ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM

PERMIT FACT SHEET – FINAL

Permit Number: AK0053619

Nikiski Combined Cycle Plant

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Wastewater Discharge Authorization Program
555 Cordova Street
Anchorage, AK 99501

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Issuance of an Alaska Pollutant Discharge Elimination System (APDES) permit to:

ALASKA ELECTRIC AND ENERGY COOPERATIVE, INC.

For wastewater discharges from

Nikiski Combined Cycle Plant
Mile 21.5 Kenai Spur Highway
Kenai, AK 99611

The Alaska Department of Environmental Conservation (the Department or DEC) proposes to reissue an APDES individual permit (permit) to the Alaska Electric and Energy Cooperative (AEEC). The permit authorizes and sets conditions on the discharge of pollutants from this facility to waters of the United States. In order to ensure protection of water quality and human health, the permit places limits on the types and amounts of pollutants that can be discharged from the facility and outlines best management practices to which the facility must adhere.

This fact sheet explains the nature of potential discharges from Nikiski Combined Cycle Plant and the development of the permit including:

- information on public comment, public hearing, and appeal procedures
- a listing of proposed effluent limitations and other conditions
- technical material supporting the conditions in the permit
- proposed monitoring requirements in the permit

Appeals Process

The Department has both an informal review process and a formal administrative appeal process for final APDES permit decisions. An informal review request must be delivered within 15 days after receiving the Department's decision to the Director of the Division of Water at the following address:

Director, Division of Water
Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, AK 99501

Interested persons can review 18 AAC 15.185 for the procedures and substantive requirements regarding a request for an informal Department review.

See http://dec.alaska.gov/commish/review-guidance/informal-reviews for information regarding informal reviews of Department decisions.

An adjudicatory hearing request must be delivered to the Commissioner of the Department within 30 days of the permit decision or a decision issued under the informal review process. An adjudicatory hearing will be conducted by an administrative law judge in the Office of Administrative Hearings within the Department of Administration. A written request for an adjudicatory hearing shall be delivered to the Commissioner at the following address:

Commissioner
Alaska Department of Environmental Conservation
410 Willoughby Street, Suite 303
Juneau, AK 99811-1800

Interested persons can review 18 AAC 15.200 for the procedures and substantive requirements regarding a request for an adjudicatory hearing. See http://dec.alaska.gov/commish/review-guidance/adjudicatory-hearing-guidance for information regarding appeals of Department decisions.

Documents are Available

The permit, fact sheet, application, and related documents can be obtained by visiting or contacting DEC between 8:00 a.m. and 4:30 p.m. Monday through Friday at the addresses below. The permit, fact sheet, application, and other information are located on the Department's Wastewater Discharge Authorization Program website: http://dec.alaska.gov/water/wastewater/.

Alaska Department of Environmental Conservation Division of Water Wastewater Discharge Authorization Program 555 Cordova Street Anchorage, AK 99501 (907) 269-6285	Alaska Department of Environmental Conservation Division of Water Wastewater Discharge Authorization Program 410 Willoughby Avenue, Suite 310 Juneau, AK 99801 (907) 465-5180
Alaska Department of Environmental Conservation Division of Water Wastewater Discharge Authorization Program 43335 Kalifornsky Beach Rd. - Suite 11 Soldotna, AK 99669 (907) 262-5210	

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1.0 APPLICANT

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Name of Facility:	Nikiski Combined Cycle Plant
APDES Permit Number:	AK0053619
Facility Location:	Mile 21.5 Kenai Spur Highway, Kenai, AK 99611
Mailing Address:	280 Airport Way, Kenai, AK 99611-5280
Facility Contact:	Mr. Bruce Linton, Environmental Compliance Officer, 907-283-6223

The maps in APPENDIX A to the Fact Sheet show the location of the combined cycle plant and the discharge location.

2.0 FACILITY INFORMATION

The Nikiski Combined Cycle (NCC) Plant, a combined cycle electric generation facility, is owned and operated by Alaska Electric and Energy Cooperative, Inc. (AEEC). AEEC is a member-owned, non-profit electric cooperative with a single member, the Homer Electric Association (HEA). HEA is also a member-owned, non-profit electric cooperative, but it has numerous members consisting of electricity consumers. The NCC power plant is located at Mile 21.5 of Kenai Spur Highway in Kenai, Alaska and supplies power to approximately 23,000 members located in the southern Kenai Peninsula.

Agrium originally constructed the cogeneration portion of the NCC in 1998. In 2008, HEA purchased the cogeneration equipment from Agrium and operated the facility independently as a simple cycle facility, using an underground injection system for wastewater disposal. Conversion of the NCC plant from a simple to a combined cycle electric generation facility began in 2010, and was completed in December 2012. The conversion resulted in waste heat from the natural gas combustion turbine generator (CTG) being routed to the heat recovery steam generator (HRSG), where the heat is used to produce steam. The steam from the HRSG is used to drive a steam turbine generator (STG).

The combined cycle power generation process requires a continuous supply of high purity water. Raw water is obtained from a groundwater well. The groundwater contains dissolved arsenic and copper, and has a variable pH. The groundwater is pumped from the well to an onsite Water Treatment Building (WTB). Sources of wastewater generated within the WTB and discharged through Outfall 001 are described in Fact Sheet Section 2.1.

The NCC plant disposes of domestic wastewater to an approved subsurface onsite system. The previous permit identified wastewater sumps in the STG and CTG buildings as sources of wastewater discharged through Outfall 001. The wastewater, consisting of pump seal leaks, condensate system pressure relief, and wash water, is now collected and pumped to two 2,000 gallon holding tanks, transferred to a vacuum truck and disposed of in a permitted industrial septic facility or an oily water disposal facility as necessary. The STG and CTG holding tanks are not disposed of via Outfall 001, have no connectivity to Outfall 001, and are no longer authorized for discharge in the permit.

2.1 Sources of Wastewater

2.1.1 Water Treatment Building Floor Drains

Wastewater is collected from the sinks and floor drains of the WTB and conveyed to two sumps prior to final discharge through Outfall 001.

2.1.2 Granulated Activated Carbon Filter Backwash

Groundwater from an onsite well and water from the HRSG blow down are conveyed to a 240,000 gallon fire/service water tank. The HRSG blow down contains three steam cycle chemical additives- ChemTreat BL1744 (boiler water internal treatment), ChemTreat BL1280 (oxygen scavenger) and ChemTreat BL1552 (corrosion inhibitor). The fire/service water tank provides water for pretreatment via a granulated activated carbon (GAC) filter. The GAC filter is used to adsorb natural organic compounds. The GAC filter media bed is backwashed periodically using reverse osmosis (RO) feed water when a pressure drop across the GAC bed is noted. GAC backwash is collected in a 2,500 gallon holding tank where solids settle out. Settled GAC backwash water is then decanted for final discharge via Outfall 001. The GAC backwash tank sludge is periodically removed and disposed offsite.

2.1.3 First Stage Reverse Osmosis Reject

Water treated by the GAC filter is referred to as “reverse osmosis (RO) feed water.” RO feed water is disinfected via ultraviolet (UV) lights and then stored in a 220 gallon RO feed tank, treated with RO scale inhibitor (ChemTreat RL9007) via an anti-scalant injection system, and processed through the first stage of the RO filtration system. The first stage RO reject water is conveyed to the lift station sump for discharge through Outfall 001.

The first stage RO permeate is pH adjusted using a sodium hydroxide solution (Univar 50% sodium hydroxide) and processed through the second stage RO membranes. The second stage RO reject stream is recycled back to the RO feed water tank. The second stage RO permeate is stored in a 100,000 gallon tank. The RO system is operated in an “on/off” condition, as required to maintain the 100,000 gallon water level in the demineralized water storage tank, resulting in intermittent generation of RO reject water.

2.1.4 RO membrane cleaning waste

The RO system is equipped with a clean in place (CIP) system, used to clean the RO membranes and allow reuse. CIP, as opposed to dissembling the system, saves significant labor and time. The CIP system uses cleaning chemicals ChemTreat RL2016 and RL21700 for low and high pH membrane cleaners, respectively, to remove scaling and fouling. A liquid biocide product, Chemical Treatment CL206 produced by ChemTreat, is applied to the membranes to reduce red slime forming bacteria. Sodium bisulfite is introduced into the effluent stream to counteract any residual toxicity of the CL206.

2.2 Outfall Characteristics

The lift station effluent sump is 72 inches in diameter and has a maximum water level of approximately 36 inches. The resulting maximum water volume capacity is 634 gallons. Effluent is discharged to Cook Inlet at an average flow rate of 9 to 10 gallons per minute. There are periods of no discharge when the pump shuts off while the sump refills. The discharge sump measures discharge flow, temperature and pH. The WTB has an effluent sample point, a refrigerated flow weighted compositor and a sink where effluent samples are collected and tested.

The discharge line extends from the discharge sump approximately 0.5 miles to the outfall. The four inch diameter high-density polyethylene (HDPE) pipe outfall is located approximately 1,016 feet from the mean lower low water (MLLW) shoreline of Cook Inlet. The vertically oriented diffuser extends approximately 10 feet above the seafloor, with three discharge ports located at the two, three, and four feet elevation on the stem pipe (depths of approximately -31 feet MLLW, -32 feet MLLW, and -33 feet MLLW). The diffuser diameter tapers from four to three inches prior to the diffuser ports. Ports are equipped with Tideflex® TF-2 “duckbill” check valves to prevent inflow of seawater and provide protection from clogging. The diffuser assembly is anchored in place, embedded at least 20 feet into the hardpan of Cook Inlet and protected by a steel H-pile. The diffuser structure is located at 60.6759293° North latitude, -151.3953853° West longitude.

2.3 Pollutants of Concern

Pollutants of concern expected to be present in the effluent of the NCC plant are: temperature, pH, Total Suspended Solids (TSS), copper, total residual chlorine (TRC), whole effluent toxicity (WET), oil and grease, arsenic, five day biochemical oxygen demand (BOD_5), total organic carbon (TOC), sulfate, ortho-phosphate, barium, iron, magnesium, manganese, and zinc. Pollutants of concern in the effluent were identified by EPA effluent limit guidelines (ELGs) such as the steam electric power plant ELGs at 40 CFR part 423, laboratory analytical results provided by the applicant in the permit application process, and water quality based effluent limits (WQBELs) implemented in the previous permit. Pollutants detected in five analytical monitoring events performed by AEEC in October 2016 for permit reissuance are depicted in Table 1. Effluent pollutant concentrations submitted per the previous permit discharge monitoring reports (DMRs) are depicted in Table 2. Volatile and semi-volatile organic compounds were not detected in the NCC power plant effluent. WET testing information is presented in Fact Sheet Section 5.4.

Table 1: Detected Pollutants, October 2016

Pollutant	Units[a]	10/25/16	10/26/16	10/27/16	10/31/16	10/31/16
Barium[b]	µg/L	10.3	10.4	9.9	15.6	16.4
BOD_5[b]	mg/L	Non Detect (ND)	ND	ND	3.07	2.34
Iron[b]	µg/L	ND	ND	287	1,030	1,110
Magnesium[b]	mg/L	16.3	15.6	14.2	11.9	11.7
Manganese	µg/L	11.7	36.8	104	460	463
Ortho-Phosphate[b]	mg/L	1.92	2.07	2.05	1.41	1.42
Sulfate[b]	mg/L	9.36	8.41	7.68	6.36	6.37
TOC[b]	mg/L	2.79	2.95	2.71	2.31	2.2
Zinc	µg/L	11.3	13	17	40.6	41.5

Footnotes:
a. µg/L = micrograms per Liter; mg/L = milligrams per liter
b. There are no applicable marine water quality standard numeric criteria for this pollutant.

Table 2: Effluent Data Summary, April 2013-April 2018

Pollutant	Units[a]	Minimum	Maximum	Average[b]
Temperature	°C	1.3	29.9	17.4
pH, Minimum	SU	6.5	8.4	7.8
pH, Maximum	SU	7.4	8.6	8.3
TSS	mg/L	ND	39.5	4.7
Oil and grease	mg/L	ND	8.5	4.7
Arsenic	µg/L	21.2	65.4	40.7
Copper	µg/L	1.4	12.1	3.8
Total Residual Chlorine (TRC)	mg/L	ND	0.13	0.12[c]

Footnotes:
a. °C = degrees Celsius; SU = standard units; µg/L = micrograms per Liter; mg/L = milligrams per liter
b. Average of detected values.
c. Only two detected results of TRC occurred, the other 59 samples were ND.

3.0 PERMIT BACKGROUND

AEEC applied for an APDES permit in January 2011, and subsequently revised the application in October 2011. APDES permit AK0053619 was issued to AEEC effective June 1, 2012 and expired at midnight on May 31, 2017. AEEC applied for permit reissuance as required on December 2, 2016, prior to the December 3 application deadline. The timely application for a new permit was submitted, therefore, the 2012 permit was administratively continued by the Department in May 2017 and remains in effect and enforceable until such time as a new permit is reissued.

A summary of effluent values from the time period April 2013 to April 2018 is depicted in Table 2. The facility reported no discharge for the months of September 2014 and October 2014. Because the technology based effluent limits (TBELs) for steam electric power plants contain a narrative prohibition against polychlorinated biphenyls (PCBs), AEEC tests for PCBs once per year. PCBs have not been detected in the NCC power plant effluent and there are no transformers containing PCBs onsite.

4.0 COMPLIANCE HISTORY

Discharge Monitoring Reports (DMRs) from April 2013 to April 2018 were reviewed to determine the facility's compliance with effluent limits. DMRs submitted from April 2013 to November 2013 did not correctly calculate or report pollutant mass loadings in pounds per day, however none of the reporting errors corresponded with effluent limit violations. Subsequent DMRs illustrate that AEEC began correctly reporting and calculating mass loadings. The facility was inspected by the Environmental Protection Agency (EPA) on June 22, 2015. EPA issued a warning letter to AEEC on August 3, 2016 to apprise the permittee of violations found during a review of administrative records, including DMRs. Findings in the warning letter included:

- lack of a required quarterly total recoverable copper sample in the second quarter of 2013,
- lack of a required chronic toxicity test for the summer (June 1- September 30) of 2014,
- failure to provide the annual certification of the Best Management Practices (BMP) plan for the years 2013 and 2014,
- composite sampling that occurred over a 7 hour period as opposed to the required 24 hour period,
- violation of hold times for TRC samples, and

The warning letter encouraged AEEC to continue efforts to maintain full knowledge of the permit requirements and other appropriate statutes. Table 3 summarizes permit limitation exceedances during the time period April 2013 to April 2018. A noncompliance notification does not appear to have been submitted for the August 2016 TSS effluent limit violation.

Table 3: Effluent Violations April 2013 – April 2018

Violation Date	Pollutant	Permit Limit	Reported Value
August 2016	TSS	30 mg/L monthly average	39.5 mg/L
May 2015	pH	8.5 SU maximum	8.61 SU

5.0 EFFLUENT LIMITS AND MONITORING REQUIREMENTS

5.1 Basis for Permit Effluent Limits

The Clean Water Act (CWA) requires that the limits for a particular pollutant be the more stringent of either TBELs or WQBELs. TBELs are set according to the level of treatment that is achievable using available technology. A WQBEL is designed to ensure that the Alaska Water Quality Standards (WQS) of a water body are met. WQBELs may be more stringent than TBELs. Both TBELs and WQBELs are included in the permit.

The applicable TBELs are found in Title 40 Code of Federal Regulations (CFR) § 423, Effluent Limit Guidelines (ELG) for the Steam Electric Power Generating Point Source Category. The monitoring data used to calculate the WQBELs was supplied in the permit application. Note that permit limits were only included for those parameters that either had an applicable ELG or showed reasonable potential at the boundary of the mixing zone. The basis for the proposed effluent limits in the permit is provided in Fact Sheet APPENDIX B.

5.2 Basis for Effluent and Receiving Water Monitoring

In accordance with Alaska Statutes (AS) 46.03.101(d), the Department may specify in a permit the terms and conditions under which waste material may be disposed. Monitoring in permits is required to determine compliance with effluent limits. Monitoring may also be required to gather effluent and surface water data to determine if additional effluent limits are required and/or to monitor effluent impact on receiving waterbody quality. The permittee is responsible for conducting the monitoring and for reporting results on DMRs or on the application for reissuance, as appropriate, to the Department. Fact Sheet Sections 5.3, 5.4 and 5.5 summarizes monitoring requirements DEC has determined necessary to implement in the permit.

