

4.1 Air Quality

The proposed project is located in the Four Corners region of northwestern New Mexico within the San Juan Air Basin (Figure 4.1-1). This air basin comprises the Four Corners region of northwest New Mexico, southwest Colorado, southeast Utah, and northeast Arizona. For the purposes of this EIS, the Proposed Action area encompasses a 300-kilometer (km) (186-mile) radius from FCPP, which includes the Navajo and Hopi tribal trust lands, consistent with EPA's area of evaluation for the FIP for FCPP. San Juan Basin air quality is generally good and meets EPA ambient air quality standards. Primary issues of concern in this region include regional haze and visibility issues, as well as the potential deposition of metals from air to soil and water as a result of industrial air emissions.

The Navajo Mine and FCPP are located on Navajo tribal trust land; therefore, air emissions and air quality are under the jurisdiction of the NNEPA and overseen by the EPA Region IX in San Francisco.¹ Federal and tribal law defines criteria pollutants to include the following: reactive or volatile organic compounds (ROCs or VOCs), nitrogen oxides (NO_x as NO and NO₂), ozone (O₃), carbon monoxide (CO), sulfur dioxide (SO₂), respirable particulate matter (PM₁₀), and fine particulate matter (PM_{2.5}). Of these, VOCs and NO_x are precursors of ground-level photochemical O₃, which can result in decreased visibility and haze.

In addition, the EPA published a Final Ruling regarding the Source Specific FIP to implement BART at the FCPP in August 2012, which provides requirements for future operation of the plant. The FIP and associated BART requirements have been determined and as such comprise part of the environmental baseline for assessing the consequences of the Proposed Action and alternatives. A detailed discussion of the regulatory framework regarding air quality and air emissions as applicable to the proposed Project is provided below.

Coal mining would cause air emissions from combustion of motor fuels (diesel and gasoline) used to operate mining equipment, portable equipment, and support vehicles. Mining activities also cause air emissions from explosives detonation (NO₂, SO₂, and CO) and fugitive dust (PM₁₀ and PM_{2.5}) from earthmoving activities. Power plant operation and maintenance would cause air emissions from the combustion of coal in boilers as well as motor fuels (diesel and gasoline) used in off-road equipment, portable equipment, and support vehicles. Support activities include switchyard and transmission line maintenance near the plant. Several quantitative models were conducted to evaluate the potential air quality impacts of the Proposed Action and alternatives. These include calculations of mobile and stationary source emissions in comparison to Federal standards, air deposition modeling, O₃ Assessment; and plume visibility. Each of these models, their results, and implications with regard to potential impacts are described in the environmental consequences section.

Human health risk assessment of hazardous air pollutants (HAPs), diesel particulate matter, and fugitive dust are presented in Section 4.17, Health and Safety. These issues are also mentioned in this section.

4.1.1 Regulatory Compliance Framework

4.1.1.1 *Air Quality Standards*

Air quality in a given location is determined by the concentration of various pollutants in the atmosphere. National Ambient Air Quality Standards (NAAQS) have been established by the EPA under the CAA of 1970 (amended 1977 and 1990, 42 USC 7401 et seq.). The NAAQS represent maximum levels of background pollution that are considered safe, with an adequate margin of safety, to protect public health (primary standards) and welfare (secondary standards such as diminished production and quality of agricultural crops, reduced visibility, degraded soils, materials and infrastructure damage, and damaged

¹ In 2005, the Nation and owners of the FCPP entered into a VCA under which FCPP agreed to apply for and obtain a CAA Title V operating permit from NNEPA provided, among other things, that permit requirements would be no more stringent than federal requirements unless FCPP agreed to more stringent requirements and the administration and enforcement of the permit would be no more stringent than what EPA would do and that would be required under federal court decisions.

vegetation). Recently, the EPA has proposed developing new secondary standards for SO₂ and NO_x aimed at reducing the impacts of atmospheric deposition on surface waters (Government Accounting Office [GAO] 2013). Individual states have the option to adopt more stringent standards and to include other pollution sources. However, all states in the Four Corners region – New Mexico, Arizona, Utah, and Colorado – have adopted NAAQS in lieu of adopting more stringent state standards. Also, the sovereign nations – Navajo Nation, Hopi Tribe, and Southern Ute Indian Tribe – use NAAQS as tribal standards.

The Navajo Mine and FCPP are located on Navajo tribal trust lands; therefore, air emissions and air quality are under the jurisdiction of the NNEPA and overseen by the EPA Region IX in San Francisco. Federal and tribal law defines criteria pollutants to include O₃, NO₂, CO, SO₂, PM₁₀, PM_{2.5}, and lead (Pb). Elimination of tetraethyl lead in motor gasoline has eliminated emissions of Pb from vehicles and portable equipment, although tetraethyl lead is still used in some types of aviation gasoline. O₃ is not directly emitted, rather, its precursors NO_x and VOC are the pollutants which react with sunlight to form ground-level photochemical O₃ and contribute to regional haze, along with SO₂ and particulate matter. Criteria emissions – also referred to as regulated pollutants – caused by the Action include ROCs or VOCs, NO_x as NO and NO₂, CO, SO₂, PM₁₀, and PM_{2.5}. Each pollutant is described below.

Ozone (O₃)

Ground-level O₃ is a secondary pollutant formed in the atmosphere by a series of complex chemical reactions and transformations in the presence of sunlight. NO_x and VOCs are the principal constituents in these reactions. An important source of NO_x and VOC emissions is the high-temperature combustion of fossil fuels such as in motor vehicle engines and power plant boilers. Thus, regulation and control of NO_x and VOCs from these sources is essential to reduce the formation of ground-level O₃.

O₃ is a strong irritating gas that can chemically burn and cause narrowing of airways, forcing the lungs and heart to work harder to provide oxygen to the body. A powerful oxidant, O₃ is capable of destroying organic matter, including human lung and airway tissue. O₃ damages cells in the lungs, making the passages inflamed and swollen. O₃ also causes shortness of breath, nasal congestion, coughing, eye irritation, sore throat, headache, chest discomfort, breathing pain, throat dryness, wheezing, fatigue, and nausea. It can damage alveoli, the individual air sacs in the lungs where oxygen and CO₂ are exchanged. O₃ has been associated with a decrease in resistance to infections. People most likely to be affected by O₃ include the elderly, the young, and athletes. O₃ may pose its worst health threat to people who already suffer from respiratory diseases such as asthma, emphysema, and chronic bronchitis (VCAPCD 2003).

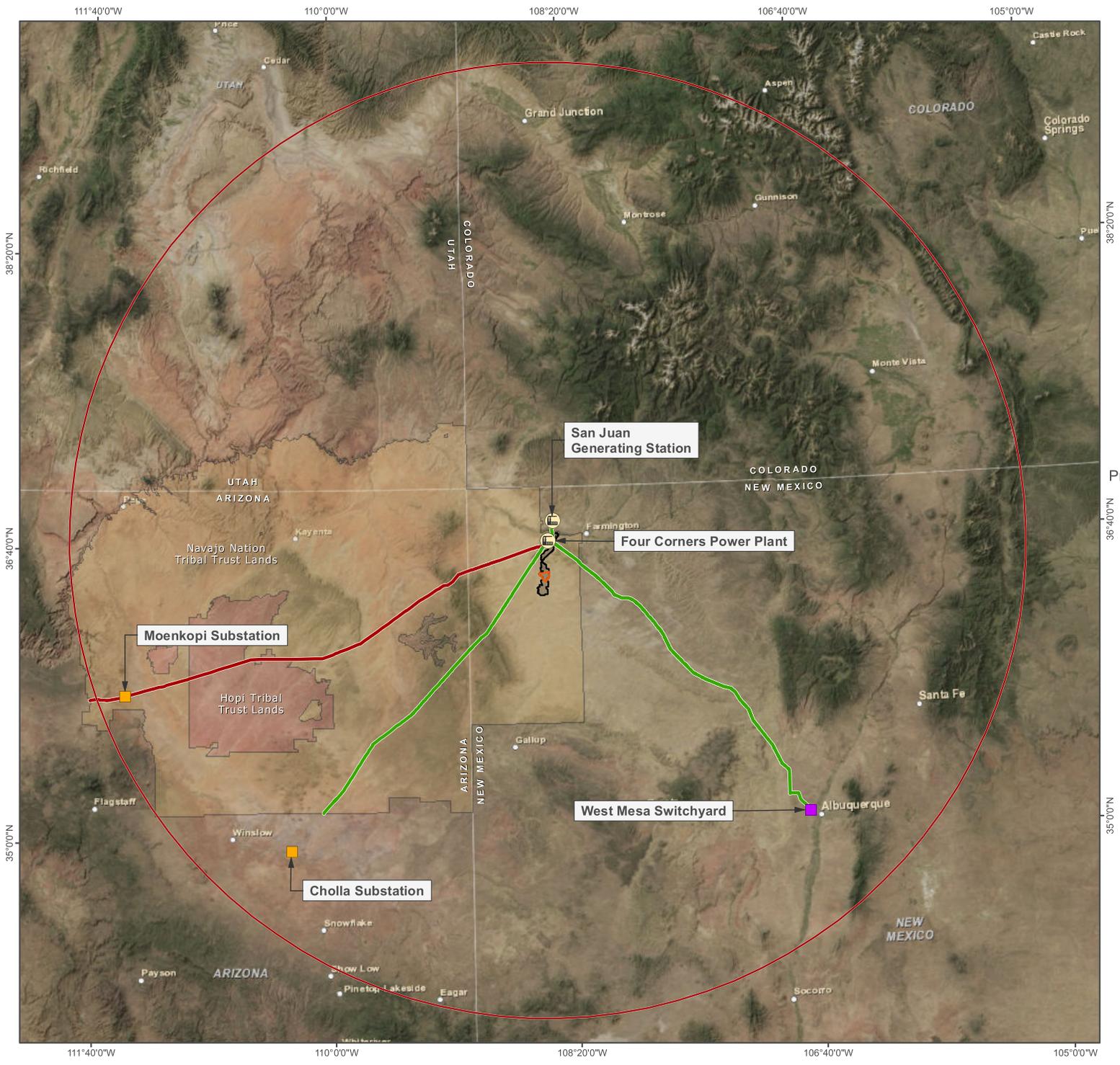
Nitrogen Dioxide (NO₂)

NO₂ is formed in the atmosphere primarily by the rapid reaction of the colorless gas nitric oxide (NO) with atmospheric oxygen. It is a reddish brown gas with an odor similar to that of bleach. NO₂ participates in the photochemical reactions that result in O₃. The greatest source of NO, and subsequently NO₂, is the high-temperature combustion of fossil fuels such as in motor vehicle engines and power plant boilers. NO₂ and NO are referred to collectively as NO_x. NO₂ can irritate and damage the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections such as influenza. Researchers have identified harmful effects, similar to those caused by ozone, with progressive changes over four hours of exposure causing impaired pulmonary function, increased incidence of acute respiratory disease, and difficult breathing for both bronchitis sufferers and healthy persons (Ventura County Air Pollution Control District [VCAPCD] 2003).

Four Corners Power Plant and Navajo Mine Energy Project

ENVIRONMENTAL SETTING
& CONSEQUENCES

Figure 4.1-1
300km Radius of FCPP Boundary



PROJECT FACILITIES

- Power Plant 
- Substation 
- Switchyard 

PROJECT BOUNDARIES

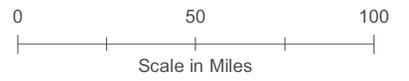
- Navajo Mine Lease Area 
- Proposed Pinabete SMCRA Permit Boundary 
- 300km Radius 

TRANSMISSION LINES

- 345kV 
- 500kV 

TRIBAL LANDS

- Hopi Tribal Trust Lands 
- Navajo Nation Tribal Trust Lands 



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Carbon Monoxide (CO)

CO is a common, colorless, odorless, highly toxic gas. It is produced by natural and anthropogenic (caused by human activity) combustion processes. The major source of CO is incomplete combustion of carbon-containing fuels (primarily gasoline, diesel fuel, natural gas, and coal). However, it also results from combustion processes including forest fires and agricultural burning. Ambient CO concentrations are generally higher in the winter, usually on cold, clear days and nights with little or no wind. Low wind speeds inhibit horizontal dispersion, and surface inversions inhibit vertical mixing. Traffic-congested intersections have the potential to result in localized high CO levels.

When inhaled, CO does not directly harm the lungs. The impact from CO is on oxygenation of the entire body. CO combines chemically with hemoglobin, the oxygen transporting component of blood. This diminishes the ability of blood to carry oxygen to the brain, heart, and other vital organs. Red blood cells have 220 times the attraction for CO as for oxygen. This affinity interferes with movement of oxygen to the body's tissues. Effects from CO exposure include headaches, nausea, and death. People with heart ailments are at risk from low-level exposure to CO. Also sensitive are people with chronic respiratory disease, the elderly, infants and fetuses, and people suffering from anemia and other conditions that affect the oxygen carrying capacity of blood. High CO levels in a concentrated area can result in asphyxiation. Studies show a synergistic effect (an effect that is greater than just the sums of the two constituents) when CO and O₃ are combined (VCAPCD 2003).

Sulfur Dioxide (SO₂)

SO₂ is a colorless gas with a sharp, irritating odor. It can react in the atmosphere to produce sulfuric acid and sulfates, which contribute to acid deposition and atmospheric visibility reduction. It also contributes to the formation of PM₁₀. Most of the SO₂ emitted into the atmosphere is from burning sulfur-containing fossil fuels by mobile sources such as marine vessels and farm equipment and stationary fuel combustion, such as coal-fired power plants. SO₂ irritates the mucous membranes of the eyes and nose and may also affect the mouth, trachea, and lungs. Healthy people may experience sore throats, coughing, and breathing difficulties when exposed to high concentrations. SO₂ causes constriction of the airways and poses a health hazard to asthmatics, which are very sensitive to SO₂. Children often experience more respiratory tract infections when they are exposed to SO₂ (VCAPCD 2003).

Respirable Particulate Matter, 10 Microns (PM₁₀)

PM₁₀ consists of particulate matter, fine dusts and aerosols, 10 microns or smaller in diameter. When inhaled, particles larger than 10 microns generally are caught in the nose and throat and do not enter the lungs. PM₁₀ can enter the large upper branches of the lungs just below the throat, where they are caught and removed (by coughing, spitting, or swallowing).

The primary sources of PM₁₀ include dust from paved and unpaved roads and construction and demolition operations. Lesser sources of PM₁₀ include wind erosion, agricultural operations, residential wood combustion, smoke, tailpipe emissions, and industrial sources. These sources have different constituents and, therefore, varying effects on health. Road dust is composed of many particles other than soil dust. It also includes engine exhaust, tire rubber, oil, and truck load spills. Airborne particles absorb and adsorb toxic substances and can be inhaled and lodge in the lungs. Once in the lungs, the toxic substances can be absorbed into the bloodstream and carried throughout the body. PM₁₀ concentrations tend to be lower during the winter months because weather greatly affects PM₁₀ concentrations. During rain, concentrations are relatively low, and on windy days, PM₁₀ levels can be high. Photochemical aerosols, formed by chemical reactions with man-made emissions, may also influence PM₁₀ concentrations.

Elevated ambient particulate levels are associated with premature death, an increased number of asthma attacks, reduced lung function, aggravation of bronchitis, respiratory disease, cancer, and other serious

health effects. Short-term exposure to particulates can lead to coughing, minor throat irritation, and a reduction in lung function. Long-term exposure can be more harmful. EPA estimates that 8 percent of urban nonsmoker lung cancer risk is due to PM₁₀ in soot from diesel trucks, buses, and cars. Additional studies by EPA and the Harvard School of Public Health estimate that 50,000 to 60,000 deaths per year in the United States are caused by particulates. PM₁₀ particles collect in the upper portion of the respiratory system, affecting the bronchial tubes, nose, and throat. They contribute to aggravation of asthma, premature death, increased number of asthma attacks, bronchitis, reduced lung function, respiratory disease, aggravation of respiratory and cardiovascular disease, alteration of lung tissue and structure, changes in respiratory defense mechanisms, and cancer (VCAPCD 2003).

Fine Particulate Matter, 2.5 Microns (PM_{2.5})

PM_{2.5} is a mixture of particulate matter fine dusts and aerosols 2.5 microns or smaller in aerodynamic diameter. PM_{2.5} can enter the deepest portions of the lungs where gas exchange occurs between the air and the blood stream. These are the most dangerous particles because the lungs have no efficient mechanisms for removing them. If these particles are soluble in water, they pass directly into the blood stream within minutes. If they are not soluble in water, they are retained deep in the lungs and can remain there permanently. This increases the risks of long-term disease including chronic respiratory disease, cancer, and increased and premature death. Other effects include increased respiratory stress and disease, decreased lung function, alterations in lung tissue and structure, and alterations in respiratory tract defense mechanisms.

EPA's PM Integrated Science Assessment concluded that "many constituents of PM_{2.5} can be linked with multiple health effects, and the evidence is not yet sufficient to allow differentiation of those constituents or sources that are more closely related to specific outcomes" (EPA 2009a). While some particles may have higher or lower toxicity than the average for all fine particles, the body of scientific evidence supports the conclusion that reducing all fine particles will result in substantial public health benefits.

PM_{2.5} particles are emitted from activities such as industrial and residential combustion processes, wood burning, and from diesel and gasoline-powered vehicles. They are also formed in the atmosphere from gases such as SO₂, NO_x, ammonia, and VOCs that are emitted from combustion activities and then become particles as a result of chemical transformations in the air (secondary particles) (VCAPCD 2003).

4.1.1.2 Attainment Status

Table 4.1-1 displays the NAAQS (EPA 2012f). States and county or regional air districts are required to monitor air pollutant levels to ensure that NAAQS are met and, in the event that they are not, to develop strategies to meet these standards. Sovereign nations (e.g., Navajo, Southern Ute) also monitor air pollutant levels as required. Depending on whether the standards are met or exceeded, the local air basin or air quality control region is classified as being in "attainment" or "nonattainment." Where insufficient data exist to make a determination, an area is deemed "unclassified." A General Conformity determination is required for Federally sponsored, permitted, or funded actions in NAAQS nonattainment areas or in certain maintenance areas when the total direct and indirect net emissions of nonattainment pollutants (or their precursors) exceed specified thresholds (Clean Air Act Amendments of 1990 Section 176[c]).

Table 4.1-1 National Ambient Air Quality Standards (NAAQS)

| Pollutant | Type | Averaging Time | Concentration ppmv | Concentration ppbv | Concentration $\mu\text{g}/\text{m}^3$ | Statistical Form |
|--------------------------------------|-----------------------|-----------------|--------------------|--------------------|----------------------------------------|------------------------------------------------------------------------------|
| Ozone (O_3) | Primary and Secondary | 8-hour | 0.075 | 75 | 147 | Annual 4th-highest daily maximum 8-hour concentration averaged over 3 years |
| Nitrogen Dioxide (NO_2) | Primary | 1-hour | 0.100 | 100 | 188 | 98th percentile averaged over 3 years |
| Nitrogen Dioxide (NO_2) | Primary and Secondary | Annual | 0.053 | 53 | 100 | Annual mean |
| Sulfur Dioxide (SO_2) | Primary | 1-hour | 0.075 | 75 | 196 | 99th percentile of 1-hour daily maximum concentrations averaged over 3 years |
| Sulfur Dioxide (SO_2) | Secondary | 3-hour | 0.5 | 500 | 1,309 | Not to be exceeded more than once per year |
| Carbon Monoxide (CO) | Primary | 1-hour | 35 | 35,000 | 40,072 | Not to be exceeded more than once per year |
| Carbon Monoxide (CO) | Primary | 8-hour | 9 | 9,000 | 10,304 | Not to be exceeded more than once per year |
| Particulates (as PM_{10}) | Primary and Secondary | 24-hour | — | — | 150 | Not to be exceeded more than once per year on average over 3 years |
| Particulates (as $\text{PM}_{2.5}$) | Primary and Secondary | 24-hour | — | — | 35 | 98th percentile averaged over 3 years |
| Particulates (as $\text{PM}_{2.5}$) | Primary | Annual | — | — | 12 | Annual mean averaged over 3 years |
| Particulates (as $\text{PM}_{2.5}$) | Secondary | Annual | — | — | 15 | Annual mean averaged over 3 years |
| Lead (Pb) | Primary and Secondary | 3-month rolling | — | — | 0.15 | Not to be exceeded at any time |

Source: EPA 2012f.

Notes:

All NAAQS generally correspond to an Air Quality Index (AQI) of 100

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter ($10^{-6} \text{g}/\text{m}^3$)

ppbv = parts per billion by volume ($\text{cc}/10^9 \text{m}^3$)

ppmv = parts per million by volume (cc/m^3)

For gases, equivalent $\mu\text{g}/\text{m}^3$ calculated from ppmv based on molecular weight and standard conditions:

Standard Ambient Temperature 25°C

Standard Barometric Pressure 760 mm Hg

Standard Molar Volume 24.465 liters/g-mole

On December 17, 2014, EPA published a proposal to revise the NAAQS standard for O₃ from the current 75 parts per billion (ppb) to 65 - 70 ppb (Federal Register 75234). The purpose of publishing a draft proposal is to solicit comments from the public, other federal agencies, state and local governments, and industry. After consideration of comments, EPA will promulgate a final rule. In response to comments on this proposal, the EPA may decide on a final primary standard of anywhere from 60 to 70 ppb, or may come to a different conclusion altogether. Because of the uncertainty in the final decision timing, uncertainty as to the final determination of primary and secondary standards, and the uncertainty related to implementation of any new standards, the Final EIS impact analysis has been conducted against the current promulgated O₃ standard, as was done in the Draft EIS; to do otherwise would be speculative.

However, considering the proposed revision to the NAAQS standard for O₃, the FIP for BART at FCPP addressed O₃ emission reductions. The EPA addressed NO_x emissions from the FCPP, the primary O₃ precursor compound emitted from the boiler stacks. In this final action, EPA required FCPP to reduce NO_x emissions. Since reducing NO_x emissions from FCPP would not be the sole cause of any change in regional O₃ concentrations, whether upward or downward, under a new standard, the proposed rule would not lead to a change in the assessment of significance. This settled EPA action was included in the Draft EIS analysis of potential FCPP O₃ emissions impacts, and is unchanged in the Final EIS analysis. Furthermore, the proposed change to the NAAQS would not require a General Conformity determination, as discussed in the Draft EIS. A General Conformity determination is required for Federally sponsored, permitted, or funded actions in NAAQS nonattainment areas or in certain maintenance areas when the total direct and indirect net emissions of nonattainment pollutants (or their precursors) exceed specified thresholds (CAA Amendments of 1990 Section 176[c]). This regulation ensures that federal actions conform to SIPs and agency NAAQS attainment plans. General Conformity would not apply because the Four Corners region is currently in attainment with promulgated NAAQS, and because the Proposed Action will result in “no emissions increase or an increase in emissions which is clearly de minimis” (40 CFR §93.153[c][2]). Additionally, pursuant to §93.153(d)(4), because the Proposed Action encompasses “alteration and additions of existing structures as specifically required by new or existing applicable environmental legislation or environmental regulations” (i.e., 40 CFR 49; 78 Federal Register 8274), a General Conformity determination would not be required. The states which comprise the Four Corners region (New Mexico, Arizona, Colorado, and Utah) are all classified as in attainment for all Federal NAAQS (EPA 2012f). In general, the Four Corners region experiences low concentrations of most pollutants when compared to Federal standards; however, ambient concentrations of O₃ and particulate matter have sometimes approached, but not exceeded, Federal standards in the three most recent years for which validated data are available. Since the Action area is presently in NAAQS attainment or unclassified for all pollutants, a General Conformity determination is not applicable to the proposed project.

4.1.1.3 Hazardous Air Pollutants

HAPs, also known as toxic air pollutants or air toxics, are those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. Title III of the CAA Amendments of 1990 currently identifies 187 pollutants as HAPs, the Federal term for air toxics. In 2001, the EPA identified 21 HAPs as mobile source air toxics, 6 of which are designated priority pollutants (66 Federal Register 17235): acetaldehyde, acrolein, benzene-1, 3-butadiene, diesel exhaust (PM and organic gases), and formaldehyde. Diesel particulate matter (DPM, as PM₁₀) is considered a carcinogenic air toxic. An EPA assessment “examined information regarding the possible health hazards associated with exposure to diesel engine exhaust (DE), which is a mixture of gases and particles. The assessment concludes that long-term (i.e., chronic) inhalation exposure is likely to pose a lung cancer hazard to humans, as well as damage the lung in other ways depending on exposure. Short-term (i.e., acute) exposures can cause irritation and inflammatory symptoms of a transient nature, these being highly variable across the population” (EPA 2002). However, no EPA standard exists for DPM.

In addition to DPM from mining equipment and heavy trucks, coal combustion in power plant boilers emits a wide range of inorganic and organic HAPs from stacks, according to the EPA (EPA 2011a, 40 CFR 63 Subpart UUUUU). Inorganic metals include: antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), and selenium (Se). Organics and nonmetallic inorganics include: acetaldehyde, acetophenone, acrolein, benzene, benzyl chloride, bis(2-ethylhexyl)phthalate (DEHP), carbon disulfide, chlorobenzene, chloroform, cyanide, 2,4-dinitrotoluene, ethyl benzene, ethyl chloride, formaldehyde, hexane, hydrogen chloride, hydrogen fluoride, isophorone, methyl bromide, methyl chloride, methyl ethyl ketone, methylene chloride, polycyclic aromatic hydrocarbons (PAHs), phenol, propionaldehyde, tetrachloroethylene, toluene, styrene, and xylenes (ortho-, meta-, para- isomers).

Mercury and Air Toxics Standards

Coal-fired power plants are the largest source of mercury and acid gas emissions in the United States and are responsible for about 50 percent of mercury emissions and about 77 percent of acid gas emissions. Most mercury deposited in the western U.S., however, originates in Asia (Strode et al. 2008). Peer-reviewed scientific literature shows that mercury emissions from Electric Generating Units in the U.S. enhance mercury deposition and the response of ecosystems in the U.S. (77 FR 9339). Other toxic metals emitted from power plants include arsenic, chromium, hexavalent chromium, nickel, and selenium (EPA 2013a).

When elemental mercury from the air reaches surface waters via direct and indirect deposition, microorganisms can convert it into methylmercury, a highly toxic form that bio-accumulates in fish. Humans are primarily exposed to mercury by eating contaminated fish. Methylmercury exposure is a particular concern for women of childbearing age, fetuses, and young children because studies have linked high levels of methylmercury to damage to the developing nervous system, which can impair children's' ability to think and learn. Mercury and other power plant emissions also damage the ecological environment (EPA 2013a).

On December 16, 2011, the EPA issued the final Mercury and Air Toxics Standards (MATS) and Utility New Source Performance Standards (Utility NSPS) rulemakings which were published in the Federal Register on February 16, 2012 (77 FR 9304). Promulgated as 40 CFR 63 Subpart UUUUU – National Emission Standards for Hazardous Air Pollutants (NESHAPS) for Coal- and Oil-Fired Electric Utility Steam Generating Units, the MATS rule establishes emission limitations and work practice standards for HAPs emitted from coal- and oil-fired electric utility steam generating units along with requirements to demonstrate initial and continuing compliance with the HAP emission limits.

The EPA estimates there are about 1,400 existing generating units affected by the MATS rule – 1,100 coal-fired units and 300 oil-fired units – at about 600 power plants nationwide. As an existing coal-fired generating facility, FCPP must comply with specific HAP emissions limits for the following pollutants:

- a) Filterable PM or total nonmercury HAP metals or individual HAP metals (antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, selenium);
- b) Hydrogen chloride or SO₂; and,
- c) Mercury.

The MATS emissions limits are based on existing control technologies that are widely available and commonly used in the electric utility industry such as electrostatic precipitators, fabric filters (baghouses), flue gas desulfurization (scrubbers), or dry sorbent injection. For existing controlled units such as FCPP Units 4 and 5, which are equipped with baghouses and scrubbers, compliance can be achieved by April 16, 2015, and maintained as follows (EPA 2013a):

- *Operations and Maintenance.* Emissions and operating limits apply at all times except during periods of startup and shutdown. The plant must operate and maintain all equipment, including air

pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. Determination of whether such operation and maintenance procedures are being used is based on information available to the EPA which may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source.

- *Testing and Monitoring of PM and non-Mercury Metals.* Initial performance testing is required for all pollutants to demonstrate compliance with the applicable emission limits. In certain circumstances, such as when a unit does not qualify as a low-emissions unit for total nonmercury HAP metals, individual nonmercury HAP metals, or filterable PM, compliance with applicable emissions limits must be demonstrated through an initial source compliance demonstration test and ongoing continuous monitoring through use of either a PM continuous parametric monitoring system, a PM continuous emission monitoring system, or quarterly source compliance demonstration testing. Units which use PM continuous parametric monitoring system must establish a site-specific operating limit corresponding to the results of the source compliance demonstration test for the applicable pollutant profile. Alternatively, a source can opt to install and operate a PM continuous emission monitoring system.
- *Testing and Monitoring of Hydrogen Chloride and Mercury.* If a unit does not qualify as low-emitter of the acid gas hydrogen chloride (HCl), a source may demonstrate initial and ongoing compliance through use of an HCl continuous emission monitoring system, conducting initial and quarterly source compliance demonstration testing, or if the unit uses wet or dry flue gas desulfurization technology, it may install and operate an SO₂ continuous emissions monitoring system. If a unit does not qualify as a low-emitter of mercury, a source must demonstrate initial and ongoing compliance through use of an approved mercury continuous emissions monitoring system or a sorbent trap monitoring system.
- *Recordkeeping and Reporting.* A source must monitor and collect data according to EPA specifications and a site-specific monitoring plan and periodically submit electronic reports to the EPA. As MATS sources are also Title V (Federal Operating Permit) sources, all monitoring and operating data records must be retained for a minimum of 5 years.

On March 28, 2013, the EPA finalized updates to certain emission limits for new power plants under the MATS rule, including mercury, PM, SO₂, acid gases, and certain individual metals. Additionally, certain testing and monitoring requirements that apply to new sources were adjusted. The new standards affect only new coal- and oil-fired units that will be built in the future (78 FR 24073). The update does not change the final emission limits or other requirements for existing power plants such as FCPP.

4.1.1.4 Federal Visibility Protection and Atmospheric Deposition Control Programs

Protection of Visibility (Regional Haze Rule)

Visibility and haze are regulated under the Regional Haze Rule of the CAA (40 CFR 51 Subpart P). Under the CAA, Class I areas are those in which visibility is protected more stringently than under NAAQS. Class I areas include national parks and monuments, wilderness areas, and other areas of special national and cultural significance. Section 169A (42 USC Part 7491) of the CAA sets forth a national goal for visibility which is the “prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution” (64 FR 35714).

There are 156 Class I areas in the United States, 49 of which are national parks and monuments. The Regional Haze Rule, enacted in 1999, requires states to establish goals and emission reduction strategies for improving visibility in all Class I areas as part of State Implementation Plans (SIPs) as geographically applicable. In addition, the EPA encourages states to work together in regional

partnerships to develop and implement multistate strategies to reduce emissions of visibility-impairing fine particle (PM_{2.5}) pollution (64 FR 35714).

Due to long range transport of visibility-impairing fine particles, all 50 states are required to participate in planning, analysis, and in many cases, emission control programs. Each state must develop coordinated strategies and implement programs to make reasonable progress toward the goal of no “man-made impairment” in Class I areas by reducing emissions that contribute to haze. The Regional Haze Rule requires states to establish goals for each affected Class I area which improve visibility on the haziest days (20 percent most-impaired days) and ensure no degradation occurs on the clearest days (20 percent least-impaired days). The reasonable progress goals are designed to reach natural conditions by 2060. States are required to conduct certain analyses, including analyses of improvement rates, to ensure that they set reasonable progress goals (64 FR 35714, Colorado State University [CSU] 2013a).

Relationship to NAAQS

On December 14, 2012, the EPA established the current primary NAAQS standards to protect the public health, in accordance with CAA Section 109A and secondary NAAQS standards to protect the public welfare, in accordance with CAA Section 109B for PM_{2.5} (see Table 4.1-1). However, consistent with the purposes of Section 169A of the CAA, the EPA recognizes that uniform NAAQS cannot eliminate visibility impairment in all parts of the country. The regional haze program contributes to improvement of local visibility impacts outside of Class I areas that may persist after attainment of the secondary standard (64 FR 35714).

Relationship to BART

The Regional Haze Rule (40 CFR 51 Subpart P) requires the use of BART at older coal-fired power plants to reduce haze and improve visibility. The BART provision in Section 169A(b)(2)(A) addresses the pollution from a specific set of existing sources, such as coal-fired power plants near Class I areas (e.g., FCPP, San Juan Generating Station, Navajo Generating Station). The BART provision requires EPA to promulgate regulations requiring states to revise their SIPs to contain measures to make reasonable progress toward the national visibility goal, including a requirement that certain existing stationary sources procure, install, and operate BART (64 FR 35714).

The CAA defines the sources potentially subject to BART as major stationary sources, including reconstructed sources, from 1 of 26 identified source categories which have the potential to emit 250 tons per year (tpy) or more of any air pollutant, and which were placed into operation between August 1962 and August 1977. This set of sources potentially subject to BART was defined in the 1977 amendments to the CAA and the 2012 Regional Haze Rule is consistent with these amendments, 35 years later. Chief among the 26 source categories are fossil-fuel fired steam electric plants of more than 250 million British thermal units per hour (mmBTU/hr) heat input such as FCPP.

Consistent with the Regional Haze Rule, the *Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation* (40 CFR 49) requires FCPP to reduce emissions of NO_x and defines emission limits for PM based on emission rates currently achieved at FCPP. The FIP requires that Units 4 and 5 meet a BART emission limit of 0.015 lb/mmBTU within 60 days after restart following the scheduled major outages for Units 4 and 5 in 2013 and 2014, suggesting that the emission limit is achievable through the proper operation of the existing baghouses. FCPP must continue to meet the existing 20 percent opacity limit on Units 4 and 5 and is required to comply with a 20 percent opacity limit on its material handling operations, including coal handling.

NO_x and PM pollutants contribute to visibility impairment in the mandatory Class I Federal areas surrounding FCPP. These pollutants contribute to visibility impairment in the mandatory Class I Federal areas surrounding FCPP, of which there are 16 within the 300-km radius as shown in Appendix A, Section A3. For NO_x emissions, APS has opted to close Units 1, 2, and 3 and install SCR controls on Units 4 and 5

to meet an emission limit of 0.098 pound NO_x per million BTU² (lbs/mmBTU) heat input each (30-day rolling average), which is an 80 percent reduction from 0.49 lb/mmBTU. For PM, Units 4 and 5 must meet an emission limit of 0.015 lb/mmBTU, while retaining the existing 20 percent opacity limit, through the proper operation of the existing baghouses. EPA is also requiring FCPP to comply with a 20 percent opacity limit on its coal and material handling operations (77 FR 51620) (Refer to Section 4.1.3).

Atmospheric Deposition

Since the 1970s, implementation of CAA regulations has reduced emissions of NO_x, SO₂, and mercury and reduced the impact of atmospheric deposition on water quality and aquatic ecosystems. However, in spite of progress, atmospheric deposition continues to affect water quality and harm aquatic ecosystems (GAO 2013).

According to EPA's 2008 National Emissions Inventory, domestic emissions of NO_x declined from about 26 million tons in 1990 to about 17 million tons in 2008. About 74 percent of this reduction came from reduced emissions from power plants and vehicles. Also according to the inventory, emissions of SO₂ declined from 23 million tons in 1990 to 10 million tons in 2008, and about 64 percent of this reduction came from reduced emissions from power plants (EPA 2011b, GAO 2013).

Three key regulations or programs have contributed to reductions in acid rain precursors: (1) Title II emission standards for mobile sources (motor vehicles), (2) actions designed to meet primary NAAQS, and (3) the Acid Rain Program. Although neither vehicle emissions standards nor actions to meet primary NAAQS are designed to address the deposition effects of NO_x and SO₂ emissions on surface waters, these standards have contributed to overall reductions in these criteria pollutants. In contrast, the Acid Rain Program was designed, in part, to address the effect of NO_x and SO₂ on surface waters (GAO 2013).

The Acid Rain program implements requirements for significant decreases in the emissions of NO_x and SO₂ from power plants to improve air quality and protect ecosystems that have been damaged by acid rain, including aquatic ecosystems. According to the 2011 National Acid Rain Precipitation Assessment Program report, the Acid Rain Program has been successful in reducing NO_x and SO₂ emissions from electric power generation to below levels set by Congress in 1990. By 2009, SO₂ emissions from power plants were 3.25 million tons lower than the final 2010 cap level of 8.95 million tons, and NO_x emissions were 6.1 million tons less than the levels projected for 2000. As a result of these reductions, air quality has improved and acid deposition has decreased to the extent that some acid-sensitive areas are beginning to show signs of recovery. However, current emission reductions pursuant to rules finalized in 2005 are not sufficient to allow full recovery of acid-sensitive ecosystems. Estimates from modeling presented in the National Acid Rain Precipitation Assessment Program report show that additional emission reductions are necessary to protect and recover acid-sensitive ecosystems. However, since the mandated emission reductions have been achieved, no additional reductions in emissions can reasonably be expected from the Acid Rain Program as currently designed (National Science and Technology Council [NSTC] 2011).

Two recent developments –new environmental regulations and changing market conditions – could affect future NO_x and SO₂ emissions from power plants (EPA 2013b, GAO 2013):

- The Cross-State Air Pollution Rule promulgated by EPA on July 6, 2011, was challenged in the DC Circuit Court of Appeals (Case No. 11-1302, August 21, 2012) on the grounds that the Cross-State Air Pollution Rule exceeds the EPA's statutory authority in two independent respects. For each of those two independent reasons, the Court ruled that the Cross-State Air Pollution Rule violates Federal law and therefore must be vacated. On October 5, 2012, the EPA filed a petition with the Court seeking en banc rehearing of the case, and on January 24, 2013, the Court denied EPA's petition. On March 29, 2013 the U.S. Solicitor General petitioned the Supreme Court to

² One British Thermal Unit (BTU) is the amount of heat required to raise the temperature of one pound (453.6 grams) of pure water from 39 to 40 °F (3.9 to 4.4 °C)

review the DC Circuit Court's decision. The Supreme Court granted certiorari and heard arguments for the case on December 11, 2013. The Supreme Court reversed the DC Circuit Court of Appeals in *EPA v. EME Homer City Generation*, 134 S. Ct. 1584 (2014), upholding EPA's Cross-State Air Pollution Rule.

- Contemporaneous (occurring at the same time) changes in energy market conditions have been weighing on the future viability of coal-fired power plants. Key among these has been the decline in the price of natural gas due to increased supply, which has made it more attractive to electric power providers in lieu of burning coal. Natural gas emits far less NO_x and SO₂ than coal, and about half as much GHGs for the same level of generating efficiency, and even less in new high-efficiency (i.e., combined-cycle) generating units. Thus, as more new power plants opt for natural gas in lieu of coal, acid deposition would be expected to continue to decrease overall (GAO 2013).

Similar to NO_x and SO₂ emission reductions, mercury emissions from domestic anthropogenic (caused by human activity) sources declined from about 246 tons in 1990 to about 61 tons in 2008, according to the 2008 National Emissions Inventory. More than half of this decline can be attributed to reduced emissions from municipal waste combustors and medical waste incineration. According to the inventory, in 1990, these two sources emitted about 108 tons of mercury; in 2008, they emitted less than 2 tons of mercury (an approximately 98 percent decrease). Mercury emissions from power plants also declined from about 59 tons of mercury in 1990 to about 30 tons of mercury in 2008 (EPA 2011b, GAO 2013).

On February 16, 2012, EPA promulgated the MATS establishing for the first time emission limitations on mercury and other toxic pollutants, mainly metals, from existing and new power plants. Legal challenges are pending before the DC Circuit Court of Appeals; however, proceedings have been delayed until EPA, in response to a petition for reconsideration, updates certain emission limits for new power plants, which were finalized on March 28, 2013. EPA reopened the public comment period on reconsideration of startup and shutdown provisions on June 25, 2013, and argued the case before the Court of Appeals on December 10, 2013. Existing sources have 3 years to comply with the new standards but can seek an additional year from the permitting authority. When fully implemented, EPA projects that the MATS will reduce future mercury emissions from domestic power plants to about 9 tons by 2016, a 70 percent reduction from 2008 (GAO 2013). The Court of Appeals upheld the MATS in *White Stallion Energy Center v. EPA*, No. 12-1100, 748 F.3d 1222 (D.C. Cir. 2014).

Acid Rain Program

FCPP is subject to the Acid Rain Program, as administered by NNEPA and EPA. To achieve this goal in a cost-effective manner the program employs both traditional command-and-control and innovative market-based approaches for controlling air pollution. The program also encourages energy efficiency and pollution prevention. The Acid Rain Program was developed with consultation from various stakeholders including electric utilities, energy companies, pollution control equipment vendors, labor, academia, public utility commissions, state environmental agencies, and conservation groups. As an affected source, FCPP is a participant in the Acid Rain Program.

