ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM

STATEMENT OF BASIS

General Permit Authorization: AKG315220 – Furie Operating Alaska LLC

Allegra Leigh Platform

DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Wastewater Discharge Authorization Program
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Proposed issuance of an Alaska Pollutant Discharge Elimination System (APDES) authorization under AKG315200 Oil and Gas Exploration, Development and Production in State Waters in Cook Inlet (CIGP) authorization to:

Furie Operating Alaska LLC

For produced water (Discharge 015) from

Allegra Leigh Platform (ALP)
Kitchen Lights Unit Oil and Gas Lease Area
(15 miles Northwest of Nikiski Bay)

The Alaska Department of Environmental Conservation (Department or DEC) proposes to issue an authorization specifically for produced water under APDES general permit authorization **AKG315220 – Furie Operating Alaska LLC, ALP** (Authorization). The Authorization sets conditions on the discharge of produced water from this facility to waters of the United States. To ensure protection of water quality and human health, the Statement of Basis (SOB) places limits on the types and amounts of pollutants that can be discharged in the produced water from the facility and outlines best management practices to which the facility must adhere.

This SOB presents supporting information for the authorization of produced water, including:

- information on public comment, public hearing, and appeal procedures;
- effluent characterization, proposed mixing zone(s), effluent limitations, monitoring, other permit requirements, and
- Antidegradation Analysis that supports expanding copper limits based on new data.

Upon authorization, the addition of produced water from the ALP will be added to the existing CIGP. Hence, the additional produced water from ALP will be automatically included in the next reissuance of the CIGP given this Statement of Basis is issued a 30-day public notice and results in the decision to authorize the produced water discharge by the Department per Cook Inlet GP Sections 1.1.7, 1.3.4.2, and 3.4.9.

Appeals Process

A person authorized under a provision of 18 AAC 15 may request an informal review of a contested decision by the Division Director in accordance with 18 AAC 15.185 and/or an adjudicatory hearing in accordance with 18 AAC 15.195 – 18 AAC 15.340. See DEC's "Appeal a DEC Decision" web page https://dec.alaska.gov/commish/review-guidance/ for access to the required forms and guidance on the appeal process. Please provide a courtesy copy of the adjudicatory hearing request in an electronic format to the parties required to be served under 18 AAC 15.200. Requests must be submitted no later than the deadline specified in 18 AAC 15.

TABLE OF CONTENTS

TABLES

FIGURES

LIST OF APPENDICES

1 INTRODUCTION

1.1 Applicable Permits

On December 15, 2023, the Alaska Department of Environmental Conservation (DEC or Department) Alaska Pollutant Discharge Elimination System (APDES) Program received an administratively complete application from Furie Operating Alaska LLC (Furie or applicant) to support a Statement of Basis (SOB) to allow for adding produced water to existing general permit authorization AKG315220 issued under General Permit AKG315200 – Oil and Gas Exploration, Development, and Production Facilities in State Waters in Cook Inlet (CIGP).

Currently, produced water is authorized for this facility under Individual Permit AK0053686 – KLU Julius R. Platform (IP). Because the CIGP did not specify coverage of produced water from the Platform, a SOB issued for a 30-day public comment period is necessary per CIGP Sections 1.1.7, 1.3.4.2, and 3.4.9. Once the authorization of produced water is obtained via public notice of the SOB, all discharges for the facility will be included in AKG315220 and the IP will be terminated.

1.2 Applicant

This SOB provides information on Authorization AKG315220 under the CIGP for the following entity:

Permittee:	Furie Operating Alaska, LLC
Name of Facility:	Allegra Leigh Platform (ALP)
APDES General Permit Authorization:	AKG315220
Facility Location:	Latitude 60.936667°, Longitude -151.156389°
Mailing Address:	53360 Rodneyshelley Ave, Nikiski AK 99611
Facility Contact:	Mr. Ben Christianson

Figure A-1 in Appendix A shows the location of ALP.

1.3 Authority

The National Pollutant Discharge Elimination System (NPDES) Program regulates the discharge of wastewater to the waters of the United States (U.S.). For waters of the U.S. (WOTUS) under jurisdiction of the State of Alaska, the NPDES Program is administered by DEC as the APDES Program. Currently the facility is covered by both an IP and a CIGP authorization. If, and when, produced water becomes authorized under the CIGP, all discharges will be covered by the CIGP Authorization AKG315220 allowing for termination of AK0053686. This SOB only covers produced water because all other discharges have already been through the public notice process for the CIGP and are available to Furie for immediate coverage.

Clean Water Act (CWA) Section 301(a) and 18 AAC 83.015 provide that the discharge of pollutants to WOTUS is unlawful except in accordance with an APDES permit developed per 18 AAC 83.115 and 18 AAC 83.120. A violation of a condition contained in the Permit constitutes a violation of the CWA and subjects the permittee of the facility with the permitted discharge to the penalties specified in Alaska Statute (AS) 46.03.760 and AS 46.03.761.

1.4 Permit History

1.4.1 Previous Permit Issuances

DEC first issued the IP to Furie for the Kitchen Lights Unit (KLU) Gas Production Platform A on April 18, 2014, (2014 Permit) for a five-year term, which became effective May 18, 2014. The 2014 IP covered wastewater discharges associated with the construction of the offshore platform and a marine pipeline but did not include produced water at that time. Based on preliminary information from the beluga formation, produced water was assumed to have de minimis volumes, approximately 50 barrels per day (bbl/d), that could be transferred to the Central Processing Facility (CPF) via subsea pipeline, containerized, and disposed into a third-party underground injection control (UIC) well. Due to this assumption, produced water discharge was not requested at that time. However, it was found later that the Sterling formation had significantly more produced water, approximately 2,000 bbl/d. Other unknown conditions followed.

1.4.2 Gas Hydrate Formation

During the winter conditions of January 2019, while producing from both the Sterling and Beluga,gas hydrates in the produced water formed precipitates in the gas pipeline to the onshore facility causing a pipeline blockage substantial enough to completely halt gas production for 75 days. Furie injected methanol into the well and gathering line to reduce the potential formation of hydrates. Unfortunately, to ensure hydrates do not form later in the pipeline to the CPF the produced water had to be treated and discharged at the platform rather than transferring to shore for injection as originally intended. This situation posed a design challenge to find a produced water treatment system that could adequately treat the produced water and be installed within the limited space available on the platform.

While the 2014 IP was under administrative extension, Furie conducted a pilot test for a produced water treatment system and submitted design drawings and a supplemental application to address treating and discharging produced water at the platform. The design drawings were based on the pilot test and the Department approved the design for construction on February 4, 2020. However, Furie did not construct the produced water treatment system until after the IP was reissued in February 2021 (2021 IP), which used the pilot test data to establish limits. As DEC and Furie were coordinating on this SOB in March 2025, the ALP experienced another shutdown due to hydrates in the gas pipeline.

1.4.3 Sediment Slugs

On July 1, 2020, the ALP was obtained by HEX Cook Inlet LLC, Alaska (HEX) in a Chapter 11 Bankruptcy Sale with Cornucopia Oil & Gas Company, LLC. After installing the treatment system and operating for several months successfully, Furie struggled to comply with the copper and the oil and grease permit limits beginning in June 2021. The inability to meet copper limits appeared to be due to sediment entering the production system after a workover of one of the wells; the sediment load overwhelmed the filtration system. Over time, Furie worked to reestablish production and after drilling sidetracks on the impacted well and came back into compliance on or about May 2022. Furie is evaluating operational modifications to lessen the impacts of both sediment and hydrates, possibly concurrently. Furie is currently modulating flow velocity and/or pressure from the wells as Best Management Practices (BMPs) to manage sediment and hydrates flowing from the well to maintain permit compliance. This SOB considers these operational BMPs as essential given there is limited space for additional treatment at the ALP.

2 BACKGROUND

2.1 Facility Information

The ALP is a natural gas production platform located in water approximately 35 meters (100 feet) deep and 15 miles northwest of Nikiski Bay in the coastal zone of Cook Inlet, Alaska. In 2014 and 2015, Furie constructed the ALP with one production well in Kitchen Lights Unit (KLU) of the Cook Inlet oil and gas lease area, an onshore CPF located near Nikiski, and a single connecting marine pipeline between the two facilities (See Figure A-1).

In late 2015, Furie initiated natural gas production from a single production well into the Beluga formation at the platform. At that time, the estimated volume of produced water was 2,000 bbl/d; the produced water treatment system was designed based on that estimate. Today, there are multiple production wells completed in the Beluga and Sterling formations that require a discharge of 5,000 bbl/d on an average monthly limit (AML) basis. Furie continues to execute plans to increase production by drilling additional new wells into nearby reservoirs, and may need to increase the volume limit again in the future. Meanwhile, the existing treatment system has struggled meet limits due to intermittent high sediment loads from the excess water formations that were not accounted for during the Pilot Test.

During the plan review for the existing produced water treatment system, a Professional Alaskan Engineer (PE) certified the system would be capable of treating the produced at 146 gallons per minute (gpm) to attain the desired 5,000 bbl/d AML. The PE did not support the certification with calculations because the vendor declared such information as proprietary; the results of the Pilot Test were used to justify the certification. Unfortunately, the Pilot Test did not account for the intermittent sediment loads that overwhelm the cartridge filters. During the Pilot Study, the carbon filtration step was the determinant process restricting the design flow. Now that we know about the sediment, the treatment system flow is likely dependent upon the cartridge filters and not the carbon. Hence, because the Pilot Study failed to account for intermittent sediment, the originally certified throughput is open for reevaluation. An increase in carbon treatment may not result in a significant increase in design flow unless sediment load is mitigated at the source.

The proposed increases in influent concentrations of critical parameters affecting limits under the permit (e.g., oil and grease, dissolved hydrocarbons, and copper) and increased flow as more wells are added could exceed the treatment capacity of the current treatment system if the sediment loads are not mitigated. In general, the occurrence of sediment in the produced water was not known during the Pilot Test for the existing treatment system; sediment load affects oil separation as well as copper removal. The applicant has requested increases to copper limits to account for unverified variations of fine-grained sediment containing copper while evaluating the effectiveness of BMPs to prevent spikes in sediment from the wells. Given significant space limitations, both DEC and Furie anticipate future upgrades to increase design volumes but only after sufficient characterization of the influent while implementing BMPs that are intended to decrease sediment and copper. The following sections provide additional information on the current produced water characteristics and the treatment capacity of the produced water system.

2.2 Produced Water Characterization

2.2.1 General Characteristics

Variable amounts of water are co-produced from oil and gas wells during the routine production of hydrocarbons. The amount of produced water that is recovered from any well during an economic lifetime will often vary greatly depending on a variety of complex geological, commercial, and natural hydrodynamic factors. Some wells will produce large amounts of produced water throughout the entire production history while other wells may produce little or no water at all. Regardless, it takes time under operation to adequately quantify produced water volumes and characterize parameters of concern for newly constructed facilities.

Formation water is a complex mixture of paleo-seawater, fresh surface waters, and highly saline connate (or interstitial) water produced due to the pressure and thermal modification of sediments at depth. The physical and chemical properties of co-produced formation water vary widely depending on the geologic age, regional hydrodynamic systems, depth, and geochemistry of the hydrocarbon-bearing formation. When a hydrocarbon reservoir is penetrated by a well, the produced fluids commonly contain formation water in addition to the oil, natural gas, natural gas liquid hydrocarbons, and sediment. Effective management and disposal of produced water impacts the economic life of a producing well. As a result, each source of produced water tends to have unique attributes that require characterization to inform appropriate treatment requirements. When a facility is new and complex, it may not be possible to accurately characterize the produced water during normal operations when there are excessive degrees of freedom in variables that may affect the characterization process (e.g., multiple zones of produced water with unknown variability in quality). For this and other reasons, new facilities often need to update produced water characteristics based on actual data from a fully operational facility.

2.2.2 Specific Characteristics at ALP

The Furie wells produce only natural gas in the form of non- associated biogenic methane with no associated liquid hydrocarbons or hydrogen sulfide. The Sterling and Beluga produced water is relatively fresh with measured salinities of less than 8,500 ppm chlorides. As a comparison, seawater has salinities typically in the 30,000 parts per million (ppm) range. At the ALP, the Sterling Formation has been observed to produce approximately 40 times more produced water than the Beluga Formation, while the Beluga Formation is observed to have higher concentrations of pollutants. Both conditions differ from the conditions observed during the Pilot Study conducted in 2019. In addition, the applicant suggests that past limit exceedances may not be solely due to recent workover miscues but could represent a “new normal” in influent quality represented by unpredictable hydrate formation and sediment loads that affect copper and oil and grease concentrations treatment efficiencies. When multiple wells are operating out of both formations, it is not easy to characterize the produced water impacted by unexpected sediment and/or hydrate slugs. Data obtained during the term of the 2019 Permit tends to support this assertion as copper-laden sediment caused wide variations in copper concentrations resulting in several limit exceedances (See Section 2.3). To help ensure future compliance Furie is faced with increasing predictability and mitigating sediment using BMPs given the treatment system was not designed for unexpected sediment loads originating from the formations. The use of methanol to reduce hydrate formation will continue to be implemented to prevent pipeline blockages However, if methanol enters the produced water treatment system, compliance with chronic whole effluent toxicity limit may be impacted.

There is currently insufficient data to ascertain whether the increase in sediment and/or hydrates in the influent can be adequately detected or controlled at the wellhead before these conditions result in noncompliance or, even worse, facility shutdown. If the increase in influent flow and concentration is the new normal, then the existing treatment system will likely be inadequate unless there is a means to detect and mitigate sediment and/or manage methanol concentrations for hydrate control. Note that an increase in limited concentrations triggers both the Backsliding and Antidegradation Policies and subsequently an alternative analysis for ensuring there is adequate treatment. While treatment cannot be ignored, an upgrade may be delayed until the impacts of sediment and/or hydrates is understood sufficiently to render a design upgrade that fits within the limited deck space of ALP.

2.2.2.1 Pilot Study Approach

When the treatment system was originally designed in 2019, Furie evaluated a potential treatment system based primarily on capability of meeting technology-based effluent limitations required per effluent limitation guidelines (ELGs) in 40 CFR 435 – Oil and Extraction Point Source Category for oil and grease. TAH, chronic whole effluent toxicity (WET), and copper were also evaluated during the Pilot Study given these parameters were of interest for water quality-based effluent limits (WQBELs). However, none of the produced water evaluated during the pilot study included sediment slugs that are now impacting treatment efficiency.

Prior to conducting the Pilot Study, Furie collected a total of nine analytical samples from the onshore CPF facility downstream of a three-phase separator for representing both formations. After evaluation at the CPF, Furie collected three samples downstream of three-phase separation at the platform (PF) for the Beluga formation (B) and two samples from the well into the Sterling formation (S) prior to separation in conduct a compare and contrast analysis of raw produced water characteristics. This analysis found that the raw, untreated produced water contained concentrations of arsenic, copper, lead, manganese, nickel, selenium, silver, zinc, and mercury in excess of applicable water quality criteria. In addition to these metals, TAH and TAqH were also found in concentrations exceeding water quality criteria. Note again, the impacts from episodic sediment load and/or hydrates were not evaluated in the Pilot Study. These impacts could only be addressed as part of a long-term strategy as short-term Pilot Studies may not capture real-world conditions. Pilot Studies are appropriate but seldom perfect.

2.2.2.2 Pilot Test Configuration and Execution

In September 2019, Furie conducted a short-term pilot test of a full-scale system that would later be installed at the platform. The Pilot Study was set up at the CPF to determine the efficiency of the system for removing oil and grease, TAH, TAqH, and the following metals: copper, lead, manganese, nickel, selenium, silver, zinc and mercury. Prior to treatment in the filters, the produced water was stored in a tank at the CPF that had been transferred from the ALP via the marine pipelines after three-phase separation. The test system consisted of two parallel sets of cartridge filters and two parallel sets of carbon filters piped to allow series or parallel operation allowing flexibility in operation. Based on the results of the Pilot Study and certification by an Alaskan Professional Engineer, the system was granted Approval to Construct the produced water treatment system on the ALP on February 4, 2020. This treatment system includes an oil water separator (i.e. Spincep), cartridge filtration, and carbon filtration. However, the configuration for series operation was not included as the system was designed for lead/lag operation to allow for continuous operation during filter changeout.

2.2.3 Treatment System Performance

The treatment system began operating in June 2021 and had trouble meeting permit limits during start-up, which is common. Beyond initial start-up, the treatment system appeared to perform as intended until August 16, 2021, when wireline work was conducted on the KLU A-4 well. The A-4 well, which had been shut in for wireline operations, was unloaded until believed to be stabilized. The produced water from A-4 was treated separately while produced water from the other wells was diverted to the CPF. The treatment system initially handled the produced water, but oil and grease results on August 18 and 25, 2021 became the first indication of treatment system problems. The treatment system continued to have difficulty meeting oil and grease permit limits as copper-laden sediment started to cause copper and chronic whole effluent toxicity (WET) violations in addition to oil and grease. Samples were collected within the produced water treatment system to track contaminant levels at several points along the treatment system to determine the nature and cause of the high oil and grease, copper, and WET results. The oil and grease exceedance was suspected to be caused by pressure testing surface control equipment with diesel, which was used as freeze protection for hydrates. Analytical results for copper showed much higher concentrations of total recoverable copper compared to dissolved copper indicating the copper exceedances were most likely attributable to sediments from the A-4 well work. This assertion is supported by reported difficulties in operating the cartridge filters, which had to be replaced frequently. In May 2022 the A-1 well was brought back online, produced water volumes increased and since April 2022 to the present WET, oil and grease, and copper results have normalized with most result near or below permit limits. Characterization data (June 2021 through December 2024) is shown in Table 3.

