Exhibit 1

AR-EPA-SSS-4

U.S. Environmental Protection Agency Region 10,
Supplemental Response to Comments for Outer Continental Shelf Prevention of Significant Deterioration Permits, Noble Discoverer Drillship, Shell Offshore Inc., Beaufort Sea Exploration Drilling Program, Permit No. R10OCS/PSD-AK-2010-01, Shell Gulf of Mexico Inc., Chukchi Sea Exploration Drilling Program,
Permit No. R10OCS/PSD-AK-09-01
(Sept. 19, 2011)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 10

SEATTLE, WASHINGTON

SUPPLEMENTAL RESPONSE TO COMMENTS

FOR

OUTER CONTINENTAL SHELF

PREVENTION OF SIGNIFICANT DETERIORATION PERMITS

NOBLE DISCOVERER DRILLSHIP

SHELL OFFSHORE INC.
BEAUFORT SEA EXPLORATION DRILLING PROGRAM
PERMIT NO. R10OCS/PSD-AK-2010-01

SHELL GULF OF MEXICO INC.
CHUKCHI SEA EXPLORATION DRILLING PROGRAM
PERMIT NO. R10OCS/PSD-AK-09-01

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5 USC § 552. In some instances, Region 10 may withhold all or a portion of inspection reports and other information in accordance with FOIA, 5 USC § 552(b).

Comment P.2: A group of commenters states that if Region 10 does not have the requisite resources to dedicate to the arctic OCS, Region 10 should coordinate with BOEMRE or other federal agencies to ensure compliance with air permit conditions.

Response: Region 10 will coordinate with other federal agencies as necessary and appropriate to ensure appropriate oversight of Shell's operations under the permits.

Comment P.3: Several commenters request that Region 10 promptly share the records, reports, and information gained from physical inspections of the Discoverer and Associated Fleet with the public and establish methods to communicate results of compliance with the permit conditions and monitoring requirements. The commenters would like to know whether the applicant is within limits, exceeding limits with plans for correction, and/or in-between when it comes to air quality. The commenters state that this of this information will be useful to North Slope Borough staff as well as its residents when reviewing future proposals for offshore activities. Other commenters ask that the Iñupiat Community of the Arctic Slope be copied on all construction reports, monitoring reports, and air pollution emission reports.

Response: This comment was addressed in issuance of the 2010 Permits and was not the subject of a petition. The underlying basis of this issue is not affected by any revisions to the permits or analysis for the 2011 Revised Draft Permits. As such, it is beyond the scope of the remand and a response is not necessary. 2010 Chukchi Response to Comments at 79-81; Remand Order I at 82.

As discussed above, key compliance information will be available via EPA's ECHO website. http://www.epa-echo.gov/echo/ The public also has a right to request this information under FOIA. See also response to comment P.1.

Comment P.4: A commenter states that the local community wants to see equal enforcement of the laws on the oil companies and that the local community does not have the staff and feel intimidated by the oil companies.

Response: Region 10 shares the commenter's interest in ensuring that laws are enforced in a fair manner. See response to comment P.1 for a discussion of Region 10's enforcement authorities and mechanisms in place to help assure permit requirements are met and violations are detected.

Q. CATEGORY – AMBIENT AIR BOUNDARY

Comment Q.1: Commenters contend that Region 10's decision to set the ambient air boundary at 500 meters from the center of the Discoverer is arbitrary and unlawful and conceals the true maximum impacts of Shell's emissions. The commenters state that, to comply with EPA's longstanding policy on ambient air, Region 10 must set the ambient

air boundary at the hull of the Discoverer, noting that EPA has defined "ambient air" as "that portion of the atmosphere, external to buildings, to which the general public has access." The commenters state that, under EPA policy, an exemption from ambient air is available only for the atmosphere over land owned or controlled by the source and to which public access is precluded by a fence or other physical barriers, and that Shell does not own or control the area within the 500 meter radius and it cannot effectively prevent public access. The commenters continue that Shell's proposal to implement a public access control program to "locate, identify and intercept the general public" does not constitute the fence or other physical barrier excluding the public that EPA's policy requires.

Response: Ambient air is defined as "…that portion of the atmosphere, external to buildings, to which the general public has access." 40 CFR § 50.1(e). Region 10 agrees with the commenters that EPA's longstanding interpretation is that "exemption from ambient air is available only for the atmosphere over land owned or controlled by the source and to which the public access is precluded by a fence or physical barrier." See Letter from Administrator Douglas M. Costle, EPA, to Senator Jennings Randolf, Chairman, Environment and Public Works Committee, re: Ambient Air, dated December 19, 1980. EPA has observed that "control" under this criteria means that "the source has certain rights to use of the land/property, including the power to control public access to it." Memorandum from Steven D. Page, Office of Air Quality Planning and Standards (OAQPS), re: Interpretation of "Ambient Air" in Situations Involving Leased Land under the Regulations for Prevention of Significant Deterioration, Attachment at 3, dated June 22, 2007 (Leased Land Guidance). Region 10 believes that excluding the area within a safety zone established by the United States Coast Guard from ambient air is consistent with this interpretation.

As discussed in the Supplemental Statement of Basis (at 26), Shell modeled emissions from the Discoverer beginning 500 meters from the center of the Discoverer and assumes that the Coast Guard will impose a safety zone of this distance around the Discoverer to exclude the public from the area in which the Discoverer's anchor array will be deployed and in which Shell will be conducting its main operations. Shell therefore agreed that Region 10 would require as a condition of operation under the permits that Shell have in place at all times of operation as an OCS source a safety zone of at least 500 meters within which the Coast Guard prohibits public access.[12] See 2011 Revised Draft Beaufort Permit at 12; 2011 Revised Draft Chukchi Permit at 12.

The conditions of the permit provide sufficient assurance that the general public will not have access to the area inside the safety zone, consistent with the two primary criteria EPA has used to determine when such an exclusion may apply. Given that the permitted activities occur over open water in the Arctic, these criteria must be adapted to some

[12]Shell had previously applied for and obtained a Coast Guard Safety Zone for its operations in the Beaufort and Chukchi Seas for the 2010 drilling season. See 75 Fed. Reg. 19404 (April 12, 2010), but had withdrawn its request that the safety zone be used as the ambient air boundary in issuance of the 2010 permits. See response to comment Q.2. Thus, Shell must apply for and the Coast Guard must establish a safety zone for operation under these permits. The Coast Guard establishes safety zones on the OCS pursuant to 33 CFR § 14710.

extent when applied to this environment, but they are still satisfied in this instance in a manner sufficient to effectively preclude public access from the safety zone.

Region 10 recognizes that Shell does not "own" the areas of the Beaufort and Chukchi Seas on which the Discoverer will be operating as might be the case for a stationary source on land. Shell has a lease authorizing the company to use these areas for the activities covered by the permits. The Coast Guard safety zone establishes legal authority for excluding the general public from the area inside the zone. EPA has previously recognized a safety zone established by the Coast Guard as evidence of sufficient ownership or control by a source over areas over water so as to qualify as a boundary for defining ambient air where that safety zone is monitored to pose a barrier to public access. Letter from Steven C. Riva, EPA Region 2, to Leon Sedefian, New York State Department of Conservation, re: Ambient Air for the Offshore LNG Broadwater Project, dated October 9, 2007 (Broadwater Letter).

To meet the second of the criteria applied by EPA and ensure the source actually takes steps to preclude public access, Shell proposed and Region 10 required as a condition of operation under the permits that Shell develop in writing and implement a public access control program to locate, identify, and intercept the general public by radio, physical contact, or other reasonable measures to inform the public that they are prohibited by Coast Guard regulations from entering the area within 500 meters of the Discoverer. Region 10 believes that, for the overwater locations in the arctic environment at issue in these permitting actions, such a program of monitoring and notification is sufficiently similar to a fence or physical barrier on land such that the area within the Coast Guard safety zone qualifies for exclusion from ambient air. See Broadwater Letter at 2.

Shell therefore appropriately excluded the area within 500 meters of the center of Discoverer from the source impact analysis it conducted to meet the requirements of the PSD regulations.

Comment Q.2: Some commenters contend that Region 10 has taken an inconsistent approach in setting the ambient air boundary. The commenters state that, when Shell initially applied for the air permits, the company's application materials included an ambient air boundary of 900 meters and that Shell assumed that the ambient air would begin at this distance because it had "submitted a request to the US Coast Guard, for issuance of a safety exclusion and equipment protection zone surrounding the Discoverer . . . ." Nevertheless, the commenters state, in issuing the 2010 Permits, Region 10 required Shell to model impacts from the hull of the Discoverer, outward, yet Region 10 is now indicating that it will allow Shell to model impacts starting 500 meters from the center of the Discoverer. The commenters allege that if Region 10 were to recognize that the edge of the hull is the appropriate boundary, Shell has not demonstrated that its operations will not cause a violation of air quality standards in the "ambient air" and that Shell has in fact stated that maximum impacts occur only a short distance from the drillship (citing to Shell statements that "at all receptors, the cumulative concentrations were less than the peak Project contribution alone, which occurs only 80 meters downwind of the drill site").

Response: The commenters are correct that Shell's February 2009 application for an OCS/PSD permit for operations in the Chukchi Sea did request an ambient air boundary based on a Coast Guard safety zone. See Shell February 2009 Application at 63. Shell later withdrew that request. Email from Roger Steen, Air Sciences, to Janis Hastings, EPA, re: Discoverer - Notification of Elimination of the Ambient Air Boundary Based on a Safety Zone, dated April 29, 2009. The 2010 Permits issued by Region 10 therefore did not base the ambient air boundary on a Coast Guard safety zone, but instead assumed that ambient air began at the hull of the Discoverer. 2010 Chukchi Statement of Basis at 99. As discussed in the Supplemental Statement of Basis, the supplemental application materials submitted by Shell to support its revised air quality analysis modeled emissions from the Discoverer beginning 500 meters from the center of the Discoverer and assumes that the Coast Guard will impose a safety zone of this distance around the Discoverer to exclude the public from the area in which the Discoverer's anchor array will be deployed and in which Shell will be conducting its main operations. Supplemental Statement of Basis at 26; Shell March 18, 2011 Submittal at 38, fn. 15. The permits therefore authorize operation only if the Discoverer is subject to a currently effective safety zone established by the Coast Guard. Because the area within the safety zone is not considered ambient air, demonstrating compliance with the NAAQS and PSD increments within that zone is not required. Thus, Region 10 acted consistently with Shell's application materials, legal requirements, and EPA guidance in determining the ambient air boundary based on a Coast Guard safety zone. See also response to comment Q.1.

Comment Q.3: Commenters are concerned that Shell plans to allow marine mammal observers and subcontractors, who the commenters contend are not Shell employees but are instead members of the public, onto and near Shell's vessels within the 500 meter boundary. One commenter states that many observers are Alaskan Natives and must take sometimes scarce job opportunities in their rural villages and he hopes that the observers are informed of and understand the risks they are taking to support their families.

Response: Region 10's understanding is that Marine Mammal Observers will be employees of Shell or Shell contractors. 2012 Revised Camden Bay Exploration Plan at 11-4 (Marine Mammal Observers provide an opportunity for local hire). Under established EPA policy, contractors, subcontractors, and employees that are expressly granted access to a site by the entity with control over the site are not considered the general public vis-à-vis that entity, but instead are considered "business invitees." See Leased Land Guidance Attachment at 5. Their presence within the Coast Guard safety zone thus does not deprive that area from qualifying for exclusion from ambient air.

Comment Q.4: Commenters contend that allowing OCS sources to establish ambient air boundaries in the Arctic based on safety zones raises concerns regarding the cumulative impacts to offshore air quality that several such operations with ambient air quality boundaries would have on air quality. The commenters cite to a Government Accounting Office Report, GAO, EPA's Ambient Air Policy Results in Additional Pollution, July 1989 (available at: http://archive.gao.gov/d26t7/139340.pdf) and assert that that EPA has been subject to scrutiny for creating ambient air boundaries in the first instance because they allow for

greater air quality deterioration. The commenters ask Region 10 to explain why this boundary works in the Arctic and how Region 10 arrived at the decision to allow more pollution instead of less, particularly in light of the heavy use of offshore areas by subsistence communities. Commenters expressed concern about what Region 10's decision means for air quality on the OCS where people hunt and fish.

Response: Safety zones are established by the Coast Guard based on safety considerations, not air quality considerations. See, e.g., 75 Fed. Reg. 803 (January 6, 2010) ("The purpose of the temporary safety zone is to protect the DRILLSHIP from vessels operating outside normal shipping channels and fairways. Placing a temporary safety zone around the DRILLSHIP will significantly reduce the threat of allisions, oil spills, and releases of natural gas, and thereby protect the safety of life, property, and the environment")(capitalization in original). However, because such a safety zone combined with Shell's public access control program has the effect of restricting the general public's access to the relevant area, as discussed in response Q.1, Region 10 believes the presence of a safety zone supports excluding the area inside the zone from ambient air for air quality purposes consistent with prior EPA interpretations of its regulations. The GAO report cited by the commenters focused primarily on concerns with land acquisition to increase the size of the ambient air boundary and thus as a pollution control technique, which is not implicated in the application for and the establishment of a Coast Guard safety zone based on safety considerations. As discussed above in response to comment Q.1, EPA has previously determined that a Coast Guard safety zone is an appropriate basis for establishing an ambient air boundary within which demonstration of compliance with the NAAQS is not required. As discussed in Sections 5 and 6.4 of the Supplemental Statement of Basis and the Region 10 Technical Analysis, emissions under these permits are not expected to cause or contribute to violations of the NAAQS in any area that constitutes ambient air, including in areas where local communities regularly conduct subsistence activities. With respect to cumulative impacts, please see the response to comments in Category Z.

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Comment Q.5: Commenters request that, if the ambient air boundary remains in place, Region 10 examine options for requiring monitoring at 500 meters from the Discoverer for the first two weeks of the drilling season. The commenters state they are not aware of any reasons why it would not be technologically feasible to operate monitoring equipment from a moored vessel.

Response: Region 10 believes that the background monitoring data that have been collected in conjunction with the air quality modeling conducted to support these permit actions adequately demonstrate that emissions under the permits will not cause or contribute to a violation of the NAAQS. The emission limits and associated monitoring, recordkeeping, and reporting requirements in the permits are adequate to verify that the NAAQS will not be exceeded and Region 10 therefore does not believe the additional monitoring requested by the commenters is warranted.

