

**STATE OF NEW MEXICO
ENVIRONMENTAL IMPROVEMENT BOARD**

IN THE MATTER OF PROPOSED NEW REGULATION,
20.2.50 NMAC – Oil and Gas Sector – Ozone Precursor Pollutants

No. EIB 21-27 (R)

DIRECT TESTIMONY OF MICHAEL BACA

My name is Michael Baca, and I am the Control Strategies Manager for the Air Quality Bureau (“Bureau”) of the New Mexico Environment Department (“NMED” or “Department”). I am presenting this written testimony on behalf of the Department in this proceeding on proposed new air quality regulations at 20.2.50 NMAC (“Part 50”). My testimony will address the following topics: the federal and state statutory authorities and regulatory frameworks for ozone, NMED’s Ozone Attainment Initiative, and the EPA Ozone Advance program.

I. QUALIFICATIONS

I have been an employee of the Department for 16 years, 13 of which have been with the Bureau. In my current position as the staff manager for the Bureau’s Control Strategies Unit, I oversee a staff of six that are responsible for the development of air quality plans and regulations, including the State Implementation Plan (“SIP”) for New Mexico. I hold a B.A. degree in Chemistry from Carleton College.

My full background and qualifications are set forth in my resume, which is marked as NMED Exhibit 2.

II. THE CLEAN AIR ACT REGULATORY FRAMEWORK FOR OZONE

The federal Clean Air Act (“CAA”) requires the U.S. Environmental Protection Agency (“EPA”) to set National Ambient Air Quality Standards (“NAAQS”) for pollutants that EPA determines are harmful to public health and the environment. *See* 42 U.S.C. § 7408. These standards are in the form of maximum allowable concentrations in the ambient air during a

1 specified time period and are designed to protect the most sensitive individuals from harm from
2 airborne pollutants. The CAA identifies two sets of NAAQS to accomplish this: Primary
3 standards provide public health protection, including protecting the health of vulnerable
4 populations such as asthmatics, children, and the elderly; Secondary standards provide public
5 welfare protection, including protection against decreased visibility and damage to animals,
6 crops, vegetation, and buildings. *Id* at § 7408(b).

7 The EPA has set NAAQS for six principal pollutants, known as “criteria” air pollutants:
8 ozone, nitrogen dioxide, sulfur dioxide, carbon monoxide, particulate matter 10 microns or less,
9 particulate matter 2.5 microns or less, and lead. *See* 40 C.F.R. Part 50. The CAA requires EPA to
10 review the standards on a periodic basis, which may result in the standards being revised based
11 on health and environmental criteria that apply to the concentration of a pollutant in outdoor air
12 to limit harmful exposures and detrimental effects. 42 U.S.C. § 7409(d). The primary ozone
13 NAAQS are set to protect people most at risk from breathing ozone in the ambient air, including
14 asthmatics, children, older adults and people who are active outdoors, such as workers. Children
15 are at greatest risk from ozone exposure because their lungs are still developing and they are
16 more likely to be active outdoors when ozone levels are high, which increases their exposure.
17 Some of the health problems caused by ozone include coughing, sore throat, difficulty breathing,
18 inflammation and damage to airways, increased frequency of asthma attacks, and aggravation of
19 lung diseases such as asthma, emphysema and chronic bronchitis. *See* NMED Exhibit 3 – EPA
20 Integrated Science Assessment (“ISA”) for Ozone and Related Photochemical Oxidants,
21 Executive Summary (April 2020);¹ *see also* 85 Fed. Reg. 87256, 87268-87275.

¹ Full ISA available at <https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=348522>

1 Air quality management agencies use data from monitors to calculate a “design value” to
2 determine an area’s compliance status with the NAAQS. The design value represents the metric
3 used to compare monitoring data to the level specified by the standard. Ozone monitoring and
4 the federal requirements for monitoring equipment are addressed in the testimony of NMED
5 witness Brent Ellington. Calculation of design values, quality assurance of data, and submission
6 of data to EPA are addressed in the testimony of NMED witness Andrew Ahr.

7 Following promulgation of a new or revised NAAQS, EPA undertakes a process of
8 designating all areas within each state as in attainment, nonattainment, or unclassifiable for the
9 standard. *See* 42 U.S.C. § 7407(d). This process entails collaborating with states and tribes and
10 considering their recommendations, including proposed nonattainment boundaries based on data
11 and information from air quality monitors or modeling. If the concentrations of a criteria
12 pollutant in a geographic area meets or fall below the NAAQS, the area is designated as in
13 “attainment” of the standard. Areas that exceed the NAAQS are designated as “nonattainment”
14 areas. Areas that do not have monitoring data available are designated as
15 “attainment/unclassifiable” or “unclassifiable”. EPA is required to designate areas of the States
16 within two years of promulgating a new or revised NAAQS. *Id.*

17 In October 2015, following a periodic review, EPA revised the ozone NAAQS downward
18 from 0.075 parts per million (ppm) to 0.070 ppm. *See* 80 Fed. Reg. 65291. For the 2015 ozone
19 NAAQS, all states were required to submit their designation recommendations to EPA by
20 October 1, 2016. Ozone data collected by NMED from 2014 through 2016 showed that a
21 monitor located in the Sunland Park area in southern New Mexico was violating the revised
22 ozone standard. NMED submitted a nonattainment area recommendation for the Sunland Park
23 area and recommended attainment or attainment/unclassifiable designations for the remainder of

1 New Mexico. EPA concurred with the recommendations and finalized the area designations for
2 New Mexico on August 3, 2018. *See* 83 Fed. Reg. 25776.

3 On December 23, 2020, EPA retained the existing 2015 ozone NAAQS. *See* 85 Fed. Reg.
4 87256. The CAA does not require EPA to promulgate area designations when an existing
5 NAAQS is retained following the periodic review process. In line with this and historical
6 practice, EPA did not designate new nonattainment areas following this periodic NAAQS
7 review. However, the current EPA administration has indicated that it intends to revisit the
8 review process, including the available scientific evidence and exposure/risk information, to
9 assess the adequacy of public health and welfare protection provided under the current NAAQS.

10 Ozone monitoring data for 2018-2020 indicate that other areas of the state are
11 approaching or violating the 2015 ozone NAAQS. In particular, Eddy County and sites in
12 southern Doña Ana County are monitoring ozone levels in violation of the NAAQS, while San
13 Juan, Lea, Santa Fe, Sandoval and Valencia Counties are within 95% of the standard.
14 Additionally, oil and gas sources located in Rio Arriba and Chaves Counties contribute to
15 elevated ozone concentrations in the San Juan and Permian Basins, respectively.

16 The New Mexico Air Quality Control Act (“AQCA”), NMSA 1978, Sections 74-2-1 to -
17 17, requires the State to plan for ozone mitigation in areas where sources cause or contribute to
18 ozone levels greater than or equal to 95% of the ozone standard. NMED is addressing these areas
19 through the Ozone Attainment Initiative and EPA’s Ozone Advance program, as discussed
20 below.

21 **III. OZONE REGULATION UNDER THE NEW MEXICO AIR QUALITY**
22 **CONTROL ACT AND REGULATIONS**

23 The Environmental Improvement Board (“Board”) is authorized to adopt Part 50
24 pursuant to the AQCA. Section 74-2-5(A) of the AQCA provides that the Board “shall prevent or

1 abate air pollution.” Section 74-2-5(B)(1) states that the Board shall “adopt, promulgate, publish,
2 amend, and repeal rules and standards consistent with the Air Quality Control Act to attain and
3 maintain national ambient air quality standards and prevent or abate air pollution . . .” The

4 AQCA defines “air pollution” as

5 the emission, except emission that occurs in nature, into the outdoor atmosphere of one or
6 more air contaminants in quantities and of a duration that may with reasonable
7 probability injure human health or animal or plant life or as may unreasonably interfere
8 with the public welfare, visibility or the reasonable use of property.

9 NMSA 1978, § 74-2-2(B). “Air contaminant” is defined as “a substance, including any
10 particulate matter, fly ash, dust, fumes, gas, mist, smoke, vapor, micro-organisms, radioactive
11 material, any combination thereof or any decay or reaction product thereof.” NMSA 1978, § 74-
12 2-2(A).

13 The AQCA also contains provisions that specifically authorize the Board to adopt
14 regulations to ensure attainment and maintenance of the ozone NAAQS. Section 74-2-5(C) of the
15 AQCA mandates that the Board take action to control VOC and NO_x emissions when the Board
16 determines that emissions from sources within its jurisdiction cause or contribute to ozone
17 concentrations in excess of ninety-five percent of the ozone NAAQS. Under this statutory
18 provision, the Board is required to “adopt a plan, including rules, to control emissions of oxides
19 of nitrogen, or NO_x, and volatile organic compounds, or VOCs, to provide for the attainment and
20 maintenance of the standard.”

21 **IV. THE DEPARTMENT’S OZONE ATTAINMENT INITIATIVE**

22 Currently, nine counties under the Board’s jurisdiction are registering or contributing to
23 ozone design values exceeding 95% of the NAAQS: San Juan, Rio Arriba, Santa Fe, Sandoval,
24 Valencia, Eddy, Lea, Chaves and Doña Ana.

1 To address the statutory requirement in Section 74-2-5(C) of the AQCA, the Bureau has
2 embarked upon the Ozone Attainment Initiative (“OAI”) to develop a plan that consists of a
3 series of mandatory rules and voluntary measures to mitigate emissions of NO_x and VOCs in the
4 aforementioned counties. This rulemaking is the first of the mandatory rules being brought
5 before the Board under the OAI. The Department intends to propose addition rules targeting
6 other sectors. For instance, Section 177 of the Clean Air Act allows other states to adopt
7 California’s motor vehicle emission standards, and the Department intends to bring before the
8 Board regulations setting standards for low emission vehicles (“LEV”), and zero emission
9 vehicles (“ZEV”) for adoption in 2022 that will provide further mitigation of ozone precursors.

10 The Department has also submitted a letter of participation to EPA for the Ozone
11 Advance Program. The Advance Program is a means to promote local actions in areas designated
12 as in attainment to reduce ozone levels for the continued maintenance of the NAAQS. The
13 Bureau will coordinate efforts with local governments, industry, academia, and the public to take
14 proactive steps towards the protection of air quality. In addition to positioning areas to avoid a
15 nonattainment designation, the Advance Program can allow communities to choose control
16 measures that are cost effective and that make the most sense for their area, potentially resulting
17 in multi-pollutant benefits.

18 The Department has developed a path forward for Ozone Advance that outlines all the
19 activities, programs, and control measures to be included as part of our program. A copy of the
20 “Ozone Advance Path Forward for New Mexico” is included as NMED Exhibit 4. The
21 Department requests that the Board adopt this document as the “Plan” required by Section 74-5-
22 3(C) of the AQCA.

1 Because the ozone design value in Bernalillo County also exceeds 95% of the ozone
2 NAAQS, the Bureau is coordinating its efforts for ozone mitigation with the City of
3 Albuquerque's Environmental Health Department, which has jurisdiction over air quality in
4 Bernalillo County. In addition to the OAI, Ozone Advance and vehicle emissions standards, the
5 Department is also working with the City of Albuquerque on preparing revised Regional Haze
6 SIPs for submittal to EPA in July of 2021. The goal of the Regional Haze provisions of the CAA
7 is to improve visibility in protected national parks and wilderness areas (referred to as "Class I"
8 areas), and states are required to make reasonable progress over time towards the long-term goal
9 of attaining natural visibility conditions by 2064. The Regional Haze program requires states to
10 submit Regional Haze SIPs approximately once every ten years. Based on data collected at
11 monitors operated by federal land managers, visibility impairment at the Class I areas in New
12 Mexico is driven by sulfates and nitrates, so the Department is evaluating potential additional
13 controls for sulfur dioxide (SO₂) and NO_x emissions from twenty-three major sources within our
14 jurisdiction. Three of these sources are electric generating units, and the remainder are in the oil
15 and gas sector, specifically, natural gas compressor stations and processing plants. Any
16 additional NO_x controls for these sources adopted as part of this Regional Haze SIP revision will
17 also serve to reduce the formation of ozone.



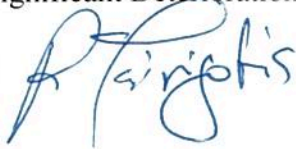
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

APR 17 2018

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program

FROM: Peter Tsirigotis 
Director

TO: Regional Air Division Directors, Regions 1-10

The purpose of the attached document is to provide guidance on compliance demonstration tools for use with ozone and fine particles (PM_{2.5}) in the Prevention of Significant Deterioration (PSD) permitting program. The Environmental Protection Agency (EPA) has developed a new analytical approach and has used it to identify a significant impact level (SIL) for each ozone and PM_{2.5} National Ambient Air Quality Standard (NAAQS) and for the PM_{2.5} PSD increments. Permitting authorities may use these values to help determine whether a proposed PSD source causes or contributes to a violation of the corresponding NAAQS or PSD increments. Separately, we have developed a technical document that provides a detailed discussion of the technical analysis used in the development of these values and a legal memorandum that provides further detail on the legal basis that permitting authorities may choose to adopt to support using SILs to show that requirements for obtaining a PSD permit are satisfied.¹ This guidance provides a summary of the results of the technical analysis and information on the particular points in the PSD air quality analysis at which permitting authorities may decide to use these values on a case-by-case basis in the review of PSD permit applications. This guidance, and the technical and legal documents, are not final agency actions and do not create any binding requirements on permitting authorities, permit applicants or the public.

Please share this guidance with permitting authorities in your Region. If you have questions regarding the guidance, please contact Raj Rao at rao.raj@epa.gov or (919) 541-5344. For questions regarding the technical document, please contact Tyler Fox at fox.tyler@epa.gov or (919) 541-5562. For questions regarding the legal document, please contact Brian Doster at doster.brian@epa.gov or (202) 564-1932.

Attachment

¹ "Technical Basis for the EPA's Development of Significant Impact Thresholds for PM_{2.5} and Ozone," EPA-454/R-18-001, April 2018; "Legal Memorandum: Application of Significant Impact Levels in the Air Quality Demonstration for Prevention of Significant Deterioration Permitting under the Clean Air Act," April 2018.

Attachment

Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program

I. INTRODUCTION

When a Prevention of Significant Deterioration (PSD) permit applicant has shown through air quality modeling that the projected air quality impact from a proposed source for a particular pollutant is not significant or meaningful, the EPA believes there is a valid analytical and legal basis in most cases for the permitting authority to conclude that the proposed source will not cause or contribute to a violation of a National Ambient Air Quality Standard (NAAQS) or PSD increment for that pollutant. To show that the proposed source will not have a significant or meaningful impact on air quality, permit applicants and permitting authorities may elect to use these Significant Impact Level (SIL) values (air quality concentration values) as a compliance demonstration tool. In this guidance and accompanying documents, the EPA has provided policy, technical and legal analyses that permitting authorities may choose to adopt in supporting the use of the SILs to make the required demonstration in particular PSD permitting actions. The use of SILs can help satisfy PSD requirements while expediting the permitting process and conserving resources for permit applicants and permitting authorities.

The EPA has previously issued guidance describing particular uses of SILs.^{1,2,3,4} The EPA has also recognized that permitting authorities have the discretion to apply SILs on a case-by-case basis in the review of individual permit applications, provided such use is justified in the permitting record.⁵ In an effort to reduce the need for case-by-case justification by permitting authorities, the EPA finalized a rule in 2010 to codify, among other things, particular PM_{2.5} SIL values and specific

¹ Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance Concerning the Implementation of the 1-hour SO₂ NAAQS for the Prevention of Significant Deterioration Program," August 23, 2010.

² Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance Concerning the Implementation of the 1-hour NO₂ NAAQS for the Prevention of Significant Deterioration Program," June 29, 2010.

³ Memorandum from Stephen D. Page, EPA OAQPS, to OAQPS Personnel and EPA Regional Modelers, "Modeling Procedures for Demonstrating Compliance with PM_{2.5} NAAQS," March 23, 2010.

⁴ Memorandum from Gerald A. Emison, EPA OAQPS, to Thomas J. Maslany, EPA Air Management Division, EPA Region 3, "Air Quality Analysis for Prevention of Significant Deterioration (PSD)," July 5, 1988.

⁵ Order Responding to Petitioner's Request that the Administrator Object to Issuance of a State Operating Permit, *In the Matter of CF&I Steel, L.P. dba EVRAZ Rocky Mountain Steel*, Petition Number VIII-2011-01, at 15-17 (May 31, 2012) ("Rocky Mountain Steel Order"); *In re: Mississippi Lime Company*, 15 E.A.D. 349, 375-379 (Environmental Appeals Board (EAB) 2011).

applications of those values (“2010 rulemaking”).⁶ However, in the course of subsequent litigation over this rule, the EPA conceded the regulation was flawed because it did not preserve the discretion of permitting authorities to require additional analysis in certain circumstances, and the court granted the EPA’s request to vacate and remand the rule so that the EPA could address the flaw.⁷

Following the litigation, the EPA began developing a new rule to address the flaw identified in the 2010 rulemaking.⁸ However, after further evaluation and the identification of a revised set of SIL values based on the technical and legal analyses described below, the EPA believes it should first obtain experience with the application of these values in the permitting program before establishing a generally applicable rule.⁹ Thus, the EPA intends at this point to take a two-step approach.

First, the EPA is providing non-binding guidance so that we may gain valuable experience and information as permitting authorities use their discretion to apply and justify the application of the SIL values identified below on a case-by-case basis in the context of individual permitting decisions. We will be seeking to learn generally about permitting agencies’ experiences in applying SILs in particular PSD permitting decisions. We will also be seeking more specific information, including how often and in what types of settings the application of a SIL at the single-source assessment and cumulative assessment stages of the PSD air quality analysis has made a critical difference in whether a conclusion was reached that the proposed source will not cause or contribute to a NAAQS or PSD increment violation. The EPA intends to obtain this information through its own PSD permitting activities in states that do not have SIP-approved PSD programs, regular discussions between our Regional offices and air agencies, regular conference calls with the permitting committees of national organizations of air agencies, and technical conferences of air quality modelers and others interested in permitting activities.

Second, the EPA will use this experience and information to assess, refine and, as appropriate, codify SIL values and specific applications of those values in a future, potentially binding rulemaking. During this second step, to assess whether it is appropriate to codify particular SIL

⁶ 75 FR 64864 (October 20, 2010).

⁷ *Sierra Club v. EPA*, 705 F.3d 458, 463-66 (D.C. Cir. 2013). In its litigation brief at n. 10, the EPA stated an intent to issue guidance in the near future concerning PM_{2.5} values remaining in 40 CFR 51.165(b)(2). The EPA issued such guidance in May 2014. Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, “Guidance for PM_{2.5} Permit Modeling,” May 20, 2014.

⁸ Fall 2015 Regulatory Agenda, USEPA, 80 FR 78024, December 15, 2015. Ozone and Fine Particulate Matter (PM_{2.5}) Significant Impact Levels (SILs) for Prevention of Significant Deterioration (PSD), RIN: 2060-AR28. <http://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201510&RIN=2060-AR28>.

⁹ See *SEC v. Chenery Corp.*, 332 U.S. 194, 199-203 (1947) (recognizing that some principles may warrant further development before they are ready to be codified in a rule of general applicability).

values for ozone and PM_{2.5}, the EPA will consider whether permitting experience has confirmed that the recommended SIL values are suitable in all circumstances to show that an increase in air quality concentration below the value does not cause or contribute to a violation of the NAAQS or PSD increments.

Permitting authorities retain discretion to use or not to use these EPA-derived SILs in particular PSD permitting actions. If a permitting authority chooses to use these SIL values to support a case-by-case permitting decision, it must justify the values and their use in the administrative record for the permitting action.¹⁰ Permitting authorities also have discretion to develop their own SIL values, provided that such values are properly supported in the record for permitting actions or decisions in which the values are used to make the required showing. Detailed technical guidance on the development of alternative SIL values is beyond the scope of this document; however, we provide a limited discussion later in this document (see, e.g., page 12). This guidance (including the legal and technical documents) supporting the EPA's recommended SIL values may be viewed as a model for permitting authorities that seek to develop alternative SIL values. Permitting authorities may elect to utilize alternative "confidence intervals" as well as regional or local factors in developing their own SIL values.¹¹

Since the 2010 rulemaking, the EPA has examined the legal basis for using SIL values in PSD air quality impact analyses. In addition, the EPA has sought to develop a stronger analytical foundation for the EPA recommended SIL values. This guidance and supporting documents are the products of this effort. They identify specific SIL values for ozone and PM_{2.5} and provide a supporting justification that permitting authorities may choose to apply on a case-by-case basis. The values and supporting justification are designed so that permitting authorities can choose to apply the SIL values to demonstrate that a proposed source does not cause or contribute to a violation of NAAQS or PSD increments. In contrast to the 2010 rulemaking, we have developed separate SIL values for the PM_{2.5} NAAQS and PSD increments, and we have developed SILs for the ozone NAAQS. Since there are no PSD increments for ozone, the EPA has not developed SILs for ozone.

The EPA believes that the application of these SILs in the manner described below would be sufficient in most situations for a permitting authority to conclude that a proposed source will not cause or contribute to a violation of an ozone or PM_{2.5} NAAQS or PM_{2.5} PSD increments. However, this guidance is not a final agency action and does not reflect a final determination by the EPA that any particular proposed source with a projected impact below the recommended SIL value does not cause or contribute to a violation. A determination that a proposed source does not cause or contribute to a violation can only be made by a permitting authority on a permit-specific basis after consideration of the permit record. This guidance is not legally binding and does not affect the rights or obligations of permit applicants, permitting authorities, or others. The SIL

¹⁰ *Rocky Mountain Steel Order* at 16-18, supra footnote 5. Such a justification may incorporate the information compiled by the EPA to support the SILs recommended in this memorandum.

¹¹ A description of the "confidence interval" is provided at page 12 of this document and in the technical document at section 2.2 (Statistical Methods and Assessing Significance Using Confidence Intervals).

values identified by the EPA have no practical effect unless and until permitting authorities decide to use those values in particular permitting actions. The experience of permitting authorities using these SILs on a case-by-case basis, or in choosing to limit or forego their use in specific situations, will be valuable information for the EPA to consider in a future rulemaking. Permitting authorities retain the discretion to apply and justify different approaches and to require additional information from the permit applicant to make the required air quality impact demonstration, consistent with the relevant PSD permitting requirements.

II. BACKGROUND

A PSD permit applicant must demonstrate that “emissions from construction or operation of such facility will not cause, or contribute to, air pollution in excess of any” NAAQS or PSD increment.¹² The EPA has reflected this requirement in its PSD regulations.¹³ The Clean Air Act (Act) does not specify how a permit applicant or permitting authority is to make this demonstration, but section 165(e) authorizes the EPA to determine how the analysis is to be conducted, including the use of air quality models. In accordance with this authority, the EPA has promulgated regulations that identify such models and the conditions under which they may be used in the PSD program to make the demonstration required under the Act.¹⁴

Using the models identified in the EPA’s regulations, there are two basic ways that a PSD permit applicant can demonstrate that the proposed source’s emissions will not cause or contribute to a violation of a NAAQS or PSD increment. One way is to demonstrate that no such violation is occurring or projected to occur in the area affected by the emissions from the proposed source.¹⁵ A second way is to demonstrate that the emissions from the proposed source do not cause or contribute to any identified violation of the NAAQS or PSD increments.¹⁶

The Act does not define “cause” or “contribute.” Reading these terms in context, the EPA has historically interpreted this provision in section 165(a)(3) of the Act and associated regulations to mean that a source must have a “significant impact” on ambient air quality in order to cause or contribute to a violation.¹⁷ Thus, the EPA and other permitting authorities have concluded that a

¹² 42 U.S.C. 7475(a)(3) (section 165(a)(3) of the Act). The EPA interprets the phrase “in excess of” to mean a violation, not the exceedance described in 40 CFR 50.1(l).

¹³ 40 CFR 51.166(k); 40 CFR 52.21(k).

¹⁴ The PSD regulations at 40 CFR 51.166(l) and 52.21(l) require the use of “applicable models, data bases, and other requirements” specified in 40 CFR part 51, Appendix W, also known as the *Guideline on Air Quality Models (Guideline)*.

¹⁵ 1990 Draft New Source Review (NSR) Workshop Manual at C.51.

¹⁶ 40 CFR part 51, App. W, § 9.2.3; 1990 Draft NSR Workshop Manual at C.52.

¹⁷ *In re: Prairie State Generating Co.*, 13 E.A.D. 1, 105 (EAB 2006). This EAB opinion includes a long discussion of the EPA’s prior guidance with other examples.

proposed source may meet the requirements in section 165(a)(3) and the EPA's PSD regulations by showing that its projected impact on air quality at the site of a modeled violation is below a level of air quality impact considered to be significant.¹⁸

Historic Use of SILs

In the context of section 165(a)(3), the EPA has historically used pollutant-specific concentration levels known as “significant impact levels” to identify the degree of air quality impact that “causes, or contributes to” a violation of a NAAQS or PSD increment.¹⁹ Consistent with the EPA guidance, proposed sources have met the requirement to demonstrate that they do not cause or contribute to a violation by showing that the ambient air quality impacts resulting from the proposed source's emissions would be below these concentration levels.²⁰ The SIL values have served as a compliance demonstration tool to make the required demonstration in the PSD program. They have helped to reduce the burden on permitting authorities and permit applicants to conduct often time-consuming and resource-intensive air dispersion modeling where such modeling was unnecessary to demonstrate that a permit applicant meets the requirements of section 165(a)(3), consistent with the procedures set forth originally in 1977 in the “Guidelines for Air Quality Maintenance Planning and Analysis, Volume 10 (Revised) and Procedures for Evaluating Air Quality Impact of New Stationary Sources.”²¹

Recent Status of SILs for Ozone and PM_{2.5}

Since the inception of the PSD program, the EPA has faced technical challenges with providing compliance demonstration tools for those pollutants that are not directly emitted by sources (ozone and secondarily-formed PM_{2.5}) and which form through chemical reactions of precursor pollutants. In July 2010, the Sierra Club petitioned the EPA to initiate rulemaking regarding the establishment of air quality models for ozone and PM_{2.5} for use by PSD permit applicants. In January 2012, the EPA granted the petition and committed to engage in rulemaking to evaluate whether updates to the *Guideline* are warranted and, as appropriate, incorporate new analytical techniques or models for ozone and secondarily-formed PM_{2.5}. In granting the petition, the EPA explained that the “complex chemistry of ozone and secondary formation of PM_{2.5} are well-documented and have historically presented significant challenges to the designation of particular models for assessing

¹⁸ 1990 Draft NSR Workshop Manual at C.52.

¹⁹ 61 FR 38250, 38293 (July 23, 1996); 72 FR 54112, 54139 (September 21, 2007).

²⁰ 1990 Draft NSR Workshop Manual at C.51-C.52.

²¹ October 1977, U.S. EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711. The 1977 document did not discuss SILs, but did identify procedures for air quality analyses pursuant to the PSD program.

the impacts of individual stationary sources on the formation of these air pollutants”²² Because of these considerations, the EPA’s past judgment had been that it was not technically sound to designate with particularity specific models that must be used to assess the impacts of a single source on ozone and secondarily-formed PM_{2.5} concentrations. Instead, the EPA established a consultation process with permitting authorities for determining (on a permit-specific basis) the analytical techniques that should be used for single-source analyses for both ozone and secondarily-formed PM_{2.5}.

The EPA has responded to the Sierra Club petition by finalizing revisions to the EPA’s *Guideline*.²³ As discussed in the preamble to the *Guideline*, recent technical advances have made it reasonable for the EPA to provide more specific guidelines that identify appropriate analytical techniques or models that may be used in compliance demonstrations for the ozone and PM_{2.5} NAAQS and PM_{2.5} PSD increments. The revisions to the *Guideline* include criteria and process steps for choosing single-source analytical techniques or models to estimate ozone impacts from precursor nitrogen oxide (NO_x) and volatile organic compound (VOC) emissions and to assess concentrations of direct and secondarily-formed PM_{2.5}. The ozone and PM_{2.5} SIL values recommended in this guidance are intended to complement the *Guideline* updates by providing thresholds that may be used to determine whether an increase in air pollutant concentration (impact) predicted by the chosen technique or model causes or contributes to a violation.

In the 2010 rulemaking, the EPA established SIL values for PM_{2.5} in paragraph (k)(2) of the PSD regulations at 40 CFR 51.166 and 52.21. In January 2013, the U.S. Court of Appeals for the District of Columbia Circuit granted the EPA’s request to vacate and remand the paragraph (k)(2) provision in both PSD regulations so the EPA could correct them.²⁴ Paragraph (k)(2) as promulgated in 2010 included numerical values of PM_{2.5} SILs and statements about their role in completing an air quality impact analysis with regard to the PM_{2.5} NAAQS and PSD increments. Specifically, the 52.21(k)(2) rule text stated that if the impact of a proposed source seeking a federal PSD permit was below the relevant SIL value(s), then the proposed source would be deemed to not cause or contribute to a violation. The 51.166(k)(2) rule text stated that a state’s PSD rules could contain a similar provision. The EPA asked the court to vacate and remand the (k)(2) paragraphs of both PSD regulations so that the EPA could correct an inconsistency between (1) that rule text, which left no discretion for the permitting authority, and (2) our statements in the preamble to the 2010 rulemaking, which identified certain circumstances where it may not be

²² Letter from Gina McCarthy, Assistant Administrator, EPA Office of Air and Radiation, to Robert Ukeiley, Sierra Club, January 4, 2012.

²³ 82 FR 5182 (January 17, 2017).

²⁴ *Sierra Club v. EPA*, 705 F.3d 458, 466 (D.C. Cir. 2013).

appropriate for a permitting authority to rely solely on the PM_{2.5} SILs as a basis for concluding that a proposed source does not cause or contribute to a violation.²⁵

The court left intact the PM_{2.5} NAAQS significance levels separately promulgated at 40 CFR 51.165(b)(2), because the regulatory text in that section did not say that a proposed source that has an impact less than the significance level is always deemed to not cause or contribute to a violation. The regulatory text at 40 CFR 51.165(b)(2) says that a major source or major modification with a projected impact greater than the listed significance level at any location that does not or would not meet the applicable NAAQS will be considered to cause or contribute to a violation, but this provision does not compel the opposite conclusion for projected impacts equal to or below that level.²⁶

III. RECOMMENDED SIL VALUES FOR USE IN AIR QUALITY IMPACT DEMONSTRATION REQUIRED TO OBTAIN A PSD PERMIT

As discussed above, the EPA has interpreted the phrase “cause, or contribute to” in section 165(a)(3) of the Act to mean that a proposed source will have a “significant impact” on air pollutant concentrations that violate the standards. In this context, the EPA believes permitting authorities may read the phrase “cause, or contribute to” in section 165(a)(3) to be inapplicable to an air quality impact that is insignificant. This interpretation is more fully explained in the legal memorandum. In the context of this section of the Act, the EPA believes an insignificant impact is an impact on air quality concentrations that is small and not meaningful (e.g., the EPA has often described such an impact as “trivial” or “*de minimis*”).

As discussed in more detail in the legal memorandum, a permitting authority may conclude that a PSD permit applicant will “cause” a modeled violation of a NAAQS when the increased emissions from construction or modification of the proposed source are the reason for, responsible for, or the “but for” cause of the violation. However, a permitting authority must also consider whether emissions “contribute” to a violation in circumstances where a violation of the NAAQS is present before considering the proposed increase in emissions from a PSD construction project, or when

²⁵ These preamble statements were the following: “[N]otwithstanding the existence of a SIL, permitting authorities should determine when it may be appropriate to conclude that even a *de minimis* impact will ‘cause or contribute to’ an air quality problem and to seek remedial action from the proposed new source or modification.” See 75 FR 64864, 64892. “[T]he use of a SIL may not be appropriate when a substantial portion of any NAAQS or increment is known to be consumed.” See 75 FR 64864, 64894. “[W]e earlier provided an example of when it might be appropriate to require a modified source to mitigate its contribution to a violation of a NAAQS or increment even when the predicted ambient impact of the proposed emissions increase would result in what is normally considered to be *de minimis*.” See 75 FR 64864, 64894.

²⁶ 40 CFR 51.165(b)(2) is phrased such that an impact equal to the listed value is treated the same as impacts below the listed value. This contrasts to the approach in former 40 CFR 51.166(k)(2) and 52.21(k)(2), and, in this guidance, that an impact equal to the SIL is treated the same as impacts above the SIL.

emissions from multiple sources may impact a particular area. In the absence of specific language in section 165(a)(3) regarding the degree of contribution that is required (such as the term “significantly”), a permitting authority has the discretion under this provision to exercise its judgment to determine the degree of impact that contributes to adverse air quality conditions based on the particular context in which the term contribute is used. A permitting authority may also identify criteria or factors that may be used to determine whether something contributes, including qualitative or quantitative criteria that are appropriate to the particular context.²⁷

For purposes of implementing section 165(a)(3) of the Act, the EPA has found it more expedient and practical to use a quantitative threshold (expressed as a level of change in air quality concentration) to determine whether increased emissions from proposed construction or modification of a source will cause or contribute to air quality concentrations in violation of applicable standards. One of the goals of the development of SILs as a compliance demonstration tool is to ensure an appropriate balance between maintenance of air quality and PSD permit process streamlining. The EPA believes that the permitting process can be streamlined without compromising air quality if the EPA and permitting authorities are able to identify a quantitative threshold or dividing line between an insignificant and a significant impact on air pollutant concentrations. Using a quantitative threshold for this purpose is permissible as long as the EPA or the appropriate permitting authority provides a reasoned explanation for why impacts below that value do not cause or contribute to a violation in a particular context.

Historical Approach for Developing SILs

To determine what is (and is not) a significant impact in the context of section 165(a)(3) of the Act, the EPA has previously supported using the levels in 40 CFR 51.165(b)(2).²⁸ The EPA has

²⁷ See *Catawba County, N.C. v. EPA*, 571 F.3d 20, 39 (D.C. Cir. 2009). In this case interpreting the term “contributes” in section 107(d) of the Act, the court held that the EPA is not required to establish a quantitative or objective, bright-line test to define a contribution by sources to adverse air quality conditions in a nearby area in the context of designations with respect to attainment of a NAAQS. The court recognized that the EPA has the discretion to use a totality-of-the-circumstances test if the Agency defines and explains the criteria that it is applying. While this opinion said that a quantified threshold is not required to define “contribution” in the context of section 107(d), the court’s reasoning does not preclude PSD permitting authorities from choosing to use a quantitative level of impact to represent a contribution to a violation of the NAAQS or PSD increment when implementing section 165(a)(3) of the Act.

²⁸ The Emison Memo, *supra* footnote 5, references 40 CFR 51.165(b)(2) for the purpose of defining “significant” in this context. The NSR Workshop Manual at C.26-C.28 lists values from 40 CFR 51.165(b)(2) for the purpose of defining the area of “significant ambient impact.”

described these levels as “significance levels.”²⁹ 40 CFR 51.165(b)(2) was originally promulgated by the EPA in 1987 as part of an offset provision permitting authorities could apply after it was determined that construction at a stationary source was predicted to cause or contribute to a violation of the NAAQS.³⁰ This regulation provides that a proposed source planning to locate in an attainment area will be considered to “cause or contribute to” a violation of the NAAQS if its impact would exceed specific values identified in the regulation. For example, 40 CFR 51.165(b)(2) states that a proposed source impact that is greater than 5 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for the 24-hour sulfur dioxide (SO_2) NAAQS causes or contributes to a violation of that NAAQS. The section refers to these values as “significance levels.” Values are not provided for every NAAQS, particularly ozone (and not for $\text{PM}_{2.5}$ until the 2010 rulemaking), but for those NAAQS covered in this regulation, the application is the same. Over time, these air quality concentration significance levels in 40 CFR 51.165(b)(2) have become known as “significant *impact* levels”³¹ [emphasis added] in order to distinguish them from the significant *emissions rates* reflected in the definition of the term “significant,” which serve a different function in the PSD program.³² The EPA has also issued guidance memoranda that have provided recommended SIL values for the 1-hour nitrogen dioxide (NO_2) and SO_2 NAAQS, to be used for the purpose of determining what are (and are not) significant impacts for these pollutants in the context of the 1-hour standards.³³

As referenced above, the EPA’s values contained in 40 CFR 51.165(b)(2) originally were related to the level of protection afforded by the PSD increments that Congress established for Class I areas.³⁴ The EPA generally relied on that approach in 2010 by using the ratio of the $\text{PM}_{2.5}$ NAAQS

²⁹ The EPA initially promulgated these same concentration values in 1978 and described them as the “minimum amount of ambient impact that is significant.” 43 FR 26380, 26398 (June 19, 1978). In the 1979 Emissions Offset Interpretative Ruling (Appendix S to 40 CFR part 51), the EPA used these values as the “significance levels” under which a source locating in the “clean” portion of a nonattainment area may be exempt from the preconstruction review requirements. 44 FR 3274, 3283 (January 16, 1979). Under Appendix S, as revised in 1980, the EPA considered a source to “cause or contribute to” a violation if the impact of the source or modification would exceed these significance levels at any locality that does not meet the NAAQS. 45 FR 31307, 31311 (May 13, 1980).

³⁰ 52 FR 24672, 24713 (July 1, 1987).

³¹ The first reference to “significant impact levels” is in the 1980 NSR Workshop Manual, which the EPA subsequently updated in the 1990 draft. It is worth noting that the 1977 comments to the proposed Appendix W rule (45 FR 58543) addressed whether a single-source screening technique should be used to determine if a cumulative modeling analysis would be required in a preconstruction review; industry and state agency comments indicated both groups favored some use of a tool to alleviate resource burden.

³² 40 CFR 52.21(b)(23) defines the term “significant” and applies discrete values for determining if the emissions increase from a proposed source will be significant. This regulation states that an increase in emissions of each ozone precursor (VOC and NO_x) is significant if it equals or exceeds 40 tons per year (tpy) and, for direct emissions of $\text{PM}_{2.5}$ the significance level is 10 tpy. For $\text{PM}_{2.5}$ precursor emissions, the significance level is 40 tpy for SO_2 and 40 tpy for NO_x .

³³ Page memoranda, *supra* footnotes 1 and 2 of this attachment.

³⁴ 43 FR 26380, 26398.

to the particulate matter 10 micrometers or less in diameter (PM₁₀) NAAQS as a multiplier to add PM_{2.5} values to 40 CFR 51.165(b)(2) and to establish PM_{2.5} SIL values in 40 CFR 51.166(k)(2) and 52.21(k)(2).³⁵ However, given limitations in the rationale supporting them, the EPA recognized in the preamble to the 2010 rulemaking that a permitting authority may not be able to apply the SIL values derived through this approach in every situation to show that proposed construction does not cause or contribute to a violation of standards. The EPA acknowledged that “the use of a SIL may not be appropriate when a substantial portion of any NAAQS or increment is known to be consumed.” The EPA also said that “notwithstanding the existence of a SIL, permitting authorities should determine when it may be appropriate to conclude that even a *de minimis* impact will ‘cause or contribute to’ an air quality problem and to seek remedial action from the proposed new source or modification.”³⁶ To guard against the improper use of the 2010 SILs for PM_{2.5} in such circumstances, the EPA later recommended that permitting authorities use those SILs only where they could establish that the difference between background concentrations in a particular area and the NAAQS was greater than those SIL values.³⁷ This approach was intended to guard against misuse of the SILs in situations where the existing air quality was already close to the NAAQS.

Analytical Foundation for Recommended SILs

Since the May 2014 PM_{2.5} modeling guidance was issued, the EPA has conducted a statistical analysis that provides an improved analytical foundation for the EPA’s selection, based on the policy considerations described below, of a degree of change in concentration that permitting authorities may use to represent an insignificant impact on air pollutant concentrations for ozone and PM_{2.5} in the context of PSD permitting. This technical method, referred to as the air quality variability approach, is described in the technical document. Given the improvements reflected in this method, the EPA does not see a need for permitting authorities to show that the difference between background concentrations and the relevant NAAQS is greater than the SIL value before applying one of the recommended PM_{2.5} SIL values. The EPA’s intention with this new method was to derive SIL values that are more universally applicable to a range of conditions, including those where a substantial portion of the NAAQS or PSD increment is known to be consumed. However, permitting authorities retain discretion whether to apply SILs as a general matter, or in particular permitting actions, based on information in the permit record.

In order for a specific change in air quality concentrations to be used to show that a proposed source does not cause or contribute to a violation of the NAAQS, the concentration change must

³⁵ 75 FR 64890.

³⁶ 75 FR 64864, 64892.

³⁷ Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, “Guidance for PM_{2.5} Permit Modeling,” May 20, 2014.

represent a level of impact on ambient air quality that is not significant or meaningful. The EPA's judgment is that values representing such a level can be selected from a statistical analysis of the variability of air quality, using data from the U.S. ambient monitoring network for ozone and PM_{2.5}. Due to fluctuating meteorological conditions and changes in day-to-day operations of all air pollution sources in an area, there is an inherent variability in the air quality in the area surrounding a monitoring site. This variability can be characterized through the application of a well-established statistical framework for quantifying uncertainty.^{38,39} The analysis described in the technical document quantifies the inherent variability in pollutant concentrations (as measured by design values) and informs the EPA's choice of a value for a change in concentrations that the EPA does not consider significant or meaningful because changes of this magnitude are well within the inherent variability of observed design values.⁴⁰ Once the precautionary choices described below are built into the calculation, this degree of change in concentration is, thus, indistinguishable from the inherent variability in the measured atmosphere and may be observed even in the absence of the increased emissions from a new or modified source. Therefore, a permitting authority can reasonably conclude that emissions of a proposed source that have a projected impact below the SIL values provided in this memorandum are not the reason for, responsible for, or the "but for" cause of a NAAQS violation. Likewise, this indicates that changes in air quality within this range are not meaningful, and, thus, do not contribute to a violation of the NAAQS.

Before delving in detail into the technical and policy considerations that inform the EPA's choice of the SILs recommended in this document, it is important to point out that the discretion of the EPA and other permitting authorities is limited by the 2010 rulemaking. Specifically, since the EPA has established by regulation that a PM_{2.5} impact greater than a certain value will be considered to cause or contribute to a violation of the relevant NAAQS, permitting authorities may not use a value higher than 1.2 µg/m³ for the 24-hour PM_{2.5} NAAQS or a value higher than 0.3 µg/m³ for the annual PM_{2.5} NAAQS. Because ozone is not addressed in 40 CFR 51.165(b)(2), permitting authorities are not precluded from developing a higher ozone NAAQS SIL value than recommended in this guidance. Likewise, 40 CFR 51.165(b)(2) does not address PSD increments and, thus, does not constrain the discretion of a permitting authority to develop a higher SIL value and use it for PSD increment purposes.

³⁸ Efron, B. (1979); "Bootstrap methods: Another look at the jackknife". *The Annals of Statistics* 7 (1): 1–26. doi:10.1214/aos/1176344552.

³⁹ Efron, B. (2003); *Second Thoughts on the Bootstrap*. *Stat. Sci.*, 18, 135-140.

⁴⁰ The EPA conducted an external peer review of the technical document containing the statistical analysis used for developing the SILs for ozone and PM_{2.5}. The peer review comments were supportive of the air quality variability method as being appropriate for application for SILs. The comments also suggested several considerations for improvements to the technical document and analyses to better support the application of the analysis to determine specific SIL values. Therefore, the EPA made a number of revisions to the technical document, including conducting new analyses to investigate issues raised by the reviewers, edits to a number of sections for clarity and accuracy, and updating the analysis to include the most recent data. A peer review report that outlines the subsequent changes to the technical analysis is available from the U.S. EPA library, library number EPA 454/S-18-001.

Basis for Development of Recommended SILs for Ozone and PM_{2.5}

In developing the recommended SILs for ozone and PM_{2.5}, we assessed the variability in pollutant concentrations, as determined by the national monitoring network, from the design value at each monitor (i.e., baseline value). The technical analysis uses traditional statistical techniques based on statistical significance testing to characterize the variability in air quality. The conceptual underpinnings of the analysis are an application of the concept of “statistical significance” to inform a policy decision regarding what represents an insignificant impact and, therefore, may serve as the basis for developing a SIL for use in the air quality impact analyses required for PSD permitting. More specifically, traditional statistics is based on the concept of identifying what constitutes a statistically significant change from a baseline value where the “baseline” is the statistic of interest, such as the mean or, in this case, the design value. Rather than focusing on statistically significant changes, the purpose of the analysis was to calculate changes in the design values that, once precautionary choices are applied, may be considered not significant or meaningful. To identify recommended SILs for the desired application in the PSD program, the EPA determined that the findings of the statistical analysis can be used to identify a change in the design value (i.e., an air quality impact) below which a permitting authority may reasonably conclude that the impact does not cause or contribute to a violation of a NAAQS. The principles of statistical significance testing do not by themselves provide a single, unique threshold for determining the statistical significance of a change in the design value. Statistical significance testing provides a range of concentration values that can be considered to represent a statistically significant change in air quality or, in this application, a change in air quality that is not statistically significant. Therefore, it is necessary to consider the function and application of SIL values in the context of the PSD program and to select a change in air quality that is reasonably representative of the showing that a proposed source will not cause or contribute to a NAAQS violation, as required by the Act and PSD regulations.

In making a recommendation for an appropriate SIL value, the EPA balanced two considerations: 1) the usefulness of the SIL as a compliance demonstration tool in the PSD permitting program, and 2) the likelihood of a SIL value representing an impact that is not significant. In balancing these considerations, the EPA made policy decisions concerning the confidence interval (CI) to represent the inherent variability for purposes of the NAAQS compliance demonstration, the approach used to scale local variability to the level of the NAAQS, the geographic extent of each summary value, and the design value year or years from which to use the variability results. As described below, for each of these factors, the EPA chose options that are precautionary, leading to SILs designed to ensure the protection of air quality.

Through the statistical analysis, we calculated CIs, which represent different assessments of the level of change in air quality based on the inherent variability in the air quality of an area. We then selected the recommended SIL values as a function of the CIs, the baseline value, and policy considerations. The selection of a CI in defining a particular SIL value required an exercise of judgment based on the technical and policy considerations (as described below) such that the selected value represents a level of change in air quality concentration that can be considered not significant or meaningful in the context of evaluating the impact of emissions from a proposed

source. These policy considerations work in conjunction with the statistical analysis, to provide a rational basis to select values derived from the statistical analysis that can be applied as a tool for making the PSD compliance demonstration required by the Act and PSD regulations. For more information on the design and results of the technical analysis, please refer to the technical document.

The technical analysis relies upon data from the national ambient monitoring network for ozone and PM_{2.5}. Because these data generally are the basis for determining NAAQS attainment, they are an appropriate basis to characterize air quality, with the statistical analysis evaluating the variation in the design value at each monitoring site across the nation. This variability in air quality concentrations is described by the different CIs computed from the statistical analysis. The CIs identify a statistically significant deviation from the baseline value. As described in the technical document (Section 3.0), the EPA has calculated CIs at the 25 percent, 50 percent, 68 percent, 75 percent, and 95 percent intervals for consideration in defining SIL values for ozone and PM_{2.5}. The smallest CI that might be used to identify a statistically significant change would be a 68 percent CI, which corresponds to one standard deviation from the baseline value. Thus, any change in the design value larger than the variation represented by the 68 percent CI could be considered to be a statistically significant change. However, for purposes of the PSD program, we are seeking to identify a concentration value that constitutes an insignificant impact, meaning a change in the design value that does not reflect a meaningful difference in air quality based on the introduction of a new source. Thus, from a statistical perspective, the EPA believes that the CIs used in determining an appropriate SIL value should be below 68 percent, corresponding to a change of less than one standard deviation.

Very small SIL values would have limited use to permitting authorities (i.e., would lead to “false positives”), while larger values (closer to the air quality change represented by the 68 percent CI) would lead to “false negatives.” In weighing these competing considerations to select an appropriate SIL value, the EPA believes that air quality change represented by a 50 percent CI represents a protective approach for a SIL value because it is sufficiently within the 68 percent CI, while still being sufficiently higher than zero such that it can be a useful compliance demonstration tool for the PSD permitting process. Of the available choices, the 50 percent CI has more utility as a screening tool under the permitting program, while providing a value that adequately reflects a change in air quality concentrations that is not significant or meaningful.

The EPA chose to use the relative variability rather than the absolute variability in calculating the SILs because the technical analysis (Section 4.0) showed that the relative variability is fairly consistent across the range of design values, suggesting a commonality in the relative variability across a wide range of geographic regions, chemical regimes, and baseline air quality levels in the development of the SILs.

In order to promote national consistency, the EPA has historically provided national SIL values rather than regional or local values. The EPA considered whether a SIL value should be informed by the statistical analysis at the particular site of the proposed source or the central tendency across all monitored sites in the U.S., regardless of the proposed source’s planned location. The EPA

continues to recommend using a national SIL value based on the variability aggregated across the nation rather than developing regional or local values. Findings from the statistical analysis indicate that while there are local spatial correlations, there are few instances of large scale (e.g., region-to-region) trends in ambient air variability. Thus, national numbers are supported by the spatial analysis and suitable for use here. Because NAAQS and PSD increments are set on a national basis, the EPA and permitting authorities have historically used national SILs in the PSD program. National SIL values are designed to be used for any location subject to PSD requirements and eliminate the need to determine local or regional approaches for developing a SIL value, including addressing the status of local air quality monitoring (which would be needed if regional or local SILs were to be determined). However, as noted above, local permitting authorities have the discretion to develop alternate SILs.⁴¹ Having a national SIL value promotes consistency in implementation and prevents possible confusion or arbitrary choices that may arise with highly localized SIL values (i.e., determining which monitors to use for computations and other possible deviations from national protocol). Given these considerations, the EPA recommends continuing the practice of using national SIL values. Furthermore, as shown in the technical analysis (Section 4.0), because the median statistic is less influenced by high variability areas, the median statistic is preferred for use in selecting a SIL. Therefore, using the median statistic of the relative variability from the 50 percent CIs from the entire U.S. ambient monitoring network satisfies the policy needs for a SIL and is congruent with the physical and chemical processes that result in this variability.

Next, the EPA chose to use the most recently available years of ambient monitoring data (2012-2016) in the technical analysis to derive the recommended SILs. The SILs should reflect the most recent and representative state of the nation's atmosphere. In assessing the historical trends in ozone and PM_{2.5} air quality levels across the nation, there are observable downward trends in concentrations that indicate more recent data are most appropriate. To have more confidence that the resulting values would not be unduly influenced by temporary circumstances or episodic events, the EPA's recommended SILs are based on an average of the most recent three design value years as a basis for ozone and PM_{2.5} SIL development (i.e., 2012-2014, 2013-2015, 2014-2016).

⁴¹ In the cases where a permitting authority is considering an alternative SIL(s) due to the characteristics of regional variability (e.g., if, based on the analysis presented in the technical document, a specific area appears to have more localized variability than the national average), it is important to understand the factors driving that apparent variability to fully support the application of alternative SIL(s). For example, the results presented in section 4.3 of the technical document show some areas with regional variability for the 24-hour PM_{2.5} standard, though no regional trends were apparent for the annual PM_{2.5} standard and the ozone standard. Furthermore, these regional trends for the 24-hour PM_{2.5} standard were not apparent in the other data years shown in the appendix of the technical document. Additionally, the discussion in the technical document highlights potential causes for some of the variability in these regions (e.g., lower sampling frequency, that can lead to apparently higher variability than would otherwise be shown with higher sampling frequency). Similar issues are discussed in the technical document and can have important consequences for the results and conclusions drawn from more localized analyses of the ambient data and should be thoroughly vetted when considering alternative SILs.

SILs for NAAQS

Using the method described above, the EPA developed SIL values for the 8-hour ozone NAAQS and the annual and 24-hour PM_{2.5} NAAQS. Table 1 lists these SIL values for the NAAQS. Each of these SIL values is based on the level, averaging period and statistical form of its corresponding NAAQS. For the reasons discussed in this guidance and supporting documents, we recommend that PSD permitting authorities use the following values as SILs on a case-by-case basis in the manner described in the next section.

Table 1. Recommended SIL Values for Ozone and PM_{2.5} NAAQS

Criteria Pollutant (NAAQS level)	NAAQS SIL concentration
Ozone 8-hour (70 ppb)	1.0 ppb
PM _{2.5} 24-hour (35 µg/m ³)	1.2 µg/m ³ *
PM _{2.5} annual (12 µg/m ³ or 15 µg/m ³)	0.2 µg/m ³

* The table accounts for the significance level for the 24-hour PM_{2.5} NAAQS in 40 CFR 51.165(b)(2). Refer to the guidance discussion for details.

For the 8-hour ozone NAAQS, the SIL value we recommend is 1.0 part per billion (ppb). Consistent with the form of the NAAQS, this value is based on the annual 4th highest daily maximum 8-hour concentration, averaged over 3 years. The recommended SIL value for ozone is the same as the derived value from the air quality variability analysis.

For the 24-hour PM_{2.5} NAAQS, the SIL value we recommend is 1.2 µg/m³. The derived value from the air quality variability analysis is 1.5 µg/m³ and is based on an analysis of the 98th percentile 24-hour concentrations averaged over 3 years. However, 40 CFR 51.165(b)(2) still lists 1.2 µg/m³ as the significance level for the 24-hour PM_{2.5} NAAQS. In the 2010 rulemaking, the EPA determined that an impact above this value will be considered to cause or contribute to a violation of the 24-hour PM_{2.5} NAAQS at any location that does not meet this standard. In the same rule, the EPA also sought to establish that an impact below this value would not cause or contribute to a violation of this NAAQS but acknowledged that there could be circumstances where this conclusion was not always valid. Even though the ambient air quality variability approach indicates that an impact below 1.5 µg/m³ is not significant, significance levels for PM_{2.5} remain in the EPA's regulations at 40 CFR 51.165(b)(2) and the EPA is presently bound by its prior conclusion (that an impact above 1.2 µg/m³ is significant and will cause or contribute to a violation of the 24-hour PM_{2.5} NAAQS). Thus, the EPA cannot conclude at this time that an impact between 1.2 µg/m³ and 1.5 µg/m³ is an insignificant impact or an impact that will not cause or contribute to a violation of the NAAQS. However, based on the ambient air quality variability

approach, the EPA can conclude that impacts below $1.2 \mu\text{g}/\text{m}^3$ are insignificant at any location and will not cause or contribute to a violation of the NAAQS.⁴²

For the annual $\text{PM}_{2.5}$ NAAQS, we recommend $0.2 \mu\text{g}/\text{m}^3$ as the SIL value, which is the value based on a 3-year average of annual average concentrations. This value is lower than the value of $0.3 \mu\text{g}/\text{m}^3$ listed in 40 CFR 51.165(b)(2). Since 40 CFR 51.165(b)(2) does not address whether an impact below $0.3 \mu\text{g}/\text{m}^3$ causes or contributes to a violation of the NAAQS, the EPA and other permitting authorities retain the discretion under this provision to determine on a case-by-case basis whether an impact between $0.2 \mu\text{g}/\text{m}^3$ and $0.3 \mu\text{g}/\text{m}^3$ will cause or contribute to a violation of the annual $\text{PM}_{2.5}$ NAAQS. However, based on the ambient air quality variability approach, the EPA's judgment is that an impact below $0.2 \mu\text{g}/\text{m}^3$ is not significant and should be considered to not cause or contribute to any violation of the annual $\text{PM}_{2.5}$ NAAQS that is identified.

We recommend that these SIL values apply to the NAAQS everywhere, regardless of the class of the airshed.⁴³ For $\text{PM}_{2.5}$, this recommendation is different than what was provided in the vacated (k)(2) paragraphs, where the SIL value that would be used for NAAQS purposes was different for Class I areas than for Class II and III areas. The EPA recognizes that, historically, Congress has provided special protections to Class I areas, as described below in the discussion of SILs for PSD increments. The EPA believes that because each ozone and $\text{PM}_{2.5}$ NAAQS is uniform throughout the class areas, no class-specific protection via SILs is necessary when assessing whether a source causes or contributes to a violation of the NAAQS.

SILs for PSD Increments

There are no PSD increments established for ozone and, thus, no ozone SIL values are needed for PSD increment compliance purposes. We used the air quality variability approach to develop PSD increment SILs for the $\text{PM}_{2.5}$ PSD increments (see Table 2), but in an indirect way. The SIL values

⁴² 40 CFR 51.165(b)(2) provides that a source impact higher than one of the listed significance levels is to be considered significant. A source impact exactly equal to a significance level need not be considered significant. In contrast, in this guidance, consistent with past guidance, we are recommending that a value exactly equal to a recommended SIL be considered significant. Thus, these two approaches treat a value equal to the stated level differently. In practice, we do not expect this to be a practical difference because it will be very unusual for a source's impact to exactly equal one of the recommended SIL values.

⁴³ When Congress established the PSD program requirements under the 1977 Act Amendments, it included specific numerical PSD increment levels for SO_2 and particulate matter (expressed at that time as "total suspended particulate") for Class I, II and III areas. Congress designated Class I areas (including certain national parks and wilderness areas) as areas of special national concern, where the need to prevent deterioration of air quality is the greatest. Consequently, the PSD increments are the smallest in Class I areas. The PSD increments of Class II areas are larger than those of Class I areas and allow for a moderate degree of emissions growth. Class III areas have the largest PSD increments, but to date no Class III areas have been designated. The EPA subsequently defined Class I, II and III PSD increments for NO_2 and PM_{10} , and $\text{PM}_{2.5}$ in multiple rulemakings.

for the PM_{2.5} PSD increments are derived from the recommended NAAQS SIL values and reflect that, under the PSD regulations, the allowable PSD increment values are different for Class I, II and III areas. For Class II areas (which comprise most of the U.S.) and Class III areas (of which there are currently none), we recommend that the values of the NAAQS SILs also be used for PSD increment SILs. For Class I areas, we are recommending annual and 24-hour PSD increment SIL values that are lower than the NAAQS SIL values. This is because the EPA recognizes that Congress intended to establish special protection for Class I areas, as observed by the more stringent statutory Class I PSD increments, as well as provisions for use of air quality related values (including protection against visibility impairment).⁴⁴ To help reflect this additional protection, we applied the ratios of the Class I and Class II allowable PSD increments to the NAAQS SIL values derived in our technical analysis.⁴⁵ The EPA believes these values for Class I areas will continue to reflect this higher level of protection through the PSD increment SILs.

Table 2. Recommended SIL Values for PM_{2.5} PSD Increments

Criteria Pollutant (averaging period)	PSD increment SIL concentration		
	Class I	Class II	Class III
PM _{2.5} (24-hour)	0.27 µg/m ³	1.2 µg/m ³	1.2 µg/m ³
PM _{2.5} (annual)	0.05 µg/m ³	0.2 µg/m ³	0.2 µg/m ³

IV. APPLICATION OF SILS

The EPA recommends that permitting authorities consider using these SIL values for ozone and PM_{2.5} on a case-by-case basis at the same points in the PSD air quality analysis as SIL values historically have been used in the PSD program, as described below, with one exception regarding defining the spatial extent for modeling.

First, permitting authorities may elect to use the SIL values reflected in this guidance in a preliminary (single-source) analysis that considers only the impact of the proposed source in the permit application on air quality to determine whether a full (or cumulative) impact analysis is necessary before reaching a conclusion as to whether the proposed source would (or would not) cause or contribute to a violation.⁴⁶ A modeled result predicting that a proposed source's maximum impact will be below the corresponding SIL value recommended above generally may be considered to be a sufficient demonstration that the proposed source will not cause or contribute to a violation of the applicable NAAQS or PSD increment. If the single-source analysis shows that a proposed source will not have a significant impact on air quality, permitting authorities may

⁴⁴ Section 165(d)(2) of the Act sets forth procedures affording special protection against adverse air quality impacts in Class I areas. Also, section 169A of the Act declares a national goal of preventing future and remedying any existing impairment of visibility in Class I areas. 42 U.S.C. 7475 and 7491.

⁴⁵ To derive the Class I PSD increment SIL values, we started with the corresponding NAAQS SIL value as the base number and adjusted it by the ratio of the associated Class I and II PSD increments. For the annual PM_{2.5} increment, we reduced the NAAQS SIL value by the ratio of 1:4, because the Class I PSD increment is 1 µg/m³ and the Class II PSD increment is 4 µg/m³. We used the ratio of 2:9 for the 24-hour PM_{2.5} increment. For the 24-hour increment, we used the 40 CFR 51.165(b)(2) value of 1.2 µg/m³ as our base number.

⁴⁶ 1990 Draft NSR Workshop Manual at C.24-C.25, C.51.

generally conclude there is no need to conduct a cumulative impact analysis to assess whether there will be any violations of the NAAQS or PSD increment. However, upon considering the permit record in an individual case, if a permitting authority has a basis for concern that a demonstration that a proposed source's impact is below the relevant SIL value at all locations is not sufficient to demonstrate that the proposed source will not cause or contribute to a violation, then the permitting authority should require additional information from the permit applicant to make the required air quality impact demonstration.

