To: susan.kihara@doh.hawaii.gov[susan.kihara@doh.hawaii.gov]; CHANG, RANDALL[Chang.Randall@epa.gov]; lisa.young@doh.hawaii.gov[lisa.young@doh.hawaii.gov]
Cc: Vallano, Dena[Vallano.Dena@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
From: YOSHIMURA, GWEN
Sent: Tue 8/18/2015 7:27:05 PM
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

We may need to reschedule this call, FYI (Meredith won't be able to make it this afternoon). Randy has a whole bunch of meetings today – I'll try to catch him during his 1pm meeting so he can send something more definitive.

Gwen M. Yoshimura
Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: YOSHIMURA, GWEN
Sent: Tuesday, August 18, 2015 12:23 PM
To: 'Kihara, Susan'; CHANG, RANDALL; lisa.young@doh.hawaii.gov
Cc: Vallano, Dena; Bohnenkamp, Carol
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Oh! So you would like to talk about the exceptional events notification process, not about SO2 data requirements rule.

Randy, do you want Meredith or Michael for that discussion? I don't think you need Dena, Carol, or myself (though I can join if you like).

Thanks,

Gwen

Gwen M. Yoshimura
Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Kihara, Susan [mailto:susan.kihara@doh.hawaii.gov]
Sent: Tuesday, August 18, 2015 12:20 PM
To: CHANG, RANDALL; lisa.young@doh.hawaii.gov
Cc: Vallano, Dena; YOSHIMURA, GWEN; Bohnenkamp, Carol
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Discussion Points:

1. New "process" seems irrelevant to Hawaii's situation, our volcanic eruption is a single event that is NOT short-term or limited, it has been ongoing since **1983**.

2. Our time and effort in providing all this information is so that EPA can decide whether or not this event qualifies as an EE? Hasn't it already been established that our event is an exceptional event? EPA has approved our PM2.5 EE doc and we have already submitted the first draft for our SO2 EE document.

3. We submit notifications for exceedances that occur almost daily at multiple sites. So, according to Randall's email, EPA, you will be responding EVERY MONTH to tell us:

a. Whether or not our volcano qualifies as an EE (which we have already established it is with our PM2.5 EE document);

b. Whether or not we can submit an EE package (which we have already done, with our PM2.5 EE document and now with the first draft of our SO2 document); and

c. Whether or not our exceedances have regulatory impact. How about non-attainment?

I want to clarify the purpose of this "new" Initial Notification of Potential Exceptional Events. The key word here is "potential".

From: CHANG, RANDALL [mailto:Chang.Randall@epa.gov]
Sent: Tuesday, August 18, 2015 4:46 AM
To: Young, Lisa Y L; Kihara, Susan
Cc: Vallano, Dena; YOSHIMURA, GWEN; Bohnenkamp, Carol
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi Lisa and Susan,

Would noon-1 pm (HST) today work for you two?

Randy

Randall Chang

U.S. EPA, Pacific Southwest (Region 9)

Air Quality Analysis Office

75 Hawthorne Street (AIR-7)

San Francisco, CA 94105

phone: 415.947.4180

email: chang.randall@epa.gov

From: Young, Lisa Y L [mailto:lisa.young@doh.hawaii.gov]
Sent: Monday, August 17, 2015 7:36 PM
To: CHANG, RANDALL; susan.kihara@doh.hawaii.gov
Cc: Vallano, Dena; YOSHIMURA, GWEN; Bohnenkamp, Carol
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi Randy,

I just wanted to let you know that this Friday is a holiday for us, if we can't schedule a call this week I'd like to send the questions to EPA. We need to respond to the questions by next week.

Thanks,

Lisa

From: Young, Lisa Y L
Sent: Friday, August 14, 2015 12:00 PM
To: 'CHANG, RANDALL'; Kihara, Susan
Cc: Vallano, Dena; YOSHIMURA, GWEN; 'Bohnenkamp.Carol@epamail.epa.gov' (Bohnenkamp.Carol@epamail.epa.gov)
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi,

Is it possible to have a conference call Monday, Tuesday or Wednesday (any time after 10 am) of next week regarding the DRR? We have some questions related to the EPA's approval of the monitoring sites that we would like run by you. There are great challenges in trying to set up a monitoring station by the timelines in the DRR.

Thanks,

Lisa

From: CHANG, RANDALL [mailto:Chang.Randall@epa.gov]
Sent: Tuesday, August 11, 2015 5:11 AM
To: Yee, Henry H. Y.; Young, Lisa Y L
Cc: Vallano, Dena; YOSHIMURA, GWEN
Subject: FW: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today
Importance: High

Hi Lisa and Henry

See email below regarding the just-signed SO2 Data Requirements Rule.

Please note the following deadlines included in the Data Requirements Rule, as the first few will come up very quickly (Bold = included in the March 2015 consent decree)**:**

- 1/15/2016

- States submit list of sources subject to the DRR (>2,000 tpy SO2).

- 7/1/2016

- For each applicable source, states let EPA know what path they've chosen and submit the associated documentation:

•□□□□□□□□ A. Monitoring → Annual Network Plan is due on this date, and must include these monitors.

•□□□□□□□□ B. Modeling → Modeling protocol is due on this date.

•□□□□□□□□ C. Commit to having federally permanent and enforceable emissions limits to bring the source below 2,000 tpy by January 13, 2017.

- **1/1/2017**

- **A. Monitors required to be installed and operational by January 1, 2017.**

- 1/13/2017

- B. Modeling is due to EPA*

- C. Documentation demonstrating that the source has permanent and federally enforceable emissions limits that brings the source below 2,000 tpy due to EPA.

- **12/31/2017**

- **B. EPA promulgates designations for modeled areas**

- **12/31/2020**

- **A. EPA promulgates designations for all remaining areas**

*Note: If an area is designated attainment based on actual emissions (as opposed to allowables), states are required to address the situation (i.e. assess whether the existing modeling is adequate) by July 1st of each year.

These timeframes and the Data Requirements Rule will be further discussed during a webinar on August 19th, 1:00 – 2:30 **ET**. See below for details.

Please feel free to contact Gwen Yoshimura (yoshimura.gwen@epa.gov) if you have further questions. Thanks!

Randy

Randall Chang

U.S. EPA, Pacific Southwest (Region 9)

Air Quality Analysis Office

75 Hawthorne Street (AIR-7)

San Francisco, CA 94105

phone: 415.947.4180

email: chang.randall@epa.gov

From: Drake, Kerry
Sent: Monday, August 10, 2015 1:20 PM
To: darwin.henry@azdeq.gov; massey.eric@azdeq.gov; rcorey@arb.ca.gov; Karperos, Kurt@ARB; Alan Abbs; nolan.hirai@doh.hawaii.gov; demme@ndep.nv.gov; pshoopman@ndep.nv.gov
Cc: YOSHIMURA, GWEN; McKaughan, Colleen; Zimpfer, Amy; Adams, Elizabeth; Busterud, Gretchen; Kelly, Johnj; Kurpius, Meredith; Lakin, Matt; Wallace, Larry
Subject: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Dear Colleagues,

I wanted to let you know that EPA Administrator Gina McCarthy signed the Data Requirements Rule for the 2010 1-Hour SO2 NAAQS on Monday, August 10, 2015. A fact sheet is attached, and the rule will be posted on the http://www.epa.gov/airquality/sulfurdioxide/implement.html. We anticipate publication of this rule in the *Federal Register* in approximately 2-3 weeks.

A webinar covering the contents of the final Data Requirements Rule is scheduled for Wednesday, August 19. Details for the webinar are located at the end of this email. Materials will not be distributed prior to the webinar. We will post a link to the recording at http://www.epa.gov/airquality/sulfurdioxide/implement.html as soon as we can after the webinar. Participants will have the opportunity to ask questions during the webinar. Please pass this along to your staff.

If you have any questions, please contact me or ask your staff to contact:

Gwen Yoshimura at (415) 947-4134 at yoshimura.gwen@epa.gov or

Larry Wallace at (919) 541-0906 or at wallace.larry@epa.gov.

With regards,

Kerry Drake

Associate Director, Air Division

U.S. EPA, Region 9

(415) 947-4157

Webinar: Overview of the Final SO_2 Data Requirements Rule

Date: August 19, 2015

Time: 1:00-2:30 PM ET (includes time for Q&A)

Intended Audience: State, Local, and Tribal Air Agencies

Webinar Link: To join the webinar, go to
https://epa.connectsolutions.com/so2naaqs/

Description: On August 10, the EPA finalized the Data Requirements Rule (DRR) which directs air agencies to characterize sulfur dioxide (SO_2) air quality in areas across the country with sources of SO_2 emissions greater than 2,000 tons per year. This data requirements rule for the 2010 1-hour SO_2 standard lays out a common sense approach that focuses on characterizing current air quality in areas with the largest sources of SO_2 emissions. This action finalizes a reasonable schedule for air agencies to characterize air quality and provide that air quality data to the EPA. In developing the rule, the EPA carefully considered stakeholder feedback obtained during an extensive outreach process.

Logistics: You will listen to the audio via your computer. We highly recommend running a connect test on your system before logging into the webinar to ensure that the proper add-ins are enabled and the audio is working properly:
http://admin.adobeconnect.com/common/help/en/support/meeting_test.htm

To: CHANG, RANDALL[Chang.Randall@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Vallano, Dena[Vallano.Dena@epa.gov]
Cc: susan.kihara@doh.hawaii.gov[susan.kihara@doh.hawaii.gov]
From: Young, Lisa Y L
Sent: Tue 8/18/2015 9:28:57 PM
Subject: FW: Request for discussion on the Data Requirements Rule 1-Hour SO2 modeling for monitoring
removed.txt
2014_05_12_Draft_Kahe_SO2_Monitor_Placement_Report.pdf
2015_05_12_Draft_Waiau_SO2_Monitor_Placement_Report.pdf

Hi all,

For today's call.

Thank you,

Lisa

From: Madsen, Michael A
Sent: Tuesday, May 19, 2015 11:42 AM
To: Bohnenkamp, Carol (Bohnenkamp.Carol@epa.gov)
Cc: McFall, Keith; Wong, David Tien Lun; Young, Lisa Y L
Subject: FW: Request for discussion on the Data Requirements Rule 1-Hour SO2 modeling for monitoring

Hi Carol,

I'm sending you 1-hour SO2 modeling reports to determine monitoring station placement for the Kahe and Waiau Generating Stations for review prior to this Thursday's meeting.

Thank you,

Mike

Mike Madsen

Hawaii Department of Health

Clean Air Branch

Phone: (808) 586-4200

Fax: (808) 586-4359

From: McFall, Keith
Sent: Thursday, May 14, 2015 10:09 AM
To: Bohnenkamp, Carol
Cc: Madsen, Michael A; Wong, David Tien Lun; YOSHIMURA, GWEN; Young, Lisa Y L
Subject: RE: Request for discussion on the Data Requirements Rule 1-Hour SO2 modeling for monitoring

Hi Carol,

I confirmed with Mike and David that next Thursday should work for us. Whenever you can propose a time, that would be great.

Keith

From: Bohnenkamp, Carol [mailto:Bohnenkamp.Carol@epa.gov]
Sent: Thursday, May 14, 2015 9:08 AM

To: McFall, Keith
Cc: Madsen, Michael A; Wong, David Tien Lun; YOSHIMURA, GWEN
Subject: Re: Request for discussion on the Data Requirements Rule 1-Hour SO2 modeling for monitoring

Keith, I think that I would be a good idea to meet next week. I am available on Thursday. I may need to cancel because of jury duty, but I would rather go ahead with the call, and cancel if necessary.

From: McFall, Keith <Keith.McFall@doh.hawaii.gov>
Sent: Tuesday, May 12, 2015 2:27 AM
To: Bohnenkamp, Carol
Cc: Madsen, Michael A; Wong, David Tien Lun
Subject: Request for discussion on the Data Requirements Rule 1-Hour SO2 modeling for monitoring

Hi Carol,

Would you be available for a telecom sometime next week? Would sometime Wednesday (5/21) or Thursday (5/22) work?

Background:

Our monitoring group (Lisa Young is the Section chief) has been talking to their EPA counterparts about monitor siting for the Data Requirements Rule. An existing HECO monitor (Timberline) is a candidate. Depending upon the final rule threshold(s), one monitor may be sufficient. We just received two draft modeling reports from HECO and Mike & David are going to be reviewing their modeling files (coming to us soon) and performing some additional modeling. A discussion next week would be helpful for us if you are available.

Thank you,

Keith

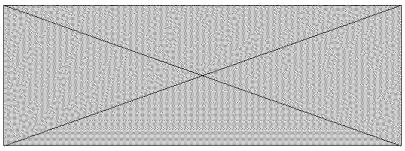
Keith McFall, PE, PhD

Environmental Engineer, Clean Air Branch

Environmental Management Division

keith.mcfall@doh.hawaii.gov

☎ 808.586.4200 | 6 808-586-4359



Hawaiian Electric Company, Inc.

1-Hour SO_2 Modeling to Inform Monitor Placement

Kahe Generating Station

Island of O'ahu, Hawai'i

Prepared by

jca

Working Draft - May2015

DRAFT

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1.0 INTRODUCTION AND SUMMARY

The Environmental Protection Agency (EPA) has proposed the *Data Requirements Rule for the 1-Hour Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS)* (79 FR 27446). In this proposed rule, EPA directs state and tribal air agencies (air agencies) to provide data characterizing current air quality in areas with large sources of SO_2 emissions. The proposed rule defines large sources of SO_2 emissions as:

> *Sources with actual SO_2 emissions greater than 1,000 tons per year in metropolitan areas[1] with population greater than 1 million[2]; and sources greater than 2,000 tons per year everywhere else.*

The proposed rule specifies that these sources must use either dispersion modeling or ambient monitoring to demonstrate that the area sounding the source is in attainment with the 1-hour SO_2 NAAQS. The EPA issued the following non-binding draft technical assistance documents (TADs) to assist the air agencies in preparing these demonstrations:

- *SO_2 NAAQS Designations Modeling Technical Assistance Document* (modeling TAD), draft dated December 2013, and
- *SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document* (monitoring TAD), draft dated December 2013.

The Hawaiian Electric Company, Inc. (Hawaiian Electric) Kahe Generating Station's 2014 actual SO_2 emissions exceeded 2,000 tons. Therefore, a source specific attainment demonstration is required for the Kahe Generating Station. Hawaiian Electric proposes that the source-oriented monitoring option be used.

Figure 1.0-1 shows the proposed location of the source-oriented SO_2 monitor based on modeling to inform monitor placement as described in the monitoring TAD. The modeling methodology used for the monitor site selection is discussed in Section 2.0. The monitor site selection process is discussed in Section 3.0.

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[1] Metro areas are based on Core Based Statistical Areas (CBSA). CBSAs are defined and maintained by the Office of Management and Budget (OMB) pursuant to OMB Bulletin 13-01 (February 28, 2013). The most recent revision to CBSA definitions were developed in accordance with OMB's "Standards for Delineating Metropolitan and Micropolitan Statistical Areas," 75 FR 37246 (June 28, 2010).

[2] Hawaii is divided into the following Core Based Statistical Areas (CBSA): 1) CBSA Code 27980 – Kahului-Wailuku-Lāhainā, HI Metropolitan Statistical Area; Maui County, 2) CBSA Code 46520 – Urban Honolulu, HI Metropolitan Statistical Area; Honolulu County, 3) CBSA Code 25900 – Hilo, HI Micropolitan Statistical Area; Hawai'i County, 4) CBSA Code 28180 – Kapa'a, HI Micropolitan Statistical Area Principal City; Kaua'i County. Of these CBSAs, only Urban Honolulu has a population close to 1,000,000. Urban Honolulu's 2013 estimated population is 983,429.