The permits do require post-construction monitoring for $PM_{2.5}$. See Discoverer Beaufort Final OCS/PSD Permit, Condition S; Discoverer Chukchi Final OCS/PSD Permit,

Condition R. Given the challenges of conducting ambient air monitoring in harsh, remote arctic conditions, Region 10 does not believe it is appropriate to require that this monitoring be conducted on a vessel at the ambient air boundary. In addition, Region 10 believes collection of background air quality data within a closer proximity to a community provides more beneficial information on potential health-based exposure than a monitor located well offshore.

Comment Q.6.: A commenter states that the ships in question here are large and produce large amounts of exhaust. The commenter contends that moving the location where the standards had to be met half a kilometer away was done to accommodate, or perhaps hide, the amount of emissions that will occur and that it will result in heavy pollutants in a very sensitive area.

Response: Permitted emissions have been significantly reduced under the 2011 Revised Draft Permits as compared to the 2010 Permits. For a discussion of the basis for considering a Coast Guard safety zone as an appropriate basis for an ambient air boundary, please see response to comment Q.1.

R. CATEGORY – GENERAL COMMENTS ON AMBIENT AIR QUALITY ANALYSIS AND SUPPORTING DATA

Comment R.1: One commenter states that Shell will emit large amounts of fine particulate matter which can cause breathing problems, heart disease, and even death and that, according to a panel of experts from the American Heart Association, there is no safe level of fine particulate matter exposure.

Response: Emissions of fine particulate ($PM_{2.5}$) have been reduced by more than 60% in the 2011 Revised Draft Permits as compared to the 2010 Permits, from 52 tons per year in the Chukchi Sea and 57 tons per year in the Beaufort Sea to 21 tons per year in each Sea. Region 10 Technical Analysis at 8. Moreover, the air quality analysis demonstrates that the 24-hour $PM_{2.5}$ NAAQS will be attained at all areas that constitute ambient air, with an impact, including background, at the modeled location of maximum impact of 67 % of the $PM_{2.5}$ NAAQS in the Chukchi Sea and 52% of the $PM_{2.5}$ NAAQS in the Beaufort Sea. Supplemental Statement of Basis at 57- 58. Onshore impacts from $PM_{2.5}$ emissions from Shell's operations are predicted to be substantially lower. The NAAQS are health-based standards, set at a level to protect public health with an adequate margin of safety, including sensitive populations such as children, the elderly, and asthmatics.

Comment R.2: Commenters note Region 10's statement that "Shell submitted a single analysis for operation in both the Beaufort and Chukchi Seas, using the Associated Fleet to be authorized under the Beaufort 2011 Revised Draft Permit." The commenters ask Region 10 to verify that the use of the Associated Fleet for the Beaufort Sea is sufficient to capture the impacts from the fleet in the Chukchi Sea, where higher air quality impacts are predicted to occur.

than the level of the NAAQS, higher concentrations in the remainder of the year could raise the annual average such that the NAAQS could be violated. It is important to recognize that the limitations in the permits result in emissions from authorized operations impacting short-term and annual standards in different ways. During the drilling season, authorized emissions impact short-term standards during every averaging period (i.e., 1-hour, 3-hour, 8-hour, and 24-hour), but the authorized emissions do not impact those averaging period outside of the drilling season. As such, it is appropriate to use only background concentrations derived from monitoring data collected during the drilling season for determining NAAQS compliance with short-term standards. In contrast, for annual standards (specifically, the annual NO_2 and SO_2 NAAQS), authorized emissions contribute to the calendar year annual average concentration even though operation is not permitted outside of the drilling season. As discussed above, the contribution of the emissions authorized under the permits during the drilling season need to be added to the background concentrations during the entire calendar year in order to compare to the annual NAAQS.

In consideration of the comment, Region 10 has reviewed the NO_2 and SO_2 data to see what, if any, impact using only data from the drill season would have on average concentrations. The results of that review (shown below) show that in all cases, the average concentrations during the drill season are equal to, or less than, the annual average concentrations. Therefore, using annual average concentrations for a calendar year is not only technically correct for use as background levels for the annual NAAQS, in this case it is also more conservative than (incorrectly) using only data from the drill season.

Monitoring Site	Pollutant	Drill Season Average	Annual Average
Wainwright Permanent Site (2010)	SO_2	0.37 ppb	0.37 ppb
	NO_2	0.4 ppb	0.6 ppb
Wainwright Near Term Site (2009)	SO_2	0.11 ppb	0.14 ppb
	NO_2	0.8 ppb	0.9 ppb
Badami	NO_2	0.3 ppb	0.5 ppb
SDI (2007, 2008)	SO_2	0.9 ppb	1.1 ppb
	NO_2	0.6 ppb	2.8 ppb
CCP (2009)	SO_2	1.9 ppb	2.6 ppb
	NO_2	10 ppb	10 ppb
A Pad (2008)	SO_2	2.5 ppb	3.2 ppb
	NO_2	1.6 ppb	1.9 ppb

W. CATEGORY – AIR QUALITY ANALYSIS FOR 1-HOUR NO_2 NAAQS

W.1 SUBCATEGORY – IN GENERAL

Comment W.1.a.: A commenter states that Shell's air pollution will increase levels of NO_2 pollution beyond levels EPA says are safe and that such high NO_2 levels can cause

people to have breathing problems and are especially harmful to older people, children, and people who already have breathing problems such as asthma.

Response: As discussed in Section 5 of the Supplemental Statement of Basis and in the Region 10 Technical Analysis, Region 10 believes Shell has demonstrated that emissions authorized under these permits will not cause or contribute to a violation of the NAAQS, including the NO_2 NAAQS. The NAAQS are health-based standards, set at a level to protect public health with an adequate margin of safety, including sensitive populations such as children, the elderly, and asthmatics.

Comment W.1.b: Commenters acknowledge EPA's new "data handling conventions for NO_2" whereby NAAQS compliance is "based on the 3-year average of the 98th percentile of the yearly distribution of 1-hour daily maximum concentrations," but assert that the new data handling convention is specific to determining "area-wide" compliance with the revised NAAQS. The commenters contend that there is no basis in the Clean Air Act or the new standard itself for the PSD permitting approach that Region 10 has adopted here which allowed a proposed new source to discount its highest projected impacts. The commenters conclude that such an approach ignores both the importance of the absolute value of the NAAQS standard—which must be set at the requisite level to protect human health—as well as the PSD program requirement that a proposed new source demonstrate that it will not cause a NAAQS exceedance.

Response: The commenters appear to be arguing that, as applied in PSD permitting, a source must demonstrate that the impact of its emissions does not exceed the level of the NAAQS. Region 10 disagrees with this position.

Shell's approach for demonstrating compliance with the 1-hour NO_2 standard is consistent with the form of the NAAQS and EPA guidance on demonstrating compliance with the 1-hour NO_2 NAAQS. See Memorandum from Stephen Page, OAQPS, re: Guidance Concerning the Implementation of the 1-Hour NO_2 NAAQS for the Prevention of Significant Deterioration Program, dated June 29, 2010 (June 2010 1-hour NO_2Modeling Guidance); Memorandum from Tyler Fox, OAQPS, re: Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour NO_2 NAAQS, dated March 21, 2011 (March 2011 1-Hour NO_2 Modeling Guidance). The commenters have provided no specific information showing how Shell's approach "discount[ed] its highest projected impacts" in a manner that is inconsistent with the form of the NAAQS.

Although it is true that the modeling showed individual 1-hour impacts higher than the 100 ppb (188 µg/m^3) level of the 1-hour NO_2 NAAQS, the 98th percentile point of the annual distribution of daily maximum 1-hour concentrations does not exceed 100 ppb (188 µg/m^3) at any location that constitutes ambient air. The commenters have provided no information to support their contention that, for an air quality analysis submitted in connection with a PSD permit application, the applicant must establish not only that they will not cause or contribute to a violation of the NAAQS, but also that they will not cause or contribute to ambient concentrations that exceed the level of a NAAQS. The

commenters state as part of this argument that the PSD program requires that "a proposed new source [must] demonstrate that it will not cause a NAAQS exceedance, citing to CAA § 165(a)(3) and 40 CFR § 52.21(k). The PSD regulation cited by the commenters, however, plainly states that a source must demonstrate that it will not cause or contribute to "a violation of" any NAAQS, and does not refer to "an exceedance." See 40 CFR § 52.21(k)(1). To the extent CAA § 165(a)(3)(B) is ambiguous on the issue of whether Congress intended to mean air pollution in excess of the level of the NAAQS or in excess of the NAAQS itself, EPA's interpretation of that language in 40 CFR § 52.21(k) is entitled to deference and the time for challenging that interpretation has long since past. See CAA § 307(b). See also response to comment W.1.c.

Comment W.1.c: Commenters state that Shell has understated maximum 1-hour NO_2 impacts by failing to accurately calculate the multiyear average of the 98th percentile of the annual distribution of daily maximum 1-hour values. The commenters continue that EPA estimated that, when evaluating the measured concentrations for a year's worth of monitoring data, the 98th percentile would be equivalent to the 7th or 8th highest daily maximum for the 365-day period. In calculating its compliance with the 1-hour NO_2 standard, the commenters assert, Shell selected the 8th highest daily maximum but that this is an underestimate of the true 98th percentile associated with its operations because Shell's drilling season is only 120 days long, and it modeled only that many days. The commenters conclude that selecting the 8th highest daily maximum from 120 days corresponds roughly to the 93rd percentile, not the 98th percentile, and that Shell has therefore failed to demonstrate that its proposed operations will not cause or contribute to air pollution violations, as required by 40 CFR § 52.21(k).

Response: Region 10 continues to believe that the air quality analysis performed by Shell for assessing compliance with the 1-hour NO_2 NAAQS is consistent with 40 CFR Part 51, Appendix W (Guideline on Air Quality Models) and EPA guidance for implementing the 1-hour NO_2 NAAQS. In practice, assessing compliance with the 1-hour NO_2 NAAQS can generally be summarized as a three step process involving the collection and preparation of appropriate background data, paring background data with modeled impacts, and finally comparing the resulting total concentration to the NAAQS. Because the form of the 1-hour NO_2 NAAQS is the 3-year average of the 98th percentile of the daily maximum 1-hour averages, there can be a certain number of hourly values each year that exceed the NAAQS threshold. In this analysis, two years of monitoring data are available. Although initially one year of modeled results were available and were used in the compliance demonstration at the time of issuance of the 2011 Revised Draft Permits, in response to public comment, Region 10 has since performed additional modeling for 2010, such that two years of modeled results are used in the demonstration. See response to comment U.2

For the first step, Shell calculated diurnal hourly background values (that is, a background value for each hour of day) for the drilling season (a 5 month period) using background monitoring data collected in 2009 and 2010 for both the Beaufort and Chukchi Seas. Shell took all available hourly NO_2 data during the drilling season period for a particular hour and calculated, for that hour, the 98th percentile NO_2 concentration

recorded for that hour in each of the two years of available monitoring data. 40 CFR Part 50, Appendix S, Table 1 prescribes the rank associated with the 98th percentile value based on the number of available valid samples within a period. Following this procedure for determining a 98th percentile of the monitoring data for each hour, Shell used a 2nd, 3rd or 4th high, depending on the number of available data points, to determine the hourly 98th percentile value (*i.e.*, if 153 hourly values were available, the 4th high represented the 98th percentile for this hour, while a data set with only 100 hourly values would use the 2nd high to represent the 98th percentile for that hour). For each hour, the 98th percentile result for each year is averaged and this average hourly value is then used to pair with the respective modeled result for that hour. The result of this approach is a generic day's worth of NO_2 background data that represents the 98th percentile value for each hour in a drilling season. Results of this procedure are found in Shell's April 29, 2011 submittal "ALTERNATE APPROACHES TO EVALUATING 1-HOUR NO2 IMPACTS FOR THE SHELL DISCOVERER DRILLSHIP – NO2 PAIRING AND NO2/NOX RATIOS" in Tables 3 and 4, pages 6-7. Region 10 determined that this approach followed EPA guidance and provides a representative monitored hour by season diurnal profile for the drilling season.

For the second and third steps, Shell paired, for each modeled hour and receptor location (again, over a 5 month period), the result of the modeled impact with the hourly monitored background value for that hour calculated in step 1 above. The highest hourly total concentration (paired modeled and monitored impact) in a calendar day was then calculated, and the 8th highest paired modeled/monitored impact for each receptor was used to compare with the NAAQS. Using the 8th highest value that occurred over the 5 month drilling season is appropriate because emissions from Shell's operations during periods other than the drilling season are zero (so the total concentration consists only of the background value, yet the form of the standard is a 3-year average of the 98th percentile daily 1-hour maximums). The time period during which no drilling will be occurring is therefore considered in determining the annual 98th percentile value for each year and the 3-year average of annual 98th percentile values, but, because there will be no emissions from Shell's operations in the total concentration during the periods of no drilling, the 8 highest total concentrations for a given year are not predicted to occur during this period, but instead are predicted to occur during the drilling season for that year. In other words, although there are 365 days used in the 98th percentile calculation, the majority of these days (7 months worth) will have no Shell impacts because Shell is not permitted to operate outside of the 5 month drilling season. Because of this, the 8 highest values, and thus the 98th percentile value,[17] are all days that fall within the drilling season. The commenters have not identified any day outside of the drilling season that would have had a higher total concentration than the 8th highest total concentration during the drilling season.

In summary, Region 10 disagrees with the commenters that selecting the 8th highest daily maximum from 120 days corresponds to the 93rd percentile, not the 98th percentile. For the monitored background data, Shell was required to use a 2nd, 3rd, or 4th high value

[17]The 1-hour NO_2 standard is based on the 98th percentile (8th highest) of the annual distribution of maximum daily 1-hour values. March 2011 1-Hour NO_2Modeling Guidance at 1, fn. 1.

depending on the available data because the monitored data relied on in the modeling analysis consisted of less than a year (approximately 5 months). For the modeled impacts, which are paired with the monitored data, however, Shell appropriately used the 8th high modeled-plus-background value, which is the 98th percentile among the 365 days of the year (the timeframe averaged as part of the standard) and evaluated this value against the NAAQS. This approach is consistent with EPA guidance for the 1-hour NO_2 standard. March 2011 1-Hour NO_2 Modeling Guidance at 2 (discussing the procedure for demonstrating compliance with the NAAQS) and 17-21 (describing the appropriate methodology for incorporating background concentrations into a 1-hour impact analysis). Shell has followed EPA guidance in demonstrating compliance with the 1-hour NO_2 NAAQS.

