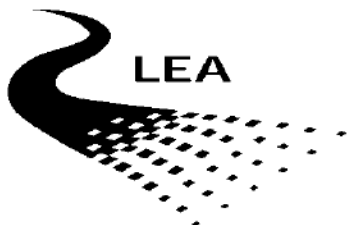


**Draft Permit Technical Review**  
On Draft APDES General Permit #AKG315200 (Feb. 19, 2019)  
For Oil and Gas (O-G) Exploration, Development, and  
Production in State Waters in Cook Inlet, Alaska

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## 1. Summary

This report reviews and comments on Alaska Department of Environmental Conservation (ADEC) on the draft APDES General Permit #AKG315200 (February 19, 2019) for Oil and Gas (O-G) Exploration, Development, and Production in State Waters in Cook Inlet, Alaska (Draft GP)<sup>1</sup> This review includes the draft permit Fact Sheet.<sup>2</sup>

The draft (2019) permit is weaker than the previous 2007 permit. This is because the discharge mixing zones (MZs) are being enlarged once again. This results in greater pollutant loads and greater environmental footprints.

ADEC is attempting to correct permit limit mistakes of the 2007 permit by expanding the proposed MZs under the draft (2019) permit. ADEC maintains that sensitivity analysis and new data account for changes in the permit limits. However, the corrections made to the MZ analysis are based on the expanding MZ geometry. The physically expanded MZ defines the boundary at which the revised permit limit concentrations are reported.

ADEC increases the sizes of all the permitted MZs, which increases the pollutant loads based on the same facility flow and concentration limit. This weakens the permit because greater pollutant loads are allowed. In the case of the TBPF, the pollutant loads all increase by 50 percent for toxic metals mercury, silver and zinc. This increasing pollutant load pattern is repeated for the other facilities and discharge pollutants.

The worsening permit trend is also inherent in the lack of adherence to widely used guidance for sizing mixing zones in both the 2007 and 2019 permits. ADEC does not identify the EPA guidance in defining mixing zones in the Technical Support Document (TSD), nor does ADEC delineate the guidance it is using. For example, ADEC stated that the 10<sup>th</sup> and 90<sup>th</sup> percentile velocities are used based on the “new data” but it does not explain why this is the case. Under its own policy, ADEC is required to adhere to the EPA TSD but it does not.<sup>3</sup>

The draft permit does not provide a rationale for the use of the 10<sup>th</sup> and 90<sup>th</sup> percentile velocities. ADEC does not provide a basis for this methodology, nor is the methodology derived from the “new data”. The MZ evaluation use of the 10<sup>th</sup> and 90<sup>th</sup> percentile velocities are part of the State of Washington’s methodology. However, Washington Ecology restricts estuarine MZ size to 200 feet plus depth<sup>4</sup>.

The proposed MZ size for TBPF is 64 times greater than would be allowed in Washington State. Yet, it appears, ADEC is using selective Washington State methodology to size the proposed MZ for TBPF.

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<sup>1</sup>ADEC Draft Permit (2019) for Draft APDES General Permit #AKG315200, February 19, 2019, pp. 171.

<sup>2</sup> ADEC Fact Sheet (2019) for Draft APDES General Permit #AKG315200, pp. 170.

<sup>3</sup> ADEC APDES (2008).

<sup>4</sup> That is water depth at Mean Lower Low Water (MLLW). That would be about 33 feet at the TBPF for a total MZ size of 233 feet.

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The Draft Permit also reduces effluent monitoring compared to the 2007 permit. This will likely result in more effluent limit violations going undetected.

Appendix A contains a description of permitted discharge types, tidal charts, tidal CORMIX inputs and MZ size comparisons.

Appendix B has available mass loading calculations based on the draft permit effluent limitations.

Appendix C contains comparison tables for effluent limits for the current 2007 permit and the draft 2019 permit.

Appendix D has excerpts from the CORMIX modeling results for the new and expanded discharges.



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## 2. Key Technical Issues

Key technical issues associated with the draft Permit (2019) and Fact Sheet (2019):

- 1) Representative Cook Inlet conditions were disregarded in the setting of the draft permit limits. The permit neglects realistic critical period values for temperatures, salinity, tidal flow velocities and directions, ambient background concentrations, stratification, freshwater inputs, neap or spring tide conditions<sup>5</sup>, waterbody classification<sup>6</sup>, outfall configuration and maximum effluent concentration. ADEC is determining the pollutant loads desired by the dischargers and then back-calculating expanded mixing zones. This is contrary to the MZ sizing requirements that must result in the smallest MZ practicable.
- 2) The lack of realistic simulation of receiving water conditions results in ADEC's mischaracterization of Cook Inlet as exceptionally capable of receiving and assimilating more pollution. Consequently, ADEC claims to be incapable of enforcing zero discharge alternatives<sup>7</sup> such as well-injection (FS 2019, CIK 2006). This is because discharges into Cook Inlet are permitted based on MZ modeling, which is distorted in favor of the discharger. ADEC asserts injection is not possible because of limitations in the geologic formations in many cases. Yet, hundreds of injection wells operate in the Cook Inlet Basin.<sup>8</sup> The permit does not provide sufficient analysis of reinjection costs or technical feasibility.
- 3) The mixing zone analyses used in deriving the permit limits, using the CORMIX model, did not critically evaluate tidal, stratification and outfall conditions in the Cook Inlet simulations. Cook Inlet is modeled as a river with non-varying flow and either very weak or no stratification. ADEC has provided stacks of non-representative CORMIX model runs for its existing and future facilities. However, ADEC does not identify the specific CORMIX input and output files resulting in its promulgated permit effluent limits.<sup>9</sup>
- 4) Non-representative effluent concentrations were used in evaluating the effect of discharges. Alaska's guidance<sup>10</sup> indicates that the maximum potential concentrations must be calculated based on the EPA's TSD. This statistical procedure is misleading in the permit and fact sheet because of the rudimentary (grab samples) and infrequent (one-per-month) monitoring of continuous discharges of toxic chemicals.<sup>11</sup>

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<sup>5</sup> Neap tide results in the smallest tidal range based on water surface height; spring tide results in the greatest tidal range based on water surface height,

<sup>6</sup> Examples of waterbody classifications are: estuarine, oceanic and riverine.

<sup>7</sup> FS (2019), see Page 46 of 171, second and third paragraphs.

<sup>8</sup> See <http://aogweb.state.ak.us/DataMiner3/Forms/Injection.aspx>, maintained by Alaska Oil and Gas Conservation Commission (AOGCC),

<sup>9</sup> See Draft Permit and Fact Sheet (2019), CORMIX1 (1990) and CORMIX2 (1991).

<sup>10</sup> ADEC APDES (2008), Alaska Pollutant Discharge Elimination System Program Description, Final October 29, 2008, amended August 11, 2011. See Pages 28-30 under Subsection 10. Reasonable Potential Analysis and Water Quality-Based Effluent Limits. See particularly, the 2nd full paragraph on Page 30.

<sup>11</sup> EPA (2004), *NPDES Compliance Inspection Manual*, report number EPA 305-X-04-001, July 2004.

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- 5) The draft permit sampling types and monitoring frequencies will potentially result in unacknowledged permit exceedances because they are too infrequent and rudimentary<sup>12</sup> to capture realistic wastewater characteristics, maximum effluent concentrations and on-going loadings. In many cases<sup>13</sup>, the present (2007) permit sampling results are coarse with no concentration difference between maximum and average monthly reporting.
  - 6) Mixing zone sizes must be as small as practicable to protect Cook Inlet water quality and environment. Instead, ADEC relies on an approach that generates mixing zones that are as large as possible to increase the pollutant allowances. This is seen in the expanded MZs proposed in this draft permit.<sup>14</sup> The expansion of MZs between the present 2007 permit and the draft (2019) permit once again depict a process of ever increasing MZ sizes. ADEC is continuing the practice, set earlier by EPA, of continuously increasing MZ sizes. From the predecessor 1999 permit, to the present 2007 permit, and through to this 2019 draft permit, the trend is toward larger mixing zones.<sup>15</sup> ADEC has chosen MZs as large as possible rather than determining sizes that are as small as practicable.
  - 7) MZ sizing is supposed to be controlled by the discharge length scale consistent with the EPA TSD (1991)<sup>16</sup>, which ADEC policy<sup>17</sup> states it adheres to but which the draft permit does not.
  - 8) ADEC does not provide a critical period technical basis for sizing its MZs. EPA identifies critical period conditions applicable to Cook Inlet but these are disregarded by ADEC.
  - 9) ADEC increases the sizes of all the permitted MZs, which increases the pollutant loads based on the same facility flow and concentration limit. This weakens the permit as greater pollutant loads are allowed. For TBPF, the pollutant loads increase by 50 percent for toxic metals mercury, silver and zinc. This increasing pollutant load pattern is repeated for the other facilities and discharge pollutants.
  - 10) As the Cook Inlet oil fields age, the water/oil ratio increases resulting in larger pollutant loadings. ADEC is expanding MZ sizes to accommodate increased loading. This means that older field inefficiencies will be taken up by expanding MZs rather than improved treatment or alternative disposal methods.

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<sup>12</sup> For example, instantaneous grab samples are permitted rather than the more accurate and widely-used 24-hour composite type sampling consistent with the proposed discharges.

<sup>13</sup> DMR Avg and max effluent concentration examples.

<sup>14</sup> See Fact Sheet Table 27 on Page 79 of 171.

<sup>15</sup> See also: the preliminary draft permit EPA (2005a), draft permit, EPA (2006a&b), EPA (2007a&b), EPA (1991).

<sup>16</sup> TSD (1991), see Section 4.3.2 - Minimizing the Size of Mixing Zones see Pages 70-71. Particularly see the last full paragraph on Page 70 and the second bullet on the top of Page 71.

<sup>17</sup> ADEC APDES (2008), see Pages 28-30 under Section 10. Reasonable Potential Analysis and Water Quality-Based Effluent Limits and Subsection 11. Mixing Zone (Page 30).

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### 3. Overview of Proposed Mixing Zones

The proposed mixing zones (MZ) for Cook Inlet are very large, easily the largest I have seen in my 29 years of experience working on receiving water projects throughout the United States. See my curriculum vitae (CV) in Appendix E.

The larger the MZ, the greater the pollutant allowance and greater the environmental footprint. Under ADEC's MZ approach, the cleaner the receiving water, the more readily it can receive pollutants.

#### **Documents Used in this Review**

Documents used in this review include the primary documents from the 2007 draft permit review LEA (2006) as well as the present draft permit (2019) related documents, which include discharger mixing zone (MZ) documents obtained (February 14, 2019) from ADEC and related to discharger activities.

ADEC and the dischargers have relied on the study Produced Water Discharge Fate and Transport in Cook Inlet, 2008-2009.<sup>18,19</sup> This report became available in 2010 after the 2007 permit was issued. The study appears crucial in ADEC's decision to continue mixing zone modeling and expansion without representative tidal and stratification conditions. These errors cause apparent dilution values to be higher than in actuality, which is highly problematic because it allows greater pollutant loads.

