

## **Technical Comments on Alaska LNG Project - Liquefaction Plant PSD Permit**

**By:**

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**Submitted on behalf of National Parks Conservation Association**

In preparing these comments, I have relied primarily upon the Alaska Department of Environmental Conservation (ADEC) Technical Analysis Report (TAR) dated September 11, 2020 as the source of information about the air quality dispersion modeling that was performed in support of the Alaska LNG Project liquefaction plant PSD permit. However, based on information presented in the TAR, my understanding is that the air quality dispersion modeling supporting the PSD application for the most part relied upon the applicant's modeling prepared for the Alaska LNG Project Environmental Impact Statement (EIS).

Based on the ADEC assertions about the liquefaction plant PSD permit modeling, I reviewed the NAAQS compliance and PSD Class I increment modeling results listed by ADEC in the TAR against those listed Resource Report #9, Appendix D. Resource Report #9 was used to support the EIS. I found that the results matched for the Class II increment consumption and NAAQS compliance modeling, confirming that ADEC did in fact rely on the Draft EIS modeling results when reviewing the liquefaction plant PSD permit. ADEC also made available electronic copies of certain air quality modeling files and my review of the electronic modeling files also confirmed that the liquefaction plant PSD permit modeling relied upon the EIS data for the Class II and NAAQS compliance modeling. As such, I have also used information in Resource Report #9, Appendix D, which was submitted by the applicant in support of the EIS because this document carried additional information about the modeling procedures and data inputs not otherwise disclosed in the ADEC TAR.

However, I was not able to make a similar comparison against Resource Report #9 for the Class I impact modeling because ADEC did not disclose the Class I modeling results in the TAR other than to assert that the modeling showed compliance with the Class I PSD increments. In addition, ADEC's assertion regarding the Class I PSD increment compliance could not be verified based on the level of detail presented in the TAR. Nevertheless, I have assumed that the EIS modeling results were also used by ADEC for the liquefaction plant PSD permit Class I modeling since the electronic modeling files provided by ADEC did not contain any more recent Class I modeling data.

Lastly, by not listing the level of PSD increment consumption that would occur from the proposed liquefaction plant source at nearby Class I areas, ADEC has also failed to meet the requirements to notify the public of the degree of increment consumption as is required under 40 CFR 51.166(q)(2)(iii).

## **GENERAL COMMENTS**

As noted above, the PSD permit modeling for the most part relied upon air quality modeling completed by the applicant for the EIS. However, the EIS modeling was seriously flawed and these flaws were therefore carried forward into the PSD permit modeling. For example, the EIS itself indicated that the technical data about the Project used for the air quality modeling assessment were outdated and/or incorrect. For example, the construction-related emissions were inconsistent with the applicant's current project schedule and as such were outdated (Draft EIS, Page 4-898), the CALPUFF modeling addressing Class I area impacts was incomplete because cumulative impacts were not properly addressed (Draft EIS, Page 4-907), and the maritime emissions were not calculated based on the maximum number of vessels serving the liquefaction facility (Draft EIS, Page 4-926). As noted, these same errors would also be present in the PSD permit modeling.

In addition, no mitigation measures were proposed to address adverse air quality impacts identified by the modeling results. This is important as the implementation of any such measures would potentially impact liquefaction plant design and/or air emissions. As such, the air quality modeling relied upon by ADEC was incomplete, inaccurate, and would not provide for a complete understanding and analysis of air quality impacts as is required under federal and State of Alaska PSD permit regulations.

Lastly, the PSD permit is also a separate regulatory action of the State of Alaska which is independent of the EIS. ADEC's reliance on the EIS modeling, which was completed to fulfill a separate legal requirement, was inappropriate and in turn led to substantial and significant errors in the assessment of the real-world air quality impacts.

Additional issues related to ADEC's reliance on the EIS air quality impact modeling are addressed elsewhere in these comments.

In my comments below, any citation to the USEPA Guideline on Air Quality Models (40 CFR 51, Appendix W) refers to the current (2017) version of Appendix W.