Title IV of the CAA Amendments of 1990 set the goal of reducing annual SO₂ emissions by 10 million tpy below 1980 levels. To achieve these reductions, the Act required a two-phase approach to reducing SO₂ and NO_x emissions from fossil fuel power plants. Phase I began in 1995 and affected 445 generating units, mainly at coal-fired electric utility plants located in eastern and mid-western states. Phase II began in 2000 and lowered annual emissions limits imposed on large, higher emitting plants and also set limits on smaller, cleaner plants fired by coal, oil, and gas, encompassing over 2,000 generating units rated 25 megawatts or greater nationwide. The Act (1990) also required a 2 million tpy reduction in NO_x emissions by 2000 using technology such as low-NO_x burners in coal-fired units.

FCPP is subject to the principal provisions of the Acid Rain Program, under the authority of the NNEPA and EPA Region IX, respectively. This includes appointing a Designated Representative, filing an Acid Rain

permit application and compliance plan, and monitoring and recording emissions. FCPP is also able to take part in allowance trading, and is required to hold sufficient SO₂ allowances to cover annual emissions (EPA 2013b). These provisions are described in detail in Appendix A.

4.1.1.5 Federal Prevention of Significant Deterioration (PSD) Program

PSD (40 CFR 51.166 and 40 CFR 52.21) provides the overall regulatory framework for the permitted operation of FCPP. The PSD Program is designed to:

- Protect public health and welfare;
- Preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value;
- Ensure that economic growth will occur in a manner consistent with the preservation of existing clean air resources; and,
- Ensure that any decision to permit increased air pollution in any area to which this section applies is made only after careful evaluation of all the consequences of such a decision and after adequate procedural opportunities for informed public participation in the decision making process.

PSD does not prohibit new or existing stationary sources, such as oil refineries, factories, or power plants, from increasing emissions; rather, PSD is designed to ensure that emissions increases would have no significant effect on regional air quality (EPA 2013d).

PSD permitting applies to new major sources or major modifications at existing sources (e.g., FCPP) located in NAAQS attainment or unclassified areas for applicable pollutants. Since FCPP is located in an NAAQS attainment area for all criteria pollutants (see Table 4.1-4), PSD applies to emissions of NO_x, VOC, CO, SO₂, PM₁₀, PM_{2.5}, and Pb (EPA 2013d). Details of the requirements of PSD permitting are provided in Appendix A.

A PSD permit would be required for a major modification at FCPP. A recent DC Circuit Court decision on PSD rules related to PM_{2.5} increments and baselines could affect FCPP in the future. On January 22, 2013, the U.S. Court of Appeals for the District of Columbia Circuit granted a request from the EPA to vacate and remand portions of two PSD PM_{2.5} rules which addressed the Significant Impact Levels so that the EPA could correct errors in the rules. The Court also vacated parts of rules establishing PM_{2.5} Significant Monitoring Concentrations due to regulatory errors. The Court's decision became final on March 15, 2013, and the affected provisions of 40 CFR 51.166 and 52.21 were vacated. The EPA will develop replacement PSD PM_{2.5} rules to correct errors and address the Court's decision (EPA 2013d). On November 26, 2013, EPA issued a good cause final rule to remove elements of the Clean Air Act PSD program for fine particle pollution. These elements address air quality modeling and monitoring provisions for fine particle pollution in areas protected by the PSD program.

Specific to the Proposed Action, APS is planning to install SCR NO_x control equipment on FCPP Units 4 and 5 in compliance with 40 CFR 49 BART requirements. Preliminary engineering calculations have shown that this would result in byproduct emissions of H₂SO₄ in excess of the 7 tpy threshold. APS has prepared the PSD permit application for the Proposed Action, including PSD increments modeling. The PSD permitting action is exempt from NEPA; but not from ESA Section 7 reviews. As such, APS is also preparing an ESA impacts analysis (discussed in detail in Section 4.8, Special Status Species). Engineering estimates for NO_x and H₂SO₄ emissions used in the impacts analyses were done prior to installation of the SCR equipment. These estimated values were conservative and subsequent analyses are expected to result in lower values and lower impacts once actual SCR performance is known. The PSD permit will ultimately contain actual values determined after the SCR equipment is installed and operating. For Section 7 ESA compliance, EPA has its own permitting process, commencing with

publication of the draft PSD permit and the public comment period. Before EPA can take further action on the PSD permit, it must comply with ESA requirements.

4.1.1.6 Federal Stationary Source Regulations

The NNEPA and EPA are both cooperating agencies in the review of the continued operations of FCPP. As described above, the Regional Haze Rule requires the use of BART at older coal-fired power plants to reduce haze and improve visibility. In August 2012, EPA issued its final rule for BART compliance at FCPP. The final rule allows APS the choice in either complying with the EPA's 2010 draft rule or the APS counter-proposal to meet stated NO_x and particulate matter emissions limits. In compliance with the first of the options provided by EPA, APS shut down Units 1, 2, and 3 on December 30, 2013 and plans to install selective catalytic reduction devices on Units 4 and 5 by July 31, 2018. Because EPA's decision precedes this EIS, the compliance actions are considered part of the environmental baseline for analysis of the consequences of the Proposed Action and alternatives.

Source Specific FIP for Implementing BART for FCPP

The primary goal of the *Source Specific FIP for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation* [EPA-R09-OAR-2010-0683; FRL-9703-2] is reducing emissions of the PM_{2.5} precursor NO_x, thereby improving visibility in the region. The FIP requires FCPP to meet new emissions limits required by the BART provision of the CAA for NO_x and PM. These pollutants contribute to visibility impairment in the 16 mandatory Class I Federal areas surrounding FCPP. Under the FIP, FCPP could choose between two emissions control strategies (options) and notify EPA of its choice by July 1, 2013 (EPA 2012g), which was extended by EPA to December 31, 2013. The final BART determination requires FCPP to meet a plant-wide heat input-weighted emission limit of 0.11 lb/mmBTU on a rolling 30-day average, which represents an 80 percent reduction from historic NO_x emission rates in one of two ways:

- FCPP could implement post-combustion NO_x controls (i.e., SCR) on Units 1 through 5, with implementation of SCR devices on one of the 750 MW units (i.e., 4 or 5) completed within 4 years of promulgation, and SCR devices on the remaining units completed within 5 years of promulgation.
- FCPP could implement an alternative emissions control strategy which required permanent closure of Units 1, 2, and 3 by December 31, 2013, and implementation of SCR on Units 4 and 5 by July 31, 2018, to meet a NO_x emission limit of 0.098 lb/mmBTU each on a 30-day rolling average. This represents an 80 percent reduction of NO_x, down from 0.49 lb/mmBTU. For PM, the Rule requires Units 4 and 5 to meet a BART emission limit of 0.015 lb/mmBTU within 60 days after restart following the scheduled major outages for Units 4 and 5 in 2013 and 2014. This emission limit is achievable through the proper operation of the existing baghouses and FCPP must continue to meet the existing 20 percent plantwide opacity limit, which also applies to material handling operations, including coal handling.

On December 31, 2013, APS notified EPA that it preferred the alternative FIP emissions control strategy. As such, Units 1, 2, and 3 were shut down on December 30, 2013. Thus, emissions from Units 1, 2, and 3 permanently ceased. In addition, APS will install SCR devices on Units 4 and 5 by July 31, 2018. As a result, there would be a transition period from 2014 to mid-2018 during which Units 1, 2, and 3 are shut-down and Units 4 and 5 operate without SCR (refer to Section 4.1.3).

Title V Operating Permits

Parts 70 and 71 implement Title V of the CAA, 42 USC 7661, et seq. Title V operating permits are legally enforceable documents that permitting authorities issue to major stationary sources of air pollution regulating their emissions. Title V major source thresholds are defined by the NAAQS attainment status of the jurisdiction, with progressively lower (more stringent) thresholds in moderate, serious, severe, and

extreme nonattainment areas. Part 70 permits are issued by state and local (county or district) permitting authorities. Part 71 permits are issued either directly by the EPA or through tribal EPAs on sovereign tribal lands. The Part 71 permit for FCPP is issued by the NNEPA.

The current Part 71 permit for FCPP (NN-ROP-05-07) expired August 1, 2013; however, FCPP submitted a permit renewal application on January 25, 2013. FCPP may operate according to their present permit terms and conditions until NNEPA either issues a new permit or denies their renewal application.

Section II.A.2 of the permit contains the following enforceable limitations on SO₂, NO_x, PM, and opacity emissions (40 CFR 49.23):

- Minimum 88 percent SO₂ control efficiency (reduction) on a plantwide weighted annual average basis, calculated daily using heat input data (this is stated as a maximum 12 percent post-control residual SO₂ emissions compared to pre-control uncontrolled emissions).
- Maximum 17,900 pounds per hour SO₂ emissions on a plantwide 3-hour rolling average basis.
- Maximum 0.050 lb/mmBTU particulate matter emission rate from any unit, determined by source testing.
- Maximum plume opacity of 20 percent from Units 4 and 5, except for brief periods of not more than 27 percent opacity lasting not more than 6 minutes in an hour.
- Maximum 0.85 lb/mmBTU NO_x emission rate from Units 1 and 2 on a 30-day rolling average basis.
- Maximum 0.65 lb/mmBTU NO_x emission rate from Units 3, 4, and 5 on a 30-day rolling average basis.
- Maximum 335,000 pounds per day NO_x emissions on a plantwide 24-hour basis, discounted by 1,542 pounds per hour for any of Units 1, 2, or 3 not operating and discounted by 4,667 pounds per hour for any of Units 4 or 5 not operating.

Section II.A.3 of the Part 71 permit contains testing and monitoring requirements to quantify the above emissions limitations, and Section II.A.4 contains emissions recordkeeping and reporting requirements. Section II.B incorporates by reference provisions of the Phase II Acid Rain permit (40 CFR Parts 72, 72, and 75). Section II.C defines Compliance Assurance Monitoring (40 CFR Part 64) requirements for monitoring particulate matter emissions from Units 1, 2, 3, 4, and 5 per the above limitation.

Continuous Emissions Monitoring

The FCPP is subject to Part 75 requirements for the monitoring, recordkeeping, and reporting of SO₂, NO_x, CO₂ emissions, volumetric flow, and opacity data from affected units under the Acid Rain Program pursuant to Sections 412 of the CAA, 42 USC 7401-7671, et seq. Part 75 and the GHG Reporting Rule, 40 CFR Part 98 also sets forth provisions for the monitoring, recordkeeping, and reporting of NO_x mass emissions, which are required to be controlled to demonstrate compliance with a NO_x mass emission reduction program. For FCPP, this is consistent with the *Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation*. Under Part 75 operating and emissions records must be retained for a minimum of 5 years.

4.1.1.7 Mobile Source Regulations

The EPA regulates mobile sources of air pollution in the state of New Mexico and Navajo Nation via Federal mobile source standards. In most jurisdictions, self-propelled nonroad mining and construction equipment is considered a vehicle, as defined by vehicle codes. Operations at both the FCPP and Navajo Mine are subject to mobile source emissions standards.

A vehicle may have an engine that both propels the vehicle and powers equipment mounted on the vehicle, typically via hydraulics. As such, single-engine vehicles are generally exempt from direct regulation by states, air districts, or sovereign tribes. However, not included in most exemption provisions is any non driveline engine-powered equipment mounted on a vehicle that would otherwise require a permit under state, air district, or tribal regulations. An example of this dual-engine configuration would be a vacuum street sweeper where an auxiliary engine drives the vacuum blower. Another example would be a mobile crane or drilling rig with an independent hoist or draw-works engine, respectively.

Federal Tier 1 standards for off-road diesel engines were adopted in 1995. Federal Tier 2 and Tier 3 standards were adopted in 2000 and selectively apply to the full range of diesel off-road engine power categories. Both Tier 2 and Tier 3 standards include durability requirements to ensure compliance with the standards throughout the useful life of the engine (40 CFR 89.112).

On May 11, 2004, the EPA signed the final rule implementing Tier 4 emission standards which are to be phased-in over the period of 2008-2015 (69 FR 38957-39273, June 29, 2004). The Tier 4 standards require that emissions of PM and NO_x be further reduced by about 90 percent. Such emission reductions can be achieved through the use of advanced control technologies – including advanced exhaust gas after treatment similar to those required by the 2007-2010 standards for highway diesel engines.

4.1.1.8 Subtitle D of the Resource Conservation and Recovery Act (RCRA)

EPA published the Disposal of Coal Combustion Residuals from Electric Utilities final rule on December 19, 2014. The final rule regulates CCR as a RCRA Subtitle D solid waste. FCPP is required to comply with EPA’s Final Rule, which provides specific deadlines for compliance. EPA issued minimum national criteria, including requirements for composite liners, groundwater monitoring, structural stability requirements, corrective action, and closure/post closure care. The final rule includes air criteria to address the pollution caused by windblown dust from CCR units and requires owners and operators to minimize CCR from becoming airborne at the facility. The CCR rule (257.80) requires that operators adopt measures that will effectively minimize CCR from becoming airborne at the facility, including CCR fugitive dust originating from CCR units, roads, and other CCR management and material handling activities.

4.1.2 Affected Environment Pre-2014

4.1.2.1 Area Climate

The Four Corners area is located in a high desert region averaging over 5,000 feet elevation and over 270 clear days per year with low humidity and generally warm daytime temperatures. As shown in Table 4.1-2, average summer daytime high temperatures in Shiprock and Fruitland are about 93°F and average winter nighttime low temperatures are about 15°F, with an average year-round temperature of about 52°F. Average annual precipitation is typically 7.8 inches with light snowfalls in winter (World Climate 2013). Average high desert wind speed is about 9 miles per hour with a typical east-by-northeast and west-by-southwest diurnal wind direction pattern (National Oceanic and Atmospheric Administration [NOAA] 2008, 2013). Due to the area’s aridity, climate change could have a substantial impact if the already low precipitation amounts decrease in the future (New Mexico Agency Technical Work Group 2005).

Table 4.1-2 Climate Data for the Navajo Nation (Based on Measurements in Shiprock and Fruitland)

| Month | Maximums °F | Minimums °F | Averages °F | Precipitation inches | Wind mph |
|----------|-------------|-------------|-------------|----------------------|----------|
| January | 41.6 | 15.4 | 28.6 | 0.6 | 8.0 |
| February | 50.5 | 21.8 | 36.1 | 0.6 | 8.8 |
| March | 59.5 | 27.2 | 43.3 | 0.6 | 9.9 |
| April | 69.0 | 33.0 | 51.0 | 0.5 | 10.7 |

| Month | Maximums °F | Minimums °F | Averages °F | Precipitation inches | Wind mph |
|---------------|-------------|-------------|-------------|----------------------|------------|
| May | 78.5 | 41.5 | 60.0 | 0.5 | 10.5 |
| June | 88.5 | 49.9 | 69.2 | 0.3 | 9.8 |
| July | 93.0 | 57.5 | 75.2 | 0.7 | 8.9 |
| August | 90.3 | 56.0 | 73.3 | 1.0 | 8.1 |
| September | 82.9 | 47.1 | 65.0 | 1.0 | 8.4 |
| October | 71.1 | 35.5 | 53.4 | 1.0 | 8.2 |
| November | 55.7 | 26.2 | 40.8 | 0.8 | 7.9 |
| December | 43.7 | 17.4 | 30.7 | 0.7 | 7.6 |
| Annual | 93.0 | 15.4 | 52.2 | 8.3 | 8.9 |

Sources: World Climate 2013, NOAA 2008.

4.1.2.2 Ambient Air Quality

Air quality is affected by a variety of sources in the Project Area. Large stationary sources such as FCPP and San Juan Generating Station emit substantial amounts of NO_x and SO₂, along with PM₁₀ and PM_{2.5}. Oil and gas production facilities in the region emit mainly NO_x and VOCs along with some SO₂, PM₁₀, and PM_{2.5}. Light motor vehicles, diesel powered construction equipment, and commercial trucks used in the region are another source of these pollutants. Non-combustion sources of PM₁₀ and PM_{2.5} include fugitive dust from roads, construction, demolition, and earthmoving, as well as wind-blown dust and forest fires. Finally, commercial and general aviation aircraft operating at nearby airports generate emissions that affect air quality.

O₃ is a secondary pollutant that is not emitted directly by sources, but rather is formed by a reaction between NO_x and VOCs in the presence of sunlight. Reductions in O₃ concentrations are dependent upon reducing emissions of these precursors. Principal sources of O₃ precursors are motor vehicles and other mobile equipment (including agricultural equipment), solvent use, petroleum industry activities, nonelectric agricultural water pumping, and electric utilities operation such as power plant boilers. Another secondary pollutant is condensable PM_{2.5}, which is formed by precursors SO₂, NO_x, VOCs, and ammonia (California Air Resources Board [CARB] 2005). Condensable PM_{2.5} is a principal driver of regional haze (visibility degradation); therefore, reductions in regional levels of NO_x and SO₂ would also reduce the amount of haze.

The New Mexico Environmental Department (NMED), Navajo Nation, Southern Ute Indian Tribe, Colorado Department of Public Health and Environment, U.S. Forest Service (USFS), and NPS in combination operate an extensive regional air monitoring network composed of 17 stations that collectively measure the ambient concentrations of six criteria air pollutants: O₃, NO₂, SO₂, CO, PM₁₀, and PM_{2.5}. Not all monitoring stations are fully instrumented for these pollutants, while some sites have not been operating for adequate periods of time to provide representative data for determination of attainment status. In addition, one site measures Pb and sulfate (SO₄) within total suspended particulate matter (TSP). Each site listed in Table 4.1-3 and shown on Figure 4.1-2 is categorized by the monitoring program it operates under (EPA 2012e):

Table 4.1-3 Ambient Monitoring Site Descriptions and Parameters – Four Corners Region

| Site ID Code | State | County | Location | North Latitude | West Longitude | Type of Site | Reporting Agency | Criteria Pollutants Monitored O ₃ | Criteria Pollutants Monitored NO ₂ | Criteria Pollutants Monitored SO ₂ | Criteria Pollutants Monitored CO | Criteria Pollutants Monitored PM ₁₀ | Criteria Pollutants Monitored PM _{2.5} | Criteria Pollutants Monitored Other |
|--------------|------------|-----------|-------------------------|----------------|----------------|--------------|------------------|-------------------------------------------------|--------------------------------------------------|--------------------------------------------------|-------------------------------------|---------------------------------------------------|----------------------------------------------------|----------------------------------------|
| 35-45-0006 | New Mexico | San Juan | Farmington | 36.727500 | -108.220833 | SLAMS | NMED | | | | X | X | X | |
| 35-45-0008 | New Mexico | San Juan | Farmington | 36.735833 | -108.238333 | SLAMS | NMED | | | X | | | | |
| 35-45-0009 | New Mexico | San Juan | Bloomfield | 36.742222 | -107.976944 | SLAMS | NMED | X | X | X | | | | |
| 35-45-0014 | New Mexico | San Juan | Kirtland (near FCPP) | 36.708333 | -108.500278 | SLAMS | NMED | | X | X | | | | |
| 35-45-0017 | New Mexico | San Juan | Shiprock | 36.752778 | -108.716667 | SLAMS | NMED | | | X | | X | | |
| 35-45-0018 | New Mexico | San Juan | Navajo Dam | 36.809730 | -107.651580 | SLAMS | NMED | X | X | | | | X | |
| 35-45-0019 | New Mexico | San Juan | Farmington | 36.774162 | -108.165034 | SLAMS | NMED | | | | | X | X | |
| 35-45-1005 | New Mexico | San Juan | Farmington | 36.796667 | -108.472500 | SLAMS | NMED | X | X | X | | | | |
| 35-45-1223 | New Mexico | San Juan | Shiprock (Diné College) | 36.807100 | -108.695230 | Tribal | Navajo | X | X | X | | X | | |
| 08-67-1004 | Colorado | La Plata | Weminuche Wilderness | 37.303890 | -107.484167 | Federal | USFS | X | X | | | | | |
| 08-67-7001 | Colorado | La Plata | Pine River Valley | 37.136780 | -107.628630 | Tribal | S. Ute | X | X | | X | X | X | |
| 08-67-7002 | Colorado | La Plata | La Plata River Plateau | 37.096389 | -108.183333 | Tribal | S. Ute | X | X | | | | | |
| 08-67-7003 | Colorado | La Plata | Animas River Valley Rim | 37.102580 | -107.870219 | Tribal | S. Ute | X | X | | | X | X | |
| 08-83-0005 | Colorado | Montezuma | Mesa Verde NP | 37.203611 | -108.491944 | SLAMS | CDPHE | | | | | | | X |

| Site ID Code | State | County | Location | North Latitude | West Longitude | Type of Site | Reporting Agency | Criteria Pollutants Monitored O ₃ | Criteria Pollutants Monitored NO ₂ | Criteria Pollutants Monitored SO ₂ | Criteria Pollutants Monitored CO | Criteria Pollutants Monitored PM ₁₀ | Criteria Pollutants Monitored PM _{2.5} | Criteria Pollutants Monitored Other |
|--------------|----------|-----------|---------------|----------------|----------------|--------------|------------------|----------------------------------------------|-----------------------------------------------|-----------------------------------------------|----------------------------------|------------------------------------------------|-------------------------------------------------|-------------------------------------|
| 08-83-0006 | Colorado | Montezuma | Cortez | 37.350054 | -108.592334 | Special | CDPHE | X | | | | | X | |
| 08-83-0101 | Colorado | Montezuma | Mesa Verde NP | 37.198333 | -108.490278 | Federal | NPS | X | | | | | | |
| 08-83-9000 | Colorado | Montezuma | Mesa Verde NP | 37.198413 | -108.491357 | IMPROVE | NPS | | | | | X | X | |

Source: EPA 2012e.

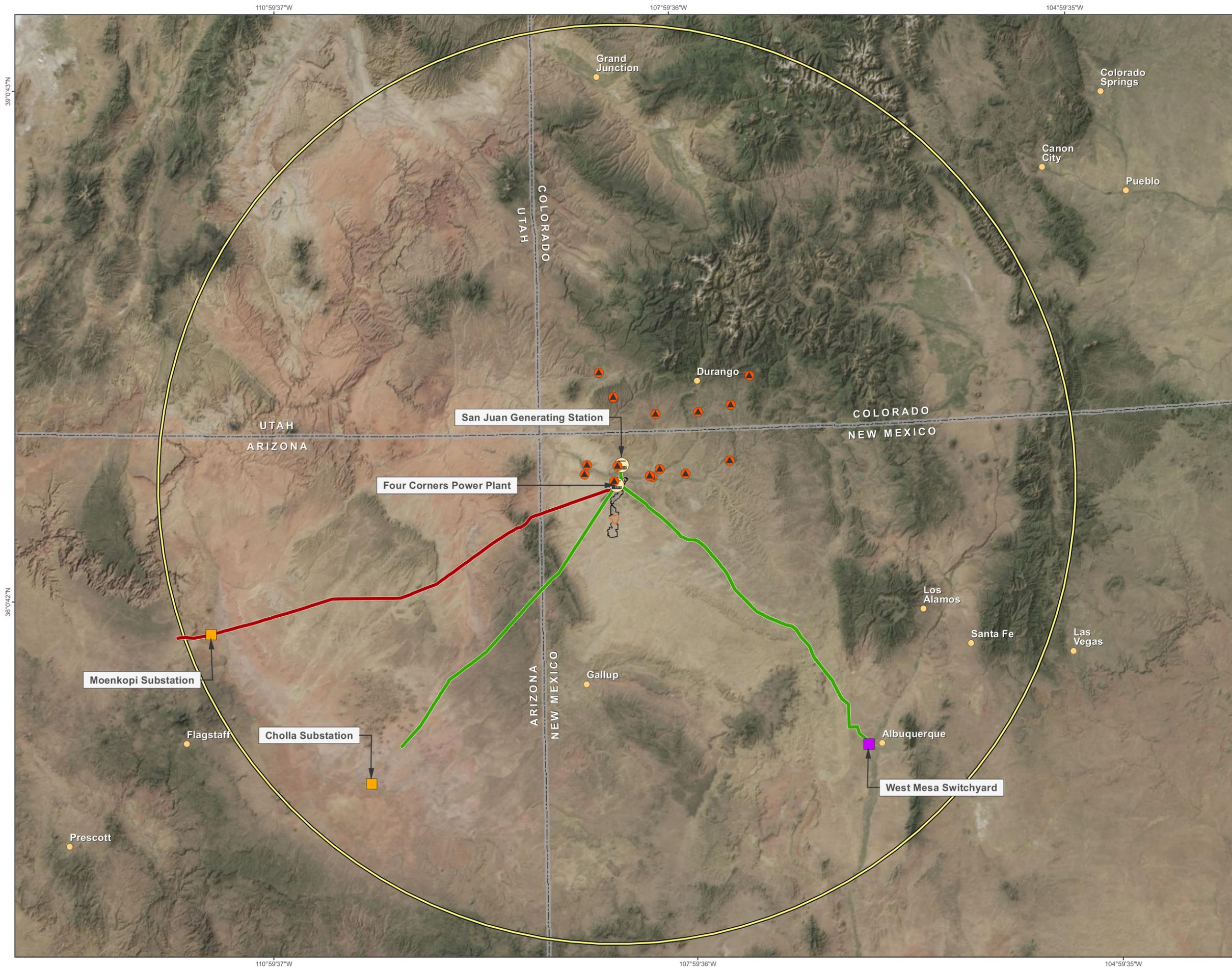
Notes:

- CDPHE = Colorado Department of Public Health and Environment
 - CO = carbon monoxide
 - Federal = Non-EPA Federal Monitors (USFS, NPS)
 - IMPROVE = Interagency Monitoring of Protected Visual Environments (NPS)
 - NMED = New Mexico Environment Department
 - NO₂ = nitrogen dioxide
 - NPS = National Park Service
 - O₃ = ozone
 - PM₁₀ = particulate matter having an aerodynamic diameter of 10 microns or less
 - PM_{2.5} = particulate matter having an aerodynamic diameter of 2.5 microns or less
 - SLAMS = EPA State and Local Air Monitoring Stations (New Mexico, Colorado)
 - SO₂ = sulfur dioxide
 - Special = Special Purpose Monitors (Colorado)
 - Tribal = Tribal Monitors (Navajo Nation, Southern Ute Indian Tribe)
 - USFS = U.S. Forest Service
- Site 08-83-0005 monitored Total Suspended Particulate, Lead, and Sulfate in 1996 (as Other)

Four Corners Power Plant and Navajo Mine Energy Project

ENVIRONMENTAL SETTING & CONSEQUENCES

Figure 4.1-2
Air Quality Monitoring Stations



PROJECT FACILITIES

- Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete SMCRA Permit Boundary
- Four Corners Power Plant 300km Buffer

TRANSMISSION LINES

- 345kV
- 500kV

AIR QUALITY FEATURES

- Monitoring Stations, Four Corners Region



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- State and Local Air Monitoring Stations (SLAMS) (New Mexico, Colorado)
- Tribal Monitors (Navajo Nation, Southern Ute Indian Tribe)
- Non-EPA Federal Monitors (USFS, NPS)
- Special Purpose Monitors (Colorado)
- Interagency Monitoring of Protected Visual Environments (IMPROVE) (NPS)

Data collected by the various monitoring programs is ultimately reported to the EPA, which oversees the programs and provides technical support, quality assurance, data processing, and public access (EPA 2012e). Ambient air monitoring data summaries are presented in Table 4.1-4.

4.1.2.3 Stationary Sources of Air Pollutants – Electric Power Generation

The electric utility sector involves the generation, transmission, and distribution of electricity. The main source of emissions from the sector is power plants. Stack criteria emissions include NO_x, SO₂, CO, VOC, PM₁₀, and PM_{2.5}. Air toxics (HAPs) are emitted in relatively small quantities compared to criteria pollutants or GHGs. These gases and particulates are released during the combustion of fossil fuels, such as coal, oil, and natural gas (EPA 2011a).

Fossil fuel combustion to generate electricity accounts for about 70 percent of SO₂ emissions and about 20 percent of NO_x emissions nationwide (EPA 2012c), and coal combustion emits significantly more air contaminants, SO₂ in particular, than burning natural gas or petroleum to generate electricity (EPA 2011a). In 2010, about 45 percent of electricity was generated using coal and about 25 percent was generated using natural gas. The percentage of natural gas generation has grown in recent years due to its reputation as a “clean” fuel and increased supply, which has driven down prices. Petroleum accounts for less than 1 percent of electricity generation, down significantly from the past. The remaining generation comes from nuclear plants (about 20 percent) and renewable sources (about 10 percent), which includes hydroelectric, geothermal, biomass (wood and agricultural wastes), wind, and solar (photovoltaic and thermal) (EPA 2012d). Nuclear, hydroelectric, wind, and solar emit no criteria pollutants. Geothermal may emit some SO₂, depending on the resource being tapped, and biomass emits NO_x, SO₂, CO, VOC, PM₁₀, and PM_{2.5} because it involves combustion of non-fossil fuels.

Although PM_{2.5} is a subset of PM₁₀, it differs from the rest of PM₁₀. While most of ambient PM₁₀ results from direct emissions of the pollutant, a significant amount of the ambient PM_{2.5} results from transformation of precursors and condensing of gaseous pollutants in the atmosphere. Other than direct PM_{2.5} emissions, the key pollutants contributing to PM_{2.5} concentrations in the atmosphere are SO₂, NO_x, VOCs, and ammonia (CARB 2005). Pursuant to 40 CFR 49, *Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation*, the primary goal of controlling NO_x emissions from FCPP is to reduce PM_{2.5} precursors and thereby improve visibility in the region.

Electric power generating resources are rated in terms of kilowatts (KW) or MW output capacity. As a point of reference, at an average peak load of 10 KW each, 1 MW would power 100 homes. Except for photovoltaic “solar panels” which have no moving parts, all generation of 50 or 60 Hertz (Hz) sine-wave alternating current (AC) power involves spinning a synchronous generator (alternator) from a source of rotational energy (turbine or engine). Utility-scale turbines include hydraulic turbines, steam turbines, gas or combustion turbines, and wind turbines. Utility-scale engines include spark-ignition natural gas, compression-ignition diesel, or dual fuel.

Table 4.1-4 Ambient Air Monitoring Sites and Parameters in Vicinity of Proposed Action - Four Corners Region

| Aerometric Parameter | Averaging Time | Data Years | 00-08 | 00-03 | 00-11 | 94 | 98 | 05-11 | 08-11 | 00-11 | 10-11 | 04-11 | 00-11 | 94 | 00-11 | 96 | 08-11 | 00-11 | 95 | |
|------------------------------------|------------------------|-------------------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|-------|------|-------|------|-------|-------|------|----|
| | | State Code | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 08 | 08 | 08 | 08 | 08 | 08 | 08 | 08 |
| | | County Code | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 67 | 67 | 67 | 67 | 83 | 83 | 83 | 83 |
| | | Site Number | 0006 | 0008 | 0009 | 0014 | 0017 | 0018 | 0019 | 1005 | 1233 | 1004 | 7001 | 7002 | 7003 | 0005 | 0006 | 0101 | 9000 | |
| O ₃ | 1-hour | ppmv | | | X | | | X | | X | X | X | X | X | X | | X | X | | |
| O ₃ | 8-hour running average | ppmv | | | X | | | X | | X | X | X | X | X | X | | X | X | | |
| CO | 1-hour | ppmv | X | | | | | | | | | | X | | | | | | | |
| CO | 8-hour running average | ppmv | X | | | | | | | | | | X | | | | | | | |
| Nitric Oxide (NO) | 1-hour | ppbv | | | X | | | X | | X | | X | X | | X | | | | | |
| NO ₂ | 1-hour | ppbv | | | X | X | | X | | X | X | X | X | X | X | | | | | |
| NO _x | 1-hour | ppbv | | | X | | | X | | X | | X | X | | X | | | | | |
| SO ₂ | 5-minute | ppbv | | | X | | | | | X | | | | | | | | | | |
| SO ₂ | 1-hour | ppbv | | X | X | X | X | | | X | X | | | | | | | | | |
| SO ₂ | 3-hour bulk average | ppbv | | X | X | X | X | | | X | X | | | | | | | | | |
| SO ₂ | 24-hour bulk average | ppbv | | X | X | X | X | | | X | X | | | | | | | | X | |
| PM ₁₀ Total 0-10 µm STP | 1-hour | µg/m ³ | | | | | | | | | X | | | | | | | | | |
| PM ₁₀ Total 0-10 µm STP | 24-hour bulk average | µg/m ³ | X | | | | X | | X | | X | | X | | X | | | | | |
| PM ₁₀ Local Conditions | 24-hour composite | µg/m ³ | X | | | | X | | X | | | | | | | | | | X | |

| Aerometric Parameter | Averaging Time | Data Years | 00-08 | 00-03 | 00-11 | 94 | 98 | 05-11 | 08-11 | 00-11 | 10-11 | 04-11 | 00-11 | 94 | 00-11 | 96 | 08-11 | 00-11 | 95 | |
|-------------------------------------------|----------------------|-----------------------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|-------|------|-------|------|-------|-------|------|----|
| | | State Code | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 08 | 08 | 08 | 08 | 08 | 08 | 08 | 08 |
| | | County Code | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 67 | 67 | 67 | 67 | 83 | 83 | 83 | 83 |
| | | Site Number | 0006 | 0008 | 0009 | 0014 | 0017 | 0018 | 0019 | 1005 | 1233 | 1004 | 7001 | 7002 | 7003 | 0005 | 0006 | 0101 | 9000 | |
| PM _{2.5} AQI and Speciation Mass | 1-hour | µg/m ³ | | | | | | X | | | | | | | | | | | | |
| PM _{2.5} AQI and Speciation Mass | 24-hour bulk average | µg/m ³ | | | | | | X | | | | | | | | | | | X | |
| PM _{2.5} Local Conditions | 24-hour composite | µg/m ³ | X | | | | | | X | | | | X | | X | | X | | X | |
| Pb | 24-hour composite | TSP µg/m ³ | | | | | | | | | | | | | | X | | | | |
| SO ₄ | 24-hour composite | TSP µg/m ³ | | | | | | | | | | | | | | X | | | | |
| Total Suspended Particulate STP | 24-hour composite | µg/m ³ | | | | | | | | | | | | | | X | | | | |

Source: EPA 2012d.

Notes:

µg/m³ = micrograms per cubic meter (10⁻⁶ g/m³)

µm = microns (10⁻⁶ meters)

08 = State of Colorado

35 = State of New Mexico

45 = San Juan County

67 = La Plata County

83 = Montezuma County

5-minute SO₂ data applies only for 2010-11 (new averaging time)

AQI = Air Quality Index

FED = Non-EPA Federal Monitors (USFS, NPS)

IMPV = Interagency Monitoring of Protected Visual Environments (NPS)

ppb = parts per billion (by volume)

ppm = parts per million (by volume)

SLAMS = EPA State and Local Air Monitoring Stations (New Mexico, Colorado)

SP = Special Purpose Monitors (Colorado)

STP = standard temperature and pressure for ambient air measurements (25 °C, 760 mm Hg)

TRB = Tribal Monitors (Navajo Nation, Southern Ute Indian Tribe)

TSP = total suspended particulate matter

Steam turbines, due to their ability to use a wide range of heat sources (fuels), are a principal means of generating base load³ electric power in the U.S. and worldwide. Four Corners is a coal-fired steam turbine power plant, as are other large generating stations in the region, such as San Juan and Navajo generating stations (San Juan Generating Station and Navajo Generating Station, respectively). While turbine-generator arrangements are basically the same (i.e., synchronous direct drive operating at 3,600 or 1,800 revolutions per minute [rpm] in 60 Hz systems), the source of steam can be a boiler or steam generator heated by combustion of fossil fuel, biomass, solar thermal energy, or nuclear fission; geothermal energy also powers steam turbines, either directly or indirectly.

Four Corners Power Plant

Turbine-generator nameplate capacities at FCPP are 170 MW each for Units 1 and 2, 220 MW for Unit 3, and 770 MW each for Units 4 and 5. The boilers are rated at 2,551 mmBTU⁴/hr each for Units 1 and 2, 3,387 mmBTU/hr for Unit 3, and 8,612 mmBTU/hr each for Units 4 and 5. Total installed generator capacity is 2,100 MW and combined boiler ratings are 25,713 mmBTU/hr.

Air pollution control equipment installed on FCPP Units 4 and 5 consists of baghouses (fabric filters) for PM (fly ash) control, low-NO_x burners designed to reduce NO_x emissions, and caustic wet scrubbers (i.e., FGD) which use hydrated lime (calcium hydroxide, Ca(OH)₂) in solution to control SO₂ and acid gases via absorption. Unit 4 and 5 FGD absorber systems went into service in 1985 and in 2004-2005 APS undertook a voluntary trial to increase SO₂ removal. The FGD system consists of 10 100-foot tall absorber towers for reduction of SO₂ and acid gases to base salts (e.g., CaSO₄, calcium chloride [CaCl₂]). Mercury (Hg) is incidentally captured by the baghouses and FGD. During operation, boiler exhaust (flue gas) passes through the baghouses and then FGD before being released to the atmosphere via the auxiliary stacks, bypassing the original Units 4 and 5 stacks. The Units 4 and 5 baghouses trap over 99 percent of PM and FGD removes approximately 90 percent of SO₂ from the flue gas.

The following summarizes stationary sources of emissions from the FCPP. For the representative 12-year⁵ period 2000 to 2011, Table 4.1-5 shows historic plantwide generation (MW-hrs per year), SO₂ and NO_x emissions (short tpy), and emission rates (kilograms per megawatt-hour [kg/MW-hr], same as grams per KW-hour) from FCPP Units 1, 2, 3, 4, and 5, as reported to EPA pursuant to the CAA. Emissions of PM are estimated by applying EPA emission factors as noted.

Table 4.1-5 Historic Aggregated Part 75 Emissions - ORISPL 2442 Units 1, 2, 3, 4, and 5

| Year | Generation MW-hrs/yr | Sulfur Dioxide tons/yr | Sulfur Dioxide kg/MW-hr | Nitrogen Oxides tons/yr | Nitrogen Oxides kg/MW-hr | Particulate Matter tons/yr | Particulate Matter kg/MW-hr |
|------|-------------------------|------------------------------|-------------------------------|-------------------------------|--------------------------------|----------------------------------|-----------------------------------|
| 2000 | 16,109,134 | 38,332 | 2.16 | 46,513 | 2.62 | 2,107 | 0.12 |
| 2001 | 16,472,108 | 39,564 | 2.18 | 47,300 | 2.60 | 2,170 | 0.12 |
| 2002 | 14,768,989 | 32,847 | 2.02 | 41,577 | 2.55 | 1,972 | 0.12 |
| 2003 | 16,857,882 | 35,094 | 1.89 | 45,197 | 2.43 | 1,998 | 0.11 |
| 2004 | 16,134,118 | 20,943 | 1.18 | 40,742 | 2.29 | 1,964 | 0.11 |
| 2005 | 16,829,089 | 12,653 | 0.68 | 41,743 | 2.25 | 2,051 | 0.11 |
| 2006 | 17,162,615 | 15,192 | 0.80 | 44,649 | 2.36 | 2,040 | 0.11 |
| 2007 | 15,700,442 | 10,239 | 0.59 | 41,083 | 2.37 | 1,979 | 0.11 |
| 2008 | 15,821,299 | 10,398 | 0.60 | 40,311 | 2.31 | 1,969 | 0.11 |

³ Base load is continuous generation operating at or near full capacity 24 hours per day for optimum efficiency

⁴ British Thermal Unit (BTU): the amount of heat required to raise the temperature of 1 pound of water 1°F, from 39 to 40°F

⁵ The Title V recordkeeping requirement is 5 years.

| Year | Generation MW-hrs/yr | Sulfur Dioxide tons/yr | Sulfur Dioxide kg/MW-hr | Nitrogen Oxides tons/yr | Nitrogen Oxides kg/MW-hr | Particulate Matter tons/yr | Particulate Matter kg/MW-hr |
|-------------------|-------------------------|------------------------------|-------------------------------|-------------------------------|--------------------------------|----------------------------------|-----------------------------------|
| 2009 | 16,804,764 | 12,450 | 0.67 | 42,511 | 2.29 | 2,030 | 0.11 |
| 2010 | 14,955,046 | 11,043 | 0.67 | 38,837 | 2.36 | 1,908 | 0.12 |
| 2011 | 15,066,283 | 11,822 | 0.71 | 38,712 | 2.33 | 1,852 | 0.11 |
| Historic Baseline | 16,048,505 | 11,971 | 0.68 | 41,121 | 2.32 | 1,976 | 0.11 |
| Plantwide Share | 100% | 100% | — | 100% | — | 100% | — |

Source: EPA 2012h.