Table 1: Produced Water Data Characterization

Parameter (Units)	# D/T [1]	Limits [2]		Criteria			Range [4]
		MDL	AML	Acute	Chronic	HH [3]	(Min – Max; Ave)
Flow (mgd) [5]	n/a	---	0.21	---	---	---	0.000383 – 0.146; 0.0446
pH (SU)[6]	90/90	6.0 < pH < 9.0		6.5 ≤ pH ≤ 8.5			*6.0* – 8.0; 7.6
Oil & Grease (mg/L) [7]	49/112	42	29	---	---	---	< 2 – **59.9**; 5.77
Total Recoverable Copper (µg/L) [8]	40/51	16.7	8.3	5.78	3.74	1,300	< 1.37 – ***146***; ***14.39*** [9]
WET (TU_c) [10]	43/43	410	---	---	1.0	---	*2.84 – 112.36; 33.09* [10]
TAH (µg/L)	8/17	---	---	---	10	---	< 1.18 – *36.17*; 4.74
TAqH (µg/L)	8/17	---	---	---	15	---	< 1.45 – *36.43*; 4.94
Manganese (µg/L)	16/16	---	---	---	---	100	53.7 – 1,890; *199* [11]
Mercury (ng/L) [12]	10/18	---	---	2,100	1,100	51	< 0.5 – < 50; 3.13 [11]
Nickel (µg/L)	12/16	---	---	75	8.3	4,600	< 1.98 – *317; 40.5*
Selenium (µg/L)	8/15	---	---	290	71	11,000	2.2 – 37.7; 8.44
MeOH (mg/L)	19/44	---	---	---	---	---	< 10 – 72,000; 2218

Table Notes:

1. "D/T" represents the number of detected results divided by the total number of samples.
2. "MDL" stands for Maximum Daily Limit and "AML" stands for Average Monthly Limit.
3. "HH" stands for "Human Health." Average concentrations are used to compare to HH criteria.
4. Data that exceeds current limits are shown as bold. Data that exceeds criteria are shown in italics.
5. "mgd" stands for million gallons per day.
6. For pH, "SU" stands for standard units and the median is used in place of average.
7. "mg/L" stands for milligrams per liter. Anomalously high results from October 2021 to May 2022 excluded.
8. "µg/L" stands for micrograms per liter.
9. Anomalously high value of 841 µg/L excluded and another value of 69.5 µg/L taken during treatment system start-up excluded as nonrepresentative.
10. "TU_c" stands for Chronic Toxicity Units. Anomalously high WET results from October 2021 through May 2022 have been excluded.
11. Average for manganese is a geometric mean for use in evaluating human health mixing zone.
12. "ng/L" stands for nanograms per liter.

After critical review and coordination with Furie, DEC believes that the anomalously high oil and grease and Chronic WET results observed from October 2021 through May 2022 were due to diesel and should not be considered part of normal/routine operating conditions. Although high sediment loading from the well occurred at approximately the same time as the diesel, DEC believes sediment may be more of a normal/routine condition. Based on critical review of the data, copper is still the driving parameter for the acute mixing zone and is a parameter of concern (POC) to be used in sizing the acute mixing zone and considered in the reasonable potential analysis (RPA). Similarly, chronic WET remains the driving parameter for the chronic mixing zone and must be considered during the RPA.

2.3 Produced Water Compliance History

Two facets of compliance were assessed: the ability of the facility to meet the numeric and narrative permit limitations and monitoring and reporting requirements. The Permit required submission of monthly discharge monitoring reports (DMRs) as well as self-reporting of noncompliance events.

2.3.1 Limits Exceedances

Produced water effluent limit exceedances for total recoverable copper, oil and grease, and Chronic WET occurred during the current permit term from June 2021 through January 2024 as outlined in Compliance Order by Consent (COBC) signed on May 8, 2024. Table 2 lists exceedances that occurred during this timeframe.

Table 2. Effluent Limit Violations of Produce Water from 2021-2022

Date Range	Limit Exceedance	Explanation/Corrective Action
11/10/2021 – 12/5/2021	Oil & Grease – 219 mg/L Oil & Grease – 190 mg/L Oil & Grease – 63.5 mg/L	Filters were replaced on 12/5/2021 and a TOG/TPH Analyzer was ordered to conduct more frequent testing of produced water instead of having to wait on results from a lab.
12/15/2021 – 1/5/2022	Oil & Grease – 196 mg/L Copper – 81.2 µg/L Oil & Grease – 86.4 mg/L Oil & Grease – 350 mg/L	Filter breakthrough event. Filters were replaced on 1/5/2022 and testing frequency and location was increased.
12/21/2021 – 1/11/2022	Chronic WET – 500 TUc	May have been result of the above high oil and grease levels. Cartridge and carbon filters were changed on 1/11/2022.
2/2/2022 – 2/9/2022	Oil & Grease – 57.1 mg/L Copper – 32.6 µg/L	Filter breakthrough event. Filters were replaced on 2/3/2022 and 2/13/2022.
3/9/2022 – 3/29/2022	Copper – 810 µg/L	Filter breakthrough event. Filters were replaced on 3/2/2022. The frequency that the sandtraps were emptied at the start of the production was increased to reduce buildup of sand that might contribute to permit limit exceedance.
3/16/2022 – 4/4/2022	Oil & Grease – 320 mg/L Oil & Grease – 45.8 mg/L	Filter breakthrough event. Filters were replaced on 4/2/2022 and 4/4/2022. Weekly meetings with DEC begin.
4/6/2022	Copper – 146 µg/L	Elevated copper levels may be related to increased sedimentation from producing well. The system was checked for an extraneous source of copper, but none was found. Increased attention and monitoring of copper results. Weekly meetings with DEC personnel regarding test results.
4/7/2022	Chronic Wet – 833 TUc	Lab results indicated toxicity for *Menidia beryllina* but not for the more sensitive species *Americamysis bahia*. Lab suggests that microbial interference may have occurred. Retest 5/4/2022.
4/30/2022	Copper – 23.7 µg/L	Filter breakthrough event. Filters were replaced on 5/3/2022 and sandtraps were emptied on 5/13/2022. Increased output from the Sterling formation is expected to bring the test results back into compliance.
6/1/2022	Oil & Grease – 320 mg/L	Filter breakthrough event. Filters were replaced same day. Anomaly due to operator mistake.
7/13/2022	Copper – 9.58 µg/L	An additional sample was collected 8/10/2022 to determine if additional action was required.

2.3.2 Reporting Noncompliance

During the review period, the method of reporting transitioned from paper to electronic DMRs (NetDMRs). The EPA Electronic Reporting (eReporting) Rule (40 CFR 127) was initiated in December of 2016 and has been implemented in phases. The eReporting Rule also authorized delegated State

Programs, including Alaska, to integrate NetDMR data with the EPA Integrated Compliance Information System (ICIS) database. During the 2019 permit term, seven reporting violations occurred: two failures to notify, four failures to submit required report, and one late submittal of a DMR.

2.3.3 Compliance Order By Consent

A Compliance Order By Consent (COBC) was issued May 5, 2024. A COBC is an enforceable agreement that gives steps to resolve violations that are agreed upon by the violator and DEC that must be taken for the violator to continue to operate while coming into compliance. The COBC addresses both domestic wastewater and produced water effluent violations and provides a plan for how these violations can be reduced and eliminated. In this SOB, only those elements related to produced water are notable. Notably for produced water, in response to a Notice of Violation, Furie stated that no environmental harm occurred because of effluent limit violations due to low volumes of produced wastewater and the dilution provided by the receiving water. They suspected this violation was caused by diesel contamination and higher than anticipated sediment loads. Furie suspects that during the summer of 2021, wireline contractors used diesel in a manner that resulted in it being introduced downhole during their wireline fishing operations on the KLU A-4 well. This presumably caused diesel to enter the formation, then to be returned to surface during subsequent production activities. In June of 2023, Furie stated that they intended to move all authorized discharges under AK0053686 to the CIGP. The COBC also states that the respondent should coordinate with DEC to obtain an authorization to discharge under the CIGP and provide a status report on this progress one year after the effective date May 8, 2024 of the order.

3 RECEIVING WATERBODY

3.1 Water Quality Standards

Section 301(b)(1)(C) of the CWA requires the development of limits in permits necessary to meet water quality standards by July 1, 1977. Per 18 AAC 83.435, APDES permits must include conditions to ensure compliance with 18 AAC 70 – Alaska Water Quality Standards (WQS). The WQS are composed of waterbody use classifications, numeric and/or narrative water quality criteria, and an Antidegradation Policy. The use classification system designates the beneficial uses that each waterbody as a whole is expected to achieve. The numeric and/or narrative water quality criteria are the criteria deemed necessary by the state to support beneficial use classifications of each waterbody. The Antidegradation Policy ensures that beneficial uses and existing water quality are maintained.

Waterbodies in Alaska are designated 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 Department has determined that there has been no reclassification nor has site-specific water quality criteria been established for Cook Inlet at the location of the permitted discharge. Accordingly, site-specific criteria are not applicable.

3.2 Water Quality Status of Receiving Water

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

Cook Inlet is not included as an impaired waterbody in *Alaska's Final 2022 Integrated Water Quality Monitoring and Assessment Report*, August 31, 2022. Nor is Cook Inlet listed as a CWA 303(d) waterbody requiring a TMDL. Accordingly, a TMDL has not been established for Cook Inlet.

3.3 Mixing Zone Analysis

Per 18 AAC 70.240, as amended through March 23, 2006, the Department may authorize mixing zone(s) in an APDES permit. Determination of mixing zones requires an evaluation of critical characteristics of the receiving water, effluent discharges and other pertinent factors, combined with use of an approved mixing zone modeling program such as the Cornell Mixing Zone Model or Visual Plumes.

The Mixing Zone Analysis Checklist (Appendix D) outlines the criteria that must be considered and met per mixing zone regulations for the Department to authorize a mixing zone. These criteria include the size of the mixing zone, treatment technology, existing uses of the waterbody, human consumption, spawning areas, human health, aquatic life, and endangered species. The following summarizes the Department's regulatory mixing zone analysis.

3.3.1 Modeling Inputs and Outputs

3.3.1.1 Outfall Configuration and Ambient Conditions

On January 17, 2022 the applicant submitted Form M, including a mixing zone analysis for a submerged produced water discharge based on the critical ambient conditions and the existing outfall configuration. However, after submitting the application, Furie requested approval per 18 AAC 72.275(a)(5) to relocate the outfall to another existing port at the ALP to support the addition of new infrastructure. DEC approved this relocation upon evaluating the potential impact on the mixing zones. Given the relocation results in negligible changes to the existing mixing zone sizes when all other critical ambient conditions and other parameters are held constant, DEC considers the relocation to be equivalent to the existing port configuration when considering the error bound of the CORMIX Model.

The critical ambient conditions at ALP include an unstratified salinity profile at 1018 kilogram per meter cubed (kg/m^3), a 90^{th} percentile current of 2.3 meters per second (mps), a 10^{th} percentile current of 0.2 mps, and alignment of the ebb and flood current directions, which are 180 degrees opposite at this location in Cook Inlet. To account for higher concentration limits for copper in the acute mixing zone and lowered limits on WET in the chronic mixing zone, DEC used the new produced water characteristics with critical ambient conditions in a mixing zone analysis that directly correlates with the mixing zone approach used in the Cook Inlet GP incorporating new data derived from buoy deployments that allow for a comprehensive evaluation of current speeds and directions at slack tide (i.e., at 10^{th} percentile currents). This information allows for better interpretations of mixing zone widths.

3.3.1.2 Produced Water Mixing Zone Modeling Approach

The Cook Inlet GP mixing zone approach evaluates the current rose for both the 10^{th} and 90^{th} percentile currents using data from recent deployed buoys. The 90^{th} percentile current rose shows little variation in current direction and supports using these higher currents for the mixing zone lengths and provides a better prediction of the alignment of the ebb and flood cycles that are not exactly 180 degrees opposite.

Meanwhile, the 10^{th} percentile current rose has significant variation in current direction, at times approaching 90 degrees from the ebb or flood alignments. Hence, the result of the 10^{th} percentile current length from CORMIX is applied 90 degrees from either the ebb or flood alignments. This approach ensures that the mixing zones dimensions, especially the width, always results in meeting applicable water quality criteria at the boundary.

Using this approach, DEC evaluated the mixing zone dimensions needed to ensure compliance with water quality criteria at the boundaries using the new data from the previous permit term. The dimensions of the chronic mixing zone is driven by chronic WET with a probable maximum expected toxicity (MEC) of approximately 146 TUc and a chronic WET criterion of 1.0 TU_c. Whereas, the acute mixing zone is driven by total recoverable copper with a probable MEC of 344 µg/L, an ambient concentration of 0.926 µg/L, and acute criterion of 5.78 µg/L.

3.3.1.3 Mixing Zone Size Summary

The discharge of produced water is authorized to have a rectangular chronic mixing zone with a chronic dilution factor of 145 that is 138 meters long (69 meters in each prevailing current direction) by 30.75 meters wide extending from the sea surface to the seafloor for chronic toxicity, copper, pH, TAH, TAqH, nickel, and manganese. Manganese is included in the chronic mixing zone as a human health parameter that must meet human health criteria prior to the chronic mixing zone boundary; applicable criteria for both are met within a few feet of the discharge point. In addition, DEC authorizes an acute mixing zone with a dilution factor of 59 that is 54 meters long (27 meters in each prevailing current direction) by 15.25 meter wide extending from the sea surface to the seafloor for copper and nickel.

3.3.2 Regulatory Size Constraints

Per 18 AAC 70.240(k), mixing zones must be as small as practicable and the Department will ensure that existing uses of the waterbody outside the mixing zones are maintained and fully protected. Per 18 AAC 70.240(k)(1)(A), for estuarine and marine waters, measured at the mean lower low water (MLLW) level, the cumulative linear length for all mixing zones intersected on any given cross section of an estuary, inlet, cove, channel, or other marine water may not exceed 10% of the total length of that cross section. Additionally, per 18 AAC 70.240(k)(1)(B), the total horizontal area allocated to all mixing zones at any depth may not exceed 10% of the surface area. DEC determined the critical cross section for produced water mixing zones extends through Furie and the Bruce Platform produced water mixing zones. The total transect is approximately 29.2 kilometers long, while the cumulative length of the intersected mixing zones is approximately 401 meters, or 1.3% of the total length. Hence, the mixing zones are less than 10% of the critical cross section. On an area basis, the area of Cook Inlet where oil and gas discharge may be allowed is approximately 416,528 hectares. Meanwhile, the total area of all produced water mixing zones in Cook Inlet, including ALP, is 1275.9 hectare. Hence, the area of the mixing zone is infinitesimal (0.3%) compared to the overall surface area of the waterbody making it significantly smaller than the size allowed by 18 AAC 70.255(k)(1)(B). See Figure A-4 for more information.

Per 18 AAC 70.240(d)(7), acute mixing zones must be sized so there will be no reasonable expectation of lethality to passing organisms in the mixing zone. If a passing organism is in the acute mixing zone for less than 15 minutes, then no lethality is present, and no further evaluation is necessary. DEC begins the evaluation of potential lethality to passing organisms by calculating the exposure time required for drifting organisms to pass through the mixing zone during 10-percentile current conditions. In this case, the length of the mixing zone in one direction is 27 meters and the current is 0.2 mps. A drifting organism would only be exposed to toxic effects for 2.25 minutes, which supports the determination that the acute mixing zone is small as practicable.

3.3.3 Technology

18 AAC 70.240(c)(1) requires the Department to determine if "an effluent or substance 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" before authorizing a mixing zone. Applicable "highest statutory and regulatory requirements" are described in 18 AAC 70.240(c)(A), (B), and (C) as follows:

- Any federal TBEL identified in 40 CFR 125.3 and 40 CFR 122.29, as revised as of July 1, 2005 and adopted by reference;
- Minimum treatment standards in 18 AAC 72.050; and
- Any treatment requirement imposed under another state law that is more stringent than the requirement of this chapter.

The first part of the definition includes all TBELs applicable to federal ELGs that may be adopted by reference at 18 AAC 83.010(g)(3) or TBELs developed using case-by-case best professional judgement (BPJ). The Permit applies TBELs based on the ELGs for produced water establishing limits for oil and grease, 42 mg/L MDL and 29 mg/L AML. DEC also establishes a TBEL for pH using case-by-case BPJ that is $6.0 < pH < 9.0$.

The second part of the definition per 18 AAC 72.050 refers to the minimum treatment requirements for domestic wastewater. This SOB covers only produced water which is not applicable to 18 AAC 72.050.

The third part of the definition includes any treatment required by state law that is more stringent than 18 AAC 70. Other regulations beyond 18 AAC 70 that may apply to this permitting action include 18 AAC 83, 18 AAC 72 and 18 AAC 15. The Permit is consistent with 18 AAC 83, the minimum treatment requirements of 18 AAC 72 and neither the regulations in 18 AAC 15 nor another state legal requirement, that the Department is aware of, impose more stringent treatment requirements than 18 AAC 70. Therefore, the third and final part of the definition is also met.