## **MODELING SCENARIOS**

The dispersion modeling for the liquefaction facility addressed "normal operations", which was represented as full build-out of the liquefaction processing equipment at the maximum production rate. However, Resource Report No. 9 Appendix D states that "considerable flaring over six (6) months" will occur during liquefaction plant commissioning and start-up. The flaring associated with commissioning of the liquefaction plant was not addressed in the PSD permit modeling evaluation. Flaring will have different emissions and different air dispersion characteristics and would produce air quality impacts that might vary significantly from those modeled under "normal operations". As such, ADEC cannot rely solely on emissions comparisons when deciding if and when to model possible flaring scenarios. Appropriate flaring scenarios need to be independently considered; otherwise, the liquefaction plant air dispersion modeling analysis as presented by the ADEC TAR is incomplete.

Also, for the liquefaction plant combustion turbines, only 100% load was considered in the air quality modeling impact analysis. Under the EPA Guideline on Air Quality Models (40 CFR 51, Appendix W), modeling of combustion sources at partial load is recommended because the plume rise will be less during partial load conditions, which can lead to elevated ground-level pollutant impacts even when emissions are less (See Appendix W Guideline, Section 8.2.2.d). It was not realistic for ADEC to assume that the liquefaction plant combustion sources would only operate at or near full capacity. The air quality modeling needed to address the possibility of operating the combustion turbines and other combustion sources at less than 100% load. In the absence of such modeling, the PSD permit should have imposed appropriate operational restrictions to prohibit operating the turbines and other combustion sources at less than 100% load.

## **METEOROLOGICAL DATA**

The liquefaction modeling analysis relied on five years of meteorological data from Kenai Airport (2008-12), yet ADEC's TAR (Appendix D, Section 5.3) documents that on-site meteorological monitoring data was also collected near the liquefaction plant. The Appendix W modeling guideline indicates a preference for on-site data when such data are available (See: Appendix W Guideline, Section 8.4.4.1). The applicant should have used the on-site meteorological monitoring data for the air quality modeling calculations or explained why the Kenai Airport data were more appropriate for the liquefaction plant air quality analysis.

In any case, any meteorological data used as input in models supporting a PSD permit application need to be "representative" of the transport and dispersion conditions in the project area. Specifically, Appendix W carries the following language regarding representative meteorological data: *"The meteorological data used as input to a dispersion model should be selected on the basis of spatial and climatological (temporal) representativeness as well as the ability of individual parameters to characterize the transport and dispersion conditions in the area of concern"* (See Appendix W Guideline, Section 8.4.1.b). However, the ADEC TAR and other information in the record are silent as to whether the Kenai Airport data are "representative". Until the Kenai Airport data are evaluated and shown to meet the Appendix W "representative data" criterion, they cannot be used to support a PSD permit application.

Lastly, the TAR notes that the applicant's modeling of air quality impacts "randomized" the wind directions when processing the Kenai Airport meteorological data. This is contrary to USEPA recommendations when meteorological data are processed with the AERMINUTE data processor, which occurred in this case. The applicable EPA recommendations on this issue were well established and date to 2013, long before the applicant filed the modeling protocol and completed the liquefaction plant air modeling for the PSD permit (See: EPA Memorandum from Tyler Fox to Regional Modeling Contacts, *Use of ASOS meteorological data in AERMOD dispersion modeling*; March 8, 2013). ADEC should have invalidated the applicant's modeling and instead required that the meteorological data processing conform with EPA and ADEC guidelines (please refer to separate comments later in this report that address ADEC's so-called sensitivity analyses, which is how ADEC tried to address this issue and other inconsistencies between the applicant's modeling and applicable modeling guidelines).

## **REPRESENTATIVE BASELINE AIR QUALITY DATA**

All PSD applicants need to collect ambient air quality measurements documenting baseline conditions representative of the current air quality at the project site, or otherwise demonstrate that the applicable monitoring exemptions under the applicable PSD regulations were achieved (See Appendix W Guideline, Section 8.3). In part, the applicant met this requirement by collecting on-site measurements for nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), and carbon monoxide (CO). This monitoring program operated from September 2018 through August 2019.

However, for the PM-10, PM-2.5, and ozone (O<sub>3</sub>) baseline monitoring, the applicant relied upon data collected during 2013-14 to support a previous PSD permit action by a nearby facility (Agrium). These data cannot be used to support a PSD permit action in 2020 as the 2013-14 data no longer accurately represent the current baseline air quality conditions around the liquefaction plant site. Even at the time that the PSD permit application was filed by the applicant (May 1, 2018), the Agrium monitoring data were approaching five years old. The applicant has not complied with the PSD baseline monitoring requirements because the applicant has relied upon data which is out of date and no longer representative of baseline air quality conditions.