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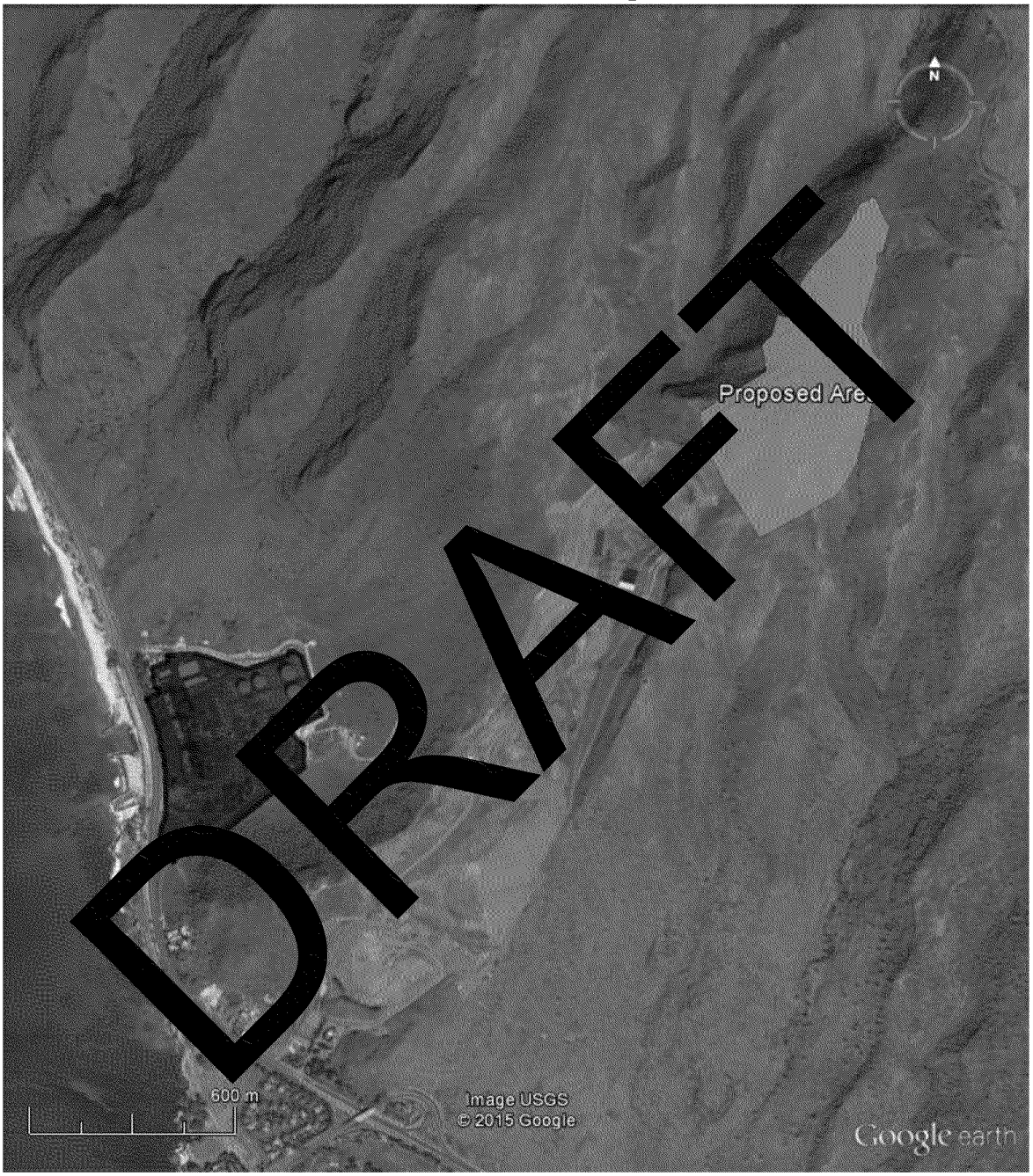
FIGURE 1.0-1 PROPOSED SOURCE-ORIENTED SO_2 MONITOR LOCATION AREA



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2.0 MODELING METHODOLOGY

The modeling in this report is based on the guidance presented in the modeling and monitoring TADs (EPA, 2013a; EPA, 2013b).

2.1. MODEL SELECTION AND OPTIONS

EPA's recommended dispersion model, AERMOD (version 14134), was used for this modeling analysis. AERMOD is a steady-state plume model capable of modeling simple, intermediate, and complex terrain receptors. In the stable boundary layer (nighttime), it assumes the concentration distribution to be Gaussian in both the vertical and horizontal. In the convective boundary layer (daytime) the probability density function describing the horizontal distribution is assumed to be Gaussian, while the vertical distribution is assumed to be bi-Gaussian. AERMOD also contains the PRIME algorithm which incorporates the two fundamental features associated with building downwash: (1) enhanced plume dispersion coefficients due to the turbulent wake, and (2) reduced plume rise caused by a combination of the descending streamlines in the lee of the building and the increased entrainment in the wake (EPA, 2004a and EPA, 2004d).

AERMOD's regulatory default options were used when modeling SO_2 impacts.

AERMOD (starting with version 11059) is capable of calculating the distribution of daily maximum 1-hour values. The daily maximum 1-hour values are calculated when the pollutant ID is either "SO2" or "NO2" and the only short term averaging period specified is "1-hour".

2.2. STACK PARAMETERS AND EMISSION RATES

The TADs specify the modeling should be based on actual hourly SO_2 emissions and stack parameters. Table 2.2-1 lists the stack locations and the CSP application stack parameters.

Hourly 2012 through 2014 actual SO_2 emission rates were calculated as each unit's hourly fuel use in pounds multiplied by two times the maximum rolling prior 30-day fuel sulfur content. The data recovery for the hourly fuel flow was 100%. As specified in the monitoring TAD, each unit's hourly actual SO_2 emission rates were normalized using the following steps:

1. Determine the total actual SO_2 emission rates from all units for each hour in the data period.
2. Determine the maximum hourly SO_2 emission rate calculated in Step 1.
3. Divide all hourly actual SO_2 emission rates by the SO_2 emission rate identified in Step 2.

The normalized hourly SO_2 emission rates were input into AERMOD using the HOUREMIS keyword in the source path way.

The black start diesel engine generators (A and B) are not included in the modeling, due to their limited operation (less than 150 hrs/yr total). Also, during calendar years 2012 to 2014 the black start diesel engine generators were fired on ultra-low sulfur diesel (ULSD) and continue to fire ULSD.

2.3. METEOROLOGICAL DATA

Representative meteorological data that is concurrent with the hourly emissions files is not available. The modeling TAD states that older site-specific meteorological data that have been used in past regulatory applications may be used to inform monitor placement if the dates are adjusted to match the hourly emissions file. Therefore, the 12 months of site-specific meteorological data collected at the Kahe site-specific meteorological tower and SODAR (sonic

[3] The oxidation rate of fuel sulfur to SO_2 based on the ratio of molecular weights (64 lb SO_2/lb-mole / 32 lb S/lb-mole = 2).

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detection and ranging) were used in this study. The 12-month collection period was from April 1, 1993 through March 31, 1994.

EPA's meteorological processor for AERMOD, AERMET (version 14134), was used to create the required meteorological input files. The meteorological tower collected hourly wind speed, wind direction, sigma-theta, vertical wind speed, and sigma-w at heights of 10 m, 100 m, and 150 m. The meteorological tower also collected temperature data and temperature differences at heights of 2 m, 10 m, 100 m, and 150 m. The SODAR recorded hourly values of horizontal wind speed, horizontal wind direction, and sigma-w at 25-m intervals between 200 m and 500 m. Figure 2.3-1 presents a wind rose of the 12 months of 100-m horizontal wind data.

Using a text editor, the 12-months of site-specific meteorological data in the surface and profile files were repeated three times and the dates were adjusted to match the dates in the hourly emissions file[4].

The Līhu'e Airport and Hilo International Airport are the only available sources of upper air meteorological data in the state of Hawai'i. The Līhu'e Airport station is operated by the National Weather Service (NWS) and is located on the Island of Kaua'i. As previously recommend by DOH for sources on the Island of O'ahu, the Līhu'e Airport sounding provided the required upper air meteorological data for AERMET.

Appendix A contains a catalogue of the meteorological modeling files.

AERMOD uses several different boundary layer parameters to model how pollutants disperse in the atmosphere. Many of these parameters are not observed, but are estimated from other variables that are more easily measured. To make these estimates, observed near-surface wind and temperature and site-specific surface characteristics are required. AERMET requires the following site-specific surface characteristics:

- Surface roughness length (z_0) - the height above the ground at which horizontal wind velocity is typically zero,
- Noon-time albedo (r) - the fraction of radiation reflected by the surface, and
- Daytime Bowen ratio (B_o) - the ratio of sensible heat flux (H) to the latent heat flux (λE).

EPA has developed a program called AERSURFACE to calculate the above parameters based on United States Geological Survey (USGS) land use/land cover data. However, the required USGS 1992 National Land Cover Data (NLCD92) is not available for Hawai'i. Section 3.1.2 of the AERMOD Implementation Guide provides the recommended methods for determining surface characteristics. These methods should be followed unless a case-by-case justification can be provided for an alternative method (EPA, 2009a).

The selection of the surface parameters follows the land use procedure provided in the AERMOD Implementation Guide (EPA, 2009a) and the Alaska Department of Environmental Conservation (ADEC) on how to calculate geometric means (ADEC, 2009). The land uses are determined using a geographic information system (GIS) to analyze the USGS 2001 National Land Cover Data (NLCD2001). Table 2.3-1 lists the NLCD2001 land cover categories and the corresponding values for surface roughness length, albedo, and Bowen ratio.

The AERMOD Implementation Guide specifies that the albedo and Bowen ratio should be based on a 10-km by 10-km area centered on the meteorological tower. Figure 2.3-2 shows the 10-km by 10-km area centered on the meteorological tower. Albedo is determined using a simple unweighted arithmetic mean (i.e., no direction or distance dependency). Bowen ratio is

[4] The meteorological data does not cover a leap year. Therefore, February 28, 2012 was repeated with a new date of February 29 to be concurrent with the hourly emissions file (EPA, 2013a).

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determined using a simple unweighted geometric mean (i.e., no direction or distance dependency). Table 2.3-2 lists the area of land cover categories for the 10 x 10 km domain.

The AERMOD Implementation Guide specifies that the surface roughness length should be based on an inverse distance weighted geometric mean for a recommended upwind fetch of 1 km relative to the meteorological tower. Surface roughness length may vary by sector to account for variations in land cover near the measurement site; however, the sector widths should be no smaller than 30 degrees. Figure 2.3-3 shows the area within a 1-km radius of the meteorological tower and the selected sector boundaries. Table 2.3-3 lists the area of land cover categories for each sector.

Table 2.3-4 shows the calculated values of surface roughness length for each sector and the albedo and Bowen ratio.

2.4. Urban/Rural Classification

The selection of either rural or urban dispersion coefficients in the air quality modeling follows the procedure provided in 40 CFR Part 51, Appendix W. Categorizing an area as urban or rural is determined by land use classification or population. A review of the land use surrounding the facility shows that urban land use types are less than [illegible]% of the area within a 3-km radius of the source. Therefore, the area was classified as rural.

2.5. Receptor Data

The modeling TAD states:

> *For the purposes of modeling for SO_2 designations, the receptor placement strategy differs since the modeling is acting as a surrogate monitoring. In areas where it is not feasible to place a monitor (water bodies, etc.) receptors can be ignored or not placed in those locations. In any case, receptor placement should be of sufficient density to provide resolution needed to detect significant gradients in the concentrations, with receptors placed closer together near the source to detect local gradients and placed farther apart away from the source* (EPA, 2014a).

Receptor elevations and height scales were extracted from the USGS National Elevation Dataset (NED) data using EPA's AERMAP (version 11103) program. Figure 2.5-1 shows the modeling grid consisting of a space of receptors centered at 592600.0 m Easting, 2365000.0 m Northing to [illegible] km. Three discrete receptors along the coast were placed at the following locations:

- 58[illegible]0.00 m Easting, [illegible]63000.00 m Northing,
- 5903[illegible]0 m Easting, [illegible]61000.00 m Northing, and
- 590200.[illegible] m Easting, [illegible]361500.00 m Northing.

Receptors were not placed overwater, on-property, or on the property line because it is infeasible to locate a monitor in these areas. Appendix A contains a catalogue of files used in the receptor grid processing.

2.6. Building Downwash

For air quality modeling purposes, the stacks were evaluated in terms of their proximity to nearby structures to determine whether stack effluents may be affected by downwash in the turbulent wake of such structures. AERMOD uses the following building parameters to account for downwash:

- BUILDHGT, the building height,
- BUILDWID, the projected width of the building perpendicular to the flow,
- BUILDLEN, the projected length of the building along the flow,

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- XBADJ, the along-flow distance from the stack to the center of the upwind face of the projected building, and
- YBADJ, the across-flow distance from the stack to the center of the upwind face of the projected building.

Building parameters were obtained using EPA's Building Profile Input Program for PRIME (BPIPPRM – version 04274). BPIPPRM calculates the building parameters for 36 wind directions based on the physical dimensions of the structures surrounding a source.

Off property structures meeting the following requirements should be included in the BPIPPRM processing:

- The structure is less than 800 meters from the source, and
- The structure is located within 5L (five times the lesser of the height or width of the structure) of the source.

A review of the Honolulu Land Information System[5] (HoLIS) and Google Earth determined that off-site buildings did not need to be included in the BPIPPRM processing. Figure 6-1 shows the structures and heights entered into BPIPPRM. Appendix A contains a catalogue of files used in the BPIPPRM processing.

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[5] City & County of Honolulu, Department of Planning & Permitting http://gis.hicentral.com

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TABLE 2.2-1 STACK LOCATIONS AND STACK PARAMETERS

Unit	NAD83 UTM Coordinates Easting (m)	NAD83 UTM Coordinates Northing (m)	Base Elevation (ft)	Base Elevation (m)	Stack Height (m)	Stack Diameter (m)	Stack Velocity (m/s)	Stack Temperature (K)
K1	590358.99	2361874.63	30.0	9.14	91.44	[illegible]	16.0	424.0
K2	590353.25	2361872.57	30.0	9.14	91.44	3.20	15.3	404.0
K3	590355.30	2361866.83	30.0	9.14	91.44	3.20	[illegible]	423.0
K4	590361.04	2361868.89	30.0	9.14	91[illegible]	3.[illegible]0	16.2	413.0
K5	590367.25	2361753.14	26.0	7.92	92.[illegible]	[illegible].88	11.0	430.0
K6	590384.01	2361675.07	30.0	9.14	137.20	4.88	10.1	418.0

Notes:

1. Stack locations are provided in UTM coordinates (NAD[illegible]3, Ha[illegible]) based on esti[illegible]s from Google Earth.
2. Stack parameters are from the initial CSP Application.

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TABLE 2.3-1 SURFACE CHARACTERISTIC VALUES FOR NLCD2001 LAND COVER CATEGORIES

Land Cover Category		Surface Roughness		Bowen Ratio		
Name	No.	Length (m)	Albedo	Wet	Average	Dry
Open Water	11	0.001	0.10	[illegible]	0.1	0.1
Perennial Ice/Snow	12	0.002	0.60	[illegible]	0.5	0.5
Developed, Open Space	21	0.02	0.15	0.3	0.5	1.5
Developed, Low Intensity	22	0.54	[illegible]	0.6	0.8	2.0
Developed, Medium Intensity	23	1.00	[illegible]	1.0	[illegible]	3.0
Developed, High Intensity	24	0.80	0.18	1.0	[illegible]	3.0
Barren Land	31	0.05	0.20	1.0	1.5	3.0
Deciduous Forest	41	1.30	[illegible]	0.2	0.3	0.6
Evergreen Forest	42	1.30	[illegible]	0.2	0.3	0.6
Mixed Forest	43	1.30	[illegible]	0.2	0.3	0.6
Shrub/Scrub	52	0.30	[illegible]	0.8	1.0	2.5
Grasslands/Herbaceous	71	[illegible]	[illegible]	0.4	0.8	2.0
Pasture Hay	81	[illegible]	0.20	0.3	0.5	1.5
Cultivated Crops	82	0.20	[illegible]	0.3	0.5	1.5
Woody Wetlands	90	[illegible]	0.14	0.1	0.2	0.2
Emergent Herbaceous Wetlands	[illegible]	[illegible]	0.14	0.1	0.1	0.2

Notes:

1. Surface characteristic values [illegible] surface roughness length, albedo, and Bowen ratio are based on values contained in Appendix A of EPA's AERSURFACE User's Guide (January 2008).