Second, where the preliminary analysis described in the prior paragraph shows a significant impact, permitting authorities may choose to use the recommended SIL values in a cumulative impact analysis for a NAAQS, which, in addition to the proposed new major stationary source or major modification, includes the impact of existing sources (onsite with the proposed major modification, as well as other existing sources), and the appropriate background concentration. The EPA has described this application of a SIL as a "culpability analysis."⁴⁷ Where a cumulative impact analysis predicts a NAAQS violation, the permitting authority may further evaluate whether the proposed source will cause or contribute to the violation by comparing the proposed source's modeled contribution to that violation to the corresponding SIL value. If the modeled impact is below the recommended SIL value at the violating receptor during the violation, the EPA believes this will be sufficient in most cases for a permitting authority to conclude that the source does not cause or contribute to (is not culpable for) the predicted violation. This demonstration would, thus, allow the permit to be issued if all other PSD requirements are satisfied. If the proposed source's modeled impact is higher than or equal to the recommended SIL value at the violating receptor during a violation, then a permit should not be issued unless (1) further modifications are made to the proposed source to reduce the proposed source's impact to a not significant level at the affected receptor during the violation, or (2) the proposed source obtains sufficient emissions reductions from other sources to compensate for its contribution to the violation.⁴⁸

Third, permitting authorities may decide to use the SIL values recommended above in a cumulative impact analysis for a PSD increment. According to 40 CFR 51.166(c)(1) and 52.21(c), an allowable PSD increment based on an annual average may not be exceeded, and the allowable PSD increment for any other time period may be exceeded once per year at any one location. In either case, the PSD increment SILs recommended above may be used to determine if the proposed source will cause or contribute to that exceedance. If the cumulative impact analysis shows an annual average PM_{2.5} PSD increment exceedance or a 24-hour PSD increment exceedance at a location, then the comparison of the proposed source's impact at that location during the exceedance to the corresponding SIL value may be used to determine whether the proposed source will cause or contribute to the exceedance(s) at that receptor. If the modeled impact is below the SIL for the relevant pollutant, then the permitting authority may conclude that the source does not cause or contribute to a violation of the PSD increment for that pollutant.

⁴⁷ *Prairie State*, 13 E.A.D. at 100; *Mississippi Lime*, 15 E.A.D. at 374.

⁴⁸ 1990 Draft NSR Workshop Manual at C.52-C.53; this latter alternative is referred to as a PSD offset, and state implementation plans may include an offset program based on federal regulations at 40 CFR 51.165(b).

In the past, SILs have been used in defining the spatial extent of the modeling domain for a cumulative impact analysis. Because an impact from a proposed source below a SIL value is considered not to cause or contribute to a violation, the EPA has previously recognized that there was no informational value in placing modeling receptors farther from the proposed source than the most distant point at which the proposed source's impact is equal to or greater than the applicable SIL value. Streamlining the modeling demonstration to reduce the number of receptors to those of value in determining if the proposed source will cause or contribute to a violation of the applicable NAAQS or PSD increment has enabled permit applicants to complete the required modeling with a reasonable effort. As discussed earlier, the EPA recently updated its *Guideline*. The revisions include providing an appropriate, revised basis for determining the modeling domain for NAAQS and PSD increment assessments. Thus, the revised *Guideline* should be used when considering the extent of the modeling domain.

The SILs identified in this guidance should not influence Air Quality Related Values analyses in Class I areas, which are independent reviews by the Federal Land Managers during the application review process.

Subject to limitations described in this guidance, permitting authorities may use the values in the above tables on a case-by-case basis to support air quality analyses and demonstrations required for issuance of PSD permits. Since this guidance is neither a final determination nor a binding regulation, permitting authorities retain the discretion not to use SILs as described here, either in specific cases or programmatically.

The case-by-case use of SIL values should be justified in the record for each permit. To ensure an adequate record, any PSD permitting decision that is based on this guidance (including the technical and legal documents) should incorporate the information contained in them. The permitting authority should also consider any additional information in the record that is relevant to making the required demonstration.

Permitting authorities also retain the discretion to use other values that may be justified separately from this guidance as levels of insignificant impact, subject to one limitation for the PM_{2.5} NAAQS. Since the EPA has established by regulation that a PM_{2.5} impact greater than certain values will cause or contribute to a violation of the relevant NAAQS, permitting authorities may not use a value higher than 1.2 µg/m³ for the 24-hour PM_{2.5} NAAQS or a value higher than 0.3 µg/m³ for the annual PM_{2.5} NAAQS. Because the 2010 rulemaking constrains the discretion of state and local permitting authorities, the EPA is committed to reassessing 40 CFR 51.165(b)(2) through a future rulemaking process that will begin within 18 months.

Because ozone is not addressed in 40 CFR 51.165(b)(2), permitting authorities are not precluded from developing a higher ozone NAAQS SIL value than recommended in this guidance. Likewise, 40 CFR 51.165(b)(2) does not address PSD increments and, thus, does not constrain the discretion of a permitting authority to use a higher SIL value that a permitting authority may develop for PSD increment purposes. Permitting authorities are also not precluded from developing and using lower SIL values than recommended in this guidance. Permitting authorities may elect to utilize

alternative CIs, based on regional or local factors, in developing their own SIL values. The case-by-case use of a SIL value should be supported by a comparable record in each instance that shows that the value represents a level below which a proposed source does not cause or contribute to a violation of the NAAQS or PSD increment.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Washington, D.C. 20460

JUN 13 1989

MEMORANDUM

SUBJECT: Guidance on Limiting Potential to Emit in New Source Permitting

FROM: Terrell E. Hunt
Associate Enforcement Counsel
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Office of Enforcement and Compliance Monitoring

John S. Seitz, Director
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Office of Air Quality Planning and Standards

TO: Addressees

This memorandum transmits the final guidance on conditions in construction permits which can legally limit a source's potential to emit to minor or de minimis levels. We received many helpful comments on the January 24, 1989 draft of this guidance, and have incorporated the comments into the final document wherever possible. A summary of the major changes which have been made to the guidance in response to these comments is provided below.

Several commenters noted that the draft guidance used the term "federally enforceable" to mean both federally enforceable as defined in the new source regulations (40 C.F.R. Sections 52.21(b) (17), 51.165(a) (1) (xiv), 51.166(b) (17)), and enforceable as a practical matter. We have tried to distinguish the places where each term should be used, explained the relationship between the two terms, and indicated that in order to properly restrict potential to emit, limitations must be both federally enforceable as defined in the regulations and practically enforceable.

Some commenters requested that the section on averaging times for production limits be more specific as to when it is appropriate to use limitations which exceed a one month time basis. We have tried to explain why it is not possible to develop generic criteria for making this distinction, and to indicate situations where exceptions to the policy that production and operation limitations not exceed one month may be warranted.

There were some requests for a section on enforcement. We have included a new Section VI which addresses this topic. We also received many good suggestions on the example permit limitations. The section on examples has been substantially reworked to reflect your comments.

Finally, we learned through the comments that in two specific circumstances, short term emission limits are the most useful and reasonable way to restrict and verify limits on potential to emit. These circumstances are: 1) when control equipment is installed but control equipment operating parameters are difficult to measure during enforcement inspections; and 2) in surface coating operations with numerous and unpredictable use of coatings containing varying VOC content, where add-on control equipment is not employed. Therefore, we have made a narrow exception to the flat prohibition on use of emission limits to restrict potential to emit for these specific circumstances, and only when certain additional conditions have been met.

Again, we appreciate the thoughtful comments we have received on this guidance. Please insert this document into your Clean Air Act Compliance/Enforcement Policy Compendium as Item Number H.3. If you have any questions, please contact Judith Katz in the Air Enforcement Division at FTS 382-2843, or Sally Farrell in the Stationary Source Compliance Division at FTS 382-2875.

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DOJ

LIMITING POTENTIAL TO EMIT IN NEW SOURCE PERMITTING

JUNE 13, 1989

AIR ENFORCEMENT DIVISION
OFFICE OF ENFORCEMENT AND COMPLIANCE MONITORING

STATIONARY SOURCE COMPLIANCE DIVISION
OFFICE OF AIR QUALITY PLANNING AND STANDARDS

Limiting Potential to Emit in New Source Permitting

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Limiting Potential to Emit in New Source Permitting

I. Introduction

Whether a new source or modification is major and subject to new source review under Parts C and D of the Clean Air Act is dependent on whether that source or modification has or will have the potential to emit major or significant amounts of a regulated pollutant. Therefore, the definition of "potential to emit" under the new source regulations is extremely important in determining the applicability of new source review to a particular source. The federal regulations define "potential to emit" as:

the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of fuel combusted, stored or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable.

40 C.F.R Sections 52.21(b) (4), 51.165(a) (1) (iii), 51.166(b) (4).

Permit limitations are very significant in determining whether a source is subject to major new source review. This is because they are the easiest and most common way for a source to obtain restrictions on its potential to emit. A permit does not

have to be a major source permit to legally restrict potential emissions. A minor source construction permit issued pursuant to a state program approved by EPA as meeting the requirements of 40 C.F.R. Section 51.160 is federally enforceable. In fact, any permit limitation can legally restrict potential to emit if it meets two criteria: 1) it is federally enforceable as defined by 40 C.F.R. Sections 52.21(b) (17), 51.165(a) (1) (xiv), 51.166(b) (17), i.e., contained in a permit issued pursuant to an EPA-approved permitting program or a permit directly issued by EPA, or has been submitted to EPA as a revision to a State Implementation Plan and approved as such by EPA; and 2) it is enforceable as a practical matter. The second criterion is an implied requirement of the first criterion. A permit requirement may purport to be federally enforceable, but, in reality cannot be federally enforceable if it cannot be enforced as a practical matter.

Non-permit limitations can also legally restrict potential to emit. These limitations include New Source Performance Standards codified at 40 C.F.R. Part 60 and National Emission Standards for Hazardous Air Pollutants codified at 40 C.F.R. Part 61.

The appropriate means of restricting potential to emit through permit conditions has been an issue in recent enforcement cases. Through these cases and through guidance issued by EPA, the Agency has addressed three questions: what types of permit

limitations can legally limit potential to emit; whether long averaging times for production limitations are enforceable as a practical matter; and whether sources may limit potential to emit to minor source levels as a means of circumventing the preconstruction review requirements of major source review.

II. The Louisiana-Pacific Case

In United States v. Louisiana-Pacific Corporation, 682 F. Supp. 1122 (D. Colo. Oct. 30, 1987) and 682 F. Supp. 1141 (D. Colo. March 22, 1988), Judge Alfred Arraj discussed the type of permit restrictions which can be used to limit a source's potential to emit. The Judge concluded that:

... not all federally enforceable restrictions are properly considered in the calculation of a source's potential to emit. While restrictions on hours of operation and on the amount of materials combusted or produced are properly included, blanket restrictions on actual emissions are not.

682 F. Supp. at 1133.

The Court held that Louisiana-Pacific's permit conditions which limited carbon monoxide emissions to 78 tons per year and volatile organic compounds to 101.5 tons per year should not be considered in determining "potential to emit" because these blanket emission limits did not reflect the type of permit conditions which restricted operations or production such as limits on hours of operation, fuel consumption, or final product.

The Louisiana-Pacific court was guided in its reasoning by the D.C. Circuit's holding in Alabama Power v. Costle, 636 F. 2d 323 (D.C. Circuit 1979). Before Alabama Power, EPA regulations required potential to emit to be calculated according to a source's maximum uncontrolled emissions. In Alabama Power, the D. C. Circuit remanded those regulations to EPA with instructions that the Agency include the effect of in-place control equipment in defining potential to emit. EPA went beyond the minimum dictates of the D.C. Circuit in promulgating revised regulations in 1980 to include, in addition to control equipment, any federally enforceable physical or operational limitation. The Louisiana-Pacific court found that blanket limits on emissions did not fit within the concept of proper restrictions on potential to emit as set forth by Alabama Power.

Moreover, Judge Arraj found that:

...a fundamental distinction can be drawn between the federally enforceable limitations which are expressly included in the definition of potential to emit and (emission) limitations.... Restrictions on hours of operation or on the amount of material which may be combusted or produced ... are, relatively speaking, much easier to "federally enforce." Compliance with such conditions could be easily verified through the testimony of officers, all manner of internal correspondence and accounting, purchasing and production records. In contrast, compliance with blanket restrictions on actual emissions would be virtually impossible to verify or enforce.

Id. Thus, Judge Arraj found that blanket emission limits were not enforceable as a practical matter.

Finally, the Court reasoned that allowing blanket emission limitation to restrict potential to emit would violate the intent of Congress in establishing the Prevention of Significant Deterioration (PSD) program.

III. Types of Limitations that will Restrict Potential to Emit

As an initial matter in this discussion, a few important terms should be defined. Emission limits are restrictions over a given period of time on the amount of a pollutant which may be emitted from a source into the outside air. Production limits are restrictions on the amount of final product which can be manufactured or otherwise produced at a source. Operational limits are all other restrictions on the manner in which a source is run, including hours of operation, amount of raw material consumed, fuel combusted, or conditions which specify that the source must install and maintain add-on controls that operate at a specified emission rate or efficiency. All production and operational limits except for hours of operation are limits on a source's capacity utilization. Potential emissions are defined as the product of a source's emission rate at maximum operating capacity, capacity utilization, and hours of operation.

To appropriately limit potential to emit consistent with the opinion in Louisiana-Pacific, all permits issued pursuant to 40 C.F.R. Sections 51.160, 51.166, 52.21 and 51.165 must contain a

production or operational limitation in addition to the emission limitation in cases where the emission limitation does not reflect the maximum emissions of the source operating at full design capacity without pollution control equipment. Restrictions on production or operation that will limit potential to emit include limitations on quantities of raw materials consumed, fuel combusted, hours of operation, or conditions which specify that the source must install and maintain controls that reduce emissions to a specified emission rate or to a specified efficiency level. Production and operational limits must be stated as conditions that can be enforced independently of one another. For example, restrictions on fuel which relates to both type and amount of fuel combusted should state each as an independent condition in the permit. This is necessary for purposes of practical enforcement so that, if one of the conditions is found to be difficult to monitor for any reason, the other may still be enforced.

When permits contain production or operational limits, they should also have recordkeeping requirements that allow a permitting agency to verify a source's compliance with its limits. For example, permits with limits on hours of operation or amount of final product should require an operating log to be kept in which the hours of operation and the amount of final product produced are recorded. These logs should be available

for inspection should staff of a permitting agency wish to check a source's compliance with the terms of its permit.

When permits require add-on controls operated at a specified efficiency level, permit writers should include, so that the operating efficiency condition is enforceable as a practical matter, those operating parameters and assumptions which the permitting agency depended upon to determine that the control equipment would have a given efficiency.

An emission limitation alone would limit potential to emit only when it reflects the absolute maximum that the source could emit without controls or other operational restrictions. When a permit contains no limits on capacity utilization or hours of operation, the potential to emit calculation should assume operation at maximum design or achievable capacity (whichever is higher) and continuous operation (8760 hours per year).

The particular circumstances of some individual sources make it difficult to state operating parameters for control equipment limits in a manner that is easily enforceable as a practical matter. Therefore, there are two exceptions to the absolute prohibition on using blanket emission limits to restrict potential to emit. If the permitting agency determines that setting operating parameters for control equipment is infeasible in a particular situation, a federally enforceable permit

containing short term emission limits (e.g. lbs per hour) would be sufficient to limit potential to emit, provided that such limits reflect the operation of the control equipment, and the permit includes requirements to install, maintain, and operate a continuous emission monitoring (CEM) system and to retain CEM data, and specifies that CEM data may be used to determine compliance with the emission limit.

Likewise, for volatile organic compound (VOC) surface coating operations where no add-on control is employed but emissions are restricted through limiting VOC contents and quantities of coatings used, emission limits may be used to restrict potential to emit under the following limited circumstances. If the permitting agency determines for a particular surface coating operation that operating and production parameters (e.g. gallons of coating, quantities produced) are not readily limited due to the wide variety of coatings and products and due to the unpredictable nature of the operation, emission limits coupled with a requirement to calculate daily emissions may be used to restrict potential to emit. The source must be required to keep the records necessary for this calculation, including daily quantities and the VOC content of each coating used. Emission limits may be used in this limited circumstance to restrict potential to emit since, in this case, emission limits are more easily enforceable than operating or production limits.

IV. Time Periods For Limiting Production and Operation

As discussed above, a limitation specifically recognized by the regulations as reducing potential to emit is a limitation on production or operation. However, for these limitations to be enforceable as a practical matter, the time over which they extend should be as short term as possible and should generally not exceed one month. This policy was explained in a March 13, 1987 memorandum from John Seitz to Bruce Miller, Region IV. The requirement for a monthly limit prevents the enforcing agency from having to wait for long periods of time to establish a continuing violation before initiating an enforcement action.

EPA recognizes that in some rare situations, it is not reasonable to hold a source to a one month limit. In these cases, a limit spanning a longer time is appropriate if it is a rolling limit. However, the limit should not exceed an annual limit rolled on a monthly basis. EPA cannot now set out all inclusive categories of sources where a production limit longer than a month will be acceptable because every situation that may arise in the future cannot now be anticipated. However, permits where longer rolling limits are used to restrict production should be issued only to sources with substantial and unpredictable annual variation in production, such as emergency

boilers. Rolling limits could be used as well for sources which shut down or curtail operation during part of a year on a regular seasonal cycle, but the permitting authority should first explore the possibility of imposing a month-by-month limit. For example, if a pulp drier is periodically shut down from December to April, the permit could contain a zero hours of operation limit for each of those months, and then the appropriate hourly operation limit for each of the remaining months. Under no circumstances would a production or operation limit expressed on a calendar year annual basis be considered capable of legally restricting potential to emit.

V. Sham Operational Limits

In the past year, several sources have obtained purportedly federally enforceable permits with operating restrictions limiting their potential to emit to minor or de minimis levels for the purpose of allowing them to commence construction prior to receipt of a major source permit. In such cases where EPA can demonstrate an intent to operate the source at major source levels, EPA considers the minor source construction permit void ab initio and will take appropriate enforcement action to prevent the source from constructing or operating without a major source permit.

The following example illustrates the kind of situation addressed in this section: An existing major stationary source proposes to add a 12.5 megawatt electric utility steam generating unit, and applies for a federally enforceable minor source permit which restricts operation at the unit to 240 hours per year. Because the project is designed as a baseload facility, EPA does not believe that the source intends to operate the facility for only 240 hours a year. Further investigation would probably uncover documentation of the source's intent to operate at higher levels than those for which it is permitted.

This situation raises the question of whether a source can lawfully bypass the preconstruction or premodification review requirements of Prevention of Significant Deterioration (PSD) and nonattainment New Source Review by committing to permit conditions which restrict production to a level at which the source does not intend to operate for any extensive time. If, after constructing and commencing operation, the source obtains a relaxation of its original permit conditions prior to exceeding them, does this constitute a violation of the preconstruction review requirements? This section discusses why it is improper to construct a source with a minor source permit when there is intent to operate as a major source, and provides guidelines for identifying these "sham" permits.

A. Permits with conditions that do not reflect a source's planned mode of operation are void ab initio and cannot act to shield the source from the requirement to undergo preconstruction review.

1. Sham permits are not allowed by 40 CFR Section 52.21(r) (4) Section

52.21(r) (4) states:

At such time that a particular source or modification becomes a major stationary source or major modification solely by virtue of a relaxation in any enforceable limitation which was established after August 7, 1980 on the capacity of the source or modification otherwise to emit a pollutant, such as a restriction on hours of operation, then (PSD) shall apply to the source or modification as though construction had not yet commenced on the source or modification.

When a source that is minor because of operating restrictions in a construction permit later applies for a relaxation of that construction permit which would make the source major, Section 52.21(r) (4) prescribes the methodology for determining best available control technology (BACT). However, it does not foreclose EPA's ability, in addition to the retroactive application of BACT and other requirements of the PSD program, to pursue enforcement where the Agency believes that the initial minor source permit was a sham. EPA will limit its activity to requiring application of 40 CFR 52.21(r) (4) only for the cases where a source legitimately changes a project after finding that the operating restrictions which were taken in good faith cannot be complied with. Whether a source has acted in good faith is a factual question which is answered by available evidence in the particular case.

2. Sham permits are not allowed by the definition of potential to emit:

40 C.F.R. Sections 52.21(b) (4), 51.165(a) (1) (iii), 51.166(b) (4).

The definition of potential to emit enables sources to obtain federally enforceable permits with operational restrictions as a means of limiting emissions to minor source levels. However, implicit in the application of these limitations is the understanding that they comport with the true design and intended operation of the project.

3. Sham permits are not allowed by the Clean Air Act

Parts C and D of the Clean Air Act exhibit Congress's clear intent that new major sources of air pollution be subject to preconstruction review. The purposes for these programs cannot be served without this essential element. Therefore, attempts to expedite construction by securing minor source status through the receipt of operational restrictions from which the source intends to free itself shortly after operation are to be treated as circumvention of the preconstruction review requirements.

B. Guidelines for determining when minor source construction permits are shams.

EPA's determination that a purportedly federally enforceable construction permit is a sham is made based on an evaluation of specific facts and evidence in each individual case. The following are criteria which should be scrutinized when making such a determination:

1. Filing a PSD or nonattainment NSR permit application

If a major source or major modification permit application is filed simultaneously with or at approximately the same time as the minor source construction permit, this is strong evidence of an intent to circumvent the requirements of preconstruction review. Even a major source application filed after the minor source application, but either before operation has commenced or after less than a year of operation should be looked at closely.

2. Applications for funding

Applications for commercial loans or, for public utilities, bond issues, should be scrutinized to see if the source has guaranteed a certain level of operation which is higher than that in its construction permit. If the project would not be funded or if it would not be economically viable if operated on an extended basis

(at least a year) at the permitted level of production, this should be considered as evidence of circumvention.

3. Reports on consumer demand and projected production levels.

Stockholder reports, reports to the Securities and Exchange Commission, utility board reports, or business permit applications should be reviewed for projected operation or production levels. If reported levels are necessary to meet projected consumer demand but are higher than permitted levels, this is additional evidence of circumvention.

4. Statements of authorized representatives of the source regarding plans for operation.

Statements by representatives of the source to EPA or to state or local permitting agencies about the source's plans for operation can be evidence to show intent to circumvent preconstruction review requirements.

Note that if a determination is made that a permit is a "sham" for one pollutant and, therefore, the source is a major source or major modification, the permit may possibly still contain valid limits on potential to emit for other pollutants.

In such cases, the entire source must still go through new source review, during which, for PSD review, all pollutants for which there is a net significant increase must be analyzed for BACT. In nonattainment new source review, new sources must have LAER determinations only for pollutants for which they are major. Major modifications, however, must have LAER determinations for all nonattainment pollutants emitted in significant amounts. If the valid limits in a partially void minor source construction permit keep certain pollutants below significance levels, then those pollutants would not have to be analyzed for BACT or LAER. However, if a source or modification is determined to be major for PSD or NSR because part of its minor permit is deemed void, it would have to undergo BACT or LAER analysis for all significant pollutants.

VI. Enforcement Procedures

This guidance has discussed permit conditions which will legally restrict potential to emit, shielding a source from the requirement to comply with major new source permitting regulation. Failure by a permitting agency to adhere to these guidelines may result in a permit that does not legally restrict potential to emit, thereby subjecting a source to major new source review. If that source has not gone through preconstruction review, it is a significant violator of the Clean Air Act and is subject to enforcement for constructing or

modifying without a major new source permit.

The enforcement options available to EPA in these situations include administrative action under Sections 167 or 113 (a) (5) of the Act or federal judicial action under Sections 113 (b) (2), 113 (b) (5), 113(c), or 167. Which enforcement option is selected depends on the facts of the particular situation. (See July 15, 1988 guidance on EPA Procedures for Addressing Deficient New Source Permits.)

VII. Examples

The following examples are provided to illustrate the type of permit restrictions which would and would not legally limit potential to emit to less than major source thresholds. These examples are provided for purposes of clarifying the potential to emit and averaging time guidance only. They are not intended to reflect all the permit conditions necessary for a valid permit. Specific test methods, compliance monitoring and recordkeeping and reporting requirements are necessary to make permit limitations enforceable as a practical matter. The use of examples where averaging times are the longest times allowed under EPA policies is not intended to necessarily condone the selection of the longest averaging times; averaging times should in practice be as short as possible.

1. The minor source construction permit for a boiler contains the following restrictions:
250,000 gal fuel/month; 0.8% S fuel; 8000 hours/year.

These conditions are federally enforceable production and operation limits, but do not limit potential to emit because one of them does not meet EPA policies on enforceability as a practical matter. The averaging time for hours of operation, one of the operational limits necessary to restrict emissions to less than 250 tpy, exceeds a monthly or rolling yearly limit. If, instead of 8000 hours/year, the hourly restriction were stated as 666 hours/month, the permit would serve to keep the source a minor source, assuming the permit contains appropriate recordkeeping provisions.

2. A waferboard plant which has the physical capacity to emit over 300 tpy of carbon monoxide in the absence of using specific combustion techniques has the following permit restriction as the sole emission limitation: 249 tpy.

This does not limit potential to emit since an operational or production restriction is necessary for the source to be restricted to 249 tpy. The permit must contain a restriction on hours of operation or capacity utilization which, when multiplied by the maximum emission rate for the CO sources at the plant, results in emissions of 249 tpy. Additionally, while the

emission limit alone cannot restrict potential to emit, the emission limit is unenforceable as a practical matter since it is limited on an annual basis. The permit should contain a short term emission limit (in addition to the annual emission limit), consistent with the compliance period or parameter in the applicable test method for determining compliance.

3. A small scale rock crushing plant that cannot emit more than 240 tpy under maximum operation without controls (including plant-wide particulate emissions from transfer and storage operations) has the following permit restriction as the sole emission limitation: 240 tpy particulate matter.

Since no operational limitations are necessary for the source to emit below 250 tpy, no operational restrictions need be in the permit to limit potential to emit. However, although this is not a major source, the state agency should express the emission limit in this permit as a lb/hour measure or gr/dscf so that it will be enforceable as a practical matter.

4. A plant consisting solely of a small rock crusher has the following permit restrictions: 0.05 lb gr PM/dscf; fabric filter must be employed and maintained at 99% efficiency.

Assuming that maintaining the fabric filter at 99% efficiency will result in emissions of less than 250 tpy, this permit would limit

potential to emit if it also contained either 1) parameters that allowed the permitting agency to verify the fabric filter's operating efficiency or 2) a requirement to install and operate continuous opacity monitors (COMs) and a specification that COM data may be used to verify compliance with emission limits. Note that if this second alternative were adopted, it would not be necessary to require that the fabric filter be maintained at 99% efficiency.

To determine potential to emit, the efficiency rate of the fabric filter would be multiplied by the maximum uncontrolled emission rate, the maximum number of operating hours and maximum throughput capacity since there are no other operating or production limits. However, the efficiency rate of the fabric filter would not be enforceable as a practical matter unless there were an enforceable means to monitor ESP performance on a short term basis. The two alternatives mentioned above would satisfy this requirement.

5. A surface coating operation has the capability of utilizing 15,000 gal coating/month, with the following permit restrictions: 3.0 lb VOC/gal coating minus water; 20.5 tons VOC/month; monthly VOC emissions to be determined from records of the daily volumes of coatings used times the manufacturers specified VOC content.

This does not limit potential to emit since the source has the physical capacity to exceed 250 tpy of VOC, and the permit does not contain a production or an operational limitation. A monthly limit on gallons of coating used which when multiplied by 3.0 lb/gal equates to less than the 250 tpy threshold (13,500 gallons/month), with appropriate recordkeeping, would generally be necessary to limit potential to emit. If, however, the permitting agency determines, due to the wide variety of coatings employed and products produced, that restrictions on operation or production are not practically enforceable, then the above emission limits could restrict potential to emit if there are requirements that the source calculate emissions daily, and keep the appropriate records.

If the source was alternatively to meet the 20.5 ton/month limit by employing add-on controls, the permit would need to contain an operational limit, such as the requirement to install and operate an incinerator at 99% efficiency. A requirement to monitor incinerator efficiency (either directly or indirectly via temperature monitoring for example), and appropriate recordkeeping requirements to verify compliance with each of the permit conditions would also be necessary to make the permit conditions enforceable as a practical matter. Note, however, that in the case where add-on controls are employed, the source may be able to meet a shorter term emission limit than the ton per month figure.

VIII. Conclusion

We hope this guidance will help EPA Regions identify sources which have the potential to emit major amounts of an air pollutant which will subject those sources to the requirements of preconstruction new source review. Every source which is subject to these requirements but has not obtained a major new source permit should be seriously considered for enforcement action.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 25 1995

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

SUBJECT: Guidance an Enforceability Requirements for
Limiting Potential to Emit through SIP and §112 Rules
and General Permits

FROM: Kathie A. Stein, Director
Air Enforcement. Division

TO: Director, Air and, Pesticides and Toxics
Management Division, Regions I and IV
Director, Air and Waste Management Division,
Region II
Director, Air, Radiation and Toxics Division,
Region III
Director, Air and Radiation Division,
Region V
Director, Air, Pesticides and Toxics Division,
Region VI
Director, Air and Toxics Division,
Regions VII, VIII, IX, and X

Attached is a guidance document developed over the past year by the former Stationary Source compliance Division in coordination with the Air Enforcement Division, Office of Air Quality Planning and Standards\$ OAR's Office of Policy Analysis and Review, and the Office of General Counsel, as well-as with significant input from several Regions.

A number of permitting authorities have begun discussions with or have submitted programs for review by EPA that would provide alternative mechanisms for limiting potential to emit. Several authorities have submitted SIP rules and at least one State has been developing a state general permit approach.; We believe that this guidance is important to assist the EPA Regions as well as States in approving and developing such approaches.

For additional information regarding this guidance, please contact me or Clara Poffenberger of my staff at (202) 564-8709.

cc: John Rasnic, Director
Manufacturing, Energy, and Transportation Division Office of Compliance

Air Branch Chiefs, Regions I -X

Enforceability Requirements for Limiting potential to Emit Through SIP and §112 Rules and General Permits

Introduction

As several EPA guidance describe, there are several mechanisms available for sources to limit potential to emit. EPA guidance have also describe the importance of practical enforceability or the means used to limit the Potential to Emit. This guidance is intended to provide additional guidance on practical enforceability for such limits. We provide references for guidance an practical enforceability for permits and rules in general and provide guidance in this document for application of the same principles to "limitations established by rule or general permit," as described in the guidance document issued January 25, 1995, entitled "Options for Limiting Potential to Emit (PTE) of a Stationary Source under section 112 and Title V of the Clean Air Act (Act)." The description is as follows:

Limitations established by rules. For less complex plant sites, and for source categories involving relatively few operations that are similar in nature, case-by-case permitting may not be the most administratively efficient approach to establishing federally enforceable restrictions. One approach that has been used is to establish a general rule which creates federally enforceable restrictions at one time for many sources (these rules have been referred to as "prohibitory" or "exclusionary" rules). The concept of exclusionary rules is described in detail in the November 3, 1993 memorandum ["Approaches to Creating Federally Enforceable Emissions Limits," from John S. Seitz]. A specific suggested approach for VOC limits by rule was described in EPA's memorandum dated October 15, 1993 entitled "Guidance for State Rules for Optional Federally Enforceable Emissions Limits Base Upon Volatile Organic Compound (VOC) Use." An example of such an exclusionary rule is a model rule developed for use in California. (The California model rule is attached, along with a discussion of its applicability to other situations - see Attachment 2). Exclusionary rules are included in a State's SIP or 112 program and generally become effective upon approval by the EPA.

The EPA prefers the term "exclusionary rule" in that this phrase is a less ambiguous description of the overall purpose of these rules.

General permits -A concept similar to the exclusionary rule is the establishment of a general permit for a given source type. A general permit is a single permit that establishes terms and conditions that must be complied with by all sources subject to that permit. The establishment of a general permit could provide for emission limitations in a one-time permitting process, and thus avoid the need to issue separate permits for each source. Although this concept is generally thought of as an element of Title V permit programs there is no reason that a state or local agency could not submit a general permit program as a SIP submittal aimed at creating synthetic minor sources. Additionally FESOP [Federally Enforceable State Operating Permit usually referring to Title I State Operating Permit Programs approved under- the criteria established by EPA in the June 28, 1989 Federal Register notice, 54 FR 27274] programs can include general permits as an element of the FESOP program being approved into the SIP. The advantage of a SIP general permit, when compared to an exclusionary rule, is that upon approval by the EPA of the state's general permit program, a general permit could be written for an additional source type without triggering the need for the formal SIP revision process. (January 25, 1995 Seitz and Van Heuvelen memorandum, page 4.)

SIP or §112 Rules

Source-category standards 'approved in the SIP or under 112, if enforceable as a practical matter, can be used as federally enforceable limits on potential to emit. Such provisions require public participation and EPA review. Once a specific source qualifies under the applicability requirements of the source category rule, additional public participation is not required to make the limits federally enforceable as a matter of legal sufficiency since the rule itself underwent public participation and EPA review. The rule must still be enforceable as practical matter in order to be considered federally enforceable. A source that violates this type of rule limiting potential to emit below major source thresholds or is later determined not to qualify for coverage under the rule, could be subject to enforcement action for violation of the rule and for constructing or operating without a proper permit (a. part 70, a New Source Review permit, or operating without meeting §112 requirements, or any combination thereof).

General Permits

The title V regulations set out provisions for general permits covering numerous similar sources. The primary purpose of general permits is to provide a permitting alternative where

the normal permitting process would be overly burdensome, such as for area sources under section 112. General permits may be issued to cover any category of numerous similar sources, including major sources, provided that such sources meet certain criteria laid out in 40 CFR part 70. Sources may be issued general permits strictly for the purpose of avoiding classification as major source. In other words, general permits may be used to limit the potential to emit for numerous similar sources. However, general permits must also meet both legal and practical federal enforceable requirements.

With respect to legal sufficiency, the operating permit regulations provide that once the general permit has been issued, after opportunity for public participation and, EPA and affected State review, the permitting authority may grant or deny a sources request to be covered by a general permit without further public participation or EPA or affected State review. The action of granting or denying the source's request is not subject to judicial review. A general permit does not carry a permit shield. A source may be subject to enforcement action for operating without a part 70 permit if the source is later determined not to qualify for coverage under the general permit. Sources covered by general permits must comply with all part 70 requirements.

State SIP or 112(l) General Permits

Another mechanism available to limit potential to emit is a general permit program approved into the SIP or under section 112(1), the hazardous air pollutant program authority. This mechanism allows permitting authorities to issue and revise general permits consistent with SIP or 112(1) program requirements without going through the SIP or 112(1) approval process for each general permit or revision of a general permit. The program is also separate from title V, like Title I state operating permits, and issuance and revisions of the permits are to comply with title V procedures.

Once a program is approved, issuing and revising general permits should be significantly less burdensome and time-consuming for State legislative and rulemaking authorities. The EPA review should also be less burdensome and time-consuming. After a program is approved, permitting authorities have the flexibility to submit and issue general permits as needed rather than submitting them all at once as part of a SIP submittal. Given the reduced procedural burden, permitting authorities should be able to issue general permits to small groups or categories or sources rather than attempt to cover broad categories with a generic rule. We anticipate that specific permit requirements or general permits may be readily developed with the assistance of interested industry groups.

The state general permit approach may allow sources to meet the federal the federal enforceability requirements more easily than other approaches. However, to use this approach, states must have a federally enforceable program that provides the state the authority, to issue such permits; to accomplish this, EPA must approve the program into the SIP or pursuant to section. 112(1) of the Clean Air Act.

Enforceability Principles

In 1989, in response to challenges from the Chemical Manufacturers Association and other industry groups, EPA reiterated its position that controls and limitations used to limit a source's Potential to emit must be federally enforceable. See 54 FR 27274 (June 28, 1989). Federally enforceable limits can be established by Clean Air Act programs such as NSPS, NESHAPs, MACTs, and SIP requirements. However, source-specific limits are generally set forth in permits. Generally, to be considered federally enforceable, the permitting program must be approved by EPA into the SIP and include provisions for public participation. "In addition, permit terms and conditions must be practicably enforceable to be considered federally enforceable. EPA provided specific guidance on federally enforceable permit conditions in a June 13, 1989 policy memo "Limiting Potential to Emit in New Source Permitting" from John Seitz and in the June 28, 1989 Federal Register notice (54 FR 27274) Additional guidance Can also be found in United states v. Louisiana Pacific, 682 F. Supp 1122 (D. Colo. 1987) 682 F. Supp 1141 (D. Colo.1988), which led to these guidance statements and a number of other memoranda covering practicable enforceability as it relates to rolling averages, short-term averages, and emission caps. See "Use of Long Term Rolling Averages to Limit Potential to Emit," from John. B. Rasnic to David Kee, February 24, 1992; "Limiting Potential to Emit;" from Mamie Miller to George Czerniak, August, 1992; "Policy Determination an Limiting Potential to Emit for Koch Refining Company's Clean Fuels Project", from John B. Rasnic to David Kee, March 13, 1992; and "3M Tape Manufacturing Division Plant, St. Paul, Minnesota" from. John B. Rasnic to David Kee, July 14, 1992.

In 1987, EPA laid out enforceability criteria that SIP rules must meet. see "Review of State Implementation Plans and Revisions for Enforceability and Legal Sufficiency," from Michael Alushin, Alan Eckert, and John Seitz, September 3, 1987 (1997 SIP memo). The criteria include clear statements as to applicability, specificity as to the standard that must be met, explicit statements of the compliance time frames (e.g. hourly, daily, monthly, or 12-month averages, etc.), that the time frame and method of compliance employed must be sufficient to protect the standard involved, record keeping requirements must be specified, and equivalency provisions must meet certain requirements.

Based on these precedents this guidance describes six enforceability criteria which a rule or a general permit must meet to make limits enforceable as a practical matter. In general, practical enforceability for a source-specific permit term means that the provision must specify (1) a technically accurate limitation and the portions of the source subject to the limitation; (2) the time period for the limitation (hourly, daily, monthly, annually); and (3) the method to determine compliance including appropriate monitoring, record keeping and reporting. For rules and general permits that apply to categories of sources, practical enforceability additionally requires that the provision (4) identify the categories of sources that are covered by the rule; (5) where coverage is optional, provide for notice to the permitting authority of the source's election to be covered by the rule; and (6) recognize the enforcement consequences relevant to the rule.

This guidance will address requirements (4) "and (5) first as they are concepts that are unique to rules and general permits.

A. Specific Applicability

Rules and general permits designed to limit potential to emit must be specific as to the emission units or sources covered by the rule or permit. In other words, the rule or permit must clearly identify the category(ies) of the sources that qualify for the rule's coverage. The rule must apply to categories of sources that are defined specifically or narrowly enough so that specific limits and compliance monitoring can be identified and achieved by all sources in the categories defined.

A rule or general permit that covers a homogeneous group of sources should allow standards to be set that limit potential to emit and provide the specific monitoring requirements. (Monitoring is more fully addressed in section D.) The State can allow for generic control efficiencies where technically sound and appropriate, depending on the extent of the application and ability to monitor compliance with resultant emission limits. Similarly, specific and narrow applicability may allow generic material usage or limits on hours of operation to be sufficient. For example, a rule or general permit that applies to fossil fuel fired boilers of a certain size may allow for limits on material usage, such as fuel-type and quantity. A rule or general permit that applies only to standby diesel generators or emergency generators may allow restrictions on hours of operation to limit potential to emit. The necessary compliance terms (i.e., monitoring or record keeping) associated with any of these limits, such as with hours of operation, can readily be specified in the rule or the general permit itself.

General permits under Title V are assumed to include this

enforceability principle because the Part 70 regulations set out specific criteria that states should consider in developing their general permit provisions (See 57 FR 32278). These factors include requirements that

“categories of sources covered by general permits should be generally homogenous in terms of operations, processes, and emissions. All sources in the category should have essentially similar operations or processes and emit pollutants with similar characteristics.”

Another factor stated is “sources should be subject to the same or substantially similar requirements governing operation, emissions, monitoring, reporting, or record keeping.” Examples of source categories appropriate for general permits include: degreasers, dry cleaners, small heating systems, sheet fed printers, and VOC storage tanks (see 57 FR 32278).

B. Reporting or Notice to Permitting Authority

The rule or general permit should provide specific reporting requirements as part of the compliance method. Although the compliance method for all sources must include record keeping requirements, the permitting authority may make a determination that reporting requirements for small sources would provide minimal additional compliance assurance. Where ongoing reporting requirements are determined not to be reasonable for a category of sources, the rule or general permit should still provide that the source notify the permitting authority of its coverage by the rule or the permit. In the limited situation where all the sources described in a source category are required to comply with the all of the provisions of a rule or general permit, notice is not needed. However, where there are no reporting requirement's and no opt-in provisions, the permitting authority must provide the public with the names and locations of sources subject to the rule or permit.

For Title V general permits, Part 70 requires sources to submit an application for a general permit which must be approved or disapproved by the permitting authority. For SIP or §112 rules and SIP or §112 general permits, in response to receiving the notice or application, the permitting authority may issue an individual permit, or alternatively, a letter or certification. The permitting authority may also determine initially whether it will issue a response for each individual application or notice, and may initially specify a reasonable time period after which a source that has submitted an application or notice will be deemed to be authorized, to operate under the general permit or SIP or §112 rule.

C. Specific Technically Accurate Limits

The rule or general permit issued pursuant to the SIP or §112 must specify technically accurate limits on the potential to emit. The rule or general permit must clearly specify the limits that apply, and include the specific associated compliance monitoring. (The compliance monitoring requirements are discussed further in the next section.) The standards or limits must be technically specific and accurate to limit potential to emit, identifying any allowed deviations.

The 1987 policy on SIP enforceability states that limitations "must be sufficiently specific so that a source is fairly on notice as to the standard it must meet." For example, "alternative equivalent technique" provisions should not be approved without clarification concerning the time period over which equivalency is measured as well as whether the equivalency applies on a per source or per line basis or is facility-wide.

Further, for potential to emit limitations, the standards set must be technically sufficient to provide assurance to EPA and the public that they actually represent a limitation on the potential to emit for the category of sources identified. Any presumption for control efficiency must be technically accurate and the rule must provide the specific parameters as enforceable limits to assure that the control efficiency will be met. For example, rules setting presumptive efficiencies for incineration controls applied to a specific or broad category must state the operating temperature limits or range, the air flow, or any other parameters that may affect the efficiency on which the presumptive efficiency is based. Similarly, material usage limits such as fuel limits, as stated above, require specifying the type of fuel and may require specifying other operating parameters.

A rule that allows sources to submit the specific parameters and associated limits to be monitored may not be enforceable because the rule itself does not set specific technical limits. The submission of these voluntarily accepted limits on parameters or monitoring requirements would need to be federally enforceable. Absent a source-specific permit and appropriate review and public participation of the limits, such a rule is not consistent with the EPA's enforceability principles.

D. Specific compliance Monitoring

The rule must specify the methods to determine compliance. Specifically, the rule must state the monitoring requirements, record keeping requirements, reporting requirements, and test methods as appropriate for each potential to emit limitation; and clarify which methods are used for making a direct determination of compliance with the potential to emit limitations.

"Monitoring" refers to many different types of data collection, including continuous emission or opacity monitoring, and measurements of various of Parameters of process or control devices (e.g. temperature, pressure drop, fuel usage) and record keeping of parameters that been limited, such as hours of operation, production levels, or raw material usage. Without a verifiable plantwide, verifiable emission limits must assigned to each unit or group of units subject to the subject to the rule or general permit. Where monitoring cannot be used to determine emissions directly, limits on appropriate operating parameters must be established for the units or source, and must the monitoring must be sufficient to yield data form the relevant time period that is representative of the source's compliance with the standard or limit. Continuous emissions monitoring, especially in the case of smaller sources, is not required.

E. Practicably Enforceable Averaging Times

The averaging time for all limits must be practicably enforceable. In other words, the averaging time period must readily allow for determination of compliance. EPA policy expresses a preference toward short term limits, generally daily but not to exceed one month. However, EPA policy allows for rolling limits not to exceed 12 months or 365 days where the permitting authority finds that the limit provides an assurance that compliance can be readily determined and verified. See June 13, 1989 "Guidance on Limiting Potential to Emit," February 24, 1992 memorandum "Use of Long Term Rolling Averages to Limit Potential to Emit" from John Rasnic to David Kee and March 13 1992 "Policy Determination on Limiting Potential to Emit for Koch Refining Company Clean Fuels Project" from John B. Rasnic to David Kee, stating that determinations to allow an annual rolling average versus a shorter term limit must be made on a case by case basis. Various, factors weigh in favor of allowing a long term rolling average, such as historically unpredictable emissions. Other factors may weigh in favor of shorter term limit, such as the inability to set interim limits during the first year. The permitting agency must make a determination as to what monitoring and averaging period is warranted for the particular source-category in light of how close the allowable emissions would be to the applicability threshold.

F. Clearly Recognized Enforcement

Violations of limits imposed by the rule or general permit that limit potential to emit constitute violations of major source requirements. In other words the source would be violating a "synthetic minor" requirement which may result in the source being treated as a major source under Titles I and V. The 1989 Federal Register Notice provides for separate enforcement

and permitting treatment depending on whether the source subsequently chooses to become a major or remain minor. Thus violations of the rule or general permit or violation of the specific conditions of the rule or general permit subjects the source to potential enforcement under the Clean Air Act and state law. The operating permit rule states that notwithstanding the shield provisions of part 70, the source subject to a general permit may be subject to enforcement action for operating without a part 70 permit if the source is later determined not to qualify or the conditions and terms of the general permit. Moreover, violation of any of the conditions of the rule or general permit may result in a different determination of the source's potential to emit and thus may subject the source to major requirements and to enforcement action for failure to comply with major source requirements from the initial determination.

G. Rule Requirements for State General Permit Programs

As discussed above, general permit programs must be submitted to EPA for approval under SIP authority or under section 112(1), or both, depending on its particular pollutant application. SIP and §112(1) approval and rulemaking procedures must be met, including public notice and comment. The specific application of the enforceability principles for establishing State SIP or §112(1) general permit programs require that the rule establishing the program set out these principles as rule requirements. In other words, these principles must be specific rule requirements to be met by each general permit.

The rule establishing the program must require that (1) general permits apply to a specific and narrow category of sources; (2) sources electing coverage under general permits where coverage is not mandatory, provide notice or reporting to the permitting authority; (3) general permits provide specific and technically accurate(verifiable) limits that restrict the potential to emit; (4) general permits contain specific compliance requirements; (5) Limits in general permits are established based on practicably enforceable averaging times; and (6) violations of the permit are considered violations of the state and federal requirements and result in the source being subject to major source requirements.

In addition, since the rule establishing the program does not provide the specific standards to be met by the source, each general permit, but not each application under each general permit, must be issued pursuant to public and EPA notice and comment. The 1989 Federal Register notice covering enforceability of operating permits requires that SIP operating permit programs issue permits pursuant to public and EPA notice and comment. Title V requires that permits, including general permits, be issued subject to EPA objection.

Finally, sources remain liable for compliance with major source requirements if the specific application of a general permit to the source does not limit the source's potential to emit below major source or major modification thresholds. (The limits provided in these mechanisms may actually limit the potential to emit of sources but may not limit the potential to emit for some sources to below the threshold necessary to avoid major source requirements. For example, a general permit for industrial boilers may in fact provide limits that are sufficient to bring a source with only two or three boilers to below the subject thresholds but a source with more than three boilers may have a limited PTE but not limited below the major source threshold.) Also, where the source is required to use another mechanism to limit potential to emit, i.e., a construction permit, the general permit may not be relied upon by the source or the State, to limit potential to emit.

Permits issued pursuant to the approved program, meeting the above requirements, are adequate to provide federally enforceable limits on potential to emit for New Source Review, title V, and §112 programs as long as they are approved pursuant to SIP (section 110) and section 112(1) authorities.

	)	
IN THE MATTER OF:	)	
	)	ORDER RESPONDING TO
HU HONUA BIOENERGY FACILITY	)	PETITIONER’S REQUEST THAT
PEPEEKEO, HAWAII	)	THE ADMINISTRATOR
	)	OBJECT TO ISSUANCE OF
PERMIT NO. 0724-01-C	)	STATE OPERATING PERMIT
	)	
ISSUED BY THE CLEAN AIR BRANCH	)	
FOR THE HAWAII DEPARTMENT OF HEALTH	)	PETITION No. IX-2011-1
	)	
	)	

I. INTRODUCTION

¹ In its Petition, the Petitioner references a “Revised Draft Permit,” a “Draft Permit,” and a “proposed title V permit.” *See e.g.*, Petition at 1, 3, 5. In referencing permits other than the Proposed Permit, the EPA’s understanding is that the Petition is addressing a version of the permit other than the final permit since the final permit was issued after the Petitioner submitted its Petition. In this Order, we will refer to the Proposed Permit when generally discussing the Petitioner’s request that the EPA object to Hu Honua’s title V permit, and we will note the specific version of the permit that we are referencing as needed.

1

The Petitioner requests that the Administrator object to the Proposed Permit because the Petitioner alleges that the Proposed Permit does not comply with the CAA and implementing regulations at 40 C.F.R. Part 70. The Petitioner raises thirteen Claims in its Petition as bases for the Administrator to object to the Proposed Permit. Each Claim is explained further in Section IV of this Order.

This Order contains the EPA's response to the Petition. Based on a review of the Petition, other relevant materials, including the Final Permit, permit record, and relevant statutory and regulatory authorities, and as explained below, I grant in part and deny in part the Petition requesting that the EPA object to the Hu Honua title V Proposed Permit.

II. STATUTORY AND REGULATORY FRAMEWORK

Section 502(d)(1) of the CAA, 42 U.S.C. § 7661a(d)(1), requires each state to develop and submit to the EPA an operating permit program to meet the requirements of title V of the CAA. The state of Hawaii originally submitted its title V program governing the issuance of operating permits on December 20, 1993. *See* 59 *Fed. Reg.* 37957 (July 26, 1994). The EPA granted interim approval of Hawaii's title V program on December 1, 1994, and granted full approval on November 30, 2001. 59 *Fed. Reg.* 61549; 66 *Fed. Reg.* 62945; 40 C.F.R. Part 70, Appendix A. The program is now codified in H.A.R., Title 11, Chapter 60.

All major stationary sources of air pollution and certain other sources are required to apply for title V operating permits that include emission limitations and other conditions as necessary to assure compliance with applicable requirements of the CAA, including the requirements of the applicable State Implementation Plan (SIP). CAA §§ 502(a) and 504(a), 42 U.S.C. §§ 7661a(a) and 7661c(a). The title V operating permit program does not generally impose new substantive air quality control requirements (referred to as "applicable requirements"), but does require permits to contain monitoring, recordkeeping, reporting and other requirements to assure sources' compliance with applicable requirements. 57 *Fed. Reg.* 32250, 32251 (July 21, 1992). One purpose of the title V program is to "enable the source, States, EPA, and the public to understand better the requirements to which the source is subject, and whether the source is meeting those requirements." *Id.* Thus, the title V operating permit program is a vehicle for ensuring that air quality control requirements are appropriately applied to facility emission units and for assuring compliance with such requirements.

Applicable requirements for a new major stationary source or for a major modification to a major stationary source include the requirement to obtain a preconstruction permit that complies with applicable new source review (NSR) requirements. For major sources, the NSR program is comprised of two core types of preconstruction permit programs. Part C of the CAA establishes the Prevention of Significant Deterioration (PSD) program, which applies to areas of the country, such as Pepeekeo, Hawaii, that are designated as attainment or unclassifiable for the national ambient air quality-standards (NAAQS). CAA §§ 160-169, 42 U.S.C. §§ 7470-7479. Part D of the Act establishes the nonattainment NSR program, which applies to areas that are designated as nonattainment with the NAAQS. At issue in this Order is the PSD part of the NSR program, which requires a major stationary source in an attainment area to obtain a PSD permit before beginning construction of a new facility or undertaking certain modifications. CAA § 165(a)(1),

42 U.S.C. § 7475(a)(1). The analysis under the PSD program must address two primary and fundamental elements (among other requirements) before the permitting authority may issue a permit: (1) an evaluation of the impact of the proposed new or modified major stationary source on ambient air quality in the area, and (2) an analysis ensuring that the proposed facility is subject to Best Available Control Technology (BACT) for each pollutant subject to regulation under the Act. CAA §§ 165(a)(3), (4), 42 U.S.C. §§ 7475(a)(3), (4); 40 C.F.R. § 52.21(j), (k).

The EPA has two largely identical sets of regulations implementing the PSD program: one set, found at 40 C.F.R. § 51.166, contains the requirements that state PSD programs must meet to be approved as part of a SIP. The other set of regulations, found at 40 C.F.R. § 52.21, contains the EPA's federal PSD program, which applies in areas without a SIP-approved PSD program. Because Hawaii's SIP lacks an approved PSD program, the applicable requirements governing the issuance of PSD permits in Hawaii are the federal PSD regulations at 40 C.F.R. § 52.21. *See* 40 C.F.R. § 52.632. Accordingly, the applicable requirements of the Act for new major sources or major modifications in Hawaii include the requirement to comply with PSD requirements under 40 C.F.R. § 52.21. *See, e.g.,* 40 C.F.R. § 70.2.³ Although the EPA Region 9 delegated administration of the PSD program to Hawaii, 48 *Fed. Reg.* 51682 (Nov. 10, 1983); 54 *Fed. Reg.* 23978 (June 5, 1989), PSD permits issued by HDOH are federal permits.⁴

State and local permitting authorities issue title V permits pursuant to the EPA-approved title V programs. Under CAA section 505(a), 42 U.S.C. § 7661d(a), and the relevant implementing regulations at 40 C.F.R. § 70.8(a), states are required to submit each proposed title V operating permit to the EPA for review. Upon receipt of a proposed permit, the EPA has 45 days to object to final issuance of the proposed permit if the EPA determines that the proposed permit is not in compliance with applicable requirements or the requirements of the Act. 42 U.S.C. § 7661d(b)(1); *see also* 40 C.F.R. § 70.8(c) (providing that the EPA will object if the EPA determines that a proposed permit is not in compliance with applicable requirements or requirements under 40 C.F.R. Part 70).

If the EPA does not object to a permit on its own initiative, section 505(b)(2) of the Act and 40 C.F.R. § 70.8(d) provide that any person may petition the Administrator, within 60 days of the expiration of the EPA's 45-day review period, to object to the permit. The petition shall be based only on objections to the permit that were raised with reasonable specificity during the public comment period provided by the permitting agency (unless the petitioner demonstrates in the petition to the Administrator that it was impracticable to raise such objections within such period or unless the grounds for such objection arose after such period). 42 U.S.C. § 7661d(b)(2); 40 C.F.R. § 70.8(d). Section 505(b)(2) indicates the Administrator "shall grant or deny such petition

³Under 40 C.F.R. § 70.1(b), "[a]ll sources subject to [the title V regulations] shall have a permit to operate that assures compliance by the source with all applicable requirements." "Applicable requirements" are defined in 40 C.F.R. § 70.2 to include "(1) [a]ny standard or other requirement provided for in the applicable implementation plan approved or promulgated by EPA through rulemaking under title I of the [Clean Air] Act that implements the relevant requirements of the Act, including any revisions to that plan promulgated in [40 C.F.R.] part 52; (2) [a]ny term or condition of any preconstruction permits issued pursuant to regulations approved or promulgated through rulemaking under title I, including parts C or D, of the Act."

⁴Appeals of those permits are accordingly governed by 40 C.F.R. § 124.19 and are heard exclusively by the Environmental Appeals Board. Furthermore, where a federal PSD permit is appealed to the Board, the permit is not effective and construction may not begin until the Board has disposed of the appeal. 40 C.F.R. § 124.15.

within 60 days after the petition is filed.” This provision does not direct how the Administrator must address the individual issues in each petition, thus providing the EPA with discretion in determining the best approach for addressing individual issues in each petition. The EPA may consider the complexity of the issues, the inter-relatedness of the issues, agency resources, public participation opportunities, source-specific considerations and other relevant factors in deciding the most appropriate approach for addressing the issues in each petition. *See also In the Consolidated Environmental Management, Inc. – Nucor Steel Louisiana*, Petition Nos. VI-2010-02 and VI-2011-03 at 11 (March 23, 2012) (*Nucor I Order*) (“Section 505(b)(2) does not specify whether the EPA must respond initially to all of the issues raised in a petition....the Act does not explicitly require that, nor does it foreclose the EPA from granting a petition based on one or more threshold issues where those issues potentially affect the analysis or disposition of other issues in the petition.”).

In response to such a petition, the Act requires the Administrator to issue an objection if a petitioner demonstrates that a permit is not in compliance with the requirements of the Act. 42 U.S.C. § 7661d(b)(2); 40 C.F.R. § 70.8(c)(1); *see also New York Public Interest Research Group, Inc. (NYPIRG) v. Whitman*, 321 F.3d 316, 333 n.11 (2d Cir. 2003). Under section 505(b)(2) of the Act, the burden is on the petitioner to make the required demonstration to the EPA. *MacClarence v. EPA*, 596 F.3d 1123, 1130-33 (9th Cir. 2010); *Sierra Club v. Johnson*, 541 F.3d 1257, 1266-1267 (11th Cir. 2008); *Citizens Against Ruining the Environment v. EPA*, 535 F.3d 670, 677-78 (7th Cir. 2008); *Sierra Club v. EPA*, 557 F.3d 401, 406 (6th Cir. 2009) (discussing the burden of proof in title V petitions); *Whitman*, 321 F.3d at 333 n.11; *In the Consolidated Environmental Management, Inc. – Nucor Steel Louisiana*, Petition Nos. VI-2011-06 and VI 2012-07 at 4-8 (June 19, 2013) (*Nucor II Order*) (explaining the petitioner’s demonstration burden). In evaluating a petitioner’s claims, the EPA considers, as appropriate, the adequacy of the permitting authority’s rationale in the permitting record, including the response to comments. If, in responding to a petition, the EPA objects to a permit that has already been issued, the EPA or the permitting authority will modify, terminate, or revoke and reissue the permit consistent with the procedures set forth in 40 C.F.R. §§ 70.7(g)(4) and (5)(i) - (ii), and 40 C.F.R. § 70.8(d).

III. BACKGROUND

A. Facility

A more detailed description of Hu Honua is included in HDOH’s Initial Covered Source Permit Review Summary, dated August 2011 (Final Permit Review Summary).⁵ In summary, Hu Honua is located in Pepeekeo, Hawaii, on a 2,557-acre site on the Big Island of Hawaii. “The Hu Honua Bioenergy facility will generate electricity for Hawaii Electric Light Company, Inc. (HELCO) and consists of a 407 MMBtu/hour boiler⁶, a steam turbine generator, and an 836 kilowatt (kW) emergency generator.” *Id.* at 2. Hu Honua will have a net power output of 21.5 megawatts (MW)

⁵ Part 70 requires permitting authorities to prepare a “statement of basis” for each title V permit. 40 C.F.R. § 70.7(a)(5). A “permit review summary” prepared and issued by HDOH in conjunction with a covered source permit is the functional equivalent of a statement of basis.

⁶ “MMBtu” means one million British thermal units.

to the grid. *Id.* at 1. “Hu Honua is proposing to burn biomass in the form of wood in the boiler and burn 100% biodiesel during startups and as a supplemental fuel during low-load operation of the boiler. An 836 kW electrical generator will be operated only during emergencies and will only combust 100% biodiesel.” *Id.* at 1.

B. Permit History

On August 28, 2009, Hu Honua submitted an application for a new covered source permit (Permit Application)⁷ to HDOH to re-start operations at the facility, which had previously ceased operation on December 31, 2004. Final Permit Review Summary at 2. On August 13, 2010, HDOH released a Draft Permit for public comment. On December 27, 2010, Hu Honua submitted a revised application (Revised Permit Application) to HDOH.⁸ On February 17, 2011, HDOH released a Revised Draft Permit for a second round of public comment. After the end of the second public comment period on March 21, 2011, HDOH made significant changes to the Revised Draft Permit before submitting the Proposed Permit to the EPA on May 19, 2011. The EPA’s 45-day review period on the Proposed Permit ended on July 5, 2011. During its 45-day review period, the EPA did not object to the Proposed Permit, but did send a letter to HDOH dated June 30, 2011, with several comments on the Proposed Permit (EPA Letter).⁹ The Petitioner timely filed its Petition on August 26, 2011, within the 60-day window following the EPA’s 45-day review period, which ended on September 6, 2011. *See* CAA § 505(b)(2), 42 U.S.C. § 7661d(b)(2). On August 31, 2011, HDOH issued the Final Permit and the Final Permit Review Summary, which included Addendum A (HDOH’s summary of and its responses to public comments received during the second public comment period, or “2011 RTC”) and Addendum B (HDOH’s response to the EPA Letter, or “HDOH Response to EPA Letter”). It is the EPA’s understanding that on September 1, 2011, HDOH announced on its website and Hu Honua announced on its website that the Final Permit had been issued.

C. Timeliness of Petition

Pursuant to the CAA, if the EPA does not object during its 45-day review period, any person may petition the Administrator within 60 days after the expiration of the 45-day review period to take such action. CAA § 505(b)(2); 42 U.S.C. § 7661d(b)(2). Thus, any petition seeking the EPA’s objection to the Proposed Permit was due on or before September 6, 2011. The Petition, dated August 26, 2011, was received by the EPA on August 30, 2011. Thus, the EPA finds the Petitioner timely filed its Petition.

⁷ HDOH refers to its title V program as the “covered source” program. That term is defined in HDOH’s regulations (HAR §11-60.1-1) and delineates the universe of stationary sources subject to title V permitting in Hawaii. The program is an integrated permitting program in which a source’s title V and preconstruction requirements are addressed in a single permitting process. HDOH implements provisions of both its own regulations and federal PSD regulations (40 C.F.R. § 52.21) in issuing permits to its covered sources. *See* Hawaii Department of Health – Clean Air Act Title V Operating Permit Program Evaluation, Final Report, conducted by the U.S. Environmental Protection Agency, Region 9 (September 28, 2010).

⁸ HDOH’s permit record references several other submittals of additional information between August 2009 and February 2011. *See, e.g.*, Final Permit Review Summary.

⁹ We discuss specific elements of the EPA Letter as appropriate in the EPA Responses in Section IV of this document.

