



# Introduction to Air Quality Modeling for Permitting Programs

September 30, 2021 (Webinar 2)

**Tribal Air Monitoring**



**Support Center**




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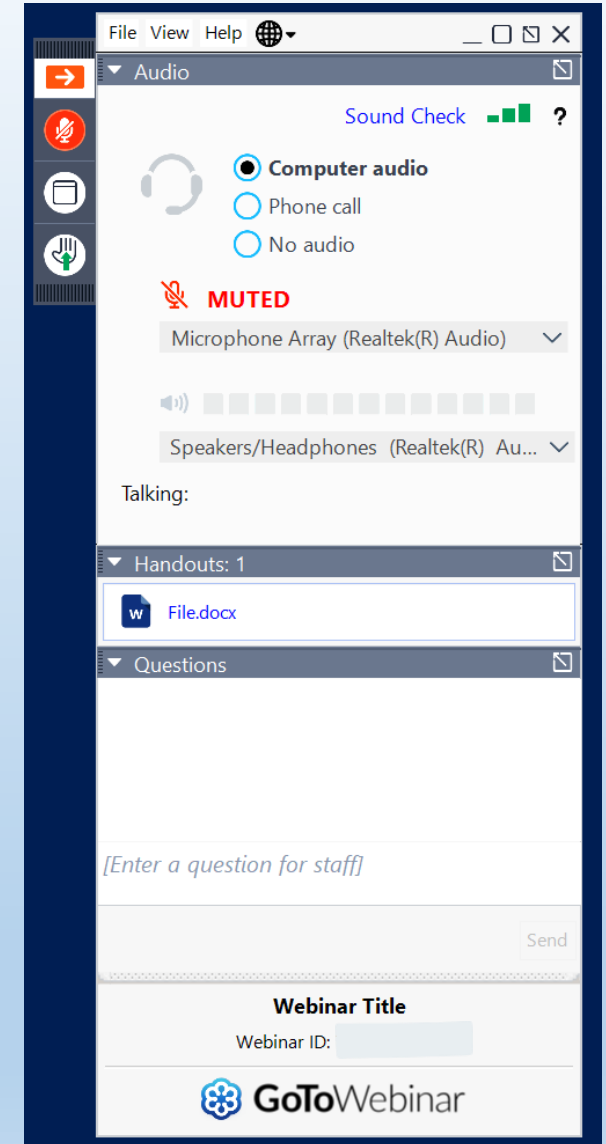
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Presented by the Institute for Tribal Environmental Professionals  
American Indian Air Quality Training Program  
Questions? Contact [Christal.Black@nau.edu](mailto:Christal.Black@nau.edu)





# Polling Questions

# Poll Question 1



- Which of the following best describes your role?
  - Environmental Staff
  - Community or Tribal Leader
  - Federal or State Partner
  - Other

# Poll Question 2



- Have you ever reviewed an Air Quality Dispersion Model or have used Air Dispersion Modeling software?
  - Yes
  - No
  - Unsure



# Presenter

**Michael King**  
**NAU ITEP TAMS Center**



Michael King is the Technical Training Analyst with NAU ITEP's Tribal Air Monitoring Support (TAMS) Center. Mike started working for ITEP in 2019 where he provides technical air monitoring assistance and data management for tribes throughout Indian Country. Before working with ITEP, he worked in tribal air programs for over ten years providing technical air quality management for the Southern Ute Indian Tribe, Ute Mountain Ute Tribe, and Navajo Nation.

Mike received his BS degree in Environmental Science from Haskell Indian Nations University in 2005 and a MS degree from Purdue University in 2013. Mike can be reached by e-mail at [Michael.King@nau.edu](mailto:Michael.King@nau.edu)

# Webinar 1

# Presenters



**Charles Buckler**  
**US EPA OAQPS**



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# Webinar 1 Re-Cap



- What is an air quality dispersion model and why are they needed
  - Modeling vs. Monitoring
  - Regulatory Models – AERMOD
- Understanding modeling inputs and outputs
- Modeling within the Permitting Program (PSD Increment, NSR, Minor Source)
- Tribal case study