2. The relationship between NLCD92 and NLCD2001 land cover categories and numbers are from Table 1 of *USGS's Completion of the National Land Cover Database (NLCD) 1992-2001 Land Cover Change Retrofit Product.*

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TABLE 2.3-2 LAND COVER BREAKDOWN FOR BOWEN RATIO AND ALBEDO CALCULATIONS

Land Cover Category		Area (km^2) of Land Cover Categories for Bowen Ratio and Albedo
Name	**No.**	
Open Water	11	39.95
Perennial Ice/Snow	12	--
Developed, Open Space	21	5.25
Developed, Low Intensity	22	4.76
Developed, Medium Intensity	23	4.61
Developed, High Intensity	24	1.69
Barren Land	31	1.44
Deciduous Forest	41	--
Evergreen Forest	42	15.24
Mixed Forest	43	--
Shrub/Scrub	52	18.60
Grasslands/Herbaceous	71	8.04
Pasture Hay	81	--
Cultivated Crops	82	0.40
Woody Wetlands	90	--
Emergent Herbaceous Wetlands	95	0.02

Note: The areas for each land use category and sector were developed using ESRI ArcGIS (Version 10) software and land cover data from the NLCD2001 digital database.

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TABLE 2.3-3 LAND COVER BREAKDOWN FOR SURFACE ROUGHNESS LENGTH CALCULATIONS

Land Cover Category		Area (km^2) of Land Cover Categories Surface Roughness Length Sectors								
Name	No.	1	2	3	4	[illegible]	6	7	8	9
Open Water	11	--	--	--	--	[illegible]	0.17	0.21	0.17	0.02
Perennial Ice/Snow	12	--	--	--	--	--	--	--	--	--
Developed, Open Space	21	--	0.01	0.02	0.02	0.02	[illegible]002	--	--	--
Developed, Low Intensity	22	--	0.01	0.03	[illegible]02	0.03	[illegible]	0.01	0.01	0.02
Developed, Medium Intensity	23	--	0.02	0.001	0.01	0.04	[illegible]	0.01	0.01	0.01
Developed, High Intensity	24	--	0.01	[illegible]	0.03	0.07	0.05	[illegible].02	0.003	--
Barren Land	31	0.002	0.07	[illegible]1	0.05	--	0.02	0.01	0.02	0.004
Deciduous Forest	41	--	--	[illegible]	[illegible]	--	--	--	--	--
Evergreen Forest	42	0.01	--	--	[illegible]	--	--	--	--	--
Mixed Forest	43	--	--	--	--	--	--	--	--	--
Shrub/Scrub	52	0.83	[illegible].06	0.03	[illegible]	0.06	--	0.00	0.01	0.07
Grasslands/Herbaceous	71	0.21	[illegible]	0.04	[illegible]	0.03	0.001	0.004	0.04	0.14
Pasture Hay	81	--	--	[illegible]	--	--	--	--	--	--
Cultivated Crops	82	--	--	[illegible]	[illegible]	--	--	--	--	--
Woody Wetlands	90	--	[illegible]	--	--	--	--	--	--	--
Emergent Herbaceous Wetlands	[illegible]	--	[illegible]	--	--	--	--	--	--	--

Note: The areas for each land use category [illegible] sector [illegible] developed using ESRI ArcGIS (Version 10) software and land cover data from the NLCD2001 digital database.

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TABLE 2.3-4 SURFACE PARAMETERS

Sector	Sector Arc (Degrees from North) Start	Sector Arc (Degrees from North) End	Sector Width (Degrees)	Surface Roughness Length (m)	Bowen Ratio	Albedo
1	330	90	120	0.233		
2	90	120	30	0.166		
3	120	150	30	0.165		
4	150	180	30	[illegible]		
5	180	210	30	[illegible]291	0.53	0.14
6	210	240	30	[illegible]4		
7	240	270	30	0.0[illegible]		
8	270	300	30	0.011		
9	300	330	3[illegible]	0.122		

Note: The value for Bowen ratio dry surface moist[illegible] conditio[illegible]ed on the average of annual precipitation for 1993 and 1994 in comparison to the [illegible]0-year [illegible]period from 1981-2010.

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FIGURE 2.3-1 KAHE SITE-SPECIFIC WIND ROSE

(100-M LEVEL WINDS● APRIL 1, 1993 – MARCH 31, 1994)

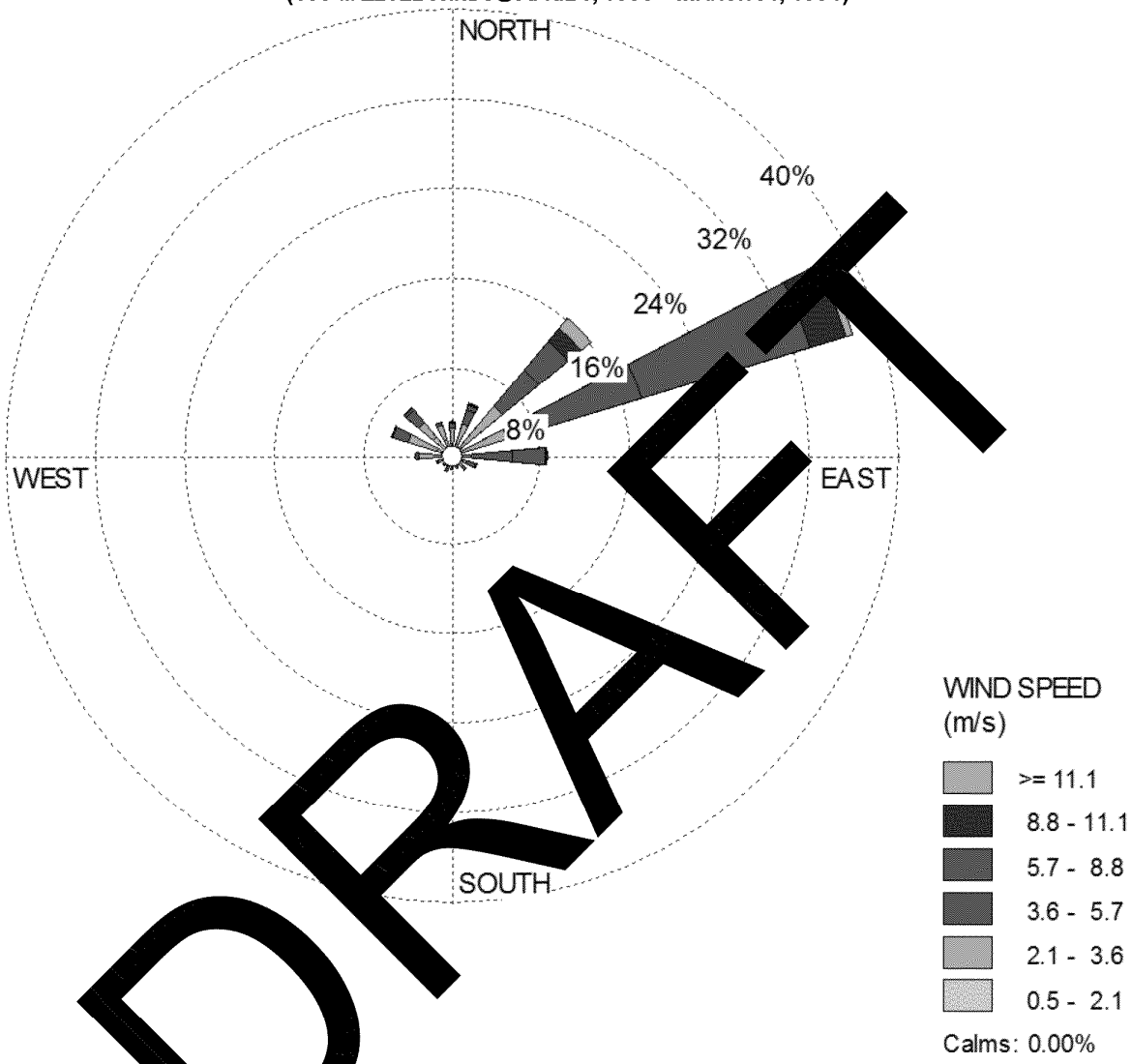

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FIGURE 2.3-2 USGS NLCD2001 SURROUNDING THE KAHE SITE-SPECIFIC METEOROLOGICAL TOWER (10 X 10 KM DOMAIN)

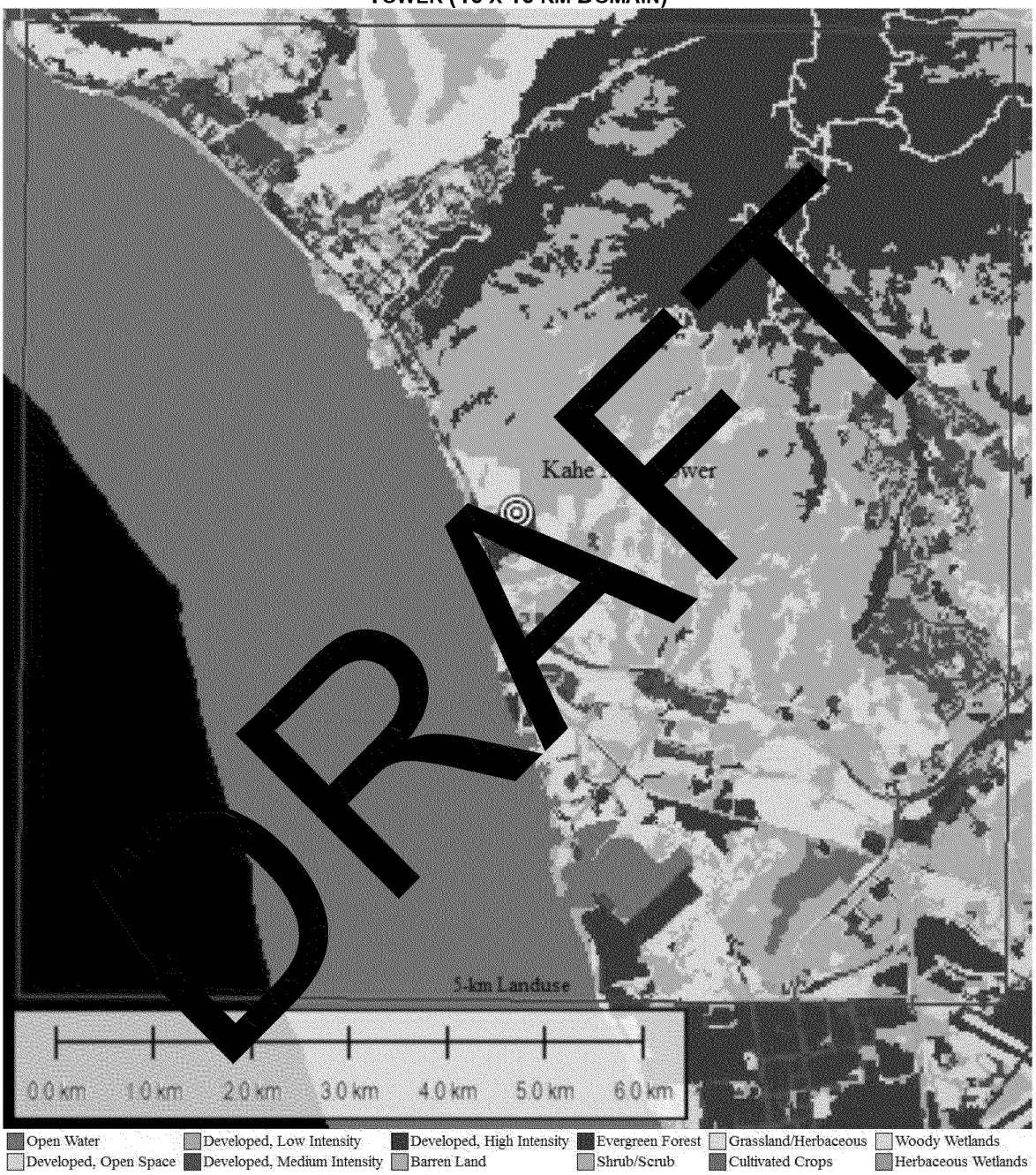

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FIGURE 2.3-3 USGS NLCD2001 SURROUNDING THE KAHE SITE-SPECIFIC METEOROLOGICAL TOWER (1-KM RADIUS)