Notes:

PM calculated per AP-42 Chapter 1.1 support document Tables 4-7 and A-3; Title V permit condition (Units 1, 2, and 3); 40 CFR 49 final rule (Units 4 and 5).

Baseline period is 2005-11 (flue gas desulfurization, FGD, installed on Units 4 and 5)

Projected future emissions from FCPP and regional plants are estimated in Section 4.1.4 referencing the 7-year historic baseline period of 2005 to 2011 when FGD became active on Units 4 and 5. It is necessary to define this historic baseline period because FGD affects boiler performance by a small amount, mainly due to increased exhaust back-pressure. In turn, this affects turbine-generator output by a small amount. For analysis of future emissions impacts in Section 4.1.4, the continuing operation of Units 4 and 5 with FGD and SCR represents the future baseline condition of the Proposed Action.

In addition to criteria pollutants, HAP emissions from coal combustion are estimated in Section 4.1.3 based on historic operating data for Units 1, 2, 3, 4, and 5 and projected future utilization of Units 4 and 5 using EPA emission factors (EPA 2011a, 40 CFR 63 Subpart UUUUU).

Navajo Mine

No stationary sources are present at the Navajo Mine SMCRA Permit Area; therefore, this discussion is only applicable to the FCPP.

Transmission Lines

No stationary sources are present at any of the subject transmission lines; therefore, this discussion is only applicable to the FCPP.

4.1.2.4 Mobile Sources of Air Pollutants

While stationary sources such as power plants and oil refineries emit large quantities of criteria pollutants, mobile sources, due to their sheer numbers nationwide, also emit significant amounts. Mobile sources include on-road vehicles (e.g., automobiles, trucks, motorcycles), off-road equipment (e.g., earthmovers, cranes, portable pumps, and generators), trains (e.g., freight, passenger, light rail), vessels (e.g., boats, ships, watercraft), and aircraft (e.g., general aviation, commercial, military). Mobile source fuels include gasoline, diesel, heavy fuel oil, and jet fuel, all of which emit NO_x, SO₂, CO, VOC, PM₁₀, and PM_{2.5} when combusted, also HAPs.

Four Corners Power Plant

Mobile sources associated with FCPP include materials handling equipment, maintenance equipment, and support vehicles, as well as employee personal vehicles. Similar to the Navajo Mine, the dominant fuel used for mobile sources is diesel fuel and some gasoline. Emissions of fugitive dust occur through earthmoving activities and unpaved road travel within the FCPP lease area. Table 4.1-6 below displays estimated criteria emissions from mobile sources at FCPP.

Table 4.1-6 Estimated Criteria Emissions from FCPP Mobile Sources

| Mobile Sources | VOC tons/yr | CO tons/yr | NO _x tons/yr | SO _x tons/yr | PM ₁₀ tons/yr | PM _{2.5} tons/yr |
|--------------------------------|----------------|---------------|----------------------------|----------------------------|-----------------------------|------------------------------|
| Power Plant Off-road Equipment | 0.31 | 3.69 | 2.05 | 0.004 | 0.13 | 0.11 |
| Power Plant On-road Vehicles | 0.11 | 0.76 | 0.86 | 0.002 | 0.04 | 0.03 |
| Annual Totals | 0.42 | 4.46 | 2.90 | 0.006 | 0.16 | 0.14 |

Sources: APS 2012a, EPA 2011a, SCAQMD 2008.

Notes:

PM₁₀ and PM_{2.5} for exhaust only, fugitive dust accounted for in BNCC FONSI.

- CO = carbon monoxide
- NO_x = nitric oxide
- PM₁₀ = particulate matter having an aerodynamic diameter of 10 microns or less
- PM_{2.5} = particulate matter having an aerodynamic diameter of 2.5 microns or less
- SO_x = sulfur oxide
- tons/yr = tons per year
- VOC = volatile organic compound

Navajo Mine

All emissions from the Navajo Mine operations (within the Navajo Mine SMCRA Permit Area) are considered mobile source emissions. Mobile sources associated with operations at the Navajo Mine SMCRA Permit Area include diesel-powered draglines, loaders, coal haul trucks, support vehicles, and explosives detonation. The dominant fuel used for mobile sources at the Navajo Mine SMCRA Permit Area is diesel fuel, also referred to as distillate fuel oil no. 2, along with some gasoline. In addition to engine exhaust, emissions of fugitive dust, as PM₁₀ and PM_{2.5}, is caused by earthmoving and unpaved road travel primarily at the Navajo Mine SMCRA Permit Area. Coarser particles (e.g., PM₃₀) also may be emitted from activities that disturb topsoil, such as overburden removal at the mine. Other localized sources include agriculture, construction, wind-blown dust, pollen, salts, brake dust, and tire wear. Fugitive dust is the largest component of mining emissions; however, review of Navajo Mine SMCRA Permit Area records by OSMRE indicates that no formal complaints regarding dust control or dust emissions at the mine have been received to date. Table 4.1-7 below summarizes these emissions.

Table 4.1-7 Estimated Criteria and DPM Emissions from Navajo Mine SMCRA Permit Area Operations

| Mobile and Fugitive Sources | VOC tons/yr | CO tons/yr | NO _x tons/yr | SO _x tons/yr | PM ₁₀ tons/yr | PM _{2.5} tons/yr | DPM tons/yr |
|---------------------------------------------|----------------|---------------|----------------------------|----------------------------|-----------------------------|------------------------------|----------------|
| Overburden Drilling and Blasting | — | 19.67 | 4.99 | 0.59 | 3.36 | 0.97 | — |
| Coal Seam Drilling and Blasting | — | 241.96 | 61.39 | 7.22 | 4.82 | 1.40 | — |
| Overburden Dragline Stripping | — | — | — | — | 62.96 | 5.56 | — |
| Mine Extraction Operations and Loading | 15.44 | 65.57 | 141.75 | 0.20 | 183.59 | 20.58 | 5.11 |
| Coal Hauling Trucks to Stockpiles | 14.16 | 68.08 | 125.40 | 0.18 | 276.47 | 27.65 | 5.31 |
| Mining Support Vehicle Travel | 3.36 | 9.91 | 33.73 | 0.05 | 180.73 | 18.07 | 0.77 |
| Unloading at Stockpiles and Railcar Loading | — | — | — | — | 0.71 | 0.22 | — |
| Reclamation | — | — | — | — | 124.50 | 24.90 | — |
| Coal Preparation Plant (except stockpile) | — | — | — | — | 13.89 | 4.05 | — |

| Mobile and Fugitive Sources | VOC tons/yr | CO tons/yr | NO _x tons/yr | SO _x tons/yr | PM ₁₀ tons/yr | PM _{2.5} tons/yr | DPM tons/yr |
|--------------------------------------|----------------|---------------|----------------------------|----------------------------|-----------------------------|------------------------------|----------------|
| Wind Erosion (coal and spoils piles) | — | — | — | — | 58.82 | 21.03 | — |
| Annual Totals | 32.96 | 405.19 | 367.26 | 8.23 | 909.85 | 124.43 | 11.20 |

Source: OSMRE 2012b.

Notes:

SO_x emissions estimated from FONSI supporting data.

PM₁₀ and PM_{2.5} includes exhaust and fugitive dust as determined in FONSI.

For diesels, DPM estimated as 7.8% of CO emissions per off-road emissions factors (SCAQMD 2008).

- CO = carbon monoxide
- NO_x = nitric oxide
- PM₁₀ = particulate matter having an aerodynamic diameter of 10 microns or less
- PM_{2.5} = particulate matter having an aerodynamic diameter of 2.5 microns or less
- SO_x = sulfur oxide
- tons/yr = tons per year
- VOC = volatile organic compound

As shown in Table 4.1-7, mining mobile and fugitive source NO_x emissions are a small fraction of FCPP stack emissions, about 370 tpy (OSMRE 2012a, APS 2012a). As FCPP baseline NO_x emissions are about 41,100 tpy, mining mobile and fugitive sources represent only 0.9 percent of total NO_x emissions from the combined operations. Also as shown in the table, mining mobile and fugitive source PM₁₀ emissions are about 910 tpy and FCPP baseline PM₁₀ emissions are about 1,980 tpy.

Transmission Line Mobile Sources

Mobile source emissions associated with transmission line maintenance are included with FCPP off-road equipment and on-road vehicle usage shown in Table 4.1-6 and represent a very small fraction of overall emissions.

Hazardous Air Pollutants

Coal combustion in power plant boilers emits a wide variety of inorganic and organic HAPs. Tables 4.1-8 and 4.1-9 show estimated average annual HAP emissions from FCPP based on historic (pre-Project) operating data prior to implementation of 40 CFR 63 Subpart UUUUU for Units 1, 2, 3, 4, and 5.

Table 4.1-8 Estimated Historic HAP Metals Emissions - ORISPL 2442

| HAP (Metals) | 2000-11 Units 1 – 5 Average lbs/yr |
|--------------------------------------------|------------------------------------------|
| Antimony (Sb) | 156 |
| Arsenic (As) | 3,552 |
| Beryllium (Be) | 182 |
| Cadmium (Cd) | 442 |
| Chromium (Cr) | 2,252 |
| Cobalt (Co) | 866 |
| Copper (Cu) | 4,938 |
| Lead (Pb) | 3,639 |
| Manganese (Mn) | 4,245 |
| Mercury (Hg) | 719 |
| Nickel (Ni) | 2,426 |
| Selenium (Se) | 11,262 |
| Average FCPP Generation (MW-hrs/yr) | 16,056,814 |

Table 4.1-9 Estimated Historic HAP Nonmetals Emissions - ORISPL 2442

| HAP (Organics and Inorganics) | 2000-11 Units 1 – 5 Average lbs/yr |
|---------------------------------------|------------------------------------------|
| Acetaldehyde | 4,938 |
| Acetophenone | 130 |
| Acrolein | 2,512 |
| Benzene | 11,262 |
| Benzyl chloride | 6,064 |
| Bis (2-ethylhexyl)phthalate (DEHP) | 632 |
| Carbon disulfide | 1,126 |
| Chlorobenzene | 191 |
| Chloroform | 511 |
| Cyanide | 21,659 |
| 2,4-Dinitrotoluene | 2 |
| Ethyl benzene | 814 |
| Ethyl chloride | 364 |
| Formaldehyde | 2,079 |
| Hexane | 580 |
| Hydrogen chloride | 10,396,140 |
| Hydrogen fluoride | 1,299,518 |
| Isophorone | 5,025 |
| Methyl bromide | 1,386 |
| Methyl chloride | 4,592 |
| Methyl ethyl ketone | 3,379 |
| Methylene chloride | 2,512 |
| PAHs (composite total) | 180 |
| Phenol | 139 |
| Propionaldehyde | 3,292 |
| Tetrachloroethylene | 373 |
| Toluene | 2,079 |
| Styrene | 217 |
| Xylenes (o,m,p) | 321 |
| Average Generation (MW-hrs/yr) | 16,056,814 |

4.1.2.5 Visibility / Regional Haze

Regional haze is visibility impairment caused by multiple sources and activities which emit fine particles and their precursors and which are located across a broad geographic area. In 1980, when adopting the initial visibility protection provisions of the CAA, Congress specifically recognized that the “visibility problem is caused primarily by emission into the atmosphere of SO₂, NO_x, and particulate matter (PM), especially fine particulate matter (PM_{2.5}), from inadequately controlled sources.” Fine PM such as sulfates, nitrates, organic carbon, elemental carbon, and soil dust impairs visibility by scattering and absorbing sunlight, can cause health effects and increase mortality in humans, and contributes to environmental effects such as acid deposition (acid rain) and eutrophication (depletion of oxygen in lakes and ponds) (64 FR 35714).

Visibility has been defined as “the greatest distance at which an observer can just see a black object viewed against the horizon sky.” An object is usually referred to as at “threshold contrast” when the difference between the brightness of the sky and the brightness of the object is reduced to such a degree that an observer can just barely see the object. Visibility is closely associated with conditions that allow appreciation of landscape features, which is especially true in the desert southwest, where recognition and appreciation of the form, contrast detail, and color of near and distant features is valued by society (Cooperative Institute for Research in the Atmosphere [CIRA] 1999).

Visibility degradation is caused by diffraction, refraction, phase-shift, and absorption of light by atmospheric particles, aerosols, and gases that are nearly the same size as the wavelengths of the visible light spectrum. Without the effects of anthropogenic (caused by human activity) air pollution, maximum natural visual range in the western U.S. is about 120 miles (180 km) and about 80 miles (110 km) in the east. Sulfates, including ammonium sulfate, comprise about 70 percent of visibility impacts in the east and about 30 percent in the west. Due to photochemistry, the visibility impacts of nitrates tend to be highest during the winter (less sunlight) and lowest during the summer (more sunlight) (CIRA 1999). Sulfates and nitrates resulting from SO₂ and NO_x emissions also contribute to visibility impairment. In the west, nitrates and carbon are factors, but sulfates have been implicated as a cause of visibility impairment in many of the Colorado River Plateau National Parks, including the Grand Canyon, Canyonlands, and Bryce Canyon (EPA 2013c, CIRA 1999).

The role of regional transport of fine particles and aerosols which contribute to elevated PM levels and regional haze impairment has been well-documented through decades of research. Data from the IMPROVE network (described below) shows that chronic visibility impairment occurs at most national park, national monument, and wilderness area monitoring sites in the west. Average visual range in many Class I areas in the west is 60 to 90 miles (100 to 150 km) equivalent to 13.6 to 9.6 deciviews,⁶ or about 50 to 70 percent of the visual range that would exist without anthropogenic air pollution from stationary and mobile sources (64 FR 35714). Tables 4.1-10 through 4.1-16 provide historic O₃ and O₃ precursor levels in the Four Corners Region. Table 4.1-17a shows trends in regional visibility over the same time period.

Visibility conditions are presented by individual park or wilderness areas in Table 4.1-17b to show how conditions vary geographically. The trends shown on Table 4.1-17a are represented graphically on Figure 4.1-3. As can be seen in the graphic, deciviews have steadily decreased; thus, regional visibility has improved during the 11-year period, apparently due to improved control of air pollution from sources such as power plants. Thus, progress is apparent toward the future goal of the Regional Haze Rule; i.e., achieving natural conditions by 2060.

⁶ One deciview represents the minimal perceptible change in visibility to the human eye and is proportional to the logarithm of the light extinction coefficient. As such, it is linear with respect to perceived visual changes over its entire range, analogous to the decibel scale for sound. A 1 dv change represents about a 10 percent change in the extinction coefficient. The higher the deciview value, the poorer the visibility.

Table 4.1-10 Historic Ozone Trends

| Site ID Code | Averaging Time | Standard (ppbv) | MVP ppbv 1990s | MVP ppbv 2000 | MVP ppbv 2001 | MVP ppbv 2002 | MVP ppbv 2003 | MVP ppbv 2004 | MVP ppbv 2005 | MVP ppbv 2006 | MVP ppbv 2007 | MVP ppbv 2008 | MVP ppbv 2009 | MVP ppbv 2010 | MVP ppbv 2011 | 3-Year Trend | Meet Std. |
|--------------|----------------|-----------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|-----------|
| 35-45-0009 | 8-hour 4th max | 75 | — | 79 | 74 | 76 | 73 | 68 | 75 | 63 | 69 | 63 | 52 | 65 | 66 | 61 | Yes |
| 35-45-0009 | 1-hour 1st max | — | — | 96 | 94 | 91 | 89 | 78 | 87 | 79 | 80 | 76 | 60 | 77 | 77 | 77 | — |
| 35-45-0018 | 8-hour 4th max | 75 | — | — | — | — | — | — | — | 79 | 79 | 69 | 62 | 69 | 74 | 68 | Yes |
| 35-45-0018 | 1-hour 1st max | — | — | — | — | — | — | — | — | 104 | 94 | 83 | 75 | 80 | 90 | 90 | — |
| 35-45-1005 | 8-hour 4th max | 75 | — | 80 | 74 | 75 | 75 | 69 | 72 | 71 | 73 | 69 | 59 | 63 | 68 | 63 | Yes |
| 35-45-1005 | 1-hour 1st max | — | — | 93 | 87 | 87 | 91 | 80 | 88 | 93 | 86 | 82 | 69 | 80 | 75 | 80 | — |
| 35-45-1233 | 8-hour 4th max | 75 | — | — | — | — | — | — | — | — | — | — | — | 185 | 63 | — | — |
| 35-45-1233 | 1-hour 1st max | — | — | — | — | — | — | — | — | — | — | — | — | 422 | 79 | — | — |
| 08-67-1004 | 8-hour 4th max | 75 | — | — | — | — | — | 67 | 75 | 74 | 69 | 69 | 71 | 74 | 77 | 74 | Yes |
| 08-67-1004 | 1-hour 1st max | — | — | — | — | — | — | 86 | 91 | 92 | 79 | 81 | 93 | 83 | 86 | 93 | — |
| 08-67-7001 | 8-hour 4th max | 75 | — | 63 | 52 | 60 | 62 | 63 | — | — | 58 | 67 | 65 | 68 | 72 | 68 | Yes |
| 08-67-7001 | 1-hour 1st max | — | — | 77 | 68 | 69 | 75 | 77 | — | — | 77 | 78 | 76 | 77 | 90 | 90 | — |
| 08-67-7002 | 8-hour 4th max | 75 | 69 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 08-67-7002 | 1-hour 1st max | — | 82 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

| Site ID Code | Averaging Time | Standard (ppbv) | MVP ppbv 1990s | MVP ppbv 2000 | MVP ppbv 2001 | MVP ppbv 2002 | MVP ppbv 2003 | MVP ppbv 2004 | MVP ppbv 2005 | MVP ppbv 2006 | MVP ppbv 2007 | MVP ppbv 2008 | MVP ppbv 2009 | MVP ppbv 2010 | MVP ppbv 2011 | 3-Year Trend | Meet Std. |
|--------------|----------------|-----------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|-----------|
| 08-67-7003 | 8-hour 4th max | 75 | — | 61 | 51 | 55 | 60 | 60 | 66 | 63 | 71 | 67 | 66 | 67 | 69 | 67 | Yes |
| 08-67-7003 | 1-hour 1st max | — | — | 85 | 66 | 75 | 70 | 68 | 77 | 92 | 86 | 80 | 78 | 83 | 88 | 88 | — |
| 08-83-0006 | 8-hour 4th max | 75 | — | — | — | — | — | — | — | — | — | 64 | 64 | 64 | 71 | 66 | Yes |
| 08-83-0006 | 1-hour 1st max | — | — | — | — | — | — | — | — | — | — | 78 | 77 | 88 | 86 | 88 | — |
| 08-83-0101 | 8-hour 4th max | 75 | — | 73 | 65 | 70 | 67 | 69 | 76 | 74 | 70 | 69 | 69 | 66 | 70 | 68 | Yes |
| 08-83-0101 | 1-hour 1st max | — | — | 96 | 77 | 80 | 88 | 80 | 88 | 94 | 77 | 75 | 81 | 87 | 81 | 87 | — |

Sources: EPA 2012e, 2012f.

Notes:

Standards are 2012 NAAQS; 1990s data are 1994 (08-67-7002); 8-hour trend is 3-year average of most recent data (4th highest daily maximum); 1-hour trend is 3-year maximum of most recent data (1st highest daily maximum); Site 35-45-1233 certification is not required, or the state [or tribe] has not certified to the EPA that the underlying raw data are complete and accurate.

MVY = Measured Values by Year

ppbv = parts per billion by volume ($cc/10^3 m^3$)

Table 4.1-11 Historic Nitrogen Dioxide Trends

| Site ID Code | Averaging Time | Standard (ppbv) | MVY ppbv 1990s | MVY ppbv 2000 | MVY ppbv 2001 | MVY ppbv 2002 | MVY ppbv 2003 | MVY ppbv 2004 | MVY ppbv 2005 | MVY ppbv 2006 | MVY ppbv 2007 | MVY ppbv 2008 | MVY ppbv 2009 | MVY ppbv 2010 | MVY ppbv 2011 | 3-Year Trend | Meet Std. |
|--------------|----------------|-----------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|-----------|
| 35-45-0009 | 1-hour | 100 | — | 39 | 41 | 45 | 44 | 41 | 39 | 43 | 45 | 44 | 36 | 41 | 44 | 40 | Yes |
| 35-45-0009 | Annual Mean | 53 | — | 24 | 25 | 29 | 26 | 25 | 25 | 28 | 30 | 27 | 27 | 27 | 26 | 27 | Yes |
| 35-45-0014 | 1-hour | 100 | 49 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 35-45-0014 | Annual Mean | 53 | 20 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 35-45-0018 | 1-hour | 100 | — | — | — | — | — | — | 49 | 45 | 47 | 37 | 40 | 37 | 40 | 39 | Yes |
| 35-45-0018 | Annual Mean | 53 | — | — | — | — | — | — | 34 | 25 | 23 | 21 | 20 | 21 | 20 | 20 | Yes |
| 35-45-1005 | 1-hour | 100 | — | 44 | 42 | 41 | 55 | 40 | 39 | 59 | 44 | 35 | 35 | 40 | 36 | 37 | Yes |
| 35-45-1005 | Annual Mean | 53 | — | 22 | 22 | 22 | 25 | 21 | 22 | 27 | 24 | 19 | 18 | 20 | 19 | 19 | Yes |
| 35-45-1233 | 1-hour | 100 | — | — | — | — | — | — | — | — | — | — | — | 32 | 34 | — | — |
| 35-45-1233 | Annual Mean | 53 | — | — | — | — | — | — | — | — | — | — | — | 16 | 18 | — | — |
| 08-67-1004 | 1-hour | 100 | — | — | — | — | — | 14 | 18 | 17 | 19 | 13 | 16 | 16 | 21 | 18 | Yes |
| 08-67-1004 | Annual Mean | 53 | — | — | — | — | — | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | Yes |
| 08-67-7001 | 1-hour | 100 | — | 27 | 30 | 19 | 30 | 14 | 29 | 26 | 35 | 30 | 47 | 35 | 33 | 38 | Yes |
| 08-67-7001 | Annual Mean | 53 | — | 22 | 22 | 22 | 25 | 21 | 22 | 27 | 24 | 19 | 18 | 20 | 19 | 19 | Yes |

| Site ID Code | Averaging Time | Standard (ppbv) | MVY ppbv 1990s | MVY ppbv 2000 | MVY ppbv 2001 | MVY ppbv 2002 | MVY ppbv 2003 | MVY ppbv 2004 | MVY ppbv 2005 | MVY ppbv 2006 | MVY ppbv 2007 | MVY ppbv 2008 | MVY ppbv 2009 | MVY ppbv 2010 | MVY ppbv 2011 | 3-Year Trend | Meet Std. |
|--------------|----------------|-----------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|-----------|
| 08-67-7002 | 1-hour | 100 | 23 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 08-67-7002 | Annual Mean | 53 | 6 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 08-67-7003 | 1-hour | 100 | — | 38 | 45 | 39 | 42 | 37 | 41 | 40 | 42 | 37 | 37 | 39 | 38 | 38 | Yes |
| 08-67-7003 | Annual Mean | 53 | — | 18 | 18 | 18 | 19 | 19 | 19 | 18 | 17 | 16 | 16 | 14 | 15 | 15 | Yes |

Sources: EPA 2012e, 2012f.

Notes:

Standards are 2012 NAAQS; 1990s data are 1994 (35-45-0014) (08-67-7002); 1-hour trend is 3-year average of most recent data (98th percentile); Annual trend is 3-year average of most recent data (annual mean)

MVY = Measured Values by Year

ppbv = parts per billion by volume ($cc/10^3 m^3$)

Table 4.1-12 Historic Sulfur Dioxide Trends

| Site ID Code | Averaging Time | Standard (ppbv) | MVY ppbv 1990s | MVY ppbv 2000 | MVY ppbv 2001 | MVY ppbv 2002 | MVY ppbv 2003 | MVY ppbv 2004 | MVY ppbv 2005 | MVY ppbv 2006 | MVY ppbv 2007 | MVY ppbv 2008 | MVY ppbv 2009 | MVY ppbv 2010 | MVY ppbv 2011 | 3-Year Trend | Meet Std. |
|--------------|----------------|-----------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|-----------|
| 35-45-0008 | 1-hour | 75 | — | 37 | 30 | 28 | 31 | — | — | — | — | — | — | — | — | 30 | Yes |
| 35-45-0008 | 3-hour | 500 | — | 26 | 31 | 56 | 21 | — | — | — | — | — | — | — | — | 56 | Yes |
| 35-45-0009 | 1-hour | 75 | — | 23 | 30 | 20 | 18 | 22 | 18 | 15 | 5 | 4 | 5 | 6 | 9 | 7 | Yes |
| 35-45-0009 | 3-hour | 500 | — | 19 | 24 | 36 | 17 | 26 | 20 | 13 | 4 | 4 | 5 | 4 | 8 | 8 | Yes |
| 35-45-0014 | 1-hour | 75 | 141 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 35-45-0014 | 3-hour | 500 | 130 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 35-45-0017 | 1-hour | 75 | 78 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 35-45-0017 | 3-hour | 500 | 32 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 35-45-1005 | 1-hour | 75 | — | 182 | 86 | 73 | 96 | 78 | 82 | 74 | 75 | 20 | 25 | 14 | 20 | 20 | Yes |
| 35-45-1005 | 3-hour | 500 | — | 144 | 58 | 61 | 90 | 58 | 124 | 45 | 83 | 16 | 20 | 10 | 37 | 37 | Yes |
| 35-45-1233 | 1-hour | 75 | — | — | — | — | — | — | — | — | — | — | — | 163 | 136 | — | — |
| 35-45-1233 | 3-hour | 500 | — | — | — | — | — | — | — | — | — | — | — | 175 | 54 | — | — |

Sources: EPA 2012e, 2012f.

Notes:

Standards are 2012 NAAQS.

1990s data are 1994 (35-45-0014) and 1998 (35-45-0017).

1-hour trend is 3-year average of most recent data (99th percentile).

3-hour trend is 3-year maximum of most recent data (not to be exceeded).

Site 35-45-1233 certification is not required, or the state [or tribe] has not certified to the EPA that the underlying raw data are complete and accurate.

MVY = Measured Values by Year

ppbv = parts per billion by volume (cc/10³ m³)

Table 4.1-13 Historic Carbon Monoxide Trends

| Site ID Code | Averaging Time | Standard (ppmv) | MVY ppmv 1990s | MVY ppmv 2000 | MVY ppmv 2001 | MVY ppmv 2002 | MVY ppmv 2003 | MVY ppmv 2004 | MVY ppmv 2005 | MVY ppmv 2006 | MVY ppmv 2007 | MVY ppmv 2008 | MVY ppmv 2009 | MVY ppmv 2010 | MVY ppmv 2011 | 3-Year Trend | Meet Std. |
|--------------|----------------|-----------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|-----------|
| 35-45-0006 | 1-hour | 35 | — | 5.4 | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 35-45-0006 | 8-hour | 9 | — | 1.9 | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 08-67-7001 | 1-hour | 35 | — | — | — | — | — | 2.5 | 1.8 | 1.2 | 1.7 | 1.5 | 1.4 | 1.2 | 1.4 | 1.4 | Yes |
| 08-67-7001 | 8-hour | 9 | — | — | — | — | — | 1.6 | 1.6 | 0.8 | 1.3 | 1.0 | 0.9 | 0.7 | 0.7 | 0.9 | Yes |

Sources: EPA 2012e, 2012f.

Notes:

Standards are 2012 NAAQS; 1-hour trend is 3-year maximum of most recent data (not to be exceeded); 8-hour trend is 3-year maximum of most recent data (not to be exceeded).

MVY = Measured Values by Year

ppbv = parts per billion by volume (cc/10³ m³)

ppmv = parts per million by volume (cc/m³)

Table 4.1-14 Historic Respirable Particulate (PM₁₀) Trends

| Site ID Code | Averaging Time | Standard (µg/m ³) | MVY µg/m ³ 1990s | MVY µg/m ³ 2000 | MVY µg/m ³ 2001 | MVY µg/m ³ 2002 | MVY µg/m ³ 2003 | MVY µg/m ³ 2004 | MVY µg/m ³ 2005 | MVY µg/m ³ 2006 | MVY µg/m ³ 2007 | MVY µg/m ³ 2008 | MVY µg/m ³ 2009 | MVY µg/m ³ 2010 | MVY µg/m ³ 2011 | 3-Year Trend | Meet Std. |
|--------------|----------------------|-------------------------------|-----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|--------------|-----------|
| 35-45-0006 | 24-hour bulk average | 150 | — | 27 | 30 | 41 | 57 | 28 | 42 | 41 | 30 | 116 | — | — | — | 116 | Yes |
| 35-45-0006 | 24-hour composite | 150 | — | 24 | 26 | 34 | 49 | 23 | 39 | 37 | 27 | 102 | — | — | — | 102 | Yes |
| 35-45-0017 | 24-hour bulk average | 150 | 15 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 35-45-0017 | 24-hour composite | 150 | 14 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 35-45-0019 | 24-hour bulk average | 150 | — | — | — | — | — | — | — | — | — | 22 | 73 | 22 | 38 | 73 | Yes |
| 35-45-0019 | 24-hour composite | 150 | — | — | — | — | — | — | — | — | — | 19 | 61 | 18 | 32 | 61 | Yes |
| 35-45-1233 | 24-hour bulk average | 150 | — | — | — | — | — | — | — | — | — | — | — | 56 | 61 | — | — |
| 35-45-1233 | 24-hour composite | 150 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 08-67-7001 | 24-hour bulk average | 150 | — | — | — | 18 | 94 | 31 | 37 | 24 | — | — | — | — | — | 37 | Yes |
| 08-67-7001 | 24-hour composite | 150 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 08-67-7003 | 24-hour bulk average | 150 | — | — | — | 109 | 88 | 26 | 40 | 24 | — | — | — | — | — | 40 | Yes |
| 08-67-7003 | 24-hour composite | 150 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

| Site ID Code | Averaging Time | Standard ($\mu\text{g}/\text{m}^3$) | MVY $\mu\text{g}/\text{m}^3$ 1990s | MVY $\mu\text{g}/\text{m}^3$ 2000 | MVY $\mu\text{g}/\text{m}^3$ 2001 | MVY $\mu\text{g}/\text{m}^3$ 2002 | MVY $\mu\text{g}/\text{m}^3$ 2003 | MVY $\mu\text{g}/\text{m}^3$ 2004 | MVY $\mu\text{g}/\text{m}^3$ 2005 | MVY $\mu\text{g}/\text{m}^3$ 2006 | MVY $\mu\text{g}/\text{m}^3$ 2007 | MVY $\mu\text{g}/\text{m}^3$ 2008 | MVY $\mu\text{g}/\text{m}^3$ 2009 | MVY $\mu\text{g}/\text{m}^3$ 2010 | MVY $\mu\text{g}/\text{m}^3$ 2011 | 3-Year Trend | Meet Std. |
|--------------|----------------------|---------------------------------------|------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--------------|-----------|
| 08-83-9000 | 24-hour bulk average | 150 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 08-83-9000 | 24-hour composite | 150 | 29 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

Sources: EPA 2012e, 2012f.

Notes:

Standards are 2012 NAAQS; 1990s data are 1998 (35-45-0017); 24-hour trend is 3-year maximum of most recent data (not to be exceeded).

MVY = Measured Values by Year

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter (10^{-6} g/ m^3)

Table 4.1-15 Historic Fine Particulate (PM_{2.5}) Trends

| Site ID Code | Averaging Time | Standard (µg/m ³) | MVY µg/m ³ 1990s | MVY µg/m ³ 2000 | MVY µg/m ³ 2001 | MVY µg/m ³ 2002 | MVY µg/m ³ 2003 | MVY µg/m ³ 2004 | MVY µg/m ³ 2005 | MVY µg/m ³ 2006 | MVY µg/m ³ 2007 | MVY µg/m ³ 2008 | MVY µg/m ³ 2009 | MVY µg/m ³ 2010 | MVY µg/m ³ 2011 | 3-Year Trend | Meet Std. |
|--------------|-------------------|-------------------------------|-----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|--------------|-----------|
| 35-45-0006 | 24-hour composite | 35 | — | 12.9 | 14.3 | 16.8 | 13.4 | 13.2 | 11.3 | 11.5 | 14.9 | 14.4 | — | — | — | 13.6 | Yes |
| 35-45-0006 | Annual Mean | 12 | — | 6.0 | 6.0 | 6.9 | 6.7 | 6.1 | 5.5 | 6.1 | 6.0 | 5.9 | — | — | — | 6.0 | Yes |
| 35-45-0018 | 24-hour composite | 35 | — | — | — | — | — | — | 4.4 | 6.3 | 9.0 | 7.3 | 7.6 | 12.0 | 10.6 | 10.1 | Yes |
| 35-45-0018 | Annual Mean | 12 | — | — | — | — | — | — | 2.1 | 2.4 | 4.5 | 3.3 | 2.5 | 3.0 | 2.7 | 2.7 | Yes |
| 35-45-0019 | 24-hour composite | 35 | — | — | — | — | — | — | — | — | — | 9.7 | 10.4 | 18.0 | 12.0 | 13.5 | Yes |
| 35-45-0019 | Annual Mean | 12 | — | — | — | — | — | — | — | — | — | 4.3 | 4.4 | 4.8 | 4.2 | 4.5 | Yes |
| 08-67-7001 | 24-hour composite | 35 | — | — | — | — | — | — | — | — | — | — | 8.6 | 7.6 | 10.0 | 8.7 | Yes |
| 08-67-7001 | Annual Mean | 12 | — | — | — | — | — | — | — | — | — | — | 4.4 | 4.1 | 4.3 | 4.3 | Yes |
| 08-67-7003 | 24-hour composite | 35 | — | — | — | — | — | — | — | — | — | — | 11.8 | 11.1 | 12.1 | 11.7 | Yes |
| 08-67-7003 | Annual Mean | 12 | — | — | — | — | — | — | — | — | — | — | 4.2 | 4.3 | 4.6 | 4.4 | Yes |
| 08-83-0006 | 24-hour composite | 35 | — | — | — | — | — | — | — | — | — | 25.3 | 15.0 | 13.3 | 14.8 | 14.4 | Yes |
| 08-83-0006 | Annual Mean | 12 | — | — | — | — | — | — | — | — | — | 6.1 | 6.8 | 5.9 | 6.1 | 6.3 | Yes |

| Site ID Code | Averaging Time | Standard ($\mu\text{g}/\text{m}^3$) | MVY $\mu\text{g}/\text{m}^3$ 1990s | MVY $\mu\text{g}/\text{m}^3$ 2000 | MVY $\mu\text{g}/\text{m}^3$ 2001 | MVY $\mu\text{g}/\text{m}^3$ 2002 | MVY $\mu\text{g}/\text{m}^3$ 2003 | MVY $\mu\text{g}/\text{m}^3$ 2004 | MVY $\mu\text{g}/\text{m}^3$ 2005 | MVY $\mu\text{g}/\text{m}^3$ 2006 | MVY $\mu\text{g}/\text{m}^3$ 2007 | MVY $\mu\text{g}/\text{m}^3$ 2008 | MVY $\mu\text{g}/\text{m}^3$ 2009 | MVY $\mu\text{g}/\text{m}^3$ 2010 | MVY $\mu\text{g}/\text{m}^3$ 2011 | 3-Year Trend | Meet Std. |
|--------------|-------------------|---------------------------------------|------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--------------|-----------|
| 08-83-9000 | 24-hour composite | 35 | 10.3 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 08-83-9000 | Annual Mean | 12 | 3.1 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

Sources: EPA 2012e, 2012f.

Notes:

Standards are 2012 NAAQS; 1990s data are 1995 (08-83-9000); 24-hour trend is 3-year average of most recent data (98th percentile); Annual trend is 3-year average of most recent data (annual mean).

MVY = Measured Values by Year

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter (10^{-6} g/ m^3)

Table 4.1-16 TSP / Lead / Sulfate

| Site ID Code | Averaging Time | TSP $\mu\text{g}/\text{m}^3$ | Pb $\mu\text{g}/\text{m}^3$ | SO ₄ $\mu\text{g}/\text{m}^3$ |
|--------------|-----------------|------------------------------|-----------------------------|------------------------------------------|
| 08-83-0005 | 24-hour average | 45 | 0.02 | 7.3 |
| 08-83-0005 | Standard | 150 | 0.15 | — |
| 08-83-0005 | Meet Standard | Yes | Yes | — |

Sources: EPA 2012e, 2012f.

Notes:

Standards are 2012 NAAQS.

Data are 1996 (08-83-0005).

$\mu\text{g}/\text{m}^3$ = microgram(s) per cubic meter

Table 4.1-17a Historic Composite Visibility - 10 IMPROVE Sites

| Year | Lowest 20% of Days Mean dV | Lowest 20% of Days Median dV | Highest 20% of Days Mean dV | Highest 20% of Days Median dV | Average of all Days Mean dV | Average of all Days Median dV |
|---------------------------------|-------------------------------------------|---------------------------------------------|--------------------------------------------|----------------------------------------------|--------------------------------------------|----------------------------------------------|
| 2000 | 3.46 | 3.45 | 11.88 | 11.21 | 7.39 | 7.03 |
| 2001 | 3.46 | 3.62 | 10.67 | 10.90 | 7.02 | 7.07 |
| 2002 | 3.47 | 3.73 | 12.25 | 11.95 | 7.47 | 7.34 |
| 2003 | 3.36 | 3.22 | 12.67 | 12.25 | 7.44 | 6.80 |
| 2004 | 3.27 | 3.72 | 10.35 | 10.40 | 6.70 | 6.68 |
| 2005 | 2.60 | 2.59 | 11.66 | 11.93 | 6.85 | 6.85 |
| 2006 | 3.11 | 2.89 | 10.73 | 10.88 | 6.77 | 6.77 |
| 2007 | 2.95 | 3.09 | 11.18 | 11.20 | 6.92 | 7.09 |
| 2008 | 2.48 | 2.60 | 10.88 | 11.07 | 6.59 | 6.65 |
| 2009 | 2.63 | 2.86 | 11.01 | 10.91 | 6.40 | 6.55 |
| 2010 | 2.31 | 2.27 | 9.89 | 9.68 | 5.93 | 5.92 |
| 11-Year Trend Change | -1.18 | -1.22 | -1.40 | -1.08 | -1.22 | -0.82 |
| Relative Improvement | 33% | 33% | 12% | 9% | 16% | 11% |

Source: CSU 2013b.

Notes:

Aggregated data for 10 sites: BAND1, CANY1, CAPI1, GRCA2, GRSA1, MEVE1, PEFO1, SAPE1, WEMI1, WHPE1; Missing data substituted by interpolation (11 of 110 sets); Change and improvement calculated on linear trend basis.

dV = deciview

Table 4.1-17b Historic Visibility - 10 IMPROVE Sites

| National Park or Wilderness (NPS code) | dV Lowest 20% of Days | dV Highest 20% of Days | dV Average of all Days |
|-----------------------------------------------|----------------------------------|-----------------------------------|-----------------------------------|
| Bandelier National Monument (BAND1) | 4.45 | 11.82 | 7.87 |
| Canyonlands National Park (CANY1) | 3.21 | 11.08 | 6.82 |
| Capitol Reef National Park (CAPI1) | 2.88 | 10.66 | 6.57 |
| Grand Canyon National Park (GRCA2) | 2.12 | 11.62 | 6.54 |
| Great Sand Dunes National Park (GRSA1) | 3.97 | 11.90 | 7.71 |
| Mesa Verde National Park (MEVE1) | 3.66 | 12.11 | 7.44 |
| Petrified Forest National Park (PEFO1) | 4.76 | 12.96 | 8.52 |
| San Pedro Parks Wilderness (SAPE1) | 1.17 | 9.86 | 5.50 |
| Weminuche Wilderness (WEMI1) | 2.63 | 10.10 | 6.16 |
| Wheeler Peak Wilderness (WHPE1) | 1.03 | 9.68 | 5.31 |

Source: CSU 2013b.
 dV = deciview

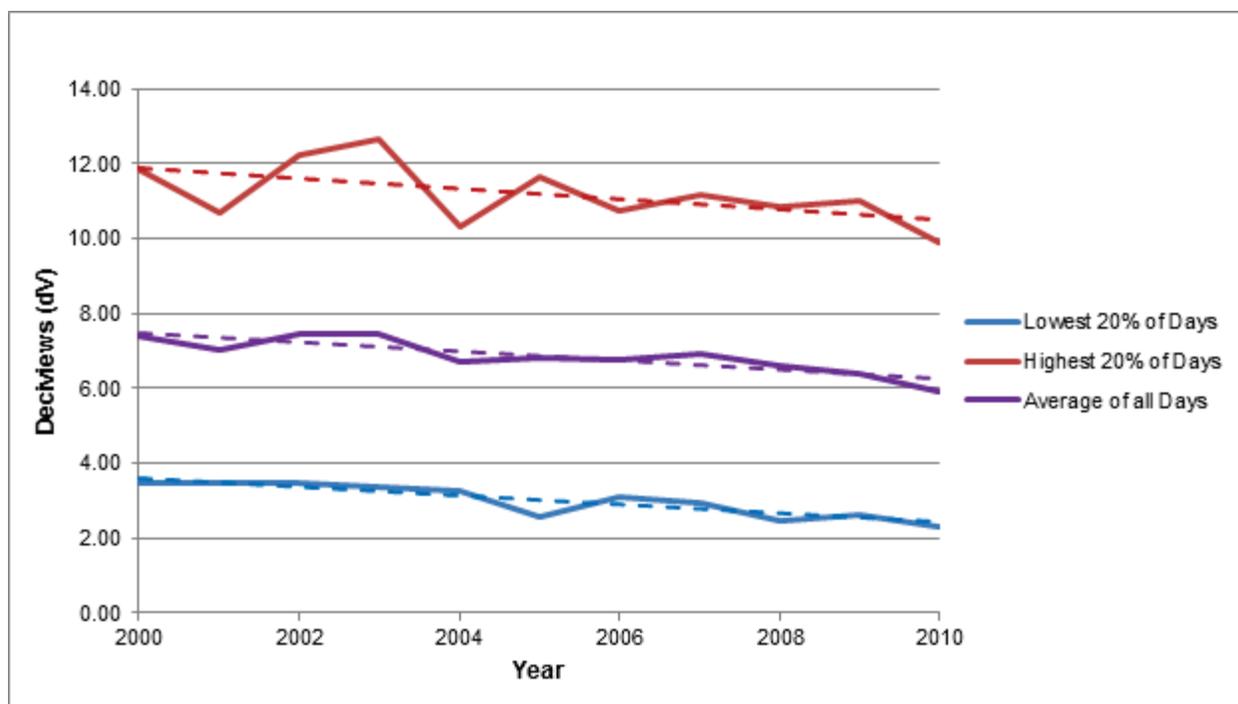


Figure 4.1-3 Historic Composite Visibility Trend

Four Corners Air Quality Study

In 2009, the NMED Air Quality Bureau released the *Air Quality Modeling Study for the Four Corners Region* (NMED 2009). The main study was conducted during the latter half of 2007 in response to concerns about the air quality impacts of growth comprising many types of sources, especially the oil and gas industry and electric power generation, on Class I and surrounding Class II areas in the Four Corners region. The speculative study examined five conceptual emissions mitigation scenarios that could be implemented in the future with the aim of halting further deterioration of regional air quality and possibly improving it.