5.3 Effluent Limits and Monitoring Requirements

The permit requires monitoring of the effluent that is discharged through Outfall 001 for flow, TSS, Oil & Grease, pH, TRC, temperature, PCBs and copper to determine compliance with the permit effluent limits. See Fact Sheet Appendices B, C and D for more details regarding the legal and technical basis surrounding the selection of effluent limits.

The TRC effluent limits in the permit are more stringent than the previous permit. The previous permit implemented a WQBEL for TRC as AEEC originally intended to use sodium hypochlorite to disinfect service water prior to filtration by the GAC filter. AEEC found that sufficient disinfection was achieved using the ultraviolet (UV) disinfection unit after the GAC filter but prior to the RO filters. The TRC water quality standards (WQS) numeric criteria for affects to aquatic life for marine water are 13 µg/L acute and 7.5 µg/L chronic, which are not quantifiable using EPA-approved analytical methods.

DEC uses the minimum level (ML) of 0.1 mg/L as the compliance evaluation level for TRC. This is consistent with EPA guidance in numerous documents including the Technical Support Document for Water Quality-based Toxics Control (TSD) that states that the recommended approach for these situations is to include the calculated limit in the permit regardless of the proximity of the limit to the analytical detection level. This is consistent with regulations at 18 AAC 83.455 that require permit limits to be protective of water quality standards. The limit should also contain an accompanying requirement that any sample analyzed in accordance with an approved analytical method that can achieve the compliance evaluation level will be deemed in compliance with the effluent limit. TRC is not an intentional component of the NCC plant process, however, two of the 59 monthly effluent monitoring analytical results for TRC showed detected values of 0.13 mg/L (January 2016) and 0.1 mg/L (April 2013). Because TRC was detected in the effluent, the Department retained a WQBEL for TRC. However, the Department revised the WQBEL to reflect that TRC is not expected to be present in the effluent the majority of the time and reduced the monitoring frequency from monthly to once per quarter. More information on TRC is available in Fact Sheet APPENDIX B, section B.3.3.3.

Temperature monitoring frequency was increased from once per week to five times per week. The permittee is already recording temperature at this frequency, therefore the permit requirement formalizes the reporting of that data. The Department conducted a RPA on the NCC plant's effluent temperature data and determined temperature has reasonable potential to exceed the marine WQS numeric criteria. Temperature was the pollutant in the chronic mixing zone that required the largest dilution to meet WQS, therefore the permit implements a new WQBEL for temperature. Temperature was examined consistent with the narrative WQS as the difference between the effluent temperature and the receiving

water temperature, referred to as delta T (ΔT). More information on temperature is available in Fact Sheet APPENDIX B, section B.2.4.4.

In addition, the permit requires monitoring of the effluent for arsenic, zinc, manganese and Whole Effluent Toxicity (WET) in order to conduct future reasonable potential analyses (RPA) for these pollutants. Three of the five manganese laboratory results submitted with the permit application exceeded the human health numeric criteria for manganese of 100 µg/L. Accordingly, the permit now requires quarterly monitoring for manganese. The manganese samples were all collected during the same week and the results are highly variable. The human health criteria for manganese is organoleptic-based (intended to minimize objectionable qualities like undesirable taste, staining, etc) rather than based on toxic effects. The permit also requires quarterly monitoring for zinc. Zinc was detected in every sample and the highest concentration was almost half of the chronic aquatic life water quality standard numeric criteria. This will allow time for more data to be collected to inform a more robust and accurate RPA in the next permit issuance that characterizes the presence and variability of concentrations of manganese and zinc in the effluent over the course of several years.

The frequency of monitoring for arsenic has been reduced from monthly to quarterly. The highest observed concentration of arsenic was 65.4 µg/L. The concentrations consistently measured on a monthly basis range from 21.2 µg/L to 65.4 µg/L with an average concentration of 40.7 µg/L. The aquatic life WQS numeric criteria for arsenic are 36.05 µg/L chronic and 68.55 µg/L acute. Arsenic has reasonable potential to exceed the WQS numeric criteria and is included in the mixing zone, but quarterly monitoring will be sufficient to inform the reasonable potential analysis in the next permit issuance.

The permittee is required to notify the Department if new chemical additives are added to the process waters 30 days prior to their anticipated use and supply necessary information for the Department to evaluate. Necessary information includes a description of the treatment to be employed and its purpose, the name and manufacturer, a list of active ingredients and their percentage of composition, material safety data sheets, a proposed schedule and quantity of chemical usage, an engineering analysis or technical evaluation of the active ingredients to determine their concentration in the discharge and available aquatic toxicity information for each proposed additive.

Monitoring frequencies are based on the nature and effect of a pollutant, as well as a determination of the minimum sampling necessary to adequately monitor the facility's performance. Permittees have the option of taking more frequent samples than are required under the permit. These additional samples must be included in calculations and used for averaging if they are conducted using the Department-approved test methods (generally found in 18 AAC 70 and 40 CFR §136 [adopted by reference in 18 AAC 83.010]) and if the method detection limits are less than the effluent limits.

Table 4 contains Outfall 001 effluent limits and monitoring requirements. Table 5 contains parameters for which effluent limits or monitoring requirements have changed since the previous permit.

Table 4: Outfall 001: Effluent Limits and Monitoring Requirements

Parameter	Effluent Limits				Monitoring Requirements	
	Daily Minimum	Monthly Average	Daily Maximum	Units[a]	Sample Frequency	Sample Type
Total Discharge Flow[b]	N/A	Report	50,400	GPD	Continuous	Recorded
TSS	N/A	30.0	100.0	mg/L	1/Month	24-hour Composite[d]
	N/A	12.6	42.0	lbs/day[c]		Calculated
Oil & Grease[e]	N/A	15.0	20.0	mg/L	1/Month	Grab
	N/A	6.31	8.41	lbs/day		Calculated
pH	6.5	N/A	8.5	SU	5/Week	Grab
TRC	N/A	7.5[f]	13[f]	µg/L	1/Quarter	Grab
Temperature	N/A	27.9	36.2	°C	5/Week	Grab
PCBs[g]	N/A	N/A	No Discharge	µg/L	1/Year	24-hour Composite
Arsenic[h]	N/A	N/A	Report	µg/L	1/Quarter	24-hour Composite
Copper[h]	N/A	8.28	17.09	µg/L	1/Month	24-hour Composite
	N/A	3.48	7.18	lbs/day		Calculated
Manganese[h]	N/A	N/A	Report	µg/L	1/Quarter	24-hour Composite
Zinc[h]	N/A	N/A	Report	µg/L	1/Quarter	24-hour Composite
WET	N/A	N/A	Report	TU_c	2/Year[i]	24-hour Composite

Footnotes:

a. GPD = gallons per day; lbs/day = pounds per day; °C = degrees Celsius; SU = standard units; µg/L = micrograms per Liter; mg/L = milligrams per liter; TUc = Toxic Units, chronic.
b. The total wastewater discharge flow shall not exceed the maximum hydraulic design flow rate approved in the Final Approval to Operate issued by the Department. Final Approval to Operate means that the Department has reviewed and approved the wastewater treatment works engineered plans submitted to the Department in accordance with 18 AAC 72.210 through 18 AAC 72.285.
c. Mass limitations are based on an effluent discharge volume of 35 gallons per minute and are expressed in pounds per day (lbs/day).
d. Composite samples must consist of at least eight grab samples collected at equally spaced intervals and proportionate to flow so that composite samples reflect effluent quality during the compositing period.
e. Effluent sampling to take place when discharging turbine building wash.
f. The TRC effluent limits are not quantifiable using EPA-approved analytical methods. DEC will use the minimum level (ML) of 0.1 mg/L as the compliance evaluation level for this parameter.
g. There shall be no discharge of polychlorinated biphenyl compounds such as those commonly used for transformer fluid (40 CFR §423.15(b))
h. All metals shall be reported as total recoverable.
i. Twice per year consists of one sample taken in the second quarter (April 1-June 30) and one sample taken in the 4th quarter (October 1-December 31).

Table 5: Effluent Monitoring and Limit Changes from Previous Permit

Parameter	Units	Average Monthly Limit		Maximum Daily Limit		Sample Frequency	
		2012 Permit	Current Permit	2012 Permit	Current Permit	2012 Permit	Current Permit
Copper	µg/L	Report	8.28	Report	17.09	1/Quarter	1/Month
TRC	mg/L	26	0.0075	52	0.013	1/Month	1/Quarter
Arsenic	µg/L	Report	Report	Report	Report	1/Month	1/Quarter
Temperature	°C	Report	27.9	Report	36.2	1/Week	5/Week
Manganese	µg/L	N/A	Report	N/A	Report	Application Testing	1/Quarter
Zinc	µg/L	N/A	Report	N/A	Report	Application Testing	1/Quarter

5.4 Whole Effluent Toxicity Monitoring

18 AAC 83.435 requires that a permit contain limitations on WET when a discharge has reasonable potential to cause or contribute to an exceedance of a WQS. WET tests use small vertebrate and invertebrate species to measure the aggregate toxicity of an effluent. Chronic toxicity tests measure reductions in survival, growth, and reproduction over a two (bivalve) or seven (topsmelt) day exposure. The permittee shall conduct chronic toxicity monitoring once during the permit term as specified in the permit and according to the methods approved by EPA in *Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms*, 1995, EPA 600-R-95-136.

The previous permit required WET tests to be performed twice per year, once during the summer (June-September) and once during the winter (October-May). The permit originally required testing two species; the oyster, *Crassostrea gigas* and the topsmelt, *Atherinops affinis.* The permit allowed for the permittee to propose alternative species if screening was performed first. After the permit issuance, the permittee indicated that both permit-required WET test species were not available on a dependable basis at the chosen WET testing facility. With Department approval, the permittee substituted bay mussels, *Mytilus galloprovincialis* for the oyster and inland silverside, *Menidia beryllina*, for the topsmelt.

The previous permit required a WET dilution series of 100%, 0.05%, 0.025%, 0.014%, 0.007% and a control, for the silverside, and 70%, 0.05%, 0.025%, 0.014%, 0.007% and a control for the bay mussel. As the discharge occurs to marine waters, but the effluent is fresh water, the salinity of the effluent had to be adjusted by the WET laboratory. Salinity adjustment occurred via hypersaline brine addition for the bay mussel and sea salts for the inland silverside. This resulted in a maximum concentration of effluent tested of 70% for the bay mussel and 100% for the inland silverside.

Toxicity was not observed in any of the nine WET tests performed on the inland silverside, even at 100% effluent concentration. The previous permit contained a provision that the permittee could request to cease WET tests if four consecutive sample results indicated no toxicity. Accordingly, the permittee contacted DEC and requested permission to cease WET tests for the inland silverside in April 2017. The Department granted this request in part, requesting that the permittee conduct one more inland silverside test in May 2017 and then granted permission to cease inland silverside testing.

The bay mussel WET tests provided different results illustrating it was the more sensitive species to the NCC power plant effluent. Specifically, no toxicity was observed for the larval survival of the bay mussels during the course of nine WET tests, but five of the nine tests resulted in a no observed effects concentration (NOEC) of 0.05% effluent for normality/survived, meaning that chronic toxicity could be occurring somewhere in the broad range of 0.05% effluent and 70% effluent.

The previous permit chronic dilution factor was 7,000:1, making the WET dilution series fairly broad. Accordingly, a WET RPA was not performed as the Department's understanding of the pollutants of concern in the discharge have changed, as has the mixing zone chronic dilution factor, which determines the dilution series of the WET tests. The Department determined the receiving water concentration (RWC) based off of the dilution required for copper to meet the WQS chronic aquatic life numeric criteria, which is 7.7:1. This is appropriate as although temperature requires the most dilution to reach WQS in the chronic mixing, it is not a toxic pollutant. The purpose of WET testing is to assess the aggregate toxic effect of an effluent. Although chemical-specific effluent limits and monitoring are included in the permit, toxicity testing is needed to address chemical interactions/aggregate toxicity of the effluent. Accordingly, the RWC is 13% (100/7.7).

It is reasonable to assume that chronic toxicity could exist in the NCC power plant effluent and the Department is including more robust accelerated testing permit requirements in the permit. The previous permit did not include accelerated testing requirements beyond requiring that the permittee contact the Department if toxicity greater than 1.0 TUc was observed. Given the results for normality of the bay

mussel and the significantly reduced chronic dilution factor, the permit includes more prescriptive requirements for accelerated testing of the effluent if toxicity is greater than 7.7 TUc in any test. The permit requires that if the permittee demonstrates through an evaluation of facility operations that the cause of an exceedance is known and corrective actions have been implemented, only one accelerated test is necessary. If the cause of the exceedance is unknown, two more biweekly WET tests be conducted over a four week period.

If toxicity is greater than 7.7 TUc in any of the accelerated tests, the permittees must initiate a Toxicity Reduction Evaluation (TRE). A TRE is required so that the specific cause of the toxicity can be identified and mitigated (see Permit Section 1.3.3 for further details). If a TRE is initiated, a toxicity identification evaluation (TIE) may also be initiated and must be performed in accordance with EPA guidance manuals, *Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I* (EPA/600/6-91/005F, 1992); *Methods for Aquatic Toxicity Identification Evaluations, and Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity* (EPA/600R-92/080, 1993).

The WET dilution series was determined consistent with guidance specified in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms*, "West Coast Methods", EPA/600/R-95/136, August 1995. The West Coast Methods recommend that RWC of < 25% effluent have a dilution series of the RWC bracketed by: 1) four times the RWC (52), 2) two times the RWC (26%), 3) RWC/2 (6.5%), and 4) RWC/4 (3.25%). Accordingly, the dilution series implemented in the permit is 52%, 26%, 13%, 6.5% 3.25% effluent and a control.

WET testing will continue to be required twice per year, one test required to be performed in the second quarter (during the timeframe April 1- June 30) and one test required to be performed in the fourth quarter (during the timeframe October 1-December 31) each year the permit is in effect. The Department adjusted the timing of the WET monitoring to coincide with months with the highest effluent copper and arsenic concentrations, as well as months in which a higher possibility of chronic toxicity was observed in previously performed WET tests (when the NOEC was between 70%-0.05%). WET testing will provide the data necessary to ascertain if WET limits are necessary in subsequent permit reissuances and to ensure the discharge is not imparting toxicity in the receiving water. The quantities of pollutants can be analytically determined; however, these measurements may not be able to specifically identify observable toxic responses, biological availability, and complex interactions within the effluent..

5.5 Receiving Water Limits and Monitoring Requirements

The previous permit required sampling of the receiving water for TRC, temperature, and arsenic at the boundary of the mixing zone and immediately above the diffuser structure twice per year. TRC was not detected in the receiving water. Because TRC was not detected in the receiving water and TRC is no longer expected to be present in the effluent in significant concentrations, TRC is no longer required to be monitored in the receiving water.

Arsenic was detected in one sampling event in a concentration of 49.5 µg/L at the boundary of the mixing zone. The thirteen other analytical samples collected above the outfall or at the boundary of the mixing zone did not detect arsenic above the limit of quantitation. The limit of quantitation of the receiving water arsenic analytical results ranged from 5-125 µg/L. Because arsenic was detected in the receiving water and because the sampling was not sufficiently sensitive in all cases to determine compliance with the most stringent WQS chronic numeric criteria for arsenic in aquatic life for marine water (36 µg/L chronic), the requirement to sample arsenic in the receiving water was retained.

The permittee performed temperature monitoring of the receiving water twice per year. Results varied seasonally from 3.4 °C to 13 °C and correlated with the National Oceanic and Atmospheric Administration (NOAA) National Data Buoy Center Station NKTA2 data collected less than a kilometer away from the NCC plant outfall. The Department is no longer requiring the permittee to collect

temperature data in the receiving water. Temperature data can be obtained from the existing NKTA2 buoy.

The Department is requiring total recoverable copper, zinc, and manganese monitoring of the receiving water to inform a RPA for those pollutants in the next permit issuance.

Table 6: Receiving Water Monitoring Requirements

Parameter [a]	Units	Frequency	Sample Type
Arsenic	µg/L	Twice per year [b]	Grab
Manganese			
Copper			
Zinc			

Footnotes:

a. All metals shall be reported as total recoverable.

b. Twice per year consists of taking one sample in the summer months (June 1– September 30) and one sample in the winter months (October 1-May 31), a minimum of 60 days apart.