IV. EPA DETERMINATIONS ON CLAIMS RAISED BY THE PETITIONER

A. CLAIM 1: The Administrator Must Object Based on Issues Raised by the EPA Itself

Petitioner's Claim. The Petitioner claims that the CAA “precludes EPA from deferring to state authority regarding the adequacy of a Title V permit.” Petition at 5, *citing* CAA § 505(b)(2),¹⁰ and *Whitman*, 321 F.3d at 333. The Petitioner points to the EPA Letter as evidence of such “impermissible deferral” since the EPA Letter “falls short of ‘objecting’ to Hu Honua’s Draft Permit, rather deferring to [HDOH] to add final permit conditions...to ensure, on an on-going basis, that Hu Honua is not a major source of CO and HAPs....” Petition at 5. The Petitioner asserts that H.A.R. § 11-60-1-90(1) “specifically requires permits contain ‘emission limitations and standards, including operational requirements and limitations to assure compliance with all applicable requirements at time of permit issuance.” *Id.* (emphasis in original). The Petitioner asserts that the “Revised Draft Permit that the EPA and the public reviewed does not contain operational requirements and limitations to assure compliance with all applicable requirements, and [the EPA Letter] acknowledge[s] this fact in identifying additional conditions that [HDOH] must add to the final permit to ensure on an on-going basis that Hu Honua is not a major source of CO and HAPs.” *Id.* at 5-6 (emphasis in original). The Petitioner therefore concludes, “[w]here, as here, the draft permit is inadequate, EPA has a duty to object (CAA § 505(b)(2); *Whitman*, 321 F.3d at 333).” *Id.* at 6.

EPA's Response. For the reasons provided below, I deny the Petitioner's request for an objection to the Proposed Permit on this claim.

The EPA finds that the Petitioner's claim is moot because, as explained later in this Order with respect to Claims 2, 4 and 8, the EPA is granting the Petitioner's claims regarding ensuring compliance with applicable criteria pollutant and hazardous air pollutant (HAP) regulations. The Petitioner's Claim 1 contends that the EPA should have objected to the Proposed Permit based on these specific issues (i.e., ensuring compliance with applicable PSD and MACT requirements). In this Order, the EPA is granting the Petitioner's request that it object to issues regarding PSD and MACT requirements as raised in Claims 2, 4 and 8 of the Petition. Therefore, no further response on the issues raised in Claims 2, 4 and 8 is necessary. And, I find that Claim 1 of the Petition is moot.

I also deny the Petitioner's request for an objection to the Proposed Permit on this claim on the alternative basis that the Petitioner may not raise this claim in a title V petition. This is not a claim that the title V permit is out of compliance with the requirements of the Act; rather, the Petitioner is making a separate claim that the EPA had a duty to object to the Proposed Permit as a result of the EPA Letter. That is not a proper claim to raise in a petition submitted under CAA § 505(b)(2). Under § 505(b)(2), a petitioner must demonstrate that “the *permit* is not in compliance with the requirements” of the CAA before the EPA will object to the permit. *See* 42 U.S.C. § 7661d(b)(2) (emphasis added). Under § 505(b)(2) of the Act, the burden is on the

¹⁰ Petitioner cites to CAA § 505(b)(2) as support for its assertions in this claim. We note, however, that CAA § 505(b)(2) contains the EPA's authority to object to a permit in response to a petition filed with the Administrator, while § 505(b)(1) contains the EPA's authority to object to a permit during the EPA's 45-day review period.

petitioner to make the required demonstration to the EPA. *MacClarence*, 596 F.3d at 1130-33; *Sierra Club v. Johnson*, 541 F.3d at 1266-1267; *Citizens Against Ruining the Environment*, 535 F.3d at 677-78; *Sierra Club v. EPA*, 557 F.3d at 406; *Whitman*, 321 F.3d at 333 n.11. Here, the Petitioner's claim is not based on a substantive flaw with the Proposed Permit, or a procedural flaw with how the permitting authority processed the permit, as required by CAA § 505(b)(2). *See also* 40 C.F.R. § 70.8(c) and (d). Instead, it appears this claim is based on contentions regarding the EPA's obligations to act under a separate provision of the CAA. The title V petition process is not the appropriate forum to challenge such actions or inactions.

I also deny the Petitioner's request for an objection to the Proposed Permit on this claim on the alternative basis that the Petitioner has not demonstrated that the EPA had an obligation to object to the Proposed Permit. Even if this is a proper claim to be raised in a title V petition, the Petitioner does not demonstrate how the EPA Letter qualifies as the requisite determination that would trigger the EPA's obligation to object to the Proposed Permit. Section 505(b)(1) and 40 C.F.R. § 70.8(c)(1) govern when the EPA must object to a permit as a result of its 45-day review. The Petitioner does not demonstrate how the EPA Letter constitutes the Administrator's determination under these provisions. Instead, the Petitioner cites H.A.R. §11-60.1-90(1) as requiring the EPA to object to the Proposed Permit because the Petitioner seemingly views the EPA Letter as evidence that the Proposed Permit does not contain "all applicable requirements at the time of permit issuance." Petition at 5-6. The Petitioner does not explain how this provision, which apparently governs the contents of HDOH's final covered source permits, applies to an EPA decision-making process on the Proposed Permit.

Moreover, we find that the Petitioner's reliance on *NYPIRG v. Whitman* is inapposite because the court in that case considered a different statutory provision in a different context from this Petition, i.e., whether CAA § 505(b)(2) requires the EPA to object to a permit in response to a petition from the public. *Whitman*, 321 F.3d at 332-334. Here, the EPA was commenting on a Proposed Permit during its 45-day review period under CAA § 505(b)(1), and the Petitioner has not demonstrated why it was inappropriate for the EPA to issue a comment letter instead of objecting to the Proposed Permit.

For the foregoing reasons, I deny the Petition as to this claim.

B. CLAIM 2: The Permit Fails to Ensure Compliance with Criteria Air Pollutant Emission Limits

Petitioner's Claim. The Petitioner contends generally that the Proposed Permit "fails to ensure compliance with criteria air pollutant emission limits," that the major source threshold of 250 tons per year (tpy) would have been exceeded if the CO emissions estimate had been based on a more accurate CO emissions factor, and that sources over this threshold are subject to PSD requirements. Petition at 6.

The Petitioner makes four sub-arguments related to this claim as to whether Hu Honua is a major source. *See generally* Petition at 6-10. First, the Petitioner contends that the "draft permit underestimates CO emissions." Petition at 6 (listed as Claim 2A in the Petition). Citing the EPA Letter, the Petitioner asserts, among other things, that it has not been sufficiently established that

Hu Honua's boiler will not be a major source of CO. *Id.*; *see also* EPA Letter at 3. The Petitioner contends that Hu Honua's CO potential to emit (PTE) as calculated in the Revised Permit Application underestimates CO emissions because it used an emission factor for biodiesel fuel (which is used to start up the boiler) that is based on limited and low-quality data and on steady-state operations, thus underestimating boiler CO emissions during startup. *Id.* at 7, citing the Revised Permit Application at 11. In addition, the Petitioner claims that Hu Honua's calculated CO emissions "omit [CO] emissions during shutdown or upset conditions." *Id.* at 8. The Petitioner points out that the total annual estimated CO emissions are 246.4 tpy, which is just 3.6 tpy below the 250 tpy major source threshold. *Id.* at 6, 8. The Petitioner further states that "[a]ctual emissions of CO are likely to exceed the PSD threshold when accounting for startup, shutdown, and upset conditions." *Id.* at 8.

Second, the Petitioner claims that "the permit lacks enforceable conditions limiting biodiesel usage." *Id.* at 9 (listed as Claim 2C in the Petition). The Petitioner states that "[a]bsent adequate fuel usage limits and monitoring provisions, the Revised Draft Permit fails to ensure that [Hu Honua] is a synthetic minor source." *Id.*

Third, the Petitioner contends that Hu Honua does not qualify as a synthetic minor source because "the Revised Draft Permit lacks federally enforceable conditions to ensure compliance with emission limitations for CO and NO_x." *Id.* at 9¹¹ (listed as Claim 2D in the Petition.) The Petitioner claims that "after the fact testing" and "imposition of subsequent controls" is "inappropriate" because "the facility's emissions will not be known, and permit limitations cannot be enforced until after initial startup and after a violation occurs." *Id.* at 9-10. The Petitioner additionally asserts that "[s]ince the State has failed to properly quantify projected emissions and secure adequate initial and on-going emissions, and to impose practically and federally enforceable emission limitations, EPA cannot adequately enforce these limitations and thus must object to this permit." *Id.* at 10.

Fourth, the Petitioner claims that "the draft permit fails to include emissions limitations and monitoring for [sulfur dioxide (SO₂)]." *Id.* at 8-9 (listed as Claim 2B in the Petition). Pointing to requirements that title V permits incorporate emission limits and standards and contain sufficient periodic monitoring, the Petition claims that "[t]he Draft Permit contains neither emission limits nor monitoring provisions" for SO₂ emissions from biofuels combustion from the boiler. *Id.* at 8.¹² The Petitioner further explains that Hu Honua calculated annual SO₂ emissions of 39.2 tpy

¹¹ Citing the EPA Letter and citing EPA guidance on potential to emit found in three memoranda "dated January 25, 1995 and restated August 25, 1996 and July 10, 1988." Petition at 9. While the Petition does not provide titles or authors for these memoranda, the intended references appear to include: "Options for Limiting the Potential to Emit (PTE) of a Stationary Source Under Section 112 and Title V of the Clean Air Act (Act)," John S. Seitz, Director, Office of Air Quality Planning and Standards (January 25, 1995); "Extension of January 25, 1995 Potential to Emit Transition Policy," John S. Seitz, Director, Office of Air Quality Planning and Standards, and Robert I. Van Heuvelen, Director, Office of Regulatory Enforcement (August 27, 1996); "Second Extension of January 25, 1995 Potential to Emit Transition Policy and Clarification of Interim Policy," John S. Seitz, Director, Office of Air Quality Planning and Standards, and Eric V. Schaeffer, Director, Office of Regulatory Enforcement (July 10, 1998).

¹² Citing H.A.R. §§ 11-60.1-90(1) and 11-60.1-90(7)(B), 40 C.F.R. §§ 70.6(a)(3) and 71.6(a)(3), and the EPA's Periodic Monitoring Guidance (pp. 3-4). While the Petition does not provide titles or authors for this memorandum, the intended reference appears to be: Eric V. Schaeffer, Director, Office of Regulatory Enforcement, and John S. Seitz, Director, Office of Air Quality Planning and Standards, "Periodic Monitoring Guidance for Title V Operating Permits Programs" (September 15, 1998).

based on an emission rate of 0.028 lb/MMBtu and a maximum heat input of 2,800,000 MMBtu/year, and claims that “the Draft Permit contains no provisions to monitor SO₂ and, thus, lacks a trigger for the adjustment of sorbent injection if the SO₂ emission rate of 0.028 lb/MMBtu were exceeded.” *Id.* The Petitioner asserts that without emission limitations and adequate compliance monitoring, the facility’s SO₂ emissions “may exceed the major source significance threshold for SO₂ emissions of 40 tons [per] year set in H.A.R. § 11-60.1-1, which would require a [Best Available Control Technology (BACT)] analysis for SO₂.” *Id.* at 8-9.

EPA’s Response. I grant the Petitioner’s request for an objection to the Proposed Permit on this claim. I grant specifically in regard to the Petitioner’s contention that HDOH has failed to ensure that the synthetic minor limits for CO and NO_x, which were intended to restrict CO and NO_x PTE below the major source threshold of 250 tpy, are enforceable as a practical matter.¹³ However, as explained more fully below, in light of this grant, I am not resolving other issues raised by the Petitioner in Claim 2.

HDOH implements the PSD program under a delegation agreement with the EPA. Under the governing provisions in 40 C.F.R. § 52.21(b)(4), the calculation of a facility’s PTE for purposes of determining whether the facility triggers PSD requirements for a particular pollutant includes consideration of “[a] physical or operational limitation on the capacity of the source to emit [the] pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed,...if the limitation or the effect it would have on emissions is federally enforceable.”¹⁴ In other words, “if a permit applicant agrees to an enforceable limit that is sufficient to restrict PTE, the facility’s PTE is calculated based on that limit.” *In the Matter Of Cash Creek Generation, LLC*, Order on Petition No. IV-2010-4 at 15 (June 22, 2012) (*Cash Creek Order*).

In this case, Hu Honua agreed to accept source-wide CO and NO_x emission limits of less than 250 tpy, see Final Permit, Section C.6, which along with other permit requirements, were intended to ensure that CO and NO_x PTE remained below the major source threshold and thus avoid applicability of PSD requirements.¹⁵ Therefore, an EPA objection is warranted if the Final

¹³ The EPA uses the term “synthetic minor” in this Order to reflect the fact that Hu Honua accepted operational and emissions limits in order to restrict its PTE for purposes of avoiding applicability of major source PSD and MACT requirements, as explained in more detail below. The EPA’s use of this term in this sense is not intended to affect HDOH’s conclusion that the source was not a “synthetic minor source” but rather a major source as defined in H.A.R. §§ 11-60.1-1 because the PTE for CO and NO_x exceeded 100 tons per year. Final Permit Review Summary at 7.

¹⁴ Although the federal definition of PTE for PSD includes the term “federally enforceable,” following two court decisions, *National Mining Association v. EPA*, 59 F.3d 1351 (D.C. Cir.1995), and *Chemical Manufacturers Ass’n v. EPA*, No. 89-1514, 70 F.3d 637 and 1995 U.S. App. LEXIS 39215 (D.C. Cir. 1995), the EPA clarified that the term “federally enforceable” as used in relation to the definition of PTE for the federal PSD program in 40 C.F.R. § 52.21(b)(4) should be read to mean “federally enforceable or legally and practicably enforceable by a state or local air pollution control agency.” John Seitz, Director, Office of Air Quality Planning and Standards, and Robert Van Heuvelen, Director, Office of Regulatory Enforcement, “Release of Interim Policy on Federal Enforceability of Limitations on Potential to Emit” (Jan. 22, 1996), at 3. The term “federal enforceability” has also been interpreted to require practical enforceability. See, e.g., *In re Shell Offshore, Inc., Kulluk Drilling Unit and Frontier Discoverer Drilling Unit*, 13 E.A.D. 357 at 394, n.54 (EAB 2007).

¹⁵ See Final Permit, Attachment II, Section C.8 (“This source is exempt from a [PSD] review ... due to the emission limits in Attachment II, Special Conditions Nos. C.6”). Also, in response to a comment that if Hu Honua were

Permit does not impose enforceable limits on the source's CO and NO_x emissions such that source-wide emissions remain below 250 tpy, the applicable threshold for determining whether Hu Honua is a major stationary source for PSD purposes. 42 U.S.C. § 7479(1) (defining "major emitting facility"); 40 C.F.R. 52.21(b)(1)(i)(b) (defining "major stationary source"). To effectively limit Hu Honua's CO and NO_x PTE to less than 250 tpy, the CO and NO_x emissions limits included in Section C.6 of the Final Permit must apply at all times to all actual emissions, and all actual CO and NO_x emissions must be considered in determining compliance with the respective limits. *See Cash Creek Order* at 15 (finding that a VOC limit was not enforceable as a practical matter where the state agency "failed to provide a reasoned explanation for how the compliance demonstration method associated with the VOC emissions limit, which is used to determine compliance with the source-wide VOC limit, accounts for all actual VOC emissions"). The Final Permit for Hu Honua states that "CO and NO_x emissions from the facility, including during boiler startups and shutdowns, shall not equal or exceed 250 tons per year, on any rolling twelve-month (12-month) period." Final Permit, Section C.6. However, the Final Permit does not specify how the facility's CO and NO_x emissions shall be determined or measured for assessing compliance with these CO and NO_x emission limits in Section C.6, and it is unclear whether all actual CO and NO_x emissions must be considered in determining compliance with these limits, including emissions during other non-startup/shutdown operating conditions referenced in the permit, such as periods of "malfunction" or "upset conditions." *See, e.g.,* Final Permit, Sections F.3, F.8. and F.9.

The EPA notes that the Final Permit does contain a condition in Section E.14 providing that the "permittee shall calculate and record the CO and NO_x emissions from the facility, including during boiler startups and shutdowns, on a monthly and rolling twelve-month (12-month) basis." Final Permit, Section E.14. The EPA additionally notes that the Final Permit requires submission of semi-annual monitoring report forms that include "CO and NO_x emissions from the facility on a monthly and rolling twelve-month (12-month) basis." Final Permit, Section F.6.a.vi. The Final Permit does not specify, however, how the CO and NO_x emissions shall be calculated for purposes of these two conditions or what information such calculations would be based upon.¹⁶ Nor does the Final Permit specifically connect the reports in Section F.6.a.vi. to determining compliance with the CO and NO_x emission limits in Section C.6. In addition, these conditions do not clearly provide that all actual facility CO and NO_x emissions should be considered in determining compliance with the CO and NO_x emission limits in Section C.6 and do not clearly state that emissions during other non-startup/shutdown operating conditions referenced in the permit (such as malfunction or upset) must be included in determining compliance with those

permitted as a synthetic minor source instead of as a PSD source the CO and NO_x PTE limits would need to be made practicably enforceable, HDOH explained: "The permit has been revised with PSD emission caps for CO and NO_x in Attachment II, Special Condition No.C.6., monitoring and recordkeeping requirements in Attachment II, Special Condition No.E.14, and additional semiannual reporting requirements to include the data in Attachment II, Special Condition No. F.6.a.vi." 2011 RTC, Addendum B. at 3. In the Final Permit Review Summary, HDOH explained: "To ensure that PSD is not triggered, the permit limits the annual heat input to 2,800,000 MMBtu/yr. In addition to the annual heat input limit of 2,800,000 MMBtu/yr for the boiler, the permit also requires that the CO and NO_x emissions from the facility, including during boiler startups and shutdowns, shall not exceed 250 tons per year, on any rolling twelve-month (12-month) period." Final Permit Review Summary at 6. *See also id.* at 4 (determining that PSD is a "non-applicable requirement").

¹⁶ The EPA notes that the EPA Letter included a comment on adding conditions requiring the use of CEMS data to verify compliance with the annual CO and NO_x emissions limitations. *See* EPA Letter at 4.

limits. In addition, Section F.6.a.vi does not clearly state that emissions during startup and shutdown (as well as emissions during other non-startup/shutdown operating conditions) must be included in the semi-annual reports or in determining compliance with the CO and NO_x emission limits in Section C.6.

In addition, the EPA notes that the Final Permit does not appear to contain any monitoring or recordkeeping requirements that would allow for calculation or consideration of any CO and NO_x emissions associated with the operation of the emergency generator at the facility in determining compliance with the CO and NO_x emission limits in Section C.6. Because, as currently provided in the Final Permit, the overall emission limits for CO and NO_x in Section C.6. state that the source “shall not equal or exceed” 250 tpy, those facility-wide limits would be ineffective at ensuring that the source remains below the 250 tpy major source PSD threshold if any emission unit at the facility that emitted CO or NO_x was not covered by those limits and/or not subject to sufficient monitoring, recordkeeping, and reporting to ensure that those limits were enforceable as a practical matter.

Moreover, as defined for PSD purposes, PTE encompasses “the maximum capacity of a stationary source to emit a pollutant under its physical and operational design.” 40 C.F.R. § 52.21(b)(4). Thus, emissions from all emission units that are part of the source’s physical and operational design must be included in calculating PTE for purposes of determining PSD applicability, including emission units that have been designated as “insignificant activities.”¹⁷ Similarly, the EPA has previously explained that when a source accepts a source-wide PTE limit for a pollutant, all actual emissions of that pollutant from the source must be considered in determining compliance with the limit.¹⁸ Although HDOH treated the emergency generator as an “insignificant activity” under H.A.R. § 11-60.1-82(f)(5),¹⁹ that provision makes clear that a generator cannot qualify as an insignificant activity if it would trigger PSD review based on its PTE. H.A.R. § 11-60.1-82(f)(5)(B). Accordingly, the emergency generator’s actual CO and NO_x emissions must be considered in determining the permit’s compliance requirements.

The EPA acknowledges that Hu Honua accepted a fuel consumption limit on the boiler of 2,800,000 MMBtu/yr in an effort “to ensure that plant utilization does not exceed the stated emission levels in the permit application and PSD thresholds are not exceeded.” *See* 2011 RTC, Addendum A at 11; *see also* Final Permit, Section D.1.a.iii. However, CO and NO_x emissions at the facility are a function of both fuel consumption (MMBtu/yr) and the CO and NO_x emissions rate (lb/MMBtu). The permit contains two short term emission limits (lb/MMBtu) for CO and one for NO_x from the boiler (see Final Permit, Section C.1), and HDOH explained that

¹⁷ This is consistent with the EPA’s guidance explaining how to calculate PTE for emergency generators, as the EPA would not have needed to provide this guidance if the EPA believed that emissions from emergency generators did not need to be considered in PTE calculations. *See* John Seitz, Director, Office of Air Quality Planning and Standards, “Calculating Potential to Emit (PTE) for Emergency Generators” (Sept. 6, 1995) (available at <http://www.epa.gov/region07/air/title5/t5memos/emgen.pdf>). This is also consistent with 40 C.F.R. § 70.5(c), which provides that a title V application “may not omit information needed to determine the applicability of, or to impose, any applicable requirement.”

¹⁸ *See, e.g., Cash Creek Order* at 15; *In the Matter of Kentucky Syngas, LLC*, Order on Petition No. IV-2010-9 at 29-30 (*Kentucky Syngas Order*) (June 22, 2012).

¹⁹ *See* Final Permit Review Summary at 3.

multiplying these emission limits by the 2,800,000 MMBtu/yr limit shows that the facility will not exceed 250 tpy for CO and NO_x. See Final Permit Review Summary at 6. However, the Final Permit explicitly provides that the Section C.1 emission limits for NO_x and one of those limits for CO do not apply during boiler startup and shutdown.²⁰ See Final Permit, Section C.2. Thus, HDOH has not provided a basis in the record to conclude that the 2,800,000 MMBtu per year heat input limit will ensure that CO and NO_x emissions from the facility will not exceed 250 tpy. Because the relevant short-term CO and NO_x emission limits do not apply at all times, they do not ensure that the emission rate from fuel consumption at the boiler will not exceed the lb/MMBtu levels that HDOH used to explain why the 2,800,000 MMBtu/yr limitation would ensure that CO and NO_x emissions will not exceed 250 tpy.

For the reasons described above, I am granting the Petition regarding the Petitioner's claim that the synthetic minor limits for CO and NO_x limits are not enforceable as a practical matter.

HDOH can respond to this objection by revising the Final Permit to ensure that the source-wide CO and NO_x emission limits of less than 250 tpy in Section C.6 are enforceable. In doing so, HDOH should clarify in the Final Permit that those limits apply at all times to all actual facility CO and NO_x emissions and that all actual CO and NO_x emissions must be considered in determining compliance with those limits, and make any changes or clarifications necessary to the measures for determining compliance with those limits, including monitoring, recordkeeping, and reporting provisions, to ensure that those limits are enforceable as a practical matter. Under this approach, HDOH would also need to revise the Final Permit to clarify that CO and NO_x emissions from the emergency generator must be included in determining whether the facility has exceeded the source-wide CO and NO_x emission limits of less than 250 tons per year and add any necessary monitoring, recordkeeping, or reporting for the CO and NO_x emissions from the emergency generator. Alternatively, HDOH may utilize another approach, consistent with the applicable PSD program, to ensure that PSD is not triggered for CO or NO_x (including consideration of the emergency generator emissions) or it could respond to this objection by requiring Hu Honua to comply with the PSD requirements for CO and NO_x. In addition, the EPA notes that although the Final Permit contains various monitoring, recordkeeping and reporting requirements in Sections E and F related to steam load, wood fuel use, wood heat input, wood sampling and analysis, biodiesel fuel meters, as well as other related requirements, the Final Permit is unclear regarding how annual fuel consumption will be determined for purposes of determining compliance with the 2,800,000 MMBtu/yr limit. In addressing this objection, assuming that HDOH retains this limit, it should also clarify in the permit specifically how compliance with this 2,800,000 MMBtu/yr limit will be calculated, including specifying how heat input will be determined for biodiesel.

Because this grant focuses on the adequacy of the synthetic minor limits that were intended to restrict the facility's PTE to minor source levels for PSD purposes, along with the monitoring, recordkeeping and reporting to ensure compliance with those limits, I am not resolving the separate issues raised in this claim of the Petition, including those regarding how the facility's

²⁰ With respect to the other CO short term emissions limit, Section C.2 of the Final Permit simply states the "CO emission limit shall be based on a 3-hour average when conducting the performance test required in Attachment II, Special Condition No. G.1.a." Section G.1.a of the Final Permit states that the permittee "shall not conduct performance tests during periods of startup, shutdown or malfunction."

PTE was calculated for PSD purposes. See *Cash Creek Order* at 15; *Kentucky Syngas Order* at 30. In response to this grant, HDOH may take steps to ensure that the CO and NO_x PTE limits are enforceable as a practical matter. If HDOH does so, PTE for CO may be calculated based on the CO limit, obviating concerns about the initial PTE calculations, and concerns about the enforceability of the CO and NO_x PTE limits would be addressed. Depending on HDOH's response to this objection, several issues raised in Claim 2 could be moot or substantively different. Thus, as explained above, it is an appropriate exercise of the EPA's discretion and a reasonable use of agency resources to not resolve those issues. In particular, for these reasons, I am not resolving the separate issues in the Petition regarding: the CO PTE calculation and CO emission factors as raised in pages 6-8 of the Petition; the Petitioner's contentions related to the lack of enforceable conditions limiting biodiesel usage as raised on page 9 of the Petition; and the other issues concerning enforceability of the CO and NO_x limits and post-issuance testing and controls to limit CO and NO_x emissions as raised on pages 9-10 of the Petition. See *Kentucky Syngas Order* at 30; *Cash Creek Order* at 15.

With respect to the Petitioner's assertions that the Draft Permit failed to include emissions limitations and monitoring for SO₂, as raised in pages 8-9 in the Petition, the Petitioner suggests that without emission limits and adequate monitoring for SO₂, Hu Honua's emissions may exceed the 40 tpy "major source significance threshold" for SO₂ "set in H.A.R. § 11-60.1-1," which would trigger the need for a BACT analysis for SO₂. Petition at 8-9. To the extent that the Petitioner is asserting a claim about applicability of federal BACT requirements, the EPA notes that because PSD is implemented under a delegation agreement in Hawaii, the significance threshold for SO₂ for purposes of determining whether a new major stationary source in Hawaii has a BACT requirement under the PSD program would be found in 40 C.F.R. § 52.21(b)(23)(i). Thus, at the time Hu Honua's Final Permit was issued, any determination of whether Hu Honua was subject to a federal BACT requirement for SO₂ would have been made with reference to the significant emissions rate in 40 C.F.R. § 52.21(b)(23)(i). The EPA further notes that the Final Permit does include an emission limit for SO₂, and SO₂ is also addressed in some of the source testing requirements. See Final Permit Section C.1 (limiting SO₂ emissions from the boiler to 0.028 lb/MMBtu) and Section G.1.a and G.2 (addressing SO₂ in boiler performance testing).

If, in response to the objection described above, HDOH takes steps to ensure that the Final Permit contains restrictions on CO and NO_x PTE that are legally and practicably enforceable and that have the effect of restricting sourcewide CO and NO_x PTE below 250 tpy, Hu Honua would not be a major source for PSD purposes, so analysis regarding the applicability of federal requirements for SO₂ for major sources would be unnecessary. Alternatively, to the extent that the Petitioner is asserting that a minor source limit was deficient or that a minor source requirement was not satisfied, that claim, as applicable, could be moot if HDOH responds to the grant in this claim by permitting Hu Honua as a PSD source. If HDOH takes steps to ensure that Hu Honua's PSD synthetic minor limits are legally and practicably enforceable, any claims relating to minor NSR requirements would be more appropriately addressed if and when HDOH assesses whether any applicable SIP-approved minor source requirements should be included in a revised permit.

Because this issue could be moot or substantively different depending on HDOH's response to my objection in this claim, I am not resolving the issues raised on pages 8-9 of the Petition

related to SO₂. As explained above, it is an appropriate exercise of the EPA's discretion and a reasonable use of agency resources to not resolve this claim. Depending on how HDOH revises the permit in light of this grant, I suggest that HDOH also consider the technical issues raised in Claim 2 with respect to SO₂, as applicable, particularly whether SO₂ monitoring is required to ensure that SO₂ emissions do not exceed the 0.028 lb/MMBtu limit in Section C.1.

C. CLAIM 3: The Permit Fails to Ensure Compliance with BACT Requirements for CO

Petitioner's Claim. The Petitioner asserts that BACT is required for CO because "Hu Honua's CO calculated emissions of 245.4 tons/year exceed the significance level of 100 tons/year established by H.A.R. § 11-60.1-1." Petition at 10. The Petitioner then asserts that the CO emission limit contained in the permit "is not BACT." *Id.* Citing to the definition of BACT in H.A.R. § 11-60.1-1, and in CAA § 169(3), 42 U.S.C. § 7479(3), as well as to several title V Orders, the Petitioner contends: "While "Hu Honua's BACT Analysis purports to follow the "top-down" process, the BACT analysis of CO is incomplete" because: (1) "the emission limitation identified as BACT excludes startup and shutdown" without explaining why such exclusion is appropriate; and (2) "the analysis identifies significantly lower CO emission limits at another facility... but does not describe...why Hu Honua could not achieve comparable emissions." *Id.* at 10-11. The Petitioner therefore asserts "the [BACT] analysis is legally inadequate." *Id.* at 11.

EPA's Response. Since I am granting the Petitioner's request for an objection to the Proposed Permit based on Claim 2, I am not resolving the Petitioner's request for an objection to the Proposed Permit on this claim. As explained in the response to Claim 2, the EPA is granting the Petition regarding the synthetic minor limits for CO because the EPA has determined that the limits in the Final Permit that were intended to restrict CO PTE below the major source threshold are not practicably enforceable. In response to that grant, HDOH may take steps to ensure that those limits are practicably enforceable. If HDOH takes steps to ensure that the Final Permit contains restrictions on CO PTE that are legally and practicably enforceable and that have the effect of restricting source-wide CO PTE below 250 tpy, Hu Honua would not be a major source of CO. At the time the Final Permit was issued, the only federal BACT requirement that could have applied to Hu Honua would have been the BACT requirement under the PSD program in 40 C.F.R. § 52.21. If Hu Honua is not a major source of CO, analysis regarding the applicability of federal requirements for major sources of CO to Hu Honua would be unnecessary. Alternatively, to the extent that the Petitioner is asserting that a minor source limit was deficient, that claim, as applicable, would be moot if HDOH treats Hu Honua as a major source. If HDOH takes steps to ensure that Hu Honua's PSD synthetic minor limits are legally and practicably enforceable, any claims relating to minor NSR requirements would be more appropriately addressed if and when HDOH assesses whether any applicable SIP-approved minor source requirements should be included in a revised permit.

Accordingly, I am not resolving this claim. As described in Section II., the CAA affords the EPA discretion in deciding how it responds to each title V petition. In this instance, some questions could be moot and others could be substantively different depending on HDOH's response to the issues upon which the EPA grants in this Order. Thus, it is an appropriate exercise of the EPA's

discretion and a reasonable use of agency resources to not resolve this claim. I suggest that when HDOH revises the permit in light of my grant on Claim 2, HDOH consider the specific technical issues raised in Claim 3 in those revisions, as applicable.

D. CLAIM 4: The Permit Fails to Ensure Compliance with Hazardous Air Pollutant Emission Limits

Petitioner's Claim. The Petitioner contends generally that HAP emissions from Hu Honua “would result in [Hu Honua] exceeding the 25 tpy major source threshold” if the HAP emissions estimate had been based on more accurate HCl and acrolein emissions factors. Petition at 11-12. The Petitioner asserts Hu Honua “avoid[s] numerous requirements applicable to major HAP sources,” which results in “a seriously flawed permit that is wholly incapable of ensuring compliance with section 112 of the CAA.” *Id.* at 12.

The Petitioner makes four sub-arguments related to this claim and to whether Hu Honua is a major source of HAP. *See generally* Petition at 11-14. First, the Petitioner asserts Hu Honua “calculated [an emission factor for HCl] by picking favorable, low chlorine numbers from the range of test surveys” of eucalyptus wood test data as opposed to using AP-42 emission factors.²¹ *Id.* at 12 (listed as Claim 4A in the Petition). The Petitioner alleges “[t]he permit limits are based on chlorine concentration of 0.03%, when an average of the 6 eucalyptus samples included in Table 2-A of Appendix D showed an average chlorine concentration of 0.12%, and a high of 0.434% in rose gum bark.” *Id.* The Petitioner also alleges that “Hu Honua skewed the chlorine concentration of Project feedstock and emissions by omitting the highest concentration feedstock – rose gum bark – and including the lowest concentration – rose gum without bark – even though the Revised Draft Permit includes bark in the boiler’s feedstock.” *Id.* The Petitioner asserts that using a higher emission factor “that is more representative of the boiler’s feedstock” would considerably increase the HCl PTE and would likely have resulted in Hu Honua “exceeding the major source threshold for HAPs of 25 tpy.” *Id.*

Second, the Petitioner asserts that emissions for acrolein were based on emission factors from the Maine Department of Environmental Protection (Maine DEP), which do not take into account tropical eucalyptus as a common feedstock. Petition at 12-13 (listed as Claim 4B in the Petition). The Petitioner states “EPA Region IX expressed serious concern regarding the accuracy of the Maine DEP emission factor,” quoting the EPA Letter, which noted the absence of source test requirements in the permit “to verify that the proposed emission factor is accurate for wood combustion at Hu Honua.” *Id.* at 13. The Petitioner asserts “if the HAP calculation had been based on the AP-42 emission factor for acrolein, acrolein emissions would be 5.6 tpy and total HAPs would be 29 tpy, which exceeds the HAP major source threshold.” *Id.* The Petitioner asserts “[b]ecause the accuracy of the Maine DEP emission factor with respect to eucalyptus feedstock for Hu Honua is not verified, the more conservative AP-42 emission factor must be used in the PTE calculations.” *Id.*

Third, citing to the periodic monitoring requirements of 40 C.F.R. §§ 70.6(a)(3) and 71.6(a)(3), and the EPA’s Periodic Monitoring Guidance, as well as H.A.R. § 11-60.1-90(7)(B), the

²¹ AP-42, *Compilation of Air Pollutant Emission Factors*, has been published since 1972 as the primary compilation of the EPA’s emission factor information.

Petitioner asserts the Revised Draft Permit “fails to include adequate assurances that the irregular fuel source...will be monitored at sufficient frequencies to assure achievement of the emissions limitations.” Petition at 13 (listed as Claim 4C in the Petition). The Petitioner states that “EPA Region IX commented that an initial source test and annual source testing is required to ensure that emissions from Hu Honua do not exceed the major source thresholds of 10 tpy and 25 tpy for all HAPs.” Petition at 13. The Petitioner asserts that initial and annual source testing is not sufficient; instead, the Petitioner asserts that “because the wood fuel stock is naturally variable, more frequent source testing – preferably continuous – is required for all HAPs (not only HCL-see Special Condition E.7.).” *Id.* The Petitioner asserts such monitoring is necessary to “provide sufficiently reliable and timely information for determining compliance.” *Id.* at 13, *citing to* 42 U.S.C. § 7661c(b). The Petitioner asserts that because the Revised Draft Permit fails to include such monitoring, “it fails to ensure the facility’s compliance with emission limits.” *Id.* at 14.

Fourth, the Petitioner notes Hu Honua’s permit application reported total HAP emission at 23.8 tpy, which are “very close to the HAP Major Source threshold of 25 tons.” Petition at 14 (listed as Claim 4D in the Petition). The Petitioner alleges “if Hu Honua had applied the AP-42 emission factors to HCl, acrolein, or both, [Hu Honua’s] emissions would exceed the 25 tpy major source threshold for MACT applicability.” *Id.*

EPA’s Response. I grant the Petitioner’s request for an objection to the Proposed Permit on this claim. I grant specifically in regard to the Petitioner’s contentions that the Proposed Permit fails to ensure that individual and total HAP emissions will be below the respective 10 and 25 tpy major source thresholds. While HDOH included synthetic minor limits for HAP in the Final Permit, which were intended to restrict HAP PTE below the individual HAP major source threshold of 10 tpy and the total HAP major source threshold of 25 tpy²², these limits are not enforceable as a practical matter. As explained more fully below, in light of this grant, I am not resolving some of the issues raised by the Petitioner in Claim 4.

Under the governing provisions of CAA § 112(a) and 40 C.F.R. § 63.2, the calculation of a source’s PTE for purposes of determining whether the source triggers requirements for major stationary sources of HAP includes consideration of “any physical or operational limitation on the capacity of the stationary source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, ... if the limitation or effect it would have on emissions is federally enforceable.”²³ *See also* H.A.R. § 11-60.1-1. As we have stated, “if a permit applicant agrees to an enforceable limit that is sufficient to restrict PTE, the facility’s PTE is calculated based on that limit.” *Cash Creek Order* at 15. In this case, Hu Honua agreed to accept source-wide individual HAP and

²²As HDOH explained in the Final Permit Review Summary: “To ensure that the facility remains an area source for HAPs, the permit requires the total of all HAPs emissions and any individual HAP emissions from the facility, including during boiler startups and shutdowns, shall not exceed 25 tons per year and 10 tons per year, respectively, on any rolling twelve month period.” Final Permit Review Summary at 7; *see also* 2011 RTC at 6.

²³The definition of PTE for HAP in 40 C.F.R. § 63.2 includes the term “federally enforceable.” Consistent with the court decisions, *National Mining Association v. EPA*, 59 F.3d 1351 (D.C. Cir.1995) and *Chemical Manufacturers Ass’n v. EPA*, No. 89-1514, 70 F.3d 637 (D.C. Cir. 1995), permit terms to limit HAP emissions must be federally enforceable. The term “federal enforceability” has also been interpreted to require practical enforceability. *See* John Seitz and Robert Van Heuvelen, “Release of Interim Policy on Federal Enforceability of Limitations on Potential to Emit” (Jan. 22, 1995) at 2- 3.

total HAP emission limits of less than 10 tpy and less than 25 tpy, respectively. See Final Permit, Section C.7. Therefore, an EPA objection regarding whether Hu Honua's Final Permit ensures compliance with requirements for major stationary sources of individual HAP and total HAP is warranted if the permit does not impose enforceable limits on the source's individual and total HAP emissions such that source-wide emissions remain below 10 tpy for individual HAP and 25 tpy total HAP, the applicable thresholds for determining whether Hu Honua is a major stationary source of HAP. 42 U.S.C. § 7412(a)(1); 40 C.F.R. § 63.2; H.A.R. § 11-60.1-1.

To effectively limit Hu Honua's individual HAP and total HAP PTE to less than 10 and 25 tpy, respectively, as specified, the individual and total HAP emission limits in Section C.7 of the Final Permit must apply at all times to all actual emissions, and all actual individual and total HAP emissions must be considered in determining compliance with the respective limits. See *Cash Creek Order* at 15 (finding that a VOC limit was not enforceable as a practical matter because the state agency "failed to provide a reasoned explanation for how the compliance demonstration method associated with the VOC emissions limit, which is used to determine compliance with the source-wide VOC limit, accounts for all actual VOC emissions"). The Final Permit for Hu Honua states that "the total of all HAPs emissions and any individual HAP emissions from the facility, including during boiler startups and shutdowns, shall not equal or exceed 25 tons per year and 10 tons per year, respectively, on any rolling twelve-month (12-month) period." Final Permit, Section C.7. However, the Final Permit does not specify how the facility's individual HAP and total HAP emissions shall be determined or measured for assessing compliance with these individual HAP and total HAP emission limits in Section C.7, and it is unclear whether all actual individual HAP and total HAP emissions must be considered in determining compliance with these limits, including emissions during other non-startup/shutdown operating conditions referenced in the permit, such as periods of "malfunction" or "upset conditions." See, e.g., Final Permit, Sections F.8, F.9, and F.3.

The EPA notes that the Final Permit does contain a condition in Section E.15 providing that the "permittee shall calculate and record the total of all HAPs and all individual HAP emissions from the facility, including during boiler startups and shutdowns, on a monthly and rolling twelve-month (12-month) basis." See Final Permit, Section E.15. The EPA additionally notes that the Final Permit requires submission of semi-annual monitoring report forms that include "the total of all HAPs emissions and the largest individual HAP emissions from the facility on a monthly and rolling twelve-month (12-month) basis." Final Permit, Section F.6.a.vii. However, the Final Permit does not specify how the total HAP and individual HAP emissions shall be calculated for purposes of these two conditions or what information such calculations would be based upon. Nor does the Final Permit specifically connect the calculations in Section F.6.a.vii to determining compliance with the individual HAP and total HAP emission limits in Section C.7. In addition, these conditions do not clearly provide that all actual source-wide total HAP and individual HAP emissions should be considered in determining compliance with the total HAP and individual HAP emission limits in Section C.7 and do not clearly state that emissions during other non-startup/shutdown operating conditions referenced in the permit (such as malfunction or upset) must be included in determining compliance with those limits. In addition, Section F.6.a.vii does not clearly state that emissions during startup and shutdown must be included in determining compliance with the total HAP and individual HAP emission limits in Section C.7.

The EPA further notes that the Final Permit does not appear to contain any monitoring or recordkeeping requirements that would allow for calculation or consideration of any total HAP and individual HAP emissions associated with the operation of the emergency generator at the source in determining compliance with the total HAP and individual HAP emission limits in Section C.7.

Moreover, as defined for purposes of determining whether a stationary source is a major source of HAP, PTE encompasses “the maximum capacity of a stationary source to emit a pollutant under its physical and operational design.” 40 C.F.R. § 63.2; H.A.R. § 11-60.1-1. Thus, emissions from all emission units that are part of the source’s physical and operational design must be included in calculating PTE for purposes of determining HAP major source applicability, including emission units that have been designated as “insignificant activities.”²⁴ Similarly, the EPA has previously explained that when a source accepts a source-wide PTE limit for a pollutant, all actual emissions of that pollutant from the source must be considered in determining compliance with the limit.²⁵ Although HDOH treated the emergency generator as an “insignificant activity” under H.A.R. § 11-60.1-82(f)(5), that provision states that a generator cannot qualify as an insignificant activity if it would trigger a covered source review based on its PTE for HAP. H.A.R. § 11-60.1-82(f)(5)(B). Accordingly, the emergency generator’s actual total HAP and individual HAP emissions must be considered in determining whether Hu Honua is subject to various requirements.

For these reasons, I am granting the Petition regarding the Petitioner’s claim that “the permit fails to ensure [Hu Honua’s] compliance with emission limits,” for all individual HAP and total HAP in Section C.7. of the Proposed Permit, and accordingly cannot ensure that emissions from Hu Honua do not exceed the major source threshold of 10 tpy for each HAP and 25 tpy for all HAP.

HDOH can respond to this objection on this claim by revising the Final Permit to ensure that the source-wide total HAP and individual HAP emission limits of less than 25 tpy and 10 tpy, respectively, in Section C.7 are enforceable. To do so, HDOH should clarify in the Final Permit that those limits apply at all times to all actual source-wide individual HAP and total HAP emissions and that all actual individual HAP and total HAP emissions must be considered in determining compliance with those limits. HDOH should also make any changes or clarifications necessary to the measures for determining compliance with those limits, including monitoring, recordkeeping, and reporting provisions, to ensure that those limits are enforceable as a practical matter. In identifying in the Final Permit the measures for determining compliance with the individual HAP and total HAP emission limits, HDOH should specify how the actual annual total HAP and individual HAP emissions will be calculated, including what, if any, emission rates determined pursuant to Section G.1.c.i. would be used and how calculations using such

²⁴ This is consistent with the EPA’s guidance explaining how to calculate PTE for emergency generators, as the EPA would not have needed to provide this guidance if the EPA believed that emissions from emergency generators did not need to be considered in PTE calculations. See John Seitz, Calculating Potential to Emit (PTE) for Emergency Generators (Sept. 6, 1995) (available at <http://www.epa.gov/region07/air/title5/t5memos/emgen.pdf>). This is also consistent with 40 CFR § 70.5(c), which provides that a title V application “may not omit any information needed to determine the applicability of, or impose, any applicable requirement.”

²⁵ See, e.g., *Cash Creek Order* at 15; *Kentucky Syngas Order* at 29.

rates would ensure that actual annual total HAP and individual HAP emissions remain below the respective 25 and 10 ton per year limits.

Under this approach, HDOH could revise the Final Permit to clarify that all actual individual HAP and total HAP emissions from the source, including emissions during all actual operational scenarios and from the emergency generator, must be included in determining whether the source has exceeded the source-wide individual HAP and total HAP emission limits of less than 10 tpy and 25 tpy, respectively, and add any necessary monitoring, recordkeeping, or reporting for the individual HAP and total HAP emissions from the boiler and the emergency generator.

Alternatively, HDOH may utilize another approach, consistent with H.A.R. § 11-60.1-5 and Hawaii's approved title V program, to ensure that major stationary source requirements are not triggered for individual HAP or total HAP, or it could respond to this objection by requiring Hu Honua to comply with applicable major stationary source requirements.

Accordingly, as described above, I am granting the Petitioner's claim that the Proposed Permit fails to ensure that individual and total HAP emissions will be below the respective 10 tpy and 25 tpy major source thresholds. To ensure that it does, the synthetic minor limits for individual and total HAP emissions in Section C.7 of the Final Permit must be enforceable as a practical matter. In response to this grant, HDOH may take steps to ensure that the individual and total HAP PTE limits apply to all source-wide emissions and are enforceable as a practical matter in order to address concerns about the enforceability of those limits. When the Final Permit is so modified, PTE for individual and total HAP emissions may be calculated based on the HAP limits. Depending on HDOH's response to this objection, several issues raised in Claim 4 could be moot or substantively different. Thus, it is an appropriate exercise of the EPA's discretion and a reasonable use of agency resources to not resolve those issues. For these reasons, I am not resolving the separate issues in the Petition regarding: whether Hu Honua used appropriate emission factors in determining potential HCL and acrolein emissions and whether Hu Honua would exceed the major stationary source threshold of 25 tpy of total HAP raised on pages 11-13 and 14 of the Petition. See *Kentucky Syngas Order* at 30; *Cash Creek Order* at 15.

E. CLAIM 5: The Baghouse is Not Adequately Described or Monitored

Petitioner's Claim. The Petitioner contends "the Revised Draft Permit fails to ensure continuous compliance with the proposed BACT limits for PM as required by Condition C.4." Petition at 14. In support of its arguments, the Petitioner states that the Revised Draft Permit "fails to include an adequate description of the baghouse (e.g. number of bags, capacity) or any conditions specifying maintenance and inspection requirements for baghouse operations." *Id.* The Petitioner also asserts that initial and annual source tests and the continuous opacity monitoring system (COMS) are inadequate to assure compliance with the PM BACT limits. *Id.*

EPA's Response. I deny the Petitioner's request for an objection to the Proposed Permit on this claim. This claim does not appear to be based on the Proposed Permit. See, e.g., 40 C.F.R. §§ 70.7(c) and (d). In the Petition, this claim does not cite to the Proposed Permit, but refers only to the Revised Draft Permit. The claim does not address many relevant terms and conditions in the Proposed Permit that describe the baghouse and relevant monitoring requirements for controlling PM emissions. For example, the Petitioner does not address the following requirements that were

included in the Proposed Permit: (1) section A.1.a.i, which describes the type of Electrostatic Precipitator (ESP) and Baghouse to be used at the facility as a “B & W Pulse Jet Fabric Filter or equivalent;” (2) section D.2.a, which states that the permittee shall not operate if a problem affecting PM control efficiency of the ESP and/or baghouse could cause the ESP and/or baghouse to operate outside the respective normal range; (3) sections D.2.b-d, which contain further routine maintenance requirements to ensure the ESP and baghouse are operating properly; (4) section E.12, which requires the facility to install a pressure drop meter on the baghouse, which is to be monitored and recorded daily; and (5) sections F.6.a.iii-iv, which require further semi-annual monitoring and recordkeeping of the ESP and baghouse. See Proposed Permit, Attachment II. The EPA notes these same requirements are also included in the Final Permit.

By not addressing these control technologies and maintenance and recording requirements in the Proposed Permit, the Petitioner has not demonstrated that these and other requirements in the Proposed Permit are insufficient to ensure that the boiler will meet its PM limits. In other words, the Petitioner has not demonstrated that the Proposed Permit “is not in compliance with the requirements of [the CAA.]” CAA § 505(b)(2). The EPA interprets the “demonstration” requirement in CAA § 505(b)(2) as “placing the burden on the Petitioner to supply information to the EPA sufficient to demonstrate the validity of the objection raised to the title V permit,” *In the Matter of Luminant Generation Co. – Sandow 5 Generating Plant*, Order on Petition Number VI-2011-05 at 9 (Jan. 15, 2013) (*Luminant Order*); see also *MacClarence*, 596 F.3d at 1131 (affirming denial of a petition where the petitioner had not provided legal reasoning, evidence, and references to support the claim). The Petitioner’s general assertion that the Revised Draft Permit fails to ensure compliance with PM limits is conclusory and without supporting information, thus falling short of demonstrating “the validity of the objection raised” in the Petition. *Luminant Order* at 9. The Petitioner states that the Revised Draft Permit “fails to ensure continuous compliance with the proposed BACT limits for PM as required by C.4,” but only cites to the March 21, 2011, Pless comment letter as evidence for this claim. See March 21, 2011 Pless Letter at 6. However, the comment letter contains no additional supporting information for the Petitioner’s position. The letter lists “example” requirements taken from permits for other biomass facilities with baghouses, without explaining why these example provisions would be more effective for ensuring that Hu Honua’s boiler will meet its PM limits. HDOH actually included some of these “example” provisions in the Proposed Permit, which the Petitioner did not address in its Petition.

For the foregoing reasons, I deny the Petition as to this claim.

F. CLAIM 6: The Permit Fails to Ensure Compliance with Applicable HAR and SIP Requirements

Petitioner’s Claim. The Petitioner asserts the permit “does not comply with” H.A.R. § 11-60.1-179 and Hawaii’s SIP because “the Permit fails to ensure [Hu Honua] will not emit HAPs and criteria air pollutants at levels injurious to human health.” Petition at 15. The Petitioner states that H.A.R. § 11-60.1-179 “prohibits the emission of HAPs from any stationary source in quantities that contribute to an ambient air concentration that endangers human health, and provides that any new major source of hazardous air pollutants must demonstrate that emissions

of HAPs from the source will not contribute to any significant ambient concentrations of HAPs.” *Id.* at 14-15 (emphasis in original). The Petitioner also states that Hawaii’s SIP “similarly prohibits any person from permitting or causing air pollution, defined as ‘the presence in the outdoor atmosphere of one or more air pollutants in such quantities and duration as is or tends to be injurious to human health or welfare.’” *Id.* at 15, citing H.A.R. §§ 11-60-17, 11-60-1 (def. “Air Pollution”). The Petitioner asserts Hu Honua “severely underestimated its emissions of both HAPs and criteria air pollutants, and accordingly the modeling underestimated the facility’s health risk.” *Id.* The Petitioner also states that “the accuracy of the meteorological data used in the modeling is questionable, given that it was collected at Hilo Airport and not Pepe’ekeo,” where Hu Honua will be operating. *Id.* The Petitioner insists Hu Honua “provides no support for [its] assertion” that “wind flow patterns are comparable” between the two locations. *Id.*

EPA’s Response. I deny the Petitioner’s request for an objection to the Proposed Permit on this claim. Regarding whether the Proposed Permit fails to comply with the prohibition on HAP emissions contained in H.A.R. § 11-60.1-179, this provision is a state only requirement and not a part of Hawaii’s SIP; therefore, it is not an applicable requirement for purposes of title V and not subject to review in a title V petition. *See* 40 C.F.R. § 70.2.

Regarding whether the Proposed Permit fails to comply with the general prohibition on air pollution contained in H.A.R. § 11-60-17 (renumbered as H.A.R. § 11-60.1-2 in 2012 (*see* 77 *Fed. Reg.* 25084)), the Petitioner has not demonstrated that the Proposed Permit is not in compliance with the applicable requirements of the Act. The EPA has pointed out in numerous orders that, in particular cases, general assertions or allegations did not meet the demonstration standard. *See, e.g., Luminant Order* at 9; *In the Matter of BP Exploration (Alaska) Inc., Gathering Center #1*, Order on Petition Number VII-2004-02 at 8 (Apr. 20, 2007) (*BP Alaska Order*); *In the Matter of Chevron Products Co., Richmond, Calif. Facility*, Order on Petition No. IX-2004-10 at 12, 24 (Mar. 15, 2005) (*Chevron Order*). Also, if the petitioner did not address a key element of a particular issue, the petition should be denied. *See, e.g., In the Matter of Public Service Company of Colorado, dba Xcel Energy, Pawnee Station*, Order on Petition Number: VIII-2010-XX at 7–10 (June 30, 2011) (*Pawnee Order*); *In the Matter of Georgia Pacific Consumer Products LP Plant*, Order on Petition No. V-2011-1 at 10–11, 13–14 (July 23, 2012) (*Georgia Pacific Order*). Here, the Petitioner only makes general assertions and fails to analyze the actual elements of the provision. H.A.R. § 11-60.1-2 contains a general prohibition against “air pollution or ...the emissions of any regulated or hazardous air pollutants without first securing approval in writing” from HDOH. The Petitioner does not demonstrate how the Proposed Permit fails to ensure compliance with this provision. For example, the Petitioner does not identify which “air pollutant,” as defined in H.A.R. § 11-60.1-1, Hu Honua is emitting inconsistent with the general prohibition, nor does it allege that Hu Honua is doing so without “approval in writing” from HDOH. Moreover, general assertions regarding inappropriate use of meteorological data and wind flow patterns are not adequate to demonstrate that the permit is inconsistent with the general prohibition on air pollution in the SIP. *See MacClarence*, 596 F.3d at 1131-1133; *Luminant Order* at 9; *Chevron Order* at 12, 24; *In the Matter of Transalta Centralia Generation, LLC*, Order on Petition Regarding Permit No. SW98-8-R3 at 4-8 (April 28, 2011) (*Transalta Order*); *In the Matter of Hercules, Inc.*, Order on Petition Number: IV-2003-01 (November 10, 2004) (*Hercules Order*).

Additionally, the Petitioner did not address the information in the record, which was available to the Petitioner during the permit review period, concerning the ambient air quality modeling for criteria pollutants for this permit. *See, e.g.* Permit Application at 17-30; Revised Permit Application at 29-45; Draft Permit Review Summary and Revised Draft Permit Review Summary at 13-16. The Petitioner also provides no additional information regarding why the wind flow patterns at Hilo International Airport would not be appropriate for use in Hu Honua's modeling analysis. Furthermore, the Petitioner does not demonstrate that the use of airport data is inconsistent with the EPA's Guidelines on the use of meteorological data in Appendix W of 40 C.F.R. part 51. *See Kentucky Syngas Order* at 41 (denying title V petition issue where petitioners failed to acknowledge or reply to state's response to comments or provide a particularized rationale for why the state erred or the permit was deficient).

For the foregoing reasons, I deny the Petition as to this claim.

G. CLAIM 7: The Permit Fails to Ensure Compliance with MACT Requirements

Petitioner's Claim. The Petitioner claims that Hu Honua is a major source of HAP and is therefore "required to obtain from [HDOH] an approved MACT determination according to one of the review options specified in the applicable regulation." Petition at 15, *citing* 40 C.F.R. § 63.43; H.A.R. §§ 11-60.1-174, 11-60.1-175. The Petitioner also alleges "[b]ecause Hu Honua 'artificially reduced its HAP emission thresholds to avoid Major Source classification, no MACT determination was sought.'" *Id.*

EPA's Response. Since I am granting the Petitioner's request for an objection to the Proposed Permit based on Claim 4, I am not resolving the Petitioner's request for an objection to the Proposed Permit on this claim. As explained in the response to Claim 4, the EPA is granting the Petition regarding the HAP limits because the EPA has determined that the limits in the Final Permit that were intended to restrict HAP PTE below the major source thresholds²⁶ are not practicably enforceable. In response to that grant, HDOH may take steps to ensure that those limits are practicably enforceable. When HDOH takes steps to ensure that the Final Permit contains restrictions on HAP PTE that are legally and practicably enforceable and that have the effect of restricting source-wide HAP PTE below 10 tpy for individual HAP and 25 tpy for total HAP, Hu Honua would not be a major source of HAP. If Hu Honua is not a major source of HAP, analysis regarding the applicability of federal requirements for major sources of HAP to Hu Honua would be unnecessary. Accordingly, I am not resolving this claim. As described in Section II., the CAA affords the EPA with discretion in deciding how it responds to each title V petition. In this instance, some questions could be moot and others could be substantively different depending on HDOH's response to the issues upon which the EPA grants in this Order. Thus, it is an appropriate exercise of the EPA's discretion and a reasonable use of agency resources to not resolve this claim. Depending on how HDOH revises the permit in light of my grant on Claim 4, I suggest that HDOH consider the specific issues raised in Claim 7 in those revisions, and make any necessary changes to the permit or permit record.

²⁶ As HDOH explained in the Final Permit Review Summary: "To ensure that the facility remains an area source for HAPs, the permit requires the total of all HAPs emissions and any individual HAP emissions from the facility, including during boiler startups and shutdowns, shall not exceed 25 tons per year and 10 tons per year, respectively, on any rolling twelve month period." Final Permit Review Summary at 7; *see also* 2011 RTC at 6.

H. CLAIM 8: The Permit Impermissibly Exempts Startup and Shutdown from Emission Limits

Petitioner's Claim. The Petitioner alleges that “the Revised Draft Permit fails to ensure compliance with applicable requirements” because Condition C.2 of the Revised Draft Permit fails to require compliance with emission limits on the boiler for NO_x, VOC, CO, and HCl during boiler startup and shutdown. Petition at 15-16. The Petitioner contends that this exemption violates requirements of federal and state law. *Id.* at 15-16, *citing Sierra Club v. EPA*, 551 F.3d 1019 (D.C. Cir. 2008); CAA §§ 110(a) and 504(a); EPA’s Memorandum re Vacatur of Startup, Shutdown, and Malfunction Exemption (July 22, 2009); and H.A.R. § 11-60.1-16 (which the Petitioner states “requires reporting of ‘deviations’”). The Petitioner also contends that the exemption in Condition C.2 “improperly excludes a significant portion of the facility’s emissions that must be included in the permit for purposes of calculating [PTE] and the applicability of Major Source procedures and requirements, including PSD and MACT requirements.” *Id.* at 16.

EPA Response: Since I am granting the Petitioner’s request for an objection to the Proposed Permit based on Claims 2 and 4, I am not resolving the Petitioner’s request for an objection to the Proposed Permit on this claim as it relates to the PTE calculations, but I am granting with respect to the Petitioner’s claim regarding the exemption in Section C.2 because the permit record does not provide an adequate rationale for this exemption that would allow the EPA to evaluate whether it is consistent, or not, with federal law, in light of the applicable requirements and requirements of title V for Hu Honua.

With respect to the PTE calculations for CO, NO_x, and HCl, the Petitioner claims that Section C.2 “improperly excludes a significant portion of the facility’s emissions that must be included in the permit for purposes of calculating the potential to emit and the applicability of Major Source procedures and requirements, including PSD and MACT requirements.” Petition at 16. As explained above, the EPA is granting on Claims 2 and 4 because it has determined that the synthetic minor limits in the Final Permit for CO, NO_x, individual HAP and total HAP emissions are not practicably enforceable. In response to that grant, HDOH may take steps to ensure that those source-wide limits are practicably enforceable such that Hu Honua is neither a major stationary source for PSD nor a major source of HAP. 42 U.S.C. §§ 7412(a)(1), 7479(1); 40 C.F.R. § 52.21(b)(1)(i)(b); 40 C.F.R. § 63.2. If it does so, the Petitioner’s claims relating to PTE calculations for CO, NO_x and HCl would be irrelevant, as PTE could be determined based on those enforceable limits. *See* 40 C.F.R. § 52.21(b)(4); 40 C.F.R. § 63.2; *Cash Creek Order* at 15. Because these issues could be moot or substantively different depending on HDOH’s response to the issues upon which the EPA grants in this Order, it is an appropriate exercise of the EPA’s discretion and a reasonable use of agency resources to not resolve this claim, as explained above.

As regards the Petitioner’s claim that the PTE calculations for VOC excluded emissions that should have been included in such calculations, as raised on page 16 of the Petition, the EPA notes that HDOH calculated VOC PTE at 39.2 tpy and thus determined that VOC was below the significance level defined in HAR §11-60.1-1 and that a BACT analysis was not required. Final Permit Review Summary at 5. To the extent that the Petitioner’s VOC PTE claim concerns applicability of a federal BACT requirement, the EPA notes that at the time Hu Honua’s Final

Permit was issued any determination of whether Hu Honua was subject to a federal BACT requirement would have been made with reference to the significant emissions rate under 40 C.F.R. § 52.21(b)(23). If, in response to the objection described above for Claim 2, HDOH takes steps to ensure that the Final Permit contains restrictions on CO and NO_x PTE that are legally and practicably enforceable and that have the effect of restricting sourcewide CO and NO_x PTE below 250 tpy, Hu Honua would not be a major source for PSD purposes, so analysis regarding the applicability of federal requirements based on VOC emissions for major sources would be unnecessary. Alternatively, to the extent that the Petitioner is claiming that a minor source limit was deficient or that a minor source requirement was not satisfied for VOC, that claim, as applicable, could be moot if HDOH responds to the objection on Claim 2 by permitting Hu Honua as a PSD source. Because this issue could be moot or substantively different depending on HDOH's response to my objection in Claim 2, it is an appropriate exercise of the EPA's discretion and a reasonable use of agency resources to not resolve this claim, as explained above.