The NMED, in coordination with the Colorado Department of Public Health and Environment, convened the Four Corners Air Quality Task Force comprised of states, tribes, Federal land managers and other stakeholders to develop strategies for air quality management in the region. As part of the effort, the Four Corners Air Quality Task Force identified the need to model the air quality impacts of various proposed mitigation strategies being developed by Task Force working groups. Estimates of mitigation scenario effects on O₃, PM, visibility (regional haze), and atmospheric deposition (acid rain, metals) were needed. In addition, peak O₃ and visibility impacts in the Mesa Verde, San Pedro Parks, and Weminuche Class I areas and surrounding Class II areas were of primary interest. In response to these requirements, NMED conducted a comprehensive atmospheric modeling study.

As a result, a high-resolution (4 x 4 km [2.5 x 2.5 miles] horizontal grid cell size) regional scale dispersion model of the Four Corners region was developed. This effort produced a regional air quality planning tool which can be used to evaluate impacts of both future development projects and alternative emission reduction strategies. Results of the modeling study are intended to inform the direction of future air quality management efforts in the Four Corners region.

An updated emissions inventory for 2005 and a projected inventory for 2018 were developed for use in this study. Inventories previously developed for the Western Regional Air Partnership were used as the main starting points for these inventories. The 2005 and 2018 inventories comprised emissions from electric power generation, oil and gas exploration and production, other proximate anthropogenic sources,

along with applicable mobile source, fugitive dust, biogenic, and wildfire emissions. The resulting model-ready emissions were used to estimate the air quality impacts of five alternative mitigation scenarios focused on various combinations of emissions reductions from electric power generation and oil and gas activities in the Four Corners region.

Emissions in the Comprehensive Air Quality Model with Extensions (CAMx) model changed very little overall between the 2005 base case and the 2018 base case; the O₃ results are nearly identical. Annual fourth-highest daily maximum 8-hour average O₃ values predicted show either no change or a decline of 1 or 2 parts per billion (ppb) in the fourth-highest modeled daily maximum 8-hour O₃ concentrations at most locations. Results of an O₃ source apportionment analysis performed on the 2018 base case scenario showed that local oil and gas and electric generating unit (EGU) sources are the biggest contributors to local O₃ episodes. The comparison between 2005 baseline and projected 2018 emissions are a comparison of Four Corners Regional air quality, where the shutdown of Units 1, 2, and 3 are factors, but not sufficient to change the regional modeling projection. Table 4.18-2 presents EPA-published regional emissions for the 12-year period from 2000 to 2011 and Table 4.18-3 presents projected regional emissions from 2014 to 2026.

O₃ concentrations predicted under the 2018 base case with each of five mitigation scenarios were compared for two key months; April (when high O₃ is predicted at higher elevations in the San Juan and other mountain ranges) and July (when high O₃ is predicted at lower elevations). Time series of hourly predicted O₃ show that O₃ reductions under the mitigation scenarios are generally less than 5 ppb. Some increases in O₃ are evident during some off-peak hours due to negative benefits of NO_x reductions under VOC limited conditions. Seasonal differences showed that the higher O₃ values observed during the late spring are more heavily influenced by precursor sources and O₃ transport from outside the 4 km domain, compared to summer values.

The five emissions mitigation scenarios focused on EGU and oil and gas sources in the Four Corners area. Results in the 2018 base case inventory included a 70 percent NO_x reduction and a 16 percent SO₂ reduction from local (i.e., 4 km domain) EGU sources as well as an approximate 50 percent VOC reduction and a 16 percent NO_x reduction from local oil and gas sources. EGU and oil and gas together account for 75 percent of 4 km domain NO_x emissions (oil and gas alone accounts for 37 percent of 4 km domain NO_x emissions) and 33 percent of 4 km domain VOC emissions. Thus, the combined EGU and oil and gas NO_x controls considered here amount to roughly a 50 percent reduction in local NO_x emissions and a 16 percent reduction in local VOC emissions. These mitigation scenarios resulted in peak predicted O₃ changes generally limited to less than about 5 ppb.

A combination of VOC and NO_x controls on oil and gas sources is more effective at reducing O₃ than VOC or NO_x controls alone. There also appears to be a synergistic effect resulting in enhanced O₃ reduction when the EGU controls are combined with the oil and gas controls: EGU controls alone result in inconsistent reductions from day-to-day depending on meteorological conditions but combining them with the oil and gas controls appears to put a “floor” under the reductions resulting in larger and more consistent reductions.

4.1.2.6 Atmospheric Deposition / Acid Rain

Atmospheric deposition transfers air pollutants such as NO_x, SO₂, and mercury (Hg) from the air to the earth's surface and affects water quality due to precipitation runoff into waterbodies. Nitrogen compounds such as ammonia (NH₃) contribute to nutrient over-enrichment (i.e., algae blooms) which can result in oxygen depleted areas known as “dead zones,” where fish and other organisms cannot survive. Once in water, mercury becomes concentrated in fish and can harm the health of individuals who consume these fish, particularly children. Further, acid rain threatens certain aquatic ecosystems, especially in high-altitude mountain lakes and streams with limited buffering capacity (EPA 2013c, GAO 2013).

Nitrogen oxides react with moisture and oxygen in the atmosphere to form nitric acid (HNO_3), nitrates (NO_3^-), and nitrites (NO_2^-) while SO_2 reacts to form H_2SO_4 , sulfates (SO_4^{2-}), and sulfites (SO_3^{2-}). Other inorganic pollutants include ammonium ion (NH_4^+), chloride ion (Cl^-), light metals such as beryllium (Be), calcium (Ca), magnesium (Mg), potassium (K), and sodium (Na), and heavy metals such as antimony (Sb), arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), and selenium (Se). Organic pollutants can include PCBs and PAHs, both of which are carcinogenic, along with some metals listed above.

The term "acid rain" is a broad reference to mixtures of wet and dry deposition containing higher than normal amounts of sulfuric and nitric acids. The main anthropogenic precursors of acid rain are SO_2 and NO_x emissions from fossil fuel combustion. In the U.S., about 67 percent of all SO_2 and about 25 percent all NO_x is emitted from fossil fuel electric power generation, in particular, coal-fired power plants. Acid rain occurs when these gases react (hydrolyze) in the atmosphere with water, oxygen, and other chemicals to form a weak solution of sulfuric and nitric acids, typically pH^7 3 to 5. When SO_2 and NO_x are released from power plant stacks and other sources, prevailing winds transport these compounds across state and national borders, sometimes over hundreds of miles, resulting in environmental impacts far away from the pollution source. Acid rain causes acidification of lakes and streams and contributes to damage to trees and many sensitive forest soils. It also accelerates the decay of building materials and paints, including irreplaceable buildings, statues, and sculptures which are part of the national cultural heritage (EPA 2013c).

The EPA and National Acid Deposition Program (NADP) operate nationwide networks of deposition-oriented monitoring sites. Sites in the vicinity of the Project area shown listed on Table 4.1-18 and shown on Figure 4.1-4. Descriptions of applicable monitoring projects are provided in Appendix A.

Clean Air Status and Trends Network (CASTNET) Data

For the historic 12-year period from 2000 through 2011, Tables 4.1-19a (metric units) and 4.1-19b (English units) show measured precipitation, wet and dry ammonium (NH_4^+), wet and dry nitrate (NO_3^-), wet and dry sulfate (SO_4^{2-}), dry nitric acid (HNO_3), and dry sulfur dioxide (SO_2) as reported by CASTNET for cumulative annual periods (EPA 2013e). Precipitation units are depth in centimeters (cm) and inches; deposition units are mass per unit area in kilograms per hectare (kg/ha) and pounds per acre (lb/acre).

Table 4.1-20 shows total nitrogen compounds and total sulfur compounds deposition rates versus annual precipitation amounts. Total deposition is expressed two ways, absolute in units of kg/ha and normalized in units of kilograms per hectare per decimeter precipitation (kg/ha-dm).

⁷ pH is defined as the negative (base 10) logarithm of the hydrogen ion concentration (moles per liter). For example, if $[\text{H}^+] = 0.0001$ moles/liter, then $\text{pH} = 4$.

Table 4.1-18 Deposition Monitoring Sites - Four Corners Region and Vicinity

| Site ID Code | Network | State | Location / Site Name | Elevation MSL meters | Elevation MSL feet | North Latitude | West Longitude | Monitoring Start Date |
|--------------|---------|------------|-----------------------------------------|----------------------|--------------------|----------------|----------------|-----------------------|
| GRC474 | CASTNET | Arizona | Grand Canyon National Park | 2,073 | 6,801 | 36.0597 | -112.1822 | 5/16/1989 |
| PET427 | CASTNET | Arizona | Petrified Forest National Park | 1,723 | 5,653 | 34.8225 | -109.8919 | 9/12/2002 |
| MEV405 | CASTNET | Colorado | Mesa Verde National Park | 2,165 | 7,103 | 37.1983 | -108.4903 | 1/1/1995 |
| CAN407 | CASTNET | Utah | Canyonlands National Park | 1,809 | 5,935 | 38.4586 | -109.8211 | 1/1/1995 |
| AZ03 | NTN | Arizona | Grand Canyon National Park | 2,071 | 6,795 | 36.0586 | -112.1840 | 8/11/1981 |
| AZ97 | NTN | Arizona | Petrified Forest National Park | 1,707 | 5,600 | 34.8224 | -109.8925 | 12/3/2002 |
| CO00 | NTN | Colorado | Alamosa | 2,285 | 7,497 | 37.4421 | -105.8680 | 4/22/1980 |
| CO91 | NTN | Colorado | Wolf Creek Pass ¹ | 3,287 | 10,784 | 37.4686 | -106.7870 | 5/26/1992 |
| CO96 | NTN | Colorado | Molas Pass ¹ | 3,248 | 10,656 | 37.7500 | -107.6890 | 7/29/1986 |
| CO99 | NTN | Colorado | Mesa Verde National Park | 2,162 | 7,093 | 37.1979 | -108.4910 | 4/28/1981 |
| NM07 | NTN | New Mexico | Bandelier National Monument | 1,997 | 6,552 | 35.7788 | -106.2660 | 6/22/1982 |
| UT09 | NTN | Utah | Canyonlands National Park | 1,797 | 5,896 | 38.4584 | -109.8210 | 11/11/1997 |
| UT98 | NTN | Utah | Green River | 1,256 | 4,121 | 39.0010 | -110.1740 | 4/25/1985 |
| UT99 | NTN | Utah | Bryce Canyon National Park ² | 2,477 | 8,127 | 37.6186 | -112.1728 | 1/29/1985 |
| AZ02 | MDN | Arizona | Sycamore Canyon Wilderness ³ | 2,046 | 6,713 | 35.1406 | -111.9692 | 2/28/2006 |
| CO96 | MDN | Colorado | Molas Pass ⁴ | 3,248 | 10,656 | 37.7500 | -107.6890 | 6/30/2009 |
| CO99 | MDN | Colorado | Mesa Verde National Park | 2,162 | 7,093 | 37.1979 | -108.4910 | 12/26/2001 |
| NM98 | MDN | New Mexico | Navajo Lake | 1,972 | 6,470 | 36.8097 | -107.6515 | 4/21/2009 |
| NM98 | AMoN | New Mexico | Navajo Lake | 1,972 | 6,470 | 36.8097 | -107.6515 | 1/11/2008 |
| NM99 | AMoN | New Mexico | Farmington | 1,634 | 5,361 | 36.7358 | -108.2380 | 1/9/2008 |

Sources: EPA 2013e, NADP 2013.

Notes:

¹ Indicates location is nondesert characteristic (mountains), data not used due to sufficient characteristic sites.

² Indicates location is outside 300-km radius of FCPP, data not used due to sufficient characteristic sites.

³ Indicates location is outside 300-km radius of FCPP, data used due to insufficient characteristic sites.

⁴ Indicates location is nondesert characteristic (mountains), data used due to insufficient characteristic sites.

AMoN = Ammonia Monitoring Network (NADP)

CASTNET = Clean Air Status and Trends Network (EPA)

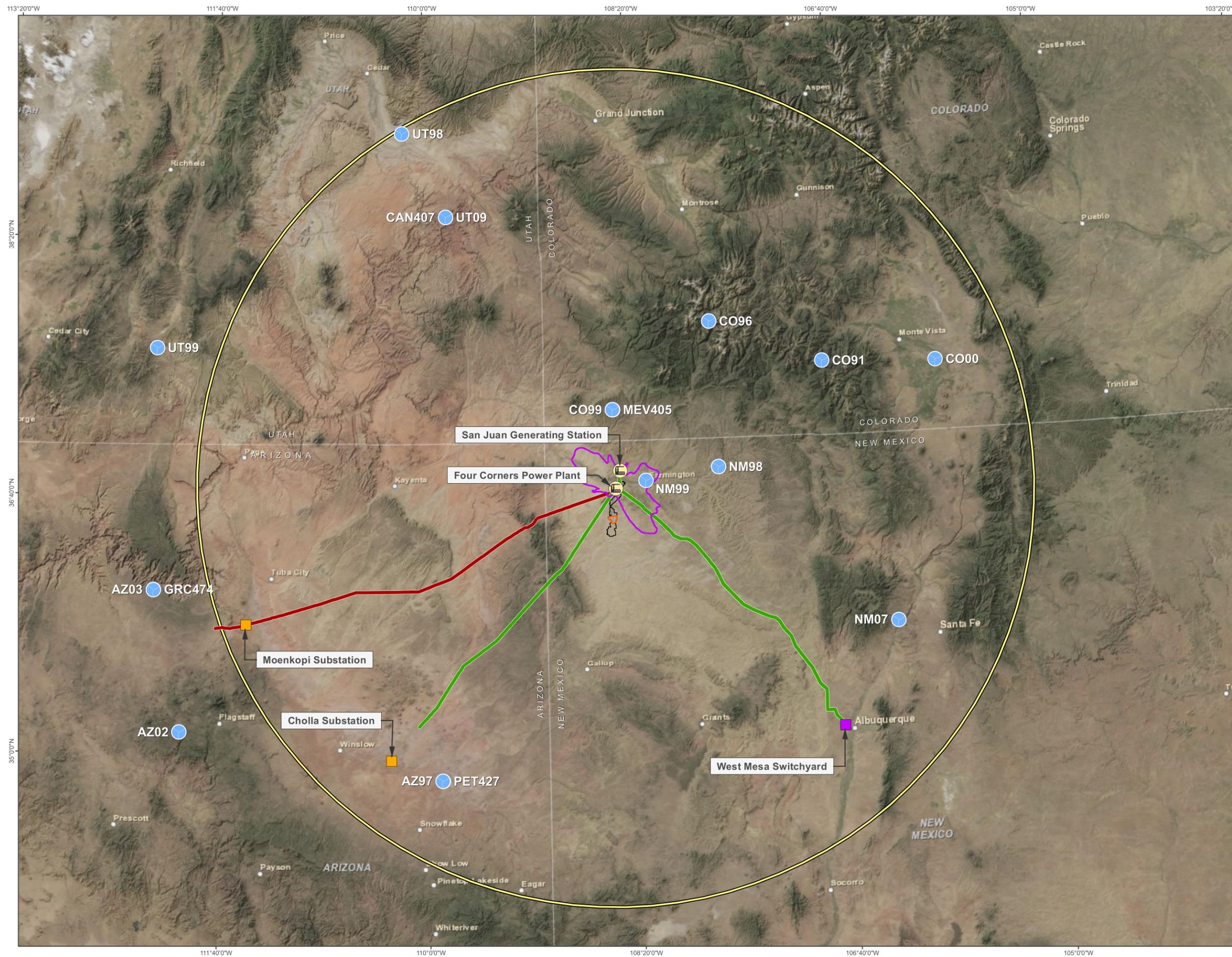
MDN = Mercury Deposition Network (NADP). MDN Site NM98 Navajo Lake closed 9/25/12; remains active as AMoN site NM98

NTN = National Trends Network (NADP)

Four Corners Power Plant and Navajo Mine Energy Project

ENVIRONMENTAL SETTING & CONSEQUENCES

Figure 4.1-4
Deposition Monitoring Sites



PROJECT FACILITIES

- Power Plant 
- Substation 
- Switchyard 

PROJECT BOUNDARIES

- Navajo Mine Lease Area 
- Proposed Pinabete SMCRA Permit Boundary 
- Four Corners Power Plant 300km Buffer 
- FCPP Deposition Area 

TRANSMISSION LINES

- 345kV 
- 500kV 

AIR QUALITY FEATURES

- Deposition Monitoring Sites 



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Table 4.1-19a Historic Speciated Deposition - 4 CASTNET Sites (metric units)

| Year | Precip cm | Wet NH ₄ kg/ha | Wet NO ₃ kg/ha | Dry HNO ₃ kg/ha | Dry NO ₃ kg/ha | Dry NH ₄ kg/ha | Wet SO ₄ kg/ha | Dry SO ₂ kg/ha | Dry SO ₄ kg/ha |
|------------|--------------|------------------------------|------------------------------|-------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 2000 | 23.6 | 0.34 | 0.68 | 0.89 | 0.03 | 0.12 | 0.58 | 0.12 | 0.14 |
| 2001 | 27.0 | 0.40 | 0.71 | 0.85 | 0.03 | 0.12 | 0.64 | 0.12 | 0.15 |
| 2002 | 19.2 | 0.48 | 0.53 | 0.89 | 0.04 | 0.11 | 0.50 | 0.11 | 0.13 |
| 2003 | 21.8 | 0.39 | 0.53 | 0.97 | 0.03 | 0.11 | 0.41 | 0.22 | 0.13 |
| 2004 | 31.1 | 0.68 | 0.78 | 0.91 | 0.04 | 0.11 | 0.79 | 0.21 | 0.14 |
| 2005 | 36.4 | 0.58 | 0.70 | 0.92 | 0.03 | 0.12 | 0.73 | 0.21 | 0.15 |
| 2006 | 28.9 | 0.64 | 0.77 | 0.92 | 0.03 | 0.10 | 0.68 | 0.21 | 0.13 |
| 2007 | 29.8 | 0.49 | 0.70 | 0.96 | 0.04 | 0.12 | 0.57 | 0.24 | 0.14 |
| 2008 | 30.2 | 0.42 | 0.59 | 0.78 | 0.03 | 0.11 | 0.48 | 0.15 | 0.14 |
| 2009 | 22.1 | 0.50 | 0.54 | 0.68 | 0.03 | 0.10 | 0.66 | 0.11 | 0.12 |
| 2010 | 44.5 | 0.83 | 0.90 | 0.64 | 0.03 | 0.09 | 0.75 | 0.11 | 0.11 |
| 2011 | 32.4 | 0.67 | 0.76 | 0.63 | 0.03 | 0.10 | 0.69 | 0.10 | 0.12 |
| Mean | 28.9 | 0.54 | 0.68 | 0.84 | 0.03 | 0.11 | 0.62 | 0.16 | 0.13 |
| Median | 29.3 | 0.49 | 0.70 | 0.89 | 0.03 | 0.11 | 0.65 | 0.13 | 0.14 |
| Cumulative | 347.0 | 6.42 | 8.20 | 10.03 | 0.40 | 1.31 | 7.49 | 1.89 | 1.60 |

Source: EPA 2013e.

Notes:

Aggregated data for 4 sites: CAN407, GRC474, MEV405, PET427.

Missing data compensated by aggregation (25 of 384 points = 6.5%).

cm = centimeter

kg/ha = kilogram(s) per hectare

Table 4.1-19b Historic Speciated Deposition - 4 CASTNET Sites (English units)

| Year | Precip in | Wet NH ₄ lb/acre | Wet NO ₃ lb/acre | Dry HNO ₃ lb/acre | Dry NO ₃ lb/acre | Dry NH ₄ lb/acre | Wet SO ₄ lb/acre | Dry SO ₂ lb/acre | Dry SO ₄ lb/acre |
|------------|--------------|--------------------------------|--------------------------------|---------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| 2000 | 9.3 | 0.30 | 0.61 | 0.80 | 0.03 | 0.10 | 0.52 | 0.10 | 0.13 |
| 2001 | 10.6 | 0.36 | 0.63 | 0.76 | 0.03 | 0.11 | 0.57 | 0.10 | 0.13 |
| 2002 | 7.6 | 0.43 | 0.48 | 0.79 | 0.04 | 0.10 | 0.44 | 0.09 | 0.12 |
| 2003 | 8.6 | 0.34 | 0.48 | 0.87 | 0.03 | 0.10 | 0.37 | 0.19 | 0.12 |
| 2004 | 12.3 | 0.61 | 0.70 | 0.81 | 0.03 | 0.10 | 0.71 | 0.19 | 0.12 |
| 2005 | 14.3 | 0.52 | 0.62 | 0.82 | 0.02 | 0.11 | 0.65 | 0.19 | 0.13 |
| 2006 | 11.4 | 0.57 | 0.69 | 0.82 | 0.03 | 0.09 | 0.60 | 0.18 | 0.11 |
| 2007 | 11.7 | 0.44 | 0.62 | 0.85 | 0.03 | 0.10 | 0.51 | 0.21 | 0.13 |
| 2008 | 11.9 | 0.38 | 0.52 | 0.69 | 0.03 | 0.10 | 0.43 | 0.13 | 0.12 |
| 2009 | 8.7 | 0.44 | 0.48 | 0.60 | 0.03 | 0.09 | 0.59 | 0.09 | 0.11 |
| 2010 | 17.5 | 0.74 | 0.80 | 0.57 | 0.03 | 0.08 | 0.67 | 0.10 | 0.10 |
| 2011 | 12.8 | 0.60 | 0.68 | 0.56 | 0.03 | 0.09 | 0.62 | 0.09 | 0.11 |
| Mean | 11.4 | 0.48 | 0.61 | 0.75 | 0.03 | 0.10 | 0.56 | 0.14 | 0.12 |
| Median | 11.5 | 0.44 | 0.62 | 0.79 | 0.03 | 0.10 | 0.58 | 0.12 | 0.12 |
| Cumulative | 136.6 | 5.73 | 7.31 | 8.94 | 0.36 | 1.17 | 6.68 | 1.68 | 1.43 |

Source: EPA 2013e.

Notes:

Aggregated data for 4 sites: CAN407, GRC474, MEV405, PET427.

Missing data compensated by aggregation (25 of 384 points = 6.5%).

in = inches

lb/acre = pound per acre

Table 4.1-20 Historic Composite Deposition Rates - 4 CASTNET Sites

| Year | Precipitation cm | Precipitation dm | Nitrogen Compounds kg/ha | Nitrogen Compounds kg/ha-dm | Sulfur Compounds kg/ha | Sulfur Compounds kg/ha-dm |
|--------|---------------------|---------------------|--------------------------------|-----------------------------------|------------------------------|---------------------------------|
| 2000 | 23.6 | 2.36 | 2.06 | 0.87 | 0.84 | 0.36 |
| 2001 | 27.0 | 2.70 | 2.11 | 0.78 | 0.91 | 0.34 |
| 2002 | 19.2 | 1.92 | 2.06 | 1.07 | 0.74 | 0.38 |
| 2003 | 21.8 | 2.18 | 2.04 | 0.93 | 0.76 | 0.35 |
| 2004 | 31.1 | 3.11 | 2.52 | 0.81 | 1.14 | 0.37 |
| 2005 | 36.4 | 3.64 | 2.34 | 0.64 | 1.09 | 0.30 |
| 2006 | 28.9 | 2.89 | 2.46 | 0.85 | 1.01 | 0.35 |
| 2007 | 29.8 | 2.98 | 2.30 | 0.77 | 0.95 | 0.32 |
| 2008 | 30.2 | 3.02 | 1.93 | 0.64 | 0.77 | 0.25 |
| 2009 | 22.1 | 2.21 | 1.84 | 0.83 | 0.88 | 0.40 |
| 2010 | 44.5 | 4.45 | 2.50 | 0.56 | 0.97 | 0.22 |
| 2011 | 32.4 | 3.24 | 2.19 | 0.68 | 0.91 | 0.28 |
| Trend | — | — | — | -0.28 | — | -0.09 |
| Change | — | — | — | -30% | — | -24% |

Source: EPA 2013e.

Notes:

Aggregated data for 4 sites: CAN407, GRC474, MEV405, PET427.

Missing data compensated by aggregation (25 of 384 points = 6.5%).

Change and improvement calculated on normalized linear trend basis (see Figure 4.1-6).

cm = centimeter

dm = decimeter

kg/ha = kilogram(s) per hectare

kg/ha-dm = kilogram(s) per hectare per decimeter

Deposition is normalized in units of kg/ha-dm to eliminate the variability of precipitation amounts and discern the actual deposition contents of precipitation (i.e., concentrations).

Figures 4.1-5 and 4.1-6 illustrate historic deposition trends as measured by the CASTNET monitoring program. Figure 4.1-5 shows absolute amounts of precipitation, total nitrogen compounds, and total sulfur compounds over the 12-year period. Since the amount of deposition is proportional to the amount of precipitation received, Figure 4.1-6 shows normalized total nitrogen compounds and total sulfur compounds where normalized precipitation is expressed as unity.

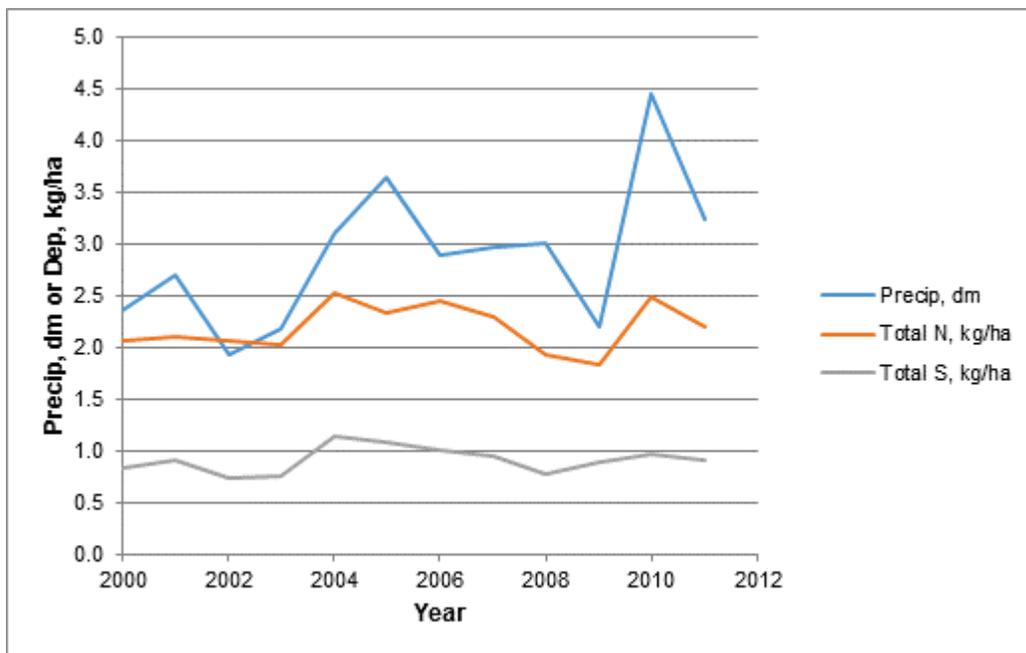


Figure 4.1-5 Historic CASTNET Precipitation and Deposition

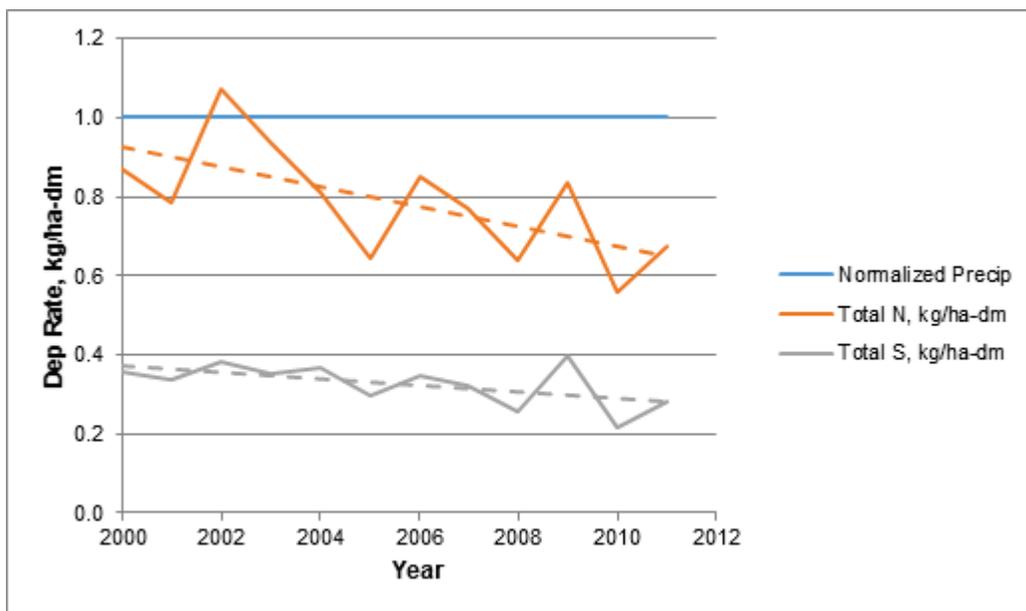


Figure 4.1-6 Historic CASTNET Deposition Rates - Normalized

As shown in Table 4.1-20 and Figure 4.1-6, the data suggests the average rate of nitrogen and sulfur deposition in the Four Corners region has been trending downward over the 12-year period. The data also suggests that total nitrogen compound deposition has decreased by about 30 percent and total sulfur compound deposition has decreased by about 24 percent, as measured by CASTNET from 2000 to 2011. These apparent downward trends suggest that regional emissions of NO_x and SO₂ from stationary and mobile sources may have decreased overall due to improved emission controls, lower-polluting fuels, and changes in economic activity, among other factors.

National Trends Network

Annual summary data from seven National Trends Network (NTN) sites located at Canyonlands, Grand Canyon, Mesa Verde, Petrified Forest, Alamosa, Bandelier, and Green River is aggregated to provide a general estimate of historic deposition in the Four Corners region. Deposition is calculated by NADP based on the NTN wet bucket method and measured precipitation (NADP 2013).

For the historic 12-year period from 2000 through 2011, Tables 4.1-21a (metric units, kg/ha) and 4.1-21b (English units, lb/acre) show measured precipitation, free acidity (H⁺ as pH), calcium (Ca²⁺), magnesium (Mg²⁺), sodium (Na⁺), potassium (K⁺), sulfate (SO₄²⁻), nitrate (NO₃⁻), chloride (Cl⁻), and ammonium (NH₄⁺) ions, also total inorganic nitrogen (N) as reported by NTN for cumulative annual periods (NADP 2013).

Table 4.1-22 shows absolute and normalized acid/base ion deposition rates in metric units for sulfate, nitrate, chloride, and ammonium. Table 4.1-23 shows absolute and normalized light metal ion deposition rates in metric units for calcium, magnesium, potassium, and sodium.

Table 4.1-21a Historic Speciated Deposition - 7 NTN Sites (metric units)

| Year | Precip cm | Ca kg/ha | Mg kg/ha | K kg/ha | Na kg/ha | NH ₄ kg/ha | NO ₃ kg/ha | Inorg N kg/ha | Cl kg/ha | SO ₄ kg/ha | H ⁺ kg/ha |
|------------|--------------|-------------|-------------|------------|-------------|--------------------------|--------------------------|------------------|-------------|--------------------------|-------------------------|
| 2000 | 23.7 | 1.96 | 0.19 | 0.16 | 0.33 | 1.30 | 7.99 | 2.82 | 0.52 | 4.52 | 0.06 |
| 2001 | 25.9 | 2.34 | 0.25 | 0.14 | 0.42 | 1.64 | 8.59 | 3.22 | 0.60 | 5.10 | 0.05 |
| 2002 | 16.3 | 1.76 | 0.15 | 0.08 | 0.21 | 0.98 | 3.53 | 1.56 | 0.30 | 2.26 | 0.01 |
| 2003 | 18.7 | 1.56 | 0.15 | 0.10 | 0.17 | 1.04 | 4.37 | 1.80 | 0.27 | 2.41 | 0.02 |
| 2004 | 28.1 | 3.38 | 0.33 | 0.23 | 0.58 | 2.47 | 10.58 | 4.32 | 0.91 | 6.45 | 0.06 |
| 2005 | 33.6 | 3.30 | 0.30 | 0.23 | 0.52 | 2.66 | 10.43 | 4.42 | 0.72 | 7.65 | 0.09 |
| 2006 | 26.8 | 3.18 | 0.32 | 0.18 | 0.41 | 2.01 | 8.33 | 3.45 | 0.61 | 4.85 | 0.04 |
| 2007 | 26.6 | 3.49 | 0.31 | 0.20 | 0.50 | 1.99 | 8.32 | 3.43 | 0.77 | 5.10 | 0.05 |
| 2008 | 25.9 | 3.05 | 0.30 | 0.18 | 0.43 | 1.58 | 7.02 | 2.81 | 0.65 | 4.09 | 0.04 |
| 2009 | 21.1 | 5.87 | 0.34 | 0.29 | 0.48 | 1.35 | 5.10 | 2.20 | 0.61 | 4.19 | 0.02 |
| 2010 | 34.7 | 6.12 | 0.73 | 0.37 | 0.93 | 3.77 | 13.89 | 6.07 | 1.46 | 7.70 | 0.07 |
| 2011 | 25.0 | 3.79 | 0.38 | 0.21 | 0.52 | 2.05 | 7.80 | 3.36 | 0.72 | 4.76 | 0.03 |
| Mean | 25.5 | 3.32 | 0.31 | 0.20 | 0.46 | 1.91 | 8.00 | 3.29 | 0.68 | 4.92 | 0.05 |
| Median | 25.9 | 3.24 | 0.31 | 0.19 | 0.46 | 1.82 | 8.15 | 3.29 | 0.63 | 4.81 | 0.04 |
| Cumulative | 306.4 | 39.80 | 3.75 | 2.37 | 5.51 | 22.86 | 95.96 | 39.45 | 8.12 | 59.07 | 0.54 |

Source: NADP 2013.

Notes:

Aggregated data for 7 sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98; Site AZ97 commenced operation 2003 (no data for 2000, 2001, 2002).

| | | |
|-------------------------------|------------------------|---------------------------------|
| Ca = calcium | Cl = chloride | cm = centimeter(s) |
| H ⁺ = free acidity | K = potassium | kg/ha = kilogram(s) per hectare |
| Mg = magnesium | Na = sodium | NH ₄ = ammonium |
| NO ₃ = nitrate | precip = precipitation | SO ₄ = sulfate |

Table 4.1-21b Historic Speciated Deposition - 7 NTN Sites (English Units)

| Year | Precip in | Ca lb/acre | Mg lb/acre | K lb/acre | Na lb/acre | NH ₄ lb/acre | NO ₃ lb/acre | Inorg N lb/acre | Cl lb/acre | SO ₄ lb/acre | H ⁺ lb/acre |
|------------|--------------|---------------|---------------|--------------|---------------|----------------------------|----------------------------|--------------------|---------------|----------------------------|---------------------------|
| 2000 | 9.3 | 1.75 | 0.17 | 0.14 | 0.30 | 1.16 | 7.13 | 2.52 | 0.46 | 4.03 | 0.06 |
| 2001 | 10.2 | 2.09 | 0.22 | 0.12 | 0.38 | 1.46 | 7.67 | 2.87 | 0.54 | 4.55 | 0.05 |
| 2002 | 6.4 | 1.57 | 0.14 | 0.07 | 0.19 | 0.87 | 3.15 | 1.39 | 0.27 | 2.01 | 0.01 |
| 2003 | 7.4 | 1.39 | 0.13 | 0.09 | 0.15 | 0.93 | 3.90 | 1.61 | 0.24 | 2.15 | 0.02 |
| 2004 | 11.0 | 3.02 | 0.30 | 0.20 | 0.52 | 2.21 | 9.44 | 3.85 | 0.81 | 5.75 | 0.05 |
| 2005 | 13.2 | 2.94 | 0.27 | 0.20 | 0.46 | 2.38 | 9.30 | 3.94 | 0.64 | 6.83 | 0.08 |
| 2006 | 10.6 | 2.84 | 0.29 | 0.16 | 0.36 | 1.79 | 7.44 | 3.07 | 0.55 | 4.33 | 0.04 |
| 2007 | 10.5 | 3.11 | 0.27 | 0.18 | 0.45 | 1.78 | 7.42 | 3.06 | 0.69 | 4.55 | 0.04 |
| 2008 | 10.2 | 2.72 | 0.27 | 0.16 | 0.38 | 1.41 | 6.27 | 2.51 | 0.58 | 3.65 | 0.04 |
| 2009 | 8.3 | 5.23 | 0.31 | 0.26 | 0.43 | 1.21 | 4.55 | 1.97 | 0.55 | 3.74 | 0.02 |
| 2010 | 13.7 | 5.46 | 0.65 | 0.33 | 0.83 | 3.36 | 12.40 | 5.42 | 1.30 | 6.87 | 0.06 |
| 2011 | 9.9 | 3.38 | 0.34 | 0.19 | 0.46 | 1.83 | 6.96 | 2.99 | 0.64 | 4.25 | 0.03 |
| Mean | 10.1 | 2.96 | 0.28 | 0.18 | 0.41 | 1.70 | 7.13 | 2.93 | 0.60 | 4.39 | 0.04 |
| Median | 10.2 | 2.89 | 0.27 | 0.17 | 0.41 | 1.62 | 7.28 | 2.93 | 0.56 | 4.29 | 0.04 |
| Cumulative | 120.6 | 35.50 | 3.34 | 2.11 | 4.91 | 20.40 | 85.62 | 35.20 | 7.25 | 52.70 | 0.49 |

Source: NADP 2013.

Notes:

Aggregated data for 7 sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98.

Site AZ97 commenced operation 2003 (no data for 2000, 2001, 2002).