# Webinar 2 Overview



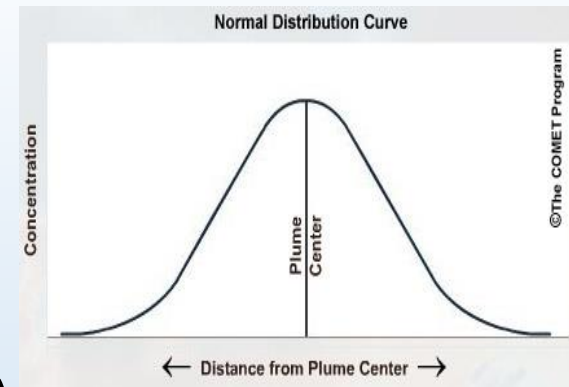
- What is a Modeling Protocol
- Understanding and interpreting Modeling Protocol inputs
- Why it is important to have a Modeling Protocol
- Modeling Protocol Summary
- Tribal case study

# What is a Modeling Protocol

- Details the methodology and model inputs before modeling begins
  - Modeling Methodology
  - Source Characterization/Information
  - Receptor Grids
  - Terrain Elevations
  - Building Downwash
  - Meteorological Data
  - Source Inventories
  - Background Values
  - Additional impact analysis, impacts to Class I/II areas
- Protocol supports the modeling decisions and provide a basis for evaluation of those decisions
- Protocol must be approved by the reviewer (EPA Regional Modeling Contact) and the modeler (permitting applicant)

# Modeling Methodology

- Specify the model to be used, the version of model
  - Use the latest version of the AMS/EPA Regulatory Model (AERMOD)
  - GUI AERMOD can be purchased from Lakes Environmental
  - Near-field model ( $\leq 50\text{km}$ ), Far-field model ( $>50\text{km}$ )
- There are two input data processors that are regulatory components of the AERMOD modeling system:
  - AERMET/AERSURFACE - meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and surface characteristics
  - AERMAP, a terrain preprocessor that incorporates complex terrain using United States Geological Survey (USGS) Digital Elevation Data.
- AERSCREEN (preprocessor) may be used as a screening tool





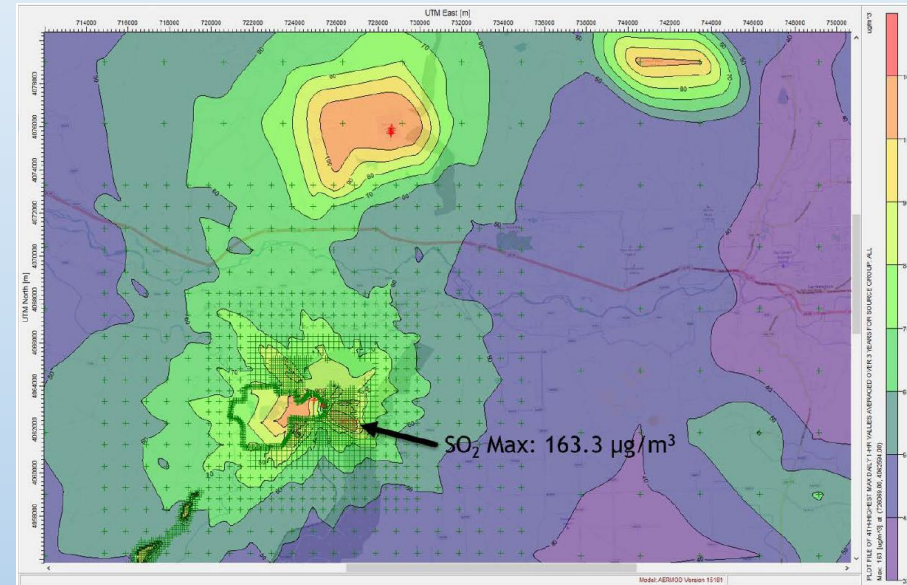
# Source Information

- Identify affected pollutants and source type (point, area or volume)
- Topographic (USGS) map and plat map of facility and surrounding areas (covering approx.. 5 km)
- Specify emission units (maximum emission rates or gas exit velocity & temperature)
  - Stacks (horizontal, downward, capped)
  - Cooling Towers
  - Indoor Venting
- Buoyant line sources (long series of vents rather than single stack)
- Fugitive sources (storage piles, haul roads)
- Merged sources
- Ancillary sources
- Varying operation loads/restrictions
- Building downwash
- Offsite source inventories