6.0 RECEIVING WATER

6.1 Description of Receiving Water Body

Cook Inlet is a 217 mile (350 kilometer) long, narrow, and semi-enclosed waterbody that has a free connection to the open ocean with a general northeast-southwest orientation. The inlet is divided naturally into the upper and lower regions by the East and West Forelands, where Cook Inlet is approximately 10 miles (16 kilometers) wide. The East and West Forelands constrict water flow and influence the movement of water. Cook Inlet, and its channels, coves, flats, and marshes, are a mixture of terrestrial sources from numerous river drainages and marine waters of Shelikof Strait and the Gulf of Alaska. Tidal components are responsible for mixing freshwater inputs from rivers within Cook Inlet and from the Alaska Coastal Current entering Cook Inlet at Kennedy Entrance. Cook Inlet varies in width from about 62 miles (100 kilometers) near the entrance to less than 12 miles (20 kilometers) at its head. Shoals are present towards the head of the inlet where it separates into two narrow shallow arms (Knik and Turnagain) (DEC 2014).

6.2 Outfall Location

The permittee discharges effluent into Cook Inlet at a depth of approximately 30 feet below MLLW at 60.6759293° North latitude, -151.3953853° West longitude. The outfall is designated in the permit as Outfall 001.

6.3 Water Quality Standards

Regulations in 18 AAC 70 require that the conditions in permits ensure compliance with the Alaska WQS. The State's WQS are composed of use classifications, numeric and/or narrative water quality criteria, and an Antidegradation Policy. The use classification system identifies the designated uses that each waterbody is expected to achieve. The numeric and/or narrative water quality criteria are the criteria deemed necessary by the state to support the designated use classification of each waterbody. The Antidegradation Policy ensures that the existing water uses and the level of water quality necessary to protect the uses are maintained and protected.

Waterbodies in Alaska are protected for all uses unless the water has been reclassified under 18 AAC 70.230, as listed under 18 AAC 70.230(e). Some waterbodies in Alaska can also have site–specific water quality criterion per 18 AAC 70.235, such as those listed under 18 AAC 70.236(b).

The receiving water, Cook Inlet (near Port Nikiski), has not been reclassified pursuant to 18 AAC 70.230, nor does it have site-specific water quality criteria pursuant to 18 AAC 70.235. Therefore, Cook Inlet must be protected for all marine water uses listed in 18 AAC 70.020(a)(2). These marine water use classes consist of the following: aquaculture, seafood processing, and industrial water supply; contact and secondary water recreation; the growth and propagation of fish, shellfish, other aquatic life, and wildlife; and, the harvesting for consumption of raw mollusks or other raw aquatic life.

6.4 Water Quality Status of Receiving Water

Any part of a water body for which the water quality does not or is not expected to meet applicable WQS is defined as a "water quality limited segment" and placed on the state's impaired water body list. For an impaired water body, Section 303(d) of the CWA requires states to develop a Total Maximum Daily Load (TMDL) management plan. The TMDL documents the amount of a pollutant a water body can assimilate without violating a state's WQS and allocates that load to known point sources and nonpoint sources.

Cook Inlet (near Port Nikiski) is not included on the *Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report*, July 15, 2010, nor to a proposed or approved TMDL.

6.5 Mixing Zone Analysis

In accordance with state regulations at 18 AAC 70.240, as amended through June 26, 2003, the Department may authorize a mixing zone in a permit. A chronic mixing zone is sized to protect the ecology of the waterbody as a whole and an acute mixing zone is sized to prevent lethality to passing organisms.

The permittee submitted a mixing zone model to the Department on December 2, 2016. The permittee utilized the Cornell Mixing Zone Expert System (CORMIX) version 11.0 modeling program to predict the effluent concentrations of pollutants and thermal heat transfer in the area surrounding the outfall location in Cook Inlet at a maximum design discharge volume of 35 gallons per minute.

The NCC plant utilizes a vertically oriented diffuser with three-two inch diameter discharge ports fitted with Tideflex "duckbill" check valves affixed to a three inch diameter HDPE pipe. This configuration of a vertically oriented, multiport diffuser is a design that is not immediately accommodated in CORMIX 2 for multiport discharges, as CORMIX 2 assumes that multiport discharges emit from a horizontally oriented diffuser. Accordingly, the CORMIX proprietors advise modelling vertical multi-port diffusers with CORMIX1 for single port discharges. This approach is also appropriate since the diffuser ports are only spaced one foot apart. To account for the presence of three discharge ports into a mixing zone model that only accommodates one discharge port, CORMIX advises modelling a single port that has the equivalent port area/diameter as all three ports on the diffuser (Mixzon, 2018) to avoid overestimating the dilution a single port would offer over the three ports that exist on the diffuser. The permittee calculated the area of three circular two inch diffuser ports and modelled a single port area of 9.42 square inches, which equates to a port with a 3.46 inch diameter.

The permittee supplied data from a National Oceanic and Atmospheric Administration (NOAA) current survey of Cook Inlet conducted from July 15, 2008 to September 1, 2008. The station was located approximately 950 meters south west of the NCC outfall. The study concluded that the 90th percentile current speed was 1.68 meters per second (m/s), the 10th percentile current speed was 0.29 m/s and the 50th percentile current speed was 1.08 m/s.

The permittee evaluated mixing for pollutants of concern under a variety of six worst case conditions. The permittee concluded that copper required the most dilution to meet acute WQS, manganese required the most dilution to meet human health criteria, and that the thermal plume met temperature WQS within four meters of the diffuser. The permittee requested an acute mixing zone driven by copper with a length of 0.2 meters and a width of 0.1 meters, a chronic mixing zone driven by manganese 2.98 meters

long and 0.4 meters wide and a thermal mixing zone 0.8 meters long and 0.2 meters wide. The permittee relied on the 10th and 90th percentile currents in their modelling.

The final mixing zones authorized by the Department differ slightly in size than those of the permittee, but preserve the majority of model inputs provided. During the course of the Department's mixing zone model review, DEC consulted with the permittee on some model inputs such as the sigma angle (horizontal angle between the projection of the port centerline onto the horizontal plane and the direction of ambient flow) and the permittee agreed to the Department's suggested minor model input adjustments for those items and the final authorized mixing zones reflect these modified model inputs. Key model inputs are summarized in Table 7.

Table 7: Summary of CORMIX1 Model Inputs

Parameter Modeled	Maximum Expected Concentration	Ambient Concentration /Temperature	Chronic Water Quality Criterion /Temperature	Acute Water Quality Criterion
Copper	15.35 µg/L	1.75 µg/L	4.05 µg/L	1.99 µg/L
Temperature	29.9°C	0°C	1°C	N/A
Outfall and Receiving Waterbody Characteristics				
Outfall Type and Length	309.7(from MLLW) meters long outfall with a submerged vertically oriented multiport diffuser modelled as a single port			
Depth at Discharge	13.7 meters			
Number and Size of Ports	1 port 3.46 inches (0.0879 meters) diameter			
Port Height above Seabed	13.7 meters			
Density	1019.84 kilograms per cubic meter (kg/m^3)			
Ambient Velocity	0.29 meters per second 10th percentile 1.08 meters per second 50th percentile 1.68 meters per second 90th percentile			
Wind Velocity	3.3 meters per second			
Effluent Characteristics				
Flow Rate	0.00221 cubic meters per second (m^3/s)			
Temperature	11°C summer/4°C winter			

As described in further detail in Fact Sheet Section 5.3, the Department opted to require additional effluent monitoring data for manganese to appropriately characterize its variability in the effluent and conduct a robust RPA in the next permit issuance rather than develop a WQBEL for manganese and include it in the mixing zone.

The final mixing zone model selected for temperature differed slightly. The Department implemented the temperature WQS numeric criteria by calculating the delta T (ΔT) difference between the effluent and receiving water temperature and compared the largest observed ΔT to the WQS numeric criteria for marine temperature, which the Department assumed was 1°C, calculated off the assumption that the

smallest observed non-negative ambient temperature was 0°C. More details about ΔT can be found in Fact Sheet APPENDIX B, Section B.3.3.4. The Department modelled ΔT in both summer and winter seasons and concluded that winter was the critical season where the difference between the ambient and effluent temperature was the highest. The discharge was modelled both as a concentration and as a thermal discharge and both modelling efforts produced the same results, a chronic mixing zone for temperature with a width of 0.44 meters (sized from the 10th percentile current speed) and a length of 6.7 meters (sized from the 90th percentile current speed).

Copper was modelled according to guidance in the CORMIX User Manual as well, with the discharge concentration entered as an amount above ambient by subtracting the ambient concentration from the effluent and WQS numeric criteria (17.1µg/L – 1.75 µg/L = 15.35 µg/L). The ambient concentration was the 85th percentile concentration of ambient copper data provided by nearby APDES permitted facilities, 1.75 µg/L total recoverable. The ambient concentration was subtracted from the WQS numeric criteria for acute and chronic aquatic life (5.8 µg/L – 1.75 µg/L = 4.05 µg/L acute, 3.7 µg/L-1.75 µg/L = 1.95 µg/L chronic).

Appendix E, Mixing Zone Analysis Checklist, outlines criteria that must be considered when the Department analyzes a permittee's request for a mixing zone. These criteria include the size of the mixing zone, treatment technology, existing uses of the water body, human consumption, spawning areas, human health, aquatic life, and endangered species. All criteria must be met in order to authorize a mixing zone. The following summarizes this analysis:

6.5.1 Mixing Zone Size.

In accordance with 18 AAC 70.255, the mixing zone must be as small as practicable. In order to ensure that the mixing zone is as small as practicable, DEC used CORMIX to model the chronic and acute mixing zones at various critical tidal velocities, effluent temperatures, effluent flow rates and ambient density profiles. 18 AAC 70.245(b)(5) requires the Department to consider the characteristics of the effluent after treatment of the wastewater. DEC reviewed the most recent five years of DMRs from April 2013 to April 2018 and NCC's wastewater discharge application, Form 2C, to determine which parameters had RP to exceed WQ criteria at the end of pipe, and then which of the parameters required the most dilution to meet WQ criteria for the chronic and acute mixing zones.

The previous permit authorized a circular acute mixing zone with a radius of six meters and dilution factor of 4000:1. The chronic mixing zone was also circular with a radius of eight meters from the diffuser with an associated dilution factor of 7000:1. The mixing zone was authorized for temperature, copper, arsenic and TRC, but TRC was the driving parameter of both mixing zones.

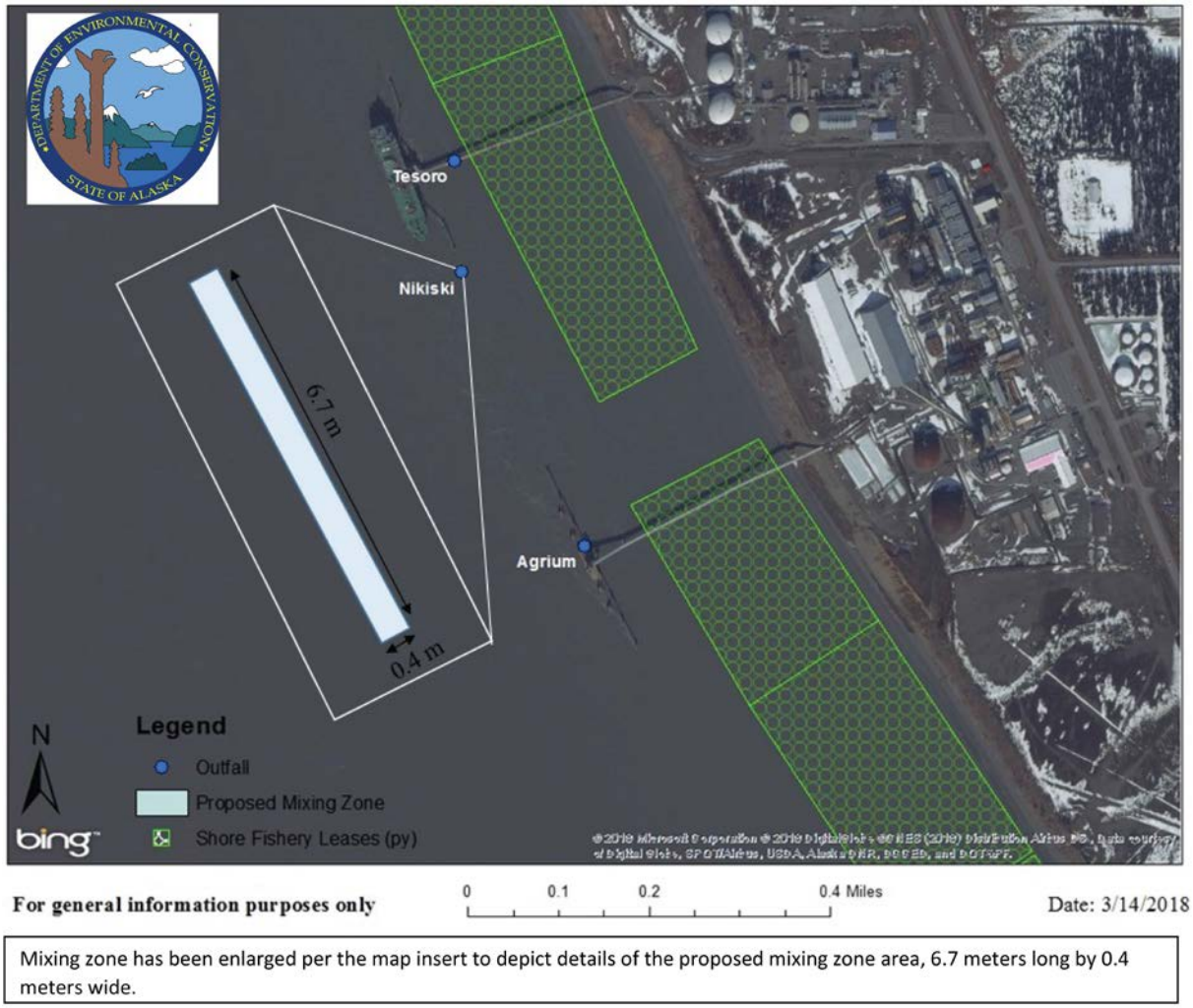
Model boundary conditions include position of the outfall structure and effluent port diameter. Variables include effluent discharge velocity, temperature, salinity, and estimated pollutant concentrations. Conservative (worst case) effluent conditions were used as effluent input variables. Cook Inlet ambient data were used to incorporate temperature, salinity, and current speeds in the Nikiski area. The model was run to simulate both summer and winter cases during such times where both effluent and ambient conditions differ. Six simulation scenarios were modeled. The first case simulated summer conditions at 10th percentile current speeds for copper, the second simulates summer conditions at 90th percentile current speeds for copper, the third simulates summer conditions at 50th percentile current speeds for copper, the fourth simulates winter conditions for temperature at 10th percentile current speeds, the fifth simulates winter conditions for temperature at 90th percentile current speeds, and the sixth simulates winter conditions for temperature at 50th percentile current speeds.

The chronic mixing zone was sized according to the 10th percentile current speed winter temperature case width of 0.44 meters and the 90th percentile current speed temperature case length of 6.7 meters, with a dilution factor of 29.7. The chronic mixing zone is smaller than previously authorized. WET, copper, and arsenic required less dilution, therefore, fit inside the chronic mixing zone sized for

temperature. The approximate travel time of an object to traverse the chronic mixing zone is less than 15 seconds. The acute mixing zone driving parameter was copper and was sized according to the 90th percentile current speed at 0.06 meters wide and the 10th percentile current speed for length at 0.4 meters long, with dilution factor of 3.8. Arsenic fits within the acute mixing zone sized for copper. The approximate travel time of an object to traverse the acute mixing zone is less than 3 seconds. The proposed chronic mixing zone is depicted in Figure 1.

In accordance with 18 AAC 70.255, the Department determined that the size of the mixing zone for the NCC discharge is appropriate. The dilution factor and size of the mixing zone has decreased from the previous permit issuance.