- Ca = calcium
- Cl = chloride
- H* = free acidity
- in = inch(es)
- K = potassium
- lb/acre = pound per acre
- Mg = magnesium
- Na = sodium
- NH₄ = ammonium
- NO₃ = nitrate
- precip = precipitation
- SO₄ = sulfate

Table 4.1-22 Historic Acid/Base Ion Deposition Rates - 7 NTN Sites

| Year | Precip cm | Precip dm | SO ₄ Comp kg/ha | SO ₄ Comp kg/ha-dm | NO ₃ Comp kg/ha | NO ₃ Comp kg/ha-dm | Cl Comp kg/ha | Cl Comp kg/ha-dm | NH ₄ Comp kg/ha | NH ₄ Comp kg/ha-dm |
|--------|--------------|--------------|----------------------------------|-------------------------------------|----------------------------------|-------------------------------------|---------------------|------------------------|----------------------------------|-------------------------------------|
| 2000 | 23.7 | 2.37 | 4.52 | 1.90 | 7.99 | 3.37 | 0.52 | 0.22 | 1.30 | 0.55 |
| 2001 | 25.9 | 2.59 | 5.10 | 1.97 | 8.59 | 3.32 | 0.60 | 0.23 | 1.64 | 0.63 |
| 2002 | 16.3 | 1.63 | 2.26 | 1.39 | 3.53 | 2.17 | 0.30 | 0.18 | 0.98 | 0.60 |
| 2003 | 18.7 | 1.87 | 2.41 | 1.29 | 4.37 | 2.33 | 0.27 | 0.14 | 1.04 | 0.56 |
| 2004 | 28.1 | 2.81 | 6.45 | 2.30 | 10.58 | 3.77 | 0.91 | 0.32 | 2.47 | 0.88 |
| 2005 | 33.6 | 3.36 | 7.65 | 2.28 | 10.43 | 3.10 | 0.72 | 0.21 | 2.66 | 0.79 |
| 2006 | 26.8 | 2.68 | 4.85 | 1.81 | 8.33 | 3.11 | 0.61 | 0.23 | 2.01 | 0.75 |
| 2007 | 26.6 | 2.66 | 5.10 | 1.92 | 8.32 | 3.13 | 0.77 | 0.29 | 1.99 | 0.75 |
| 2008 | 25.9 | 2.59 | 4.09 | 1.58 | 7.02 | 2.72 | 0.65 | 0.25 | 1.58 | 0.61 |
| 2009 | 21.1 | 2.11 | 4.19 | 1.98 | 5.10 | 2.41 | 0.61 | 0.29 | 1.35 | 0.64 |
| 2010 | 34.7 | 3.47 | 7.70 | 2.22 | 13.89 | 4.00 | 1.46 | 0.42 | 3.77 | 1.09 |
| 2011 | 25.0 | 2.50 | 4.76 | 1.90 | 7.80 | 3.12 | 0.72 | 0.29 | 2.05 | 0.82 |
| Trend | — | — | — | 0.24 | — | 0.19 | — | 0.14 | — | 0.27 |
| Change | — | — | — | 14% | — | 7% | — | 75% | — | 47% |

Source: NADP 2013.

Notes:

Aggregated data for 7 sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98; Site AZ97 commenced operation 2003 (no data for 2000, 2001, 2002).

- Cl = chloride
- cm = centimeter(s)
- dm = decimeter
- kg/ha = kilogram(s) per hectare
- kg/ha-dm = kilogram(s) per hectare per decimeter
- NH₄ = ammonium
- NO₃ = nitrate
- precip = precipitation
- SO₄ = sulfate

Table 4.1-23 Historic Light Metal Ion Deposition Rates - 7 NTN Sites

| Year | Precip cm | Precip dm | Ca Comp kg/ha | Ca Comp kg/ha-dm | Mg Comp kg/ha | Mg Comp kg/ha-dm | K Comp kg/ha | K Comp kg/ha-dm | Na Comp kg/ha | Na Comp kg/ha- dm |
|--------|--------------|--------------|---------------------|------------------------|---------------------|------------------------|--------------------|-----------------------|---------------------|----------------------------|
| 2000 | 23.7 | 2.37 | 1.96 | 0.83 | 0.19 | 0.08 | 0.16 | 0.07 | 0.33 | 0.14 |
| 2001 | 25.9 | 2.59 | 2.34 | 0.90 | 0.25 | 0.09 | 0.14 | 0.05 | 0.42 | 0.16 |
| 2002 | 16.3 | 1.63 | 1.76 | 1.08 | 0.15 | 0.09 | 0.08 | 0.05 | 0.21 | 0.13 |
| 2003 | 18.7 | 1.87 | 1.56 | 0.83 | 0.15 | 0.08 | 0.10 | 0.05 | 0.17 | 0.09 |
| 2004 | 28.1 | 2.81 | 3.38 | 1.21 | 0.33 | 0.12 | 0.23 | 0.08 | 0.58 | 0.21 |
| 2005 | 33.6 | 3.36 | 3.30 | 0.98 | 0.30 | 0.09 | 0.23 | 0.07 | 0.52 | 0.15 |
| 2006 | 26.8 | 2.68 | 3.18 | 1.19 | 0.32 | 0.12 | 0.18 | 0.07 | 0.41 | 0.15 |
| 2007 | 26.6 | 2.66 | 3.49 | 1.31 | 0.31 | 0.12 | 0.20 | 0.08 | 0.50 | 0.19 |
| 2008 | 25.9 | 2.59 | 3.05 | 1.18 | 0.30 | 0.12 | 0.18 | 0.07 | 0.43 | 0.17 |
| 2009 | 21.1 | 2.11 | 5.87 | 2.77 | 0.34 | 0.16 | 0.29 | 0.14 | 0.48 | 0.23 |
| 2010 | 34.7 | 3.47 | 6.12 | 1.76 | 0.73 | 0.21 | 0.37 | 0.11 | 0.93 | 0.27 |
| 2011 | 25.0 | 2.50 | 3.79 | 1.51 | 0.38 | 0.15 | 0.21 | 0.09 | 0.52 | 0.21 |
| Trend | — | — | — | 1.13 | — | 0.10 | — | 0.05 | — | 0.10 |
| Change | — | — | — | 155% | — | 139% | — | 108% | — | 84% |

Source: NADP 2013

Notes:

Aggregated data for 7 sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98; Site AZ97 commenced operation 2003 (no data for 2000, 2001, 2002).

- Ca = calcium
- dm = decimeter
- K = potassium
- kg/ha = kilogram(s) per hectare
- kg/ha-dm = kilogram(s) per hectare per decimeter
- Mg = magnesium
- Na = sodium
- precip = precipitation

Figures 4.1-7a, 4.1-7b, and 4.1-7c illustrate the normalized rates shown in Tables 4.1-22 and 4.1-23 using compatible Y-axis scales (i.e., 0-1, 0-2, 0-4). Figure 4.1-7a shows normalized magnesium, potassium, sodium, chloride, and acidity. Figure 4.1-7b shows ammonium and total inorganic nitrogen. Figure 4.1-7c shows calcium, nitrate, and sulfate. In each of these normalized figures, precipitation is expressed as unity.

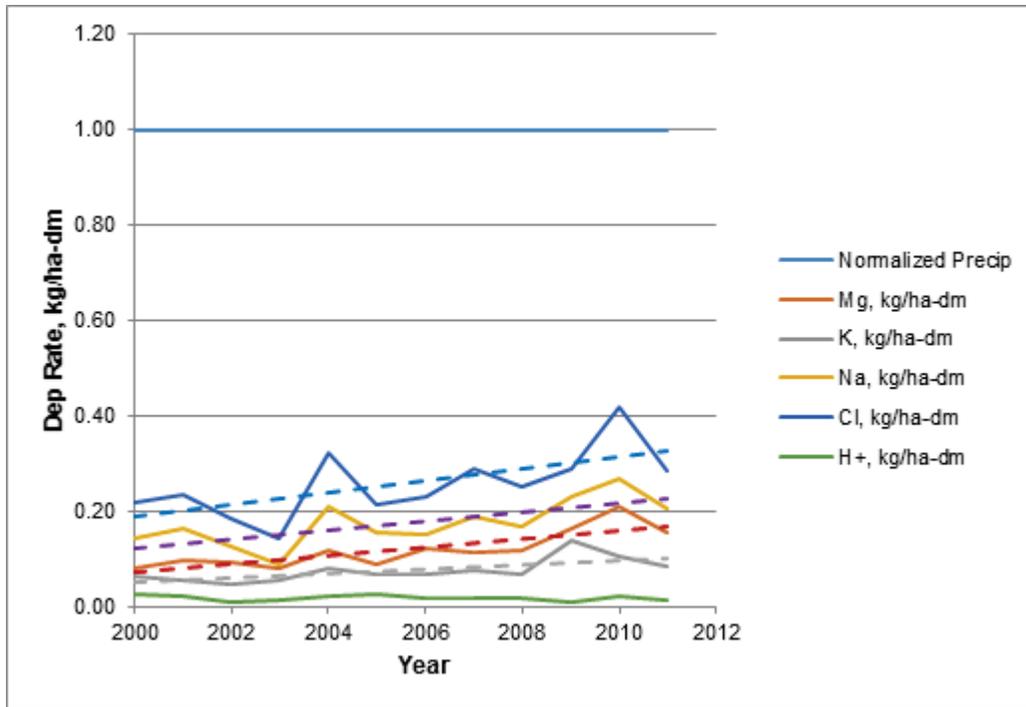


Figure 4.1-7a Historic NTN Deposition Rates – Normalized (Mg, K, Na, Cl, H+)

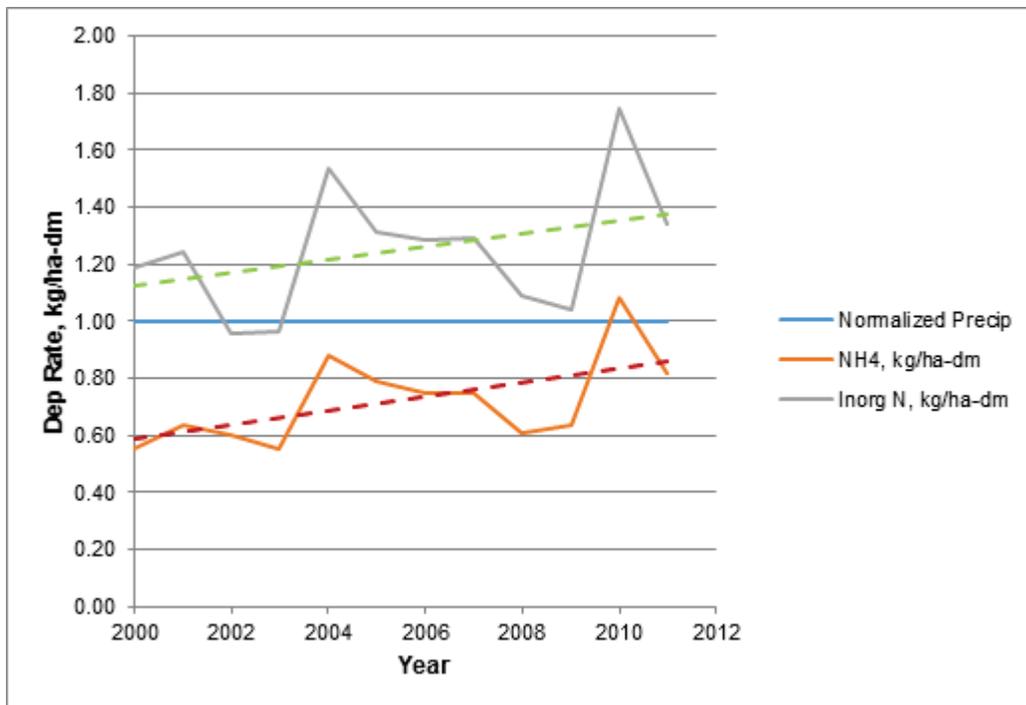


Figure 4.1-7b Historic NTN Deposition Rates – Normalized (Ammonia)

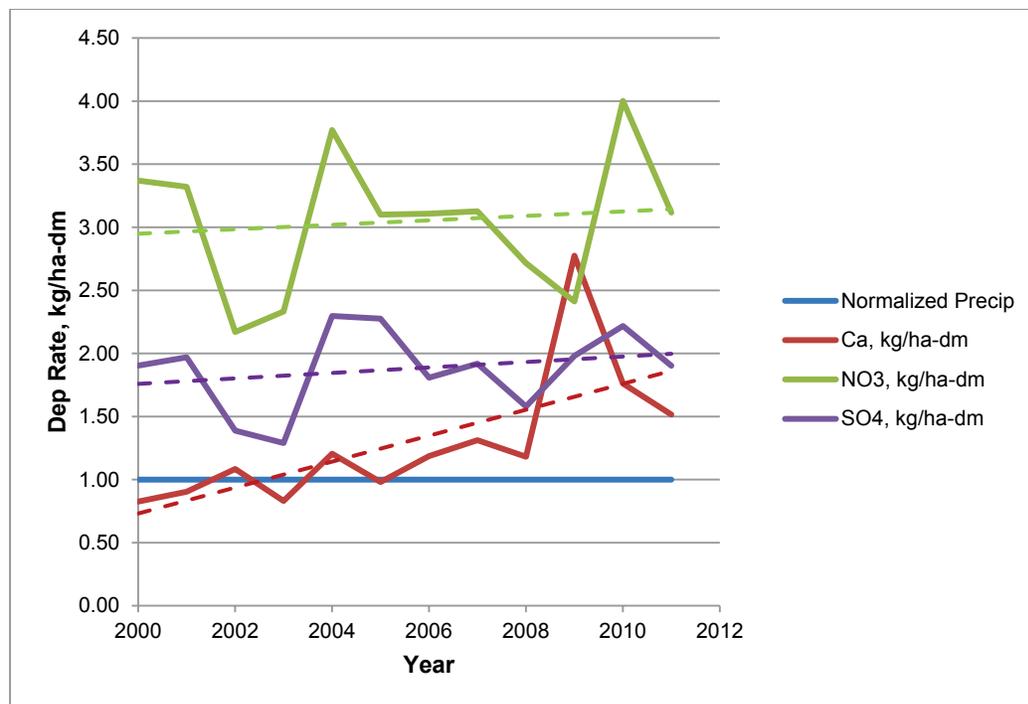


Figure 4.1-7c Historic NTN Deposition Rates – Normalized (Ca, NO₃, SO₄)

As shown in Tables 4.1-22 and 4.1-23 and Figures 4.1-7a, 4.1-7b, and 4.1-7c, NTN data suggests the average rate of deposition for all analytes in the Four Corners region has been trending upward over the 12-year period. The data also suggests that sulfate, nitrate, chloride, and ammonium deposition has increased by about 14 percent, 7 percent, 75 percent, and 47 percent, respectively, over the 12-year period. Further, calcium, magnesium, potassium, and sodium deposition has increased by an average of about 120 percent, as measured by NTN from 2000 to 2011.

The lower rates of increase for sulfate and nitrate suggests that regional emissions of NO_x and SO₂ from stationary and mobile sources may not be increasing as rapidly overall due to improved emission controls and lower-polluting fuels; however, these factors could be offset by use of agricultural chemicals such as fertilizers which can contain these compounds. The higher rate of increase for the metallic analytes (calcium, magnesium, potassium, sodium) suggests that drought conditions in the region could be responsible for increased airborne soil dusts which can contain these minerals. For the remaining analytes chloride and ammonium, increases are moderate, which suggests that while chloride could be attributable to soil dust, ammonium could be attributable to fertilizer application, animal husbandry, or NO_x emissions controls on stationary sources.

Because CASTNET and NTN employ very different measurement principles, results from the two networks are not directly comparable and differences in results and trends cannot be strictly viewed as inconsistent or contradictory. Rather, the two different methods should be considered complimentary as they each provide insight into the complexities of atmospheric deposition.

Mercury Deposition Network (MDN)

Annual sampling data from four MDN sites located at Sycamore Canyon, Molas Pass, Mesa Verde, and Navajo Lake is compared and aggregated to provide a general estimate of historic mercury deposition in the Four Corners region. Total mercury (Hg) deposition (organic + elemental) is calculated by NADP in units of nanograms per square meter (ng/m²) based on the amount of sample collected in the wet bottle in equivalent millimeters (mm) times its mercury concentration in nanograms per liter (ng/l). In contrast to

NTN, precipitation gage data are not used for data reduction since the bottle quantity is a more precise measurement for trace quantities (NADP 2013).

For the historic 10-year period from 2002 through 2011, individual site results are shown in Table 4.1-24 comprising absolute units of ng/m^2 and kg/ha , and normalized units of $\text{ng}/\text{m}^2\text{-mm}$ as reported by MDN on a discrete sample basis (NADP 2013). Since the number of sites and samples is not large, absolute percent difference (variation) about the weighted arithmetic mean is shown to assess measurement variability (consistency) from year-to-year.

Table 4.1-25 aggregates the results shown in Table 4.1-24 to provide a general estimate of region-wide mercury deposition rates over the 10-year period. Figure 4.1-8 illustrates these normalized mercury deposition rates in units of $\text{ng}/\text{m}^2\text{-mm}$. For consistency with NTN precipitation data from multiple (7) rain gages over 12 years, Table 4.1-26 correlates MDN trending results against NTN precipitation amounts to obtain estimated mercury deposition as if it were an NTN parameter, as illustrated on Figure 4.1-9.

The normalized MDN results shown in Table 4.1-25 and Figure 4.1-8 suggest an upward trend in the rate of mercury deposition in the region over a decade. As shown in Table 4.1-26, from 2000 to 2011, the estimated average trending deposition rate increased by about $6 \text{ ng}/\text{m}^2\text{-mm}$ or about 40 percent overall with an average annual variability of less than 20 percent, which indicates that results are reasonably consistent overall. The trending analysis suggests that mercury deposition in the Western region has been increasing.

While increases are due in part to trans-Pacific transport of mercury from sources in Asia (refer to Section 4.8, Special-Status Species for a more detailed discussion), coal-fired power plants are the largest source of mercury emissions in the U.S. Mercury is emitted from EGUs in three forms; each of which has specific physical and chemical properties that determine how far it travels in the atmosphere before depositing to the landscape. Although gaseous oxidized mercury and particle-bound mercury are generally local/regional mercury deposition concerns, all forms of mercury may deposit to local or regional watersheds. U.S. coal-fired power plants account for over half of the U.S. controllable emissions of the quickly depositing forms of mercury (Federal Register 2012). According to the EPRI baseline scenario modeling results, the maximum contribution of FCPP mercury emissions to mercury total deposition is about 28 percent in San Juan County near the FCPP and contributions from FCPP range from 2 to 28 percent in the vicinity of the plant; however, the contributions from FCPP are less than 2 percent over the remainder of the San Juan basin (EPRI 2013).

Table 4.1-24 Historic Mercury Deposition - 4 MDN Sites

| Site ID Code | Year | Months Operation | Valid Samples | Precipitation Collected mm | Precipitation Collected cm | Measured Mercury Deposition ng/m ² | Measured Mercury Deposition kg/ha | Measured Mercury Deposition ng/m ² -mm | Measured Mercury Deposition variation |
|------------------------|------|------------------|---------------|----------------------------|----------------------------|-----------------------------------------------|-----------------------------------|---------------------------------------------------|---------------------------------------|
| AZ02* | 2006 | 10 | 29 | 429 | 42.9 | 8,678 | 8.68E-05 | 20.2 | 13% |
| AZ02* | 2007 | 12 | 21 | 401 | 40.1 | 10,358 | 1.04E-04 | 25.8 | 10% |
| AZ02* | 2008 | 12 | 22 | 459 | 45.9 | 8,567 | 8.57E-05 | 18.7 | 20% |
| AZ02* | 2009 | 12 | 25 | 178 | 17.8 | 5,384 | 5.38E-05 | 30.3 | 30% |
| AZ02* | 2010 | 12 | 23 | 313 | 31.3 | 7,859 | 7.86E-05 | 25.1 | 8% |
| AZ02* | 2011 | 12 | 28 | 287 | 28.7 | 7,436 | 7.44E-05 | 25.9 | 11% |
| <i>AZ02 Cumulative</i> | | | 148 | 2067 | 206.7 | 48,282 | 4.83E-04 | 23.4 | 14% |
| NM98 | 2009 | 8 | 18 | 151 | 15.1 | 3,762 | 3.76E-05 | 24.9 | 5% |
| NM98 | 2010 | 12 | 20 | 241 | 24.1 | 7,126 | 7.13E-05 | 29.6 | 25% |
| NM98 | 2011 | 12 | 24 | 231 | 23.1 | 4,294 | 4.29E-05 | 18.6 | 22% |
| NM98 | 2012 | 9 | 18 | 152 | 15.2 | 3,179 | 3.18E-05 | 20.9 | 12% |
| <i>NM98 Cumulative</i> | | | 80 | 775 | 77.5 | 18,360 | 1.84E-04 | 23.7 | 16% |
| CO96** | 2009 | 6 | 22 | 331 | 33.1 | 4,928 | 4.93E-05 | 14.9 | 14% |
| CO96** | 2010 | 12 | 39 | 614 | 61.4 | 8,475 | 8.47E-05 | 13.8 | 5% |
| CO96** | 2011 | 12 | 44 | 790 | 79.0 | 9,307 | 9.31E-05 | 11.8 | 10% |
| <i>CO96 Cumulative</i> | | | 105 | 1735 | 173.5 | 22,709 | 2.27E-04 | 13.1 | 9% |
| CO99 | 2002 | 11 | 23 | 190 | 19.0 | 3,471 | 3.47E-05 | 18.3 | 3% |
| CO99 | 2003 | 12 | 29 | 301 | 30.1 | 4,914 | 4.91E-05 | 16.3 | 8% |
| CO99 | 2004 | 12 | 27 | 327 | 32.7 | 3,161 | 3.16E-05 | 9.7 | 45% |
| CO99 | 2005 | 12 | 30 | 481 | 48.1 | 5,433 | 5.43E-05 | 11.3 | 36% |
| CO99 | 2006 | 12 | 30 | 310 | 31.0 | 4,963 | 4.96E-05 | 16.0 | 9% |
| CO99 | 2007 | 12 | 33 | 380 | 38.0 | 6,708 | 6.71E-05 | 17.6 | 0% |
| CO99 | 2008 | 12 | 28 | 404 | 40.4 | 6,021 | 6.02E-05 | 14.9 | 16% |
| CO99 | 2009 | 12 | 25 | 321 | 32.1 | 10,100 | 1.01E-04 | 31.5 | 79% |

| Site ID Code | Year | Months Operation | Valid Samples | Precipitation Collected mm | Precipitation Collected cm | Measured Mercury Deposition ng/m ² | Measured Mercury Deposition kg/ha | Measured Mercury Deposition ng/m ² -mm | Measured Mercury Deposition variation |
|------------------------|------|------------------|---------------|----------------------------|----------------------------|-----------------------------------------------|-----------------------------------|---------------------------------------------------|---------------------------------------|
| CO99 | 2010 | 12 | 30 | 458 | 45.8 | 10,583 | 1.06E-04 | 23.1 | 31% |
| CO99 | 2011 | 12 | 28 | 373 | 37.3 | 7,203 | 7.20E-05 | 19.3 | 9% |
| <i>CO99 Cumulative</i> | | | 283 | 3545 | 354.5 | 62,558 | 6.26E-04 | 17.6 | 24% |

Source: NADP 2013.

Notes:

* Indicates location is outside 300 km radius of FCPP.

** Indicates location is nondesert characteristic (mountains).

Site NM98 ceased operation September 2012.

Variation is absolute difference between annual value and cumulative mean of annual values.

cm = centimeter

kg/ha = kilogram(s) per hectare

mm = millimeter

ng/m² = nanogram(s) per square meter

ng/m²-mm = nanogram(s) per square meter- millimeter

Table 4.1-25 Historic Annual Mercury Deposition - 4 MDN Sites

| Year | Sites Operating | Valid Samples | Precipitation Collected mm | Precipitation Collected cm | Deposition Rate ng/m ² -mm | Deposition Rate variation |
|-------------------|-----------------|---------------|----------------------------|----------------------------|---------------------------------------|---------------------------|
| 2002 | 1 | 23 | 190 | 19.0 | 18.3 | 2% |
| 2003 | 1 | 29 | 301 | 30.1 | 16.3 | 13% |
| 2004 | 1 | 27 | 327 | 32.7 | 9.7 | 48% |
| 2005 | 1 | 30 | 481 | 48.1 | 11.3 | 39% |
| 2006 | 2 | 59 | 739 | 73.9 | 18.5 | 1% |
| 2007 | 2 | 54 | 782 | 78.2 | 21.8 | 17% |
| 2008 | 2 | 50 | 863 | 86.3 | 16.9 | 9% |
| 2009 | 4 | 90 | 980 | 98.0 | 24.7 | 32% |
| 2010 | 4 | 112 | 1,626 | 162.6 | 20.9 | 12% |
| 2011 | 4 | 124 | 1,681 | 168.1 | 16.8 | 10% |
| Cumulative | — | 598 | 7,969 | 796.9 | 18.7 | 18% |
| Trend | — | — | — | — | 6.2 | — |
| Change | — | — | — | — | 43% | — |

Source: NADP 2013.

Notes:

Aggregated data for 4 sites: AZ02, NM98, CO96, CO99; Site NM98 ceased operation September 2012. Variation is absolute difference between annual value and cumulative mean of annual values

cm = centimeter

mm = millimeter

ng/m²-mm = nanogram(s) per square meter- millimeter

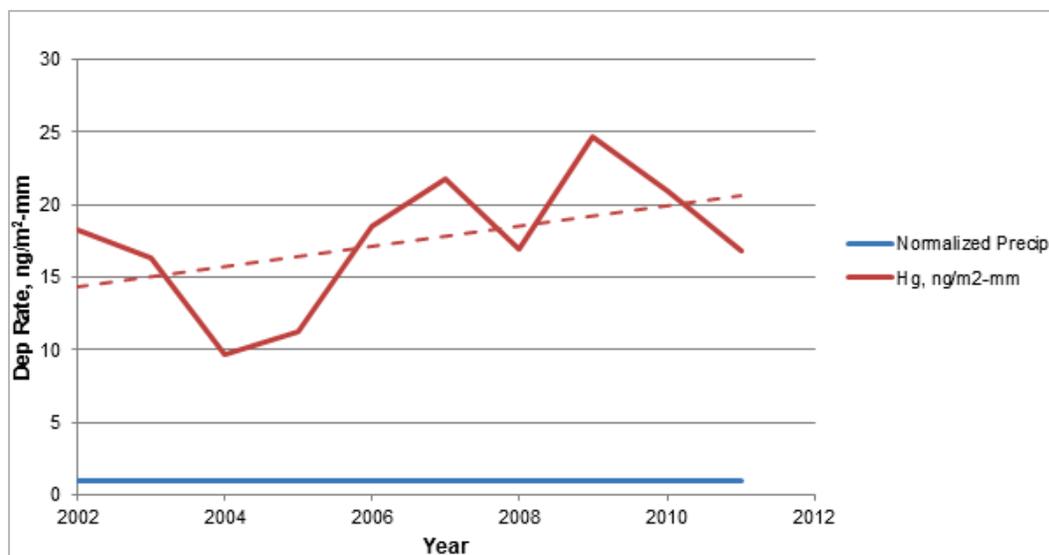


Figure 4.1-8 Historic MDN Deposition Rates – Normalized

Table 4.1-26 Estimated NTN-Correlated Annual Mercury Deposition

| Year | NTN Precipitation cm | NTN Precipitation mm | Average Deposition ng/m ² -mm | Average Deposition ng/m ² | Average Deposition kg/ha |
|-------------------|----------------------------|----------------------------|------------------------------------------------|--------------------------------------------|--------------------------------|
| 2000 | 23.7 | 237 | 13.0 | 3,086 | 3.09E-05 |
| 2001 | 25.9 | 259 | 13.7 | 3,546 | 3.55E-05 |
| 2002 | 16.3 | 163 | 14.4 | 2,341 | 2.34E-05 |
| 2003 | 18.7 | 187 | 15.1 | 2,827 | 2.83E-05 |
| 2004 | 28.1 | 281 | 15.8 | 4,430 | 4.43E-05 |
| 2005 | 33.6 | 336 | 16.5 | 5,540 | 5.54E-05 |
| 2006 | 26.8 | 268 | 17.2 | 4,604 | 4.60E-05 |
| 2007 | 26.6 | 266 | 17.9 | 4,751 | 4.75E-05 |
| 2008 | 25.9 | 259 | 18.6 | 4,798 | 4.80E-05 |
| 2009 | 21.1 | 211 | 19.2 | 4,070 | 4.07E-05 |
| 2010 | 34.7 | 347 | 19.9 | 6,923 | 6.92E-05 |
| 2011 | 25.0 | 250 | 20.6 | 5,165 | 5.16E-05 |
| Mean | 25.5 | 255 | — | 4,340 | 4.34E-05 |
| Median | 25.9 | 259 | — | 4,517 | 4.52E-05 |
| Cumulative | 306.4 | 3064 | — | 52,080 | 5.21E-04 |

Source: NADP 2013.

Notes:

Aggregated precip data for 7 NTN sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98; Aggregated Hg dep data for 4 MDN sites: AZ02, NM98, CO96, CO99; Average deposition rate determined from 10-year trend line.

cm = centimeter

kg/ha = kilogram(s) per hectare

mm = millimeter

ng/m² = nanogram(s) per square meter

ng/m²-mm = nanogram(s) per square meter- millimeter

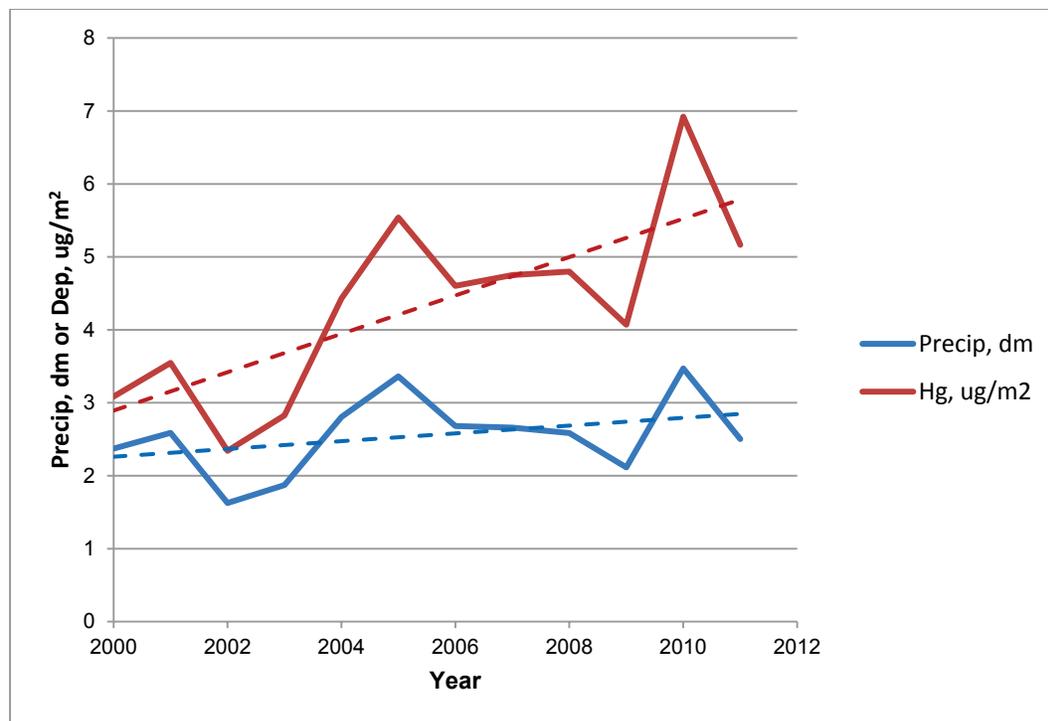


Figure 4.1-9 Estimated NTN-Correlated Annual Mercury Deposition

Ammonia Monitoring Network

Annual sampling data from two Ammonia Monitoring Network (AMoN) sites located in Navajo Lake and Farmington are compared and aggregated to provide a general estimate of historic ambient ammonia concentrations in the Four Corners region. Concentrations are calculated by NADP based on the AMoN diffusion filter method and measured air flow rates (NADP 2013).

For the historic 4-year 8-month period from January 2008 through August 2012, individual and aggregated site results are shown in Table 4.1-27 comprising units of nanograms per cubic meter (ng/m^3) and parts per billion by volume (ppbv) as reported by AMoN on a discrete sample basis (NADP 2013). Since the number of sites and samples is not large, absolute percent difference (variation) about the weighted arithmetic means are shown to assess measurement variability (consistency) from year-to-year. Figure 4.1-10 illustrates the results shown in Table 4.1-27 and contrasts them against the overall mean value obtained by averaging all samples overall years at both sites.

The trending results shown in Table 4.1-27 and Figure 4.1-10 indicate an apparent rise in mean ambient ammonia concentration of about 240 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) or about 0.3 ppbv, which is about a 40 percent increase, with an average annual variability of 15 percent over the course of the active monitoring period. This suggests that changes in ambient ammonia concentrations could be attributable to changes in fertilizer application, animal husbandry, or NO_x emissions controls on stationary sources. Another possible explanation for these changes is overall improvement in the relatively new measurement technique over time, from field procedures to laboratory analysis. This could have resulted in better sensitivity and data capture as the program progressed, which would tend to detect an analyte, which may have previously been under-detected or undetected; i.e., a lowering of the method detection limit (MDL).

Table 4.1-27 Historic Ambient Ammonia Concentration - 2 AMoN Sites

| Site ID Code | Year | Months Operation | Valid Samples | Days of Data | Measured Ammonia ng/m ³ | Measured Ammonia ppbv | Measured Ammonia variation |
|--------------|------|----------------------------------|---------------|--------------|------------------------------------|-----------------------|----------------------------|
| NM98 | 2008 | 12 | 18 | 246 | 331 | 0.48 | 14% |
| NM98 | 2009 | 12 | 26 | 356 | 354 | 0.51 | 8% |
| NM98 | 2010 | 10 | 20 | 270 | 463 | 0.67 | 20% |
| NM98 | 2011 | 12 | 26 | 348 | 330 | 0.47 | 14% |
| NM98 | 2012 | 8 | 17 | 236 | 483 | 0.70 | 25% |
| | | NM98 Weighted Average | 107 | 1456 | 385 | 0.55 | 17% |
| | | Trend | — | — | 112 | 0.16 | — |
| | | Change | — | — | 33% | 33% | — |
| NM99 | 2008 | 12 | 18 | 253 | 844 | 1.21 | 22% |
| NM99 | 2009 | 12 | 24 | 309 | 1,008 | 1.45 | 7% |
| NM99 | 2010 | 12 | 26 | 354 | 1,213 | 1.75 | 12% |
| NM99 | 2011 | 12 | 26 | 356 | 1,054 | 1.52 | 3% |
| NM99 | 2012 | 8 | 14 | 195 | 1,341 | 1.93 | 24% |
| | | NM99 Weighted Average | 108 | 1467 | 1,084 | 1.56 | 14% |
| | | Trend | — | — | 416 | 0.60 | — |
| | | Change | — | — | 47% | 47% | — |
| NM98/99 | 2008 | 24 | 36 | 499 | 592 | 0.85 | 20% |
| NM98/99 | 2009 | 24 | 50 | 665 | 658 | 0.95 | 11% |
| NM98/99 | 2010 | 22 | 46 | 624 | 887 | 1.28 | 21% |
| NM98/99 | 2011 | 24 | 52 | 704 | 696 | 1.00 | 5% |
| NM98/99 | 2012 | 16 | 31 | 431 | 870 | 1.25 | 18% |
| | | NM98/99 Composite Average | 215 | 2923 | 736 | 1.06 | 15% |
| | | Trend | — | — | 238 | 0.34 | — |
| | | Change | — | — | 38% | 38% | — |

Source: NADP 2013.

Note:

Variation is absolute difference between annual value and cumulative mean of annual values.

ng/m³ = nanogram(s) per cubic meter

ppbv = part(s) per billion (by volume)

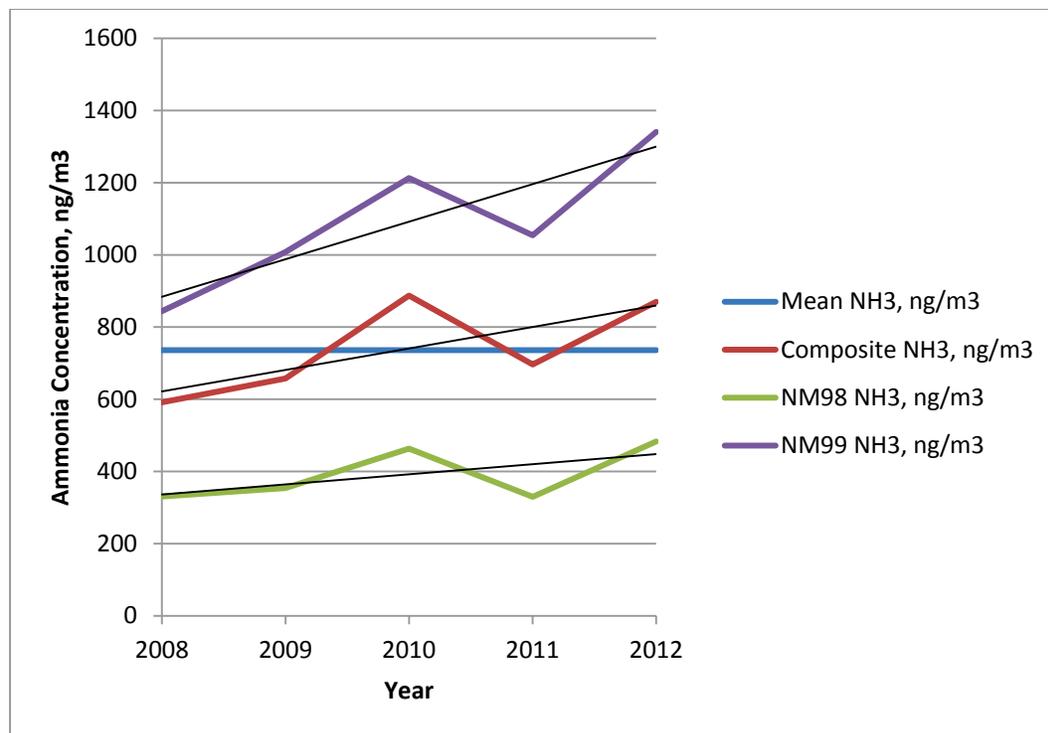


Figure 4.1-10 Historic Ambient Ammonia – Northwest New Mexico

4.1.2.7 Sensitive Receptors

Certain population groups are considered more sensitive to air pollution and odors than others; those that are particularly sensitive include children, elderly, and acutely ill and chronically ill persons, especially those with cardio respiratory diseases such as asthma and bronchitis. Sensitive receptors (land uses) indicate locations where such individuals are typically found, namely schools, daycare centers, hospitals, senior citizen centers, residences of sensitive persons, and parks with active recreational uses, such as youth sports.

Persons engaged in strenuous work or physical exercise also have increased sensitivity to poor air quality. Residential areas are considered more sensitive to air quality conditions than commercial and industrial areas, because people generally spend longer periods of time at their residences, resulting in greater exposure to ambient air quality conditions. Recreational uses such as parks are also considered sensitive, due to the greater exposure to ambient air quality conditions and because the presence of pollution detracts from the recreational experience.

Four Corners Power Plant

The FCPP generating units are located more than ½ mile from any sensitive land uses such as schools, hospitals, and senior citizen centers. The nearest sensitive receptors are homes located greater than 1 mile from the FCPP (see Figure 4.14-2).

Navajo Mine

Four residences are within 0.5 mile (800 meters) of the Pinabete SMCRA Permit Area. Of these four residences, three are located within the Pinabete SMCRA Permit Area boundary. MMCo has completed relocations of two of these residents out of the proposed mining area. MMCo has an agreement in place

with the third residence to relocate in advance of mining operations in Area IV South. Several other isolated single-family residences are in the vicinity of the proposed mining disturbance zone of Area IV North, the nearest of which is about 4,500 feet (1,370 meters) away. Three residences are within 1 mile (1,600 meters) of the edge of the disturbance area. Four additional residences lie within 1 mile (1,600 meters) of the mining disturbance zone of Area III within the Navajo Mine SMCRA Permit Area. The nearest structure is approximately 3,900 feet (1,190 meters) north of Area III (see Figure 4.14-2).

Transmission Lines

Numerous residences and other sensitive receptors, including parks, and schools, are located in close proximity (within ½ mile) to the transmission line ROWs.

4.1.3 Changes to Air Quality Affected Environment Post-2014

Two completed Federal Actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed Federal Actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section.

The transfer of the SMCRA permit for the Navajo Mine from BNCC to NTEC would not affect the air quality baseline.

The implementation of BART at FCPP would cause a substantial change to the environmental baseline. As part of a separate action, Southern California Edison divested its 48 percent share of Units 4 and 5 to APS. The sale was finalized December 30, 2013. APS notified EPA that the alternative emissions control strategy is preferred and subsequently APS shut down Units 1, 2, and 3 on December 30, 2013. Thus, emissions from Units 1, 2, and 3 have permanently ceased as of that date. As a result, there would be a transition period from 2014 to mid-2018 after which Units 1, 2, and 3 have been shut down and during which Units 4 and 5 would operate without SCR. This interim air quality baseline is presented in this section. Once BART and MATS are fully implemented after 2018 (i.e., post-2018 emissions from Units 4 and 5), the reduction in air emissions from FCPP would decrease substantially. Table 4.1-28 summarizes the reductions.