It is important to note that there are several conservative assumptions that will likely result in substantially lower total concentrations than those predicted by the model. One such assumption is that the modeling assumed the Discoverer will be located at the same drill site for the entire three year period considered in determining compliance with the 1-hour NO_2 standard. In the more likely event that Shell will be operating at a different drill site in each of the three years (and possibly more than one drill site in each year), the expected 3-year average of the 98th percentile concentrations at each drill site would be much lower. Another conservative assumption underlying the modeling analysis is the fact that the background data used to represent offshore conditions was collected onshore, where it is influenced by local sources. See response to comment V.1.

Comment W.1.d Commenters contend that Region 10 has failed to ensure that Shell's modeling assumptions reflect actual operating conditions because Shell does not establish that its modeling captures all realistic combinations of allowable operations, background levels, and meteorological conditions that may result in maximum impacts. In modeling its effect on 1-hour NO_2 standards, the commenters assert, Shell assumes a perfect choreography of closely-timed events and favorable conditions and lines up events and conditions in an unrealistically precise manner by varying—for every hour of its proposed 2,880 hours of operation— meteorological conditions, background concentrations, and fleet operations. This method of modeling operations, the commenters continue, is therefore likely not representative of actual operating conditions, does not capture a full, realistic range of potential operations and conditions, and is vulnerable to missing maximum impacts. Thus, the commenters conclude, Shell has not demonstrated compliance with applicable standards, including the 1-hour NO_2 NAAQS. The commenters assert that Shell's modeling should be based instead on scenarios in which meteorological conditions, background concentrations, and vessel operations combine to maximize impacts and reproduces the full range of operating scenarios and impacts.

Response: Region 10 believes the combinations of operating conditions modeled by Shell accurately reflect the expected emissions that will occur with the permitted operations. It is not possible to model all potential combinations of emissions scenarios, thus the need to select conservatively representative emissions scenarios that conform to the permitted emission rates.

Region 10 carefully reviewed the emissions scenarios and required several model iterations using two different drilling start times such that all hours during the drilling season are accounted for. While Region 10 acknowledges the actual operations will not exactly mirror what was modeled, the approach taken is expected to conservatively represent permitted emissions during a drilling season. The comment does not identify any realistic range of potential operations and conditions that have not been captured in the conservatively representative emissions scenarios used in the modeling supporting these permits.

Region 10 also disagrees that there is a "perfect choreography of closely-timed events and favorable conditions" and that Shell's modeling "lines up events and conditions in an unrealistically precise manner." The emissions sequences used in the modeling reflect the general sequence of drilling operations as they would be expected to occur. Obviously, the exact sequence will not exactly mirror that modeled but the general order is correct and reflective of what is allowed in the permits. The other conditions the commenter discuses, such as lining up meteorological and background values, are reflective of actual collected data which, when coupled with conservative assumptions, such as orienting the Associated Fleet with hourly modeled wind direction and using emission release characteristics based on actual meteorological conditions result in a conservative analysis which has demonstrated compliance with the NAAQS.

Moreover, as discussed in response to comment W.1.c and W.3.a, there are several other conservative assumptions underlying the modeling that are not related to the operating scenarios. These assumptions, in conjunction with the reasonable operating scenarios modeled by Shell, make it very unlikely that actual impacts will in fact cause or contribute to a violation of the 1-hour NO_2 NAAQS.

W.2 SUBCATEGORY – LOCATION OF RECEPTORS

Comment W.2: Commenters assert that Region 10 must require Shell to remodel its impact on 1-hour NO_2 concentrations in the Chukchi Sea using a higher density of receptors and that the approach used by Shell may have missed identifying the maximum projected impacts from Shell's proposed operations. The commenters contend that it is well-established protocol among air agencies that ambient air modeling should include the placement of additional receptors in the vicinity of projected maximum impacts to ensure that the model does not miss the true maximum. As support, they state that the Alaska Department of Environmental Conservation (ADEC) recommends a 25 meter spaced grid surrounding the receptor with the maximum impact to ensure the maximum has truly been defined. Because the maximum 1-hour NO_2 impact in the Chukchi Sea is predicted to occur at 1.5 kilometers from the center of the Discoverer rather than at 500 meters, the commenters contend, Shell did not have a sufficient density of receptors in the location of the predicted maximum impact. The commenters assert that Shell had a spacing of 250 meters at this distance, whereas other permitting agencies would have required a spacing of 25 meters. By failing to model with sufficient receptor points around the location of maximum projected impact, the commenters state, Shell has failed

to account for the true magnitude of the impacts of its NO_2 emissions upon air quality. In fact, the some commenters contend, their modeling expert reviewed Shell's analysis and performed an additional modeling runs revealing a cluster of elevated 1-hour NO_2 concentrations, including numerous receptors registering a level that would exceed 188 $\mu g/m^3$ when added to the background concentrations for that hour. The commenters allege that this shows that the 98_{th} percentile concentration reported by Shell in the permit application is underestimated and will be higher with additional receptors at 100 m resolution and, since the existing total impact of 174 $\mu g/m^3$ is close to the NAAQS of 188 $\mu g/m^3$, it is highly likely that this standard can be exceeded with higher concentrations at these additional receptors. The commenters ask that Region 10 require Shell to rerun its models with additional receptors in the region between 1 and 5 kilometers and that if Shell's additional modeling reveals a NAAQS violation, additional controls must be imposed upon Shell's operations. This is necessary, the commenters assert, to ensure that Shell, as an OCS source, is held to the same requirements "as would be applicable if the source were located in the corresponding onshore area."

Response: In response to these comments, Region 10 repeated the AERMOD modeling run performed by Shell in the Chukchi Sea for the 1-hour NO_2 NAAQS to include a 100 meter receptor spacing domain wide with a 25 meter receptor spacing centered on the highest modeled receptor identified in the Shell modeling and verified in the Region 10 analysis. Region 10 also used the latest regulatory version of AERMOD, version 11103, in this revised analysis. Results for the receptors that are in common in the Shell and Region 10 modeling indicate slightly higher 1-hour NO_2 concentrations when using the latest version of AERMOD. In the prior Shell analysis, the highest modeled impact (including background) in the Chukchi Sea occurred at receptor (-1500, 1500) and was 174.0 $\mu g/m^3$. In the revised Region 10 analysis using the latest version of AERMOD, the concentration at this receptor is 175.2 $\mu g/m^3$, an increase of 1.2 $\mu g/m^3$. Region 10 also reviewed the additional 100 meter spaced receptors and determined that receptor (-1500, 1500) was still the high on the domain. Region 10 then reviewed the 25 meter receptor grid that was placed over the (-1500, 1500) receptor and found a maximum modeled concentration of 175.7 $\mu g/m^3$.[18]

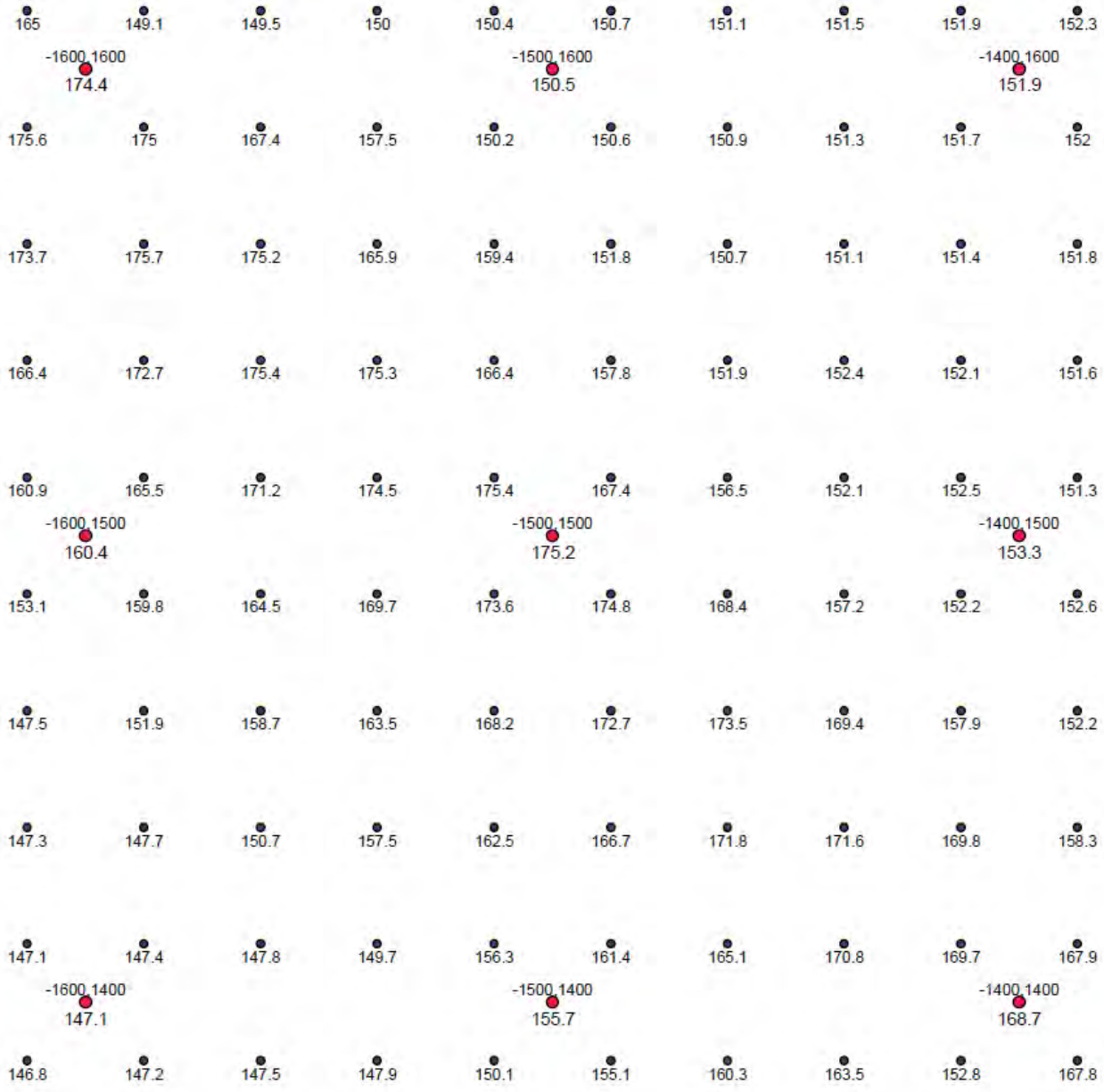
Figure 1 provides an overview of the modeling results that Region 10 performed. Red receptors are those receptors spaced at 100 meters with modeled concentrations labeled below the receptor. Black receptors are the additional 25 meter spaced receptors placed over the domain-wide modeled maximum (receptor -1500, 1500 in case of the Chukchi Sea), with modeled concentrations labeled below the receptor. As discussed above, this analysis determined a maximum modeled concentration of 175.7 $\mu g/m^3$, at receptor

[18] Region 10 also notes that the ADEC Modeling Review Procedures Manual is an internal guidance document "to help staff more efficiently review air quality ambient assessments (*i.e.*, air quality dispersion modeling analyses), and to improve the processing time of air permit applications." ADEC Modeling Review Procedures Manual at 1. The manual states: "The manual provides general guidance for reviewing common modeling assessments. It does not cover all cases that may occur in Alaska, and does not prohibit staff from using alternative approaches on a case-by-case basis. It is also a 'living document' that will be updated as national modeling techniques and tools change." Id. at TOC-1.

(-1587.5, 1562.5). This additional analysis continues to indicate that the 1-hour NO_2 NAAQS will be protected.

Because the modeled differences, using additional receptors and the latest regulatory version of AERMOD, still demonstrate compliance with the NAAQS and have very similar concentrations to the prior Shell analysis, Region 10 believes no additional analysis, other than that provided here, is needed and that the commenter's concerns have been addressed.

Figure 1. Region 10 Supplemental 1-Hour NO_2 Modeling Analysis Using 100 Meter and 25 Meter Receptor Spacing



W.3 SUBCATEGORY – BACKGROUND DATA FOR 1-HOUR NO_2 NAAQS/PAIRED DATA

Comment W.3.a: Commenters state that Shell has understated 1-hour NO_2 impacts by using background data in a manner that understates health and environmental risks and does not demonstrate compliance with the 1-hour NO_2 NAAQS because Shell has used background ambient air data in a manner that systematically understates the impact of its operations. The commenters contend that Shell has neglected to use the highest background pollution levels measured in the vicinity of its proposed operations and has instead adjusted background ambient air data by using multiyear averages of the 98th percentile background concentrations for each hour of the day. The commenters acknowledge that compliance with the 1-hour NO_2 standard is determined using a "probabilistic" form (*i.e.*, the 98th percentile maximum 1-hour impact), but argue that Shell has made two downward adjustments: in addition to discounting the highest concentrations caused by its operations, Shell has assumed that such concentrations will not occur at a time when background concentrations are at their highest observed levels. The commenters contend that this has the effect of "compounding" the 98th percentile adjustment, thereby understating the true maximum impacts that may occur as a consequence of Shell's operations. Although acknowledging that EPA has indicated that this technique may be appropriate in some circumstances, the commenters contend that this guidance is not consistent with the 1-hour NO_2 standard itself, which they claim is evaluated with a single adjustment for the 98th percentile. According to the commenters, Shell's manner of selecting 1-hour NO_2 background data for use in its model disregards the highest possible background levels, underestimates the true maximum impact of Shell's operations, and fails to demonstrate that it will not cause a violation of air quality standards.

Response: The 98th percentile of the monitored background concentrations based on the Badami and Wainwright monitors in the Beaufort and Chukchi Seas is a conservative estimate of the background levels at the location of the 98th percentile of the modeled concentrations, and therefore provides a conservative estimate of cumulative NO_2 impacts from Shell's operation. Using background concentrations from onshore monitors is a conservative estimate of offshore NO_2 concentrations, where Shell's operations will be located, because the onshore monitors are influenced by local sources. See response to comment V.1. This is especially true in the Chukchi Sea where Shell's leases are far from the influence of onshore sources.