# Receptor Grid Information

- Receptors are locations where the model measures pollutant concentrations
- Receptors placed in **ambient air** locations (outside fence-line or barriers)
- Receptors should include a Cartesian grid with receptors spaced as follows:

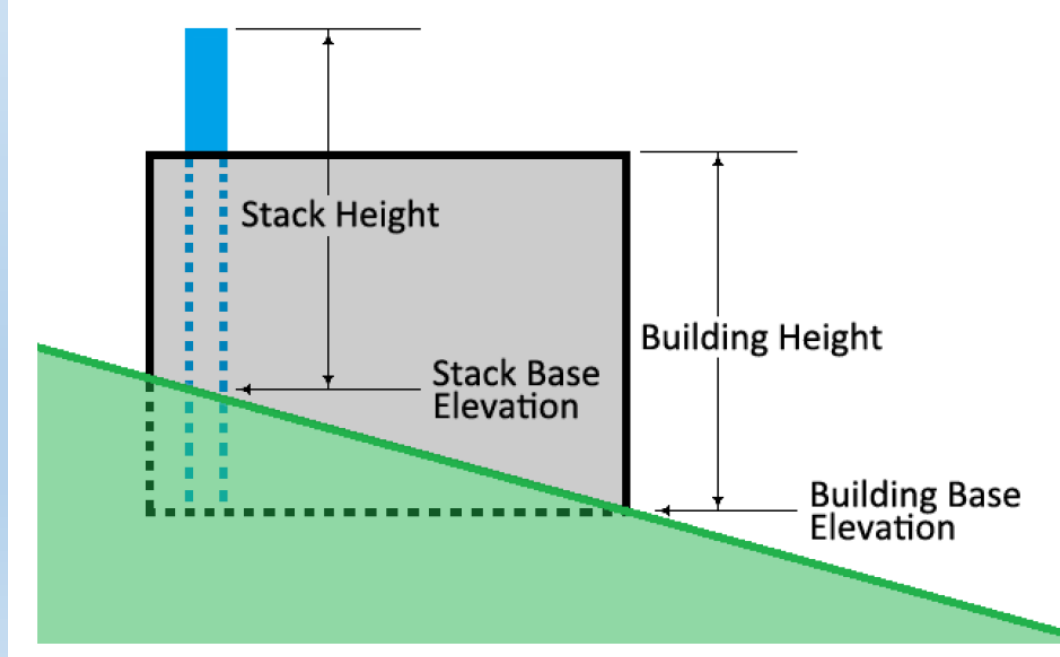
- 50 m along the ambient boundary
- 50 m extending the ambient boundary to 0.5 km
- 100 m extending from 0.5 km to 1.5 km
- 250 m extending from 1.5 km to 3 km
- 500 m extending from 3 km to 5 km



- Fine grids (50 m) should be placed over the area(s) of maximum concentration to ensure true maximum concentration is identified
- The receptor grid should be of sufficient size and resolution to identify the maximum pollutant impact

# Terrain Elevations

- Identify base elevations of the sources and buildings
- Based on survey data or National Elevation Dataset (NED)
- Data is imported into AERMOD using AERMAP preprocessor
- Determine actual stack height above the base elevation



# Building Downwash

- Identify buildings and structures and how they impact pollutant plume dispersion
- Building downwash analysis conducted using EPA's Building Profile Input Program with Plume Rise Enhancements (BPIP-PRIME)
  - Preprocessor contains wind direction-specific building dimensions
- Off-property buildings that affect downwash must be included
- BPIP-PRIME preprocessed data is used to generate input files into AERMOD for building downwash





# Meteorological Data

- Identify meteorological data used to input into AERMOD
- Must have at least 1 year of on-site met data or 5 years of NWS data
- 10 m surface met tower (profile base = met station elevation)
- AERMET and AERSURFACE preprocessed data is used to generate input files into AERMOD for the surface boundary layer parameters and meteorological profile