With respect to the Petitioner's claim on pages 15-16 of the Petition that Section C.2 violates certain legal requirements because it fails to require compliance with the NO_x, VOC, HCl, and CO emission limits on the boiler during boiler startup and shutdown, the EPA notes that it is not clear from the permit record what the legal basis is for the statement in Section C.2 that emission limits for NO_x, VOC, HCl, and CO "shall be complied with at all times, except during boiler startup and shutdown." Final Permit, Section C.2. For this reason, the EPA is not able to readily determine whether this provision is consistent or inconsistent with federal law²⁷, the applicable requirements, and the requirements of title V for Hu Honua. Because the permit and permit record do not provide a rationale in the record for this exemption, including a description of the legal basis for it, there is not sufficient information for the EPA and the public to be able to evaluate the exemption in Section C.2 in light of the applicable requirements and the requirements of title V. Accordingly, I am granting on this aspect of this claim. *Cf., e.g., Nucor I Order* (granting a title V petition where the information in the permit record did not give the EPA and the public sufficient information to determine whether the requirements of the SIP and of title V were met). When HDOH revises the permit in responding to the objection on Claims 2 and 4, if it decides to retain the emissions limits on the boiler currently in Section C.1 and the exemptions during periods of boiler startup and shutdown currently in Section C.2 for any pollutant, it must explain the basis and authority for any such exemption in the revised permit or permit record so that the EPA can evaluate whether it is consistent or inconsistent with federal law, in light of the applicable requirements and requirements of title V for Hu Honua.

I. CLAIM 9: The Facility's Biomass Handling, Chipping and Storage Operation Does Not Qualify as an "Insignificant Activity"

Petitioner's Claim. The Petitioner asserts that Hu Honua's "biomass handling and chipping operations do not qualify as an 'insignificant activity' pursuant to H.A.R. § 11.60-82(f)(7), and associated emissions must therefore be included in [Hu Honua's] PTE." Petition at 16. The Petitioner states: "The Permit Review Summary fails to quantify emissions from [Hu Honua's]

²⁷ See *Sierra Club v. EPA*, 551 F.3d 1019 (D.C. Cir. 2008) (vacating startup and shutdown exemptions as violating the CAA's requirement that emissions standards or limitations must apply continuously).

chipper operations, and, thus, fails to demonstrate that [Hu Honua's] chipper operations would indeed satisfy the conditions of H.A.R. § 11.60-82(f)(7), specifically that emissions of particulate matter would not exceed the specified thresholds pursuant to Subsections (B) and (D)." *Id.* at 17. The Petitioner also contends "neither the Permit Review Summary nor the Draft Permit provide any information for [Hu Honua's] electric biomass chipping operation beyond stating that the chipper would operate within an enclosed building with a dust collector." *Id.* As a result, the Petitioner contends it is "impossible to estimate emissions from these activities." *Id.* The Petitioner cites to a biomass facility in Florida with "approximately twice the capacity as Hu Honua" and notes that its estimated PM emissions are 15.7 tpy of PM and 7.4 tpy of PM₁₀. *Id.* Based on this information, the Petitioner concludes that a low estimate of biomass handling and chipping emissions from Hu Honua would be 7.8 tpy of PM and 3.7 tpy of PM₁₀, which would exceed the 2 tpy significance threshold for PM for insignificant activities pursuant to H.A.R. § 11.60-82(f)(7)(D). *Id.* The Petitioner therefore asserts "the Revised Draft Permit is flawed for failing to include emissions from the [chipper operations] in [Hu Honua's] PTE." *Id.* at 18.

EPA Response: I deny the Petitioner's request for an objection to the Proposed Permit on this claim.

The Petitioner has not demonstrated that HDOH's treatment of the biomass handling, storage, and chipping operations (wood chipping operations) did not assure compliance with any applicable requirement under the CAA. The analysis in the Petition does not demonstrate that the wood chipping operations would not qualify as an "insignificant activity" under H.A.R. § 11-60.1-82(f)(7). The Petitioner provides an alternative PTE for PM from the wood chipping operations, but does not adequately explain why this alternative PTE is appropriate for estimating emissions at Hu Honua. Petition at 17. To develop the alternative PTE, the Petitioner relies only on the boiler size of a Florida facility, Adage Hamilton, to estimate Hu Honua PM emissions of 7.8 tpy of PM and 3.7 tpy of PM₁₀ from wood chipping operations. *Id.* However, boiler size alone is not adequate to determine PTE for this facility, and the Petitioner does not explain why the emission estimates from the Adage Hamilton facility are appropriate for determining emissions from Hu Honua, in light of other considerations, including Hu Honua's wood's moisture content, building enclosure, dust collection, or any aspect of Hu Honua's physical and operational design. For these reasons, the Petitioner has not demonstrated that the emissions from Hu Honua's wood chipping operations fail to qualify as an insignificant activity pursuant to H.A.R. § 11-60.1-82(f)(7). Even assuming Hu Honua must include the PM emissions from its wood chipping operations in its PTE calculation, the Petitioner has not discussed or analyzed how doing so would result in applicability of a requirement under the CAA that has not been addressed. Thus, the Petitioner has not demonstrated how HDOH's failure to include these emissions in Hu Honua's PTE in the Revised Draft Permit did not assure compliance with an applicable requirement under the CAA.

Also, as we discuss in more detail in our response to Claim 13, some relevant parts of the record were available during the public comment period, including the Revised Permit Application and the Permit Review Summary for the Revised Draft Permit. (Revised Draft Permit Review Summary). Those documents included some of HDOH's responses to the Petitioner's comments on this issue. For example, the Revised Permit Application clearly explained that only about 25-30 percent of the wood needed for the boiler is expected to be chipped onsite, that the wood

would be chipped in an enclosed building with dust control, and that contracts would limit the moisture control of the wood, further limiting PM₁₀ emissions. Revised Permit Application at 2-3. The Revised Draft Permit Review Summary also explained that the wood chipper would be operated in an enclosed building with a dust collector, and that the wood to be received would not have a moisture content greater than 45 percent, “thereby further limiting PM₁₀ emissions.” Revised Draft Permit Review Summary at 3. The Petitioner failed to address in the Petition the Revised Permit Application and HDOH’s reasoning in the Revised Draft Permit Review Summary concerning PM emissions from the wood chipping operations. *MacClarence*, 596 F.3d at 1123, 1130-33; *Sierra Club v. Johnson*, 541 F.3d at 1266-1267 ; *Citizens Against Ruining the Environment*, 535 F.3d at 677-78 ; *Sierra Club v. EPA*, 557 F.3d at 406; *In the Matter of Noranda Alumina, LLC*, Order on Petition No. VI-2011-04 at 20 (December 14, 2012) (*Noranda Order*) (denying title V petition issue where petitioners did not respond to state’s explanation in response to comments or explain why the state erred or the permit was deficient); *Kentucky Syngas Order* at 41 (denying title V petition issue where petitioners did not acknowledge or reply to state’s response to comments or provide a particularized rationale for why the state erred or the permit was deficient).

Additionally, the record contains other information on PM emissions from the wood chipping operations. As HDOH explained in its Response to Comments on the Draft Permit (2010 RTC), wood chipping emissions were approximated using emission factors from a biomass facility in Gadsden County, Florida, which used an emission factor of 0.002 lb per ton of wood chipped. 2010 RTC at 24, *citing* ADAGE Gadsden LLC Permit Application, Gadsden County, Florida, for a 55.5 MW Net Wood Biomass Electric Power Plant, January 2010. Using this emission factor, HDOH explained that it “conservatively assumed” that all wood would be chipped onsite, concluding that 0.5 tons per year of fugitive PM₁₀ would be emitted. HDOH thus estimated emissions of regulated pollutants from the wood chipper would be less than 2 tpy. In support of this conclusion, HDOH explained that wood chipping and handling will occur in a completely enclosed building, with dust control and covered conveyers; dust generation will be further limited by the high moisture content of the wood, while the wood chipper itself will be powered by steam and electricity, eliminating combustion generated air pollutants. 2010 RTC at 24. Thus, any assertions regarding the record failing to provide information for PM emissions from the wood chipping operation are now moot.

For the foregoing reasons, I deny the Petition as to this claim.

J. CLAIM 10: The Permit Fails to Address Emissions from Trona or Lime and Ash Handling

Petitioner’s Claim. The Petitioner asserts “the Permit Review Summary did not include emissions from trona or lime handling or from ash handling.” Petition at 18. The Petitioner further asserts that “emissions that can be easily captured and vented through a stack (i.e. non-fugitive emissions), *e.g.*, particulate matter emissions from a storage silo captured via a vent filter, must be quantified and included in the Facility’s PTE.” *Id.*

EPA’s Response. I deny the Petitioner’s request for an objection to the Proposed Permit on this claim. The Petitioner has not demonstrated that the Proposed Permit is not in compliance with

the Act. *See* 42 U.S.C. § 7661d(b)(2); *MacClarence*, 596 F.3d at 1131. The Petitioner does not identify any particular statutory or regulatory basis for its allegations. *Id.* at 1131 (“the Administrator’s requirement that [a title V petitioner] support his allegations with legal reasoning, evidence, and references is reasonable and persuasive”); *In the Matter of Murphy Oil USA, Inc.*, Order on Petition No. VI-2011-02 at 12 (Sept. 21, 2011) (*Murphy Oil Order*) (denying a title V petition claim, where petitioners did not cite any specific applicable requirement that lacked required monitoring). Specifically, the Petitioner has not identified any specific statutory or regulatory requirements applicable to trona or lime handling or ash handling emissions or that would have been applicable if emissions from those activities had been included in any of the PTE calculations. The Petitioner also fails to analyze or address the key elements related to the issue. *Pawnee Order* at 7–10; *Georgia Pacific Order* at 10–11, 13–14. For example, even assuming trona or lime handling or ash handling emissions generate PM emissions, the Petitioner provides no estimate of PM emissions that were omitted from consideration. In particular, while the Petitioner refers to PM emissions from a storage silo captured by a vent filter, it does not attempt to quantify PM emissions from any storage silo or other storage facility at the facility or explain how consideration of such emissions would have affected the determination of the regulatory requirements that apply to Hu Honua. Even assuming that such PM emissions were required to be included in Hu Honua’s PTE, the Petitioner does not demonstrate how such an omission in the Permit Review Summary would mean that the Proposed Permit is not in compliance with an applicable requirement under the CAA.

For the foregoing reasons, I deny the Petition as to this claim.

K. CLAIM 11: [HDOH] Failed to Address Ammonia Slip and Sulfuric Acid Mist Emissions

Petitioner’s Claim. The Petitioner alleges “neither the Application nor the Permit Review Summary or the Draft Permit mention the ammonia slip emissions that would be associated with the proposed Nalco ROTAMIX selective non-catalytic reduction system (SNCR) (or equivalent) or the sulfuric acid mist emissions associated with biomass firing.” Petition at 18. The Petitioner alleges these emissions “must be quantified, permit limits must be set, and enforceable permit conditions must be developed.” *Id.*

EPA’s Response. I deny the Petitioner’s request for an objection to the Proposed Permit on this claim.

Regarding the Petitioner’s claim that the “Application..., Permit Review Summary [and] the Draft Permit” do not address ammonia slip emissions, this issue is now moot as the Proposed and Final Permits do contain an ammonia slip limit for the urea injection system, as well as recordkeeping and performance testing requirements. *See* Proposed Permit and Final Permit, Section C.5 for ammonia slip emissions limit; Section E.11 for records of ammonia slip emissions; and Section G.2.i for ammonia slip performance testing.

Regarding sulfuric acid mist emissions, the Petitioner has not identified any requirement under the CAA that HDOH failed to address in the Proposed Permit. The Petitioner’s general assertion

is not sufficient to demonstrate that the Proposed Permit is not in compliance with the Act. See *MacClarence*, 596 F.3d at 1131; also see *Luminant Order* at 9; *BP Alaska Order* at 8; *Chevron Order* at 12, 24. The Petitioner has merely stated that conditions for sulfuric acid mist emissions from biomass firing must be added to the Proposed Permit, without providing any technical and legal basis for this claim, such as information concerning the amount of sulfuric acid mist emissions, the regulatory program under which sulfuric acid mist emissions must be addressed, or how the regulatory requirement applies to Hu Honua.

For the foregoing reasons, I deny the Petition as to this claim.

L. CLAIM 12: HDOH Failed to Directly Regulate and Evaluate the Impacts of PM_{2.5} Emissions

Petitioner's Claim. The Petitioner asserts HDOH “must directly assess and regulate PM_{2.5} emissions from [Hu Honua], even if it determines [Hu Honua] is not a major source of PM_{2.5} or any other pollutant.” Petition at 18-19, *citing* 45 C.S.R. §§13-2.20.b, 13.2-24.b, 13-8.3, 14-2.79, 14.21.1.b; 70 *Fed. Reg.* 65984 (July 18, 1997); 70 *Fed. Reg.* 66043 (November 1, 2005); 73 *Fed. Reg.* 28321, 28344 (May 16, 2008). The Petitioner notes that PM_{2.5} has significant public health impacts. Petition at 19-20. The Petitioner asserts that the Revised Draft Permit does not “directly regulate or evaluate emissions of PM_{2.5} from [Hu Honua],” a criteria air pollutant, as required by the CAA. Petition at 21. The Petitioner asserts HDOH “failed to quantify the amount of PM_{2.5} that would be emitted at the source,” and that the only mention of PM_{2.5} is in the Permit Review Summary, which proposes a BACT emission limit for PM_{2.5} of 0.025 lb/MMBtu. *Id.* The Petitioner states: “This purported ‘PM_{2.5} emission limit’ is rendered meaningless by the Draft Permit’s failure to specify those limits and require any PM_{2.5} monitoring.” *Id.* The Petitioner also asserts that there is “no analysis of whether the controls required for PM₁₀ also minimize PM_{2.5},” and “as a result, it is unclear whether the purported PM_{2.5} emission limits are achievable, and they certainly are not enforceable.” *Id.* Finally, the Petitioner asserts it is “unacceptable as a matter of law and not technically justified” to use PM₁₀ as a surrogate for PM_{2.5} because “PM_{2.5} and PM₁₀ are different pollutants that require different control measures.” *Id.*

EPA Response: I deny the Petitioner’s request for an objection to the Proposed Permit on this claim.

As a general matter, the Petitioner makes various statements about the health effects of PM_{2.5}, which do not represent a “claim” to which the EPA is responding. Petition at 19-20. Further, the Petitioner makes several statements regarding the NSR PM_{2.5} Implementation Rule. Petition at 18-19. The rule speaks for itself and those portions of the Petition also do not raise an “issue” regarding the permit to which the EPA is responding.

The EPA has looked at a number of criteria in determining whether the petitioner has demonstrated noncompliance with the Act. One factor the EPA has examined is whether the petitioner has provided the relevant analyses and citations to support its claims. If the petitioner does not, the EPA is left to work out the basis for petitioner’s objection, contrary to Congress’ express allocation of the burden of demonstration to the petitioner in CAA § 505(b)(2). See *MacClarence*, 596 F.3d at 1131 (“the Administrator’s requirement that [a title V petitioner]

support his allegations with legal reasoning, evidence, and references is reasonable and persuasive”); *Murphy Oil Order* at 12 (denying a title V petition claim, where petitioners did not cite any specific applicable requirement that lacked required monitoring). Here, the Petitioner does not identify any applicable requirement that would mandate regulation of PM_{2.5} emissions from Hu Honua if it is not a major source. Nor does the Petitioner identify any applicable requirement of the CAA that would require a “BACT PM_{2.5} emission limit” or PM_{2.5} emissions analysis. To the extent the Petitioner is attempting to claim that Hu Honua is a major stationary source on the basis of PM_{2.5} emissions such that PSD requirements should apply, the Petitioner has not provided any data or information demonstrating that Hu Honua’s PM_{2.5} emissions exceed major source thresholds. *See generally*, Petition at 18-22.

Additionally, to the extent that the Petitioner is attempting to claim that the PM₁₀ monitoring is inadequate to demonstrate compliance with emission limits, the Petitioner has not identified an applicable requirement for which the monitoring is inadequate. *Murphy Oil Order* at 12. The EPA also notes that HDOH revised the Final Permit to incorporate PM performance test requirements, in response to the EPA comments. *See* HDOH Response to the EPA Letter at 10. Specifically, the Final Permit at Sections G.2.e and G.3.e require the use of Method 5 for filterable PM, Method 202 for condensible PM and Method 201A for filterable PM₁₀.

Finally, the Petitioner cites to the EPA’s final NSR PM_{2.5} Implementation Rule, in which the EPA stated that states are obligated to address direct PM_{2.5} and precursor emissions from both major and minor sources, but the Petitioner does not tie this rule to any applicable requirement or SIP requirement in place at the time the Final Permit was issued. Petition at 18-19. Therefore, any purported duty to revise Hawaii’s SIP to address PM_{2.5} for minor sources is outside of the EPA’s review in this Title V Petition.

For the foregoing reasons, I deny the Petition as to this claim.

M. CLAIM 13: [HDOH] Failed to Adequately Respond to Significant Public Comments

Petitioner’s Claim. The Petitioner asserts that HDOH “had an obligation to adequately respond” to four “significant” comments that the Petitioner raised during the public comment periods and that are incorporated into the Petition as Claims 9-12. Petition at 22, *citing In the Matter of Wisconsin Public Service Corporation’s JP Pulliam Power Plant*, Order on Petition V-2009-01 at 5 (June 28, 2010) (*Pulliam Power Plant Order*). The Petitioner states: “In her comments on the Revised Draft Permit, Dr. Pless identified four significant issues raised in her initial comments that [HDOH] failed to provide a direct response to.” *Id.* The four specific issues are as follows: (1) “failure to include emission limits and monitoring for biomass handling, chipping, and storage operation as a source of particulate matter emissions;” (2) failure to include emission limits and monitoring for trona or lime and ash handling as a source of particulate matter emissions;” (3) “failure to include emission limits and monitoring for sulfuric acid mist emissions;” and (4) “failure to include emission limits and monitoring for [PM_{2.5}].” *Id.* The Petitioner contends that given HDOH’s “practice of iterative Permit revisions to address some public concerns,” the public has difficulty understanding “what comments are addressed in revisions and which are not.” Petition at 23. The Petitioner further contends that HDOH

“effectively wears out the opposition through their practice of serial, incremental [permit] revisions without a statement of basis or response to comments to explain the issues addressed, and those ignored, during the series of permit revisions that accompany [HDOH’s] review of controversial [permits].” *Id.* at 23.

EPA’s Response. I deny the Petitioner’s request for an objection to the Proposed Permit on this claim. Each of the four issues raised in Claim 13 was also raised substantively as part of this Petition and are responded to in Claims 9 through 12 of this Order.

In addition, the Petitioner appears to be asserting that HDOH’s failure to provide any response to these comments resulted in the Proposed Permit not being in compliance with the Act. However, the EPA notes that HDOH did provide a response to these four issues. *See* 2010 RTC at 21, 24, 29, and 27, respectively, concerning HDOH’s responses on issues 1, 2, 3, and 4 in Claim 13. Thus, to the extent that the Petitioner contends that HDOH provided no response to the four comments, and this failure to respond is itself an inadequate response, the claim is moot, as HDOH did provide a response to all four comments in its 2010 RTC.

The Petitioner also contends that HDOH has a practice of making “serial, incremental” revisions to covered source permits without providing a statement of basis or response to comments concerning the permit revisions. The EPA’s response to this point is focused on the Hu Honua title V permit. For Hu Honua, the following items were available as part of the record during the first public comment period on the Draft Permit, consistent with H.A.R. § 11-60.1 and 40 C.F.R. § 70.7(h): (1) the Permit Application; (2) the Draft Permit Review Summary; and (3) the Draft Permit. Likewise, during the second public comment period on the Revised Draft Permit, in addition to the documents already noted, the following items were available to the public as part of the record, consistent with H.A.R. § 11-60.1 and 40 C.F.R. § 70.7(h): (1) the Revised Permit Application; the Revised Draft Permit Review Summary; (3) the Top-Down BACT Analysis for the Biomass Boiler; and (4) the Revised Draft Permit. The EPA notes that the Revised Draft Permit Review Summary, as well as the Revised Permit Application, also included updated information in response to the four specific comments raised during the first public comment period.²⁸ Thus, while the processes may appear “iterative” – the permitting rules specifically provide for new public comment opportunities as appropriate. Thus, there is nothing inherently unlawful about this process. In this case, HDOH provided additional opportunities consistent with its authority under the applicable requirements.

As a general matter, a “response to comment” (RTC) document is not included during the public comment period because comments have not yet been received. The Petitioner does not point to any Hawaii or EPA rule that requires permitting authorities to distribute a RTC when providing a second comment period. In this instance, the EPA appreciates the numerous opportunities for public comment provided by HDOH on the various iterations of Hu Honua’s title V permit. As

²⁸ *See* Revised Draft Permit Review Summary at 5 (PM₁₀ emissions 33.6 tpy); Revised Permit Application at 3 (concerning PM emissions from trona or lime handling and ash handling). Also, concerning sulfuric acid mist emissions, the Revised Draft Permit Review Summary explained that SO₂ emissions from the biomass-fired boiler were based on a sulfur content of 15 ppm in the fuel for S15 biodiesel and 100% conversion of sulfur to SO₂. Revised Draft Permit Review Summary at 7. The Revised Permit Application also explained how SO₂ emissions were calculated. Revised Permit Application at 9.

HDOH stated in its 2011 RTC, the public participation opportunities provided were consistent with their own administrative rules and 40 C.F.R. Part 70. 2011 RTC at 37. HDOH also explained that it conducted a public hearing and extended the first comment period to 60 days, beyond the required 30 days, to accommodate community concerns. HDOH further explained that it limited the second public comment period to changes in the Revised Draft Permit, since the public already had sufficient time – 60 days versus the minimum 30 days – to provide comments on other matters during the first comment period on the Draft Permit. HDOH also noted that the second comment period extended beyond the required 30 days to 32 days for public participation. 2011 RTC at 37.

The EPA notes that we posted the Proposed Permit on our website on May 19, 2011, and that we posted the EPA Letter on our website on July 5, 2011. The Petitioner references the EPA Letter in the Petition. The EPA also notes that the 60-day petition period commenced on July 5, 2011, and ended on September 6, 2011.²⁹

The EPA realizes that completing the title V permitting process generally requires substantial state agency staff efforts. The EPA also notes that HDOH made substantive changes to the Draft, Revised Draft, Proposed, and Final Permits, each of which were intended, by HDOH, to be responsive to public comments on prior versions of the permit. Even the Petitioner acknowledged that the iterative versions of the permit were to address public concerns. Petition at 23. As a matter of “best practice,” the EPA recommends that, when appropriate and possible from a state or local agency resources standpoint, state or local agencies provide their responses to comments at the time that they provide notice of opportunity to comment on a revised draft permit. Additionally, the EPA recommends that permitting authorities carefully consider when it is appropriate to provide the public with another opportunity to comment on a revised draft permit. This practice assures that the public has an opportunity to meaningfully participate in the permitting process, including the opportunity to comment on each permit revision.

Furthermore, the EPA notes that providing the entire record for a Proposed Permit at the beginning of the EPA’s 45-day review³⁰ period serves to enhance the EPA’s review of the Proposed Permit by providing a fuller understanding of the permitting history and the state’s rationale for its permitting decisions. Where the entire record is available at the beginning of the 45-day review period, the EPA has the benefit of understanding the permitting history and the state’s rationale for its permitting decisions. Likewise, where the entire record is available at the beginning of the public’s 60-day window to submit petitions to the Administrator, the public has the benefit of understanding the permitting history and the state’s rationale for its permitting decisions. Providing the entire record before the start of the public’s 60-day petition period would allow the public to better assess any issues with the permit that they may have identified. Where a state agency provides a record containing an adequately articulated rationale for its

²⁹ While the EPA is not relying upon these facts as the basis for its decision, the EPA notes that the Proposed and Final Permits, as well as the RTCs on the Draft, Revised Draft, and Proposed Permits were made available to the public on August 31, 2011, 6 days before the end of the 60-day petition period. The Petitioner submitted its Petition on August 26, 2011, 11 days before the end of the 60-day petition period.

³⁰ The EPA notes that the EPA’s 45-day review period begins when the permitting authority has provided the EPA with “the proposed permit and all necessary supporting information.” See 40 C.F.R § 70.8(c).

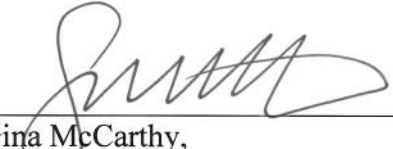
permitting actions, petitioners must demonstrate that such rationale is inadequate when petitioning the EPA to grant a claim. *See MacClarence*, 596 F.3d at 1132-33; *see also, e.g., In Noranda Order* at 20 (denying title V petition issue where petitioners did not respond to state's explanation in response to comments or explain why the state erred or the permit was deficient); *Kentucky Syngas Order* at 41 (denying title V petition issue where petitioners did not acknowledge or reply to state's response to comments or provide a particularized rationale for why the state erred or the permit was deficient).

For the foregoing reasons, I deny the Petition as to this claim.

V. CONCLUSION

For the reasons set forth above and pursuant to CAA § 505(b)(2) and 40 C.F.R. § 70.8(d), I hereby grant in part and deny in part the Petition requesting that the EPA object to the Hu Honua title V Proposed Permit.

Date: 2/7/14



Gina McCarthy,
Administrator

Monitor Values Report

Geographic Area: New Mexico

Pollutant: Ozone

Year: 2016

Exceptional Events: Excluded (if any)

First Max 8hr	Second Max 8hr	Third Max 8hr	Fourth Max 8hr	Days 8hr Max >STD	Required Days 8hr	Valid Days 8hr	Percent Days 8hr	First Max 1hr	Second Max 1hr	Days 1hr Max >STD	Est Days 1hr Max >STD	Required Days 1hr	Valid Days 1hr	Missing Days 1hr	Exc Events	Monitor Number	Site ID	Address	City	County	State	EPA Region
0.07	0.069	0.068	0.067	0	366	354	97	0.079	0.078	0	0	366	358	8	None	1	350010023	4700a San Mateo Ne	Albuquerque	Bernalillo	NM	06
0.066	0.066	0.063	0.063	0	366	341	93	0.073	0.07	0	0	366	345	5	None	1	350010029	201 Prosperity Se	South Valley	Bernalillo	NM	06
0.07	0.066	0.065	0.064	0	366	343	94	0.075	0.072	0	0	366	347	11	None	1	350011012	8901 Lowell Ne	Albuquerque	Bernalillo	NM	06
0.07	0.066	0.064	0.063	0	366	363	99	0.077	0.076	0	0	366	365	1	None	2	350130008	7048 Mcnutt, La Union, Nm	Not in a City	Dona Ana	NM	06
0.071	0.069	0.068	0.067	1	366	363	99	0.083	0.078	0	0	366	365	1	Excluded	1	350130020	680 Mccombs, Chaparral, Nm	Not in a City	Dona Ana	NM	06
0.079	0.071	0.07	0.07	2	366	364	99	0.09	0.089	0	0	366	366	0	None	1	350130021	5935a Valle Vista, Sunland Park, Nm	Not in a City	Dona Ana	NM	06
0.076	0.073	0.071	0.069	3	366	362	99	0.087	0.084	0	0	366	365	1	None	1	350130022	104-2 Santa Teresa International Blvd,Nm	Not in a City	Dona Ana	NM	06
0.066	0.065	0.065	0.064	0	366	356	97	0.074	0.07	0	0	366	357	3	None	1	350130023	750 N.Solano Drive, Las Cruces, Nm	Las Cruces	Dona Ana	NM	06
0.065	0.064	0.064	0.063	0	366	358	98	0.075	0.07	0	0	366	359	4	None	1	350151005	2811 Holland St,Carlsbad,Nm	Carlsbad	Eddy	NM	06
.	.	.	.	.	.	.	.	.	.	.	0	366	0	0	Excluded	1	350153001	Carlsbad Caverns National Park	Not in a City	Eddy	NM	06
0.069	0.066	0.065	0.065	0	366	355	97	0.072	0.072	0	0	366	360	2	None	1	350250008	2320 N. Jefferson St, Hobbs, New Mexico	Hobbs	Lea	NM	06
0.064	0.064	0.063	0.063	0	366	358	98	0.068	0.067	0	0	366	359	7	None	1	350390026	21 New Mexico 96, Coyote, Nm, 87012	Not in a City	Rio Arriba	NM	06
0.067	0.065	0.064	0.064	0	366	359	98	0.078	0.077	0	0	366	361	5	None	1	350431001	600 Oak Street, Bernalillo, Nm	Not in a City	Sandoval	NM	06

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Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: April 24, 2021

Monitor Values Report

Geographic Area: New Mexico

Pollutant: Ozone

Year: 2016

Exceptional Events: Excluded (if any)

First Max 8hr	Second Max 8hr	Third Max 8hr	Fourth Max 8hr	Days 8hr Max >STD	Required Days 8hr	Valid Days 8hr	Percent Days 8hr	First Max 1hr	Second Max 1hr	Days 1hr Max >STD	Est Days 1hr Max >STD	Required Days 1hr	Valid Days 1hr	Missing Days 1hr	Exc Events	Monitor Number	Site ID	Address	City	County	State	EPA Region
0.069	0.065	0.065	0.065	0	366	363	99	0.073	0.073	0	0	366	366	0	None	1	350450009	2200 N 1st Street, Bloomfield, Nm	Bloomfield	San Juan	NM	06
0.073	0.072	0.068	0.067	2	366	345	94	0.079	0.077	0	0	366	348	2	None	1	350450018	423 Hway 539, Navajo Dam, Nm 87419	Not in a City	San Juan	NM	06
0.063	0.063	0.063	0.062	0	366	365	100	0.071	0.07	0	0	366	366	0	None	1	350451005	Shiprock Electrical Substation, Waterflow, Nm	Not in a City	San Juan	NM	06
.	.	.	.	.	.	.	.	.	.	.	0	366	0	0	Excluded	1	350451233	Dine College, Gis Lab	Shiprock	San Juan	NM	06
0.067	0.065	0.064	0.064	0	366	363	99	0.072	0.068	0	0	366	362	4	None	1	350490021	2001 Aviation Drive, Santa Fe, Nm	Not in a City	Santa Fe	NM	06
0.069	0.067	0.066	0.065	0	366	359	98	0.074	0.071	0	0	366	362	4	None	1	350610008	1000 W. Main St, Los Lunas, Nm 87031	Not in a City	Valencia	NM	06

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Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: April 24, 2021

Monitor Values Report

Geographic Area: New Mexico

Pollutant: Ozone

Year: 2017

Exceptional Events: Excluded (if any)

First Max 8hr	Second Max 8hr	Third Max 8hr	Fourth Max 8hr	Days 8hr Max >STD	Required Days 8hr	Valid Days 8hr	Percent Days 8hr	First Max 1hr	Second Max 1hr	Days 1hr Max >STD	Est Days 1hr Max >STD	Required Days 1hr	Valid Days 1hr	Missing Days 1hr	Exc Events	Monitor Number	Site ID	Address	City	County	State	EPA Region
0.076	0.072	0.07	0.069	2	365	357	98	0.085	0.08	0	0	365	361	4	None	1	350010023	4700a San Mateo Ne	Albuquerque	Bernalillo	NM	06
0.069	0.067	0.066	0.066	0	365	357	98	0.075	0.074	0	0	365	361	4	None	1	350010029	201 Prosperity Se	South Valley	Bernalillo	NM	06
0.076	0.076	0.072	0.071	4	365	357	98	0.084	0.083	0	0	365	362	3	None	1	350011012	8901 Lowell Ne	Albuquerque	Bernalillo	NM	06
0.074	0.072	0.071	0.071	6	365	362	99	0.085	0.08	0	0	365	365	0	None	2	350130008	7048 Mcnutt, La Union, Nm	Not in a City	Dona Ana	NM	06
0.076	0.075	0.072	0.071	4	365	361	99	0.09	0.089	0	0	365	363	2	None	1	350130020	680 Mccombs, Chaparral, Nm	Not in a City	Dona Ana	NM	06
0.083	0.078	0.076	0.073	6	365	363	99	0.093	0.088	0	0	365	364	1	None	1	350130021	5935a Valle Vista, Sunland Park, Nm	Not in a City	Dona Ana	NM	06
0.086	0.078	0.078	0.077	19	365	361	99	0.093	0.089	0	0	365	361	4	None	1	350130022	104-2 Santa Teresa International Blvd,Nm	Not in a City	Dona Ana	NM	06
0.071	0.071	0.069	0.068	2	365	358	98	0.077	0.076	0	0	365	365	0	None	1	350130023	750 N.Solano Drive, Las Cruces, Nm	Las Cruces	Dona Ana	NM	06
0.082	0.078	0.077	0.076	10	365	362	99	0.094	0.091	0	0	365	363	2	None	1	350151005	2811 Holland St,Carlsbad,Nm	Carlsbad	Eddy	NM	06
.	.	.	.	.	.	.	.	.	.	.	0	365	0	0	Excluded	1	350153001	Carlsbad Caverns National Park	Not in a City	Eddy	NM	06
0.08	0.074	0.072	0.069	3	365	362	99	0.088	0.078	0	0	365	364	1	None	1	350250008	2320 N. Jefferson St, Hobbs, New Mexico	Hobbs	Lea	NM	06
0.072	0.071	0.071	0.07	3	365	357	98	0.077	0.077	0	0	365	358	4	None	1	350390026	21 New Mexico 96, Coyote, Nm, 87012	Not in a City	Rio Arriba	NM	06
0.072	0.069	0.068	0.067	1	365	361	99	0.078	0.078	0	0	365	361	4	None	1	350431001	600 Oak Street, Bernalillo, Nm	Not in a City	Sandoval	NM	06

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Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: April 22, 2021

Monitor Values Report

Geographic Area: New Mexico

Pollutant: Ozone

Year: 2017

Exceptional Events: Excluded (if any)

First Max 8hr	Second Max 8hr	Third Max 8hr	Fourth Max 8hr	Days 8hr Max >STD	Required Days 8hr	Valid Days 8hr	Percent Days 8hr	First Max 1hr	Second Max 1hr	Days 1hr Max >STD	Est Days 1hr Max >STD	Required Days 1hr	Valid Days 1hr	Missing Days 1hr	Exc Events	Monitor Number	Site ID	Address	City	County	State	EPA Region
0.073	0.073	0.068	0.068	2	365	359	98	0.079	0.077	0	0	365	359	2	None	1	350450009	2200 N 1st Street, Bloomfield, Nm	Bloomfield	San Juan	NM	06
0.08	0.076	0.072	0.069	3	365	329	90	0.086	0.08	0	0	365	335	0	None	1	350450018	423 Hway 539, Navajo Dam, Nm 87419	Not in a City	San Juan	NM	06
0.068	0.066	0.066	0.064	0	365	225	62	0.076	0.073	0	0	365	276	3	None	1	350450020	Chaco Culture National Historical Park - Radio Repeater	Not in a City	San Juan	NM	06
0.073	0.073	0.072	0.071	5	365	358	98	0.079	0.077	0	0	365	362	3	None	1	350451005	Shiprock Electrical Substation, Waterflow, Nm	Not in a City	San Juan	NM	06
.	.	.	.	.	.	.	.	.	.	.	0	365	0	0	Excluded	1	350451233	Dine College, Gis Lab	Shiprock	San Juan	NM	06
0.07	0.065	0.065	0.065	0	365	356	98	0.076	0.076	0	0	365	359	4	None	1	350490021	2001 Aviation Drive, Santa Fe, Nm	Not in a City	Santa Fe	NM	06
0.071	0.069	0.068	0.067	1	365	360	99	0.075	0.074	0	0	365	359	6	None	1	350610008	1000 W. Main St, Los Lunas, Nm 87031	Not in a City	Valencia	NM	06

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Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: April 22, 2021

Monitor Values Report

Geographic Area: New Mexico

Pollutant: Ozone

Year: 2018

Exceptional Events: Excluded (if any)

First Max 8hr	Second Max 8hr	Third Max 8hr	Fourth Max 8hr	Days 8hr Max >STD	Required Days 8hr	Valid Days 8hr	Percent Days 8hr	First Max 1hr	Second Max 1hr	Days 1hr Max >STD	Est Days 1hr Max >STD	Required Days 1hr	Valid Days 1hr	Missing Days 1hr	Exc Events	Monitor Number	Site ID	Address	City	County	State	EPA Region
0.076	0.075	0.075	0.075	14	365	355	97	0.084	0.084	0	0	365	356	4	None	1	350010023	4700a San Mateo Ne	Albuquerque	Bernalillo	NM	06
0.07	0.07	0.069	0.069	0	365	354	97	0.078	0.076	0	0	365	355	7	None	1	350010029	201 Prosperity Se	South Valley	Bernalillo	NM	06
0.077	0.075	0.075	0.073	10	365	362	99	0.084	0.082	0	0	365	363	2	None	1	350011012	8901 Lowell Ne	Albuquerque	Bernalillo	NM	06
0.079	0.075	0.074	0.072	5	365	363	99	0.093	0.091	0	0	365	364	1	None	2	350130008	7048 Mcnutt, La Union, Nm	Not in a City	Dona Ana	NM	06
0.079	0.076	0.076	0.076	9	365	361	99	0.094	0.087	0	0	365	364	1	None	1	350130020	680 Mccombs, Chaparral, Nm	Not in a City	Dona Ana	NM	06
0.087	0.082	0.081	0.081	17	365	358	98	0.103	0.101	0	0	365	362	3	None	1	350130021	5935a Valle Vista, Sunland Park, Nm	Not in a City	Dona Ana	NM	06
0.082	0.079	0.078	0.076	18	365	348	95	0.091	0.09	0	0	365	351	2	None	1	350130022	104-2 Santa Teresa International Blvd,Nm	Not in a City	Dona Ana	NM	06
0.077	0.074	0.073	0.071	4	365	361	99	0.08	0.079	0	0	365	364	1	None	1	350130023	750 N.Solano Drive, Las Cruces, Nm	Las Cruces	Dona Ana	NM	06
0.096	0.095	0.091	0.083	18	365	363	99	0.128	0.104	1	1	365	363	1	None	1	350151005	2811 Holland St,Carlsbad,Nm	Carlsbad	Eddy	NM	06
0.083	0.078	0.077	0.076	6	365	359	98	0.096	0.086	0	0	365	362	3	None	1	350250008	2320 N. Jefferson St, Hobbs, New Mexico	Hobbs	Lea	NM	06
0.078	0.075	0.074	0.07	3	365	356	98	0.085	0.079	0	0	365	358	5	None	1	350390026	21 New Mexico 96, Coyote, Nm, 87012	Not in a City	Rio Arriba	NM	06
0.076	0.075	0.073	0.073	12	365	351	96	0.084	0.083	0	0	365	353	7	None	1	350431001	600 Oak Street, Bernalillo, Nm	Not in a City	Sandoval	NM	06
0.077	0.076	0.074	0.074	5	365	362	99	0.084	0.083	0	0	365	364	1	None	1	350450009	2200 N 1st Street, Bloomfield, Nm	Bloomfield	San Juan	NM	06

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Generated: April 22, 2021

Monitor Values Report

Geographic Area: New Mexico

Pollutant: Ozone

Year: 2018

Exceptional Events: Excluded (if any)

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0.077	0.076	0.076	0.074	8	365	354	97	0.083	0.081	0	0	365	357	1	None	1	350450018	423 Hway 539, Navajo Dam, Nm 87419	Not in a City	San Juan	NM	06
0.071	0.071	0.069	0.068	2	365	333	91	0.081	0.075	0	0	365	343	10	None	1	350450020	Chaco Culture National Historical Park - Radio Repeater	Not in a City	San Juan	NM	06
0.079	0.078	0.075	0.074	14	365	355	97	0.085	0.085	0	0	365	356	4	None	1	350451005	Shiprock Electrical Substation, Waterflow, Nm	Not in a City	San Juan	NM	06
.	.	.	.	.	.	.	.	.	.	.	0	365	0	0	Excluded	1	350451233	Dine College, Gis Lab	Shiprock	San Juan	NM	06
0.077	0.074	0.071	0.069	3	365	351	96	0.08	0.078	0	0	365	353	12	None	1	350490021	2001 Aviation Drive, Santa Fe, Nm	Not in a City	Santa Fe	NM	06
0.073	0.072	0.071	0.071	5	365	357	98	0.078	0.077	0	0	365	357	5	None	1	350610008	1000 W. Main St, Los Lunas, Nm 87031	Not in a City	Valencia	NM	06

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Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: April 22, 2021

Monitor Values Report

Geographic Area: New Mexico

Pollutant: Ozone

Year: 2019

Exceptional Events: Excluded (if any)

First Max 8hr	Second Max 8hr	Third Max 8hr	Fourth Max 8hr	Days 8hr Max >STD	Required Days 8hr	Valid Days 8hr	Percent Days 8hr	First Max 1hr	Second Max 1hr	Days 1hr Max >STD	Est Days 1hr Max >STD	Required Days 1hr	Valid Days 1hr	Missing Days 1hr	Exc Events	Monitor Number	Site ID	Address	City	County	State	EPA Region
0.073	0.069	0.068	0.068	1	365	356	98	0.092	0.082	0	0	365	354	7	None	1	350010023	4700a San Mateo Ne	Albuquerque	Bernalillo	NM	06
0.072	0.067	0.066	0.066	1	365	347	95	0.084	0.082	0	0	365	350	7	None	1	350010029	201 Prosperity Se	South Valley	Bernalillo	NM	06
0.073	0.073	0.071	0.069	3	365	354	97	0.093	0.079	0	0	365	357	6	None	1	350011012	8901 Lowell Ne	Albuquerque	Bernalillo	NM	06
0.081	0.075	0.07	0.068	2	365	360	99	0.089	0.084	0	0	365	361	4	None	2	350130008	7048 Mcnutt, La Union, Nm	Not in a City	Dona Ana	NM	06
0.078	0.074	0.073	0.072	6	365	337	92	0.089	0.085	0	0	365	338	6	None	1	350130020	680 Mccombs, Chaparral, Nm	Not in a City	Dona Ana	NM	06
0.09	0.082	0.079	0.077	8	365	352	96	0.096	0.089	0	0	365	354	4	None	1	350130021	5935a Valle Vista, Sunland Park, Nm	Not in a City	Dona Ana	NM	06
0.091	0.079	0.078	0.075	8	365	350	96	0.094	0.087	0	0	365	352	4	None	1	350130022	104-2 Santa Teresa International Blvd,Nm	Not in a City	Dona Ana	NM	06
0.081	0.073	0.073	0.073	8	365	359	98	0.088	0.083	0	0	365	361	2	None	1	350130023	750 N.Solano Drive, Las Cruces, Nm	Las Cruces	Dona Ana	NM	06
0.082	0.08	0.078	0.074	6	365	166	45	0.087	0.084	0	0	365	167	0	None	1	350150010	727 Carlsbad Caverns Highway	Not in a City	Eddy	NM	06
0.095	0.092	0.084	0.08	19	365	359	98	0.114	0.103	0	0	365	361	4	None	1	350151005	2811 Holland St,Carlsbad,Nm	Carlsbad	Eddy	NM	06
0.082	0.075	0.073	0.07	3	365	360	99	0.096	0.083	0	0	365	364	1	None	1	350250008	2320 N. Jefferson St, Hobbs, New Mexico	Hobbs	Lea	NM	06
0.067	0.066	0.061	0.061	0	365	352	96	0.074	0.073	0	0	365	354	2	None	1	350390026	21 New Mexico 96, Coyote, Nm, 87012	Not in a City	Rio Arriba	NM	06
0.069	0.066	0.066	0.065	0	365	355	97	0.077	0.075	0	0	365	358	2	None	1	350431001	600 Oak Street, Bernalillo, Nm	Not in a City	Sandoval	NM	06

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Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: April 22, 2021

Monitor Values Report

Geographic Area: New Mexico

Pollutant: Ozone

Year: 2019

Exceptional Events: Excluded (if any)

First Max 8hr	Second Max 8hr	Third Max 8hr	Fourth Max 8hr	Days 8hr Max >STD	Required Days 8hr	Valid Days 8hr	Percent Days 8hr	First Max 1hr	Second Max 1hr	Days 1hr Max >STD	Est Days 1hr Max >STD	Required Days 1hr	Valid Days 1hr	Missing Days 1hr	Exc Events	Monitor Number	Site ID	Address	City	County	State	EPA Region
0.064	0.062	0.062	0.062	0	365	354	97	0.069	0.068	0	0	365	355	6	None	1	350450009	2200 N 1st Street, Bloomfield, Nm	Bloomfield	San Juan	NM	06
0.067	0.066	0.065	0.064	0	365	347	95	0.071	0.071	0	0	365	349	3	None	1	350450018	423 Hway 539, Navajo Dam, Nm 87419	Not in a City	San Juan	NM	06
0.065	0.065	0.065	0.065	0	365	346	95	0.069	0.069	0	0	365	349	3	None	1	350450020	Chaco Culture National Historical Park - Radio Repeater	Not in a City	San Juan	NM	06
0.067	0.067	0.064	0.064	0	365	343	94	0.071	0.071	0	0	365	345	7	None	1	350451005	Shiprock Electrical Substation, Waterflow, Nm	Not in a City	San Juan	NM	06
.	.	.	.	.	.	.	.	.	.	.	0	365	0	0	Excluded	1	350451233	Dine College, Gis Lab	Shiprock	San Juan	NM	06
0.071	0.066	0.066	0.066	1	365	352	96	0.078	0.077	0	0	365	353	6	None	1	350490021	2001 Aviation Drive, Santa Fe, Nm	Not in a City	Santa Fe	NM	06
0.068	0.068	0.068	0.066	0	365	352	96	0.079	0.079	0	0	365	359	3	None	1	350610008	1000 W. Main St, Los Lunas, Nm 87031	Not in a City	Valencia	NM	06

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Generated: April 22, 2021

Monitor Values Report

Geographic Area: New Mexico

Pollutant: Ozone

Year: 2020

Exceptional Events: Excluded (if any)

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0.074	0.069	0.068	0.068	1	366	357	98	0.083	0.074	0	0	366	358	6	None	1	350010023	4700a San Mateo Ne	Albuquerque	Bernalillo	NM	06
0.071	0.068	0.068	0.066	1	366	359	98	0.075	0.071	0	0	366	362	4	None	1	350010029	201 Prosperity Se	South Valley	Bernalillo	NM	06
0.076	0.072	0.072	0.071	5	366	356	97	0.083	0.077	0	0	366	360	2	None	1	350011012	8901 Lowell Ne	Albuquerque	Bernalillo	NM	06
0.077	0.077	0.072	0.071	4	366	355	97	0.094	0.083	0	0	366	356	8	None	2	350130008	7048 Mcnutt, La Union, Nm	Not in a City	Dona Ana	NM	06
0.075	0.073	0.071	0.068	3	366	358	98	0.089	0.084	0	0	366	360	4	None	1	350130020	680 Mccombs, Chaparral, Nm	Not in a City	Dona Ana	NM	06
0.088	0.082	0.08	0.077	13	366	359	98	0.107	0.099	0	0	366	361	5	None	1	350130021	5935a Valle Vista, Sunland Park, Nm	Not in a City	Dona Ana	NM	06
0.08	0.075	0.074	0.072	7	366	357	98	0.097	0.081	0	0	366	360	6	None	1	350130022	104-2 Santa Teresa International Blvd,Nm	Not in a City	Dona Ana	NM	06
0.071	0.07	0.067	0.067	1	366	359	98	0.079	0.075	0	0	366	361	3	None	1	350130023	750 N.Solano Drive, Las Cruces, Nm	Las Cruces	Dona Ana	NM	06
0.074	0.074	0.073	0.072	9	366	358	98	0.083	0.083	0	0	366	358	1	None	1	350150010	727 Carlsbad Caverns Highway	Not in a City	Eddy	NM	06
0.075	0.075	0.075	0.073	5	366	320	87	0.088	0.087	0	0	366	327	1	None	1	350151005	2811 Holland St,Carlsbad,Nm	Carlsbad	Eddy	NM	06
0.062	0.06	0.06	0.06	0	366	355	97	0.067	0.066	0	0	366	363	3	None	1	350250008	2320 N. Jefferson St, Hobbs, New Mexico	Hobbs	Lea	NM	06
0.067	0.065	0.065	0.064	0	366	358	98	0.076	0.071	0	0	366	361	5	None	1	350390026	21 New Mexico 96, Coyote, Nm, 87012	Not in a City	Rio Arriba	NM	06
0.076	0.075	0.074	0.074	5	366	352	96	0.082	0.081	0	0	366	358	5	None	1	350431001	600 Oak Street, Bernalillo, Nm	Not in a City	Sandoval	NM	06

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Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: April 23, 2021

Monitor Values Report

Geographic Area: New Mexico

Pollutant: Ozone

Year: 2020

Exceptional Events: Excluded (if any)

First Max 8hr	Second Max 8hr	Third Max 8hr	Fourth Max 8hr	Days 8hr Max >STD	Required Days 8hr	Valid Days 8hr	Percent Days 8hr	First Max 1hr	Second Max 1hr	Days 1hr Max >STD	Est Days 1hr Max >STD	Required Days 1hr	Valid Days 1hr	Missing Days 1hr	Exc Events	Monitor Number	Site ID	Address	City	County	State	EPA Region
0.069	0.068	0.064	0.063	0	366	361	99	0.073	0.072	0	0	366	361	5	None	1	350450009	2200 N 1st Street, Bloomfield, Nm	Bloomfield	San Juan	NM	06
0.072	0.072	0.071	0.068	3	366	356	97	0.076	0.076	0	0	366	360	6	None	1	350450018	423 Hway 539, Navajo Dam, Nm 87419	Not in a City	San Juan	NM	06
0.069	0.068	0.068	0.068	0	366	331	90	0.081	0.076	0	0	366	330	3	None	1	350450020	Chaco Culture National Historical Park - Radio Repeater	Not in a City	San Juan	NM	06
0.073	0.073	0.071	0.069	3	366	350	96	0.076	0.076	0	0	366	356	6	None	1	350451005	Shiprock Electrical Substation, Waterflow, Nm	Not in a City	San Juan	NM	06
.	.	.	.	.	.	.	.	.	.	.	0	366	0	0	Excluded	1	350451233	Dine College, Gis Lab	Shiprock	San Juan	NM	06
0.071	0.07	0.07	0.069	1	366	354	97	0.077	0.075	0	0	366	357	7	None	1	350490021	2001 Aviation Drive, Santa Fe, Nm	Not in a City	Santa Fe	NM	06
0.072	0.071	0.07	0.07	2	366	353	96	0.078	0.075	0	0	366	359	1	None	1	350610008	1000 W. Main St, Los Lunas, Nm 87031	Not in a City	Valencia	NM	06

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Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

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Article

Making the Environmental Justice Grade: The Relative Burden of Air Pollution Exposure in the United States

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Abstract: This paper assesses whether the Clean Air Act and its Amendments have been equally successful in ensuring the right to healthful air quality in both advantaged and disadvantaged communities in the United States. Using a method to rank air quality established by the American Lung Association in its 2009 State of the Air report along with EPA air quality data, we assess the environmental justice dimensions of air pollution exposure and access to air quality information in the United States. We focus on the race, age, and poverty demographics of communities with differing levels of ozone and particulate matter exposure, as well as communities with and without air quality information. Focusing on PM_{2.5} and ozone, we find that within areas covered by the monitoring networks, non-Hispanic blacks are consistently overrepresented in communities with the poorest air quality. The results for older and younger age as well as poverty vary by the pollution metric under consideration. Rural areas are typically outside the bounds of air quality monitoring networks leaving large segments of the population without information about their ambient air quality. These results suggest that substantial areas of the United States lack monitoring data, and among areas where monitoring data are available, low income and minority communities tend to experience higher ambient pollution levels.

Keywords: environmental justice; air pollution; ozone; particulate matter

1. Introduction

The Clean Air Act of 1970, as amended in 1990, gives the United States Environmental Protection Agency (EPA) the mandate to regulate air pollutant emissions. Under the Clean Air Act, the EPA is required to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment within an “adequate margin of safety” [1]. In response to this mandate, the EPA has established NAAQS for six major pollutants, most commonly called the “criteria air pollutants,” including particulate matter (PM₁₀ and PM_{2.5}) and ozone. In setting NAAQS, the EPA explicitly considers sensitive subpopulations [1]. Because the Clean Air Act establishes an expectation of clean air everywhere through nationally uniform standards, it essentially establishes clean air as a right of all people of the United States. This paper explores whether differential potential exposure to ozone and particulate matter exist between advantaged and disadvantaged populations.

Significant research has been directed toward understanding the potential health effects of air pollution. After major improvements in air quality in the 1970s and 1980s, research now focuses on the impacts of lower level chronic exposure to various pollutants, including fine particulate matter (PM_{2.5}) and ozone [2]. Fine particles penetrate deeply into the respiratory system and may have other toxic substances (lead, sulfates, and various metals) adsorbed to their surface [2]. Even at levels lower than the current NAAQS, particulate matter and ozone are linked to mortality and hospital visits [3,4], commonly through their impact on respiratory and cardiovascular disease [2,5]. In addition, exposure to particulate matter and ozone has been linked to poor birth outcomes [6–9].

To assess whether geographic areas are in compliance with the NAAQS, a network of air pollution monitors that measure ambient levels of each of the criteria pollutants has been established across the United States. The number of monitors in a given location typically reflects the population density of the area with a minimum number of monitors prescribed by regulation. For ozone, a minimum of two monitors are required for areas with a population greater than 200,000. If an area has an ozone nonattainment designation of serious, severe, or extreme, up to five monitors are required [10]. For PM_{2.5}, the number of required monitors ranges from 1 in metropolitan statistical areas (MSAs) with populations greater than 200,000, to 10 in MSAs with populations greater than 8 million [11]. The monitoring network used for ozone is separate from and uses different equipment than the monitoring network for particulate matter.

The principal objective of the monitoring network is to measure ambient concentrations of various pollutants where people live, work, and play. Ozone monitors are placed to measure the ozone concentration where the highest population density might be exposed to a significant ozone concentration and in areas with maximum downwind concentration [10]. For compliance with the annual PM_{2.5} standard, monitors are located at sites that represent exposure on an urban or community scale, while sites representing maximum exposure are selected for evaluation against the short-term 24-hour standard [11].

The American Lung Association (ALA) issues an annual report entitled “The State of the Air,” which uses data from the U.S. EPA’s Air Quality System (AQS) to characterize the ozone and PM_{2.5} concentrations at each monitoring site across the United States [12]. These two pollutant are especially relevant for evaluating human health impacts, as they have been linked to adverse health outcomes, even at low concentration levels [2,6]. The ALA describes trends in the number of sites where air quality has either improved or worsened over the past year and lists America’s “cleanest” and “dirtiest” cities with respect to air quality.

This paper uses the air quality ranking approach established by the ALA in its 2009 State of the Air report along with EPA air quality data to assess the environmental justice (EJ) dimensions of air pollution exposure in the United States. The EPA defines environmental justice as:

“the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA has this goal for all communities and persons across this Nation [13].”

Racial and economic disparity in environmental quality have long been recognized in the United States. The environmental justice movement arose from community concern that toxic waste sites were disproportionately located in poor and minority communities, as described by Robert Bullard in his early work, including “Dumping in Dixie” [14]. A 1987 report by the United Church of Christ Commission for Racial Justice, “Toxic Wastes and Race in the United States” catalyzed national attention when it documented that hazardous waste facilities were sited disproportionately in communities of color [15]. This report was updated in 2007 to use 2000 Census data and more sophisticated spatial analytical techniques, and found that disparities in the location of hazardous waste sites has persisted [16].

Research on environmental justice and equity has investigated whether certain groups have higher exposure to pollution, lower overall environmental quality and amenities, and abnormally high rates of environmentally-driven disease compared to other racial, ethnic, or socioeconomic groups. These studies have been conducted on a variety of pollutants and pollution sources including air pollution, Superfund sites, and manufacturing facilities [17–20]. These analyses have generally demonstrated a correlation with both income and race though there is much variation across regions and amongst these variables that is not well explained [19,21]. Spatially-based approaches are powerful ways to characterize environmental inequity [22,23].

In this paper, we focus on the EJ implications of poor air quality and of monitoring network design by analyzing the race, ethnicity, age, and poverty demographics of communities with differing levels of ozone and particulate matter exposure. The objectives of this paper are to:

- Determine whether counties with sufficient AQS monitoring data are different on key demographic variables compared to those without AQS monitors or with insufficient data (this speaks to the location of the AQS monitors).
- Use the ALA methodology for rating air quality to conduct a national county-level analysis assessing the association between air quality and race, ethnicity, age, and poverty rates.
- Use a buffer analysis to develop a highly resolved geographic analysis of the EJ implications of air quality in the United States.

We are particularly interested in how the implementation of the Clean Air Act and its Amendments has shaped air quality in both advantaged and disadvantaged communities in the United States.

2. Experimental Section

2.1. Air Quality Monitoring Data

We queried the AQS Data Mart [24] for daily 8-hr maximum concentrations of ozone at each monitoring site in the United States in 2005, 2006, and 2007. Consistent with the methodology employed by the ALA, only measurements during the EPA-defined ozone season and only 8-hr ozone concentrations that were based on 6–8 hours of hourly measurements were included in the analysis. The ozone season is designated by EPA on a state-by-state basis, reflecting different seasons of hot weather. Most states in the contiguous United States have an April to September–October ozone season [25].

Daily 24-hour averaged $PM_{2.5}$ concentrations collected using EPA approved reference and equivalent methods during the 2005–2007 period at each monitoring site were also obtained from the AQS database [26]. Annual $PM_{2.5}$ data for 2005–2007 were downloaded as EPA-summarized, annual design values at the county-level [27].

2.2. From Monitoring Data to Air Quality Metrics

We reproduced the ranking methodology for ozone and daily $PM_{2.5}$ previously described in detail in the ALA State of the Air 2009 report [12]. We specifically chose to use the ALA approach because it is highly-regarded and widely cited. The annual report presents a practical and transparent way to condense and present thousands of data points in a manner that is understandable and familiar to the general public and to policymakers. The ALA assigns grades separately for both ozone levels and daily $PM_{2.5}$ levels ranging from “A” to “F” to each county in the United States (where sufficient monitoring data are available for each pollutant). These grades are based on the weighted average of the number of days on which at least one monitor in a county reported a pollution level reaching an air quality designation of orange (unhealthy for sensitive populations, weighting factor = 1), red (unhealthy, weighting factor = 1.5), purple (very unhealthy, weighting factor = 2), or maroon (hazardous, weighting factor = 2.5) [12]. The ALA uses the county-level weighted average number of poor air quality days to assign a letter grade to each county based on the severity of air pollution. This grading was done separately for ozone and daily $PM_{2.5}$ both because the two pollutants are measured by different monitors which may or may not be placed in the same counties, but also because they represent different reasons for concern. Our methodology differed from that of the ALA in that we did not use the letter grade categorization, but instead used the weighted average of the number of days with poor air quality as a direct metric of air quality. In addition to the county-level analysis, we used the same approach to calculate weighted average number of poor air quality days for each individual ozone and daily $PM_{2.5}$ monitor, allowing us to do sub-county analysis.

In addition to metrics based on daily ozone and $PM_{2.5}$ data, attainment of the year-round particulate pollution (annual $PM_{2.5}$) NAAQS is accessed using “design values” that are calculated by EPA. A design value is defined by EPA as a statistic, based on multiple years of monitoring data which

describes the air quality status of a given area relative to the level of the NAAQS [28]. In our analysis, we used the 2005–2007 annual PM_{2.5} design values to rank county-level air quality. Since annual PM_{2.5} design values are available only at the county-level, individual monitoring sites could not be ranked for annual PM_{2.5}. Note that the daily ozone and PM_{2.5} metrics provide measures of short term peak exposures, and the annual PM_{2.5} design value metric provides a measure of long term exposure.

We used three air quality metrics—weighted averages of the number of poor air quality days for (1) daily ozone, (2) daily PM_{2.5}, and (3) design values for annual PM_{2.5}—to rank order all counties with sufficient air quality monitoring data. This allowed us to identify the 20% of counties with the best air quality and the 20% of counties with the worst air quality for each pollution metric. (We note that other comparisons are certainly available and relevant; we chose the top/bottom 20% because it allows us to compare extremes while maintaining a sufficiently large sample size—and is also a familiar metric comparison to the general public.) We first determined the best 20% and worst 20% of counties nationally and then did the same for each of the individual 10 EPA regions. Then, for ozone and daily PM_{2.5}, we ranked individual monitoring sites based on the weighted averages of the number of poor air quality days to identify the 20% of monitoring sites with the best and worst air quality. The monitor-level rankings were only done at the national level.

2.3. Demographic Data

Demographic and socioeconomic data were obtained from the 2000 U.S. Census. County and block group level data on age, race, ethnicity, and poverty status were extracted from the Summary Tape File 3 database [29]. Using standard variable definitions from the U.S. Census, we identified percent under 5 years of age, percent 65 years of age and older, percent non-Hispanic black (NHB), percent Hispanic, and percent in poverty as key metrics of environmental justice. While many other demographic variables have been considered in the literature (e.g., percent female-headed households [19]), our selected variables are highly correlated with those of other studies. Recognizing that 2000 Census data may now be outdated and not fully reflect the current composition of communities, we explored using the U.S. Census 2005–2007 American Community Survey (ACS) estimates of key demographic and socioeconomic measures. Although the ACS estimates temporally correspond with the air quality data used in this analysis, ACS data is currently limited to geographic areas with at least 20,000 people [30]. Given the limitations of the ACS, we believe that the advantages of using the Census 2000 data, including the ability to use more geographically refined data and the inclusion of geographic areas with fewer than 20,000 people, outweighed the issue of using older demographic and socioeconomic data in this case. The Census 2000 data will still highlight any systematic differences in the populations affected by different levels of air pollution, and once the 2010 U.S. Census data are available, we plan to run the analyses presented here with updated air quality and demographic data.

2.4. Statistical Analysis

For counties without air quality monitoring data, or less than three years of monitoring data in the 2005–2007 study period, we could not calculate the air quality metrics. In order to determine if there were differences between communities with access to information about their air quality and those lacking such access or information, we compared the Census 2000 county-level rates of key

demographic and socioeconomic indicators for counties with and without monitoring data using population-weighted univariate t-tests. The demographic composition of the communities in monitored *versus* unmonitored counties was compared at both the national and EPA regional level. Because ozone and PM_{2.5} have separate monitoring networks and the data requirements differ between the ALA weighted average number of poor air quality days for short-term PM_{2.5} metric and the EPA-calculated annual design values, the demographic comparisons constitute three separate analyses.