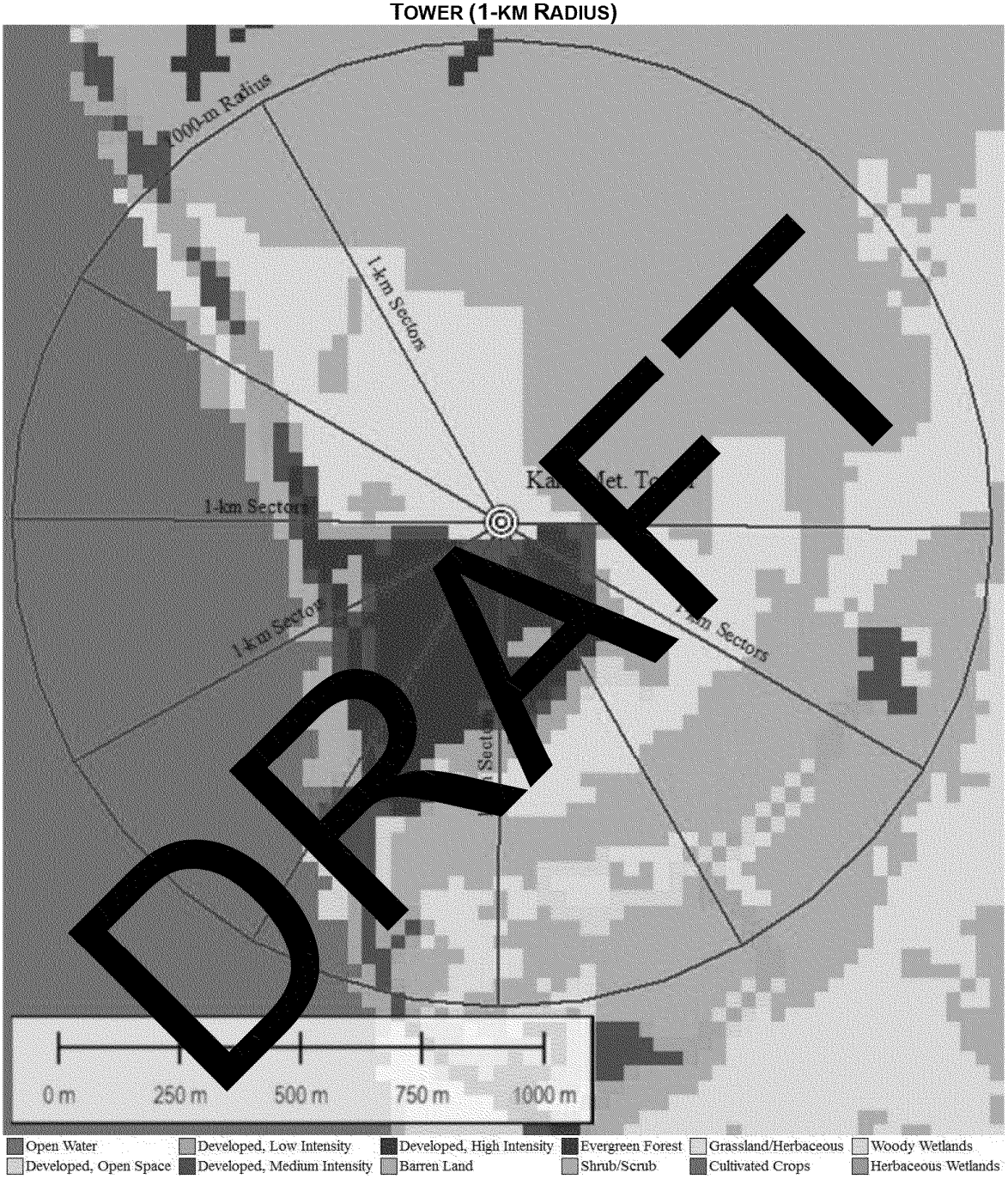

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FIGURE 2.5-1 RECEPTOR GRID

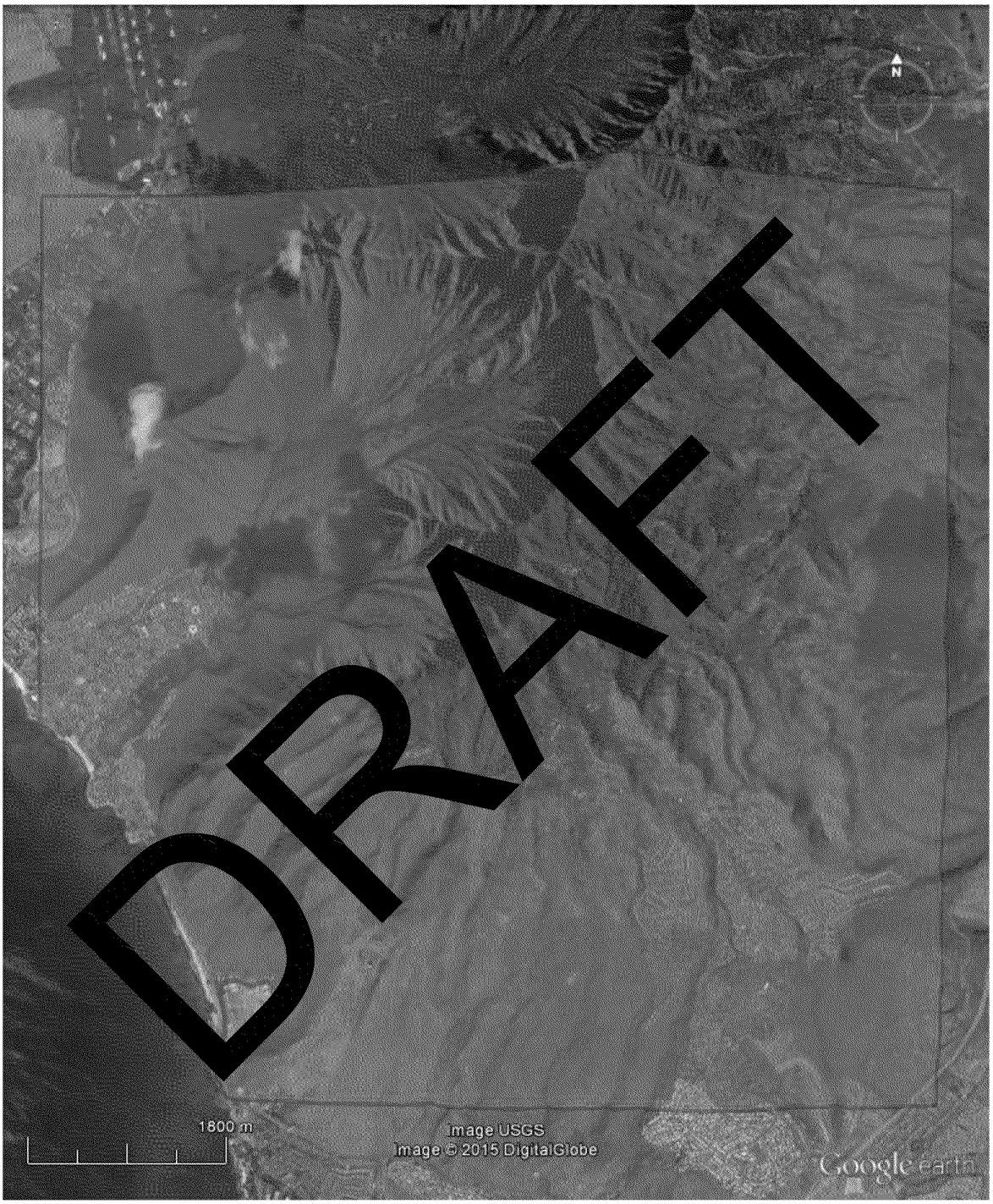

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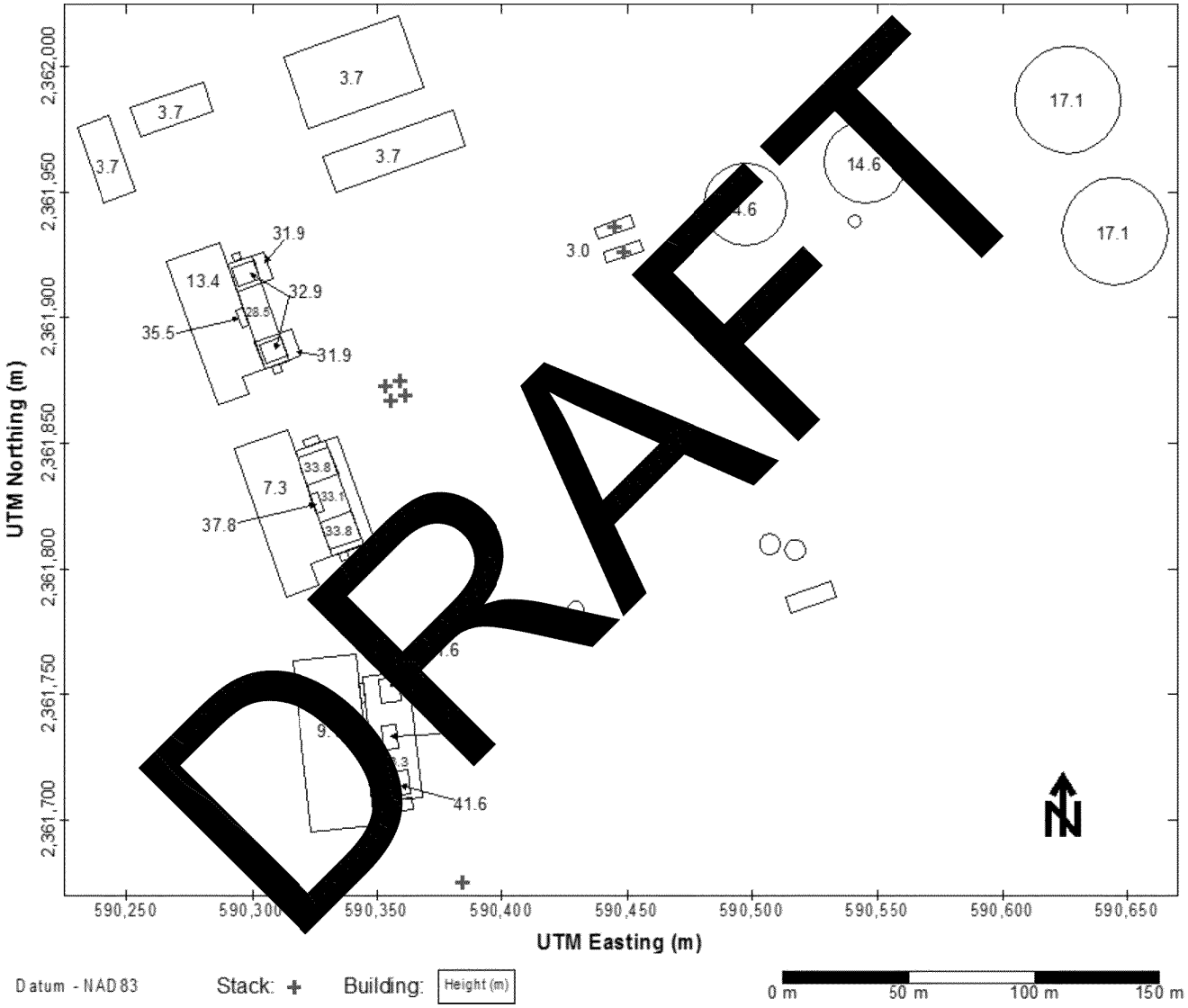
FIGURE 2.6-1 BPIPPRM INPUTS



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3.0 MONITOR LOCATION SELECTION

3.1. MONITOR PLACEMENT SCORING

The monitoring TAD (EPA, 2013b) presents a scoring strategy to rank the receptors for consideration of monitor placement. The monitoring TAD states:

> *This scoring strategy can be conducted as follows:*
>
> *1. Calculate the normalized design value at each receptor and rank from highest to lowest receptor. Rank of 1 means the highest design value.*
>
> *2. Using the MAXDAILY output option in AERMOD, determine each day's highest normalized concentration and receptor. The MAXDAILY option in AERMOD outputs each receptor's highest concentration for each modeled day.*
>
> *3. Using the output from step 2, determine the number of days each receptor is the highest concentration for the day among all receptors.*
>
> *4. Rank the results from step 3 from highest to lowest number of days. Rank of 1 means the highest number of days having the daily maximum value.*
>
> *5. For each receptor, add the concentration rank and the day rank. The lowest possible score is 2, meaning the receptor was the highest overall normalized design value and also had the highest number of days where the receptor was the highest concentration for the day.*

Since the hourly SO_2 emissions were normalized, the AERMOD output concentrations are called normalized design values (NDVs). The NDVs are the 3-year average of the 99th percentile (4th rank) of the 1-hour daily maximum concentrations on a receptor-by-receptor basis. Appendix A contains a catalogue of the modeling files. Figure 3.1-1 presents color coded NDVs to illustrate the distribution of the NDVs. Figure 3.1-2 shows the receptors with the top 25 NDVs. The NDV rankings for all receptors are listed in Appendix B, Table B-1.

Next, the MAXDAILY output option in AERMOD was used to determine the number of days each receptor has the daily maximum 1-hour concentration for the day among all receptors. The MAXDAILY output is imported into an Access database to perform this calculation and ranking. As shown in Figure 2.3-1, the majority of the time the plumes are being transported over the ocean where receptors are not located. Therefore, daily maximum 1-hour NDVs that are less than 5% of the overall maximum are excluded from the cumulative calculations. This filter outs insignificant impacts on the terrain.

Figure 3.1-3 presents the cumulative number of days a receptor had the daily maximum 1-hour concentration. Note that the receptor with the overall highest NDV is not the receptor with the largest number of cumulative days with the daily maximum 1-hour NDV. The cumulative number of day rankings for receptors are listed in Appendix B, Table B-1.

Next, the NDV rank and the cumulative number of days rank were added to calculate the monitor placement score. Figure 3.1-4 shows the scoring results and Figure 3.1-5 shows the top 10 scoring ranks. Appendix B, Table B-1 presents the receptor scores.

3.2. SITE SELECTION EVALUATIONS

Based on the scoring, one area was selected for additional site feasibility evaluation. Figure 3.2-1 shows the preferred area for monitor placement. This area is located northeast of the facility and contains receptors with the 1st and 4th scoring ranks. It is important to note that these two receptors have the 1st and 2nd NDV ranks. Based on scoring, this area is the preferred location for establishing the source specific SO_2 monitoring station. If this site is determined infeasible, additional areas will be identified and evaluated.

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FIGURE 3.1-1 NORMALIZED DESIGN VALUES (NDVS)

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FIGURE 3.1-2 RECEPTORS WITH THE TOP 25 NDVS

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FIGURE 3.1-3 CUMULATIVE NUMBER OF DAYS WITH THE DAILY MAXIMUM 1-HOUR NDV

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FIGURE 3.1-4 MONITOR PLACEMENT SCORING

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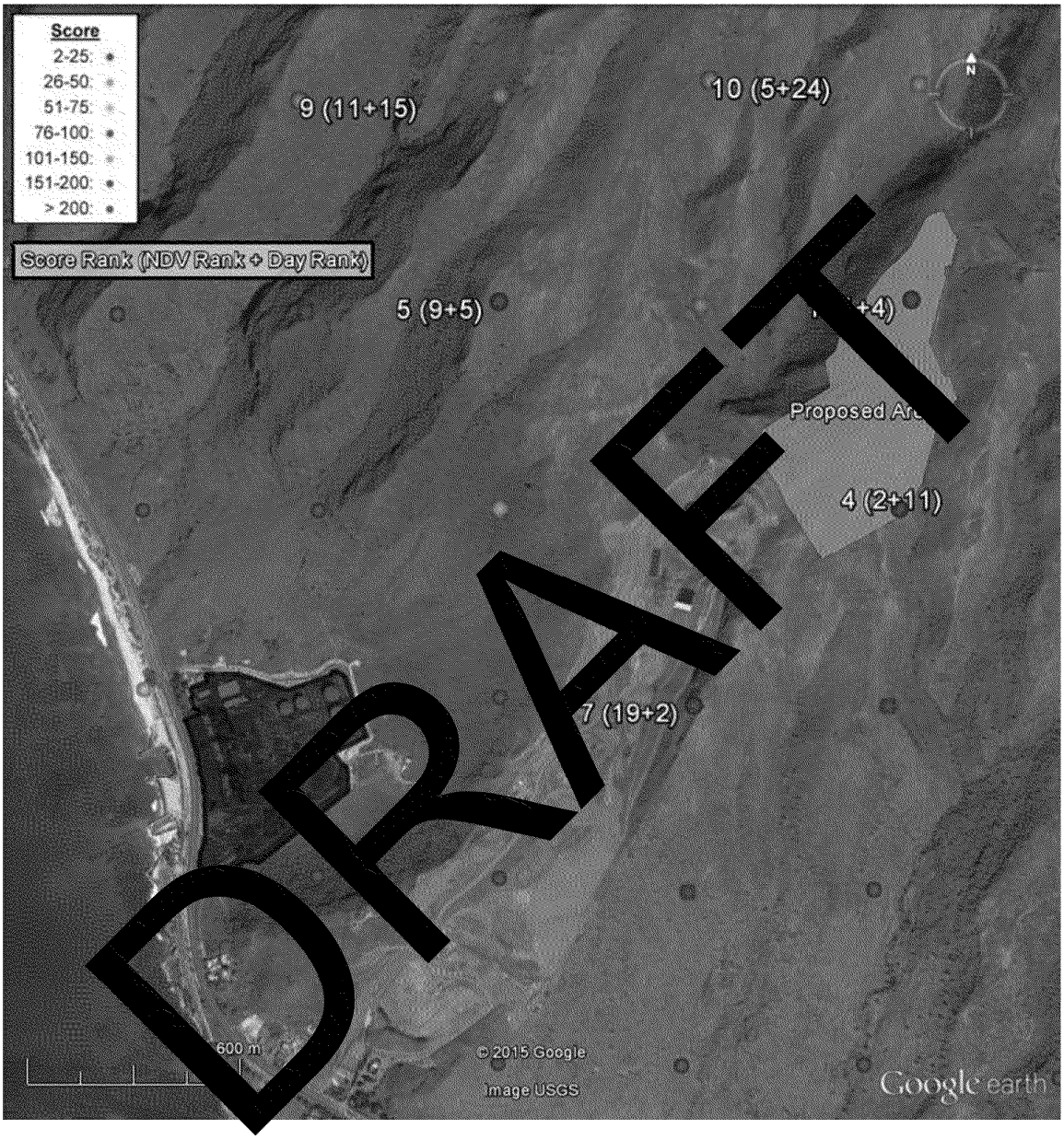
FIGURE 3.1-5 TOP 10 MONITOR PLACEMENT SCORING RANKS

FIGURE 3.2-1 POTENTIAL MONITOR LOCATION



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ALTERNATE FIGURE 3.2-1 POTENTIAL MONITOR LOCATION

4.0 REFERENCES

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40 CFR 51 - Appendix W. Guideline on Air Quality Models.