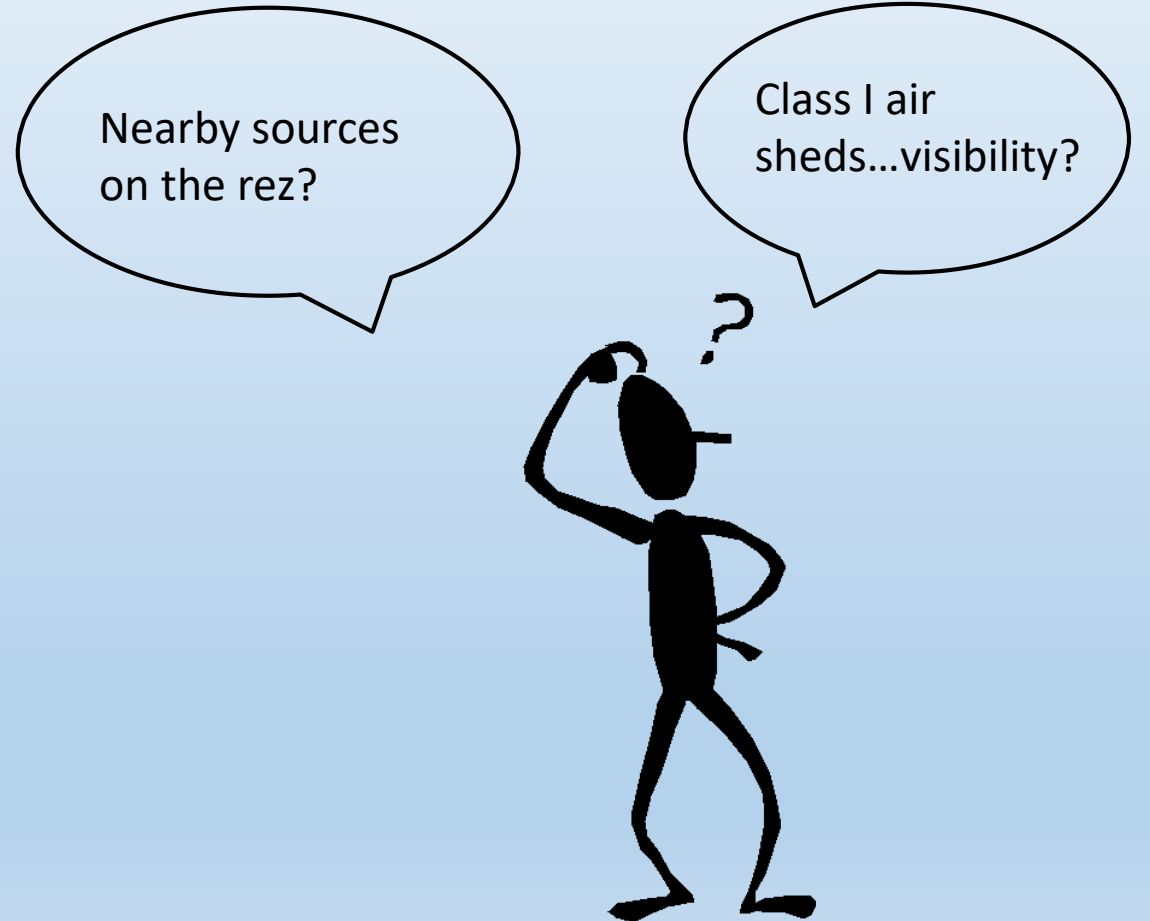
# Background Values

- Identify background concentrations for each pollutant being modeled
- Acceptable method for determining ambient background values is to use data collected from State, Local, Air Monitoring Stations (SLAMS)
- The background concentrations are added to the modeled concentrations, which are then compared to the applicable National Air Quality Standard (NAAQS) to determine compliance.



# Source Inventories & Additional Impact Analysis

- Identify the extent of the significant impact area and whether an offsite source inventory of facilities should be considered for the full impact analysis.
- Additional impact analysis assesses the impact of the emissions from the source and any associated growth on soils, vegetation, and visibility.



