Exhibit 11

U.S. Environmental Protection Agency, Public Hearing,
Shell Discoverer revised PSD air permits for oil and gas exploration in
Beaufort Sea and Chukchi Sea, Barrow, Alaska (Aug. 4, 2011)

EPA
Public Hearing
Shell Discoverer revised PSD air permits for oil and gas exploration in Beaufort Sea and Chukchi Sea
August 4, 2011
6:00 p.m. AT, Barrow, Alaska[1]

Ted Rockwell: I'd like to welcome everyone here this evening who is here in person as well as all the folks on the telephone. Good evening. We'll come to order and begin tonight's proceedings. Tonight's the 4th of August 2011, and it's 7:08 pm. We're here to hold a public hearing on the Environmental Protection Agency's proposed revised air permits to Shell for oil and gas exploration using the Discoverer drillship in the Beaufort Sea (Camden Bay) and Chukchi Sea on the outer continental shelf. EPA is asking for public comment from July 6 to August 5, 2011 on these revised draft air permits.

Shell plans to operate the Discoverer drillship and support fleet for oil and gas exploration drilling beginning in 2012 on the Beaufort Sea OCS, within and beyond 25 miles of the Alaska seaward boundary and on the Chukchi Sea OCS, 25 miles beyond the Alaska seaward boundary as authorized by the U.S. Bureau of Ocean and Energy Management and Regulatory Enforcement.

EPA Region 10 issued the previous permits in 2010. The current 2011 draft permits, 2011 supplemental statement of basis, and 2011 supplemental application are available on EPA's website.

The Environmental Appeals Board remanded the 2010 permits to EPA Region 10 for further consideration. EPA Region 10 has proposed revised draft air permits to address these remand issues.

Only those parts of the current 2011 revised draft permits proposed for revision and the information and analyses supporting those revisions are open for public comment. Please identify in your comments if your comments relate to the Shell Chukchi permit, the Shell Beaufort permit, or both.

This hearing is to receive your comments on the proposed revised air permits. To state again for the record, this hearing is being held on Thursday, August 4, 2011, in the Inupiat Heritage Center, Barrow, Alaska.

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[1] Transcribed by Suzanne Skadowski, EPA Region 10, from digital recording of hearing and telephone recording of conference line. Transcript was completed on September 13, 2011.

Communities outside of Barrow can participate in this hearing at all of the North Slope Borough teleconference centers who have joined us on the phone tonight.

I'd like to remind the folks on the phone tonight that we can take their testimony but they will need to let us know that they want to provide testimony. Cathy Villa in the back of the room by the sign-in sheet or any of the other EPA people here tonight can take your name on the sign in sheet and get that to me so that I am able to call on you.

My name is Ted Rockwell. I'm the acting deputy director of the Alaska Operations office and I'm the Public Hearing Officer for EPA Region 10 for this public hearing.

As the Hearing Officer for tonight's hearing, it's my responsibility to ensure this hearing is run properly and that any person who wants to provide testimony can do so.

I would like to introduce the following people from EPA who are here with me: Rick Albright, Air Office Director, Doug Hardesty, who is the Air Permit Project Manager, Andy Hawkins, air modeler and Cathy Villa, Alaska Tribal Coordinator.

We are recording this hearing with a digital recorder up here, and recording the EPA teleconference telephone line - which is why we had to take the earlier pause so that we could get that properly set up. We're doing this so that we can accurately record the testimony being given. If you're going to be providing testimony this evening, please speak slowly and clearly into the microphone at the table here in front of me and please spell your first and last names.

We will receive comments until all people who wish have had an opportunity to speak.

Public notice of this hearing was published in the "Anchorage Daily News" on July 1st and in the "Arctic Sounder" on July 11th. As well as by multiple notices sent via web, email and mail. The public comment period began on July 6th and ends August 5th, 2011.

This public hearing has been called with two goals in mind. 1st, we would like to give all interested parties an opportunity to express their views on the proposed revised air quality permits, 2nd we want to obtain as much relevant information from you as possible to assist us in approving or modifying these proposed permits.

EPA will respond to all comments received in a written response to comments document that will accompany our final permit decisions. Copies of the permits and a statement of basis for the permits are available in city offices or libraries in Barrow, Kaktovik, Nuiqsut, Wainwright, Point Hope, Point Lay, Anaktuvuk Pass and Atqasuk and at the EPA offices in Anchorage and Seattle, and on our Web site.

If you wish to provide testimony this evening, please sign up at the sign-in table or if you are on the phone, please let Cathy Villa know, so she can give your name to me.

You do not need to provide testimony this evening in order to have your concerns or comments considered. Written comments are given equal consideration in our decision making. You have the option of providing spoken testimony tonight, written comments later or both. If you choose to provide written comments you need to mail or e-mail them to the addresses shown on the information sheet. You can also send EPA your comments recorded on a cassette tape or CD or electronic file. All of your comments must be postmarked to EPA by midnight August 5th 2011– that's tomorrow.

Yesterday, on August 3rd, and again earlier tonight we held an informational meeting on these air permits, to explain the permits and to answer questions from the public. If you have any further questions, we will take note of your questions, and we will follow up with you by telephone or email.

I'd like to begin taking your comments at this time. Once again reminding you if anyone would like to give testimony to please sign up at the back.

So to begin, let me remind you to state your name clearly for the record and include your organization if you represent an organization. And please spell your first and last names.

I would also like to suggest that if you have testimony that is similar to a previous speaker, if you wish you can simply say that "I agree with [name the person]" and their testimony will be entered into the record as your testimony as well, if you feel that you don't want to reiterate what someone else has said.

With that, I ask Price Leavitt to be our first speaker. [INAUDIBLE]

Price Leavitt: My name is Price Leavitt and I represent the Inupiat Community of the Arctic Slope. Am I speaking close enough to the mic? How about on the people on the teleconference line, can you hear me?

the goal of having no significant impact on the environment or coastal villages.

For the Discoverer PSD permits, Shell has reduced its allowable emissions below those allowed in the original 2010 permits by incorporating additional measures into our program. These measures include the commitment to use Ultra Low Sulfur fuel in all of our vessels, not just the Discoverer. And we will be installing SCR and other control technologies not only on the engines of the Discoverer but also on our ice management vessels and our anchor handling vessels.

These efforts as well as other smaller steps add to a significant reduction in Shell's allowable emissions from those in the 2010 permits. Specifically, we have demonstrated a 59% reduction in NOx emissions from the Discoverer and 80% reductions in NOx from the associated fleet, a 30% reduction in PM from the Discoverer and close to 65% reductions in PM from the associated fleet. Reductions of 35% in our CO emissions from the Discoverer and close to 70% from the associated fleet. A 65% reduction of VOC from the Discoverer and over 50% lower VOC emissions from the associated fleet.

These current permits now reflect more closely our actual emissions. Shell understands the importance of maintaining high air quality standards for the residents of the North Slope. This draft permit goes even farther than previous permits to enable us to do just exactly that. To quote Lisa Jackson, the EPA Administrator, in her testimony to Senator Lisa Murkowski during a March 2011 senate interior appropriations subcommittee hearing regarding Shell's permits, quote "I just have to say that I believe that the analysis will clearly show that there is no public health concern here." Ms. Jackson continues to state that, "In fact, these activities will not cause air pollution that will endanger public health."

Ted Rockwell: Thank you very much. At this time have we had any requests from anyone on the telephone to provide testimony?

Cathy Villa: I have not heard from anybody.

Ted Rockwell: Would anyone on the telephone like to give testimony? Is there anyone in the room who would like to give testimony? Sir?

Earl Kingik: My name is Earl Kingik. First of all you mentioned earlier that if you like somebody's testimony to request to put your name on their testimony? I would like to have my name on Rosemary's testimony, because she comes from an impacted community, and my community will be impacted. I work for Alaska Wilderness League as their tribal liaison officer for the last 4 or 5 years. I would like to testify on behalf of the Chukchi Sea and

Beaufort Sea sea mammals that couldn't be here and wishing that they could be here to teach you guys giving permits and stuff like that. First of all, I would like you to let BOEMRE know to reject any kind of permit that Shell Oil is bringing forth, both in the Chukchi and the Beaufort air quality permits.

Shell Oil has a bad history in the [inaudible] Islands, South America, Africa and elsewhere. Every day you get to see what kind of activities they have made and what kind of damage that has happened in those other countries. We don't want that to happen in the Arctic, in the Chukchi Sea or in the Beaufort. We don't want any permits to be applied. We want BOEMRE to reject all Shell Oil permits, Conoco permits, Statoil or any development that's going to be happening in the Arctic.

I come from a community that is very old - the oldest inhabited community on the North American continent. I don't follow animals to go hunt, animals come to me. They help keep me alive, to put food on the table, to unite my people, and to keep our way of life together. It's been like this for thousands of years. Point Hope is part of the ecosystem of the ocean. We want to protect our garden that we love the most, that keeps our people together.

So you see, I strongly recommend that EPA tell BOEMRE: "no permits should be permitted to Shell Oil." Under the revised permits that EPA has now proposed, Shell's actions shall pose great risk to human health and the pelagic environment. The new permits under consideration do not do enough to make sure that Shell air pollution will not harm the local people and the environment. EPA should require Shell to comply with additional limits and demonstrate that the air pollution will not violate air standards established to protect human health.

Also, Region 10, my friend, Region 10 must be sure to take into account whether other polluting activities could make the affects of Shell's operations even worse. They should also fully analyze the potential for Shell's operations to harm Alaska natives whose communities would be exposed to the amount of pollution from Shell's drilling.

It is EPA's mission to protect, to protect Americans from environmental harm. Once again, it is EPA's mission to protect Americans from environmental harm. The permits under consideration still pose a great threat to human health and to the surrounding environment that local people and wildlife depend on to provide for us.

The Inupiaq people spend much of our time on the ice and boating on the Arctic Ocean. Winds can carry air pollution for miles, impacting hunters and the nearby communities. EPA should enforce stronger regulation to protect human health and uphold environmental justice. Once again, EPA should enforce the strongest regulation to protect human health and uphold environmental justice.

Thank you very much for listening. Still, I recommend that BOEMRE should not give permission to do anything in the Chukchi and the Beaufort. I wish that the bowhead whale, I wish the walrus, the bearded seal, and all the other sea mammals could come and testify. Tonight I have testified on behalf of them. Thank you.

Ted Rockwell: Thank you. Next is Doreen Lampe.

Doreen Lampe: [Portions of Doreen Lampe's testimony is inaudible. Region 10 requested via email that Doreen Lampe provide us a written copy of her testimony from which she read at the hearing. As of September 13, 2011, Region 10 had not received a copy of her testimony.]

My name is Doreen Lampe. First of all I want to thank you for honoring the Inupiat Community of the Arctic Slope request for government to government consultation at the meeting yesterday.

[inaudible] Regarding the Shell Oil Discoverer air permits, number 1, I'd like to request that ICAS offices be added to the cc list for all construction reports and monitoring reports and air pollution emission reports.

Number 2, the AERMOD modeling that is used to determine the threshold pollution limits should be better explained. [inaudible] and the [inaudible] comment period extended to use the new standards regarding global climate change, the amounts of CO levels, and CO2 levels.

Number 3, you need to show the enforceability of self-monitoring by the companies, and honest reporting, for example the BP Deepwater Horizon incident. I don't think there was any honest reporting going on there.

[inaudible] Number 4, the inspection of vessels like the Discoverer and Kulluk should be before entering and using in harsh arctic conditions. They should be inspected in person by the tribes and the communities. We heard one of Shell's vessels was in a storm and was badly damaged. [inaudible]

Number 5, I'd like to see a program where the oil industry have to use the [inaudible] monitoring program and have a separate entity like the Inupiat oil industry who can monitor and inspect the whole drilling process.

[inaudible] Also have a stronger entity like President Barak Obama or [inaudible] involved in enforcing these permit conditions. At this time no one can really enforce the laws and the oil industry will not voluntarily abide by something that would jeopardize their million-dollar project. For

Exhibit 12

Pacific Environment, 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)

PACIFIC ENVIRONMENT
Protecting the Living Environment of the Pacific Rim

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

Pacific Environment hereby submits 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 planned oil and gas exploration drilling operations in the Beaufort Sea and the Chukchi Sea.

As an initial matter, Pacific Environment submits these comments in addition and in support of the comments submitted by Earthjustice, Pacific Environment, Alaska Wilderness League and other environmental groups who are invested in the health of the people and the ecosystems of America's Arctic.

Pacific Environment is a nonprofit organization dedicated to working with communities to protect the living environment of the Pacific Rim and Arctic regions adjacent thereto. Pacific Environment has been working to protect Alaska and Russian Arctic regions for nearly two decades. We work closely with communities who are greatly concerned about environmental justice violations and threats to their way of life as well as their health. This work has included advocating for the protection of endangered whales and other mammals from the harms posed by seismic testing, vessel traffic, and offshore oil and gas drilling. It has also included extensive advocacy for the protection of grey whales, beluga whales, bowhead whales, polar bears, walrus, and other marine mammals, birds and fish species, upon which Arctic indigenous peoples depend. We regularly travel to Arctic Slope communities, listening to community members concerns about such issues as, asthma and respiratory problems that have developed since oil and gas development began in Prudhoe Bay. Our work has included petitions under the Endangered Species Act and administrative advocacy at a variety of public hearings related to oil and gas development, seismic testing, fisheries protection, shipping traffic, the protection of important subsistence resources, and global warming. In sum, Pacific Environment has a significant history of advocacy and involvement in environmental and social justice issues affecting the biological and cultural diversity of Alaska and its marine environment. Our current involvement with regard to issues affecting the Beaufort Sea and Chukchi Sea falls squarely within our organizational interests and mission.

We are submitting this brief letter in addition to our technical comments to advocate for an inspection of Shell's *Frontier Discoverer* and associated vessels by the EPA. Over the years, Shell has made many assertions about the drill-worthiness of its ships as well as the technological upgrades they have undergone. For example, Shell has asserted throughout the years that the *Kulluk* was "drill-ready"[1] In January 2011, Pete Slaiby asserted "We've spent $200 million in improvements to the Kulluk but we've had it up in the Mackenzie Delta for the last two years, so we have to bring it back and re-heat it, get it ready to go to an active state."[2] When the North Slope Borough (NSB), upon invitation by Shell, along with Shell's own air permit consultant (who drafts their permit applications) toured the *Kulluk*, they found that those assertions were false. Pete Slaiby, in fact, prohibited NSB and Shell's own consultant from participating in a tour of the vessel to view the technological upgrades, which had been previously approved by another Shell employee. Upon questioning by the NSB's consultant, Mr. Slaiby admitted that the *Kulluk* was not drill-ready and that there was no need to, in particular, evaluate the vessel's air pollution sources and control systems because none had been replaced or upgraded as purported.[3] Similar to the *Kulluk,* Shell has made assertions of upgrades to the *Discoverer* and associated vessels that it has requested to operate in the Beaufort and Chukchi seas. As EPA is charged with protecting human health and the environment, it is 1) the agency's obligation due to the reasons outlined in the group letter that Shell's air permits by be denied; but, in the alternative, 2) at the minimum, verify Shell's claims of upgrades to air pollution sources and control systems prior to approving permits for drilling in the Beaufort and Chukchi seas. This can only be done by EPA conducting on-site inspections of the vessels.

In addition to EPA's own mission of protecting human health and the environment, it has the obligation to ensure environmental justice and that the human rights of indigenous peoples on the Arctic Slope are respected. 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 . . . ." Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations, 59 FR 7629 (Feb. 16, 1994). The Obama Administration has repeatedly voiced its concerns that environmental justice issues are addressed, including with Alaska Natives.[4]

Indigenous peoples' traditional lands and natural resources are essential to their physical and cultural survival. Environmental damage such as that wrought by air pollution that adversely affects people and the environment can interfere with the rights of indigenous peoples to life

[1] Shell Scales Back 2011 Arctic Exploration Plan, The Associated Press, October 7, 2010.
[2] Alaska Offshore Special Report: Shell Adds Spill Response Capabilities, Petroleum News, January 23, 2011.
[3] *See* Kulluk Drill Rig Site Visit, Susan Harvey Consulting Report to North Slope Borough, March 11, 2011.
[4] *See* "Every community deserves strong federal protection against pollution and other environmental hazards," said U.S. Department of the Interior Secretary Ken Salazar. "The Department of the Interior is committed to ensuring environmental justice for all populations in the United States – including American Indians, Alaska Natives and rural communities who may be among the most vulnerable to health risks."

and to cultural integrity. It is a fundamental principle of international law that States have a duty to prevent and remedy violations of their international obligations. This extends to non-governmental actors within a States' jurisdiction. The Inter-American Commission on Human Rights has recognized the responsibility of States to prevent non-governmental entities, such as oil companies, from causing environmental degradation that violate human rights.

As the United Nations expert on human rights, Madame Erica Daes stated in her study on land *"Indigenous peoples have a distinctive and profound spiritual and material relationship with their lands and with the air, waters, coastal sea, ice, flora, fauna and other resources. This relationship has various social, cultural, spiritual, economic and political dimensions and responsibilities."*[5]

The International Covenant on Civil and Political Rights (IESCR) was adopted by General Assembly resolution 2200 A (XXI) and came into effect in March 1976. Article 6(1) states that *"every human being has the inherent right to life. This right shall be protected by law. No one shall be arbitrarily deprived of his life."*

Also, article 27 of the IESCR provides that *"in States in which ethnic groups, religious or linguistic minorities exist, persons belonging to such minorities shall not be denied the right, in community with the other members of their group, to enjoy their own culture, to profess and practice their own religion, or to use their own language."*

Article30 of the Convention on the Rights of the Child states that "*in those States in which ethnic, religious, or linguistic minorities or persons of indigenous origin exist, a child belonging to such a minority or who is indigenous shall not be denied the right, in community with other members of his or her group, to enjoy his or her own culture, to profess and practice his or her own religion, or to use his or her own language."*

The United Nations Declaration on the Rights of Indigenous Peoples (the Declaration) was adopted by the General Assembly on September 2007 and is the most comprehensive and relevant human rights standard-setting instrument for Indigenous Peoples. The Declaration itself is a reaffirmation of rights that are found in the UN Charter, both UN Covenants and other legally binding and non-legally binding international instruments relevant to Indigenous Peoples. Article 29 of the Declaration proclaims "*Indigenous people have the right to the conservation and protection of the environment."*

The American Declaration and the American Convention, as well as numerous other international instruments guarantee the right to use and enjoy property. The Inter-American Commission on Human Rights has declared this right to be "among the fundamental rights of man." In the case of indigenous peoples, both the Inter-American Court and the Inter-American Commission recognized that the right to property guarantees the use of those lands to which indigenous peoples have historically had access for their traditional activities and

5 See conclusion of the document E/CN.4/Sub.2/2001/21

livelihood, regardless of domestic title.[6] The Commission has stated that the right to property is impeded "when the State itself, or third parties acting with the acquiescence or tolerance of the State, affect the existence, value, use or enjoyment of that property."[7]

The rights to life, physical integrity and security are the most fundamental of rights guaranteed in all major American and international human rights agreements. In the Inter-American Commission's 1997 Report on the Situation of Human Rights in Ecuador, the Commission addressed environmental degradation caused by irresponsible petroleum exploitation, and noted that where environmental harm causes "serious physical illness, impairment and suffering on the part of the local populace, [it is] inconsistent with the right to be respected as a human being." When the children of villages, such as Nuiqsut, suffer from increased respiratory illnesses due to oil and gas activities, then their basic human rights are being violated.

Additionally, the United States is a member of the Arctic Council. In 1998, the Arctic Council ministers adopted PAME's regional program of action (RPA) for the protection of the Arctic marine environment. The goals for the regional program of action are: to protect human health, prevent and reduce degradation of the marine environment and coastal areas; remediate contaminated areas; support conservation and sustainable use of marine resources; maintain biodiversity; and maintain cultural values.

Shell's exploration plans to drill in the Beaufort and Chukchi seas flout all of these goals. Shell's drilling and support vessels could have considerable human health impacts and will significantly worsen the air quality in and around the drill sites and on the coast. The pollutants released may have serious effects on the health of Alaska Natives in the area, including in the villages of Nuiqsut, Kaktovik and Wainwright. Alaska Natives on the North Slope are already suffering increased respiratory ailments from development -- to increase their exposure shows a wanton disregard for them as individuals and as a people.

On April 24, 2009 indigenous representatives from the Arctic, North America, Asia, Pacific, Latin America, Africa, Caribbean and Russia signed the Anchorage Declaration which was drafted from the Indigenous Peoples' Global Summit on Climate Change. In the Anchorage Declaration, indigenous representatives "call on the phase out of fossil fuel development and a moratorium on new fossil fuel developments on or near Indigenous lands and territories."[8]

[6] *Maya Indigenous Communities of the Toledo District (Belize Maya),* Case 12.053, Inter-Am. C.H.R. Report 40/04 (2004) (Belize) at ¶ 117 (Indigenous property rights are broad, and are not limited "exclusively by entitlements within a state's formal legal regime, but also include that indigenous communal property that arises from and is grounded in indigenous custom and tradition." *See also Awas Tingni* case, *supra*, at ¶ 149 ("By the fact of their very existence, indigenous communities have the right to live freely on their own territories."); *Case of Mary and Carrie Dann* ("*Dann*"), Report No. 75/02, Case 11.140 (United States), Inter-Am. C.H.R., 2002 ¶ 129 (2002).
[7] *Maya Indigenous Communities of the Toledo District (Belize Maya),* Case 12.053, Inter-Am. C.H.R. Report 40/04 (2004) (Belize) at ¶ 140.
[8] Anchorage Declaration, Call for Action 1(A).

PACIFIC ENVIRONMENT
Protecting the Living Environment of the Pacific Rim

Due to the ecological sensitivity of the Arctic, as well as the political sensitivity around possible human rights and environmental justice violations, Pacific Environment asks that Shell's air permits for operations in the Beaufort and Chukchi seas be denied. In the alternative, at the very least, the EPA should inspect all vessels related to the operations and ensure that Shell has indeed made the modifications they have indicated. This request is in addition to the technical comments made on behalf of the coalition of environmental groups.

Respectfully,

Carole A. Holley
Alaska Program Co-Director
Pacific Environment

Exhibit 13

U.S. Environmental Protection Agency, Public Notice,
Shell Discoverer Air Permit, Beaufort Sea

URL: http://yosemite.epa.gov/R10/airpage.nsf/Permits/beaufortap
Last updated on Sunday, October 23rd, 2011.

Region 10: the Pacific Northwest

You are here: EPA Home Region 10 Air Page Permits beaufortap

Shell Discoverer Air Permit - Beaufort Sea

Final air permits issued

On September 19, 2011, EPA issued final Outer Continental Shelf/Prevention of Significant Deterioration Clean Air Act permits to Shell Gulf of Mexico Inc. and Shell Offshore Inc. for oil and gas exploration in the Beaufort Sea and the Chukchi Sea. The permits authorize air emissions from Shell's exploration drilling with the Discoverer drillship and a support fleet of icebreakers, oil spill response vessels, and supply ships for up to 120 days each year. Shell plans to begin exploration drilling in 2012, as authorized by the U.S. Bureau of Ocean and Energy Management and Regulatory Enforcement.

The public comment period on the draft air permits began July 6 and ended August 5, 2011. EPA received numerous written and oral comments on the permits. EPA Region 10 has carefully reviewed and considered the comments , federal statutes and regulations, and additional relevant material contained in the administrative record. EPA Region 10 has decided to issue final OCS/PSD permits to Shell Gulf of Mexico Inc. and Shell Offshore Inc. in accordance with 40 CFR 52.21 and 40 CFR Part 55.

Petitions for review of these permits must be submitted to the Environmental Appeals Board no later than **October 24, 2011**. See below for more information about appeals.