The modeled to monitor pairing approach is also appropriate as there may be changes in NO_2 values throughout the season or time of day. Take, for example, space heating using propane or diesel, which will occur more during the colder months than in the 5 month season of July through November when operations are authorized under the permits. Combustion of propane or diesel for space heating may cause higher monitored NO_2 values in onshore locations (and thus higher background values reflected in the background monitoring data incorporated into Shell's analysis), and this may occur during the 7 month period Shell is not authorized to operate under the permits. Conversely, there may be more activity of other types during the summer months associated with NO_2 emissions. If this is the case, this should be reflected in the

background monitoring data incorporated into the modeling analysis. These simple examples help illustrate why, consistent with EPA guidance on modeling for the 1-hour NO_2 NAAQS, using a seasonal monitored value is appropriate for this NAAQS standard. A similar argument will hold for hourly readings during the day. At any one time, a monitor may be impacted by a single source. For that impact to occur and be captured by the monitor the wind has to move or transport the emissions from the source to the monitor. At this point in time the monitor may read a high value, but another location in the vicinity may be experiencing no impacts. By using an average 98^{th} percentile by hour of the day, Region 10 is attempting to account for systematic variations in activities and transport that may be occurring and that would lead to a higher or lower monitoring concentration in any one hour. Region 10 is also attempting to use an appropriate background monitoring value for the entire offshore modeled area. The averaging approach by hour and season used by Shell provides a more realistic but still conservative background value to use for such a large area.

It is also important to consider the form of the standard, which is based on probability. The modeling/monitoring pairing approach used by Shell uses a background concentration for all receptors, again, that is based on a two-year average of the annual 98^{th} percentile value by hour and season. In reality, the actual NO_2 monitoring data indicates there are many hours with zero monitored concentrations. So the pairing approach Shell has used is already increasing the probability of a high modeled value corresponding to a relatively high background value, when in reality the actual monitoring values show many hours of zeros. When this pairing approach is coupled with other assumptions, such as the Discoverer remaining at a single drill location for 3 years, which also increases the probability of high modeled results at a receptor, the end result is a conservative analysis. Even with these conservative assumptions, the analysis has demonstrated that the NAAQS is protected.

Finally, there is no requirement to base a NAAQS demonstration on "the true maximum impacts that may occur," and using the overall highest 1-hour monitored 1-hour NO_2 concentration as a background value would be overly conservative in this case. Region 10 strongly disagrees with the commenter that compounding adjustments have occurred which will understate the potential maximum impacts. Region 10 believes instead that it is more likely that compounding assumptions actually increase the probability that the analysis Shell submitted would overstate actual impacts at any single receptor. These assumptions include such things as a single well location for three years, having the Associated Fleet always aligned with the prevailing wind directions, not averaging across three years of meteorological data, and using onshore monitoring data to represent overwater locations while using a diurnal pattern of background monitoring values for all hours when monitoring shows many hours of lower concentrations. All of these assumptions compound to form an analysis weighted towards conservatism. See also response to comments W.1.c, W.3.a, and V.2.

Comment W.3.b: Some commenters support Region 10's decision not to allow a $PM_{2.5}$ modeling analysis that pairs modeled data with monitored data (in time) to determine compliance with the NAAQS, and contend that EPA has in the past said, that pairing data

does not ensure protection of the air quality standards, citing to a letter from EPA Region 8. The commenters assert that this approach is needed to ensure that a violation will not occur in the future, not simply to determine that a violation occurred over the period of time modeled. The commenters state that even in recently allowing limited, case-by-case situations where paired data can be modeled to demonstrate compliance with the 1-hour NO_2 NAAQS, EPA is admitting that this type of analysis results in "a less conservative" estimate of impacts, citing to EPA's March 1, 2011 NO_2 Modeling memo. Although these commenters support Region 10's decision not to allow pairing of NO_2 data as Shell originally proposed (*i.e.*, hour-by-hour pairing of modeled concentrations with background concentrations), the commenters do not agree that the diurnal pairing of the 2-year average of the 98^{th} percentile NO_2 concentrations by hour (based on the number of samples) between July 1 and November 30 with corresponding modeled concentrations for that hour is protective enough of the NAAQS. The commenters state that a more protective approach would be to use the 98^{th} percentile of the annual distribution of daily maximum 1-hour average values averaged across the 2-year meteorological data period used in the dispersion modeling and that a more conservative approach is warranted in this case given the fact that the predicted 1-hour average NO_2 "maximum" modeled impact in the Chukchi Sea is very close to the standard (93% of the NAAQS).

Response: The pairing approach used in the 24-hour $PM_{2.5}$ modeling analysis uses the maximum modeled 24-hour $PM_{2.5}$ concentrations averaged over modeled drilling seasons 2009 and 2010 and this value is paired with a representative 98^{th} percentile monitored background concentration for evaluation against the NAAQS. This approach follows EPA guidance and is conservative. Region 10 appreciates the support.

Concerning pairing for the 1-hour NO_2 standard, Region 10 acknowledges the approach taken is potentially "a less conservative" approach than using the 98^{th} percentile annual distribution. The Region believes the approach taken, however, is still protective of the NAAQS and is consistent with EPA guidance. The commenters also fail to address the difference between the two standards, mainly the averaging period of 1-hour versus 24-hours, and offer no explanation why the pairing approach used for the 1-hour NO_2 standard is not valid and conservative. In addition, it is appropriate to account for diurnal (daily) and seasonal patterns in pairing modeled concentrations with monitored background concentrations. Pairing the 98^{th} percentile of the annual background with the 98^{th} percentile modeled contribution, irrespective of these diurnal or seasonal patterns, may impose additional conservatism that is not warranted. The seasonal pattern is especially relevant in this case because the permits limit operations to a defined period (or season.) Please also see response to comments W.4.a and W.4.b.

W.4 SUBCATEGORY - NO_2/NO_X RATIOS

Comment W.4.a: Noting that that the Plume Volume Molar Ratio Method (PVMRM) algorithm used in the ambient analysis to determine the atmospheric conversion of NO_X to NO_2 requires estimates of in-stack ratios of NO_2/NO_X, some commenters assert that these in-stack ratios appear to be important parameters in the modeling. The commenters go on to state that Region 10 must therefore ensure the ratios used are protective of the

Exhibit 2

AR-EPA-BBB-150

Alaska Department of Environmental Conservation,
Modeling Review Procedures Manual
(Sept. 14, 2011)

ADEC Modeling Review Procedures Manual

September 14, 2011

Notice

This manual provides general guidance to Alaska Department of Environmental Conservation (ADEC) staff reviewing air quality modeling assessments submitted by regulated sources or the public in support of a permit action, permit-avoidance action, or petition to revise Air Quality Control Regulations. This guidance may also be used by staff reviewing an existing source assessment under 18 AAC 50.201. The manual provides general guidance for reviewing common modeling assessments. It does not cover all cases that may occur in Alaska, and does not prohibit staff from using alternative approaches when warranted. It is also a "living document" that will be updated as national modeling techniques and tools change.

This manual references several commercial modeling programs that provide a Graphical User Interface to the public-domain programs provided by the U.S. Environmental Protection Agency (EPA). ADEC tends to predominately use one of these programs for conducting modeling reviews, and has included specific steps regarding the use of this program as an aid to staff. However, other commercial programs are equally valid and appropriate. Mention of products or services does not convey, and should not be interpreted, as conveying official ADEC approval, endorsement, or recommendation.

NOTE: ADEC developed this manual to teach staff how to conduct an efficient air quality modeling review. It was *not* developed to impose requirements on model users (including permit applicants), and cannot be used as such, absent future public review and adoption in accordance with the Alaska Administrative Procedures Act (AS 44.62).

There are numerous sections that need to be updated. The topics that need updating include: model references (e.g., AERMOD has replaced ISCST3 as the typical, onshore new source review dispersion model); regulatory citations; the inclusion of new ambient air quality standards and thresholds; and inclusion of new EPA guidance. There are also a number of topics that need clarification as to when the given suggestion may be applicable.

ADEC is in the process of conducting a major rewrite of this manual to incorporate the above changes and to make the manual more "user-friendly." In the mean-time, ADEC has issued this September 14, 2011 update to the previous October 13, 2006 release in order to acknowledge the dated content, and non-regulatory basis of this review manual. ADEC has also included a limited number of revisions that were previously developed in support of the major rewrite.

Table of Contents

List of Appendices:

1. Introduction

The Alaska Department of Environmental Conservation (ADEC) Air Permits Program (program) developed this Modeling Review Procedures Manual to provide staff some of the *background* information they should know for efficiently reviewing a permit applicant's ambient demonstration. However, it should *not* be used in lieu of sound judgment, or to circumvent the modeling requirements listed in 18 AAC 50.215 and the U.S. Environmental Protection Agency's (EPA's) *Guideline on Air Quality Models* (Guideline) – which is adopted by reference in 18 AAC 50.040(f). Staff should also utilize the guidance documents posted on the Air Permit Program's modeling web-page (see http://dec.alaska.gov/air/ap/modeling.htm) and the information posted on EPA's modeling web-page (see http://www.epa.gov/ttn/scram/).

This review manual contains the following information. Section 1 presents some frequently asked questions about dispersion modeling, some suggestions on the reviewer's perspective, and an overview of both EPA and Federal Land Manager guidance on conducting modeling analyses. Section 2 presents an overview of the procedures for performing a review of an ambient air quality assessment. Sections 3 through 9 present specific review procedures and "expert tips" on various technical items, such as meteorological data processing and receptor grid generation. Section 10 discusses the criteria that the ambient assessment is compared against. Section 11 discusses the role of ADEC in reviewing and coordinating any Class I assessments. Section 12 provides specific guidance on the format of content of the electronic data submittal from the permit applicant. Section 13 presents a list of common acronyms.

Appendix A presents information and expert tips on the dispersion models commonly used in ambient assessments, including SCREEN3, VISCREEN, ISCST3, AERMOD, OCD, and CALPUFF. Appendix B presents examples of ADEC correspondences regarding modeling protocols. Appendix C provides examples of deficiency notices. Appendix D provides examples of a modeling review memorandum. Appendix E is reserved for future use. The modeling review template that was in Appendix E may now be found in the Title I portion of the Quality Management System (QMS) library. Appendix F provides ADEC guidance memos on specific issues.

Disclaimer. This manual provides guidance for reviewing common modeling assessments. However, it does not cover all unique cases that could or have arisen in Alaska.

Fugitive emissions from area or volume sources require special attention. Take the time to understand the nature of the fugitive emission process, understand where these processes occur, and ensure that they are accurately represented in the model. See further discussion in Section 4.3.

3.3 Location of Fence Line, Property, and Ambient Air Boundaries

The air quality modeling assessment must be performed in all locations of "ambient air", which has been defined by EPA as 'that portion of the atmosphere, external to buildings, to which the general public has access' (40 CFR 50.1(e))[9]. In order to limit public access to a source's property, EPA and ADEC have generally required that a fence or some other barrier must be present, and so the fence line, not the property line, is used to define the ambient air boundary[10]. In limited circumstances and on a case-by-case basis, geographical barriers such as a cliff or river may preclude public access and be used to define the ambient air boundary. Alaska also has some stationary sources where the use of a fence or similar physical barrier is impractical or creates a safety concern (e.g., in some areas, fences can become hazards during whiteout conditions). In these rare cases, ADEC has allowed applicants to establish an access control plan for their ambient air boundary.[11]

Facility fence lines and property boundaries must be shown on the required site plan, and the model receptor grid must start on the fence line or ambient air boundary. You should graphically review the receptor grid to ensure the ambient air boundary has been correctly represented. Refer to Section 7.3 for details on reviewing receptor grids.

[9] Adopted by reference in AS 46.14.990(2)

[10] Refer to the Ambient Air policy memorandum on EPA's SCRAM Website under Generic/Recurring Issues, notably memorandum AMA-3 at http://www.epa.gov/scram001/guidance/mch/ama3.txt .

[11] Applicants who desire to use an Access Control Plan must also show that they have a legal right to preclude public access at the proposed ambient air boundary.

Exhibit 3

AR-EPA-RRR-30

Alaska Wilderness League, *et al.*'s
Comments on Revised Draft Air Permits for Shell's Proposed Oil and Gas Exploration Drilling in the Beaufort Sea and Chukchi Sea, Alaska
(Aug. 5, 2011)

Comments on Shell's Revised Draft Air Permits , part 1
Sarah Saunders to: R10OCSAirPermits 08/05/2011 08:13 PM

Attached is the Alaska Wilderness League, et al.'s Comments on the Revised Draft Air Permits for Shell's Proposed Oil and Gas Exploration Drilling in the Beaufort Sea and Chukchi Sea, Alaska, and part 1 of the attachment in support of these comments. Parts 2 through 7 of the attachment will be submitted in separate emails to follow.

If you have any concerns, please contact David Hobstetter at 907-792-7104 or me at 907-792-7101.

Thank you.

Sarah Saunders

Sarah Saunders
Litigation Assistant/Administrative Coordinator
Earthjustice
441 West 5th Avenue
Suite 301
Anchorage, AK 99501-2340
T: 907-792-7101
F: 907-277-1390
www.earthjustice.org
Because the earth needs a good lawyer

AWL, et al. Comment to EPA on Draft Shell Supplemental PSD Permits.pdf

AWL, et al Comments, Attachment part 1.pdf

ALASKA WILDERNESS LEAGUE—AUDUBON ALASKA
CENTER FOR BIOLOGICAL DIVERSITY—DEFENDERS OF WILDLIFE
GREENPEACE— EARTHJUSTICE—NATIONAL WILDLIFE FEDERATION
NATIVE VILLAGE OF POINT HOPE
NATURAL RESOURCES DEFENSE COUNCIL
NORTHERN ALASKA ENVIRONMENTAL CENTER—OCEAN CONSERVANCY
OCEANA—PACIFIC ENVIRONMENT—REDOIL—SIERRA CLUB
THE WILDERNESS SOCIETY—WORLD WILDLIFE FUND

August 5, 2011

VIA EMAIL

Shell Discoverer Air Permits
EPA Region 10
1200 6th Ave., Ste. 900, AWT-107
Seattle, WA 98101
Email: R10ocsairpermits@epa.gov

Re: Revised Draft Air Permits for Shell's Proposed Oil and Gas Exploration Drilling in the Beaufort Sea and Chukchi Sea, Alaska

Alaska Wilderness League, Audubon Alaska, Center for Biological Diversity, Defenders of Wildlife, Greenpeace, Earthjustice, National Wildlife Federation, Native Village of Point Hope, Natural Resources Defense Council, Northern Alaska Environmental Center, Ocean Conservancy, Oceana, Pacific Environment, REDOIL, Sierra Club, The Wilderness Society, and Word Wildlife Fund hereby submit the following comments on U.S. EPA Region 10's revised draft Outer Continental Shelf ("OCS") Prevention of Significant Deterioration ("PSD") Clean Air Act Permits for Shell Gulf of Mexico, Inc. and Shell Offshore Inc. (collectively, "Shell"), authorizing air emissions from Shell's *Discoverer* drillship and associated vessels for proposed oil and gas exploration drilling operations in the Beaufort Sea and the Chukchi Sea.