Figure 1: Proposed Mixing Zone Location



6.5.2 Technology.

In accordance with 18 AAC 70.240(a)(3), as amended through July 2003, the Department finds that available evidence reasonably demonstrates that the effluent will be treated to remove, reduce, and disperse pollutants, using methods found by the Department to be the most effective and technologically and economically feasible, consistent with the highest statutory and regulatory treatment requirements. The water used in the steam electric process must be of high purity; therefore, the groundwater and other sources of water to the facility are treated prior to use. This includes treatment with granular activated carbon, reverse osmosis, chemical additions, and disinfection. Process wastewaters that do not meet APDES permit criteria are disposed of off-site. The level of treatment wastewaters received for those discharged to Cook Inlet is dependent on the use of the water during the electric generation process. The

treatment methods include pH neutralization with carbon dioxide, filtration, separation, and settling. Overall, these treatment methods are commonly employed and accepted throughout the U.S. for wastewater discharges associated with this industry.

6.5.3 Existing Use.

In accordance with 18 AAC 70.245, the mixing zone has been appropriately sized to fully protect the existing uses of the receiving water in the area covered under the permit. The discharge volume, outfall structure and location, and receiving water characteristics have been examined to ensure no impacts to the biological integrity of Cook Inlet. The Department examined mixing zones that were recently reauthorized in the vicinity of the NCC plant since the last permit issuance, including AK0000507 Agrium Kenai Plant, AK0000841 Tesoro Alaska Petroleum Company LLC Kenai Refinery and AK0001155 Kenai LNG Plant and determined that none of the mixing zones overlap with the proposed NCC plant mixing zone. Based on the low volume of effluent discharged, the large tidal fluctuations and flushing occurring in Cook Inlet, and the small size of the authorized mixing zone, DEC has determined that the existing uses and biological integrity of the water body will be maintained and fully protected under the terms of the permit, as required by 18 AAC 70.245(a)(1-2), 18 AAC 70.250(a)(3), and 18 AAC 70.250(a)(4).

6.5.4 Human Health.

In accordance with 18 AAC 70.250(a)(1), 18 AAC 70.255(b) and (c), and 18 AAC 70.255(e)(3)(B), the mixing zone will not result in pollutants discharged at levels that will bioaccumulate, bioconcentrate, or persist above natural levels in sediments, water, or biota or at levels that otherwise will create a public health hazard through encroachment on a water supply or contact recreation uses. The pollutants discharged cannot produce objectionable color, taste, or odor in aquatic resources harvested for human consumption; nor can the discharge preclude or limit established processing activities or commercial, sport, personal use, or subsistence fish and shellfish harvesting.

Of the pollutants expected in the discharge, the primary constituent of concern with respect to human health is arsenic. According to the United States Geological Survey, Alaska Science Center, the addition of arsenic to water in the Cook Inlet Basin due to industrial activity is minimal (Glass, Roy L, Distribution of Arsenic in Ground Water and Surface Water, Cook Inlet Basin, Alaska, 2001). Arsenic is a naturally occurring element and is commonly found in the Cook Inlet Basin due to recent glaciation and volcanic activity in the area. The most toxic form of arsenic is inorganic arsenic. Inorganic arsenic is the principal form in surface waters and almost the exclusive form in ground waters. However, because of the metabolic processes affecting arsenic in the food chain, the arsenic in fish and most shellfish is largely present as organic arsenic, which is significantly less toxic than the inorganic form (EPA, 1998).

In a 2007 study, arsenic compounds were found to be speciated in marine fish and shellfish (Peshut, P.J. et al., 2007). In this study, inorganic arsenic was found to be a minor component of the total arsenic fraction. Results found that the proportion of inorganic arsenic was far below the values typically used in human health risk assessments when total arsenic is analyzed.

Target species included various trophic levels and included species commonly harvested for human consumption. For the majority of the samples, inorganic arsenic comprised less than 5% of the total arsenic content. Some higher levels were detected in mollusks, which tend to naturally contain higher levels of arsenic in general. These were in the range of 1% to 5%. Another study, performed in 2018, sampled the total arsenic and arsenic species in 19 marine organisms (including fish, shrimp and crab) from 12 locations in Daya Bay, China. This 2018 study found higher concentrations of organic than inorganic arsenic in the studied biota. The study also performed a health risk assessment using inorganic arsenic, as EPA recommends, and found that there was no apparent health hazard through the consumption of wild marine organisms (Zhang, 2018).

For the discharge, the outfall structure and mixing model were analyzed to determine if the effluent could potentially bioaccumulate, bioconcentrate, or persist above natural levels in the sediments, water, or biota of Cook Inlet. The outlet structure is approximately 10 feet above the sea floor. The mixing study estimates that the chronic and acute arsenic criteria for marine discharges will be met less than one half of a second and less than one half of a meter from the point of discharge. Taking into account the arsenic and mixing studies discussed in preceding paragraphs, it has been determined that arsenic will not persist or occur at significantly adverse levels in Cook Inlet, the sediments, or biota.

Arsenic is listed as a carcinogen. However, as detailed above, arsenic is projected to meet applicable WQS in less than one half a meter from the outfall. The receiving water is not used as a drinking water source and contact recreation or other potential sources of exposure to the effluent is highly unlikely due to the outfall location.

There is no indication that the pollutants discharged have produced objectionable color, taste, or odor in aquatic resources harvested for human consumption. Additionally, the discharge has not precluded or limited established activities or commercial, sport, personal use, or subsistence fish and shellfish harvesting.

Based on a review of the applicant's mixing study, the speciation study, and the information provided herein, the Department concludes that the discharge conditions are consistent with 18 AAC 70.250(a)(1), 18 AAC 70.255(b) and (c), and 18 AAC 70.255(e)(3)(B).

6.5.5 Spawning Areas.

The mixing zone is authorized in the marine waters of Cook Inlet. 18 AAC 70.255(h), which prohibits authorizing mixing zones in streams, rivers or other flowing fresh waters used for anadromous or resident fish spawning, does not apply. Discharges to fresh waters are not authorized under the permit.

6.5.6 Aquatic Life.

In accordance with 18 AAC 70.250 and 18 AAC 70.255, the mixing zone authorized in the permit shall be protective of aquatic life and wildlife. Pollutants for which the mixing zone will be authorized will not accumulate in concentrations outside of the mixing zone that are undesirable, present a nuisance to aquatic life, cause permanent or irreparable displacement of indigenous organisms, or result in a reduction in fish or shellfish population levels. CORMIX modeling conducted for this discharge to Cook Inlet incorporated the most stringent WQ criteria in the model for protection of the growth and propagation of fish, shellfish, other aquatic life, and wildlife, and all WQ criteria will be met at the boundary of the authorized mixing zone. CORMIX models of the outfall indicate that high dilution occurs relatively rapidly and pollutants discharged will have a relatively short residence time in the mixing zones prior to mixing to WQ criteria levels. The Department determined that the mixing zones will not create a significant adverse effect to fish spawning or rearing, form a barrier to migratory species, fail to provide a zone of passage, result in undesirable or nuisance aquatic life, result in permanent or irreparable displacement of indigenous organisms, or result in reduction in fish population levels and that 18 AAC 70.250(a)(2)(A-C) and 18 AAC 70.250(b)(1) are met..

6.5.7 Endangered Species.

In accordance with 18 AAC 70.250(a)(2)(D), the authorized mixing zone will not cause an adverse effect on threatened or endangered species. DEC consulted the United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) websites to identify any threatened or endangered species under their jurisdiction in the vicinity of the NCC Outfall. See Fact Sheet section 10.2 for summary information regarding critical habitat and endangered species.

No detrimental effects to fauna in the area have been documented with previously authorized mixing zone for the facility, nor does the mixing zone appear to pose an undesirable nuisance to aquatic life. The RPA and CORMIX modeling resulted in an overall decrease in the size of the mixing zone, further

reducing the possibility for any threatened or endangered species potentially in the area to come into contact with the wastewater. Due to the reduced size and short residence time of pollutants in the mixing zone, the Department has concluded that the mixing zones are sized to not cause an adverse effect on threatened or endangered species in the vicinity of the discharge. DEC will provide a copy of the permit and fact sheet to NMFS and USFWS when it is public noticed. Any comments received from the agencies regarding endangered species will be considered prior to issuance of the permit.

7.0 ANTIBACKSLIDING

18 AAC 83.480 requires that "effluent limitations, standards, or conditions must be at least as stringent as the final effluent limitations, standards, or conditions in the previous permit." 18 AAC 83.480(c) also states that a permit may not be reissued "to contain an effluent limitation that is less stringent than required by effluent guidelines in effect at the time the permit is renewed or reissued."

The permittee requested a mixing zone for pH to revise the effluent limits from the WQBELs of 6.5-8.5 SU implemented in the previous permit to the TBELs of 6-9 SU. The permittee stated that because the original permit was issued prior to the facility commencing discharge that effluent data was not available to support decision making. The permittee stated that the availability of effluent data justifies modified, less stringent effluent limits for pH. The Department reviewed the effluent pH data and concluded that the facility has consistently met the WQBELs for pH with one exception in May 2015. Revision of the pH WQBEL is not necessary and backsliding is not warranted.

All permit effluent limits in the permit are at least as stringent as in the previously issued permit and are consistent with 18 AAC 83.480. Permit monitoring requirements that changed from the previous permit issuance include the removal of receiving water monitoring for TRC and temperature. These revised receiving water monitoring requirements are based on information that was not available during the previous permit issuance. This new information includes the TRC monitoring results collected during the previous permit term, the facility's use of UV instead of sodium hypochlorite to disinfect service water, and the extensive receiving water temperature data available from the NOAA buoy. The altered receiving water monitoring requirements are appropriate and necessary given the evolving understanding of the facility's pollutants of concern. Additional information about changes to receiving water monitoring is available in Fact Sheet Section 5.5. Additionally, the frequency of TRC and arsenic effluent monitoring was reduced from monthly to quarterly to reflect the value of the effluent data already collected for those pollutants. Accordingly, no further backsliding analysis is required for this permit reissuance.

8.0 ANTIDEGRADATION

Section 303(d)(4) of the CWA states that, for water bodies where the water quality meets or exceeds the level necessary to support the water body's designated uses, WQBELs may be revised as long as the revision is consistent with the State's Antidegradation Policy. The Antidegradation Policy of the WQS (18 AAC 70.015) states that the existing water uses and the level of water quality necessary to protect existing uses must be maintained and protected. This section analyzes and provides rationale for the Department's decisions in the permit issuance with respect to the Antidegradation Policy.

The Department's approach to implementing the Antidegradation Policy, found in 18 AAC 70.015, is currently based on the Department's *Policy and Procedure Guidance for Interim Antidegradation Implementation Methods (Interim Methods)*, dated July 14, 2010. Note that the Lieutenant Governor signed and filed Antidegradation Implementation Methods regulations on March 7, 2018 with an effective date of April 6, 2018. The regulations were subsequently submitted to EPA on March 9, 2018 for review and approval. The new regulations may not be used for CWA purposes (e.g., APDES permits) until EPA approves the regulations for use in such purposes. As such, until the new regulations are approved by EPA for use in APDES permitting, the existing *Interim Methods* will be used in conjunction with the application of the Antidegradation Policy.

Using these procedures and policy, the Department determines whether a water body, or portion of a water body, is classified as Tier 1, Tier 2, or Tier 3, where a higher numbered tier indicates a greater level of water quality protection. At this time, no Tier 3 waters have been designated in Alaska. Cook Inlet is not listed as impaired on DEC's most recent *Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report*; therefore, a Tier 1 designation is not warranted. Accordingly, this antidegradation analysis conservatively assumes that the discharge is to a Tier 2 water body.

The State's Antidegradation Policy in 18 AAC 70.015(a)(2) states that if the quality of water exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water (i.e. Tier 2 waters), that quality must be maintained and protected. The Department may allow a reduction of water quality only after finding that five specific requirements of the Antidegradation Policy at 18 AAC 70.015(a)(2)(A)-(E) are met. The Department findings follow:

1. **18 AAC 70.015 (a)(2)(A).** ***Allowing lower water quality is necessary to accommodate important economic or social development in the area where the water is located.***

   Based on the evaluation required per 18 AAC 70.015(a)(2)(D) below, the Department has determined that the most reasonable and effective pollution prevention, control, and treatment methods are being used and that the localized lowering of water quality is necessary.

   Operation of the facility and dispatching of power resulted in the creation of 34 full-time, long term jobs and reduced dependence on outside providers of power. After a thorough alternatives analysis and opportunity for public input, the AEEC governing board selected the NCC project because it met all of AEEC's power supply objectives and necessary operational requirements, including: providing AEEC with control over the construction and operating costs of their power supply system; allowing AEEC to integrate renewable energy projects into their power supply system in the future; making good use of existing assets; creating 34 additional jobs on the Kenai Peninsula; and providing reliable power sources for AEEC customers. HEA supplies power to its 22,892 members located in the southern Kenai Peninsula making it a crucial contributor to the local infrastructure and economy. The local housing market is supported by the fact that virtually all of HEA's employees live in surrounding Kenai Peninsula communities.

   The Department determined that the permitted activities are necessary to accommodate important economic and social development and the anticipated lowering of water quality is necessary for these purposes and that the finding is met.

2. **18 AAC 70.015 (a)(2)(B).** ***Except as allowed under this subsection, reducing water quality will not violate the applicable criteria of 18 AAC 70.020 or 18 AAC 70.235 or the whole effluent toxicity limit in 18 AAC 70.030.***

   Section 1.2.2 of the permit requires that the discharge shall not cause a violation of the WQS at 18 AAC 70 except if excursions are authorized in accordance with provisions in 18 AAC 70.200 – 70.270 (e.g., variance, mixing zone, etc.). As a result of the plant's RP to exceed WQ criteria at the end of pipe for temperature and copper, a mixing zone is authorized in the permit in accordance with 18 AAC 70.240. The resulting effluent end-of-pipe limitations and monitoring requirements in the permit protect WQS, and therefore, will not violate the WQ criteria found at 18 AAC 70.020. There are no site-specific criteria associated the discharge and associated waterbody under 18 AAC 70.235.

   Alaska WQS at 18 AAC 70.030 requires that an effluent discharged to a waterbody may not impart chronic toxicity to aquatic organisms, expressed as 1.0 toxic units (TUc), at the point of discharge, or if the Department authorizes a mixing zone in a permit, approval, or certification, at or beyond the mixing zone boundary, based on the minimum effluent dilution achieved in the mixing zone.

   Discharge allowed by the permit at Outfall 001 conforms to the requirements of 18 AAC 70.020 and 18 AAC 70.030. Modeling results indicate that all WQS will be met within 6.7 meters of the diffuser. Accordingly, WQS will not be exceeded at or beyond the boundary of the mixing zone as result of the

authorized discharge. Toxicity monitoring is required during this permit cycle. The Department has determined that the reduction in water quality will not violate the applicable criteria of 18 AAC 70.020, 18 AAC 70.235, or 18 AAC 70.030, and that the finding is met.

3. **18 AAC 70.015(a)(2)(C).** ***The resulting water quality will be adequate to fully protect existing uses of the water.***

   The WQS serve the specific purpose of protecting the existing uses of the receiving waterbody. Cook Inlet is protected for all designated uses (See Section 6.3 of this fact sheet); therefore, the most stringent WQ criteria found in 18 AAC 70.020 and in the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances* (2008) were selected for use in determining whether the discharge from NCC had RP to exceed WQ criteria. Use of these protective criteria will ensure that the resulting water quality at and beyond the boundary of the authorized mixing zone will fully protect all existing uses of the receiving waterbody. See Fact Sheet Section 6.5 and Fact Sheet Appendices B and C for more information regarding DEC's application of the most stringent WQ criteria.

   The Department has reviewed the expected volume of discharge, the types and amounts of regulated pollutants, and the effluent limits imposed in the permit. The Department has determined that the discharge from NCC will be adequate to fully protect existing uses of the waterbody and that the finding is met

4. **18 AAC 70.015(a)(2)(D).** ***The methods of pollution prevention, control, and treatment found by the Department to be most effective and reasonable will be applied to all wastes and other substances to be discharged***.

   The Department finds the most effective and reasonable methods of prevention, control, and treatment are the practices and requirements set out in the APDES permit. This type of treatment and associated discharge is similar in nature to other like facilities and discharges located throughout the U.S. Further, because of the widespread employment of this type of treatment and subject wastewater discharge, EPA promulgated technology-based ELGs to regulate this group of discharges (40 CFR Part 423, Steam Electric Generation Point Source Category). The development of the ELG included an extensive analysis of economic treatment alternatives for these types of discharges and concluded this type of pollution prevention, control and treatment is effective and reasonable. In addition, the permittee is required to develop and implement a Quality Assurance Project Plan (QAPP) and a Best Management Practices (BMP) Plan. The BMP Plan includes specific pollution prevention measures and controls to prevent and/or minimize the generation and release of pollutants from waste streams. Adherence to the limits in the permit will ensure that the treatment will be the most effective and reasonable.