Table 4.1-28 Summary of Air Emission Reductions from BART Compliance at FCPP

| Criteria Pollutants, Greenhouse Gases and Target Metals | Historic Pre-2014 Baseline Emissions Units 1, 2, 3, 4, 5 tons/yr | Estimated Post-2018 Baseline Emissions Units 4 & 5 tons/yr | Post-2018 versus Pre-2014 Baseline Reduction Percent |
|---------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------|
| Sulfur Dioxide (SO ₂) | 11,971 | 9,800 | 18% |
| Nitrogen Oxides (NO _x) | 41,121 | 5,420 | 87% |
| Carbon Monoxide (CO) | 2,096 | 1,580 | 25% |
| Filterable Particulate (PM) | 1,976 | 830 | 58% |
| Carbon Dioxide Equivalents (CO ₂ e) | 15,439,236 | 11,396,710 | 26% |
| Arsenic (As) | 1.78 | 0.06 | 96% |
| Lead (Pb) | 1.82 | 0.07 | 96% |
| Mercury (Hg) | 0.36 | 0.07 | 81% |
| Selenium (Se) | 5.63 | 0.28 | 95% |

tons/yr = tons per year

4.1.3.1 Stationary Source Emissions

Pursuant to 40 CFR 49, Source Specific FIP for Implementing BART for FCPP: Navajo Nation, the primary goal of controlling NO_x emissions from FCPP is to reduce PM_{2.5} precursors and thereby improve visibility in the region. Table 4.1-29 shows historic generation (kg/MW-hr, same as grams per KW-hour) from Units 1, 2, and 3 for the representative 12-year period 2000-2011; and Table 4.1-30 shows historic generation from Units 4 and 5. These two tables split SO₂, NO_x, and PM data to illustrate the relative contributions of the older, less efficient generating units (1, 2, and 3) and the newer, more efficient generating units (4 and 5).

Table 4.1-29 Historic Grouped Part 75 Emissions - ORISPL 2442 Units 1, 2, and 3 (to be decommissioned)

| Year | Generation MW-hrs/yr | Sulfur Dioxide tons/yr | Sulfur Dioxide kg/MW-hr | Nitrogen Oxides tons/yr | Nitrogen Oxides kg/MW-hr | Particulate Matter tons/yr | Particulate Matter kg/MW-hr |
|----------------------|-------------------------|------------------------------|-------------------------------|-------------------------------|--------------------------------|----------------------------------|-----------------------------------|
| 2000 | 4,550,595 | 11,387 | 2.27 | 15,201 | 3.03 | 1,240 | 0.25 |
| 2001 | 4,642,272 | 12,779 | 2.50 | 16,997 | 3.32 | 1,299 | 0.25 |
| 2002 | 4,664,651 | 10,783 | 2.10 | 16,403 | 3.19 | 1,256 | 0.24 |
| 2003 | 4,503,798 | 9,887 | 1.99 | 15,316 | 3.09 | 1,152 | 0.23 |
| 2004 | 4,799,830 | 4,966 | 0.94 | 16,798 | 3.17 | 1,227 | 0.23 |
| 2005 | 4,936,157 | 3,501 | 0.64 | 16,743 | 3.08 | 1,254 | 0.23 |
| 2006 | 4,683,715 | 3,170 | 0.61 | 16,722 | 3.24 | 1,202 | 0.23 |
| 2007 | 4,851,740 | 2,643 | 0.49 | 17,079 | 3.19 | 1,252 | 0.23 |
| 2008 | 4,823,075 | 2,853 | 0.54 | 16,390 | 3.08 | 1,245 | 0.23 |
| 2009 | 4,780,246 | 2,736 | 0.52 | 16,008 | 3.04 | 1,220 | 0.23 |
| 2010 | 4,646,445 | 2,914 | 0.57 | 16,301 | 3.18 | 1,221 | 0.24 |
| 2011 | 4,258,209 | 3,052 | 0.65 | 15,315 | 3.26 | 1,133 | 0.24 |
| Historic Baseline | 4,711,369 | 2,981 | 0.57 | 16,365 | 3.15 | 1,218 | 0.23 |
| Plantwide Share | 29% | 25% | — | 40% | — | 62% | — |

Source: EPA 2012h.

Notes:

PM calculated per AP-42 Chapter 1.1 support document Tables 4-7 and A-3; Title V permit condition (Units 1, 2, and 3).

Baseline period is 2005-11 (flue gas desulfurization, FGD, installed on Units 4 and 5).

kg/MW-hr = kilogram(s) per megawatt-hour

MW-hrs/yr = megawatt hours per year

tons/yr = tons per year

Table 4.1-30 Historic Grouped Part 75 Emissions - ORISPL 2442 Units 4 and 5

| Year | Generation MW-hrs/yr | Sulfur Dioxide tons/yr | Sulfur Dioxide kg/MW-hr | Nitrogen Oxides tons/yr | Nitrogen Oxides kg/MW-hr | Particulate Matter tons/yr | Particulate Matter kg/MW-hr |
|----------------------|-------------------------|------------------------------|-------------------------------|-------------------------------|--------------------------------|----------------------------------|-----------------------------------|
| 2000 | 11,558,538 | 26,945 | 2.11 | 31,312 | 2.46 | 867 | 0.07 |
| 2001 | 11,829,836 | 26,785 | 2.05 | 30,303 | 2.32 | 870 | 0.07 |
| 2002 | 10,104,338 | 22,064 | 1.98 | 25,174 | 2.26 | 715 | 0.06 |
| 2003 | 12,354,084 | 25,207 | 1.85 | 29,880 | 2.19 | 846 | 0.06 |
| 2004 | 11,334,289 | 15,976 | 1.28 | 23,944 | 1.92 | 737 | 0.06 |
| 2005 | 11,892,933 | 9,152 | 0.70 | 25,000 | 1.91 | 796 | 0.06 |
| 2006 | 12,478,900 | 12,022 | 0.87 | 27,927 | 2.03 | 838 | 0.06 |
| 2007 | 10,848,702 | 7,596 | 0.64 | 24,004 | 2.01 | 728 | 0.06 |
| 2008 | 10,998,224 | 7,546 | 0.62 | 23,922 | 1.97 | 724 | 0.06 |
| 2009 | 12,024,518 | 9,714 | 0.73 | 26,503 | 2.00 | 810 | 0.06 |
| 2010 | 10,308,601 | 8,129 | 0.72 | 22,536 | 1.98 | 687 | 0.06 |
| 2011 | 10,808,075 | 8,770 | 0.74 | 23,397 | 1.96 | 719 | 0.06 |
| Historic Baseline | 11,337,136 | 8,990 | 0.72 | 24,756 | 1.98 | 757 | 0.06 |
| Plantwide Share | 71% | 75% | — | 60% | — | 38% | — |

Source: EPA 2012h.

Notes:

PM calculated per AP-42 Chapter 1.1 support document Tables 4-7 and A-3; 40 CFR 49 final rule (Units 4, 5).

Baseline period is 2005-11 (flue gas desulfurization, FGD, installed on Units 4 and 5).

kg/MW-hr = kilogram(s) per megawatt-hour

MW-hrs/yr = megawatt hours per year

tons/yr = tons per year

As shown in Tables 4.1-29 and 4.1-30, Units 1, 2, and 3 generated 29 percent of electric power at FCPP during the baseline period but emitted 40 percent of NO_x and 62 percent of PM while Units 4 and 5 generated 71 percent of electric power but emitted 60 percent of NO_x and 38 percent of PM. Emissions of SO₂ are about on-par with generation percentages. This demonstrates that Units 4 and 5 are more efficient and have lower NO_x and PM emission rates in units of kg/MW-hr.

4.1.3.2 Hazardous Air Pollutants

Coal combustion in power plant boilers emits a wide variety of inorganic and organic HAPs. Tables 4.1-31 and 4.1-32 show estimated average annual HAP emissions from FCPP based on historic (pre-2014) operating data prior to implementation of 40 CFR 63 Subpart UUUUU for Units 1, 2, 3, 4, and 5, and projected (post-2014) average annual HAP emissions from Units 4 and 5 operating in compliance with 40 CFR 63 Subpart UUUUU. For the pre-2014 condition, emissions are totaled for Units 1 through 5, Units 1, 2, and 3 (decommissioned in 2013), and Units 4 and 5 to show the relative contributions of the grouped units. Estimated HAP emissions are based on historic operating data, projected operating data, and regulatory default emission factors published by the EPA (EPA 2011a, 40 CFR 63 Subpart UUUUU).

Table 4.1-31 Estimated Historic and Future HAP Metals Emissions - ORISPL 2442

| HAP (Metals) | 2000-11 Units 1 - 5 Average lbs/yr | 2000-11 Units 1, 2, and 3 Average lbs/yr | 2000-11 Units 4 and 5 Average lbs/yr | 2014 Units 4 and 5 Average lbs/yr | Comparison of Historic Levels to Baseline Reduction Percent |
|------------------------------------------------|------------------------------------------------|------------------------------------------------------|--------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------|
| Antimony (Sb) | 156 | 50 | 106 | 91 | 42% |
| Arsenic (As) | 3,552 | 1,140 | 2,412 | 124 | 96% |
| Beryllium (Be) | 182 | 58 | 124 | 23 | 88% |
| Cadmium (Cd) | 442 | 142 | 300 | 34 | 92% |
| Chromium (Cr) | 2,252 | 723 | 1,530 | 317 | 86% |
| Cobalt (Co) | 866 | 278 | 588 | 91 | 90% |
| Copper (Cu) | 4,938 | 1,584 | 3,354 | 702 | 86% |
| Lead (Pb) | 3,639 | 1,167 | 2,471 | 136 | 96% |
| Manganese (Mn) | 4,245 | 1,362 | 2,883 | 453 | 89% |
| Mercury (Hg) | 719 | 231 | 488 | 136 | 81% |
| Nickel (Ni) | 2,426 | 778 | 1,648 | 396 | 84% |
| Selenium (Se) | 11,262 | 3,613 | 7,649 | 566 | 95% |
| Overall Reduction (all metals) | | | | | 91% |
| Average FCPP Generation (MW-hrs/yr) | 16,056,814 | 4,678,394 | 11,378,420 | 12,410,900 | 23% |

Sources: 77 FR 32 Tables 3 and 5; 40 CFR 63 Subpart UUUUU Table 2; EPA 2011a (AP-42 Tables 1.1-13, -14, -15, -18)

Notes:

For metals, pre-Project (2000-11) AP-42 Table 1.1-18, post-Project (2014-25) Part 63 Subpart UUUUU Table 2.

For coal-fired units not low rank virgin coal.

Megawatts (MW) gross electric power output.

Part 63 regulation assumes heat rate = 10,000 BTU/KW-hr = 34.13% conversion efficiency.

Higher heating value (HHV) of Navajo coal = 17.632 mmBTU/ton (AP-42 Section 1.1 Background Table A-3).

AP-42 emission factors rated "E" (poor) not used.

Assumed future annual gross heat input based on 2000-11 historic actual capacity factors plus contingency margin.

Capacity factor contingency margin = 9%.

Copper not a 40 CFR 63 Subpart UUUUU metal; included here for consistency with ERA modeling protocol.

Copper estimated based on chromium (metal with closest boiling point) and 2010 FCPP TRI Cu/Cr ratio of 2.21.

lbs/yr = pounds per year

Table 4.1-32 Estimated Historic and Future HAP Nonmetals Emissions - ORISPL 2442

| HAP (Organics and Inorganics) | 2000-11 Units 1 - 5 Average lbs/yr | 2000-11 Units 1, 2, and 3 Average lbs/yr | 2000-11 Units 4 and 5 Average lbs/yr | 2014 Units 4 and 5 Average lbs/yr | Comparison of Historic Levels to Baseline Reduction Percent |
|---------------------------------------|------------------------------------------------|------------------------------------------------------|--------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------|
| Acetaldehyde | 4,938 | 1,584 | 3,354 | 3,658 | 26% |
| Acetophenone | 130 | 42 | 88 | 96 | 26% |
| Acrolein | 2,512 | 806 | 1,706 | 1,861 | 26% |
| Benzene | 11,262 | 3,613 | 7,649 | 8,343 | 26% |
| Benzyl chloride | 6,064 | 1,946 | 4,119 | 4,493 | 26% |
| Bis (2-ethylhexyl)phthalate (DEHP) | 632 | 203 | 430 | 469 | 26% |
| Carbon disulfide | 1,126 | 361 | 765 | 834 | 26% |
| Chlorobenzene | 191 | 61 | 129 | 141 | 26% |
| Chloroform | 511 | 164 | 347 | 379 | 26% |
| Cyanide | 21,659 | 6,949 | 14,710 | 16,045 | 26% |
| 2,4-Dinitrotoluene | 3 | 1 | 2 | 2 | 26% |
| Ethyl benzene | 814 | 261 | 553 | 603 | 26% |
| Ethyl chloride | 364 | 117 | 247 | 270 | 26% |
| Formaldehyde | 2,079 | 667 | 1,412 | 1,540 | 26% |
| Hexane | 580 | 186 | 394 | 430 | 26% |
| Hydrogen chloride | 10,396,140 | 3,335,293 | 7,060,847 | 226,323 | 98% |
| Hydrogen fluoride | 1,299,518 | 416,912 | 882,606 | 962,694 | 26% |
| Isophorone | 5,025 | 1,612 | 3,413 | 3,722 | 26% |
| Methyl bromide | 1,386 | 445 | 941 | 1,027 | 26% |
| Methyl chloride | 4,592 | 1,473 | 3,119 | 3,402 | 26% |
| Methyl ethyl ketone | 3,379 | 1,084 | 2,295 | 2,503 | 26% |
| Methylene chloride | 2,512 | 806 | 1,706 | 1,861 | 26% |
| PAHs (composite total) | 180 | 58 | 122 | 133 | 26% |
| Phenol | 139 | 44 | 94 | 103 | 26% |
| Propionaldehyde | 3,292 | 1,056 | 2,236 | 2,439 | 26% |
| Tetrachloroethylene | 373 | 120 | 253 | 276 | 26% |
| Toluene | 2,079 | 667 | 1,412 | 1,540 | 26% |
| Styrene | 217 | 69 | 147 | 160 | 26% |
| Xylenes (o,m,p) | 321 | 103 | 218 | 237 | 26% |
| Average Generation (MW-hrs/yr) | 16,056,814 | 4,678,394 | 11,378,420 | 12,410,900 | 23% |

Sources: 77 FR 32 Tables 3 and 5; 40 CFR 63 Subpart UUUUU Table 2; EPA 2011a (AP-42 Tables 1.1-13, -14, -15, -18)

Notes:

For HCl, pre-Project (2000-11) AP-42 Table 1.1-15, post-Project (2014-25) Part 63 Subpart UUUUU Table 2.

For coal-fired units not low rank virgin coal.

MW gross electric power output.

Part 63 regulation assumes heat rate = 10,000 BTU/KW-hr = 34.13% conversion efficiency.

Higher heating value (HHV) of Navajo coal = 17.632 mmBTU/ton (AP-42 Section 1.1 Background Table A-3).

AP-42 emission factors rated "E" (poor) not used.

Assumed future annual gross heat input based on 2000-11 historic actual capacity factors plus contingency margin.

Capacity factor contingency margin = 9%.

lbs/yr = pounds per year

As shown in Table 4.1-31, the shutdown of Units 1, 2, and 3 and compliance with 40 CFR 63 Subpart UUUUU for Units 4 and 5 would reduce estimated annual metal HAP emissions by about 91 percent overall compared to estimated historic regulatory default emissions. The Human Health Risk Assessment (AECOM 2013d) used EPRI emissions factors for calculating FCPP HAPS emission levels instead of AP-42 emissions factors. Use of EPRI emissions factors results in lower historic emissions and, therefore, a lower estimate of reductions compared to post-2014 emissions, as follows: a 37 percent reduction for all HAP metals (except mercury and selenium), a 67 percent reduction in mercury emission estimates, and a 79 percent reduction in selenium emission estimates over 2000-2011 levels. This reduction is largely due to the shutdown of Units 1, 2, and 3 and partially due to MATS compliance on Units 4-5. The use of the AP-42 emissions factors is appropriate and is consistent with other EIS analyses.

As shown in Table 4.1-32, except for hydrogen chloride (an acid gas), estimated emissions of nonmetal HAPs would be reduced by about 26 percent overall compared to estimated historic emissions. However, beginning in 2014, nonmetal inorganic and organic HAP emissions from Units 4 and 5 specifically may increase about 9 percent compared to recent 12-year historic levels for these Units due to the potential for increased generation following the shutdown of Units 1, 2, and 3.

4.1.3.3 Visibility/Regional Haze

Closure of Units 1, 2, and 3 and implementation of SCR on Units 4 and 5 would yield a compound NO_x reduction of about 87 percent on a plantwide basis. Because NO_x is an O₃ precursor, elimination of up to 35,700 tpy (98 tons per day) of NO_x emissions⁸ would result in a clean air benefit for the region in addition to an incremental improvement in regional haze and visibility.

A regional assessment of O₃ precursor (VOCs and NO_x) emissions was conducted to show the predicted fourth-highest maximum 8-hour impacts for PSD Class I and affected sensitive Class II areas.

Tables 4.1-33 through 4.1-35 summarize the decrease in O₃ levels at Class I and Class II areas in the region that would occur by the end of the baseline period, in comparison to historic levels.

⁸ Potential reduction from 41,100 tpy (pre-Project) to 5,400 tpy (post-Project).

Table 4.1-33 Fourth-Highest Maximum 8-Hour Ozone Impacts - PSD Class I Areas

| | Historic Ozone¹ ppbv | Baseline Ozone² ppbv | Endpoint NAAQS status |
|----------------------------------------------|--------------------------------------------|--------------------------------------------|------------------------------|
| Sixteen Class I Areas | | | |
| Petrified Forest National Park (AZ) | 69.9 | 67.9 | Meet |
| Grand Canyon National Park (AZ) | — | — | — |
| Capitol Reef National Park (UT) | — | — | — |
| Canyonlands National Park (UT) | 62.4 | 61.0 | Meet |
| Arches National Park (UT) | — | — | — |
| Mesa Verde National Park (CO) | 67.3 | 65.0 | Meet |
| Black Canyon of the Gunnison Wilderness (CO) | — | — | — |
| Weminuche Wilderness (CO) | 75.5 | 74.7 | Meet |
| La Garita Wilderness (CO) | 76.2 | 75.4 | Exceed |
| West Elk Wilderness (CO) | — | — | — |
| Maroon Bells – Snowmass Wilderness (CO) | — | — | — |
| Great Sand Dunes National Monument (CO) | — | — | — |
| Wheeler Peak Wilderness (NM) | — | — | — |
| Pecos Wilderness (NM) | 69.0 | 66.8 | Meet |
| Bandelier National Monument (NM) | 69.1 | 66.8 | Meet |
| San Pedro Parks Wilderness (NM) | 70.0 | 67.5 | Meet |

Notes:

bolded values indicate exceedances.

¹ Year 2005.

² Year 2018 (note that modeling results were not available for 2013. 2018 represents the period wherein Units 1, 2, and 3 have been shut-down and SCR has been installed on Units 4 and 5.

ppbv = parts per billion by volume

Table 4.1-34 Fourth-Highest Maximum 8-Hour Ozone Impacts - Affected Sensitive Class II Areas

| | Historic Ozone¹ ppbv | Baseline Ozone² ppbv | Endpoint NAAQS status |
|--------------------------------------------------------|--------------------------------------------|--------------------------------------------|------------------------------|
| Affected Sensitive Class II Areas | | | |
| Carson National Forest | 75.2 | 72.0 | Meet |
| Grand Mesa, Uncompahgre, and Gunnison National Forests | 76.2 | 75.4 | Exceed |
| Handies Peak Wilderness Study Area | 75.1 | 74.3 | Meet |
| Jicarilla Apache Indian Reservation | 75.2 | 72.3 | Meet |
| Navajo Nation | 78.7 | 74.9 | Meet |
| Redcloud Peak Wilderness Study Area | 74.9 | 74.0 | Meet |
| Rio Grande National Forest | 76.0 | 75.2 | Exceed |
| San Juan National Forest | 75.1 | 74.2 | Meet |
| Uncompahgre Wilderness Area (BLM managed) | 75.0 | 74.1 | Meet |
| Uncompahgre Wilderness Area (USFS managed) | 74.9 | 74.1 | Meet |

Notes:

bolded values indicate exceedances.

¹ Year 2005.

² Year 2018 (note that modeling results were not available for 2013. 2018 represents the period wherein Units 1, 2, and 3 have been shut-down and SCR has been installed on Units 4 and 5.

ppbv = parts per billion by volume

Table 4.1-35 Attainment Test 8-Hour Ozone Design Values - Four Corners Region

| Areas and Monitoring Sites | Historic Ozone ¹ ppbv | Baseline Action Ozone ² ppbv | Endpoint NAAQS Status |
|------------------------------------------|-------------------------------------|--------------------------------------------|-----------------------|
| San Juan County, New Mexico (35-45-0009) | 69.7 | 66.5 | Meet |
| San Juan County, New Mexico (35-45-1005) | 71.3 | 68.1 | Meet |
| La Plata County, Colorado (08-67-1004) | 72.0 | 69.8 | Meet |
| La Plata County, Colorado (08-67-7003) | 63.7 | 60.3 | Meet |
| Montezuma County, Colorado (08-83-0101) | 72.0 | 65.1 | Meet |

Source: AECOM 2013b.

¹ Year 2005.

² Year 2018 (note that modeling results were not available for 2013. 2018 represents the period wherein Units 1, 2, and 3 have been shut-down and SCR has been installed on Units 4 and 5.

ppbv = parts per billion by volume

The 2005 Baseline simulation was conducted using the 2005 Four Corners Air Quality Study regional emissions inventory from SLAMS and NADP sites Part 75 data for FCPP (AECOM 2013b). The report is also the source of the two future year 2018 scenarios developed to assess the impacts of the proposed FCPP proposed action. Regional comparisons show an overall decrease in cumulative O₃ concentrations for the 2018 year simulations relative to the 2005 baseline. The largest changes occur in the western and central areas of the 4-km domain where the model-predicted fourth-highest daily maximum 8-hour average O₃ concentrations decrease to 7 ppbv. The only locations where O₃ is observed to increase are in San Juan County in New Mexico, in an area immediately downwind of the FCPP. The maximum increase in the fourth-highest 8-hour O₃ occurs in a region where ozone concentrations do not exceed the NAAQS. These impacts occur almost entirely in San Juan County, New Mexico about 11 miles southeast of the FCPP and about 16 miles southwest of Farmington.

In 2005, four Class I and Class II areas exceeded the NAAQS; La Garita Wilderness Area, Grand Mesa National Forest, Navajo Nation, and Rio Grande National Forest. The 2018 model-predicted results indicate none of these areas would exceed the NAAQS. The FCPP does not contribute to the O₃ concentrations in any of these areas, as the FCPP contribution in these areas is 0.0 ppbv. The unmonitored area analysis indicated that in 2005 there was one sensitive Class II area, Sandia Mountain Wilderness Area, with modeled O₃ exceedences. By 2018, the O₃ concentrations in this area will decrease but O₃ exceedences may still occur episodically. The FCPP contributes 0.1 ppbv at Sandia Mountain.

The model-predicted FCPP O₃ contribution at the Navajo Nation is 0.6 ppb. The monitored area analysis indicates that in 2005 one monitor exceeded the NAAQS, but by 2018, no monitors in the 4-km modeling domain would exceed the NAAQS. Using this method to predict future O₃ concentrations, the O₃ levels at the Navajo Nation are notably lower than the absolute model impacts and the contribution of the FCPP to this area is between 0.0 and 0.1 ppbv.

O₃ concentrations are predicted to decrease in 2018 throughout the 4-km modeling domain relative to conditions in 2005. Overall, the model-predicted future O₃ concentrations are similar regardless of the methods used to analyze the results. Modeled O₃ impacts from the FCPP in 2018 under the Proposed Action do not contribute to areas that may continue to have O₃ concentrations that exceed the NAAQS.

The analysis indicates that under baseline conditions, after implementation of the new BART upgrades to FCPP, no monitoring sites are expected to exceed the 8-hour O₃ NAAQS. Five O₃ monitors are in the vicinity with predicted nonzero impacts ranging from 0.2 to 1.0 ppbv. In general, ambient O₃ concentrations are predicted to decrease under baseline conditions relative to historic conditions in 2005 (AECOM 2013b).

4.1.3.4 Atmospheric Deposition

Under the FIP for FCPP, APS shut down Units 1, 2, and 3 on December 30, 2013. As shown in Table 4.1-29, the shut-down of these units reduced the SO₂ and NO_x emissions by 18 and 87 percent, respectively, on a plantwide basis, and 4 and 34 percent, respectively, on a regional basis. In general, these emissions reductions could incrementally lower acid deposition impacts downwind of FCPP to some extent, subject to assessment through long-term monitoring.

As shown in Table 4.1-29, shut-down of Units 1, 2, and 3 resulted in an approximate 90 percent overall reduction in metals emissions, when considered in combination with Units 4 and 5 operating in compliance with 40 CFR 63 Subpart UUUUU and Part 71 permit conditions. In particular, emissions of mercury are about 80 percent lower than uncontrolled regulatory default levels. Similarly, other large emissions reductions (over 90 percent) would include arsenic, cadmium, Pb, and selenium.

As shown in Table 4.1-13, there is an approximate 25 percent overall reduction in nonmetal inorganic and organic HAP emissions due to closure of Units 1, 2, and 3 in combination with Units 4 and 5 operating in compliance with 40 CFR 63 Subpart UUUUU and Part 71 permit conditions. Subpart UUUUU hydrogen chloride acid gas (a precursor to chloride ion, Cl⁻) emissions are over 90 percent lower than uncontrolled regulatory default levels due to absorption in the caustic wet scrubbers used to control SO₂ emissions from Units 4 and 5.

4.1.4 Environmental Consequences

The following sections present the results of the quantitative assessment of emissions from FCPP and the Navajo Mine from 2016 to 2041. Emissions from continued operation of the transmission lines would have minor impact compared to any potential impact from the FCPP and Navajo Mine; therefore, these are described qualitatively. Predicted emissions from FCPP are based on historic operating data reported to the EPA and estimated mining emissions are cited from the recent *Area IV North EA/Finding of No Significant Impact* (OSMRE 2012b). For FCPP, projected PM emissions are calculated based on EPA data, permit conditions, and process rates. In addition to criteria pollutants, estimated future emissions of noncriteria HAPs from FCPP are based on historic operating data and regulatory air emission factors published by the EPA.

4.1.4.1 Modeling

Extensive modeling efforts were conducted in order to assess the potential effects to air quality. This includes a NAAQS Modeling Study (AECOM 2013a) and an Ozone Impact Assessment (AECOM 2013b). Also conducted was a plume visibility assessment to evaluate the potential contributions of the Proposed Action on regional haze. The results of these models have been critically reviewed by Federal agencies (e.g., NPS, EPA), and where applicable, are incorporated into the impact analyses for each alternative. The analyses predict the rate and mass of air emissions and atmospheric deposition, typically presenting the rates by year or as annual averages. In this way, the cumulative effects of 25 years of combustion of coal at FCPP are described. A brief summary description of the methodology of each model is provided below.

NAAQS Modeling Study Summary

The *NAAQS Modeling Study* (2013a) evaluated the impacts of criteria emissions from FCPP Units 4 and 5 on local ambient air quality, along with fugitive dust emissions from mining, coal handling, lime handling, ash placement, and vehicle traffic on mine and plant roads, including employee vehicles. The objective of the study was to determine whether criteria emissions from FCPP and Navajo Mine would cause an exceedance of NAAQS. This is particularly important for SO₂ and NO₂ because current NAAQS are more stringent (lower) than when prior air quality studies (NMED 2009) were performed.

The modeling analyses for the power plant and mine were based on procedures contained in the *Guideline on Air Quality Models*, which is codified in 40 CFR Part 51, Appendix W (EPA 2005a). The guideline asserts that the suitability of an air quality dispersion model for a particular application is dependent upon several criteria, which include (1) stack height relative to nearby structures, (2) dispersion environment, (3) local terrain, and (4) availability of representative meteorological data. Based on a review of these factors, the most current version of the AERMOD⁹ program was used to quantify emissions from the FCPP and Navajo Mine (AECOM 2014a).

The NAAQS Modeling Study was performed using EPA's latest version of AERMOD dispersion model (version 13350). Issues were previously identified that in low wind conditions, the friction velocity formulation in AERMOD results in under-predictions of an important planetary boundary layer parameter (EPA 2004). These issues were addressed in AERMET and AERMOD versions 13350. During an EPA webinar on January 14, 2014, EPA staff stated that they are generally in favor of the AERMET beta u* option as it is based on peer-reviewed activities.

Ozone Impact Assessment Summary

As part of the NAAQS assessment, APS conducted photochemical modeling on a regional level to assess the impacts of NO_x emissions from FCPP. The assessment was conducted by modeling FCPP emissions in combination with other regional sources and comparing the resulting O₃ concentrations to the current 8-hour O₃ NAAQS and also the former (1979-97) 1-hour O₃ NAAQS. O₃ impacts were assessed near FCPP (maxima), in nearby PSD Class I and sensitive Class II areas, and at existing O₃ monitoring sites (AECOM 2013b).

For consistency and economy, APS utilized input data, configurations, and supporting information for the CAMx modeling program¹⁰, which was used for the Four Corners Air Quality Study (NMED 2009). As part of the modeling procedure, the Four Corners Air Quality Study regional emissions inventory was updated with current data for other sources in the 4-km domain, and APS provided updated emissions for FCPP consistent with the final BART rule. The modeling period spanned May through August because monitored O₃ concentrations are highest during the summer months due to stronger sunlight, which drives photochemical reactions.

Impacts on regional O₃ concentrations were evaluated by using CAMx to simulate three scenarios for the years 2005 and 2018:

1. The 2005 Baseline simulation used the updated Four Corners Air Quality Study 2005 emissions inventory for an analysis of current air quality conditions. Modeling emissions for 2005 established historic air quality levels against which the alternatives were evaluated.
2. The 2018 No Action Alternative simulation was based on Four Corners Air Quality Study 2018 Mitigation Scenario No. 4 and included impacts for all regional emissions except those from FCPP. This scenario hypothetically applied aggressive NO_x and SO₂ control measures at coal-fired power plants in the region as well as new controls on oil and gas industry NO_x and VOC sources in San Juan and Rio Arriba counties.
3. The 2018 Proposed Action was also based on Four Corners Air Quality Study 2018 Mitigation Scenario No. 4 and includes contributions from estimated future emissions from Units 4 and 5.

The outputs of the three CAMx simulations were post-processed to perform the following analyses: (1) assessment of maximum O₃ impacts due to the Proposed Action; (2) comparison of modeled

⁹ AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources and both simple and complex terrain. It is the regulatory default model required to be used for SIP revisions for existing sources, and for New Source Review (NSR) and PSD programs.

¹⁰ The CAMx modeling system includes a meteorological model, an emissions data processor, and a photochemical grid model.

concentrations to the 8-hour O₃ NAAQS; and, (3) attainment tests for monitored and unmonitored areas, including PSD Class I and sensitive Class II areas.

The NPS has expressed concern that a 5-year old estimated regional future emissions scenario developed as part of the Four Corners Air Quality Study (NMED 2009) and used to predict O₃ levels for 2018 may have overestimated future NO_x emissions from FCPP and San Juan Generating Station while possibly underestimating future VOC emissions from the oil and gas industry in the region. This suggested that the 2018 emissions scenario may not have been totally credible with respect to today's view of the near future (i.e., generating unit shutdowns and slower growth in the oil and gas industry). However, due to conservative assumptions made for the O₃ impact modeling, any re-modeled O₃ impacts would not be significantly different from the original impacts and overall conclusions would remain the same.

Deposition Effects – Monitoring Networks

Estimates or assumptions used to predict future conditions can introduce some level of uncertainty into forecasts. In *Guidelines for Ecological Risk Assessment*, the EPA notes that a major source of uncertainty is extrapolation (i.e., the greater [or longer] the extrapolation, the greater the uncertainty) (EPA 1998a). This point is particularly true for screening-level forecasts or assessments, where assumptions are generally intended to provide conservative upper-bound estimates. However, it is important to recognize that findings made using these techniques do not necessarily mean that predicted conditions would actually occur under real circumstances. The following predictions of deposition monitoring network observations are based on extrapolation of historic data while taking into account the anticipated impacts of the alternatives and other changes in the region (i.e., emissions reductions). Thus, the results are somewhat uncertain, but provide an upper bound to the impacts.

To delineate the area to be evaluated in the Ecological Risk Assessment (discussed in detail in Section 4.8, Threatened and Endangered Species), deposition modeling was conducted using the CALPUFF¹¹ model. A screening procedure was applied to estimate potential changes to soil concentrations of selected metals associated with 25 years of cumulative deposition from future FCPP operations. The estimated concentrations of emitted metals in ambient air and the amount deposited to surface soil were calculated and compared to measured soil concentrations within San Juan County (AECOM 2013c).

Eight metals were selected for initial modeling in the FCPP/Navajo screening procedure: arsenic, cadmium, chromium, mercury, antimony, lead, copper, and selenium (AECOM 2013c). The CALPUFF model was applied within a 300-km (186-mile) radius of FCPP to simulate dispersion and deposition of the eight metals due to continuous full load (99th percentile) operation of FCPP for 25 years. The deposition area was determined by predicting where incremental increases in soil concentrations of any of the eight metals was more than 1 percent of present-day concentrations per data provided by the U.S. Geological Survey (USGS). This procedure determined that the deposition area extended less than 50 km (31 miles) from FCPP; therefore, more detailed air dispersion and deposition modeling was performed using AERMOD¹² and refined emissions estimates. The same comparative procedures were used to estimate impacted soil concentrations against the USGS data, and it was found that the deposition patterns of the CALPUFF and AERMOD analyses were similar in shape and overlapped significantly, thus providing a validation of the modeling results (AECOM 2013c).

Significance Thresholds

Significance thresholds for evaluating air quality impacts with regard to criteria pollutants are defined in the CAA. With regard to visibility, significance thresholds have been defined by the EPA. In terms of potential impacts of HAPs on sensitive receptors, no EPA, NNEPA or other local regulatory threshold has

¹¹ CALPUFF is the EPA-approved model to simulate dispersion and deposition over a large area for long-range transport and complex terrain on scales of tens to hundreds of kilometers. The 300 km (186-mile) radius was selected to encompass a large distance from FCPP for screening purposes.

¹² AERMOD is the EPA-approved steady-state plume model that incorporates air dispersion for simple and complex terrains and is designed for short-range modeling up to 50 km (31 miles).

been defined; therefore, the threshold used by air quality agencies outside of the Four Corners region is used to evaluate potential impacts. No significance thresholds are defined with regard to deposition of air emissions. This information is presented within this impacts chapter to provide data regarding the area of deposition under each alternative; however, impacts of deposition are assessed in Section 4.5, Water Resources, and Section 4.8, Special-Status Species, as applicable.

Criteria Emissions

Pursuant to 40 CFR 51.166(23)(i), PSD significance thresholds related to NAAQS are shown below. Per the regulatory definition, *significant* means a net emissions increase at an existing source (e.g., FCPP) or the potential of a new source to emit air pollutants that would equal or exceed any of the mass rates in units of short tpy as listed in Table 4.1-36.

Table 4.1-36 PSD Emission Significance Thresholds

| PSD Pollutant | Significance Threshold |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Carbon monoxide | 100 tpy |
| Nitrogen oxides | 40 tpy |
| Sulfur dioxide | 40 tpy |
| Particulate matter | 25 tpy (total) or 15 tpy of PM ₁₀ |
| PM _{2.5} | 10 tpy of direct PM _{2.5} emissions; 40 tpy of SO ₂ emissions; 40 tpy of NO _x emissions unless demonstrated not to be a PM _{2.5} precursor |
| Ozone | 40 tpy VOCs or NO _x precursors |
| Lead | 0.6 tpy |
| Fluorides | 3 tpy |
| Sulfuric acid mist (H ₂ SO ₄) | 7 tpy |
| Hydrogen sulphide | 10 tpy |
| Total reduced sulphur (including H ₂ S) | 10 tpy |
| Reduced sulphur compounds (including H ₂ S) | 10 tpy |

Key concepts in projecting future emissions are capacity factor and potential-to-emit (PTE), as defined below:

- Capacity factor is defined as actual utilization divided by theoretical design capacity. For generating units, this factor is typically expressed as actual MW-hrs generated in a year versus design rating in MW times 8,760 hours per year (maximum theoretical MW-hrs). Since generating units must be periodically shut down for maintenance and seldom operate at full design rating (load) to extend equipment life, capacity factor is always less than 100 percent, typically in the range of 80 to 95 percent for base load generating units, depending on overall reliability.
- PTE is defined as maximum theoretical emissions for a pollutant at permitted operating conditions. Traditionally, PTE is determined assuming maximum allowable emission rate at 100 percent capacity factor; however, since actual capacity factor is less than 100 percent, theoretical PTE is never normally achieved unless limited by permit condition.

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Stack Emissions – SO₂, NO_x, CO, Pb, Filterable PM₁₀, and PM_{2.5}, Condensable H₂SO₄, and Organics

Modeled mass emission rates from the Units 4 and 5 stacks were based on historic hourly data, Title V permit conditions, EPA emission estimation techniques (EETs), and BART limits for NO_x and PM. Modeled stack temperature and exhaust velocity were based on actual hourly data recorded from 2009

through 2011. Per guidance received from the EPA, APS modeled 3 years of actual 1-hour SO₂ emissions from Units 4 and 5. Since the BART emission rate for NO_x is based on a 30-day rolling average, which is appropriate for visibility impacts, both 30-day and 1-hour average emission rates for NO_x were modeled. In addition, modeled PM₁₀ and PM_{2.5} emission rates included condensable emissions consistent with increased sulfuric acid mist (H₂SO₄) conversion, a byproduct of SCR operation. Table 4.1-37 reproduces the mass emission rates used for modeling future operations of Units 4 and 5 assuming an average historic annual capacity factor of 86 percent.¹³ Surface meteorological data comprised 5 years (2006 through 2010) from Navajo Met Towers 1 and 3 along with concurrent upper air data from Albuquerque International Airport.

Table 4.1-37 Modeled Future Criteria Pollutant Emissions Rates - ORISPL 2442 Units 4 and 5

| Criteria Pollutant | Factor lb/mmBTU | Factor Reference Notes | Units 4 and 5 Combined mmBTU/hr | Units 4 and 5 Combined lbs/hr | Units 4 and 5 Combined g/sec |
|-------------------------------------------------------------|--------------------|------------------------------------------------------|------------------------------------------|----------------------------------------|---------------------------------------|
| Sulfur Dioxide (SO ₂) | 0.190 | 40 CFR 75 historic average (1-hour) | 14,822 | 2,816 | 354.83 |
| Nitrogen Oxides (NO _x), average | 0.098 | 40 CFR 49 BART Rule (30-day rolling average) | 14,822 | 1,453 | 183.02 |
| Nitrogen Oxides (NO _x), maximum | 0.190 | 1-hour average | 14,822 | 2,816 | 354.83 |
| Carbon Monoxide (CO) | 0.028 | AP-42 Table 1.1-3; 17.632 mmBTU/ton | 14,822 | 415 | 52.29 |
| Lead (Pb) | 1.2E-06 | 40 CFR 63 Subpart UUUUU Table 2 | 14,822 | 0.02 | 0.0022 |
| Filterable Particulate (PM) | 0.01500 | 40 CFR 49 BART Rule | 14,822 | 222.33 | 28.01 |
| Total Filterable PM ₁₀ | 0.01380 | AP-42 Table 1.1-6; 92% of filterable PM | 14,822 | 204.54 | 25.77 |
| "Coarse" Filterable PM ₁₀ | 0.00585 | difference (total filterable - fine filterable) | 14,822 | 86.71 | 10.93 |
| Fine Filterable PM _{2.5} | 0.00795 | AP-42 Table 1.1-6; 53% of filterable PM | 14,822 | 117.83 | 14.85 |
| Fine "Soil" PM _{2.5} | 0.00766 | difference (fine filterable - fine elemental carbon) | 14,822 | 113.48 | 14.30 |
| Fine Elemental Carbon PM _{2.5} | 0.00029 | EPA 68-D-98-046 Table 6; 3.7% of PM _{2.5} | 14,822 | 4.36 | 0.55 |
| Total Condensable PM ₁₀ / PM _{2.5} | 0.00835 | sum (sulfuric acid + organics) | 14,822 | 123.81 | 15.60 |
| Condensable Sulfuric Acid (H ₂ SO ₄) | 0.00435 | Stack test and EPRI removal efficiency (%) | 14,822 | 64.52 | 8.13 |
| Condensable Organics | 0.00400 | AP-42 Table 1.1-5; 20% of 0.02 lb/mmBTU | 14,822 | 59.29 | 7.47 |
| Grand Total PM ₁₀ | 0.02215 | Total Filterable + Total Condensable | 14,822 | 328.35 | 41.37 |
| Grand Total PM _{2.5} | 0.01630 | Fine Filterable + Total Condensable | 14,822 | 241.64 | 30.45 |

Source: AECOM 2013a.

g/sec = grams per second
 lb/mmBTU = pound(s) per million British thermal units
 lbs/hr = pounds per hour
 mmBTU/hr = million British thermal unit(s) per hour

¹³ Expressed as a continuous heat input of 7,411 mmBTU/hr for each generating unit rated at 8,612 mmBTU/hr, determined as the 99th percentile of boiler operating data for the 3-year period 2009 through 2011.