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Appendix A: Modeling Files Catalogue

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TABLE A-1 AERMET PROCESSING FILES

Filename	File Type	Description
KAHE_93-94_S1.INP	Input	Stage 1 input file
KAHE_93-94_S2.INP	Input	Stage 2 input file
KAHE_93-94_S3.INP	Input	Stage 3 input file
22536_93-94.UA	Input	Upper Air Observations from Lihu'e Airport
22521_93-94.DAT	Input	HNL Airport surface data
KAHE_93-94_S1.MSG	Output	Stage 1 processing information
KAHE_93-94_S1.RPT	Output	Stage 1 summary report
OSQAOUT.DSK	Output	Extracted and QAed surface observations
SFEXOUT.DSK	Output	Extracted surface observations
SFQAOUT.DSK	Output	QAed surface observations
UAEXOUT.DSK	Output	Extracted NWS upper air data
UAQAOUT.DSK	Output	QAed upper air data
KAHE_93-94_S2.MSG	Output	Stage 2 processing information
KAHE_93-94_S2.RPT	Output	Stage 2 summary report
MERGE.DSK	Output	Merged upper air and surface data
KAHE_93-94_S3.MSG	Output	Stage 3 processing information
KAHE_93-94_S3.RPT	Output	Stage 3 summary report
KAHE_93-94.SFC	Output	AERMOD input met. surface data (site-specific data period)
KAHE_93-94.PFL	Output	AERMOD input met. profile data (site-specific data period)
KAHE_SS_12-14.SFC	Output	AERMOD input met. surface data (2012-2014)
KAHE_SS_12-14.PFL	Output	AERMOD input met. profile data (2012-2014)

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TABLE A-2 AERMAP PROCESSING FILES

Filename	File Type	Description
Oahu_west_45720481.tif	Input	USGS 1/3 Degree NED covering western O'ahu, downloaded July 17, 2012
KAHE_SO2_500.INP	Input	Receptor Grid ROI input file
KAHE_SO2_500.xy	Input	Receptor GRID ROI list of receptor locations
KAHE_SO2_500.out	Output	Grid ROI output file
KAHE_SO2_500.RE	Output	Receptor Grid ROI receptor output file

TABLE A-3 BPIPPRM PROCESSING FILES

Filename	File Type	Description
KAHE_BOILER_BPIPPRM.INP	Input	Input BPIPPRM
KAHE_BOILER_BPIPPRM.OUT	Output	BPIPPRM output information
KAHE_BOILER_BPIPPRM.SUM	Output	BPIPPRM summary file
KAHE_BOILER_BPIPPRM.SO	Output	BPIPPRM output information; Input file for AERMOD

TABLE A-4 AERMOD MODELING RUN LOG

Run ID	Averaging Period	Comments
KAHE_NSO2_500	1-hr	Modeled impacts based on normalized 2012-2014 actual SO2 emissions

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Appendix B: Detailed Scoring Calculations

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TABLE B-1 DETAILED SCORING CALCULATIONS

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		Score
Easting	Northing	Elevation	Height Scale	Rank			
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
592100.00	2363000.00	353.08	943.34	1	32	4	5
590600.00	2364000.00	327.40	943.34	4	20	7	11
592600.00	2363000.00	359.11	943.34	3	19	8	11
592100.00	2362500.00	288.55	943.34	2	15	11	13
591100.00	2363000.00	313.05	943.34	9	30	5	14
592600.00	2362500.00	306.37	943.34	8	15	11	19
591600.00	2362000.00	234.61	943.34	19	96	2	21
591100.00	2364000.00	359.96	943.34	6	12	16	22
590600.00	2363500.00	291.61	943.34	11	[illegible]	15	26
591600.00	2363500.00	401.76	943.34	5	[illegible]	24	29
592100.00	2363500.00	385.63	943.34	10	8	[illegible]	35
591100.00	2363500.00	319.21	943.34	12	6	21	39
592600.00	2363500.00	442.55	943.34	15	6	27	42
593100.00	2363000.00	340.87	943.34	[illegible]	1	37	44
590100.00	2363500.00	244.09	943.34	[illegible]	[illegible]	10	46
591600.00	2363000.00	289.27	943.34	18	5	31	49
591100.00	2364500.00	427.81	943.34	16	1	37	53
591600.00	2364000.00	418.40	943.34	23	4	32	55
593600.00	2363500.00	412.29	94[illegible]	13	0	42	55
593600.00	2363000.00	323.28	943[illegible]	14	[illegible]	42	56
593100.00	2363500.00	441.72	943.3[illegible]	[illegible]	0	42	59
594100.00	2363500.00	347.22	943.34	[illegible]	0	42	62
594100.00	2363000.00	318.43	943.34	21	0	42	63
594600.00	2363500.00	32[illegible]	943.34	22	0	42	64
592100.00	2364000.00	[illegible]2.83	943.34	24	0	42	66
589600.00	2367000.00	[illegible]400.03	943.34	47	11	20	67
594100.00	2364000.0[illegible]	411.98	943.34	25	0	42	67
592600.00	2364000.00	[illegible]84.96	[illegible]	26	0	42	68
593600.00	2364000.00	[illegible]	943.34	27	0	42	69
590600.00	23[illegible].00	29[illegible]	943.34	28	0	42	70
594600.00	[illegible]4000.[illegible]	357.[illegible]	943.34	29	0	42	71
591600.0[illegible]	2364500.00	[illegible]89.34	943.34	30	0	42	72
5931[illegible]	2362500.00	[illegible]9.85	943.34	31	0	42	73
5921[illegible]	2365500.00	[illegible].85	952.31	32	0	42	74
591100.0[illegible]	[illegible]362500.00	[illegible].22	943.34	59	12	16	75
595100.00	[illegible]4500.00	[illegible]4.54	943.34	33	0	42	75
594600.00	23[illegible]00.00	[illegible]14.97	943.34	34	0	42	76
593600.00	2362[illegible]	284.27	943.34	35	0	42	77
594600.00	2363000[illegible]	300.35	943.34	37	0	42	79
595100.00	2364000.00	319.02	943.34	38	0	42	80
590600.00	2367500.00	348.77	952.31	39	0	42	81
594100.00	2364500.00	450.99	943.34	40	0	42	82
592100.00	2366000.00	422.42	943.34	41	0	42	83
595100.00	2363500.00	297.15	943.34	42	0	42	84
595600.00	2364500.00	352.61	943.34	43	0	42	85
592100.00	2362000.00	224.16	943.34	44	0	42	86

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TABLE B-1 DETAILED SCORING CALCULATIONS (CONTINUED)

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		Score
Easting	Northing	Elevation	Height Scale	Rank			
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
590600.00	2363000.00	215.61	943.34	61	7	26	87
591600.00	2366000.00	352.94	952.31	45	0	42	87
592100.00	2365000.00	428.77	943.34	46	0	42	88
595600.00	2365000.00	342.32	943.34	48	0	42	90
592100.00	2366500.00	349.09	952.31	49	0	42	91
595100.00	2367000.00	382.82	952.31	50	0	42	92
593100.00	2364000.00	531.88	818.76	51	0	42	93
595100.00	2365000.00	464.18	943.34	52	0	42	94
595600.00	2364000.00	289.76	943.34	53	0	42	95
594100.00	2362500.00	281.21	943.34	54	[illegible]	42	96
591100.00	2367500.00	324.70	952.31	55	0	[illegible]	97
590100.00	2366500.00	314.01	952.31	56	0	[illegible]	98
591600.00	2361500.00	158.40	943.34	91	19	8	99
592600.00	2367000.00	413.64	952.31	57	0	42	99
595100.00	2365500.00	414.87	943.34	[illegible]	[illegible]	42	100
593600.00	2362000.00	245.47	943.34	[illegible]	[illegible]	37	101
593600.00	2365000.00	510.12	943.34	60	0	42	102
596100.00	2364000.00	292.86	943.34	62	0	42	104
591600.00	2365000.00	295.20	952.[illegible]	63	0	42	105
591600.00	2367500.00	334.94	952.[illegible]	65	[illegible]	42	107
593100.00	2362000.00	238.20	943.[illegible]	[illegible]	[illegible]	42	108
592600.00	2364500.00	546.81	943.3[illegible]	[illegible]	0	42	109
595100.00	2367500.00	403.53	952.31	[illegible]8	0	42	110
595600.00	2365500.00	342.[illegible]	943.34	69	0	42	111
593600.00	2364500.00	5[illegible]02	943.34	70	0	42	112
595100.00	2366500.00	[illegible]14.79	952.31	71	0	42	113
595100.00	2363000.00	277.87	943.34	72	0	42	114
595100.00	2366000.00	428.51	[illegible]	73	0	42	115
591100.00	2368500.00	[illegible]7.3[illegible]	952.31	74	0	42	116
594600.00	2365000.00	4[illegible]	943.34	75	0	42	117
592600.00	[illegible]	453[illegible]	952.31	76	0	42	118
592100.00	[illegible]367500.00	376.21	952.31	77	0	42	119
591100.[illegible]	2365000.00	[illegible]65.42	952.31	78	0	42	120
5921[illegible]	2367000.00	[illegible].48	952.31	79	0	42	121
594600.[illegible]	2366500.00	4[illegible].70	943.34	80	0	42	122
592100.00	[illegible]64500.00	[illegible].50	943.34	81	0	42	123
596100.00	2[illegible]500.00	[illegible]4.52	943.34	82	0	42	124
590600.00	236[illegible].00	466.24	952.31	83	0	42	125
593600.00	23615[illegible]	204.96	943.34	111	14	14	125
594600.00	2362000.00	245.54	943.34	84	0	42	126
596100.00	2366000.00	319.91	952.31	85	0	42	127
595600.00	2366000.00	435.55	943.34	86	0	42	128
590200.00	2361500.00	5.03	943.34	128	239	1	129
592100.00	2368500.00	433.52	952.31	87	0	42	129
592600.00	2362000.00	200.16	943.34	88	0	42	130
594100.00	2362000.00	237.96	943.34	89	0	42	131

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TABLE B-1 DETAILED SCORING CALCULATIONS (CONTINUED)

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		Score
Easting	Northing	Elevation	Height Scale	Rank			
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
593100.00	2364500.00	559.61	943.34	90	0	42	132
594600.00	2367000.00	458.14	952.31	92	0	42	134
595600.00	2368000.00	339.64	952.31	93	0	42	135
595600.00	2367000.00	345.50	952.31	94	0	42	136
589600.00	2366500.00	273.51	952.31	95	0	42	137
595100.00	2368000.00	413.61	952.31	96	0	42	138
592600.00	2365500.00	499.68	943.34	97	0	42	139
591600.00	2368500.00	462.94	952.31	98	0	42	140
592100.00	2369000.00	323.64	952.31	99	0	42	141
592600.00	2369000.00	394.42	952.31	100	[illegible]	42	142
594600.00	2366000.00	533.38	943.34	101	0	[illegible]	143
590100.00	2367000.00	516.18	943.34	107	1	[illegible]	144
594600.00	2362500.00	246.96	943.34	102	0	42	144
591600.00	2368000.00	511.90	952.31	10[illegible]	0	42	145
595600.00	2368500.00	346.44	952.31	[illegible]	[illegible]	42	146
590100.00	2362000.00	1.09	943.34	[illegible]	[illegible]	3	147
594600.00	2367500.00	465.35	952.31	105	0	42	147
595600.00	2367500.00	310.27	952.31	106	0	42	148
595600.00	2366500.00	336.88	952.[illegible]	108	0	42	150
591600.00	2362500.00	187.69	943.[illegible]	116	[illegible]	35	151
592100.00	2368000.00	506.29	952.[illegible]	[illegible]	[illegible]	42	151
594600.00	2365500.00	535.09	943.3[illegible]	[illegible]	0	42	152
596100.00	2365500.00	275.36	952.31	[illegible]12	0	42	154
590600.00	2361500.00	50.[illegible]	943.34	149	21	6	155
592600.00	2361500.00	[illegible]28	943.34	120	2	35	155
595100.00	2362500.00	[illegible]0.33	943.34	113	0	42	155
590100.00	2363000.00	176.81	943.34	114	0	42	156
592100.00	2361500.00	130.22	[illegible]	119	1	37	156
590100.00	2362500.00	[illegible]7.4[illegible]	943.34	137	11	20	157
596100.00	2362500.00	2[illegible]	943.34	115	0	42	157
591100.00	[illegible]	61.[illegible]	943.34	143	12	16	159
595600.00	[illegible]362500.00	231.0[illegible]	943.34	117	0	42	159
592600.[illegible]	2367500.00	[illegible]4.93	952.31	118	0	42	160
5901[illegible]	2364000.00	[illegible]6.87	943.34	121	0	42	163
590300.[illegible]	2361000.00	[illegible]63	943.34	153	15	11	164
591600.00	[illegible]67000.00	[illegible].93	952.31	122	0	42	164
593100.00	2[illegible]500.00	[illegible]2.27	943.34	123	0	42	165
592600.00	236[illegible].00	522.16	952.31	124	0	42	166
591100.00	2362[illegible]	108.02	943.34	151	12	16	167
595100.00	2362000.00	221.53	943.34	125	0	42	167
595600.00	2369000.00	345.91	952.31	126	0	42	168
595600.00	2363500.00	236.34	943.34	127	0	42	169
593100.00	2367000.00	539.43	943.34	129	0	42	171
594600.00	2361500.00	202.38	943.34	130	0	42	172
595100.00	2368500.00	468.87	952.31	131	0	42	173
591600.00	2365500.00	239.95	952.31	132	0	42	174

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TABLE B-1 DETAILED SCORING CALCULATIONS (CONTINUED)

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		Score
Easting	Northing	Elevation	Height Scale	Rank			
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
591100.00	2368000.00	548.44	952.31	133	0	42	175
596100.00	2368000.00	286.37	952.31	134	0	42	176
591600.00	2366500.00	237.07	952.31	135	0	42	177
596100.00	2368500.00	290.05	952.31	136	0	42	178
590600.00	2362500.00	64.14	943.34	146	3	33	179
590600.00	2361000.00	21.04	943.34	160	11	20	180
594100.00	2361500.00	162.52	943.34	138	0	42	180
594100.00	2366500.00	567.39	943.34	139	0	42	181
594100.00	2365000.00	617.32	843.67	140	0	42	182
595100.00	2361500.00	188.40	943.34	141	[illegible]	42	183
594100.00	2366000.00	576.11	943.34	142	0	[illegible]	184
593100.00	2365000.00	602.05	943.34	145	0	[illegible]	187
591600.00	2361000.00	75.50	943.34	161	6	27	188
593600.00	2361000.00	108.90	943.34	14[illegible]	0	42	189
593100.00	2361000.00	107.66	943.34	[illegible]	[illegible]	42	190
592100.00	2361000.00	62.99	943.34	[illegible]	[illegible]	42	192
592600.00	2366000.00	655.32	943.34	152	0	42	194
591100.00	2361000.00	66.92	943.34	172	10	23	195
591600.00	2369000.00	255.44	1064.[illegible]	154	0	42	196
589650.00	2363000.00	6.24	952.[illegible]	170	[illegible]	27	197
594100.00	2367000.00	566.91	943.[illegible]	[illegible]	[illegible]	42	197
592600.00	2361000.00	127.51	943.3[illegible]	[illegible]	0	42	198
593600.00	2365500.00	606.44	943.34	[illegible]57	0	42	199
596100.00	2369000.00	282.[illegible]	952.31	158	0	42	200
594100.00	2365500.00	6[illegible]96	943.34	159	0	42	201
595100.00	2369000.00	[illegible]2.73	952.31	162	0	42	204
596100.00	2366500.00	257.11	952.31	163	0	42	205
596600.00	2364000.00	218.80	[illegible]	164	0	42	206
594600.00	2361000.00	[illegible]0.2[illegible]	943.34	165	0	42	207
589600.00	2366000.00	2[illegible]	952.31	166	0	42	208
594100.00	[illegible]	127[illegible]	943.34	167	0	42	209
595600.00	[illegible]363000.00	222.3[illegible]	943.34	168	0	42	210
592600.[illegible]	2368000.00	[illegible]15.21	943.34	169	0	42	211
59466[illegible]	2368500.00	[illegible]0.03	952.31	171	0	42	213
590600.[illegible]	2367000.00	2[illegible].97	952.31	173	0	42	215
593100.00	[illegible]67500.00	[illegible].52	943.34	174	0	42	216
595600.00	2[illegible]000.00	[illegible]3.38	943.34	175	0	42	217
593100.00	236[illegible]0.00	654.65	943.34	176	0	42	218
596100.00	2365[illegible]	219.68	952.31	177	0	42	219
594600.00	2368000.00	548.52	952.31	178	0	42	220
595100.00	2361000.00	120.49	943.34	179	0	42	221
588600.00	2365500.00	19.83	952.31	180	0	42	222
596100.00	2362000.00	174.24	943.34	181	0	42	223
595600.00	2361500.00	120.62	943.34	182	0	42	224
596600.00	2362500.00	131.68	943.34	183	0	42	225
596100.00	2367500.00	252.01	952.31	184	0	42	226