Shell 2011 Final Air Permit Documents

- New! Final Shell Discoverer Beaufort Air Permit (PDF) (100 pp, 630K, About PDF)
- New! EPA's Response to Public Comments (PDF) (125 pp, 700K)
- 2011 Supplemental Statement of Basis for Shell Discoverer Chukchi and Beaufort Permits (PDF) (70 pp, 842K)

Draft Permit and Other Related Documents

- Shell Beaufort Final OCS PSD Air Permit redline strikeout version (PDF) (101 pp, 724K) *This redline/strikeout version of the final permit is provided only to show the changes to the final permit as compared to the draft permit.*
- 2011 Shell Discoverer Beaufort Revised Draft Permit (PDF) (101 pp, 711K, About PDF)
- 2011 public comments on draft permits for Shell Discoverer (as of August 12, 2011)
- Review of Ambient Air Quality Impact Analysis (PDF) (35 pp, 1.7MB)
- Supplemental Environmental Justice Analysis (PDF) (21 pp, 688K)
- 2011 Supplemental Application Documents for Shell Discoverer Chukchi and Beaufort Permits
- 2011 Shell Discoverer Beaufort Revised Draft Permit - Redline/Strikeout Version (PDF) (106 pp, 819K) *This redline/strikeout version of the permit is provided only to show the changes to the 2011 Revised Draft Permit as compared to the 2010 Permit.*
- 2010 Final Air Permit
- 2010 Proposed Air Permit
- 2010 Permit Application Materials and EPA Responses
- 2010 Public Comments

Contact Us

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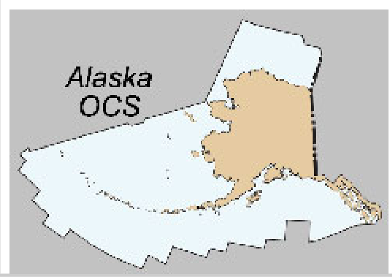
Join our mailing list to receive updates about Arctic water and air permits.

Related Information

- Alaska Outer Continental Shelf (OCS) Permits
  - Shell Discoverer Air Permit (Chukchi Sea)
  - Shell Kulluk Air Permit (Beaufort Sea)
  - ConocoPhillips Air Permit (Chukchi Sea)
- Arctic Oil & Gas Wastewater General Permits
- New Source Review/Prevention of Significant Deterioration Permits

What is the Outer Continental Shelf?

The Outer Continental Shelf (OCS) refers to federal submerged lands that lie seaward of the states' jurisdiction (generally three nautical miles from the shoreline).



Environmental Appeals Board - Petitions Due by October 24, 2011

EPA Region 10 issued the original permits to Shell for this project in March and April 2010. The permits were appealed and overturned on some issues by the Environmental Appeals Board (EAB). EPA appealed for reconsideration and these revised final permits address the concerns raised by the EAB.

Any person who commented on the proposed permits may petition the EAB to review any condition of the final permits. The petition must include a statement of the reasons for requesting review by the EAB including a demonstration that any issues being raised were raised during the public comment period and, when appropriate, a showing that the conditions are based on 1) a finding of fact or conclusion of law which is erroneous, or 2) an exercise of discretion or an important policy consideration which the EAB should review. Any person who did not file comments or did not participate in the public hearing on the draft permits may petition for administrative review only on changes from the proposed permit to the final permits.

Any person who failed to file comments or failed to participate in the public hearing on the draft permits may petition for administrative review only to the extent of the changes from the proposed permits to the final permits decisions.

Per the EAB Orders, appeals of the revised final permits are limited to issues addressed by EPA Region 10 in the revised permits and to issues otherwise raised in the petitions on the 2010 permits but not addressed by EPA Region 10 in the revised final permits. No new issues may be raised that could have been raised but were not raised in appeals of the 2010 permits. This permit becomes effective 35 days after the service of notice of the final permits decisions, unless the permits are appealed to the EAB.

Petitions for review of these permits must be submitted to the EAB no later than **October 24, 2011**. For more information about the procedures for appeal to the EAB:

- Environmental Appeals Board
- 40 CFR 124.19 (PDF) (2 pp, 40K) - Appeal of RCRA, UIC, NPDES, and PSD Permits.

Where to Review Hard Copy Documents

The permit record includes Shell's applications and supplemental application materials, the final permits, supplemental statement of basis, EPA Region 10's response to public comments, and all other materials relied on by EPA.

The permit record is available for review at **EPA Region 10, 1200 6th Ave, Seattle, Washington, 9am-5pm Monday-Friday (206-553-1200)**.

The final permits, supplemental statement of basis, and response to public comments will also be available at these locations in Alaska:

> **EPA, Federal Building**, 222 West 7th Ave, Anchorage (907-271-5083); **Barrow City Office**, 2022 Ahkovak Street, Barrow (907-852-4050); **Nuiqsut City Office**, 2230 2nd Avenue, Nuiqsut (907-480-6727); **Kaktovik City Office**, 2051 Barter Avenue, Kaktovik (907-640-6313); **Wainwright City Office**, 1217 Airport Road, Wainwright (907-763-2815); **Kali School Library**, 1029 Ugrak Ave, Point Lay (907-833-2312); **Point Hope City Office**, 530 Natchiq Street, Point Hope (907-368-2537); **Atqasuk City Office**, 5010 Ekosik Street, Atqasuk (907-633-6811); **Anaktuvuk Pass City Office**, 3031 Main St, Anaktuvuk Pass (907-661-3612).

For more information or to request a copy of permit documents, contact Suzanne Skadowski, 206-553-6689.

Exhibit 14

U.S. Environmental Protection Agency, Public Notice,
Shell Discoverer Air Permit, Chukchi Sea

URL: http://yosemite.epa.gov/R10/airpage.nsf/Permits/chukchiap
Last updated on Sunday, October 23rd, 2011.

Region 10: the Pacific Northwest

You are here: EPA Home Region 10 Air Page Permits chukchiap

Shell Discoverer Air Permit - Chukchi Sea

Final air permits issued

On September 19, 2011, EPA issued final Outer Continental Shelf/Prevention of Significant Deterioration Clean Air Act permits to Shell Gulf of Mexico Inc. and Shell Offshore Inc. for oil and gas exploration in the Chukchi Sea and the Beaufort Sea. The permits authorize air emissions from Shell's exploration drilling with the Discoverer drillship and a support fleet of icebreakers, oil spill response vessels, and supply ships for up to 120 days each year. Shell plans to begin exploration drilling in 2012, as authorized by the U.S. Bureau of Ocean and Energy Management and Regulatory Enforcement.

The public comment period on the draft air permits began July 6 and ended August 5, 2011. EPA received numerous written and oral comments on the permits. EPA Region 10 has carefully reviewed and considered the comments , federal statutes and regulations, and additional relevant material contained in the administrative record. EPA Region 10 has decided to issue final OCS/PSD permits to Shell Gulf of Mexico Inc. and Shell Offshore Inc. in accordance with 40 CFR 52.21 and 40 CFR Part 55.

Petitions for review of these permits must be submitted to the Environmental Appeals Board no later than **October 24, 2011**. See below for more information about appeals.

Shell 2011 Final Air Permit Documents

- New! Final Shell Discoverer Chukchi Air Permit (PDF) (81 pp, 600K, About PDF)
- New! EPA's Response to Public Comments (PDF) (125 pp, 700K)
- 2011 Supplemental Statement of Basis for Shell Discoverer Chukchi and Beaufort Permits (PDF) (70 pp, 842K)

Draft Permit and Other Related Documents

- Shell Discoverer Chukchi Final OCS PSD Air Permit redline strikout version (PDF) (82 pp, 690K) *This redline/strikeout version of the final permit is provided only to show the changes to the final permit as compared to the draft permit.*
- 2011 Shell Discoverer Chukchi Revised Draft Permit (PDF) (81 pp, 672K)
- 2011 public comments on draft permits for Shell Discoverer (as of August 12, 2011)
- Review of Ambient Air Quality Impact Analysis (PDF) (35 pp, 1.7MB)
- Supplemental Environmental Justice Analysis (PDF) (21 pp, 688K)
- 2011 Supplemental Application Documents for Shell Discoverer Chukchi and Beaufort Permits
- 2011 Shell Discoverer Chukchi Revised Draft Permit - Redline/Strikeout Version (PDF) (106 pp, 819K) *This redline/strikeout version of the permit is provided only to show the changes to the 2011 Revised Draft Permit as compared to the 2010 Permit.*
- 2010 Final Air Permit and Related Documents
- 2010 Proposed Air Permit
- 2010 Permit Application Materials
- EPA Responses to Initial 2010 Permit Applications
- 2010 Public Comments
- 2009 Proposed Air Permit
- 2009 Public Comments

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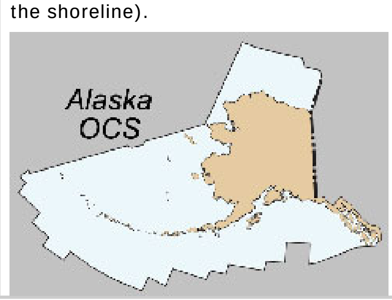
Join our mailing list to receive updates about Arctic water and air permits.

Related Information

- Alaska Outer Continental Shelf (OCS) Permits
  - Shell Discoverer Air Permit (Beaufort Sea)
  - Shell Kulluk Air Permit (Beaufort Sea)
  - ConocoPhillips Air Permit (Chukchi Sea)
- Arctic Oil & Gas Wastewater General Permits
- New Source Review/Prevention of Significant Deterioration Permits

What is the Outer Continental Shelf?

The Outer Continental Shelf (OCS) refers to federal submerged lands that lie seaward of the states' jurisdiction (generally three nautical miles from the shoreline).



Environmental Appeals Board - Petitions Due by October 24, 2011

EPA Region 10 issued the original permits to Shell for this project in March and April 2010. The permits were appealed and overturned on some issues by the Environmental Appeals Board (EAB). EPA appealed for reconsideration and these revised final permits address the concerns raised by the EAB.

Any person who commented on the proposed permits may petition the EAB to review any condition of the final permits. The petition must include a statement of the reasons for requesting review by the EAB including a demonstration that any issues being raised were raised during the public comment period and, when appropriate, a showing that the conditions are based on 1) a finding of fact or conclusion of law which is erroneous, or 2) an exercise of discretion or an important policy consideration which the EAB should review. Any person who did not file comments or did not participate in the public hearing on the draft permits may petition for administrative review only on changes from the proposed permit to the final permits.

Any person who failed to file comments or failed to participate in the public hearing on the draft permits may petition for administrative review only to the extent of the changes from the proposed permits to the final permits decisions.

Per the EAB Orders, appeals of the revised final permits are limited to issues addressed by EPA Region 10 in the revised permits and to issues otherwise raised in the petitions on the 2010 permits but not addressed by EPA Region 10 in the revised final permits. No new issues may be raised that could have been raised but were not raised in appeals of the 2010 permits. This permit becomes effective 35 days after the service of notice of the final permits decisions, unless the permits are appealed to the EAB.

Petitions for review of these permits must be submitted to the EAB no later than **October 24, 2011**. For more information about the procedures for appeal to the EAB:

- Environmental Appeals Board
- 40 CFR 124.19 (PDF) (2 pp, 40K) - Appeal of RCRA, UIC, NPDES, and PSD Permits.

Where to Review Hard Copy Documents

The permit record includes Shell's applications and supplemental application materials, the final permits, supplemental statement of basis, EPA Region 10's response to public comments, and all other materials relied on by EPA.

The permit record is available for review at **EPA Region 10, 1200 6th Ave, Seattle, Washington, 9am-5pm Monday-Friday (206-553-1200)**.

The final permits, supplemental statement of basis, and response to public comments will also be available at these locations in Alaska:

> **EPA, Federal Building**, 222 West 7th Ave, Anchorage (907-271-5083); **Barrow City Office**, 2022 Ahkovak Street, Barrow (907-852-4050); **Nuiqsut City Office**, 2230 2nd Avenue, Nuiqsut (907-480-6727); **Kaktovik City Office**, 2051 Barter Avenue, Kaktovik (907-640-6313); **Wainwright City Office**, 1217 Airport Road, Wainwright (907-763-2815); **Kali School Library**, 1029 Ugrak Ave, Point Lay (907-833-2312); **Point Hope City Office**, 530 Natchiq Street, Point Hope (907-368-2537); **Atqasuk City Office**, 5010 Ekosik Street, Atqasuk (907-633-6811); **Anaktuvuk Pass City Office**, 3031 Main St, Anaktuvuk Pass (907-661-3612).

For more information or to request a copy of permit documents, contact Suzanne Skadowski, 206-553-6689.

Exhibit 15

U.S. Environmental Protection Agency, 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

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, 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 $\mu g/m^3$) 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 $\mu g/m^3$) 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 98^{th} 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 98^{th} 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 98^{th} 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 93^{rd} percentile, not the 98^{th} 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 98^{th} 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 98^{th} 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

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[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 8^{th} high modeled-plus-background value, which is the 98^{th} 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 98^{th} 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.

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 98^{th} 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 98^{th} 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 98^{th} 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 98^{th} 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 98^{th} 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

Exhibit 16

U.S. Environmental Protection Agency, Region 10
Results_Disco_Iter01e_NO2_BS09B, Calc Sheet

Petitioners' Note: This exhibit is an excerpted, modified, printed version of a modeling file, in the form of an Excel spreadsheet, that was provided to counsel for Petitioners by Region 10. The original file is part of the administrative record.

Each row of this excerpt represents a distinct receptor location for which ambient 1-hour average concentrations of nitrogen dioxide (NO_2) were modeled; the original file contains roughly two thousand additional rows.

The eight columns of this excerpt list, from left to right, each receptor's eight highest daily maximum 1-hour NO_2 concentrations, expressed in micrograms per cubic meter ($\mu g/m^3$). The original file contains a few thousand additional columns, including one for each hour of the drilling season that was modeled.

The single highest daily maximum 1-hour NO_2 concentration for each receptor appears in the first column (column 1). The rows of the original modeling file were sorted by the value in this column, highest (top) to lowest (bottom). The rows were sorted in this manner to make the highest daily maximum 1-hour average concentrations readily apparent.

High Daily 1-hr High Impacts

HxH Impacts

1	2	3	4	5	6	7	8
198.7749	86.94934	84.14408	54.57531	32.8138	32.72093	32.45333	31.8498
192.8293	104.7269	67.85459	49.27217	33.01605	32.81506	29.84139	29.66532
185.3475	111.9301	68.38077	54.00442	34.70633	32.69926	30.27015	27.00285
182.2643	83.652	79.18977	54.44079	34.42804	33.74926	33.26913	31.8538
179.2358	84.95646	71.41112	50.65539	33.47982	33.17854	31.93625	31.14087
177.8023	150.4326	136.4241	91.70668	45.95192	44.15269	39.61499	38.58947
175.6229	167.6711	143.3942	84.96967	43.93878	40.64432	37.74897	36.18357
173.5576	108.0079	42.37514	38.74945	37.4796	35.86509	35.30338	34.25213
172.2824	81.0098	64.58373	41.46328	36.24044	33.51042	32.97591	32.13194
171.8108	101.1382	68.43602	55.45832	35.31252	32.27773	32.0521	28.41879
171.7476	121.0498	54.34502	47.16126	33.63093	32.27568	27.72405	27.13201
170.9443	151.8771	150.1451	73.77016	41.26721	40.60004	38.29013	35.19396
169.0264	117.6181	55.35136	51.3688	35.36542	32.62154	28.76461	27.46707
167.567	101.9566	43.41963	42.36858	39.30925	37.7703	36.92573	35.81344
165.9146	94.08699	61.13917	41.43294	36.61306	31.85299	31.54279	30.98569
165.324	93.36623	61.3905	47.74366	42.97784	33.69378	31.61054	30.92508
164.9296	133.6095	129.4499	94.37795	49.58145	47.32482	43.16893	41.0044
163.9107	72.25114	68.22258	62.98378	62.44725	59.62941	52.21202	49.56724
162.8802	135.2631	129.7217	68.411	42.6927	42.2841	39.22285	35.91075
161.0851	137.5849	131.7224	51.61777	48.5152	44.54584	39.81483	38.0259
161.0691	104.8342	47.54167	46.41581	42.50472	40.58539	40.24965	36.37745
160.9112	103.7101	56.03287	53.5171	36.22506	32.45573	30.29642	27.7563
160.8179	101.6706	46.73163	39.37218	36.57711	34.59955	34.54959	31.83486
160.0759	77.34273	60.19425	49.70096	41.32047	33.88922	33.87047	31.86181
160.0273	82.45424	69.12092	52.24698	36.14822	34.06628	32.96208	30.92885
159.7042	98.05255	38.95749	37.49861	35.67074	35.30645	33.89979	33.82217
159.0934	78.29777	72.86911	71.51882	61.70666	61.57446	51.14689	48.575
159.0122	74.77527	70.2557	64.60332	63.5096	61.6556	52.86418	50.07853
158.8353	99.18273	83.47511	45.27779	42.80168	32.99712	30.91581	30.50915
158.7525	139.035	131.8717	84.93685	44.22295	35.84115	35.63688	35.21474
157.988	120.5973	113.6538	80.97862	71.07315	65.97656	65.22041	64.5017
157.9856	149.142	119.2707	58.76776	58.75148	47.85715	39.53686	38.42459
156.2438	114.146	45.63174	45.03659	40.94934	39.23882	36.0406	35.07921
156.0429	80.57485	68.14258	54.54247	35.18611	33.10613	31.56951	30.3829
155.6326	98.114	87.66239	72.8631	72.49728	71.42974	69.85718	67.85409
155.4471	110.77	44.87458	43.99072	33.65222	31.83177	28.28701	26.61738
155.3077	111.7475	48.27787	45.31897	35.39372	32.28725	27.71693	25.02398
154.0086	80.89545	72.97136	72.77193	63.70226	62.67545	51.55751	49.19924
153.8305	77.42065	72.4213	66.16472	64.60678	63.84316	53.50433	50.56027

Exhibit 17

Email from Julie Vergeront, Region 10, to David Hobstetter and Colin O'Brien, Earthjustice, Discoverer 1-hour NO2 Impacts Question (Sep. 30, 2011)

Sarah Saunders

Subject: FW: Discoverer 1-hour NO2 Impacts Question
Attachments: pic29348.gif; pic01278.gif

-----Original Message-----
From: Vergeront.Julie@epamail.epa.gov [mailto:Vergeront.Julie@epamail.epa.gov]
Sent: Friday, September 30, 2011 12:22 PM
To: David Hobstetter; Colin O'Brien
Cc: Skadowski.Suzanne@epamail.epa.gov
Subject: Re: Discoverer 1-hour NO2 Impacts Question

Hi David,

You should have by now received (or soon will) as a further interim response to your FOIA request a disc that contains documents in the administrative record for the final Discoverer permits. There are additional modeling files that are on hard drives at Region 10 (the same additional modeling files as identified in connection with the draft permits) and are not on the disc I sent on Wednesday, September 28, 2011.

Your request did not specify which sea you are interested in. We assume you are interested in the Chukhci Sea because that had the highest 1-hour NO2 values.

The eight highest 1-hour NO2 values for the Chukchi Sequence B from Shell's 2009 run (just Shell's impact, no background) are:
(Embedded image moved to file: pic29348.gif)

These results can be found in the spreadsheet:
Results_Disco_NO2_CS09B_Iter01d.xlsx
which is located at \Impact Analyses\Modeling - Full Analysis\Results accompanying Shell's March 18, 2011 submittal. This information is on the hard drives on file with Region 10. Please let us know if you would like to make arrangements to obtain the information on these hard drives.

If you are in interested in the re-analysis R10 did for Sequence B using the new version of AERMOD (including paired background values) that is discussed in the Response to Comments, the top eight 1-hour NO2 values are:
(Embedded image moved to file: pic01278.gif)

These data are located in zipped files on the disc I sent out on Wednesday, September 28, 2011. It is the last entry under Section BB (AERMOD files for Disco RTC (Attachments: 2009a, 2009b, 2010a, 2010b, readme, shell reanalysis with 2010 met)).

Regards,

Julie A. Vergeront
Office of Regional Counsel
U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue, ORC-158
Seattle, WA 98101
Phone (206) 553-1497
Fax (206) 553-0163

From: Suzanne Skadowski/R10/USEPA/US
To: David Hobstetter <dhobstetter@earthjustice.org>, Colin O'Brien <cobrien@earthjustice.org>
Cc: Julie Vergeront/R10/USEPA/US@EPA
Date: 09/29/2011 04:39 PM
Subject:Re: Discoverer 1-hour NO2 Impacts Question

Hi David,

When Julie Vergeront and our air modeler are back in the office tomorrow (Friday), they will get back to you with the information you requested.

Thanks!

Suzanne Skadowski
Community Involvement Coordinator
Environmental Protection Agency
(206) 553-6689

From: David Hobstetter <dhobstetter@earthjustice.org>
To: Suzanne Skadowski/R10/USEPA/US@EPA
Cc: Colin O'Brien <cobrien@earthjustice.org>
Date: 09/29/2011 11:15 AM
Subject:Discoverer 1-hour NO2 Impacts Question

Hi Suzanne,

I hope you are doing well. We have another question for you, and we were hoping that someone with Region 10 could help us. We have looked through the Discoverer documents, and while we were able to find statements of Shell's 98th percentile 1-hour NO2 impact, we were not able to find a record of the top seven highs. Could you please tell us where in the record or the modeling files we could find the rank order list for the top eight highs? Also, if you have the information available, it would be even easier if you could just tell us what the top seven impacts were.

Thank you again for all of your help.

Best,
David

____

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F: 907-277-1390
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Because the earth needs a good lawyer

318.4233	239.663	214.3453	176.9928	174.5737	169.7232	162.2285	160.8279

333.4633	251.883	246.5604	202.4894	185.1216	179.1232	175.3885	175.1879

Exhibit 18

Memorandum from Stephen D. Page, Director, Office of Air Quality Planning and Standards, Re: Guidance Concerning the Implementation of the 1-hour NO2 NAAQS for the PSD Program (June 29, 2010)

Further clarification of this guidance and application of Appendix W for the 1-hour NO2 standard was published March 1, 2011 and is available in the Region 7 NSR Policy & Guidance database.

http://www.epa.gov/region07/air/nsr/nsrmemos/appwno2_2.pdf

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

JUN 29 2010

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program

FROM: Stephen D. Page, Director
Office of Air Quality Planning and Standards

TO: Regional Air Division Directors

On January 22, 2010, the Environmental Protection Agency (EPA) announced a new 1-hour nitrogen dioxide (NO_2) National Ambient Air Quality Standard (hereinafter, either the 1-hour NO_2 NAAQS or 1-hour NO_2 standard) of 100 parts per billion (ppb), which is attained when the 3-year average of the 98th-percentile of the annual distribution of daily maximum 1-hour concentrations does not exceed 100 ppb at each monitor within an area. EPA revised the primary NO_2 NAAQS to provide the requisite protection of public health. The final rule for the new 1-hour NO_2 NAAQS was published in the Federal Register on February 9, 2010 (75 FR 6474), and the standard became effective on April 12, 2010. EPA policy provides that any federal Prevention of Significant Deterioration (PSD) permit issued under 40 CFR 52.21 on or after that effective date must contain a demonstration of source compliance with the new 1-hour NO_2 standard.

EPA is aware of reports from stakeholders indicating that some sources—both existing and proposed—are modeling potential violations of the 1-hour NO_2 standard. In many cases, the affected units are emergency electric generators and pump stations, where short stacks and limited property rights exist. However, larger sources, including coal-fired and natural gas-fired power plants, refineries, and paper mills, could also model potential violations of the new NO_2 NAAQS.

To respond to these reports and facilitate the PSD permitting of new and modified major stationary sources, we are issuing the attached guidance, in the form of two memoranda, for implementing the new 1-hour NO_2 NAAQS under the PSD permit program. The guidance contained in the attached memoranda addresses two areas. The first memorandum, titled, "General Guidance for Implementing the 1-hour NO_2 National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim 1-hour NO_2 Significant Impact Level," includes guidance for the preparation and review of PSD permits with respect to the new 1-hour NO_2 standard. This guidance memorandum sets forth a recommended interim 1-hour NO_2 significant impact level (SIL) that states may consider when carrying out the required

PSD air quality analysis for NO_2, until EPA promulgates a 1-hour NO_2 SIL via rulemaking. The second memorandum, titled "Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard," includes specific modeling guidance for estimating ambient NO_2 concentrations and determining compliance with the new 1-hour NO_2 standard.

This guidance does not bind state and local governments and the public as a matter of law. Nevertheless, we believe that state and local air agencies and industry will find this guidance useful when carrying out the PSD permit process. We believe it will provide a consistent approach for estimating NO_2 air quality impacts from proposed construction or modification of NOx emissions sources. For the most part, the attached guidance reiterates existing policy and guidance, but focuses on how this information is relevant to implementation of the new 1-hour NO_2 NAAQS.

Please review the guidance included in the two attached memoranda. If you have questions regarding the general implementation guidance contained in the first memorandum, please contact Raj Rao (rao.raj@epa.gov). If you have questions regarding the modeling guidance in the second memorandum, please contact Tyler Fox (fox.tyler@epa.gov). We are continuing our efforts to address permitting issues related to NO_2 and other NAAQS including the recently-signed 1-hour sulfur dioxide NAAQS. We plan to issue additional guidance to address these new 1-hour standards in the near future.