Materials Handling Emissions – PM₁₀ and PM_{2.5}

For the two lime silos equipped with baghouses for dust control, PM emissions were estimated using the permissible outlet loading in units of grains¹⁴ per cubic foot of exhaust air from the baghouses and the volumetric displacement of air when lime is loaded into a silo. The fly ash waste disposal area has five silos, all equipped with baghouses, and three pug mills with scrubbers for processing fly ash. Fly ash baghouse and scrubber emissions were estimated and modeled using the outlet grain loading and air flowrate for each control device. For the lime slurry mixing process, fugitive droplets were modeled as volume sources. Open transfer points within the coal transport system were also modeled as volume sources.

Plant Traffic – PM₁₀ and PM_{2.5}

Paved and unpaved road source characteristics were developed to represent vehicular traffic at FCPP. Based on EPA guidance, roads were represented by lines of volume sources. For daytime operations, fly ash disposal trucks, fly ash sales trucks, lime delivery trucks, SCR reagent (ammonia or urea) delivery trucks, road-watering trucks, and company and employee vehicles (autos, pickups, sport utility vehicles, vans) were included. Vehicular traffic during overnight hours was assumed to be minimal, and roads are watered several times a day. Fugitive dust from paved and unpaved roads was calculated using EETs published by the EPA, taking into account road watering as an effective dust control method. Fugitive dust controls can cut emissions by at least 50 percent and up to 90 percent if applied copiously (EPA 2006).

Lime and Ash Piles – PM₁₀ and PM_{2.5}

Area sources at FCPP consist of stockpiles located at the lime processing area and the ash disposal area. Wind erosion of stockpiles is highly intermittent due to the relatively high threshold wind speeds needed to entrain lime and ash. To facilitate modeling, triggered wind events were evaluated by reviewing on-site wind speed data correlated to threshold friction velocity guidance and EETs published by the EPA. The fly ash has high moisture content when transported and unloaded by the haul trucks. Surfactant is applied regularly to reduce the amount of fugitive dust that can become airborne during triggering wind events.

Navajo Mine

Navajo Mine North – PM₁₀ and PM_{2.5}

The Navajo Mine coal preparation plant is in the northern portion of the lease area and adjacent to FCPP on the eastern side. A train transports coal from Lowe Stockpile to the processing area where the railcars are unloaded into one of two hoppers, displacing air upward, which entrains some coal dust. Water sprays inside each receiving hopper are activated when a railcar is unloaded, reducing entrained coal dust by about 50 percent. For modeling, particulate emissions from the coal hoppers were estimated by APS per published EPA guidance taking into account site-specific factors such as drop distance. Other principal components of the coal preparation plant modeled by APS include towers silos, crushers, and conveyors. Coal stockpiles were evaluated in a similar manner to lime and ash stockpiles described above (AECOM 2013a).

Navajo Mine South (Area IV) – NO_x, SO₂, CO, PM₁₀, and PM_{2.5}

Sources in the southern portion of the Navajo Mine include the Pinabete SMCRA Permit Area, transport of coal from the Pinabete SMCRA Permit Area to Lowe Stockpile, unloading at the pile and loading into railcars, blasting, and overburden replacement. Emission factors, control efficiencies, and equipment lists were provided to APS by MMCo. Mining emissions comprise diesel engine exhaust and fugitive dust. Mobile sources modeled by APS included shot hole drilling, dragline activity, bulldozing, loading coal into trucks with front-end loaders, scraping, and road grading.

¹⁴ One pound of material has 7,000 grains, or 1 gram of material has 15.432 grains.

Coal and overburden blasting emits CO, NO₂, and SO₂ from detonation of ANFO explosive. Emission factors published by the EPA were used to calculate emissions of CO and NO₂. Since Navajo Mine SMCRA Permit Area and Pinabete SMCRA Permit Area operations use ultralow sulfur diesel fuel in its ANFO mixture, SO₂ emissions are significantly less than cited in the EPA emission factors, which were adjusted accordingly. Coal blasting routinely occurs 3 days per week about mid-day within a 4-hour time window; however, the ANFO emission rate was conservatively modeled for 4 hours per day, 5 days per week, for a total of 20 hours per week to simplify the modeling. Each blast is in a different location and meteorological conditions vary; therefore, the modeled concentrations were conservative. In contrast, overburden blasting occurs only once per month over a larger area and never occurs in the same location twice. Due to the transient and temporal nature of overburden blasting, it was not included in the NAAQS modeling based on specific EPA guidance for intermittent sources (EPA 2011a).

Mine Traffic – PM₁₀ and PM_{2.5}

Traffic impacts from coal haul trucks, watering trucks, scrapers, end dump trucks, and pickups on the roads between the active mining areas and Lowe Stockpile were characterized by modeling activities occurring 24 hours per day (AECOM 2013a). Fugitive dust was calculated using EETs published by the EPA, taking into account road watering as an effective dust control method, supplemented by a nontoxic chemical dust suppressant applied to major unpaved roads annually.

Mine Coal Stockpiles – PM₁₀ and PM_{2.5}

Coal from the active mining areas is transported and unloaded onto Lowe Stockpile and compacted using bulldozers. As modeled by APS, unloading and bulldozing activities occur 24 hours per day, and coal is loaded from the pile into railcars for transport to the coal preparation plant. Wind erosion of stockpiles was modeled by APS by evaluating triggering wind events correlated to threshold friction velocity guidance and EETs published by the EPA. Wind erosion of overburden reclaim piles was modeled in the same manner (AECOM 2013a).

Hazardous Air Pollutants

Air toxics are pollutants that may result in an increase in mortality or serious illness, or that may pose a present or potential hazard to human health. Health effects of air toxics include cancer, birth defects, neurological damage, damage to the body's natural defense system, and diseases that can lead to premature death.

A screening-level Health Risk Assessment (HRA) for DPM was performed using conservative methodology for upper-bound mining activity levels and timeframes. Detailed results of the HRA are provided in Section 4.17, Public Health. In general, due to the broad geographic dispersion of mining activities, their short-term temporary nature at any particular location, and lack of proximate receptors within 1,000 feet (300 meters), no significant risk to sensitive receptors or the general public would be posed by mining-related HAP emissions.

Plume Visibility

The screening analysis was conducted per guidance contained in the *Workbook for Plume Visual Impact Screening and Analysis* (EPA 1992a), with additional recommendations provided by the NPS. EPA's screening-level plume visibility model VISCREEN was used with site-specific meteorological data to calculate plume visibility parameters corresponding to worst-case conditions. As a screening model, VISCREEN does not calculate plume height above the ground, but hypothetically places the observer at plume height, looking horizontally at various sun-time intervals through the plume centerline. VISCREEN then computes the combinations of sun-plume-observer geometry that the result in the largest degree of plume visual impact. Because of this simplified line-of-sight geometry, the results from VISCREEN are conservative; thus, actual visual impacts would be less than otherwise predicted.

The model calculates linear Gaussian¹⁵ dispersion of PM and NO₂, the two pollutants known to contribute most to visible plumes, notwithstanding condensing water vapor in cold weather. However, as a near-field model, VISCREEN does not address the secondary formation of nitrate (NO₃⁻) and sulfate (SO₄²⁻) particles which are known to contribute to regional haze at longer distances. The model outputs two visual impact parameters: plume contrast and plume perceptibility. According to the EPA, plume contrast (Cp) values exceeding an absolute value of 0.05 should be used as a screening threshold, inferring that a 5 percent change in intensity is likely to be noticed by a casual observer,¹⁶ Plume perceptibility (ΔE) evaluates the degree to which a plume can be seen either against a background sky or terrain. The EPA has established a ΔE threshold of 2.0 to indicate the presence of a visible plume against a background sky or terrain (EPA 1992a). Therefore, for the purposes of this analysis, a vista is significantly improved if the baseline ΔE exceeds 2.0 and the future ΔE is less than 2.0. Conversely, a vista is significantly degraded if the baseline ΔE is less than 2.0 and the future ΔE exceeds 2.0.

No criteria exist for evaluating visible plumes from sources beyond the boundaries of Federal Class I areas, While no Class I areas exist in the 50-mile radius study area, the Class I criterion was used to determine if emissions from the Proposed Action would affect visibility within 50 miles of the project.

4.1.4.2 Alternative A – Proposed Action

Future Criteria Emissions

Under the Proposed Action, Units 4 and 5 at the FCPP, and the Navajo Mine SMCRA Permit Area and Pinabete Permit Area would continue to operate and emit criteria and noncriteria pollutants, including HAPs, for the duration of the 25-year lease agreement, with the required installation and commissioning of SCR equipment by July 2018. Since SCR requires ammonia reagent (urea is the selected form) to reduce NO_x to nitrogen (N₂) and water vapor (H₂O), some unreacted (residual) ammonia (NH₃) would be emitted from the boiler stacks as “ammonia slip,” typically 5 to 10 ppmv for BART installations.

On-road vehicles and off-road equipment owned by FCPP are used for plant and switchyard maintenance. Segments of the transmission lines nearest FCPP are also maintained using plant vehicles and equipment. These vehicles and equipment emit air contaminants in engine exhaust during normal use. All equipment and vehicle engines used at the plant meet Federal emissions standards applicable on the date of manufacture.

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Emissions from Units 4 and 5 would continue through 2041, supplied with coal from the Navajo Mine. Table 4.1-38 shows estimated future (2014 through 2026) potential criteria emissions (SO₂, NO_x and calculated PM) from Units 4 and 5 assuming a maximum annual generation capacity factor of 92 percent based on the 7-year period from 2005 to 2011 when FGD became active on Units 4 and 5. Pre-project metals emissions are based on historical capacity factor of 84 percent and AP-42 regulatory default emission factors as “uncontrolled” emissions. Post-project metal emissions are based on projected maximum capacity factor of 92 percent and 40 CFR 63 Subpart UUUUU emission factors as “controlled” emissions. The large reductions in metals emissions are because the Subpart UUUUU controlled factors are much lower than the AP-42 uncontrolled factors. For nonmetal HAPs, the same set of AP-42 regulatory default emission factors are used for both pre- and post-project emissions estimates as these are not subject to Subpart UUUUU (except HCl). Because the maximum annual capacity factor (92 percent) is 9 percent higher than the historic capacity factor (84 percent), the nonmetal HAPs potential-to-emit is also 9 percent higher. To be conservative, this 92 percent capacity factor is 9 percent higher than the historic average of 84 percent for the same period. For the 12-year period beginning in 2000, a 92 percent capacity factor was achieved only during 2 years, 2003 and 2006, all other years were less. Thus, the probability of achieving 92 percent capacity factor is estimated to be 1 in 6 or about

¹⁵ Normal functions developed by German mathematician Karl Friedrich Gauss (1777-1855) that express natural phenomena.

¹⁶ A positive Cp means the plume is a lighter color than the sky, a negative Cp means the plume looks darker than the sky.

17 percent overall, which is a reasonable contingency over the long run. Projected annual emissions for years 2027 through 2041 are assumed to be the same as year 2026 (12 years from now) due to potential load-demand maturity over the long-term.

Table 4.1-38 Estimated Future Maximum Part 75 Emissions - ORISPL 2442 Units 4 and 5 (with phased SCR controls)

| Year | Generation MW-hrs/yr | Sulfur Dioxide tons/yr | Sulfur Dioxide kg/MW-hr | Nitrogen Oxides tons/yr | Nitrogen Oxides kg/MW-hr | Particulate Matter tons/yr | Particulate Matter kg/MW-hr |
|------|----------------------|------------------------|-------------------------|-------------------------|--------------------------|----------------------------|-----------------------------|
| 2014 | 12,410,900 | 9,800 | 0.72 | 27,100 | 1.98 | 830 | 0.06 |
| 2015 | 12,410,900 | 9,800 | 0.72 | 27,100 | 1.98 | 830 | 0.06 |
| 2016 | 12,410,900 | 9,800 | 0.72 | 27,100 | 1.98 | 830 | 0.06 |
| 2017 | 12,410,900 | 9,800 | 0.72 | 19,870 | 1.45 | 830 | 0.06 |
| 2018 | 12,410,900 | 9,800 | 0.72 | 12,640 | 0.92 | 830 | 0.06 |
| 2019 | 12,410,900 | 9,800 | 0.72 | 5,420 | 0.40 | 830 | 0.06 |
| 2020 | 12,410,900 | 9,800 | 0.72 | 5,420 | 0.40 | 830 | 0.06 |
| 2021 | 12,410,900 | 9,800 | 0.72 | 5,420 | 0.40 | 830 | 0.06 |
| 2022 | 12,410,900 | 9,800 | 0.72 | 5,420 | 0.40 | 830 | 0.06 |
| 2023 | 12,410,900 | 9,800 | 0.72 | 5,420 | 0.40 | 830 | 0.06 |
| 2024 | 12,410,900 | 9,800 | 0.72 | 5,420 | 0.40 | 830 | 0.06 |
| 2025 | 12,410,900 | 9,800 | 0.72 | 5,420 | 0.40 | 830 | 0.06 |
| 2026 | 12,410,900 | 9,800 | 0.72 | 5,420 | 0.40 | 830 | 0.06 |

Source: EPA 2012h.

Notes:

Projected emissions for years 2027 through 2041 same as year 2026 (flat extrapolation assumed).

PM calculated per AP-42 Chapter 1.1 support document Tables 4-7 and A-3; 40 CFR 49 final rule (Units 4 and 5).

Maximum annual capacity factor = 92% based on historic operations (average historic annual capacity factor = 84%).

kg/MW-hr = kilogram(s) per megawatt-hour

MW-hrs/yr = megawatt hours per year

tons/yr = tons per year

All air emissions from FCPP would remain as described in the baseline, which accounts for the decreased emissions due to the shutdown of Units 1, 2, and 3 and application of BART. PSD thresholds for sulfuric acid mist would be exceeded by the Proposed Action; ammonia slip emissions from SCR operation do not fall under PSD because ammonia is not a regulated criteria pollutant.

Table 4.1-39 shows estimated criteria emissions from FCPP vehicles and mobile equipment (APS 2012a), a very small portion of which is attributable to transmission line maintenance. In comparison to boiler (stack) emissions, FCPP mobile source NO_x emissions are only 0.05 percent, which would result minor impact in the short- or long-term.

Table 4.1-39 Estimated Criteria Emissions from FCPP Mobile Sources

| Mobile Sources | VOC tons/yr | CO tons/yr | NO _x tons/yr | SO _x tons/yr | PM ₁₀ tons/yr | PM _{2.5} tons/yr |
|--------------------------------|----------------|---------------|----------------------------|----------------------------|-----------------------------|------------------------------|
| Power Plant Off-road Equipment | 0.31 | 3.69 | 2.05 | 0.004 | 0.13 | 0.11 |
| Power Plant On-road Vehicles | 0.11 | 0.76 | 0.86 | 0.002 | 0.04 | 0.03 |
| Annual Totals | 0.42 | 4.46 | 2.90 | 0.006 | 0.16 | 0.14 |

Sources: APS 2012a, EPA 2011a, SCAQMD 2008.

Note:

PM₁₀ and PM_{2.5} for exhaust only, fugitive dust accounted for in OSMRE 2012b.

tons/yr = tons per year

Navajo Mine

Continue development of the Navajo Mine SMCRA Permit and development of the Pinabete SMCRA Permit Area (Area IV North and South) and associated coal reserves under the Proposed Action would use best-practice surface mining methods and equipment to supply coal to FCPP for up to 25 years beginning in 2016 and ending in 2041. Mining activity would cause emissions from diesel-powered off-road equipment and on-road vehicles, explosives detonation, fugitive methane liberated from coal seams, and fugitive dust. All equipment and vehicle engines used at the mine meet Federal emissions standards applicable on the date of manufacture.

Table 4.1-40 shows estimated criteria emissions and DPM from Navajo mining operations in the existing Navajo Mine SMCRA Permit Area and the proposed Pinabete SMCRA Permit Area and related activities. These quantifiable sources contribute about 6.8 percent of NO_x PTE and about 0.1 percent of SO₂ PTE. Reasonable variations in mining-related mobile source estimates for NO_x and SO₂ would have minor impact in the short- or long-term because a 10 percent change in mining-related NO_x or SO₂ emissions would represent only 0.7 percent of total project NO_x emissions and 0.01 percent of SO₂ emissions, which is well within EPA precision limits of -2 to +5 percent for fossil fuel combustion (EPA 2012b).

Table 4.1-40 Estimated Criteria and DPM Emissions from Navajo Mine Operations (both Navajo Mine SMCRA and Pinabete SMCRA Permit Areas)

| Mobile and Fugitive Sources | VOC tons/yr | CO tons/yr | NO _x tons/yr | SO _x tons/yr | PM ₁₀ tons/yr | PM _{2.5} tons/yr | DPM tons/yr |
|---------------------------------------------|----------------|---------------|----------------------------|----------------------------|-----------------------------|------------------------------|----------------|
| Overburden Drilling and Blasting | — | 19.67 | 4.99 | 0.59 | 3.36 | 0.97 | — |
| Coal Seam Drilling and Blasting | — | 241.96 | 61.39 | 7.22 | 4.82 | 1.40 | — |
| Overburden Dragline Stripping | — | — | — | — | 62.96 | 5.56 | — |
| Mine Extraction Operations and Loading | 15.44 | 65.57 | 141.75 | 0.20 | 183.59 | 20.58 | 5.11 |
| Coal Hauling Trucks to Stockpiles | 14.16 | 68.08 | 125.40 | 0.18 | 276.47 | 27.65 | 5.31 |
| Mining Support Vehicle Travel | 3.36 | 9.91 | 33.73 | 0.05 | 180.73 | 18.07 | 0.77 |
| Unloading at Stockpiles and Railcar Loading | — | — | — | — | 0.71 | 0.22 | — |
| Reclamation | — | — | — | — | 124.50 | 24.90 | — |
| Coal Preparation Plant (except stockpile) | — | — | — | — | 13.89 | 4.05 | — |
| Wind Erosion (coal and spoils piles) | — | — | — | — | 58.82 | 21.03 | — |
| Annual Totals | 32.96 | 405.19 | 367.26 | 8.23 | 909.85 | 124.43 | 11.20 |

Source: OSMRE 2012b.

Notes:

SO_x emissions estimated from FONSI supporting data.

PM₁₀ and PM_{2.5} includes exhaust and fugitive dust as determined in FONSI.

For diesels, DPM estimated as 7.8% of CO emissions per off-road emissions factors (SCAQMD 2008).

tons/yr = tons per year

Fugitive dust emissions from coal mining and coal handling are estimated at 910 tpy, which is about 10 percent greater than power plant stack emissions (830 tpy). Mining PM emissions are mainly in the form of relatively uncontrolled fugitive dust; therefore, are highly variable. Power plant PM emissions are controlled using baghouses; therefore are highly controlled and less variable. Because of the variability, fugitive dust emissions cannot be directly compared to power plant stack PM emissions.

Transmission Lines

Mobile source emissions from maintenance of transmission lines would include diesel exhaust from truck trips. Maintenance would occur at various points along each of the transmission lines, on less than an annual basis at each site. Therefore, emissions would have minor impact in the short- or long-term (less than 1 percent of aggregated mobile sources) and would not result in exceedances of any NAAQS.

Combined Emissions Summary

Table 4.1-41 summarizes the NAAQS modeling results for all pollutants with monitored (existing) ambient background concentrations added in. As shown in Table 4.1-41, future total concentrations for all pollutants and averaging times would be expected to meet current NAAQS (AECOM 2013a):

- Quarterly Pb, 1-hour and 3-hour SO₂, 1-hour and annual NO₂ impacts would be from Units 4 and 5 stack emissions.
- Annual and 24-hour PM_{2.5} impacts would be dominated by low elevation sources such as coal preparation, lime and ash handling, and road dust.
- Active mining and mine vehicle traffic emissions would dominate the impact for 24-hour PM₁₀.
- 1-hour and 8-hour CO impacts would be driven by the coal blasting emissions, which were modeled for 4 hours per day even though these emissions occur less than 1 hour per day.

Modeling using conservative assumptions for elevated stack or ground-level fugitive sources at FCPP or Navajo Mine SMCRA Permit Area and Pinabete SMCRA Permit Area show that NAAQS would not be exceeded (AECOM 2013d). Air quality regulations require that NAAQS be measured at the site boundary, where no densely populated areas exist near the plant or mine. In addition to stack emissions, modeling of fugitive dust emissions from road traffic, materials handling, and mining operations determined that the Proposed Action would not cause local exceedances of NAAQS for PM₁₀ (respirable particulate) and PM_{2.5} (fine particulate); however, the estimate of PM_{2.5} emissions from the Proposed Action approaches the NAAQS (33.9 µg/m³ as compared with the 35 µg/m³ NAAQS). Refer to Section 4.1.4 for the modeling assumptions, including operational control factors assumed in the modeling. For PM_{2.5}, the guidance in the March 23, 2010, EPA/Stephen Page memo for adding modeled to background concentrations was followed. This guidance indicates that the peak 24-hour modeled concentration should be added to the 98th percentile background concentration. However, the new EPA draft procedure for PM_{2.5} modeling released on March 4, 2013, indicates that the 98th percentile modeled 24-hour concentration should be added to the 98th percentile background concentration in certain situations. This proposed procedure would be applicable in the FCPP case due to the fact that the peak modeled concentration is due to fugitive emissions (no precursor emissions). Using the recent draft guidance, the 24-hour PM_{2.5} design concentration would be reduced from about 33 µg/m³ to about 26 µg/m³. Therefore, for both SO and PM, the design concentrations are on the order of 75 percent of the NAAQS, leaving considerable room for uncertainties in background concentrations. Attainment of primary NAAQS is protective of public health, including sensitive receptors (see also Section 4.17, Public Health, for justification that NAAQS are protective); therefore, impacts in the short- or long-term operation of the FCPP and Navajo Mine are estimated to be minor.

Table 4.1-41 NAAQS Modeling Results - FCPP & Navajo Mine Vicinity

| Pollutant | Standard | Averaging Time | Modeled Impact $\mu\text{g}/\text{m}^3$ | Monitored Background $\mu\text{g}/\text{m}^3$ | Total Impact $\mu\text{g}/\text{m}^3$ | NAAQS $\mu\text{g}/\text{m}^3$ | NAAQS status |
|--------------------------------------|---------------------|-----------------|-----------------------------------------|-----------------------------------------------|---------------------------------------|--------------------------------|--------------|
| Ozone (O ₃)* | Primary & Secondary | 8-hour | -6.3 | 139.7 | 133.5 | 147 | Meet |
| Nitrogen Dioxide (NO ₂) | Primary | 1-hour | — | — | 175.2 | 188 | Meet |
| Nitrogen Dioxide (NO ₂) | Primary & Secondary | Annual | 3.3 | 37.4 | 40.7 | 100 | Meet |
| Sulfur Dioxide (SO ₂) | Primary | 1-hour | — | — | 192.6 | 196.4 | Meet |
| Sulfur Dioxide (SO ₂) | Secondary | 3-hour | 184.7 | 44.5 | 229.2 | 1,309 | Meet |
| Carbon Monoxide (CO) | Primary | 1-hour | 932.4 | 1610.0 | 2542.4 | 40,072 | Meet |
| Carbon Monoxide (CO) | Primary | 8-hour | 182.5 | 1035.0 | 1217.5 | 10,304 | Meet |
| Particulates (as PM ₁₀) | Primary & Secondary | 24-hour | 75.4 | 44.0 | 119.4 | 150 | Meet |
| Particulates (as PM _{2.5}) | Primary & Secondary | 24-hour | 20.3 | 13.6 | 33.9 | 35 | Meet |
| Particulates (as PM _{2.5}) | Primary | Annual | 4.0 | 4.4 | 8.3 | 12 | Meet |
| Particulates (as PM _{2.5}) | Secondary | Annual | 4.0 | 4.4 | 8.3 | 15 | Meet |
| Lead (Pb) | Primary & Secondary | 3-month rolling | 0.001 | 0.006 | 0.007 | 0.15 | Meet |

Sources: AECOM 2014a, 2013b; EPA 2012f.

Notes:

Primary standards provide public health protection, including protecting the health of “sensitive” populations such as asthmatics, children, and the elderly.

Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

*Site 35-045-1005 (Farmington, San Juan County, New Mexico).

All NAAQS generally correspond to an Air Quality Index (AQI) of 100.

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter (10⁻⁶ g/m³).

Future HAP Emissions

Four Corners Power Plant

Coal combustion in power plant boilers emits a wide variety of inorganic and organic HAPs. Tables 4.1-42 and 4.1-43 show estimated average annual HAP emissions from FCPP under baseline conditions (Units 1, 2, and 3 shut-down) and projected average annual HAP emissions from Units 4 and 5 operating in compliance with 40 CFR 63 Subpart UUUUU. Estimated HAP emissions are based on historic operating data, projected operating data, and regulatory defined emission factors published by the EPA (EPA 2011a). As shown in the tables, compliance with 40 CFR 63 Subpart UUUUU for Units 4 and 5 would reduce estimated annual hydrogen chloride emissions by about 98 percent due to acid gas removal (absorption and neutralization) by the caustic wet scrubbers used to control SO₂ emissions. Emissions of metals from FCPP under the Proposed Action decrease substantially with the installation of SCR on Units

4 and 5. In contrast, non-metal emissions would increase by approximately 9 percent due to the projected increase in annual capacity factor applicable to HAPs not subject to Subpart UUUUU.

Table 4.1-42 Estimated Historic and Future HAP Metals Emissions - ORISPL 2442

| Hazardous Air Pollutants Metals | 2000-11 Units 4 and 5 Average lbs/yr | 2014-25 Units 4 and 5 Average lbs/yr | Comparison of Baseline to Emissions under the Proposed Action Change Percent |
|--------------------------------------|--------------------------------------|--------------------------------------|------------------------------------------------------------------------------|
| <i>Average Generation, MW-hrs/yr</i> | 11,378,420 | 12,410,900 | 9% |
| Antimony (Sb) | 106 | 91 | -16% |
| Arsenic (As) | 2,412 | 124 | -94% |
| Beryllium (Be) | 124 | 23 | -81% |
| Cadmium (Cd) | 300 | 34 | -89% |
| Chromium (Cr) | 1,530 | 317 | -79% |
| Cobalt (Co) | 588 | 91 | -85% |
| Copper (Cu) | 3,354 | 702 | -79% |
| Lead (Pb) | 2,471 | 136 | -94% |
| Manganese (Mn) | 2,883 | 453 | -84% |
| Mercury (Hg) | 488 | 136 | -72% |
| Nickel (Ni) | 1,648 | 396 | -76% |
| Selenium (Se) | 7,649 | 566 | -93% |

lbs/yr = pounds per year

Table 4.1-43 Estimated Historic and Future HAP Nonmetals Emissions - ORISPL 2442

| Hazardous Air Pollutants (Organics and Inorganics) | 2000-11 Units 4 and 5 Average lbs/yr | 2014-25 Units 4 and 5 Average lbs/yr | Comparison of Baseline to Emissions under the Proposed Action Change Percent |
|----------------------------------------------------|--------------------------------------|--------------------------------------|------------------------------------------------------------------------------|
| <i>Average Generation, MW-hrs/yr</i> | 11,378,420 | 12,410,900 | +9% |
| Acetaldehyde | 3,354 | 3,658 | +9% |
| Acetophenone | 88 | 96 | +9% |
| Acrolein | 1,706 | 1,861 | +9% |
| Benzene | 7,649 | 8,343 | +9% |
| Benzyl chloride | 4,119 | 4,493 | +9% |
| Bis(2-ethylhexyl)phthalate (DEHP) | 430 | 469 | +9% |
| Carbon disulfide | 765 | 834 | +9% |
| Chlorobenzene | 129 | 141 | +9% |
| Chloroform | 347 | 379 | +9% |
| Cyanide | 14,710 | 16,045 | +9% |
| 2,4-Dinitrotoluene | 2 | 2 | 0% |
| Ethyl benzene | 553 | 603 | +9% |
| Ethyl chloride | 247 | 270 | +9% |
| Formaldehyde | 1,412 | 1,540 | +9% |
| Hexane | 394 | 430 | +9% |
| Hydrogen chloride | 7,060,847 | 226,323 | -96% |
| Hydrogen fluoride | 882,606 | 962,694 | +9% |

| Hazardous Air Pollutants (Organics and Inorganics) | 2000-11 Units 4 and 5 Average lbs/yr | 2014-25 Units 4 and 5 Average lbs/yr | Comparison of Baseline to Emissions under the Proposed Action Change Percent |
|----------------------------------------------------|--------------------------------------|--------------------------------------|------------------------------------------------------------------------------|
| Isophorone | 3,413 | 3,722 | +9% |
| Methyl bromide | 941 | 1,027 | +9% |
| Methyl chloride | 3,119 | 3,402 | +9% |
| Methyl ethyl ketone | 2,295 | 2,503 | +9% |
| Methylene chloride | 1,706 | 1,861 | +9% |
| PAHs (composite total) | 122 | 133 | +9% |
| Phenol | 94 | 103 | +9% |
| Propionaldehyde | 2,236 | 2,439 | +9% |
| Tetrachloroethylene | 253 | 276 | +9% |
| Toluene | 1,412 | 1,540 | +9% |
| Styrene | 147 | 160 | +9% |
| Xylenes (o,m,p) | 218 | 237 | +9% |

lbs/yr = pounds per year

Navajo Mine

As described in Sections 3.1.2.3 and 3.1.2.7, diesel particulate matter is considered a HAP; thus, larger and more persistent sources of DPM could present a health risk to nearby sensitive receptors. An example of this situation would be mining operations where large diesel-powered equipment and vehicles are used in active areas for extended lengths of time, months or years; however, such use does not meet the definition of a stationary source of air contaminants.

Any residences (i.e., sensitive receptors) in the vicinity of the Navajo Mine SMCRA Permit Area and Pinabete SMCRA Permit Area could be affected by mining-related emissions such as DPM, fugitive dust, and blasting gases (NO₂, SO₂, and CO). As described above, the nearest sensitive receptor would be approximately ½ mile (800 meters) from proposed Area IV mining activities. However, no agency-published guidelines for significance criteria exist to assess these impacts. Further, due to the broad geographic dispersion of mining activities, their short-term temporary nature at any particular location, and lack of proximate receptors within 1,000 feet (300 meters), minor impacts to sensitive receptors or the general public would be posed by short- and long-term mining-related HAP emissions since the cited public health risk thresholds would not be exceeded (BAAQMD 1999, 2010).

Transmission Lines

No emissions of HAPs are anticipated to result from maintenance activities associated with continued operation of the subject transmission lines.

Deposition Modeling Results

The following discussion applies to emissions from the FCPP. No short- or long-term impacts related to deposition of air emissions would result from continued operation of the Navajo Mine SMCRA Permit Area, Pinabete SMCRA Permit Area, or transmission lines since the principal source of long-range deposition pollutants is power plant stacks, not mining activities.

Four Corners Power Plant

The refined deposition area identified using AERMOD extended less than 50 km from FCPP in all directions. However, to allow the fate and transport modeling software to predict the contributions of contaminants to water bodies within the deposition area from upstream watersheds, it was necessary to

extend the AERMOD domain to a 50-km radius in all directions, the maximum distance recommended by the EPA. This extension was necessary because contributions to water bodies from upstream watersheds can enter the deposition area by leaching through the soil profile and entering the shallow groundwater system, or through soil erosion and surface water runoff into the San Juan River system (AECOM 2013c).

Clean Air Status and Trends Network

Continued operation of the FCPP under the Proposed Action would be expected to contribute to overall downward trends in regional deposition rates measured by CASTNET over the last decade because of the emission reductions required by BART (see Section 4.1.3). Assuming that these trends would be consistent over time, Table 4.1-44 and Figure 4.1-11 show projected sulfur and nitrogen compound deposition rates from 2014 to 2026, the same timeframe as projected by the IMPROVE program described in Section 4.1.2.5.

Table 4.1-44 Projected Normalized CASTNET Deposition Rates for Region

| Year | Normalized Precipitation dm | Total Nitrogen kg/ha-dm | Total Sulfur kg/ha-dm |
|---------------|--------------------------------|----------------------------|--------------------------|
| 2014 | 1.0 | 0.57 | 0.26 |
| 2015 | 1.0 | 0.55 | 0.25 |
| 2016 | 1.0 | 0.52 | 0.24 |
| 2017 | 1.0 | 0.50 | 0.23 |
| 2018 | 1.0 | 0.47 | 0.22 |
| 2019 | 1.0 | 0.45 | 0.22 |
| 2020 | 1.0 | 0.42 | 0.21 |
| 2021 | 1.0 | 0.40 | 0.20 |
| 2022 | 1.0 | 0.37 | 0.19 |
| 2023 | 1.0 | 0.35 | 0.18 |
| 2024 | 1.0 | 0.32 | 0.18 |
| 2025 | 1.0 | 0.30 | 0.17 |
| 2026 | 1.0 | 0.27 | 0.16 |
| Trend | — | -0.30 | -0.10 |
| Change | — | -53% | -38% |

Source: EPA 2013e

Note:

Based on aggregated historic data for four existing sites: CAN407, GRC474, MEV405, PET427.

dm = decimeter

kg/ha-dm = kilogram(s) per hectare per decimeter

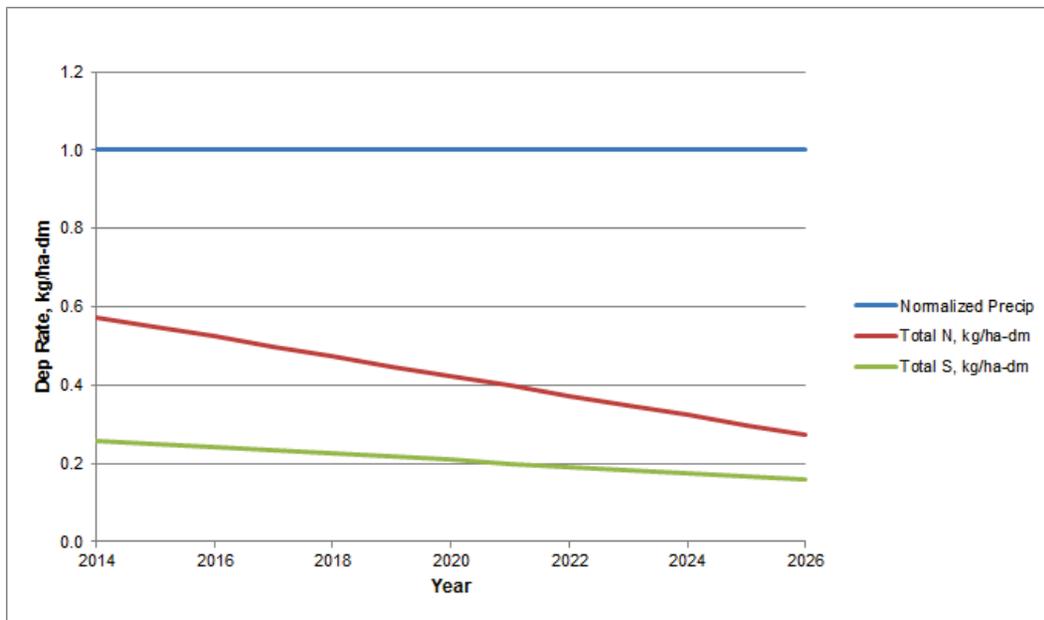


Figure 4.1-11 Projected Normalized CASTNET Deposition Rates

As shown in Table 4.1-44 and on Figure 4.1-11, projected nitrogen compounds deposition could decrease by about 0.3 kg/ha-dm and sulfur compounds deposition could decrease by about 0.1 kg/ha-dm. These projected changes in deposition rates could represent decreases of about 50 and 40 percent, respectively, from 2014 to 2026.

National Trends Network

As described in Section 4.1.2.6, the NTN measures free acidity (H^+ as pH), calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+), sulfate (SO_4^{2-}), nitrate (NO_3^-), chloride (Cl^-), and ammonium (NH_4^+) ions, also total inorganic nitrogen (N). As shown on Figures 4.1-7a, 4.1.7b, and 4.1.7c, these 10 analytes have been trending upward over the past 12 years; however, the lower rates of increase for sulfate and nitrate, 14 and 7 percent, respectively, suggests that regional emissions of SO_2 and NO_x from stationary and mobile sources may not be increasing as rapidly overall due to improved emission controls and lower-polluting fuels in the region which could reduce future NO_x emissions by about 20 percent (NMED 2009). Similarly, reduced NO_x and SO_2 emissions from FCPP (also San Juan and Navajo Generating Stations) not fully accounted for in the Four Corners Air Quality Study — as a result of compliance with BART — could also marginally contribute to lowering regional nitrogen and sulfur acid deposition rates measured by NTN by several percent, as conservatively projected in Table 4.1-45 and on Figure 4.1-12 for 2014 to 2026. However, the apparently increasing deposition of calcium, magnesium, sodium, potassium, and chloride may be attributable to increased soil dust transport brought on by drought conditions. Also, increased ammonia emissions from Units 4 and 5 due to SCR operation could increase deposition of ammonium ion and inorganic nitrogen to some extent (see AMoN discussion below for further context). Specifically, with respect to sulfate and nitrate deposition in the region, implementation of BART or approved alternatives would reduce nitrate precursor (NO_x) emissions by approximately 87 percent at FCPP, 62 percent at San Juan Generating Station, and 84 percent at Navajo Generating Station. Similarly, BART or approved alternatives would reduce sulfate precursor (SO_2) emissions by approximately 18 percent at FCPP and 67 percent at San Juan Generating Station. However, Navajo Generating Station is currently emitting approximately 90 percent less SO_2 than in the past due to installation and operation of FGD scrubbers and no further reductions are planned. Thus, due to the potential for large decreases in future mass emissions of SO_2 and NO_x from power plants in the region, mass deposition rates of sulfates and nitrates in the region

could nominally decrease by several percent with respect to the past (EPA 2012h, 2012i, 2013g; PNM 2013; NGS 2013).

Table 4.1-45 Projected Normalized NTN Deposition Rates for Region

| Year | Normalized Precipitation dm | Total Nitrate kg/ha-dm | Total Sulfate kg/ha-dm |
|---------------|-----------------------------|------------------------|------------------------|
| 2014 | 1.0 | 3.12 | 2.02 |
| 2015 | 1.0 | 3.06 | 2.00 |
| 2016 | 1.0 | 3.00 | 1.98 |
| 2017 | 1.0 | 2.94 | 1.96 |
| 2018 | 1.0 | 2.88 | 1.94 |
| 2019 | 1.0 | 2.82 | 1.92 |
| 2020 | 1.0 | 2.76 | 1.90 |
| 2021 | 1.0 | 2.70 | 1.88 |
| 2022 | 1.0 | 2.64 | 1.86 |
| 2023 | 1.0 | 2.58 | 1.84 |
| 2024 | 1.0 | 2.52 | 1.82 |
| 2025 | 1.0 | 2.46 | 1.80 |
| 2026 | 1.0 | 2.40 | 1.78 |
| Trend | — | -0.72 | -0.24 |
| Change | — | -23% | -12% |

Sources: NADP 2013, EPA 2013e.