Shell proposes to undertake large-scale and long-term industrial operations involving many ships that will emit large amounts of pollution into the environment and create significant amounts of noise that is harmful to Arctic species. Shell's operations would affect a huge region, all the way from the western Alaskan Beaufort Sea down to the Bering Sea. Further, Shell's *Discoverer* permit applications are just the beginning of what could become a massive influx of oil company development in the Arctic. Indeed, Region 10 has also received Clean Air Act permit applications from Shell for exploration drilling operations in the Beaufort Sea using the *Kulluk* drill rig and from ConocoPhillips ("Conoco") for exploration drilling operations in the Chukchi Sea using a jack-up rig. Thus, it is essential that Region 10 exercise extreme diligence and caution in reviewing these first permit applications. The agency's actions here likely will have consequences beyond the *Discoverer*'s potential operations, and will establish precedents that must provide sufficient protection to the Arctic's people and environment.

As an initial matter, we maintain that Region 10 must account for the substantial lack of data concerning the Arctic environment. Since the Environmental Appeals Board ("EAB") remanded the *Discoverer* permits back to Region 10, the Secretary of Interior released a major report from the U.S. Geological Survey on the gaps in the scientific understanding of the United States' Arctic. *See* Holland-Bartels, Leslie, and Pierce, Brenda, eds., 2011, An evaluation of the science needs to inform decisions on Outer Continental Shelf energy development in the Chukchi and Beaufort Seas, Alaska: U.S. Geological Survey Circular 1370. It concludes that there are large information gaps about the Arctic Ocean, and these gaps are a "major constraint to a defensible science framework for critical Arctic decision making." *Id.* at 151. Moreover, the Alaska Federal District Court remanded Chukchi Lease Sale 193 because the agency had not fully considered the importance of missing information in its environmental impact analysis. Region 10 must acknowledge these shortcomings in the scientific understanding of the Arctic and move forward cautiously, ensuring that any permits it issues are designed to provide maximum protection for human health and the environment.

With regard to the revised draft air permits for Shell, the current permits offer some limited improvements upon the previous drafts. For example, the required use of selective catalytic reduction and oxidation catalyst pollution controls on ice breaker #1's main propulsion engines and generators will reduce emissions of nitrogen oxides (NO_X) and particulate matter. Also, Region 10 improved the permit by abandoning its previous, unlawful approach to determining when the *Discoverer* constitutes an Outer Continental Source ("OCS"), opting instead to determine that the ship is such a source from the moment the first anchor attaches to the seabed at the drill site until the moment the last anchor is removed.

Despite these improvements, the revised draft permits and the underlying analysis upon which they are predicated is unlawfully inadequate. The draft permits' significant flaws include the following:

- Region 10 unlawfully has established an ambient air boundary of 500 meters around the *Discoverer*. Such a distant boundary conceals the true maximum impacts of Shell's pollution.
- Shell has failed to demonstrate that it will not cause a violation of the new national ambient air quality standard ("NAAQS") for 1-hour nitrogen dioxide (NO_2), as required by 40 C.F.R. § 52.21(k).
- Shell's modeling fails to demonstrate compliance with NAAQS because it does not account for Conoco's planned exploration activities, which may occur in close proximity to Shell's operations.
- Region 10 has not provided a sufficient analysis of potential secondary fine particulate matter ("$PM_{2.5}$") pollution formation because it failed to determine whether Shell will emit significant quantities of $PM_{2.5}$ precursors.
- Region 10 has neglected to require Shell to comply with all applicable Clean Air Act standards, including the recently updated increment for $PM_{2.5}$.
- The draft permits lack both reliable controls on Shell's greenhouse gas emissions as well as critical monitoring requirements for those emissions; without such permit conditions, Region 10 has not lawfully exempted Shell's operations from stringent technological controls for greenhouse gases.

- Region 10's environmental justice analysis is wholly inadequate because the agency has not considered Shell's contribution to Arctic warming or the disproportionate effect that such warming may have on Alaska Natives.
- Region 10 has not imposed stringent "best available control technology" ("BACT") on Shell's associated vessels, as required by the Clean Air Act.

I. The permits' 500 meter ambient air boundary is unlawful.

Region 10's decision to set the ambient air quality boundary at 500 meters from the center of the *Discoverer* is arbitrary and unlawful. This is because the 500 meter boundary is inconsistent with EPA's policy regarding where the ambient air begins. In order to comply with this longstanding policy, Region 10 must set the ambient air boundary at the hull of the *Discoverer*.

The Clean Air Act requires EPA to promulgate standards protecting the quality of the ambient air. 42 U.S.C. § 7409. EPA has defined "ambient air" as "that portion of the atmosphere, external to buildings, to which the general public has access." 40 C.F.R. § 50.1(e). According to EPA policy, an "exemption from ambient air is available only for the atmosphere over land owned or controlled by the source and to which public access is precluded by a fence or other physical barriers." Letter from Douglas M. Costle, EPA Administrator to The Honorable Jennings Randolf, re: Ambient Air (Dec. 19, 1980) ("Letter Costle to Randolf"). EPA's interpretation is a longstanding policy: it has been in force for over 30 years.

For Shell's permits, Region 10 has taken an inconsistent approach in setting the ambient air boundary. When Shell initially applied for the air permits, the company's application materials included an ambient air boundary of 900 meters. *See* Shell, Outer Continental Shelf Pre-Construction Air Permit Application, Frontier Discoverer, Chukchi Sea Exploration Drilling Program at 63 (Feb. 23, 2009) ("Shell Feb. 23, 2009, Chukchi App."). Shell assumed that the ambient air would begin at this distance because it had "submitted a request to the US Coast Guard, for issuance of a safety exclusion and equipment protection zone surrounding the *Discoverer* . . . ." *Id.* Nevertheless, for the original draft permits, Region 10 required Shell to model impacts from the hull of the *Discoverer*, outward. *See, e.g.*, Region 10, Statement of Basis for Proposed Outer Continental Shelf Prevention of Significant Deterioration Permit No. R10OCS/PSD-AK-09-01, Shell Gulf of Mexico Inc., Frontier Discoverer Drillship, Chukchi Sea Exploration Drilling Program at 99 (Jan. 8, 2010) ("2010 Chukchi Statement of Basis"). Now, in the Supplemental Statement of Basis for the revised draft permits, Region 10 has indicated that it will allow Shell to model impacts starting 500 meters from the center of the *Discoverer*. Region 10, Supplemental Statement of Basis for Proposed Outer Continental Shelf Prevention of Significant Deterioration Permits, Noble Discoverer Drillship, Shell Offshore Inc., Beaufort Sea Drilling Program, Permit No. R10OCS/PSD-AK-2010-01, Shell Gulf of Mexico Inc. Chukchi Sea Exploration Drilling Program, Permit No. R10OCS/PSD-AK-09-01 at 26 (July 6, 2011) ("Supp. Statement of Basis").

The 500 meter ambient air boundary Region 10 has proposed to establish for the revised draft permits is inconsistent with the EPA policy detailed above. EPA has established that an exemption from the ambient air is available only for areas "owned or controlled by the source and to which public access is precluded by a fence or other physical barriers." *See* Letter Costle

to Randolph. Shell does not own or control the area within the 500 meter radius and it cannot effectively prevent public access. Shell's proposal to implement a public access control program to "locate, identify and intercept the general public" clearly does not constitute the fence or other physical barrier excluding the public that EPA's policy requires. *See* Supp. Statement of Basis at 26. In fact, Shell actually plans to allow members of the public—such as marine mammal observers and subcontractors, who are not Shell employees—onto and near Shell's vessels within the 500 meter boundary.

If Region 10 were to recognize, as it should, that the edge of the hull is the appropriate boundary, Shell has not demonstrated that its operations will not cause a violation of air quality standards in the "ambient air." In its 2010 permit application, Shell directly states that maximum impacts occurred only a short distance from the drill ship. *See* Shell, Outer Continental Shelf Pre-Construction Air Permit Application, Frontier Discoverer, Beaufort Sea Exploration Program at 166 (Jan. 2010) ("Shell Jan. 2010 Beaufort App.") ("at all receptors, the cumulative concentrations were less than the peak Project contribution alone, which occurs only 80 meters downwind of the drill site"). In the Supplemental Statement of Basis, EPA likewise acknowledges that maximum impacts could occur close to the drill ship, stating that "modeled impacts generally decrease as the distance from the 500 meter boundary increases, and in general there is a rapid decrease in concentrations as the distance from the Discoverer increases." Supp. Statement of Basis at 59. Because EPA has arbitrarily approved an inappropriate boundary, Shell did not provide information about compliance with standards at a distance less than 500 meters.

Thus, in order to identify maximum impacts, properly ensure that Shell will not violate NAAQS, and comply with EPA's policy defining the extent of ambient air, EPA must set the ambient air boundary at the *Discoverer*'s hull.

II. Shell has not demonstrated that its operations will not cause a violation of air quality standards.

Both the statute and applicable regulations dictate that Region 10 may not issue Shell a PSD permit unless Shell demonstrates that "allowable emission increases from the proposed source . . . in conjunction with all other applicable emissions increases . . . (including secondary emissions), would not cause or contribute to air pollution in violations of" any NAAQS or increment. 40 C.F.R. § 52.21(k); *see also* 42 U.S.C. § 7475(a)(3). As described below, Shell has not made this demonstration.

a. Shell has not demonstrated that it will comply with the new 1-hour NO_2 standard.

The 1-hour NO_2 NAAQS became effective on April 12, 2010. 75 Fed. Reg. 6,474, 6,474 (Feb. 9, 2010). EPA set the 1-hour NAAQS at a level of 188 $\mu g/m^3$ (or 100 parts per billion). *Id.* This standard reflects EPA's recognition of the substantial body of scientific evidence demonstrating that the previous, annual NO_2 NAAQS alone was insufficient to protect human health. *Id.* at 6,479-81. Short term spikes in NO_2 concentrations are associated with a range of negative human health effects, including breathing problems and even death. *Id.* The new 1-hour NO_2 NAAQS also includes a new "form" for the standard: compliance is "based on the 3-year average of the

98th percentile of the yearly distribution of 1-hour daily maximum concentrations . . . ." *Id.* at 6,474.[1]

Region 10 cannot issue Shell the permits unless Shell demonstrates that it will comply with the 1-hour NO_2 standard. 40 C.F.R. § 52.21(k). Shell has not made this demonstration: (i) Shell's modeling fails to identify maximum impacts because Shell's modeling did not include sufficient receptors; (ii) Shell has understated 1-hour NO_2 impacts by inappropriately excluding data confirming higher impacts; (iii) Shell has utilized offsite background air quality data in a manner that systematically understates pollution levels; (iv) Shell's use of the PVMRM model is unlawful; (v) Shell employed NO_2/NO_X ratios in its modeling that result in an unjustified downward bias; (vi) Shell's modeling is predicated upon operating scenarios that fail to include the various ways in which Shell may operate and the wide range of conditions Shell may encounter; (vii) Shell understated maximum 1-hour NO_2 impacts by using area polygons; and (viii) Shell has failed to obtain the amount of meteorological data required by EPA's regulations.

i. Region 10 must require Shell to remodel its impact on 1-hour NO_2 concentrations in the Chukchi Sea using a higher density of receptors.

Using a sufficient density of modeling receptors is essential to identifying the maximum projected impacts from Shell's proposed operations. Quite obviously, a model cannot identify a maximum impact if there is no receptor located in the area of highest impact. Region 10 recognizes as much, stating that Shell's receptor grid should be designed to "characterize the pattern and location of maximum 1-hour impacts from the *Discoverer* and Associated Fleet." Supp. Statement of Basis at 42. Indeed, it is well-established protocol among air agencies that ambient air modeling should include the placement of additional receptors in the vicinity of projected maximum impacts to ensure that the model does not miss the true maximum. For example, the Alaska Department of Environmental Conservation ("ADEC") "recommends a 25 meter spaced grid surrounding the receptor with the maximum impact to ensure the maximum has truly been defined." ADEC Modeling Review Procedures Manual at 60. As ADEC explains, "[i]f the location of the maximum concentrations are not within a 25-meter spaced grid . . . then the maximum concentration may not have been correctly identified." *Id.* The Wyoming Department of Environmental Quality likewise states that "[f]ine-spaced (100-m or less) receptors should be used to refine the maximum predicted impacts if they occur in an area with

[1] Our comments below acknowledge EPA's new "data handling conventions for NO_2" whereby NAAQS compliance is "based on the 3-year average of the 98th percentile of the yearly distribution of 1-hour daily maximum concentrations." 75 Fed. Reg. at 6,474. Significantly, the new data handling convention is specific to determining "area-wide" compliance with the revised NAAQS. *See, e.g., id*. at 6,482. There is no basis in the Clean Air Act nor the new standard itself for the PSD permitting approach that Region 10 has adopted here, namely, allowing a proposed new source to discount its highest projected impacts. Indeed, such an approach ignores both the importance of the absolute value of the NAAQS standard—which must be set at the requisite level to protect human health, *see* 42 U.S.C. § 7409—as well as the PSD program requirement that a proposed new source demonstrate that it will not cause a NAAQS exceedance. 42 U.S.C. § 7475(a)(3); 40 C.F.R. § 52.21(k).

receptor spacing of 250-m or more." Wyoming Department of Environmental Quality/Air Quality Division Guidance for Submitting Major Source/PSD Modeling Analyses at 1.