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TABLE B-1 DETAILED SCORING CALCULATIONS (CONTINUED)

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		Score
Easting	Northing	Elevation	Height Scale	Rank			
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
594100.00	2367500.00	599.26	943.34	185	0	42	227
588600.00	2364500.00	1.00	952.31	195	3	33	228
595600.00	2361000.00	96.36	943.34	186	0	42	228
589600.00	2363500.00	9.73	952.31	187	0	42	229
596600.00	2364500.00	201.25	952.08	188	0	42	230
589100.00	2366000.00	25.47	952.31	189	0	42	231
596100.00	2361500.00	109.80	943.34	190	0	42	232
596600.00	2365500.00	210.40	952.31	191	0	42	233
596100.00	2367000.00	242.80	952.31	192	0	42	234
589100.00	2365000.00	9.58	952.31	193	[illegible]	42	235
588600.00	2365000.00	2.48	952.31	194	0	[illegible]	236
596100.00	2363000.00	176.28	943.34	196	0	[illegible]	238
596600.00	2363000.00	134.75	943.34	197	0	42	239
589100.00	2365500.00	59.36	952.31	19[illegible]	0	42	240
589600.00	2364000.00	23.81	952.31	[illegible]	[illegible]	42	241
596600.00	2366000.00	214.93	952.31	2[illegible]	[illegible]	42	242
596600.00	2361500.00	104.44	943.34	201	0	42	243
596600.00	2369000.00	241.93	952.31	202	0	42	244
594600.00	2369000.00	610.68	952[illegible]	203	0	42	245
596100.00	2363500.00	201.04	943[illegible]	204	[illegible]	42	246
589100.00	2366500.00	47.44	1200[illegible]	[illegible]	[illegible]	42	247
596600.00	2368500.00	246.05	952.3[illegible]	2[illegible]	0	42	248
589600.00	2365500.00	42.99	952.31	[illegible]07	0	42	249
589100.00	2364000.00	3.8[illegible]	952.31	208	0	42	250
588600.00	2367000.00	[illegible]3	1233.11	209	0	42	251
596100.00	2361000.00	[illegible]9.87	[illegible]943.34	210	0	42	252
596600.00	2362000.00	126.90	943.34	211	0	42	253
589100.00	2364500.00	9.00	[illegible]	212	0	42	254
589600.00	2365000.00	[illegible]3.5[illegible]	952.31	213	0	42	255
589600.00	2364500.00	[illegible]	952.31	214	0	42	256
588600.00	[illegible]	5.[illegible]	1200.94	215	0	42	257
588600.00	[illegible]366500.00	14.99	1233.11	216	0	42	258
594100.[illegible]	2368000.00	[illegible]57.57	943.34	217	0	42	259
58860[illegible]	2367500.00	[illegible].00	1233.11	218	0	42	260
593100.[illegible]	2368500.00	6[illegible].48	952.31	219	0	42	261
589100.00	[illegible]67000.00	[illegible].61	1233.11	220	0	42	262
596600.00	2[illegible]000.00	[illegible]4.13	952.31	221	0	42	263
593600.00	236[illegible].00	657.22	943.34	222	0	42	264
590100.00	23645[illegible]	84.09	952.31	223	0	42	265
593100.00	2369000.00	650.32	952.31	224	0	42	266
588600.00	2368000.00	17.87	1233.11	225	0	42	267
596600.00	2361000.00	49.88	943.34	226	0	42	268
592600.00	2365000.00	680.46	746.81	227	0	42	269
589100.00	2367500.00	99.20	1233.11	228	0	42	270
591100.00	2366500.00	167.66	952.31	229	0	42	271
596600.00	2367500.00	225.47	952.31	230	0	42	272

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TABLE B-1 DETAILED SCORING CALCULATIONS (CONTINUED)

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		Score
Easting	Northing	Elevation	Height Scale	Rank			
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
588600.00	2368500.00	20.04	1233.11	231	0	42	273
591100.00	2367000.00	181.43	952.31	232	0	42	274
593600.00	2366000.00	672.75	943.34	233	0	42	275
594100.00	2368500.00	679.92	943.34	234	0	42	276
596600.00	2366500.00	196.82	952.31	235	0	42	277
593100.00	2365500.00	682.94	785.55	236	0	42	278
590100.00	2365000.00	32.32	952.31	237	0	42	279
589100.00	2368000.00	17.53	1233.11	238	0	42	280
588600.00	2369000.00	22.45	1233.11	239	0	42	281
590600.00	2365000.00	126.85	952.31	240	[illegible]	42	282
593600.00	2368000.00	696.73	943.34	241	0	[illegible]	283
591100.00	2365500.00	149.89	952.31	242	0	[illegible]	284
596600.00	2363500.00	146.64	943.34	243	0	42	285
590100.00	2367500.00	202.93	952.31	24[illegible]	0	42	286
596600.00	2365000.00	175.99	952.31	[illegible]	[illegible]	42	287
596600.00	2367000.00	193.43	952.31	2[illegible]	[illegible]	42	288
590100.00	2365500.00	57.39	952.31	247	0	42	289
590600.00	2368500.00	200.63	1233.11	248	0	42	290
590600.00	2365500.00	74.48	952.[illegible]	249	0	42	291
589600.00	2367500.00	163.77	952.[illegible]	250	[illegible]	42	292
590100.00	2368000.00	199.96	1064[illegible]	[illegible]	[illegible]	42	293
589100.00	2368500.00	24.00	1233.[illegible]	2[illegible]	0	42	294
593100.00	2366000.00	708.39	943.34	[illegible]53	0	42	295
590100.00	2366000.00	136[illegible]	952.31	254	0	42	296
590600.00	2366500.00	1[illegible]44	952.31	255	0	42	297
591100.00	2369000.00	[illegible]6.21	1233.11	256	0	42	298
589100.00	2369000.00	26.92	1233.11	257	0	42	299
591100.00	2366000.00	137.52	[illegible]	258	0	42	300
589600.00	2368000.00	[illegible]0.5[illegible]	1233.1[illegible]	259	0	42	301
590600.00	2366000.00	[illegible]	952.31	260	0	42	302
593600.00	[illegible]	730[illegible]	943.34	261	0	42	303
589600.00	[illegible]368500.00	28.84	1233.11	262	0	42	304
589600.[illegible]	2369000.00	[illegible]5.01	1233.11	263	0	42	305
5901[illegible]	2368500.00	[illegible].63	1233.11	264	0	42	306
590100.[illegible]	2369000.00	[illegible]00	1233.11	265	0	42	307
593600.00	[illegible]367000.00	[illegible].43	943.34	266	0	42	308
590600.00	2[illegible]000.00	[illegible]7.03	1233.11	267	0	42	309
594100.00	236[illegible].00	743.05	943.34	268	0	42	310
593100.00	2368[illegible]	846.17	943.34	269	0	42	311
593600.00	2368500.00	789.99	943.34	270	0	42	312
593600.00	2369000.00	857.75	943.34	271	0	42	313

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Hawaiian Electric Company, Inc.

1-Hour SO_2 Modeling to Inform Monitor Placement

Waiau Generating Station

Island of O'ahu, Hawai'i

Prepared by

jca

Working Draft - May2015

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1.0 INTRODUCTION AND SUMMARY

The Environmental Protection Agency (EPA) has proposed the *Data Requirements Rule for the 1-Hour Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS)* (79 FR 27446). In this proposed rule, EPA directs state and tribal air agencies (air agencies) to provide data characterizing current air quality in areas with large sources of SO_2 emissions. The proposed rule defines large sources of SO_2 emissions as:

> *Sources with actual SO_2 emissions greater than 1,000 tons per year in metropolitan areas[1] with population greater than 1 million[2]; and sources greater than 2,000 tons per year everywhere else.*

The proposed rule specifies that these sources must use either dispersion modeling or ambient monitoring to demonstrate that the area sounding the source is in attainment with the 1-hour SO_2 NAAQS. The EPA has issued the following non-binding draft technical assistance documents (TADs) to assist the air agencies in preparing their demonstrations:

- *SO_2 NAAQS Designations Modeling Technical Assistance Document* (modeling TAD), draft dated December 2013, and
- *SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document* (monitoring TAD), draft dated December 2013.

The Hawaiian Electric Company, Inc. (Hawaiian Electric) Waiau Generating Station's 2014 actual SO_2 emissions exceeded 2,000 tons. Therefore, a source specific attainment demonstration is required for the Waiau Generating Station. Hawaiian Electric proposes that the source-oriented monitoring option be used.

Figure 1.0-1 shows the proposed location of the source-oriented SO_2 monitor based on modeling to inform monitor placement as described in the monitoring TAD. The modeling methodology used for the monitor site selection is discussed in Section 2.0. The monitor site selection process is discussed in Section 3.0.

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[1] Metro areas are based on Core Based Statistical Areas (CBSA). CBSAs are defined and maintained by the Office of Management and Budget (OMB) pursuant to OMB Bulletin 13-01 (February 28, 2013). The most recent revision to CBSA definitions were developed in accordance with OMB's "Standards for Delineating Metropolitan and Micropolitan Statistical Areas," 75 FR 37246 (June 28, 2010).

[2] Hawaii is divided into the following Core Based Statistical Areas (CBSA): 1) CBSA Code 27980 – Kahului-Wailuku-Lāhainā, HI Metropolitan Statistical Area; Maui County, 2) CBSA Code 46520 – Urban Honolulu, HI Metropolitan Statistical Area; Honolulu County, 3) CBSA Code 25900 – Hilo, HI Micropolitan Statistical Area; Hawai'i County, 4) CBSA Code 28180 – Kapa'a, HI Micropolitan Statistical Area Principal City; Kaua'i County. Of these CBSAs, only Urban Honolulu has a population close to 1,000,000. Urban Honolulu's 2013 estimated population is 983,429.

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FIGURE 1.0-1 PROPOSED SOURCE-ORIENTED SO_2 MONITOR LOCATION

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2.0 MODELING METHODOLOGY

The modeling in this report is based on the guidance presented in the modeling and monitoring TADs (EPA, 2013a; EPA, 2013b).

2.1. MODEL SELECTION AND OPTIONS

EPA's recommended dispersion model, AERMOD (version 11103 or later), was used for this modeling analysis. AERMOD is a steady-state plume model capable of modeling simple, intermediate, and complex terrain receptors. In the stable boundary layer (nighttime), it assumes the concentration distribution to be Gaussian in both the vertical and horizontal. In the convective boundary layer (daytime) the probability density function describing the horizontal distribution is assumed to be Gaussian, while the vertical distribution is assumed to be bi-Gaussian. AERMOD also contains the PRIME algorithm which incorporates the two fundamental features associated with building downwash: (1) enhanced plume dispersion coefficients due to the turbulent wake, and (2) reduced plume rise caused by a combination of the descending streamlines in the lee of the building and the increased entrainment in the wake (EPA, 2004a and EPA, 2004d).

AERMOD's regulatory default options were used when modeling SO_2 impacts.

AERMOD (starting with version 11059) is capable of calculating the distribution of daily maximum 1-hour values. The daily maximum 1-hour values are calculated when the pollutant ID is either "SO2" or "NO2" and the only short term averaging period specified is "1-hour".

2.2. STACK PARAMETERS AND EMISSION RATES

The TADs specify the modeling should be based on actually SO_2 emissions and stack parameters. The CTs (W9 and W10) have been burning 500 ppm maximum sulfur fuel which makes their contribution to the modeled SO_2 impacts minimal. Table 2.2-1 lists the stack locations and the CSP application stack parameters.

The boiler hourly 2012 through 2014 actual SO_2 emission rates were calculated as each unit's hourly fuel use in pounds multiplied by the[3] the maximum rolling prior 30-day fuel sulfur content. The hourly 2012 through 2014 actual SO_2 emission rates for the CTs were calculated from each unit's hourly fuel use in gallons and a 500 ppm fuel sulfur content. The data recovery for the hourly fuel data was 100%. As specified in the monitoring TAD, each unit's hourly actual SO_2 emission rates were normalized using the following steps:

1. Determine the total actual SO_2 emission rates from all units for each hour in the data period.
2. Determine the maximum hourly SO_2 emission rate calculated in Step 1.
3. Divide all hourly actual SO_2 emission rates by the SO_2 emission rate identified in Step 2.

The normalized hourly SO_2 emission rates were input into AERMOD using the HOUREMIS keyword in the source pathway.

2.3. METEOROLOGICAL DATA

EPA's meteorological processors for AERMOD, AERMET (version 14134) and AERMINUTE (version 14337), were used to create the required meteorological input files. National Weather Service (NWS) surface data from Honolulu International (HNL) Airport provided the meteorological data for the modeling. The 3-year data collection period was from January 1, 2012 through December 31, 2014. AERMINUTE calculates the hourly wind speed and direction

[3] The oxidation rate of fuel sulfur to SO_2 based on the ratio of molecular weights (64 lb SO_2/lb-mole / 32 lb S/lb-mole = 2).

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from the 1-minute Automated Surface Observing System (ASOS) data. The hourly values of wind speed and direction were measured at 10 m. Figure 3.3-1 presents a wind rose of the 3 years of data.

The Līhu'e Airport and Hilo International Airport are the only available sources of upper air meteorological data in the state of Hawai'i. The Līhu'e Airport station is operated by the NWS and is located on the Island of Kaua'i As previously recommend by DOH for sources on the Island of O'ahu, the Līhu'e Airport soundings provided the required upper air meteorological data for AERMET.

Appendix A contains a catalogue of the meteorological modeling files.

AERMOD uses several different boundary layer parameters to model how pollutants disperse in the atmosphere. Many of these parameters are not observed, but are estimated from other variables that are more easily measured. To make these estimates, observed near-surface wind and temperature and site-specific surface characteristics are required. AERMET requires the following site-specific surface characteristics:

- Surface roughness length (z_o) - the height above the ground at which horizontal wind velocity is typically zero,
- Noon-time albedo (r) - the fraction of radiation reflected by the surface, and
- Daytime Bowen ratio (B_o) - the ratio of the sensible heat flux (H) to the latent heat flux (λE).

EPA has developed a program called AERSURFACE to calculate the above parameters based on United States Geological Survey (USGS) land use/land cover data. However, the required USGS 1992 National Land Cover Data (NLCD92) is not available for Hawai'i. Section 3.1.2 of the AERMOD Implementation Guide provides recommended methods for determining surface characteristics. These methods should be followed unless a case-by-case justification can be provided for an alternative method (EPA, 2009a).