3.3.4 Existing Use

Per 18 AAC 70.240(c)(2), the mixing zones have been appropriately sized to fully protect the existing uses of Cook Inlet. Water quality criteria are developed to ensure protection of existing uses such that if the water quality is met in the receiving water the uses are protected. The mixing zones have been appropriately sized to meet applicable acute, chronic, and human health criteria at and beyond the boundary of each mixing zone. Therefore, the mixing zones results in the protection of the existing uses of the waterbody as a whole.

3.3.5 Human Consumption

Per 18 AAC 70.240(c)(4)(B) the mixing zone must not create a public health hazard that would preclude existing uses of the waterbody for water supply or contact recreation. Per 18 AAC 70.240(c)(4)(C), the mixing zone must not preclude, or limit, established processing activities or commercial, sport, personal use, or subsistence fish and shellfish harvesting. Lastly, per 18 AAC 70.240(d)(6) the pollutants discharged cannot produce objectionable color, taste, or odor in aquatic resources harvested for human consumption.

The mixing zones are not authorized in a location where aquatic resources are harvested or that could result in precluding or limiting established processing activities or commercial, sport, personal use, or subsistence fish and shellfish harvesting. Nor is there any indication that the pollutants discharged would produce objectionable color, taste or odor in aquatic resources harvested for human consumption if such activity occurred near the outfall. Any human consumption of marine water would require a level of treatment that would remove virtually all pollutants (e.g., desalination or reverse osmosis). Therefore, human consumption is not impacted by the discharges under the Permit.

3.3.6 Spawning Areas

Per 18 AAC 70.240(e)(1) and (2), a mixing zone will not be authorized in lakes, streams, rivers, or other flowing freshwaters in spawning area of any of the five species of Pacific salmon found in the state or be allowed to adversely affect the present and future capability of an area to support spawning of these species. Per 18 AAC 70.240(f), a mixing zone will not be authorized in a spawning area for the following resident fish: Arctic Grayling; northern pike; lake trout; brook trout; sheefish; burbot; landlocked coho salmon, chinook salmon, or sockeye salmon; anadromous or resident rainbow trout, Arctic char, Dolly Varden, whitefish, or cutthroat trout. Because the permit does not authorize the discharge of effluent to open waters of a freshwater lake, river, or other flowing freshwater, there are not associated discharges to anadromous fish spawning areas or the resident freshwater fish listed in the regulation.

3.3.7 Human Health

Per 18 AAC 70.240(d)(1), the mixing zones must 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 Department reviewed monitoring data from the most the previous permit term and found that the only human health parameter that exceeded their criteria at the point of discharge is manganese.

Unlike aquatic life criteria that have short exposure periods, human health criteria are based on much longer exposure periods (e.g., lifetime exposure). Therefore, when assessing human health criteria, it is appropriate to consider average effluent and receiving water conditions commensurate with the long exposure periods for which the human health criteria are based. Comparing the geometric mean of the data to the human health criterion for manganese, the dilution factor would be less than two. Per 18 AAC 70.240, human health criteria must be met prior to the boundary of the chronic mixing zone, which is based on a DF of 146. Hence, human health criteria are met within a fraction of the overall chronic mixing zone. The analysis of available information reasonably demonstrates that the authorized chronic mixing zone will protect human health.

In addition, per 18 AAC 70.240(d)(2) pollutants discharged must not present an unacceptable risk to human health from carcinogenic, mutagenic, teratogenic, or other effects as determined using a risk assessment method approved by the Department and consistent with 18 AAC 70.025, which indicates the lifetime incremental cancer risk level is 1 in 100,000 for exposed individuals. There are no cancer-causing pollutants being discharged at concentrations that present unacceptable risks.

3.3.8 Aquatic Life and Wildlife

Per 18 AAC 70.240(c)(4)(A), (D), and (E), pollutants for which the mixing zones will be authorized will not result in an acute or chronic toxic effect in the water column, sediments, or biota outside the boundaries of the mixing zone; a reduction in fish or shellfish population levels; or in permanent or irreparable displacement of indigenous organisms. In addition, the mixing zone must not result in undesirable or nuisance aquatic life per 18 AAC 70.240(d)(5). Because all criteria are met at the respective acute and chronic mixing zone boundaries, toxic effects in the water column, sediments, or biota will not occur outside these boundaries; existing water quality criteria protect from these occurrences. In addition, there are no anticipated displacement of indigenous species nor promotion of undesirable or nuisance aquatic life.

3.3.9 Endangered Species

Per 18 AAC 70.240(c)(4)(F), the mixing zone will not cause an adverse effect on threatened or endangered species. Based on the information regarding endangered species in the area of the discharge, the authorized mixing zones are not likely to adversely affect threatened or endangered species per the Beluga Recovery Plan. The discharge area is within Type 2 habitat for the beluga whale, which primarily serves as a seasonal migration pathway between upper Cook Inlet summer feeding areas and lower birthing and rearing locations. Based on limited time that beluga whales migrate through this area, the discharges are not likely to cause adverse effects to beluga whales.

4 EFFLUENT LIMITS AND MONITORING REQUIREMENTS

4.1 Basis for Effluent Limits

Per 18 AAC 83.015, the Department prohibits the discharge of pollutants to waters of the U.S. unless the applicant has first obtained an APDES permit that meets the purposes of AS 46.03 and is in accordance with CWA Section 402. Per these statutory and regulatory provisions, the Permit includes effluent limits that require the discharger to meet standards reflecting levels of technological capability, comply with WQS, and comply with other state requirements that may be more stringent. The CWA requires that the limits for a particular pollutant be the more stringent of either TBELs or WQBELs.

The following summarizes the limits for Discharge 015A – Produced Water include numeric TBELs for pH, oil and grease and numeric WQBELs for chronic WET and copper. DEC also issues a narrative WQBELs for oil and grease (visible sheen).

4.1.1 Effluent Limits and Monitoring Requirements for Produced Water (Discharge 015)

In accordance with AS 46.03.110(d), the Department may specify the terms and conditions for discharging wastewater in a permit. The Permit includes monitoring requirements so that compliance with effluent limits can be determined but may also be required to characterize the effluent and to assess impacts to the receiving water. Based on sufficient data and results consistently below applicable water quality criteria, DEC is removing the monitoring requirements from the previous permit for Selenium. Note too that methanol (MeOH) is also eliminated from monitoring given there is no applicable water quality criterion and MeOH correlation to chronic WET has proven unsuccessful. Sufficiently sensitive methods as required in 40 CFR 136 are required for analyzing collected wastewater samples. The permittee must verbally report all violations of MDLs within 24 hours per Appendix A, Standard Conditions, Section 3.4 – 24-Hour Reporting. Violations of all other effluent limits are to be reported per Appendix A, Standard Conditions, Section 3.5 – Other Noncompliance Reporting.

The development of limits and monitoring requirements for this Authorization is summarized in Appendix C. Facility-specific effluent limits for Flow, pH, oil and grease, Total Recoverable Copper, and Chronic WET and monitoring requirements for TAH, TAqH, Nickel, Manganese, and Mercury are provided in Table 3 with referenced table notes provided in subsequent sections.

Table 3: Effluent Limits and Monitoring Requirements for Produced Water (Discharge 015)

Parameter (Units)	Effluent Limitations		Monitoring Requirements	
	MDL	AML	Frequency	Sample Type
Flow Rate (mgd)	Report	0.21	l/Week	Estimate or Measure
pH (SU)	6.0 < pH < 9.0		1/Week	Grab
Oil and Grease (Visible Sheen) 4.1.1.1	No Discharge		1/Week	Observation
Oil and Grease (mg/L)	42	29	1/Week	Grab
Total Recoverable Copper (μg/L)	288	97	l/Month	Grab
Chronic WET (TU_c) 4.1.2	255	---	l/Month	Grab
TAH (μg/L)	Report		l/Quarter	Grab
TAqH (μg/L)	Report		l/Quarter	Grab
Nickel (μg/L)	Report		l/Quarter	Grab
Manganese (μg/L)	Report		l/Quarter	Grab
Mercury (μg/L)	Report		l/Quarter	Grab

4.1.1.1 Visual Sheen and Supplemental Oil and Grease Monitoring

While discharging from platforms, the permittee shall monitor for oil and grease using visual observations of the receiving water surface in the vicinity of the discharge during periods of the day when observation of a sheen on the water surface is possible. If conditions prevent observations, the permittee may use the Static Sheet Test (EPA Method 1617). Static Sheen Test equipment must be maintained onsite. Observations must be maintained in a log at the facility and reported on the DMR. Upon observation of a sheen, a supplemental oil and grease sample must be collected and analyzed by a laboratory for verification the numeric limit has not been exceeded.

4.1.1.2 Simplified Well Design and Operational BMPs

Furie has established simplified well design alternatives that enable a wider range of downhole sediment control techniques in conjunction with operation BMPs; well design and BMPs work in tandem to control sediment. BMP Plans are considered a "living document" that must be updated to reflect the actual BMPs being implemented. Furie must continue advancing well designs and isolation of excess water formations as necessary for mitigating sediment while also advancing production and wastewater treatment BMPs as described in the following Sections. Furie must track these cause and response actions to improve the BMPs using the experience gained and update the BMPs at least annually to reflect the new knowledge and procedural changes.

4.1.1.2.1 **Sediment Detection BMPs**

The permittee must develop and implement a minimum of three operational BMPs for the purpose of early detection of sediment from wells to help prevent overloading the produced water treatment system, or worse, complete facility shutdown due to pipeline blockages. The three primary BMPS include: 1) installation of acoustic detectors, 2) sample and analysis of the sediment and/or oil in produced water, and 3) observing production and treatment parameters that may indicate incoming sediment loads. Early detection of sediment allows for quick response to the onset of sediment using subsequent operation changes as part of the overall BMP Plan objectives.

4.1.1.2.2 Well Operation/Incremental Choking

Having isolated the excess water formation and upon detection of a sediment threshold that triggers a response from operators, subsequent BMPs are implemented based on past experience. Because excess water formations are believed to be precursor to sediment and hydrates, Furie must apply BMPs including, but not limited to, incremental well choking and optimizing sediment source control and optimizing operation of the produced water system. The optimization of the treatment system should consider both sediment escaping source control as well as impacts from hydrate formation. Even though hydrates have not been observed, there is still a connection between the use of chemicals to ameliorate hydrate formation and chronic WET. Hence, optimization may include impacts on chemicals on chronic WET.

4.1.1.2.3 Hydrate Prevention/Mitigation

The BMPs for hydrate prevention and mitigation include monitoring and controlling temperature and pressure in the system so that hydrates are not likely to form. When monitoring suggests hydrate formation is beginning to occur, Furie may use MeOH, or other approved chemical, to counteract the hydrates. This monitoring and response should be documented and included in a BMP to guide the decisions based on past experiences.

4.1.2 Chronic WET Monitoring for Compliance and Characterization

The permittee must conduct chronic WET testing for two purposes: 1) conducting chronic WET monitoring under the Permit for compliance with the limit in Table 5, and 2) and for chronic toxicity characterization that may be used in future permit development. To comply with chronic WET limits, the permittee is required to conduct chronic WET monitoring for both a vertebrate and invertebrate species discussed in Sections 4.1.3.1 and 4.1.3.2, respectively. The WET monitoring must be coordinated with other monitored parameters so that if an observed WET result is higher than expected, it may be correlated to analytical results for individual pollutants.

An expanded dilution series is presented to provide both characterization and compliance such that the critical dilution for the limit of 255 is bracketed (critical dilution is approximately 0.4%). The compliance dilution series in percent effluent is 0.25, 0.5, 1.0, 2.0, 4.0. and 16 including a control (zero % effluent) and a maximum after hypersaline adjustment (approximately 70%). Should any chronic WET result exceed the limit in Table 5: Effluent Limits and Monitoring Requirements for Produced Water (Discharge 015), the permittee must notify DEC within 24 hours per Appendix A - Standard Conditions Section 3.4.1, research the anomalously high toxicity event (e.g., evaluate analytical data of other monitored parameters and root causes), and provide written notification to DEC within one week including information on any unusual circumstance and assessment as to what may have caused the exceedance. The permittee must repeat the chronic WET monitoring within 30 days of notifying DEC and submit a follow-up written notification of the subsequent results. Based on these results, DEC may require additional monitoring.

4.1.3 Test Species and Methods

The permittee must conduct chronic WET testing on one vertebrate and one invertebrate species.

4.1.3.1 Vertebrate (survival and growth)

Atherinops affinis (topsmelt). In the event that topsmelt is not available, *M. beryllina* may be used as a substitute. The permittee shall document the use of substitute species in the DMR for the testing.

4.1.3.2 Invertebrate

The permittee must use one of the three invertebrate species for chronic WET characterization and compliance. If a most-sensitive species has been determined, the permittee should use that species unless there are compelling reasons for substitution (e.g., species availability).

For larval development tests, the permittee may use bivalve species *Crassostrea gigas* (Pacific Oyster) or *Mytilus spp*. (mussel). For survival and growth, the permittee may use *Americamysis bahia* (formerly *Mysidopsis bahia*, mysid shrimp). Due to seasonal variability, testing may be performed during reliable spawning periods (e.g., December through February for mussels and June through August for oysters). Substitutions for the most-sensitive species may be approved by the Department based if species is compromised or unavailable.

4.1.4 Monitoring Frequency.

Initially, the permittee must conduct monthly monitoring for Chronic WET. The permittee may request a reduction in monitoring frequency to quarterly if the maximum Chronic WET result over a two-year period (24 monthly samples) is less than 127 TU_c. The permittee must submit the request to DEC in writing for Department approval.

4.1.5 Procedures.

The permittee must conduct chronic WET testing using the following procedures.

4.1.5.1 Methods and Endpoints

For the shrimp and alternate fish species, inland silverside, the presence of chronic toxicity must be estimated as specified in *EPA Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms, Third Edition* (EPA-821-R-02-014). For the bivalve species and topsmelt, chronic toxicity must be estimated as specified in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136). The WET testing will determine the 25 % effect concentration (EC_{25}) endpoint estimate of the effluent concentration that would cause a 25 % reduction in normal embryo development for the bivalves or in survival for fish and/or mysid shrimp. The WET testing will also determine the 25 % inhibition concentration (IC_{25}) point estimate of the effluent concentration that would cause a 25 % reduction in the growth of the fish and/or mysid shrimp.

4.1.5.2 Reporting Results

Results must be reported on the DMR using TU_c, where $TU_c = 100/EC_{25}$ or $100/IC_{25}$. The reported EC_{25} or IC_{25} must be the lowest point estimate calculated for the applicable survival, growth or normal embryo development endpoints. The permittee must report the NOECs in the full WET test report. DEC may compare this information with the IC_{25} during reissuance of the Permit.

4.1.5.3 Acute Toxicity Estimates

Although acute WET testing is not required, the permittee must provide an estimate of acute toxicity based on observations of mortality when appropriate (e.g., vertebrates). Acute toxicity estimates, if available, must be documented in the full report.

4.1.5.4 Hold Times

WET sample holding times are established at 36 hours but longer hold times up to 72 hours may be approved by DEC. The permittee must document the conditions that resulted in the need for the holding time to exceed 36 hours and the potential effect on the test results.

4.1.5.5 Additional Quality Assurance Procedures

In addition to those quality assurance measures specified in the methodology, the following quality assurance procedures must be followed:

a) If organisms are not cultured by the testing laboratory, concurrent testing with reference toxicants must be conducted, unless the test organism supplier provides control chart data from at least the previous five months of reference toxicant testing. Where organisms are cultured by the testing laboratory, monthly reference toxicant testing is sufficient.
b) If either of the reference toxicant tests or the effluent tests do not meet all test acceptability criteria as specified in the test methods manual, then the permittee shall re-sample and re-test within the following month.
c) Control and dilution water must be receiving water, or salinity adjusted lab water. If the dilution water used is different from the culture water, a second control, using culture water must also be used.

4.1.6 WET Reporting

4.1.6.1 DMRs and Full Report Deliverables

The permittee shall submit chronic WET test results on next month's DMR following the month of sample collection. The permittee must also submit the full WET Report as an attachment to the DMR per Section 4.1.6.2

4.1.6.2 Full Report Preparation

The report of results shall include all relevant information outlined in Section 10 of Report Preparation in the U.S. EPA Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms, Third Edition (EPA-821-R-02-014).

4.1.6.3 Additional Reporting Information

In addition to toxicity test results, the permittee shall report:

a) The date and time of sample collection and initiation of each test,
b) The discharge flow rate at the time of sample collection,
c) A list of corrosion inhibitors, biocides, algaecides, clarifying agents, or other additives (i.e., methanol) being used by facility that could potentially be in the effluent during the 30-day period preceding sampling,
d) All raw data and statistical analysis from the tests, including reference toxicant tests, and
e) Analytical results for other monitored parameters.

5 ANTIBACKSLIDING

Per 18 AAC 83.480, "effluent limitations, standards, or conditions must be at least as stringent as the final effluent limitations, standards, or conditions in the previous permit" Per 18 AAC 83.480, 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."