## **NO<sub>x</sub> EMISSIONS MODELING**

The liquefaction plant NO<sub>x</sub> modeling used the Tier 2 Ambient Ratio Method (ARM2), but the application of ARM2 for this particular PSD permit did not conform to the current version of the USEPA Appendix W Air Quality Modeling Guideline. The recommended lower limit in the ARM2 calculations is 0.5 (See: Appendix W Guideline, Section 4.2.3.4.d), but the liquefaction plant modeling assigned the ARM2 lower limit as 0.2. It is recognized that prior versions of Appendix W may have listed lower thresholds for this variable. However, ADEC's reliance on previous versions of Appendix W means that the current thinking about the proper and scientifically defensible application of air quality models has not been used by ADEC. At this point, the 2017 Appendix W guideline has been in effect for nearly four years and there is no credible scientific reason for not applying the most current data and information to the liquefaction plant PSD permit modeling.

## **MARITIME EMISSIONS**

Based on the air quality modeling description in Resource Report No. 9, Appendix D, maritime emissions were only considered when they occurred in the immediate vicinity of the LNG loading dock (within 500 meters). Air quality impacts from individual sources often extend to considerable distances from the source and these impacts are not limited to just 500 meters. The 500 meter modeling limitation for maritime emissions was not appropriate nor was it scientifically defensible. The air quality modeling should have considered maritime emissions associated with the project beyond those that occur close to the loading dock.

Also, as noted previously under the general comments, the Alaska LNG Project Draft EIS stated that the maritime emissions were not calculated based on the maximum number of vessels serving the liquefaction facility (Draft EIS, Page 4-926). As the PSD permit modeling used the modeling data generated by the Draft EIS, this error also translated to the PSD permit modeling and resulted in the air quality impacts being underestimated.

Lastly, an impact analysis for maritime emissions transiting the Cook Inlet on the Class I Tuxedni National Wildlife Refuge (TUXE) has not been conducted. These maritime emissions would consume PSD increment and would have the potential to impact any nearby onshore Class I PSD area. Any increase in emissions from maritime traffic occurring after the minor source baseline date consumes PSD increment. As such, PSD increment consuming emissions would be present not only from maritime traffic travelling to/from the liquefaction plant, but also from some of the maritime traffic serving other facilities in Kenai and elsewhere in the Cook Inlet. By not properly considering the maritime emissions at the point where such emissions are in the proximity of TUXE, the air quality impacts to this Class I area have been underestimated.

## FLARING

The air quality modeling included emissions from emergency equipment such as flares, emergency engines, etc. However, in many cases, these sources were modeled at their annual average emissions rate, which substantially underestimated short-term emissions when these emergency sources actually operate. The air quality modeling assessment needed to be based on realistic scenarios for operation of the emergency equipment that accounted for the actual short-term emissions of such equipment when these sources operate. The current modeling analysis underestimated the short-term emissions and associated impacts from this equipment.

The emissions modeling for the flaring scenarios are documented in Resource Report #9, Appendix D, Table 4-3. The table below extracts the data on the flaring emissions modeled by the applicant from the EIS documentation. Although this table comes from the EIS documentation, ADEC has asserted that it relied upon the EIS modeling for the purpose of quantifying air quality impacts for the liquefaction plant PSD permit. Also listed in this table are the operating hours upon which the annual emissions at the individual flares were computed.

Model ID	Description	Op Hrs	NO <sub>x</sub> (g/sec)		SO <sub>2</sub> (g/sec)			PM-10/PM-2.5 (g/sec)	
			1-hr	Ann	1-hr	3& 24-hr	Ann	24-hr	Ann
DRYMAX 1&2	Dry Grnd Flare: Max Case	500	29.3	29.3	1.08	3.14	1.08	4.44	12.2
WETMAX 1&2	Wet Grnd Flare: Max Case	500	6.86	6.86	0.251	0.734	0.251	1.04	2.85
LPMAX	Low Press Flare: Max Case	144	0.148	0.148	5.67E-3	0.345	5.67E-3	3.55	5.83E-2

Based on the above table, flaring emissions for compliance with the applicable 1-hour NO<sub>x</sub> and SO<sub>2</sub> NAAQS were modeled at the annual emissions rate. This approach significantly underestimated the short-term emissions from max case flaring operations as this approach essentially smoothed out flaring emissions over the year instead of modeling the short-term spikes in flaring emissions that would actually occur.