   The Department has determined that the methods of pollution prevention, control, and treatment found to be most effective and reasonable will be applied to all wastes and substances discharged from NCC, under the practices and requirements set out in the permit, and that the finding is met.

5. **18 AAC 70.015(a)(2)(E).** ***All wastes and other substances discharged will be treated and controlled to achieve (i) for new and existing point sources, the highest statutory and regulatory requirements; and (ii) for nonpoint sources, all cost-effective and reasonable best management practices.***

   The applicable "highest statutory and regulatory treatment requirements" are defined in 18 AAC 70.990(30) (as amended June 26, 2003) and in the July 14, 2010 DEC guidance titled *Interim Methods*. Accordingly, there are three parts to the definition, which are:

   (A) any federal technology-based effluent limitation guidelines (ELGs) identified in 40 CFR §125.3 and 40 CFR §122.29, as amended through August 15, 1997, adopted by reference at 18 AAC 83.010;

   (B) minimum treatment standards in 18 AAC 72.040; and

(C) any treatment requirements imposed under another state law that is more stringent than a requirement of this chapter.

The first part of the definition includes all federal technology-based ELGs, which would include those that apply to the NCC facility at 40 CFR Part 423 (Steam Electric Generation Point Source Category). The permit implements the ELGs that follow new source performance standards that apply to low-volume wastes; therefore, this requirement is met.

The second part of the definition 18 AAC 70.990(B) (2003) appears to be in error, as 18 AAC 72.040 describes discharges to sewers and not minimum treatment. The correct reference appears to be the minimum treatment standards found at 18 AAC 72.050, which refers to domestic wastewater discharges only. The NCC facility does not discharge domestic wastewater; therefore, this regulation does not apply and further analysis for this particular finding is not warranted.

The third part of the definition includes any more stringent treatment required by state law, including 18 AAC 70 and 18 AAC 72. Neither the regulations in 18 AAC 15 and 18 AAC 72, nor another state law that the Department is aware of impose more stringent requirements than those found in 18 AAC 70. The correct operation of equipment, visual monitoring, and implementing BMPs, as well as other permit requirements, will control the discharge and satisfy all applicable federal and state requirements.

If potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy described in this section is subject to 33 U.S.C. 1326 (commonly known as Section 316 of the CWA). Based on the temperature mixing modeling, the most stringent water quality criteria for temperature will be met approximately 6.7 meters away from the discharge pipe. Accordingly, the discharge is highly unlikely to cause a temperature water quality impairment.

After review of the applicable statutory and regulatory requirements, including 18 AAC 70, 18 AAC 72, and 18 AAC 83, the Department finds that the discharge from the NCC facility meets the highest applicable statutory and regulatory requirements and that this finding is met.

9.0 OTHER PERMIT CONDITIONS

9.1 Electronic Discharge Monitoring Report

E-Reporting Rule for DMRs (Phase I).

The permittee must submit DMR data electronically through Network Discharge Monitoring Report (NetDMR) per Phase I of the E-Reporting Rule (40 CFR Part 127) upon the effective date of this permit. Authorized persons may access permit information by logging into the NetDMR Portal (https://cdxnodengn.epa.gov/oeca-netdmr-web/action/login). Permittees submitting DMRs in compliance with the E-Reporting Rule are not required to submit as described in permit Appendix A – Standard Conditions unless requested or approved by DEC. Permittees shall include any DMR data required by the permit that cannot be reported in a NetDMR field (e.g., mixing zone receiving water data, etc.) as an attachment to the NetDMR submittal. DEC has established an E-Reporting website at http://dec.alaska.gov/water/Compliance/EReportingRule.htm that contains general information about this new reporting format. Training materials and webinars for NetDMR can be found at https://netdmr.zendesk.com/home.

E-Reporting Rule for Other Reports (Phase II).

Phase II of the E-Reporting Rule will integrate electronic reporting for all other reports required by the permit (e.g., Annual Reports and Certifications), and implementation is expected to begin December 2020. The permittee should monitor DEC's E-Reporting website (http://dec.alaska.gov/water/Compliance/EReportingRule.htm) for updates on Phase II of the E-

Reporting Rule and will be notified when required to begin submitting all other reports electronically. Until such time, other reports required by the permit may be submitted in accordance with permit Appendix A – Standard Conditions.

9.2 Quality Assurance Project Plan

The permittee is required to develop procedures to ensure that the monitoring data submitted are accurate and to explain data anomalies if they occur. The QAPP shall consist of standard operating procedures the permittee must follow for collecting, handling, storing, and shipping samples; laboratory analysis; precision and accuracy requirements; data reporting, including method detection/reporting limits; and quality assurance/quality control (QA/QC) criteria. The permittee is required to amend the QAPP whenever any procedure addressed by the QAPP is modified. The permittee is required to develop and implement the QAPP within 120 days of the effective date of the final permit. The QAPP shall be retained on site and made available to the Department upon request.

9.3 Best Management Practices Plan

In accordance with AS 46.03.110(d), the Department may specify in a permit the terms and conditions under which waste material may be disposed. This permit requires the permittee to review their current BMP Plan, update as necessary, and implement the updated BMP Plan in order to prevent or minimize the potential for the release of pollutants to waters and lands of the State of Alaska through plant site runoff, spillage or leaks, or erosion. The permit contains certain BMP conditions that must be included in the BMP Plan. The permit requires the permittee to implement the BMP Plan within 180 days of the effective date of the final permit. The BMP Plan shall be retained on site and made available to the Department upon request.

9.4 Standard Conditions

Appendix A of the permit contains standard regulatory language that must be included in all APDES permits. These requirements are based on the regulations and cannot be challenged in the context of an individual APDES permit action. The standard regulatory language covers requirements such as monitoring, recording, reporting requirements, compliance responsibilities, and other general requirements.

10.0 OTHER LEGAL REQUIREMENTS

10.1 Ocean Discharge Criteria

Section 403(a) of the CWA, Ocean Discharge Criteria, prohibits the issuance of a permit under Section 402 of the CWA for a discharge into the territorial sea, the water of the contiguous zone, or the oceans except in compliance with Section 403. Permits for discharges seaward of the baseline of the territorial seas must comply with the requirements of Section 403, which include development of an Ocean Discharge Criteria Evaluation (ODCE). An interactive map depicting Alaska's baseline plus additional boundary lines is available at:

https://alaskafisheries.noaa.gov/mapping/arcgis/rest/services/NOAA_Baseline/MapServer

The map is provided for information purposes only. The U.S. Baseline committee makes the official determinations on baseline.

A review of the baseline line maps revealed that a baseline has been established from the southern portion of Kalgin Island crossing Cook Inlet to Ninilchik, approximately 32 miles southwest from the NCC plant discharge point. The NCC discharges landward of this baseline. Therefore, Section 403 of the CWA does not apply to the permit, and an ODCE is not required to be completed for this permit

reissuance. Further, the permit requires compliance with WQS such that 40 CFR §125.122(b) is met and therefore the discharge is presumed not to cause unreasonable degradation of the marine environment.

10.2 Endangered Species Act

The Endangered Species Act (ESA) requires a federal agency to consult with the USFWS and NMFS to determine whether their authorized actions could beneficially or adversely affect any threatened and endangered species or their habitats. NMFS is responsible for administration of the ESA for listed cetaceans, seals, sea lions, sea turtles, anadromous fish, marine fish, marine plants, and corals. All other species (including polar bears, walrus, and sea otters) are administered by the USFWS.

As a state agency, DEC is not required to consult with USFWS or NMFS regarding permitting actions; however, DEC used these federal agencies' websites to obtain listings of threatened and endangered species near the discharge.

The USFWS has directed the Department to consult their Information, Planning, and Conservation System (http://www.fws.gov/alaska/fisheries/endangered/index.htm) to obtain lists of threatened and endangered species within the jurisdiction of the USFWS in the Outfall area. The Department used this website to gain an approximate determination that the area surrounding the Outfall may contain endangered short-tailed albatross.

NOAA has directed the Department to consult their Marine Mammal Species Range and Critical Habitat Interactive map at http://alaskafisheries.noaa.gov/mapping/esa/. The Department used this website to gain an approximate determination that the area surrounding the Outfall may contain critical habitat for the endangered Cook Inlet beluga whales, and is within "Critical Habitat Area Two." Additionally endangered western Distinct Population Segment Steller sea lions could be present.

This fact sheet and the permit will be submitted to the agencies for review during the public notice period and any comments received from these agencies will be considered prior to issuance of the permit.

10.3 Essential Fish Habitat

Essential fish habitat (EFH) includes the waters and substrate (sediments, etc.) necessary for fish from commercially-fished species to spawn, breed, feed, or grow to maturity. The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires federal agencies to consult with NOAA when a proposed discharge has the potential to adversely affect (reduce quality and/or quantity of) EFH.

As a state agency, DEC is not required to consult with NOAA on EFH; however, DEC consulted NOAA's EFH Mapper at http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html to obtain locations of EFH in the area of Cook Inlet adjacent to NCC's discharge. The Department used this website to gain an approximate determination that the area NCC discharges to could be EFH for all five species and life stages of Pacific salmon.

DEC will provide NMFS with copies of the permit and fact sheet during the public notice period. Any comments received from NMFS regarding EFH will be considered prior to issuance of the permit.

10.4 Permit Expiration

The permit will expire five years from the effective date of the permit.

11.0 References

1. Alaska Department of Environmental Conservation, 2003, *Water Quality Standards*, as amended June 26, 2003, Alaska Department of Environmental Conservation 18 AAC 70.
2. Alaska Department of Environmental Conservation, 2003. *Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances*, as amended through December 12, 2008.
3. Alaska Department of Environmental Conservation, 2010. *Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report*, July 15, 2010.
4. Alaska Department of Environmental Conservation, 2013. Interim Antidegradation Implementation Methods. Retrieved from http://www.dec.state.ak.us/water/wqsar/Antidegradation/docs/P&P-Interim_Antidegradation_Implemenation_Methods.pdf
5. Alaska Department of Environmental Conservation, 2014. *Alaska Pollutant Discharge Elimination System permits reasonable potential analysis and effluent limits development guide.*
6. MixZon, 2018. *Email communication with Frank Opila re: Mixing Zone Inputs*, February 28, 2018.
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8. Robert Doneker and Gerhard Jirka, 2007. *CORMIX User Manual*, U.S. Environmental Protection Agency, EPA-823-K-07-001, December 2007.
9. U.S. Environmental Protection Agency, 2015. *Steam Electric Power Generating Point Source Category*, November 3, 2015. U.S. Environmental Protection Agency, 40 CFR Part 423.
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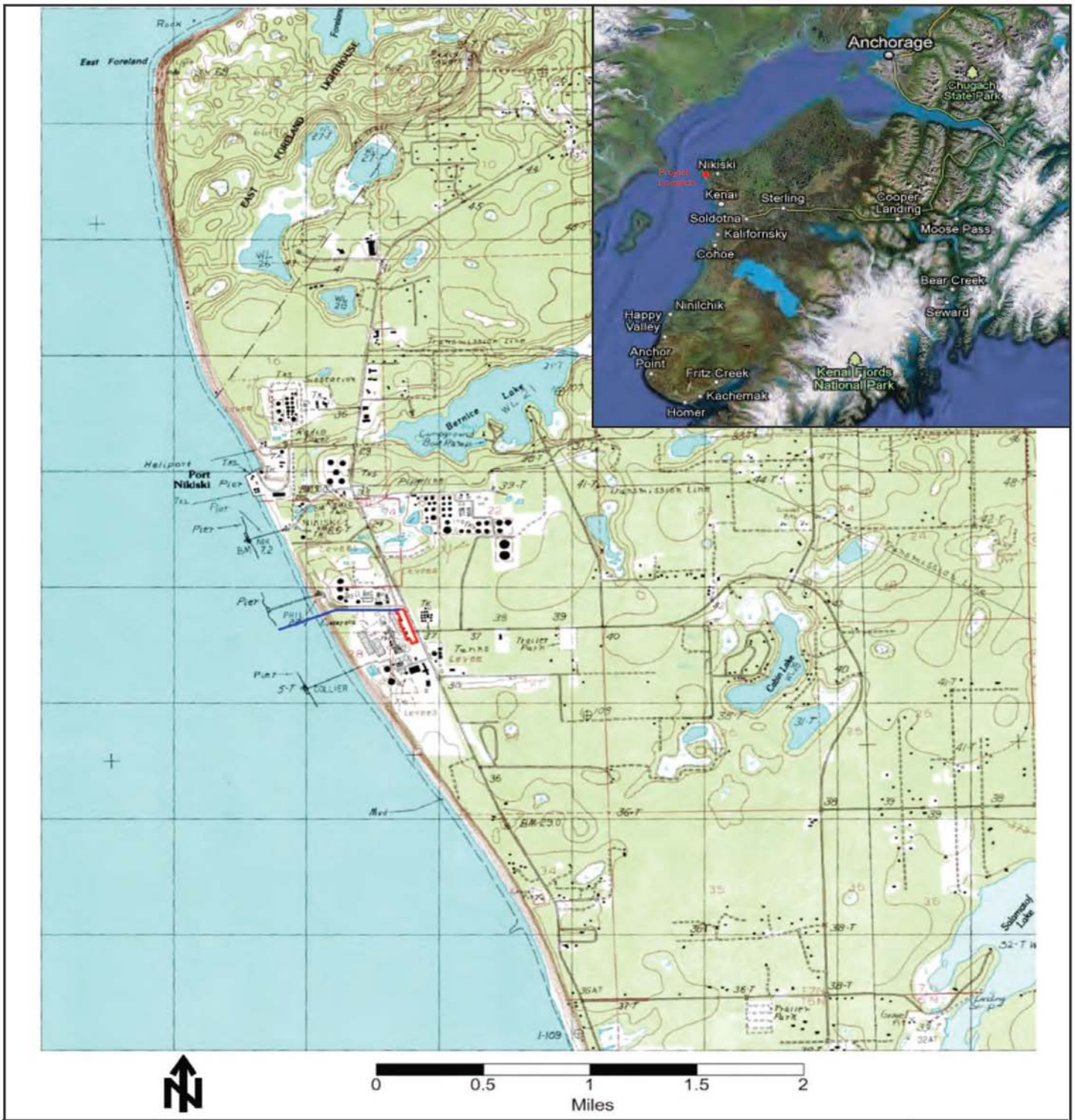
11. U.S. Environmental Protection Agency, 2010. Denton DL, Miller JM, Stuber RA. 2007. *EPA Regions 8, 9 and 10 toxicity training tool (TTT)*. January 2010. San Francisco, CA.
12. U.S. Environmental Protection Agency, 2010. *National Pollution Discharge Elimination System* (*NPDES) Permit Writers' Manual*. Office of Wastewater Management, Water Permits Division State and Regional Branch Office of Water Regulations and Standards. Washington DC, September 2010. EPA-833-K-10-001.
13. U.S. Environmental Protection Agency, 1991. *Technical Support Document for Water Quality-based Toxics Control*. Office of Water Enforcement and Permits, Office of Water Regulations and Standards. Washington DC, March 1991. EPA/505/2-90-001.
14. U.S. Geological Survey (USGS). 2001. Distribution of Arsenic in Water and Streambed Sediments, Cook Inlet Basin, Alaska. Alaska Science Center. Anchorage, AK, September 2001. USGS Fact Sheet FS-083-01.
15. Peshut, P.J. et al. 2007. Arsenic speciation in marine fish and shellfish from American Samoa, Chemosphere (2007). Doi: 10.1016/j.chemosphere. 2007.10.014.
16. DEC, 2014. Alaska Pollutant Discharge Elimination System Fact Sheet – Final, AKG315100 – Mobile Oil and Gas Exploration Facilities in State Waters in Cook Inlet,"
17. Wei Zhang, Zhiqiang Guo, Dongdong Song, Sen Du, Li Zhang, 2018. *Arsenic speciation in wild marine organisms and a health risk assessment in a subtropical bay of China*, January 18, 2018. Science of the Total Environment, Volume 626, p 621-629.
18. U.S. Environmental Protection Agency, 1998. *Withdrawal from Federal Regulations of the Applicability to Alaska's Waters of Arsenic Human Health Criteria*. U.S. Environmental Protection Agency, Office of Water, Seattle, WA, 40 CFR Part 131, FRL-5971-9, March 2, 1998.