A major document submitted to ADEC by Hilcorp (2017) is largely unidentified by ADEC in the Fact Sheet. This document is entitled the Supplemental Mixing Zone Study for Cook Inlet Oil and Gas Production Facilities (SMZS).<sup>20</sup> The study comprises 2,732 pages. It contains in its Appendix G, without distinguishing the actual permit limit model runs, the CORMIX input and output files for TBPF, MGS, GPTF and the platforms Baker, Bruce, Dillon and Tyonek A. Appendix A3 shows the tidal conditions in Cook Inlet in the vicinity of Trading Bay.

The CORMIX (2007) manual (excerpted in Appendix A2) illustrates tidal reversing ambient conditions applicable to Cook Inlet. This was not modeled by ADEC or the dischargers.

Hilcorp shows Cook Inlet tidal conditions in the vicinity of the outfalls (see excerpts in Appendix A3).<sup>21</sup> Surprisingly, none of the Hilcorp CORMIX runs simulate this more

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<sup>18</sup> Produced Water Study (2010), NPDES Permit No. AKG-31-5000, Produced Water Discharge Fate and Transport in Cook Inlet, 2008-2009, Final Report, submitted to U.S. Environmental Protection Agency and Alaska Department of Environmental Conservation, prepared by Kinetic Laboratories, Inc. for discharger, July 2010.

<sup>19</sup> This report was obtained from ADEC by Cook Inletkeepers on February 14, 2019. This was part of the permit related review and comment period.

<sup>20</sup> Hilcorp (2017), Supplemental Mixing Zone Study for Cook Inlet Oil and Gas Production Facilities, herein after called the SMZS (2017), prepared by Parametrix for Hilcorp Alaska, LLC, March 31, 2017.

<sup>21</sup> Ibid, see the charts on PDF Pages 80 through 82 of the SMZS (2017).



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stringent case that would result in a MZ size that is as small as practicable. For example, the CORMIX (2007) manual demonstrates how tidal conditions are simulated in CORMIX (Appendix A4). None of these tidal inputs and outputs are presented in the 2017 Hilcorp study.

An accurate and representative tidal simulation in CORMIX would include:

- Tidal Simulation at time T relative to slack tide
- Instantaneous ambient velocity
- Maximum tidal velocity
- Rate of tidal reversal
- Period of reversal T = 12.4 hours (This is the time between tidal highs or lows with each occurring approximately twice a day, i.e., semi-diurnal.)

These inputs are absent from the ADEC analysis.

### **Mixing Zone Sizing Analysis**

Considerable data is referred to by ADEC in the Fact Sheet and by the operators in the Produced Water Study but the data sets used have not been made available in a complete assessment. For example, in the following excerpt 10<sup>th</sup> and 90<sup>th</sup> percentile values for current (velocity) are referred to but no full statistical analysis of the original data is provided showing all the percentiles including the slack tide. Nor does ADEC identify how the analysis defines critical conditions, which in its scenario favor the largest MZ size. There is no technical basis provided by ADEC, or the dischargers, for the methodology described below. The 10<sup>th</sup> and 90<sup>th</sup> percentile currents (velocities) not representative of Cook Inlet ambient conditions but no explanation is given by ADEC as to why this should be the case. No slack tide conditions were evaluated in the cases evaluated by ADEC or the dischargers.

A range of current percentiles were evaluated for each facility to determine critical current conditions. Although most facilities resulted in the 90th percentile determining plume length and the width using the 10th percentile, there were exceptions where other current percentiles represented critical conditions (e.g., TBPf and MGS Onshore). In general, the width dimensions were determined by modeling the 10th percentile current, or other percentile if appropriate, and then evaluating the applicable range of current directions during that period using the new NOAA data. For TBPf and MGS Onshore, this method had to be modified for facility-specific reasons. TBPf has a diffuser array and **MGS Onshore has a single port aligned in the current direction, which makes modeling the discharge difficult in CORMIX.** Except for TBPf, MGS Onshore, and Tyonek A, the analysis generally resulted in produced water mixing zones that are shorter than those in the 2007 GP and all have wider dimensions due to the new conservative approach for estimating plume behavior during tidal reversal at slack tide. Note that although the mixing zones became larger, this is reflective of taking a conservative approach with new information rather than due to increases in pollutants as there were also noted decreases in authorized dilution factors.<sup>22</sup> **[Bold by LEA.]**

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<sup>22</sup> ADEC Fact Sheet Page 70 of 171. Second paragraph under subsection 6.2.3.6 - Produced Water (Discharge 015).

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This is not what EPA TSD (1991) guidance says about how to model an estuary mixing zone [see also EPA Estuaries (1992); Fischer et al., (1979); Thomann and Mueller, (1987)], or even an oceanic MZ.<sup>23</sup> The TSD requires that slack tide conditions be assessed along with critical period stratification. ADEC avoids the slack tide analysis, chooses non-critical stratification conditions, and substitutes liberal ambient velocities based only the 10<sup>th</sup> and 90<sup>th</sup> percentile values.

The above excerpt notes that the MGS outfall modeling is “difficult in CORMIX”. That is because the outfall design is faulty, with the “single port aligned in the current direction”, i.e., pointing upstream. CORMIX resists this case because it is an unpredictable and substandard design. Once again, as is shown throughout these comments, ADEC and the dischargers ignore warnings generated by CORMIX to avoid implementing the smallest MZ practicable.

The resulting mixing zone size should be as small as possible yet the ADEC methodology results in mixing zone sizing that is as large as possible. The avoidance of representative tidal, stratification and outfall conditions in the Cook Inlet result in MZs that are as large as possible. The CORMIX simulations made available by ADEC do not provide analysis aimed at MZs that are as small as practicable. See CORMIX1 (1990), CORMIX2 (1991) and the CORMIX Manuals from 1996 and 2007 for modeling detail as well as Baumgartner, et al., 1994.

No technical basis is provided for using the 10<sup>th</sup> or 90<sup>th</sup> percentile current (ambient velocity) values as confirmation of critical current speeds. Compare the EPA’s more restrictive estuarine conditions with ADEC’s non-varying flow river analysis. The EPA conditions that apply to Cook Inlet are relative to slack tide and critical period stratification. The excerpt below identifies ebb and flood current directions but none of the draft permit (2019) MZ model simulations account for these tidal conditions.

#### **A.2 New Cook Inlet Data for Mixing Zone Analysis**

As discussed in Fact Sheet Section 6.2.1, the applicants submitting revised mixing zone evaluations for reissuance researched new information that was previously unavailable to refine past modeling efforts to result in better predictions of plume behavior. New information included current data collected by buoys deployed by the National Oceanographic and Atmospheric Administration (NOAA) at the Forelands, Middle Ground Shoal, and North Forelands over various short-term periods from 2005 to 2012. **The NOAA current data provided confirmation of critical current speeds for the 10th and 90th percentile currents as well as the prevailing ebb and flood current directions.** Typically, for rectangular mixing zones the 10th percentile current is used to determine plume width and the 90th percentile for the plume length in models. Previously, this led to long and narrow mixing zones that may not adequately explain plume behavior. By developing current roses, the applicants could evaluate ranges of current directions occurring around slack tide that led to conservative estimates of plume width. Because the main axis of the ebb and flood are not always 180 degrees apart as previously assumed, the authorized mixing zones have non-rectangular shapes that better define the actual boundaries of the acute and chronic mixing zones. Also, because there were multiple NOAA stations within the area of coverage, the applicants evaluated currents spatially and were able to adjust critical currents through interpolate or extrapolate for various facilities within the area of coverage. However, these adjustments were minor and the evaluation of the current data supports the generalized use of 0.3

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<sup>23</sup> EPA TSD (1991), see 4.4.2 Critical Design Periods for Waterbodies under 3) Estuaries, Page 74.

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meters per second (m/s) for the 10th percentile current and 2.3 m/s in most areas of coverage, similar to previous modeling determination.<sup>24</sup> [Bold by LEA]

#### *Cook Inlet – Estuarine Conditions*

Okkonen, et al. (2009), USACE (1993), Piatt (1994), Gatto (1976) characterize Cook Inlet as consisting of large seasonal freshwater inputs, as well as estuarine hydrodynamics that are highly tidal with a defined back and forth channel flow.

Cook Inlet must be modeled as an estuary using representative ambient conditions. This includes seasonal variations for summer and winter periods with variation in freshwater inputs to Cook Inlet. Compare this to ADEC and the dischargers that liberally model Cook Inlet velocities and dilution as derived from a predominately downstream flowing river. ADEC provided no technical analysis of freshwater mixing, salinity, stratification, two-dimensional horizontal flow conditions and tidal reversal:

Cook Inlet is a broad, long, and shallow embayment extending northward from the Gulf of Alaska into south-central Alaska (Figures 1 and 2). **Several large rivers flow into the northern (upper) section of Cook Inlet. Discharges from these rivers have large seasonal variability with high flows associated with snowmelt in the spring and storm events in the fall.** The bathymetry shoals to less than 100 m near the mouth of Cook Inlet. A deeper channel extends along the axis of the Inlet, and has branches into Kachemak Bay and around Kalgin Island. The shape and depth of Cook Inlet is such that the M2 tide resonates leading to a very large tidal amplitude. The Inlet is narrower towards the north causing the tidal amplitude and resulting currents to increase towards the constriction formed by the Forelands. **Changes in tidal flow associated with the changes in bathymetry forms strong shear and convergence zones locally known as rips.** These rips accumulate debris, ice, and oil, as was demonstrated in the 1987 T/V Glacier Bay oil spill. [Bold by LEA].

#### *Actual Ambient Conditions Disregarded*

Considerable evidence exists that estuarine tidal conditions exist in the vicinity of the proposed discharges. See Okkonen and Howell, 2003; Okkonen, 2005; Moore, et al., 2000; USACE (1993); and Bakus, et al. (1979). Yet the MZ modeling used in the effluent limitation development neglects this more stringent condition. While the text of the Fact Sheet (2019) discusses tidal conditions, the actual simulations using CORMIX disregard this critical fact.

Seasonal variations, which are significant in Cook Inlet, are also neglected in the ADEC permit analysis. ADEC disregards the effects of large freshwater inputs that occur in spring and summer that affect estuarine conditions including stratification. ADEC also disregards the very low mixing that occurs without freshwater inputs and results in high salinity conditions that occur in winter.

#### *Ambient Velocity Analysis*

The current speed analysis data does not support the MZ modeling assumptions for the Trading Bay facility outfall. Cook Inlet velocities are obviously variable (non-uniform),

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<sup>24</sup> ADEC FS Page 144 of 171 first paragraph under A.2 New Cook Inlet Data for Mixing Zone Analysis.



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having different velocities at different times and reversing direction ADEC and the Operator's MZ analyst consistently and directly refer to ebb and flood tide conditions.<sup>25</sup>

The discharger's Executive Summary (ES) suggests a low salinity environment for Cook Inlet. This is a characteristic of estuarine conditions, not those simulated by the "ocean" environment with much higher salinity (over 30 parts per thousand)<sup>26</sup> values used for a marine environment as modeled for the permit MZs.