Effluent limitations may be relaxed as allowed under 18 AAC 83.480(b), CWA Section 402(o) and CWA Section 303(d)(4). 18 AAC 83.480(b) allows relaxed limitations in renewed, reissued, or modified permits when there have been material and substantial alterations or additions to the permitted facility that justify the relaxation, or, if the Department determines that technical mistakes were made.

CWA Section 303(d)(4)(A) states that, for waterbodies where the water quality does not meet applicable WQS, effluent limitations may be revised under two conditions, the revised effluent limitation must ensure the attainment of the WQS (based on the waterbody TMDL or the waste load allocation) or the designated use which is not being attained is removed in accordance with the WQS regulations.

CWA Section 303(d)(4)(B) states that, for waterbodies where the water quality meets or exceeds the level necessary to support the waterbody's designated uses, WQBELs may be revised as long as the revision is consistent with the State's Antidegradation Policy. Even if the requirements of CWA Section 303(d)(4) or 18 AAC 83.480(b) are satisfied, 18 AAC 83.480(c) prohibits relaxed limits that would result in violations of WQS or ELGs (if applicable).

State regulation 18 AAC 83.480(b) only applies to effluent limitations established on the basis of CWA Section 402(a)(1)(B), and modification of such limitations based on effluent guidelines that were issued under CWA Section 304(b). Accordingly, 18 AAC 83.480(b) applies to the relaxation of previously established case-by-case TBELs developed using BPJ. To determine if backsliding is allowable, the regulation provides five regulatory criteria in 18 AAC 83.480(b)(1-5) that must be evaluated and satisfied.

5.1 Antibacksliding of WQBELs

The copper MDL and AML have increased from those in the previous IP. The WQBELs in the previous IP were developed using preliminary pilot study data and were not based on an adequate amount of data to characterize normal operations, in this instance, to get limits that reflect actual site conditions. Now that more data representing actual operating conditions is available, the WQBELs developed for this Permit present a better understanding of effluent variability as they are based on a greater number of data points from actual operation.

Per CWA 402(o)(1), backsliding is allowable as long as it is based on new information, does not violate an ELG, and complies with WQS including the Antidegradation Policy per CWA 303(d)(4). The new WQBEL limits for copper have been developed using standard procedures and new data ensuring WQS are met.

6 ANTIDEGRADATION

6.1 Legal Basis

Antidegradation is implicit in CWA Section 101(a) goals, explicitly referenced in CWA Section 303(d)(4)(B), and implemented through 40 CFR 131.12. Section 303(d)(4) of the CWA states that, for waterbodies where the water quality meets or exceeds the level necessary to support the waterbody's designated uses, WQBELs may be revised as long as the revision is consistent with the State Antidegradation Policy and Implementation Methods. Alaska's current Antidegradation Policy and Implementation Methods are presented in 18 AAC 70.015 *Antidegradation Policy* (*Policy*) and in 18 AAC 70.016 *Antidegradation Implementation Methods for Discharges Authorized Under the Federal Clean Water Act* (*Implementation Methods*). For these state regulations to apply under the CWA, they must be previously approved by EPA per CWA Section 303(c)(3). The *Policy* and *Implementation Methods* have been amended through April 6, 2018; are consistent with the CWA and 40 CFR 131.12; and were approved by EPA on July 26, 2018.

The following subsections document Department conformance with the *Policy* and *Implementation Methods* for authorization under APDES General Permit AKG315200.

6.2 Receiving Water Tier Determination

Per the *Implementation Methods*, the Department determines a Tier 1 or Tier 2 classification and protection level on a parameter by parameter basis. The *Implementation Methods* also describe a Tier 3 protection level applying to designated waters. However, at this time no Tier 3 waters have been designated in Alaska.

As previously presented in Section 3.2, the facility's produced water covered under the authorization discharges to the coastal marine waters of Cook Inlet, which are not listed as being impaired by any water quality parameter. Consequently, there are no parameters where only the Tier 1 protection level applies. However, a Tier 1 analysis must be conducted even for Tier 2 waters to ensure existing uses are protected. Accordingly, this antidegradation analysis conservatively assumes that the Tier 2 protection level applies to all parameters, consistent with 18 AAC 70.016(c)(1).

The antidegradation analysis must be conducted with implementation procedures in 18 AAC 70.016(b)(5)(A-C) for Tier 1 protection (Tier 1 analysis), and with the implementation procedures in 18 AAC 70.016(c)(7)(A-F) for Tier 2 protection (Tier 2 analysis). Because Tier 3 waters have not been designated in Alaska, an analysis for the Tier 3 protection level (Tier 3 analysis) is not applicable. These antidegradation analyses and associated findings are summarized below.

6.3 Tier 1 Analysis of Existing Use Protection

The summary below presents the Department's Tier 1 analysis of existing use protections per 18 AAC 70.016(b)(5) finding that:

(A) existing uses and the water quality necessary for protection of existing uses have been identified based on available evidence, including water quality and use related data, information submitted by the applicant, and water quality and use related data and information received during public comment;

The Department reviewed water quality data, environmental monitoring studies, and information submitted by the applicant on existing uses in the vicinity of the ALP. The Department finds the reviewed information sufficient to identify existing uses and water quality necessary for Tier 1 protection.

(B) existing uses will be maintained and protected;

Per 18 AAC 70.020 and 18 AAC 70.050, marine waters are protected for all uses. Consequently, the most stringent water quality criteria found in 18 AAC 70.020 and in the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances* (DEC 2008) apply and were evaluated to ensure existing uses and the water quality necessary for protection of existing uses of the receiving waterbody are fully maintained and protected. The Permit includes WQBELs that either meet water quality criteria at the point of discharge or at the boundary of an appropriately sized mixing zone. Because the criteria have been developed to protect the uses of the waterbody, and all applicable criteria are to be met at the point of discharge or at the boundary of a mixing zone, the uses of the receiving waterbody as a whole are fully maintained and protected.

(C) the discharge will not cause water quality to be lowered further where the Department finds that the parameter already does not meet applicable criteria in 18 AAC 70.020(b), 18 AAC 70.030, or 18 AAC 70.236(b).

The Permit requires that the discharge shall not cause or contribute to a violation of WQS. As previously stated, the receiving water, the marine waters of Cook Inlet, are not listed as impaired. Therefore, no parameters were identified as not meeting the applicable water quality criteria in 18 AAC 70.020(b), 18 AAC 70.030 or 18 AAC 70.236(b).

As a result of the Tier 1 analysis, the Department concludes the terms and conditions of the authorization are adequate to fully protect and maintain the existing uses of the receiving water and that the findings required under 18 AAC 70.016(b)(5) for Tier 1 protection are met.

6.4 Limiting Scope for Tier 2 Analysis

Per 18 AAC 70.016(c)(2), an antidegradation analysis is only required for those waterbodies needing Tier 2 protection and which have any new or existing discharges that are being expanded based on permitted increases in loading, concentration, or other changes in effluent characteristics that could result in comparative lower water quality or posing new adverse environmental impacts.

DEC reviewed information provided by the applicant to determine if a Tier 2 analysis is required. The review indicates the provided information is sufficient and credible per 18 AAC 70.016(c)(4). The notice of intent indicated that produced volumes are proposed to increase. This additional produced water generated by the ALP and its potential to lower water quality in Cook Inlet is the focal point of the Antidegradation Tier 2 analysis. If other produced water is added in the future to AKG315200, another anti degradation analysis may be triggered. The additional produced water contributed by the platform is to be added to the total produced water covered by the CIGP. When AKG315200 is reissued, the antidegradation analysis will not be triggered again so long as other new produced water discharges are not added at that time. Hence, this antidegradation analysis is applied to the CIGP, not the authorization AKG315220.

6.5 Tier 2 Alternatives Analysis

Per 18 AAC 70.016(c)(4)(C-F) the applicant must submit a description and analysis of a range of practicable alternatives that have the potential to prevent or lessen the degradation associated with the new discharge of produced water. The analysis must identify the water quality environmental impacts and relative costs for each practicable alternative. The following paragraphs summarize the applicant's alternative analysis which led to their decision to request the new discharge of produced water.

6.5.1 Alternatives Eliminated Due to Being Impracticable.

The Tier 2 Antidegradation Alternative Analysis does not require the applicant to consider alternatives that are known not to be practicable. The term "practicable" is defined in 18 AAC 70.990 (18) as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." The goal of this alternative analysis is to identify a practicable alternative that can result in permit compliance while allowing for continued gas production at KLU. Mitigating the potential for hydrate formation and sediment slugs that cause facility shutdown is paramount for achieving this goal. In addition, the platform has space limitations that make expanding treatment difficult. Although long-term plans include doubling the discharge of produced water, this option does not appear to be practicable until hydrate formation and sediment slugs are sufficiently mitigated. Future increases to produced water discharge will require demonstration that mitigating BMPs for hydrates and sediment are effective, at a minimum, but will likely also require some expansion of the treatment system to the extent possible within space limitations. Based on these limiting conditions, the following alternatives were eliminated due to being impracticable at this time while holding the authorized discharge flow at 5,000 bbd.

6.5.1.1 Impracticality of Onshore Processing and Discharge/Disposal of Produced Water

The applicant indicates that transferring produced water to the onshore CPF for treatment and discharge to marine waters, or disposal via injection, is not practicable because of hydrates forming in the gas pipeline system. The produced water containing hydrates is best mitigated at the platform to ensure hydrates do not plug the subsea pipeline to the CPF. Although the gas from the Beluga formation has significantly less produced water and hydrates, the economics of operating the platform requires production from both the Beluga and Sterling formations. Eliminating the 23.6 billion standard cubic feet (BSCF) reserves from the Sterling formation would be detrimental to not just Furie, but the State and local communities reliant on Cook Inlet gas production for energy as well. DEC concurs with eliminating this broad alternative on the basis of being impracticable.

6.5.1.2 Impracticality of Offshore Disposal via Injection at the Platform

The 2019 individual permit application estimated the cost of installing an injection well at the ALP at approximately 20 million dollars ($20M) with no guarantee of finding a subsurface formation capable of accepting the volume of produced water necessary for operation. In Cook Inlet, the typical formation used for waste disposal is gas reservoirs that have been depleted such that injection would not affect the ability to produced gas. A producing formation, such as the Beluga or Sterling, is incompatible with waste injection. Similar to the onshore treatment and disposal alternative, the lost revenue associated with eliminating one of the gas producing formations imposes significant economic hardship to Furie and the State. The 2019 individual permit application estimated that injection at the platform would result a loss of 12.6 billion standard cubic feet (BSCF) of gas reserves with $86M lost revenue to Furie and $10.7M lost by the State. DEC concurs with the assessment by Furie that injection at the platform is not practicable. It appears that treatment and discharging to marine water at the platform represents a practicable solution.

6.5.1.3 Impracticality of Typical Treatment Technology Given Space Constraints

The ALP was constructed to have a small footprint based on the presumption there would be limited produced water production and did not include consideration of space for treatment equipment for produced water. In the 2019 IP application, the applicant considered the footprint of the model technology described in the ELGs: induced gas flotation (IGF) and/or Dissolved Air Flotation (DAF). The antidegradation analysis submitted by Furie in December 2023 also evaluated installing a flocculation system for solids removal. These treatment units require more space than is available at the platform. Furie considers installation of model technology as impracticable and DEC concurs. In the 2019 IP, given the fact that produced water from the Beluga and Sterling formations does not have significant concentrations of oil and grease, a unique treatment solution was determined to be more effective and practicable and approval was given to install the existing treatment system based on the limited understanding of effluent characteristics and process choices at the time.

6.5.2 Practicable Alternatives Considered

The evaluated alternatives include:

1. BMPs: Modified Well Designs and Sediment/Hydrate Detection and Operational Controls;
2. Continued Parallel Treatment but 10-micron filters rather than 25-micron; and
3. Modified Staged Series Treatment 25-micron then 10-micron.

6.5.2.1 Alternative 1 – Technology and BMPs for Down-well Hydrate/Sediment Control

Under Alternative 1, Furie would continue to use and optimize BMPs developed over the last several years that have resulted in increasing compliance and reducing the possibility of a system shutdown from either sediment or hydrate solids. The sediment BMPs include:

1. simplifying well design that reduces the flow of sediment to the well while additively expanding the range of readily available down-well sand control techniques,
2. detecting sediment in the flowlines using acoustic sensors,
3. establishing well-choking protocol to ameliorate the flow of sediment to the well,
4. updating the Produced Water Treatment System Operating Procedures (SOP) for operating during high sediment loads, and
5. operating in safe pressure and temperature ranges to prevent hydrate formation.

The following sections provide more details about alternative 1.

Well Design Simplification: The original wells A-1, A-2A, KLU-3, and A-4 had a complex well design through both the Beluga and Sterling formations. The design used a 3 ½-inch inner tubing tailpipe inside the 9 5/8-inch casing. When well A-1 encountered sediment, sediment filled the casing from the tailpipe and some distance below. The fill prevented flow from well perforations below the sediment plug. After multiple attempts to clear the sediment plug over 2 to 3 years that cost approximately $10 MM, Well A-1 was abandoned and replaced using a simpler well design. Now, the 3 ½-inch tubing only extends into the Beluga formation, allowing for more options to ameliorate sediment issue if/when they occur in the future.

Another well design change includes using downhole tools to identify which perforated zone is producing excess free water so that it can be isolated from other zones. Excess free water is typically a precursor to sediment in the well. Once identified and isolated, Furie can either install a filter or other sediment control technique in that zone or completely blind off that zone to save the remainder of the well. These well design simplifications work in tandem with well management BMPs.

Well Management BMPs: Furie has developed and is implementing well management BMPs that can be optimized over time. These BMPs include:

1. early detection of sediment using acoustic detectors sensing particle strikes against the pipe wall, and
2. incremental choking of the gas flow to the well, and
3. operating within a safe temperature-pressure range that does not promote hydrate formation.

Sediment detection and monitoring equipment: Furie uses three methods of solids detection: 1) acoustic detectors, 2) water sampling analysis, and 3) System Operability.

Acoustic detectors have been installed on the four existing wells and two more will be installed on the new wells drilled in 2025. Each acoustic detector costs approximately $30,000 each to purchase and install. Acoustic detectors pick up the sound of sand impinging against the wall of the flowline. In addition, when conducting monthly flow tests for gas and water, water samples are collected and run through a centrifuge to determine the sediment load. If solids production becomes an issue, more frequent centrifuge samples can be collected to inform on the extend changes to well operation have meliorated sediment. This increase in monitoring is expected to increase weekly costs by approximately $2,000.

Well Operation/Incremental Choking: After isolating the excess water formation during well construction, the operational modifications to counter sediment and/or hydrate events are a combination of reducing or eliminating the source and optimizing the produced water treatment system if sediment is unavoidable by source control. Controlling the source of sediment is the highest priority because once sediment is in the system it can stop production either by plugging the well or the produced water treatment system. The increase in cost to implement incremental choking is insignificant. However, choking comes with some loss in overall production as well as the implications of a complete facility shutdown.

Optimization of produced water treatment is primarily focused on sediment removal and secondarily on impacts from hydrate formation. Although Furie has not observed ice crystal formations in the produced water treatment system to date, there is a direct connection between inhibitors used to ameliorate hydrate formation and chronic WET. Furie must document the use of MeOH, or other approved chemical inhibitors, so that if there is a chronic WET limit exceedance there is information on a probable contributing factor. Hydrate control is not only part of compliance but that of facility viability.

Hydrate Prevention/Mitigation: Because hydrate formation can impact produced water treatment and completely plug pipelines, Furie must manage temperature and pressures throughout the system. Hydrates tend to form at low temperatures and high pressure. Furie has developed a chart calibrated using field data on the subsea pipeline pressure fluctuations that seemed to have non-catastrophic hydrate formations (e.g., hydrates start to form resulting in pressure change but the pipeline does not plug up). Note that Furie has evaluated the temperature and pressure ranges in the produced water system. Hydrate formation in the system is less likely now that Furie has developed charts using empirical temperature and pressure data that guide practices.

6.5.2.2 Alternative 2 – Parallel Treatment Changeout 25-micron Cartridges for 10-micron

The existing produced water treatment system currently uses only 25-micron cartridge filters on each of the parallel treatment trains. Alternative 2 includes increasing filtration by installing 10 - micron cartridge filters instead of 25-micron currently.

An important operational consideration for the produced water treatment system is to maintain one of the two parallel treatment trains in standby mode until the operating train is due for cartridge or carbon filter maintenance. In the order of most frequent to less, cartridge filters are replaced, carbon filters backwashed or the media replaced once exhausted. Based on sediment sieve analysis to date, most of the sediment remaining after sand removal in sand traps is sand and silt that is approximately 97 % smaller than 12.5 µm. The effective pore size of the carbon is not known but assumed to be approximately 20 µm. Even with bridging effects considered, the removal efficiency would only improve by 5 to 10 %. Meanwhile, the reduced cartridge filter would have significant impacts to operations when an increased sediment load occurs. Given alternating parallel operations, high sediment loads could be unmanageable based on past experiences. Furie informs there have been situations where treating produced water during high sediment loads requires cartridge filter replacement so frequent that the operator struggles to maintain full facility operation. The small increase in removal efficiency would not justify operating at an increased risk of facility shutdown; Furie provides an essential gas supply affecting a large populous. The current operations and maintenance costs using 25 µm cartridge filters are approximately $10,000 per year. If 10 µm filters are used instead, Furie estimates about a four-fold increase due to more frequent changeouts and resulting increase in life-cycle costs. Note also that this alternative also increases cross-media environmental costs as there would be more vessel trips due to an increase in cartridge filter changeouts.