Attachments:

1. Memorandum from Anna Marie Wood, Air Quality Policy Division, to EPA Regional Air Division Directors, "General Guidance for Implementing the 1-hour NO_2 National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim 1-hour NO_2 Significant Impact Level" (June 28, 2010).
2. Memorandum from Tyler Fox, Air Quality Modeling Group, to EPA Regional Air Division Directors, "Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard" (June 28, 2010).

cc: Anna Marie Wood
Richard Wayland
Raj Rao
Tyler Fox
Dan deRoeck
Roger Brode
Rich Ossias
Elliott Zenick
Brian Doster

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

June 28, 2010

MEMORANDUM

SUBJECT: General Guidance for Implementing the 1-hour NO_2 National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim 1-hour NO_2 Significant Impact Level

FROM: Anna Marie Wood, Acting Director /s/
Air Quality Policy Division

TO: Regional Air Division Directors

INTRODUCTION

We are issuing the following guidance to explain and clarify the procedures that may be followed by applicants for Prevention of Significant Deterioration (PSD) permits and permitting authorities reviewing such applications to properly demonstrate that proposed construction will not cause or contribute to a violation of the new 1-hour nitrogen dioxide (NO_2) National Ambient Air Quality Standard (hereinafter, either the 1-hour NO_2 NAAQS or 1-hour NO_2 standard) that became effective on April 12, 2010. EPA revised the primary NO_2 NAAQS by promulgating a 1-hour NO_2 NAAQS to provide the requisite protection of public health. Under section 165(a)(3) of the Clean Air Act (the Act) and sections 52.21(k) and 51.166(k) of EPA's PSD regulations, to obtain a permit, a source must demonstrate that its proposed emissions increase will not cause or contribute to a violation of any NAAQS.

This guidance is intended to: (1) explain the recommended procedures for stakeholders to follow to properly address concerns over high preliminary modeled estimates of ambient NO_2 concentrations that suggest potential violations of the new 1-hour NO_2 standard under some modeling and permitting scenarios; (2) help reduce the burden of modeling for the hourly NO_2 standard where it can be properly demonstrated that a source will not have a significant impact on ambient 1-hour NO_2 concentrations; and (3) identify approaches that allow sources and permitting authorities to mitigate, in a manner consistent with existing regulatory requirements, potential modeled violations of the 1-hour NO_2 NAAQS, where appropriate. Accordingly, the techniques described in this memorandum may be used by permit applicants and permitting authorities to configure projects and permit conditions in order to reasonably conclude that a proposed source's emissions do not cause or contribute to modeled 1-hour NO_2 NAAQS violations so that permits can be issued in accordance with the applicable PSD program requirements.

This guidance discusses existing provisions in EPA regulations and previous guidance for applying those provisions but focuses on the relevancy of this information for implementing the new NAAQS for NO_2. Importantly, however, this guidance also sets forth a recommended interim 1-hour NO_2 significant impact level (SIL) that EPA will use for implementing the federal PSD program, and that states may choose to rely upon to implement their PSD programs for NOx if they agree that these values represent *de minimis* impact levels and incorporate into each permit record a rationale supporting this conclusion. This interim SIL is a useful screening tool that can be used to determine whether or not the emissions from a proposed source will significantly impact hourly NO_2 concentrations, and, if significant impacts are predicted to occur, whether the source's emissions "cause or contribute to" any modeled violations of the new 1-hour NO_2 NAAQS.

BACKGROUND

On April 12, 2010, the new 1-hour NO_2 NAAQS became effective. EPA interprets its regulations at 40 CFR 52.21 (the federal PSD program) to require permit applicants to demonstrate compliance with "any" NAAQS that is in effect on the date a PSD permit is issued. (See, e.g., EPA memo dated April 1, 2010, titled "Applicability of the Federal Prevention of Significant Deterioration Permit Requirements to New and Revised National Ambient Air Quality Standards.") Due to the introduction of a short-term averaging period for the 1-hour NO_2 NAAQS, we anticipate that some stationary sources with relatively short stacks may experience increased difficulty demonstrating that emissions from new construction or modifications will not cause or contribute to a violation of the 1-hour NO_2 NAAQS.

We are responding to reports from stakeholders which indicate that some sources, existing and proposed, are modeling high hourly NO_2 concentrations showing violations of the 1-hour NO_2 NAAQS—based only on the source's projected emissions of NOx under some modeling and permitting scenarios. We find that, in many cases, the modeled violations are resulting from emissions at emergency electric generators and pump stations, where short stacks and limited property rights exist. In other cases, the problem may occur during periods of unit startup, particularly where controls may initially not be in operation. Finally, certain larger sources, including coal-fired and natural gas-fired power plants, refineries, and paper mills could also experience problems in meeting the new 1-hour NO_2 NAAQS using particular modeling assumptions and permit conditions.

We believe that, in some instances, the projected violations result from the use of maximum modeled concentrations that do not adequately take into account the form of the 1-hour standard, and are based on the conservative assumption of 100% NOx-to-NO_2 conversion in the ambient air. To the extent that this is the case, it may be possible to provide more accurate projections of ambient NO_2 concentrations by applying current procedures which account for the statistical form of the 1-hour NO_2 standard, as well as more realistic estimates of the rate of conversion of NOx emissions to ambient NO_2 concentrations. See EPA Memorandum from Tyler Fox, Air Quality Modeling Group, to EPA Regional Air Division Directors, "Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard" (June 28, 2010) for specific modeling guidance for estimating ambient NO_2 concentrations consistent with the new 1-hour NO_2 NAAQS. In addition, where short stacks are currently being used, or are under design, it may be possible to lessen the source's air quality impacts without improper dispersion by implementing "good engineering practice" (GEP) stack heights to increase the height of existing or designed stacks to avoid excessive concentrations due to downwash, as described in the guidance below.

It is EPA's expectation that the guidance in this memorandum and available modeling guidance for NO_2 assist in resolving some of the issues arising from preliminary analyses that are reportedly showing potential exceedances of the new 1-hour NO_2 NAAQS that would not be present under more refined modeling applications. In addition, the techniques described in this memorandum may also help avoid violations of the standard through design of the proposed source or permit conditions, consistent with existing regulatory requirements, which enable the source to demonstrate that its proposed emissions increase will not cause or contribute to a modeled violation of the 1-hour NO_2 standard. Moreover, the interim 1-hour NO_2 SIL that is included in this guidance will provide a reasonable screening tool for efficiently implementing the PSD requirements for an air quality impact analysis.

The following discussion provides guidance concerning demonstrating compliance with the new NAAQS and mitigating modeled violations using air quality-based permit limits more stringent than what the Best Available Control Technology provisions may otherwise require, air quality offsets, the use of GEP stack heights, possible permit conditions for emergency generators, and an interim 1-hour NO_2 SIL.

AIR-QUALITY BASED EMISSIONS LIMITATIONS

Once a level of control required by the Best Available Control Technology provisions is proposed by the PSD applicant, the proposed source's emissions must be modeled at the BACT emissions rate(s) to demonstrate that those emissions will not cause or contribute to a violation of any NAAQS or PSD increment. EPA's 1990 Workshop Manual (page B.54) describes circumstances where a source's emissions based on levels proposed through the top-down process may not be sufficiently controlled to prevent modeled violations of an increment or NAAQS. In such cases, it may be appropriate for PSD applicants to propose a more stringent control option (that is, beyond the level identified via the top-down process) as a result of an adverse impact on the NAAQS or PSD increments.

DEMONSTRATING COMPLIANCE WITH THE NEW NAAQS & MITIGATING MODELED VIOLATIONS WITH AIR QUALITY OFFSETS

A 1988 EPA memorandum provides procedures to follow when a modeled violation is identified during the PSD permitting process. See Memorandum from Gerald A. Emison, EPA OAQPS, to Thomas J. Maslany, EPA Air Management Division, "Air Quality Analysis for Prevention of Significant Deterioration (PSD)." (July 5, 1988). In brief, a reviewing authority may issue a proposed new source or modification a PSD permit only if it can be shown that the proposed project's emissions will not "cause or contribute to" any modeled violations.

To clarify the above statement, in cases where modeled violations of the 1-hour NO_2 NAAQS are predicted, but the permit applicant can show that the NOx emissions increase from the proposed source will not have a significant impact *at the point and time of any modeled violation*, the permitting authority has discretion to conclude that the source's emissions will not contribute to the modeled violation. As provided in the July 5, 1988, guidance memo, in such instances, because of the proposed source's *de minimis* contribution to any modeled violation, the source's impact will not be considered to cause or contribute to such modeled violations, and the permit could be issued. This concept continues to apply, and the significant impact level (described further below) may be used as part of this analysis. A 2006 decision by the EPA Environmental Appeals Board (EAB) provides detailed reasoning that demonstrates the permissibility of finding that a PSD source would not be considered to cause or contribute to a modeled NAAQS violation because its estimated air quality impact was insignificant at the time and place of the modeled violations.[1] See In re *Prairie State Gen. Co.*, 13 E.A.D. ___, ___, PSD Appeal No. 05-05, Slip. Op. at 137-144 (EAB 2006)

However, where it is determined that a source's impact does cause or contribute to a modeled violation, a permit cannot be issued without some action taken to mitigate the source's impact. In accordance with 40 CFR 51.165(b)[2], a major stationary source or major modification (as defined at §51.165(a)(1)(iv) and (v)) that locates in an NO_2 attainment area, but would cause or contribute to a violation of the 1-hour NO_2 NAAQS anywhere may "reduce the impact of its emissions upon air quality by obtaining sufficient emission reductions to, at a minimum, compensate for its adverse ambient [NO_2] impact where the major source or major modification would otherwise cause or contribute to a violation ...." An applicant can meet this requirement for obtaining additional emissions reductions by either reducing its emissions at the source, e.g., promoting more efficient production methodologies and energy efficiency, or by obtaining air quality offsets (see below). See, e.g., In re *Interpower of New York, Inc.*, 5 E.A.D. 130, 141 (EAB 1994).[3] A State may also provide the necessary emissions reductions by imposing emissions limitations on other sources through an approved State Implementation Plan (SIP) revision. These approaches may also be combined as necessary to demonstrate that a source will not cause or contribute to a violation of the NAAQS.

Unlike emissions offset requirements in nonattainment areas, in addressing the air quality offset concept, it may not be necessary for a permit applicant to fully offset the proposed emissions increase if an emissions reduction of lesser quantity will mitigate the adverse air quality impact on a modeled violation. ("Although full emission offsets are not required, such a source must obtain emission offsets sufficient to compensate for its air quality impact where the violation occurs." 44 FR 3274, January 16, 1979, at 3278.) To clarify this, the 1988 guidance memo referred to above states that:

> offsets sufficient to compensate for the source's significant impact must be obtained pursuant to an approved State offset program consistent with State Implementation Plan (SIP) requirements under 40 CFR 51.165(b). Where the source is contributing to an

[1] While there is no 1-hour NO_2 significant impact level (SIL) currently defined in the PSD regulations, we believe that states may adopt interim values, with the appropriate justification for such values, to use for permitting purposes. In addition, we are recommending an interim SIL as part of this guidance for implementing the NO_2 requirements in the federal PSD program, and in state programs where states choose to use it.

[2] The same provision is contained in EPA's Interpretative Ruling at 40 CFR part 51 Appendix S, section III.

[3] In contrast to Nonattainment New Source Review permits, offsets are not mandatory requirements in PSD permits if it can otherwise be demonstrated that a source will not cause or contribute to a violation of the NAAQS. See, In re *Knauf Fiber Glass, GMBH*, 8 E.A.D. 121, 168 (EAB 1999).

existing violation, the required offset may not correct the violation. Such existing violations must be addressed [through the SIP].

In addition, in order to determine the appropriate emissions reductions, the applicant and permitting authority should take into account modeling procedures for the form of the 1-hour standard and for the appropriate NOx-NO_2 conversion rate that applies in the area of concern. As part of this process, existing ambient ozone concentrations and other meteorological conditions in the area of concern may need to be considered. Note that additional guidance for this and other aspects of the modeling analysis for the impacts of NOx emissions on ambient concentrations of NO_2 are addressed in EPA modeling guidance, including the June 28, 2010, Memorandum titled, "Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard."

"GOOD ENGINEERING PRACTICE" STACK HEIGHT & DISPERSION TECHNIQUES

If a permit applicant is unable to show that the source's proposed emissions increase will not cause or contribute to a modeled violation of the new 1-hour NO_2 NAAQS, the problem could be the result of plume downwash effects which may cause high ambient concentrations near the source. In such cases, a source may be able to raise the height of its existing stacks (or designed stacks if not yet constructed) to a GEP stack height of at least 65 meters, measured from the ground-level elevation at the base of the stack.

While not necessarily totally eliminating the effects of downwash in all cases, raising stacks to GEP height may provide substantial air quality benefits in a manner consistent with statutory provisions (section 123 of the Act) governing acceptable stack heights to minimize extensive concentrations due to atmospheric downwash, eddies or wakes. Permit applicants should also be aware of the regulatory restrictions on stack heights for the purpose of modeling for compliance with NAAQS and increments. Section 52.21(h) of the PSD regulations currently prohibits the use of dispersion techniques, such as stack heights above GEP, merged gas streams, or intermittent controls for setting NOx emissions limits or to meet the annual and 1-hour NAAQS and annual NO_2 increments. However, stack heights in existence before December 31, 1970, and dispersion techniques implemented before then, are not affected by these limitations. EPA's general stack height regulations are promulgated at 40 CFR 51.100(ff), (gg), (hh), (ii), (jj), (kk) and (nn), and 40 CFR 51.118.

a. *Stack heights*: A source cannot take credit for that portion of a stack height in excess of the GEP height when modeling to develop the NOx emissions limitations or to determine source compliance with the annual and 1-hour NO_2 NAAQS. It should be noted, however, that this limitation <u>does not limit</u> the actual height of any stack constructed by a new source or modification.

The following limitations apply in accordance with §52.21(h):

- For a stack height less than GEP, the actual stack height must be used in the source impact analysis for NOx emissions;

- For a stack height equal to or greater than 65 meters, the impact on NOx emission limits may be modeled using the greater of:
  - A *de minimis* stack height equal to 65 meters, as measured from the ground-level elevation at the base of the stack, without demonstration or calculation (40 CFR 51.100(ii)(1));
  - The refined formula height calculated using the dimensions of nearby structures in accordance with the following equation:

  GEP = H + 1.5L, where H is the height of the nearby structure and L is the lesser dimension of the height or projected width of the nearby structure (40 CFR 51.100(ii)(2)(ii)).[4]

- A GEP stack height exceeding the refined formula height may be approved when it can be demonstrated to be necessary to avoid "excessive concentrations" of NO_2 caused by atmospheric downwash, wakes, or eddy effects by the source, nearby structures, or nearby terrain features. (40 CFR 51.100(ii)(3), (jj), (kk));

- For purposes of PSD (and NOx/NO_2), "excessive concentrations" means a maximum ground-level concentration of NO_2 due to NOx emissions from a stack due in whole or in part to downwash, wakes, and eddy effects produced by nearby structures or nearby terrain features which individually is at least 40 percent in excess of the maximum NO_2 concentration experienced in the absence of such effects and (a) which contributes to a total NO_2 concentration due to emissions from all sources that is greater than the annual or 1-hour NO_2 NAAQS or (b) greater than the PSD (annual) increment for NO_2. (40 CFR 51.100(kk)(1)).

Reportedly, for economic and other reasons, many existing source stacks have been constructed at heights less than 65 meters, and source impact analyses may show that the source's emissions will cause or contribute to a modeled violation of the annual or 1-hour NO_2 NAAQS. Where this is the case, sources should be aware that they can increase their stack heights up to 65 meters without a GEP demonstration.

b. *Other dispersion techniques*: The term "dispersion technique" includes any practice carried out to increase final plume rise, subject to certain exceptions (40 CFR 51.100(hh)(1)(iii), (2)(i) – (v)). Beyond the noted exceptions, such techniques are not allowed for getting credit for modeling source compliance with the annual and 1-hour NO_2 NAAQS and annual NO_2 increment.

[4] For stacks in existence on January 12, 1979, the GEP equation is GEP = 2.5 H (provided the owner or operator produces evidence that this equation was actually relied on in establishing an emission limitation for NOx (40 CFR 51.100(ii)(2)(i)

OPERATION OF EMERGENCY EQUIPMENT & GENERAL STARTUP CONDITIONS

In determining an emergency generator's potential to emit, existing guidance (EPA memo titled "Calculating Potential to Emit (PTE) for Emergency Generators," September 6, 1995) allows a default value of 500 hours "for estimating the number of hours that an emergency generator could be expected to operate under worst-case conditions." The guidance also allows for alternative estimates to be made on a case-by-case basis for individual emergency generators. This time period must also consider operating time for both testing/maintenance as well as for emergency utilization. Likewise, existing EPA policy does not allow NOx emissions to be excluded from the source impact analysis (NAAQS and increments) when the emergency equipment is operating during an emergency. EPA provides no exemption from compliance with the NAAQS during periods of emergency operation. Thus, it is not sufficient to consider only emissions generated during periods of testing/maintenance in the source impact analysis.

If during an emergency, emergency equipment is never operated simultaneously with other emissions units at the source that the emergency equipment will back up, a worst-case hourly impact analysis may very well occur during periods of normal source operation when other emissions units at the facility are likely to be operating simultaneously with the scheduled testing of emergency equipment. To avoid such worst-case modeling situations, a permit applicant may commit to scheduling the testing of emergency equipment during times when the source is not otherwise operating, or during known off-peak operating periods. This could provide a basis to justify not modeling the 1-hour impacts of the emergency equipment under conditions that would include simultaneous operation with other onsite emissions units. Accordingly, permits for emergency equipment may include enforceable conditions that specifically limit the testing/maintenance of emergency equipment to certain periods of time (seasons, days of the week, hours of the day, etc.) as long as these limitations do not constitute dispersion techniques under 40 CFR 51.1(hh)(1)(ii).

We also note that similar problems associated with the modeling of high 1-hour NO_2 concentrations have been reported to occur during startup periods for certain kinds of emissions units—often because control equipment cannot function during all or a portion of the startup process. EPA currently has no provisions for exempting emissions occurring during equipment startups from the air quality analysis to demonstrate compliance with the NAAQS. Startup emissions may occur during only a relatively small portion of the unit's total annual operating schedule; however, they must be included in the required PSD air quality analysis for the NAAQS. Sources may be willing to accept enforceable permit conditions limiting equipment startups to certain hours of the day when impacts are expected to be lower than normal. Such permit limitations can be accounted for in the modeling of such emissions. Applicants should direct other questions arising concerning procedures for modeling startup emissions to the applicable permitting authority to determine the most current modeling guidance.

SCREENING VALUES

In the final rule establishing the hourly NO_2 standard, EPA discussed various implementation considerations for the PSD permitting program. 75 FR.6474, 6524 (Feb. 9, 2010). This discussion included the following statements regarding particular screening values that have historically been used on a widespread basis to facilitate implementation of the PSD permitting program:

> We also believe that there may be a need to revise the screening tools currently used under the NSR/PSD program for completing NO_2 analyses. These screening tools include the significant impact levels (SILs), as mentioned by one commenter, but also include the significant emissions rate for emissions of NOx and the significant monitoring concentration (SMC) for NO_2. EPA intends to evaluate the need for possible changes or additions to each of these important screening tools for NOx/NO_2 due to the addition of a 1-hour NO_2 NAAQS. If changes or additions are deemed necessary, EPA will propose any such changes for public notice and comment in a separate action. 75 FR 6525.

EPA intends to conduct an evaluation of these issues and submit our findings in the form of revised significance levels under notice and comment rulemaking if any revisions are deemed appropriate. In the interim, for the reasons provided below, we recommend the continued use of the existing significant emissions rates (SER) for NOx emissions as well as an interim 1-hour NO_2 SIL that we are setting forth today for conducting air quality impact analyses for the 1-hour NO_2 NAAQS. As described in the section titled Introduction, EPA intends to implement the interim 1-hour NO_2 SIL contained herein under the federal PSD program and offers states the opportunity to use it in their PSD programs if they choose to do so. EPA is not addressing the significant monitoring concentrations in this memorandum.

SIGNIFICANT EMISSIONS RATE

Under the terms of existing EPA regulations, the applicable significant emissions rate for nitrogen oxides is 40 tons per year. 40 CFR 52.21(b)(23); 40 CFR 51.166(b)(23). The significant emissions rates defined in those regulations are specific to individual pollutants but are not differentiated by the averaging times of the air quality standards applicable to some of the listed pollutants. Although EPA has not previously promulgated a NO_2 standard using an averaging time of less than one year, the NAAQS for SO_2 have included standards with 3-hour and 24-hour averaging times for many years. EPA has applied the 40 tons per year significant emissions rate for SO_2 across all of these averaging times. Until the evaluation described above and any associated rulemaking is completed, EPA does not believe it has cause to apply the NO_2 significant emissions rate any differently than EPA has historically applied the SO_2 significant emissions rate and others that apply to standards with averaging times less than 1 year.

Under existing regulations, an ambient air quality impact analysis is required for "each pollutant that [a source] would have the potential to emit in significant amounts." 40 CFR 52.21(m)(1)(i)(a); 40 CFR. 51.166(m)(1)(i)(a). For modifications, these regulations require this analysis for "each pollutant for which [the modification] would result in a significant net emissions increase." 40 CFR.52.21(m)(1)(i)(b); 40 CFR.51.166(m)(1)(i)(b). EPA construes this regulation to mean that an ambient impact analysis is not necessary for pollutants with emissions rates below the significant emissions rates in paragraph (b)(23) of the regulations. No additional action by EPA or permitting authorities is necessary at this time to apply the 40 tpy significant emissions rate in existing regulations to the hourly NO_2 standard.

INTERIM 1-HOUR NO_2 SIGNIFICANT IMPACT LEVEL

A significant impact level (SIL) serves as a useful screening tool for implementing the PSD requirements for an air quality analysis. The primary purpose of the SIL is to serve as a screening tool to identify a level of ambient impact that is sufficiently low relative to the NAAQS or PSD increments such that the impact can be considered trivial or *de minimis*. Hence, the EPA considers a source whose individual impact falls below a SIL to have a *de minimis* impact on air quality concentrations that already exist. Accordingly, a source that demonstrates that the projected ambient impact of its proposed emissions increase does not exceed the SIL for that pollutant at a location where a NAAQS or increment violation occurs is not considered to cause or contribute to that violation. In the same way, a source with a proposed emissions increase of a particular pollutant that will have a significant impact at some locations is not required to model at distances beyond the point where the impact of its proposed emissions is below the SILs for that pollutant. When a proposed source's impact by itself is not considered to be "significant," EPA has long maintained that any further effort on the part of the applicant to complete a cumulative source impact analysis involving other source impacts would only yield information of trivial or no value with respect to the required evaluation of the proposed source or modification. The concept of a SIL is grounded on the *de minimis* principles described by the court in *Alabama Power Co. v. Costle*, 636 F.2d 323, 360 (D.C. Cir. 1980); See also *Sur Contra La Contaminacion v. EPA*, 202 F.3d 443, 448-49 (1st Cir. 2000) (upholding EPA's use of SIL to allow permit applicant to avoid full impact analysis); *In re: Prairie State Gen. Co.,* PSD Appeal No. 05-05, Slip. Op. at 139 (EAB 2006)

EPA has codified several SILs into regulations at 40 CFR 51.165(b). EPA plans to undertake rulemaking to develop a 1-hour NO_2 SIL for the new NAAQS for NO_2. However, EPA has recognized that the absence of an EPA-promulgated SIL does not preclude permitting authorities from developing interim SILs for use in demonstrating that a cumulative air quality analysis would yield trivial gain. Response to Comments, Implementation of New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers in Diameter ($PM_{2.5}$), pg. 82 (March 2008) [EPA-HQ-OAR-2003-0062-0278].

Until such time as a 1-hour NO_2 SIL is defined in the PSD regulations, we are herein providing a recommended interim SIL that we intend to use as a screening tool for completing the required air quality analyses for the new 1-hour NO_2 under the federal PSD program at 40 CFR 52.21. To support the application of this interim SIL in each instance, a permitting authority that utilizes this SIL as part of an ambient air quality analysis should include in the permit record the analysis reflected in this memorandum and the referenced documents to demonstrate that an air quality impact at or below the SIL is *de minimis* in nature and would not cause a violation of the NAAQS.

Using the interim 1-hour NO_2 SIL, the permit applicant and permitting authority can determine: (1) whether, based on the proposed increase in NOx emissions, a cumulative air quality analysis is required; (2) the area of impact within which a cumulative air quality analysis should focus; and (3) whether, as part of a cumulative air quality analysis, the proposed source's NOx emissions will cause or contribute to a modeled violation of the 1-hour NO_2 NAAQS.