# Modeling Protocol Summary

- Characterization of the source, receptor domain or modeled area
- Methodology for preparing air quality and meteorology inputs including choice of meteorological data and representativeness of the data
- An emissions analysis of the area under consideration for NAAQS designations

Additionally, after approval of the protocol the documentation should include:

- Summary and analysis of modeling results
- Copies of modeling data inputs and outputs in electronic form
- In cases of variable emissions, summary of the emissions used



# Poll Question 3



- Do you think you can now review and interpret an Air Quality Modeling Protocol?
  - Yes
  - No
  - Unsure

# Tribal Case Study – Implementing EPA's SO<sub>2</sub> Data Requirements Rule (DRR) on the Navajo Nation



- On August 21, 2015, the EPA finalized and promulgated the SO<sub>2</sub> DRR (80 FR 51052).
- EPA's DRR requires the characterization of ambient SO<sub>2</sub> air quality around SO<sub>2</sub> emission sources emitting 2,000 or more tons per year of SO<sub>2</sub>.
- The air quality characterization can be carried out through **ambient monitoring, air dispersion modeling** or establishment of federally enforceable emission limits
- In 2016, Navajo Nation EPA developed a **Modeling Protocol** and submitted it to US EPA Region 9 who deemed it appropriate for use in satisfying source-oriented SO<sub>2</sub> DRR modeling requirements

# Timeline for EPA's SO<sub>2</sub> Data Requirements Rule (DRR)

- Adhere to the timeline to complete modeling protocol and analysis

**TIMELINE FOR 2010 PRIMARY SO<sub>2</sub> NAAQS DESIGNATION PROCESS**

MILESTONE	DATE**
<b>ROUND 1 – Areas Associated with 2009-2011 Monitored Violations</b>	
EPA signs notice promulgating final SO <sub>2</sub> area designations for 29 nonattainment areas	July 25, 2013
FR Publication (78 FR 47191)	August 5, 2013
Effective Date	October 4, 2013
<b>ROUND 2 – Areas Associated with 68 Power Plants &amp; New Monitored Violations</b>	
Court Order	March 2, 2015
States may submit updated recommendations and supporting information for area designations to EPA	No later than September 18, 2015
EPA notifies states concerning any intended modifications to their recommendations (120-day letters)	January 22, 2016 (no later than 120 days prior to final designations)
EPA publishes public notice of state recommendations and EPA's intended modifications and initiates 30-day public comment period	o/a February 3, 2016
End of 30-day public comment period	o/a March 4, 2016
States and tribes submit additional information, if desired, to demonstrate why an EPA modification is inappropriate	o/a April 8, 2016
EPA signs notice promulgating final SO <sub>2</sub> area designations (no later than 16 months from Court Order)	No later than July 2, 2016
<b>ROUND 3 – Modeled Areas and Areas w/o Monitors</b>	
States submit air quality modeling results for selected areas ( <i>per proposed SO<sub>2</sub> DRR*</i> )	January 13, 2017
EPA notifies states concerning any intended modifications to their recommendations (120-day letters)	No later than September 1, 2017
EPA signs notice promulgating final SO <sub>2</sub> area designations (per Court Order)	No later than December 31, 2017
<b>ROUND 4 – New Monitored Areas/All Remaining Areas</b>	
States begin operating new monitoring network ( <i>per proposed SO<sub>2</sub> DRR*</i> )	January 1, 2017
States certify 2019 monitoring data (to calculate 2017-2019 design value)	May 1, 2020
EPA notifies states concerning any intended modifications to their recommendations (120-day letters)	No later than September 2, 2020
EPA signs notice promulgating final SO <sub>2</sub> area designations (per Court Order)	No Later than December 31, 2020

\* Proposed SO<sub>2</sub> DRR = Data Requirements Rule for the 1-Hour Sulfur Dioxide (SO<sub>2</sub>) Primary National Ambient Air Quality Standard (NAAQS); Proposed Rule (79 FR 27446, May 13, 2014)