The selection of the surface parameters follows the land use procedure provided in the AERMOD Implementation Guide (EPA, 2009) and the Alaska Department of Environmental Conservation (ADEC) on how to calculate geometric means (ADEC, 2009). The land uses are determined using geographic information system (GIS) to analyze the USGS 2001 National Land Cover Data (NLCD2001). Table 2.3-1 lists the NLCD2001 land cover categories and the corresponding values for surface roughness length, albedo, and Bowen ratio.

The AERMOD Implementation Guide specifies that the albedo and Bowen ratio should be based on a 10-km by 10-km area centered on the meteorological tower. Figure 2.3-2 shows the 10-km by 10-km area centered on the meteorological tower. Albedo is determined using a simple unweighted arithmetic mean (i.e., no direction or distance dependency). Bowen ratio is determined using the unweighted geometric mean (i.e., no direction or distance dependency). Table 2.3-2 lists the area of land cover categories for the 10 x 10 km domain.

The AERMOD Implementation Guide specifies that the surface roughness length should be based on an inverse distance weighted geometric mean for a recommended upwind fetch of 1 km relative to the meteorological tower. Surface roughness length may vary by sector to account for variations in land cover near the measurement site; however, the sector widths should be no smaller than 30 degrees. Figure 2.3-3 shows the area within a 1-km radius of the meteorological tower and the selected sector boundaries. Table 2.3-3 lists the area of land cover categories for each sector.

Table 2.3-4 shows the calculated values of surface roughness length for each sector and the albedo and Bowen ratio.

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2.4. Urban/Rural Classification

The selection of either rural or urban dispersion coefficients in the air quality modeling follows the procedure provided in 40 CFR Part 51, Appendix W. Categorizing an area as urban or rural is determined by land use classification or population. A review of the land use surrounding the facility shows that urban land use types are less than 50% of the area within a 3-km radius of the source. However, the population density within a 3-km radius of the source is greater than 75 people/km^2. Since the facility is located in an urbanized area, the area was classified as urban.

The urban option in AERMOD requires information about two parameters: 1) the population of the urban complex and 2) the urban roughness. For relatively isolated urban areas, which Honolulu is, the population input into AERMOD is equal to the published census data corresponding to the Metropolitan Statistical Area (MSA) for that location. As such, a value of 876,000 people, based on the 2000 Census, was used as the population input for all sources within the modeling analysis. The default value of 1 meter for the urban roughness parameter was used.

2.5. Receptor Data

The modeling TAD states:

> *For the purposes of modeling for SO_2 designations, receptor placement strategy differs since the modeling is acting as a surrogate for monitoring. In areas where it is not feasible to place a monitor (water bodies, etc.), receptors can be ignored or not placed in those locations. In any case, receptor placement should be of sufficient density to provide resolution needed to detect significant changes in the concentrations, with receptors placed closer together near the source to detect local gradients and placed farther apart away from the source* (EPA, 2013a).

Receptor elevations and height scales were derived from the USGS National Elevation Dataset (NED) data using EPA's AERMAP (version 11103) program. Figure 2.5-1 shows the modeling grid consisting of 100-m spaced receptors from the center of the property to 5 km. Receptors were not located overwater, on-property, along the jogging path, or on the property line because it is infeasible to locate a monitor in these areas. Appendix A contains a catalogue of files used in the receptor processing.

2.6. Building Downwash

For air quality modeling purposes, the stacks were evaluated in terms of their proximity to nearby structures to determine whether stack effluents may be affected by downwash in the turbulent wake of such structures. AERMOD uses the following building parameters to account for downwash:

- BUILDHGT, the building height,
- BUILDWID, the projected width of the building perpendicular to the flow,
- BUILDLEN, the projected length of the building along the flow,
- XBADJ, the along-flow distance from the stack to the center of the upwind face of the projected building, and
- YBADJ, the across-flow distance from the stack to the center of the upwind face of the projected building.

Building parameters were obtained using EPA's Building Profile Input Program for PRIME (BPIPPRM – version 04274). BPIPPRM calculates the building parameters for 36 wind directions based on the physical dimensions of the structures surrounding a source. Equivalent

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building dimensions (EBDs) determined during a June 1998 wind tunnel study replaced the building parameters for specific wind directions for units W3 through W8.

Off property structures meeting the following requirements should be included in the BPIPPRM processing:

- The structure is less than 800 meters from the source, and
- The structure is located within 5L (five times the lesser of the height or width of the structure) of the source.

For example, the Sears Distribution Center warehouse is located approximately 280 meters from unit W3. The warehouse would need to be 56 meters (184 ft) tall to be included in the modeling. A review of the Honolulu Land Information System[4] (HoLIS) and Google Earth determined that off-site buildings did not need to be included in the BPIPPRM processing. Figure 2.6-1 shows the structures and heights entered into BPIPPRM. Appendix A contains a catalogue of files used in the BPIPPRM processing.

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[4] City & County of Honolulu, Department of Planning & Permitting http://gis.hicentral.com/

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TABLE 2.2-1 STACK LOCATIONS AND STACK PARAMETERS

Unit	NAD 83 UTM Coordinates Easting (m)	NAD 83 UTM Coordinates Northing (m)	Base Elevation (ft)	Base Elevation (m)	Stack Height (m)	Stack Diameter (m)	Stack Velocity (m/s)	Stack Temperature (K)
W3	607643.18	2365570.42	23.2	7.06	42.0624	3.[illegible]0	12.25	469.0
W4	607663.96	2365560.90	22.8	6.94	42.0624	3.0480	12.25	469.0
W5	607683.22	2365520.86	16.0	4.89	41.9100	2.7432	12.[illegible]	414.0
W6	607706.44	2365510.42	14.1	4.29	41.9[illegible]	2.7432	12.25	414.0
W7	607775.94	2365477.81	10.0	3.06	41.9[illegible]	[illegible]2004	16.12	422.0
W8	607747.47	2365490.33	13.6	4.16	41.9100	3.2004	16.06	429.0
W9	607516.36	2365475.43	5.6	1[illegible]	9.6774	[illegible]3053	37.30	861.0
W10	607557.53	2365457.37	3.0	0.9[illegible]	9.[illegible]	4.[illegible]53	37.30	861.0

Notes:

1. Stack locations are provided in UTM co[illegible]s (NAD 83, [illegible]) based on estimates from Google Earth.
2. Stack parameters are from the initial [illegible]P Appl[illegible]on.

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TABLE 2.3-1 SURFACE CHARACTERISTIC VALUES FOR NLCD2001 LAND COVER CATEGORIES

Land Cover Category		Surface Roughness		Bowen Ratio		
Name	No.	Length (m)	Albedo	Wet	Average	Dry
Open Water	11	0.001	0.10	[illegible]	0.1	0.1
Perennial Ice/Snow	12	0.002	0.60	[illegible]	0.5	0.5
Developed, Open Space	21	0.02	0.15	0.3	0.5	1.5
Developed, Low Intensity	22	0.54	[illegible]	0.6	0.8	2.0
Developed, Medium Intensity	23	1.00	[illegible]	1.0	[illegible]	3.0
Developed, High Intensity	24	0.80	0.18	1.0	[illegible]	3.0
Barren Land	31	0.05	0.20	1.0	1.5	3.0
Deciduous Forest	41	1.30	[illegible]	0.2	0.3	0.6
Evergreen Forest	42	1.30	[illegible]	0.2	0.3	0.6
Mixed Forest	43	1.30	[illegible]	0.2	0.3	0.6
Shrub/Scrub	52	0.30	[illegible]	0.8	1.0	2.5
Grasslands/Herbaceous	71	[illegible]	[illegible]	0.4	0.8	2.0
Pasture Hay	81	[illegible]	0.20	0.3	0.5	1.5
Cultivated Crops	82	0.20	[illegible]	0.3	0.5	1.5
Woody Wetlands	90	[illegible]	0.14	0.1	0.2	0.2
Emergent Herbaceous Wetlands	[illegible]	[illegible]	0.14	0.1	0.1	0.2

Notes:

1. Surface characteristic values [illegible] surface roughness length, albedo, and Bowen ratio are based on values contained in Appendix A of EPA's AERSURFACE User's Guide (January 2008).

2. The relationship between NLCD92 and NLCD2001 land cover categories and numbers are from Table 1 of *USGS's Completion of the National Land Cover Database (NLCD) 1992-2001 Land Cover Change Retrofit Product.*

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TABLE 2.3-2 LAND COVER BREAKDOWN FOR BOWEN RATIO AND ALBEDO CALCULATIONS

Land Cover Category		Area (km^2) of Land Cover Categories for Bowen Ratio and Albedo
Name	**No.**	
Open Water	11	47.43
Perennial Ice/Snow	12	--
Developed, Open Space	21	11.94
Developed, Low Intensity	22	8.00
Developed, Medium Intensity	23	8.92
Developed, High Intensity	24	7.96
Barren Land	31	0.31
Deciduous Forest	41	--
Evergreen Forest	42	2.61
Mixed Forest	43	--
Shrub/Scrub	52	2.53
Grasslands/Herbaceous	71	0.11
Pasture Hay	81	--
Cultivated Crops	82	--
Woody Wetlands	90	0.18
Emergent Herbaceous Wetlands	95	0.02

Note: The areas for each land use category and sector were developed using ESRI ArcGIS (Version 10) software and land cover data from the NLCD2001 digital database.

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TABLE 2.3-3 LAND COVER BREAKDOWN FOR SURFACE ROUGHNESS LENGTH CALCULATIONS

Land Cover Category		Area (km^2) of Land Cover Categories Surface Roughness Length Sectors							
Name	No.	1	2	3	4	5	6	7	8
Open Water	11	--	--	0.001	0.0[illegible]	0.02	--	--	--
Perennial Ice/Snow	12	--	--	--	[illegible]	[illegible]	--	--	--
Developed, Open Space	21	0.20	0.25	0.23	0.24	0.[illegible]	0.16	0.19	0.07
Developed, Low Intensity	22	0.06	0.03	0.0[illegible]	0.05	0.03	0.04	0.02	0.003
Developed, Medium Intensity	23	0.04	0.02	[illegible]	0.03	0.01	0.03	0.01	0.02
Developed, High Intensity	24	0.07	0.09	0.07	0.03	0.02	0.[illegible]	0.17	0.30
Barren Land	31	--	--	--	[illegible]	--	--	--	--
Deciduous Forest	41	--	--	--	--	--	--	--	--
Evergreen Forest	42	0.01	0.01	[illegible]	0.04	0.04	0.01	--	--
Mixed Forest	43	--	--	[illegible]	--	--	--	--	--
Shrub/Scrub	52	[illegible]	--	--	0.004	--	--	--	--
Grasslands/Herbaceous	71	[illegible]	[illegible]	--	[illegible]	--	--	--	--
Pasture Hay	81	[illegible]	--	--	[illegible]	--	--	--	--
Cultivated Crops	82	--	--	[illegible]	--	--	--	--	--
Woody Wetlands	90	--	[illegible]	--	--	--	--	--	--
Emergent Herbaceous Wetlands	[illegible]	--	--	--	--	--	--	--	--

Note: The areas for each land use cate[illegible]y and se[illegible] were dev[illegible]ed using ESRI ArcGIS (Version 10) software and land cover data from the NLCD2001 digital data[illegible]e.

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TABLE 2.3-4 SURFACE PARAMETERS

Sector	Sector Arc (Degrees from North) Start	End	Sector Width (Degrees)	Surface Roughness Length (m)	Bowen Ratio Wet	Average	Dry	Albedo
1	0	45	45	0.090				
2	45	90	45	0.079				
3	90	135	45	0.107				
4	135	180	45	0.077				
5	180	225	45	0.046	0.26	0.33	0.51	0.14
6	225	270	45	0.189				
7	270	315	45	0.126				
8	315	360	45	0.299				

Note: The surface moisture conditions for Honolulu International Airport were wet during 2012, average during 2013, and wet during 2014.

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FIGURE 2.3-1 HNL AIRPORT WIND ROSE

(10-M LEVEL WINDS● JANUARY 1, 2012–DECEMBER 31, 2014)

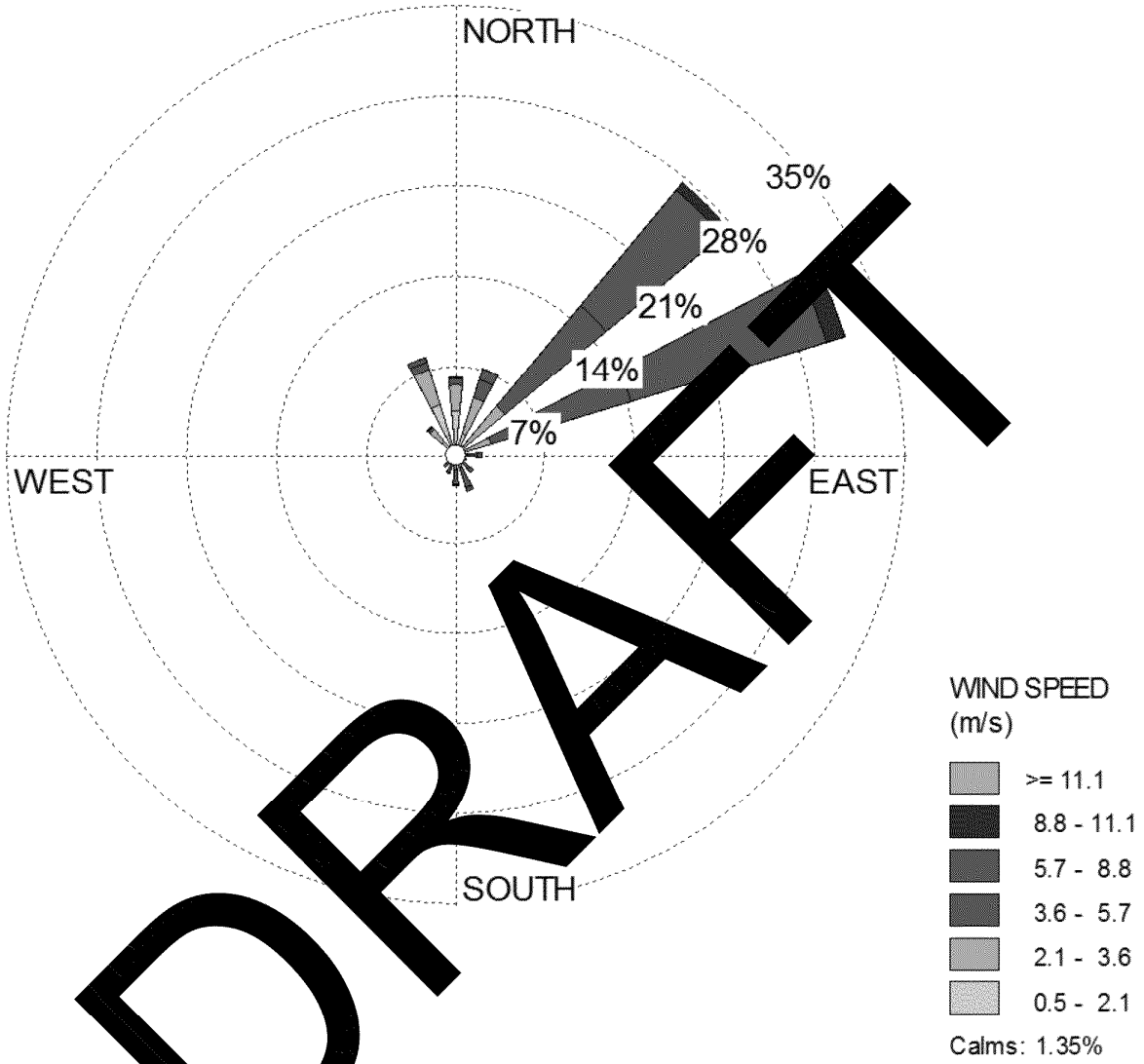

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FIGURE 2.3-2 USGS NLCD2001 SURROUNDING THE KAHE SITE-SPECIFIC METEOROLOGICAL TOWER (10 X 10 KM DOMAIN)