In this guidance, EPA recommends an interim 1-hour NO_2 SIL value of 4 ppb. To determine initially whether a proposed project's emissions increase will have a significant impact (resulting in the need for a cumulative air quality analysis), this interim SIL should be compared to either of the following:

- The highest of the 5-year averages of the maximum modeled 1-hour NO_2 concentrations predicted each year at each receptor, based on 5 years of National Weather Service data; or
- The highest modeled 1-hour NO_2 concentration predicted across all receptors based on 1 year of site-specific meteorological data, or the highest of the multi-year averages of the maximum modeled 1-hour NO_2 concentrations predicted each year at each receptor, based on 2 or more, up to 5 complete years of available site-specific meteorological data.

Additional guidance will be forthcoming for the purpose of comparing a proposed source's modeled impacts to the interim 1-hour NO_2 SIL in order to make a determination about whether that source's contribution is significant when a cumulative air quality analysis identifies violations of the 1-hour NO_2 NAAQS (i.e., "causes or contributes to" a modeled violation).

We derived this interim 1-hour NO_2 SIL by using an impact equal to 4% of the 1-hour NO_2 NAAQS (which is 100 ppb). We have chosen this approach because we believe it is reasonable to base the interim 1-hour NO_2 SIL directly on consideration of impacts relative to the 1-hour NO_2 NAAQS. In 1980, we defined SER for each pollutant subject to PSD. 45 FR 52676, August 7, 1980 at 52705-52710. For PM and SO_2, we defined the SER as the emissions rate that resulted in an ambient impact equal to 4% of the applicable short-term NAAQS. The 1980 analysis focused on levels no higher than 5% of the primary standard because of concerns that higher levels were found to result in unreasonably large amounts of increment being consumed by a single source. Within the range of impacts analyzed, we considered two factors that had an important influence on the choice of *de minimis* emissions levels: (1) cumulative effect on increment consumption of multiple sources in an area, each making the maximum *de minimis* emissions increase; and (2) the projected consequence of a given *de minimis* level on administrative burden. As explained in the preamble to the 1980 rulemaking and the supporting documentation,[5] EPA decided to use 4% of the 24-hour primary NAAQS for PM and SO_2 to define the significant emissions rates (SERs) for those pollutants. It was noted that, at the time, only an annual NO_2 NAAQS existed. Thus, for reasons explained in the 1980 preamble, to define the SER for NOx emissions we used a design value of 2% of the annual NO_2 NAAQS. See 45 FR 52708. Looking now at a short-term NAAQS for NO_2, we believe that it is reasonable as an interim approach to use a SIL value that represents 4% of the 1-hour NO_2

[5] EPA evaluated de minimis levels for pollutants for which NAAQS had been established in a document titled "Impact of Proposed and Alternative De Minimis Levels for Criteria Pollutants"; EPA-450/2-80-072, June 1980.

NAAQS. EPA will consider other possible alternatives for developing a 1-hour NO_2 SIL in a future rulemaking that will provide an opportunity for public participation in the development of a SIL as part of the PSD regulations.

Several state programs have already adopted interim 1-hour NO_2 SILs that differ (both higher and lower) from the interim value being recommended herein. The EPA-recommended interim 1-hour NO_2 SIL is not intended to supersede any interim SIL that is now or may be relied upon to implement a state PSD program that is part of an approved SIP, or to impose the use of the SIL concept on any state that chooses to implement the PSD program—in particular the ambient air quality analysis—without using a SIL as a screening tool. Accordingly, states that implement the PSD program under an EPA-approved SIP may choose to use this interim SIL, another value that may be deemed more appropriate for PSD permitting purposes in the state of concern, or no SIL at all. The application of any SIL that is not reflected in a promulgated regulation should be supported by a record in each instance that shows the value represents a *de minimis* impact on the 1-hour NO_2 standard, as described above.

In the event of questions regarding the general implementation guidance contained in this memorandum, please contact Raj Rao (rao.raj@epa.gov).

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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June 28, 2010

MEMORANDUM

SUBJECT: Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard

FROM: Tyler Fox, Leader
Air Quality Modeling Group, C439-01

TO: Regional Air Division Directors

INTRODUCTION

On January 22, 2010, EPA announced a new 1-hour nitrogen dioxide (NO_2) National Ambient Air Quality Standard (1-hour NO_2 NAAQS or 1-hour NO_2 standard) which is attained when the 3-year average of the 98th-percentile of the annual distribution of daily maximum 1-hour concentrations does not exceed 100 ppb at each monitor within an area. The final rule for the new 1-hour NO_2 NAAQS was published in the Federal Register on February 9, 2010 (75 FR 6474-6537), and the standard became effective on April 12, 2010 (EPA, 2010a). This memorandum clarifies the applicability of current guidance in the *Guideline on Air Quality Models* (40 CFR Part 51, Appendix W) for modeling NO_2 impacts in accordance with the Prevention of Significant Deterioration (PSD) permit requirements to demonstrate compliance with the new 1-hour NO_2 standard.

SUMMARY OF CURRENT GUIDANCE

While the new 1-hour NAAQS is defined relative to ambient concentrations of NO_2, the majority of nitrogen oxides (NOx) emissions for stationary and mobile sources are in the form of nitric oxide (NO) rather than NO_2. Appendix W notes that the impact of an individual source on ambient NO_2 depends, in part, "on the chemical environment into which the source's plume is to be emitted" (see Section 5.1.j). Given the role of NOx chemistry in determining ambient impact levels of NO_2 based on modeled NOx emissions, Section 5.2.4 of Appendix W recommends the following three-tiered screening approach for NO_2 modeling for annual averages:

- Tier 1 - assume full conversion of NO to NO_2 based on application of an appropriate refined modeling technique under Section 4.2.2 of Appendix W to estimate ambient NOx concentrations;
- Tier 2 - multiply Tier 1 result by empirically-derived NO_2/NOx ratio, with 0.75 as the annual national default ratio (Chu and Meyer, 1991); and

- Tier 3 - detailed screening methods may be considered on a case-by-case basis, with the Ozone Limiting Method (OLM) identified as a detailed screening technique for point sources (Cole and Summerhays, 1979).

Tier 2 is often referred to as the Ambient Ratio Method, or ARM. Site-specific ambient NO_2/NOx ratios derived from appropriate ambient monitoring data may also be considered as detailed screening methods on a case-by-case basis, with proper justification. Consistent with Section 4.2.2, AERMOD is the current preferred model for "a wide range of regulatory applications in all types of terrain" for purposes of estimating ambient concentrations of NO_2, based on NOx emissions, under Tiers 1 and 2 above. We discuss the role of AERMOD for Tier 3 applications in more detail below.

APPLICABILITY OF CURRENT GUIDANCE TO 1-HOUR NO_2 NAAQS

In general, the Appendix W recommendations regarding the annual NO_2 standard are also applicable to the new 1-hour NO_2 standard, but additional issues may need to be considered in the context of a 1-hour standard, depending on the characteristics of the emission sources, and depending on which tier is used, as summarized below:

- Tier 1 applies to the 1-hour NO_2 standard without any additional justification;
- Tier 2 may also apply to the 1-hour NO_2 standard in many cases, but some additional consideration will be needed in relation to an appropriate ambient ratio for peak hourly impacts since the current default ambient ratio is considered to be representative of "area wide quasi-equilibrium conditions"; and
- Tier 3 "detailed screening methods" will continue to be considered on a case-by-case basis for the 1-hour NO_2 standard. However, certain input data requirements and assumptions for Tier 3 applications may be of greater importance for the 1-hour standard than for the annual standard given the more localized nature of peak hourly vs. annual impacts. In addition, use of site-specific ambient NO_2/NOx ratios based on ambient monitoring data will generally be more difficult to justify for the 1-hour NO_2 standard than for the annual standard.

While Appendix W specifically mentions OLM as a detailed screening method under Tier 3, we also consider the Plume Volume Molar Ratio Method (PVMRM) (Hanrahan, 1999a) discussed under Section 5.1.j of Appendix W to be in this category at this time. Both of these options account for ambient conversion of NO to NO_2 in the presence of ozone, based on the following basic chemical mechanism, known as titration, although there are important differences between these methods:

$$NO + O_3 \rightarrow NO_2 + O_2 \qquad \text{(Eq. 1)}$$

As noted in Section 5.1.j, EPA is currently testing the PVMRM option to determine its suitability as a refined method. Limited evaluations of PVMRM have been completed, which show encouraging results, but the amount of data currently available is too limited to justify a designation of PVMRM as a refined method for NO_2 (Hanrahan, 1999b; MACTEC, 2005). EPA is currently updating and extending these evaluations to examine model performance for predicting hourly NO_2 concentrations, including both the OLM and PVMRM options, and results of these additional evaluations will be provided at a later date. A sensitivity analysis of the OLM and PVMRM options in AERMOD has been conducted that compares modeled concentrations based on OLM and PVMRM with Tiers 1 and 2 for a range of source characteristics (MACTEC, 2004). This analysis serves as a useful reference to understand how ambient NO_2 concentrations may be impacted by application of this three-tiered screening approach, and includes comparisons for both annual average and maximum 1-hour NO_2 concentrations.

Key model inputs for both the OLM and PVMRM options are the in-stack ratios of NO_2/NOx emissions and background ozone concentrations. While the representativeness of these key inputs is important in the context of the annual NO_2 standard, they will generally take on even greater importance for the new 1-hour NO_2 standard, as explained in more detail below. Recognizing the potential importance of the in-stack NO_2/NOx ratio for hourly NO_2 compliance demonstrations, we recommend that in-stack ratios used with either the OLM or PVMRM options be justified based on the specific application, i.e., there is no "default" in-stack NO_2/NOx ratio for either OLM or PVMRM.

The OLM and PVMRM methods are both available as non-regulatory-default options within the EPA-preferred AERMOD dispersion model (Cimorelli, *et al.*, 2004; EPA, 2004; EPA, 2009). As a result of their non-regulatory-default status, pursuant to Sections 3.1.2.c, 3.2.2.a, and A.1.a(2) of Appendix W, application of AERMOD with the OLM or PVMRM option is no longer considered a "preferred model" and, therefore, requires justification and approval by the Regional Office on a case-by-case basis. While EPA is continuing to evaluate the PVMRM and OLM options within AERMOD for use in compliance demonstrations for the 1-hour NO_2 standard, as long as they are considered to be non-regulatory-default options, their use as alternative modeling techniques under Appendix W should be justified in accordance with Section 3.2.2, paragraph (e), as follows:

> "e. Finally, for condition (3) in paragraph (b) of this subsection [preferred model is less appropriate for the specific application, or there is no preferred model], an alternative refined model may be used provided that:
>
> i. The model has received a scientific peer review;
> ii. The model can be demonstrated to be applicable to the problem on a theoretical basis;
> iii. The data bases which are necessary to perform the analysis are available and adequate;
> iv. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates; and
> v. A protocol on methods and procedures to be followed has been established."

Since AERMOD is the preferred model for dispersion for a wide range of application, the focus of the alternative model demonstration for use of the OLM and PVMRM options within AERMOD is on the treatment of NOx chemistry within the model, and does not need to address basic dispersion algorithms within AERMOD. Furthermore, items i and iv of the alternative model demonstration for these options can be fulfilled in part based on existing documentation (Cole and Summerhays, 1979; Hanrahan, 1999a; Hanrahan, 1999b; MACTEC, 2005), and the remaining items should be routinely addressed as part of the modeling protocol, irrespective of the regulatory status of these options. The issue of applicability to the problem on a theoretical basis (item ii) is a case-by-case determination based on an assessment of the adequacy of the ozone titration mechanism utilized by these options to account for NOx chemistry within the AERMOD model based on "the chemical environment into which the source's plume is to be emitted" (Appendix W, Section 5.1.j). The adequacy of available data bases needed for application of OLM and PVMRM (item iii), including in-stack NO_2/NOx ratios and background ozone concentrations, is a critical aspect of the demonstration which we discuss in more detail below. It should also be noted that application of the OLM or PVMRM methods with other Appendix W models or alternative models, whether as a separate post-processor or integrated within the model, would require additional documentation and demonstration that the methods have been implemented and applied appropriately within that context, including model-specific performance evaluations which satisfy item iv under Section 3.2.2.e.

Given the form of the new 1-hour NO_2 standard, some clarification is needed regarding the appropriate data periods for modeling demonstrations of compliance with the NAAQS vs. demonstrations of attainment of the NAAQS through ambient monitoring. While monitored design values for the 1-hour NO_2 standard are based on a 3-year average (in accordance with Section 1(c)(2) of Appendix S to 40 CFR Part 50), Section 8.3.1.2 of Appendix W addresses the length of the meteorological data record for dispersion modeling, stating that "[T]he use of 5 years of NWS [National Weather Service] meteorological data or at least 1 year of site specific data is required." Section 8.3.1.2.b further states that "one year or more (including partial years), up to five years, of site specific data . . . are preferred for use in air quality analyses." 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 for use of 5 years of NWS meteorological data or at least 1 year of site specific data. The 5-year average based on use of NWS data, or an average across one or more years of available site specific data, serves as an unbiased estimate of the 3-year average for purposes of modeling demonstrations of compliance with the NAAQS. Modeling of "rolling 3-year averages," using years 1 through 3, years 2 through 4, and years 3 through 5, is not required. Furthermore, since modeled results for NO_2 are averaged across the number of years modeled for comparison to the new 1-hour NO_2 standard, the meteorological data period should include complete years of data to avoid introducing a seasonal bias to the averaged impacts. In order to comply with Appendix W recommendations in cases where partial years of site specific meteorological data are available, while avoiding any seasonal bias in the averaged impacts, an approach that utilizes the most conservative modeling result based on the first complete-year period of the available data record vs. results based on the last complete-year period of available data may be appropriate, subject to approval by the appropriate reviewing authority. Such an approach would ensure that all available site specific data are accounted for in the modeling analysis without imposing an undue burden on the applicant and avoiding arbitrary choices in the selection of a single complete-year data period.

The form of the new 1-hour NO_2 standard also has implications regarding appropriate methods for combining modeled ambient concentrations with monitored background concentrations for comparison to the NAAQS in a cumulative modeling analysis. As noted in the March 23, 2010 memorandum regarding "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS" (EPA, 2010b), combining the 98th percentile monitored value with the 98th percentile modeled concentrations for a cumulative impact assessment could result in a value that is below the 98th percentile of the combined cumulative distribution and would, therefore, not be protective of the NAAQS. However, unlike the recommendations presented for $PM_{2.5}$, the modeled contribution to the cumulative ambient impact assessment for the 1-hour NO_2 standard should follow the form of the standard based on the 98th percentile of the annual distribution of daily maximum 1-hour concentrations averaged across the number of years modeled. A "first tier" assumption that may be applied without further justification is to add the overall highest hourly background NO_2 concentration from a representative monitor to the modeled design value, based on the form of the standard, for comparison to the NAAQS. Additional refinements to this "first tier" approach based on some level of temporal pairing of modeled and monitored values may be considered on a case-by-case basis, with adequate justification and documentation.

DISCUSSION OF TECHNICAL ISSUES

While many of the same technical issues related to application of Appendix W guidance for an annual NO_2 standard would also apply in the context of the new 1-hour NO_2 standard, there are some important differences that may also need to be considered depending on the specific application. This section discusses several aspects of these technical issues related to the new 1-hour NO_2 NAAQS, including a discussion of source emission inventories required for modeling demonstrations of compliance with the NAAQS and other issues specific to each of the three tiers identified in Section 5.2.4 of Appendix W for NO_2 modeling.

Emission Inventories

The source emissions data are a key input for all modeling analyses and one that may require additional considerations under the new 1-hour NO_2 standard is the source emissions data. Section 8.1 of Appendix W provides guidance regarding source emission input data for dispersion modeling and Table 8-2 summarizes the recommendations for emission input data that should be followed for NAAQS compliance demonstrations. Although existing NOx emission inventories used to support modeling for compliance with the annual NO_2 standard should serve as a useful starting point, such inventories may not always be adequate for use in assessing compliance with the new 1-hour NO_2 standard since some aspects of the guidance in Section 8.1 differs for long-term (annual and quarterly) standards vs. short-term ($\leq$ 24 hours) standards. In particular, since maximum ground-level concentrations may be more sensitive to operating levels and startup/shutdown conditions for an hourly standard than for an annual standard, emission rates and stack parameters associated with the maximum ground-level concentrations for the annual standard may underestimate maximum concentrations for the new 1-hour NO_2 standard. Due to the importance of in-stack NO_2/NOx ratios required for application of the OLM and PVMRM options within AERMOD discussed above, consideration should also be given to the potential variability of in-stack NO_2/NOx ratios under different operating conditions when those non-regulatory-default options are applied. We also note that source emission input data recommendations in Table 8-2 of Appendix W for "nearby sources" and "other sources" that may be needed to conduct a cumulative impact assessment include further differences between emission data for long-term vs. short-term standards which could also affect the adequacy of existing annual NOx emission inventories for the new 1-hour NO_2 standard. The terms "nearby sources" and "other sources" used in this context are defined in Section 8.2.3 of Appendix W. Attachment A provides a more detailed discussion on determining NOx emissions for permit modeling.

While Section 8.2.3 of Appendix W emphasizes the importance of professional judgment by the reviewing authority in the identification of nearby and other sources to be included in the modeled emission inventory, Appendix W establishes "a significant concentration gradient in the vicinity of the source" under consideration as the main criterion for this selection. Appendix W also indicates that "the number of such [nearby] sources is expected to be small except in unusual situations." See Section 8.2.3.b. Since concentration gradients will vary somewhat depending on the averaging period being modeled, especially for an annual vs. 1-hour standard, the criteria for selection of "nearby" and "other" sources for inclusion in the modeled inventory may need to be reassessed for the 1-hour NO_2 standard.

The representativeness of available ambient air quality data also plays an important role in determining which nearby sources should be included in the modeled emission inventory. Key issues to consider in this regard are the extent to which ambient air impacts of emissions from nearby sources are reflected in the available ambient measurements, and the degree to which emissions from those background sources during the monitoring period are representative of allowable emission levels under the existing permits. The professional judgments that are required in developing an appropriate inventory of background sources should strive toward the proper balance between adequately characterizing the potential for cumulative impacts of emission sources within the study area to cause or contribute to violations of the NAAQS, while minimizing the potential to overestimate impacts by double-counting of modeled source impacts that are also reflected in the ambient monitoring data. We would also caution against the literal and uncritical application of very prescriptive procedures for identifying which background sources should be included in the modeled emission inventory for NAAQS compliance demonstrations, such as those described in Chapter C, Section IV.C.1 of the draft *New Source Review Workshop Manual* (EPA, 1990), noting again that Appendix W emphasizes the importance of professional judgment in this process. While the draft workshop manual serves as a useful general reference regarding New Source Review (NSR) and PSD programs, and such procedures may play a useful role in defining the spatial extent of sources whose emissions may need to be considered, it should be recognized that "[i]t is not intended to be an official statement of policy and standards and does not establish binding regulatory requirements." See, Preface.

Given the range of issues involved in the determination of an appropriate inventory of emissions to include in a cumulative impact assessment, the appropriate reviewing authority should be consulted early in the process regarding the selection and proper application of appropriate monitored background concentrations and the selection and appropriate characterization of modeled background source emission inventories for use in demonstrating compliance with the new 1-hour NO_2 standard.

Tier-specific Technical Issues

This section discusses technical issues related to application of each tier in the three-tiered screening approach for NO_2 modeling recommended in Section 5.2.4 Appendix W. A basic understanding of NOx chemistry and "of the chemical environment into which the source's plume is to be emitted" (Appendix W, Section 5.1.j) will be helpful for addressing these issues based on the specific application.

Tier 1:

Since the assumption of full conversion of NO to NO_2 will provide the most conservative treatment of NOx chemistry in assessing ambient impacts, there are no technical issues associated with treatment of NOx chemistry for this tier. However, the general issues related to emission inventories for the 1-hour NO_2 standard discussed above and in Attachment A apply to Tier 1.

Tier 2:

As noted above, the 0.75 national default ratio for ARM is considered to be representative of "area wide quasi-equilibrium conditions" and, therefore, may not be as appropriate for use with the 1-hour NO_2 standard. The appropriateness of this default ambient ratio will depend somewhat on the characteristics of the sources, and as such application of Tier 2 for 1-hour NO_2 compliance demonstrations may need to be considered on a source-by-source basis in some cases. The key technical issue to address in relation to this tier requires an understanding of the meteorological conditions that are likely to be associated with peak hourly impacts from the source(s) being modeled. In general, for low-level releases with limited plume rise, peak hourly NOx impacts are likely to be associated with nighttime stable/light wind conditions. Since ambient ozone concentrations are likely to be relatively low for these conditions, and since low wind speeds and stable atmospheric conditions will further limit the conversion of NO to NO_2 by limiting the rate of entrainment of ozone into the plume, the 0.75 national default ratio will likely be conservative for these cases. A similar rationale may apply for elevated sources where plume impaction on nearby complex terrain under stable atmospheric conditions is expected to determine the peak hourly NOx concentrations. By contrast, for elevated sources in relatively flat terrain, the peak hourly NOx concentrations are likely to occur during daytime convective conditions, when ambient ozone concentrations are likely to be relatively high and entrainment of ozone within the plume is more rapid due to the vigorous vertical mixing during such conditions. For these sources, the 0.75 default ratio may not be conservative, and some caution may be needed in applying Tier 2 for such sources. We also note that the default equilibrium ratio employed within the PVMRM algorithm as an upper bound on an hourly basis is 0.9.

Tier 3:

This tier represents a general category of "detailed screening methods" which may be considered on a case-by-case basis. Section 5.2.4(b) of Appendix W cites two specific examples of Tier 3 methods, namely OLM and the use of site-specific ambient NO_2/NOx ratios supported by ambient measurements. As noted above, we also believe it is appropriate to consider the

PVMRM option as a Tier 3 detailed screening method at this time. The discussion here focuses primarily on the OLM and PVMRM methods, but we also note that the use of site-specific ambient NO_2/NOx ratios will be subject to the same issues discussed above in relation to the Tier 2 default ARM, and as a result it will generally be much more difficult to determine an appropriate ambient NO_2/NOx ratio based on monitoring data for the new 1-hour NO_2 standard than for the annual standard.

While OLM and PVMRM are both based on the same simple chemical mechanism of titration to account for the conversion of NO emissions to NO_2 (see Eq. 1) and therefore entail similar technical issues and considerations, there are some important differences that also need to be considered when assessing the appropriateness of these methods for specific applications. While the titration mechanism may capture the most important aspects of NO-to-NO_2 conversion in many applications, both methods will suffer from the same limitations for applications in which other mechanisms, such as photosynthesis, contribute significantly to the overall process of chemical transformation.· Sources located in areas with high levels of VOC emissions may be subject to these limitations of OLM and PVMRM. Titration is generally a much faster mechanism for converting NO to NO_2 than photosynthesis, and as such is likely to be appropriate for characterizing peak 1-hour NO_2 impacts in many cases.

Both OLM and PVMRM rely on the same key inputs of in-stack NO_2/NOx ratios and hourly ambient ozone concentrations. Although both methods can be applied within the AERMOD model using a single "representative" background ozone concentration, it is likely that use of a single value would result in very conservative estimates of peak hourly ambient concentrations since its use for the 1-hour NO_2 standard would be contingent on a demonstration of conservatism for all hours modeled. Furthermore, hourly monitored ozone concentrations used with the OLM and PVMRM options must be concurrent with the meteorological data period used in the modeling analysis, and thus the temporal representativeness of the ozone data for estimating ambient NO_2 concentrations could be a factor in determining the appropriateness of the meteorological data period for a particular application. As noted above, the representativeness of these key inputs takes on somewhat greater importance in the context of a 1-hour NO_2 standard than for an annual standard, for obvious reasons. In the case of hourly background ozone concentrations, methods used to substitute for periods of missing data may play a more significant role in determining the 1-hour NO_2 modeled design value, and should therefore be given greater scrutiny, especially for data periods that are likely to be associated with peak hourly concentrations based on meteorological conditions and source characteristics. In other words, ozone data substitution methods that may have been deemed appropriate in prior applications for the annual standard may not be appropriate to use for the new 1-hour standard.

