Analyzed
Aroclor 1260	8.0	2.8	15	23	42.1	P	1	09/16/15

Appendix D:
Qualifications of the Environmental Professionals

Erik D. Mundahl, P.E. Environmental Engineer

Employer: **Travis/Peterson Environmental Consulting, Inc.**
Discipline: Environmental Engineer, State of Alaska Registered Professional Engineer EV14420
Residency: Alaska
Education: B.S. Environmental Engineering, Michigan Technological University - 2009

Biological Science Experience:

General tasks/skills:

- Backpack electrofishing
- Fish collection, identification
- Stream habitat assessment (depth, velocity, substrate assessment, embeddedness, fish cover, riparian buffer assessments, soil compaction, pebble counts, cross section construction, longitudinal stream profiles)
- GPS based wildlife monitoring
- Data management, analyses (spreadsheet, IBI calculations)
- Aquatic invertebrate collection, sorting, identification
- Lab fish maintenance

Research Project Experience:

- Fish population and distribution surveys in streams and rivers of the Iniskin Peninsula, Alaska
- Habitat use and selection by slimy sculpin (*Cottus cognatus*) in coldwater streams of southeastern Minnesota
- Stream habitat assessment for slimy sculpin reintroduction
- Diet assessment of slimy sculpin in coldwater streams
- Feeding rates of slimy sculpin: influence of water temperatures
- Fish communities and stream habitats along a warmwater to coldwater longitudinal stream gradient: South Branch Whitewater
- Long-term monitoring of stream fish communities in southeastern Minnesota trout streams: application of a coldwater index of biotic integrity
- Fish communities in warmwater streams in an agricultural landscape: upper South Branch Root River
- Habitat assessments for stream fish communities: warmwater and coldwater streams (Whitewater River watershed, South Branch Root River)
- Deterioration of stream fish habitats: loss of pool volume to fine sediment deposition
- Effects of livestock grazing management (conventional, rotational) on stream fish communities and stream habitats

Stephen T. Grabacki, FP-C

P.O.Box 100506 ✣ Anchorage, Alaska ✣ 99510-0506 USA
phone: +1-907-272-5600 ✣ ***fisheyecon@gmail.com***

SUMMARY

An experienced professional with thorough grounding in fisheries biology, environmental studies & documents, and fisheries management.

PRESIDENT
(since 1985)

FISHEYE Consulting / GRAYSTAR Pacific Seafood, Ltd., Anchorage
A wide variety of fisheries biology & ecology, baseline & impact studies, and environmental permits & documents. Clients are in the public and private sectors. *Representative projects* –

* ASMI's Responsible Fisheries Management program
* Fisheries baseline study: Iniskin oil/gas exploration
* Strategic fisheries-related consultation, Chuitna coal, Pebble LP
* Third-party FAO-based certification of Alaska fisheries management
* Fisheries baseline study: Yerrick Creek and Bradley Lake hydroelectric
* Fisheries baseline study: Lik base metals mine and Pogo Gold
* EIS coordination, including marine fishes: Chukchi Sea OCS exploration
* EIS coordination: Endicott causeway
* Consultation on settlement of EVOS claims by harvesters and processors
* Plans for Fishery-Based Community Development (SWAMC & CRWP)

SENIOR BIOLOGIST
(1981-1985)

DAMES & MOORE, Anchorage
Consulting in commercial fisheries, and economic and environmental impact studies. *Representative projects* --

* Fisheries biology baselines: Slate Creek asbestos, Quartz Hill molybdenum
* Environmental baseline & permitting: Unalaska geothermal exploration
* Bering Sea Commercial Fishing Industry Impact Analysis (MMS)
* EIS: Wasilla Bypass (New Parks Highway)
* Bristol Bay Underdeveloped Commercial Fisheries Potential (ADCRA)
* Fisheries Research Alternatives for the State of Alaska (AVTEC & FITC)

VICE PRESIDENT, OPERATIONS
(1976-1978)

GENERAL PRESS COLORS, Ltd., Addison, Illinois
All phases of production, research, & quality assurance operations for a start-up manufacturer of printing-ink pigment dispersions.

RESEARCH ASSISTANT
(1974-1976)

SCRIPPS INSTITUTION OF OCEANOGRAPHY
and DEPAUL UNIVERSITY, at McMurdo Station, Antarctica
Basic research in marine biology, including winter-over.

Education:

* **Master of Science**, University of Alaska, Fairbanks, 1981
Major: Fisheries Biology *Minor*: Business Management
Research Topic: Effects of Exploitation on Fish Population Dynamics

* **Bachelor of Science**, DePaul University, Chicago, 1973
Major: Biology *Minor*: Chemistry

Certifications:

* **Certified Fisheries Professional**, *American Fisheries Society*

-- continued ⟶

Awards:

* **Antarctic Service Medal of the USA,** *National Science Foundation*
* **Eagle Scout**, *Boy Scouts of America*

Affiliations:

* **American Fisheries Society**
* **Pacific Fisheries Technologists**

Services:

* **Chairman, Board of Directors,** *since* 2011
ALASKA SEALIFE CENTER, Seward

* **Chairman,** *since* 2010
ALASKA MINERS ASSOCIATION, Fisheries Committee

* **Adjunct Faculty,** *since* 1998
UNIVERSITY OF ALASKA, Anchorage
courses in: **Seafood Supply Chain Management** *and* **Fisheries Management**

* **Board of Directors,** *since* 2014
RESOURCE DEVELOPMENT COUNCIL FOR ALASKA, Anchorage

Recent Communications:

Grabacki, S.T. 2011 Environmental Limitations and General Impact on Properties of the Catch and Onboard Quality Systems (2 chapters) *in:* Daczkowska-Kozon, E.G. & B. Sun Pan (eds.) Environmental effects on seafood availability, safety and quality issues. CRC Press

Grabacki, S.T. 2010 Mining And Fisheries; coordinator of a 2-day short course for the annual convention of the Alaska Miners Association, Anchorage

Grabacki, S.T., & P.T. Hanley 2008 The Oil / Fisheries Group Of Alaska -- An Early Example Of Inter-Industry Collaboration *in*: Allee, B.J. (editor) North Aleutian Basin Energy-Fisheries: workshop proceedings. Alaska Sea Grant, University of Alaska Fairbanks

Grabacki S.T. 2008 Sustainable Management Of Alaska's Fisheries: A Primer, A Checklist For Fisheries Resource Management Issues Seen From The Perspective Of The FAO Code Of Conduct For Responsible Fisheries, and several other documents on sustainable Alaska fisheries, available at -- www.alaskaseafood.org/sustainability

Grabacki, S.T., M. Ronchetti, T. Humphrey, & O. Hedgepeth 2006 RFID -- How It Will Transform Packaging, Distribution, and Handling of Alaska Seafood Pacific Fisheries Technologists, Anchorage

Grabacki, S.T. 2005 Fishery Management Regulations and Practices: How They Affect Seafood Quality Collaborative Insights, Global Food Collaborative

Quoter *since* 1995 Weekly Seafood Market Information and Price Quotes, KSKA Public Radio