Okkonen, et al. (2009) also characterizes Cook Inlet as estuarine:

Our results are consistent with the findings of Burbank (1977) and Muench et al. (1978) **which depict Cook Inlet exhibiting typical estuarine circulation.** The dominant freshwater flows are southwestward along the western side of Cook Inlet and the ACC flowing westward across the mouth of Cook Inlet (Figure 35). Consistent with the findings of Muench et al. (1978, 1981), our results also suggest that the core of the ACC tends to follow the 100 m isobaths. **[Bold by LEA.]**

ADEC ambiguously implies that Cook Inlet can be characterized as exhibiting Ocean conditions by using the 10<sup>th</sup> percentile condition. The EPA TSD (1991) identifies critical conditions for Ocean environments including maximum thermal stratification, spring tide and neap tide currents. These critical conditions were not modeled by ADEC in the documents made available.<sup>27</sup>

#### 4) Oceans

Critical design periods for ocean analyses are described in two separate documents, the Section 301 (h) Technical Support Document [22] and the Section 301 (h) document, initial Mixing Characteristics of Municipal Ocean Discharges [24]. The following subsection contains a summary from these documents. Like discharges to estuaries, discharges to ocean waters are subject to two-dimensional horizontal flows. **Oceanic critical design periods must include periods with maximum thermal stratification, or density stratification. These periods shorten the distance of vertical diffusion that occurs in the zone of initial dilution.** Thus, during these periods it is difficult to achieve the recommended 100-to-1 dilution that is to occur before the plume begins a predominantly horizontal flow as compared to vertical flow. Periods when discharge characteristics, oceanographic conditions (spring tide and neap tide currents), wet and dry weather periods, biological conditions, or water quality conditions that indicate that water quality standards are likely to be exceeded should also be noted. **The 10<sup>th</sup> percentile value from the cumulative frequency of each parameter should be used to define the period of minimal dilution.** **[Bold by LEA.]**

The new modeling analyses avoid the critical conditions including: maximum thermal or density stratification and seasonal effects.

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<sup>25</sup> ADEC FS, ebb and flood tides identified on Pages 71, 72, 141, 144 of 171. Chevron TBPF for Cook Inlet, Produced Water Study on Pages ES-viii, 212, 240, 243-251, 257-259, 267,

<sup>26</sup> ppt - parts per thousand

<sup>27</sup> EPA TSD (1991), see 4.4.2 Critical Design Periods for Waterbodies under 4) Oceans, Page 74.



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Oceanographers and fisheries experts (Okkonen and Howell, 2003; Okkonen, 2005; Moore, et al., 2000), characterize Cook Inlet as an estuary in the vicinity of the dischargers. EPA identifies the critical conditions relative to slack tide and minimum and maximum stratification.<sup>28</sup>

### 3) Estuaries and Coastal Bays

This receiving water category encompasses estuaries, which are defined as having a main channel reversing flow, and coastal bays, which are defined as having significant two-dimensional flow in the horizontal directions. For both waterbodies, the critical design conditions recommended here are based on astronomical, not meteorological, tides.

Determining the nature and extent of the discharge plume is complicated in marine systems by such conditions as differences in tides, riverine input, wind intensity and direction, and thermal and saline stratification. Because of the tidal nature of the estuaries and coastal systems and their complex circulation patterns, dilution of discharges cannot be determined simply by calculating the discharge rate and the rate of receiving water flow (i.e., the design flow). For example, tidal frequency and amplitude vary significantly in different coastal regions of the United States. Furthermore, tidal influences at any specific location have daily and monthly cycles. These and additional factors require that direct, empirical steps be taken to ensure that basic dilution characteristics of a discharge to salt water are determined. **In estuaries without stratification, the critical dilution condition includes a combination of low-water slack at spring tide for the estuary and design low flow for riverine inflow. In estuaries with stratification, a site-specific analysis of a period of minimum stratification and a period of maximum stratification, both at low water slack, should be made to evaluate which one results in the lowest dilution. In general, minimum stratification is associated with low river inflows and large tidal ranges (spring tide), whereas maximum stratification is associated with high river inflows and low tidal ranges (neap tide).**

After either stratified or unstratified estuaries are evaluated at critical design conditions, an off-design condition should be checked. The off-design condition (e.g., higher flow or lower stratification) recommended for both cases is the period of maximum velocity during a tidal cycle. This off-design condition results in greater dilution than the design condition, but it causes the maximal extension of the plume. Extension of the plume into critical resource areas may cause more water quality problems than the high-concentration, low-dilution situation. Recommendations for a critical design for coastal bays are the same as for stratified estuaries. The period of maximum stratification must be compared with the period of minimum stratification in order to select the worst case. The off-design condition of maximum tidal velocity should also be evaluated to predict the worst-case extent of the plume. **[Bold by LEA.]**

The Trading Bay Production Facility (TBPF) with an existent mixing zone length of 7,933 feet (1.5 miles) to accommodate the very large pollutant loads intended to be discharged into it. It is not founded on the principal that the MZ should be as small as practicable<sup>29</sup> but rather should be as large as possible to provide virtually unlimited pollutant allowances.

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<sup>28</sup> EPA TSD (1991), see 4.4.2 Critical Design Periods for Waterbodies under 3) Estuaries, Page 74.

<sup>29</sup> 18 AAC 70.240: “(k) The department will approve a mixing zone, as proposed or with conditions, only if it finds that the **mixing zone is as small as practicable** and will comply with the following size restrictions, unless the department finds that evidence is sufficient to reasonably demonstrate that these size restrictions can be safely increased: (1) **for estuarine** and marine waters, measured at mean lower low water, (A) the cumulative linear length of all mixing zones intersected on any given cross section of an estuary, inlet, cove, channel, or other marine water may not exceed 10 percent of the total length of that

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For a sense of proportion, compare the existing TBPf mixing zone length of 7,933 feet with the MZ limited length of 200 feet plus depth for estuaries in the State of Washington.<sup>30</sup> This works out to a MZ length of about 233 feet at the TBPf outfall site. Parametrix makes use of the 10<sup>th</sup> and 90<sup>th</sup> percentile velocities, which suggests the use of Washington State methodology. Neither ADEC nor Parametrix acknowledge they are using State of Washington methodology in evaluating receiving water velocities.<sup>31,32</sup>

This basic information on mixing zone sizing appears to be omitted because otherwise the more practicable mixing zone length of 233 feet would control rather than the 34 times greater MZ length of 7,933 feet. ADEC and the discharger have selectively chosen those elements of MZ analysis that will result in the largest MZ size, not the smallest practicable. This is accomplished by ADEC in ignoring the more restrictive essentials of MZ analysis as described in the TSD, i.e., MZ sizing based on acute toxicity and the discharge length scale. It is worth noting that the Washington State sizing methodology (200 feet plus water depth) fits well into the TSD because of its disciplined adherence to the most restrictive and “small as practicable” constraint. These include actual conditions for tidal velocities, tidal fluctuation and reversal, effective stratification, representative Cook Inlet temperature and salinity conditions, representative effluent concentrations, and correcting CORMIX outfall design error warnings.

Even if Cook Inlet waters were considered oceanic<sup>33</sup>, the MZ length would still be restricted to about 333 feet under Washington state methodology.<sup>34</sup> Accordingly, the MZ length of 7,933 feet is about 24 times greater than that would be allowable if ADEC acknowledged that it is using Washington State methodology even for oceanic conditions.

The draft permit lists effluent limitations in DP Tables 13 through 20.<sup>35</sup> Loads can be calculated based on the listed limits in the draft permit. This was undertaken in Appendix B1.

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cross section; and (B) the total horizontal area allocated to all mixing zones at any depth may not exceed 10 percent of the surface area;”

<sup>30</sup> See WAC 173-201A-400 (7): “(b) In estuaries, mixing zones, singularly or in combination with other mixing zones, shall: (i) Not extend in any horizontal direction from the discharge port(s) for a distance greater than two hundred feet plus the depth of water over the discharge port(s) as measured during mean lower low water;”

<sup>31</sup> WDOE (2015), Water Quality Program Permit Writer’s Manual, see Appendix Pages 68-69, Washington Department of Ecology, revised January 2015, updated September 2018.

<sup>32</sup> It is noteworthy that Hilcorp’s MZ analyst for Trading Bay, Parametrix, is located in Washington State.

<sup>33</sup> This appears unwarranted because Cook Inlet freshwater inputs, channel flow reversal, salinities, and two-dimensional horizontal currents do not support the oceanic classification.

<sup>34</sup> See WAC 173-201A-400 (7): “(c) In oceanic waters, mixing zones, singularly or in combination with other mixing zones, shall not extend in any horizontal direction from the discharge port(s) for a distance greater than three hundred feet plus the depth of water over the discharge port(s) as measured during mean lower low water.”

<sup>35</sup> See Draft Permit Pages 32 through 38 of 58.

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In its text discussion of Fact Sheet Table 27, ADEC states that “increases in mixing zone sizes do not mean that pollutant loads under the permit have increased.” ADEC does not provide an analysis for the basis of this misleading claim. For TBPF, the MZ length is proposed to increase 87 percent<sup>36</sup> between the present permit (2007) and draft permit (2019)<sup>37</sup>. This expansion of the MZ results in a direct increase in pollutant loadings for mercury, silver, zinc and manganese. For the same facility flow and concentration limit, pollutant loadings must increase.

If permit concentration limits are reduced, as they were for TAH and copper at TBPF, this is independent of the expanding MZ. It is the result of ADEC back-calculating from a premise of no increased in pollutant loads for TAH and copper despite the MZ expansion.

Compare the present 2007 permit loadings for TBPF in Appendix A6, with the proposed loadings in Appendix Table B2-1. Mercury, a persistent and bioaccumulating metal<sup>38</sup>, will increase under the draft permit from 0.028 lb/day to 0.042 lb/day. This is an increase in mercury loading of 50 percent.

Other toxic metals being discharged by the TBPF will also have increased loadings. Silver will increase under the draft permit from 1.1 lb/day to 1.6 lb/day, a 50 percent increase. Zinc will increase under the draft permit from 42.0 lb/day to 63.1 lb/day, a 50 percent increase. Manganese will increase under the draft permit from 1167 lb/day to 1751 lb/day, a 50 percent increase.

Under the draft (2019) permit, the concentration limits are reduced for TAH and copper to 67 and 26 percent, respectively.<sup>39</sup> Even with the expansion of the MZ size, ADEC still had to lower the effluent limits to appear to meet toxic WQ criteria. Regarding MZ expansion for TAH and copper, increasing facility flow is the significant issue over pollutant loadings<sup>40</sup>.

For the same effluent TAH concentration, for example, pollutant loads would be increased with increasing facility flows with resulting increases in instream concentrations. The effluent concentration limits are decreased by ADEC to claim no increase in pollutant loads under conditions where the facility flow is being increased.

Consequently, increasing the MZ size is not consistent with the requirement that the MZ be as small as practicable. Requiring more effective treatment of wastewater or alternative disposal methods is the solution to this problem.

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<sup>36</sup> See Table 2.