Unfortunately, Region 10 ignored established modeling practice and did not require Shell to utilize a receptor density capable of reliably capturing the maximum projected air quality impacts of Shell's operations. Shell spaced receptors at intervals of 25 meters along the ambient air boundary (at 500 meters), then placed receptors 100 meters apart out to one kilometer, and then 250 meters apart out to five kilometers. *See* Region 10, Technical Support Document, Review of Shell's Supplemental Ambient Air Quality Impact Analysis for the Discoverer OCS Permit Applications in the Beaufort and Chukchi Seas at 9-11 (Jun. 24, 2011) ("Technical Support Document"). Shell claimed that this arrangement would be effective in capturing maximum impacts, noting that for most pollutants AERMOD predicts that the highest ambient air concentration will be predicted at the 500 meter ambient air boundary. *See* Shell, Discoverer Drillship Impact Evaluation for SO_2 and NO_2 using AERMOD, Chukchi and Beaufort Seas, Shell Alaska Exploratory Drilling Program at 38 (Mar. 18, 2011) ("Shell Mar. 18, 2011, App."). Region 10 agreed, stating that it had "reviewed Shell's receptor grid and determined that it ha[d] sufficient density and coverage for characterizing the maximum impacts from Shell's drilling operations." Supp. Statement of Basis at 42. Yet Shell's maximum modeled impact for 1-hour NO_2 did not occur at the 500 meter ambient air boundary (with 25 meter spacing for receptors) or even within a distance of one kilometer (100 meter spacing); rather, it occurred 1.5 kilometers from the center of the *Discoverer*, in an area where the receptors were coarsely spaced at 250 meters, suggesting that other higher impacts were lost in the gaps between receptors.

Air modeling expert Khanh Tran reviewed Shell's analysis and, for the hour during which the maximum NO_2 impacts are predicted, duplicated Shell's modeling with additional receptors placed around the area of maximum impact. As described in the attached report, the results of this additional modeling run reveal a cluster of elevated 1-hour NO_2 concentrations, including numerous receptors registering a level that would exceed 188 $\mu g/m^3$—the NAAQS limit—when added to the background concentrations for that hour. Comparing a first model run (identical to Shell's approach) with a second model run (that incorporated more receptors), Mr. Tran reported:

> High concentrations above 174.8 ug/m3 (exceeding the NAAQS with the added background) have been predicted at more receptors in the second run than in the first run: the first run has 9 receptors exceeding 174.8 ug/m3 while the second run has 56 such receptors. As shown in Appendix A (page 10), the concentration of 160.8 ug/m3 at the receptor (x=-1500 m, y =1500 m) is ranked 65th in the first run. This same concentration is ranked 425th in the second run in Appendix B (page 23). Thus, the 98^{th} percentile concentration reported by Shell in the permit application is underestimated and will be higher with additional receptors at 100 m resolution. <u>Since the existing total impact of 174 ug/m3 is close to the NAAQS of 188 ug/m3, it is highly likely that this standard can be exceeded with higher concentrations at these additional receptors</u>.

Statement of Khanh Tran at 5-6 (emphasis added). These findings illustrate the need, consistent with well established protocol, for Region 10 to require Shell to remodel impacts with a higher

density of receptors in the vicinity of maximum impacts in order to capture the true effect of Shell's proposed project on air pollution concentrations.[2]

By failing to model with sufficient receptor points around the location of maximum projected impact, Shell has failed to account for the true magnitude of the impacts of its NO_2 emissions upon air quality. With such maximum impacts not only unaccounted for, but also likely in violation of the NO_2 NAAQS, Shell has failed to demonstrate that its operations "would not cause or contribute to air pollution in violation" of the NAAQS, as required by 42 U.S.C. § 52.21(k). To correct this obvious error—an error that Region 10 has implicitly acknowledged—Region 10 must direct Shell to rerun its models with additional receptors in the region between 1 and 5 kilometers. And if Shell's additional modeling reveals a NAAQS violation, additional controls must be imposed upon Shell's operations.

ii. Shell has understated 1-hour NO_2 impacts by inappropriately excluding data confirming higher impacts.

Shell has understated maximum 1-hour NO_2 impacts by failing to accurately calculate the multiyear average of the 98th percentile of the annual distribution of daily maximum 1-hour values. EPA determined that use of the 98th percentile is appropriate for determining compliance with the 1-hour NO_2 standard because it will help insulate the standard from extreme events, meaning outlier concentrations. 75 Fed. Reg. at 6,492-93. EPA estimated that, when evaluating the measured concentrations for a year's worth of monitoring data, the 98th percentile would be equivalent to the 7th or 8th highest daily maximum for the 365-day period. *Id*. at 6,492.

In calculating its compliance with the 1-hour NO_2 standard, Shell selected the 8th highest daily maximum, but this is an underestimate of the true 98th percentile associated with its operations. Shell's drilling season is only 120 days long, and it modeled only that many days. *See* Supp. Statement of Basis at 11, 41. Selecting the 8th highest daily maximum from 120 days corresponds roughly to the 93rd percentile, not the 98th percentile. Having failed to identify the 98th percentile maximum daily 1-hour NO_2 impact associated with the duration of its actual operations, Shell has not demonstrated that its proposed operations will not cause or contribute to air pollution violations, as required by 40 C.F.R. § 52.21(k).

iii. Shell has understated 1-hour NO_2 impacts by using background data in a manner that understates health and environmental risks.

Shell has not demonstrated compliance with the 1-hour NO_2 NAAQS because Shell has used background ambient air data in a manner that systematically understates the impact of its operations. In order to ensure compliance, Region 10 must direct Shell to estimate background values in a manner that does not bias the results and underestimate impacts.

[2] Consistent with the requirement of Clean Air Act section 328 that OCS sources be held to the same requirements "as would be applicable if the source were located in the corresponding onshore area, 42 U.S.C. § 7627(a)(1), EPA should require Shell to model with receptors at a distance of 25 meters in the vicinity of its predicted maximum impacts. *See* ADEC Modeling Review Procedures Manual at 60.

In its modeling, Shell has neglected to use the highest background pollution levels measured in the vicinity of its proposed operations. Instead, Shell has adjusted background ambient air data by using multiyear averages of the 98th percentile background concentrations for each hour of the day. Although compliance with the 1-hour NO_2 standard is determined using a "probabilistic" form (*i.e.*, the 98th percentile maximum 1-hour impact), Shell has made two downward adjustments: in addition to discounting the highest concentrations caused by its operations, Shell has assumed that such concentrations will not occur at a time when background concentrations are at their highest observed levels. This has the effect of "compounding" the 98th percentile adjustment, thereby understating the true maximum impacts that may occur as a consequence of Shell's operations.

Region 10 has not offered any explanation for why Shell's double-discounting approach is consistent with the standard. In separate guidance, EPA has indicated that this technique may be appropriate in some circumstances. *See* Memorandum from Tyler Fox to Regional Air Division Directors, Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour NO_2 National Ambient Air Quality Standard at 19-20 (Mar. 11, 2011) ("Fox Memo"). However, it is impossible to square this guidance with the 1-hour NO_2 standard itself. The 1-hour NO_2 NAAQS limit is 188 ug/m^3 (or 100 ppb), and compliance with this standard is evaluated with a single adjustment for the 98th percentile.

Shell's manner of selecting 1-hour NO_2 background data for use in its model disregards the highest possible background levels and underestimates the true maximum impact of Shell's operations. In light of this downward bias, Shell plainly has failed to demonstrate that it will not cause a violation of air quality standards, as required by 40 C.F.R. § 52.21(k).

iv. Shell's use of the PVMRM model adjustment is unlawful.

Region 10 has specifically requested public comment on Shell's use of the Plume Volume Molar Ratio Method ("PVMRM") as a component of its ambient air modeling. *See* Supp. Statement of Basis at 13, 50. Shell used AERMOD's PVMRM option to model its 1-hour NO_2 impacts. Technical Support Document at 21.

The NO_X emissions created during combustion (as occurs in Shell's ship engines and other equipment) are emitted partly as nitric oxide (NO) and partly as NO_2. Once in the atmosphere, NO interacts with ozone and is ultimately converted to NO_2. Both NO and NO_2 are harmful to human health and the environment. However, compliance with the final 1-hour NO_2 NAAQS is calculated by measuring NO_2 alone. *See* 75 Fed. Reg. at 6,474. The standard relies upon NO_2 as an indicator for ambient NO_X, 75 Fed. Reg. at 7,490, mostly as a matter of administrative convenience.

Region 10 must reject Shell's use of PVMRM to demonstrate compliance with the 1-hour NO_2 standard. In predicting ambient air impacts, PVMRM significantly understates the extent to which NO will convert to NO_2 in the presence of ozone. PVMRM fixates on the short-term rates of conversion, even though nearly all NO is eventually converted to NO_2.

The use of PVMRM also contradicts—and undermines—the underlying assumptions of the NO_2 standard itself. In promulgating the 1-hour NO_2 standard, EPA elected to rely on NO_2—as opposed to other nitrogen oxides—as the overall indicator for ambient NO_X. 75 Fed. Reg. at 6,490. Although NO_2 was chosen as the indicator, EPA intended for the 1-hour standard to not only reduce NO_2 levels, but to provide a corresponding reduction in other harmful nitrogen oxides as well. *See id.* PVMRM is necessarily unacceptable because it allows modelers to hide other harmful nitrogen oxides in low NO_2/NO_X ratios, resulting in a substantial understatement of total concentrations.

Thus, in order to maintain consistency with EPA's declared purpose of using NO_2 as an indicator to reduce total NO_X, Region 10 must reject Shell's use of PVMRM.

v. Shell has utilized NO_2/NO_X ratios that underestimate the expected maximum impacts of its operations.

Predictions of ambient 1-hour concentrations of NO_2 require data (or assumptions) about the initial, in-stack ratio of NO_2 to NO_X in the emissions generated by a pollution source. Characterizing a source's emissions with a reliable NO_2/NO_X ratio (or ratios) is therefore essential to the modeling of 1-hour NO_2 impacts. An underestimation of the proportion of NO_X emissions that are NO_2 leads to greatly understated projections of ambient NO_2 concentrations.

Initially, Shell conducted 90 stack tests to determine empirically the various NO_2/NO_X ratios associated with its emission units. *See* Shell Mar. 18, 2011, App., Attachment E. These tests revealed ratios ranging from 0.042 to 0.469. Shell Mar. 18, 2011, App. at 46. Further, they showed that NO_2/NO_X ratios varied depending on the equipment tested and the operating load. Technical Support Document at 22. However, to simplify its calculations—in light of the many potential combinations of equipment and operating loads—Shell ultimately elected to employ generic ratios. *Id.*

Shell's use of generic ratios is problematic on its face. Shell should have reacted to the difficulty in identifying the correct NO_2/NO_X ratios by increasing the complexity of its modeling; instead, Shell reacted by using generic ratios to erase that complexity. This falsely characterizes Shell's intricate operations–operations in which many combinations of different activities could occur together, to the detriment of air quality.

Recognizing that Shell's generic ratios likely were not representative of Shell's operations, Region 10 required Shell to conduct "several" additional modeling runs with alternative in-stack ratios, employing Shell's data collected from the in-stack ratios. While this is better than allowing Shell to rely upon generic ratios alone, it is not clear that these additional modeling runs demonstrate compliance with the 1-hour NO_2 NAAQS. Region 10 acknowledges that equipment factors and operating load significantly affect the resulting ratios, and Shell's stack tests are not sufficiently comprehensive to reveal the full range of emission ratios that might actually occur during Shell's operations. *See* Shell Mar. 18, 2011, App., Attachment E. Thus, it is unlikely that the additional modeling runs Region 10 required actually provided a realistic representation of potential operating scenarios.

Region 10 and Shell have not provided any basis for concluding that the NO_2/NO_X ratios used in Shell's modeling are representative of the ratios that actually may result from Shell's operations. Due to the importance of these ratios to assessing 1-hour NO_2 impacts, Shell cannot say that it has demonstrated compliance with the standard. If Shell believes that its operations are simply too complex to actually measure resultant ratios, EPA's guidance provides a ready solution: EPA guidelines include a default in-stack NO_2/NO_X ratio (0.50) that is much higher than the ratios utilized by Shell. *See* Fox Memo at 5. If Shell does not obtain more reliable data, Region 10 should direct Shell to use this default ratio.

vi. Region 10 has failed to ensure that Shell's modeling assumptions reflect actual operating conditions.

Shell's modeling fails to demonstrate compliance with the new 1-hour NO_2 standard because Shell does not establish that its modeling captures all realistic combinations of allowable operations, background levels, and meteorological conditions that may result in maximum impacts. In modeling its effect on 1-hour NO_2 standards, Shell assumes a perfect choreography of closely-timed events and favorable conditions. Such modeling likely is not representative of actual operating conditions. Per 40 C.F.R. § 52.21(k), Region 10 must ensure that Shell has actually modeled the ways in which its operations could affect air quality.

Shell's modeling lines up events and conditions in an unrealistically precise manner by varying—for every hour of its proposed 2,880 hours of operation— meteorological conditions, background concentrations, and fleet operations. This method of modeling operations, however, is vulnerable to missing maximum impacts as it is difficult to imagine that Shell's projected coincidences of well-timed fluctuations in background pollution levels, weather, and equipment operations will necessarily describe actual potential impacts. Shell's modeling should be based instead on scenarios in which meteorological conditions, background concentrations, and vessel operations combine to maximize impacts.

While commenters were unable to review all of Shell's 2,880 modeling hours, it appears that Shell has not performed its modeling in a manner that will capture a full, realistic range of potential operations and conditions. Thus, Shell has not demonstrated compliance with applicable standards, including the 1-hour NO_2 NAAQS. Shell must model in a way that will reproduce the full range of operating scenarios and impacts.

vii. Shell's use of area polygons to model the emissions of associated vessels underestimates impacts.

Shell has not demonstrated compliance with 1-hour NO_2 standards, as required by 40 C.F.R. § 52.21(k), because its modeling dilutes Shell's associated vessel emissions over a large area, artificially reducing projected maximum impacts. Region 10 should direct Shell to remodel impacts using a method that does not bias modeled impacts in this manner.

In modeling the emissions of its associated vessels, Shell has used area polygons rather than volume sources to represent the emissions of associated vessels. Supp. Statement of Basis at 35. Shell's use of this method results in the distribution of associated vessel emissions within the

"areapoly." Shell Mar. 18, 2011, App. at 26-27. The ice breaker emissions appear to be distributed over an area of roughly eight square kilometers, and the emissions of other support vessels distributed over four square kilometers. *Id.* at 29.