\*\* o/a = on or about

# Why Monitor vs Model SO<sub>2</sub>

- SO<sub>2</sub> ambient monitoring network has 400+ monitors nationwide
- Approx. two-thirds of the SO<sub>2</sub> monitors are not located to characterize maximum concentration from sources
- It was observed that some areas without monitoring likely have concentrations violating the NAAQS
- Two major sources of SO<sub>2</sub> were identified on Navajo Nation: **Four Corners Power Plant & Navajo Generating Station**
- Monitoring was not feasible due to lack of monitoring equipment, funding support and infrastructure
- NNEPA determined that the best approach to characterize air quality surrounding two coal-fired power plants was to conduct **near-field air dispersion modeling**
- AERMOD was used to demonstrate compliance with the 2010 1-Hour (75 ppb) Sulfur Dioxide (SO<sub>2</sub>) Primary National Ambient Air Quality Standard (NAAQS)





# How was Navajo Nation EPA's SO<sub>2</sub> DRR Modeling Protocol Developed?

- Reviewed U.S. EPA's 2016 Draft SO<sub>2</sub> NAAQS Designations Modeling Technical Assistance Document (Modeling TAD)
- Modeling TAD is consistent with the EPA's *Guideline on Air Quality Models* (U.S. EPA, 2005), or Appendix W to 40 CFR part 51
- The primary objective of the modeling is to determine compliance with SO<sub>2</sub> NAAQS for designation purposes
- Consulted with the EPA Region 9 Modeling Contact (Scott Bohning) to discuss any specific questions

## SO<sub>2</sub> NAAQS Designations Modeling Technical Assistance Document

U.S. EPA

Office of Air and Radiation

Office of Air Quality Planning and Standards

Air Quality Assessment Division

February 2016

DRAFT

# Navajo Nation EPA's SO<sub>2</sub> DRR Four Corners Power Plant Modeling Protocol vs 40 CFR Part 51, App. W

- Navajo Nation differs from Guidelines for Air Quality Models, 40 CFR Part 51, Appendix W, for the following:
  - Placement of receptors only in areas where it is feasible to place a monitor vs. all ambient air locations (NSR, PSD, and SIP).
  - Use of the most recent 3 years of actual emissions (designations) vs. maximum allowable emissions (NSR, PSD, and SIP).
  - Use of 3 years of meteorological data (designations) vs. one to five years (NSR, PSD, and SIP).
  - Use of actual stack height for designations using actual emissions vs. Good Engineering Practice (GEP) stack height for other regulatory applications (NSR, PSD, and SIP).