<sup>37</sup> The average facility flow for TBPF is being increased from 5.6 MGD under the present (2007) permit to 8.4 MGD under the draft (2019) permit.

<sup>38</sup> EPA Criteria (1986), see discussion under Mercury.

<sup>39</sup> See Appendix Table C1-1a- concentration limitation comparison between the present (2007) permit and the draft (2019) permit.

<sup>40</sup> The facility flow is considered at the draft permit average monthly limit (AML).



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ADEC and EPA assured the public during the 2007 permit review that the prescribed MZs were the smallest practicable. Now the public is being told that “No”, the smallest practicable MZ are much larger as incorporated in the draft (2019) permit. ADEC does not explain this capitulation of the 2007 permit limits and MZ sizes.

Nor does ADEC explain the reason for the implementation of larger MZ sizes. ADEC claims that the new permit limits are the result of “new information, included sensitivity analysis to increase certainty, and included an extensive evaluation of effluent and receiving water data”. However, ADEC is increasing MZ sizes solely to accommodate higher pollutant loadings and facility flows. This generates larger areas and volumes of degraded water quality. This applies to all the facilities shown in Table 2 for produced water.<sup>41</sup> Table 2 has three sections for comparison: 2a for MZ Lengths, 2b for MZ Widths and 2c for MZ Surface Areas.

TBPF is the largest contributor of produced water discharges into Cook Inlet under this permit. This is shown compared to the other produced water dischargers in Table 1. Dischargers are compared based on the average monthly limit flow rate in million-gallons-per-day (mgd). TBPF comprises an AML flow of 8.4 mgd based on a total AML flow of 10.3 mgd, 81.5 percent of all combined flows.

The Fact Sheet Table 27 shows that ADEC intends to increase mixing zone sizes once again. ADEC proposes increasing the MZ length from 7,933 feet to 14,833 feet for TBPF. This is an increase of MZ length of 87.0 percent as shown in the comparison Table 2. This table also shows how ADEC intends to significantly increase MZ sizes for numerous facilities and not just lengths but also widths and surface areas. See also Appendix A5, which contains the calculation and comparison MZ sizes for the current 2007 permit versus the draft permit (2019).

**Table 1. Facility Contribution as a Percentage of Total AML - Produced Water**

Facility	AML Flow Rate (mgd)	Contribution (Percent)
TBPF	8.40	81.5%
MGS Onshore*	0.365	3.5%
GPTF	0.195	1.9%
Baker Platform	0.045	0.4%
Bruce Platform	0.025	0.2%
Dillon Platform	0.195	1.9%
Tyonek A Platform	0.038	0.4%
Osprey Platform (New)	1.05	10.2%
Total AML Flow	10.3	100.0%

\* MGS Onshore was previously known as The East Forelands Facility in the 2007 permit.

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<sup>41</sup> Table 2 has three sections: 2a for MZ Lengths, 2b for MZ Widths and 2c for MZ Surface Areas.

**Table 2. Produced Water - Expanding the Mixing Zones Again**  
Comparison of Chronic MZ boundary distances (lengths).  
*MZ widths and surface areas have increased significantly in all cases.*

<b>Table 2a</b>	AML Flow Rate (mgd)	2007 GP (ft)	2019 draft Permit (ft)	MZ Size Increase Based on Length (percent)	MZ Size Reduction Based on Length
TBPF	8.40	7,933	14,833	87.0	-----
MGS Onshore	0.365	5,738	10,823	88.6	-----
GPTF	0.195	8,809	2,290	-----	-74.0
Baker	0.045	9,895	3,898	-----	-60.6
Bruce	0.025	6,037	2,822	-----	-53.3
Dillon	0.195	6,959	554	-----	-92.0
Tyonek A	0.038	197	938	376.7	-----
Osprey	1.05	-----	3,478	Entirely New MZ	-----

<b>Table 2b</b>	AML Flow Rate (mgd)	Widths 2007 GP (ft)	2019 draft Permit (ft)	MZ Size Increase Based on Width (percent)	MZ Size Reduction Based on Width
TBPF	8.40	1,181	6,142	420	-----
MGS Onshore	0.365	26	1,585	5,938	-----
GPTF	0.195	66	1,791	2,630	-----
Baker	0.045	22	1,457	6,627	-----
Bruce	0.025	36	1,214	3,264	-----
Dillon	0.195	22	2,808	12,870	-----
Tyonek A	0.038	3	374	11,300	-----
Osprey	1.05	-----	1,437	Entirely New MZ	-----

<b>Table 2c</b>	AML Flow Rate (mgd)	Surface Area 2007 GP (ft <sup>2</sup> )	Surface Area 2019 draft Permit (ft <sup>2</sup> )	MZ Size Increase Based on Surface Area (percent)	MZ Size Reduction Based on Surface Area
TBPF	8.40	9,369,769	91,098,332	872	-----
MGS Onshore	0.365	150,609	17,151,398	11,288	-----
GPTF	0.195	578,022	4,102,212	610	-----
Baker	0.045	214,262	5,677,661	2,550	-----
Bruce	0.025	217,862	3,425,076	1,472	-----
Dillon	0.195	150,680	1,557,150	933	-----
Tyonek A	0.038	646	350,947	54,240	-----
Osprey	1.05	-----	4,997,468	Entirely New MZ	-----

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#### **4. Non-representative Effluent Concentrations**

Non-representative effluent concentrations were used in evaluating the effect of discharges. Alaska's guidance indicates that the maximum potential concentrations must be calculated based on the EPA's TSD. This statistical procedure is misleading in the permit and fact sheet analysis because of the rudimentary (grab samples) and infrequent (one-per-month) monitoring of toxic chemicals. Grab samples are exposed to mis-management because a momentary alteration of wastewater flow can be used to mis-characterize continuous wastewater flows, typically in most permitting cases, for a month. The same problems are repeated in the whole effluent toxicity (WET) testing [EPA 2002c and 2002d], which rely once again on unreliable grab samples and infrequent sampling (quarterly and less).

The widely used and well established 24-hour continuous sampling process is more reliable for toxic discharges [EPA (2004)]. It would be technically more consistent with the use of the TSD (1991) rigorous statistical methodology. More frequent sampling (at least 4 times a month) would result in greater accuracy and protection from toxic discharges.

The EPA provides statistical methodology<sup>42</sup> for assessing maximum effluent concentrations based from a small sample set. The concept is that less frequent sampling will result in reduced accuracy in predicting critical (maximum) effluent concentrations.

Less frequent effluent sampling is proposed in the draft permit for a number of discharges. This indicates the greater likelihood that peak effluent concentrations will not be sampled. In its evaluation, ADEC does not identify basic methodology for determining maximum effluent concentrations from limited sampling sets. For example, from DMR data. Nor does ADEC acknowledge adherence to any guidance, such as the EPA's statistical method, for determining maximum effluent concentrations in its water quality and mixing zone assessments.

#### **5. All of the MZs Will Increase in Size**

The addition of the Osprey Platform would make it the second largest discharger after TBPF. This is a wholly new assignment of a MZ in Cook Inlet and would be undertaken while all of the other produced water dischargers are being granted expanded mixing zones. As shown in comparison Table 1, the two largest onshore facilities are being granted significant expansion of their MZs. Table 2 shows that is an 87.0 percent increase for length for the TBPF, and an 88.6 percent increase for length for MGS Onshore. MZ surface area enlargement is even more striking when expansion in both length and width are considered. This shows an 872 percent increase for surface area for TBPF, and an 11,288 percent increase for surface area for MGS Onshore. The Tyonek A Platform is also being granted a 376.7 percent increase in its MZ size length, with an expansion of surface area of 54,240 percent.

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<sup>42</sup> TSD (1991).



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The outlook is more problematic when MZ widths and surface areas are evaluated. As shown in Table 1, all of the produced water facilities are allowed increases in their MZ widths. That is from 420 percent (TBPF) to 12,870 percent (Dillon Platform).

Table 1 shows all the MZ surface areas are significantly expanded under the proposed permit. The MZ surface area is the overall size of the mixing zone as calculated from the length times the width. In the draft permit (2019), both the length and width are expanded over the present (2007) permit. The jump in MZ surface area sizes is dramatic. For example, the TBPF is granted an increase in size of 872 percent. That is from 9.4 million square feet (SF) in the 2007 permit, to 91.1 million SF in the 2019 draft permit.

MGS onshore, the second largest existing discharger, would be granted a MZ surface area increase of 11,288 percent under the draft (2019) permit. The Tyonek A platform would be granted a MZ surface area increase of 54,240 percent under the draft (2019) permit.

### **Expanded MZs Associated with Ageing Oil Fields**

As the Cook Inlet oil fields age, the water/oil ratio increases resulting in larger pollutant loadings. The pattern that has been developed by ADEC for ever larger MZs means that these older field inefficiencies will be expected to be taken up by expanded MZs rather than improved treatment or alternative disposal methods. This is an outcome that must not be allowed to develop.

## **6. Draft Permit Proposed Pollutant Loadings**

The discharges proposed in the draft permit reflect a wide range of sources and types. Appendix A1 of this review lists the twenty (20) different types of discharges proposed for this permit. The number of sources is extensive with the potential of numerous more facilities being brought online under this permit.<sup>43,44</sup>

Pollutant loadings in pounds-per-day (lb/d) for produced water (015) for the several discharging facilities are contained in Appendix Tables \_1 through \_2. These loadings are directly based on the allowable permit limit concentrations in the Draft Permit (DP) Tables 13 through 20 which lists all the produced water facilities presently ascribed to this permit. The loadings calculations are broken-out based on both the average monthly limit (AML) and the maximum daily limit (MDL) concentrations. See Appendix Tables

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<sup>43</sup> ADEC FS, see Page 10 of 171, second paragraph under Section 2 – Background, Subsection 2.1 - Cook Inlet Oil and Gas History and Industry Description.

<sup>44</sup> The Fact Sheet identifies the facilities as: “There are many offshore and onshore oil and gas production facilities operating in Cook Inlet, which are operated by Hilcorp Alaska, LLC (HAK), Cook Inlet Energy, LLC (CIE), and Furie Operating Alaska, LLC (Furie). Cook Inlet has several onshore oil processing facilities, including Trading Bay Production Facility (TBPF), Middle Ground Shoal (MGS) Onshore, Granite Point Tank Farm (GPTF), Kustatan Processing Facility (KPF), Furie Gas Production Facility (Furie GPF), and the Cosmopolitan Production Facility (CPF). There is also an oil refinery (formerly Tesoro) and a liquefied natural gas (LNG) facility (Formerly ConocoPhillips Alaska Inc.).



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B1-1 through B1-7 – Loading by Facility and Chemical Discharged; and B2-1 through B2-8 – Loading Calculations.

Several chemicals<sup>45</sup> are listed in the limits for each of the eight (8) facilities. These chemicals are: total aromatic hydrocarbons (TAH), copper, silver, zinc, mercury, manganese and whole effluent toxicity. Sampling of total aqueous hydrocarbons (TAqH) was required but only for reporting.