By treating the associated vessel emissions in this manner, Shell likely overestimates how much its ships will be moving and further underestimates short-term impacts to air quality. For instance, discussing its icebreakers, Shell has previously stated that "[o]ccasionally there may be multi-year ice ridges that are expected to be broken at a much slower speed than used for first-year ice. Multi-year ice may be broken by riding up onto the ice so that the weight of the icebreaker on top of the ice breaks it." Shell, Outer Continental Shelf Pre-Construction Permit Application, Frontier Discoverer, Beaufort Sea Exploration Drilling Program at 19 (May 2009). Operating over such a small area—especially close to and directly upwind of the *Discoverer*—could result in higher concentrations because the vessels will emit the pollution in essentially the same location for extended periods of time. Use of area polygons does not account for operation of the ice breakers under these foreseeable conditions. As a consequence, pollution impacts are underestimated. The potential for underestimating impacts is particularly significant with short-term standards like the 1-hour NO_2 standard.

An additional problem with the area polygons is that due to their size, associated vessel emissions will never be modeled as directly upwind or downwind of major *Discoverer* emission units. Shell represents the *Discoverer* as being about 150 meters long and a little over 25 meters wide. Shell Mar. 18, 2011, App. at 28. But Shell's area polygon for its ice breakers, at its widest, is over three kilometers wide. *Id.* at 29. The area polygon—by its very configuration—prevents an accurate assessment of the maximum impacts that would be expected during alignment of *Discoverer* and icebreakers.

Admittedly, Shell's main purpose in using the area polygon approach was to dilute the projected ambient concentrations of its pollutants. Shell used area polygons because of a problem it encountered with PVMRM, and not because of the accuracy of area polygons. According to Shell, the regulatory version of the AERMOD model with PVMRM code allows the modeling of volume sources, but it has an error that overestimates the NO_2 chemistry for point sources when volume sources are also included. *See* Shell Mar. 18, 2011, App. at 27. EPA provided Shell with a beta version of AERMOD with PVMRM code that addresses this problem, but Shell declined to use it. *Id.* If there truly is a problem with Shell's use of the regulatory and beta versions of AERMOD, the solution is not to allow Shell to use area polygons that will underestimate impacts.

viii. Region 10 cannot issue Shell the permits because Shell has collected far fewer meteorological data than required by EPA's regulations.

Region 10 may not issue Shell permits because Shell has not met minimum regulatory requirements for the amount of site-specific meteorological data Shell must obtain to support a modeling demonstration that Shell's operations will not violate air standards. As Region 10 states, Shell must obtain a minimum of one year of site-specific data, or five years of National Weather Service data. *See* Technical Support Document at 5 (citing 40 C.F.R. Part 51, App. W §

8.3.1.2(b). EPA's guidelines for the implementation of the 1-hour NO_2 NAAQS confirm that this requirement is applicable to new sources attempting to demonstrate compliance with the new standard. *See* Fox Memo at 4 ("Although the monitored design value for the 1-hour NO_2 standard is defined in terms of the 3-year average, this definition does not preempt or alter the Appendix W requirement of the use of 5 years of NWS meteorological data or at least 1 year of site specific data."). According to EPA's PSD Ambient Monitoring Guidelines, site-specific data are data collected on-site. *See* EPA, Ambient Monitoring Guidelines for Prevention of Significant Deterioration at 48 (May 1987) ("Site-specific data are always preferable to data collected off-site.").

Region 10 does not detail why it believes Shell's meteorological data meet this standard; instead, it merely lists the data sets available. *See* Technical Support Document at 5. Many of these data were available in 2009, when Region 10 was initially considering these permits. *See* Shell Mar. 18, 2011, App. at 37. Interestingly, at the time, the agency did not believe they were sufficient to support an analysis. *See* 2010 Chukchi Statement of Basis at 97 ("Because site-specific meteorology was not available, Shell used screening meteorology"); Region 10, Statement of Basis for Proposed Outer Continental Shelf Prevention of Significant Deterioration Permit No. R10OCS/PSD-AK-2010-01, Shell Offshore Inc., Frontier Discoverer Drillship, Beaufort Sea Exploration Drilling Program at 102 (Feb. 17, 2010) ("Because meteorological data representative of the open Beaufort Sea was not available, Shell used screening meteorology").

Indeed, the meteorological data Shell has collected do not come close to meeting the standard set by EPA's guidelines. For the Chukchi Sea, Shell has only a few months of site-specific data. Shell Mar. 18, 2011, App. at 37. These data amount to far less than a year, and because Shell did not obtain site-specific data for early July or late November, the data do not even cover the period during which Shell may drill. *Id.* Also, all of Shell's Chukchi data together—including both site-specific and on-land Wainwright and Point Lay data—amount to roughly 30 months and less than the full five years required for non-site specific data. For the Beaufort Sea, Shell similarly has failed to provide one year of site-specific data or five years of National Weather Service meteorological data. Shell's site-specific data covers the period from August 13th to October 11th, meaning that Shell has no site-specific data for July or November, and has data for only about half of August and October. *Id.* All of Shell's Beaufort Sea data total under 4 years of data, and the vast majority of these data were collected on-land and far from Shell's potential drill sites. *Id.* at 36-37.

Therefore, Region 10 cannot issue Shell's permits because Shell has failed to meet the regulatory minimum requirements for meteorological data collection. Region 10 must retract the draft permits and direct Shell to collect additional meteorological data.

b. Shell has failed to account for emissions from ConocoPhillips's exploration operations planned for the Chukchi Sea.

Contrary to agency guidelines, Shell's modeling assumes that its drilling operations will be undertaken in complete isolation from other Arctic development projects. EPA's air quality modeling regulations require that "[a]ll sources expected to cause a significant concentration gradient in the vicinity of the source . . . under consideration for emission limit(s) should be

explicitly modeled." 40 C.F.R. Part 51, App. W 8.2.3(b). Shell's modeling does not comply with this requirement because it fails to account for Conoco's potential operations on the Devil's Paw prospect of the Chukchi Sea.

On July 22, 2011, Region 10 issued a draft air permit for Conoco. It appears that Conoco's drillship could operate as little as 20 miles away from Shell's operations, and as a result, its ice breaker and oil spill response vessel operations could take place as little as 15 and 10 miles away, respectively. *See* ConocoPhillips, Outer Continental Shelf Air Permit Application, Chukchi Sea, Devil's Paw Prospect, Appendix L at L-11, L-20 (Feb. 2010). Like Shell, Conoco's operations will emit large amounts of pollution. According to Conoco, its operations as a whole have the potential to emit 225 tons per year ("tpy") of NO_X, 173 tpy of CO, and 14 tpy of $PM_{2.5}/PM_{10}$. *Id.* at 2-1. Also, Conoco says that its ice breakers, together, have the potential to emit 92.6 tpy of NO_X, and the oil spill response vessel has the potential to emit 48.9 tpy of NO_X. *Id.* at 2-6. According to Conoco's application documents, Conoco's potential to emit for NO_X is roughly two-thirds Shell's potential to emit. *See* Technical Support Document at 8. It is especially important for Shell to account for Conoco's potential emissions because the ambient air quality monitoring data will not otherwise account for them.

By failing to account for such a significant nearby and contemporaneous source of emissions, Shell's modeling underestimates the total, cumulative impact of its own operations. This is cause for concern because Shell's current modeling shows 1-hour NO_2 levels reaching 93 percent of NAAQS—without accounting for Conoco. Further, in determining that Shell will not contribute to a violation of ozone standards, Region 10 relies on "the fact that there are no other stationary sources in the more immediate regional vicinity of Shell's operations in the Chukchi Sea that contribute ozone precursors to the airshed . . . ." Supp. Statement of Basis at 57.

Without accounting for Conoco's nearby operations, Region 10 cannot determine validly that Shell has demonstrated its operations will comply with NAAQS. Accordingly, Region 10 must require Shell to rerun its model in a manner that accounts for Conoco's potential emissions. In doing so, Shell should model Conoco's operations from its nearest potential locations to Shell.

c. Region 10's analysis of potential secondary $PM_{2.5}$ formation remains insufficient.

Despite the EAB's clear direction on the issue, neither Shell nor Region 10 have performed a proper analysis of Shell's potential contribution to secondary $PM_{2.5}$. Shell cannot demonstrate compliance with NAAQS until it has performed a sufficient secondary $PM_{2.5}$ analysis.

In issuing the *Discoverer* permits in 2010 to Shell, EPA did not analyze Shell's potential contribution to secondary $PM_{2.5}$ formation. The EAB remanded Region 10's $PM_{2.5}$ analysis in order to ensure the proper accounting of secondary $PM_{2.5}$ formation. In particular, the EAB was concerned with Region 10's failure to follow EPA's guidance on modeling $PM_{2.5}$ impacts. *See Shell Gulf of Mexico Inc. and Shell Offshore Inc.*, 15 E.A.D. __, 17 (Mar. 14, 2011, Opinion). This guidance states that "if the facility emits significant quantities of $PM_{2.5}$ precursors, some assessment of their potential contribution to cumulative impacts as secondary $PM_{2.5}$ may be necessary." *Id.* at 10 (citing Memorandum from Stephen D. Page, Director, Office of Air Quality

Planning & Standards, U.S. EPA, to EPA Regional Modeling Contacts, U.S. EPA, *Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS* at 9 (Mar. 23, 2010)). Region 10 argued to the EAB that Shell's operations would not emit significant quantities of precursor pollution; however, the EAB ruled that this was simply a post hoc rationale that could not sustain Region 10's permitting decision. *Shell Gulf of Mexico*, 15 E.A.D. at 17 (Mar. 14, 2011, Opinion). In remanding the permitting decision to Region 10, the EAB specifically instructed that "the Region should . . . provide an explanation of why modeling secondary $PM_{2.5}$ is necessary or not after determining whether $PM_{2.5}$ precursors will be emitted in significant quantities." *Id.* at 2.

Region 10 has not performed—or required Shell to perform—the analysis the EAB demanded. The EAB specifically directed Region 10 to first determine whether $PM_{2.5}$ precursors will be emitted in significant quantities. Region 10 has blatantly ignored this order. The Supplemental Statement of Basis states that "Region 10 has not made a determination of whether $PM_{2.5}$ precursor emissions from the project are significant . . . ." Supp. Statement of Basis at 55 n.20. Region 10's refusal to make a finding on the significance of Shell's precursor emissions is odd given that the Supplemental Statement of Basis notes that Shell's emissions will exceed the regulatory "significant emission rate" for the precursor NO_X. *See id*. at 55 (citing 40 C.F.R. § 52.21(b)(23)(i). In fact, Shell's emissions exceed this level by many times. *See* Supp. Statement of Basis at 55.

Region 10's failure to assess whether Shell will emit significant quantities of $PM_{2.5}$ precursors is important. If Region 10 does not determine whether those precursor emissions are significant, it certainly cannot accurately estimate the amount of potential secondary $PM_{2.5}$ formation; and indeed, Region 10 has not tried to do so. Instead, it has based its determination primarily on a rough comparison of Shell's potential emissions to North Slope emissions and the observation that North Slope sources do not currently appear to be contributing to substantial secondary formation in onshore communities. *Id.* at 55. Region 10 should not—and indeed, pursuant to the EAB's order, cannot—rely on such generalizations. Region 10 must assess directly whether Shell will emit precursors in a significant quantity.

In analyzing potential secondary $PM_{2.5}$ formation, Region 10 should address additional factors. For example, as described above, neither Region 10 nor Shell have accounted for Conoco's potential operations, which will also emit a substantial amount of NO_X. Together, these two operations will generate more precursors—resulting in more secondary $PM_{2.5}$—than if they were operating in isolation. Additionally, Region 10 acknowledges that secondary $PM_{2.5}$ formation can occur at a different time and place than where the precursors were emitted. This being true, Region 10 must account for the emission of precursors from Shell's operation before it has technically become an OCS source and after it has stopped being one, since these non-OCS source emissions could react with OCS source emissions.

III. Region 10 must require Shell to comply with new $PM_{2.5}$ increments.

In remanding the permits, the EAB ordered Region 10 to "apply all applicable standards in effect at the time of issuance of the new permits . . . ." *Shell Gulf of Mexico*, 15 E.A.D. at 35 (Dec. 30, 2010, Opinion). The EAB later clarified that EPA could use "any discretion it has" to interpret what "all applicable standards" means. *Shell Gulf of Mexico*, 15 E.A.D. at 24 (Feb. 10, 2011,

Opinion). Region 10 has construed this as a statement that it possesses "discretion to determine whether a specific standard is 'applicable' on remand." Supp. Statement of Basis at 9. Region 10 misreads the EAB's order. Region 10 does not have complete discretion, but must exercise "any discretion it has" within the boundaries of applicable law and through the proper processes. *See Shell Gulf of Mexico*, 15 E.A.D. at 24 (Feb. 10, 2011, Opinion).

Shell's modeling indicates that Shell's emissions could increase 24-hour $PM_{2.5}$ concentrations in excess of 12 $\mu g/m^3$. Supp. Statement of Basis at 57-58 (indicating "Shell Only Impacts" of 12.2 $\mu g/m^3$ for the Beaufort Sea and 12.4 $\mu g/m^3$ for the Chukchi Sea). This increase easily exceeds EPA's newly enacted 24-hour $PM_{2.5}$ increment of 9 $\mu g/m^3$. 75 Fed. Reg. 64,864, 64,865 (Oct. 20, 2010). While the new increment does not become effective for all sources until October 20, 2011, 75 Fed. Reg. at 64,898, Region 10 must nevertheless require Shell to demonstrate compliance.

Region 10 has no discretion to determine whether the new $PM_{2.5}$ increment is an applicable standard because the plain language of section 328 of the Clean Air Act, 42 U.S.C. § 7627(a)(1), defines which standards apply. Section 328 states that "[n]ew OCS sources shall comply with such requirements on the date of promulgation." 42 U.S.C. § 7627 (emphasis added). As a "new OCS source" yet to commence operation, Shell's proposed Arctic drilling operations must comply with all NAAQS and PSD program requirements that pre-date commencement of operations, including the new $PM_{2.5}$ increments. *See* 42 U.S.C. §§ 7411(a)(2), 7475(a), 7627(a)(1) and (a)(4)(D). Moreover, with respect to OCS sources, Congress clearly prohibited grandfathering by directing that even "existing OCS sources shall comply on the date 24 months" after promulgation of standards. 42 U.S.C. § 7627(a)(1).[3] EPA may not excuse Shell from the strict requirements of section 328 because it "does not have the power to adopt a policy that directly conflicts with its governing statute." *Maislin Indus. v. Primary Steel, Inc.*, 497 U.S. 116, 134-35 (1990).