APPENDIX A. FACILITY INFORMATION

Figure 2: Nikiski Combined Cycle Plant Map



Title/Notes:

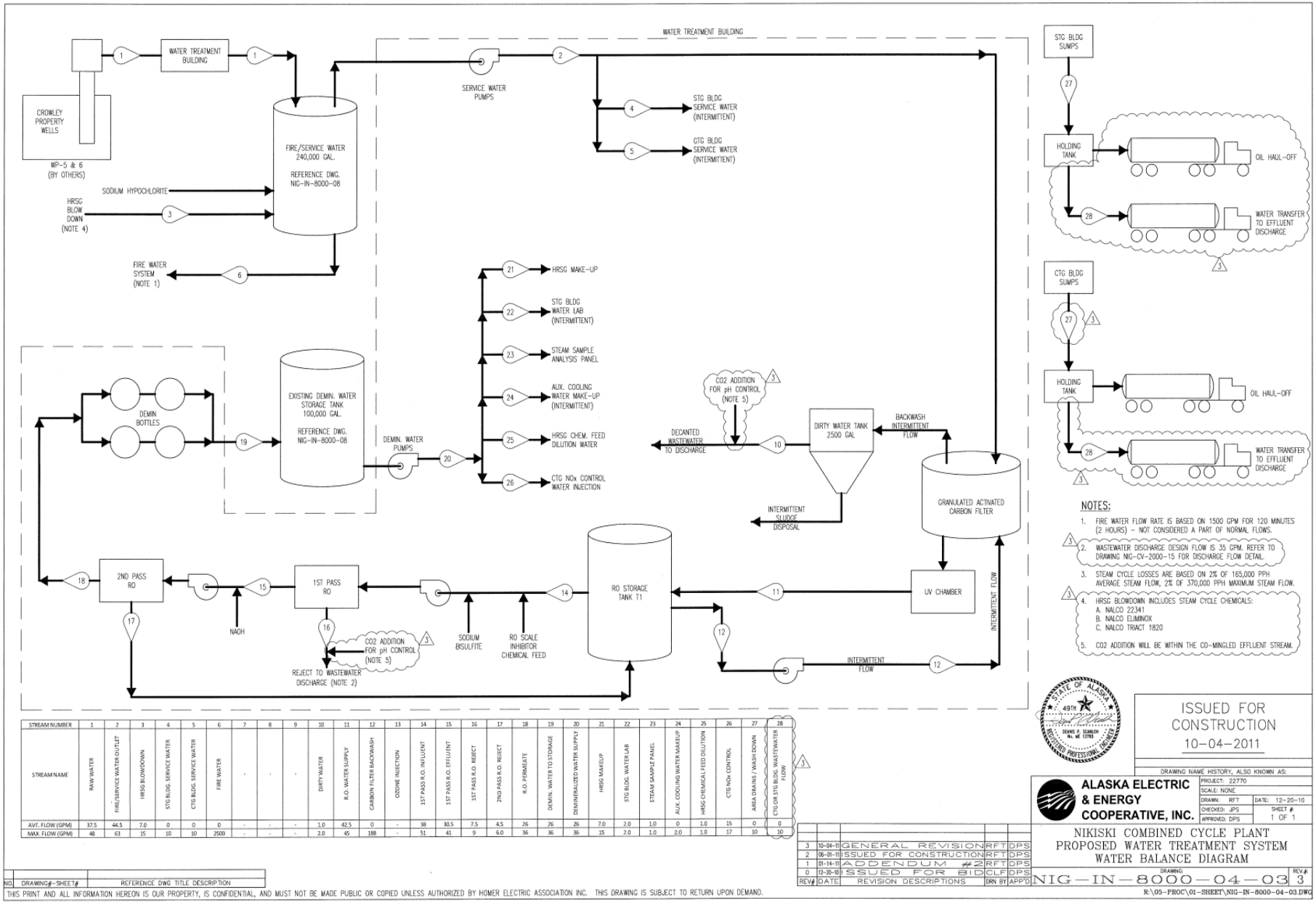
USGS Map Showing Location of the Project

(Facility boundary is outlined in red, the effluent discharge line is blue)

Figure:

1

Figure 3: Nikiski Combined Cycle Plant Process Flow Diagram



STREAM NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
STREAM NAME	RAW WATER	FIRE/SERVICE WATER OUTLET	HRSG BLOWDOWN	STG BLDG. SERVICE WATER	CTG BLDG. SERVICE WATER	FIRE WATER	-	-	-	DIRTY WATER	R.O. WATER SUPPLY	CARBON FILTER BACKWASH	OZONE INJECTION	1ST PASS R.O. INFLUENT	1ST PASS R.O. EFFLUENT	1ST PASS R.O. REJECT	2ND PASS R.O. REJECT	R.O. PERMEATE	DEMIN. WATER TO STORAGE	DEMINERALIZED WATER SUPPLY	HRSG MAKEUP	STG BLDG. WATER LAB	STEAM SAMPLE PANEL	AUX. COOLING WATER MAKEUP	HRSG CHEMICAL FEED DILUTION	CTG NOx CONTROL	AREA DRAINS / WASH DOWN	CTG OR STG BLDG. WASTEWATER FLOW
AVE. FLOW (GPM)	37.5	44.5	7.0	0	0	0	-	-	-	1.0	42.5	0	-	38	30.5	7.5	4.5	26	26	26	7.0	2.0	1.0	0	1.0	15	0	0
MAX. FLOW (GPM)	48	63	15	10	10	2500	-	-	-	2.0	45	188	-	51	41	9	6.0	36	36	36	15	2.0	1.0	2.0	1.0	17	10	10

NO.	DRAWING#-SHEET#	REFERENCE DWG TITLE DESCRIPTION

REV#	DATE	REVISION DESCRIPTIONS	DRN BY	APP'D
3	10-04-11	GENERAL REVISION	RFT	DPS
2	06-01-11	ISSUED FOR CONSTRUCTION	RFT	DPS
1	01-14-11	ADDENDUM #2	RFT	DPS
0	12-20-10	ISSUED FOR BID	CLF	DPS

DRAWING NAME HISTORY, ALSO KNOWN AS:
PROJECT: 22770
SCALE: NONE
DRAWN: RFT DATE: 12-20-10
CHECKED: JPS SHEET # 1 OF 1
APPROVED: DPS
DRAWING: NIG-IN-8000-04-03 REV.# 3
R:\05-PROC\01-SHEET\NIG-IN-8000-04-03.DWG

APPENDIX B. BASIS FOR EFFLUENT LIMITS

The Clean Water Act (CWA) requires that the effluent limit for a particular pollutant be the more stringent of either technology-based effluent limits (TBELs) or water quality-based effluent limits (WQBELs). TBELs are established by the Environmental Protection Agency (EPA) for many industries in the form of Effluent Limitation Guidelines (ELG) and are based on available pollution control technology. The Department adopts the subject ELGs by reference in 18 AAC 83.010. TBELs are national in scope and establish performance standards for all facilities within an industrial category or subcategory. The Department may find, by analyzing the effect of an effluent discharge on the receiving water body, that TBELs are not sufficiently stringent to meet water quality standards (WQS). In such cases, the Department is required to develop more stringent WQBELs, which are designed to ensure that the WQS of the receiving water body are met.

The permit contains effluent limits for those parameters that either had an applicable ELG, had a preexisting WQBEL from the previous permit issuance, or showed reasonable potential at the boundary of the mixing zone. When TBELs do not exist for a particular pollutant expected to be in the effluent, the Department must determine if the pollutant may cause or contribute to an exceedance of a WQS for the water body. If a pollutant causes or contributes to an exceedance of a WQS, a WQBEL for the pollutant must be established in the permit.

B.1 Statutory and Regulatory Basis

18 AAC 70.010 prohibits conduct that causes or contributes to a violation of the water quality standards (WQS). 18 AAC 15.090 requires that permits include terms and conditions to ensure criteria are met, including operating, monitoring, and reporting requirements.

The regulations require the permitting authority to make this evaluation using procedures that account for existing controls on point and nonpoint sources of pollution, the variability of the pollutant in the effluent, species sensitivity (for toxicity), and where appropriate, dilution in the receiving water body. The limits must be stringent enough to ensure that WQS are met and must be consistent with any available waste load allocation (WLA).

B.2 Technology-Based Effluent Limitations

B.2.1 Mass-Based Limitations

The regulation at 18 AAC 83.540 requires that effluent limits be expressed in terms of mass, if possible. The mass based limits are expressed in pounds per day and are calculated as follows:

Mass-based limit (lbs/day) = concentration limit (mg/L) × design flow (mgd) × 8.34[1]

B.2.2 Effluent Limitation Guidelines

Section 301(b)(2) of the CWA requires that, by March 31, 1989, all permits contain effluent limitations which control toxic pollutants and nonconventional pollutants through the use of “best available technology economically achievable” (BAT) and “best conventional pollutant control technology” (BCT) for conventional pollutants. In no case may BCT or BAT be less stringent than “best practicable control technology currently available”, which is a minimum level of control required by section 301(b)(1)(A) of the CWA.

Effluent limit guidelines (ELGs) are technology-based regulations that are national in scope and establish performance standards for all facilities within an industrial category or subcategory. They are intended to represent the greatest pollutant reductions that are economically achievable for an industry. Technology-based numeric limitations for industrial wastewater discharges are set at several levels of control. These include BAT, BCT, best practicable control technology currently available (BPT), new source

[1] 8.34 is a conversion factor with units (lb × L) / (mg × gallon × 10^6)

performance standards (NSPS), pretreatment standards for new sources (PSNS), and pretreatment standards for existing sources (PSES).

The Clean Water Act (CWA) requires technology-based controls on effluent from steam electric generating power plants discharging to waters of the United States. The Steam Electric Power Generating Point Source Category ELGs regulate discharges from the operation of generation units by establishments primarily engaged in the generation of electricity for distribution and sale, which results primarily from utilizing fossil-type fuel in conjunction with a thermal cycle employing the steam water system as the thermodynamic medium.

ELGs for steam electric power generation facilities may not limit every parameter that may be present in the effluent. ELGs are often established only for those pollutants that are necessary to ensure that industrial facilities comply with the technology-based requirements of the CWA. ELGs have only been developed for total suspended solids (TSS), oil and grease for new sources discharging low volume wastes, and pH and polychlorinated biphenyls (PCBs) for all new sources discharging wastewater. When ELGs do not exist for a particular pollutant expected to be in the effluent, the Department must determine if the pollutant may cause or contribute to an exceedance of a water quality (WQ) criterion for the waterbody. If a pollutant causes or contributes to an exceedance of a WQ criterion, a water quality-based effluent limit (WQBEL) for the pollutant must be established in the permit.

ELGs for the Steam Electric Power Generating Point Source Category can be found at 40 Code of Federal Regulations (CFR) Part 423 (amended November 3, 2015), adopted by reference at 18 AAC 83.010(g)(3). The ELGs applicable to a new source are sources that have commenced construction after the ELGs were promulgated (initially in 1974, revised on November 19, 1982, revised again 1995 and 2015). The Nikiski Combined Cycle Plant (NCC) is a combined cycle power station that routes exhaust heat from an existing natural gas combustion turbine generator (CTG) to produce steam in an existing heat recovery steam generator (HRSG), which propels a steam-driven turbine generator (STG). Since construction of the facility commenced after 40 CFR Part 423 was promulgated, the ELGs based on new source performance standards (NSPS) in 40 CFR §423.15 apply.

The ELGs contained in 40 CFR §423.15 include effluent limits for the following waste streams: low volume wastes, chemical metal cleaning wastes, bottom ash transport water, fly ash transport water, once-through cooling water, cooling tower blow down, and coal pile runoff. The facility's discharge consists entirely of low volume wastes (intermittent discharges of first pass reverse osmosis reject water, and raw water treatment system filtration unit backwash). Therefore, the following ELGs apply to the facility at Outfall 001:

Table B-1: Technology-Based Effluent Limits (40 CFR §423.15, New Source Performance Standards)

Parameter	Average of daily values for 30 consecutive days shall not exceed (mg/L)	Maximum for any 1 day (mg/L)	Source
pH	a		40 CFR §423.15(a)
PCBs	b		40 CFR §423.15(b)
Total Suspended Solids (TSS)	30.0	100.0	40 CFR §423.15(c)
Oil and Grease	15.0	20.0	40 CFR §423.15(c)

Footnotes:

a. The pH of all discharges, except once through cooling water, shall be within the range of 6.0–9.0 standard units (SU).

b. There shall be no discharge of PCBs such as those commonly used for transformer fluid

B.3 Water Quality-Based Effluent Limitations

WQBELs included in APDES permits are derived from WQS. APDES regulation 18 AAC 83.435(a)(2) requires that permits include WQBELs that can achieve WQS established under Clean Water Act §303, including state narrative criteria for water quality. The State's WQS are composed of use classifications, numeric and/or narrative water quality criteria, and an antidegradation policy (See Section 8.0, Antidegradation). The use classification system identifies the designated uses that each waterbody is expected to achieve. The numeric and/or narrative water quality criteria are the criteria deemed necessary by the state to support the designated use classification of each waterbody. The antidegradation policy ensures that the designated and existing water uses and the level of water quality necessary to protect the uses are maintained and protected. Designated uses are those uses specified in WQS for each waterbody or segment whether or not they are being attained [40 CFR § 131.3(f)]. Existing uses are those uses actually attained in a waterbody on or after November 28, 1975, whether or not they are included in the WQS [40 CFR § 131.3(e)].

Waterbodies in Alaska are designated for all uses unless the waterbody has been reclassified under 18 AAC 70.230 as listed under 18 AAC 70.230(e). Some waterbodies in Alaska may also have site–specific WQ criteria per 18 AAC 70.235, such as those listed under 18 AAC 70.236(b).

B.3.1 Reasonable Potential Analysis

When evaluating the effluent to determine if WQBELs based on chemical-specific numeric criteria are needed, the Department projects the receiving waterbody concentration downstream of where the effluent enters the receiving waterbody for each pollutant of concern. The chemical-specific concentration of the effluent and receiving waterbody and, if appropriate, the dilution available from the receiving waterbody, are factors used to project the receiving waterbody concentration. If the projected concentration of the receiving waterbody exceeds the numeric criterion for a limited parameter, then there is RP that the discharge may cause or contribute to an excursion above the applicable WQ criterion, and a WQBEL must be developed. DEC assesses RP to exceed both acute and chronic criterion. Appendix C contains more details on the RPA conducted for this permit.

The Department may authorize a volume of receiving water to provide dilution of the effluent; this volume is called a mixing zone. According to 18 AAC 70.990(38), a mixing zone is an area in a water body surrounding, or downstream of, a discharge where the effluent plume is diluted by the receiving water within which specified water quality criteria may be exceeded. Water quality criteria and limits may be exceeded within a mixing zone. A mixing zone can be authorized only when adequate receiving water flow volume, dilution, and the concentration of the pollutant of concern in the receiving water body is below the numeric criterion necessary to protect the designated uses of the water body. Mixing zone allowances will increase the allowable mass loadings of the pollutant to the waterbody.

B.3.2 Procedure for Deriving Water Quality-Based Effluent Limits

The Department used the process described in the *Technical Support Document (TSD) for Water Quality-Based Toxics Control* (EPA, 1991) and DEC's guidance, *APDES Permits Reasonable Potential Analysis and Effluent Limits Development Guide* (June 30, 2014) to evaluate NCC Power Plant's effluent. The first step in developing a WQBEL is to develop a WLA for the pollutant. A WLA is the concentration or loading of a pollutant that the permittee may discharge without causing or contributing to an exceedance of WQ criteria or a total maximum daily load in the receiving waterbody. If a mixing zone is authorized in the permit, the WQS apply at all points outside the mixing zone.

In cases where a mixing zone is not authorized, either because the receiving waterbody already exceeds the criterion, the receiving waterbody flow is too low to provide dilution, or for some other reason one is not authorized, the criterion becomes the WLA. Establishing the criterion as the WLA ensures that the permittee will not cause or contribute to an exceedance of the criterion.