Note:

Based on aggregated historic data for seven existing sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98.

dm = decimeter

kg/ha-dm = kilogram(s) per hectare per decimeter

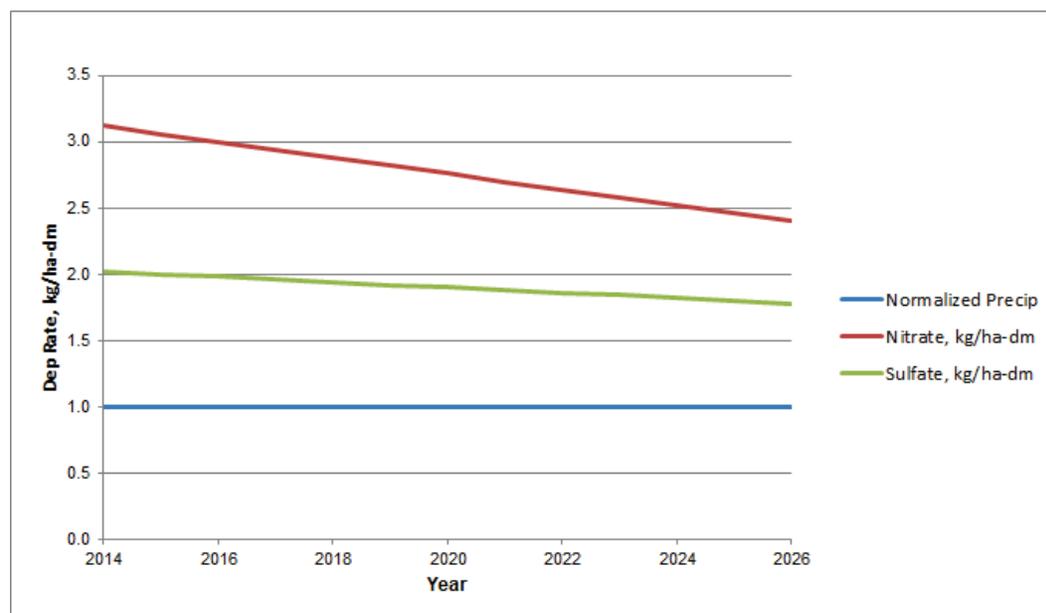


Figure 4.1-12 Projected Normalized NTN Deposition Rates

Mercury Deposition Network

As described in Section 4.1.2.6, normalized MDN results shown in Table 4.1-46 and on Figure 4.1-13 suggest an upward trend in the measured rate of mercury deposition in the region over a decade. The trending analysis suggests that mercury deposition measured in the western region has been increasing, due in large part to trans-Pacific transport from sources in Asia. EPRI (2013) indicate that “Baseline contributions of Hg emissions from non-U.S. sources to Hg deposition in the San Juan basin range from 70% to 98%. Hg emissions from China contribute from 13 to 16% to Hg deposition in the basin in the post-2014 scenario.” Table 4.1-46 and Figure 4.1-13 show projected mercury deposition rates, which could be measured by MDN from 2014 to 2026 based on the following assumed conditions: (1) trans-Pacific transport continues historic trend due to economic growth in Asia, (2) regional power plants continue to emit proportionally, and (3) FCPP achieves MATS compliance in concert with the Proposed Action. The latter two conditions help define conservative upper and lower bounds for broadly estimating regional and local impacts of reduced mercury emissions from FCPP against apparent transport from outside the region:

- The historic trend extrapolates historic data as described in Section 4.1.2.6, which could represent a worst-case scenario, however unlikely.
- The upper bounding estimate assumes an 80 percent reduction of 19 percent of emissions, the FCPP regional share.
- The lower bounding estimate assumes an 80 percent reduction of 45 percent of emissions, the FCPP state/local share.

Table 4.1-46 Projected Normalized MDN Deposition Rates for Region

| Year | Normalized Precipitation dm | Historic Trend $\mu\text{g}/\text{m}^2\text{-dm}$ | Proposed Action Range Upper $\mu\text{g}/\text{m}^2\text{-dm}$ | Proposed Action Range Lower $\mu\text{g}/\text{m}^2\text{-dm}$ |
|---------------|-----------------------------|---------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|
| 2014 | 1.0 | 2.27 | 1.93 | 1.45 |
| 2015 | 1.0 | 2.34 | 1.98 | 1.50 |
| 2016 | 1.0 | 2.41 | 2.04 | 1.54 |
| 2017 | 1.0 | 2.48 | 2.10 | 1.59 |
| 2018 | 1.0 | 2.55 | 2.16 | 1.63 |
| 2019 | 1.0 | 2.62 | 2.22 | 1.68 |
| 2020 | 1.0 | 2.69 | 2.28 | 1.72 |
| 2021 | 1.0 | 2.76 | 2.34 | 1.76 |
| 2022 | 1.0 | 2.83 | 2.40 | 1.81 |
| 2023 | 1.0 | 2.90 | 2.46 | 1.85 |
| 2024 | 1.0 | 2.96 | 2.51 | 1.90 |
| 2025 | 1.0 | 3.03 | 2.57 | 1.94 |
| 2026 | 1.0 | 3.10 | 2.63 | 1.99 |
| Trend | — | 0.83 | 0.36 | -0.29 |
| Change | — | 37% | 16% | -13% |

Sources: NADP 2013; EPA 2012a, 2011a; 40 CFR 63 Subpart UUUUU

Notes:

Based on aggregated historic data for 4 MDN sites: AZ02, NM98, CO96, CO99. Historic trend assumes ongoing status quo, including trans-Pacific transport. Estimated action assumes 80% reduction of Hg emissions from FCPP in compliance with MATS; upper and lower ranges reflecting regional and local shares.

dm = decimeter

$\mu\text{g}/\text{m}^2\text{-dm}$ = microgram(s) per square meter-decimeter

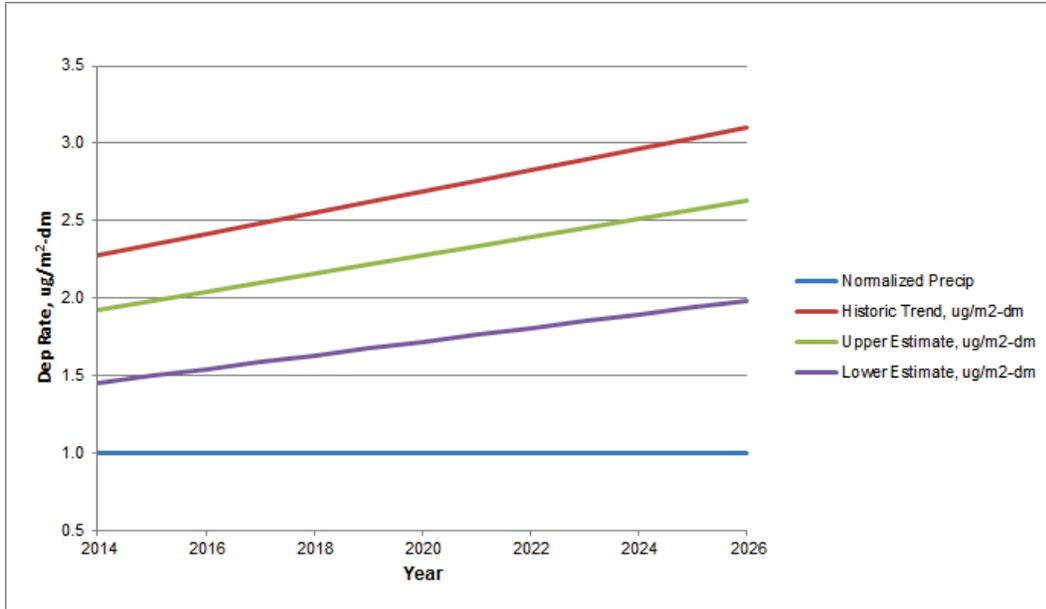


Figure 4.1-13 Projected Normalized MDN Deposition Rates

Based on historic trends, the zone between the estimated upper and lower bounds could represent a range of normalized mercury deposition ($\mu\text{g}/\text{m}^2\text{-dm}$),¹⁷ which could be measured in aggregate by MDN over the long term as a result of the Proposed Action.

Ammonia Monitoring Network

The Proposed Action, by implementing SCR on Units 4 and 5 to reduce NO_x emissions, would increase emissions of ammonia (NH_3) as unreacted “ammonia slip” in stack gas by about 140 tpy; however, there is no applicable significance criteria for ammonia mass emissions, only concentrations in ambient air, as discussed below¹⁸. In addition to ammonia slip, SCR operation would also cause formation of about 280 tpy of sulfuric acid mist (H_2SO_4) in stack gas, which is significant pursuant to 40 CFR 51.166(23)(i) which defines the PSD significance threshold for sulfuric acid mist emissions as 7 tpy. Under certain conditions, NH_3 and H_2SO_4 can combine to form ammonium sulfate ($[(\text{NH}_4)_2\text{SO}_4]$), a crystalline salt and a source of nitrogen nutrient deposition measured by NTN.

Table 4.1-47 and Figure 4.1-14 show projected ambient ammonia concentrations in northwestern New Mexico based on measurement data collected at AMoN sites in Navajo Lake (NM98) and Farmington (NM99) during the 2008 through 2012 timeframe, which is shorter than the 12-year data timeframes available for other deposition analytes.

¹⁷ To convert $\mu\text{g}/\text{m}^2\text{-dm}$ to $\text{ng}/\text{m}^2\text{-mm}$ multiply by 10.

¹⁸ Assumes 5 ppmv ammonia slip at 3 percent oxygen in stack gas, to be determined by BART permit condition.

Table 4.1-47 Projected AMoN Ambient Concentrations - Northwestern New Mexico

| Year | Historic Composite ng/m ³ | Proposed Action Range Upper ng/m ³ | Proposed Action Range Lower ng/m ³ |
|---------------|-----------------------------------------|-----------------------------------------------------|-----------------------------------------------------|
| 2014 | 979 | 1,509 | 504 |
| 2015 | 1,038 | 1,613 | 532 |
| 2016 | 1,098 | 1,717 | 560 |
| 2017 | 1,157 | 1,821 | 588 |
| 2018 | 1,217 | 1,925 | 617 |
| 2019 | 1,277 | 2,029 | 645 |
| 2020 | 1,336 | 2,133 | 673 |
| 2021 | 1,396 | 2,237 | 701 |
| 2022 | 1,455 | 2,341 | 729 |
| 2023 | 1,515 | 2,445 | 757 |
| 2024 | 1,574 | 2,549 | 785 |
| 2025 | 1,634 | 2,653 | 813 |
| 2026 | 1,693 | 2,757 | 841 |
| Trend | 715 | 1,248 | 336 |
| Change | 73% | 83% | 67% |

Source: NADP 2013; EPA 2011b, 1992b; CDC 2013.

Notes:

Based on aggregated historic data for 2 AMoN sites: NM98 Navajo Lake (lower), NM99 Farmington (upper).

Historic composite trend assumes ongoing status quo.

NIOSH Recommended Exposure Limit (REL) = 25 ppmv = 17,370 µg/m³ = 17,370,000 ng/m³.

ng/m³ = nanogram(s) per cubic meter

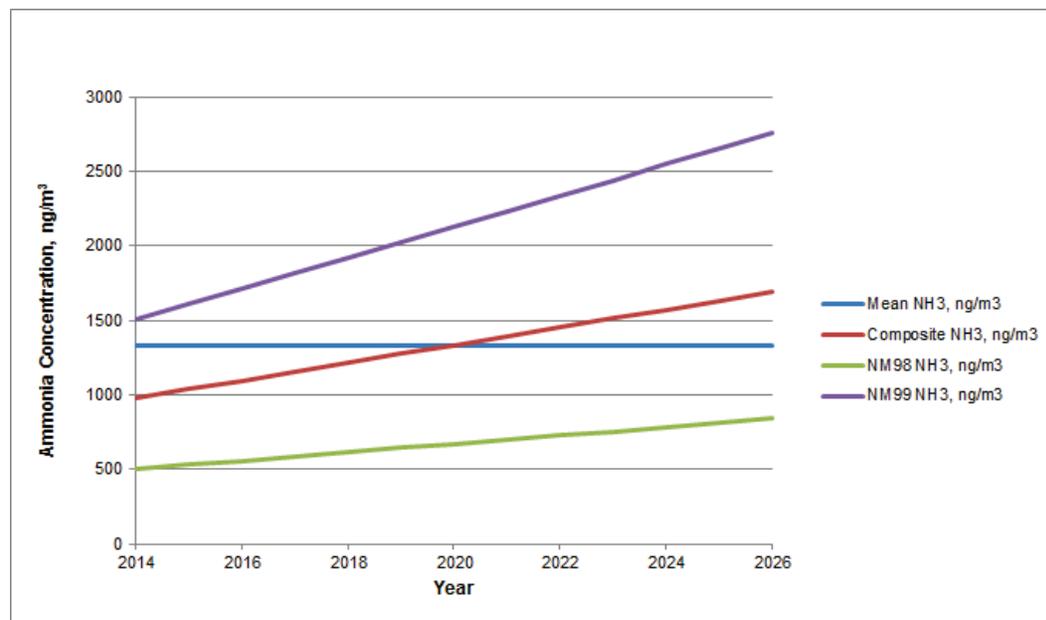


Figure 4.1-14 Projected AMoN Ambient Concentrations - Northwestern New Mexico

As discussed in Section 4.17, Public Health and Safety, in more detail, for occupational exposure to ammonia, the National Institute of Occupational Safety and Health (NIOSH) reference exposure level (REL) for ammonia (CAS No. 7664-41-7) is 25 ppmv or 17,300 $\mu\text{g}/\text{m}^3$ on a time-weighted average basis (Centers for Disease Control [CDC] 2013). No EPA standard has been adopted for public exposure to ammonia; therefore, the California Office of Environmental Health and Hazard Assessment (2013) REL is provided as a conservative benchmark from which to compare the project concentrations. As such, acute (1 hour) REL is 3,200 $\mu\text{g}/\text{m}^3$ and the chronic (long-term) REL is 200 $\mu\text{g}/\text{m}^3$.

As shown on Figure 4.1-14, measured mean ambient ammonia concentrations range from about 0.74 $\mu\text{g}/\text{m}^3$ (historic) to about 1.34 $\mu\text{g}/\text{m}^3$ (projected). These airborne concentrations represent less than 1 percent of the 200 $\mu\text{g}/\text{m}^3$ chronic REL; thus, no significant risk to public health from airborne ammonia is indicated for northwestern New Mexico since the chronic REL is not exceeded.

Visibility Impacts

The following discussion applies only to emissions from the FCPP. Because long-range visibility impacts are principally caused by emissions of NO_x and PM from power plant stacks (the regulatory aim of 40 CFR Part 49), visibility impacts from continued operation of the Navajo Mine SMCRA Permit Area and Pinabete SMCRA Permit Area (ground-level fugitive dust), and transmission lines (mobile sources) would be minor in comparison to the FCPP; therefore, implementation of these aspects (i.e., mine and transmission lines) of the Proposed Action would not have any impacts on long-range regional visibility or O_3 levels.

Four Corners Power Plant

Regional Haze

As discussed in Section 4.1.6, the *Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation* (40 CFR 49) requires FCPP to reduce emissions of NO_x and defines emission limits for PM based on emission rates currently achieved at FCPP. These pollutants contribute to visibility impairment (regional haze) in the 16 mandatory Class I Federal areas surrounding FCPP within a 300-km (186-mile) radius. Installation of SCR controls on Units 4 and 5 will reduce NO_x emissions 80 percent from 0.49 to 0.098 lb/mmBTU on a 30-day rolling average basis. For PM, Units 4 and 5 must meet an emission limit of 0.015 lb/mmBTU, while retaining the existing 20 percent opacity limit (77 FR 51620).

Compared to plantwide historic levels, implementation of 40 CFR 49 will reduce potential NO_x emissions 87 percent, from about 41,100 to 5,400 tpy over the long term, and will reduce potential PM emissions 58 percent, from about 1,980 to 830 tpy. While these reductions are very significant on a plantwide basis, they are somewhat less significant on a regional scale. Controlled NO_x emissions from FCPP would presumably comprise about 5 percent of regional NO_x emissions by 2020, and about 3 to 8 percent of regional PM emissions, depending on future control actions taken at other power plants. These regional percentages suggest that reducing emissions from FCPP would result in an incremental improvement in regional haze and visibility if emissions for the Proposed Action would affect visibility in Class I areas; however, at present, no major improvement would require effective control efforts at other power plants in the region.¹⁹

As described in Section 4.1.6.4 and shown on Figure 4.1-5, average visibility in the region has improved by about 15 percent over the 11-year period from 2000 to 2010, apparently due to improved control of air pollution from sources such as power plants. If this historic trend continues into the future, average deciviews could improve at a rate of about -0.12 per year. Thus, during the first half of the 25-year relicensure period (2014 to 2026), an average improvement of about -1.5 deciviews could be possible, as projected in Table 4.1-48 and illustrated on Figure 4.1-15 for the IMPROVE program (see Section 4.1.6.3).

¹⁹ Assessing future control strategies elsewhere is beyond the scope of this analysis.

Table 4.1-48 Projected Regional Visibility

| Year | Lowest Mean dV | Highest Mean dV | Average Mean dV |
|-----------------------------|----------------|-----------------|-----------------|
| 2014 | 1.9 | 9.9 | 5.8 |
| 2015 | 1.8 | 9.8 | 5.6 |
| 2016 | 1.7 | 9.7 | 5.5 |
| 2017 | 1.6 | 9.5 | 5.4 |
| 2018 | 1.5 | 9.4 | 5.3 |
| 2019 | 1.3 | 9.2 | 5.2 |
| 2020 | 1.2 | 9.1 | 5.0 |
| 2021 | 1.1 | 9.0 | 4.9 |
| 2022 | 1.0 | 8.8 | 4.8 |
| 2023 | 0.9 | 8.7 | 4.7 |
| 2024 | 0.8 | 8.5 | 4.5 |
| 2025 | 0.6 | 8.4 | 4.4 |
| 2026 | 0.5 | 8.3 | 4.3 |
| 13-Year Trend Change | -1.4 | -1.7 | -1.5 |
| Relative Improvement | 73% | 17% | 25% |

Source: CSU 2013c.

dV = deciview

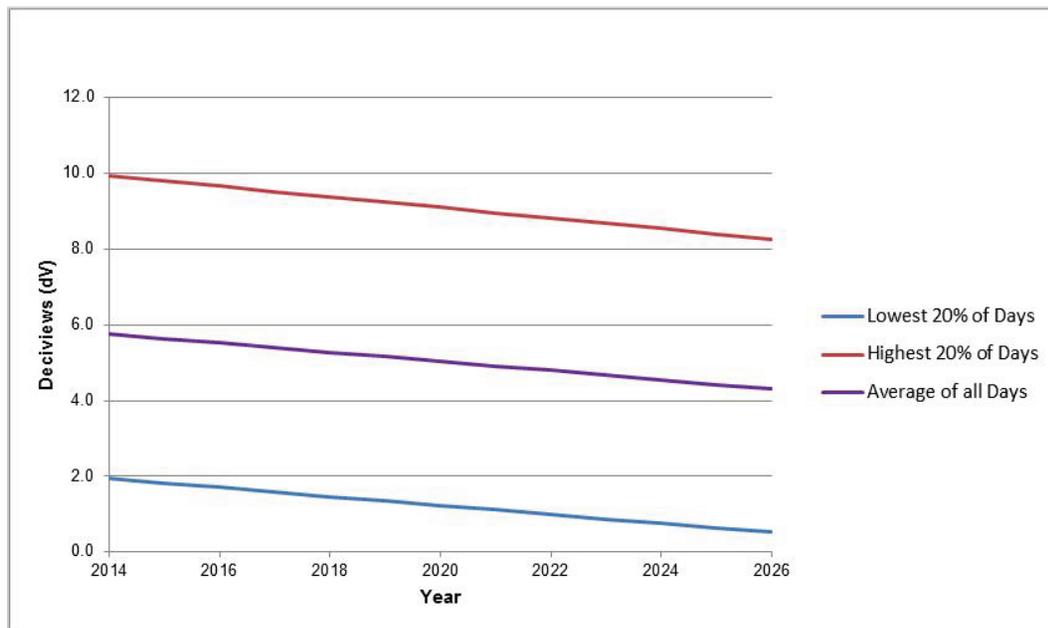


Figure 4.1-15 Projected Composite Visibility Trends

Plume Visibility Assessment Summary

A screening-level plume visibility analysis for a land area within 50 km (31 miles) of FCPP was conducted (AECOM 2013d) to assess whether a plume from the Units 4 and 5 stack would be visible to casual observers during daylight hours in fair weather, and to what extent. For the study, 16 roadside viewpoints were identified that provide vistas of natural landmarks in the vicinity of FCPP:

1. Ford Butte West Viewpoint (US Route 491)
2. Bennet Rock East Viewpoint (US Route 491)
3. Barber Peak West Viewpoint (US Route 491)
4. Table Mesa East Viewpoint (US Route 491)
5. Cathedral Cliff South Viewpoint (US Route 491)
6. Shiprock South Viewpoint (Red Rock Highway/Indian Route 13)
7. Shiprock North Viewpoint (US Route 64)
8. Chimney Rock West Viewpoint (US Route 491)
9. Chimney Rock East Viewpoint (Mancos Canyon Road)
10. Hogback West Viewpoint (US Route 64)
11. Hogback East Viewpoint (US Route 64)
12. Piñon Mesa East Viewpoint (NM State Route 170)
13. Piñon Mesa South Viewpoint (NM State Route 170)
14. Angel Peak West Viewpoint (US Route 550)
15. Bisti Badlands West Viewpoint (County Road 7260)
16. Bisti Badlands West Viewpoint (NM State Route 371)

Tables 4.1-49 and 4.1-50 summarize the screening-level results in terms of the vistas with greatest change, the least change as a percent of significance threshold for each parameter, and the number of vistas for which the visibility parameters would be improved or be degraded.

Note that controlling emissions of PM and NO_x from Units 4 and 5 would not contribute proportionally to reductions in plume visibility for all viewpoints and vistas due to the predicted increase in sulfate emissions from Units 4 and 5 SCR operation, which would result in a slight increase in light scattering and minor degradation of some vistas (AECOM 2013e).

As shown in Tables 4.1-49 and 4.1-50, the assessment of plume visibility from Units 4 and 5 indicates likely times when a downwind plume would be perceptible from various viewpoints in the area. This indication is because maximum values of the plume visibility parameters Cp and ΔE for worst-case meteorological conditions would exceed the contrast and perceptibility thresholds established by the EPA. The overall results suggest that the Proposed Action would improve view aesthetics in the area surrounding FCPP due to reduced visible plumes compared to present-day conditions. No criteria exist for evaluating visible plumes from sources beyond the boundaries of Federal Class I areas; therefore, this criteria was used to determine if emissions from the Proposed Action would affect visibility within Class I areas. However, at present, Federal Class I areas exist within the 50-km analysis area (AECOM 2013e).

Table 4.1-49 Plume Perceptibility (ΔE) Modeling Results

| Visual Parameter | Morning Plume Perceptibility (ΔE)⁵ Terrain Forward | Morning Plume Perceptibility (ΔE)⁵ Terrain Backward | Morning Plume Perceptibility (ΔE)⁵ Sky Forward | Morning Plume Perceptibility (ΔE)⁵ Sky Backward | Afternoon Plume Perceptibility (ΔE)⁵ Terrain Forward | Afternoon Plume Perceptibility (ΔE)⁵ Terrain Backward | Afternoon Plume Perceptibility (ΔE)⁵ Sky Forward | Afternoon Plume Perceptibility (ΔE)⁵ Sky Backward |
|------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Vista with Most Improvement ¹ | -3.78 | -11.85 | -9.13 | -5.30 | -1.67 | -16.73 | -8.08 | -6.73 |
| Vista with Least Improvement ¹ | 0.25 | -0.16 | -3.62 | -0.40 | 0.31 | -0.41 | -1.90 | -0.55 |
| EPA Significance Threshold (ΔE) | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Number of Vistas Evaluated ² | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| Number of Vistas Improved | 7 | 16 | 16 | 16 | 7 | 16 | 16 | 16 |
| Number of Vistas Degraded | 9 | 0 | 0 | 0 | 9 | 0 | 0 | 0 |
| Number of Vistas Significantly Improved ³ | 0 | 5 | 0 | 0 | 0 | 11 | 0 | 0 |
| Number of Vistas Significantly Degraded ⁴ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: AECOM 2013e.

Notes:

ΔE = plume perceptibility

1 A negative value represents an improvement in visibility.

2 From 16 viewpoints a sky background is observed and for 16 viewpoint-landmark combinations a terrain background is observed.

3 A vista is significantly improved if the baseline ΔE exceeds 2.0 and the future ΔE is less than 2.0.

4 A vista is significantly degraded if the baseline ΔE is less than 2.0 and the future ΔE exceeds 2.0.

5 Two theta (Θ) angles represent the sun being in front of the observer (forward scatter) where $\Theta = 10^\circ$ or behind the observer (backward scatter) where $\Theta = 140^\circ$.

Table 4.1-50 Plume Contrast (Cp) Modeling Results

| Visual Parameter | Morning Plume Contrast (Cp) ⁵ | Afternoon Plume Contrast (Cp) ⁵ |
|------------------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
| | Terrain Forward | Terrain Backward | Sky Forward | Sky Backward | Terrain Forward | Terrain Backward | Sky Forward | Sky Backward |
| Vista with Most Improvement ¹ | -0.10 | -0.19 | 0.06 | -0.06 | -0.07 | -0.08 | 0.08 | -0.05 |
| Vista with Least Improvement ¹ | 0.00 | 0.00 | 0.35 | -0.03 | 0.00 | 0.00 | 0.24 | -0.03 |
| EPA Significance Threshold [Cp] | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Number of Vistas Evaluated ² | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| Number of Vistas Improved | 15 | 16 | 0 | 16 | 15 | 16 | 1 | 16 |
| Number of Vistas Degraded | 0 | 0 | 16 | 0 | 0 | 0 | 15 | 0 |
| Number of Vistas Significantly Improved ³ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of Vistas Significantly Degraded ⁴ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: AECOM 2013e.

Notes:

Cp = plume contrast

- 1 A negative value represents an improvement in visibility.
- 2 From 16 viewpoints a sky background is observed and for 16 viewpoint-landmark combinations a terrain background is observed.
- 3 A vista is significantly improved if the baseline Cp exceeds 0.05 and the future Cp is less than 0.05.
- 4 A vista is significantly degraded if the baseline Cp is less than 0.05 and the future Cp exceeds 0.05.
- 5 Two theta (Θ) angles represent the sun being in front of the observer (forward scatter) where $\Theta = 10^\circ$ or behind the observer (backward scatter) where $\Theta = 140^\circ$.

Ozone Impacts

Upon implementation of the Proposed Action, local O₃ would be expected to decrease by about 3 ppbv or 6 µg/m³ on an 8-hour basis. Based on the Ozone Impact Assessment conducted for the project, O₃ impacts under the Proposed Action would be the same as described for the baseline. As described in the environmental setting section, the primary reduction in O₃ precursor (VOCs and NO_x) emissions would occur upon shut-down of Units 1, 2, 3, prior to implementation of the Proposed Action.

The Four Corners area is currently in NAAQS attainment for O₃. Decreasing or unchanged O₃ levels would support continuing NAAQS attainment, notwithstanding unpredicted meteorological conditions or significant new sources of precursors NO_x and VOC originating elsewhere which is beyond the scope of the modeling study. Thus, impacts on O₃ are minor due to NAAQS attainment status remaining unchanged.

The analysis indicates that no monitoring sites would be expected to exceed the 8-hour O₃ NAAQS under the Proposed Action. Five O₃ monitors are in the vicinity with predicted nonzero impacts ranging from 0.2 to 1.0 ppbv. The largest impact of the Proposed Action at an existing monitor is 1.0 ppbv in Farmington (Site ID 35-45-1005). None of the monitoring sites predicted to have an increase in O₃ concentrations under the Proposed Action would have design values that exceed NAAQS. O₃ impacts caused by FCPP emissions under the Proposed Action would not be the sole cause of NAAQS exceedances in those areas (i.e., La Garita Wilderness in Colorado, Grand Mesa in Uncompahgre and Gunnison National Forests, and Rio Grande National Forest) that may continue to exceed NAAQS in or after 2018 (possibly due to new precursor source contributions originating elsewhere or unpredicted meteorological conditions) (AECOM 2013b).

4.1.4.3 Alternative B – Navajo Mine Extension Project Plan

Under Alternative B with FIP Alternative A, impacts would be essentially the same as for the Proposed Action. Emissions and impacts would be essentially the same as described in Section 4.1.1.2.

Four Corners Power Plant

Since the operating scenario would be the same, impacts would be the same as described in Section 4.1.1.2, stack criteria emissions would be the same as shown in Tables 4.1-1 through 4.1-3 and HAP emissions would be the same as shown in Tables 4.1-4a and 4.1-4b.

Navajo Mine

The proposed mining area would be slightly altered from the Proposed Action, resulting in increased coal hauling distances and the associated emissions and dust would result in greater impacts on localized air quality. However, this increase in emissions and dust is within estimation and precision; therefore, impacts would be essentially the same as described in Section 4.1.1.2 (OSMRE 2011).

Transmission Lines

FCPP mobile source emissions would be essentially the same as shown in Table 4.1-39, within estimation precision (APS 2012). A very small portion of these emissions (less than 1 percent) would be associated with transmission line maintenance.

4.1.4.4 Alternative C – Alternative Pinabete Mine Plan

Under Alternative C, OSMRE would disapprove the Pinabete SMCRA Permit application and issue an alternative 10,094-acre Pinabete SMCRA permit area for a proposed mining disturbance in approximately 6,492 acres. Mining would be located in both Areas IV North and South. The BIA would approve the lease amendment for FCPP, and FCPP would operate as described under the Proposed Action. Under

Alternative C impacts would be essentially the same as for the Proposed Action. Emissions and impacts would be the same as described in Section 4.1.1.2.

Four Corners Power Plant

Impacts would be the same as described in Section 4.1.1.2.

Navajo Mine

Although the mining area would be slightly altered from the Proposed Action, impacts would be the same as described in Section 4.1.1.2.

Transmission Lines

FCPP mobile source emissions would be the same as shown in Table 4.1-39. A very small portion of these emissions (less than 1 percent) would be associated with transmission line maintenance.

4.1.4.5 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete SMCRA Permit application and renew the Navajo Mine SMCRA Permit. The Navajo Mine SMCRA Permit Area and Pinabete SMCRA Permit Area would be operated as described under the Proposed Action. Impacts would be the same as described for the Proposed Action.

Four Corners Power Plant

Since the operating scenario would be the same, impacts would be the same as described in the proposed action. Although the DFADA disturbance area would be slightly reduced from the Proposed Action, impacts would be the same as described in the Proposed Action.

Transmission Lines

FCPP mobile source emissions would be essentially the same as described for the Proposed Action. A very small portion of these emissions (less than 1 percent) would be associated with transmission line maintenance.

4.1.4.6 Alternative E – No Action Alternative

Under the No Action Alternative, criteria emissions would continue through 2015 until the FCPP shuts down; after this time, stack emissions would cease. The following section provides a summary of estimated emissions under this alternative. Deposition impacts under the No Action Alternative would be the same as described in the environmental setting; therefore, no additional analysis is provided. O₃ precursor (VOCs and NO_x) emissions from the FCPP would continue through 2015. An analysis of regional visibility as a result of the No Action Alternative is provided below.

Future Criteria Emissions

Table 4.1-51 below shows estimated stationary and mobile source emissions of SO₂, NO_x, and PM under this scenario during 2014 and 2015.

Table 4.1-51 Estimated No Action Criteria Emissions - FCPP and Navajo Mine

| Year | Stationary Sources | Stationary Sources | Stationary Sources | Mobile Sources | Mobile Sources | Mobile Sources |
|---------------------|----------------------------|----------------------------|--------------------|----------------------------|----------------------------|----------------|
| | SO ₂ tons/yr | NO _x tons/yr | PM tons/yr | SO ₂ tons/yr | NO _x tons/yr | PM tons/yr |
| 2014 | 12,000 | 41,100 | 2,000 | 12 | 550 | 1,350 |
| 2015 | 12,000 | 41,100 | 2,000 | 12 | 550 | 1,350 |
| 2-Year Total | 24,000 | 82,200 | 4,000 | 24 | 1,100 | 2,700 |

Sources: EPA 2012h, 2011a; OSMRE 2011; APS 2012; SCAQMD 2008.

Notes:

Stationary - power plant emissions per 2005-11 baseline period when all Units (1, 2, 3, 4, and 5) were operational.

Mobile - mining equipment and mine and power plant support vehicles (includes fugitive dust).

Stationary sources rounded to nearest 100 tons; mobile sources NO_x and PM rounded to nearest 10 tons.

NO_x = nitrogen oxide

PM =- particulate matter

SO₂ = sulfur dioxide

Four Corners Power Plant

Under the No Action Alternative, FCPP would continue to operate in 2014 and 2015. Beginning in 2016, power plant decommissioning would involve dismantling and salvage work. Estimated stationary source emissions for the baseline period (2005-2011) years are shown in Table 4.1-51.

Navajo Mine

Beginning in 2016, mine closure would involve land reclamation and equipment removal activities, along with disposition of water rights. Reclamation would occur as described for the Proposed Action; however, at an earlier time. Estimated mobile source emissions for the preceding 2 years are shown in Table 4.1-51.

Transmission Lines

Following shut-down of the FCPP in 2015, power from the FCPP would no longer be transported via the subject transmission lines. Beginning in 2016, transmission line decommissioning may involve dismantling and salvage work; however, these tasks are presently undefined and beyond the scope of this study. A very small portion of the mobile source emissions shown in Table 4.1-51 would be associated with transmission line maintenance.

Visibility Impacts

Four Corners Power Plant

As discussed above, under the No Action Alternative, following 2015, all stationary source emissions from the FCPP would cease. The Ozone Impact Assessment conducted for the proposed Project included a comparison of the regional O₃ precursor (VOCs and NO_x) emissions between the Proposed Action and the No Action Alternative. Table 4.1-52 shows the five largest differences in regional O₃ levels between the Proposed Action and No Action scenarios for 1-hour averaging times. The maximum predicted O₃ impacts attributable to FCPP would occur in July and August. The largest impact (16 ppbv) would be about 12 miles southeast of FCPP, while the fifth largest impact (13 ppbv) would be located about 29 miles southeast of FCPP.

Table 4.1-52 Maximum 1-Hour Ozone Impacts - Five Largest Differences

| Difference Between Proposed Action and No Action ¹ ppbv | Difference Between Proposed Action and No Action ¹ month | Former NAAQS ² ppbv | Nearest Local Maximum ³ ppbv | Furthest Local Maximum ⁴ ppbv | Former NAAQS status |
|-----------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------|--------------------------------------------|---------------------------------------------|---------------------|
| 15.8 | July | 120 | 77 | 90 | Meet |
| 15.1 | August | 120 | 77 | 90 | Meet |
| 14.9 | August | 120 | 77 | 90 | Meet |
| 13.3 | July | 120 | 77 | 90 | Meet |
| 13.1 | August | 120 | 77 | 90 | Meet |

Source: AECOM 2013b

Notes:

- 1 Maxima occur between 12 and 29 miles (19 and 46 km) southeast of FCPP.
 - 2 The 1979 1-hour NAAQS for ozone was rescinded in 1997 (attainment was defined as one or fewer days per calendar year where the maximum hourly average ozone concentration was greater than 120 ppbv).
 - 3 Site 35-45-0009: 28 miles (45 km) east of FCPP monitored maximum for 2011.
 - 4 Site 35-45-0018: 47 miles (75 km) east of FCPP monitored maximum for 2011.
- ppbv = part(s) per billion (by volume)

Tables 4.1-53 and 4.1-54 show predicted fourth-highest maximum 8-hour impacts for PSD Class I and affected sensitive Class II areas as defined by the NAAQS. Table 4.1-55 shows 8-hour EPA design values for five O₃ monitoring sites in the vicinity as predicted by the NAAQS attainment test methodology. For the No Action Alternative, regional average O₃ concentrations decreased from 64 to 62 ppbv. The greatest changes occurred in the western and central areas of the region where predicted fourth-highest daily maximum 8-hour average O₃ concentrations decreased by about 5 to 7 ppbv. In contrast, under the Proposed Action, the only locations where O₃ increased were immediately downwind of FCPP [possibly due in part to predicted meteorological conditions used for the modeling and increased utilization of Units 4 and 5]. The maximum increase in the fourth-highest 8-hour O₃ concentrations was less than 4 ppbv (AECOM 2013b). Thus, since predicted O₃ concentrations in the region are expected to decrease or remain about the same and the overall region is currently in NAAQS attainment, the Proposed Action would have minor impact on ambient O₃ in the region in the short- or long-term.

Table 4.1-53 Fourth-Highest Maximum 8-Hour Ozone Impacts - PSD Class I Areas

| | Proposed Action Ozone¹ | No Action Ozone¹ | Difference Between Proposed Action and No Action | Endpoint NAAQS status |
|----------------------------------------------|------------------------------------------|------------------------------------|---------------------------------------------------------|------------------------------|
| Sixteen Class I Areas | ppbv | ppbv | ppbv | |
| Petrified Forest National Park (AZ) | 67.9 | 67.9 | 0.0 | Meet |
| Grand Canyon National Park (AZ) | — | — | — | — |
| Capitol Reef National Park (UT) | — | — | — | — |
| Canyonlands National Park (UT) | 61.0 | 61.0 | 0.0 | Meet |
| Arches National Park (UT) | — | — | — | — |
| Mesa Verde National Park (CO) | 65.0 | 64.7 | 0.3 | Meet |
| Black Canyon of the Gunnison Wilderness (CO) | — | — | — | — |
| Weminuche Wilderness (CO) | 74.7 | 74.7 | 0.0 | Meet |
| La Garita Wilderness (CO) | 75.4 | 75.4 | 0.0 | Exceed |
| West Elk Wilderness (CO) | — | — | — | — |
| Maroon Bells – Snowmass Wilderness (CO) | — | — | — | — |
| Great Sand Dunes National Monument (CO) | — | — | — | — |
| Wheeler Peak Wilderness (NM) | — | — | — | — |
| Pecos Wilderness (NM) | 66.8 | 66.8 | 0.0 | Meet |
| Bandelier National Monument (NM) | 66.8 | 66.3 | 0.5 | Meet |
| San Pedro Parks Wilderness (NM) | 67.5 | 67.4 | 0.1 | Meet |

Note:

1. Year 2018.

ppbv = part(s) per billion (by volume)

Table 4.1-54 Fourth-Highest Maximum 8-Hour Ozone Impacts - Affected Sensitive Class II Areas

| | Proposed Action Ozone¹ | No Action Ozone¹ | Difference Between Proposed Action and No Action | Endpoint NAAQS status |
|--------------------------------------------------------|------------------------------------------|------------------------------------|---------------------------------------------------------|------------------------------|
| Affected Sensitive Class II Areas | ppbv | ppbv | ppbv | |
| Carson National Forest | 72.0 | 71.9 | 0.1 | Meet |
| Grand Mesa, Uncompahgre, and Gunnison National Forests | 75.4 | 75.4 | 0.0 | Exceed |
| Handies Peak Wilderness Study Area | 74.3 | 74.3 | 0.0 | Meet |
| Jicarilla Apache Indian Reservation | 72.3 | 71.8 | 0.5 | Meet |
| Navajo Nation | 74.9 | 74.3 | 0.6 | Exceed |
| Redcloud Peak Wilderness Study Area | 74.0 | 74.0 | 0.0 | Meet |
| Rio Grande National Forest | 75.2 | 75.2 | 0.0 | Exceed |
| San Juan National Forest | 74.2 | 74.2 | 0.0 | Meet |
| Uncompahgre Wilderness Area (BLM managed) | 74.1 | 74.1 | 0.0 | Meet |
| Uncompahgre Wilderness Area (USFS managed) | 74.1 | 74.1 | 0.0 | Meet |

Note:

1 Year 2018.

ppbv = part(s) per billion (by volume)

Table 4.1-55 Attainment Test 8-Hour Ozone Design Values - Four Corners Region

| Areas and Monitoring Sites | Proposed Action Ozone¹ ppbv | No Action Ozone¹ ppbv | Difference Between Proposed Action and No Action ppbv | Endpoint NAAQS status |
|------------------------------------------|-----------------------------------------------|-----------------------------------------|--------------------------------------------------------------|------------------------------|
| San Juan County, New Mexico (35-45-0009) | 66.5 | 66.2 | 0.3 | Meet |
| San Juan County, New Mexico (35-45-1005) | 68.1 | 67.1 | 1.0 | Meet |
| La Plata County, Colorado (08-67-1004) | 69.8 | 69.6 | 0.2 | Meet |
| La Plata County, Colorado (08-67-7003) | 60.3 | 60.1 | 0.2 | Meet |
| Montezuma County, Colorado (08-83-0101) | 65.1 | 64.7 | 0.4 | Meet |

Source: AECOM 2013b.

Notes:

1 Year 2018.

ppbv = part(s) per billion (by volume)

4.1.5 Air Quality Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and BMPs for specific activities. These are described in Section 3.2.6.1. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Moreover, EPA issued its FIP for BART at FCPP to control air emissions, which led to changes in the affected environment. This completed Federal Action is considered part of the environmental baseline to which the impacts of continuing operations and the Proposed Actions are compared. As a result of the BART ruling, APS shut down Units 1, 2, and 3 on December 30, 2013, and will install SCR on the remaining Units 4 and 5. Although the BART rules specifically address NO_x and PM, the implementation of BART would result in a decrease of all air pollutants emitted as shown in Table 4.1-39.

Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures, regulatory compliance, and emissions reductions resulting from BART compliance, they are listed below as specific mitigation measures. In this instance, the Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse impacts to air quality. Therefore, no additional mitigation is recommended.

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