IV. The owner requested limit on Shell's potential to emit greenhouse gas is unenforceable as a practical matter.

The Clean Air Act requires new major stationary sources to meet BACT requirements to obtain a PSD permit. 42 U.S.C. § 7475(a)(3). Shell's operations are major sources for NO_X and CO. Shell March 18, 2011, App. at 14. For greenhouse gases, EPA has "tailored" special rules defining when a new source is major for greenhouse gases, and as a result, must meet BACT

[3] When Congress adopted the PSD program, it understood that certain sources might get caught by changing permit requirements and it offered "grandfathering" relief only to those sources on which "construction had commenced" before the enactment of the 1977 Clean Air Act Amendments. *See* 42 U.S.C. § 7478(b). Where, as here, Congress has provided express grandfathering exemptions for certain circumstances but not others, EPA may not waive otherwise applicable statutory requirements. *See Andrus v. Glover Constr. Co.*, 446 U.S. 608, 616-17 (1980) ("Where Congress explicitly enumerates certain exceptions to a general prohibition, additional exceptions are not to be implied, in the absence of evidence of a contrary legislative intent."); *see also Natural Resources Defense Council v. Env't Prot. Agency*, 489 F.3d 1250, 1259 (D.C. Cir. 2007).

requirements. For a source that is already major for another pollutant, that source will also be subject to regulation for greenhouse gas emissions if it "will emit or will have the potential to emit 75,000 tpy CO_2e or more . . . ." 40 C.F.R. § 52.21(b)(49)(iii).[4]

Whether a source is subject to BACT for greenhouse gases depends on the source's potential to emit. 40 C.F.R. § 52.21(b)(49). A source may reduce its potential to emit by including "physical or operational limitation[s] on the capacity of the source to emit a pollutant . . . ." *Id.* § (b)(4). However, the limitations must be both federally and practicably enforceable. *Weiler v. Chatham Forest Prods.*, 392 F.3d 532, 535 (2nd Cir. 2004). The "federally enforceable" component ensures that the limitations are enforceable by EPA and citizens. *See* Memo from John S. Seitz, Director, Office of Air Quality Planning and Standards, *Options for Limiting the Potential to Emit of a Stationary Source under Section 112 and Title V of the Clean Air Act*, at 2 (Jan. 25, 1995). The related, but distinct, "practically enforceable" component ensures that limitations are sufficient to allow effective enforcement. *Id.* at 5.

While Region 10 has placed a limit of 70,000 tpy of CO_2e in the permits, *see, e.g.*, Region 10, Draft Revised Outer Continental Shelf Prevention of Significant Deterioration Permit To Construct for the Beaufort Sea at 27 (2011) ("Draft Revised 2011 Beaufort Sea Permit"), making this owner requested limit federally enforceable, the limit is not practically enforceable because Shell's methane emissions would be uncontrolled and unmonitored. Shell does not have equipment that will limit these methane emissions, and it could exceed the limit on CO_2e emissions without EPA or the public knowing. In particular, Region 10 assumes that the drilling mud system will vent no more than 0.798 tons per month of methane (17 tons per month of CO_2e). Region 10 makes this assumption based on nothing more than assurances from Shell regarding its "past drilling experience . . . ." Supp. Statement of Basis at 30. Remarkably, despite the obvious risk of relying upon Shell's unsubstantiated appraisal, Region 10 determined that there is no need for Shell to monitor or report these emissions. This lack of monitoring or reporting renders the greenhouse gas owner requested limit unenforceable as a practical matter. *See* Memorandum from Terrell E. Hunt, Associates Enforcement Counsel, Air Enforcement Division, U.S. EPA Office of Enforcement and Compliance Monitoring, and John S. Seitz, *Guidance on Limiting Potential to Emit in New Source Permitting* at 5-6 (Jun. 13, 1989) (stating that some system of verification of compliance is necessary to track compliance with production or operational limits); *see also* 18 A.A.C. 50.225(b)(5) (a request for an owner requested limit shall include "a description of a verifiable method to attain and maintain the limit, including monitoring and recordkeeping requirements").

Additionally, Region 10's limit on Shell's use of fuel is not practically enforceable. The draft permits require Shell to track the use of fuel by associated vessels within 25 miles of the source. Draft Revised 2011 Beaufort Sea Permit at 27-29. However, Shell is only required to record the positions of these associated vessels once per hour. *Id.* at 26. Such infrequent monitoring could result in an underestimation of fuel usage if Shell does not record the position of a vessel until well after it has entered the 25 mile radius.

[4] CO_2e means carbon dioxide equivalent. It is a standardized measurement for the climate change forcing effect of various greenhouse gases. The CO_2e for a greenhouse gas is the concentration of CO_2 that would cause the same level of radiative forcing.

Thus, the permits' owner requested limits addressing greenhouse gas emissions are not practically enforceable. Region 10 must either calculate the true maximum potential emissions and apply BACT as necessary, or revise the owner requested limits so that they are practically enforceable.

V. Region 10's environmental justice analysis is deficient because it fails to account for Shell's emissions of greenhouse gases and black carbon.

Executive Order 12898 states that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States . . . ." *See* Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations, 59 Fed. Reg. 7,629 (Feb. 16, 1994). Region 10's environmental justice analysis fails to meet this standard because it relies entirely on expected NAAQS compliance and does not consider the effect of Shell's greenhouse gas and black carbon emissions on indigenous peoples.

The Arctic is already warming rapidly. Climate models predict that temperatures will increase by as much as 6°F by 2040. *See* Anne E. Gore & Pamela A. Miller, Broken Promises: The Reality of Oil Development in America's Arctic at 41 (Sep. 2009). This warming has resulted in visible changes to Alaska's land, water, wildlife, and people. *Id.* at 40. Perhaps the most dramatic change has been the disappearance of sea ice. "As a result of receding and thinning sea ice scientists have observed polar bears drowning and going hungry, walruses forced onto land, and sharp declines in numbers of ice-dependent sea birds." *Id.* at 41. The warming is also threatening indigenous cultures. Arctic animals and subsistence hunts are central to Alaska Native cultures. Today, subsistence hunters have to travel farther to access animals. *Id.* Also, melting permafrost is accelerating coastal erosion and forcing communities to relocate. *Id.*

Shell stands to contribute to this warming, and resulting harm to indigenous cultures, by emitting greenhouse gases and black carbon. Shell's operations could emit as much as 70,000 tpy of CO_2e. Supp. Statement of Basis at 29. EPA's Administrator has found that greenhouse gases are "reasonably anticipated to endanger public health, for both current and future generations." 74 Fed. Reg. 66,496, 66,524 (Dec. 15, 2009). Further, not all regions are equally vulnerable to the effects of climate change. *Id.* at 66,535. America's Arctic—home to a large population of Alaska Natives—stands to suffer more than other locations due to the effects of high rates of projected regional warming on natural systems. *Id.*; Supplemental Environmental Justice Analysis for Proposed Outer Continental Shelf PSD Permit No. R10OCS/PSD-AK-2010-01 & Permit No. R10OCS/PSD-AK-09-01 at 9 ("Supp. EJ Analysis").

Shell's operations also could emit up to 21 tpy of $PM_{2.5}$, *see* Technical Supporting Document at 8, a large proportion of which will be black carbon. EPA, Current Policies, Emission Trends and Mitigation Options for Black Carbon in the Arctic Region (EPA Draft White Paper) at 21-22 (April 28, 2009). Black carbon is generally regarded as the second most important driver of Arctic warming. Black carbon contributes to warming by absorbing incoming and outgoing radiation and by darkening snow and ice, "which reduces the reflection of light back to space and

accelerates melting." Environmental Protection Agency, Report to Congress on Black Carbon External Peer Review Draft at 12-1 (March 2011) ("Black Carbon Report"). Emissions of black carbon from sources in the Arctic are particularly troubling because Arctic emissions can cause substantially more regional warming than similar amounts of black carbon emitted outside the Arctic. *See* D. Hirdman et al., *Source Identification of Short-Lived Air Pollutants in the Arctic Using Statistical Analysis of Measurement Data and Particle Dispersion Model Output*, 10 ATMOS. CHEM. PHYS. 669 (2010).

EPA has recognized black carbon's role in global and Arctic warming. The Administrator has acknowledged that black carbon "is an important climate forcing agent and takes very seriously the emerging science on black carbon's contribution to . . . the high rates of observed climate change in the Arctic." 74 Fed. Reg. at 66,520. Further, in a draft report to Congress on black carbon, EPA recognizes its "high capacity for light absorption and its role in key atmospheric processes link it to a range of climate impacts, including increased temperatures, accelerated ice and snow melt, and disruptions in precipitation patterns." Black Carbon Report at 1-1. EPA states that modeling studies have shown that black carbon radiative forcing "from both atmospheric concentration and deposition on the snow and ice" has contributed to Arctic surface warming. *Id.* at 2-42. One study found that black carbon deposition on sea ice "may have resulted in a surface warming trend of as much as 0.5 to 1°C." *Id.* Other modeling studies have shown increased warming of 0.4 to 0.5°C from black carbon deposited on snow; have shown black carbon may increase snowmelt rates north of 50°N latitude by as much as 19 to 28 percent; and have indicated that black carbon forcing may be the cause of as much as 50 percent of Arctic sea ice retreat. *Id.* at 2-45.

It remains unclear exactly how much Shell's operations could contribute to the warming of the Arctic. The permits are not valid only for a particular term; they could authorize operations for many years and well into the future. However, EPA has not provided any analysis of how much CO_2 and black carbon Shell could emit over the life of the permit.

Region 10's environmental justice analysis is arbitrary because in relying entirely on NAAQS, it failed to account for the effects Shell's CO_2 and black carbon emissions could have on Alaska Natives. In its initial environmental justice analysis, Region 10 relied entirely on Shell's expected compliance with NAAQS in determining that Shell's emissions would not have disproportionately high and adverse human health or environmental effects on minority and low income populations. *See, e.g.*, Region 10, Response to Comments for Outer Continental Shelf Prevention of Significant Deterioration Permit No. R10OCS/PSD-AK-09-01 at 138 (Mar. 31, 2010). Petitioners Alaska Eskimo Whaling Commission ("AEWC") and Inupiat Community of the Arctic Slope ("ICAS") challenged this analysis, arguing that Region 10's complete reliance on NAAQS was arbitrary. AEWC and ICAS, Petition for Review at 67-71 (May 3, 2010). The EAB remanded Region 10's environmental justice analysis, holding that the reliance on then existing NAAQS was insufficient because EPA had indicated that those standards were insufficient to protect public health. *Shell Gulf of Mexico*, 15 E.A.D. at 81-82 (Dec. 30, 2010, Opinion). On remand, Region 10 has made the same mistake the EAB faulted it for previously: by relying on NAAQS compliance, Region 10 has arbitrarily ignored other pollutants and effects recognized by EPA that NAAQS do not address. Supp. EJ Analysis at 21. Region 10's environmental justice analysis is once again lacking. This analysis fails to account for the

adverse effects Shell's greenhouse gas and black carbon emissions could have on minority and low-income populations.

VI. Region 10 should require Shell's associated vessels to employ best available control technology.

On remand, Region 10 has not altered its decision not to require BACT for emissions from Shell's associated vessels. Commenters acknowledge that the EAB in its previous decision refused to compel Region 10 to mitigate those emissions through use of BACT. Nevertheless, we believe Region 10 should reconsider its position.

Despite Shell's commitment to using selective catalytic reduction and oxidation catalyst on ice breaker #1, the associated vessels still will be the source of the vast majority of Shell's emissions. *See* Shell, March 18, 2011, App. at 14. For example, the associated vessels will be responsible for close to 90 percent of Shell's emissions of $PM_{2.5}$, which causes significant effects to both human health and the Arctic environment. Especially in light of the potential for numerous oil companies to pursue similar plans in the future, Region 10 must strictly control associated vessel emissions. The agency's failure to do so could result in the substantial degradation of Arctic air quality.

The plain language of the Clean Air Act requires that Shell apply BACT to associated vessel emissions. Section 328 of the CAA defines emissions of associated vessels within 25 miles of the OCS source as direct emissions of the source. 42 U.S.C. § 7627 (a)(4)(C). It also requires that all OCS source emissions comply with the requirements of the PSD program. *Id.* § 7627(a)(1). This leaves no discretion for Region 10 to apply BACT to only some emissions of the OCS source. Region 10 should require Shell's associated vessels to comply with BACT, as the Clean Air Act demands.

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For the foregoing reasons, EPA should revoke its proposed permits for the *Discoverer*, require Shell to undertake additional analysis to demonstrate compliance with the Clean Air Act, and then determine if permits can be issued lawfully.

Respectfully submitted,

Cindy Shogan
Executive Director
ALASKA WILDERNESS LEAGUE

Eric F. Myers
Policy Director
AUDUBON ALASKA

Rebecca Noblin
Alaska Director
CENTER FOR BIOLOGICAL DIVERSITY

Sierra B. Weaver
Senior Staff Attorney
DEFENDERS OF WILDLIFE

David R. Hobstetter
Associate Attorney
EARTHJUSTICE

Melanie Duchin
Arctic Program Director
GREENPEACE

Jim Adams
Director, Pacific Region
National Wildlife Federation

Caroline Cannon
President
Native Village of Point Hope

Charles M. Clusen
Alaska Project Director
NATURAL RESOURCES DEFENSE COUNCIL

Pamela A. Miller
Arctic Program Director
Northern Alaska Environmental Center

Andrew Hartsig
Director, Arctic Program
OCEAN CONSERVANCY

Susan Murray
Senior Director, Pacific
OCEANA

Carole Holley
Alaska Program Co-Director
PACIFIC ENVIRONMENT

Robert Thompson
Chairman
REDOIL

Dan Ritzman
Alaska Program Director
SIERRA CLUB

Lois N. Epstein, P.E.
Engineer & Arctic Program Director
THE WILDERNESS SOCIETY

Layla Hughes
Senior Program Officer for Arctic Oil, Gas, and Shipping Policy
WORLD WILDLIFE FUND

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