Among those counties with monitoring data in all three years, we compared the communities in the 20% of counties with the best air quality to communities in the 20% of counties with the worst air quality. In order to determine if there were demographic differences between communities with the best and worst air quality, we compared the Census 2000 county-level rates of key demographic and socioeconomic indicators using population-weighted univariate t-tests and multivariate logistic regression controlling for county population. The demographic composition of the communities in best *versus* worst counties was compared across the entire United States and within each EPA region. Because ozone, daily PM_{2.5}, and annual PM_{2.5} all have separate monitoring networks, the demographic comparisons constitute three separate analyses.

In addition to county-level analysis, we conducted a more spatially-refined buffer analysis. For monitoring sites active each year from 2005–2007, a site-level weighted average of poor air quality days was calculated for ozone and daily PM_{2.5} per ALA methodology. Site-specific data were not available for annual PM_{2.5}, so this air quality metric could not be included in this aspect of the analysis. Monitoring sites were georeferenced using latitude and longitude coordinates provided with the AQS data and a 5 km buffer was constructed around each site. A 5 km buffer was selected to represent a neighborhood scale assessment consistent with dispersion characteristics of PM and ozone. Of note, we constructed 10 and 15 kilometer buffers and obtained similar results. Using the 50% areal containment method [31], in which a geographic unit is considered fully within the buffer zone if at least 50% of the unit's area is captured by the buffer, we identified those Census 2000 block groups within the buffer zone of monitoring sites ranked as being among the 20% of sites with the best or worst air quality. Multiple methods for constructing buffers (e.g., buffer and clip, Census areal unit centroids [32]) exist with no demonstrated superiority of any one method. Similar to the above analysis, population-weighted univariate t-tests and multivariate logistic regression controlling for population within the buffer were used to determine if the rates of the selected demographic and socioeconomic indicators differed between communities around monitoring sites with the best and worst air quality across the United States.

In summary, in all counties in the U.S. as a whole and disaggregated by EPA region, we compared the demographics of monitored *versus* unmonitored counties. In addition, among counties with monitoring data, we compared the demographics of the best and worst air quality counties. To explore the potential importance of geographic scale, we also created buffers around the best and worst monitors (in terms of air quality) across the United States and then compared the demographics within the buffers.

All statistical analysis was undertaken in SAS 9.2 (SAS Institute, Cary, NC, USA). Statistical tests were conducted with an α of 0.05. Since we conducted a large number of weighted t-tests within each set of analyses, we controlled for multiple comparisons by applying Bonferroni's correction within each set of analyses (*i.e.*, county-level national and regional monitored *versus* unmonitored analysis,

county-level national and regional cleanest *versus* dirtiest, and buffer-level national cleanest *versus* dirtiest).

3. Results and Discussion

3.1. Demographic Differences in Communities with and without Air Quality Data

Air pollution metrics were calculated for each county with sufficient monitoring data for ozone, daily $PM_{2.5}$, and annual $PM_{2.5}$ based on the methodology established by the ALA in the 2009 State of the Air report. For ozone and daily $PM_{2.5}$, counties with monitoring data for a particular pollutant in 2005, 2006, and 2007 had sufficient data to apply the ALA methodology, while counties without monitors or with data missing for any or all of the 3 years did not have sufficient monitoring data. For annual $PM_{2.5}$, counties without monitors or without enough monitoring values in each year 2005–2007 for the EPA to calculate a design value were considered not to have sufficient monitoring data. The maps in Figure 1 show the geographic distribution of counties with and without sufficient monitoring data to calculate air pollution metrics. The demographic characteristics of counties with sufficient air quality monitoring data were compared to counties with insufficient or no air quality monitoring data. Table 1 presents the results of this analysis in all counties in the U.S. as a whole and disaggregated by EPA region. In this analysis, U.S. territories were excluded, thus adjusting the geographic coverage of Region 2 (excluded Puerto Rico and the U.S. Virgin Islands) and Region 9 (excluded Guam, Trust Territories, American Samoa, and the Northern Mariana Islands).

Figure 1. County with and without sufficient air quality monitoring in 2005, 2006, and 2007 to calculate each air quality metric.

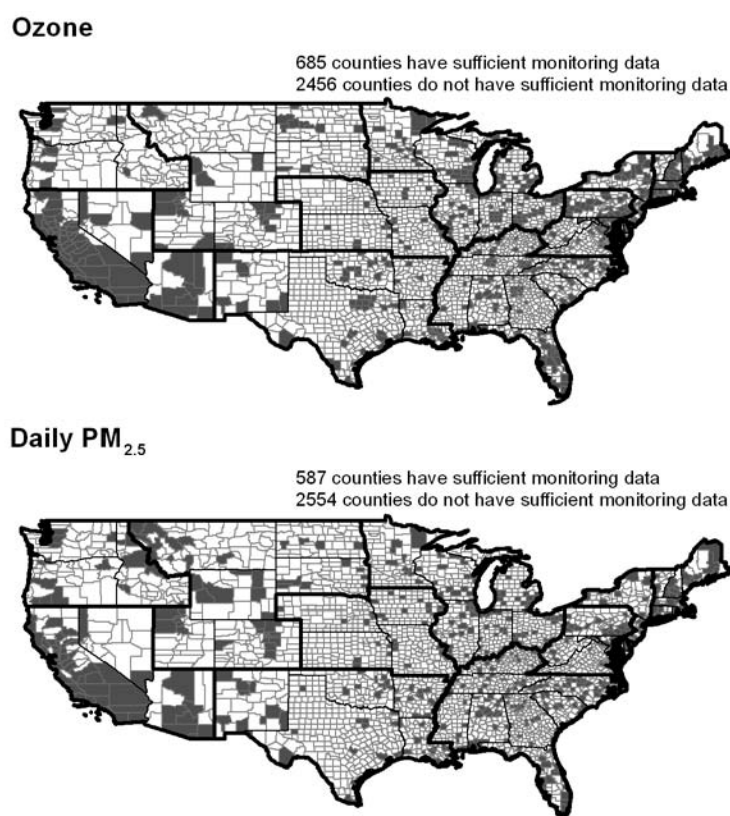


Figure 1. Cont.

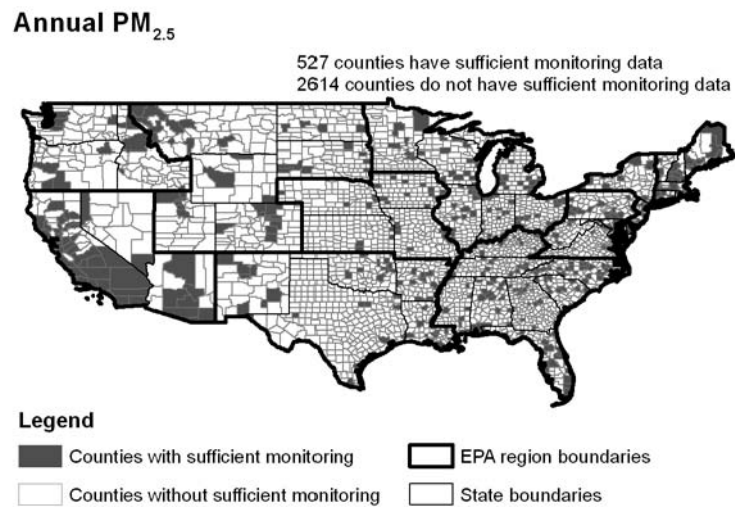


Table 1. Mean demographic composition of U.S. counties with and without sufficient monitoring data to receive an ALA air quality grade.

Demographic	EPA region	<u>Annual PM_{2.5}</u> (design value)			<u>Daily PM_{2.5}</u>			<u>Ozone</u>	
		Suff	Insuff		Suff	Insuff		Suff	Insuff
		monitoring	monitoring		monitoring	monitoring		monitoring	monitoring
% non-Hispanic	US	13.7	9.0	*	13.6	8.2	*	12.2	11.4
Black	1	6.0	2.1		5.6	1.7		5.2	1.8
	2	17.3	6.2	*	16.4	5.8	*	11.9	18.1
	3	18.2	14.3		18.9	11.5		15.9	17.4
	4	22.1	17.8		22.1	17.6		21.0	19.4
	5	15.6	2.2	*	15.2	2.2	*	14.4	2.9
	6	15.6	11.9		16.8	10.0		13.6	13.3
	7	11.6	2.2	*	11.5	2.1	*	10.7	4.1
	8	2.7	0.5	*	2.6	0.5	*	2.8	0.5
	9	6.0	3.9		6.0	1.5	*	5.9	0.9
	10	4.0	0.8	*	3.4	0.7	*	3.4	1.1
% Hispanic	US	15.5	7.4	*	15.1	6.8	*	15.1	6.7
	1	7.9	2.7	*	7.4	1.8	*	6.9	1.7
	2	18.1	5.4	*	17.3	4.4	*	14.9	13.9
	3	4.1	3.3		4.6	2.1	*	4.6	1.9
	4	9.8	3.3	*	9.5	3.4	*	9.8	3.1
	5	6.8	2.1	*	6.7	2.1	*	6.4	2.4
	6	27.9	20.1		27.2	19.5		28.6	15.4
	7	4.1	3.3		4.2	3.2		3.6	3.8
	8	12.8	7.1		12.4	7.2		12.8	7.2
	9	31.5	17.3	*	30.9	17.3	*	30.8	12.7
	10	5.7	9.0		5.9	9.7		5.9	9.1

Table 1. Cont.

Demographic	EPA region	<u>Annual PM_{2.5}</u> (design value)			<u>Daily PM_{2.5}</u>			<u>Ozone</u>		
		Suff	Insuff		Suff	Insuff		Suff	Insuff	
		monitoring	monitoring		monitoring	monitoring		monitoring	monitoring	
% under 5 years of age	US	6.9	6.6	*	6.9	6.5	*	6.9	6.5	*
	1	6.3	5.9		6.3	5.7	*	6.2	5.9	
	2	6.6	6.3		6.6	6.2		6.6	6.4	
	3	6.3	6.1		6.3	6.0		6.3	6.0	
	4	6.5	6.5		6.5	6.5		6.5	6.6	
	5	6.9	6.5	*	6.9	6.4	*	6.9	6.4	*
	6	7.8	7.2	*	7.7	7.1	*	7.8	6.9	*
	7	7.0	6.4	*	7.0	6.3	*	6.9	6.5	*
	8	7.6	6.7		7.7	6.5	*	7.8	6.4	*
	9	7.3	6.6	*	7.3	6.4	*	7.3	6.3	*
	10	6.5	7.0		6.7	6.8		6.6	7.0	
% over 64 years of age	US	11.9	13.3	*	11.9	13.5	*	12.0	13.5	*
	1	13.4	13.9		13.4	14.4		13.6	13.4	
	2	13.0	13.0		12.9	13.3		13.1	12.9	
	3	13.1	14.0		13.3	13.9		13.3	14.0	
	4	13.3	13.8		13.3	13.9		13.5	13.4	
	5	12.0	13.6	*	12.0	13.6	*	12.0	13.7	*
	6	9.7	11.9	*	9.8	12.1	*	9.4	13.2	*
	7	12.0	15.5	*	12.1	15.6	*	11.8	15.2	*
	8	9.6	12.3	*	9.4	13.0	*	8.9	13.5	*
	9	10.8	13.0	*	10.8	14.4	*	10.9	14.5	*
	10	10.7	12.0		10.5	12.7		11.1	11.7	
% in poverty	US	12.4	12.4		12.4	12.5		11.8	13.7	*
	1	10.0	7.2		9.5	7.6		9.1	9.1	
	2	14.3	8.7		13.6	9.4		11.5	14.9	
	3	9.6	12.2		10.4	11.6		9.6	13.5	*
	4	13.0	14.9	*	13.0	15.1	*	12.6	15.5	*
	5	10.7	8.8	*	10.6	8.9	*	10.2	9.6	
	6	16.0	16.2		16.5	15.6		15.3	17.4	
	7	9.5	11.5		9.5	11.6		9.1	11.6	
	8	9.9	11.4		9.6	12.1	*	8.8	13.2	*
	9	13.9	14.3		13.9	14.3		13.9	15.6	
	10	10.1	11.8		9.8	12.7	*	10.1	11.9	

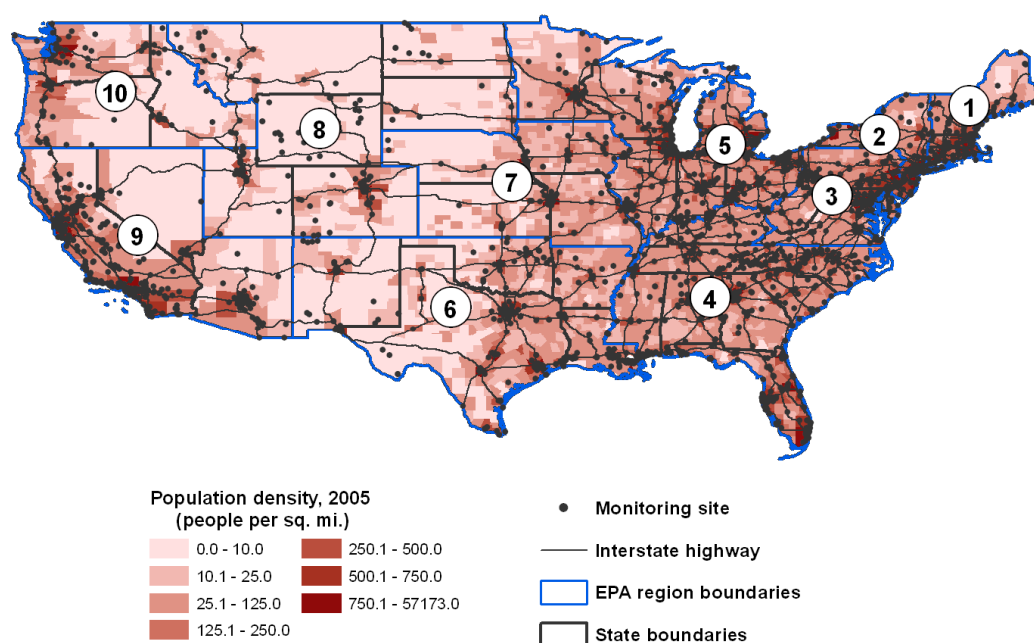
* Population-weighted t-test significant at $\alpha = 0.05$ with Bonferroni correction for multiple comparisons.

Of the 3,141 counties in the United States, 527 had sufficient monitoring data for annual PM_{2.5}, 587 had sufficient monitoring data for daily PM_{2.5}, and 685 had sufficient monitoring data for ozone. As Table 1 demonstrates, there are clear differences in the demographic characteristics of counties with sufficient air quality data to allow calculation of an air quality metric. At the national level, counties without air quality metrics for annual PM_{2.5}, daily PM_{2.5}, and ozone are characterized by a lower percent NHB, lower percent Hispanic, lower percent under 5 years of age, and higher percent 65 years

and older. Using population-weighted t-tests and the Bonferroni correction for multiple comparisons, almost all of these differences were significant at an overall α of 0.05. Counties without air quality metrics for annual $\text{PM}_{2.5}$ and daily $\text{PM}_{2.5}$ exhibit no differences in percent in poverty; however, counties without air quality metrics for ozone are characterized by a higher percent in poverty. These patterns generally held within the 10 EPA regions, although statistical significance under the correction for multiple comparisons varied.

The observed differences in the demographic characteristics of areas for which we could and could not calculate the 3 air quality metrics likely result from the strategies that the EPA pursues in siting monitors. The map in Figure 2 makes it clear that monitoring efforts for ozone and particulate matter are targeted at areas with high population density and along major interstate highways or heavily industrialized areas. While this system for placing air quality monitors captures data where the highest population density is expected to experience significant ozone and $\text{PM}_{2.5}$ exposure, it leaves rural areas with generally older, non-Hispanic white populations with limited air quality data.

Figure 2. 2005 United States county-level population density and EPA regions, overlaid with ozone and $\text{PM}_{2.5}$ air quality monitoring sites.



3.2. County Demographics and Air Quality

Among those counties with sufficient data to calculate an air quality metric (see Figure 1), we compared communities with the most extreme air quality based on each pollution metric. Specifically, we employed univariate analysis using population-weighted t-tests to compare the demographic characteristics of the 20% of counties with the best air quality with the 20% of counties with the worst air quality. For all three pollution metrics, the proportion of NHB in those counties with the worst air quality is over twice the corresponding proportion in those counties with the best air quality (significant at $\alpha = 0.05$ with Bonferroni correction). A higher percent Hispanic, higher percent under 5 years of age, and lower percent 65 years and older are characteristic of counties in the worst 20% rather than best 20% of ozone-graded counties (p significant at $\alpha = 0.05$ with Bonferroni correction).

For both annual and daily PM_{2.5}, counties with the worst air quality have higher rates of poverty than counties with the best air quality (significant at $\alpha = 0.05$ with Bonferroni correction).

We also used multivariable logistic regression to consider how the various demographic dimensions of communities drive associations with air quality. For each pollution metric, a logistic model estimated the probability of a county being in the worst 20% of counties rather than the best 20% of counties. Models were run using national data, and covariates included all the demographic variables (*i.e.*, percent NHB, percent Hispanic, percent under 5 years of age, percent 65 years and older, and percent in poverty), as well as county population and EPA region. Table 2 presents the odds ratios for a change in each covariate equal to the interquartile range (IQR) of the covariate across all U.S. counties.

Table 2. Multivariable logistic regressions modeling the probability of an ALA-graded U.S. county being in the worst 20% of counties *versus* the best 20% of counties for each air pollution metric ^a.

	Annual PM _{2.5}	Daily PM _{2.5}	Ozone
% non-Hispanic black	2.73 **	1.58 *	1.36 *
% Hispanic	0.83	1.13	0.89
% under 5 years of age	2.09	1.34	1.68 *
% over 64 years of age	0.25 **	0.51 *	0.71
% in poverty	3.95 ***	1.92 *	0.44 ***
Population in 100,000s	1.01	1.19 ***	1.12 ***
R-squared	0.60	0.51	0.34

^a Values reported as odds ratios for a change equal to the IQR for each demographic variable based on all U.S. counties. Note: EPA region was also included as a covariate in all models. The Type III p-value for the EPA region covariate was <0.05 in both PM_{2.5} models and 0.052 in the ozone model. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

When controlling for the above-named other demographic variables, we still see a dramatic difference in the percent NHB in counties with the best and worst air quality as measured by all three pollution metrics; moving from the bottom to the top of the IQR on percent NHB is associated with a 36% to 173% increase in the probability of a county being in the worst 20% of graded counties, depending on the air quality metric of interest. Percent in poverty is positively associated with the probability of a county having the worst air quality for both annual and daily PM_{2.5} ($p < 0.01$ and $p < 0.1$, respectively); however, the opposite relationship is seen for ozone ($p < 0.01$). For each pollution metric, one aspect of the age composition is significantly associated with air quality ranking; counties with the worst air quality have a younger age distribution compared to counties with the best air quality.

In each multivariable logistic model, the EPA region covariate was significant ($p < 0.05$ for both PM_{2.5} models and $p = 0.05$ for ozone model), which may indicate that the relationship between county demographics and air quality grades plays out differently in different geographic regions. Although we would like to investigate how the communities with best and worst air quality compare within regions using multivariable analysis parallel to that performed nationally, some regions do not have air quality monitoring data for a sufficient numbers of counties to permit such model-fitting.

We note that the odds ratios between the daily $PM_{2.5}$ model and the annual $PM_{2.5}$ design value model are in the same direction but differ in magnitude. This is reasonable given that the former models short term peak exposures, and the latter measures long term exposures, which do not correlate perfectly.

3.3. Demographic Characteristics of Proximate Communities

The best/worst analysis described above was executed at the county level. To assess demographic differences at a more refined geographic scale, we selected the 20% of monitors reporting the best air quality and the 20% of monitors reporting the worst air quality. We then created a 5 km buffer around each monitoring site. Figure 3 provides a representation of how the buffers were constructed, and Figure 4 shows the distribution of the cleanest *versus* dirtiest monitors using daily $PM_{2.5}$ as an example (*i.e.*, the map of cleanest *versus* dirtiest monitors is different for ozone). Using a previously developed buffering method [31], Census block groups for which 50% of the area was contained within the 5 km buffer were considered to be within the buffer zone and included in the analysis. Buffer analysis could not be undertaken for annual $PM_{2.5}$ as site-specific data are not available.

Figure 3. Representation of the area captured by 5 km buffer of AQS monitor sites.

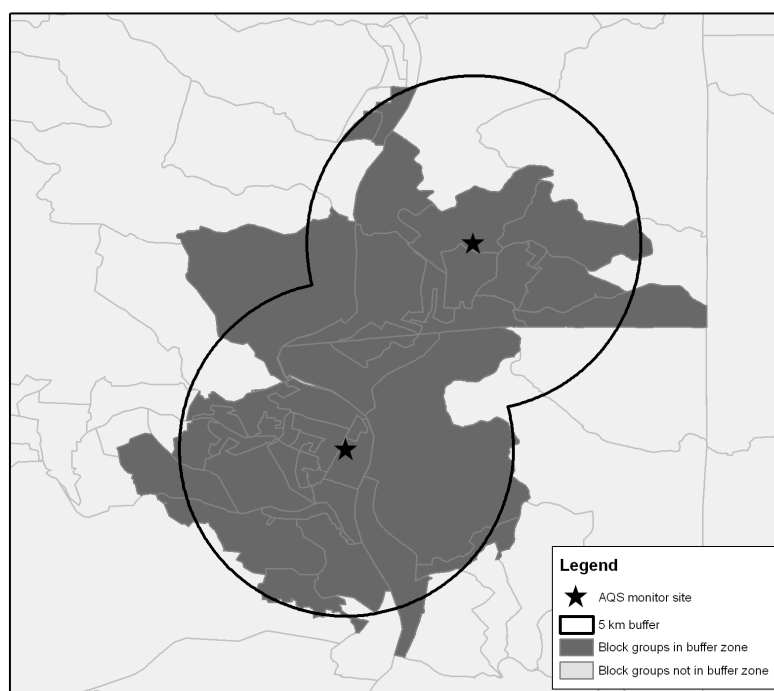
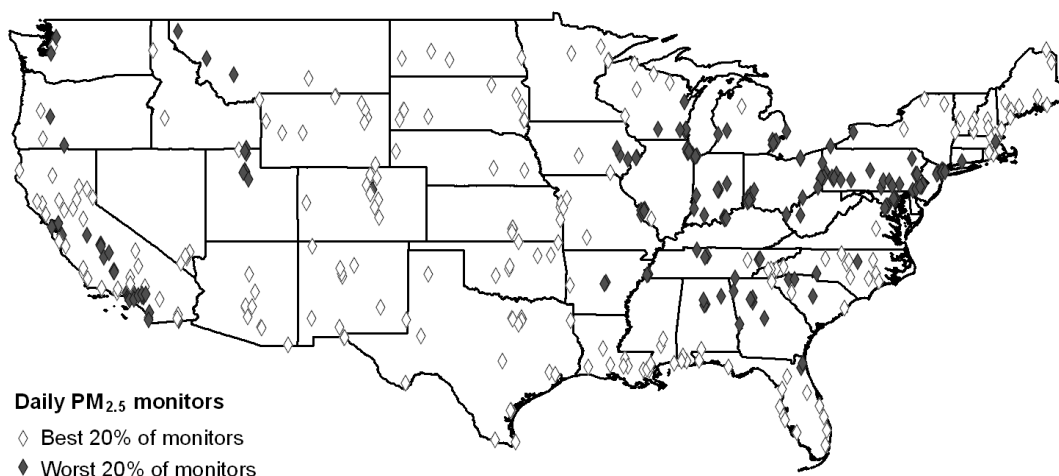


Figure 4. Location of the 20% of monitors with the best air quality and the 20% of monitors with the worst air quality for daily PM_{2.5}.



Similar to the county-level analysis, we began by exploring the univariate relationships between demographic composition and air quality for communities within the 5 km buffer zone around monitoring sites. For both daily PM_{2.5} and ozone, compared to communities surrounding monitors with the best air quality, those surrounding monitors with the worst air quality are characterized by a higher percent NHB, higher percent under 5 years of age, and lower percent 65 years and older (significant at $\alpha = 0.05$ with Bonferroni correction). Communities surrounding monitors with the worst air quality in terms of daily PM_{2.5} have higher percent Hispanic and higher percent in poverty than communities around monitors with the best air quality (significant at $\alpha = 0.05$ with Bonferroni correction). In contrast, the communities surrounding monitors with the worst air quality in terms of daily ozone have lower percent Hispanic and lower percent in poverty compared to communities around monitors with the best air quality (significant at $\alpha = 0.05$ with Bonferroni correction).

To supplement the univariate analyses, Table 3 summarizes the results of multivariable logistic models for the probability of a Census block group being within the buffer zone of a site ranking in the worst 20% *versus* the best 20% of monitoring sites for each air pollution metric. The logistic model for each pollution metric was constructed similarly to the county-level analysis above and the results are again presented as the odds ratios for a change in each covariate equal to the IQR of the covariate across all U.S. counties. The exception is population, for which the odds ratio was calculated as an increase of 1,000 individuals in order to more reasonably correspond to a plausible change in block group population.

Table 3 provides interesting contrasts to the univariate analysis. In the multivariable logistic models for PM_{2.5}, moving from the bottom to the top of the IQR for percent NHB or percent Hispanic, is associated with a 32% and 9%, respectively, increase in the likelihood of being in the worst air quality areas. Age (whether young or old), percent in poverty, and higher population were associated with a decreased risk of being in areas around the 20% of monitors with the worst air quality. For ozone, moving from the bottom to the top of the IQR for percent NHB is associated with a 6% increase in the likelihood of being in the dirtiest air quality areas. However, moving from the bottom to the top of the IQR for percent Hispanic is associated with a 6% decrease in the likelihood of being in the dirtiest air

quality areas. Moving from the bottom to the top of the IQR for percent under 5 years of age is associated with a 7% increase in the likelihood of being in the worst ozone areas, whereas older age was associated with a decreased risk of being in the worst 20% of areas, as was percent in poverty. Higher population was associated with an increased risk of being in the worst ozone areas (a 24% increase in risk for each additional 1,000 individuals per block group). Unfortunately, we were unable to perform this analysis disaggregated by EPA region due to the uneven representation of monitors with the best and worst air quality across EPA regions.

Table 3. Multivariable logistic regressions modeling the probability of a Census blockgroup being within the 5 km buffer zone of the dirtiest 20% of monitoring sites *versus* cleanest 20% of monitoring sites for each air pollution metric ^a.

	Daily PM _{2.5}		Ozone	
% non-Hispanic black	1.32	***	1.06	***
% Hispanic	1.09	***	0.94	***
% under 5 years of age	0.96	***	1.07	***
% over 64 years of age	0.90	***	0.97	**
% in poverty	0.94	***	0.90	***
Population	0.85	***	1.24	***
R-squared	0.40		0.18	

^a Values for population reported as odds ratios for an increase in the population of 1,000. All other values reported as odds ratios for a change equal to the IQR for each demographic variable based on all U.S. counties. Note: EPA region was also included as a covariate in both models. The Type III p-value for the EPA region covariate was <0.01 in both models. *p < 0.1 **p < 0.05 ***p < 0.01.

3.4. Summary of Environmental Justice Results

In both univariate and multivariate analyses, NHB are more likely to live in counties where particulate matter and ozone are well-monitored, but, among monitored locations, they are much more likely to live in areas with the worst air quality. In univariate analyses, Hispanics are also more likely to live in counties where particulate matter and ozone are well-monitored and are more likely to live in areas with the worst air quality. The latter result loses significance in the multivariate analyses.

Poverty rates do not differ between non-monitored counties for particulate matter *versus* monitored counties. Non-monitored counties for ozone are characterized by higher rates of poverty. In monitored counties, multivariate analysis suggests that counties with the worst particulate matter air quality are characterized by higher rates of poverty. In contrast, counties with the worst ozone air quality are characterized by lower rates of poverty. This may be due to the broader geographic scale at which high ozone levels tend to present.

In areas immediately proximate to the monitors, NHB are more likely to live in areas with the worst daily PM_{2.5} and ozone air quality. Hispanics are more likely to live in areas with the worst daily PM_{2.5} air quality, but less likely to live in areas with the worst ozone levels. The areas proximate monitors recording the worst daily PM_{2.5} and ozone levels are characterized by lower rates of poverty.

Taken together, these results suggest that NHB in the United States suffer worse air quality across multiple metrics, geographic scales, and multiple pollution metrics. Hispanics also suffer worse air

quality with respect to particulate matter, but not necessarily so for ozone. It also appears that environmental justice concerns are more prominent along race/ethnicity lines, rather than measures of poverty.

4. Conclusions

This paper provides an analysis of how the Clean Air Act and its Amendments have shaped air quality in both advantaged and disadvantaged communities in the United States. The results suggest, first, that the placement of monitors across the United States emphasizes more urban and densely populated communities. This means that rural areas, which are generally characterized by older, non-Hispanic white populations, are less likely to be monitored. It also means that non-Hispanic blacks and Hispanics are more likely to have access to monitoring data. Consequently, in areas without monitors, researchers, community members, and policy makers all lack access to information about local air quality. Second, we find that counties with the worst PM_{2.5} air quality are characterized by a statistically significant larger percent of NHB, smaller percent of people over 64 years of age, larger percent of people in poverty, and, for daily PM_{2.5} only, more people per county. We also find that counties with the worst ozone air quality are characterized by a statistically significant larger percent NHB, larger percent children under 5 years of age, smaller percent in poverty, and larger populations. Third, using buffering analysis to analyze at a more refined geographic scale, we found significant relationships between race, age, poverty, and air quality for both PM_{2.5} and ozone. Taken together, these results suggest that air quality is uneven across different demographic groups in the United States.

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Racial isolation and exposure to airborne particulate matter and ozone in understudied US populations: Environmental justice applications of downscaled numerical model output



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ABSTRACT

Background: Researchers and policymakers are increasingly focused on combined exposures to social and environmental stressors, especially given how often these stressors tend to co-locate. Such exposures are equally relevant in urban and rural areas and may accrue disproportionately to particular communities or specific subpopulations.

Objectives: To estimate relationships between racial isolation (RI), a measure of the extent to which minority racial/ethnic group members are exposed to only one another, and long-term particulate matter with an aerodynamic diameter of $<2.5 \mu$ (PM_{2.5}) and ozone (O₃) levels in urban and nonurban areas of the eastern two-thirds of the US.

Methods: Long-term (5 year average) census tract-level PM_{2.5} and O₃ concentrations were calculated using output from a downscaler model (2002–2006). The downscaler uses a linear regression with additive and multiplicative bias coefficients to relate ambient monitoring data with gridded output from the Community Multi-scale Air Quality (CMAQ) model. A local, spatial measure of RI was calculated at the tract level, and tracts were classified by urbanicity, RI, and geographic region. We examined differences in estimated pollutant exposures by RI, urbanicity, and demographic subgroup (e.g., race/ethnicity, education, socioeconomic status, age), and used linear models to estimate associations between RI and air pollution levels in urban, suburban, and rural tracts.

Results: High RI tracts (≥ 80 th percentile) had higher average PM_{2.5} levels in each category of urbanicity compared to low RI tracts (< 20 th percentile), with the exception of the rural West. Patterns in O₃ levels by urbanicity and RI differed by region. Linear models indicated that PM_{2.5} concentrations were significantly and positively associated with RI. The largest association between PM_{2.5} and RI was observed in the rural Midwest, where a one quintile increase in RI was associated with a $0.90 \mu\text{g}/\text{m}^3$ (95% confidence interval: $0.83, 0.99 \mu\text{g}/\text{m}^3$) increase in PM_{2.5} concentration. Associations between O₃ and RI in the Northeast, Midwest and West were positive and highest in suburban and rural tracts, even after controlling for potential confounders such as percentage in poverty.

Conclusion: RI is associated with higher 5 year estimated PM_{2.5} concentrations in urban, suburban, and rural census tracts, adding to evidence that segregation is broadly associated with disparate air pollution exposures. Disproportionate burdens to adverse exposures such as air pollution may be a pathway to racial/ethnic disparities in health.

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1. Introduction

An extensive literature has demonstrated a deleterious relationship between exposure to air pollution and adverse human health outcomes, including poor pregnancy outcomes (Ritz et al., 2002; Miranda et al.,

2009; Bell et al., 2010; Miranda et al., 2013; Gray et al., 2014), asthma (McConnell et al., 2002), and cardiovascular- and respiratory-related mortality (Dominici et al., 2003; Bateson and Schwartz, 2004; Laurent et al., 2007) and morbidity (Dominici et al., 2006; Peng et al., 2009; Bell et al., 2014). The close relationship between race/ethnicity and residential location in the US (Gee and Payne-Sturges, 2004) suggests that racial disparities in health (e.g., poor pregnancy outcomes, asthma, etc.) may be partly attributed to systematic differences in adverse exposure burdens, such as exposure to environmental pollution, poor quality built environments, or social stressors. For example, disproportionate air pollution exposure burdens among non-Hispanic blacks (NHB)

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versus non-Hispanic whites (NHW) have been implicated in racial disparities in health outcomes such as asthma (Hill et al., 2011; Nachman and Parker, 2012) and cancer (Apelberg et al., 2005). Racial residential segregation (RRS) of NHB, which refers to the purposeful and systematic geographic separation of NHB into different residential spaces separate from the majority NHW population, may underlie race-based disparities in environmental exposures (Massey and Denton, 1988; Gee and Payne-Sturges, 2004; Morello-Frosch and Lopez, 2006). Through the disinvestment of educational resources and employment opportunities and the concomitant concentration of multiple disadvantages related to such factors as environmental hazards, poor quality built environment, and food insecurity, among others, segregation fosters residential environments inimical to health (Williams and Collins, 2001; Acevedo-Garcia et al., 2003). Indeed, RRS has been associated with a range of adverse health outcomes like infant and adult mortality (Laveist, 1993), poor pregnancy outcomes (Grady, 2006; Osypuk and Acevedo-Garcia, 2008; Anthopoulos et al., 2014), and poor cardiovascular health (Kershaw et al., 2011).

RRS is a multidimensional phenomenon with five distinct dimensions, namely, evenness (also called dissimilarity), isolation (or exposure), concentration, centralization, and clustering (Massey and Denton, 1988). Evenness refers to the degree to which racial minority group members may be over or underrepresented across spatial units in a metropolitan area relative to overall group representation. Isolation (exposure) is defined as the extent to which minorities are exposed to majority group members by sharing a residential neighborhood. Concentration, centralization, and clustering capture aspects of the geographic distribution of racial minorities relative to majority group members across a metropolitan area. Historically, RRS developed through the systematic steering of NHB into separate residential spaces through political, economic, and social forces (Williams and Collins, 2001). Despite legal measures to abolish segregation, the consequences of RRS persist today: according to the dimension of evenness, in US metropolitan areas in 2000, on average, two-thirds of the NHB population would need to relocate to another neighborhood to de-segregate a given US city (Gee and Payne-Sturges, 2004). While often overlooked, NHB outside of urban areas in the US also remain segregated. For example, Lichter et al. (2007) find that levels and trends in evenness of NHB in suburban and rural US communities are similar to those observed in urban areas.

In studies examining the role of RRS in racial disparities in air pollution exposures, US metropolitan areas with higher levels of segregation have been shown to have higher overall levels of air pollution (Morello-Frosch and Lopez, 2006). Few in number, these studies have been limited to urban areas (Jones et al., 2014; Rice et al., 2014), and typically measure segregation at a global scale (for example, using city or metropolitan area boundaries) based on the dimension of evenness. In complementary research, a plethora of studies have used racial composition (e.g., percentage NHB) to reveal racial disparities in air pollution exposure, without necessarily intending to proxy segregation (Miranda et al., 2011; Bell and Ebisu, 2012). While important, these studies have not accounted for the relationships among nearby neighborhoods (Brochu et al., 2011); were often limited to areas proximate to air pollution monitors e.g., (Miranda et al., 2011; Bell and Ebisu, 2012); or overlooked potential differences in exposure burdens in urban versus nonurban areas, due to limited ambient monitoring data in less urban areas (Bell and Ebisu, 2012).

We assess the role of one dimension of RRS, racial isolation (RI), in racial differences in exposure to particulate matter with an aerodynamic diameter of $<2.5 \mu$ ($PM_{2.5}$) and ozone (O_3), in both urban and nonurban tracts across the eastern two-thirds of the US. Ozone and $PM_{2.5}$ are criteria air pollutants that are linked with adverse health outcomes (World Health Organization, 2004) and in nonattainment of the National Ambient Air Quality Standards (NAAQS) in multiple US communities (U.S. Environmental Protection Agency, 2008; U.S. Environmental Protection Agency, 2012a). We choose to focus on RI of NHB because,

compared to the commonly employed dimension of evenness, isolation may be more closely linked to health by serving as a proxy for the concentration of multiple disadvantage into a single ecological space (Shihadeh and Flynn, 1996; Acevedo-Garcia et al., 2003). While RRS is standardly conceived as a global construct, we use a previously derived spatial measure of local RI of NHB. At a more resolved geographic scale than the city or metropolitan area level, the local RI index may be more proximally linked to individual health (Anthopoulos et al., 2011), and unlike commonly applied aspatial measures of segregation, our spatial index accounts for relationships among nearby geographic units (i.e., census tracts). We use simulated air pollution concentrations to estimate exposure burdens among subpopulations living in areas without air pollution monitors. Although previous work has examined disparities in air pollution exposure for urban and rural populations in selected US cities and states (Yanosky et al., 2008; Brochu et al., 2011; Gray et al., 2013; Jones et al., 2014), the few studies examining disparities based on larger study samples noted that the use of monitoring data precluded assessing exposure in more rural populations (Miranda et al., 2011; Bell and Ebisu, 2012). Furthermore, studies examining other dimensions of RRS and air pollution have done so almost exclusively in metropolitan areas (Lopez, 2002; Morello-Frosch and Jesdale, 2006; Jones et al., 2014; Rice et al., 2014). This study extends the current understanding of racial disparities in air pollution exposures by: 1) estimating ambient air pollutant concentrations in understudied (i.e., rural) populations; and 2) using a spatial measure of local RI to estimate its association with air pollution in urban, suburban, and rural US census tracts.

2. Methods

2.1. Study area

We focus on the eastern two-thirds of the US because this is the area for which the Community Multiscale Air Quality Model (CMAQ) downscaler provides census tract level estimates of $PM_{2.5}$ and O_3 concentrations (census tracts = 53,124).

2.2. Data sources

2.2.1. Demographic data

For each census tract in the study area, we obtained population characteristics from 2000 Census data, including racial composition (U.S. Census Bureau, 2000a), age, educational attainment, poverty, and unemployment (U.S. Census Bureau, 2000b), in addition to tract-level Rural-Urban Commuting Area (RUCA) codes (U.S. Department of Agriculture, 2003). Although 2000 is not the most recent census year, it best matches our study timeframe of 2002–2006, which is determined by the years for which downscaler output are available. According to the US Census Bureau, tracts are small, relatively permanent statistical subdivisions of counties, designed to be fairly homogenous units with respect to socio-demographic characteristics and living conditions, containing on average 4,000 residents (U.S. Census Bureau, 2000c). Consistent with at least one previous study of racial/ethnic disparities in air pollution exposure (Bell and Ebisu, 2012), tracts with population < 100 ($n = 317$, $< 1\%$) were excluded from analysis.

2.2.2. Air pollution data

Concentrations of $PM_{2.5}$ and O_3 were obtained for 2002–2006 from two different sources: (1) the CMAQ downscaler (Berrocal et al., 2012; Holland, 2012); and (2) the US EPA Air Quality System (AQS) database (U.S. Environmental Protection Agency, 2012b). The AQS database contains observations from the National Air Monitoring Stations and State and Local Air Monitoring Stations (NAMS/SLAMS) network. Annual averages of 24-h ambient $PM_{2.5}$ and 8-h maximum O_3 concentrations were obtained for each year between 2002 and 2006 for 1215 $PM_{2.5}$ and 1,043 O_3 monitoring locations in the study area.

The downscaler model utilizes a Bayesian space-time modeling framework that relates monitor data and gridded CMAQ model output using a linear regression with additive and multiplicative bias coefficients that can vary in space and time. Input data to the downscaler model include monitoring data obtained from the NAMS/SLAMS network (including stations with some data missingness) and gridded CMAQ numerical output. Output from CMAQ used as input to the downscaler include PM_{2.5} and O₃ concentrations at 12 × 12 km grid cells simulated using CMAQ version 4.6. The CMAQ model is a deterministic regional air quality model using nonlinear partial differential equations to mathematically approximate underlying physical and chemical processes occurring in the atmosphere. Utilizing output from a meteorological model and an emissions inventory, CMAQ simulates chemical and physical atmospheric processes to model pollutant transformation, transport, and fate, producing estimates of pollutant concentrations and deposition fluxes at different horizontal resolutions (e.g., 12 × 12 km) and atmospheric layers (Byun and Schere, 2006). The meteorological inputs to the CMAQ simulations used in the downscaler statistical model are from the 5th generation Mesoscale Model version 3.6.3. The emissions inventory was based on the 2002 National Emissions Inventory version 3 (Houyoux et al., 2000).

The downscaler uses monitoring data and CMAQ output at 12 × 12 km grid cells to predict daily air pollution concentrations at census tract centroids (Berrocal et al., 2010a; Berrocal et al., 2010b). Specifically, downscaler output includes estimates of daily 24-h average PM_{2.5} and 8-h maximum O₃ concentrations at census tract centroids across the eastern two-thirds of the US. We used downscaler output for years 2002–2006, which provide complete coverage of the study area, such that exposures to air pollution can be estimated for all populations within the study area. Downscaler output has been used in other exposure assessment applications, including the publicly available environmental justice screening and mapping tool developed by the US Environmental Protection Agency (U.S. Environmental Protection Agency, 2015). Additional details on the downscaler modeling approach, validation, and performance are provided elsewhere (Berrocal et al., 2012). Archived daily downscaler surfaces are available from the US EPA (Holland, 2012).

2.3. Air pollution exposure assessment

2.3.1. CMAQ downscaler

Tract level estimates of ambient PM_{2.5} and O₃ concentrations obtained from downscaler output were reported at census tract centroids for every day in the study period (2002–2006). Separately for each pollutant, we averaged daily values to generate an annual average concentration estimate for each tract, then averaged annual values to generate 5y average tract level 24-h average PM_{2.5} and 8-h maximum O₃ concentrations. Five-year concentrations were calculated because we were interested in measuring differences in long-term (chronic) exposures. Most O₃ monitors record observations only during O₃ “season,” typically April–September, while the downscaler estimates concentrations daily throughout the year. Thus, O₃ exposure estimates were calculated in two ways: (1) 5 year averages calculated from 12 months of daily downscaler-derived concentrations; and (2) 5 year averages calculated from 6 months (April–Sept.) of daily downscaler-derived concentrations.

When using model-derived air pollution concentrations, researchers often compare modeled and observed concentrations as a test of model performance. To assess whether downscaler- and monitor-derived pollution concentrations were similar, we compared monitor- and downscaler-derived 5y tract level exposure estimates. Evaluation metrics of mean bias, normalized mean bias, normalized mean error, root mean square error, and correlation (Boylan and Russell, 2006; Eder and Yu, 2006) were calculated based on tracts with PM_{2.5} and O₃ monitoring data.

2.3.2. Monitoring data

We also obtained annual averages of 24-h PM_{2.5} and 8-h maximum O₃ concentrations reported at monitor locations from the AQS for 2002–2006 (U.S. Environmental Protection Agency, 2012ba). Monitors were matched to tracts based on each monitor's latitude/longitude. If multiple monitors were present for the same pollutant in a single tract, observed concentrations were averaged to create an annual average tract level concentration estimate. We averaged annual PM_{2.5} and O₃ concentrations to generate a 5y average estimate for each pollutant.

Most PM_{2.5} and O₃ monitors do not record observations every day of the year; typically, PM_{2.5} monitors record observations once every three days, while O₃ monitors record daily observations from April–September. We excluded PM_{2.5} and O₃ monitors with observations <50% of days when the monitor should have been operational for ≥3 years (y) during the 5y study period (e.g., a PM_{2.5} monitor with a 1-in-3 day sampling schedule with 100% complete data for a year would have approximately 121 days of data; if it had <61 days of data for 3y or more in the study period, the monitor was excluded). Applying this criterion excluded 133 (~11%) PM_{2.5} monitors and 28 (~3%) O₃ monitors. Monitor locations used in our analysis are shown in Supplemental Material, eFigure 1. Monitor-derived tract level air pollution estimates were calculated only for tracts in the study area containing ambient monitors: 1,053 (2.0%) tracts and 991 (1.9%) tracts for PM_{2.5} and O₃, respectively.

2.4. Urbanicity

Urbanicity was determined using primary and secondary RUCA codes (U.S. Department of Agriculture, 2003), which delineate metropolitan, micropolitan, small town, and rural commuting areas based on the size and direction of the primary (largest) commuting flows. Developed by researchers at the US Department of Agriculture in collaboration with Office of Rural Health Policy and the Rural Health Research Center, RUCA codes use measures of population density, urbanization, and size and direction of primary (largest) daily commuting flows to determine the degree of urbanicity of US census tracts (Hall et al., 2006). RUCA codes were used to classify tracts into one of three mutually exclusive categories: urban, suburban, and rural. RUCA codes and definitions are provided in eTable 1.

2.5. Racial isolation

Using 2000 US Census data on the percentage of tract population self-identifying as NHB, we calculate a local spatial measure of RI. The tract-level spatial measure of this RRS dimension was developed by Anthopolos et al. (2011); they based their index on the regional-scale spatial isolation index developed by Reardon and O'Sullivan (2004). For purposes of consistency, the notation presented here is consistent with Anthopolos et al. (2011).

Let r_i index subregions of a given region R , and $|r_i|$ indicate the area of subregion i . Let m index M mutually exclusive racial groups populating R . Define T^{r_i} as the total population count in tract r_i and $T_m^{r_i}$ to be the same but for subpopulation group m . To specify spatial relationships among tracts, let Γ be a first order adjacency matrix with entries $y_{ij} = 1$ if r_i and r_j share a boundary and 0 otherwise. Since we wish to take into account the fact that individuals can interact within their own tract, we set y_{ii} to equal a constant k , where k is restricted to be greater than or equal to 1.

For any population group m , $\tau_m^{r_i}$ is the weighted average of population intensities at all other locations in R , where weights are assigned based on adjacency to r_i . Formally, $\tau_m^{r_i} = (\sum_{r_j} y_{ij} T_m^{r_j}) / (\sum_{r_j} y_{ij} |r_j|)$. The quantity can be similarly defined for the total population: $\tau^{r_i} = (\sum_{r_j} y_{ij} T^{r_j}) / (\sum_{r_j} y_{ij} |r_j|)$. By taking the ratio of $\tau_m^{r_i}$ and τ^{r_i} , we have the

$$\text{RI of group } m \text{ in tract } r_i \text{ defined as: } mP \sim_{r_i}^* = \frac{(\sum_{r_j} y_{ij} T_{r_j}^m)}{(\sum_{r_j} y_{ij} T_{r_j}^{r_j})}.$$

Note that the double subscripting of m is used to denote that the index is measuring population group m 's exposure to itself. This can be interpreted as the average percentage of subpopulation group m in the local environment of r_i , where the local environment is defined in terms of adjacency. We calculated the RI index using weighting scheme of $y_{ij} = 1$. A detailed derivation is available from the authors.

The RI index ranges from 0 (no isolation) to 1 (complete isolation). The RI index was computed for all tracts within the study area to evaluate possible differences in air pollution exposures in tracts with higher versus lower levels of RI. To correct for edge effects in index scores for tracts along the boundary of the study area, we included bordering tracts located outside our study area in the calculation of RI.

2.6. Geography

Relationships between RI, urbanicity, and air pollution exposure were examined throughout the study area and within specific geographic regions. Based on the census classification of states (U.S. Census Bureau, 2014), tracts were classified into one of four geographic regions: Northeast, Midwest, South, or West (eFigure 2).

2.7. Statistical analysis

The RI value for each tract was used to classify tracts into quintiles of RI, which were computed within geographic region. Within each geographic region, we used ANOVA to evaluate whether 5 year average $\text{PM}_{2.5}$ and O_3 levels differed by RI quintile and urbanicity category. We assessed whether the assumption of normality in ANOVA was violated by examining histograms of model residuals. Because Levene's test (Levene, 1960) rejected the assumption of homogeneous variance, we applied the Welch correction for unequal variances among groups. Additionally, we evaluated whether results for urbanicity and RI were robust to inclusion of tracts with population < 100.

We also estimated population-level exposures for different demographic subgroups by urbanicity category and by low vs. high RI. We focused on five ways to segment the population:

- Race/ethnicity: population self-identified as NHB, NHW, Hispanic, or other
- Age: persons 0–19, 20–64, or ≥ 65 y of age
- Educational attainment: persons ≥ 25 y with less than a high school degree or equivalent; high school degree/GED or some college; or college degree
- Poverty: percentage in poverty using census-defined poverty levels
- Unemployment: percentage ≥ 16 y who are unemployed.

These variables were chosen based on associations between air pollution, race/ethnicity, and socioeconomic status (SES) in previous studies (Gray et al., 2013), and also to explore potential for concentrated disadvantage in more racially isolated (segregated) areas. For each characteristic, we estimated the average exposure to each pollutant for that demographic group in the study area by weighting pollution levels in each tract by the population as:

$$Y_i^k = \frac{\sum_{j=1}^J P_{ij} X_j^k}{\sum_{j=1}^J P_{ij}}.$$

Where:

Y_i^k is the average estimated exposure across the study area to pollutant k for persons with characteristic i (e.g., high school graduate);

J is the number of census tracts in the study area ($n = 52,807$);

P_{ij} is the number of persons with characteristic i in census tract j ; and X_j^k is the concentration of pollutant k for census tract j .

This approach produces an estimate of exposure to $\text{PM}_{2.5}$ and O_3 during the study period by population group, accounting for population size and estimated pollutant levels. To test for differences in the weighted average air pollution concentrations calculated for each demographic subgroup in a given urbanicity or RI category, we used weighted t-tests. We assessed whether the assumption of normality was violated by examining frequency histograms and boxplots.

We then fit separate linear models of average $\text{PM}_{2.5}$ and O_3 concentrations to estimate the association with RI, urbanicity, and region, and computed linear combinations of these variables. RI was measured continuously as quintiles, as exploratory analysis indicated that the association between RI and air pollution was better represented when RI quintiles were used instead of raw RI values. Urbanicity and region were entered as categorical variables. Demographic variables used in the models included percentage of population with less than a high school education, percentage in poverty, and percentage Hispanic. Variables were selected based on associations observed between air pollution, race/ethnicity, and SES observed in previous studies (Miranda et al., 2011; Gray et al., 2013).

All statistical analyses were performed using R version 3.1.2 (R Core Team, 2014). P -values from 2-sided 95% confidence intervals were used for statistical inference.

3. Results

Results were based on 52,807 census tracts in the eastern US with a population ≥ 100 in the 2000 Census. The median and mean population in tracts in the study area was 3,937 and 4,257, respectively (standard deviation = 2,114). Tracts vary in land area and shape: median area for tracts in the study area = 6.19 km^2 ; standard deviation = 396.1 km^2 ; min-max = <1 km^2 –12,992 km^2 .

Metrics of downscaler performance were superior when comparing monitored 5y average O_3 concentrations with downscaler 5y averages based on April–September estimates versus year-round estimates. Henceforth we use 5y O_3 averages based on daily downscaler output from April–Sept. (2002–2006), and 5 year $\text{PM}_{2.5}$ averages based on daily downscaler data, year-round. Average pollutant concentrations across the study area and ambient monitoring locations are shown in Fig. 1a–b. The average $\text{PM}_{2.5}$ and O_3 downscaler-derived concentrations for the study period across the study area were 12.4 $\mu\text{g}/\text{m}^3$ and 47.7 ppb, respectively. For averages computed for the entire study area, annual average concentrations were all within 1 $\mu\text{g}/\text{m}^3$ for $\text{PM}_{2.5}$ and 2 ppb for O_3 , that is, there were not clear trends in overall air pollution levels from 2002 to 2006. More detailed model evaluation results can be found in eTable 2 and eFigures 3–4 of the Supplemental Material.

3.1. Air pollution exposures and urbanicity

Higher 5 year $\text{PM}_{2.5}$ levels were clearly related to urbanicity: $\text{PM}_{2.5}$ concentrations were consistently highest in urban tracts and lowest in rural tracts (eTable 3). Urban $\text{PM}_{2.5}$ levels in the West and Northeast were 39% and 29% higher, respectively, than $\text{PM}_{2.5}$ in rural tracts within these regions. The South had the smallest differential between urban and rural $\text{PM}_{2.5}$ levels, with urban $\text{PM}_{2.5}$ levels 7% higher than those in rural tracts. The relationship between urbanicity and O_3 levels varied by region. In the Northeast, Midwest, and South, the highest O_3 levels were observed in suburban tracts. In the West, the highest O_3 levels were observed in urban tracts. For each region, the association between both $\text{PM}_{2.5}$ and O_3 and urbanicity was statistically significant (ANOVA with unequal variance correction $p < 0.05$). As a sensitivity analysis, we reproduced this analysis but included all tracts, irrespective of total population (i.e., including the 317 tracts with population < 100). Results were not significantly different from those presented here.

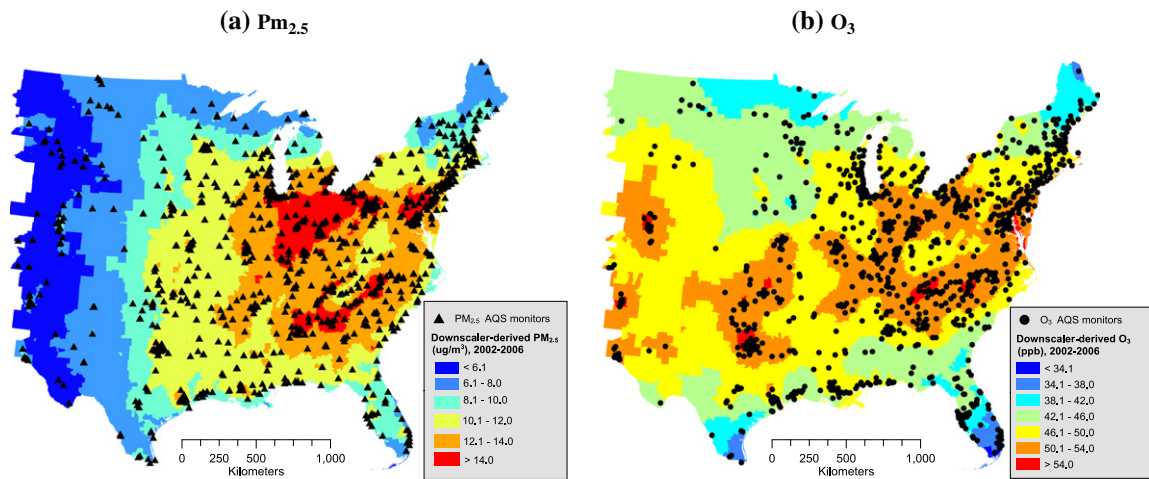


Fig. 1. a, b. Five year average tract level downscaler-derived concentrations.

3.1.1. Urbanicity and demographic subgroup exposures

Exposure estimates by urbanicity for the Northeast are presented in Table 1. For brevity, the corresponding tables for the South, Midwest and West, are presented in eTables 4, 5 and 6, respectively. Weighted *t*-tests with Welch correction for non-homogeneity of variances were used for pairwise comparisons of average pollutant levels estimated for demographic subgroups. For subgroups with more than two categories, a referent category is designated (indicated by *), and weighted *t*-tests are used for pairwise comparisons between the referent category and other categories.

Fig. 2a provides a visual representation of long-term average PM_{2.5} exposures for four racial/ethnic groups by urbanicity and region. Across regions, levels of PM_{2.5} were 0.1–1.1 µg/m³ higher for NHB compared to other race/ethnicity groups for urban, suburban, and rural tracts. Exposure to PM_{2.5} was higher for less educated (no high school diploma) urban, suburban, and rural populations compared to populations with a college degree, with the exception of the urban South (eTable 4), where college graduates had higher PM_{2.5} exposure. Otherwise, there were not clear patterns in PM_{2.5} exposure by age, education, and SES

(e.g., employment, poverty) across the different urbanicity categories in the four regions.

Race/ethnicity-based exposures to O₃ concentrations exhibited marked variation by region and urbanicity (Fig. 2b). The highest O₃ exposures were observed for NHW and NHB in the Northeast and Midwest, respectively; other races in the South; and Hispanics and other races in the West. Ozone exposure gradients by education, age, and SES did not emerge within levels of urbanicity.

3.2. Racial isolation

In each region, there was a clear pattern in which 5 year average PM_{2.5} levels increased with increasing quintile of RI (Table 2). The same pattern of consistently increasing air pollution with increasing RI did not emerge for O₃. Instead, tracts with the highest and lowest RI values tended to have lower O₃ levels than tracts with middle values of RI (e.g., 2nd and 3rd quintiles). Mean PM_{2.5} and O₃ levels differed by quintile of RI within each region (*p* < 0.05).

Table 1

Average downscaler-derived air pollution levels for each population group by urbanicity in the Northeast*.

Variable	Average PM _{2.5} level (standard deviation), µg/m ³				Average O ₃ level (standard deviation), parts per billion (ppb)			
	All tracts (n = 13,044)	Urban (n = 11,462)	Suburban (n = 841)	Rural (n = 741)	All tracts (n = 13,044)	Urban (n = 11,462)	Suburban (n = 841)	Rural (n = 741)
Average pollution level	12.8 (1.88)	13.1 (1.66)	11.5 (1.97)	10.2 (1.88)	46.8 (3.56)	46.8 (3.53)	47.4 (3.49)	45.9 (3.86)
Race/ethnicity ⁺								
Non-Hispanic White**	12.5 (1.88)	12.8 (1.70)	11.5 (1.98)	10.2 (1.93)	47.2 (3.32)	47.6 (1.70)	47.2 (3.45)	45.8 (3.85)
Non-Hispanic black	13.7 (1.27)	13.8 (1.22)	11.9 (1.78)	10.9 (1.59)	45.8 (3.46)	45.7 (1.22)	49.2 (3.40)	48.0 (2.47)
Hispanic	13.6 (1.40)	13.7 (1.34)	11.6 (1.67)	10.4 (1.48)	44.7 (3.68)	44.6 (1.34)	48.5 (3.52)	47.3 (2.86)
Other	13.3 (1.64)	13.4 (1.63)	11.1 (1.82)	9.80 (1.73)	45.7 (3.64)	45.3 (1.42)	47.0 (3.68)	45.5 (3.95)
Age (y)								
<20**	12.8 (1.81)	13.0 (1.64)	11.5 (1.95)	10.3 (1.90)	46.9 (3.49)	46.9 (1.63)	47.4 (3.48)	45.9 (3.80)
20–64	12.8 (1.83)	13.1 (1.65)	11.5 (1.98)	10.2 (1.93)	46.8 (3.55)	46.8 (1.65)	47.4 (3.50)	45.9 (3.84)
≥65	12.8 (1.85)	13.1 (1.66)	11.6 (1.97)	10.2 (1.93)	47.1 (3.46)	47.2 (1.66)	47.5 (3.39)	45.9 (3.88)
Education								
<High school**	13.1 (1.80)	13.3 (1.60)	11.7 (1.96)	10.4 (1.99)	46.3 (3.68)	46.3 (1.60)	47.7 (3.33)	46.1 (3.90)
High school	13.0 (1.86)	13.0 (1.67)	11.6 (1.96)	10.2 (1.93)	47.2 (3.56)	47.5 (1.67)	47.3 (3.46)	45.9 (3.87)
College	12.7 (1.76)	13.0 (1.61)	11.2 (1.98)	9.87 (1.77)	46.8 (3.51)	46.8 (1.61)	46.9 (3.62)	45.6 (3.64)
Socioeconomic								
Employed	12.8 (1.82)	13.0 (1.65)	11.5 (1.98)	10.2 (1.92)	46.9 (3.51)	46.9 (1.65)	47.4 (3.49)	45.9 (3.84)
Unemployed	13.1 (1.80)	13.4 (1.58)	11.5 (1.87)	10.2 (1.95)	46.2 (3.70)	46.1 (1.58)	47.6 (3.26)	46.0 (3.83)
Not in poverty	12.8 (1.82)	13.0 (1.64)	11.5 (1.98)	10.2 (1.91)	47.0 (3.48)	47.0 (1.64)	47.4 (3.29)	45.9 (3.82)
In poverty	13.1 (1.85)	13.4 (1.61)	11.5 (1.92)	10.2 (1.95)	45.8 (3.70)	45.7 (1.61)	47.5 (3.35)	45.9 (3.93)

*Values in bold indicate significant differences between categories (*p* < 0.05), assessed using weighted *t*-tests.

**Denotes referent category for comparison in groups with >2 categories.

⁺ Note that race/ethnicity definitions were based on 2000 Census data from Summary File 1, Table P4. Individuals reporting more than one race were classified in the “Other” race category.

3.2.1. Racial isolation and demographic subgroup exposures

Exposure estimates in low vs. high RI tracts in the Northeast are presented in Table 3, while corresponding tables for the three other regions are presented in eTables 7–9. Methods for hypothesis testing correspond to those used for the urbanicity analysis. Without exception across regions, PM_{2.5} exposures estimated for a given demographic subgroup are higher in tracts with the highest RI (≥ 80 th percentile) compared to tracts with the lowest RI (< 20 th percentile). In high RI tracts, NHB have the highest PM_{2.5} exposure in all regions. In low RI tracts, the racial/ethnic group with the highest exposure differed by region. Race/ethnicity-based exposures to O₃ varied by region and RI: in high RI tracts, NHW had the highest O₃ exposure in the Northeast, Midwest, and South, but in low RI tracts, the race/ethnicity groups with the highest exposure varied by region. There were not clear patterns with respect to age, education, or SES and O₃ exposure.