While these technical issues and considerations generally apply to both OLM and PVMRM, the importance of the in-stack NO_2/NOx ratios may be more important for PVMRM than for OLM in some cases, due to differences between the two methods. The key difference between the two methods is that the amount of ozone available for conversion of NO to NO_2 is based simply on the ambient ozone concentration and is independent of source characteristics for OLM, whereas the amount of ozone available for conversion in PVMRM is based on the amount of ozone within the volume of the plume for an individual source or group of sources. The plume volume used in PVMRM is calculated on an hourly basis for each source/receptor combination, taking into account the dispersive properties of the atmosphere for that hour. For a low-level release where peak hourly NOx impacts occur close to the source under stable/light wind conditions, the plume volume will be relatively small and the ambient NO_2 impact for such cases will be largely determined by the in-stack NO_2/NOx ratio, especially for sources with relatively close fenceline or ambient air boundaries. This example also highlights the fact that the relative importance of the in-stack NO_2/NOx ratios may be greater for some applications than others, depending on the source characteristics and other factors. Assumptions regarding in-stack NO_2/NOx ratios that may have been deemed appropriate in the context of the annual standard may not be appropriate to use for the new 1-hour standard. In particular, it is worth reiterating that the 0.1 in-stack ratio often cited as the "default" ratio for OLM should not be treated as a default value for hourly NO_2 compliance demonstrations.

Another difference between OLM and PVMRM that is worth noting here is the treatment of the titration mechanism for multiple sources of NOx. There are two possible modes that can be used for applying OLM to multiple source scenarios within AERMOD: (1) apply OLM to each source separately and assume that each source has all of the ambient ozone available for conversion of NO to NO_2; and (2) assume that sources whose plumes overlap compete for the available ozone and apply OLM on a combined plume basis. The latter option can be applied selectively to subsets of sources within the modeled inventory or to all modeled sources using the OLMGROUP keyword within AERMOD, and is likely to result in lower ambient NO_2 concentrations in most cases since the ambient NO_2 levels will be more ozone-limited. One of the potential refinements in application of the titration method incorporated in PVMRM is a technique for dynamically determining which sources should compete for the available ozone based on the relative locations of the plumes from individual sources, both laterally and vertically, on an hourly basis, taking into account wind direction and plume rise. While this approach addresses one of the implementation issues associated with OLM by making the decision of which sources should compete for ozone, there is only very limited field study data available to evaluate the methodology.

Given the importance of the issue of whether to combine plumes for the OLM option, EPA has addressed the issue in the past through the Model Clearinghouse process. The general guidance that has emerged in those cases is that the OLM option should be applied on a source-by-source basis in most cases and that combining plumes for application of OLM would require a clear demonstration that the plumes will overlap to such a degree that they can be considered as "merged" plumes. However, much of that guidance was provided in the context of applying the OLM method outside the dispersion model in a post-processing mode on an annual basis. The past guidance on this issue is still appropriate in that context since there is no realistic method to account for the degree of plume merging on an hourly basis throughout the modeling analysis when applied as a post-processor. However, the implementation of the OLM option within the AERMOD model applies the method on a source-by-source, receptor-by-receptor, and hour-by-hour basis. As a result, the application of the OLMGROUP option within AERMOD is such that the sources only compete for the available ozone to the extent that each source contributes to the cumulative NOx concentration at each receptor for that hour. Sources which contribute significantly to the ambient NOx concentration at the receptor will compete for available ozone in proportion to their contribution, while sources that do not contribute significantly to the ambient NOx concentration will not compete for the ozone. Thus, the OLMGROUP option implemented in AERMOD will tend to be "self-correcting" with respect to concerns that combining plumes for OLM will overestimate the degree of ozone limiting potential (and therefore underestimate ambient NO_2 concentrations). As a result of these considerations, we recommend that use of the "OLMGROUP ALL" option, which specifies that all sources will potentially compete for the available ozone, be routinely applied and accepted for all approved applications of the OLM option in AERMOD. This recommendation is supported by model-to-monitor comparisons of hourly NO_2 concentrations from the application of AERMOD for the Atlanta NO_2 risk and exposure assessment (EPA, 2008), and recent re-evaluations of hourly NO_2 impacts from the two field studies (New Mexico and Palaau) that were used in the evaluation of PVMRM (MACTEC, 2005). These model-to-monitor comparisons of hourly NO_2 concentrations show reasonably good performance using the "OLMGROUP ALL" option within AERMOD, with no indication of any bias to underestimate hourly NO_2 concentrations with OLMGROUP ALL. Furthermore, model-to-monitor comparisons based on OLM without the OLMGROUP option do exhibit a bias to overestimate hourly NO_2 concentrations. We will provide further details regarding these recent hourly NO_2 model-to-monitor comparisons at a later date.

SUMMARY

To summarize, we emphasize the following points:

1. The 3-tiered screening approach recommended in Section 5.2.4 of Appendix W for annual NO_2 assessments generally applies to the new 1-hour NO_2 standard.
2. While generally applicable, application of the 3-tiered screening approach for assessments of the new 1-hour NO_2 standard may entail additional considerations, such as the importance of key input data, including appropriate emission rates for the 1-hour standard vs. the annual standard for all tiers, and the representativeness of in-stack NO_2/NOx ratios and hourly background ozone concentrations for Tier 3 detailed screening methods.
3. Since the OLM and PVMRM methods in AERMOD are currently considered non-regulatory-default options, application of these options requires justification and approval by the Regional Office on a case-by-case basis as alternative modeling techniques, in accordance with Section 3.2.2, paragraph (e), of Appendix W.
4. Applications of the OLM option in AERMOD, subject to approval under Section 3.2.2.e of Appendix W, should routinely utilize the "OLMGROUP ALL" option for combining plumes.
5. While the 1-hour NAAQS for NO_2 is defined in terms of the 3-year average for monitored design values to determine attainment of the NAAQS, this definition does not preempt or alter the Appendix W requirement for use of 5 years of NWS meteorological data or at least 1 year of site specific data.

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ATTACHMENT A

Background on Hourly NOx Emissions for Permit Modeling for the 1-hour NO_2 NAAQS

Introduction

The purpose of this attachment is to address questions about availability of hourly NOx emissions for permit modeling under the new NO_2 NAAQS. It summarizes existing guidance regarding emission input data requirements for NAAQS compliance modeling, and provides background on the historical approach to development of inventories for NO_2 permit modeling and computation of hourly emissions appropriate for assessing the new 1-hour NO_2 standard. Although the NAAQS is defined in terms of ambient NO_2 concentrations, source emission estimates for modeling are based on NOx.

Under the PSD program, the owner or operator of the source is required to demonstrate that the source does not cause or contribute to a violation of a NAAQS (40 CFR 51.166 (k)(1) and 40 CFR 52.21 (k)(1)) and/or PSD increments (40 CFR 51.166 (k)(2) and 52.21 (k)(2)). However, estimation of the necessary emission input data for NAAQS compliance modeling entails consideration of numerous factors, and the appropriate reviewing authority should be consulted early in the process to determine the appropriate emissions data for use in specific modeling applications (see 40 CFR 51, Appendix W, 8.1.1.b and 8.2.3.b)

Summary of Current Guidance

Section 8.1 of the *Guideline on Air Quality Models*, Appendix W to 40 CFR Part 51, provides recommendations regarding source emission input data needed to support dispersion modeling for NAAQS compliance demonstrations. Table 8-2 of Appendix W provides detailed guidance regarding the specific components of the emission input data, including the appropriate emission limits (pounds/MMBtu), operating level (MMBtu/hr), and operating factor (e.g., hr/yr or hr/day), depending on the averaging time of the standard. Table 8-2 also distinguishes between the emission input data needed for the new or modified sources being assessed, and "nearby" and "other" background sources included in the modeled emission inventory.

Based on Table 8-2, emission input data for new or modified sources for annual and quarterly standards are essentially the same as for short-term standards ($\leq$ 24 hours), based on maximum allowable or federally enforceable emission limits, design capacity or federally enforceable permit conditions, and the assumption of continuous operation. However, there are a few additional considerations cited in Appendix W that could result in different emission input data for the 1-hour vs. annual NO_2 NAAQS. For example, while design capacity is listed as the recommended operating level for the emission calculation, peak hourly ground-level concentrations may be more sensitive than annual average concentrations to changes in stack parameters (effluent exit temperature and exit velocity) under different operating capacities. Table 8-2 specifically recommends modeling other operating levels, such as 50 percent or 75 percent of capacity, for short-term standards (see footnote 3). Another factor that may affect maximum ground-level concentrations differently between the 1-hour vs. annual standard is restrictions on operating factors based on federally enforceable permit conditions. While federally enforceable operating factors other than continuous operation may be accounted for in the emission input data (e.g., if operation is limited to 8 am to 4 pm each day), Appendix W also states that modeled emissions should not be averaged across non-operating time periods (see footnote 2 of Table 8-2).

While emission input data recommendations for "nearby" and "other" background sources included in the modeled emission inventory are similar to the new or modified source emission inputs in many respects, there is an important difference in the operating factor between annual and short-term standards. Emission input data for nearby and other sources may reflect actual operating factors (averaged over the most recent 2 years) for the annual standard, while continuous operation should be assumed for short-term standards. This could result in important differences in emission input data for modeled background sources for the 1-hour NO_2 NAAQS relative to emissions used for the annual standard.

Model Emission Inventory for NO_2 Modeling

For the existing annual NO_2 NAAQS, the permit modeling inventory has generally been compiled from the annual state emission inventory questionnaire (EIQ) or Title V permit applications on file with the relevant permitting authority (state or local air program). Since a state uses the annual EIQ for Title V fee assessment, the state EIQ typically requires reporting of unit capacity, total fuel combusted, and/or hours of operation to help verify annual emissions calculations for fee accuracy purposes. Likewise, Title V operating permit applications contain all of the same relevant information for calculating emissions. While these emission inventories are important resources for gathering emission input data on background sources for NAAQS compliance modeling, inventories which are based on actual operations may not be sufficient for short-term standards, such as the new 1-hour NO_2 NAAQS. However, appropriate estimates of emissions from background sources for the 1-hour NO_2 standard may be derived in many cases from information in these inventories regarding permitted emission limits and operating capacity.

Historically, it has not been a typical practice for an applicant to use the EPA's national emission inventory (NEI) as the primary source for compiling the permit modeling inventory. Since the emission data submitted to the NEI represents annual emission totals, it may not be suitable for use in NAAQS compliance modeling for short-term standards since modeling should be based on continuous operation, even for modeled background sources. Although the NEI may provide emission data for background sources that are more appropriate for the annual NO_2 standard, the utility of the NEI for purposes of NAAQS compliance modeling is further limited due to the fact that additional information regarding stack parameters and operating rates required for modeling may not be available from the NEI. While records exist in the NEI for reporting stack data necessary for point source modeling (i.e., stack coordinates, stack heights, exit temperatures, exit velocities), some states do not report such information to the NEI, or there are may be errors in the location data submitted to the NEI. Under such conditions, default stack information based upon SIC is substituted and use of such data could invalidate modeling results. Building locations and dimensions, which may be required to account for building downwash influences in the modeling analysis, may also be missing or incomplete in many cases.

A common and relatively straightforward approach for compiling the necessary information to develop an inventory of emissions from background sources for a permit modeling demonstration is as follows, patterned after the draft *New Source Review Workshop Manual* (EPA, 1990). The applicant completes initial modeling of allowable emission increases associated with the proposed project and determines the radii of impact (ROI) for each pollutant and averaging period, based on the maximum distance at which the modeled ambient concentration exceeds the Significant Impact Level (SIL) for each pollutant and averaging period. Typically, the largest ROI is selected and then a list of potential background sources within the ROI plus a screening distance beyond the ROI is compiled by the permitting authority and supplied to the applicant. The applicant typically requests permit applications or EIQ submittals from the records department of the permitting authority to gather stack data and source operating data necessary to compute emissions for the modeled inventory. Once the applicant has gathered the relevant data from the permitting authorities, model emission rates are calculated. While this approach is fairly common, it should be noted that the draft workshop manual "is not intended to be an official statement of policy and standards and does not establish binding regulatory requirements" (see, Preface), and the appropriate reviewing authority should be consulted early in the process regarding the selection of appropriate background source emission inventories for the 1-hour NO_2 standard. We also note that Appendix W establishes "a significant concentration gradient in the vicinity of the source" under consideration as the main criterion for selection of nearby sources for inclusion in the modeled inventory, and further indicates that "the number of such [nearby] sources is expected to be small except in unusual situations." See Section 8.2.3.b.

As mentioned previously, modeled emission rates for short-term NAAQS are computed consistent with the recommendations of Section 8.1 of Appendix W, summarized in Table 8-2. The maximum allowable (SIP-approved process weight rate limits) or federally enforceable permit limit emission rates assuming design capacity or federally enforceable capacity limitation are used to compute hourly emissions for dispersion modeling against short-term NAAQS such as the new 1-hour NO_2 NAAQS. If a source assumes an enforceable limit on the hourly firing capacity of a boiler, this is reflected in the calculations. Otherwise, the design capacity of the source is used to compute the model emission rate. A load analysis is typically necessary to determine the load or operating condition that causes the maximum ground-level concentrations. In addition to 100 percent load, loads such as 50 percent and 75 percent are commonly assessed. As noted above, the load analysis is generally more important for short-term standards than for annual standards. For an hourly standard, other operating scenarios of relatively short duration such as "startup" and "shutdown" should be assessed since these conditions may result in maximum hourly ground-level concentrations, and the control efficiency of emission control devices during these operating conditions may also need to be considered in the emission estimation.

Emission Calculation Example

The hourly emissions are most commonly computed from AP-42 emission factors based on unit design capacity. For a combustion unit, the source typically reports both the unit capacity and the actual total amount of fuel combusted annually (gallons, millions of cubic feet of gas, etc.) to the permitting authority for the EIQ. Likewise, Title V operating permit applications will contain similar information that can be used to compute hourly emissions.

For example, assume you are modeling an uncontrolled natural gas package boiler with a design firing rate of 30 MMBtu/hr. The AP-42 emission factor for an uncontrolled natural gas external combustion source (AP-42, Section 1.4) for firing rates less than 100 MMBtu/hr is 100 lbs. NOx/10^6 SCF natural gas combusted. The hourly emission rate is derived by converting the emission factor expressed in terms of lbs. NOx/10^6 SCF to lbs. NOx/MMBtu. The conversion is done by dividing the 100 lbs. NOx/10^6 SCF by 1,020 to convert the AP-42 factor to lbs. NOx/MMBtu. The new emission factor is now 0.098 lbs. NOx/MMBtu.

For this example, the source has no limit on the hourly firing rate of the boiler; therefore, the maximum hourly emissions are computed by multiplying the design firing rate of the boiler by the new emission factor.

E_{hourly} = 0.098 lbs/MMBtu x 30MMBtu/hr = 2.94 lbs/hr

Thus 2.94 lbs/hr represents the emission rate that would be input into the dispersion model for modeling against the 1-hour NO_2 NAAQS to comport with emission rate recommendations of Section 8.1 of Appendix W.

It is important to note that data derived for the annual state emission inventory (EI) is based on actual levels of fuel combusted for the year, and is therefore different than how allowable emissions are computed for near-field dispersion modeling. For the annual EI report, a source computes their annual emissions based upon the AP-42 emission factor multiplied by the actual total annual throughput or total fuel combusted.

In the 30 MMBtu/hr boiler example, the annual NOx emissions reported to the NEI is computed by:

E_{annual} = (AP-42 emission factor) x (total annual fuel combusted)

E_{annual} = (100 lbs/10^6 SCF) x (100 10^6 SCF/yr) = 10,000 lbs. NOx/yr or 5 tons NOx/yr

Exhibit 19

Memorandum from Tyler Fox, Leader, Air Quality Modeling Group, Re. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard (Mar. 1, 2011)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

MAR 0 1 2011

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard

FROM: Tyler Fox, Leader
Air Quality Modeling Group, C439-01

TO: Regional Air Division Directors

INTRODUCTION

On January 22, 2010, EPA announced a new 1-hour nitrogen dioxide (NO_2) National Ambient Air Quality Standard (1-hour NO_2 NAAQS or 1-hour NO_2 standard) that is attained when the 3-year average of the 98th-percentile of the annual distribution of daily maximum 1-hour concentrations does not exceed 100 ppb at each monitor within an area. The final rule for the new 1-hour NO_2 NAAQS was published in the Federal Register on February 9, 2010 (75 FR 6474-6537), and the standard became effective on April 12, 2010 (EPA, 2010a). A memorandum was issued on June 29, 2010, clarifying the applicability of current guidance in the *Guideline on Air Quality Models* (40 CFR Part 51, Appendix W) for modeling NO_2 impacts in accordance with the Prevention of Significant Deterioration (PSD) permit requirements to demonstrate compliance with the new 1-hour NO_2 standard.

This memorandum supplements the June 29, 2010 guidance memo by providing further clarification and guidance on the application of Appendix W guidance for the 1-hour NO_2 standard. Note that while the discussion of NO_x chemistry options in this memo is exclusive to the 1-hour NO_2 standard, the discussion of other topics in this memo should apply equally to the 1-hour SO_2 standard, accounting for the slight differences in the form of the 1-hour NO_2 and SO_2 standards[1]. In summary, the memo:

1. Clarifies procedures for demonstrating compliance with the 1-hour NO_2 NAAQS based on the form of the standard, including significant contribution analyses using the interim Significant Impact Level (SIL) established in the June 29, 2010 memo,

[1] The 1-hour NO_2 standard is based on the 98^{th}-percentile (8^{th}-highest) of the annual distribution of maximum daily 1-hour values, whereas the 1-hour SO_2 standard is based on the 99^{th}-percentile (4^{th}-highest) of the annual distribution of maximum daily 1-hour values.

and details updates to the AERMOD model with an internal post-processor option that supports such analyses.

2. Provides clarification on the use and acceptance of Tier 2 and Tier 3 options for NO_2, including updated model evaluation results for the OLM and PVMRM options incorporated in the AERMOD model.

3. Recommends that compliance demonstrations for the 1-hour NO_2 NAAQS address emission scenarios that can logically be assumed to be relatively continuous or which occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations based on existing modeling guidelines, which provide sufficient discretion for reviewing authorities to not include intermittent emissions from emergency generators or startup/shutdown operations from compliance demonstrations for the 1-hour NO_2 standard under appropriate circumstances.

4. Provides additional clarification and a more detailed discussion of the factors to consider in determination of background concentrations as part of a cumulative impact assessment including identification of nearby sources to be explicitly modeled.

5. Recommends an appropriate methodology for incorporating background concentrations in the cumulative impact assessment for the 1-hour NO_2 standard and details updates to the AERMOD model with an option to include temporally-varying background concentrations within the modeling analysis.

PROCEDURES FOR DEMONSTRATING COMPLIANCE WITH 1-HOUR NO_2 NAAQS

Compliance with the 1-hour NO_2 NAAQS is based on the multiyear average of the 98^{th}-percentile of the annual distribution of daily maximum 1-hour values not exceeding 100 ppb. The 8^{th}-highest of the daily maximum 1-hour values across a year is an unbiased surrogate for the 98^{th}-percentile[1]. The AERMOD dispersion model, EPA's preferred model for near-field applications under Appendix W, was recently modified (version dated 11059) to fully support the form of the 1-hour NO_2 NAAQS, as well as other analyses that may be needed in order to demonstrate that a source does not cause or contribute to a violation of the NAAQS based on the interim SIL established in the June 29, 2010, memorandum.

<u>Application of Interim SIL to Project Impacts</u>

Using the interim 1-hour NO_2 SIL, a permit applicant can determine: (1) whether, based on the proposed increase in NO_x emissions, a cumulative air quality analysis is required; (2) the area of impact within which a cumulative air quality analysis should focus; and (3) whether the proposed source's NO_x emissions will contribute to any modeled violation of the 1-hour NO_2 NAAQS identified in the cumulative analysis.

To determine initially whether a proposed project's emissions increase will have a significant impact (resulting in the need for a cumulative impact assessment), the June 29, 2010, memorandum recommended that the interim SIL should be compared to either of the following:

- The highest of the 5-year averages of the maximum modeled 1-hour NO_2 concentrations predicted each year at each receptor, based on 5 years of National Weather Service data; or
- The highest modeled 1-hour NO_2 concentration predicted across all receptors based on 1 year of site-specific meteorological data, or the highest of the multi-year averages of the maximum modeled 1-hour NO_2 concentrations predicted each year at each receptor, based on 2 or more years, up to 5 complete years of available site-specific meteorological data.

Since the form of the standard is based on the annual distribution of daily maximum 1-hour values, the maximum contribution that a project could make to the air quality impact at a receptor is the multiyear average of the highest 1-hour values at that receptor. If the multiyear average of the highest 1-hour values is below the SIL at all receptors, then the project could not contribute significantly to any modeled violations of the 1-hour NO_2 NAAQS, thus exempting that project from the cumulative impact assessment.

Application of Interim SIL to Cumulative Impact Assessment

If a project's impacts exceed the SIL at any receptors based on this initial impact analysis, then a cumulative impact assessment should be completed to determine whether the project will cause or contribute to any modeled violations of the NAAQS. While not common practice in the past, given the more complex analysis procedures associated with the form of the 1-hour NO_2 NAAQS, we deem it appropriate and acceptable in most cases to limit the cumulative impact analysis to only those receptors that have been shown to have significant impacts from a proposed new source based on the initial SIL analysis, assuming that the design of the original receptor grid was adequate to determine all areas of ambient air where the source could contribute significantly to modeled violations. This may especially be appropriate for the 1-hour NO_2 standard since the initial modeling of the project emissions without other background emission sources may have a tendency to overestimate ambient NO_2 concentrations, even under Tier 3 applications, by understating the potential ozone limiting influence of the background NO_x emissions. If modeled violations of the NAAQS are found based on the cumulative impact assessment, then the project's contribution to all modeled violations should be compared to the interim SIL to determine whether the project causes or contributes to any of the modeled violations.

In past guidance (EPA, 1988), EPA has indicated that the significant contribution analysis should be based on a source's contribution to the modeled violation paired in time and space. The form of the 1-hour NO_2 NAAQS complicates this analysis since the modeled violation is based on a multiyear average of the annual distribution of daily maximum 1-hour values, i.e., a particular modeled violation at a particular receptor represents an average based on specific hours on specific days from each of the five years of meteorological data (for National Weather Service (NWS) data). It is important to point out here that the significant contribution analysis is not limited to analyzing the source's contribution associated only with the modeled design value based on the 98^{th}-percentile cumulative air quality impact at the receptor, but rather must examine all cases where the cumulative impact exceeds the NAAQS at or below the 98^{th}-

percentile. In some cases a source's contribution to the 98th-percentile of the daily maximum 1-hour values from the cumulative impact (i.e., the cumulative impact value or modeled design value that is compared to the NAAQS) may be below the SIL, while the source's contribution to cumulative impacts below the 98th-percentile but above the NAAQS could exceed the SIL. Therefore, the significant contribution analysis should examine every multiyear average of daily maximum 1-hour values, beginning with the 8th-highest (98th-percentile)[2], continuing down the ranked distribution until the cumulative impact is below the NAAQS. Since the form of the standard is based on the annual distribution of daily maximum 1-hour values, the significant contribution analysis should be limited to the distribution of daily maximum 1-hour values, i.e., the 2nd, 3rd, 4th-highest 1-hour values during the day, and so on, are not considered in this analysis. In addition, for applications with more than one year of meteorological data, the significant contribution analysis should only examine ranks paired across the years, i.e., the multiyear average of the *N*th-highest values across each of the years processed. The recent update to the AERMOD model (dated 11059) includes an option (the MAXDCONT keyword) to automatically perform this contribution analysis (EPA, 2010b), examining the contribution from project emissions to the cumulative impacts at each receptor across a user-specified range of ranked values, paired in time and space, as an internal post-processor within the model. Other options are available in the recent AERMOD update that identify the specific data periods contributing to the cumulative modeled impacts at each receptor.

Applicability of Ambient Monitoring Requirements to Modeling Demonstrations

The June 29, 2010 memo addressed one aspect of the applicability of ambient monitoring requirements, set forth in Appendix S to 40 CFR Part 50 in relation to the 1-hour NO_2 standard[3], to modeling applications to demonstrate compliance with the NAAQS, namely the use of 3 years of ambient monitoring data as the basis for attainment of the NAAQS using monitoring vs. the use of 5 years of meteorological data for modeling demonstrations of compliance with the NAAQS. Specifically, the June 29, 2010 memo indicated that "*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 for use of 5 years of NWS meteorological data or at least 1 year of site specific data. The 5-year average based on use of NWS data, or an average across one or more years of available site specific data, serves as an unbiased estimate of the 3-year average for purposes of modeling demonstrations of compliance with the NAAQS. Modeling of 'rolling 3-year averages,' using years 1 through 3, years 2 through 4, and years 3 through 5, is not required*."