6.5.2.3 Alternative 3 – Series Treatment 25-micron to 10-micron.

This alternative includes the system described in Alternative 2, except it would be configured as series instead of parallel operation and staged cartridge filters from 25 μm in the first stage and down to 10 μm on the second stage prior to carbon filtration. While there would be improved removal efficiency for solids, this configuration would be difficult, if not impossible, to implement.

The current produced water system was not piped for series treatment so reconfiguration of the piping network would necessitate expanding the treatment system footprint. In addition, Furie would also need additional storage to support a series operation. Although there might be enough space on the platform to reconfigure piping for series operation for two cartridge filter vessels, it would be difficult, possibly impossible, to fit two more vessels to maintain redundant lead-lag operation.

Eliminating the desired operation of the treatment system in lead-lag increases risk of facility shut down. Redundancy of operation is essential to minimize the risk of treatment failure. During normal operations, the platform is staffed by only two operators. The operators are responsible for the overall well operations and maintenance of most of the equipment on the platform. Without the redundancy of the parallel systems, the operators will not have the flexibility to plan filter replacements. When another sediment event occurs and the operators are in full response mode, Furie would have to shut down, replace cartridges, and then restart. The loss of redundancy would significantly increase the risk of full facility shut down as the operator becomes conflicted between the produced water treatment system and maintaining facility operation, a situation that can easily spiral out of control.

In addition to the cost for consumables, transportation, and disposal of filter or filter media provide in Alternative #2 ($40,000), there would be an additional cost for reconfiguring the piping network to accomplish series treatment ($75,000).

Even more compelling is the costs associated with potential shut down of the facility and well recovery of a sediment impacted well. For example, the costs in the failed attempt to restore KLU A-1 were upward of $500,000 and the side-track installed cost $23M. Finally, the loss of production during the KLU A-1 sediment event resulted in deferred production of approximately 2.7 bscf that correlates to approximately $20M in lost revenue. The risk of facility shutdown has not only affected revenue but also diminishes the amount of critical gas being supplied to the Cook Inlet Region.

6.5.2.4 Selected Alternative

Alternative #2, provides minimal increase to sediment removal efficiency while increasing life cycle and cross-media cost and burden. Alternative #3 similar results in minimal increase compared to life cycle and cross-media costs presented in Alternative #2 but fails to protect the overall viability of ALP’s ability to produce critical gas for the Cook Inlet Region. Furie should not be forced to operate with an unacceptable risk of failing to provide gas required by contracts. The cost of deferred production in the event of a well shut-in conflicts with increased sediment removal.

The best alternative is Alternative #1. Some of the costs provided have already been spent to mitigate sediment using the stated BMPs. In addition, the BMPs are working documents that should be updated with new information during operation. At the current produced water flow rates, Furie has demonstrated that Alternative #1 is the best practicable treatment alternative that results in sufficient environmental protection while supporting important economic and social programs in the Cook Inlet Region.

6.5.3 Basis for Reduction of Water Quality

Based on the above finding, the Department can authorize a reduction in water quality only after the applicant has submitted evidence in accordance with the following requirements under 18 AAC 70.015(a)(2):

6.5.3.1 Accommodation of Important Social or Economic Develop in the Vicinity

> ***(A) Allowing lower water quality is necessary to accommodate important economic or social development in the area where the water is located.***

To maintain production levels to meet existing contracts or to expand production for future contracts, Furie states that it may drill up to 6 more wells at the ALP in the next two to three years if it can do so economically. The ALP has two open well slots available for future development. Expenditures on a new production well may exceed $30M, much of which would be spent on local labor, equipment rental, and other goods and services. Based on previous development at the platform, Furie estimated the per-well seasonal employment to be 126 full-time positions. However, Furie contributes to the local economy in jobs, commercial spending, royalties, and tax revenue is expected to decrease if it cannot continue to develop and produce gas from the KLU at a competitive price. (Jacobs 2020). Issuance of the Permit is crucial for Furie to realize these economic and social benefits.

The development and production of natural gas resources provides community services to Southcentral Alaska in the form of a stable energy supply (natural gas) for home heating, cooking, and electricity. Gas and electric public utilities contribute to health and safety in ways such as providing hot water for sanitary activities such as bathing, dish washing, and hand washing as well as light and warmth in the winter. Affordable energy also powers industries and businesses, supports economic activity, and is an essential component of modern life in Southcentral Alaska.

Furie provides a diversification of supply to the local railbelt utilities. Furie is currently the second largest producer of natural gas in Cook Inlet, producing approximately 10.6% of the natural gas in Cook Inlet.

When Furie entered the Cook Inlet gas market in November of 2015 it contracted with local utilities to provided new gas to the railbelt. At the time, Furies gas was priced lower than alternative suppliers. Furie has sold gas to Chugach Electric Association (CEA), Matanuska Electric Association (MEA), Homer Electric Association (HEA), Marathon Petroleum, and Enstar Natural Gas Company (ENSTAR). In 2025, Furie successfully drilled and completed two new natural gas wells, doubling their gas production from the previous year. Fure installed additional well conductors to double the total capacity of gas wells from the original design of 6 wells to 12 wells. Furie currently is contracted with Marathon Petroleum and ENSTAR. The local electric and gas utilities are evaluating importing LNG to supplement local Cook Inlet natural gas production. The cost to retrofit the dormant LNG export plant on the Kenai Peninsula to receive cargos could cost $500M or more (Alaska Beacon, 2025).

To continue providing these social and economic benefits, Furie must find a means to treat and discharge produced water and continue to reduce the costs associated with delivering the gas to market (Jacobs 2020).

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

6.5.3.2 Reducing Water Quality Will Not Violate Applicable Criteria

(B) Except as allowed under this subsection [of 18 AAC 70.015(a)(2)], 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.

18 AAC 70.020(b) specifies the State's protected water use classes, subclasses, and water quality criteria. The Permit places limits and conditions on the discharge of pollutants. The limits and conditions are established after comparing TBELs and WQBELs and applying the more stringent of these limits, or any other requirements from statutes or regulations that may be more stringent. The water quality criteria upon which the WQBELs are based, serve the specific purpose of protecting the existing and designated uses of the receiving water.

As previously discussed in Section 6.3, water quality criteria is either met at the point of discharge or at the boundary of an appropriately sized chronic mixing zone. The chronic mixing zone for the produced water is 138-meter long by 30.75-meter wide rectangle based on the chronic WET caused by the addition of methanol and trace metals. All water quality criteria are met at, and beyond the boundary of each chronic mixing zone.

18 AAC 70.030(a) applies to WET limits and requires that an effluent discharged to a water may not impart chronic WET to aquatic organisms, expressed as 1.0 TU_c, at the point of discharge, or if the department authorizes a mixing zone in a permit at or beyond the mixing zone based on the minimum effluent dilution achieved in the mixing zone. Chronic WET is driving parameter of the chronic mixing zone for the produced water discharge (015) as it requires the most dilution (Dilution Factor 145) to meet the criterion. As discussed in Section 3.3.1.2, the authorized chronic mixing zone for produced water was sized for chronic toxicity being the driving parameter and has a dilution factor of 145. The maximum expected chronic toxicity in the effluent will not result in reasonable potential to cause, or contribute to, an instream excursion of 1.0 TU_c at the boundary of the authorized chronic mixing zone. Therefore, with the chronic WET limit of 255 TUc imposed in the Permit, the requirements of 18 AAC 70.030(a) are met.

18 AAC 70.020 refers to development of site-specific water quality criteria as listed in 18 AAC 70.236. Although there are site-specific criteria established for metals near Point Woronzof, the specified location of this site-specific criteria is outside of the area of influence for the Permit. Hence, the site-specific criteria at Point Woronzof is not applicable to discharges under the Permit so this requirement is met.

6.5.3.3 Tier 1 Protection of Existing Uses

(C) The resulting water quality will be adequate to fully protect existing uses of the water.

As discussed in part (B) of the preceding Tier 1 analysis, marine waters are protected for all uses and this requirement is thus met at the boundaries of the four chronic mixing zones were all criteria protective of the existing uses will be met.

6.5.3.4 All Wastes and Other Substances Discharged Will be Treated and Controlled

(D) 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...

The applicable "highest statutory and regulatory treatment requirements" are defined in18 AAC 70.015(d). The definition includes the four components noted below:

(1) Any federal technology-based effluent limitation identified in 40 CFR 122.29 and 125.3, revised as of July 1, 2017…;

EPA promulgated 40 CFR 435 Subpart D in 1996, as adopted in 18 AAC 83, and determined that discharges of produced water to Cook Inlet are appropriately controlled through ELGs for O&G that require an MDL of 42 mg/L and AML of 29 mg/L. In addition to the TBEL established through the ELG, DEC also imposes a TBEL using case-by-case BPJ for pH on produced water.

(2) any minimum treatment standards identified in 18 AAC 72.050;

18 AAC 72.050 (a) through (c) are specific to disposal of domestic wastewater which is not being evaluated in this statement of basis. This SOB only covers produced water, which is not considered domestic wastewater under 18 AAC 72.

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

This part of the definition includes any treatment required by state law that is more stringent than 18 AAC 70. Other regulations beyond 18 AAC 70 that may apply to this permitting action include 18 AAC 15, 18 AAC 72, and 18 AAC 83. The Permit is consistent with the minimum treatment requirements of 18 AAC 72 and 18 AAC 83 and neither the regulations in 18 AAC 15, nor any other state legal requirement that the Department is aware of, impose more stringent treatment requirements than 18 AAC 70. Therefore, this part of the definition is met.

(4) any water quality-based effluent limitations established in accordance with 33 U.S.C. 1311(b)(1)(C)(Clean Water Act, sec. 301(b)(1)(C).

Alaska water quality criteria are presented in 18 AAC 70.020 and the *Water Quality Criteria for Toxics and Other Deleterious Substances* amended through December 12, 2008 (*Toxics Manual*). WQBEL limits have been established to be more stringent than applicable TBELs per the *Reasonable Potential Analysis and Effluent Limits Development Guide*, June 30, 2014 (*RPA/WQBEL Guidance*), which complies with 18 AAC 83.435 and CWA 301(b)(1)(C). The Permit imposes WQBEL for chronic WET (MDL of 255 TU_c) and for copper (MDL of 288 µg/L and AML of 97 µg/L). During development of these WQBELs, DEC used ambient data collected from various receiving water studies that provided information on the existing water quality and potential contributions of pollutants in nonpoint sources and other point sources discharging within the area of coverage. For copper, an ambient concentration of 0.926 µg/L representing the 85th percentile of the data collected was used in the WQBEL development.

Per 18 AAC 70.016(c)(7)(C), DEC must consider other point sources and state-regulated non-point sources discharging to the waterbody that could impact water quality and if there are any outstanding compliance issues with point source permits or BMPs for non-point sources. In this fourth finding, DEC identifies all the discharges in the Permit and discharges from the following six permits authorizing point source discharges that have limits for O&G, pH, or copper:

- AK0000507 – Agrium Inc., Kenai Plant (No Currently Discharging),
- AK0000841 – Tesoro Alaska Petroleum Company, Kenai Refinery,
- AK0001155 – Kenai LNG LLC (subsidiary of Harvest AK), LNG Plant,
- AK0026603 – Chugach Electric Association, Beluga Power Plant,
- AK0053619 – Alaska Electric and Energy Coop., Nikiski Combined Cycle Plant, and
- AKG315000 – Various Authorizations under AKG315200 – Cook Inlet GP.

In review of these individual permits and other authorizations under AKG315200, DEC found no outstanding compliance issues that affect the antidegradation analysis. For state-regulated non-point sources, DEC considered several contaminated sites in the vicinity of the Nikiski industrialized area (e.g., refinery, LNG, power plant, fertilizer plant) that have plumes that enter Cook Inlet through groundwater. These sources are regulated by the DEC Contaminated Sites Program and require continued monitoring of plume attenuation. With respect to these point source and non-point sources, DEC indicates that none of the receiving water samples collected in various studies reported detected concentrations of TAH. In addition, the 85th percentile concentration for copper from these studies is 0.926 mg/L, which is below the chronic marine water quality criteria for copper. This information supports the finding that discharges from new and existing point sources meet the highest statutory and regulatory requirements. In addition, it supports the finding that all cost-effective and reasonable BMPs are being applied to non-point sources. Therefore, DEC concludes that the fourth finding is met.

Per the aggregate findings in Sections 6.5.3.1 through 6.5.3.4, DEC determines that the applicant has submitted sufficient evidence for the Department to authorize lowering of water quality associated with the discharge of produced water from the ALP.

7 OTHER LEGAL REQUIREMENTS

7.1 Endangered Species Act

Per Section 7 of the Endangered Species Act (ESA), federal agencies are required to consult with National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) if their actions could beneficially or adversely affect any threatened or endangered species. As a state agency, DEC is not required to consult under Section 7 regarding wastewater discharge permitting actions. However, this does not absolve DEC from complying with Section 9 and 10 of the ESA. Therefore, the Permit emphasizes that the Permit does not absolve the permittee from securing approvals from other authorities having jurisdiction (e.g., obtaining incidental take or harassment authorizations).

DEC voluntarily sent an email to both the FWS and NOAA Fisheries on September 21, 2020 notifying the agencies of current permit development activities and requesting information regarding the presence of threatened or endangered species and their critical habitat in the vicinity of the Allegra Leigh Platform. In response, NOAA Fisheries Protected Resources Division referred the Department to the Alaska Endangered Species and Critical Habitat Mapper web application and to their website for detailed information regarding endangered species and critical habitat designations. FWS referred the Department to its Information, Planning, and Conservation (IPaC) System internet tool.

DEC accessed the NOAA web application which identified the Cook Inlet beluga whale (*Delphinapterus leucas*) population to be the only listed endangered species with distribution range within the waters adjacent to the facility. While all beluga whale populations are protected under the Marine Mammal Protection Act (MMPA), NOAA Fisheries has also designated the Cook Inlet beluga whale population as depleted under the MMPA. Of the five stocks of beluga whales in Alaska, the Cook Inlet population is the most isolated stock, spending the entire year in Cook Inlet and the majority of the time in the northern portion of Cook Inlet. The critical habitat areas for Cook Inlet beluga whales are prioritized according to levels of sensitivity and are designated as Area 1 or Area 2. Area 1 has the highest concentrations of beluga whales from spring through fall as well as the greatest potential for adverse impact from anthropogenic threats. Area 2 has less concentrated spring and summer beluga whale use but is known to be dispersed fall and winter feeding and transit areas in waters where whales typically occur in smaller densities or deeper waters. The NOAA web application was also used to determine that the designated critical habitat Area 2 for the Cook Inlet Beluga Whale overlaps the waters surrounding the facility.

DEC accessed the FWS IPaC internet tool at https://ecos.fws.gov/ipac/location. The Department used this website to gain an approximate determination that the area encompassing the facility does not overlap with the range or area of influence for any listed threatened or endangered species under the jurisdiction of FWS.

7.2 Essential Fish Habitat

Essential fish habitat (EFH) is defined by textual descriptions contained in the fishery management plans developed by the regional Fishery Management Councils and includes 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 Fisheries 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 federal agencies regarding EFH. DEC did; however, voluntarily send an email request to NOAA Fisheries on September 21, 2020 notifying the agency of current permit development activities and requesting EFH listings in the vicinity of the Allegra Leigh Platform. In response, NOAA Fisheries referred DEC to the EFH information available through its Alaska EFH Mapper tool and to their website for Fisheries Management Plans.

The Alaska EFH Mapper tool is located at https://www.fisheries.noaa.gov/resource/map/alaska-essential-fish-habitat-efh-mapper. The tool reported groundfish EFH for the Alaska plaice (*Pleuronectes quadrituberculatus*), flathead sole (*Hippoglossoides elassodon*), walleye pollock (*Gadus chalcogrammus*), yellowfin sole (*Limanda aspera*), Dover sole (*Microstomus pacificus*), northern rock sole (*Lepidopsetta polyxystra*), Pacific cod (*Gadus macrocephalus*), rex sole (*Glyptocephalus zachirus*), southern rock sole (*Lepidopsetta bilineata*). The tool also identified EFH in the vicinity of the discharge for five species of Pacific salmon (*Oncorhynchus spp*): Chinook (*O. tshawytscha*), Sockeye (*O. nerka*), Coho (*O. kisutch*), Pink (*O. gorb*uscha), and Chum (*O. keta*). Habitat areas of particular concern (HAPCs) are specific sites within EFH that are of particular ecologic importance to the long-term sustainability of managed species, are of a rare type, or are especially susceptible to degradation or anthropogenic development. HAPCs are meant to provide greater focus to conservation and management efforts and may require additional protection from adverse effects. There were, however, no HAPCs identified within these EFHs."

7.3 Authorization Expiration and Administrative Extension

AKG315200 will expire December 31,2026. The permittee may submit an NOI for administrative extension at least 180 days prior to expiration per CIGP Section 1.2.