#### **Mass Loadings for TBPF**

For the Trading Bay Production Facility (TBPF), proposed discharge concentrations are listed in the Draft Permit (DP) Table 13.<sup>46</sup> The total mass loadings based on the Average Monthly Limit (AML) can be seen in Appendices B1-1 to B1-7 and B2-1.

For oil and grease, 2,032 pounds are discharged-per-day based on the average monthly (AML) flow rate of 8.4 mgd. That is 741,543 pounds per year of a harmful compound.<sup>47</sup> For TAH, 841 pounds are discharged-per-day based on the average monthly flow rate of 8.4 mgd. That is 307,000 pounds per year of a toxic pollutant. See EPA (2019); EPA (2002b); EPA (2003); ATSDR (2019); Ott, et al., (2002) in reference to the following discussion.

For Zinc, 63.1 pounds are discharged-per-day based on the average monthly flow rate of 8.4 mgd. That is 23,013 pounds per year of a toxic pollutant. For Copper, 0.84 pounds are discharged-per-day based on the average monthly flow rate of 8.4 mgd. That is 307 pounds per year of a toxic pollutant. For Mercury, 0.042 pounds are discharged-per-day based on the average monthly flow rate of 8.4 mgd. That is 15.3 pounds per year of a toxic pollutant. The total mass loadings are yet greater based on the maximum daily limit (MDL) as can be seen in Appendices B1-1 to B1-7 and B2-1.

#### **Mass Loadings for MGS Onshore**

For the Middle Ground Shoal (MGS) Onshore proposed discharge concentrations are listed in the DP Table 14. The total mass loadings based on the Average Monthly Limit (AML) can be seen in Appendices B1-1 to B1-7 and B2-2.

For oil and grease, 88 pounds are discharged-per-day based on the average monthly (AML) flow rate of 0.365 mgd. That is 33,222 pounds per year of a harmful compound. For TAH, 61 pounds are discharged-per-day based on the average monthly flow rate of 0.365 mgd. That is 22,222 pounds per year of a toxic pollutant. For Zinc, 67 pounds are discharged-per-day based on the average monthly flow rate of 0.365 mgd. That is 24,444 pounds per year of a toxic pollutant. The total mass loadings are yet greater based on the maximum daily limit (MDL) as can be seen in Appendices B1-1 to B1-7 and B2-2.

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<sup>45</sup> TAH, copper, silver, zinc, mercury, manganese and whole effluent toxicity. Measurement of TAqH was required for reporting only.

<sup>46</sup> Draft Permit Table 13 is on Page 32 of 58.

<sup>47</sup> EPA Criteria (1986), see Pages 203-208.

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### **Mass Loadings for GPTF**

Granite Point Tank Farm (GPTF) proposed discharge concentrations are listed in the DP Table 15. The total mass loadings based on the Average Monthly Limit (AML) can be seen in Appendices B1-1 to B1-7 and B2-3.

For oil and grease, 47.2 pounds are discharged-per-day based on the average monthly (AML) flow rate of 0.195 mgd. That is 17,214 pounds per year of a harmful compound. For TAH, 23 pounds are discharged-per-day based on the average monthly flow rate of 0.195 mgd. That is 8,310 pounds per year of a toxic pollutant.

For Zinc, 2.4 pounds are discharged-per-day based on the average monthly flow rate of 0.195 mgd. That is 890 pounds per year of a toxic pollutant. The total mass loadings are yet greater based on the maximum daily limit (MDL) as can be seen in Appendices B1-1 to B1-7 and B2-3.

### **Mass Loadings for Baker Platform**

Baker Platform proposed discharge concentrations are listed in the DP Table 16. The total mass loadings based on the Average Monthly Limit (AML) can be seen in Appendices B1-1 to B1-7 and B2-4.

For oil and grease, 11 pounds are discharged-per-day based on the average monthly (AML) flow rate of 0.045 mgd. That is 3,973 pounds per year of a harmful compound. For TAH, 13 pounds are discharged-per-day based on the average monthly flow rate of 0.045 mgd. That is 4,657 pounds per year of a toxic pollutant. For Zinc, 2.3 pounds are discharged-per-day based on the average monthly flow rate of 0.045 mgd. That is 822 pounds per year of a toxic pollutant. The total mass loadings are yet greater based on the maximum daily limit (MDL) as can be seen in Appendices B1-1 to B1-7 and B2-4.

### **Mass Loadings for Bruce, Dillon and Tyonek A Platforms**

The following three (3) facilities are not discussed here but are available for review in Appendices Tables B1-1 to B1-7 and B2-5 through B2-7. Bruce Platform proposed discharge concentrations are listed in the DP Table 17. Dillon Platform proposed discharge concentrations are listed in the DP Table 18. Tyonek A proposed discharge concentrations are listed in the DP Table 19.

### **Mass Loadings for Osprey Platform**

Osprey proposed discharge concentrations are listed in the DP Table 20. The total mass loadings based on the Average Monthly Limit (AML) can be seen in Appendices B1-1 to B1-7 and B2-8. For oil and grease, 254 pounds would be discharged-per-day based on the average monthly (AML) flow rate of 1.05 mgd. That is 92,693 pounds per year of a harmful compound. For TAH, 67 pounds would be discharged-per-day based on the average monthly flow rate of 1.05 mgd. That is 24,612 pounds per year of a toxic pollutant.

The total mass loadings are yet greater based on the maximum daily limit (MDL) as can be seen in Appendices B1-1 to B1-7 and B2-8.

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## 7. Sampling and Effluent Limitations Issues

Effluent limitations for produced water (015) for existing facilities are compared between the Draft Permit (2019) and the Present Permit (2007). These 14 comparison tables are contained in Appendix C1.

Existing facilities compared are TBPF, MGS Onshore, GPTF, Baker Platform, Bruce Platform, Dillon Platform and Tyonek A Platform. Two (2) tables are provided for each facility so that average monthly limits (AML) and maximum daily limit (MDL) can be compared.

The following discussion summarizes the comparison results for each facility.

### **Trading Bay Production Facility (TBPF)**

For the TBPF, see the Appendix Tables C1-1a and C1-1b for the average monthly limit and maximum daily limit (MDL), respectively. The tables show that concentration limits for TAH and copper are reduced for both the AML and MDL, and the other parameters remain unchanged. This is because the mixing zone length has been increased 87 percent from 7,933 feet to 14,833 feet (see MZ Sizes in Table 1). The MZ width has also been increased 420 percent, and the total MZ surface area has increased 872 percent under the draft permit.

Additionally, ADEC's support for the flawed discharger modeling, which employs non-representative ambient conditions for Cook Inlet and non-representative effluent concentration data, undermines the veracity of the effluent limitations. Although numerous model runs were submitted by the discharger, ADEC does not provide an actual explicit reference to the CORMIX data and runs that support these results.

With the exception of TAH, the frequency of effluent monitoring is substantially reduced from once a month (12 samples per year) with the present 2007 permit to quarterly (4 samples per year) with the draft 2019 proposed permit. The new permit also eliminates explicit toxicity unit limits on whole effluent toxicity (WET). So, under conditions where the mixing zone size is being expanded once again, monitoring is being substantially reduced.

The proposed permit also continues to use grab samples for TBPF effluent monitoring but wrongly assumes that these are peak values. The likelihood that infrequent and rudimentary (grab) sampling techniques will capture critical and peak concentrations is remote. The sampling performed is not representative. Effluent 24-hour flow-based composite sampling twice a week would be considerably more likely to capture representative data. This would provide credible evidence that representative effluent sampling is being collected.

### **Middle Ground Shoal (MGS) Onshore**

For the MGS Onshore, see the Appendix Tables C1-2a and C1-2b for the average monthly limit and maximum daily limit (MDL), respectively. For Mercury, effluent



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limitations are being increase 20% and 25% for the AML and MDL, respectively. This is despite the substantial increase in the MZ size as it is discussed below.

The tables show that concentration limits for TAH, copper, silver and zinc are reduced for both the AML and MDL, and the other parameters remain unchanged. This is because the mixing zone length has been increased 88.6 percent from 5,738 feet to 10,823 feet (see MZ Sizes in Table 1). The MZ width has also been increased 5,938 percent, and the total MZ surface area has increased 11,288 percent under the draft permit.

Additionally, ADEC's support for the flawed discharger modeling, which employs non-representative ambient conditions for Cook Inlet and non-representative effluent concentration data, undermines the veracity of the effluent limitations. Although numerous model runs were submitted by the discharger, ADEC does not provide an actual explicit reference to the CORMIX data and runs that support these results.

With the exception of TAH, the frequency of effluent monitoring is substantially reduced from once a month (12 samples per year) with the present 2007 permit to quarterly (4 samples per year) with the draft 2019 proposed permit. The new permit also eliminates explicit toxicity unit limits on whole effluent toxicity (WET). So, under conditions where the mixing zone size is being expanded once again, monitoring is being substantially reduced.

The proposed permit also continues to use grab samples for MGS onshore effluent monitoring but wrongly assumes that these are peak values. The likelihood that infrequent and rudimentary (grab) sampling techniques will capture critical and peak concentrations is remote. The sampling performed is not representative. Effluent flow-based 24-hour composite sampling twice a week would be considerably more likely to capture representative data. This would provide credible evidence that representative effluent sampling is being collected.

#### **Granite Point Tank Farm (GPTF)**

For the GPTF, see the Appendix Tables C1-3a and C1-3b for the average monthly limit and maximum daily limit (MDL), respectively. The tables show that concentration limit for copper is reduced for both the AML and MDL, and the other parameters remain unchanged. This is because, while the mixing zone length has been reduced 74 percent (see MZ Sizes in Table 1), the MZ width has been increased 2,630 percent, and the total MZ surface area has increased 610 percent under the draft permit.

Additionally, ADEC's support for the flawed discharger modeling, which employs non-representative ambient conditions for Cook Inlet and non-representative effluent concentration data, undermines the veracity of the effluent limitations. Although numerous model runs were submitted by the discharger, ADEC does not provide an actual explicit reference to the CORMIX data and runs that support these results.

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With the exception of TAH, the frequency of effluent monitoring is substantially reduced from once a month (12 samples per year) with the present 2007 permit to quarterly for copper and TAqH (4 samples per year), and only twice a year for silver, zinc, mercury and manganese with the draft 2019 proposed permit. The new permit also eliminates explicit toxicity unit limits on whole effluent toxicity (WET). So, under conditions where the mixing zone size is being expanded once again, monitoring is being substantially reduced.

The proposed permit also continues to use grab samples for GPTF effluent monitoring but wrongly assumes that these are peak values. The likelihood that infrequent and rudimentary (grab) sampling techniques will capture critical and peak concentrations is remote. The sampling performed is not representative. Effluent 24-hour flow-based composite sampling twice a week would be considerably more likely to capture representative data. This would provide credible evidence that representative effluent sampling is being collected.

### **Baker Platform**

For the Baker Platform, see the Appendix Tables C1-4a and C1-4b for the average monthly limit and maximum daily limit (MDL), respectively. The tables show that the concentration limits for TAH and zinc are reduced for both the AML and MDL, and the other parameters remain unchanged. This is because, while the mixing zone length has been reduced 60.6 percent (see MZ Sizes in Table 1), the MZ width has been increased 6,627 percent, and the total MZ surface area has increased 2,550 percent under the draft permit.