3.3. Racial isolation, urbanicity, region, and long-term air pollution exposures

Air pollution levels in urban, suburban, and rural tracts were plotted versus region-specific RI quintiles in Fig. 3 (PM_{2.5}) and eFigure 5 (O₃); plots suggest an association between PM_{2.5} and RI. We used linear regression to estimate the effect of a one quintile increase in RI by region and urbanicity, holding selected demographic variables at their mean (eTable 10). We report whether associations estimated between RI and air pollution were statistically significant and if associations differed by urbanicity within region.

In the Northeast, Midwest, and South, the association between RI and PM_{2.5} was positive and statistically significant in urban, suburban, and rural tracts. In the Midwest, associations in urban, suburban, and rural tracts were significantly different from one another. The largest association was in the rural Midwest, where a one quintile increase in RI was associated with a 0.90 $\mu\text{g}/\text{m}^3$ (95% confidence interval: 0.83, 0.99 $\mu\text{g}/\text{m}^3$) increase in PM_{2.5} concentration. In the South, the association in urban tracts was significantly higher than that in suburban or rural tracts: a one quintile increase in RI in the urban South was associated with a 0.35 $\mu\text{g}/\text{m}^3$ (0.33, 0.37 $\mu\text{g}/\text{m}^3$) increase in PM_{2.5}.

In the Northeast, Midwest, and West, the association between RI and O₃ was positive and statistically significant in urban, suburban, and rural tracts. In the South, the association between RI and O₃ was positive and statistically significant in urban tracts only. A one quintile increase in RI was associated with a 0.56 ppb (0.45, 0.68 ppb) and 0.69 ppb (0.60, 0.79 ppb) decrease in O₃ levels for suburban and rural tracts, respectively. In the Northeast, Midwest, and South, associations in urban tracts differed from those in suburban and rural tracts, while suburban and rural tracts were not significantly different from one another.

4. Discussion

We use a recently developed approach to predicting air pollution levels that allows us to estimate air pollution concentrations in locations without monitoring data and a previously derived local, spatial measure of RI to evaluate relationships among urbanicity, RI, and predicted PM_{2.5} and O₃ in urban, suburban, and rural areas of the US. Concentrations of PM_{2.5} were consistently highest in urban tracts and lowest in rural tracts for all US regions. The highest O₃ levels were found in the suburban Northeast, Midwest, and South, and the urban West. With respect to RI, there was a clear pattern in which 5y average PM_{2.5} levels increased with increasing quintile of RI within each geographic region. For PM_{2.5}, high RI tracts had higher average PM_{2.5} levels in each category of urbanicity than low RI tracts, with the exception of rural tracts in the West. Patterns of O₃ levels by urbanicity and low/high RI differed between regions.

Demographic analysis indicated that, without exception, PM_{2.5} exposure estimated for a given demographic subgroup was higher in tracts with high RI vs. low RI. Across all regions, levels of PM_{2.5} were

consistently higher for NHB compared to other race/ethnicity groups in urban, suburban, and rural tracts. While the magnitude of differences in PM_{2.5} exposure estimated for different racial/ethnic groups was not large, ranging from approximately 0.1–1.1 $\mu\text{g}/\text{m}^3$, the average difference may be small in magnitude due to averaging over the relatively large study area and regions within. Associations between RI and both PM_{2.5} and O₃ differed by urbanicity, but were positive and statistically significant with exceptions in the South and West. Within each region, associations between RI and predicted PM_{2.5} were highest in rural tracts of the Northeast and Midwest, and in urban tracts of the South and West. For O₃, associations were largest in the rural tracts of all regions except the South.

Previous work has used community-level measures of racial/ethnic composition to evaluate exposure burdens by population subgroup. Findings from our analysis of demographic subgroups are consistent with these studies (Brochu et al., 2011; Miranda et al., 2011; Bell and Ebisu, 2012; Gray et al., 2013; Ard, 2015), which find disproportionate exposure burdens for certain groups. However, a simple measure of

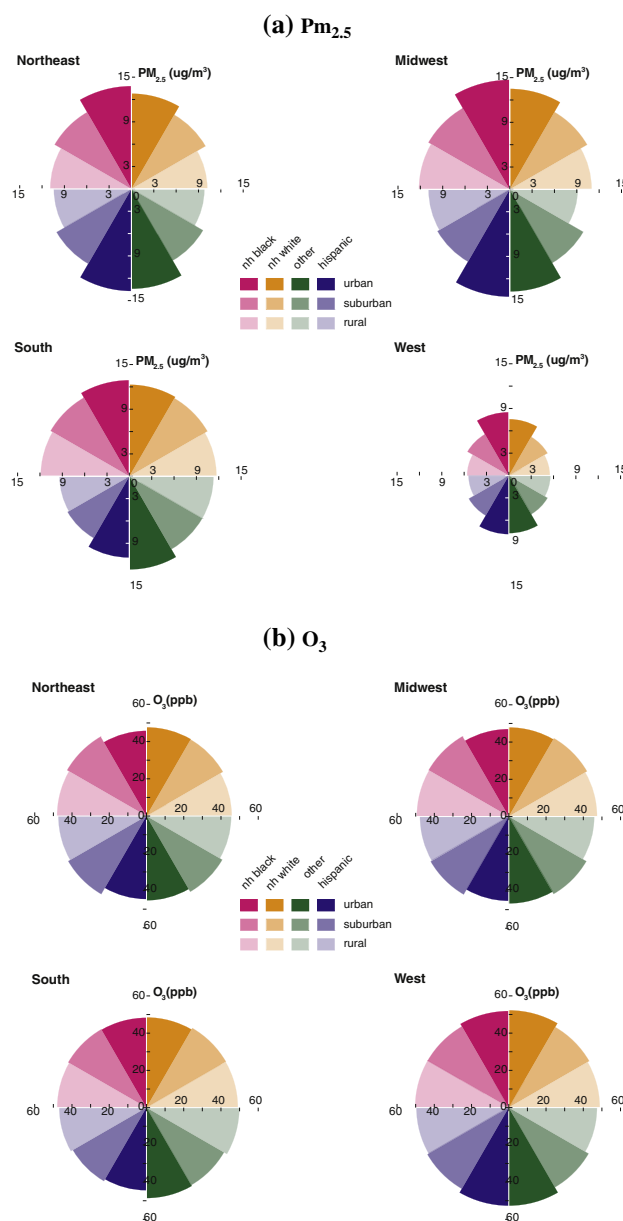


Fig. 2. a, b. Five year average downscaler derived concentrations of (a) PM_{2.5} (b) O₃ for racial/ethnic population subgroups by urbanicity and region.

Table 2

Average downscaler-derived air pollution exposure levels and racial isolation (RI), overall and by region*.

Racial isolation quintile	Average PM _{2.5} level (standard deviation) in µg/m ³				
	All regions (n = 52,807)	Northeast (n = 13,044)	Midwest (n = 16,357)	South (n = 21,776)	West** (n = 1,630)
<20th	11.1 (2.70)	11.5 (2.20)	10.7 (2.52)	11.2 (2.39)	5.91 (1.01)
20–39th	12.2 (2.40)	12.6 (1.80)	12.8 (2.21)	11.8 (2.41)	6.72 (1.26)
40–59th	12.5 (2.24)	12.9 (1.66)	13.2 (1.85)	12.2 (2.17)	7.44 (1.31)
60–79th	12.8 (2.04)	13.2 (1.56)	13.6 (1.62)	12.5 (1.86)	7.40 (1.05)
≥80th	13.5 (1.81)	13.9 (1.16)	14.6 (1.43)	12.9 (1.81)	8.07 (1.15)
	Average O ₃ level (standard deviation) in parts per billion (ppb)				
	All regions (n = 52,807)	Northeast (n = 13,044)	Midwest (n = 16,357)	South (n = 21,776)	West** (n = 1,630)
<20th	47.0 (4.12)	46.4 (3.73)	46.6 (3.10)	47.7 (6.03)	42.9 (3.51)
20–39th	48.0 (4.21)	47.4 (3.25)	47.6 (3.26)	48.3 (5.60)	44.1 (2.22)
40–59th	48.0 (4.60)	47.4 (3.36)	47.8 (3.55)	48.4 (5.22)	43.1 (1.93)
60–79th	48.1 (4.51)	47.2 (3.56)	48.1 (3.35)	48.3 (4.80)	43.7 (2.35)
≥80th	47.3 (4.31)	45.5 (3.52)	47.2 (3.28)	48.1 (4.64)	42.5 (1.88)

*Note that quintiles of RI were calculated for all census tracts (first column), and then separately for each region of census tracts. This is because the distribution of RI values differs between regions, e.g., the 20th percentile RI value for the Northeast region may not be equivalent or even similar to the 20th percentile RI value for the South region.

**The West region does not include all tracts in the census-defined West because the downscaler did not estimate air pollution exposures for all tracts in West states for 2002–2006.

racial composition may not be interpretable in the framework of RRS since 1) segregation depends on the relationship among race/ethnicity groups in neighborhoods; and 2) proportions of a given race/ethnicity group should be compared to place-wide racial composition (Morello-Frosch and Jesdale, 2006; Morello-Frosch and Lopez, 2006). Thus, such an approach may provide useful insights but does not account for the racial/ethnic composition of the larger community and thereby provide information as to whether the community's organization reveals broader patterns of racial inequity.

A smaller but growing body of work has examined air pollution exposure and racial segregation. In these studies, residential segregation is conceptualized either as (un)evenness (Lopez, 2002; Morello-Frosch and Jesdale, 2006; Rice et al., 2014), which is evaluated using a dissimilarity index (Sakoda, 1981), or clustering of tracts that significantly deviate from the racial/ethnic composition of the larger spatial unit (Getis

and Ord, 1992; Jones et al., 2014). These studies generally find higher exposures and health risks for individuals, specifically NHB (Lopez, 2002; Morello-Frosch and Jesdale, 2006) or Hispanics (Jones et al., 2014), in more segregated areas. A critical limitation of these studies is the exclusion of nonurban populations; without exception, these studies have focused on segregation and pollution only in metropolitan settings. This urban bias is likely due to the dearth of ambient monitoring data in more rural areas, but as a result, air pollution exposure levels, as well as relationships with RI, are uncharacterized for large, primarily rural and suburban swaths of the US population.

Although there is little or no research on segregation and air pollution in nonurban areas, Lichter et al., found patterns of racial unevenness in urban, suburban, and rural US communities (Lichter et al., 2007). Thus, it is not a question of whether RI exists outside of urban areas, but whether RI is related to air pollution in these locations. We find that associations between higher PM_{2.5} levels and RI or segregation are not limited to urban areas. Average air pollution levels differ by degree of urbanicity, but at least with respect to PM_{2.5}, individuals in high RI urban, suburban, and rural areas were consistently disproportionately exposed compared to their counterparts in low RI areas. Our findings also suggest that, in the Northeast and Midwest, the association between RI and PM_{2.5} is largest for rural tracts, and that the association between RI and O₃ is highest in suburban and rural areas of the Northeast, Midwest, and West. Thus, while overall pollution (e.g., PM_{2.5}) levels may be lower in nonurban versus urban areas, racially isolated tracts are disproportionately exposed compared to less racially isolated tracts at similar levels of urbanicity. This finding would seem to strengthen the case for a relationship between segregation and elevated PM_{2.5} exposure burdens.

In contrast, O₃ exposures were not clearly related to RI or consistently higher for particular demographic subgroups. The highest O₃ levels were primarily observed in suburban tracts, while the lowest levels were found in rural tracts, with the exception of the South. Differences in patterning of PM_{2.5} and O₃ exposure by RI, urbanicity, and demographic subgroup are not unexpected: PM_{2.5} is a primary pollutant, while O₃, a secondary pollutant, is formed in light-catalyzed reactions between precursor pollutants, namely nitrogen oxides (NO_x) and volatile organic compounds (VOCs) (Seinfeld and Pandis, 1998). The VOCs may come from anthropogenic or biogenic sources, thus complicating the relationship between urban/suburban/rural category and O₃

Table 3

Average downscaler-derived air pollution levels for each population group by RI in the Northeast*.

Variable	Average PM _{2.5} level (standard deviation) in µg/m ³			Average O ₃ level (standard deviation) in parts per billion (ppb)		
	All tracts	Least racially isolated (<20th percentile)	Most racially isolated (>80th percentile RI)	All tracts	Least racially isolated (<20th percentile)	Most racially isolated (>80th percentile RI)
Average pollution level	12.8 (1.88)	11.5 (2.20)	13.9 (1.16)	46.8 (3.56)	46.4 (3.74)	45.5 (3.52)
Race/ethnicity ⁺						
Non-Hispanic White**	12.5 (1.88)	11.3 (2.13)	13.6 (1.29)	47.2 (3.32)	46.7 (3.64)	47.4 (3.28)
Non-Hispanic black	13.7 (1.27)	11.8 (2.07)	14.0 (1.03)	45.8 (3.46)	47.1 (3.39)	45.3 (3.29)
Hispanic	13.6 (1.40)	12.4 (1.95)	14.0 (1.04)	44.7 (3.68)	46.5 (3.38)	44.0 (3.47)
Other	13.3 (1.64)	12.1 (2.15)	13.8 (1.08)	45.7 (3.64)	45.7 (3.32)	45.2 (3.28)
Age (y)						
<20**	12.8 (1.81)	11.5 (2.12)	13.9 (1.11)	46.9 (3.49)	46.5 (3.61)	45.4 (3.51)
20–64	12.8 (1.83)	11.5 (2.13)	13.9 (1.11)	46.8 (3.55)	46.4 (3.64)	45.5 (3.54)
≥65	12.8 (1.85)	11.5 (2.15)	13.9 (1.16)	47.1 (3.46)	46.8 (3.65)	46.0 (3.52)
Education						
<High school**	13.1 (1.80)	11.8 (2.27)	13.9 (1.09)	46.3 (3.68)	46.7 (3.75)	45.0 (3.55)
High school	12.7 (1.86)	11.5 (2.14)	13.8 (1.13)	47.2 (3.56)	46.4 (3.69)	45.8 (3.52)
College	12.7 (1.76)	11.5 (2.01)	13.8 (1.13)	46.8 (3.51)	46.4 (3.42)	45.5 (3.42)
Socioeconomic						
Employed	12.8 (1.82)	11.6 (2.13)	13.8 (1.12)	46.9 (3.51)	46.4 (3.70)	45.6 (3.52)
Unemployed	13.1 (1.80)	11.4 (2.14)	14.0 (1.06)	46.2 (3.70)	46.5 (3.63)	44.9 (3.50)
Not in poverty	12.8 (1.82)	11.5 (2.12)	13.8 (1.11)	47.0 (3.48)	46.7 (3.61)	45.8 (3.50)
In poverty	13.1 (1.85)	11.4 (2.26)	14.0 (1.12)	45.8 (3.70)	46.1 (3.85)	44.8 (3.54)

*Values in bold indicate significant differences between categories ($p < 0.05$), assessed using weighted t -tests.

**Denotes referent category for comparison in groups with >2 categories.

⁺ Note that race/ethnicity definitions were based on 2000 Census data from Summary File 1, Table P4. Individuals reporting more than one race were classified in the “Other” race category.

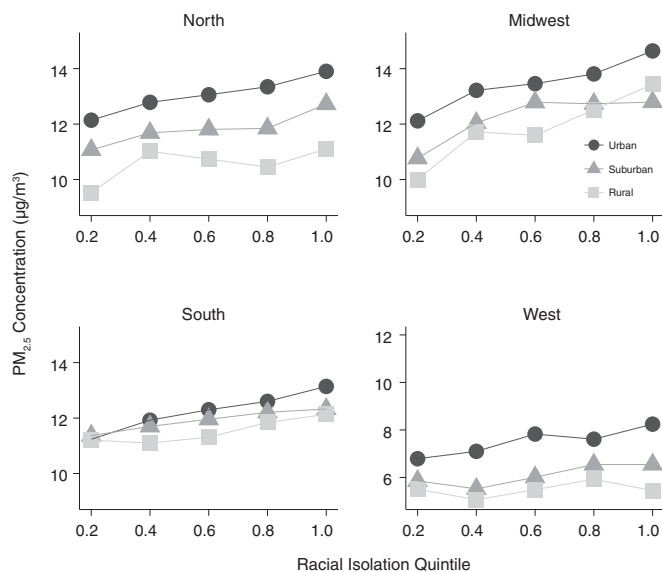


Fig. 3. Quintiles of racial isolation and average PM_{2.5} levels.

concentrations. Ozone concentrations are typically higher where there is a mixture of precursor pollutants in the atmosphere, and O₃ tends to be a “regional” pollutant, that is, it is more homogeneously distributed over larger geographies compared to PM_{2.5} (Bergin et al., 2005).

Several features of this study enhance the health-relevance of our findings. First, exposure burdens were examined as 5y averages, so even small increases in concentration represent elevated exposures that may threaten health over a long period of time. Moreover, because these are long-term averages, it is less likely that they are anomalous; elevated average concentrations observed over one day or week do not provide as convincing evidence of higher overall exposure burdens in the same way as elevated concentrations sustained over multiple years. Further, because we calculate population-level estimates, any differences in exposure apply to a large number of people, and therefore translate into substantial increases in exposure burdens for more racially isolated populations. Unequal exposure burdens, particularly when combined with social, demographic, and neighborhood risk factors, may enhance vulnerability or susceptibility and contribute to the marked disparities that are observed in many health outcomes along racial/ethnic, socioeconomic, urban/rural, neighborhood, or geographic lines (Gee and Payne-Sturges, 2004). Consequently, the association observed between air pollution exposure and RI represents an important and far-reaching public health issue.

This study has several limitations. We use downscaler predictions of air pollution concentrations for 2002–2006, and 2000 Census data to estimate demographic characteristics of tracts for those years. However, 2000 Census data may not accurately reflect population characteristics either for 2002–2006 or for present-day. This analysis may not capture finer scale patterns in RI, SES, or racial/ethnic composition related to long-term PM_{2.5} or O₃ concentrations, as the spatial resolution can impact the presence, magnitude, and extent of estimated exposure disparities (Dolinoy and Miranda, 2004). Tracts are population-based, such that tracts in densely settled urban areas are systematically smaller in size (area) than tracts in less densely populated areas. Thus, spatial “smoothing” of air pollution and RI differ in urban, suburban, and rural settings, which could affect relationships observed between RI and air pollution by urbanicity. Downscaler estimates are not equivalent to monitoring data, and we are less confident in the accuracy of exposures estimated using downscaler output in areas with less monitoring data. Further, downscaler output were only available for the eastern two-thirds of the US for 2002–2006, and entirely exclude multiple states in the western US, including Arizona, California, Idaho, Oregon, Nevada, Utah, and Washington. Finally, ambient air pollution concentrations

are not direct measures of exposure and do not capture individual-level exposures due to indoor air pollution, activity patterns, or occupation.

To our knowledge, this study is the first to examine associations between air pollution exposure burdens and RI in nonurban settings. We use a local, spatial measure of RI of NHB (Anthopoulos et al., 2011) derived from a global spatial measure of isolation (Reardon and O’Sullivan, 2004). This local measure of RI of NHB accounts for the underlying spatial relationships among spatial units, and in effect, the relationships among race/ethnicity groups in different tracts. We contend, as have others, that RRS is a multilevel construct that may manifest in different ways depending on the geographic scale of measurement (Acevedo-Garcia et al., 2003). Further, characterizing exposures in non-urban settings is important, independently of RI or demographic subgroup: pollutant mixtures, concentration, and chemical composition (in the case of PM_{2.5}) may differ between urban and rural areas (Krall et al., 2013). Urban and rural populations may also differ systematically in ways that impact exposure levels or health outcomes at a given level of exposure (i.e., effect modification) (Vanasse et al., 2010). Using downscaler-predicted air pollution levels allowed us to include a diverse population that is a larger, more representative sample of the US population than that obtained from examining exclusively urban populations.

Although this work and previous studies differ with respect to study area, segregation/isolation measures, and geographic scale, results consistently indicate that greater NHB segregation is associated with disparities in air pollution exposures (Lopez, 2002; Morello-Frosch and Jesdale, 2006; Jones et al., 2014; Rice et al., 2014). The current study uses a finer scale spatial measure of RI that can identify specific tracts with elevated air pollution levels. Such local information may more readily translate into state/tribal or county initiatives targeted at particular communities to mitigate exposure levels or pre-empt poor health outcomes among residents. Findings from this study contribute to a more comprehensive understanding of air pollution exposure and segregation, which can be used to inform policy-making and better identify and protect sensitive, susceptible, and vulnerable subpopulations.

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Competing interests/conflicts of interest

None declared.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.envint.2016.04.008>.

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Farmington Field Office Oil and Gas Lease Sale, June 2019

Environmental Assessment

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Bureau of Land Management:

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CHAPTER 1. INTRODUCTION

1.1. Background

This Environmental Assessment (EA) documents the Bureau of Land Management (BLM) Farmington Field Office (FFO) review of two (2) parcels (320.00 acres) nominated for auction in the FFO June 2019 Competitive Oil and Gas Lease Sale. Of these two (2) parcels, one is managed by private surface owners, the other is managed by BLM. All parcels contain federal minerals. For detailed information of the Leasing Process see the following website: <https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/parcel-nominations>.

1.2. Purpose and Need

The BLM's purpose is to respond to Expressions of Interest (EOIs) to lease Federal oil and gas resources through a competitive leasing process. The need for the action is established by the BLM's responsibility under the Mineral Leasing Act of 1920 (MLA), as amended, to promote the exploration and development of oil and gas on the public domain.

1.3. Decision to be Made

The BLM Authorized Officer will decide whether or not to lease the nominated parcels. If the decision is to lease, standard terms and conditions and lease stipulations would apply.

1.4. BLM Land Use Plan Conformance and Relationship to Statutes, Regulations, and Other Plans

1.4.1. BLM Land Use Plan Conformance

The applicable land use plan (LUP) for the proposed leasing is the 2003 Farmington RMP with Record of Decision (BLM 2003), as amended. One of the goals of 2003 Farmington RMP is to provide opportunities to develop mineral resources (page 2-1). All nominated lease parcels fall within areas designated in the RMP as open under standard terms and conditions. Lease stipulations originating from the 2003 Farmington RMP would apply to each parcel. Additionally, lease stipulations provided by the BIA apply to parcels with surface managed by the BIA. Lease notices and notations also provide information to prospective bidders regarding the following: 1) limitations that already exist in law, lease terms, and regulations, or operational orders; and 2) special items the lessee should consider when planning operations. Further information regarding these items can be found in Appendices A, C, D, and E.

1.4.2. Relationship to Statutes, Regulations, and Other Plans

Purchasers of oil and gas leases are required to comply with all applicable Federal, state, and local laws and regulations, including obtaining all necessary permits prior to any lease development activities. A listing of selected directly relevant statutes, regulations, and other plans is provided in Table 1.1.

Table 1.1. Relationship to Statutes, Regulations, and Other Plans

RELEVANT STATUTE, REGULATION OR PLAN	RELATIONSHIP TO THE PROPOSED LEASE SALE
Federal Lands Policy and Management Act (FLPMA)	FLPMA establishes guidelines to provide for the management, protection, development, and enhancement of public lands (Public Law [PL] 94-579). Section 103(e) of FLPMA defines public lands as any lands and interest in lands owned by the United States (U.S.). For split-estate lands where the mineral estate is an interest owned by the U.S., the BLM has no authority over use of the surface by the surface owner; however, the BLM is required to declare how Federal mineral estate is managed in the 2003 Farmington RMP, including identification of all appropriate lease stipulations (43 Code of Federal Regulations [CFR] 3101.1 and 43 CFR 1601.0-7(b); BLM Manual Handbook 1601.09 and 1624-1).
Mineral Leasing Act (MLA)	The MLA establishes that deposits of oil and gas owned by the US are subject to disposition in the form and manner provided by the MLA under the rules and regulations prescribed by the Secretary of the Interior, where consistent with the FLPMA, the NEPA, as amended (PL 91-90, 42 United States Code [USC] 4321 <i>et seq.</i>), and other applicable laws, regulations, and policies.
43 CFR Part 3100	These regulations govern onshore oil and gas leasing, development and production of Federal minerals.
Federal Onshore Oil and Gas Leasing Reform Act of 1987	This Act directs the BLM to conduct quarterly oil and gas lease sales whenever eligible lands are available for leasing.
New Mexico Surface Owner Protection Act	Of the 22 nominated parcels, parcel 10 contains private surface. This Act requires operators to provide the surface owner at least five business days' notice prior to initial entry upon the land for activities that do not disturb the surface; and at least 30 days' notice prior to conducting actual oil and gas operations. Included in this policy is the implementation of a Notice to Lessees (NTL), a requirement of lessees and operators of onshore Federal oil and gas leases within the State of New Mexico to provide the BLM with the names and addresses of the surface owners of those lands where the Federal Government is not the surface owner, not including lands where another Federal agency manages the surface.
National Historic Preservation Act of 1966 (NHPA)	Leasing is considered an undertaking under Section 106 of the NHPA. Agencies may follow a phased approach to Section 106 compliance. At the leasing level, existing records reviews and consultation drive identification of historic properties. Class III field inventories are an important part of identification at the APD level. See the text of stipulation WO-NHPA for details.

1.5. Scoping and Issues

1.5.1. Internal Scoping

A BLM FFO interdisciplinary team conducted internal scoping to identify issues, potential alternatives, and data needs by reviewing leasing actions within the context of the existing 2003 Farmington RMP under the NEPA framework. Interdisciplinary team meetings were held on December 17th, as were weekly ID team meetings. Additionally, other resource specific meetings with resource specialists were held to help refine issues related to the proposed lease sale.

1.5.2. External Scoping

A summary web page for the Farmington Field Office June 20, 2019, Competitive Oil and Gas Lease Sale was posted on the BLM's National NEPA Register website (<https://eplanning.blm.gov>). The nominated lease parcels were posted online for a 10-day public scoping period from January 28-February 8, 2019.

During public scoping, the BLM received 7 comment letters opposing the Farmington Field Office June 2019 Competitive Oil and Gas Lease Sale. The FFO received one (1) comment from a private individual, and a more detailed scoping comment letter from two (2) environmental group representing the comments from several other non-profits. Scoping comments received from two (4) pueblos, tribes, Navajo Nation Chapter Houses, or local governmental partners will be addressed through direct dialogue.

No external public scoping comments were received that were in favor of leasing the nominated lease parcels. Concerns and comments presented by the public, as well as environmental groups are summarized in Table 1.3. Similar concerns are grouped together for brevity.

Table 1.3. Summary of External Scoping Comments and Location in EA.

SCOPING COMMENT SUMMARY
Concerns regarding cultural resources.
Concerns regarding greenhouse gas (GHG) emissions as they relate to climate change.
Concerns regarding the nature and extent of planned government to government consultation.
Concerns regarding NEPA adequacy.
Concerns regarding the ongoing FFO Resource Management Plan Amendment.
Concerns regarding environmental justice.

1.5.3 Issues

The Council on Environmental Quality (CEQ) regulations state: "NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail" (40 CFR 1500.1(b)). The regulations at 40 CFR 1500.4(g) direct that the scoping process should be used "not only to identify significant environmental issues deserving of study but also to deemphasize insignificant issues narrowing the scope of the [NEPA] process accordingly."

Issues identified for detailed analysis for the lease sale in this EA are summarized in Table 1.3 and were developed in accordance with CEQ regulations and the guidelines set forth in the BLM NEPA Handbook H-1790-1) (BLM 2008) using input from internal and external scoping. The impact indicators provided are used to describe the affected environment for each issue and measure the amount or degree of change in the issue for different alternatives in Chapter 3 (Affected Environment and Environmental Impacts).

Table 1.3. Issues Identified for Detailed Analysis at the Lease-Sale Level

ISSUE	ISSUE STATEMENT	IMPACT INDICATOR
Issue 1	How would emissions of criteria pollutants (respective to the National Ambient Air Quality Standards [NAAQS]) and Volatile Organic Compounds (VOCs) from future potential development of the nominated lease parcels impact air quality?	Emissions (NAAQS, VOCs)
Issue 2	How would future potential development of the nominated lease parcels contribute to greenhouse gas (GHG) emissions?	Emissions (CO ₂ e)
Issue 3	How would future potential development of the nominated lease parcels impact surface and groundwater quantity?	Amount of water used and produced; proximity of water features to parcels (wells and springs); depth of water features (wells and springs)
Issue 4	How would future potential development of the nominated lease parcels impact environmental justice (EJ) communities and their quality of life?	Impacts of issues analyzed, evaluated as they relate to low-income and minority populations

Twenty-seven additional, potential issues were identified. These issues were considered, analyzed in brief and in the light of these assessment were dismissed from further, detailed analysis in Chapter 3. Each of the twenty-seven issues are outlined below in Table 1.4 with their corresponding analysis and rationale for not carrying the issue forward for detailed analysis. WO-ESA, WO-NHPA, and NM-11-LN would apply to all nominated lease parcels, as well as standard terms and conditions as described in the lease form.

Table 1.4. Issues Considered, Analyzed in Brief with Statement of Rationale, and Dismissed from Further Analysis

ISSUE #	ISSUE STATEMENT WITH CONTEXT DISCUSSION
ELM-1	How would future potential development of the nominated lease parcels contribute to the social cost of carbon from greenhouse gas emissions (GHGs)? The EA does not undertake an analysis of the social cost of carbon because: 1) it is not engaged in a rulemaking for which the protocol was originally developed; 2) the interagency working group, technical supporting documents, and associated guidance have been withdrawn; 3) NEPA does not require cost-benefit analysis; and 4) the full social benefits of methane and coal-fired energy production have not been monetized, and quantifying only the costs of GHG emissions but not the benefits would yield information that is both potentially inaccurate and not useful. See Appendix E for further explanation.
ELM-2	How would future potential development of the nominated lease parcels impact the Old Spanish National Historic Trail (OSNHT)? BLM previously analyzed the potential for development of Parcel 025 to interfere with the nature and purpose of the OSNHT and consulted with the Old Spanish Trail Association (OSTA; see DOI-BLM-NM-F010-2014-0154-EA). OSTA responded to consultation requests and provided additional comments during public scoping. Ultimately, feedback did not identify historic properties associated with the trail within the APE or give cause for FFO to amend its determination that development of Parcel 025 would not substantially interfere with the nature and purpose of the trail. At its nearest, the designated Armijo Route of the OSNHT passes within 2.5 miles of the indirect APE, or 3.5 miles of the direct APE, a distance more than sufficient to avoid impacts to the soundscape. Recent viewshed modeling of the direct APE of Parcel 025 shows that facilities would not be visible from any point along the trail, supporting the prior finding that there would be no substantial interference.

	At a distance of 8.6 miles from the Armijo Route, and with only about 20% of the route within 15 miles of the direct APE visible within the viewshed of the direct APE, future developments associated with Parcel 047 do not have a significant potential to create indirect impacts yielding substantial interference. See FFO's "June 2019 Oil & Gas Lease Sale, Cultural Resources Records Review and Determination of Effect," Appendices 1 and 4, for further details.
ELM-3	How would future potential development of the nominated lease parcels impact fluid minerals and energy production? Depending on the success of oil and gas well drilling, non-renewable natural gas and/or oil would be extracted and delivered to market. Production of oil or gas would result in the irretrievable loss of these resources (i.e., they would no longer be available for future development). The 2003 Farmington RMP committed these resources for oil and gas leasing. Future estimated production from these leases, based on the 2018 RFD (Crocker and Glover 2018), is 144,678 barrels (bbl) of oil and 4,479,285 thousand cubic feet (mcf) of gas.
ELM-4	How would future potential development of the nominated lease parcels impact forestry and fuelwood resources? Both parcels contain forested areas of ponderosa pine and pinyon juniper woodlands. Onshore orders, lease terms, best management practices (BMPs), and site-specific conditions (applied at the APD stage) would help protect fuelwood resources. Voluntary proponent design features and best management practices within the FFO typically provide for trees 3 inches or greater in diameter at ground level to be cut and de-limbed, and either stacked along access roads for wood gatherers or delivered to adjacent Chapter Houses of the Navajo Nation.
ELM-5	How would future potential development of on the nominated lease parcels impact fuels and fire management? Future potential development of the lease parcels could result in new surface disturbance (estimated in this EA to be around 11.2 acres). Noxious and invasive weeds (including cheatgrass [<i>Bromus tectorum</i>]) readily invade disturbed sites. The potential spread of cheatgrass could provide an opportunity for increased fine fuel loading and an environment conducive to wildland fires. However, as discussed under ELM- 11, the BLM's authority under section six of the standard lease terms and conditions would result in the application of measures to reduce or eliminate the spread of noxious and invasive weeds.
ELM-6	How would future potential development of the nominated lease parcels impact the potential for induced seismicity in the San Juan Basin? Oil and gas development on the proposed lease parcels would likely increase the amount of produced water that would be injected into the subsurface environment. While induced seismicity has been linked to wastewater injection in various parts of the United States (National Research Council 2013), the San Juan Basin has not been associated with induced seismicity (Weingarten et al. 2015). The 2018 USGS Short-term Induced Seismicity Model indicates that the San Juan Basin is in an area of less than a 1% chance of potentially minor-damage ground shaking.
ELM-7	How would future potential development of the nominated lease parcels impact lands, access, realty, and the West-wide Energy Corridor? Both parcels are well outside of the West-wide Energy Corridor. Parcel 47 is over 14 miles to the east, parcel 25 is 55 miles to the east. Oil and gas leasing is not expected to affect access to public lands because leases are subject to all valid pre-existing rights. Any proposals for future rights-of-ways (ROWs) within lease parcels would be reviewed on a site-specific basis when an application for a ROW is received by the BLM FFO. Off-lease ancillary facilities that cross public land may require separate authorizations. Coordination with the existing ROW holders and application of standard operating procedures, best management practices, and design features at the APD stage, ensure protection of existing rights. The 2003 Farmington RMP established guidelines for development within the WWEC on BLM managed surface (BLM 2003, pg. 2-11), however there are no WWEC development restrictions on Navajo Nation surface. Any surface disturbance proposed outside of this lease and within the WWEC on BLM managed surface would follow guidelines from the 2003 Farmington RMP which could include siting disturbance outside of the WWEC.
ELM-8	How would future potential development of the nominated lease parcels impact the physical and biological integrity of soils? The BLM FFO designated fragile soils (rock outcrop) are located within portions of parcel 47. No portions of parcel 25 have designated fragile soils. The aforementioned fragile soils are primarily comprised of the Badland soil type. Badland Rock Outcrop – Persayo Complex is found in parcel 47. Fragile soil impacts from

	future potential development of the lease parcels would be analyzed further during the site specific NEPA analysis conducted in conjunction with the APD process. The BLM's authority under section six of the standard lease terms and conditions would result in the application of measures to mitigate impacts to the physical and biological integrity of soils during the development of a lease.
ELM-9	How would future potential development of the nominated lease parcels impact vegetation? Future potential development on the nominated lease parcels would introduce new surface disturbance involving vegetation removal. Using land cover data from the Southwest Regional Gap Analysis Project (SWReGAP), the following vegetation types are present on one or more lease parcels: sagebrush shrublands, pinyon/juniper woodlands, badland/rock/wash, and greasewood (SWReGAP 2019). These vegetation communities provide soil cover, wildlife habitat, and livestock forage among other values to varying levels. Lease parcels would follow standard terms and conditions which include interim and final reclamation requirements, and provide the BLM with the authority to determine site specific vegetation management strategy at the APD stage.
ELM-10	How would future potential development of the nominated lease parcels impact livestock grazing? Both nominated parcels are within BLM managed allotments; these include the Rancho Largo and Woodfill grazing allotments. Vegetation communities in these allotments provide livestock forage to varying degrees, with the sagebrush grassland community primarily utilized. Future potential development on the nominated lease parcels would introduce new surface disturbance on the aforementioned livestock grazing allotments. This would involve vegetation removal and changes to forage conditions. Alterations to existing range improvements are also possible. The BLM's authority under standard lease terms and conditions would result in the application of measures to mitigate livestock grazing related impacts.
ELM-11	How would future potential development of the nominated lease parcels impact the introduction and/or spread of noxious weeds and invasive plants? Future potential development of the nominated lease parcels would introduce new surface disturbance. Invasive and noxious weeds invade disturbed sites, compete with native vegetation, and contribute to the degradation of soil health. In the event noxious weeds are discovered at any time during future potential development, standard terms and conditions provide the BLM with the authority to develop measures to address potential impacts created from noxious weeds and invasive plants. Development of these measures would occur at the APD stage of lease development and would allow for site specific treatments to be identified and implemented.
ELM-12	How would future potential development of the nominated lease parcels impact paleontological resources? Both lease parcels (as with the majority of the lands managed by the Farmington Field Office) are mapped as Potential Fossil Yield Classification (PYFC) 5. PYFC 5 lands consist of geologic units that predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils. The geologic units that are of PFYC 5 value include the Fruitland, Kirtland, Nacimiento, and San Jose Formations. Impacts to paleontological resources can be mitigated by standard lease terms under Section 6 of the lease form, which require a lessee to conduct inventories or special studies at the discretion of the lessor (BLM). Site-specific projects that cause surface disturbance in PFYC 4 or 5 areas are required to have a paleontological survey and/or monitoring conducted at the APD stage in accordance with NEPA and FLPMA. For BIA managed lands paleontological resources are addressed through NEPA. Scientifically significant paleontological resources discovered through surveys or monitoring will be collected by a permitted paleontologist and curated at an appropriate repository. If previously identified paleontological localities located in or near APD sites would be protected and avoided. If in the conduct of operations, paleontological resources are uncovered as inadvertent discoveries, the lessee must cease any operations that would result in destruction of the resource and contact the lessor (BLM). Site-specific impacts may be analyzed further under NEPA at the APD-stage when development details are known
ELM-13	How would future potential development of the nominated lease parcels impact dispersed public recreation? Future potential development under the Proposed Action would introduce new surface disturbance and related equipment, roads, and structures distributed across the nominated lease parcels. Oil and gas related disturbances have the potential to modify recreation opportunities and the recreation experience primarily as a result of changes in the landscape (viewshed), soundscape (noise), and presence of oil and gas development related activities (construction, traffic, etc.). The FFO contains a total of 7.8 million acres of public and non-public lands. Parcels 47 encompasses 120 acres of BLM-managed surface. Parcel 25 is located on non-BLM managed lands. Disturbance in the above context is unlikely to modify dispersed recreation opportunities or the

	experience of dispersed recreation because of the limited scale and existing oil and gas development. If necessary, the BLM's authority under standard lease terms and conditions would allow the application of measures to mitigate recreation-related impacts. Site-specific impacts may be analyzed further under NEPA at the APD-stage when development details are known.
ELM-14	How would future potential development of the nominated lease parcels impact travel and travel management? Future potential oil and gas lease operations would likely increase short term traffic to existing roads in regions near nominated lease parcels. Well sites, once construction, drilling, and completion have taken place, do not significantly increase travel on an individual basis, in areas where development already exists. A well site can expect one to two trips per week by a lease operator, for the productive life of a well. Leases that are not developed would not increase traffic and are only valid for a period of 10 years without production. Development of new roads and infrastructure within nominated lease parcels would be subject to standard lease terms and conditions, Onshore Orders, as well as site specific NEPA analysis in conjunction with the submittal of an APD or master development plan.
ELM-15	How would future potential development of the nominated lease parcels impact public health and safety? The nominated lease parcels are generally located in remote areas with limited public visitation in the general vicinity of the communities Lybrook and Lindrith. One or more residences typically exist within a mile of the nominated lease parcels, although no structures appear to be located in or around any of the lands within either parcel. All lease operations are subject to standard lease terms and conditions, as well as 43 CFR 3160 at the APD approval stage. Potential impacts to public health and safety may be analyzed further during project specific NEPA analysis when site-specific development details are known. Refer to section 3.7 for details on how public health and safety relates to EJ communities.
ELM-16	How would future potential development of the nominated lease parcels impact waste including solid and hazardous materials? Potential future development of the nominated lease parcels would result in the generation of waste, including solid and hazardous materials. Typical wastes associated with oil and gas development include produced water, hydrocarbons, and fracking fluids among others. Ongoing oil and gas activities include the implementation of measures to reduce or eliminate hazards associated with wastes in compliance with solid and hazardous materials laws and regulations (e.g., implementation of Spill Prevention Control and Countermeasure Plans [SPCC], disposal of wastes at approved facilities, etc.). Implementation of these measures would continue associated with all future potential development activities on nominated lease parcels because these measures are required to maintain compliance with the aforementioned laws and regulations.
ELM-17	How would future potential development of the nominated lease parcels impact watershed hydrology and surface water quality and quantity? No lease parcels are within 100 miles of the Rio Chama watershed. Future potential development under the Proposed Action could result in new surface disturbance distributed across the nominated lease parcels. The majority of the nominated lease parcels are located in areas with limited surface waters and topographic relief, with likely few water features that would be considered potentially jurisdictional waters of the U.S. subject to regulation by the U.S. Army Corps of Engineers. As a result of the above factors, watershed hydrology and surface waters would be largely outside of any potential development proposed by a future lessee or operator, reducing and greatly eliminating any impacts. In addition, if necessary the BLM's authority under standard lease terms and conditions would result in the application of measures to mitigate surface water quality and quantity related effects at the APD stage. Leasing and future potential development of the nominated lease parcels would result in oil and gas activities including well pad construction, drilling, and completion for an estimated 2 wells. Both of these would likely be horizontal wells that would employ standard industry practices related to well completion (i.e., perforation and hydraulic fracturing). The BLM requires operators to comply with the regulations at 43 CFR 3160. These regulations require oil and gas development to comply with directives in the Onshore Orders and the orders of the Authorized Officer. Onshore Order No. 2 and the regulations at 43 CFR 3162.3-3 provide regulatory requirements for hydraulic fracturing including casing specifications, monitoring and recording, and management of recovered fluids. In addition, the State of New Mexico Oil Conservation Division expressly prohibits pollution of any surface or subsurface fresh water from well completion activities and provides management of hydraulic fracturing operations. Finally, 19.15.16 New Mexico Administrative Code (NMAC) contains minimum casing and cementing standards. Complying with the aforementioned regulations requires producers and regulators to verify the integrity of casing and cement jobs. Casing specifications are designed and submitted to the BLM together with an APD. The BLM independently verifies the casing program, and the

	installation of the casing and cementing operations are witnessed by certified BLM Petroleum Engineering Technicians.
ELM-18	How would future potential development of the nominated lease parcels impact water rights in the San Juan Basin? Water is used primarily in the drilling and completion activities associated with the installation of a new oil or gas well. This use is temporary, and in many cases consists of produced waste water, which is not a portion of any water rights associated with the San Juan Basin. Surface water used for the purpose of oil and gas drilling and completion is purchased legally by those who hold water rights in or around the San Juan Basin. The transaction for this water is largely outside the regulatory framework provided the BLM under FLPMA, and is instead handled by the New Mexico Oil Conservation Division as well as the New Mexico Office of the State Engineer. Other uses of freshwater associated with oil and gas development include dust abatement, and reclamation. These uses are fractional (under one percent) in their cumulative draw from surface waters. All other water uses are evaluated at the APD stage in site-specific NEPA analysis and subject to standard lease terms and conditions.
ELM-19	How would future potential development of the nominated lease parcels impact threatened and endangered (T&E) species? According to the FWS's Information for Planning and Consultation system (IPaC), the nominated lease parcels are not within habitat of any federally listed species. A database query of the Biota Information System of New Mexico (BISON-M) found an absence of federal and state threatened, endangered, and candidate species within the vicinity of the lease sale parcels. Future potential development on the nominated lease parcels could result in new surface disturbance, however, habitat for threatened and endangered species the nominated lease parcels does not occur within or near the nominated lease parcels. Furthermore, no riparian habitat is located within the nominated lease parcels that could impact habitat for yellow-billed cuckoo and the New Mexico meadow jumping mouse. Biological evaluations would be conducted at the site-specific project level for any future actions within the lease parcels to determine if impacts to T&E species would occur. Avoidance, minimization, and/or mitigation measures would also be determined at that time. Standard terms and conditions would apply to all parcels, including stipulation F-41-LN which provides notice of the potential requirement of biological surveys prior to surface-disturbing activities. Additionally, stipulation WO-ESA-7 would be applied to all parcels with potential to contain T&E species. A list of all T&E species that may occur within the nominated lease parcels is provided in Appendix F. See Chapter 4 for additional details regarding impacts and consultation related to threatened and endangered species.
ELM-20	How would future potential development of the nominated lease parcels impact BLM Sensitive Species? Except for the species listed below, no specific BLM Sensitive Species or their habitats are known to occur within the nominated lease parcels (cite IM or SSS list). Under future potential development of these parcels, the following species and their habitat could be disturbed: Brack's cactus (<i>Sclerocactus cloveriae</i> ssp. <i>brackii</i>) potential habitat occurs within one mile of the proposed lease parcel 47, although no habitat is mapped within the boundaries of either parcel. Potential habitat, is habitat that has been modeled or assessed through mapping (i.e., GIS) to identify specific substrates (i.e., formation, soil units) and elevation ranges associated with the subject plant species. Future potential development is not currently expected to damage or remove any habitat. No amount of surface disturbance would result in a decrease in habitat quality from human presence and loss of vegetation. Biological evaluations would be conducted at the site-specific project level for any future actions within the lease parcels to determine if impacts to BLM Sensitive Species would occur. Avoidance, minimization, and/or mitigation measures would also be determined at that time. Standard terms and conditions would apply to all parcels, including stipulation F-41-LN which provides notice of the potential requirement of biological surveys prior to surface-disturbing activities. Additionally, stipulation NM-11-LN would be applied to parcels with potential to contain BLM Sensitive Species. A list of all BLM Sensitive Species that may occur within the nominated lease parcels is provided in Appendix F. See Chapter 4 for additional details regarding Endangered Species Act consultation and coordination.
ELM-21	How would future potential development of the nominated lease parcels impact migratory birds? The nominated lease parcels are within the North American Bird Conservation Initiative (NABCI) Bird Conservation Region (BCR) 16 (Southern Rockies). There are 11 bird species of conservation concern listed

	for BCR 16 (Partners in Flight 2016). Within a two-mile buffer of nominated lease parcels, USFWS IPaC system did not identify any bird species of conservation concern (USFWS2018). Surface disturbance from future potential development of nominated lease parcels is estimated to be approximately 11.2 acres. This amount of surface disturbance would result in a decrease in habitat quality from human presence and loss of vegetation. Following reclamation, these effects would decrease over time. If necessary, the BLM's authority under standard lease terms and conditions would result in the application of measures to mitigate effects to migratory birds at the APD stage. Future potential development would follow BLM FFO migratory bird policy which could include development constraints during migration and nesting seasons as well as nest surveys prior to implementation of development activities.
ELM-22	How would future potential development of the nominated lease parcels impact wildlife, including game and non-game species within Crow Mesa SDA? The FFO contains populations of big game species including deer and elk, as well as a multitude of other non-game species. Activities directly and indirectly related to potential oil and gas development of the nominated lease parcels have the potential to impact wildlife. These impacts include loss of suitable forage, loss of suitable habitat, habitat fragmentation, and avoidance of infrastructure. Parcel 47 is encompassed by the southern portion of the Crow Mesa SDA. A specific timing limitation, F-4 TL has been applied to protect important seasonal wildlife habitat (big game winter range). All other impacts will need to be evaluated on a site-specific basis consistent with the 2003 RMP management prescriptions for Crow Mesa SDA. Parcel 47 encompasses 120 acres of Game Management Unit 2C. Parcel 25 contains highly fractured, marginal to poor quality wildlife habitat. Parcel 25 acts as a migration corridor, stopover area, and general use area for big game species and contains 120 acres of wildlife habitat within Game Management Unit 2B on private surface. Any activity that involves surface disturbance or direct resource impacts would be subject to standard lease terms and conditions, as well as site specific NEPA analysis.
ELM-23	How would the visual landscape be affected by future potential development of the nominated lease parcels? The FFO reviewed aerial photography and records of existing oil and gas development to determine if new development would have a significant visual impact. In general, the significance of a new visual element relates to its proximity to a sensitive viewpoint such as residences, with the impact lessening the further away it is from that sensitive viewpoint. Impacts to visual resources from potential future development would be mitigated through application of the F-8-VRM stipulation on the leases. Lease terms and conditions #6 allows the BLM to consider further mitigation for visual resources at the APD-permit stage. The Proposed Action is consistent with VRM Class IV on BLM-managed surface on parcel 47.
ELM-24	What are the potential impacts from oil and gas leasing and future potential development on Socioeconomics? The oil and gas industry has been a substantial contributor to the social setting and economic basis of the San Juan Basin for decades. While the act of leasing Federal minerals itself would result in no direct social impacts, including impacts to environmental justice populations of concern, subsequent development of a lease may generate impacts to communities and individuals in the vicinity of the lease. At the lease sale stage, it is unknown where, or even if, development will occur in any given lease parcel. As specific types and locations of development are proposed, their impacts will be analyzed and addressed during the APD stage of development. Potential impacts could include impacts to employment opportunities related to the oil and gas and service support industries in the region, as well as impacts to State and County governments related to royalty payments and severance taxes.
ELM-25	How would future potential development of the nominated lease parcels impact groundwater quality? Leasing and future potential development of the nominated lease parcels would result in oil and gas activities, including well pad construction, drilling, and completion for an estimated 2 wells. All wells would be horizontal wells that would employ standard industry practices related to well completion (i.e., perforation and hydraulic fracturing). The BLM requires operators to comply with the regulations at 43 CFR 3160. These regulations require oil and gas development to comply with directives in the Onshore Orders and the orders of the Authorized Officer. Onshore Order No. 2 and the regulations at 43 CFR 3162.3-3 provide regulatory requirements for hydraulic fracturing, including casing specifications, monitoring and recording, and management of recovered fluids. The

	State of New Mexico also has regulations for drilling, casing and cementing, completion, and plugging to protect freshwater zones (19.15.16 New Mexico Administrative Code). Complying with the aforementioned regulations require producers and regulators to verify the integrity of casing and cement jobs. Casing specifications are designed and submitted to the BLM together with an APD. The BLM petroleum engineer independently reviews the drilling plan, and based on site-specific geologic and hydrologic information, ensures that proper drilling, casing and cementing procedures are incorporated in the plan in order to protect usable groundwater. This isolates usable water zones from drilling, completion/hydraulic fracturing fluids, and fluids from other mineral bearing zones, including hydrocarbon bearing zones. COAs are attached to the APD, if necessary, to ensure groundwater protection. Installation of the casing and cementing operations are witnessed by certified BLM Petroleum Engineering Technicians. At the end of the well's economic life, the operator must submit a plugging plan, which undergoes review by the BLM petroleum engineer prior to well plugging, which ensures permanent isolation of usable groundwater from hydrocarbon bearing zones. BLM inspectors ensure planned procedures are properly followed in the field. Requirements of Onshore Order #2 (along with adherence to state regulations) make contamination of groundwater resources highly unlikely. Surface casing and cement would be extended beyond usable water zones. Production casing would be extended and adequately cemented within the surface casing to protect other mineral formations, in addition to usable water bearing zones. These requirements ensure that drilling fluids, hydraulic fracturing fluids, and produced water and hydrocarbons remain within the well bore and do not enter groundwater or any other formations. Since the advent of hydraulic fracturing, more than 1 million hydraulic fracturing treatments have been conducted, with perhaps only one documented case of direct groundwater pollution resulting from injection of hydraulic fracturing chemicals used for shale gas extraction (Galleos and Varela 2015). There have not been documented past instances of groundwater contamination attributed to well drilling in this project area or the adjacent Rio Puerco FO's oil and gas development areas. This is an indication of how effective the use of casing and cement is at preventing leaks and contamination.
ELM-26	How would future potential development of the nominated lease parcels impact historic properties, including known Traditional Cultural Properties (TC Ps)? The Farmington Field Office "June 2019 Oil & Gas Lease Sale, Cultural Resources Records Review and Determination of Effect" looks at three general groups of data sets: ethnographic studies and consultation records, Chacoan outlier and road data sets, and archaeological site databases. Based on the results of this existing records review, FFO tentatively finds the undertaking will have no adverse effect to historic properties. However, FFO is currently engaged in NHPA Section 106 consultation on this undertaking with the New Mexico State Historic Preservation Officer (SHPO), Navajo Nation Tribal Historic Preservation Officer (THPO), and other consulting parties (see 4.2 below). No portion of CCNHP, a Chaco Culture Archaeological Protection Site, or a known Chacoan road falls within 15 miles of the direct APE. The sites constituting the Chaco Culture UNESCO World Heritage listing are subsets of CCNHP and the Chaco Culture Archaeological Protection Sites. Cultural resources effects in areas open to leasing within the BLM FFO were analyzed in the 2003 Farmington PRMP/FEIS (pg. 3-66 to 3-88; 4-116) and 2003 Farmington RMP (pg. 2-36 to 2-38; Appendix C-1).
ELM-27	How would future potential development of the nominated lease parcels impact Native American traditional, cultural, and religious concerns? Four existing resources of potential traditional religious and cultural significance to the Navajo Nation and people occur within the potential soundscape of Parcel 047 (i.e., within one mile of the area in which future related construction is likely to occur) and two fall within the viewshed. The FFO tentatively determines that standard terms and conditions and BMPs are sufficient to avoid adverse effects to these sites. The application of F-40-CSU would augment FFO's ability to modify site-specific proposals at the APD stage to avoid adverse effects or all effects. However, potential impacts to these locations are the subject of ongoing consultation with the Navajo Nation. Should consultation with the Navajo Nation or other tribes identify further properties of religious and cultural significance in the APE for either parcel, or should it result in a determination of adverse effect to any of the known properties, findings will be documented in an addendum to FFO's "June 2019 Oil & Gas Lease Sale, Cultural Resources Records Review and Determination of Effect." See this report for further details. A finding of adverse effect would result in an agreement to mitigate these effects or, potentially, could result in substantial modification to the undertaking that necessitates additional NEPA review.

CHAPTER 2. ALTERNATIVES

2.1. Alternative A – Proposed Action

Under the Proposed Action, the BLM FFO would offer for lease two (2) nominated parcels of Federal minerals administered by the BLM FFO. Parcel NM 201906-25 (Parcel 25) encompasses the NW quarter of Section 13, Township 24N, Range 2W and is located near the community of Lindrith, in Rio Arriba County NM. Parcel NM 201906-47 (Parcel 47) encompasses the SW quarter of section 33, Township 24N, Range 7W. Both parcels contain 160.00 Acres of federal mineral estate, the entire lease sale is analyzing 320.00 acres of nominated lease parcel. Parcel 47 is entirely on BLM surface, while Parcel 25 is entirely on private surface. The parcels nominated for leasing under the Proposed Action are summarized in Appendix A with their associated lease stipulations. Maps of the nominated lease parcels are provided in Appendix B. Descriptions of lease stipulations are provided in Appendix C.

The nominated lease parcels occur in areas of low, medium, and high development potential as determined by Crocker and Glover (2018). Well densities delineated for each of these development potential categories were used to calculate future potential development on the nominated lease parcels. For parcels where this method resulted in fractional values of less than one well per parcel (because of small parcel acreages and low anticipated well densities), the fractional values were rounded up to one well per parcel to provide meaningful inputs to the oil, natural gas, and water production projections.

Oil and natural gas resources within the nominated lease parcels could be developed within multiple formations, including the Fruitland coal, Pictured Cliffs, Mesa Verde, Mancos, Gallup, and Dakota. Wells could be drilled horizontally or vertically. Estimates of future potential development, as well as oil, natural gas, and water production volumes that could reasonably occur on these parcels were derived from Crocker and Glover (2018). Estimated ultimate recovery of oil, natural gas, and produced water, based on the type of well and geologic formation, are listed in Table 2.1. The estimated number of wells and associated oil, natural gas, and water production for the nominated lease parcels as well as estimated surface disturbance from future potential development on a parcel-by-parcel basis is provided in Table 2.2.

Table 2.1. Estimated Ultimate Recoveries of Oil, Natural Gas, and Produced Water by Formation

WELLBORE DIRECTION	GEOLOGIC FORMATION	OIL PRODUCTION (BBL)	GAS PRODUCTION (MCF)	PRODUCED WATER PRODUCTION (BBL)
Vertical	Generalized	19,115	3,234,964	140,382
Horizontal	Mancos	125,678	1,244,285	69,537

Table 2.2. Estimated Well Count and Production for the Nominated Lease Parcels.

PARCEL NO. (ACRES)	VERTICAL WELLS	HORIZONTAL WELLS	TOTAL WELLS ON PARCEL	ESTIMATED SURFACE DISTURBANCE (ACRES)	OIL PRODUCTION (BBL)	GAS PRODUCTION (MCF)	PRODUCED WATER PRODUCTION (BBL)
25 (160)	0	1	1	6.85	125,678	1,244,285	69,537
47 (160)	1	0	1	4.35	19,000	3,235,000	140,000
TOTAL (320.00)	1	1	2	11.2	144,678	4,479,285	209,537

It is unknown when, where, or to what extent any subsequent well sites, roads, and associated infrastructure would be proposed in the event the BLM decides to lease the nominated parcels. Future

potential development of the nominated lease parcels under the Proposed Action could include the following phases (Appendix D provides a summary of the phases of oil and gas development):

- Well pad construction;
- drilling of a well using a conventional pit system or closed-loop system;
- hydraulically fracturing a well;
- potential flaring of gas;
- construction of new access roads or expansion of existing roads;
- installation of pipeline;
- production, including vehicle traffic, hauling of produced fluids like oil or produced water, compression to move gas through pipeline systems, potential venting from storage tanks, regularly well monitoring, and work-over tasks for the life of the well; and
- well plugging and abandonment/reclamation.

Based on recent oil and gas development in the FFO, the BLM estimates 6.85 acres of surface disturbance for new horizontal wells, containing two wells on one pad, and their corresponding access road and pipeline, and 4.35 acres for new vertical wells and their corresponding access road and pipeline (Crocker and Glover 2018). Assuming future potential development of 0 vertical wells and 2 horizontal wells, approximately 11.2 total acres of new surface disturbance is anticipated (see Table 2.2).

The drilling of wells on parcels leased by BLM is not permitted until the leaseholder submits, and the BLM approves, a complete Application for Permit to Drill (APD) package (Form 3160-3) following the requirements specified under Onshore Oil and Gas Orders listed in 43 CFR 3162. APD approvals are subject to additional environmental review under NEPA. Under the authority granted in Standard Term and Conditions Section 6 attached to each lease, measures to reduce or avoid resource impacts specific to a particular APD are attached as conditions of approval (COA).

2.2. Alternative B – No Action Alternative

Under the No Action Alternative, the BLM FFO would not offer the nominated parcels for competitive leasing in the FFO June 2019 Competitive Oil and Gas Lease Sale (March 28, 2019). As a result, there would be no future potential development related to this analysis on the nominated parcels. The BLM would continue to manage this mineral estate under current management practices. Parcels would have the potential to be nominated again in a future oil and gas lease sale.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

3.1. Introduction

This section describes the existing conditions relevant to the issues presented in Table 1.3 and discloses the potential direct, indirect, and cumulative impacts of the alternatives on those issues. Cumulative actions incorporated into the analysis are described in Section 3.2, Cumulative Actions. This discussion precedes the issue analysis because past and present actions within the spatial and temporal scale of the issues analysis are components of the affected environment. Likewise, reasonably foreseeable future actions (RFFAs) are enumerated here because they contribute to the cumulative impacts analyses for each issue below.

3.2. Cumulative Actions

As defined in 40 CFR 1508.7 (CEQ regulations for implementing NEPA), a cumulative impact is an impact on the environment that results from the incremental impact of the action when combined with the

effects of past, present, and RFFAs, regardless of which agency (Federal or non-Federal) or person undertakes such other actions.

Table 3.1 provides the spatial scale of analysis for the issues and summarizes past, present, and RFFAs considered in each issue's cumulative effects analysis. The temporal scale of cumulative impacts analysis for all issues is approximately 20 years into the future. This temporal scope was chosen because it is an approximation of the lifetime of a well and the predictability of RFFAs beyond 20 years.

Table 3.1 Spatial Scale and Cumulative Actions Associated with Each Issue

ISSUE	SPATIAL SCALE	PAST & PRESENT ACTIONS	RFFAS
Issue 1	San Juan, Sandoval, Rio Arriba, and McKinley Counties	Emissions from existing sources	Proposed complete shutdown of the San Juan Generating Station Projected emissions as predicted in regional studies: ● Air Resources Technical Report for Oil and Gas Development (BLM 2018) ● RFD 2018
Issue 2	New Mexico and U.S.	GHG emissions from all existing sources	Continuation of ongoing activities contributing to GHG emissions
Issue 3	Confined aquifers: Ojo Alamo Sandstone, Kirtland Shale/Fruitland Formation, Pictured Cliffs Sandstone, Cliff House Sandstone, Menefee Formation, Point Lookout Sandstone, Gallup Sandstone, Dakota Sandstone, Morrison Formation, and Entrada Sandstone	● Coal and uranium mining ● Oil and gas development, including reuse of produced water ● Agricultural production ● Domestic and municipal use	Same as Past and Present Actions
Issue 4	● ¼-mile buffer of lease parcels (direct APE) ● 1-mile buffer of direct APE (indirect APE) ● Viewshed to 15 miles (indirect)	● Grazing ● Oil and gas development, including all forms of production equipment. ● Increased infrastructure such as transmission lines ● Highway 371 and other access roads ● Residential development	● Oil and gas development ● Community and urban growth ● On-going reclamation ● WWEC
Issue 5	Same as Issue 6	See Issues 4 and 6	See Issues 4 and 6
Issue 6	Parcel 10 and the Chapter Houses containing all other lease parcels	● Grazing ● Coal and uranium mining ● Oil and gas development	Oil and gas development

Because of its prominence in the analysis of each issue, additional details regarding past, present, and reasonably foreseeable future oil and gas development are provided below.