8 REFERENCES

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8. *18 AAC 72. Wastewater Disposal*, as amended through December 23, 2009.
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17. U.S. EPA, *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms, First Edition.* Office of Research and Development, EPA-600-R-95-136, Cincinnati, Ohio, August 1995.
18. U.S. EPA, *Interim Guidance for Performance-Based Reduction of NPDES Monitoring Frequencies*. Office of Water, EPA-833-B-96-001, Washington D.C., April 1998.
19. U.S. EPA, *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms, Third Edition.* Office of Water, EPA-821-R-02-014, Washington, D.C., October 2002.National Marine Fisheries Service. 2016. Recovery Plan for the Cook Inlet Beluga Whale (Delphinapterus leucas). National Marine Fisheries Service, Alaska Region, Protected Resources Division, Juneau, AK

Appendix A FIGURES

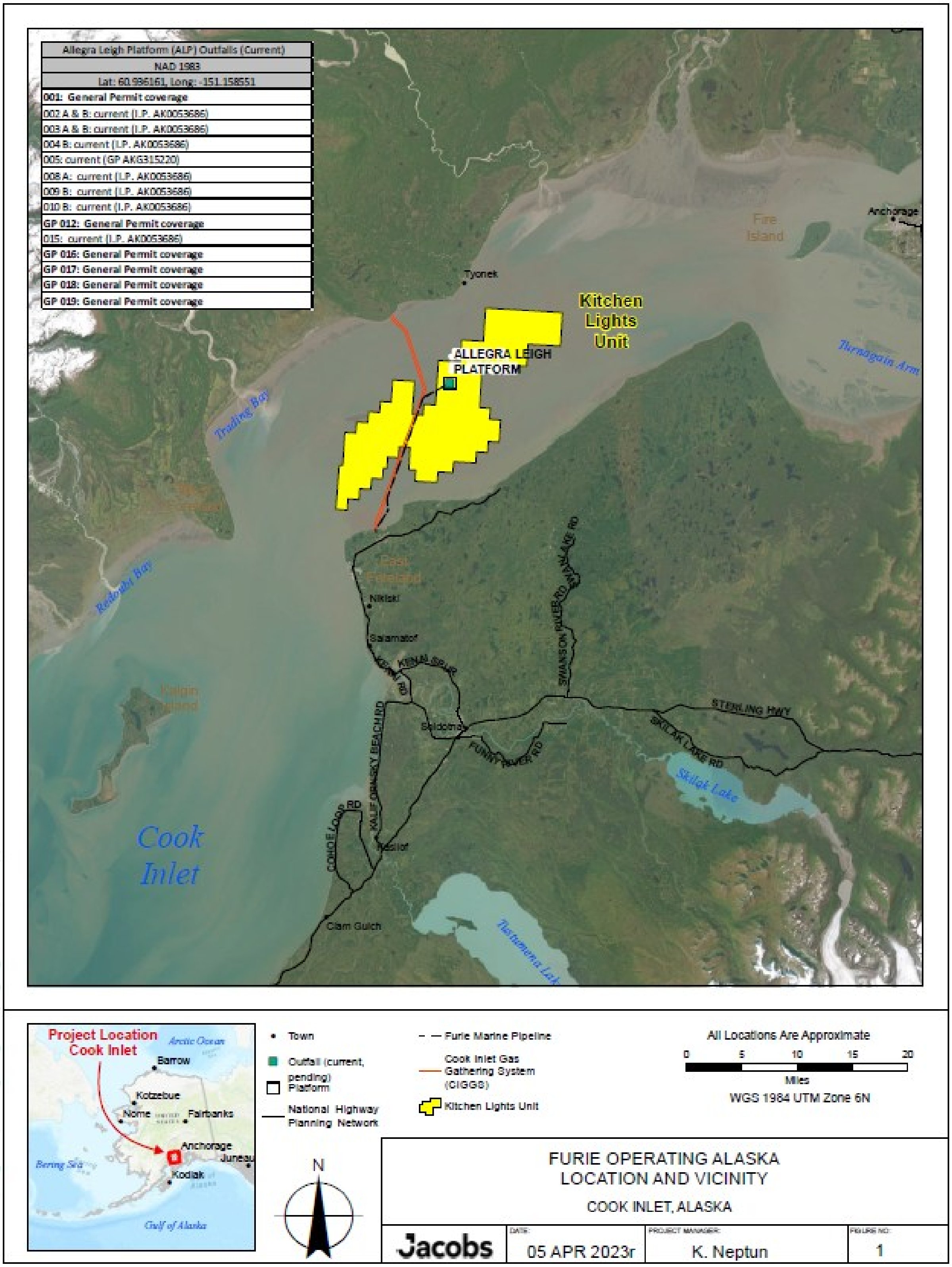


Figure A-1: Location Map – Allegra Leigh Platform

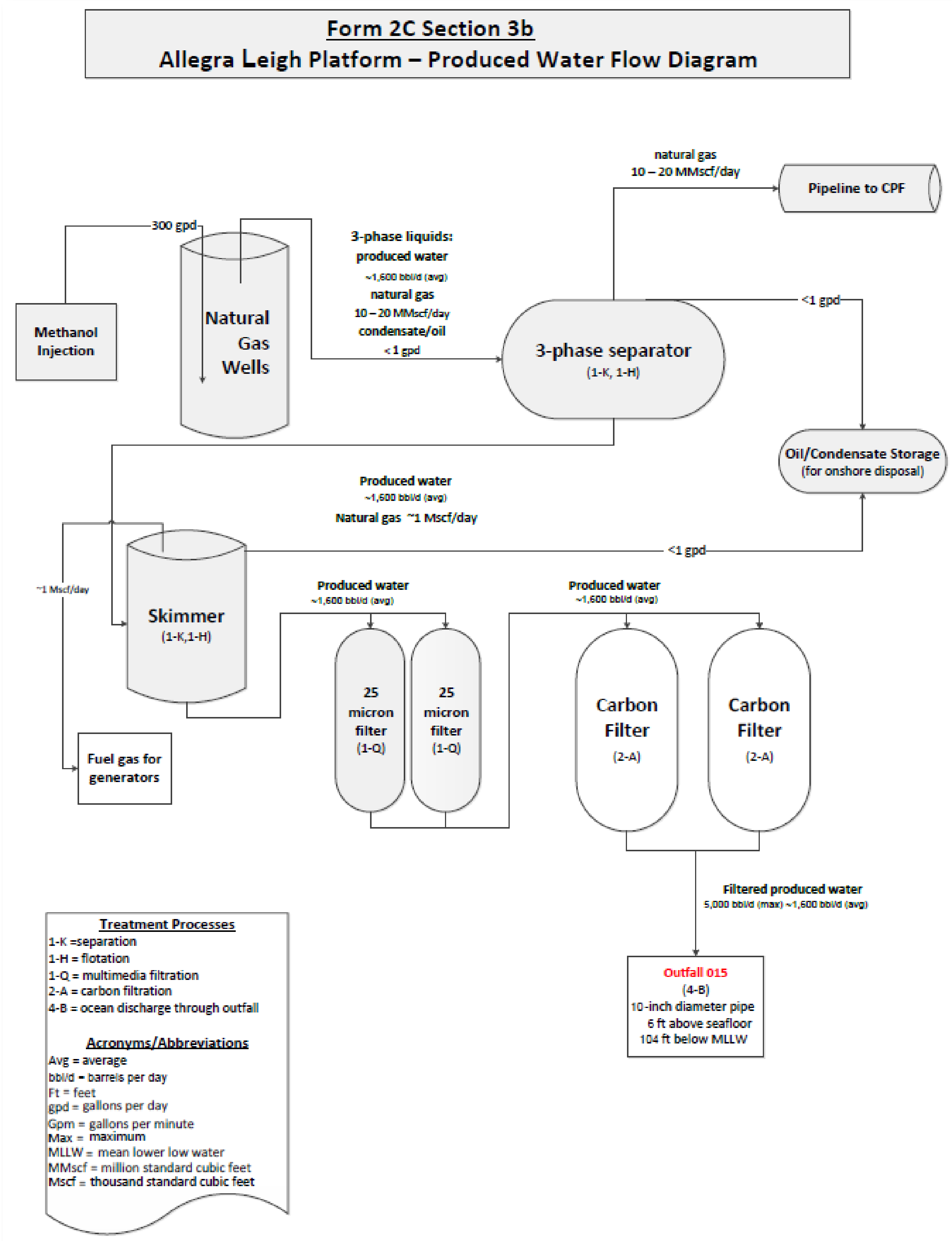


Figure A-2: Produced Water Process Flow Diagram

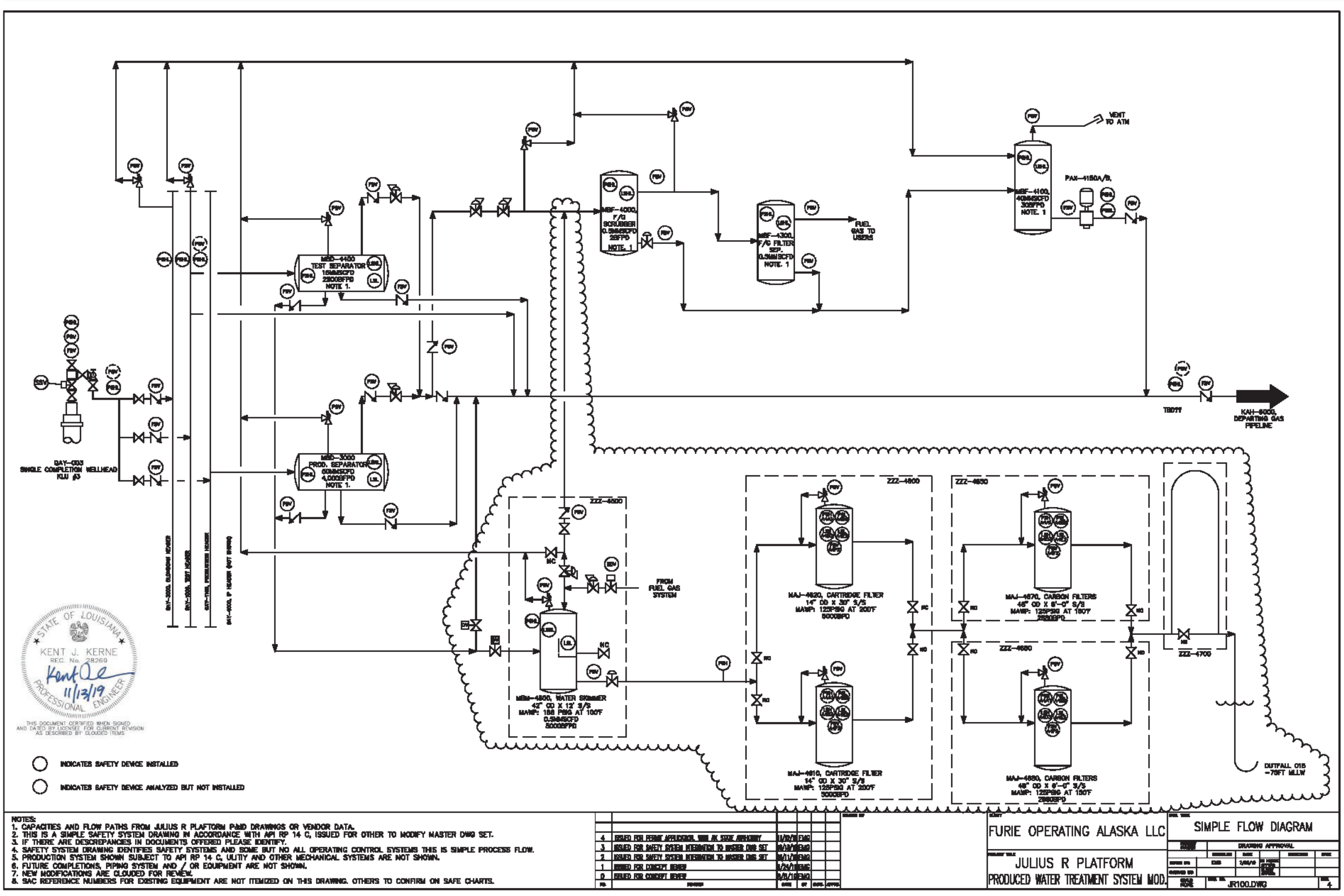
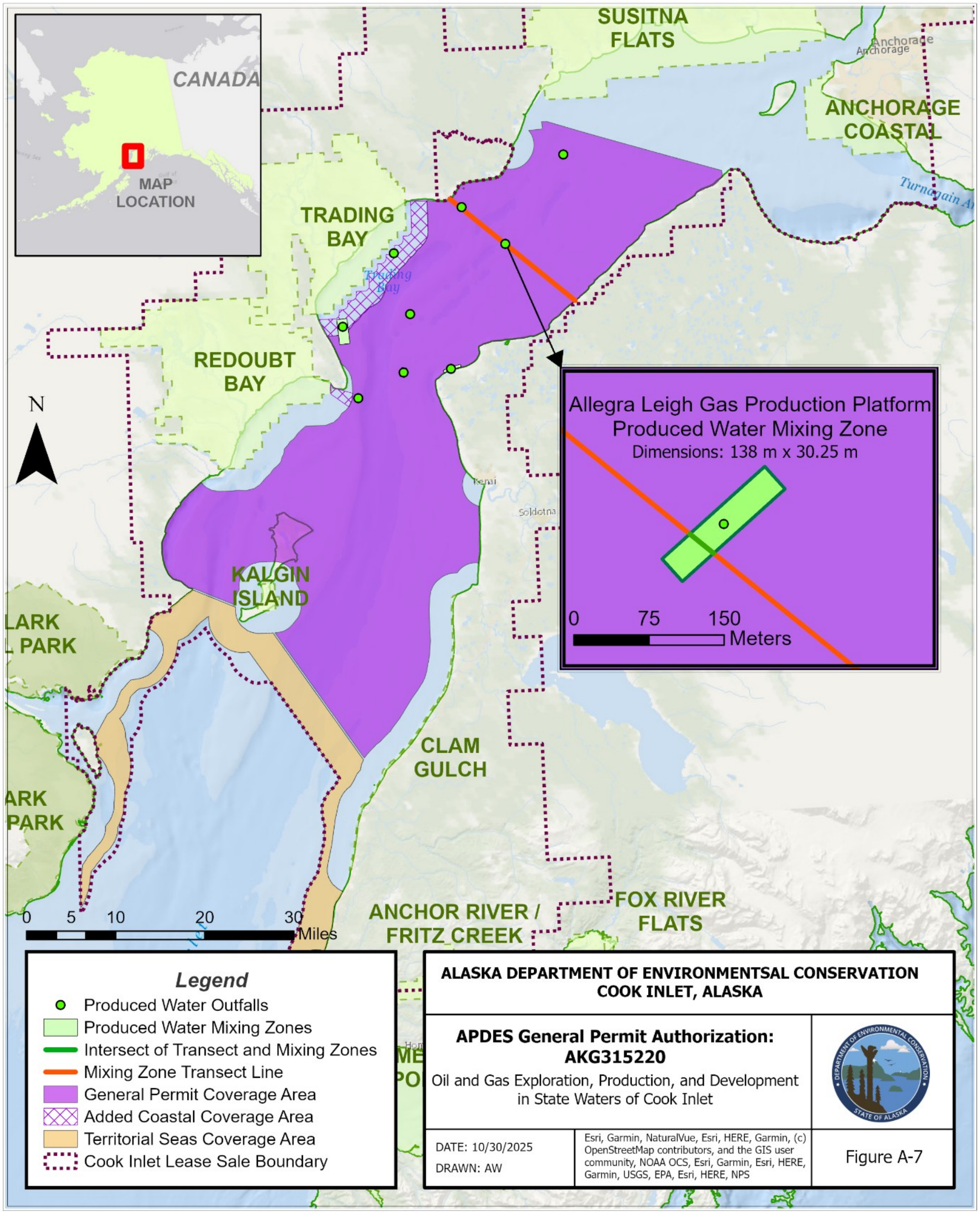


Figure A-3: Produced Water Treatment System Flow Diagram



The Department of Environmental Conservation (DEC) has compiled the computer representation from data or information sources that may not have been verified by the DEC. This general representation should not be re-used without verification of sources by an independent professional qualified to verify such data or information. DEC does not guarantee the accuracy, completeness or timelines of the information shown and shall not be liable for any loss or injury resulting from reference upon the representation. Sources: Alaska Department of Natural Resources, Land Records GIS, National Marine Fisheries Service,

Figure A-4: Cook Inlet Mixing Zone Transect and Area Evaluation

Appendix B REASONABLE POTENTIAL ANALYSIS

This Appendix summarizes the reasonable potential analysis (RPA) process used by the Alaska Department of Environmental Conservation (Department or DEC) to determine and develop water quality-based effluent limits (WQBELs) for Cook Inlet General Permit (CIGP) Authorization AKG315220 – Furie Operating Alaska LLC (Furie), Allegra Leigh Platform (ALP). Currently, the applicable WQBELs are within Individual Permit AK0053686 (2019 IP). Once the new limits are authorized under AKG315220, the 2019 IP will be terminated.