Additionally, ADEC's support for the flawed discharger modeling, which employs non-representative ambient conditions for Cook Inlet and non-representative effluent concentration data, undermines the veracity of the effluent limitations. Although numerous model runs were submitted by the discharger, ADEC does not provide an actual explicit reference to the CORMIX data and runs that support these results.

With the exception of TAH, the frequency of effluent monitoring is substantially reduced from once a month (12 samples per year) with the present 2007 permit to quarterly for zinc and TAqH (4 samples per year), and only twice a year for silver, copper, mercury and manganese with the draft 2019 proposed permit. The new permit also eliminates explicit toxicity unit limits on whole effluent toxicity (WET). So, under conditions where the mixing zone size is being expanded once again, monitoring is being substantially reduced.

The proposed permit also continues to use grab samples for Baker effluent monitoring but wrongly assumes that these are peak values. The likelihood that infrequent and rudimentary (grab) sampling techniques will capture critical and peak concentrations is remote. The sampling performed is not representative. Effluent 24-hour flow-based composite sampling twice a week would be considerably more likely to capture representative data. This would provide credible evidence that representative effluent sampling is being collected.

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### **Bruce Platform**

For the Baker Platform, see the Appendix Tables C1-5a and C1-5b for the average monthly limit and maximum daily limit (MDL), respectively. The tables show that the concentration limits for TAH and zinc are reduced for both the AML and MDL, and the other parameters remain unchanged. This is because, while the mixing zone length has been reduced 53.3 percent (see MZ Sizes in Table 1), the MZ width has been increased 3,264 percent, and the total MZ surface area has increased 1,472 percent under the draft permit.

Additionally, ADEC's support for the flawed discharger modeling, which employs non-representative ambient conditions for Cook Inlet and non-representative effluent concentration data, undermines the veracity of the effluent limitations. Although numerous model runs were submitted by the discharger, ADEC does not provide an actual explicit reference to the CORMIX data and runs that support these results.

With the exception of TAH, the frequency of effluent monitoring is substantially reduced from once a month (12 samples per year) with the present 2007 permit to quarterly for silver and TAqH (4 samples per year), and only twice a year for zinc, copper, mercury and manganese with the draft 2019 proposed permit. The new permit also eliminates explicit toxicity unit limits on whole effluent toxicity (WET). So, under conditions where the mixing zone size is being expanded once again, monitoring is being substantially reduced.

The proposed permit also continues to use grab samples for Bruce effluent monitoring but wrongly assumes that these are peak values. The likelihood that infrequent and rudimentary (grab) sampling techniques will capture critical and peak concentrations is remote. The sampling performed is not representative. Effluent 24-hour flow-based composite sampling twice a week would be considerably more likely to capture representative data. This would provide credible evidence that representative effluent sampling is being collected.

### **Dillon Platform**

For the Dillon Platform, see the Appendix Tables C1-6a and C1-6b for the average monthly limit and maximum daily limit (MDL), respectively. The tables show that the concentration limits for silver is reduced for both the AML and MDL, and the other parameters remain unchanged. This is because, while the mixing zone length has been reduced 92.0 percent (see MZ Sizes in Table 1), the MZ width has been increased 12,870 percent, and the total MZ surface area has increased 933 percent under the draft permit.

Additionally, ADEC's support for the flawed discharger modeling, which employs non-representative ambient conditions for Cook Inlet and non-representative effluent concentration data, undermines the veracity of the effluent limitations. Although numerous model runs were submitted by the discharger, ADEC does not provide an actual explicit reference to the CORMIX data and runs that support these results.



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With the exception of TAH, the frequency of effluent monitoring is substantially reduced from once a month (12 samples per year) with the present 2007 permit to quarterly for silver and TAqH (4 samples per year), and only twice a year for zinc, copper, mercury and manganese with the draft 2019 proposed permit. The new permit also eliminates explicit toxicity unit limits on whole effluent toxicity (WET). So, under conditions where the mixing zone size is being expanded once again, monitoring is being substantially reduced.

The proposed permit also continues to use grab samples for Dillon effluent monitoring but wrongly assumes that these are peak values. The likelihood that infrequent and rudimentary (grab) sampling techniques will capture critical and peak concentrations is remote. The sampling performed is not representative. Effluent 24-hour flow-based composite sampling twice a week would be considerably more likely to capture representative data. This would provide credible evidence that representative effluent sampling is being collected.

### **Tyonek A Platform**

For the Tyonek A Platform, see the Appendix Tables C1-7a and C1-7b for the average monthly limit and maximum daily limit (MDL), respectively. The tables show that the concentration limits remain unchanged for all parameters for both the AML and MDL. This is despite the mixing zone length being increased 376.7 percent (see MZ Sizes in Table 1), the MZ width has been increased 11,300 percent, and the total MZ surface area has increased 54,240 percent under the draft permit.

Additionally, ADEC's support for the flawed discharger modeling, which employs non-representative ambient conditions for Cook Inlet and non-representative effluent concentration data, undermines the veracity of the effluent limitations. Although numerous model runs were submitted by the discharger, ADEC does not provide an actual explicit reference to the CORMIX data and runs that support these results.

With the exception of TAH, the frequency of effluent monitoring is substantially reduced from once a month (12 samples per year) with the present 2007 permit to quarterly for copper and TAqH (4 samples per year), and only twice a year for zinc, silver, mercury and manganese with the draft 2019 proposed permit. The new permit also eliminates explicit toxicity unit limits on whole effluent toxicity (WET). So, under conditions where the mixing zone size is being expanded once again, monitoring is being substantially reduced.

The proposed permit also continues to use grab samples for Tyonek A effluent monitoring but wrongly assumes that these are peak values. The likelihood that infrequent and rudimentary (grab) sampling techniques will capture critical and peak concentrations is remote. The sampling performed is not representative. Effluent 24-hour flow-based composite sampling twice a week would be considerably more likely to capture representative data. This would provide credible evidence that representative effluent sampling is being collected.



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## 8. New Dischargers Mixing Zone Analyses

New and expanded discharges to Cook Inlet are listed in Table 3 but these are based on flawed mixing zone and water quality data. These include: no tidal analysis, non-representative tidal simulation, little or no stratification, outfall defects and no toxic discharge evaluation.

CORMIX mixing zone simulations, on which the permit limits are based, exist for the four (4) expanded and new discharges in the documents provided by ADEC to CIK (February 2019). Some of these are excerpted and contained in the Appendices D1 through D5.

The four additional and expanded discharges for which CORMIX session reports are excerpted here are: Osprey (Appendices D1 and D2), Furie (Appendix D3), Sabre MODU (Appendix D4), and Alaska LNG (Appendix D5).

A review of the new MZ simulations show that:

- Tidal conditions are disregarded
- Critical period Stratification is neglected
- CORMIX warnings of unstable discharge and effects on sediments are neglected
- Ambient velocities are unjustifiably large and exaggerate dilution
- Background concentrations unrealistically low and overstate available dilution
- Non-representative effluent discharge concentrations are used as critical values

All of these conditions result in more generous permit limitations than actual Cook Inlet conditions should allow.

### **More Cook Inlet Pollution**

Reduced Cook Inlet water quality is an outcome of increased pollutant loadings, and increased discharge magnitudes, from the new and expanded discharges contained in the draft permit. The lack of representative ambient Cook Inlet and effluent conditions results in greater pollutant allowances, which will contribute to worsening conditions.

The reference to “New Data” for ambient conditions, in which most of the specific data is missing, show that water quality standards are not achieved. The CORMIX simulations relying on the new data also show that water quality standards are not achieved.

**Table 3. Comparison of Actual Conditions versus What was Modeled**  
For the Four (4) New and Expanded Dischargers Under the Draft Permit (2019)

<b>Discharger</b>	<b>Discharge Type</b>	<b>ADEC Form 2M – MZ Request</b>	<b>Tidal Conditions Exist at Site?</b>	<b>Tidal Conditions Simulated for Permit?</b>	<b>Toxicity Modeled by CORMIX?</b>	<b>Stratification</b>
<b>Osprey Platform <sup>A</sup></b>	Produced Water (015)	Yes	Yes	No	Yes	No
<b>Furie Platform Alaska <sup>B</sup></b>	Commingled Wastewater (001 and 004)	Yes March 3, 2013	Yes	No – MZ Form 2M claims Cook Inlet discharge is Steady not Tidally Varying	Yes	No – MZ Form 2M states that ambient density is uniform but this is not true of critical periods
<b>Sabre MODU <sup>C</sup></b>	Mud, Cuttings and Cement at the Seafloor (013)	No – not in ADEC's file as of February 2019	Yes	No	No	Negligible amount
<b>Alaska LNG <sup>D</sup></b>	Mud, Cuttings and Cement at the Seafloor (013)	No	Yes	No	No	No

<sup>A</sup> Osprey MZ Study (2018).

<sup>B</sup> Furie Alaska (2013) ADEC Application Form 2M, MZ Kitchen Lights Unit #1 Gas Production Platform A, CORMIX Results February 2013.

<sup>C</sup> Sabre MODU (2017), CORMIX MZ Analysis, January 2017.

<sup>D</sup> Alaska LNG, Permit Application (2015), CORMIX results.

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### **WQ Failure of Proposed Facilities and Conditions– Osprey, Furie, Sabre, LNG**

For the proposed new facilities, i.e., Osprey, Furie, Sabre, LNG, the CORMIX model simulations repeatedly warn that the proposed facilities and conditions fail water quality requirements. This ensures the MZs are not as small as practicable as required by the regulations.

The CORMIX analyses used to assess the new facilities rely upon three (3) EPA test criteria, the most restrictive of which must meet acute toxicity requirements as described in the TSD (1991).<sup>48</sup> Criterion 1 as evaluated by CORMIX requires acute toxicity limits to be met no further than 5 times the water depth. This is a test based on distance to full vertical mixing.

For Criterion 2 as evaluated by CORMIX, the acute toxicity limit must be met at no greater a distance than 50 times the discharge length scale. The TSD defines the discharge length scale as the square root of the cross-sectional area of any discharge outlet. This test ensures a dilution factor of at least 10 under all possible circumstances, including situations of severe bottom interaction, surface interaction or lateral merging.<sup>49</sup>

Criterion 3 as evaluated by CORMIX requires that the Regulatory Mixing Zone (RMZ) boundary length be inputted to CORMIX to determine if acute toxicity limits are met within 10 percent of the distance from the edge of the outfall structure to the edge of the regulatory mixing zone in any spatial direction. As will be seen in this section, the dischargers consistently omit supplying the RMZ distance to CORMIX and avoid stating the distance to the RMZ boundary, and submitting the chronic toxicity limit, although in all cases these data are known. By omitting known data, the discharger avoids an evaluation of concentration conditions at the RMZ boundary.

A discussion of MZ simulations of the new dischargers follows.

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<sup>48</sup> EPA TSD (1991), see Subsection 2.2.2 – Mixing Zones on Page 33; and Subsection 4.3.3 - Prevention of Harmfulness to Passing Organisms of Pages 71-72.