Discharge monitoring reports from December 2012 to August 2017 and NCC's wastewater discharge application were reviewed to identify pollutants of concern (POC). POC are those pollutants that already have a TBEL or WQBEL for a particular pollutant, pollutants with a total maximum load waste load allocation or watershed analysis, pollutants identified as present in the effluent through monitoring, or those pollutants that are likely to be present in the effluent based on the nature of the operation.

B.3.3 Specific Water Quality-Based Effluent Limits

B.3.3.1 *pH*

The criteria at 18 AAC 70.020(b)(18)(C) for the growth and propagation of fish shellfish, other aquatic life, and wildlife are the most stringent marine standards for pH. These standards establish a pH range of at least 6.5 to a maximum of 8.5 SU. The previous permit implemented a WQBEL of 6.5-8.5 SU for pH as the permittee did not anticipate or request a mixing zone for pH, so the more stringent WQBELs were implemented in the permit as opposed to the TBELs of 6-9 SU. The permittee submitted a request to grant a mixing zone for pH and implement the TBELs in the permit reissuance, but doing so would constitute backsliding, thus the permit continues to implement the WQBELs for pH.

B.3.3.2 *Copper*

The most stringent state water quality criteria for copper to protect designated uses for marine discharges found at 18 AAC 70.020(b)(11)(c) requires that concentrations may not exceed 5.8 µg/L for acute aquatic life and 3.7 µg/L for chronic aquatic life. The previous permit included copper in the mixing zone, required quarterly monitoring of the effluent for copper and did not implement a WQBEL for copper. Copper was detected in the effluent at concentrations ranging from non-detect (ND) to a maximum observed concentration of 12.1 µg/L. Copper was the driving parameter of the acute mixing zone and required development of WQBELs. The permit implements the WQBEL and an increase in monitoring frequency from quarterly to monthly.

B.3.3.3 *Chlorine (Total Residual)*

The most stringent state water quality criteria for total residual chlorine (TRC) to protect designated uses for marine discharges found at 18 AAC 70.020(b)(11)(c) requires that concentrations may not exceed 13 µg/L for acute aquatic life and 7.5 µg/L for chronic aquatic life. These concentrations are not quantifiable using EPA-approved analytical methods, so DEC uses the minimum level (ML) of 0.1 mg/L as the compliance evaluation level for TRC. The previous permit incorporated dilution factors of 7:000:1 and 4,000:1 to calculate WQBELs of 26 mg/L as a monthly average limit and 52 mg/L as a daily maximum limit. The TRC WQBEL in the previous permit was developed using assumed concentrations and the assumption that the NCC plant would disinfect service water prior to the granular activated carbon (GAC) filter using sodium hypochlorite. The facility later chose to disinfect service water with ultraviolet radiation instead of sodium hypochlorite. Two detected values for TRC were observed during the time period April 2013-April 2018. These values were 0.1 and 0.13 mg/L respectively. The permittee cannot explain the presence of TRC in the effluent and did not request a mixing zone for TRC. The Department reduced the monitoring frequency for TRC due to the available effluent dataset demonstrating that TRC is rarely present in the effluent at detectable concentrations. The Department implemented an end of pipe WQBEL for TRC that reflects that TRC could be present in the effluent, but should not be present in significant concentrations.

B.3.3.4 *Temperature*

The criteria at 18 AAC 70.020(b)(10)(C) for the growth and propagation of fish shellfish, other aquatic life, and wildlife are the most stringent standards for temperature. The established temperature standard for marine waters is "may not cause the weekly average temperature to increase more than 1°C. The maximum rate of change may not exceed 0.5°C per hour. Normal daily temperature cycles may not be altered in amplitude or frequency."

The previous permit included temperature in the mixing zone and required weekly monitoring of the effluent temperature but did not implement a temperature WQBEL. 1,779 effluent temperature results collected on a daily basis from April 2013-April 2018 illustrate that the minimum effluent temperature observed was 1.3°C, the maximum effluent temperature observed was 29.9°C, and the average temperature was 17.4°C.

Ambient temperature data provided by the permittee, which was collected by the National Oceanic and Atmospheric Administration (NOAA) National Data Buoy Center Station NKTA2 from January 2013-December 2015 less than a kilometer away from the NCC plant outfall. The NOAA dataset, comprised of 215,167 temperature results, illustrated that the minimum ambient temperature observed was -2°C, the maximum ambient temperature observed was 17.3°C. The Department implemented the temperature WQS by examining both the summer and winter receiving water conditions. Winter conditions were determined to be the critical conditions for temperature in the receiving water.

Negative temperature values cannot be used in CORMIX thermal discharge modelling. Additionally, RPA and WQBEL equations cannot easily accommodate negative values or values less than 1. Only positive ΔT values were analyzed since zero and negative values do not result in lowering of water quality of the receiving water per application of the State's temperature water quality standard. Accordingly, the Department only used positive receiving water temperature values in the RPA, WQBEL, and mixing zone modelling for temperature. This resulted in the assumption that the critical receiving water temperature was 0°C, and the resulting WQS numeric criteria for temperature to be met at the boundary of the mixing zone was 1°C (0°C+1°C=1°C). The largest ΔT observed was 29.9°C, and this was used as the maximum observed effluent value in the RPA and WQBEL calculations. Temperature was the driving parameter of the chronic mixing zone and WQBELS were calculated using a slightly modified approach to those described in the Department of Environmental Conservation (DEC) Alaska Pollutant Discharge Elimination System (APDES) Reasonable Potential Analysis and Effluent Limits Development Guide and are described in greater detail in APPENDIX C.

B.3.3.5 *Arsenic*

The most stringent state water quality criteria for arsenic to protect designated uses for marine discharges found at 18 AAC 70.020(b)(11)(c) requires that concentrations may not exceed 68.55 µg/L for acute aquatic life and 36.05 µg/L for chronic aquatic life. The previous permit included arsenic in the mixing zone, required monthly monitoring of the effluent for arsenic, and did not implement a WQBEL for arsenic. The maximum observed effluent concentration of arsenic was 65.4 µg/L, resulting in arsenic having reasonable potential to violate WQS acute and chronic numeric criteria. Arsenic is included in the acute and chronic mixing zones, but no WQBEL is necessary as it is not the driving parameter of either mixing zone. The frequency of arsenic monitoring was reduced from monthly to quarterly as the concentration is fairly consistent in the effluent, ranging from a low of 21.2 µg/L to a high of 65.4 µg/L.

B.3.3.6 *Oil and Grease*

WQS for discharges of petroleum hydrocarbons, oils, and grease to marine waters are found at 18 AAC 70.020(2)(b)(17). The WQSs for petroleum hydrocarbons, oils, and grease are

primarily narrative, however, the WQS for discharges to marine waters with a beneficial use for aquaculture contains a numeric WQS. The marine WQS for aquaculture states:

Total aqueous hydrocarbons (TAqH) in the water column may not exceed 15 µg/l (see note 7). Total aromatic hydrocarbons (TAH) in the water column may not exceed 10 µg/l (see note 7). There may be no concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life. Surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration.

Note 7. Samples to determine concentrations of total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH) must be collected in marine and fresh waters below the surface and away from any observable sheen;….

B.3.4 Selection of Most Stringent Limitations

B.3.4.1 *Chlorine (total residual)*

The permit proposes WQBELs for chlorine (total residual). Because the facility no longer uses TRC in its process, but TRC was detected at low concentrations in two of 59 monthly TRC effluent samples, the permit implements the WQS for TRC at the end of pipe. The permittee did not request to include TRC in the mixing zone and does not expect it to be present in their effluent.

B.3.4.2 *Oil and Grease*

The permit proposes to continue to implement TBELs for oil and grease. TAqH and TAH are not expected to be present in the discharge. Five effluent samples analyzed for TAH and TaqH submitted by the permittee support the assumption. Oil and grease was detected in four of the 59 monthly effluent sample events in concentrations that ranged from non-detect to 8.5 mg/L. The TBEL is a more applicable, stringent effluent limitation and is contained in this permit.

B.3.4.3 *pH*

The permit proposes the more stringent WQBELs for pH, which shall apply at the end-of-pipe. The permittee requested a mixing zone for pH, which would require a less stringent effluent limitation than implemented in the previous permit. This would constitute backsliding, and the Department did not find that any of the required circumstances for backsliding were met.

Table B-2: Selection of pH Permit Limits

Limit Type	Minimum Daily (SU)	Maximum Daily (SU)
TBELs	6.0	9.0
WQBELs	6.5	8.5
Selected Limits	6.5	8.5

B.3.4.4 *Polychlorinated Biphenyl Compounds*

The permit proposes to continue to implement TBELs for polychlorinated biphenyl compounds (PCBs), which allow for no discharge of PCBs. Monitoring for PCBs is required once per year and no PCBs have been detected.

B.3.4.5 *Total Suspended Solids*

The permit proposes to continue to implement TBELs for TSS. There are no applicable WQS numeric criteria for TSS. TSS was detected in 28 of 59 monthly effluent sampling events in concentrations ranging from non-detect to 39.5 mg/L.

APPENDIX C. REASONABLE POTENTIAL DETERMINATION

The following describes the process the Alaska Department of Environmental Conservation (the Department or DEC) used to determine if the discharge authorized in the permit has the reasonable potential (RP) to cause or contribute to a violation of Alaska Water Quality Standards (WQS). The Department used the process described in the *Technical Support Document (TSD) for Water Quality-Based Toxics Control* (Environmental Protection Agency, 1991) and DEC's guidance, *Alaska Pollutant Discharge Elimination System (APDES) Permits Reasonable Potential Analysis and Effluent Limits Development Guide* (June 30, 2014) to determine the RP for any pollutant to exceed a WQS numeric criterion.

To determine if there is RP for the discharge to cause or contribute to an exceedance of WQS numeric criteria for a given pollutant, the Department compares the maximum projected receiving waterbody concentration to the criteria for that pollutant. RP to exceed exists if the projected receiving waterbody concentration exceeds WQS numeric criteria, and a water quality-based effluent limit must be included in the permit

The ambient concentration in the mass balance equation for copper of 1.75 micrograms per liter (µg/L) was based on the 85th percentile of nine receiving water samples (CI-5-CI8) collected by the nearby Tesoro, Conoco and Kenai facilities. This section discusses how the maximum projected receiving waterbody concentration is determined and presents the RP analysis done for all pollutants examined in Table C-1.

C.1 Mass Balance

For a discharge to a flowing waterbody, the maximum projected receiving waterbody concentration is determined using a steady state model represented by the following mass balance equation:

$$C_d Q_d = C_e Q_e + C_u Q_u \qquad \text{(Equation C-1)}$$

Where,

C_d = Receiving water body concentration downstream of the effluent discharge

C_e = Maximum projected effluent concentration

C_u = 85th percentile measured receiving waterbody ambient concentration

Q_d = Receiving water body flow rate = $Q_e + Q_u$

Q_e = Effluent flow rate (set equal to the design flow of the facility)

Q_u = Receiving waterbody flow rate

When the mass balance equation is solved for C_d, it becomes:

$$C_d = \frac{C_e Q_e + C_u Q_u}{Q_e + Q_u} \qquad \text{(Equation C-2)}$$

The above form of the equation is based on the assumption that the discharge is rapidly and completely mixed with the receiving waterbody. If a mixing zone based on a percentage of the critical flow in the receiving waterbody is authorized based on the assumption of incomplete mixing with the receiving waterbody, the equation becomes:

$$C_d = \frac{C_e Q_e + C_u (Q_U \times MZ)}{Q_e + (Q_u \times MZ)} \qquad \text{(Equation C-3)}$$

Where,

MZ = the fraction of the receiving waterbody flow available for dilution.

Where mixing is rapid and complete, MZ is equal to 1 and equation C-2 is equal to equation C-3 (i.e., all of the critical low flow volume is available for mixing).

If a mixing zone is not authorized, dilution is not considered when projecting the receiving waterbody concentration, and

$$C_d = C_e \qquad \text{(Equation C-4)}$$

In other words, if a mixing zone is not authorized, the Department considers only the concentration of the pollutant in the effluent regardless of the upstream flow and concentration. If the concentration of the pollutant in the effluent is less than the WQS numeric criteria, the discharge cannot cause or contribute to a WQ violation for that pollutant. In this case, the mixing or dilution factor (% MZ) is equal to zero and the mass balance equation is simplified to $C_d = C_e$.

Equation C-2 can be simplified by introducing a dilution factor (D):

$$D = \frac{Q_e + Q_u}{Q_e} \qquad \text{(Equation C-5)}$$

After the D simplification, this becomes:

$$C_d = \frac{(C_e - C_u)}{D} + D_u \qquad \text{(Equation C-6)}$$

C.2 Maximum Projected Effluent Concentration

To calculate the maximum projected effluent concentration, the Department used the procedure described in Section 3.3 of the *TSD*, "*Determining the Need for Permit Limits with Effluent Monitoring Data*." In this procedure, the 99th percentile of the effluent data is the maximum projected effluent concentration which is used in the calculation of the maximum projected receiving waterbody concentration.

Since there are a limited number of data points available, the 99th percentile is calculated by multiplying the maximum observed effluent concentration (MOC) by a reasonable potential multiplier (RPM). The RPM is the ratio of the 99th percentile concentration to the MOC and accounts for the statistical uncertainty in the effluent data. The RPM is calculated from the coefficient of variation (CV) of the data and the number of data points. The CV is defined as the ratio of the standard deviation of the data set to the mean. When fewer than 10 data points are available, the *TSD* recommends making the assumption that the CV is equal to 0.6. A CV value of 0.6 is a conservative estimate that assumes a relatively high variability. In the example of acute copper, the Department calculated a CV specific to the dataset of 0.6380.

DEC used ProUCL, a statistical software program, to determine that the monitoring data submitted for copper follows a gamma distribution. Therefore, the RPM equation in Section 2.4.2.1 of the *APDES Permits Reasonable Potential Analysis and Effluent Limits Development Guide* is used to determine the RPM for copper.

$$RPM = \frac{\mu_n + z_{99}\,\sigma}{\mu_n + p_n\,\sigma} \qquad \text{(Equation C-7)}$$

Where,

z_{99} = the z − statistic at the 99th percentile = 2.326

μ_n = mean calculated by ProUCL = 4.102

σ = the standard deviation calculated by ProUCL = 2.617

p_n = the z − statistic at the 95th percent confidence level of $(1 - 0.95)^{\frac{1}{n}} = 0.883$

= 1.18 (inverse of cumulative distribution function of 0.883)

$n =$ number of valid data samples $= 24$

$\mathbf{RPM = 1.4}$ (rounded)

The maximum expected concentration (MEC) is determined by multiplying the MOC by the RPM:

$$\mathrm{MEC} = (\mathrm{RPM})(\mathrm{MOC}) \qquad \text{(Equation C-8)}$$

Where,
MOC = Maximum Observed Concentration
MOC = 12.1 µg/L

In the case of copper,
MEC = (1.4)(12.1 µg/L) = 17.1 µg/L

Comparison with WQS numeric criteria for copper

In order to determine if RP exists for this discharge to violate WQS numeric criteria, the highest projected concentrations at the boundary of the mixing zone is compared with acute and chronic WQS numeric criteria. For copper:

Acute: 5.781 µg/L > 5.78 µg/L (acute criterion)

YES, there is RP to violate acute criterion

Chronic: 2.27 µg/L < 3.73 µg/L (chronic criterion)

NO, there is not RP to violate chronic criterion.

For temperature:

Chronic: 1.01°C > 1.0°C (chronic criterion)

YES, there is RP to violate chronic criterion.

The RPA procedures use statistical methods to estimate MECs or, in the case of temperature, maximum expected temperature difference between effluent and the ambient receiving water (MEΔT). Using a mass balance approach, the RPA projects the temperature at the boundary of a mixing zone. The delta T (ΔT) dataset of 1,779 values did not follow a discernible statistical distribution, but was closest to a normal distribution with a correlation coefficient of 0.97. The same equation for the RPM for copper was used to determine that the MEΔT of 29.9°C has reasonable potential to exceed the WQS numeric criteria of 1°C. The Department has determined temperature has a reasonable potential to exceed chronic marine criteria at the boundary of the chronic mixing zone.