Per Alaska Administrative Code (AAC) 18 AAC 83 – Alaska Pollutant Discharge Elimination System (APDES) Program requires limits in APDES permits to achieve water quality standards established under 33 USC 1313, including state narrative criteria for water quality. Alaska water quality standards are found in 18 AAC 70 – Water Quality Standards (WQS) and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances, May 15, 2003 (Toxics Manual).*

Per 18 AAC 83.435(b), "Effluent limits in a permit must control all pollutants or pollutant parameters, either conventional, non-conventional, or toxic pollutants, that the department determines are or may be discharged at a level that will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard (i.e., criteria), including state narrative criteria for water quality."

DEC analyzes pollutant concentrations in the discharge to determine if it will cause, or contribute to, an instream excursion of water quality criteria per the RPA procedures described in the *RPA and Water Quality-based Effluent Limits (WQBEL) Development Guide, June 30, 2014 (RPA&WQBEL Guide).* The *RPA&WQBEL Guide* is based partly on procedures in the Environmental Protection Agency (EPA) *Technical Support Document for Water Quality-Based Toxics Control, 1991* (TSD) that were modified by the Department. Some variations to the guide to account for unique situations are appropriate.

B.1 Screening of Characterization Data for the RPA for Produced Water

Produced water is the only discharge authorized under AKG315220 that requires an RPA in this SOB based on numeric criteria. The RPA and development of WQBELs in the SOB are necessary so that this information can go through a 30-day public notice so that the limits and RPA can be adopted into the CIGP. Once adopted into the CIGP, the WQBELs and RPA can be part of the next reissuance of the CIGP without triggering Antidegradation Analysis assuming no backsliding is identified.

The previous RPA and WQBELs were based on pilot test data provided by Furie. This revision to the RPA and WQBEL development uses actual data obtained during the first term of 2019 IP. As a result of unique issues from diesel and sediment, not all data was included in the RPA because they could not be considered representative of routine operations of the facility. The data was reviewed and analyzed by DEC to determine the driving parameters of concern (POCs) and is presented in SOB Sections 2.2.

For the chronic mixing zone, the characterization of the produced water after treatment indicated chronic whole effluent toxicity (WET), with or without methanol injection into the producing formations, is the driving parameter. No other parameter evaluated exceeded chronic criteria to the degree that chronic WET such that a limit for chronic WET is required.

For the acute mixing zone, copper had concentrations above detection that resulted in exceeding acute criteria the most over other metals. Hence, copper is the driving parameter for the acute mixing zone and must have a WQBEL using the statistical variability of the characterization data for that parameter.

B.2 Mass Balance

For a discharge of a POC at the maximum expected concentration (MEC) (i.e., variability factor applied to the maximum observed concentration) into a marine receiving environment with a known ambient water concentration (AWC), the projected RWC is determined using a steady state model represented by the following mass balance equation:

$$(V_{MEC} + V_{AWC})RWC = V_{MEC}MEC + V_{AWC}AWC \qquad \text{(Equation B-1)}$$

where,

RWC = Receiving waterbody concentration downstream of the effluent discharge.

MEC = Maximum expected concentration .

AWC = Ambient waterbody concentration, taken as the 85th percentile of data or 15 percent of the chronic criteria if no ambient data is available. For WET, AWC is always zero.

V_{MEC} = Volume of the maximum expected effluent discharged into the control volume.

V_{AWC} = Volume of the ambient receiving water in the control volume.

Definition:

Dilution Factor (DF), $DF = \frac{(V_{MEC}+V_{AWC})}{V_{MEC}}$ (Equation B-2)

Upon separating variables in Equation B-1 and substituting Equation B-2 yields:

$$DF = \frac{(MEC-AWC)}{(RWC-AWC)} \qquad \text{(Equation B-3)}$$

Rearranging Equation B-3 to solve for RWC yields:

$$RWC = \frac{(MEC-AWC)}{DF} + AWC \qquad \text{(Equation B-4)}$$

For known MEC and AWC, Equation B-3 can be used to determine the required DF for a constituent by substituting water quality criteria for RWC. For cases where a DF and mixing zone have been authorized, Equation B-4 is used to calculate the RWC at the boundary of the mixing zone in the RPA.

B.3 Maximum Projected Effluent Concentration

To calculate the MEC, the Department uses the *RPA&WQBEL Guide* that modifies procedures in *TSD* Section 3.3. Specifically, DEC uses a 95th confidence interval with a 99th percentile to determine a reasonable potential multiplier (RPM) that is applied to the maximum observed concentration (MOC) to account for data variability. These MECs can also be referred to as the maximum probable concentration during mixing zone determinations. In addition, when calculating the coefficient of variation (CV), DEC evaluates the distribution of the data set using *ProUCL Statistical Software Program, Version 5.2 (ProUCL)* rather than assuming a lognormal distribution as described in the *TSD*. The possible statistical distributions include lognormal, normal, gamma, or non-parametric.

The RPM is calculated differently depending on the type of distribution, CV of the data, and the number of data points. When fewer than 10 data points are available, the *RPA&WQBEL Guide* recommends an assumed CV = 0.6, a conservative estimate that assumes a relatively high variability.

The CV is defined as the ratio of the standard deviation of the data set to the mean.

$$CV = coefficient\ of\ variation = \frac{standard\ deviation}{mean},$$

For data sets with a Normal, Gamma, or Non-parametric (Kaplan-Meier) distribution:

$$CV = \frac{\hat{\sigma}}{\hat{\mu}_n} \quad \text{(Equation B-5)}$$

Where: $\hat{\mu_n}$ = estimated mean = $\Sigma[x_i] / k$, $1 \leq i \leq k$

σ^2 = estimated variance = $\Sigma[(x_i - \mu)^2] / (k - 1)$, $1 \leq i \leq k$

$\hat{\sigma}$ = estimated standard deviation = $(\sigma^2)^{1/2}$

k = number of samples

For data sets with a Lognormal or Log-ROS distribution:

$$CV = \left[\left(\exp \hat{\sigma}_y^2\right) - 1\right]^{.5} \quad \text{(Equation B-6)}$$

Where: $y_i = \ln(x_i)$ for $i = 1, 2, \ldots, k$

$\hat{\mu_y}$ = mean = $\Sigma(y_i) / k$

$\hat{\sigma_y}^2$ = variance = $\Sigma\ [(y_i - \hat{\mu_y})^2] / (k - 1)$

k = number of samples

Equation B-6 can be rearranged to calculate the lognormal variance or standard deviation for use in the RPM equation for lognormal distributions as follows:

$\sigma_y^2 = \ln(CV^2 + 1)$ for the variance, and

$\sigma_y = \ln(CV^2 + 1)^{1/2}$ for the standard deviation.

The RPM is the ratio of the upper bound of the distribution at the 99th percentile to the percentile represented MOC, at the 95% confidence level per Equation B-7. When data demonstrates a lognormal distribution, Equation B-8 and B-9 are applied using either the transformation of the CV:

$$RPM = \frac{C_{99}}{C_{Pn}} \quad \text{(Equation B-7)}$$

$$C_{99} = \exp\left[\left(Z_{99} * \hat{\sigma}_y\right) - \left(0.5 * \hat{\sigma}_y^2\right)\right] \quad \text{(Equation B-8)}$$

$$C_{Pn} = \exp\left[\left(Z_{Pn} * \hat{\sigma}_y\right) - \left(0.5 * \hat{\sigma}_y^2\right)\right] \quad \text{(Equation B-9)}$$

In the case of data displaying normal or no discernable distribution, equations for C_{99} and C_{Pn} become:

$$C_{99} = \hat{\mu}_n + Z_{99} * \hat{\sigma} \quad \text{(Equation B-10)}$$

$$C_{Pn} = \hat{\mu}_n + Z_{Pn} * \hat{\sigma} \quad \text{(Equation B-11)}$$

In all Equations B-9, B-11, and B-13, the percentile represented by the MOC is:

$$p_n = (1 - confidence\ level)^{1/n} \quad \text{(Equation B-12)}$$

Where:

$$p_n = the\ percentile\ represented\ by\ the\ MOC$$
$$n = the\ number\ of\ samples$$
$$Confidence\ Level = 0.95\ for\ this\ analysis$$

Although it is possible to have an RPM less than one with large data sets, the *RPA&WQBEL Guide* establishes the minimum RPM as one (1.0). The MEC is determined by multiplying the MOC by the RPM:

$$\text{MEC} = (\text{RPM}) \times (\text{MOC})$$ (Equation B-13)

If the RWC (acute or chronic) calculated by Equation B-4 using the MEC is found to exceed the respective criteria for the pollutant of concern, then reasonable potential exists for the parameter and a water quality based effluent limitation (WQBEL) must be developed for that parameter.

B.4 Example Calculations for WET as a Chronic WQBEL

The mixing zone analysis identified chronic WET as the driving parameter for the chronic mixing zone at the platform and the Department authorizes a chronic mixing zone with a DF_c of 146. Chronic WET is found to have reasonable potential because the required dilution factor needed to meet the chronic WET water quality criteria of 1.0 chronic toxicity unit (TU_c) is 146 and Department authorizes slightly less dilution than required to meet water quality criteria at the boundary, 145. The following calculations demonstrate how WET resulted in reasonable potential:

Number of effluent data (n) = 43
MOC = 112.4 TU_c
The data was found to have a Gamma distribution with:
$\hat{\mu_n}$ = 33.02, and
$\hat{\sigma}$ = 26.49
CV = 0.8002

For a data set containing 43 WET samples:

$$p_n = p_{43} = (1 - 0.95)^{1/43}$$
$$= 0.933$$

Because the data was found to have a Gamma distribution, the following equation applies to the RPM calculation per the *RPA/WQBEL Guide*.

$$RPM = \frac{\widehat{\mu_n} + z_{99}\,\hat{\sigma}}{\widehat{\mu_n} + z_{Pn}\,\hat{\sigma}}$$

Were:

Z_{99} = 2.326 for the 99 percentile (Calculated with Excel Spreadsheet)

$Z_{93.3}$= 1.496 for the 93.3rd percentile (Calculated with Excel Spreadsheet)

Therefore,

$$RPM = \frac{33.02+(2.326\ x\ 26.49)}{33.02+(1.5\ x\ 26.49)} = 1.303$$

Using Equation B11,

$\text{MEC} = (\text{RPM}) \times (\text{MOC})$,

MEC = (1.303)(112.4) = 146.4 TUc (maximum projected effluent concentration),

For $DF_{chronic}$ = 145:

$$\text{RWC}_{\text{chronic}} = \frac{146.4}{145} = 1.01 \text{ TUc}$$

Because the RWC for chronic WET at the boundary of chronic mixing zone is above 1 TU, the Permit must have a chronic WET WQBEL.

See Appendix C for development of this limit.

B.5 Example Calculations for Copper as an Acute WQBEL

The mixing zone analysis identified copper as the driving parameter for the acute mixing zone at the platform and the Department authorizes an acute mixing zone with a DF_a of 58.5, which is less than the dilution factor required to meet acute water quality criteria for copper (59). The calculations demonstrating reasonable potential for copper are summarized below:

Number of effluent data (n) = 51
MOC = 146.0 µg/L Total Recoverable (Conversion factor for dissolved is 0.83)
The data was found to have a Lognormal distribution with:

$\hat{\mu_n}$ = 14.26, and
$\hat{\sigma}$ = 23.62
CV = 1.65638

For a data set containing 51 copper samples:

$$p_n = p_{51} = (1 - 0.95)^{1/51}$$

$$= 0.94295$$

Because the data was found to have a Lognormal distribution, the following equation applies to the RPM calculation per the *RPA/WQBEL Guide*.

$$RPM = \frac{\exp(z_{99}\hat{\sigma}_y - 0.5\hat{\sigma}_y^2)}{\exp(z_{Pn}\hat{\sigma}_y - 0.5\hat{\sigma}_y^2)}$$

Were:

Z_{99} = 2.326 for the 99 percentile (Calculated with Excel Spreadsheet);

$Z_{94.295}$= 1.58 for the 94.295 percentile (Calculated with Excel Spreadsheet);

$\hat{\sigma}_y = [\text{In}(\text{CV}^2 + 1)]^{1/2}$; and

CV =1.65638

Therefore,

$$RPM = \frac{\exp((2.326 \, x \, 1.1489) - (0.5 \, x \, 1.1489^2))}{\exp((1.58 \, x \, 1.1489) - (0.5 \, x \, 1.1489^2))} = 2.3562409$$

Using Equation B11 for MEC ($\text{MEC} = (\text{RPM}) \times (\text{MOC})$),

MEC = (2.3562)(146.0) = 344.0 µg/L (maximum projected effluent concentration),

For DF_{acute} = 59:

$$RWC_a = \frac{344.0\frac{ug}{L} \ \ -0.926\frac{ug}{L}}{59} + 0.926\frac{ug}{L} = 6.741$$

Because the RWC for copper at the boundary of acute mixing zone is above the site specific water quality criterion for Cook Inlet of 5.8 µg/L, the Permit must have a copper WQBEL. See Appendix C for development of this limit.

Appendix C BASIS OF LIMITS

The Alaska Department of Environmental Conservation (Department or DEC) prohibits the discharge of pollutants to waters of the United States (U.S.) per Alaska Administrative Code (AAC) 18 AAC 83.015 unless first obtaining a permit issued by the Alaska Pollutant Discharge Elimination System (APDES) Program that meets the purposes of Alaska Statutes (AS) 46.03 and is in accordance with Clean Water Act (CWA) Section 402 (CWA 402). Per these statutory and regulatory requirements, general permit AKG315200 – Oil and Gas Exploration, Development, and Production in Cook Inlet in State Waters (Permit) includes effluent limitations that require the discharger to (1) meet standards reflecting levels of technological capability, (2) comply with 18 AAC 70 – Alaska Water Quality Standards (WQS), (3) and comply with other state requirements that may be more stringent.

The CWA requires that the limits for a particular parameter be the more stringent of either technology-based effluent limits (TBEL) or water quality-based effluent limits (WQBEL). TBELs are set via rule makings by the Environmental Protection Agency (EPA) in the form of Effluent Limitation Guidelines (ELGs) that correspond to the level of treatment that is achievable using available technology. In situations where ELGs have not been developed or have not considered specific discharges or pollutants, a regulatory agency can develop TBELs using best professional judgment (BPJ) on a case-by-case basis. A WQBEL is designed to ensure that WQS are maintained and the waterbody as a whole is protected. WQBELs may be more stringent than TBELs. In cases where both TBELs and WQBELs have been generated, the more stringent of the two limits will be selected as the final permit limit. Per the *Technical Support Document for Water Quality-based Toxics Control* (TSD), once a specific type of limit has been decided, the permitting authority has some discretion in specific permit limit derivation procedures. When using this discretion, the procedure should be fully enforceable, account for effluent variability, consider available receiving water dilution, protect against acute and chronic impacts, account for compliance monitoring frequencies, and protect wasteload allocation (WLA) and ultimately WQS. An example of implementing such discretion is retaining limits from the existing Permit that are found to be more stringent than those developed for the Permit using typical procedures but are attainable based on review of historic effluent performance data.

C.1 TECHNOLOGY BASED EFFLUENT LIMITS

C.1.1 TBELs Based on Effluent Limitation Guidelines

EPA has promulgated national ELGs for the Oil and Gas Extraction Point Source Category at 40 CFR 435 Subparts A (Offshore Subcategory) and D (Coastal Subcategory). DEC adopted the ELGs by reference at 18 AAC 83.010(g)(3). These subparts specify Best Available Technology Economically Achievable (BAT); Best Conventional Pollutant Control Technology (BCT); and Best Practicable Control Technology Currently Available (BPT), and new source performance standards for the Offshore and Coastal Subcategories of the Oil and Gas Point Source Category.

The ELGs for the Coastal Subcategory were promulgated in 1996. During development of the ELGs, information from the discharging platforms Anna, Baker, Bruce, Dillon, and Tyonek A along with onshore production facilities Trading Bay Production Facility (TBPF), Middle Ground Shoal Onshore, and Granite Point Tank Farm were included in the evaluation of applicable ELGs. The evaluation led to an understanding that the Cook Inlet oil and gas region is unique when compared to other coastal locations in the U.S. for discharging drilling fluids and drill cuttings and produced water. Furthermore, because the produced water treatment systems were included in the evaluation, the existing facilities listed comply with model technology and meet the definition of highest statutory and regulatory requirements for ELGs. However, the Allegra Leigh Platform (ALP) that is seeking first time authorization under the Permit to discharge produced water falls under the ELGs as a New Source and must ensure that the treatment of produced water meets, or exceeds, the best available demonstrated control technology. The following sections discuss the applicable ELGs for Produced Water (Discharge 015).

C.1.1.1 ELGs for Produced Water (015) per 40 CFR 435 Subpart A and Subpart D

The evaluation conducted by EPA during promulgation of the ELGs in 1996, led to a determination that Cook Inlet is unique compared to other coastal locations in the U.S. This uniqueness allows for the discharge of produced water when, everywhere else, it is prohibited. The ELGs for produced water discharge to Cook Inlet requires an oil and grease average monthly limit (AML) of 29 milligrams per liter (mg/L) and a maximum daily limit (MDL) of 42 mg/L. In formulating those ELGs, EPA examined all existing facilities and the pollutants that could be expected to be discharged in produced water and concluded that they could be appropriately controlled by the oil and grease limits when discharging to Cook Inlet. Therefore, DEC cannot impose more stringent TBELs using case-by-case BPJ, such as a no discharge of produced water limitation.