<sup>49</sup> EPA TSD (1991), see Page 72, last sentence under second bulleted item.

## Osprey Platform

Under the draft permit, the Osprey Platform will become the second (2<sup>nd</sup>) largest discharger of produced water, at 1.05 MGD, into Cook Inlet.<sup>50</sup> This comparison is average monthly limit (AML) based.

A detailed assessment is presented here for the Osprey because of its significance.

### *Osprey Evaluation Conditions*

Issues with the Osprey Platform mixing zone and evaluation are presented in Table 4.

**Table 4. CORMIX Modeling Results for Osprey Produced Water**  
Based on Discharger Report<sup>51</sup>

	<b>CORMIX Results — EPA Tests<sup>52</sup></b>	
<b>Parameter</b>	<b>Criterion 1</b> Discharge length scale	<b>Criterion 3</b> No RMZ defined <sup>53</sup>
Organics: TAH <sup>54</sup>	Failed – Acute Toxicity	Regulatory Mixing Zone (RMZ) test for the TDZ cannot be applied for TAH acute and chronic toxicity.
Oil and Grease omitted <sup>55</sup>	Would Fail	
Metals: Copper (Cu) Zinc (Zn) Mercury (Hg) Nickel (Ni) Manganese (Mn) Silver (Ag) omitted <sup>56</sup>	Failed – Acute Toxicity Failed – Acute Toxicity Failed – Acute Toxicity Failed – Acute Toxicity Failed – Acute Toxicity Would Fail	Regulatory Mixing Zone (RMZ) test for the TDZ cannot be applied for Metals acute and chronic toxicity.
Sediments	May be Benthic Impacts, Diffuser Discharge Instability <sup>57</sup>	
Other limitations	Non-representative – no tidal conditions, ambient velocities do not contain slack tide conditions, surface water elevations, temperatures and salinity	

<sup>50</sup> This is 10.2 percent of the total produced water discharge into Cook Inlet as listed in Table 1. TBPF is the largest discharger of produced water, based on the AML of 8.4 mgd, which is 81.5 percent of the projected Cook Inlet effluents totaling 10.3 MGD.

<sup>51</sup> Osprey MZ (2018), Osprey Produced Water Mixing Study.

<sup>52</sup> CORMIX uses the Toxic Dilution Zone (TDZ) tests as determined EPA TSD (1991).

<sup>53</sup> Although the discharger has proposed a definite RMZ distance.

<sup>54</sup> For hydrocarbons. TAH is BETX, which is benzene, ethylene, toluene, and xylene.

<sup>55</sup> Although it will be discharged, petroleum Oil and Grease was omitted in the CORMIX analysis.

<sup>56</sup> Although it would be discharged, Silver was omitted in the discharger CORMIX analysis.

<sup>57</sup> CORMIX modeling session [.ses] files



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Appendices D1 (TAH) and D2 (metals) contain excerpted portions of the CORMIX analysis for the proposed Osprey facility<sup>58</sup>. Numerous problems are apparent because tidal conditions in Cook Inlet are disregarded as are critical stratification conditions. Cook Inlet is modeled as a river with non-varying flow and no stratification.

While the discharger notes that velocity conditions and stratification conditions exist in Cook Inlet in the outfall vicinity none of this information is supplied to the Osprey CORMIX model setup, which ignores tidal and stratified conditions.<sup>59</sup> For example, the discharger uses salinity data from a single data set (from the EMAP station AKD108-015) [See CIRCAC (1999) and CIRCAC (2002) for additional context discussion.], which is over 2.5 miles away from the discharge site.<sup>60</sup>

The collected salinity data used in the analysis is suspect because of the lack of variability with depth. This fact is amplified because the supplied salinity data does not indicate whether the CTD instrument [see also CIRCAC 1999 and 2002] is allowed to acclimate at the data recording depths. No discrete logging times are provided at any of the depths to allow a reviewer to determine whether stable salinity measurements are being recorded. The salinity data has the appearance of being based on a logger that is dropped rapidly through the water column before the instrumentation can adjust at each depth. The effect is that very little variability of salinities is recorded because the logger has not recovered from the previous recording depths.

The Osprey MZ (2018) report indicates that the “station 015 observations are consistent with hydrographic results reported for the Forelands in Okkonen and Howell (2003).” This is not the case. Okkonen and Howell report salinities ranging with depth from 18.0 psu to 24.5 psu. Compare this with the non-varying values with depth employed by the discharger.<sup>61</sup> Okkonen and Howell also freely refer to tidal conditions in Cook Inlet<sup>62</sup> in the vicinity (Forelands) of the Osprey discharge, a condition ignored by ADEC and the discharger’s analysis. After all, look at the titles of the reports pertaining to Cook Inlet: “Observations of hydrography and currents in central Cook Inlet, Alaska during diurnal and semidiurnal tidal cycles” (Howell, 2005); and “Baroclinic tidal flows and inundation processes in Cook Inlet, Alaska: numerical modeling and satellite observations” (Oey, et al, 2007).

An additional difficulty is that ADEC neglects the effect of seasonal conditions on Cook Inlet in its MZ assessment. Each spring and summer, large inputs of freshwater are

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<sup>58</sup> Osprey MZ (2018), *Osprey Produced Water Mixing Study*, prepared for Glacier Oil and Gas Corporation by Parametrix, Inc., May 2018. See Appendix E-3.3 for CORMIX output files for Osprey on PDF Pages 927-953.

<sup>59</sup> See Appendix A - Current Speed and Stratification Analysis, Appendix A-2 Current Speed Analysis Summary

<sup>60</sup> Osprey MZ (2018), see Figure 2-1 on PDF page 12 of 30.

<sup>61</sup> Data is reported in practical salinity units (psu), which is in parts-per-thousand (ppt).

<sup>62</sup> Okkonen and Howell (2003) state on Page 4, last sentence of the first paragraph that “Flood tide refers to tidally-driven flow into (generally northward) Cook Inlet, whereas ebb tide refers to tidally-driven flow out of (generally southward) Cook Inlet.”

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delivered to Cook Inlet significantly altering temperatures, salinity and stratification conditions. During winter, temperatures decrease and salinity values increase once again altering stratification conditions. None of these seasonally changing conditions are evaluated, or acknowledged, by ADEC or the discharger provided analyses.

#### *Osprey Platform MZ Analysis*

The CORMIX modeling indicates that the proposed Osprey outfall fails EPA Toxic Dilution Zone (TDZ) criteria set forth in the TSD.<sup>63</sup>

For copper (Cu), insufficient mixing exists within a few feet of the outfall to meet acute toxicity requirements.<sup>64</sup> This is identified by using the discharge length scale test, which CORMIX indicates has failed for the proposed Osprey discharge site. This test criterion result is identified in the CORMIX output excerpted in Appendix D2. The test is also described in the EPA TSD.<sup>65</sup> This test failure of the copper water quality criterion for acute toxicity is disregarded by the prospective discharger and ADEC.

The additional discharges of petroleum oil and grease, TAH, TAqH, manganese, nickel, zinc, mercury and silver show similar problems with meeting acute toxicity requirements. Chronic toxicity assessment at the regulatory mixing zone (RMZ) boundary<sup>66</sup> was not evaluated in the dischargers CORMIX analysis although MZ lengths are proposed. Discharges of oil and grease, TAqH and silver are proposed in the draft permit but were not evaluated in the CORMIX analyses.

#### *Furie Platform*

Issues with the Furie Platform mixing zone and evaluation are presented in Table 5. This discharge includes commingled wastewaters with toxic components. This indicates discharge numbers 003 and 004 under the draft permit, domestic wastewater and graywater, respectively. Appendix A1 contains a listing of permit discharge numbers, which include these discharges.

Dilution of a key toxicant, chlorine, was modeled for the Furie Platform by the discharger using CORMIX. An example of this model run is excerpted in Appendix D3. Total residual chlorine (TRC) is modeled using acute toxic criteria of 13 ug/l. The CORMIX analysis shows that the discharge fails for acute toxicity.

Although the regulatory MZ length is known, and stated in the mixing zone request (Form 2M) for the Furie Platform submitted to ADEC, the discharger omits this critical information from the CORMIX analysis. Accordingly, chronic toxicity is not assessed for the regulatory MZ in the Furie evaluation.

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<sup>63</sup> TSD (1991), see Subsection 4.3.2 - Minimizing the Size of Mixing Zones see Pages 70-71.

<sup>64</sup> Cannot not exceed the Criterion Maximum Concentration (CMC) by EPA TSD (1991).

<sup>65</sup> TSD (1991), see Subsection 4.3.2 - Minimizing the Size of Mixing Zones see Pages 70-71. Particularly see the last full paragraph on Page 70 and the second bullet on the top of Page 71.

<sup>66</sup> Osprey MZ (2018) Appendix, PDF pages 927 through 953 of 1008 pages. See specifically Appendix E-3.3 – Mixing Zones, CORMIX Session Files.

CORMIX warns that the Furie Platform outfall is subject to ambient water (saltwater) intrusion. The present design results in a discharge densimetric Froude number that is well below one, predicting saltwater intrusion of the outfall pipe. This is a deleterious condition with undesirable operating effects and poor mixing.

Non-representative ambient conditions were used in the CORMIX analysis of the Furie Platform. This means that no tidal conditions were simulated relative to slack tide, non-critical ambient velocities were used, non-critical surface water elevations were used that did not reflect neap and spring tide conditions. Non-critical temperatures and non-critical salinity were employed to circumvent simulating maximum stratification conditions and seasonal variations.

**Table 5. CORMIX Modeling Results for Furie Platform**  
Commingled Wastewater (003 & 004)

	<b>CORMIX Results — EPA Tests<sup>67</sup></b>	
<b>Parameter</b>	<b>Criterion 1</b> Discharge length scale	<b>Criterion 3</b> No RMZ defined <sup>68</sup>
Toxic Component: Total Residual Chlorine (TRC)	Failed – Acute Toxicity	Regulatory Mixing Zone (RMZ) test for the TDZ cannot be applied for TRC chronic toxicity.
Outfall Pipe	Discharge velocity is less than 3mps, which is a substandard design condition. The Densimetric Froude number is less than one, which is a substandard design condition because it allows for saltwater intrusion of the pipe. <sup>69</sup>	
Other limitations	Non-representative ambient conditions – no tidal conditions, non-critical ambient velocities used, non-critical surface water elevations, non-critical temperatures and non-critical salinity.	

<sup>67</sup> CORMIX uses the Toxic Dilution Zone (TDZ) tests as determined EPA TSD (1991).

<sup>68</sup> Although the discharger has proposed a definite RMZ distance.

<sup>69</sup> CORMIX modeling session [.ses] files.



### *Sabre MODU*

Issues with the Sabre MODU mixing zone and evaluation are presented in Table 6.