Also, based on the above table and emission limits in the proposed PSD permit, flaring emissions would occur with sufficient frequency to affect to form of the standard for the 1-hour NO<sub>x</sub> and SO<sub>2</sub> NAAQS. For example, the max case flaring emissions may occur up to 500 hours per year for individual flares (based on the ADEC analysis) and at 500 hours per year, flaring would occur on a minimum of 21 days per year (e.g., 500/24 = 20.8). In reality, flaring would likely occur on significantly more days since flaring would not be expected to occur continuously over 500 hours. This means that the frequency of flaring would affect ambient air concentrations on more than 1 percent of all days for the SO<sub>2</sub> NAAQS and more than 2 percent of all days for the

NO<sub>2</sub> NAAQS. As such, the maximum hourly emissions and not the average emissions needed to be modeled for the 1-hour NAAQS compliance analysis. Otherwise, the liquefaction plant modeling fails to conform with the recommended emission rate values specified in the Appendix W Guideline at Table 8-2.

Notwithstanding the above, there are additional technical deficiencies with the flaring modeling that are documented in the following paragraphs.

For example, when modeling compliance with the 3-hour and 24-hour standards, the LPMAX emissions were in fact modeled using a higher emission rate that appears to be indicative of the maximum short-term emissions rate at this flare. However, the same approach was not used for modeling compliance with applicable 1-hour NAAQS. The maximum short-term flaring emissions should have been modeled for the 1-hour NAAQS compliance analysis as per Table 8-2 of the Appendix W Guideline.

In addition, at the dry/wet ground flares, the SO<sub>2</sub> emissions were modeled for the 3-hour and 24-hour average at a higher emissions rate, although it is unclear how the higher 3-hour/24-hour rate was derived. The data in the table show that the 3-hour/24-hour emissions were increased by about a factor of three above the annual emissions rate. However, extrapolating from 500 hours of annual operation would suggest that the maximum short-term emissions at the various ground flares should have increased by about a factor of about 17.5, e.g., 8760/500. The basis for the factor of three was not explained in the modeling documentation.

For PM-10 and PM-2.5 emissions, the table indicates that the ground flares were modeled at a lower emission rate for the 24-hour modeling compared to the annual emissions, which should never occur. The maximum 24-hour emissions should always be at or above the annual emissions rate. Again, extrapolating from 500 hours of operation would result in a factor of about 17.5 for the increase in the maximum short-term PM-10 and PM-2.5 emissions. The PM-10 and PM-2.5 emission rates in the flare modeling appear to contain a serious error.

Lastly, my understanding is that the PTE listed by ADEC in the TAR for flaring sources considered emissions from only four of the six ground-flares proposed for the liquefaction plant. This error needs to be corrected.

## **SHORELINE DISPERSION MODEL**

The applicant and ADEC have applied the Shoreline Dispersion Model (SDM) as part of the air quality modeling analysis. SDM is not listed as an approved air dispersion model under 40 CFR 51 Appendix W.

Anytime modeling for a PSD permit applies a non-guideline model, written approval of the EPA Administrator (or the Administrator's designee) is required (See: Appendix W Guideline, Section 3.2). No such approval for SDM has been secured by ADEC and/or the applicant for use in this particular PSD application.

ADEC has claimed that such approval is not required because the SDM was used to “supplement” the AERMOD modeling analysis and AERMOD was in fact the approved model. However, no such distinction for a “supplemental” model is found in 40 CFR 51 Appendix W. Appendix W discusses “Preferred Models” (Section 3.1) and “Alternative Models” (Section 3.2); however, there are no other categories addressing “supplemental” models as has been suggested by ADEC. In addition, any attempt to supplement a “preferred model” such as AERMOD could be considered to represent a modification to the approved model. Appendix W specifically prohibits modifying a “preferred” model without subjecting to model to the “alternative model” approval requirements of Appendix W.

Given that SDM is not on the list of EPA “Preferred Models”, its use in the Alaska LNG PSD permit application is by default as an “Alternative Model”. Under Appendix W, the use of any “Alternative Model” is subject to the procedures for EPA Administrator approval listed in Section 3.2 of Appendix W. ADEC’s failure to secure written EPA Administrator approval for SDM under the “Alternative Model” procedures means that the PSD permit cannot be issued.