C.1.2 TBELs Developed Using Case-by-Case Best Professional Judgement

In situations where ELGs have not been developed or have not considered specific discharges or pollutants, a regulatory agency can develop case-by-case TBELs using BPJ. Where national ELGs have not been developed, or did not consider specific pollutant parameters in discharges, the same performance-based approach applied to develop national ELGs is applied to a specific industrial facility using BPJ. The Permit contains TBELs developed on case-by-case basis using BPJ derived during development of other oil and gas permits for Cook Inlet (e.g., Cook Inlet General Permit). The Department has reevaluated these BPJ limits to ensure compliance with Section 402 of the CWA.

Per Section 402 of the CWA, developing TBELs using case-by-case BPJ requires the permitting authority to consider the age of equipment and facilities involved, the process employed, the engineering aspects of the application of various types of control techniques, process changes, the cost of achieving such effluent reduction, non-water quality environmental impact (including energy requirements), the cost of implementing these conditions relative to the environmental benefits achievable, and such other factors as deemed appropriate. The Department has evaluated the original TBELs developed by EPA using case-by-case BPJ in relation to age of equipment and current engineering aspects of control techniques, as well as other pertinent considerations. The Department has determined that these TBELs established in the 1999 and 2007 Cook Inlet General Permits are still directly applicable to the Permit. However, DEC will ultimately compare these TBELs to applicable WQBELs to determine which is more stringent for final limits.

C.1.2.1 Produced Water pH Limits Developed Using Case-by-Case BPJ

Although the discharge of produced water was included in the ELGs, the ELGs did not include pH limits and pH was considered an appropriate control. In previous Cook Inlet General Permits, EPA adopted pH limits of between 6.0 and 9.0 standard units (su) for discharges of Produced Water and DEC has evaluated these TBELs and has determined the evaluation conducted by EPA is appropriate for the Permit.

C.2 WATER QUALITY-BASED EFFLUENT LIMITS

C.2.1 Statutory and Regulatory Basis

Per 18 AAC 83.435(a), an APDES permit must include conditions (e.g., WQBELs) in addition to, or more stringent than established TBELs as necessary to protect WQS. When evaluating if WQBELs are needed in addition to TBELs, the permitting authority conducts a reasonable potential analysis (RPA) based on pertinent pollutants of concern (POCs). Pertinent POCs are those that the Department considers as having the potential to cause, or contribute to, an instream excursion above water quality criteria at the point of discharge or at the boundary of a mixing zone, if authorized. If a mixing zone is authorized, the Department may consider the dilution available in the receiving water in the analysis. Per 18 AAC 83.435(c), DEC must also use procedures that account for effluent variability (e.g., maximum expected effluent concentrations [MEC] and coefficient of variation [CV]), existing controls on point sources (e.g., treatment systems), and nonpoint sources of pollution (e.g., ambient receiving water concentrations). The Department developed and implemented a *Reasonable Potential Analysis and Effluent Limits Development Guide, June 30, 2014 (RPA/WQBEL Guidance)* and associated spreadsheet tool that were used in development of the WQBELs in the Permit.

C.2.2 Reasonable Potential Analysis

The *RPA/WQBEL Guidance* uses statistical methods to estimate MECs based on the 99th percentile at a 95 % confidence interval. Using a mass balance approach, the RPA projects the concentration at the boundary of a mixing zone, if authorized. Because DEC has authorized acute and chronic mixing zones, the mass balance procedure evaluates if the effluent causes, or contributes, to an instream excursion above water quality criteria at the boundary of either the acute or the chronic mixing zone. Based on the RPA summarized in Appendix B, the Department has determined there is a reasonable potential for the discharge to cause, or contribute to, an instream excursion above the chronic marine criterion for chronic whole effluent toxicity (WET) of 1.0 chronic toxicity unit (TUc) at the boundary of the chronic mixing zone for the discharge of produce water. DEC also determined that copper has reasonable potential to cause, or contribute to, an instream excursion above the acute marine criterion for copper at the boundary of the acute mixing zone for produced water. Accordingly, WQBELs for copper and chronic toxicity are required in the Permit and numeric WQBELs for copper and chronic WET have been developed per 18 AAC 83.435 to be consistent with the calculated available WLA and stringent enough to ensure compliance with WQS. In addition to reasonable potential for numeric water quality criteria discussed herein, reasonable potential for narrative an oil and grease criterion is presented Section C.2.6.

C.2.3 Wasteload Allocations

In the context of this section, a WLA is the concentration, or chronic WET, of a pollutant that can be discharged to the receiving water and comply with the acute (a) or chronic (c) water quality criteria ($WQC_{a,c}$), accounting for ambient concentrations and authorized acute or chronic dilution factors

($DF_{a,c}$) in the mixing zones, if applicable. The Department has authorized a chronic dilution factor of 145 for chronic toxicity and an acute dilution factor of 59 for copper. For chronic toxicity there is no ambient (Amb) toxicity to consider. For copper, data collected near produced water discharges during *the Integrated Cook Inlet Monitoring and Assessment Program (ICIEMAP)* in 2008 and 2009 and other samples collected near the industrialized location near Nikiski have been used to estimate ambient copper concentrations. The 85th percentile of the copper data is used to determine an ambient concentration of 0.926 micrograms per liter (μg/L). The WLA is calculated by rearranging Equation B-3 in Appendix B and substituting WQC for receiving water concentration and WLA for the maximum expected concentration. The resulting mass balance equation is:

$$WLA_{a,c} = DF_{a,c} (WQC_{a,c} - Amb) + Amb$$

Per the derivation of the above equation, chronic WET is the limiting parameter. This requires the chronic WQC for WET to be 1 TUc and the WLA equation simplifies to:

$$WLA_{chronicWET} = DF_c \times 1$$

C.2.4 WQBEL for Chronic Toxicity for Produced Water (Discharge 015)

This section describes the WQBEL procedure for chronic WET for the produced water discharge at ALP. The RPA revealed that chronic WET has reasonable potential to cause, or contribute to, an instream excursion above the chronic water quality criterion for toxicity at the boundary of the chronic mixing zone, requiring development of WQBELs. The authorized chronic dilution factor, DF_c, for the ALP chronic mixing zone is 145. The MDL and AML are based on a maximum expected WET (in TU_c units) derived from mass balance, a CV of 0.8022, and an assumed four compliance samples per month. The calculations for the MDL and AML for chronic WET for the ALP produced water discharge is shown below.

Input Parameters for Chronic WET WQBEL Development

- The chronic wasteload allocation (WLA_c) for chronic toxicity is 145 TU_c
- Coefficient of Variation (CV) = 0.8022
- Sampling Interval = 4 samples/month
- z statistic for 99th percentile probability basis (Z_{99}) = 2.326
- z statistic for 95th percentile probability basis (Z_{95}) = 1.645

Calculations:

Determine Long Term Averages (LTAs)

There is no acute criterion for toxicity. Therefore, the chronic LTA, LTA_c is calculated as follows:

$$LTA_c = WLA_c\,[\exp(0.5\sigma_4^2 - Z_{99}\sigma_4)], \text{ where } \sigma_4^2 = \ln(CV^2/4 + 1)$$

$$WLA_c = 145\ TUc,\ CV = 0.8022,\ Z_{99} = 2.326, \text{ and } \sigma_4^2 = 0.1492$$

$$\mathbf{LTA_c = 63.62\ TU_c}$$

Calculate the MDL

$$MDL = LTA_c\,[\exp(Z_{99}\sigma - 0.5\sigma^2)],\ \text{where } \sigma^2 = \ln(CV^2 + 1)$$

$$CV = 0.802,\ Z_{99} = 2.326,\ \text{and } \sigma^2 = 0.4968$$

MDL = 255.71 TU_c
Round Down to 255 TU_c

Because the monitoring frequency is monthly, or less, the application of an AML is not practicable given difficult logistics of coordinating and executing multiple sample events and transporting samples via helicopter during periods of inclement weather. DEC believes the benefit of conducting multiple tests per month to support an AML for chronic WET is outweighed by the risk to human life and safety and the potential for not meeting sample schedules, hold times, and persistence of WET samples exceeding hold times due to the logistics of sample collection on the platform and transportation by helicopter to onshore and to out-of-state bioassay laboratories. An MDL without an AML provides better assurance that the permittee can comply with the monthly monitoring despite remote logistics and impacts from inclement weather as well as the cost of having to repeat sample collections if weathered out. Therefore, there will only be an MDL established for the discharge.

C.2.5 WQBEL for Copper on Produced Water Discharge

This section describes the WQBEL procedure for copper for the produced water discharge at the ALP. The RPA revealed that copper has reasonable potential to cause, or contribute to, an instream excursion above the acute water quality criterion for copper at the boundary of the acute mixing zone for produced water, requiring development of WQBELs. The authorized dilution factor for the platform acute mixing zone is 59. The MDL and AML are based on an MEC derived from mass balance equal to 344.0 µg/L, a CV of 1.65638, and an assumed four samples per month. The calculations for the MDL and AML for copper on the ALP produced water discharges are shown below.

Input Parameters for copper WQBEL Development

- The chronic wasteload allocation (WLA_c) for copper is 403.16 µg/L
- The acute wasteload allocation (WLA_a) for copper is 288.49 µg/L
- Coefficient of Variation (CV) = 1.65638
- Sampling Interval = 4 samples/month
- z statistic for 99th percentile probability basis (Z_{99}) = 2.326
- z statistic for 95th percentile probability basis (Z_{95}) = 1.645

Calculations:

Determine Long Term Averages (LTAs)

The LTAs acute (a) and chronic (c) exposure were calculated as follows:

$$LTA_a = WLA_a\,[\exp(0.5\sigma^2 - Z_{99}\sigma)],\ \text{where } \sigma^2 = \ln(CV^2 + 1)$$

$$WLA_a = 288.5\ \mu g/L,\ CV = 1.65638,\ Z_{99} = 2.326,\ \text{and } \sigma^2 = 1.32$$

$LTA_a = 38.56$ µg/L

$LTA_c = WLA_c\ [\exp(0.5\sigma_4^2 - Z_{99}\sigma_4)]$, where $\sigma_4^2 = \ln(CV^2/4 + 1)$

$WLA_c = 403.16$ µg/l, $CV = 1.65638$, $Z_{99} = 2.326$, and $\sigma_4^2 = 0.5223$

$LTA_c = 97.46$ µg/L

- **Determine the most limiting (lowest) LTA**

LTA_a is most limiting = 38.56 µg/L

Calculate the MDL and AML

$MDL = LTA_a\ [\exp(Z_{99}\sigma - 0.5\sigma^2)]$, where $\sigma^2 = \ln(CV^2 + 1)$

$CV = 1.65638$, $Z_{99} = 2.326$, and $\sigma^2 = 1.32$

MDL = 288.5 µg/L
Round Down to 288

$AML = LTA_a\ [\exp(Z_{95}\sigma_4 - 0.5\sigma_4^2)]$, where $\sigma_4^2 = \ln(CV^2/4 + 1)$,

$CV = 1.65638$, $Z_{95} = 1.645$, and $\sigma_4^2 = 0.5223$

AML = 97.5 µg/L
Round up to 97 µg/L

C.2.6 Other Numeric or Narrative Water Quality-Based Effluent Limits and Monitoring

In addition to the parameters evaluated in the RPA, the limited and monitoring parameters in the existing Permit were reviewed to confirm they are appropriate for inclusion, should be modified, or removed from the reissued Permit as summarized below.

C.2.6.1 pH

The water quality criteria for pH are no less than 6.5 su and not greater than 8.5 su. Discharges of produced water (Discharge 015) have a TBEL developed using case-by-case BPJ per Section C.1.2.2 applied at the compliance point prior to commingling. DEC has assessed the impacts of authorizing these limits and determined that these limits would not result in causing, or contributing to, an instream excursion of water quality criteria at the boundary of the chronic mixing zone; the criteria will be reached in close proximity of the discharge due to available dilution and buffering capacity of the receiving water. Hence, the water quality criteria for pH can be exceeded within the mixing zone but not beyond the TBEL for pH (i.e., 6.0 to 9.0 su).

C.2.6.2 Narrative Requirements

Oil and Grease (Visual Sheen): Per 18 AAC 70.020(b)(17)(A)(i), there may be no concentrations of petroleum hydrocarbons 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. This narrative WQBEL is compared to the no free oil TBEL in Section C.3.

C.3 DETERMINATION OF MOST STRINGENT EFFLUENT LIMITS

DEC compared the narrative water quality criteria for oil and grease (visible sheen) to the TBELs based on observation of receiving water per the ELGs. Recent court cases have determined limits must be applied at the end of pipe rather than within the receiving water. Give that the TBEL for oil and grease allow for compliance with the water quality narrative using the Static Sheen Test in situations where visual observations are not possible (e.g., during periods of ice cover or broken ice conditions), DEC applies the TBEL as the appropriate limit..

Appendix D MIXING ZONE ANALYSIS CHECKLIST

Mixing Zone Authorization Checklist

based on Alaska Water Quality Standards (2025)

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 presented in the Alaska Administrative Code (AAC) at 18 AAC 70.240 are satisfied, as well as provide justification to authorize a mixing zone in an Alaska Pollution Discharge Elimination System 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.

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
Size	Is the mixing zone as small as practicable? - Applicant collects and submits water quality ambient data for the discharge and receiving waterbody (e.g. flow and flushing rates)	Yes •Technical Support Document for Water Quality Based Toxics Control •Water Quality Standards Handbook • DEC's RPA Guidance • EPA Permit Writers' Manual Statement of Basis Sections 3.1.2	18 AAC 70.240 (k)	Y

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
Technology	Were the most effective technological and economical methods used to disperse, treat, remove, and reduce pollutants? **If yes**, describe methods used in Fact Sheet Mixing Zone Analysis. Attach additional documents if necessary.	Yes Statement of Basis Section 3.1.2	18 AAC 70.240 (c)(1)	Y
Low Flow Design	**For river, streams, and other flowing fresh waters.** - Determine low flow calculations or documentation for the applicable parameters. Justify in Fact Sheet	N/A – Marine Discharge	18 AAC 70.240(l)	
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.**	No Statement of Basis Section 3.1.4	18 AAC 70.240(c)(2)	Y
	(2) impair overall biological integrity of the waterbody? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.6, 3.1.8, and 3.1.9	18 AAC 70.240(c)(3)	Y
	(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.**	Yes Statement of Basis 3.1.4	18 AAC 70.240(b)(1)	Y

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
	(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.**	No Statement of Basis 3.1.5, 3.1.6, 3.1.9, and 7.2	18 AAC 70.240(m)	Y
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.**	No Statement of Basis 3.1.5	18 AAC 70.240(d)(6)	Y
	(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.**	No Statement of Basis 3.1.5	18 AAC 70.240(c)(4)(C)	Y
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.**	No Statement of Basis 3.1.6	18 AAC 70.240 (e) and (f)	Y

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
Human Health	Does the mixing zone…			
	(1) contain bioaccumulating, bioconcentrating, or persistent chemical above natural or significantly adverse levels? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.7	18 AAC 70.240 (d)(1)	Y
	(2) contain chemicals expected to cause carcinogenic, mutagenic, tetragenic, or otherwise harmful effects to human health? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.7	18 AAC 70.240 (d)(2)	Y
	(3) Create a public health hazard through encroachment on water supply or through contact recreation? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.5	18 AAC 70.240(c)(4)(C)	Y
	(4) meet human health and aquatic life quality criteria at the boundary of the mixing zone? **If no, mixing zone prohibited.**	Yes Statement of Basis 3.1.7 and 3.1.8	18 AAC 70.240 (c),(4)(A)	Y
	(5) occur in a location where the Department determines that a public health hazard reasonably could be expected? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.5 and 3.1.7	18 AAC 70.240(c)(4)(B)	Y

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
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.**	No Statement of Basis 3.1.6	18 AAC 70.240(e) and (f)	Y
	(2) form a barrier to migratory species? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.9	18 AAC 70.240(c)(4)(G)	Y
	(3) fail to provide a zone of passage? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.8		Y
	(4) result in undesirable or nuisance aquatic life? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.8	18 AAC 70.240(d)(5)	Y
	(5) result in permanent or irreparable displacement of indigenous organisms? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.8	18 AAC 70.240(c)(4)(E)	Y
	(6) result in a reduction in fish or shellfish population levels? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.8	18 AAC 70.240(c)(4)(D)	Y
	(7) prevent lethality to passing organisms by reducing the size of the acute zone? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.2 and 3.1.8	18 AAC 70.240(d)(7)	Y

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
	(8) cause a toxic effect in the water column, sediments, or biota outside the boundaries of the mixing zone? **If yes, mixing zone prohibited.**	No Statement of Basis 3.1.8	18 AAC 70.240(c)(4)(A)	Y
Endangered Species	Are there threatened or endangered (T/E species) at the location of the mixing zone?If yes, are there likely to be adverse effects to T/E species based on comments received from United States Fish & Wildlife Service or National Oceanic & Atmospheric Administration. If yes, will conservation measures be included in the permit to avoid adverse effects? **If yes, explain conservation measures in Fact Sheet. If no, mixing zone prohibited.**	Statement of Basis 3.1.9 and 7.1	Program Description, 6.4.1 #5 18 AAC 70.240(c)(4)(F)	Y