The San Juan Basin has been a producing oil and natural gas field since the early to middle 1900s. According to available GIS data, approximately 37,000 wells have been drilled within the boundary of the FFO. Approximately 67% of these wells are gas wells, 6% are oil wells, and 26% are wells that have been plugged and abandoned with reclamation work performed. Vertical natural gas wells have been the dominant drilling activity in the FFO; however, recent drilling has dropped, with the majority of new wells being horizontal oil wells. Crocker and Glover (2018) developed a reasonably foreseeable development (RFD) scenario that estimated existing long-term surface disturbance from oil and gas activities to be 56,500 acres across the FFO. Surface disturbance after interim reclamation was estimated at 3.1 acres for existing horizontal wells (twinned) and 2.1 acres for existing vertical wells (Crocker and Glover 2018). The original disturbance area associated with each well type prior to reclamation was 6.85 acres for horizontal wells and 4.35 acres for vertical wells, and approximately 55 percent of surface disturbance was reclaimed following interim reclamation.

Table 3.2 summarizes development potential using the 2018 RFD scenario (Crocker and Glover 2018). A previous RFD scenario was developed in 2014 for the FFO (Engler et al. 2014).

Table 3.2. Summary of Development Potential Predicted in the 2018 RFD Scenario (Crocker and Glover 2018).

DEVELOPMENT POTENTIAL	ACRES IN 2018 RFD SCENARIO	WELLS PER TOWNSHIP	TYPE OF DEVELOPMENT
Negligible	249,400	<1	Likely vertical
Low	1,810,000	4-8	Likely vertical
Medium	1,635,000	6-9	Likely horizontal
High	273,000	10+	Likely horizontal

The 2018 RFD scenario projects 3,200 new oil and gas wells would be drilled within the FFO in the next 20 years (2018-2037), the majority of which (2,300) are predicted to be horizontally drilled. New surface disturbance from potential wells in this scenario is estimated at approximately 18,500 acres. New surface disturbance was estimated at 6.85 acres for future horizontal wells (twinned) and 4.35 acres for future vertical wells (RFD, 2018).

3.3. Impacts of Alternative B – No Action Alternative for all Issues

A separate analysis for each issue analyzed in detail in this EA for Alternative B (the No Action Alternative) is not provided. Under the No Action Alternative the BLM would not lease the nominated lease parcels and the existing conditions and trends related to each issue described in the affected environment would continue. Potential impacts associated with the Proposed Action would not occur under this alternative and current land and resource uses would continue. Oil and gas development would continue on leased land surrounding the nominated lease parcels. No natural gas or crude oil from the nominated lease parcels would be produced, and no royalties would accrue to Federal or State treasuries. Employment and revenue opportunities in local communities related to the oil and gas and service support industry could be lowered under this alternative.

3.4. Issue 1: How would emissions of criteria pollutants (respective to the National Ambient Air Quality Standards [NAAQS]) and volatile organic compounds (VOCs) from future potential development of the nominated lease parcels impact air quality?

Air quality is determined by the quantity and chemistry of atmospheric pollutants in consideration of meteorological factors (i.e., weather patterns) and topography, both of which influence the dispersion and concentration of those pollutants. The presence of air pollutants is due to a number of different and widespread sources of emissions. The analysis area for impacts to air quality consists of San Juan,

Sandoval, Rio Arriba, and McKinley Counties. This spatial scope of analysis was identified based on the regional nature of air pollution and to facilitate analysis using the best available air quality data, which is generally provided at the county level.

3.4.1. Affected Environment

The Clean Air Act (CAA) requires the EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. *Primary standards* provide public health protection and *secondary standards* provide for public welfare including protection against degraded visibility and damage to animals, crops, vegetation, and buildings (EPA 2016a). The primary NAAQS are set at a level to protect public health, including the health of at-risk populations, with an adequate margin of safety (EPA 2018a).

The EPA has set NAAQS for six principal pollutants (“criteria” air pollutants): carbon monoxide (CO); nitrogen dioxide (NO₂); ozone (O₃); particulate matter equal to or less than 10 microns in diameter (PM₁₀) and particulate matter equal to or less than 2.5 microns in diameter (PM_{2.5}); sulfur dioxide (SO₂); and lead (Pb). The EPA has delegated the responsibility of regulation and enforcement of the NAAQS to the State level and has approved the New Mexico State Implementation Plan (SIP), which allows the State to enforce both the New Mexico Ambient Air Quality Standards (NMAAQs) and the NAAQS on all public and private lands with the exception tribal lands and lands within Bernalillo County. The New Mexico Environment Department (NMED) Air Quality Bureau is responsible for implementation of the SIP and enforcement of air quality standards.

Ozone (O₃) is a criteria pollutant that is of most concern for the analysis area. As a secondary pollutant, O₃ is not a direct emission pollutant (that is, it is not emitted directly into the air), but is the result of chemical reactions between a group of highly reactive gasses called nitrogen oxide(s) (NO_x) and volatile organic compounds (VOCs, which are organic compounds that vaporize [i.e., become a gas] at room temperature) when exposed to sunlight (EPA 2018b). O₃ and NO₂ are criteria air pollutants (and therefore regulated under the NAAQS and NMAAQs), VOCs are not; however, because O₃ is not a direct emission pollutant, emissions of NO_x (particularly NO₂, which is used as an indicator for the larger group of gases) and VOCs are used as a proxy for determining potential levels of secondary formation of O₃. NO_x can also react with other chemicals in the air to form particulate matter, contributing to haze (EPA 2016b). Major sources of emission for both NO_x and VOCs include industrial facilities like power plants and motor vehicle exhaust (including off-road equipment). VOCs are also emitted from burning fuels (gasoline, wood, coal, or natural gas) and are associated with refineries, oil and gas production equipment, and other industrial processes. VOCs are also released from chemicals like solvents, paints and thinners, adhesives, air fresheners, copy machines and printers, cleaners and disinfectants, and other consumer products (National Institute of Health, U.S. National Library of Medicine 2017).

The upstream sources of VOCs that are produced during the production of oil and gas occur during the separation of gases from liquids and the storage process; the emissions are generally controlled with the use of enclosed combustion devices, such as flares. Leaks and ineffective control systems are also a source of VOC emissions. In the event that VOCs are produced from incomplete combustion, they become more highly reactive ozone precursors (Matichuk et al. 2016). NO_x are primarily emitted through fossil fuel combustion in electric utilities, high-temperature operations at other industrial sources, and the operation of motor vehicles (EPA 2014).

Areas that are in attainment of the NAAQS are categorized as either Class I, Class II, or Class III which determines the increment of air quality deterioration allowed. All areas that attain the NAAQS and are not specifically designated as Class I areas under the CAA are considered to be Class II for air quality, where a moderate amount of degradation is permitted. The analysis area is in attainment for the NAAQS and the NMAAQs and is categorized as a Class II area (EPA 2018c; NMED 2018a).

3.4.1.1. Criteria Pollutant Concentrations

Concentrations of air pollutants are measured at air monitor sites and expressed in parts per million (ppm), parts per billion (ppb), or micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), depending on the unit of measure for a specific standard. The EPA and New Mexico periodically analyze and review air monitor locations and will discontinue monitoring where pollutant concentrations have been well below standards, or may add monitors in areas where concentrations may be suspected of approaching the NAAQS or the NMAAQs (BLM 2018).

Design Values are statistics that describes the air quality in a certain area relative to the NAAQS, they are to be consistent with NAAQS as defined in 40 CFR Part 50. Design Values are generally used to classify and designate non-attainment areas (EPA 2018c). The measurement parameters for each air monitor vary, depending on the criteria pollutant being monitored, the scale at which that pollutant is being measured, the duration and frequency of the monitoring sample, and the monitor objective. CAA regulations establish design criteria for ambient air quality monitoring networks (also known as SLAMS, State and local air monitoring stations), including “scales of representativeness of most interest” for monitoring sites, ranging from national and global scales down to the local level (EPA 2012).

Where criteria pollutants are measured at the regional scale, the dimension area of measurement ranges from 50 km (approximately 31 miles) up to hundreds of kilometers (also hundreds of miles). Regional siting scales are established for monitoring sites that assess general ambient background levels as well as welfare-related impacts and encompass rural areas of reasonably homogeneous geography without large sources of criteria pollutants. Smaller neighborhood scales are more localized from 500 m (approximately 1,640 feet) out to 4 km (approximately 2.5 miles), which are typically population-oriented sites and may be used to assess source impacts and monitor those areas with the highest concentrations of criteria pollutants. Neighborhood scales generally account for concentrations within some extended area of a city that has relatively uniform land use (EPA 2012).

Standards for each of the criteria pollutants are measured in different ways. For instance, the ozone primary and secondary standards are set at a level of 0.070 ppm averaged over an 8-hour period. This standard is met when the fourth-highest daily maximum (for the 8-hour O_3 concentration) is less than or equal to 0.070 ppm when averaged over a 3-year period. The primary 1-hour standard for NO_2 is set at a level of 100 ppb over a 1-hour period. This standard is met when the 3-year average of the 98th percentile (of the 1-hour daily maximum concentration) is less than or equal to 100 ppb. Table 3.3 summarizes the most recent concentrations of criteria pollutants that are monitored at the regional level within the analysis area in comparison with the NAAQS and NMAAQs. The counties in the analysis area do not currently monitor for CO, Pb, or $\text{PM}_{2.5}$; however, because the counties are relatively rural in character, it is likely that these pollutants are not elevated.

Table 3.3. Design Values for Counties within the FFO (EPA 2018c)

Pollutant	2017 Design Concentrations	Averaging Time	NAAQS	NMAAQs ^a
O_3	Rio Arriba County: 0.065 ppm Sandoval County: 0.065 ppm San Juan County: 2 stations at 0.064 ppm, 1 station at 0.068 ppm	8-hour	0.070 ppm ^b	—
NO_2	San Juan County: 1 station at 10 ppb, 1 station at 6 ppb, and 1 station at 1 ppb	Annual	253 ppb ^b	50 ppb
NO_2	San Juan County: 35 ppb	1-hour	100 ppb ^b	—
SO_2	San Juan County: 2 ppb	1-hour	75 ppb ^b	—

PM _{2.5}	San Juan County: 4.1 µg/m ³ ^{c,d,f}	Annual	3,460 µg/m ³	–
PM _{2.5}	San Juan County: 4.1 µg/m ³ ^{c,d,f}	24-hour	3,635 µg/m ³	–

a Annual fourth highest daily maximum 8-hour concentration, averaged over 3 years

b Not to be exceeded during the year

c 98th percentile, averaged over 3 years

d Annual mean, average over 3 years

e 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

f The last 3-year average was from 2013–2015

g The NMAAQs standard for total suspended particulates, which was used as a comparison with PM₁₀ and PM_{2.5}, was repealed as of November 30, 2018.

h While there are no NAAQS for hydrogen sulfide (H₂S), New Mexico has set a 1-hour standard for H₂S at 0.010 ppm for all areas of the state outside of the area within 5 miles of the Pecos-Permian AQ Control Region (BLM 2018).

Breathing O₃ can have human health effects particularly for sensitive groups (children, the elderly, and those with chronic lung conditions like bronchitis, emphysema, and asthma) as well as sensitive vegetation (NMED 2018b). O₃ is most likely to reach unhealthy levels on hot, sunny days in urban environments and can be transported long distances by wind into rural areas (EPA 2018b). Biogenic sources, such as trees and plants, can represent a substantial portion of NO_x and VOC emissions in an area, including New Mexico (BLM 2018).

Monitoring conducted by the NMED (under the EPA) in the analysis area indicates that levels of O₃ have come close to, but have not yet exceeded, the NAAQS in San Juan County. If such exceedances were to occur, the area would be designated “nonattainment,” which could impact industrial development for the area (NMED 2018c). New Mexico Environment Department-Air Quality Bureau (NMED 2018d)) has begun developing an Ozone Attainment Initiative (OAI) that if implemented on schedule will have a plan in place by summer of 2020. The OAI plan will set standards for emission sources that contribute to the exceedance of design values of 95% or more, in particular to control NO_x and VOCs to achieve maintenance or attainment of the standards pursuant to New Mexico Statutes 74-2-5.3 (NMED 2018d).

Particulate matter (also known as particle pollution) is a mixture of solid particles and liquid droplets in the air. Particulate matter varies in size: PM₁₀ refers to particulate matter 10 micrometers or less in diameter (commonly considered “dust”). PM_{2.5} refers to particulate matter that measures 2.5 micrometers or less (i.e., fine particles), which are the main cause of reduced visibility (haze) in the United States (EPA 2018e). The EPA regulates inhalable particulate matter 10 micrometers in diameter or smaller (PM₁₀ and PM_{2.5}) because they are inhalable into the lungs (NMED 2018b) but does not regulate particles larger than 10 micrometers in diameter (such as sand and larger dust particles).

PM_{2.5} is not currently monitored in the analysis area, and there are no areas of high concentrations that would warrant monitoring by the NMED. Recent monitoring for PM₁₀ (dust) in the analysis area began in 2017 at the 1H Substation. Like O₃, most particulate matter is formed by reactions between other chemicals, specifically between SO₂ and NO_x, which are emitted from vehicles, power plants, and other industrial processes (EPA 2018e). Particulate matter emissions often result from activities like construction, traffic on unpaved roads, fields, and wildfires (EPA 2018e). Particulate matter is of heightened concern when emissions are near sensitive receptors, such as residences, because particulate matter can be present in higher concentrations in a localized area prior to settling or dispersion.

3.4.1.2 Criteria Pollutants Emissions

Along with criteria pollutant concentrations as measured by air monitors, the EPA provides data on human-caused criteria pollutant emissions, expressed in tons per year or total volume of pollutant released into the atmosphere. Human-caused emissions data point to which industries and/or practices are

contributing the most to the general level of pollution (BLM 2018). Total human-caused emissions within the analysis area are reported in Table 3.4 based on EPA's 2014 National Emissions Inventory (NEI) in tons per year (EPA 2018f).

These emissions are primarily the result of electrical power generation, oil and gas development, vehicles (highway and off-highway traffic), and other industrial activities (EPA 2018f). The primary source of several criteria air pollutants in the analysis area are two coal-fired electrical generation units (EGUs): the San Juan Generation Station 15 miles west of Farmington, New Mexico, and the Four Corners Power Plant on the Navajo Nation near Fruitland, New Mexico. These EGUs are the primary source of SO₂ (85%), NO_x (41%), and PM_{2.5} (3%) in the analysis area (EPA 2018f).

Table 3.4. Current Human-Caused Emissions Estimates in the Analysis Area (Tons/Year) 2014 NEI Data

County	NO _x	CO	VOCS	PM ₁₀	PM _{2.5}	SO ₂
San Juan	41,650	83,443	47,768	40,270	7,519	5,450
Sandoval	5,117	25,830	7,308	22,571	3,266	175
Rio Arriba	12,992	43,196	35,352	18,658	3,671	153
McKinley	10,496	14,465	3,335	37,226	4,443	824
Total	70,255	166,934	93,763	118,725	18,899	6,602

Source: EPA 2018f.

Note: Values include Tier 1 summaries for each county, including combustion, industrial, on-road/non-road, and miscellaneous sectors. Biogenic sources are not included.

3.4.1.3 Air Quality Index

The level of emission for a pollutant, in consideration of weather and geographical influences, is a key factor affecting the concentration of that pollutant in an area. Emissions, which contribute to concentrations, can be understood through the Air Quality Index (AQI). The AQI is used to report daily air quality information in an easy-to-understand way by explaining how local air quality relates to human health. Calculated by the EPA, the AQI considers the following: O₃, particulate matter (PM_{2.5} and PM₁₀), NO₂, SO₂, and CO (all except Pb). According to the EPA, O₃ and particulate matter, both calculated daily for the AQI, are the two air pollutants that pose the greatest threat to human health (AirNow 2016).

The AQI translates daily air quality data into a tiered, color-coded system that helps people understand how clean outdoor air is, who may be affected if pollutant levels are higher than desired, and when they may want to take measures to protect their own health. The higher the AQI value, the greater the level of air pollution and the greater concern for public health. An AQI value of 100 typically corresponds to the NAAQS set for that pollutant, and values below 100 are considered satisfactory for public health. Table 3.5 presents the AQI values (with associated color category) and levels of health concern.

Table 3.5. The Air Quality Index (AQI)

AQI Values	Levels of Health Concern	Meaning
0 to 50 (Green)	Good	Air quality is considered satisfactory, and air pollution poses little or no risk.
51 to 100 (Yellow)	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.

101 to 150 (Orange)	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
151 to 200 (Red)	Unhealthy	Everyone may begin to experience health effects and members of sensitive groups may experience more than serious health effects.
201 to 300 (Purple)	Very Unhealthy	Health alert: everyone may experience more serious health effects.
301 to 500 (Maroon)	Hazardous	Health warnings of emergency conditions. The entire population is more likely to be affected.

Note: AQI values above 500 are considered beyond the AQI and represent extreme levels of particle pollution.

Source: AirNow 2016.

The AirData AQI Summary Report (EPA 2018g) provides annual summary information, including maximum AQI values and the count of days in each AQI category. Table 3.6 provides a summary of the number of days classified above 100 (unhealthy for sensitive groups or worse) for the counties in the analysis area for the period from 2006 to 2017.

Table 3.6. AQI Summary Data for Number of Days Classified above 100 for the Analysis Area (2006–2017)

County	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
San Juan	24 ^a	45	3	0	20 ^b	18	12	6 ^c	0	2	2	6
Sandoval	17	6	0	0	0	0	0	0	0	0	0	1
Rio Arriba	0	0	0	0	0	0	0	2	0	0	0	3
McKinley	–	–	0	0	0	0	0	0	–	–	–	–

Source: EPA 2018g.

Note: All AQI values presented are classified as *unhealthy for sensitive groups* (101–150), unless otherwise indicated. Annual summary data for McKinley County is only available for 2008–2013. Annual statistics for 2018 will not be available until May 1, 2019.

a Including one (1) *unhealthy* day (above 150).

b Including five (5) *unhealthy* days (above 150) and two (2) *very unhealthy* days (above 200).

c Including one (1) *unhealthy* day (above 150).

For the reporting period, San Juan County had the most incidences of the number of days classified above 100 annually, including 9 days reaching *unhealthy* (7 days above 150) to *very unhealthy* (2 days above 200) for everyone. These days occurred in 2006 (1 *unhealthy* day), 2010 (5 *unhealthy* days and 2 *very unhealthy* days), and 2013 (1 *unhealthy* day). While there are exceedances of NAAQS on those days with AQI values over 100, these exceedances do not represent a trend of degrading AQI values over time as indicated by Table 3.6 above.

3.4.1.4 Hazardous Air Pollutants (HAPs)

The CAA requires control measures for hazardous air pollutants (also known as HAPs), which are a class of 187 toxic air pollutants that are known or suspected to cause cancer or other serious health effects and/or adverse environmental effects. National Emission Standards for Hazardous Air Pollutants (NESHAP) established by the EPA limit the release of specified HAPs from specific industries (BLM 2018). NESHAP for oil and gas development include control of benzene, toluene, ethyl benzene, mixed xylenes and n-hexane from major sources, and benzene emissions from triethylene glycol dehydration units as area sources (BLM 2018). The CAA defines a major source for HAPs as being one that emits 10 tons/year of any single HAP or 25 tons per year of any combination of HAPs. Under State regulations, a construction or operating permit may be required for a major source and for New Mexico, determining a

major source requires consideration of each oil and gas exploration and production well individually (BLM 2018). In New Mexico, regulations for major sources are found under 20.2.70 and 20.2.71 New Mexico Administrative Code.

The National Air Toxics Assessment (NATA), published by the EPA, provides a tool by which to help focus emissions reductions strategies. The most recent NATA was completed for 2014 and was released in August 2018 (EPA 2018h). The 2014 NATA models ambient concentrations and estimates exposures and risk of cancer and/or other health impacts from HAPs, represented as risk hazard indices for cancer, neurological problems, and respiratory problems for each county and census tract (BLM 2018; EPA 2018h, 2018i). NATA cannot give precise exposures and risks for a specific individual; therefore, NATA data are best applied to larger areas. NATA derives concentration and risk estimates from emissions data from a single year and assumes that a person breathes these emissions each year over a lifetime (approximately 70 years). Lastly, NATA only considers health impacts from breathing air toxics and does not take into account indoor hazards, contacting or ingesting these air toxics, or other ways in which people may be exposed (BLM 2018; EPA 2018h).

A review of the results of the 2014 NATA shows that cancer, neurological risks, and respiratory risks in the analysis area (San Juan, Sandoval, Rio Arriba, and McKinley Counties) are generally lower than statewide and national levels as well as those for Bernalillo County, where urban sources are concentrated in the Albuquerque area (EPA 2018i). The 2014 NATA map application reveals that the cancer risk index (defined as the probability of contracting cancer over the course of a lifetime [70 years], assuming continuous exposure) from human-caused emissions of HAPs in most of the analysis area is 6 to 25 (that is, 6–25 cases per 1 million people). A smaller area immediately northeast of Farmington in San Juan County and a small portion of south-central Sandoval County (immediately north of Albuquerque) have slightly higher risk at 25 to 50 cases per 1 million people (EPA 2018i).

3.4.2. Environmental Consequences

3.4.2.1. Methodology and Assumptions

The methodologies and assumptions for calculating air pollutant emissions and developing inputs for the calculators are described in the Air Resources Technical Report (BLM 2018:31–38). Emissions calculators were developed by air quality specialists at the BLM National Operations Center in Denver, Colorado, and account for a number of variables, including access and construction requirements, equipment and other infrastructure needs, as well as expected production volumes. Because these calculators quantify emissions based on averages and several assumptions (e.g., construction methods, all wells will be hydraulically fractured), these estimates provide approximations of emissions of criteria pollutants, VOCs, and HAPs relative to regional and national levels. Additionally, the BLM in New Mexico has modified the calculators and assumptions for use in analyzing a single well to more closely represent oil and gas wells in the state and to address emissions from development and production for one horizontal well (BLM 2018). Emission estimates per well are included in Appendix H.

3.4.2.2 Impacts of the Proposed Action

Future potential development of the nominated lease parcels would include increased criteria pollutant emissions, including increased particulate matter released from new well pads or roads, exhaust emissions from drilling equipment, compressor engines, vehicles, flares, dehydration and separation facilities, and VOCs during drilling and production activities. As stated above, the most substantial criteria pollutants emitted by oil and gas development and production are VOCs, particulate matter, and NO_x.

Future potential development on the nominated lease parcels is estimated at approximately 1 horizontal and 1 vertical wells across all nominated lease parcels (see Table 2.2). Table 3.7 shows estimated emissions and percent increase from existing conditions resulting from future development of the leases.

Table 3.7 Potential Percent Increase from Future Potential Development of the Lease

Sources	Lease Sale Emissions (Tons per Year[TPY])					
	PM ₁₀	PM _{2.5}	NO _x	SO ₂	CO	VOC
Human-Caused Emissions (San Juan, Sandoval, Rio Arriba, and McKinley counties)	118,725	18,899	70,255	6,602	166,934	93,763
One-well emissions (TPY) ^a	5.31	0.81	6.19	0.11	2.63	0.75 ^b
Total Emissions from Lease Sale (2 wells)	10.62	1.62	12.38	0.22	5.26	2.33
Percent Increase	0.01	0.01	0.02	<0.00	<0.00	0.002

^a The representative well used to calculate emissions is a horizontal oil well. Emissions for vertical wells were not used from this analysis due to current predominance in horizontal technological drilling methods and because presenting horizontal oil wells emissions estimates represents a more conservative summary of emissions, compared with emissions from a vertical well, with the exception of SO₂, which could be 4 to 5 times greater in a vertical well scenario. However, sulfur dioxide emissions are still estimated to be within the same magnitude and less <1 ton per year of SO₂ emissions per well. See Appendix H for additional discussion of emission factors.

^b VOC emissions at the operational phase represent a 95% control efficiency and estimates potential emissions representing the contribution for “one oil well” from the emissions at storage tanks, gathering facilities, etc.

To facilitate quantification, this analysis assumes that all parcels would be developed concurrently and in the same year, though it is more likely that future potential development would occur over a period of years. Emission estimates for a construction, operations, maintenance and reclamation are included in Table 3-7 for a one-well scenario. Construction emissions for both an oil and gas well include well pad construction (fugitive dust), heavy equipment combustive emissions, commuting vehicles, and wind erosion. Emissions from operations for an oil well include well workover operations (exhaust and fugitive dust), well site visits for inspection and repair, recompletion traffic, water and oil tank traffic, venting, compression and well pumps, dehydrators, and compression station fugitives. Operations emissions for a gas well include well workover operations (exhaust and fugitive dust), wellhead and compressor station fugitives, well site visits for inspection and repair, recompletions, compression, dehydrators, and compression station fugitives. Maintenance emissions for both oil and gas wells are for road travel and reclamation emission activities are for interim and final activities and include truck traffic, a dozer, a blade, and track hoe equipment.

Emissions under the Proposed Action are anticipated to be at the most acute level during the construction and completion phases of implementation (approximately 25 days in duration) because these phases require the highest degree of earth-moving activity, heavy-equipment use, and truck traffic, compared with the operations and maintenance phases of implementation. Emissions are anticipated to decline during operations and maintenance as the need for earth moving and heavy equipment declines. The incremental addition of criteria pollutants and VOCs would not be expected to result in any exceedances of the NAAQS or NMAAQs for any criteria pollutants in the analysis area. Because the increase in overall emission levels would be low ($\leq 0.02\%$), future potential development of the nominated lease parcels would not be expected to increase the number of days classified above 100 (unhealthy for sensitive groups, or worse); therefore, it is not anticipated that the Proposed Action would result in a change in the AQI for the analysis area.

VOCs and NO_x contribute to the formation of O₃, which is the pollutant of most concern in northwestern New Mexico and because O₃ is not a direct emission, emissions of NO_x and VOCs are used as a proxy for estimating O₃ levels. Under the Proposed Action, the additional NO_x and VOCs emitted from any oil and

gas development on these specific leases (as quantified in Appendix H for oil and gas wells, respectively, above) are anticipated to be too small in quantity to result in exceedances of O_3 in the analysis area. For many processes it is assumed that emission of HAPs will be equivalent to 10% of VOC emissions. The estimated HAP emissions of 0.23 tons/year should be considered a very gross estimate.

Under the Proposed Action, one of the primary sources of particulate matter emissions would be from construction of potential future development of the nominated parcels, where dust and fine particulates are generated by on-site equipment and activities as well as off-site vehicles (Araújo et al. 2014; Reid et al. 2010). How particulate matter interacts with the environment is dependent on a variety of factors, with the size and chemical composition of the airborne particles being the most important in terms of dispersion (distance from the source) and deposition from the atmosphere. Impacts of particulate matter emissions would not be confined to the construction site because $PM_{2.5}$ (fine particles) can travel farther in terms of distance than PM_{10} (dust) and other total suspended particulates (particles of sizes up to $50\ \mu m$) and therefore can impact local residents in the surrounding area (Araújo et al. 2014).

While impacts to air quality on a broad-scale in the analysis area would be small, the Proposed Action would result in localized impacts to air quality for nearby residences from emissions of particulate matter, VOCs, and HAPs. In the absence of precipitation, $PM_{2.5}$ can travel great distances (thousands of kilometers) can remain in the atmosphere for several days, while PM_{10} (and larger) settles within hours of being released into the atmosphere and is generally dispersed over much shorter distances (i.e., closer to the source) due to larger particle size (Araújo et al. 2014). As stated above, air quality is dependent not only on the quantity of air pollutants, but also environmental conditions (humidity, wind direction and speed, temperature) that influence concentration and/or dispersion of particulate matter.

Because the primary source of criteria pollutant, VOC, and HAP emissions would be from construction and completion from future potential development of the nominated parcels, the Proposed Action would result in short-term local area increases of these pollutant emissions lasting an average of 25 days. Exposure to criteria pollutant emissions—particularly $PM_{2.5}$ and PM_{10} —VOCs, and ground-level O_3 (as a secondary emission) would pose a temporary nuisance for those living near the future oil and gas development. While levels of HAPs would also increase during construction and completion activities under the Proposed Action, these levels would be low relative to the distance from the source and would not pose a risk to human health (including cancer) because there would be no long-term exposure to elevated levels of toxic air pollutants.

3.4.2.3 *Cumulative Impacts*

Current estimated emissions across the analysis area are reported above and air quality across the analysis area is generally good based on AQI ratings over the last decade (see Table 3.6). Current estimated emissions and AQI ratings are reflective of the effects of past and present actions. Power generation is a major source of regional air emissions, as the two major sources of criteria pollutant and VOC emissions are the San Juan Generating Station and the Four Corners Power Plant (BLM 2018). Oil and gas development is also a prominent source of emissions. There are approximately 23,034 active oil and gas wells in the New Mexico San Juan Basin. About 16,139 of the wells in these counties are Federal wells, with the remainder falling in other jurisdictions (BLM 2018).

As with past and present actions, continued oil and gas development is a prominent reasonably foreseeable future action affecting air quality in the analysis area. The February 2018 Reasonable Foreseeable Development Scenario (RFD) for Oil and Gas Activities estimates that there could be an additional 3,200 wells drilled within the analysis area by 2037 (Crocker and Glover 2018). When combined with the impacts of past, present, and reasonably foreseeable future actions, the future potential development of the nominated lease parcels under the Proposed Action would incrementally contribute to increases in air quality emissions. The future potential development of the nominated lease parcels

associated with the Proposed Action comprises 0.06 percent of the RFD. However, emissions associated with the RFD, including future potential development of the nominated lease parcels, would be offset by substantial decreases in emissions--including a 67% reduction in SO₂, 62% reduction in NO_x, 50% reduction in particulate matter, 44% reduction in CO, and 51% reduction in VOCs--resulting from power generation due to the recent shutdown of two of the units at the San Juan Generating Station. Additionally, selective catalytic reduction technology installed on the two remaining coal-fired generators at the Four Corners Power Plant would result in additional reductions in emissions from the facility, including a 36% reduction in NO_x, 43% reduction in particulate matter, and 24% reduction in SO₂ (BLM 2018). The San Juan Generating Station is also proposed for full closure by 2022, which would result in even further drops in future pollutant emissions for the analysis area. Additional measures taken to comply with recent revisions to the Regional Haze Rule in January 2017 would further reduce pollutant emissions. New Mexico will have to comply with these revisions as it develops its SIP for the second planning period (EPA 2018j). Cumulatively, it is expected that future levels of criteria pollutant, VOC, and HAP emissions would be lower than current levels due to the aforementioned factors despite the increases in emissions associated with reasonably foreseeable oil and gas development and future potential development of the nominated lease parcels.

3.4.3 Potential Mitigation Measures and Residual Effects

The EPA has promulgated air quality regulations for completion of hydraulically fractured gas wells. These rules require air pollution mitigation measures that reduce the emissions of VOCs during gas well completions. Based on its authority under the standard terms and conditions attached to leases, the BLM also requires industry to incorporate and implement BMPs designed to reduce impacts to air quality by reducing emissions, surface disturbances, and dust from field production and operations. Typical measures include requirements for watering of dirt roads during periods of high use to reduce fugitive dust emissions, collocation of wells and production facilities to reduce new surface disturbance, implementation of directional and horizontal drilling and completion technologies whereby one well provides access to petroleum resources that would normally require the drilling of several vertical wellbores, suggestions that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored, and performing interim reclamation to revegetate areas not required for production facilities and reduce the amount of fugitive dust.

In addition, the BLM encourages industry to participate in the Natural Gas STAR program that is administered by the EPA. The Natural Gas STAR program is a flexible, voluntary partnership that encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce natural gas emissions (EPA 2006).

3.5 Issue 2: How would the future potential development of nominated lease parcels contribute to greenhouse gas (GHG) emissions?

The analysis areas associated with this issue are the state of New Mexico and the United States. These geographic scales are used in this analysis to provide multiple levels of context associated with GHG emissions as a result of leasing and future potential oil and gas development of the nominated lease parcels. In addition, the effects of GHG emissions are global in nature.

3.5.1 Affected Environment

Climate change is a statistically significant and long-term change in climate patterns. The terms climate change and “global warming,” though often used interchangeably, are not the same. Climate change is any deviation from the average climate via warming or cooling and can result from both natural and human (anthropogenic) sources. Natural contributors to climate change include fluctuations in solar radiation, volcanic eruptions, and plate tectonics. Global warming refers to the apparent warming of

climate observed since the early twentieth century and is primarily attributed to human activities such as fossil fuel combustion, industrial processes, and land use changes.

The following information about GHGs, their relationship to climate change, and their effects on national and global climate is presented in the Air Resources Technical Report (BLM 2018), and briefly summarized here: Findings indicate that warming of the climate system is unequivocal and many of the observed changes are unprecedented over decades to millennia. It is certain that Global Mean Surface Temperature (GMST) has increased since the late 19th century and virtually certain that maximum and minimum temperatures over land have increased on a global scale since 1950. Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes. It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century. Additional near-term warming is inevitable due to the thermal inertia of the oceans and ongoing GHG emissions, and the GMST is expected to continue rising over the 21st century under all of the projected scenarios. Climate change will impact regions differently and warming will not be equally distributed. Data indicate that in the region encompassing southern Colorado and New Mexico, average temperatures rose just under 0.7 degrees Fahrenheit per decade between 1971 and 2011, which is approximately double the global rate of temperature increase. Climate modeling suggests that average temperatures in this region may rise by 4-6 degrees Fahrenheit by the end of the 21st century, with warming increasing from south to north. By 2080-2090, the southwestern U.S. will see a 10-20% decline in precipitation, primarily in winter and spring, with more precipitation falling as rain. A recent Bureau of Reclamation report made the following projections through the end of the 21st century for the Upper Rio Grande Basin (Southern Colorado to central southern New Mexico) based on the current and predicted future warming:

- There will be decreases in overall water availability by one quarter to one third.
- The seasonality of stream and river flows will change with summertime flows decreasing.
- Stream and river flow variability will increase. The frequency, intensity and duration of both droughts and floods will increase. (BLM 2018).

The natural greenhouse effect is critical to the discussion of climate change. The greenhouse effect refers to the process by which GHGs in the atmosphere absorb heat energy radiated by Earth's surface. Water vapor is the most abundant GHG, followed by carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and several other trace gases. These GHGs trap heat that would otherwise be radiated into space, causing Earth's atmosphere to warm and making temperatures suitable for life on Earth. Water vapor is often excluded from the discussion of GHGs and climate change since its atmospheric concentration is largely dependent upon temperature rather than emissions by specific sources. The two primary GHGs associated with the oil and gas industry are CO₂ and CH₄. Because CH₄ has a global warming potential that is 21 to 28 times greater than the warming potential of CO₂, the EPA uses measures of CO₂ equivalent (CO₂e) which take the difference in warming potential into account for reporting GHG emissions (BLM 2018). Oil and gas field production activities do not substantially contribute to N₂O levels and are therefore not included in estimating potential direct emissions in this EA.

Table 3.8 shows estimated GHG emissions for the United States, New Mexico, and the major oil and gas basins of New Mexico. Emissions are expressed in metric tons of CO₂e.

Table 3.8. 2016 Estimated GHG Emissions from Oil and Gas Production (EPA 2018k).

GHG Emissions	Metric Tons (CO₂e)	% US Emissions	% of NM O&G Emissions
Total U.S. GHG Emissions from Oil and Gas Field Production	164,400,000	2.52	NA
Total New Mexico Emissions from Oil and Gas Field Production	6,794,108	0.10	100.00
Total Emissions from Federal Oil and Gas Production in New Mexico	3,837,013	0.06	56.48
Total San Juan Basin Emissions from Oil and Gas Field Production (22,034 wells) *	2,270,359	0.03	33.42
Total Permian Basin Emissions from Oil and Gas Field Production (38,501 wells) †	4,313,166	0.07	63.48
Total Potential GHG Emissions from Oil and Gas Field Production at Full Development (2 wells)	197	0.000003	0.002902

* Includes federal and nonfederal mineral development in McKinley, Rio Arriba, Sandoval, and San Juan Counties (BLM 2018)

† Includes federal and nonfederal mineral development in Chaves, Eddy, Lea, and Roosevelt Counties (BLM 2018)

3.5.2 Environmental Impacts

3.5.2.1 Methodology and Assumptions

Oil and Natural Gas Production and Emissions Estimates

The BLM used a top down approach to estimate greenhouse gas emissions based on EPA's national Greenhouse Gas Emissions Inventory and local oil and gas production as a percentage of U.S. production. This approach is outlined in detail in the BLM's Air Resources Technical Report (BLM 2018). It is assumed that the percentage of total U.S. production is comparable to the percentage of total U.S. emissions. Therefore, emissions were estimated by taking the total oil and gas production for the United States and total GHG emissions for the United States and applying production percentages to estimate emissions for the San Juan Basin of New Mexico (see Table 3.8). This total of estimate emissions for the San Juan Basin of New Mexico was then divided by the total number of active wells (Federal and non-Federal) within the San Juan Basin of New Mexico (23,034, which was estimated using GIS and data from the Petroleum Recovery Research Center (BLM 2018). The resulting estimated average annual GHG emissions per well in the San Juan Basin of New Mexico is 98.57 metric tons of CO₂e.

End Use of Produced Oil and Gas

The BLM does not direct or regulate the end use of produced oil and/or gas. End uses of hydrocarbons extracted from the potential development of the nominated lease parcels could include the combustion of transportation fuels, fuel oils for heating and electricity generation, the production of asphalt and road oil, and the manufacturing of chemicals, plastics, and other synthetic materials. The BLM can only provide an estimate of potential GHG emissions using national approximations of where or how the end use may occur.

3.5.2.2 Impacts from the Proposed Action

Potential effects from GHG emissions would occur from any oil and gas development of the nominated lease parcels. Emissions of GHGs as a result of the Proposed Action would contribute to documented

ongoing and reasonably foreseeable climate related effects. As discussed in Section 3.5.1, these effects include the following: long-term global temperature change; intensified droughts impacting agricultural, rural, and urban communities and resulting in changes in land cover and land use; intensified and more frequent of wildfires; sea level rise, ocean warming, and reduced ocean oxygen, impacting global weather patterns, and flora and fauna; intensified flooding impacting infrastructure, natural resource-based livelihoods, and cultural resources; and human health, such as heat-associated deaths and illnesses, chronic diseases, and other health issues associated with poor air quality (Gonzalez et al. 2018).

Impacts to GHG emissions from the Proposed Action include direct emissions from the development and construction of any potential wells on the nominated lease parcels and indirect (downstream/end use) emissions from the consumption of oil and natural gas products.

Direct GHG emissions of the Proposed Action are calculated assuming full development of the nominated lease parcels (2 oil and natural gas wells). Using the average annual oil and gas production emission value of 98.57 metric tons CO₂e per well in the San Juan Basin of New Mexico and multiplying by 2 wells yields an estimate of 197.15 metric tons CO₂e of annual direct GHG emissions from the Proposed Action. This represents an increase 0.000003% of the total annual GHG emissions from oil and gas production in the United States and an increase of 0.0029% of the total annual GHG emissions from oil and gas production in New Mexico (see Table 3.8).

Potential indirect (downstream/end use) GHG emissions from the Proposed Action are estimated using oil and gas production values summarized in Table 2.2 (145,000 bbl of oil and 4,479,000 mcf of natural gas). The challenge for estimating indirect emissions comes with understanding how oil and gas would be distributed and used for energy. Because this information is not typically available, an alternate method of calculating indirect GHG emissions based on estimated production data was developed for this analysis.

GHG combustion emission factors and global warming potentials were applied and converted to units of metric tons/mcf and metric tons/bbl and finally metric tons of CO₂e. GHG combustion emission factors and global warming potentials for natural gas and petroleum were obtained from 40 CFR Part 98, Subparts A and C. GHG indirect emissions from oil production are estimated to be higher than indirect emissions from natural gas production due to the higher carbon dioxide emission factor for oil. Table 3.9 estimates indirect GHG emission contributions for the Proposed Action using the EPA's GHG equivalencies calculator (EPA 2018k).

Table 3.9. Estimated Indirect (Downstream/End Use) GHG Emissions for the Proposed Action

Product	Estimated Product Quantity	Emissions Factors	Estimated Emissions (metric tons CO ₂ e)
Crude Oil (bbl)	145,000	0.43 metric ton CO ₂ /bbl	62,350
Natural Gas (mcf)	4,479,000	0.055 metric ton CO ₂ /mcf	245,082.53
Total	–	–	307,432.53

Source EPA 2018k.

3.5.2.3 Cumulative Impacts

Cumulative impacts of GHG emissions and their relationship to climate change are evaluated at the national and global levels in the Air Resources Technical Report (BLM 2018). In 2013, total global GHG emissions were 48,257 million metric tons of CO₂e, including land-use change and forestry (BLM 2018). Estimated GHG emissions in 2018 for the United States are 6,511 million metric tons CO₂e (EPA 2018l). Future development of the nominated lease parcels would contribute to increases in GHG emissions

through both direct and indirect pathways. Additional contributions to GHG emissions would be through oil and gas development on existing leases, coal mining, electricity generation, mining, and vehicle travel, among other sources. Overall, total New Mexico total statewide gross GHG emissions are expected to increase (BLM 2018). The increase in direct and indirect GHG emissions that could result from development of the nominated lease parcels would not produce climate change impacts that differ significantly from Alternative B – No Action Alternative. This is because climate change is a global process that is impacted by the sum total of GHGs in the Earth’s atmosphere. The incremental contribution to global GHGs from the Proposed Action cannot be translated into effects on climate change globally or in the area of this site-specific action because it is currently not feasible to predict the net impacts on global or regional climate with certainty. However, it should be noted that fossil fuel combustion is the largest source of global CO₂. U.S. emissions have increased by 3.5 percent from 1990 to 2015 but decreased from 2014 to 2015 by 2.3 percent due in large to a decrease in fossil fuel combustion. Fossil fuel combustion decreases were a result of: 1) substitution from coal to natural gas consumption in the electric power sector; 2) warmer winter conditions in 2015 resulting in a decreased demand for heating fuel in the residential and commercial sectors; and 3) a slight decrease in electricity demand (BLM 2018).

3.5.3 Potential Mitigation Measures and Residual Effects

The BLM BMPs are designed to reduce impacts to air quality (see Issue #1) would also reduce methane and GHGs. In addition, the BLM encourages industry to participate in the Natural Gas STAR program that is administered by the EPA. The Natural Gas STAR program is a flexible, voluntary partnership that encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce natural gas emissions (EPA 2006).

3.6 Issue 3: How would the future potential development of the nominated lease parcels impact surface and groundwater quantity?

The following analysis summarizes information contained in the FFO Water Analysis Report, which is contained in Appendix G. The analysis area established to analyze groundwater is Rio Arriba County, where oil and gas development is projected to occur.

3.6.1 Affected Environment

In 2010, water use related to Mining amounted to about 1% of the total water withdrawals for the state of New Mexico; Approximately 5.4 percent of the mining total, or 2,244.19 AF was associated with oil and gas development. This development is assumed to occur primarily in the Permian Basin but also water use associated from the San Juan Basin (Longworth et al. 2013).

The estimated 2010 total water use for Rio Arriba County was 150,122 AF (4% of total withdrawals of the state). Of this total, irrigated agricultural is the largest user (76%); mining comprises 0.36% (546 AF) of all county water use. All withdrawals associated in mining in Rio Arriba County come from groundwater. Total groundwater use in Rio Arriba County is 6,896 AF.

3.6.2 Environmental Impacts

3.6.2.1 *Impacts from the Proposed Action*

Water use for development of the nominated lease parcels is assumed to primarily come from groundwater sources based on previous oil and gas development in the area; thus, surface water quantity would not be affected. Drilling and completion of oil and gas wells in the nominated lease parcels is estimated to use approximately 3.74 AF if all wells were developed in a single year (a maximum

development scenario). This calculation is based on the number and type of wells (Table 2.2) and values from Kelley et al. (2014), which assume use of approximately 0.54 acre-feet for drilling and completion of vertical wells and 3.2 acre-feet for drilling and completion of horizontal wells. If more water-intensive stimulation methods (e.g., slickwater fracturing) are implemented or if laterals become longer, water use could increase from estimates by Crocker and Glover (2018). Alternatively, water use estimates by Crocker and Glover (2018) could be lower if produced water is reused or recycled for use in hydraulic fracturing.

If all wells were developed in a single year (a maximum development scenario), groundwater water use associated with projected future potential development of the leases would result in an increase of 0.05% of the 2010 Rio Arriba County total groundwater use (which was 6,896 AF) and would result in a 0.68% increase over 2010 groundwater water use in the mining category for Rio Arriba County (which was 546 AF). The total estimated water use of 3.74 AF would result in an increase in water use associated with oil and gas development of 0.17% over 2010 statewide oil and gas water use (to a total of 2,247.92 AF); the percent contribution of oil and gas development to total statewide mining water use would increase to 5.4086%).

Assuming a 20- year development scenario (consistent with the Crocker and Glover 2018 RFD), the water use associated with development of the lease parcels would be 0.187 AF for any given year. As compared to 2010 oil and gas industry water use, this would result in a minor increase in water use associated with oil and gas development (to a total of 2,244.37 AF per year). The percent contribution of oil and gas development to total statewide mining water use would essentially remain the same (5.4%).

Since projected water use is so low compared with total Rio Arriba County water use and total oil and gas water withdrawals, and because oil and gas withdrawals comprise such a small percentage of total groundwater use, the BLM does not expect this lease sale to have a significant impact to groundwater quantities. The BLM will undertake more specific analysis of the impacts to groundwater at the individual project stage when the BLM will have better information on the source of the water used for that project. Water used for the purpose of oil and gas drilling and completion would be purchased legally from those who hold water rights in or around the San Juan Basin. The transaction would be handled by the New Mexico Oil Conservation Division, as well as the New Mexico Office of the State Engineer. All water uses would be evaluated at the APD stage in site-specific NEPA analysis and subject to standard lease terms and conditions.

Produced water associated with development of the lease parcels is estimated at approximately 210,000 barrels of water. Produced water would be disposed of at regulated and permitted commercial facilities (such as saltwater disposal wells) or would be used in the drilling and completion of wells. Water sourced from outside of the geological formation that is used in hydraulic fracturing, which remains in the geological formation after hydraulic fracturing is complete, is likely lost to the hydrological water cycle (Kondash et al. 2018).

3.7.2.2. Cumulative Impacts

Total estimated water use of 3.74 AF would be approximately 0.05% of the total estimated water needed for drilling and completions in the 2018 RFD scenario (7,683 AF, Crocker and Glover 2018). The cumulative impact from the base RFD is estimated by assuming wells and corresponding water use will be developed over a 20-year period (RFD scenario). Water use for any year would be 384 AF. Annual water use associated with the RFD would be approximately 17% of the water use by the oil and gas industry in 2010 in New Mexico. Groundwater water use associated with projected future potential development of the leases would be less than 1 percent of the RFD and is within the estimated use noted in the 2018 RFD scenario (Crocker and Glover 2018).

3.6.3. Mitigation Measures and Residual Effects

Public concern about water use from hydraulic fracturing is especially high in semiarid regions, where water withdrawals for hydraulic fracturing can account for a significant portion of consumptive water use within a given region. Overall, there have been calls to increase the use of alternative water sources such as brackish water or recycling produced water, minimizing the strain on local freshwater resources (Kondash et al 2018). The BLM encourages the use of recycled water in hydraulic fracturing techniques. Recent studies indicate that the water used for hydraulic fracturing may be retained within the shale formation, with only a small fraction of the fresh water injected into the ground returns as flowback water; water returning to the surface is highly saline, is difficult to treat, and is often disposed through deep-injection wells (Kondash et al. 2018). Thus the ability to recycle water may be more limited than previously reported.

3.7. **Issue 4: How would future potential development of the nominated lease parcels impact environmental justice communities and their quality of life?**

Environmental justice communities are defined in Executive Order 12898. The analysis area for this issue is the Chapter House boundaries that contain the nominated lease parcels. Parcel 25 does not exist within a Chapter House boundary, so the analysis area is Rio Arriba County, where the parcel is located. Parcel 47 is within an area adjacent to the Huerfano, Counselor and Nageezi Chapter Houses, all having equal interest in the lands associated with this parcel. This analysis area was chosen because the Chapter House boundaries that contain the nominated parcel are home to the environmental justice communities that could see impacts to quality of life by future potential development of the lease parcels.

For this analysis, “quality of life” is defined as “a feeling of well-being, fulfillment, or satisfaction resulting from factors in the external environment” (Greenwood, n.d.). The quality of life definition was chosen for the focus on external environmental factors and due to a lack of data on existing quality of life issues for the analysis area.

3.7.1 Affected Environment

The purpose of Executive Order 12898 is to identify and address, as appropriate, disproportionality high and adverse human health or environmental effects on low income populations, minority populations, or Indian Tribes (Chapter Houses in this instance) that may experience common conditions of environmental exposure or effects associated with a plan or project. Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies.

The FFO is home to a wide variety of cultural, ethnic, and tribal communities. Multiple indigenous Native American populations inhabit the study area, and many Hispanic residents can trace their family’s history of settlement of northern New Mexico back hundreds of years. These traditional and indigenous communities are intermingled with more recent Euroamerican groups and immigrants. Ranchers, miners, farmers, oil and gas workers, and service industry providers are all part of the socioeconomic mixture of people in the FFO.

The nominated lease parcels are located within rural areas of Rio Arriba County, New Mexico. None of the nominated lease parcels are located on Navajo Nation Tribal Trust surface; parcel 25 is on private surface, while parcel 47 is on BLM. Parcel 47 is located adjacent to the Huerfano, Counselor and Nageezi Chapter Houses. Using satellite imagery and site visits, the BLM FFO determined that none of the parcels have residences or older structures within them.

The nearest communities to the nominated lease parcels are Huerfano, Lindrith, Lybrook, Nageezi and Counselor. Data on population, percent minority, percent Native American, income level, and poverty rates in affected Navajo Nation Chapters; as well as Arriba County; and the State of New Mexico from the US Census Bureau (USCB) are provided in the below table (USCB 2018).

Table 3.7.1 Population, Percent Minority, Percent Native American, Income Level, and Poverty Data for Areas near the Nominated lease parcels Including Navajo Nation Chapters, Counties, and the State of New Mexico.

LOCATION	POPULATION	MINORITY (%)	NATIVE AMERICAN (%)	PER CAPITA INCOME (\$)	MEDIAN HOUSEHOLD INCOME (\$)	POVERTY RATE (%)
Nageezi Chapter	900	99	98	8,912	18,375	53
Counselor Chapter	762	100	92	7,480	14,375	68
Huerfano Chapter	2,708	98	95	10,721	27,500	38
Rio Arriba County	39,924	87	14	19,600	33,972	23
New Mexico	2,088,070	63	9	25,311	46,744	20

¹ Northern Sandoval County is primarily rural, with dispersed ranching and tribal communities scattered widely throughout the northeastern quarter of the county. Southeastern Sandoval County contains the rapidly growing communities of Rio Rancho and Bernalillo and associated suburban expansion. The presence of these communities in the southern part of the county accounts for the large difference in population and income relative to the other analysis areas in the table.

Based on BLM FFO experience with the area of the Proposed Action and the residents within, it is assumed that data on percent minority, percent Native American, income, and poverty for the Navajo Nation Chapters is more representative of residences and communities near the Proposed Action than those of local counties or larger towns in the region.

As seen in the above table, nearby Navajo Nation Chapters range from 98-100% minority and 92-99% Native American. Poverty rates for these Chapters ranges from 38-68%. Per capita income for these Chapters is below the poverty threshold, and median household income is below the poverty threshold for these Chapters except the Huerfano Chapter which is just above the poverty threshold. In general, income is lower, poverty is higher, and the percentage of minority and Native American populations are higher near the Proposed Action than in surrounding cities, counties, and the State of New Mexico.

The following environmental justice terminology developed by the Council on Environmental Quality (CEQ) is used in this analysis (CEQ 1997).

- Low-income population: A low-income population is determined based on annual statistical poverty thresholds developed by the USCB. In 2017, poverty level was based on a total income of \$12,752 for an individual and \$25,283 for a family of four (USCB 2017).
- Minority: Minorities are individuals who are members of the following population groups: American Indian, Alaskan Native, Asian, Pacific Islander, Black, or Hispanic.
- Minority population area: A minority population area is so defined if either the aggregate population of all minority groups combined exceeds 50% of the total population in the area or if the percentage of the population in the area comprising all minority groups is meaningfully greater than the minority population percentage in the broader region.
- Comparison population: For the purpose of identifying a minority population or a low-income population concentration, the comparison populations used in this study are the surrounding counties and the State of New Mexico.

Given the above data and BLM experience with the residents and communities surrounding the Proposed Action, the BLM FFO concludes that there are low-income, minority, and Native American populations

of concern (or “Environmental Justice Populations”), defined under EO 12898, that may be disproportionately impacted and potentially adversely impacted by activities resulting from development of the nominated lease parcels.

3.7.2 Environmental Impacts

Under the Proposed Action, the BLM would lease all of the nominated parcels that could result in future development of the parcels that may decrease quality of life-related values including clean air, water, noise, visual, traffic, safety, and fragmentation of habitable areas and otherwise have environmental justice related effects. For both lease parcels, 1 well, with an associated projected disturbance of 4-6 acres can be anticipated if development is ever realized on the subject lease parcels. Only parcel 47 is located within a Chapter House, in areas not containing, or within 1 mile of dwellings. Some of the impacts to quality of life for environmental justice populations are relative to the other issues analyzed in this EA, and are based on previous BLM and FFO experience with the leasing and potential future development of parcels for oil and gas production. The determination of adverse and disproportionate impacts from specific actions are the assessment of the BLM, and should not be assumed to incorporate the position of specific, potentially impacted, environmental justice populations. The BLM realizes that additional impacts may be identified by local environmental justice populations as specific development locations and types are proposed within the leased parcels. As a result, Table 3.11.2 assesses only the impacts for the issues identified by BLM during internal scoping, at the lease sale stage. The BLM will continue to work with affected environmental justice populations to identify and address additional environmental justice issues as they arise.

Table 3.7.2. Summary of conclusions from analysis of other issues and application to the Issue 4 analysis.

ISSUE ANALYSIS CONCLUSIONS	ISSUE 4: QUALITY OF LIFE EFFECTS BASED ON ANALYSIS CONCLUSIONS OF OTHER ISSUES	ISSUE 4: IS THE EFFECT BASED ON ANALYSIS CONCLUSIONS OF OTHER ISSUES ADVERSE TO ENVIRONMENTAL JUSTICE POPULATIONS?	ISSUE 4: IS THE EFFECT BASED ON ANALYSIS CONCLUSIONS OF OTHER ISSUES DISPROPORTIONATE TO ENVIRONMENTAL JUSTICE POPULATIONS?
Issue 1: A 0.023% increase in NAAQS and VOC emissions in the subject EJ communities as a result of the Proposed Action.	While a nominal increase may be measurable, the perceptive human environment would not suffer as a result of a 0.023% increase in NAAQS or VOC emissions.	Yes. As with past and present actions, continued oil and gas development is the most prominent reasonably foreseeable future action affecting air quality in the FFO	Yes. Air quality is a regional resource and is felt by all communities in the area encompassed by the proposed action and development within the FFO, however, the fugitive dust (PM2.5 or PM10) impacts would be felt more by the local residents.
Issue 2: Potential increase in GHGs for the subject EJ communities, and global GHG emissions as a result of implementation of the Proposed Action	The increase in direct and indirect potential GHG emissions resulting from development of the nominated parcels would not produce climate change impacts noticeable to EJ communities.	Yes. Future development of the nominated lease parcels would contribute to increases in GHG emissions through both direct and indirect pathways.	No. The incremental contribution to global GHGs from the Proposed Action cannot be translated into effects on climate change globally or in the area of this site-specific action because it is currently not feasible to predict the net impacts on global or regional climate with any level of certainty.
Issue 3: Impact to groundwater quality and quantity	3.7 acre-feet are anticipated for use in potential future development. Cumulative withdrawal of water from the	Yes. The water demand to complete any future wells that could be drilled from the nominated lease parcels is not	No. Groundwater resources are regional in nature. The total potential withdrawals would account

ISSUE ANALYSIS CONCLUSIONS	ISSUE 4: QUALITY OF LIFE EFFECTS BASED ON ANALYSIS CONCLUSIONS OF OTHER ISSUES	ISSUE 4: IS THE EFFECT BASED ON ANALYSIS CONCLUSIONS OF OTHER ISSUES ADVERSE TO ENVIRONMENTAL JUSTICE POPULATIONS?	ISSUE 4: IS THE EFFECT BASED ON ANALYSIS CONCLUSIONS OF OTHER ISSUES DISPROPORTIONATE TO ENVIRONMENTAL JUSTICE POPULATIONS?
	Fruitland formation from CBM wells may contribute to groundwater depletion.	expected to exceed past development demands within the San Juan Basin and is within the estimated use noted in the 2018 RFD scenario (Crocker and Glover 2018).	for less than 0.01% of all water used in McKinley, Rio Arriba, Sandoval, and San Juan counties (based on water year 2010 usages). These include non EJ communities and are effected equally.

3.7.2.1 Cumulative Impacts

Residents and communities surrounding the proposed lease parcels would generally experience a disproportionate level of direct and indirect cumulative impacts due to their proximity to any future oil and gas development. Some of these effects would be temporary, such as the addition of project lighting or flaring to the landscape. Other effects, such as the addition of roads and oil and gas facilities to the region, would be relatively longer term, and would be in use for the lifetime of the projects.

The construction of new access roads near the proposed lease parcels could allow increased public access and traffic, and could potentially expose private property to vandalism. Based on ongoing consultation with residents and communities that may be disproportionately and adversely affected by actions resulting from this lease sale, BLM may develop lease stipulations, COAs, design features, and to address environmental justice concerns. Surface owner agreements would apply for private surface owners on split estate leases which could address any environmental justice concerns.

Impacts from GHG emissions are not anticipated to be disproportional to EJ populations surrounding the proposed lease parcels. Disproportional impacts to these populations may include issues related to air quality, visual resources, noise, and dark skies. Potential impacts to groundwater quantity and quality are also anticipated to be disproportional. Scoping analysis identified that water is a critically valued resource by local residents and communities of the Navajo Nation and in the region of the proposed lease parcels. Impacts to local water wells could force residents to find other means of supplying water for domestic use. Any impacts to natural springs, including the Ojo Encino and Ojo Sandoval springs, could have adverse effects on traditional and ceremonial use of the springs and the historical character and importance of the springs to the surrounding region, even though these resources are not present within the boundaries of the nominated lease parcels.

The surrounding (EJ) communities do not have additional policies or ordinances in place, above what the BLM can analyze, that would regulate certain impacts. Other communities, that do not meet the criteria for EJ, such as the City of Farmington, have defined ordinances for oil and gas development within their city limits that include rules for the maximum allowable height for pumping units, require sound mitigation paneling, and enforce noise restrictions that bar increases in the ambient noise level at a distance of 300 feet from the nearest occupied building (City of Farmington 2018). Additional protections like these are being analyzed in the Farmington Mancos-Gallup RMPA and EIS that is in development and anticipated to be completed in 2019.

Standard design features and project specific COAs would help to minimize potential effects that could be adverse and disproportionate. Lease stipulation BIA-1 would apply, and designate that no surface occupancy is allowed within 500 feet of any house, structure, or reservoir of water to reduce impacts from drilling and production activities. Noise would be kept at or below 48.6 dBA within 100 feet of all

occupied residences surrounding the nominated lease parcels on BLM surface as described in NTL 04–2 FFO (BLM 2004). According to the CEQ (1997, pg. 10) guidelines, the identification of disproportional or adverse effects “...*should heighten agency attention to alternatives (including alternative sites), mitigation strategies, monitoring needs, and preferences expressed by the affected community or population.*”

Based on comments gained during scoping, the general preferences of the local communities near the proposed lease parcels would be to have no new oil and gas leasing until the Farmington Mancos-Gallup Draft RMPA and EIS is finished, tribal consultation has been conducted, and Section 106 requirements of the NHPA have been completed for the broader Chacoan landscape. The BLM must provide these affected environmental justice populations reasonable opportunities to identify adverse environmental impacts that may arise from the parcels in this lease sale, and should collaborate with the affected populations to determine methods and measures to alleviate any perceived adverse environmental impacts. The BLM cannot identify and mitigate any identified disproportionate and adverse effects unilaterally, but rather must do so in collaboration with the affected communities.

If future development occurs on the proposed lease parcels, identified and affected EJ populations will be given the opportunity to identify any environmental impacts that might arise from development that could have disproportionately high and adverse effects. Identified EJ populations that may be adversely and disproportionately impacted by development of leases sold in this lease sale will be engaged and be offered opportunities for meaningful involvement in alternatives development, mitigation strategies and monitoring needs, by the BLM and FFO.

4 CONSULTATION AND COORDINATION

The following consultation and coordination efforts with tribes, individuals, organizations, and agencies were conducted for the proposed leasing actions.

4.1 ESA Consultation

BLM FFO biologists have reviewed the proposed leasing and determined the proposed action would comply with threatened and endangered species management guidelines outlined in the 2002 Biological Assessment for the 2003 Farmington RMP (Consultation #2-22-01-I-389).

In 2014, the yellow-billed cuckoo was listed as threatened with proposed Critical Habitat. The proposed leasing action in this EA would have a “no effect” determination for this species due to a lack of nesting habitat within and adjacent to the nominated lease parcels for the yellow-billed cuckoo.

The New Mexico meadow jumping mouse was listed as endangered in 2014. The proposed leasing action in this EA would have a “no effect” determination for this species due to a lack of riparian habitat for the New Mexico meadow jumping mouse.