## **SECONDARY PM IMPACTS**

From the information in the TAR, secondary pollutants impacts, such as formation of sulfate and nitrate which would be additive to the primary PM-10 and PM-2.5, were not addressed in the air quality modeling analysis for the Alaska LNG Project liquefaction plant. This is critically important in the case of the liquefaction plant PSD permit, because the modeling of primary PM-10 and PM-2.5 showed results that were at or near the applicable Class II PSD increment. Based on Table 10 in the ADEC TAR, the 24-hour Class II PM-10 modeling listed a modeled concentration of 29.7 micrograms per cubic meter vs the Class II PSD increment of 30 micrograms per cubic meter. Similarly, TAR Table 10 lists the modeled PM-2.5 24-hour concentration at 8.7 micrograms per cubic meter vs the Class II increment of 9 micrograms per cubic meter. As such, the modeling results showed virtually no margin of compliance with the Class II PSD increment and it is highly likely that if the increased PM-10 and PM-2.5 associated with secondary emission had been properly considered, the modeling results would in fact have exceeded the applicable Class II PSD increment for PM-10 and/or PM-2.5.

An approach has been developed by USEPA for quantification of such secondary impacts, specifically Modeled Emission Rates for Precursors or MERPs. This approach should have been considered by ADEC to address secondary particulate matter (PM) impacts. The draft EPA MERPs report was published in late 2016, and was therefore available for use by the applicant on this project well before the PSD application was filed. The EIS appears to have attempted to address secondary PM impacts; however, this effort does not appear to have been carried over into in the PSD permit modeling. The secondary PM impacts are additive to the primary PM10/PM-2.5 impacts reported by ADEC. However, because the additive secondary impacts were not properly considered, the liquefaction modeling analysis for the PSD permit is incomplete and underestimated the real-world PM-10/PM-2.5 air quality impacts.

In addition to the point source emissions associated with the liquefaction plant, the MERPs calculation described above should also include NO<sub>x</sub> and VOC emissions associated with the adjacent marine terminal as well as project-related tanker traffic arriving and departing from the marine terminal. These emissions will be real and will add to the airshed pollutant loadings, thereby contributing to the local and regional formation of secondary pollutants such as ozone and PM-10/PM-2.5. The terminal and tanker traffic emissions would not occur but for the presence of the liquefaction plant and as such must be considered in the modeling analysis.

The situation around the liquefaction plant site is further complicated by the presence of the adjacent Agrium fertilizer facility. Based on Resource Report #9, Appendix D, Agrium has estimated ammonia emissions of approximately 700 tons per year. These ammonia emissions would be expected to react with project-related NO<sub>x</sub> and SO<sub>2</sub> emissions and form secondary PM in the near-field, increasing PM-10 and PM-2.5 above those concentrations explicitly modeled by the applicant. The nearby ammonia emissions and the associated increase in PM-10 and PM-2.5 concentrations cannot be ignored, especially given that the current PSD permit modeling has virtually no margin of safety with respect to compliance with Class II PSD increments. The secondary PM as described above would be additive to the primary PM-10 and PM-2.5 impacts otherwise modeled and these increases would likely cause the Class II PSD increments to be exceeded in the vicinity of the liquefaction plant.

The transport of nearby ammonia emissions from Agrium would also extend downwind to nearby Class I areas (see separate Class I comments below).

## **CLASS I AREA IMPACTS**

The liquefaction plant site is in proximity to two areas identified as Class I areas under the PSD regulations: 1) Tuxedni National Wildlife Refuge (TUXE), located at a distance of approximately 86 kilometers (km) and 2) Denali National Park and Preserve (DNPP), located at a distance of approximately 183 km.

First, ADEC acknowledges in the TAR that adverse air quality impacts at both TUXE and DNPP were documented in the Class I modeling. However, ADEC then goes on to assert that such adverse impacts were not of regulatory significance. Despite such assertions, ADEC cannot proceed with the liquefaction plant PSD permit without first addressing the adverse Class I impacts that have been identified at TUXE and DNPP. Specific to DNPP, AQRV impacts include excessive nitrogen deposition, which in turn causes adverse impacts to sensitive lichen species, including the globally-rare *Erioderma Pedicellatan*. ADEC needs to respect the results of the Class I modeling by requiring adoption of appropriate mitigation measures to reduce or eliminate adverse impacts to AQRV resources and make implementation of such measures enforceable permit requirements. Otherwise, ADEC has not fulfilled its regulatory obligations to protect AQRVs and other resources in the affected Class I areas.