**Table 6. CORMIX Modeling Results for Sabre MODU**  
Mud, Drill Cuttings and Cement Discharged at the Seafloor (Discharge Number 013)

	<b>CORMIX Results — EPA Tests<sup>70</sup></b>	
<b>Parameter</b>	<b>Criterion 1</b> Discharge length scale	<b>Criterion 3</b> No RMZ defined <sup>71</sup>
Toxic Component: Drilling Fluids Organics Petroleum Oil adhered to suspended solids Drilling Fluids Metals Aluminum, Chromium, Copper, Silver, Arsenic, Iron, Lead, Mercury Cadmium, Nickel, Zinc	Not evaluated for Acute Toxicity  None of these metals were evaluated for Acute Toxicity	Regulatory Mixing Zone (RMZ) test for chronic toxicity using the toxic dilution zone (TDZ) methodology is not applied for metals and organics associated with drilling fluids and drill cuttings.
Outfall Pipe	Discharge velocity is less than 3mps, which is a substandard design condition resulting in poor mixing characteristics. The Densimetric Froude number is less than one, which is a substandard design condition because it allows for saltwater intrusion of the pipe. <sup>72</sup>	
Other limitations	Non-representative ambient conditions – no tidal conditions, non- critical ambient velocities used, non-representative surface water elevations, non-critical temperatures and non-critical salinities.	

ADEC indicated that the Sabre MODU would be allowed to discharge drilling materials under the draft permit.<sup>73</sup> Pertaining to the Sabre MODU discharge, Alaska “DEC is proposing to allow additional drilling within this vicinity under the Permit based on the information presented for the Sabre IP.”<sup>74</sup> This draft or preliminary individual permit (IP) is not in the files ADEC provided to CIK in February 2019. ADEC’s Form 2M – MZ Request is also omitted in the ADEC files although the Fact Sheet suggests that the discharger is also seeking coverage under the draft general permit.

The CORMIX simulation results for Sabre state the discharge is not toxic, which is incorrect and causes CORMIX to suppress evaluation of toxic discharges from the Sabre MODU. After initially being vertically fully mixed, the discharge plume re-stratifies

<sup>70</sup> CORMIX uses the Toxic Dilution Zone (TDZ) tests as determined EPA TSD (1991).

<sup>71</sup> Although the discharger has proposed a definite RMZ distance.

<sup>72</sup> CORMIX modeling session [.ses] files for Sabre.

<sup>73</sup> Fact Sheet (2019), see last sentence of first paragraph on Page 17 of 171.

<sup>74</sup> Ibid, see last sentence of first paragraph on Page 17 of 171.

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and is not mixed in the far field. The plume stays layered, i.e., trapped, in the water column, where aquatic organisms are exposed to higher concentrations of the discharge's toxic components.

The files in Table 7 were reviewed for this discussion. The file named "001 KCL 0.3\_1.11.17.ses" above is excerpted in Appendix D4 as an example. The file shows with pdf highlights that "Toxic Discharge = no" was selected for the CORMIX simulation. No water quality standards are provided for toxic organics or toxic metals evaluation. The CORMIX simulations session reports [.ses] for the Sabre MODU, obtained from ADEC in the February 2019 directory transfer, are listed below.

**Table 7. CORMIX Session Report Files for the Sabre MODU**  
Drilling Fluids and Drill Cuttings Discharged at the Surface (Discharge Number 001)

CORMIX Session Report Names (All Provided)		Comment
001 KCL 2.3_1.11.17.ses	001 KCL 2.3 2.27.17.ses	None of the discharger's simulation files contain evaluations of toxic discharges
001 KCL 0.3_1.11.17.ses	001 WBF 0.3_2.27.17.ses	
001 KCL 0.3_2.27.17.ses	001 WBF 2.3 2.27.17.ses	

No discharge number is stated in ADEC's discussion of Sabre but the CORMIX results are for a discharge of drilling fluids and drill cuttings discharged at or near the surface of Cook Inlet, which would be discharge number 001.

Sabre will discharge Drilling Fluids and WBF, which include toxic metals, at least: aluminum, chromium, copper, silver, arsenic, iron, lead, mercury, cadmium, nickel and zinc. See Fact Sheet (2019) Tables 2 and 3 for "Metals Concentrations in Barite Used in Drilling Fluids" and "Average Metals Concentrations in Barite and WBFs"<sup>75</sup>, respectively.

The majority of these metals are persistent having the potential to bioaccumulate in the Cook Inlet environment. See Broman, et al. (1990); Bargagli, et al. (1998); Arkoosh, et al. (1998); EPA (2003); EPA 2002a and b; and EPA (1986). This presents an on-going threat of WQ degradation as these metals and organics build-up in Cook Inlet and its organisms.

ADEC expects that there is a potential for toxic discharge effects requiring sampling and testing for lethality to organisms.<sup>76</sup>

Permittees must also evaluate toxicity using a 96-hour test for a 50 % harmful concentration (LC50) on the suspended particulate phase (SPP) using the *Leptocheirus plumulosus* species (EPA Method 1619). Test procedures are found in 40 CFR 435, Subpart A, Appendix 2. The permittee must collect a sample monthly and at the end of drilling a well (EOW) where no

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<sup>75</sup> WBFs are water-based fluids.

<sup>76</sup> Fact Sheet (2019), see Page 156 of 171, last paragraph of Subsection - C.1.1.1.1 ELGs for WBF per 40 CFR 435 Subpart A and Subpart D.

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mineral oil has been used for the test. The ELG limits the SPP LC50 to 30,000 parts per million (3 %) by volume.

The EPA's effluent limitations guidelines (ELGs) for Drilling Fluids and Drill Cuttings<sup>77</sup> "limit the discharge of organic contaminants by prohibiting the discharge of free oil as determined by the Static Sheen Test (EPA Method 1617), prohibiting the discharge of diesel, and by restricting the use of mineral oil in drilling fluids. If drilling fluids and drill cuttings fail the Static Sheen Test, the permittee must collect a sample and analyze it for diesel."<sup>78</sup>

Although the proposed regulatory MZ length is known for the Sabre MODU submitted to ADEC, no evaluation of chronic toxicity is presented in the CORMIX results. The discharger omits this critical information from the CORMIX analysis.<sup>79</sup> Chronic toxicity is not assessed for the regulatory MZ in the Sabre evaluation because the discharge is claimed not toxic, which is incorrect. These CORMIX results are available in Appendix D4.

CORMIX summarizes far field mixing, which occurs after vertical mixing is complete, and warns that the discharge plume becomes re-stratified later and is not mixed in the far-field.

Non-representative ambient conditions were used in the CORMIX analysis of the Sabre MODU discharge. This means that no tidal conditions were simulated relative to slack tide, non-critical ambient velocities were used, non-critical surface water elevations were used that did not reflect neap and spring tide conditions. Non-critical temperatures and non-critical salinity were employed to circumvent simulating maximum stratification conditions and seasonal variations.

#### *Alaska LNG*

Issues with the Alaska LNG mixing zone and evaluation are presented in Table 8.

The Alaska LNG jack-up platform is proposed to discharge drilling fluids and cuttings to the seafloor (Discharge Number 013). A number of inconsistencies exist for this discharger including that the discharge was intended to be discontinued in 2016. Table 8 lists many of the problems with the potential LNG discharge based on the discharger's application.<sup>80</sup>

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<sup>77</sup> The effluent limitations guidelines (ELGs) for Drilling Fluids and Drill Cuttings are 40 CFR 435 Subparts A (Offshore Subcategory) and D (Coastal Subcategory).

<sup>78</sup> Fact Sheet (2019), see Page 156 of 171, second paragraph of Subsection - C.1.1.1.1 ELGs for WBF per 40 CFR 435 Subpart A and Subpart D.

<sup>79</sup> Fact Sheet, see third paragraph on Page 64 of 171.

<sup>80</sup> LNG (2015), APDES Permit Application for the Alaska LNG Project Cook Inlet 2015 Geophysical and Geotechnical Program, ExxonMobil Alaska LNG LLC (EMALL), March 2015.



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The Fact Sheet states that “Once all reporting requirements had been met and the Geotech IP was no longer needed, it was terminated in November 2016.”<sup>81</sup> It may be that ADEC is attempting to administratively protect the LNG discharger under the draft general permit. However, ADEC has not indicated its plan in the Fact Sheet.

The submitted MZ information, depicts a high-density discharge traveling across shallow water (5-foot depth) at the seafloor near the East Forelands. No benthic impact was evaluated nor were acute and chronic toxicity effects of the discharge considered.

After initially being vertically fully mixed, the discharge plume re-stratifies and is not mixed in the far field. The plume stays layered, i.e., trapped, in the water column, where aquatic organisms are exposed to the discharge’s toxic components.

Although the proposed regulatory MZ length is known for the Alaska LNG Jack-up platform submitted to ADEC, no evaluation of chronic toxicity is presented in the CORMIX results. The discharger omits this critical information from the CORMIX analysis.<sup>82</sup> Chronic toxicity is not assessed for the regulatory MZ in the LNG evaluation because the discharge is claimed not toxic, which is incorrect. These CORMIX results are available in Appendix D5.

CORMIX summarizes far field mixing, which occurs after vertical mixing is complete, and warns that the discharge plume becomes re-stratified later and is not mixed in the far-field.

Non-representative ambient conditions were used in the CORMIX analysis of the Alaska LNG discharge. This means that no tidal conditions were simulated relative to slack tide, non-critical ambient velocities were used, non-critical surface water elevations were used that did not reflect neap and spring tide conditions. Non-critical temperatures and non-critical salinity were employed to circumvent simulating maximum stratification conditions and seasonal variations.

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<sup>81</sup> Fact Sheet (2019), see Page 15, the last sentence under Subsection 2.2.7 - ExxonMobil AK LNG LLC Geotechnical Survey Individual Permit.

<sup>82</sup> Fact Sheet, see third paragraph on Page 64 of 171.

**Table 8. CORMIX Modeling Results for Alaska LNG Jack-up Platform**  
Mud, Drill Cuttings and Cement Discharged at the Surface Seafloor (Discharge Number 013)

Parameter	CORMIX Results — EPA Tests <sup>83</sup>	
	Criterion 1 Discharge length scale	Criterion 3 No RMZ defined <sup>84</sup>
Toxic Component: Drilling Fluids Organics Petroleum Oil adhered to suspended solids Drilling Fluids Metals Aluminum, Chromium, Copper, Silver, Arsenic, Iron, Lead, Mercury Cadmium, Nickel, Zinc	Not evaluated for Acute Toxicity  None of these metals were evaluated for Acute Toxicity	Regulatory Mixing Zone (RMZ) test for chronic toxicity using the toxic dilution zone (TDZ) methodology is not applied for metals and organics associated with drilling fluids and drill cuttings.
Outfall Pipe	Discharge velocity is less than 3mps, which is a substandard design condition resulting in poor mixing characteristics. <sup>85</sup>	
Other limitations	Non-representative ambient conditions – no tidal conditions, non-critical ambient velocities used, non-representative surface water elevations, non-critical temperatures and non-critical salinities.	

<sup>83</sup> CORMIX uses the Toxic Dilution Zone (TDZ) tests as determined EPA TSD (1991).

<sup>84</sup> Although the discharger has proposed a definite RMZ distance.

<sup>85</sup> CORMIX modeling session [.ses] files

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