We would also like to emphasize that other aspects of the ambient monitoring requirements for the 1-hour NO_2 standard should not be applied for modeling analyses to demonstrate compliance with the NAAQS. For example, Appendix S addresses the data completeness requirements for monitored NO_2 concentrations, procedures for handling missing data periods, and conventions for rounding of monitored values. Appendix S specifies that a sampling day is complete if at least 75 percent of the hourly values are valid and a quarter is complete if at least 75 percent of the sampling days have complete data, and establishes calculation procedures for identifying the monitored design value that should be compared to the

[2] For the 1-hour SO_2 standard the analysis should begin with the 4th-highest, or 99th-percentile value.
[3] Appendix T to 40 CFR Part 50 addresses ambient monitoring requirements for the 1-hour SO_2 standard.

NAAQS. While the requirements of Appendix S are appropriate in the context of ambient monitoring, application of these requirements and procedures to a dispersion modeling analysis is not appropriate and may conflict with modeling guidance in many cases. Appendix W provides guidance on data completeness for meteorological data which specifically addresses the needs of dispersion modeling, including procedures that are explicitly implemented within the meteorological processor and dispersion model to account for missing data due to calm winds or other factors. Adjustments to the calculation procedures for determining the modeled design value for comparison to the NAAQS based on Appendix S data completeness criteria is not appropriate. The EPA Model Clearinghouse has also issued guidance in the past that modeled concentrations should not be rounded before comparing the modeled design value to the NAAQS. The fundamental point to recognize here is that ambient monitoring requirements/procedures and dispersion modeling guidance/procedures address different issues and needs relative to each aspect of air quality assessment, and are often motivated by different concerns and exigencies.

APPROVAL AND APPLICATION OF TIERING APPROACH FOR NO_2

Given the stringency of the 1-hour NO_2 standard relative to the annual standard, many more permit applicants may find it necessary to use the less conservative Tier 2 or Tier 3 approaches in order to demonstrate compliance with the new NAAQS rather than relying on the Tier 1 assumption of full conversion. The June 29, 2010 memo highlighted some of the potential issues that may need to be addressed in the application of these less conservative assumptions for estimating ambient NO_2 impacts, relative to the Tier 1 option of full conversion, and clarified the status of the Tier 3 PVMRM and OLM approaches available as non-regulatory-default options within the AERMOD model.

In order to ease the burden on permit applicants in addressing the need to demonstrate compliance with the 1-hour NO_2 NAAQS, as well as the burden on the permitting authority in reviewing such applications, we offer additional discussion and recommendations in relation to the use of Tier 2 and Tier 3 options. Specifically, we recommend the following:

- Use of 0.80 as a default ambient ratio for the 1-hour NO_2 standard under Tier 2 without additional justification by applicants; and

- General acceptance of 0.50 as a default in-stack ratio of NO_2/NO_x for input to the PVMRM and OLM options within AERMOD, in the absence of more appropriate source-specific information on in-stack ratios.

The following sections explain these recommendations in more detail and also discuss the relative merits of the PVMRM and OLM options, clarifying that we have not indicated any preference of one option over the other. We also provide updated model evaluation results for the PVMRM and OLM options in AERMOD that lend further credence to the use of these Tier 3 options for 1-hour NO_2 compliance demonstrations. We anticipate that these recommendations and updated model evaluations will simplify and facilitate the process of gaining approval for use of these non-regulatory default options in AERMOD.

Tier 2 Ambient Ratio Method (ARM) for NO-to-NO_2 Conversion

Regarding the Tier 2 option of applying an ambient ratio to the Tier 1 result, the June 29, 2010 memo cautioned against use of the 0.75 national default ratio recommended in Appendix W for the annual standard for estimating hourly NO_2 impacts, without some justification of the appropriateness of that assumption. We still do not consider 0.75 as an appropriate default ambient ratio for the 1-hour standard, but several references cite ambient ratios of about 0.80 for hourly NO_2/NO_x (e.g., Wang, et al., 2011; Janssen, et al., 1991), and we believe it would be appropriate to accept that as a default ambient ratio for the 1-hour NO_2 standard. Consideration was given to adopting the default equilibrium ratio of 0.90 incorporated in the PVMRM option as an hourly ARM, but we do not consider that to be an appropriate choice since it is the maximum ratio applied on a source-by-source and hourly basis, irrespective of the predicted hourly NO_x concentration, whereas the Tier 2 ARM of 0.80 would be applied to the maximum cumulative hourly NO_x concentration.

Tier 3 Options for NO-to-NO_2 Conversion

The June 29, 2010 memo clarified that the OLM and PVMRM options in the AERMOD model should be considered as Tier 3 applications under Section 5.2.4 of Appendix W. Also, since the OLM and PVMRM methods are currently implemented as non-regulatory-default options within the AERMOD dispersion model (Cimorelli, *et al.*, 2004; EPA, 2004; EPA, 2010b), their use requires justification and approval by the Regional Office on a case-by-case basis, pursuant to Sections 3.1.2.c, 3.2.2.a, and A.1.a(2) of Appendix W. The June 29 memo also highlighted the importance of two key model inputs for both the OLM and PVMRM options in the context of the 1-hour NO_2 standard, namely the in-stack ratios of NO_2/NO_x emissions and background ozone concentrations. This section provides additional discussion of these key inputs for OLM and PVMRM and also clarifies the similarities and differences between these methods and discusses their relative merits for purposes of demonstrating compliance with the 1-hour NO_2 standard.

As noted in the June 29, 2010 memo, limited evaluations of PVMRM have been completed which show encouraging results, but the amount of data currently available is too limited to justify a designation of PVMRM as a refined method for NO_2 (Hanrahan, 1999; MACTEC, 2005). Furthermore, the original evaluations focused on model performance for annual averages since the only NO_2 standard in effect at the time was annual. We have recently updated the evaluations to reflect the current AERMOD modeling system components and extended them to examine model performance for hourly NO_2 concentrations. Preliminary results from these recent evaluations are presented in Attachment A.

While the limited scope of the available field study data imposes limits on the ability to generalize conclusions regarding model performance, these preliminary results of hourly NO_2 predictions for Palaau and New Mexico show generally good performance for the PVMRM and OLM/OLMGROUP ALL options in AERMOD. We believe that these additional model evaluation results lend further credence to the use of these Tier 3 options in AERMOD for estimating hourly NO_2 concentrations, and we recommend that their use should be generally accepted provided some reasonable demonstration can be made of the appropriateness of the key inputs for these options, the in-stack NO_2/NO_x ratio and the background ozone concentrations. Although well-documented data on in-stack NO_2/NO_x ratios is still limited for many source categories, we also feel that it would be appropriate in the absence of such source-specific in-stack data to adopt a default in-stack ratio of 0.5 as being adequately conservative in most cases and a better alternative to use of the Tier 1 full conversion or Tier 2 ambient ratio options. This value appears to represent a reasonable upper bound based on the available in-stack data. We hope that over time the range of source categories for which in-stack ratio information is available increases and the quality of such information will improve.

These preliminary model evaluation results also serve to highlight a point worth emphasizing, which is that the PVMRM option in AERMOD is not inherently superior to the OLM option for purposes of estimating cumulative ambient NO_2 concentrations. The June 29, 2010 memo indicated that both PVMRM and OLM should be considered as Tier 3 options, but did not indicate any preference between these two options. Both PVMRM and OLM simulate the same basic chemical mechanism of ozone titration, the interaction of NO with ambient ozone (O_3) to form NO_2 and O_2. The main distinction between PVMRM and OLM is the approach taken to estimate the ambient concentrations of NO and O_3 for which the ozone titration mechanism should be applied. For isolated elevated point sources, the PVMRM option does represent a more refined treatment of ozone titration since it estimates the NO and O_3 available for conversion based on simulating the actual volume of the instantaneous plume as it is transported downwind. As a result, this method will generally provide a more realistic simulation of the NO-to-NO_2 conversion rate along the path of the plume for a particular source, accounting for the influence of meteorological conditions on the entrainment of O_3 associated with growth of the plume. However, the algorithm incorporated in PVMRM for determining which plumes “compete” for available ozone for multi-source applications has not been thoroughly validated, and as shown in the model evaluation results for New Mexico, PVMRM may not always provide a “better” answer than the OLM option.

The PVMRM algorithm as currently implemented may also have a tendency to overestimate the conversion of NO to NO_2 for low-level plumes by overstating the amount of ozone available for the conversion due to the manner in which the plume volume is calculated. The plume volume calculation in PVMRM does not account for the fact that the vertical extent of the plume based on the vertical dispersion coefficient may extend below ground for low-level plumes. This overestimation of the volume of the plume could contribute to overestimating conversion to NO_2. The PVMRM option has further limitations for area source applications, especially for elongated area sources that may be used to simulate road segments. In these cases, the lateral extent of the plume used in calculating the plume volume depends on the projected width of the area source, even if only a portion of the area source actually impacts a nearby receptor. This again would tend to overestimate the volume of the plume for purposes of determining the amount of ozone available for conversion of NO to NO_2, and would likely overestimate ambient NO_2 concentrations. In light of these issues, a series of volume sources rather than elongated area sources is recommended for simulating NO_2 impacts from roadway emissions with PVMRM, especially for receptors located relatively close to the roadway. Furthermore, the OLM option with OLMGROUP ALL was used to estimate NO_2 concentrations from mobile source emissions modeled as area sources for the Atlanta area as part of the EPA’s

Risk and Exposure Assessment (REA) for the most recent NO_2 NAAQS review (EPA, 2008). Results of model-to-monitor comparisons from the REA show generally good performance, suggesting that use of OLM with OLMGROUP ALL is appropriate for modeling such emissions.

TREATMENT OF INTERMITTENT EMISSIONS

Modeling of intermittent emission units, such as emergency generators, and/or intermittent emission scenarios, such as startup/shutdown operations, has proven to be one of the main challenges for permit applicants undertaking a demonstration of compliance with the 1-hour NO_2 NAAQS. Prior to promulgation of the new 1-hour NO_2 standard, the only NAAQS applicable for NO_2 was the annual standard and these intermittent emissions typically did not factor significantly into the modeled design value for the annual standard. Sources often take a 500 hour/year permit limit on operation of emergency generators for purposes of determining the potential to emit (PTE), but may actually operate far fewer hours than the permitted limit in many cases and generally have not been required to assume continuous operation of these intermittent emissions for purposes of demonstrating compliance with the annual NAAQS. Due in part to the relatively low release heights typically associated with emergency generators, an assumption of continuous operation for these intermittent emissions would in many cases result in them becoming the controlling emission scenario for determining compliance with the 1-hour standard.

EPA's guidance in Table 8-2 of Appendix W involves a degree of conservatism in the modeling assumptions for demonstrating compliance with the NAAQS by recommending the use of maximum allowable emissions, which represents emission levels that the facility could, and might reasonably be expected to, achieve if a PSD permit is granted. However, the intermittent nature of the actual emissions associated with emergency generators and startup/shutdown in many cases, when coupled with the probabilistic form of the standard, could result in modeled impacts being significantly higher than actual impacts would realistically be expected to be for these emission scenarios. The potential overestimation in these cases results from the implicit assumption that worst-case emissions will coincide with worst-case meteorological conditions based on the specific hours on specific days of each of the years associated with the modeled design value based on the form of the hourly standard. In fact, the probabilistic form of the standard is explicitly intended to provide a more stable metric for characterizing ambient air quality levels by mitigating the impact that outliers in the distribution might have on the design value. The February 9, 2010, preamble to the rule promulgating the new 1-hour NO_2 standard stated that "it is desirable from a public health perspective to have a form that is reasonably stable and insulated from the impacts of extreme meteorological events." 75 FR 6492. Also, the Clean Air Science Advisory Committee (CASAC) "recommended a 98^{th}-percentile form averaged over 3 years for such a standard, given the potential for instability in the higher percentile concentrations around major roadways." 75 FR 6493.

To illustrate the importance of this point, consider the following example. Under a deterministic 1-hour standard, where the modeled design value would be based on the highest of the second-highest hourly impacts (allowing one exceedance per year), a single emission episode lasting 2 hours for an emergency generator or other intermittent emission scenario could determine the modeled design value if that episode coincided with worst-case meteorological conditions. While the probability of a particular 2-hour emission episode actually coinciding with the worst-case meteorological conditions is relatively low, there is nonetheless a clear linkage between a specific emission episode and the modeled design value. By contrast, under the form of the 1-hour NO_2 NAAQS only one hour from that emission episode could contribute to the modeled design value, i.e., the daily maximum 1-hour value. However, by assuming continuous operation of intermittent emissions the modeled design value for the 1-hour NO_2 NAAQS effectively assumes that the intermittent emission scenario occurs on the specific hours of the specific days for each of the specific years of meteorological data included in the analysis which factor into the multiyear average of the 98^{th}-percentile of the annual distribution of daily maximum 1-hour values. The probability of the controlling emission episode occurring on this particular temporal schedule to determine the design value under the probabilistic standard is significantly smaller than the probability of occurrence under the deterministic standard; thereby increasing the likelihood that impact estimates based on assuming continuous emissions would significantly overestimate actual impacts for these sources.

Given the implications of the probabilistic form of the 1-hour NO_2 NAAQS discussed above, we are concerned that assuming continuous operations for intermittent emissions would effectively impose an additional level of stringency beyond that intended by the level of the standard itself. As a result, we feel that it would be inappropriate to implement the 1-hour NO_2 standard in such a manner and recommend that compliance demonstrations for the 1-hour NO_2 NAAQS be based on emission scenarios that can logically be assumed to be relatively continuous or which occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations. EPA believes that existing modeling guidelines provide sufficient discretion for reviewing authorities to exclude certain types of intermittent emissions from compliance demonstrations for the 1-hour NO_2 standard under these circumstances.

EPA's *Guideline on Air Quality Models* provides recommendations regarding air quality modeling techniques that should be applied in preparation or review of PSD permit applications and serves as a "common measure of acceptable technical analysis when supported by sound scientific judgment." 40 C.F.R. Part 51, Appendix W, section 1.0.a. While the guidance establishes principles that may be controlling in certain circumstances, the guideline is not "a strict modeling 'cookbook'" so that, as the guideline notes, "case-by-case analysis and judgment are frequently required." Section 1.0.c. In particular, with respect to emissions input data, section 8.0.a. of Appendix W establishes the general principle that "the most appropriate data available should always be selected for use in modeling analyses," and emphasizes the importance of "the exercise of professional judgement by the appropriate reviewing authority" in determining which nearby sources should be included in the model emission inventory. Section 8.2.3.b.

For the reasons discussed above, EPA believes the most appropriate data to use for compliance demonstrations for the 1-hour NO_2 NAAQS are those based on emissions scenarios that are continuous enough or frequent enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations. Section 8.1.1.b of the guideline also provides that "[t]he appropriate reviewing authority should be consulted to determine appropriate source definitions and for guidance concerning the determination of emissions from and techniques for modeling various source types." When EPA is the reviewing authority for a permit, for the reasons described above, we will consider it acceptable to limit the emission scenarios included in the modeling compliance demonstration for the 1-hour NO_2 NAAQS to those emissions that are continuous enough or frequent enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations. Consistent with this rationale, the language in Section 8.2.3.d of Appendix W states that "*[i]t is appropriate to model nearby sources only during those times when they, by their nature, operate at the same time as the primary source(s) being modeled.*" While we recognize that these intermittent emission sources could operate at the same time as the primary source(s), the discussion above highlights the additional level of conservatism in the modeled impacts inherent in an assumption that they do in fact operate simultaneously and continuously with the primary source(s).

The rationale regarding treatment of intermittent emissions applies for both project emissions and any nearby or other background sources included in the modeling analysis. However, this rationale does not apply to the load analysis recommended in Table 8-2 of Appendix W, since various operating loads are not by design intended to be intermittent. Appendix W, Section 8.1.2.a. With respect to the operating level, for the proposed new or modified source, Table 8-2 calls for using "[d]esign capacity or federally enforceable permit condition." With respect to nearby sources, the guidelines call for estimating emissions based on "[a]ctual or design capacity (whichever is greater), or federally enforceable permit condition." Footnote 3 to the table notes that "[o]perating levels such as 50 percent and 75 percent of capacity should also be modeled to determine the load causing the highest concentration." The justification for not including certain intermittent operations described in this memo does not apply to these guidelines that address analyzing the load causing the highest concentration.

We recognize that case-specific issues and factors may arise that affect the application of this guidance, and that not all facilities required to demonstrate compliance with the 1-hour NO_2 NAAQS will fit within the scenario described above with clearly defined continuous/normal operations vs. intermittent/infrequent emissions. Additional discretion may need to be exercised in such cases to ensure that public health is protected. For example, an intermittent source that is permitted to operate up to 500 hours per year, but typically operates much less than 500 hours per year and on a random schedule that cannot be controlled would be appropriate to consider under this guidance. On the other hand, an "intermittent" source that is permitted to operate only 365 hours per year, but is operated as part of a process that typically occurs every day, would be less suitable for application of this guidance since the single hour of emissions from each day could contribute significantly to the modeled design value based on the annual distribution of daily maximum 1-hour concentrations. Similarly, the frequency of startup/shutdown emission scenarios may vary significantly depending on the type of facility. For example, a large base-load power plant may experience startup/shutdown events on a relatively infrequent basis whereas as a peaking unit may go through much more frequent startup/shutdown cycles. It may be appropriate to apply this guidance in the former case, but not the latter.

Another aspect of intermittent emissions worth noting is the distinction between intermittent emissions that can be scheduled with some degree of flexibility vs. intermittent emissions that cannot be scheduled. For example, a portion of emissions from an emergency generator are likely to be associated with regular testing of the equipment that may be required to ensure its reliable operation, while that portion of emergency generator emissions associated with actual emergency use typically cannot be scheduled. In this case it may be appropriate to include a permit condition that restricts operation of the emergency generator during testing to certain hours of the day, which may mitigate that source's contribution to ambient NO_2 levels based on dispersion conditions. Limiting operation to specific time periods is an appropriate permit condition under Appendix W guidance and would not constitute a "dispersion technique" subject to Section 123 of the CAA. In this case the portion of the emissions associated with scheduled testing can be accounted for more realistically by limiting the hours modeled to account for meteorological conditions that are more representative of actual operations.

Another approach that may be considered in cases where there is more uncertainty regarding the applicability of this guidance would be to model impacts from intermittent emissions based on an average hourly rate, rather than the maximum hourly emission. For example, if a proposed permit includes a limit of 500 hours/year or less for an emergency generator, a modeling analysis could be based on assuming continuous operation at the average hourly rate, i.e., the maximum hourly rate times 500/8760. This approach would account for potential worst-case meteorological conditions associated with emergency generator emissions by assuming continuous operation, while use of the average hourly emission represents a simple approach to account for the probability of the emergency generator actually operating for a given hour. Also note that the contribution of intermittent emissions to annual impacts should continue to be addressed as in the past to demonstrate compliance with the annual NO_2 standard.

A final point of clarification regarding intermittent emissions that deserves some emphasis is that the guidance provided here in relation to determining compliance with the 1-hour NO_2 NAAQS through dispersion modeling has no effect on or relevance to the existing policies and guidance regarding excess emissions that may occur during startup and shutdown, where such excess emissions violate applicable emission limitations[4]. In other words, all emissions from a new or modified source are subject to the applicable permitted emission limits and may be subject to enforcement action regarding such excess emissions, regardless of whether a portion of those emissions are not included in the modeling demonstration based on the guidance provided here.

Given the added complexity of the technical issues that arise in the context of demonstrating compliance with the 1-hour NO_2 NAAQS through dispersion modeling, we strongly encourage adherence to the recommendations in Section 10.2.1. of Appendix W that "*[e]very effort should be made by the Regional Office to meet with all parties involved in either a SIP revision or a PSD permit application prior to the start of any work on such a project. During this meeting, a protocol should be established between the preparing and reviewing parties to define the procedures to be followed, the data to be collected, the model to be used, and the analysis of the source and concentration data.*"

[4] While excess emissions during malfunctions are also addressed in the policy related to excess emissions, Appendix W explicitly excludes emissions due to malfunction from the modeling analysis to demonstrate compliance with the NAAQS, unless the excess emissions are the result of poor maintenance, careless operation, or other preventable conditions. See Section 8.1.2.a, footnote a.

DETERMINING BACKGROUND CONCENTRATIONS

Unless a facility can demonstrate that ambient impacts associated from its emissions will not exceed the appropriate SIL, a cumulative analysis of ambient impacts will be necessary, and the determination of background concentrations to include in that cumulative impact assessment will be a critical component of the analysis. The June 29, 2010 memorandum addressed some aspects of this issue, but given the stringency of the new 1-hour NO_2 standard, the "margin for error" in this aspect of the analysis is much smaller than it has been in the past. As a result, we believe it is necessary to provide additional clarification and a more detailed discussion of the factors associated with this aspect of the permitting process. We hope that this additional discussion will serve to more clearly define some of the key steps and considerations in the process that could form the basis of a generic modeling protocol. We also provide suggestions regarding some of the documentation related to this component of the modeling analysis that may facilitate and expedite the review process.

The goal of the cumulative impact assessment should be to demonstrate with an adequate degree of confidence in the result that the proposed new or modified emissions will not cause or significantly contribute to violations of the NAAQS. In general, the more conservative the assumptions on which the cumulative analysis is based, the more confidence there will be that the goal has been achieved and the less controversial the review process will be from the perspective of the reviewing authority. As less conservative assumptions are implemented in the analysis, the more scrutiny those assumptions may require and the review process may tend to be lengthier and more controversial as a result. We expect that by providing a more detailed discussion of the factors to be considered in the cumulative impact assessment, permit applicants and permitting authorities will be able to find the proper balance of the competing factors that contribute to this analysis.

Identifying Nearby Sources to Include in Modeled Inventory

As noted in the June 29, 2010 memo, Section 8.2.3 of Appendix W emphasizes the importance of professional judgment by the reviewing authority in the identification of nearby and other sources to be included in the modeled emission inventory, and establishes "a significant concentration gradient in the vicinity of the source" under consideration as the main criterion for this selection. Appendix W also suggests that "the number of such [nearby] sources is expected to be small except in unusual situations." See Section 8.2.3.b. In light of this guidance, the June 29, 2010 memo cautioned against the literal and uncritical application of very prescriptive procedures for identifying which background sources should be included in the modeled emission inventory for NAAQS compliance demonstrations, such as those described in Chapter C, Section IV.C.1 of the draft *New Source Review Workshop Manual* (EPA, 1990). This caution should not be taken to imply that the procedures outlined in the NSR Workshop Manual are flawed or inappropriate in themselves. Cumulative impact assessments based on following such procedures will generally be acceptable as the basis for permitting decisions, contingent on an appropriate accounting for the monitored contribution. Our main concern is that following such procedures in a literal and uncritical manner may in many cases result in cumulative impact assessments that are overly conservative and could unnecessarily complicate the permitting process in some cases. Such procedures might be characterized as being sufficient in most cases, but not always necessary to fulfill the requirements of a cumulative impact assessment.

A fundamental challenge in developing more detailed general guidance on the issue of determining background concentrations as part of a cumulative impact assessment is that the factors that need to be considered are very case-specific in nature. These factors include foremost the nature of the source being permitted, including the source characteristics and local meteorological and topographical factors that determine the spatial and temporal patterns of the source's ambient impacts. The initial significant impact assessment should serve to characterize these factors, and we would suggest the following:

1. As a standard practice contour plots of modeled concentrations should be prepared which clearly depict the impact area of the source, preferably overlaid on a map of the area that identifies key geographical features that may influence the dispersion patterns. The concentration contour plot also serves to visually depict the concentration gradients associated with the source's impact.
2. We also recommend that the controlling meteorological conditions for the project impacts be identified as clearly as possible. The probabilistic form of the 1-hour NO_2 standard complicates this assessment somewhat, but the recent update to the AERMOD model includes new model output options (MAXDAILY and MXDYBYYR keywords) that identify the specific time periods on which the modeled design value is based.
3. As an aid to interpreting this information, we also suggest including the location of the meteorological monitoring station used in the modeling analysis on the plot of source impacts, as well as a wind rose depicting general flow patterns.

If a cumulative impact assessment is required due to the source's impacts exceeding the interim SIL, the applicant will need to identify and acquire data on the two main components of the cumulative impact assessment, namely the location and emissions from nearby background sources that may need to be included in the modeled component of the cumulative ambient impact assessment, and the location and magnitude of air quality data from ambient NO_2 monitors located within the area. Section 8.2.1.b of Appendix W states that "[t]ypically, air quality data should be used to establish background concentrations in the vicinity of the source(s) under consideration." Section 8.2.1.c further states that "[i]f the source is not isolated, it may be necessary to use a multi-source model to establish the impact of nearby sources." While many applications will be required to include both monitored and modeled contributions to adequately account for background concentrations in the cumulative analysis, we believe that these statements imply a preference for use of ambient air quality data to account for background concentrations where possible.