Notwithstanding the above, the Class I modeling has technical errors and the result is that Class I impacts at TUXE and DNPP have been underestimated. These technical errors are documented below.

The cumulative air quality modeling for the liquefaction facility was incomplete with respect to Class I impacts because the modeling did not completely address all project-related impacts to Denali National Park and Preserve (DNPP). Several of the pipeline compression facilities associated with the Alaska LNG Project would be in close proximity to DNPP. For example, the Healy Compressor Station would be located within 5 kilometers of DNPP and the Honolulu Creek Compressor Station would be located within 14 km of DNPP. Based on the TAR, the pipeline compressor station emissions were not included in the Class I air quality modeling. However, these compressor stations emissions are part of the Alaska LNG Project and their impacts should have been evaluated. Also, any such emissions would occur after the PSD minor source baseline date and as such, would consume PSD increment at nearby Class I areas such as DNPP. Likewise, these emissions have the potential to adversely impact AQRVs such as visibility and acid deposition. The compressor station emissions needed to be addressed in combination with the liquefaction plant for the Class I analysis at DNPP; otherwise, the analysis was incomplete with respect to air quality impacts, including PSD increment along with air quality related values (AQRVs) such as visibility and acid deposition.

In the CALPUFF modeling, the selected years for meteorological data and other inputs was 2002-04. As such, the background ozone data used in CALPUFF were also from 2002-04, which meant that the ozone data input to CALPUFF were outdated as these data were more than 15 years old. The CALPUFF modeling should have been based on more recent data so that it would be representative of current conditions.

The CALMET modeling used to derive the CALPUFF meteorological fields was not consistent with current EPA/FLM guidelines (See: Clarification on EPA-FLM Recommended Settings for CALMET; USEPA Memo dated August 31, 2009). For example, the vertical layers assigned in CALMET/CALPUFF did not match the 2009 EPA/FLM guidelines. There may have been other deviations from the 2009 EPA/FLM guidelines, but that could not be determined from the information presented in Resource Report No. 9, Appendix D.

Also, as noted in earlier comments regarding flaring emissions, the flaring emissions have not been properly considered in the modeling analysis. Specific to the Class I AQRV modeling, the Federal Land Managers' (FLAG) guidance recommends that emissions for AQRV modeling represent the maximum 24-hour average emissions. ADEC needs to update the Class I AQRV modeling to be consistent with FLAG guidance by explicitly modeling the maximum 24-hour emissions associated with flaring.

As noted in earlier comments, errors also exist in specification of emissions associated with maritime traffic. These errors also translate to the Class I modeling analysis.

Finally, as noted in earlier comments, the Agrium fertilizer plant located adjacent to the liquefaction plant site is a very large source of ammonia emissions. It is likely that these ammonia emissions would be transported along with emissions from the proposed liquefaction plant to nearby Class I areas. The ammonia emissions would interact with the liquefaction plant NO<sub>x</sub> and SO<sub>2</sub> emissions to form ammonium sulfate and ammonium nitrate during the downwind transport to these nearby Class I areas and cause increased impacts to AQRVs such as visibility and acid deposition. This is contrary to the applicant's claims in the CALPUFF modeling that the liquefaction plant emissions would exist in an ammonia-limited environment. The ammonia emissions associated with the adjacent Agrium plant were not considered in the Class I impact modeling relied upon by ADEC. As such, the reported impacts to Class I areas such as DNPP and TUXE were underestimated.

## **CONSTRUCTION EMISSIONS**

Construction emissions were not modeled for the PSD permit. However, given the duration of construction and the phased nature of construction, it is apparent that construction of later project phases would overlap with initial project operations. ADEC needed to address modeling scenarios where project construction would overlap with the initial project operations in order to provide for a full and complete air quality modeling analysis.

The permit has included PM-10/PM-2.5 monitoring requirements during the construction phase. However, these monitoring requirements only provide for measurements against the NAAQS; whereas, the construction-related emissions would occur after the minor source baseline date and as such, would also consume PSD increment. The monitoring program contemplated under the permit would not be capable of demonstrating whether the construction-related emissions might cause or contribute to possible violations of the Class II PSD increment for PM-10 and PM-2.5. An accurate PSD increment assessment that addressed construction-related emissions was required, and this assessment would be best achieved through air quality modeling.