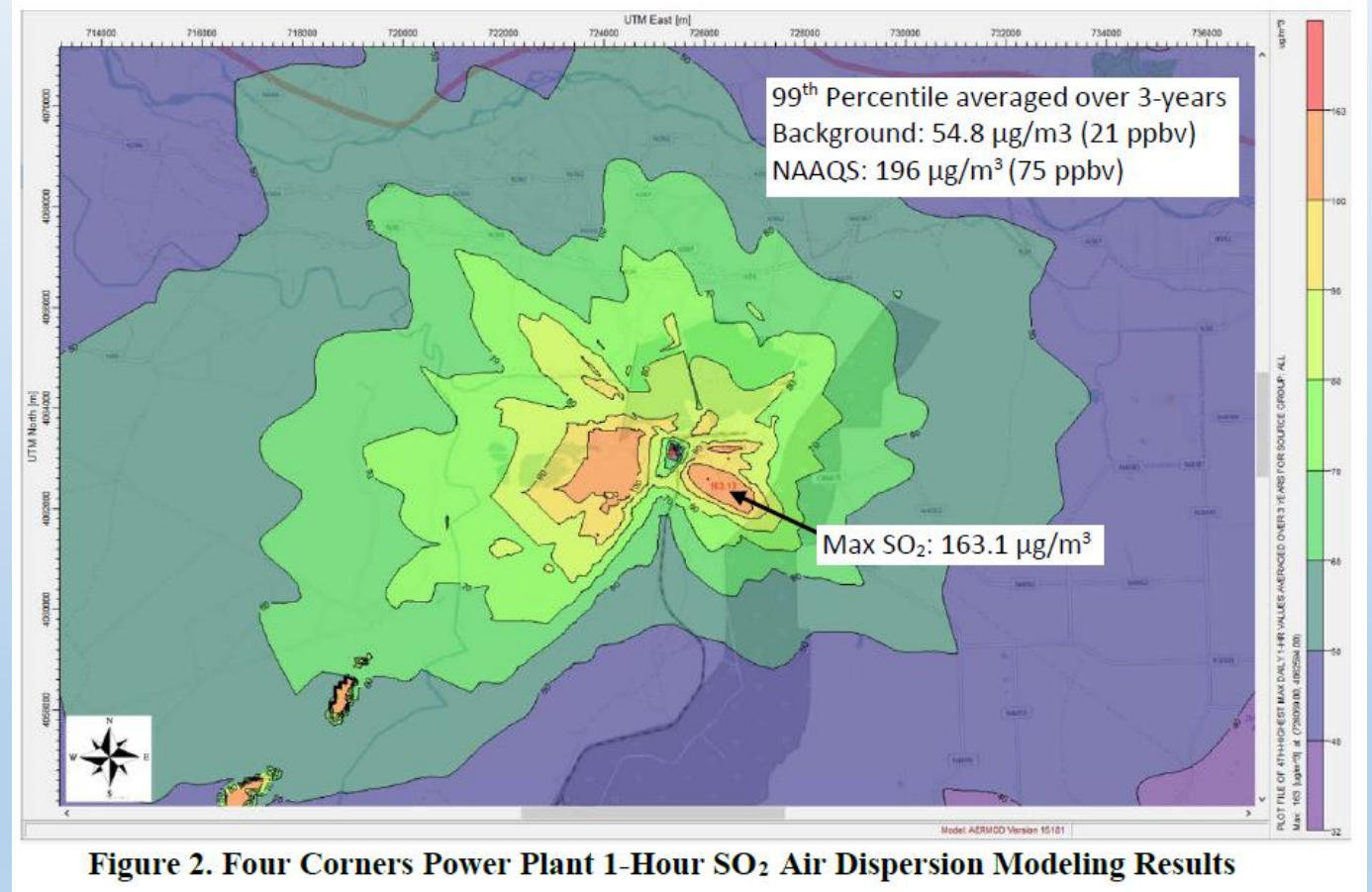
Navajo Nation Environmental Protection Agency  
Air & Toxics Department  
Air Quality Control Program

Summary of the Four Corners Power Plant SO<sub>2</sub> DRR  
Dispersion Modeling Protocol and Analysis Results

January 2017

# Navajo Nation EPA's Four Corners Power Plant Modeling Results

- The 99th percentile maximum daily values, averaged over the three years modeled, are equal to  $163.1 \mu\text{g}/\text{m}^3$  (62 ppbv), which is below the 1-Hour
- $\text{SO}_2$  NAAQS =  $196 \mu\text{g}/\text{m}^3$  (75 ppbv).
- The peak impact occurs in the area covered by 100-meter spaced receptors located less than a kilometer to the southeast of the Units 4 and 5 stack
- Results in support of a NAAQS attainment designation.



# Navajo Nation EPA's SO2 Data Requirements Rule – SO2 1-HOUR NAAQS Designation

- Unclassifiable/Attainment



E. SCOTT PRUITT  
ADMINISTRATOR

December 18, 2017

The Honorable Russell Begaye  
President of the Navajo Nation  
P.O. Box 7440  
Window Rock, Arizona 86515

Dear President Begaye:

I am writing to inform you that the U.S. Environmental Protection Agency has determined that air quality for parts of the Navajo Nation meets the health-based National Ambient Air Quality Standard for sulfur dioxide established in 2010. As such, we are designating these areas "attainment/unclassifiable." In addition, because there is not sufficient information for the Navajo Nation portion of Coconino County, the EPA is designating that area "unclassifiable." The inclusion of any Indian country in the designation area is not a determination that the state has regulatory authority under the Clean Air Act for such Indian country. This action completes area designations for your tribe.

Improving air quality to protect public health is a shared goal. Through local, state, tribal, and national programs, we have made considerable progress to reduce SO<sub>2</sub> levels throughout the country. Nationwide, monitored levels of sulfur dioxide have dropped 85 percent since 1990. I appreciate the work you have done and the partnership we have developed to achieve this impressive reduction.

If you have questions or concerns, please contact me or your staff may contact Troy Lyons, Associate Administrator for the Office of Congressional and Intergovernmental Relations, at [lyons.troy@epa.gov](mailto:lyons.troy@epa.gov) or at (202) 564-5200.