Many of the challenges and more controversial issues related to cumulative impact assessments arise in the context of how best to combine a monitored and modeled contribution to account for background concentrations. Addressing these issues requires an assessment of the spatial and temporal representativeness of the background monitored concentrations for purposes of the cumulative impact assessment and the potential for double counting of impacts from modeled sources that may be contributing to the monitored concentrations. This assessment may involve significant technical details which could complicate the review process. Therefore, the more thoroughly and clearly these issues are documented the more efficient and effective the review process is likely to be.

A key point to remember when assessing these issues is their interconnectedness – the question of which nearby background sources should be included in the cumulative modeling analysis is inextricably linked with the question of what ambient monitoring data is available and what that data represents in relation to the application. Furthermore, the question of how to appropriately combine monitored and modeled concentrations (temporally and spatially) to determine the cumulative impact depends on a clear understanding of what the ambient monitored data represents in relation to the modeled emission inventory. A more detailed temporal pairing of monitored and modeled concentrations may be acceptable in one case given the extent of the modeled emission inventory, while a more conservative assumption for combining monitored and modeled concentrations using high ranked monitored concentrations may be sufficient to justify a more limited modeling inventory. As noted above, the stringency of the new standard may require a more detailed and refined analysis of these issues in order to demonstrate compliance with the standards than was necessary in the past, and these refinements will generally increase the burden on the applicant to adequately demonstrate that the net result of the analysis is protective of the standard. A detailed analysis and explanation of any potential bias to the net result introduced by proposed refinements will be important to facilitate the review process. The issues associated with determining an appropriate method for combining modeled and monitored contributions to a cumulative impact assessment are discussed in more detail in the next section.

Building on the geographical information recommended above for the initial SIL analysis, we suggest including the following documentation:

1. A geographical depiction of the location and magnitude of nearby emission sources, along with the location and magnitude of any ambient monitored data as part of the documentation submitted with a cumulative impact assessment.
2. Depicting the impact area and pattern of the project impacts on such a figure along with a wind rose should be useful in assessing many of the issues touched on above, such as what nearby sources are likely to cause significant concentration gradients in the vicinity of the project source, or more specifically in the areas of high impacts associated with the project source. This figure should also help to identify what nearby source’s impacts are likely to be adequately represented in the available monitored data and the potential for double counting of impacts from modeled background sources if certain ambient background data are used.
3. In addition to a standard wind rose, pollution roses (i.e., a depiction of monitored pollutant concentrations as a function of wind direction and/or other meteorological factors) should also be useful for purposes of assessing the representativeness of the monitoring background concentrations in relation to the cumulative impact assessment.

Finally, we reiterate the importance of close coordination with the appropriate reviewing authority in the determination of nearby or other sources to include in the modeled emission inventory.

Significant Concentration Gradient Criterion

While Appendix W (Section 8.2.3.b) identifies "a significant concentration gradient in the vicinity of the source" as the sole criterion in relation to determining which nearby sources should be explicitly modeled as part of the cumulative impact assessment, little else has been written to explain what "significant" means in this context or even what the relevance of a "significant concentration gradient" is for this purpose. In fact, Appendix W states that no attempt was made to "comprehensively define" the term, "owing to both the uniqueness of each modeling situation and the large number of variables involved in identifying nearby sources." Section 8.2.3.b. Nothing has fundamentally changed to alter this characterization, but given the issues and challenges arising from the implementation of the new 1-hour NO_2 standard, we feel compelled to offer some additional explanation regarding what this guidance means and how it should be applied.

One definition of the term "gradient" that applies in this context is "the rate of change of a physical quantity . . . with distance[5]." In this case the physical quantity is the ground-level concentration of the pollutant being assessed. The first point worth noting is that the gradient of the ground-level concentration has two dimensions, a longitudinal (along-wind) gradient and a lateral (cross-wind) gradient. Appendix W makes no distinction as to which gradient is more important or whether both gradients should be considered. Before offering any suggestions on that question, it might be helpful to offer some thoughts on the question of why a significant concentration gradient is mentioned as the sole criterion. Since an ambient monitor is limited to characterizing air quality at a fixed location, the impact from a nearby source that causes a significant concentration gradient in the vicinity of the project source is not likely to be characterized very well by the monitored concentration in terms of its potential for contributing to the cumulative modeled design value due to the high degree of variability of the source's impact. In this sense both the longitudinal and lateral gradients could be of importance. However, since the location of impacts from a particular source relative to other sources being modeled or relative to the ambient monitor location is strongly influenced by the transport wind direction, relatively minor changes in wind direction can result in significant changes in modeled concentrations at a particular time and point in space, such as the monitor location. The longitudinal gradient will also vary as a result of changes in wind speed and atmospheric stability, but in general the impact of this longitudinal variability on concentrations at a particular time and point in space will be less significant than the variability associated with the lateral gradient. From this perspective it would appear that the lateral gradient may be more important to consider for purposes of assessing which background sources should be explicitly modeled.

Concentration gradients associated with a particular source will generally be largest between the source location and the distance to the maximum ground-level concentrations from the source. Beyond the maximum impact distance, concentration gradients will generally be much smaller and more spatially uniform. A general "rule of thumb" for estimating the distance

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[5] Webster's New World College Dictionary, Copyright © 2010 by Wiley Publishing, Inc., Cleveland, Ohio.

to maximum 1-hour impact and the region of significant concentration gradients that may apply in relatively flat terrain is approximately 10 times the source release height. For example, the maximum impact area and region of significant concentration gradients associated with a 100 meter stack in flat terrain would be approximately 1,000 meters downwind of the source, with some variation depending on the source characteristics affecting plume rise. However, the potential influence of terrain on maximum 1-hour pollutant impacts may also significantly affect the location and magnitude of concentration gradients associated with a particular source. Even accounting for some terrain influences on the location and gradients of maximum 1-hour concentrations, these considerations suggest that the emphasis on determining which nearby sources to include in the modeling analysis should focus on the area within about 10 kilometers of the project location in most cases. The routine inclusion of all sources within 50 kilometers of the project location, the nominal distance for which AERMOD is applicable, is likely to produce an overly conservative result in most cases.

The relative importance of the lateral vs. the longitudinal gradient will also depend on terrain effects and other factors, such as the atmospheric stability associated with worst-case impacts. The importance of the lateral gradient relative to the longitudinal gradient will generally increase for sources where maximum hourly impacts occur under stable conditions due to the narrowness of the plume under such conditions. The contour plots of modeled design values suggested above provide a method for examining concentration gradients more explicitly. The AERSCREEN model should also serve as a useful tool for identifying the worst-case meteorological conditions for individual sources, as well as determining locations of maximum impact and areas of significant concentration gradients.

A final point to mention in relation to this topic is that the pattern of concentration gradients can vary significantly based on the averaging period being assessed. In general, concentration gradients will be smaller and more spatially uniform for annual averages than for short-term averages, especially hourly averages. The spatial distribution of annual impacts around a source will typically have a single peak “downwind” of the source based on the prevailing wind direction, except in cases where terrain or other geographical effects are important. By contrast, the spatial distribution of peak hourly impacts will typically show several localized concentration peaks with more significant gradients. The number of peaks and the magnitude of the gradients will be somewhat smaller for modeled design values based on the form of the 1-hour NO_2 standard than for overall peak hourly values, due to the smoothing effect of using a multiyear average of the 98^{th}-percentile from the annual distribution of daily maximum values. One implication of these differences between long-term and short-term concentration patterns is that the factors affecting which sources should be included in the modeled inventory and the method for combining modeled with monitored concentrations are more complex for the 1-hour NO_2 standard than for the annual standard.

While we hope this discussion provides some useful insight into this issue, we also caution against interpreting this guidance too literally or too narrowly, and emphasize that a “large number of variables” (Appendix W, Section 8.2.3.b) are involved in this assessment.

COMBINING MODELED RESULTS AND MONITORED BACKGROUND TO DETERMINE COMPLIANCE

One important aspect of the cumulative impact assessment that also deserves further discussion and entails new challenges with the 1-hour NO_2 NAAQS is the method for combining modeled concentrations with monitored background concentrations to determine the cumulative ambient impact. The June 29, 2010 memo indicated that a "first tier" assumption for a uniform monitored background contribution that may be applied without further justification is to add the overall highest hourly background NO_2 concentration (across the most recent three years) from a representative monitor to the modeled design value[6] for comparison to the NAAQS. Use of a single uniform monitored background contribution is the simplest approach to implement since it can be applied outside of the modeling system. We recognize that use of the overall highest hourly background concentration may be overly conservative in many cases, but that conservatism also provided the basis for indicating that this approach could be used without further justification. As explained above, the more conservative the assumptions on which the cumulative analysis is based, the more confidence there will be that the goal of demonstrating that the source will not cause or contribute to violations of the NAAQS has been achieved and the less controversial the review process will be from the perspective of the reviewing authority. The June 29, 2010 memo also indicated that additional refinements to this "first tier" approach based on some level of temporal pairing of modeled and monitored values may be considered on a case-by-case basis, with adequate justification and documentation. Given the importance of this aspect of the analysis and the challenges that have arisen in application of the guidance to date, we feel compelled to offer additional guidance on this issue.

While the "first tier" assumption from the June 29, 2010 memo of using a uniform monitored background contributions based on the overall highest hourly background NO_2 concentration should be acceptable without further justification in most cases, we recognize that this approach could be overly conservative in many cases and may also be prone to reflecting source-oriented impacts from nearby sources, increasing the potential for double-counting of modeled and monitored contributions. Based on these considerations, we believe that a less conservative "first tier" for a uniform monitored background contribution based on the monitored design value from a representative monitor should be acceptable in most cases. The monitored NO_2 design value, i.e., the 98^{th}-percentile of the annual distribution of daily maximum 1-hour values averaged across the most recent three years of monitored data[7], should be used irrespective of the meteorological data period used in the dispersion modeling. This somewhat less conservative "first tier" for a uniform monitored background contribution retains the advantage of being relatively easy to implement.

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[6] The 1-hour NO_2 "modeled design value" refers to the highest (across all modeled receptors) of the 5-year average of the 98^{th}-percentile (8^{th}-highest) of the annual distribution of daily maximum 1-hour values based on NWS meteorological data, or the multiyear average of the 98^{th}-percentile of the annual distribution of daily maximum 1-hour values based on one or more complete years (up to 5 years) of site-specific meteorological data. The1-hour SO_2 "modeled design value" follows the same form except that the multiyear averages of the 99^{th}-percentile (4^{th}-highest) values are used.

[7] The monitored design value for the 1-hour SO_2 standard is based on the 99^{th}-percentile of the annual distribution of daily maximum 1-hour values averaged across the most recent three years of monitored data.

Depending on the circumstances of a particular application, use of a “first tier” assumption for a uniform monitored background contribution may represent a level of conservatism that would obviate the need to include any background sources in the modeled inventory if, for example, the number of nearby sources which could contribute to the cumulative impact is relatively few and the available ambient monitor would be expected to reflect their cumulative impacts reasonably well or conservatively in relation to the modeled design value based on the project emissions. At the other extreme, if the background source inventory included in the modeling is complete enough and background levels due to mobile sources and/or minor sources that are not explicitly modeled is expected to be small, an analysis based solely on modeled emissions and no monitored background might be considered adequate for purposes of the cumulative impact assessment.

One of the important factors to consider in relation to this issue is that the standard is based on the annual distribution of daily maximum 1-hour values, which implies that diurnal patterns of ambient impacts could play a significant role in determining the most appropriate method for combining modeled and monitored concentrations. For example, if the daily maximum 1-hour impacts associated with the project emissions generally occur under nighttime stable conditions whereas maximum monitored concentrations occur during daytime convective conditions, pairing modeled and monitored concentrations based on hour of day should provide a more appropriate and less conservative estimate of cumulative impacts than a method that ignores this diurnal pattern. This situation could occur for applications dominated by low-level sources and for elevated releases subject to plume impaction on nearby complex terrain. It is also important to consider the role of NO_x chemistry for applications using the Tier 3 options in AERMOD since diurnal patterns of background ozone concentrations may also factor into the diurnal patterns of modeled impacts. Given the potential contribution of background ozone levels to the temporal variability of modeled impacts, the seasonal variability of background monitored values could also be important. Incorporating a seasonal component to the variability of background monitored concentrations will also account for some of the variability in meteorological conditions that may contribute to high hourly impacts.

Another situation where understanding the temporal variability of modeled vs. monitored concentrations could be important in determining the most appropriate method for combining modeled and monitored concentrations is where contributions from mobile source emissions contribute significantly to either the monitored background concentrations and/or the modeled concentrations. In these cases, diurnal variability of emissions associated with morning and afternoon rush hours could contribute to the temporal variability of ambient impacts in addition to meteorological factors associated with the dispersion and conversion of NO_x emissions. Since rush hours tend to be relatively fixed in terms of time of day and also occur near the transitions from nighttime stable to daytime convective conditions, and vice versa, incorporating a seasonal or monthly element to the temporal variability should account for the variable effect that dispersion conditions may have depending on whether rush hour occurs during stable or convective hours.

With these general considerations in mind, we now examine the following guidance in relation to the use of background monitored concentrations in a cumulative impact assessment, from Section 8.2.2 of Appendix W, which applies to applications for isolated sources and for the contribution of “other sources” consisting of “[t]hat portion of the background attributable to all other sources (e.g., natural sources, minor sources and distant major sources)” in a multi-source area:

> b. Use air quality data collected in the vicinity of the source to determine the background concentration for the averaging times of concern. Determine the mean background concentration at each monitor by excluding values when the source in question is impacting the monitor. The mean annual background is the average of the annual concentrations so determined at each monitor. For shorter averaging periods, the meteorological conditions accompanying the concentrations of concern should be identified. Concentrations for meteorological conditions of concern, at monitors not impacted by the source in question, should be averaged for each separate averaging time to determine the average background value. Monitoring sites inside a 90° sector downwind of the source may be used to determine the area of impact. One hour concentrations may be added and averaged to determine longer averaging periods.
>
> c. If there are no monitors located in the vicinity of the source, a ‘‘regional site’’ may be used to determine background. A ‘‘regional site’’ is one that is located away from the area of interest but is impacted by similar natural and distant man-made sources.

The key principle in this guidance in relation to short-term averaging periods is to determine background concentrations associated with “meteorological conditions accompanying the concentrations of concern.” The concentrations thus determined “should be averaged for each separate averaging time to determine the average background value.”

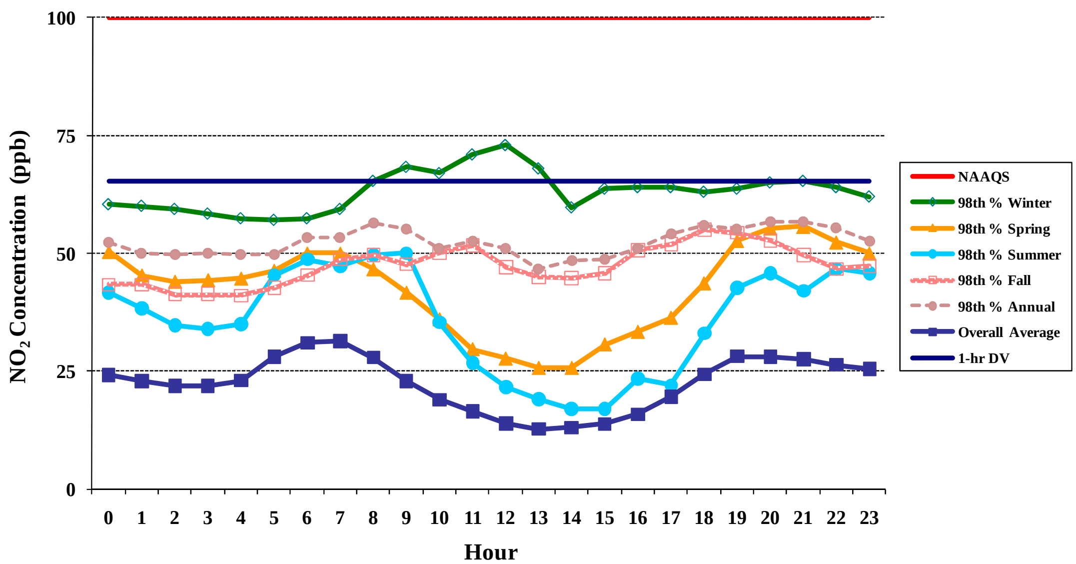
Based on this guidance, we believe that an appropriate methodology for incorporating background concentrations in the cumulative impact assessment for the 1-hour NO_2 standard would be to use multiyear averages of the 98th-percentile[8] of the available background concentrations by season and hour-of-day, excluding periods when the source in question is expected to impact the monitored concentration (which is only relevant for modified sources). For situations involving a significant mobile source component to the background monitored concentrations, inclusion of a day-of-week component to the temporal variability may also be appropriate. The rank associated with the 98th-percentile of daily maximum 1-hour values should be generally consistent with the number of “samples” within that distribution for each combination based on the temporal resolution but also account for the number of samples “ignored” in specifying the 98th-percentile based on the annual distribution. For example, Table 1 in Section 5 of Appendix S specifies the rank associated with the 98th-percentile value based on the annual number of days with valid data. Since the number of days per season will range from 90 to 92, Table 1 would indicate that the 2nd-highest value from the seasonal distribution should be used to represent the 98th-percentile. On the other hand use of the 2nd-highest value for each season would effectively “ignore” only 4 values for the year rather than the 7 values “ignored” from the annual distribution. Balancing these considerations we recommend that background values by season and hour-of-day used in this context should be based on the 3rd-highest value for each season and hour-of-day combination, whereas the 8th-highest value should be used if values vary by hour-of-day only. For more detailed temporal pairing, such as season by hour-of-

[8] The 99th-percentile should be used for the 1-hour SO_2 standard.

day and day-of-week or month by hour-of-day, the 1st-highest values from the distribution for each temporal combination should be used.[9]

Figure 1 shows the background monitored concentrations by season and hour-of-day for the Salt Lake City, UT monitor for the period 2005-2007 based on these recommendations. The values labeled “Average Winter”, “Average Spring”, etc. are the 3-year averages of the 3rd-highest values by hour-of-day for each season; the values labeled “Average 98th %” (the dashed line) are the 3-year average of the 8th-highest values by hour-of-day only; and the values labeled “Overall Average” are the averages across all values by hour-of-day. These results illustrate the significant temporal variability captured by the multiyear averages of the 98th-percentile values by season and hour-of-day. Also note that values for the 98th-percentile by hour-of-day only show little variation by hour-of-day, while values by season and hour-of-day show significant diurnal variability for some seasons.

Figure 1. Monitored Background Concentrations for Salt Lake City, UT Monitor
2005-2007 One-Hour NO_2 Concentrations



It should also be noted here that the conventions regarding observation reporting time differ between ambient air quality monitoring, where the observation time is based on the hour-beginning convention (EPA, 2009; see Section 3.20), and meteorological monitoring where the observation is based on the hour-ending convention (EPA, 2000; see Section 7.1). Thus, ambient monitoring data reported for hour 00 should be paired with modeled/meteorological data for hour 01, etc. The recent update to the AERMOD model (dated 11059) provides an option (the BACKGRND keyword on the SO pathway) to include temporally-varying background concentrations within the cumulative impact assessment based on these temporal factors, similar

[9] For 1-hour SO_2 analyses, use the 2nd-highest value for each season and hour-of-day combination, or the 4th-highest value for hour-of-day only. Use the 1st-highest value for more detailed pairing, such as month by hour-of-day or season by hour-of-day and day-of-week.

to the options that have been available in previous versions of the model to vary source emissions using the EMISFACT keyword. We believe that this technique provides a reasonable and efficient method for ensuring that the monitored contribution to the cumulative impact assessment will be representative of the "meteorological conditions accompanying the concentrations of concern" since the monitored values will be temporally paired with modeled concentrations based on temporal factors that are associated with meteorological variability, but will also reflect worst-case meteorological conditions in a manner that is consistent with the probabilistic form of the 1-hour NO_2 standard. The use of multiyear-averaged monitored values for the meteorological conditions of concern is consistent with the language in Appendix W related to this issue, and also consistent with the intent of using monitored background concentrations, which is to reflect the contribution from natural or regional levels of pollution and the net contribution of minor emission sources which are not explicitly accounted for in the modeled inventory.

Since several applications have come to our attention proposing to combine monitored background and modeled concentrations on an hour-by-hour basis, using hourly monitored background data collected concurrently with the meteorological data period being processed by the model, we feel compelled to include a discussion of the potential merits and concerns regarding such an approach. On the surface this approach could be perceived as being a more "refined" method than what is recommended above, and therefore more appropriate. However, the implicit assumption underlying this approach is that the background monitored levels for each hour are spatially uniform and that the monitored values are fully representative of background levels at each receptor for each hour. Such an assumption clearly ignores the many factors that contribute to the temporal and spatial variability of ambient concentrations across a typical modeling domain on an hourly basis. Therefore we do not recommend such an approach except in rare cases of relatively isolated sources where the available monitor can be shown to be representative of the ambient concentration levels in the areas of maximum impact from the proposed new source. Another situation where such an approach may be justified is where the modeled emission inventory clearly represents the majority of emissions that could potentially contribute to the cumulative impact assessment and where inclusion of the monitored background concentration is intended to conservatively represent the potential contribution from minor sources and natural or regional background levels not reflected in the modeled inventory. In this case, the key aspect which may justify the hour-by-hour pairing of modeled and monitored values is a demonstration of the overall conservatism of the cumulative assessment based on the combination of modeled and monitored impacts. Except in rare cases of relatively isolated sources, a single ambient monitor, or even a few monitors, will not be adequately representative of hourly concentrations across the modeled domain to preclude the need to include emissions from nearby background sources in the modeled inventory.

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ATTACHMENT A

Summary of AERMOD Model Performance for 1-hour NO2 Concentrations

As noted in the June 29, 2010 memo, limited evaluations of the Plume Volume Molar Ratio Method (PVMRM) for estimating conversion of NO to NO_2 have been completed which show encouraging results, but the amount of data currently available is too limited to justify a designation of PVMRM as a refined method for NO_2 (Hanrahan, 1999; MACTEC, 2005). The original evaluations of PVMRM also focused on model performance for annual averages since the only NO_2 standard in effect at the time was annual. These evaluations have recently been updated to reflect the current AERMOD modeling system components and extended to examine model performance for hourly NO_2 concentrations and to include the Ozone Limiting Method (OLM). Preliminary results from these recent evaluations are presented below in the form of Q-Q plots of ranked hourly NO_2 concentrations for the two monitors included in the New Mexico Empire Abo field study and for the single monitor included in the Palaau, HI field study. Evaluation results are also summarized in the form of predicted vs. observed 1-hour Robust Highest Concentrations (RHC), a model evaluation metric that represents an exponential tail fit to the top 26 ranked values in the distribution of hourly concentrations. Note that the OLM results presented here incorporate an equilibrium NO_2/NO_x ratio of 0.90, consistent with the PVMRM option.

Figures A-1 and A-2 show results in the form of hourly Q-Q plots for the North monitor and the South monitor, respectively, from the New Mexico field study based on the Tier 1 option of full conversion of NO to NO_2, the OLM option applied on a source-by-source basis, the OLM option applied using OLMGROUP ALL (OLMGRP), as recommended in the June 29, 2010, NO_2 clarification memorandum, and the PVMRM option. The New Mexico results clearly show the conservatism associated with the Tier 1 assumption of full conversion and the OLM option on a source-by-source basis, with both options showing a significant bias to overpredict hourly NO_2 concentrations. The OLMGRP option exhibits the best performance for both New Mexico monitors, with nearly unbiased results for the North monitor and a slight bias to overpredict for the South monitor. The PVMRM option shows significantly better performance than full conversion or source-by-source OLM for both monitors, but not as good performance as the OLMGRP option.

Figure A-3 shows the hourly Q-Q plot for Palaau based on the same range of options shown in Figures A-1 and A-2. Similar to the New Mexico results, the Tier 1 option of full conversion and the OLM option applied on a source-by-source basis show a significant bias to overpredict hourly NO_2 concentrations at Palaau. The PVMRM option shows the best performance for this field study with very good agreement between predicted and observed concentrations. The use of the OLMGRP option clearly improves model performance as compared to application of the OLM option on a source-by-source basis, with the peak predicted concentrations within a factor of 2 higher than observed. These Q-Q plot comparisons are consistent with the comparisons of RHCs summarized in Table A-1, where the average (geometric mean) ratios of Predicted/Observed RHCs for PVMRM and OLMGRP are about 1.5 and 1.2, respectively, and the average RHC ratios for OLMGRP and FULL conversion are much higher at 4.5 and 5.0.