Table C-1 summarizes the data, multipliers, and criteria used to determine RP to exceed WQS numeric criteria at the end of the pipe and at the boundary of the chronic mixing zone. Since there is a reasonable potential for the effluent to cause an exceedance of chronic and acute WQS numeric criteria for copper and temperature, water quality based effluent limits (WQBELs) for copper and temperature are required. See APPENDIX D for the calculations.

Table C- 1: Nikiski Combined Cycle Plant Reasonable Potential Analysis Results

Parameter	MOC	N[a]	C_u[b]	RPM	MEC (C_e)	D[c]	C_d[d]	WQS Criteria	Boundary of Mixing Zone RP?
Delta T	29.9°C	1,779	0°C	1	29.9°C	29.7	1°C	1.01°C	Yes (chronic)
Arsenic (chronic)	65.4 µg/L	59	5.4[e] µg/L	1.1	72.05 µg/L	29.7	7.65 µg/L	36.1 µg/L	No
Arsenic (acute)						3.8	22.92 µg/L	68.6 µg/L	
Copper (chronic)	12.1 µg/L	24	1.75 µg/L	1.4	17.1 µg/L	29.7	2.27 µg/L	3.73 µg/L	Yes (acute)
Copper (acute)						3.8	5.78 µg/L	5.78 µg/L	

Footnotes:

a. N = Number of valid samples

b. C_u = 85th percentile measured receiving waterbody ambient concentration, unless otherwise noted via footnote e.

c. D = Dilution Ratio

d. C_d = Calculated receiving water concentration (RWC) at mixing zone boundary

e. Ambient concentration of arsenic is assumed- 15% of chronic WQS aquatic life numeric criteria. Ambient temperature of receiving water is the lowest non-negative value observed- 0°C.

APPENDIX D. EFFLUENT LIMIT CALCULATION

If the Alaska Department of Environmental Conservation (the Department or DEC) does not authorize a mixing zone, water quality standards (WQS) numeric criteria are applied at the end of the pipe, and technology-based effluent limits (TBELs) are selected for those parameters that are solely technology based.

When DEC authorizes a mixing zone, parameters are identified in the mixing zone that will require dilution to meet WQS numeric criteria. If there are TBELs for an identified parameter in the mixing zone, TBELs apply at the end of the pipe, and WQS numeric criteria for that parameter, apply at the boundary of the mixing zone. If the reasonable potential analysis (RPA) requires the development of water-quality based effluent limits (WQBELs) for specific parameters in order to protect aquatic life at the boundary of the mixing zone, WQBELs are applied as end-of-pipe effluent limits. Those parameters that are not identified in the authorized mixing zone, must meet applicable WQS numeric criteria at the end of pipe. In the absence of WQ criteria for a particular pollutant, such as for total suspended solids (TSS), TBELs are applied as end-of pipe effluent limits.

In the case of the Nikiski Combined Cycle Plant, copper and temperature demonstrated RP to exceed at the end of pipe and required the most dilution to meet water quality numeric criteria at the boundary of the authorized acute and chronic mixing zones; therefore, the Department developed WQBELs for temperature and copper. The limit calculations are depicted below.

D.1 Effluent Limit Calculation

Once the Department determines that the effluent has a reasonable potential to exceed a WQS, a WQBEL for the pollutant is developed. The Department used the process described in the *Technical Support Document (TSD) for Water Quality-Based Toxics Control* (Environmental Protection Agency, 1991) and DEC's guidance, *Alaska Pollutant Discharge Elimination System (APDES) Permits Reasonable Potential Analysis and Effluent Limits Development Guide* (June 30, 2014) to calculate WQBELs for copper and temperature. The first step in calculating WQBELs is the development of a WLA for the pollutant.

D.2 Mixing Zone-based WLA

When the Department authorizes a mixing zone for the discharge, the WLA is calculated using the available dilution, background concentrations and WQS numeric criteria of the pollutant. Since acute aquatic life and chronic aquatic life standards apply over different time frames and may have different mixing zones, it is not possible to compare the WLAs directly to determine which standard is the most stringent. The acute criteria are applied as a one-hour average and may have a smaller mixing zone, while the chronic criteria are applied as a four-day average and may have a larger mixing zone. To allow for comparison, LTA loads are calculated from both the acute and chronic WLAs. The most stringent LTA is used to calculate the permit limits.

D.3 "End-of-Pipe" WLAs

In many cases, there is no dilution available, either because the receiving waterbody exceeds the criteria or because the state does not authorize a mixing zone for a particular pollutant. When there is no dilution available, the criterion becomes the WLA. Establishing the criterion as the WLA ensures that the permittee's discharge does not contribute to an exceedance of the criterion. As with the mixing-zone based WLA, the acute and chronic criteria must be converted to LTAs and compared to determine which one is more stringent. The more stringent LTA is then used to develop permit limits.

D.4 Permit Limit Derivation

Once the appropriate LTA has been calculated, the Department applies the statistical approach described in Chapter 5 of the TSD to calculate the maximum daily limit (MDL) and average monthly limit (AML). This approach takes into account effluent variability (using the coefficient of variation (CV)), sampling frequency, and the difference in time frames between the AML and MDL.

The MDL is based on the CV of the data and the probability basis, while the AML is dependent on these two variables and the monitoring frequency. As recommended in the TSD, the Department used a probability basis of 95% for the AML calculation and 99% for the MDL calculation.

The following is a summary of the steps to derive WQBELs from WQS numeric criteria for pollutants that have reasonable potential to exceed WQS numeric criteria. These steps are found in the Department's Reasonable Potential Analysis and Effluent Limitation Guidance and the guidance's accompanying Microsoft Excel Reasonable Potential Analysis Tool. The guidance and tool were used to calculate the MDL and AML for copper and temperature in the Nikiski Combined Cycle Power Plant permit.

<u>Step 1- Determine the WLA</u>

The acute and chronic aquatic life criteria are converted to acute and chronic waste load allocations using the following equations:

$$WLA_{a,c,hh} = \left(WQC_{a,c,hh}\right)\left(D_{a,c,hh}\right) + C_s\left(1 - D_{a,c,hh}\right)$$

$$WLA_{a,c,hh} = WQC_{a,c,hh}\left(\frac{Q_d + Q_s}{Q_d}\right) + C_s\left(1 - \left[\frac{Q_d + Q_s}{Q_d}\right]\right)$$

Where: $D_{a,c} = Dilution = \frac{(Q_d + Q_s)}{Q_d}$

$D_{hh}(Dilution\ [Human\ Health]) = D_c\ (Dilution[Chronic\ Aquatic\ Life])$

$Q_s = Critical\ Upstream\ Flow$

$Q_d = Critical\ Discharge\ Flow$

$C_s = Critical\ Upstream\ Concentration$

$WLA_{a,c} = Wasteload\ Allocation\ (acute, chronic, or\ human\ health)$

$WQC_{a,c} = C_r = Water\ Quality\ Criterion(acute, chronic, or\ human\ health)$

For copper,

$D_a = 3.8047$

$D_c = 29.7$

$C_s = 1.75\ micrograms\ per\ liter$ (µg/L)

$WLA_a = 17.09\ \mu g/L$

$WLA_c = 60.7\ \mu g/L$

$WQC_a = 5.781\ \mu g/L$

$WQC_c = 2.27\ \mu g/L$

For temperature,

$D_c = 29.7$

$C_s = 0°C$

$WLA_c = 29.7°C$

$WQC_c = 1°C$

Step 2 - Determine the Long-Term Average (LTA)

The WLAs are converted to LTAs using multipliers that are derived from equations in section 5.4 of the TSD:

$$LTA_a = WLA_a * exp(0.5\sigma^2 - z_{99}\sigma)$$

$$LTA_c = WLA_c * exp(0.5\sigma_4^2 - z_{99}\sigma_4)$$

Where:

$z_{99} = the\ z - statistic\ at\ the\ 99^{th} percentile = 2.326$

$LTA_a\ only: \sigma = ln[CV^2 + 1]^{1/2}$

$LTA_a\ only: \sigma^2 = ln[CV^2 + 1]$

$LTA_c\ only: \sigma_4 = ln\left[\left(\frac{CV^2}{4}\right) + 1\right]^{1/2}$

$LTA_c\ only: \sigma_4^2 = ln\left[\left(\frac{CV^2}{4}\right) + 1\right]$

$CV = coefficient\ of variation$

For copper:

$LTA_a = 5.21\ \mu g/L$

$LTA_c = 30.89\ \mu g/L$

For temperature:

$LTA_a = none\ (there\ is\ no\ acute\ criteria)$

$LTA_c = 24.1°C$

Step 3 – Choosing the More Limiting LTA

To protect a waterbody from both acute and chronic effects, the more limiting of the two LTAs is used to derive the effluent limits. In the case of copper, the LTA_a is more limiting. In the case of ΔT, there is no acute criteria, so LTA_c is more limiting.

Step 4 - Calculate the Permit Limits

The MDL and AML are calculated using the following equations that are found in table 5-2 of the TSD:

$$MDL_{aquatic\ life} = LTA * exp(z_{99}\sigma - 0.5\sigma^2)$$

Where:

$$z_{99} = the\ z - statistic\ at\ the\ 99^{th} percentile = 2.326$$

$$\sigma_n = ln[CV^2 + 1]^{1/2}$$

$$\sigma_n^2 = ln[CV^2 + 1]$$

$$CV = coefficient\ of variation$$

$$AML_{aquatic\ life} = LTA * exp(z_{95}\sigma_n - 0.5\sigma_n^2)$$

Where:

$$z_{95} = the\ z - statistic\ at\ the\ 95^{th} percentile = 1.645$$

$$\sigma_n = ln\left[\left(\frac{CV^2}{n}\right) + 1\right]^{1/2}$$

$$\sigma_n^2 = ln\left[\left(\frac{CV^2}{n}\right) + 1\right]$$

$$CV = coefficient\ of variation$$

$$n = number\ of\ samples\ per\ month$$

For copper:

$$MDL = 17.09\ \mu g/L$$

$$AML = 8.28\ \mu g/L$$

For temperature:

$$MDL = 36.2°C$$

$$AML = 27.9°C$$

APPENDIX E. Mixing Zone Analysis Checklist

The purpose of the Mixing Zone Checklist is to guide the permit writer through the mixing zone regulatory requirements to determine if all the mixing zone criteria at 18 AAC 70.240 through 18 AAC 70.270 are satisfied, as well as provide justification to authorize a mixing zone in an Alaska Pollutant Discharge Elimination System (APDES) permit. In order to authorize a mixing zone, all criteria must be met. The permit writer must document all conclusions in the permit Fact Sheet; however, if the permit writer determines that one criterion cannot be met, then a mixing zone is prohibited, and the permit writer need not include in the Fact Sheet the conclusions for when other criteria were met. See Section 6.5 of the Fact Sheet for the Nikiski Combined Cycle Plant mixing zone analysis.

Criteria	Description	Answer & Resources	Regulation
Size	Is the mixing zone as small as practicable? Permit writer conducts analysis and documents analysis in Fact Sheet at: Section 4.3 Mixing Zone Analysis	**Answer: Yes**, mixing zone as small as practicable. •Technical Support Document for Water Quality-Based Toxics Control •Fact Sheet, Section 5.0 & 5.1 •DEC's Reasonable Potential Analysis Guidance •Environmental Protection Agency's Permit Writers' Manual	18 AAC 70.240 (a)(2) 18 AAC 70.245 (b)(1) - (b)(7) 18 AAC 70.255(e) (3) 18 AAC 70.255 (d)
Technology	Were the most effective technological and economical methods used to disperse, treat, remove, and reduce pollutants?	**Answer: Yes** Fact Sheet, Section 5.2	18 AAC 70.240 (a)(3)
Low Flow Design	**For river, streams, and other flowing fresh waters.** - Determine low flow calculations or documentation for the applicable parameters.	**Answer: Not Applicable** Discharge occurs to marine, not fresh waters	18 AAC 70.255(f)
Existing Use	Does the mixing zone…		
	(1) partially or completely eliminate an existing use of the waterbody outside the mixing zone? **If yes, mixing zone prohibited.**	**Answer: No** Fact Sheet Section 5.3	18 AAC 70.245(a)(1)
	(2) impair overall biological integrity of the waterbody? **If yes, mixing zone prohibited.**		18 AAC 70.245(a)(2)
	(3) provide for adequate flushing of the waterbody to ensure full protection of uses of the waterbody outside the proposed mixing zone? **If no, then mixing zone prohibited.**	**Answer: Yes** Fact Sheet Section 5.3	18 AAC 70.250(a)(3)
	(4) cause an environmental effect or damage to the ecosystem that the department considers to be so adverse that a mixing zone is not appropriate? **If yes, then mixing zone prohibited.**	**Answer: No** Fact Sheet Section 5.3	18 AAC 70.250(a)(4)

Criteria	Description	Answer & Resources	Regulation
Human consumption	Does the mixing zone…		
	(1) produce objectionable color, taste, or odor in aquatic resources harvested for human consumption? **If yes, mixing zone may be reduced in size or prohibited.**	**Answer: No** Fact Sheet Section: 5.3	18 AAC 70.250(b)(2)
	(2) preclude or limit established processing activities of commercial, sport, personal use, or subsistence shellfish harvesting? **If yes, mixing zone may be reduced in size or prohibited.**		18 AAC 70.250(b)(3)
Spawning Areas	Does the mixing zone…		
	(1) discharge in a spawning area for anadromous fish or Arctic grayling, northern pike, rainbow trout, lake trout, brook trout, cutthroat trout, whitefish, sheefish, Arctic char (Dolly Varden), burbot, and landlocked coho, king, and sockeye salmon? **If yes, mixing zone prohibited.**	**Answer: No** Fact Sheet Section: 5.5	18 AAC 70.255 (h)
Human Health	Does the mixing zone…		
	(1) contain bioaccumulating, bioconcentrating, or persistent chemical above natural or significantly adverse levels? **If yes, mixing zone prohibited.**	**Answer: No** Fact Sheet Section: 5.4	18 AAC 70.250 (a)(1)
	(2) contain chemicals expected to cause carcinogenic, mutagenic, teratogenic, or otherwise harmful effects to human health? **If yes, mixing zone prohibited.**		
	(3) Create a public health hazard through encroachment on water supply or through contact recreation? **If yes, mixing zone prohibited.**		18 AAC 70.250(a)(1)(C)
	(4) meet human health and aquatic life quality criteria at the boundary of the mixing zone? **If no, mixing zone prohibited.**		18 AAC 70.255 (b),(c)
	(5) occur in a location where the department determines that a public health hazard reasonably could be expected? **If yes, mixing zone prohibited.**		18 AAC 70.255(e)(3)(B)
Aquatic Life	Does the mixing zone…		
	(1) create a significant adverse effect to anadromous, resident, or shellfish spawning or rearing? **If yes, mixing zone prohibited.**	**Answer: No** Fact Sheet Section: 5.6	18 AAC 70.250(a)(2)(A-C)
	(2) form a barrier to migratory species? **If yes, mixing zone prohibited.** (3) fail to provide a zone of passage? **If yes, mixing zone prohibited.**	**Answer: No** Fact Sheet Section: 5.6	

Criteria	Description	Answer & Resources	Regulation
	(4) result in undesirable or nuisance aquatic life? **If yes, mixing zone prohibited.**		18 AAC 70.250(b)(1)
	(5) result in permanent or irreparable displacement of indigenous organisms? **If yes, mixing zone prohibited.**		18 AAC 70.255(g)(1)
	(6) result in a reduction in fish or shellfish population levels? **If yes, mixing zone prohibited.**		18 AAC 70.255(g)(2)
	(7) prevent lethality to passing organisms by reducing the size of the acute zone? **If yes, mixing zone prohibited.**		18 AAC 70.255(b)(1)
	(8) cause a toxic effect in the water column, sediments, or biota outside the boundaries of the mixing zone? **If yes, mixing zone prohibited.**		18 AAC 70.255(b)(2)
Endangered Species	Are there threatened or endangered species (T/E spp) at the location of the mixing zone? If yes, are there likely to be adverse effects to T/E spp based on comments received from the United States Fish and Wildlife Service or National Oceanic and Atmospheric Association. If yes, will conservation measures be included in the permit to avoid adverse effects?	**Answer: Yes** Fact Sheet Section 5.7	Program Description, 6.4.1 #5 18 AAC 70.250(a)(2)(D)