## **SOILS & VEGETATION IMPACTS**

For the soils and vegetation analysis, the ADEC PSD permit analysis relies solely on compliance with NAAQS to address possible adverse impacts to soils and vegetation. This approach is wholly inadequate. The NAAQS are not intended to be protective of all soils or all vegetation species. If the NAAQS adequately protected all species from harmful effects of air pollution, there would be no need for the separate soils and vegetation analysis required by the PSD regulations at 40 CFR 52.21(o)(1). Instead, ADEC should instruct the applicant to inventory soils and vegetation species present in the area impacted by the project to determine the presence of species that may be particularly sensitive to adverse impacts from air pollution. Special attention should be paid to any threatened and endangered species that exist in the region. It is likely that the EIS already contains local/regional data on soils and vegetation that could assist in conducting a soils and vegetation assessment consistent with the basic requirements of the underlying PSD regulations. In our Class I comments, we have also identified a rare lichen species present in DNPP that is particularly sensitive to air pollution effects.

## ADEC SENSITIVITY MODELING

The underlying air quality modeling reports from the Alaska LNG Project EIS (and by extension, the liquefaction plant PSD permit) were outdated. The Appendices to Resource Report No. 9 that described the air quality modeling methods and results dated to 2017, and in some cases, the actual modeling studies described in Resource Report No. 9 were even older.

There are significant issues with using outdated air quality modeling studies. First, the US Environmental Protection Agency (EPA) models used for the Draft EIS air quality impact assessment have been revised and newer versions of the air quality models such as AERMOD and CALPUFF have been released by EPA. Also, using outdated information adversely impacted the cumulative modeling studies in that new emission sources not previously identified may have been constructed and/or proposed since the air quality modeling studies were conducted. Also, emissions at off-site modeled sources have no doubt changed. For example, more recent and complete emissions data on nearby sources has been documented in the ADEC public record for a similar PSD permit under review at the adjacent Agrium facility (Permit AQ0083CPT07). The Agrium permit is also out for public notice concurrent with the public notice for the liquefaction plant PSD permit. Based on the Agrium permit record, modeling was completed using more current (2018) emissions data. Furthermore, the Agrium permit record shows numerous nearby emission sources that were not considered in the liquefaction plant modeling. There is no valid technical reason why the nearby source inventory for the liquefaction plant PSD permit should differ from the nearby source inventory used in the Agrium PSD permit modeling, especially given that these two permits are concurrently out for the required public notice.

In summary, the air quality modeling studies supporting the liquefaction plant PSD permit should have been based on: 1) the current versions of the EPA dispersion models and 2) cumulative air quality impact modeling using current and relevant emissions data.

To some extent, ADEC recognized that flaws existed from using the outdated EIS modeling analysis. ADEC then conducted so called “sensitivity studies” as its attempt to defend the flawed modeling. However, the ADEC “sensitivity studies” were themselves flawed in several major respects: 1) these studies were limited in that they were applied only to a small subset of the EIS modeling results, 2) these studies looked at modeling errors on an individual basis and did not address the potential cumulative effect of all relevant modeling errors, and 3) the sensitivity studies did not address all modeling errors that carried over from the EIS.

ADEC’s own permit review analysis recognized that the EIS modeling was technically deficient and not up to current standards for a PSD permit. However, ADEC should have instructed the applicant to update the modeling so that the permit could rely on modeling results that were created under current modeling procedures and standards. Instead, ADEC erroneously chose a convoluted process to defend its reliance on outdated dispersion modeling created for the EIS.

## **RECOMMENDATIONS FOR THE LIQUIFACTION PLANT PSD PERMIT**

The following comments are intended to provide for compliance monitoring to support some of the assumptions used by the applicant when performing the air quality dispersion modeling. As the NAAQS/PSD increment compliance demonstration from the modeling relied on these assumptions, the applicant should be required to verify that the modeling assumptions are accurate.

1. The permit limits for emission points at the liquefaction plant should include mass-based (lb/hr) emission limits in addition to the concentration (ppm) limits which are expressed in the PSD permit. The enforceable mass-based limits should be consistent with the modeling inputs from each emissions unit. The model input used mass-based emission data and adding enforceable mass-based emission limits assures that the conversions from emissions concentration to emissions mass are accurate.
2. The permit should add testing to determine the NO<sub>2</sub>-to-NO<sub>x</sub> fraction at each emissions unit where the ARM2 assumptions were used in the compliance modeling. The ARM2 lower bound (0.2) is based on assertions made by the applicant concerning the fraction of NO<sub>2</sub> emissions in the exhaust emissions from various sources and these assumptions were in turn critical to the modeling results and compliance determination. The applicant should be required to verify the assertions about the NO<sub>2</sub> fraction in its emissions through actual testing of the relevant sources. If the measured NO<sub>2</sub> emissions are found to exceed the model assumptions, then applicant should be required to redo the modeling demonstration and implement enforceable mitigation actions as may be needed to show compliance.