Respectfully yours,

E. Scott Pruitt

## Technical Support Document:

### Chapter 24

#### Final Round 3 Area Designations for the 2010 1-Hour SO<sub>2</sub> Primary National Ambient Air Quality Standard for Navajo Nation

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (the EPA, we, or us) must designate areas as either "nonattainment," "attainment," or "unclassifiable" for the 2010 1-hour sulfur dioxide (SO<sub>2</sub>) primary national ambient air quality standard (NAAQS) (2010 SO<sub>2</sub> NAAQS). Our Notice of Availability (NOA)<sup>1</sup> and our Technical Support Document<sup>2</sup> for our intended designations for this round of designations which we are required to complete by December 31, 2017, provided background on the relevant CAA definitions and the history of the designations for this NAAQS. Chapter 1 of this TSD for the final designations explains the definitions we are applying in the final designations. The TSD for the intended Round 3 area designations also described Navajo Nation's recommended designations, assessed the available relevant monitoring, modeling, and any other information, and provided our intended designations.

For Navajo Nation, there have been no changes in Navajo Nation's recommended designations since we communicated our intended designations for areas in Navajo Nation. In addition, neither Navajo Nation nor any other party submitted additional relevant information since the publication of the NOA. This TSD does not repeat information contained in the TSD for our intended designations. For areas of Navajo Nation that are part of the Round 3 designations process, we are finalizing the designations described in our 120-day letters and the TSD for the intended Round 3 area designations. All the final designations are listed in Table 1 below.

For the areas in Navajo Nation that are part of the Round 3 designations process, Table 1 identifies the EPA's final designations and the counties or portions of counties to which they apply. It also lists Navajo Nation's current recommendations, which have not been modified since our 120-day letters were sent. The EPA's final designations for these areas are based on an assessment and characterization of air quality through ambient air quality data, air dispersion modeling, other evidence and supporting information, or a combination of the above.

<sup>1</sup> EPA Responses to Certain State Designation Recommendations for the 2010 Sulfur Dioxide Primary National Ambient Air Quality Standard: Notification of Availability and Public Comment Period, September 5, 2017 (82 FR 41903)

<sup>2</sup> Intended Round 3 Area Designations for the 2010 1-Hour SO<sub>2</sub> Primary National Ambient Air Quality Standard Technical Support Document, August 2017. <https://www.epa.gov/sulfur-dioxide-designations/initial-technical-support-documents-area-designations-round-3>

Table 1. Summary of the EPA's Final Designations and the Designation Recommendations by Navajo Nation

Area/County	Navajo Nation's Recommended Area Definition	Navajo Nation's Recommended Designation	EPA's Intended Designation	EPA's Final Area Definition	EPA's Final Designation <sup>3</sup>
Navajo Nation portion of Coconino County, Arizona	Area around Navajo Generating Station	Attainment	Unclassifiable	Navajo Nation portion of Coconino County, Arizona, located within 50 km of Navajo Nation Generating Station	Unclassifiable
Rest of Navajo Nation	No specific recommendation	No specific recommendation	Unclassifiable / Attainment	All remaining lands of the Navajo Nation <sup>1</sup> excluding the area designated unclassifiable	Attainment/ Unclassifiable

<sup>1</sup> Includes lands of the Navajo Nation geographically located within the states of New Mexico and Utah.

<sup>3</sup> Refer to Chapter 1 of Technical Support Document: Final Round 3 Area Designations for the 2010 1-Hour SO<sub>2</sub> Primary National Ambient Air Quality Standard for definitions of the designation categories and the terminology change from Unclassifiable/Attainment to Attainment/Unclassifiable.



# Resources

## US EPA SCRAM

- <https://www.epa.gov/scram>

## US EPA AERMOD

- <https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models>

## Lakes Environmental AERMOD Training (online)

- <https://www.weblakes.com/training/upcoming-courses/>

## 40 CFR Appendix W to Part 51 – Guideline on Air Quality Model

- <https://www.epa.gov/scram/clean-air-act-permit-modeling-guidance>







**Thank you for joining today's webinar!**