Since these Tier 3 options in AERMOD are intended to estimate the conversion of ambient NO to NO_2, it is also useful to compare the modeled vs. observed NO_2/NO_x ratios since offsetting errors in dispersion vs. conversion could mask poor model performance. Table A-2 summarizes the observed vs. predicted NO_2/NO_x ratios for the three monitors included in these Palaau and New Mexico field studies. These results are generally consistent with the hourly Q-Q plots of NO_2 concentrations, and clearly indicate that the OLM option on a source-by-source basis significantly overestimates the conversion of NO to NO_2. However, results for the New Mexico South monitor are interesting in that the PVMRM option shows much better agreement with observed NO_2/NO_x ratios than the OLMGRP option, whereas the OLMGRP option indicates better performance than PVMRM in terms of hourly NO_2 concentrations.

These preliminary model evaluation results of hourly NO_2 predictions for Palaau and New Mexico show generally good performance for the PVMRM and OLMGROUP ALL options in AERMOD; however, it should be emphasized that these results are very limited in terms of the number of monitors. Although the scope of the field study data is limited, this level of model performance on a paired-in-space basis is impressive, especially for the PVMRM option at Palaau and for the OLMGROUP ALL option for the North monitor at New Mexico. We believe that these additional model evaluation results lend further credence to the use of these Tier 3 options in AERMOD for estimating hourly NO_2 concentrations and to the recommendation to use the OLMGROUP ALL option whenever OLM is applied.

Figure A-1. AERMOD Model Evaluation - New Mexico North Monitor - Hourly NO2 Q-Q Plot

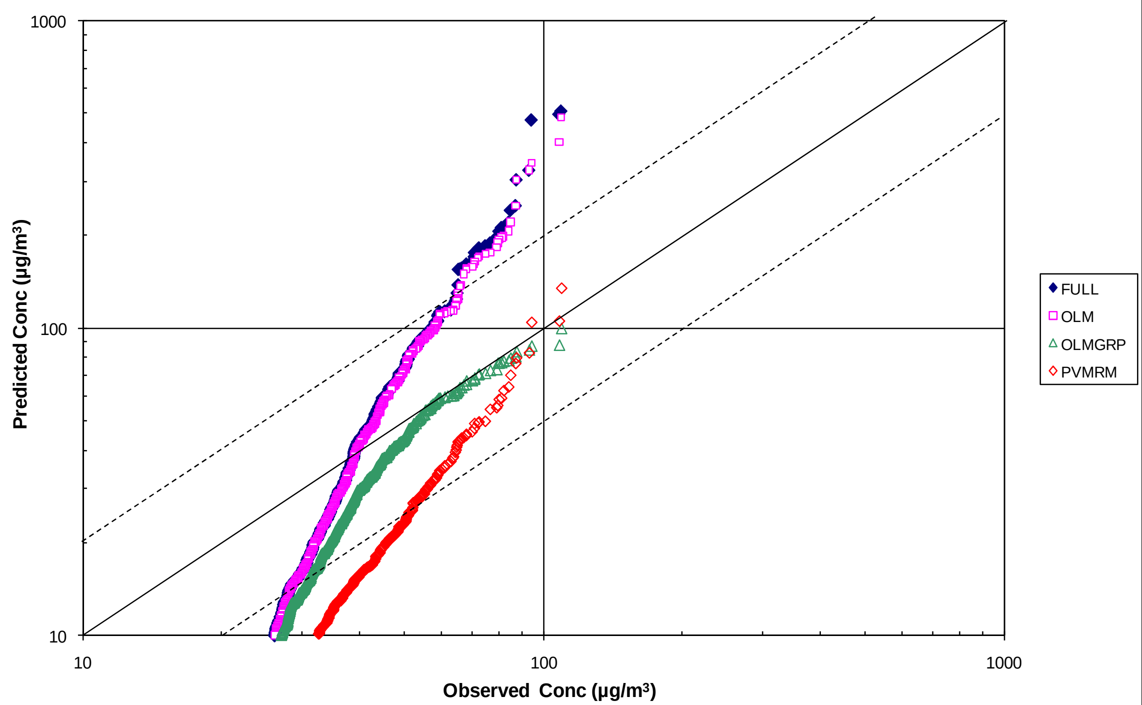
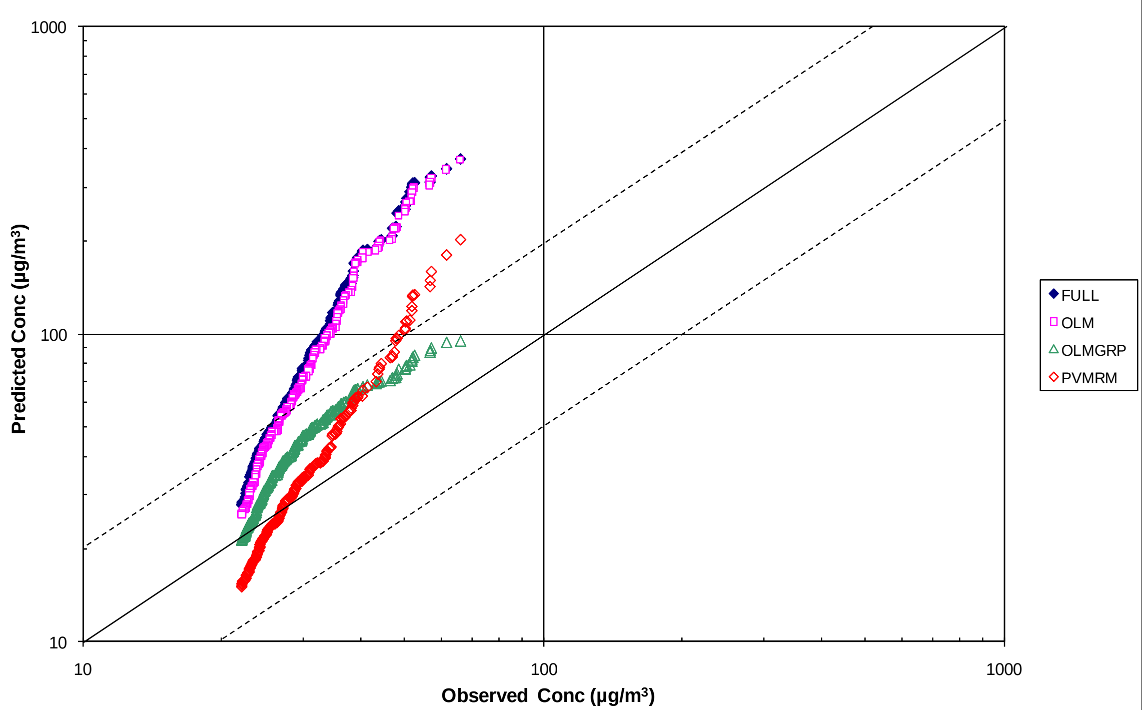


Figure A-2. AERMOD Model Evaluation - New Mexico South Monitor - Hourly NO2 Q-Q Plot



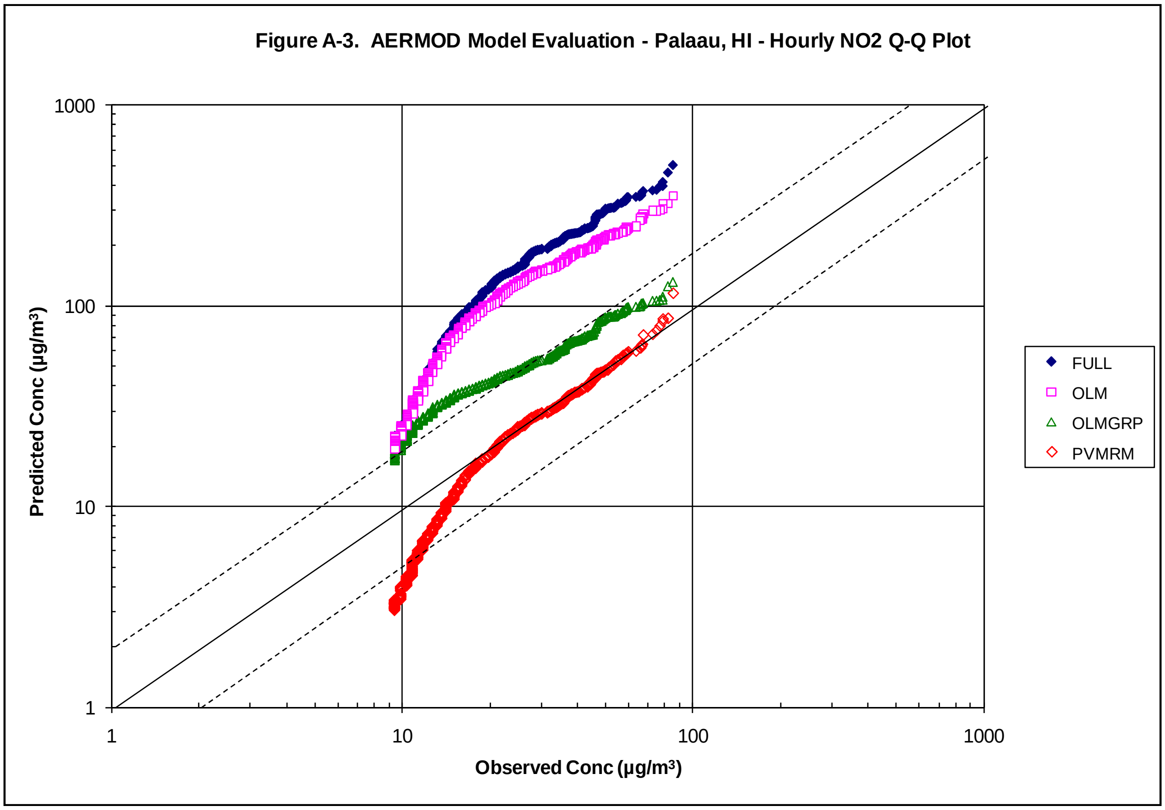


Table A-1. 1-hour NO_2 Robust Highest Concentrations (µg/m^3)

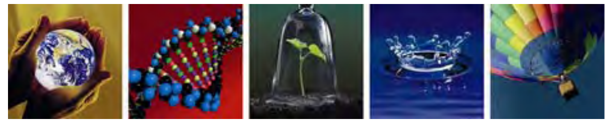
	Observed	PVMRM	OLMGRP	OLM	FULL
New Mexico Abo North Monitor RHC	117.87	116.26	108.38	444.87	449.24
New Mexico Abo South Monitor RHC	70.10	218.98	104.81	440.96	454.68
Hawaii Palaau Monitor RHC	95.42	101.57	113.18	368.57	480.38
Geometric Mean Pred/Obs RHC	---	1.486	1.177	4.510	4.993

Table A-2. Average Unpaired NO_2/NO_x Ratios for Monitored Values of NO_x > 20 ppb

	Monitored NO_2/NO_x	PVMRM NO_2/NO_x	OLMGRP NO_2/NO_x	OLM NO_2/NO_x
New Mexico Abo North Monitor (n=772)	0.455	0.377	0.669	0.976
New Mexico Abo South Monitor (n=262)	0.363	0.437	0.491	0.950
Hawaii Palaau Monitor (n=672)	0.138	0.163	0.376	0.854
Geometric Mean Pred/Obs Ratios	---	1.056	1.756	3.263

Exhibit 20

Shell, Outer Continental Shelf Pre-Construction Air Permit Application, Frontier Discoverer, Beaufort Sea Exploration Program (Jan. 2010)



Outer Continental Shelf Pre-Construction Air Permit Application

Frontier *Discoverer* Beaufort Sea Exploration Drilling Program

PREPARED FOR:
SHELL OFFSHORE INC.

Prepared by:
ENVIRON International Corporation
Lynnwood, Washington

In collaboration with:
Air Sciences Inc.
Portland, Oregon

ENVIRON PROJECT NO. 03-22090A
REVISED JANUARY 2010

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ADEC Stationary Source Identification Form

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Beaufort Sea Ice Statistics

APPENDIX M

Memorandum, Absence of Justification for Source Redefinition in BACT Analysis

receptor and any of the proposed Shell permit blocks is determined, and the Project contribution is determined from the look-up table.

7.3 Comparison with PSD Increments and Ambient Standards

Calculated cumulative concentrations are compared with PSD increments in Table 7-5. Note that all the regional source contributions to annual concentrations at the receptor with the highest cumulative concentration are zero. For each of the 24,096 receptors in the regional modeling, a regional concentration was calculated. As noted in section 7.2, the Project contribution was determined for each receptor based on the distance between the receptor and the nearest lease block area and that contribution was added to the concentration attributable to regional sources at that receptor. However, at all receptors, the cumulative concentrations were less than the peak Project contribution alone, which occurs only 80 meters downwind of the drill site. This can be confirmed by examination of Figures 7-5 and 7-7. The peak NOx concentration from regional actual emissions is just over 2 µg/m^3 while the Project contribution at 40-50 kilometers is less than 4 µg/m^3. The total (6 µg/m^3) is far below the peak value for the shell sources alone of 17.3 µg/m^3. All values in Table 7-5 comply with the PSD Increments.

Table 7-5: Comparison of Maximum Cumulative Concentrations with PSD Increments

Pollutant	Averaging Time	PSD Class II Increment (µg/m^3)	Project Contribution At Peak Receptor (µg/m^3)	Regional Source Contribution at Peak Receptor (µg/m^3)	Peak Total Concentration (µg/m^3)
Nitrogen Dioxide (NO_2)	Annual	25	19.7	0	19.7
Particulate Matter (PM_{10})	24-hour	30	20.7	N/A	20.7
	Annual	17	1.1	0	1.1
Sulfur Dioxide (SO_2)	3-hour	512	25.0	N/A	25.0
	24-hour	91	3.2	N/A	3.2
	Annual	20	0.1	0	0.1

Table 7-6 compares cumulative concentrations with ambient air quality standards. Similar to the discussion of Table 7-5, entries of zero for regional contributions implies that peak concentrations occur close to the drill ship. Table 7-6 indicates cumulative concentrations of all criteria pollutants comply with NAAQS.

Finally, it is worth noting that use of screening meteorological data to evaluate the Project overstates the potential cumulative concentrations. On those days when winds carry emissions from onshore facilities toward the Project area, the wind will also carry Project emissions away from the onshore facilities. The conservative application of screening meteorology in this application, however, assumes that winds are carrying Project emissions toward to the onshore sources at the same time that winds are carrying onshore source emissions toward the Project. This is physically impossible. Consequently, cumulative concentrations are overstated.

Table 7-6: Comparison of Maximum Cumulative Concentrations with NAAQS

Pollutant	Averaging Time	NAAQS/ AAAQS [1] (μg/m³)	Project Contribution At Peak Receptor (μg/m³)	Regional Source Contribution at Peak Receptor (μg/m³)	Background Concen. (μg/m³)	Total Concen. (μg/m³)
NO_2	Annual	100	19.7	0	11.3	31.0
PM_{10}	24-hour	150	20.7	N/A	55.1	75.8
	Annual	50	1.1	0	7.5	8.6
$PM_{2.5}$	24-hour	35	19.2	N/A	8.0	27.2
	Annual	15	1.1	0	2.0	3.1
SO_2	3-hour	1,300	25.0	N/A	41.6	66.6
	24-hour	365	3.2	N/A	13.0	16.2
	Annual	80	.01	3.38	2.6	6.0
CO	1-hour	40,000	1227.1	N/A	1,750	2977.1
	8-hour	10,000	457.5	N/A	1,070	1527.5

[1] National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards.

All electronic modeling files and associated with emissions and model calculations are provided in the compact disc attached to the back cover of this document.

7.4 Compliance with Alaska Ammonia and Hydrogen Sulfide Ambient Standards

In addition to the criteria pollutant ambient standards listed in Table 7-6, Alaska has established ambient air quality standards for reduced sulfur compounds (18 AAC 50.010) and ammonia. The Alaska ambient standard for reduced sulfur compounds (RSCs) is 50 μg/m³ on a 30-minute basis. The only sources of sulfur emissions will be from the sulfur in the diesel fuel used on the *Discoverer* and its associated fleet, and incinerator operations. Because all the fuel is ultra-low sulfur diesel, and the processes using the diesel fuel are oxidation processes, the emissions of RSCs will be negligible from these sources.

Alaska's ambient air quality standard for ammonia is 2,100 μg/m³ (8-hour average). The only substantive source of ammonia emissions is ammonia slip from the SCR applied to the six main engines on the *Discoverer*. A model evaluation of these ammonia emissions determined a peak 1-hour concentration of 2.4 μg/m³, well below the 2100 μg/m³ ambient standard for 8-hour concentrations. Background of ammonia should be near zero in the Beaufort Sea, so it can be safely concluded that the Alaska standard for ammonia will not be exceeded under any circumstances.

Exhibit 21

Letter from Douglas M. Costle, EPA Administrator, to
The Honorable Jennings Randolf, Re: Ambient Air (Dec. 19, 1980)

December 19, 1980

Honorable Jennings Randolph
Chairman, Committee on Environment
and Public Works
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

Thank you for your letter of October 23, 1980 expressing your continued interest in the Agency's definition of "ambient air." During the time since David Hawkins, my Assistant Administrator for Air, Noise, and Radiation, met with you last February, the definition has been extensively reviewed and debated.

After reviewing the issues and alternatives, I have determined that no change from the existing policy is necessary. We are retaining the policy that the 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. EPA will continue to review individual situations on a case-by-case basis to ensure that the public is adequately protected and that there is no attempt by sources to circumvent the requirement of Section 123 of the Clean Air Act.

I hope that this has been responsive to your needs.

Sincerely yours,

/s/ Douglas M. Costle

Douglas M. Costle

Exhibit 22

Letter from Nancy Helm, EPA, to John Kuterbach (Sept. 11, 2007)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

Reply To
Attn of: AWT-107

SEP 11 2007

John Kuterbach
Alaska Department of Environmental Quality
410 Willoughby Avenue, Suite 303
Juneau, Alaska 99811-1800

Re: Determining the Ambient Air Boundary for Potential Permit Application in Support of Alaska Industrial Development and Export Authority's Restart of Healy Clean Coal Project

Dear Mr. Kuterbach:

This letter responds to your May 17, 2007, request to the U.S. Environmental Protection Agency (EPA) Region 10, for guidance in determining the ambient air boundary for a source within a source. Thank you for providing EPA Region 10 with an opportunity to contribute to your decision-making. Our response is based upon our interpretation of the applicable regulations and is shaped by the facts of the case as you have presented them. I hope that you find this response to be useful in administering your regulations.

Your specific questions relate to the Healy coal-fired power plant. As you described it, the Golden Valley Electric Association (GVEA) plant site in Healy, Alaska consists of two existing steam generators. GVEA owns and operates one of the steam generators; a conventional 25 megawatt (MW) coal-fired boiler. The Alaska Industrial Development and Export Authority (AIDEA) intends to restart the other generator; a 50 MW boiler which is known as the Healy Clean Coal Project (HCCP).

The restart will be distinctly different from the initial HCCP startup in that AIDEA will process and store its coal separate from the existing GVEA operations. As your letter states, "AIDEA and GVEA will have completely separate operations, emergency power provisions, and separate access routes." You explained that restarting the HCCP will include the construction of a coal preparation plant and will trigger Alaska Department of Environmental Conservation (ADEC) minor source permitting requirements. Accordingly, pursuant to state requirements, AIDEA must provide an ambient air demonstration. You ask for clarification regarding the appropriate ambient air boundary for AIDEA's demonstration.

As you explained, ADEC predicts that the project will trigger the requirement to obtain a minor permit for air quality protection. The minor permit application must include a modeling demonstration that the proposed potential emissions from the stationary source will not interfere with the attainment or maintenance of the ambient air quality standards. Modeling receptors are positioned at locations in ambient air. In other words, a source is not required to predict its emission impacts at locations that are not ambient air. Thus, it is necessary to determine the ambient air boundary for the AIDEA operation.

On June 22, 2007, EPA issued the enclosed memorandum entitled, "Interpretation of 'Ambient Air' In Situations Involving Leased Land Under the Regulations for Prevention of Significant Deterioration."[1] The memorandum and its accompanying support document describe EPA's longstanding interpretation of "ambient air as it applies to a sources operating on leased land. The memorandum explains that in order to identify the boundary between a source and ambient air in a leased-land scenario it is important to determine whether you are dealing with a single source or with separate sources. Then, with respect to each single source, it is EPA's practice to exempt an area from ambient air only when the source owns or controls the property; and precludes public access to the property using a fence or other physical barrier.

As a preliminary matter, in your letter to EPA, you state, "the Department presumes that GVEA will be able to adequately preclude public access to the entire power plant." Your letter, however, does not provide the facts to support your presumption. However, assuming that GVEA does in fact preclude public access (including access by AIDEA employees), by fence or other physical barrier and controls access within the entire property it is correct to view the entire power plant as non-ambient for GVEA.

Your letter describes three possible scenarios and asks which portion of the property would be considered ambient air with respect to AIDEA (HCPP) emissions under each scenario. EPA, Region 10, reviewed the scenarios you described in light of the Clean Air Act, its implementing regulations and EPA's interpretation as described in the June 22, 2007, memorandum. EPA, Region 10, offers the following discussion of "ambient air" based on our understanding of the three possible scenarios you described for AIDEA's restart of HCCP.

Scenario 1

Description: AIDEA controls access to their area of the operation and GVEA would not be allowed into that part of the property. However, GVEA controls access to the entire combined property along the outer boundary. GVEA leases property to AIDEA upon which it conducts coal preparation and storage activities in addition to generating electricity via HCCP. The leased property is not accessible to the general public along the fenced/gated boundary with Healy Road.

Discussion: The operations are not under common control. Therefore, AIDEA's pollutant-emitting activities constitute a separate source distinct from GVEA's pollutant-emitting activities. In order to exempt the atmosphere above the leased property from being considered "ambient air" within the context of AIDEA's permit application, AIDEA must take steps to preclude the general public (including GVEA employees) from accessing the leased property. Public access may be precluded by erecting fence or other physical barrier in any areas where one does not currently exist. We agree that in this scenario, assuming public access is precluded by fence or other physical barrier, AIDEA's area would not be ambient air for AIDEA's modeling purposes.

Scenario 2

Description: Same as Scenario 1 except that AIDEA does not control access to its leased property. GVEA would control access to the entire property, but GVEA would not use AIDEA's

[1] http://www.epa.gov/region07/programs/artd/air/nsr/nsrmemos/leaseair.pdf

area. You suggest that a lease agreement specifically preventing GVEA from having general on emergency) access would allow AIDEA area to be considered non-ambient for AIDEA modeling purposes.

Discussion: Because AIDEA controls the HCCP operations, there is no common control and the operations are viewed as separate sources. AIDEA, however, does not preclude public access to its area by fence or other physical barrier. A lease agreement precluding GVEA general access is insufficient to control general public access to the AIDEA area. Thus, AIDEA area would be considered ambient for AIDEA modeling purposes.

Scenario 3

Description: GVEA leases property to AIDEA upon which separate coal preparation and storage activities are conducted. GVEA would become a subcontractor to AIDEA to run the HCCP and GVEA employees would have access to the entire combined property.

Discussion: AIDEA and GVEA activities clearly share the same industrial grouping (SIC 49 - Electric, Gas, and Sanitary Services) and are located on contiguous property as evidenced by the aerial photographs and plots you provided. Common control of the pollutant-emitting activity on the leased property may be established based on the contractual arrangement between AIDEA and GVEA. However, additional information regarding the operation and control of the activities on the AIDEA property (beyond just the HCCP unit) is necessary to determine whether or not all activity on the leased property is under common control and thus whether the AIDEA and GVEA operations constitute a single source.

Assuming that it is a single source and if GVEA does in fact preclude public access by fence or other physical barrier and controls access within the entire property, none of the property is considered ambient. This may require erecting a physical barrier in areas, if any, where one does not currently exist.

Please do not hesitate to contact Dan Meyer of my staff at either (206) 553-4150 or meyer.dan@epa.gov should have any questions about the views expressed in this letter.

Sincerely,

Nancy Helm
Federal and Delegated Air Programs

Enclosure

cc: Tom Chapple, ADEC
Cliff Elsmann, Montauk Environmental Engineering
Cynthia Espinoza, ADEC
Sally Ryan, ADEC
Alan Schuler, ADEC
Bill Steigers, Steigers Corporation