Note that all comments listed elsewhere in this report stand on their own merit. As such, the comments in this report will not necessarily be cured by adopting the recommended permit changes alone.

## **SUMMARY AND CONCLUSIONS**

The major findings and comments based on my review of the Alaska LNG Project Draft EIS air quality analysis are listed below:

1. The air quality modeling analyses supporting the Draft PSD Permit were outdated and needed to be redone using the current versions of the USEPA-approved air dispersion models and current emissions information for both project and non-project emission sources. Current emissions data on nearby sources are available in the permit record for the adjacent Agrium facility (Permit AQ0083CPT07), which is concurrently out for public notice. There is no basis for using different nearby source emissions data when concurrently processing two similar PSD permits for neighboring sources. In addition, the CALPUFF modeling in particular was not consistent with the current USEPA guidelines for application of the selected dispersion models.

2. The modeling scenarios for “normal operations” were inappropriate as the emissions did not include reasonable flaring scenarios. Based on data published in the Alaska LNG Project EIS, considerable flaring is anticipated during plant commissioning and start-up, yet these flaring emissions were not addressed. Flaring emission scenarios that were modeled also did not properly account for maximum short-term emissions, even though the PSD review indicates that such emissions will occur with sufficient frequency to impact the form of the NAAQS. There are also unexplained errors in the flaring emissions data.
3. The modeling also did not address partial load operation for combustion turbines and other combustion units as recommended by the Appendix W modeling guidelines.
4. The meteorological data were insufficient as the required Appendix W demonstration for “data representativeness” was lacking. The Kenai Airport meteorological data were also processed using randomized wind directions, a method that did not follow recommended EPA guidelines and standard modeling practice.
5. The NO<sub>x</sub> emissions modeling did not conform with current Appendix W modeling guidelines regarding the recommended inputs for the ARM2 modeling option.
6. The Shoreline Dispersion Model was used in the permit modeling without the required EPA Administrator’s approval under the Appendix W procedures for a non-guideline air dispersion model.
7. Secondary PM impacts were not calculated, and including such impacts would have likely resulted in modeled exceedances of the Class II PSD increment for PM-10 and PM-2.5. The occurrence of secondary PM-10 and PM2.5 would also be exacerbated at the liquefaction plant because of the presence of a large source of ammonia emissions adjacent to the plant site.
8. Maritime emissions were not calculated appropriately. Based on the EIS, the maximum number of vessels servicing the liquefaction plant was not included in the modeling. Also, the modeling did not consider emissions from vessels transiting through Cook Inlet at the point of closest approach to the Tuxedni National Wildlife Refuge, a designated PSD Class I area. Lastly, the maritime and terminal NO<sub>x</sub> and VOC emissions also needed to be included in the secondary impacts analysis for PM-10/PM-2.5 and ozone referenced above.
9. The Class I impact analysis was faulty. In some cases, the Alaska LNG Project compressor stations would be within 5 km of Denali National Park and Preserve (DNPP), a protected Class I area, yet the Class I PSD increment analysis and AQRV analysis did not address compressor station emissions in combination with the liquefaction plant and other regional emission sources. Other errors in the Class I modeling analysis were also documented in these comments. For example, ammonia emissions from the adjacent fertilizer plant were not modeled and these ammonia emissions also affect the Class I AQRV modeling for visibility and acid deposition.
10. Despite errors in underestimating various Class I area impacts, the modeling showed adverse air quality impacts at Class I PSD areas; however, ADEC has refused to acknowledge such impacts and has not proposed any measures to mitigate such adverse impacts. Mitigation to reduce or eliminate potential AQRV impacts would beneficially protect sensitive and rare lichen species known to be present at DNPP.

11. ADEC recognized that the EIS modeling relied upon for the PSD permit was outdated and flawed. ADEC nevertheless elected to use this outdated modeling to support the PSD permit. ADEC did perform additional technical analyses to help defend using the flawed EIS modeling, but these “sensitivity studies” were themselves flawed and incomplete.