For Federally-listed fish species, a separate “effects determination” would be made at a site-specific project level to ensure that water used for drilling operations is properly permitted from existing legal sources (no new water depletions) and is in compliance with the ESA. Any new water depletion would likely require Section 7 consultation under the ESA. No further consultation with the US Fish and Wildlife Service (USFWS) is required at this stage.

While Federal regulations and policies require the BLM to make its public land and resources available on the basis of the principle of multiple-use, it is BLM policy to conserve special status species and their habitats, and to ensure that actions authorized by the BLM do not contribute to the need for the species to become listed as Threatened or Endangered by the USFWS. Official species lists, whether obtained via

IPaC or local USFWS offices, are valid for 90 days. After 90 days, project proponents should confirm their results on IPaC by requesting an 'updated' official species list for their project.

4.2 Tribal Consultation

Tribal consultation for the proposed leasing action was initiated on a government to government basis by the BLM FFO to various Pueblos and tribes of New Mexico and Southern Colorado. A letter and map describing the proposed leasing and inviting consultation with the BLM FFO was sent via certified mail to each of the various Pueblos and tribes listed in Table 4.1 on January 25, 2019 with a request for response within 30 days of receipt.

Table 4.1. Pueblos and Tribes Sent Consultation Requests from the BLM FFO.

ENTITY	PERSON
Pueblo of Acoma	Governor Kurt Riley
All Pueblo Council of Governors	Governors
Becenti Chapter House	President Charles Long
Pueblo of Cochiti	Governor Dwayne Herrera
Counselor Chapter House	President Harry Domingo, Sr.
Eight Northern Indian Pueblo's Council	Governors
Five Sandoval Indian Pueblos	Governors
Huerfano Chapter House	President Ben Woody, Jr.
Pueblo of Isleta	Governor J. Robert Benavides
Pueblo of Jemez	Governor Paul S. Chinana
Jicarilla Apache Tribal Council	President Levi Pesata
Kewa Pueblo	Governor Thomas Moquino, Jr.
Pueblo of Laguna	Governor Virgil A. Siow
Lake Valley Chapter House	President Tony Padilla, Jr.
Nageezi Chapter House	President Ervin Chavez
Pueblo of Nambe	Governor Phillip A. Perez
Navajo Nation	President Russell Begaye
Ohkay Owingeh	Governor Peter Garcia, Jr.
Ojo Encino Chapter House	President George Werito
Pueblo of Picuris	Governor Craig Quanchello
Pueblo of Pojoaque	Governor Joseph M. Talachy
Pueblo Pintado Chapter House	President Rena Murphy
Pueblo of San Felipe	Governor Anthony Ortiz, Director Pinu'u Stout, Department of Natural Resources
Pueblo of San Ildefonso	Governor Perry Martinez
Pueblo of Sandia	Governor Richard Bernal
Pueblo of Santa Ana Tribal Historic Preservation Office	Tim Menchego
Pueblo of Santa Ana	Governor Glenn Tenorio
Pueblo of Santa Clara	Governor J. Michael Chavarria

ENTITY	PERSON
Southern Ute Indian Tribe	Chairwoman Christine Baker-Sage
Pueblo of Taos	Governor Gilbert Suazo, Sr.
Ten Southern Pueblo Governor's Council	Governors
Pueblo of Tesuque	Governor Frederick Vigil
The Hopi Tribe	Chairman Timothy L. Nuvangyaoma
Torreon Chapter House	President David Rico
Ute Mountain Ute Tribe	Chairman Harold Cuthair
White Rock Chapter House	President Herbert Benally
Whitehorse Lake Chapter House	President Art L. Chavez
Pueblo of Zia	Governor Anthony Delgarito
Pueblo of Zuni	Governor Val Panteah, Sr.

Consultation requests for the FFO June 2019 Competitive Oil and Gas Lease Sale were received by the BLM from the Hopi Tribe and the Pueblo of San Felipe in response to the consultation letter sent by the BLM. No meetings have occurred but are expected to occur after issuance of the Cultural Resources literature review.

4.3 SHPO and THPO Consultation

Section 106 of the NHPA and its implementing regulations (36 CFR Part 800) require Federal agencies to consider what effect their licensing, permitting, funding, or otherwise authorizing an undertaking, such as an APD or right-of-way (ROW), may have on properties on or eligible for listing on the National Register of Historic Places (NRHP). 36 CFR Part 800.16 gives specific definitions for key cultural resource management concepts such as undertakings, effects, and areas of potential effect. In the absence of applicable agreements, 36 CFR Part 800 guides Section 106 consultation with State Historic Preservation Officers (SHPOs), Tribal Historic Preservation Officers (THPOs), Native American tribes, local governments, and public entities. 36 CFR Part 800.3 outlines the process by which the agency identifies consulting parties. Non-specialists may find useful information on the public's role in the Section 106 process in the Advisory Council on Historic Preservation's (ACHP's) publication, *A Citizen's Guide to Section 106 Review* (ACHP 2016).

Oil and gas development involves at least three undertakings: 1) designating mineral estate as available for leasing under standard terms and conditions, available under special operating constraints, or closed to leasing through an RMP or RMP amendment, 2) the leasing of the minerals, and 3) the site specific development of the lease(s) through submittal of an APD(s). 36 CFR Part 800.4(b)(2) allows for a phased approach to Section 106 compliance, where portions of the identification and evaluation of historic properties may be deferred to a later stage. A recent opinion from the Advisory Council on Historic Preservation ACHP affirms the BLM's position that a review of existing data sources (e.g., past records reviews, cultural resource databases, ethnographic literature, and information shared with the agency during consultation) is generally sufficient to meet the "reasonable and good faith" identification standard at the leasing stage, so long as it is followed by more intensive efforts, such as Class III cultural resources field inventory, at the APD stage (March 7, 2018, "Review of 'no adverse effect' finding, Canyon

Country Gas and Oil Lease Sale for Mar. 2018, San Juan and Grand Counties, Utah”). The results of site identification work done to-date and FFO’s tentative determination of no adverse effect to historic properties are documented in a report, “June 2019 Oil & Gas Lease Sale, Cultural Resources Records Review and Determination of Effect.” This report serves as the basis for ongoing consultation with Section 106 consulting parties, which presently include the New Mexico SHPO, Navajo Nation THPO, the Navajo Nation Heritage & Historic Preservation Department, the Pueblo of Acoma, and the Pueblo of Zuni. Copies of the report were mailed to these organizations on March 5, 2019. Should the Section 106 process determine that the undertaking would have adverse effects to historic properties and that these effects would not be sufficiently mitigated, additional NEPA review would be necessary to analyze and disclose such significant impacts. Due to the central role location-specific cultural resource inventories and other identification efforts play in impacts analysis, the final tier of impacts analysis is deferred to the APD stage.

5 LIST OF PREPARERS

Table 5.1 Contains a list of individuals that contributed to preparation of this EA.

Table 5.1. List of EA Preparers.

NAME	AREA OF EXPERTISE	ORGANIZATION
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Stanley Allison	Outdoor Recreation Planner	BLM FFO
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Janet Guinn	NEPA Reviewer	SWCA Consultants
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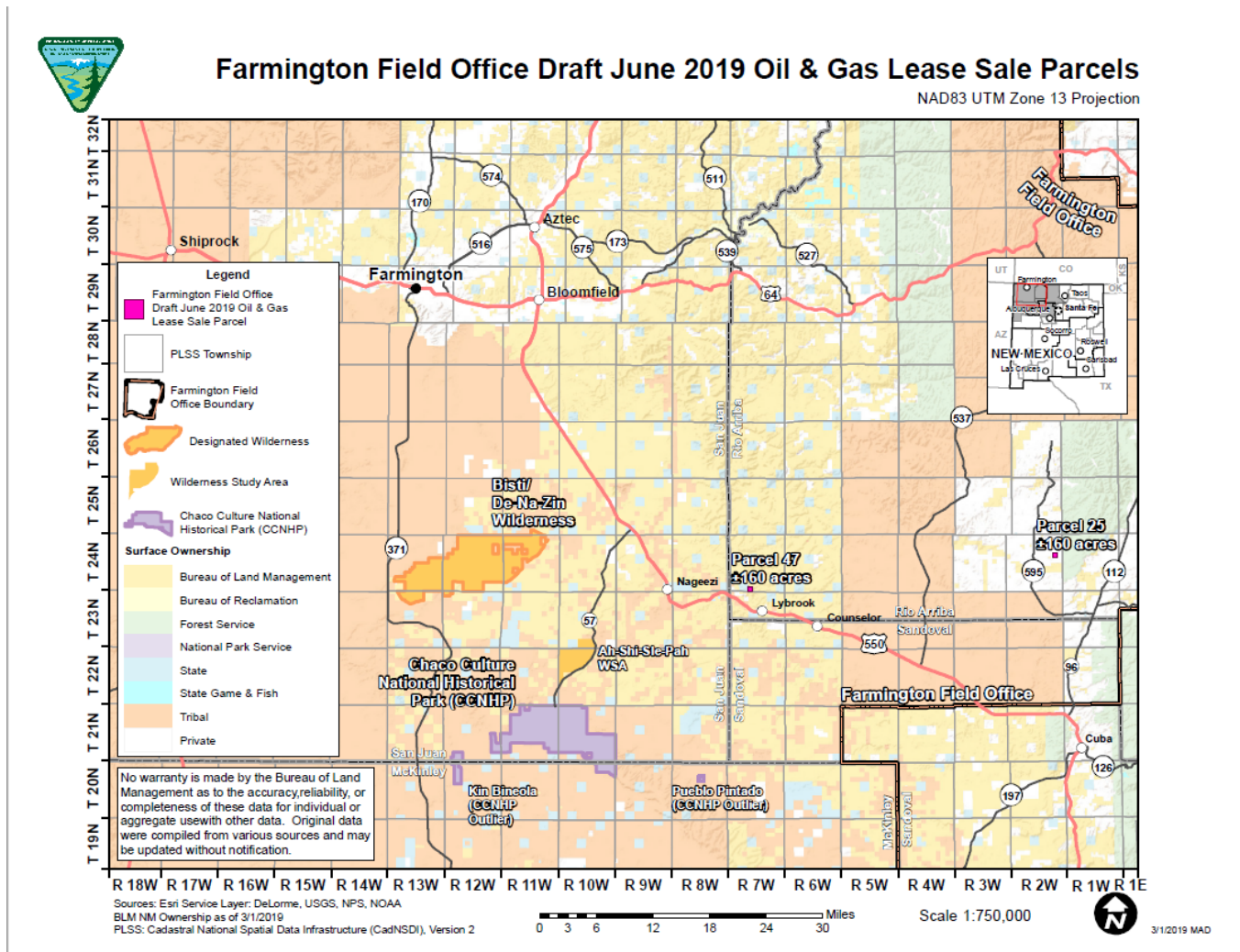
7 APPENDICES

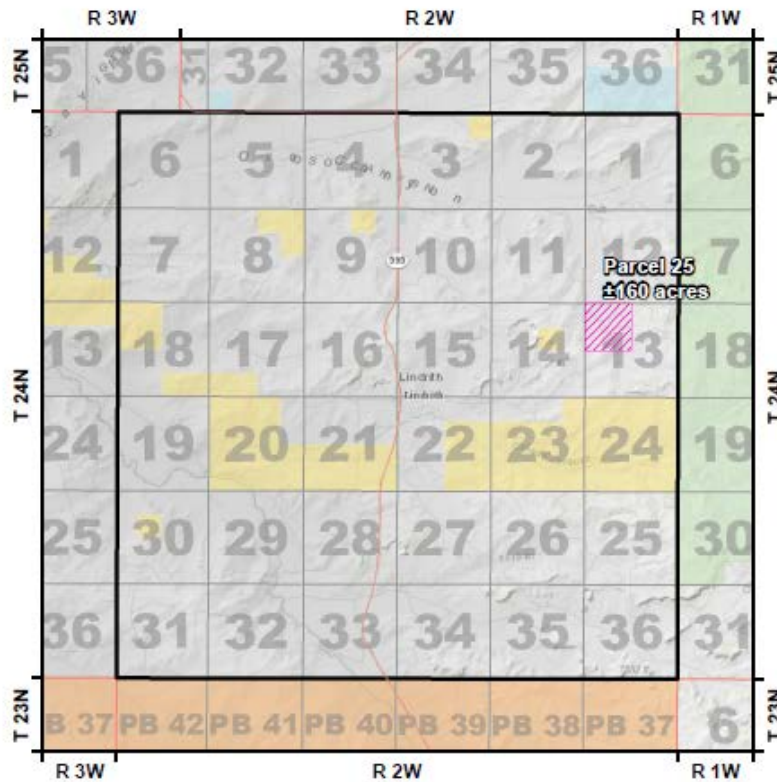
7.7 Appendix A. Nominated Parcels with Lease Stipulations for FFO June 2019 Competitive Oil and Gas Lease Sale

LEASE PARCEL	SURFACE OWNERSHIP	LEGAL DESCRIPTION	ACRES	LEASE STIPULATIONS
NM-201906-025	Private	T.0240N, R.0020W, NM PM, NM Sec. 013 NW; Rio Arriba County Farmington FO NMNM 40636 Formerly Lease No.	160.000	WO-ESA-7 WO-NHPA NM-11-LN F-4-TLS F-15-POD F-40-CSU F-41-LN F-8-VRM F-27-LN
NM-201906-047	BLM-FFO	T.0240N, R.0070W, NM PM, NM Sec. 033 SW; Rio Arriba County Farmington FO NMNM 127900, NMNM 95617 Formerly Lease No.	160.000	WO-ESA-7 WO-NHPA NM-11-LN F-4-TLS F-15-POD F-40-CSU F-41-LN F-8-VRM F-27-LN

7.8 Appendix B. Maps

Figure 7.1. Farmington Field Office June 2019 Competitive Oil and Gas Lease Sale Parcels

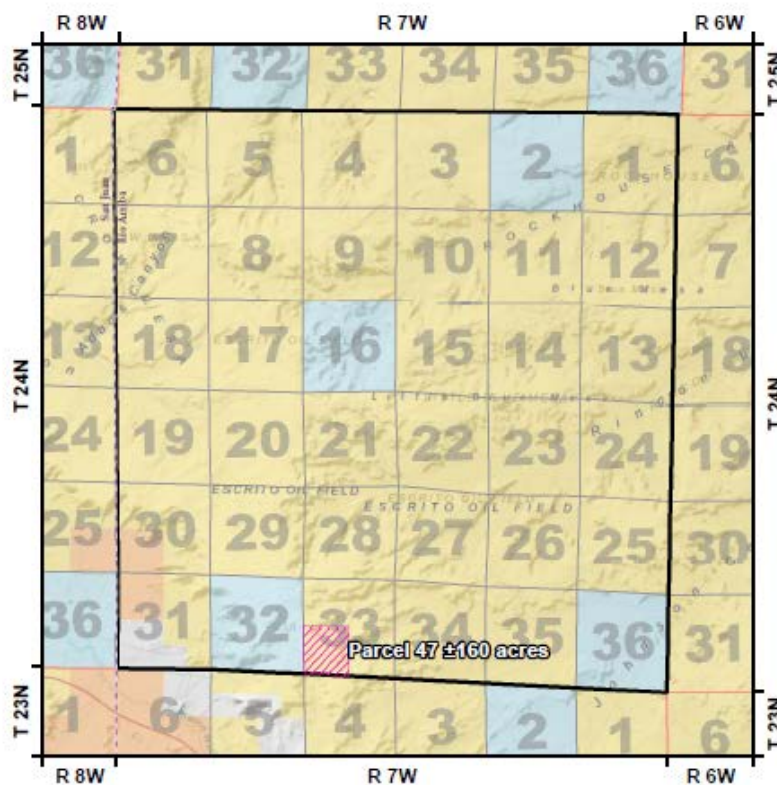




Parcel 25
T24N, R2W
Rio Arriba County, NM

- Legend**
- Farmington Field Office
Draft June 2019 Oil & Gas
Lease Sale Parcel
 - Public Land Survey System
(PLSS) Township
 - Public Land Survey System
(PLSS) Section
- Surface Ownership**
- Bureau of Land Management
 - Forest Service
 - State
 - Tribal
 - Private

NAD83 UTM Zone 13 Projection
 1:100,000
 0 0.5 1 2 3 Miles



Parcel 47
T24N, R7W
Rio Arriba County, NM

7.9 Appendix C. FFO Lease Stipulation Summary

STIPULATION	DESCRIPTION/PURPOSE
F-4-TLS	TIMING LIMITATION STIPULATION IMPORTANT SEASONAL WILDLIFE HABITAT No surface use is allowed during the following time period. December 1 through March 31 In addition, no surface use is allowed during the following time period to accommodate the migration of big game within the Lajara and Regina migration route. November 15 through March 31 This stipulation does not apply to operation and maintenance of production facilities. On the lands described below: For the purpose of: Protection of important wildlife habitat (big game winter range). If circumstances or relative resource values change or if it can be demonstrated that oil and gas operations can be conducted without causing unacceptable impacts, this stipulation may be waived, excepted, or modified by the BLM Authorized Officer, if such action is consistent with the provisions of the Farmington Resource Management Plan, or if not consistent, through a land use plan amendment and associated National Environmental Policy Act analysis document. If the BLM Authorized Officer determines that the waiver, exception, or modification shall be subject to a 30-day public review period. Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes
F-8-VRM	VISUAL RESOURCE MANAGEMENT CLASS IV OBJECTIVES SPECIAL STIPULATION Surface occupancy or use is subject to the following operational constraints: Surface activities in this parcel are subject to Visual Resource Management (VRM) Class IV restrictions as set forth in BLM Manual 8400 – Visual Resource Management. Provide for management activities which require major modification of the existing character of the landscape. Activities <u>may attract attention, may dominate the view</u>, but are still mitigated. This may require additional mitigation methods such as special painting stipulations, site placement, and/or any other measures necessary for VRM Class IV objectives. The need for additional mitigation to meet VRM Class IV will be determined on a case-by-case basis for each proposed well. For the purpose of: Protecting Visual Resources
F-15-POD	PLAN OF DEVELOPMENT (POD) STIPULATION A plan of development (POD) for the entire lease must be submitted for review and approval, including NEPA analysis, by the Bureau of Land Management (BLM) authorized officer, prior to approval of development (APD, Sundry Notices) actions. The POD must indicate planned access to well facilities (roads, DOI-BLM-NM-F010-2016-0001-EA Page 96 of 99 pipelines, power lines), and the approximate location of well sites. Should it become necessary to amend the POD, the amendment must be approved prior to the approval of subsequent development action. Deviations from a current POD are not authorized until an amended POD has been approved by BLM.
F-40-CSU	CONTROLLED SURFACE USE STIPULATION SPECIAL CULTURAL VALUES AND/OR TRADITIONAL CULTURAL PROPERTIES Controlled surface use is allowed on the lands described below: For the purpose of: Protection of known cultural resource values and/or traditional cultural properties in areas not already within ACECs. If circumstances or relative resource values change or if it can be demonstrated that oil and gas operations can be conducted without causing unacceptable impacts, this stipulation may be waived, excepted, or modified by the BLM Authorized Officer, if such action is consistent with the Farmington Resource Management Plan, or if not consistent, through a land use plan amendment and associated National Environmental Policy Act analysis document. If the BLM Authorized Officer determines that the waiver, exception, or modification involves an issue of major public concern, the waiver, exception, or modification shall be subject to a 30-day public review period. Any changes to this stipulation will be made in accordance with the land use plan and or the regulatory provisions for such changes.

STIPULATION	DESCRIPTION/PURPOSE
F-41-LN	LEASE NOTICE - BIOLOGICAL SURVEY A biological survey may be required prior to any surface disturbing activity on BLM managed lands. Proposed activities may be subject to seasonal closures within sensitive species habitat. Federal land management agencies are mandated to manage special status species so they should not need to be listed under Endangered Species Act (ESA) in the future.
F-46-CSU	CONTROLLED SURFACE USE STIPULATION – TOPOGRAPHY Surface-disturbing such as well pad activities and related facilities are prohibited on slopes 15% and greater and/or side hill cuts of more than 3 feet vertical. Maximum grade on collector and arterial roads is 8% (except pitch grades not exceeding 300 feet in length and 10% in grade). For the purpose of: To maintain soil productivity, provide necessary protection to prevent excessive soil erosion on steep slopes, and to avoid areas subject to slope failure, mass wasting, piping, and/or having excessive reclamation challenges. If circumstances or relative resource values change or if the lessee demonstrates that operations can be conducted without causing unacceptable impacts, this stipulation may be excepted, modified or waived by the Authorized Officer if such action is consistent with the provisions of the applicable land use plan, or if not consistent through a planning amendment. An exception, modification, or waiver of this stipulation will require compliance with the National Environmental Policy Act and may be subject to a 15-day public review period. Any changes to this stipulation will be made in accordance with the land use plan and/or regulatory provisions for such changes. (For guidance on the use of this stipulation, see Bureau of Land Management Manuals 1624 and 3101 or Forest Service Manuals 1950 and 2820). The following is the criteria for exceptions, modifications and waivers: Exception: The authorizing officer may grant an exception to this condition for short distances (less than 300 feet and 10% in grade) for access roads if the operator submits a certified engineering and reclamation plan that clearly demonstrates impacts from the proposed actions are acceptable or can be adequately mitigated. This plan must include and demonstrate how the following will be accomplished: - Restoration of site. - Adequate control of surface runoff. - Protection of the site and adjacent areas from accelerated erosion, such as drilling, gullying, piping, and slope failure and mass wasting. - Protection of nearby water sources from sedimentation. Water quality and quantity will be in conformance with state and Federal water quality standards. - Completion of site-specific analysis of soil physical, chemical and mechanical (engineering) properties and behavior. - Timing of surface-disturbing activities these activities will not be conducted during extended wet periods. - Timing of reclamation as reclamation will not be allowed when soils are frozen. In addition, the operator must also provide an evaluation of past practices on similar terrain and be able to demonstrate success under similar conditions.
NM-1-LN	LEASE NOTICE – POTENTIAL, SUITABLE AND OCCUPIED HABITAT FOR SPECIAL STATUS PLANT SPECIES The lease contains potential, suitable and/or occupied habitat for special status plant species; therefore, special status plant species clearance surveys may be required prior to approving any surface disturbing activities within or adjacent to BLM Special Status Plant Species’ potential, suitable and occupied habitats. Survey requirements would include the following: Clearance surveys must be conducted by a qualified botanist as determined by the BLM. The area to be surveyed will include at a minimum the project area plus an additional 100 meters outside the project area. Clearance surveys will be conducted during the blooming season or the period in which the plant species is most easily detected as determined by the BLM. Based on the results of the survey, conditions of approval may be applied to land use authorizations and permits that fall within the area of direct/indirect impacts or affected habitat, as appropriate. Possible mitigation strategies may include, but are not limited to:

STIPULATION	DESCRIPTION/PURPOSE
	Avoidance/restriction of development such as locating the surface disturbance area away from the edge of occupied or suitable habitat and ideally outside of the area where indirect/direct impacts would occur; Minimizing the area of disturbance utilizing strategies such as but not limited to twinning, and utilizing existing disturbance and corridors; Dust abatement measures; Signs, fencing, and other deterrents to reduce human disturbance; Construction of well sites, roads and associated facilities outside of the blooming season; Specialized reclamation procedures such as, but not limited to, separating soil and subsoil layers with barriers to reclaim in the correct order, using a higher percentage of forbs in the reclamation seed mix to promote pollinator habitat, collection of seeds for sensitive plant species' genetic preservation, grow-out, and reclamation; Long term monitoring of indirect/direct impacts on the species and/or habitat; Qualified, independent third-party contractors to provide general oversight and assure compliance with project terms and conditions during construction; Non-native or invasive species monitoring and control in occupied and suitable habitat; Any other on-site habitat protection or improvements, known by best available science to be beneficial. On the following lands:
NM-11- LN	LEASE NOTICE – CULTURAL RESOURCES All development activities proposed under the authority of this lease are subject to compliance with Section 106 of the NHPA and Executive Order 13007. The lease area may contain historic properties, traditional cultural properties (TCPs), and/or sacred sites currently unknown to the BLM that were not identified in the Resource Management Plan or during the lease parcel review process. Depending on the nature of the lease developments being proposed and the cultural resources potentially affected, compliance with Section 106 of the National Historic Preservation Act and Executive Order 13007 could require intensive cultural resource inventories, Native American consultation, and mitigation measures to avoid adverse effects—the costs for which will be borne by the lessee. The BLM may require modifications to or disapprove proposed activities that are likely to adversely affect TCP's or sacred sites for which no mitigation measures are possible. This could result in extended time frames for processing authorizations for development activities, as well as changes in the ways in which developments are implemented.
WO-ESA-7	ENDANGERED SPECIES ACT- SECTION 7 CONSULTATION STIPULATION The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 USC. 1531 et seq., including completion of any required procedure for conference or consultation.
WO-NHPA	CULTURAL RESOURCES AND TRIBAL CONSULTATION STIPULATION This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders. The BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations (e.g., State Historic Preservation Officer (SHPO) and tribal consultation) under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated.

7.10 Appendix D. Phases of Oil and Gas Development

7.10.1 Construction Activities

Clearing of the proposed well pad and access road would be limited to the smallest area possible to provide safe and efficient work areas for all phases of construction. First all new construction areas need to be cleared of all vegetation. All clearing activities are typically accomplished by cutting, mowing and/or grading vegetation as necessary. Cut vegetation may be mulched and spread on site or hauled to a commercial waste disposal facility.

Next, heavy equipment including but not limited to bulldozers, graders, front-end loaders, and/or track hoes are used to construct at a minimum the pad, but other features, as needed for development, may include, but is not limited to an access road, reserve pit, pipeline, and/or fracturing pond. Cut and fills may be required to level the pad or road surfaces. If a reserve pit is authorized, it would be lined using an impermeable liner or other lining mechanism (i.e. bentonite or clay) to prevent fluids from leeching into the soil. Access roads may have cattle guards, gates, drainage control, or pull-outs installed, among a host of other features that may be necessary based on the site specific situation. Long-term surfaces are typically dressed with a layer of crushed rock or soil cemented. Construction materials come from a variety of sources. Areas not needed for long-term development (i.e. portions of the pipeline or road right-of-way) are reclaimed by recontouring the surface and establishing vegetation.

If a pipeline is needed, the right-of-way would be cleared of all vegetation. The pipeline would be laid out within the cleared section. A backhoe, or similar piece of equipment, would dig a trench at least 36 inches below the surface. After the trench is dug, the pipes would be assembled by welding pieces of pipe together and bending them slightly, if necessary, to fit the contour of the pipeline's path. Once inspected, the pipe can be lowered into the trench and covered with stockpiled subsoil that was originally removed from the hole. Each pipeline undergoes hydrostatic testing prior to natural gas being pumped through the pipeline. This ensures the pipeline is strong enough and absent of any leaks.

7.10.2 Drilling Operations

When the pad is complete, the drilling rig and associated equipment would be moved onsite and erected. A conventional rotary drill rig with capability matched to the depth requirements of the proposed well(s) would be used. The well could be drilled as a vertical or horizontal well to target the desired formation. The depth of the well is entirely dependent on the target formation depth and could be several hundred feet vertical depth to over 20,000 feet vertical depth.

When a conventional reserve pit system is proposed, drilling fluid or mud is circulated through the drill pipe to the bottom of the hole, through the bit, up the bore of the well, and finally to the surface. When mud emerges from the hole, it enters into the reserve pit where it would remain until all fluids are evaporated and the solids can be buried.

A closed-loop system, operates in a similar fashion except that when the mud emerges from the hole, it passes through a series of equipment used to screen and remove drill cuttings (rock chips) and sand-sized solids rather than going into the pit. When the solids have been removed, the mud would be placed into holding tanks, and from the tank, used again.

In either situation the mud is maintained at a specific weight and viscosity to cool the bit, seal off any porous zones (thereby protecting aquifers or preventing damage to producing zone productivity), control subsurface pressure, lubricate the drill string, clean the bottom of the hole, and bring the drill cuttings to the surface. Water-based or oil-based muds can be used and is entirely dependent on the site-specific conditions.

7.10.3 Completion Operations

Once a well has been drilled, completion operations would begin once crews and equipment are available. Well completion involves setting casing to depth and perforating the casing in target zones.

Wells are often treated during completion to improve the recovery of hydrocarbons by increasing the rate and volume of hydrocarbons moving from the natural oil and gas reservoir into the wellbore. These processes are known as well-stimulation treatments, which create new fluid passageways in the producing formation or remove blockages within existing passageways. They include fracturing, acidizing, and other mechanical and chemical treatments often used in combination. The results from different treatments are additive and complement each other.

7.10.4 Hydraulic Fracturing

Hydraulic fracturing (HF) is one technological key to economic recovery of oil and gas that might have been left by conventional oil and gas drilling and pumping technology. It is a formation stimulation practice used to create additional permeability in a producing formation, thus allowing gas to flow more readily toward the wellbore. Hydraulic fracturing can be used to overcome natural barriers, such as naturally low permeability or reduced permeability resulting from near wellbore damage, to the flow of fluids (gas or water) to the wellbore (Groundwater Protection Council 2009). The process is not new and has been a method for additional oil and gas recovery since the early 1900s; however, with the advancement of technology it is more commonly used.

Hydraulic fracturing is a process that uses high pressure pumps to pump fracturing fluid into a formation at a calculated, predetermined rate and pressure to generate fractures or cracks in the target formation. For shale development, fracture fluids are primarily water-based fluids mixed with additives which help the water to carry proppants into the fractures, which may be made up of sand, walnut hulls, or other small particles of materials. The proppant is needed to “prop” open the fractures once the pumping of fluids has stopped. Once the fracture has initiated, additional fluids are pumped into the wellbore to continue the development of the fracture and to carry the proppant deeper into the formation. The additional fluids are needed to maintain the downhole pressure necessary to accommodate the increasing length of opened fracture in the formation.

Hydraulic fracturing of horizontal shale gas wells is performed in stages. Lateral lengths in horizontal wells for development may range from 1,000 feet to more than 5,000 feet. Depending on the lengths of the laterals, treatment of wells may be performed by isolating smaller portions of the lateral. The fracturing of each portion of the lateral wellbore is called a stage. Stages are fractured sequentially beginning with the section at the farthest end of the wellbore, moving uphole as each stage of the treatment is completed until the entire lateral well has been stimulated.

This process increases the flow rate and volume of reservoir fluids that move from the producing formation into the wellbore. The fracturing fluid is typically more than 99% water and sand, with small amounts of readily available chemical additives used to control the chemical and mechanical properties of the water and sand mixture (see discussion about Hazardous and Solid Wastes below).

Because the fluid is composed mostly of water, large volumes of water are usually needed to perform hydraulic fracturing. However, in some cases, water is recycled or produced water is used.

Chemicals serve many functions in hydraulic fracturing, from limiting the growth of bacteria to preventing corrosion of the well casing. Chemicals are needed to insure the hydraulic fracturing job is effective and efficient. The fracturing fluids used for shale stimulations consist primarily of water but also include a variety of additives. The number of chemical additives used in a typical fracture treatment

varies depending on the conditions of the specific well being fractured. A typical fracture treatment uses very low concentrations of between three and 12 additive chemicals depending on the characteristics of the water and the shale formation being fractured. Each component serves a specific, engineered purpose. The predominant fluids currently being used for fracture treatments in the shale gas plays are water-based fracturing fluids mixed with friction-reducing additives, also known as slickwater (Groundwater Protection Council 2009).

The make-up of fracturing fluid varies from one geologic basin or formation to another. Because the make-up of each fracturing fluid varies to meet the specific needs of each area, there is no one-size-fits-all formula for the volumes for each additive. In classifying fracture fluids and their additives it is important to realize that service companies that provide these additives have developed a number of compounds with similar functional properties to be used for the same purpose in different well environments. The difference between additive formulations may be as small as a change in concentration of a specific compound (Groundwater Protection Council 2009).

Typically, the fracturing fluids consist of about 99% water and sand and about 1% chemical additives. The chemical additives are essential to the process of releasing gas trapped in shale rock and other deep underground formation.

Some soils and geologic formations contain low levels of radioactive material. This naturally occurring radioactive material (NORM) emits low levels of radiation, to which everyone is exposed on a daily basis. When NORM is associated with oil and natural gas production, it begins as small amounts of uranium and thorium within the rock. These elements, along with some of their decay elements, notably Radium-226 and Radium-228, can be brought to the surface in drill cuttings and produced water. Radon-222, a gaseous decay element of radium, can come to the surface along with the shale gas. When NORM is brought to the surface, it remains in the rock pieces of the drill cuttings, remains in solution with produced water, or, under certain conditions, precipitates out in scales or sludges. The radiation is weak and cannot penetrate dense materials such as the steel used in pipes and tanks.

Before operators or service companies perform a hydraulic fracturing treatment, a series of tests are performed. These tests are designed to ensure that the well, casing, well equipment, and fracturing equipment are in proper working order and would safely withstand the application of the fracture treatment pressures and pump flow rates.

To ensure that hydraulic fracturing is conducted in a safe and environmentally sound manner, the BLM approves and regulates all drilling and completion operations, and related surface disturbance on Federal public lands. Operators must submit Applications for Permit to Drill (APDs) to the agency. Prior to approving an APD, a BLM Field Office geologist identifies all potential subsurface formations that would be penetrated by the wellbore. This includes all groundwater aquifers and any zones that would present potential safety or health risks that may need special protection measures during drilling, or that may require specific protective well construction measures.

Once the geologic analysis is completed, the BLM reviews the company's proposed casing and cementing programs to ensure the well construction design is adequate to protect the surface and subsurface environment, including the potential risks identified by the geologist and all known or anticipated zones with potential risks.

During drilling, the BLM is on location during the casing and cementing of the groundwater protective surface casing and other critical casing and cementing intervals. Before hydraulic fracturing takes place, all surface casing and some deeper, intermediate zones are required to be cemented from the bottom of the cased hole to the surface. The cemented well is pressure tested to ensure there are no leaks and a cement bond log is run to ensure the cement has bonded to the casing and the formation. If the fracturing

of the well is considered to be a “non-routine” fracture for the area, the BLM would always be onsite during those operations as well as when abnormal conditions develop during the drilling or completion of a well.

7.10.5 Production Operations

Production equipment used during the life of the well may include a three-phase separator-dehydrator; flow-lines; a meter run; tanks for condensate, produced oil, and water; and heater treater. A pump jack may be required if the back pressure of the well is too high. Production facilities are arranged to facilitate safety and maximize reclamation opportunities. All permanent aboveground structures not subject to safety considerations are painted a standard BLM environmental color or as landowner specified.

Workovers may be performed multiple times over the life of the well. Because gas production usually declines over the years, operators perform workover operations which involve cleaning, repairing, and maintaining the well for the purposes of increasing or restoring production.

Anticipated use or produced hazardous materials during the development may come from drilling materials; cementing and plugging materials; HF materials; production products (natural gas, condensates, produced water); fuels and lubricants; pipeline materials; combustion emissions; and miscellaneous materials. Table 7.3 includes some of the common wastes (hazardous and nonhazardous) that are produced during oil and gas development.

Table 7.3. Common Wastes Produced During Oil and Gas Development.

PHASE	WASTE	
Construction	Domestic wastes (i.e. food scraps, paper, etc.)	
	Excess construction materials	Woody debris
	Use lubricating oils	Paints
	Solvents	Sewage
	Drilling muds, including additives (i.e. chromate and barite) and cuttings; Well drilling g. completion, workover, and stimulation fluids (i.e. oil derivatives such as polycyclic aromatic hydrocarbons (PAHs), spilled chemicals, suspended and dissolved solids, phenols, cadmium, chromium, copper, lead, mercury, nickel)	
	Equipment, power unit and transport maintenance wastes (i.e. batteries; used filters, lubricants, oil, tires, hoses, hydraulic fluids; paints; solvents)	
	Fuel and chemical storage drums and containers	
	Cementing wastes	Rigwash
	Production testing wastes	Excess drilling chemicals
	Excess construction materials	Processed water
	Scrap metal	Contaminated soil
	Sewage	Domestic wastes
Hydraulic Fracturing	See below	
Production	Power unit and transport maintenance wastes (i.e. batteries; used filters, lubricants, filters, tires, hoses, coolants, antifreeze; paints; solvents, used parts)	
	Discharged produced water	
	Production chemicals	
	Workover wastes (e.g. brines)	

PHASE	WASTE
Abandonment / Reclamation	Construction materials
	Decommissioned equipment
	Contaminated soil

7.11 Appendix E. Social Cost of Carbon

A protocol to estimate what is referenced as the “social cost of carbon” (SCC) associated with Greenhouse Gas (GHG) emissions was developed by a federal Interagency Working Group (IWG), to assist agencies in addressing Executive Order (E.O.) 12866, which requires federal agencies to assess the cost and the benefits of proposed regulations as part of their regulatory impact analyses. The SCC is an estimate of the economic damages associated with an increase in carbon dioxide emissions and is intended to be used as part of a cost-benefit analysis for proposed rules. As explained in the Executive Summary of the 2010 SCC Technical Support Document “the purpose of the [SCC] estimates...is to allow agencies to incorporate the social benefits of reducing carbon dioxide (CO₂) emissions into cost-benefit analyses of regulatory actions that have small, or ‘marginal,’ impacts on cumulative global emissions.” Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 February 2010 (withdrawn by E.O. 13783). While the SCC protocol was created to meet the requirements for regulatory impact analyses during rulemakings, there have been requests by public commenters or project applicants to expand the use of SCC estimates to project-level National Environmental Policy Act (NEPA) analyses.

The decision was made not to expand the use of the SCC protocol for the lease sale NEPA analysis for a number of reasons. Most notably, this action is not a rulemaking for which the SCC protocol was originally developed. Second, on March 28, 2017, the President issued E.O. 13783 which, among other actions, withdrew the Technical Support Documents upon which the protocol was based and disbanded the earlier IWG on Social Cost of Greenhouse Gases. The Order further directed agencies to ensure that estimates of the social cost of greenhouse gases used in regulatory analyses “are based on the best available science and economics” and are consistent with the guidance contained in Office of Management and Budget (OMB) Circular A-4, “including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates” (E.O. 13783, Section 5(c)). In compliance with OMB Circular A-4, interim protocols have been developed for use in the rulemaking context. However, the Circular does not apply to project decisions, so there is no E.O. requirement to apply the SCC protocol to project decisions.

Further, the NEPA does not require a cost-benefit analysis (40 C.F.R. § 1502.23), although NEPA does require consideration of “effects” that include “economic” and “social” effects (40 C.F.R. 1508.8(b)). Without a complete monetary cost-benefit analysis, which would include the social benefits of the proposed action to society as a whole and other potential positive benefits, inclusion solely of an SCC cost analysis would be unbalanced, potentially inaccurate, and not useful in facilitating an authorized officer’s decision. Any increased economic activity, in terms of revenue, employment, labor income, total value added, and output, that is expected to occur with the proposed action is simply an economic impact, rather than an economic benefit, inasmuch as such impacts might be viewed by another person as negative or undesirable impacts due to potential increase in local population, competition for jobs, and concerns that changes in

population will change the quality of the local community. Economic impact is distinct from “economic benefit” as defined in economic theory and methodology, and the socioeconomic impact analysis required under NEPA is distinct from cost-benefit analysis, which is not required.

Finally, the SCC, protocol does not measure the actual incremental impacts of a project on the environment and does not include all damages or benefits from carbon emissions. The SCC protocol estimates economic damages associated with an increase in carbon dioxide emissions - typically expressed as a one metric ton increase in a single year - and includes, but is not limited to, potential changes in net agricultural productivity, human health, and property damages from increased flood risk over hundreds of years. The estimate is developed by aggregating results “across models, over time, across regions and impact categories, and across 150,000 scenarios” (Rose et al. 2014). The dollar cost figure arrived at based on the SCC calculation represents the value of damages avoided if, ultimately, there is no increase in carbon emissions. But the dollar cost figure is generated in a range and provides little benefit in assisting the authorized officer’s decision for project level analyses. For example, in a recent environmental impact statement, Office of Surface Mining estimated that the selected alternative had a cumulative SCC ranging from approximately \$4.2 billion to \$22.1 billion depending on dollar value and the discount rate used. The cumulative SCC for the no action alternative ranged from \$2.0 billion to \$10.7 billion. Given the uncertainties associated with assigning a specific and accurate SCC resulting from oil and gas production that could occur once the oil and gas lease is issued, and that the SCC protocol and similar models were developed to estimate impacts of regulations over long time frames, this environmental assessment (EA) quantifies direct and indirect GHG emissions and evaluates these emissions in the context of U.S. and State/County GHG emission inventories as discussed in the Affected Environment and Environmental Impacts section of the EA.

To summarize, this EA does not undertake an analysis of SCC because 1) it is not engaged in a rulemaking for which the protocol was originally developed; 2) the IWG, technical supporting documents, and associated guidance have been withdrawn; 3) NEPA does not require cost-benefit analysis; and 4) the full social benefits of oil and gas production have not been monetized, and quantifying only the costs of GHG emissions but not the benefits would yield information that is both potentially inaccurate and not useful.

References Cited

Rose, Steven et al. 2014. Understanding the Social Cost of Carbon: A Technical Assessment. Electric Power Research Institute.

E.O. 13783. Executive Order 13783 of March 28, 2017. Presidential Executive Order on Promoting Energy Independence and Economic Growth.

7.12 Appendix F BLM Sensitive Species

Species	Common Name	Farmington	Taos	Rio Puerco	Socorro
Amphibians					
<i>Anaxyrus (Bufo)microscaphus</i>	Southwestern (Arizona)toad	None	None	Potential	Verified
<i>Lithobates (Rana) pipiens</i>	Northern leopard frog	Verified	Verified	Verified	Verified
Amphibians - Watch					
<i>Craugastor (Eleutherodactylus) augustilatus</i>	Eastern barking frog	None	None	None	None
<i>Gastrophryne olivacea</i>	Western narrowmouthtoad	None	Potential	None	None
<i>Lithobates (Rana) blairi</i>	Plains leopard frog	Verified	Verified	None	None
<i>Lithobates yavapaiensis</i>	Lowland Leopard Frog	None	None	None	Potential
Arthropods					
<i>Danaus plexippus plexippus</i>	Monarch Butterfly	Verified	Verified	Verified	Verified
<i>Lytta mirifica</i>	Anthony Blister Beetle	None	None	None	None
<i>Ochlodes yuma anasazi</i>	Yuma Skipper	None	Verified	None	None
Arthropods - Watch					
<i>Bombus occidentalis</i>	Western Bumble Bee	Verified	Verified	Verified	Verified
<i>Deronectes (Stictotarsus)</i>	Bonita Diving Beetle	None	None	None	None
Birds					

Species	Common Name	Farmington	Taos	Rio Puerco	Socorro
<i>Aimophila boterii</i>	Botteri's Sparrow	None	None	None	None
<i>Ammodramus bairdii</i>	Baird's Sparrow	None	None	None	None
<i>Ammodramus savannarum</i>	Arizona Grasshopper	None	None	None	None
<i>Athene cunicularia</i>	Western Burrowing Owl	Verified	Verified	Verified	Verified
<i>Anthus spragueii</i>	Sprague's Pipit	None	None	None	Potential
<i>Antrostomus arizonae</i>	Mexican Whip-poor-will	Potential	Verified	Verified	Verified
<i>Calcarius mccownii</i>	McCown's Longspur	None	Potential	None	Potential
<i>Calcarius ornatus</i>	Chestnut-collared Longspur	Potential	Verified	None	Verified
<i>Gymnorhinus</i>	Pinyon Jay	Verified	Verified	Verified	Verified
<i>Toxostoma bendirei</i>	Bendire's Thrasher	Verified	Potential	Verified	Verified

Appendix G. Water Analysis Report Farmington Field Office June 2019 Lease Sale

The analysis of the water usage for the Rio Puerco Lease Sale Environmental Assessment is based on the New Mexico Office of the State Engineer (NMOSE), New Mexico Water Use by Categories Technical Report 54 (Longworth, Valdez, Magnuson, & Richard, 2013). This report (*the Report*) is prepared every five years by the NMOSE and represents the most comprehensive, current, and useful water use data available for New Mexico; and was prepared for the water year 2010. Oil and gas development is only projected to occur in Rio Arriba County, so this analysis tabulates water usage for that county only. This report compares water use by category and more closely examines the category of Mining (MI). This section concludes with a projection of water usage for the number of wells (NOWs) predicted for the proposed action in the lease sale environmental assessment.

Table 1 lists the total water withdrawals in Rio Arriba County for the categories contained in *the Report* for the Lease Sale. Figure 1 shows a normalized bar chart for the total water withdrawals. Table 2 lists the water withdrawals for the Mining category and figure 2 shows a pie chart for this data.

The Mining category accounts for approximately 1% of the total withdrawals in New Mexico, it includes the following self-supplied enterprises that extract minerals occurring naturally in the earth's crust: Solids, such as potash, coal, and smelting ores; Liquids, such as crude petroleum; Gases, such as natural gas. The breakdown of the major industries in the Mining category are: Metals; Oil and Gas; Potash; Aggregate; Industrial; Coal; and Geothermal. Note that the unit for water volume used in this analysis is acre-feet (AF).

Table 1. Water Usage for Rio Arriba County

<u>Category</u>	<u>WSW</u>	<u>WGW</u>	<u>TW</u>	<u>%WGW</u>	<u>%WGWCat</u>	<u>%TW</u>
Commercial	0	1566	1566	100.00	22.71	1.04
Domestic	0	1459	1459	100.00	21.16	0.97
Industrial	0	0	0		0.00	0.00
Irrigated Agriculture	112384	1282	113666	1.13	18.59	75.72
Livestock	185	208	393	52.93	3.02	0.26
Mining	0	546	546	100.00	7.92	0.36
Power	0	0	0		0.00	0.00
Public Water Supply	706	1835	2540	72.24	26.61	1.69
Reservoir Evaporation	29952	0	29952	0.00	0.00	19.95
County Totals	143227	6896	150122		100	100

Note. WSW is withdrawal surface water, WGW is withdrawal ground water, TW is total withdrawals, %WGW is the percentage of groundwater use for each category, %WGWcat is the percentage WGW use for each category normalized to total WGW withdrawals, and %TW is the percentage of water use for each category normalized to total withdrawals. Total WGW for Sandoval County is calculated at 4.6%. Note that 100 percent of the total water used in the mining category is from groundwater and approximately 8% of total groundwater withdrawal for Rio Arriba County is in the mining category.

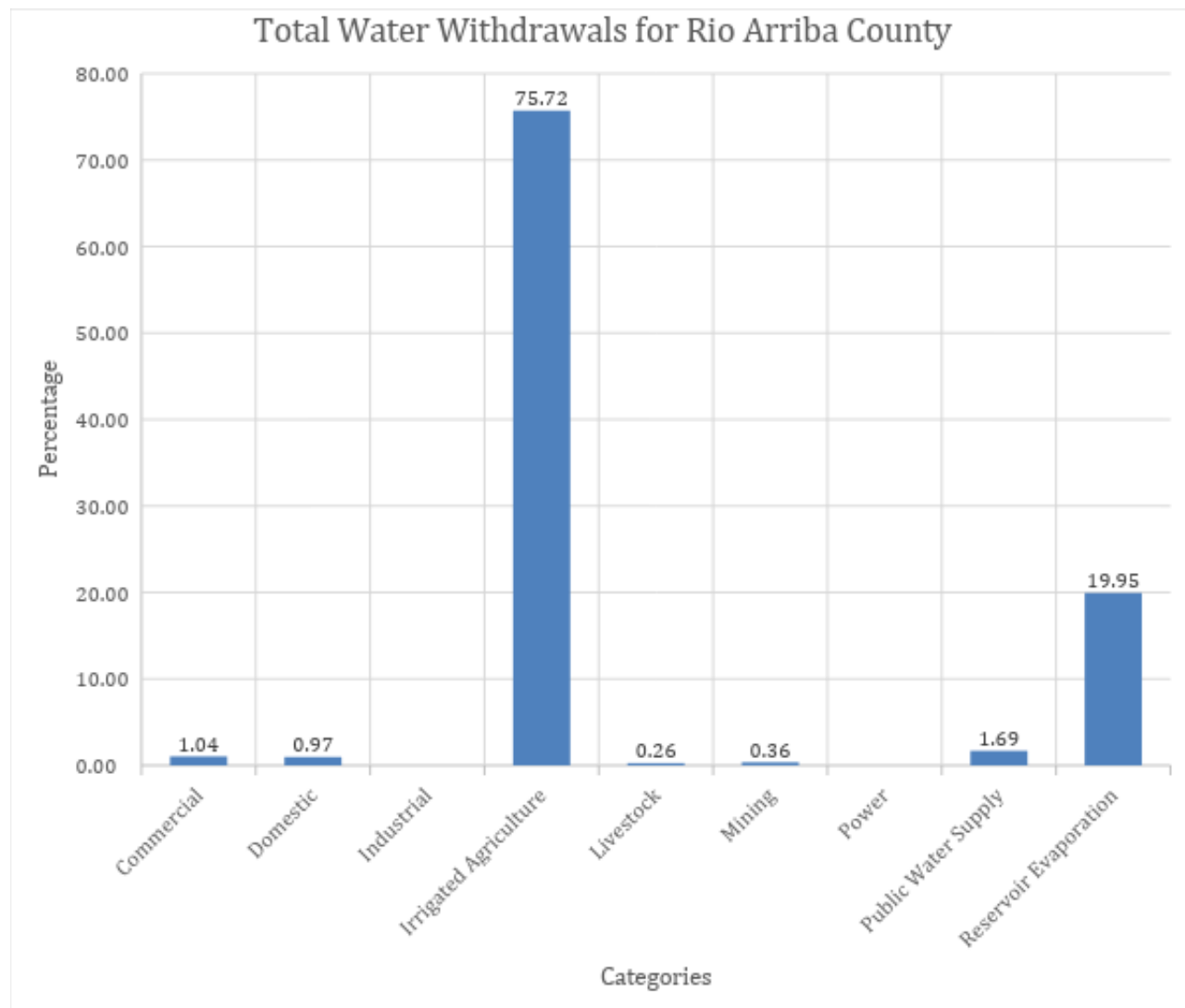


Figure 1. Total water withdrawals for Sandoval County. Categories are defined in the Report. Some 76% of the total water withdrawal is from Irrigated Agriculture, 20 % from Reservoir Evaporation, and less than 1 % (0.36%) is from the Mining category.

Table 2. Percent Water Use by the Mining Category (MI), 2010

<u>Industry</u>	<u>% 2010 State</u>	<u>Calculated AF</u>
Metals	64	26598
Oil and Gas	5.4	2244
Potash	22	9143
Aggregate	3.8	1579
Industrial	2.5	1039
Coal	2.3	956
Geothermal	0	0
Total		41559

x

Percent NM Water Use by the Mining Industry, 2010

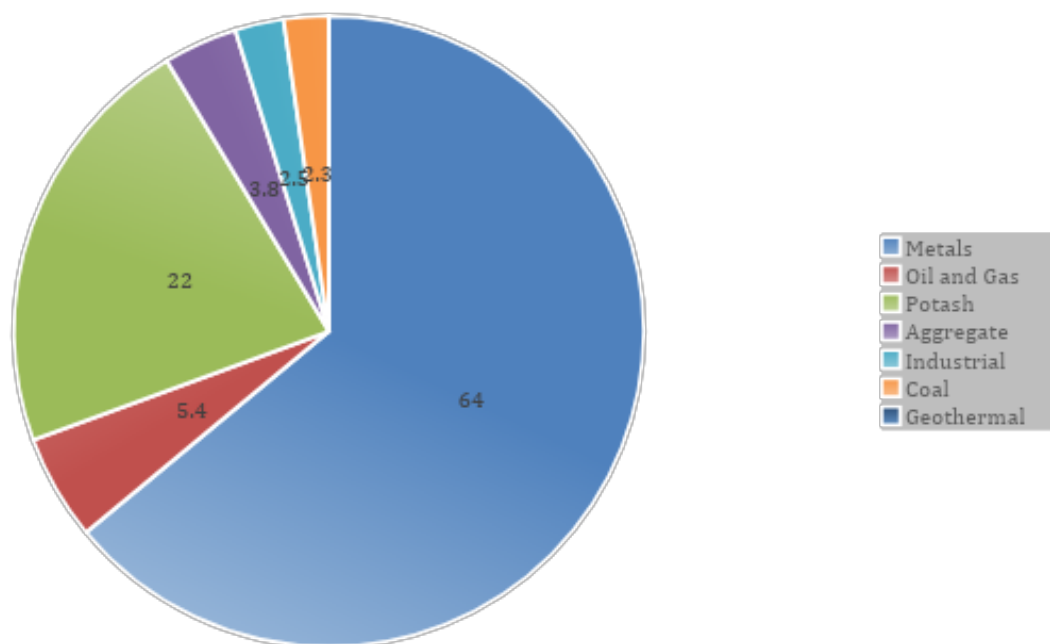


Figure 2. Oil and gas accounts for 5.4% of NM Water Use by the Mining category (2,244AF).

Discussion

Rio Arriba County water usage accounts for about 4% (150,122 AF) of the total withdrawals for the state. Irrigated Agriculture and Reservoir Evaporation are the two largest categories, accounting for about 76% (113,666 AF) and 20 % (29,952 AF), respectively, of the total water withdrawal for Rio Arriba County. Approximately 5% (6,896 AF) of the total water use for Rio Arriba County is from groundwater. The groundwater use in the mining category is 100% (546 AF) for Rio Arriba County. The lease sale water usage would be a 0.68% increase over 2010 water use in the mining category for Rio Arriba County.

The data presented for the Mining Category (MI) in the Report are for the state as a whole. Figure 2 shows the statewide water use of the MI category. The largest user was Metals at 64% (26,598 AF). Oil and gas used 5.4% (2,244 AF) of the total as compared to Potash at 22% (9,143 AF).

It is possible to make a linear projection of water use for the lease sale scenario using data from the Report and adding the additional water use due to increased drilling, predicted in the lease sale, to the “Oil and Gas” Industry row in Table 2, while keeping the other rows constant. This method will be used in the “Methodology for Estimating Number of Oil and Gas Wells section”.

Methodology for Estimating the Number of Oil and Gas Wells

Estimates for the number of oil and gas wells and oil, gas, and water production volumes that could reasonably occur on the parcels were derived from the Farmington Mancos-Gallup Reasonable Foreseeable Development Scenario (RFD) (Crocker and Glover, 2018).

One parcel occurs in an area of high development potential and one parcel occurs in an area of low development potential, as determined by Crocker and Glover (2018). Well densities delineated for this development potential category were used to calculate the projected number of wells that may be drilled on this parcel. For parcels where this method resulted in fractional values of less than one well per parcel (because of small parcel acreages and low well densities), the fractional values were rounded up to one well per parcel to provide meaningful inputs to the oil, gas, and water production projections.

These parcels occur in areas of low and moderate resource potential as determined by the 2010 NMSO RFD. Forecasted drilling rates delineated for each of these resource potential categories were used to calculate the projected number of wells that may be drilled on these parcels. For parcels where this method resulted in fractional values of less than one well per parcel (because of small parcel acreages and low anticipated drilling rates), the fractional values were adjusted to one well per parcel to provide meaningful inputs (Table 3).

In addition, the RFD estimated the water use that will be required for hydraulic fracturing in the RFD scenario, “Within the RMPA Planning Area, we estimate that hydraulically fracturing the wells projected for the period 2018-2037 will require 2.5 billion gallons (7,683 acre-feet) of water over the 20-year period. These estimates do not account for re-use or recycling of hydraulic fracturing fluid. Fracturing fewer wells and/or re-using or recycling hydraulic fracturing fluid would reduce these volumes.”

The number of wells predicted for the Proposed Action in the lease sale is 2. Table 3 shows the vertical and horizontal number of wells, and water usage for the lease sale. The water usage column used a factor of 3.2 AF/horizontal well (Engler, 2015) and 0.537 (Glover & Crocker,

2017) AF/vertical well. The total water use for the Proposed Action is 3.73 AF, that is, approximately 0.05% of the RFD scenario.

Table 3. Well Counts and Water Use for June 2019 BLM Rio Puerco Lease Sale EA

Parcel Number	Acres	Vertical Wells	Horizontal Wells	Total Wells on Parcel	County	TWU
47	160	0	1	1	Rio Arriba	3.2
25	160	1	0	1	Rio Arriba	0.5371
TOTAL	320	1	1	2		3.7371

A projection of water use for the lease sale into the Mining Category, 2010, can be made using the following method. The total water use is 3.74 AF for the lease sale. The RFD is a 20-year scenario. For any given year, the water use would be the total water use divided by 20 years, giving a 0.187 AF increase over the 2244 AF in *the Report*, for a total of 2244.373 AF for the Oil and Gas Industry (also see Table 2). The water use for the Oil and Gas Industry would increase from 5.40% to 5.400425% of the Mining category for the Proposed Action (a very small number). If all wells were developed in a single year (a maximum development scenario), the water use for the Oil and Gas Industry would increase from 5.40% to 5.4086% of the Mining category for the Proposed Action.

Cumulative Impacts

Based on the water usage for the Proposed Action (3.73 AF), water usage per year is expected to increase by 0.187 AF for any given year. This is 0.0001 percent of the total water usage for the county of Rio Arriba alone (Longworth, Valdez, Magnuson, & Richard, 2013). Since this percentage of water use for the lease sale is such a small portion of the overall usage for Rio Arriba County, BLM does not expect the lease sale to have a significant impact on ground and surface water resources.

It is not possible to predict the impacts to any particular aquifer because the water is sourced from different locations for each individual project. The BLM will undertake more specific analysis of the impacts to ground water at the individual project stage when the BLM will have better information on the source of the water used for that project.

With consideration of a maximum development scenario, this lease sale could raise groundwater withdrawals in Rio Arriba County, within the Mining Category, by 0.68%.

Water sourced from outside of the geological formation that is used in hydraulic fracturing, which remains in the geological formation after hydraulic fracturing is complete, is likely lost to the hydrological water cycle (Kondash, Lauer, & Vengosh, 2018).

Surface and groundwater quality is not likely to be impacted because of design features, the regulatory framework regarding drilling and spills, the relatively low concentrations of chemicals used in hydraulic fracturing, and the depth at which hydraulic fracturing occurs.

Summary

The analysis of the water usage for this Lease Sale was taken from the New Mexico Office of the State Engineer, New Mexico Water Use by Categories Technical Report 54 (Longworth, Valdez, Magnuson, &

Richard, 2013). Rio Arriba County water usage accounts for about 4% (150,122 AF) of the total withdrawals for the state. Approximately 4.6% (6,896 AF) of the total water use for Rio Arriba County is from groundwater, with 100% groundwater withdrawal in the Mining Category. The Mining Category accounts for approximately 1% of the total withdrawals for the state, of which, oil and gas accounts for 5.4% (2,244 AF). The total water use for the Proposed Action is 3.74 AF, that is, approximately 0.05% of the RFD scenario. The proposed action would increase the “NM Water Use by Mining Category” from 5.4% to 5.400425% for any given year. If all wells were developed in a single year (a maximum development scenario), the water use for the Oil and Gas Industry would increase from 5.40% to 5.4086 % of the Mining category for the Proposed Action.

The cumulative impact, if all wells were developed in a single year, is 0.002% of the total withdrawals for Rio Arriba County in 2010. Since the percentage of water use for this lease sale is such a small portion of the overall usage in Rio Arriba County, BLM does not expect the lease sale to have a significant impact on ground and surface water resources.

WORKS CITED

- Engler, T. W. (2015). *Update to Reasonable Foreseeable Development (RFD) for Northern New Mexico*. Socorro: New Mexico Institute of Mining and Technology.
- Glover, J. F., & Crocker, K. (2017). *Reasonable Foreseeable Development Scenario for Oil and Gas Activities in the TriCounty Planning Area, south-central New Mexico*. Wyoming State Office: United States Department of the Interior.
- Kondash, A. J., Lauer, N. E., & Vengosh, A. (2018). The intensification of the water footprint of hydraulic fracturing. *Sci. Adv.*
- Longworth, J. W., Valdez, J. M., Magnuson, M. L., & Richard, K. (2013). *New Mexico Water Use by Categories 2010*. Santa Fe: New Mexico Office of the State Engineer, Technical Report 54.

Appendix H. Emission Estimates for Oil and Gas Wells

Table I-2 Emission Estimates for One Horizontal Oil Well

Activity/ Phase	Annual Emissions (Tons)*						
	PM ₁₀	PM _{2.5}	NO _x	SO ₂	CO	VOC†	HAPs
Construction	2.41	0.49	5.21	0.11	1.44	0.42	0.42
Operations	2.90	0.33	0.80	0.00	1.11	0.75	1.18
Maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reclamation**	0.00	0.00	0.18	0.00	0.08	0.00	0.00
Total	5.31	0.81	6.19	0.11	2.63	1.17	1.60

* Values where a “0.00” appear may be too small and not appear due to rounding.

† VOC emissions at the operational phase represent a 95% control efficiency and estimates potential emissions representing the contribution for “one oil well” from the emissions at storage tanks, gathering facilities, etc.

**Reclamation PM₁₀ emissions were estimated to be twice the value of Maintenance PM₁₀ values.

Table I-2 Emission Estimates for One Horizontal Gas Well

Activity/Phase	Annual Emissions (Tons)*						
	PM ₁₀	PM _{2.5}	NO _x	SO ₂	CO	VOC	HAPs
Construction	0.64	0.31	5.18	0.11	1.41	0.61	0.41
Operations	0.28	0.18	0.34	0.00	0.46	0.16	0.18
Maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reclamation†	0.00	0.00	0.18	0.00	0.08	0.00	0.00
Total	0.92	0.49	5.71	0.11	1.95	0.77	0.59

* Values where a “0.00” appear may be too small and not appear due to rounding.

† Reclamation PM₁₀ emissions were estimated to be twice the value of Maintenance PM₁₀ values.