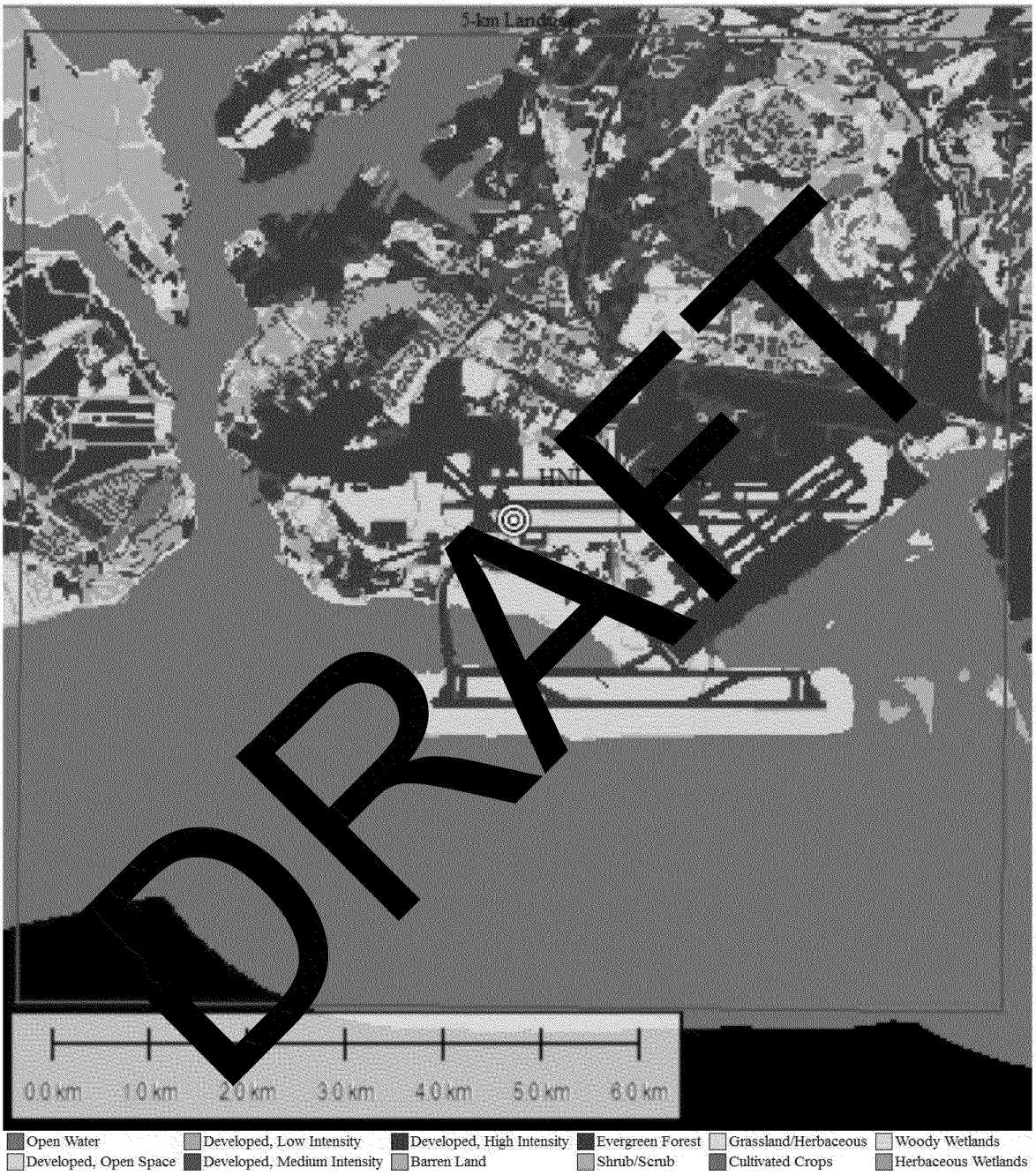

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FIGURE 2.3-3 USGS NLCD2001 SURROUNDING THE KAHE SITE-SPECIFIC METEOROLOGICAL TOWER (1-KM RADIUS)

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FIGURE 2.5-1 RECEPTOR GRID

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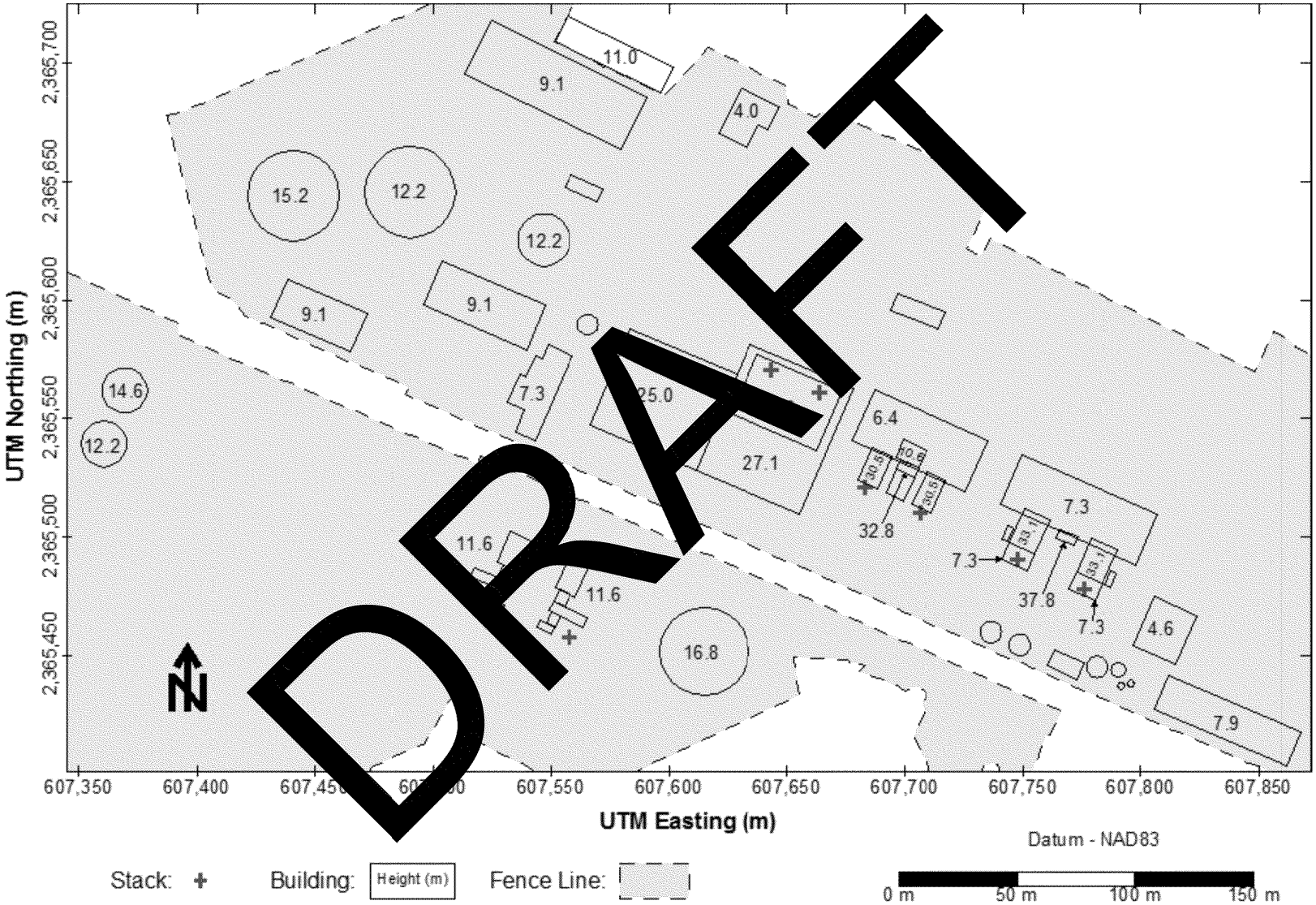
FIGURE 2.6-1 BPIPPRM INPUTS



3.0 MONITOR LOCATION SELECTION

3.1. MONITOR PLACEMENT SCORING

The monitoring TAD (EPA, 2013b) presents a scoring strategy to rank the receptors for consideration of monitor placement. The monitoring TAD states:

> *This scoring strategy can be conducted as follows:*
>
> *1. Calculate the normalized design value at each receptor and rank from highest to lowest receptor. Rank of 1 means the highest design value.*
>
> *2. Using the MAXDAILY output option in AERMOD, determine each day's highest normalized concentration and receptor. The MAXDAILY option in AERMOD outputs each receptor's highest concentration for each modeled day.*
>
> *3. Using the output from step 2, determine the number of days each receptor is the highest concentration for the day among all receptors.*
>
> *4. Rank the results from step 3 from highest to lowest number of days. Rank of 1 means the highest number of days having the daily maximum value.*
>
> *5. For each receptor, add the concentration rank and the day rank. The lowest possible score is 2, meaning the receptor was the highest overall normalized design value and also had the highest number of days where the receptor was the highest concentration for the day.*

Since the hourly SO_2 emissions were normalized, the AERMOD output concentrations are called normalized design values (NDVs). The NDVs are the 3-year average of the 99th percentile (4th rank) of the 1-hour daily maximum concentrations on a receptor-by-receptor basis. Appendix A contains a catalogue of the modeling files. Figure 3.1-1 presents color coded NDVs to illustrate the distribution of the NDVs. Figure 3.1-2 shows the receptors with the top 200 NDVs. The NDV rankings for the top 200 receptors are listed in Appendix B, Table B-1.

Next, the MAXDAILY output option in AERMOD was used to determine the number of days each receptor is the highest concentration day among all receptors. The MAXDAILY output was imported into an Access database to perform this calculation and ranking. This modeling was limited to the 200 receptors with the highest NDVs. This limit keeps the AERMOD MAXDAILY output file to a manageable size[5] and focuses the site selection to areas with the highest NDVs.

Figure 3.1-3 presents the cumulative number of days a receptor had the daily maximum 1-hour concentration. The cumulative number of day rankings for the top 200 receptors are listed in Appendix B, Table B-1. All the daily maximum 1-hour concentration were located at one of these 200 receptors.

Next, the NDV rank and the cumulative number of days rank were added to calculate the monitor placement score. Figure 3.1-4 shows the scoring results and Figure 3.1-5 shows the top 10 scoring ranks. Appendix B, Table B-1 presents the receptor scores.

3.2. SITE SELECTION EVALUATIONS

Based on the scoring, three areas were selected for site feasibility additional evaluations. Figure 3.2-1 shows the following three areas:

- Area 1 (Sears Warehouse) – This area is located north of the facility and contains receptors with the 2nd, 3rd, 5th, and 10th scoring ranks. Figure 3.2-2 shows a zoomed in aerial

[5] For 200 receptors and a 3-year (1,096-day) data period, there were 219,200 (200 receptors * 1,096 days) lines of output.

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photograph of this area adjacent to a transmission line right-of-way. This is an ideal location for an ambient monitoring station. Also, this area is adjacent to residential areas.

- Area 2 (Wooded Area) – This area is located adjacent to the western property line of the facility and contains receptors with the 1st and 6th scoring ranks. Figure 3.2-3 shows a zoomed in aerial photograph of this area. This area is undeveloped and has potential security concerns. This area is adjacent to a wetland.
- Area 3 (Pearl Harbor Warehouse) – This area is located across the East Loch, is adjacent to a group of warehouses, and contains receptors with the 4th, 7th, and 8th scoring ranks. Figure 3.2-4 shows a zoomed in aerial photograph of this area. Portions of this area are classified as wetlands.

Based on scoring and logistics, Area 1 is the preferred location for establishing the source specific SO_2 monitoring station.

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FIGURE 3.1-1 NORMALIZED DESIGN VALUES (NDVS)

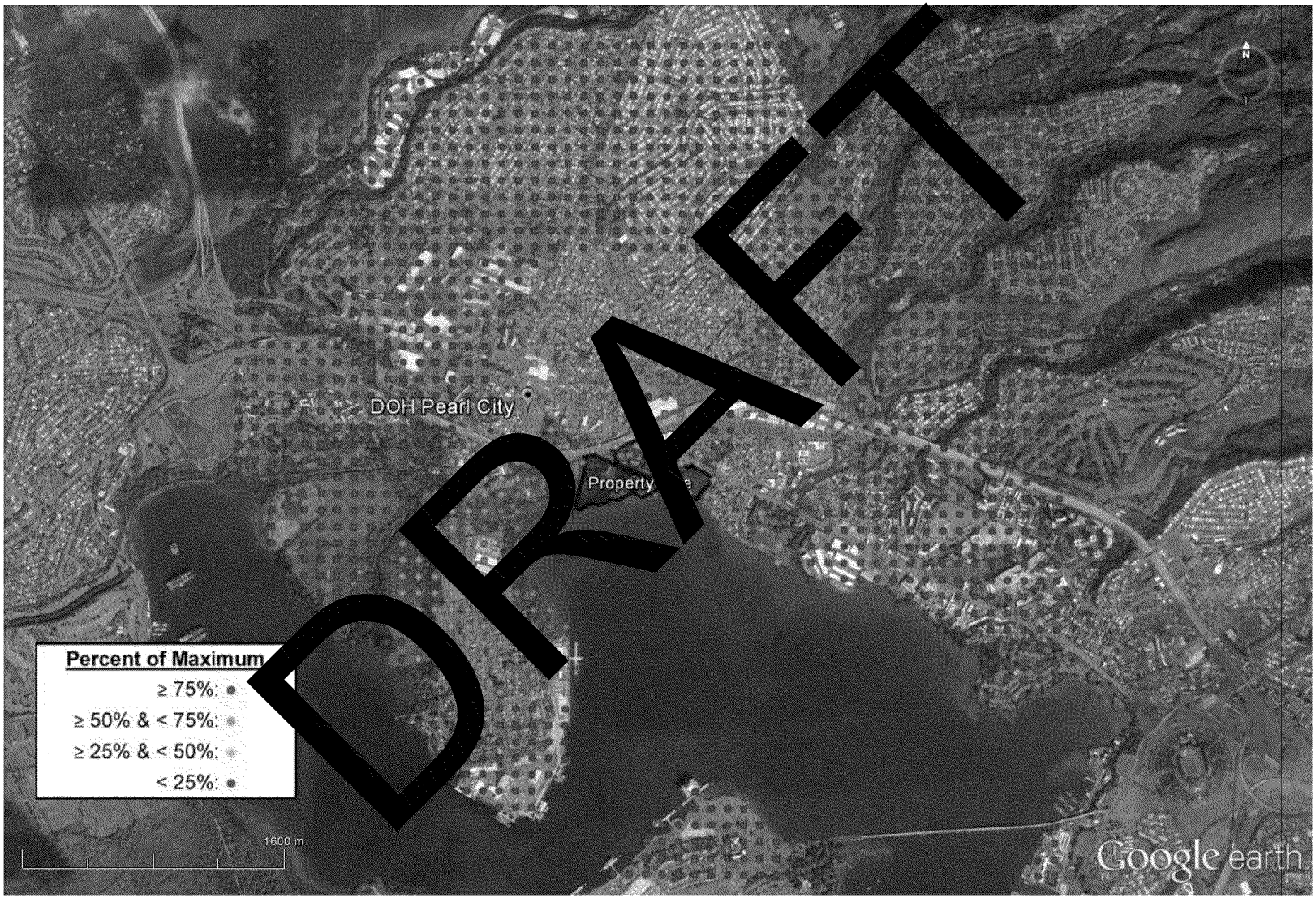

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FIGURE 3.1-2 RECEPTORS WITH THE TOP 200 NDVS

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FIGURE 3.1-3 CUMULATIVE NUMBER OF DAYS WITH THE DAILY MAXIMUM 1-HOUR NDV

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FIGURE 3.1-4 MONITOR PLACEMENT SCORING

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FIGURE 3.1-5 TOP 10 MONITOR PLACEMENT SCORING RANKS

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FIGURE 3.2-1 POTENTIAL MONITORING LOCATIONS

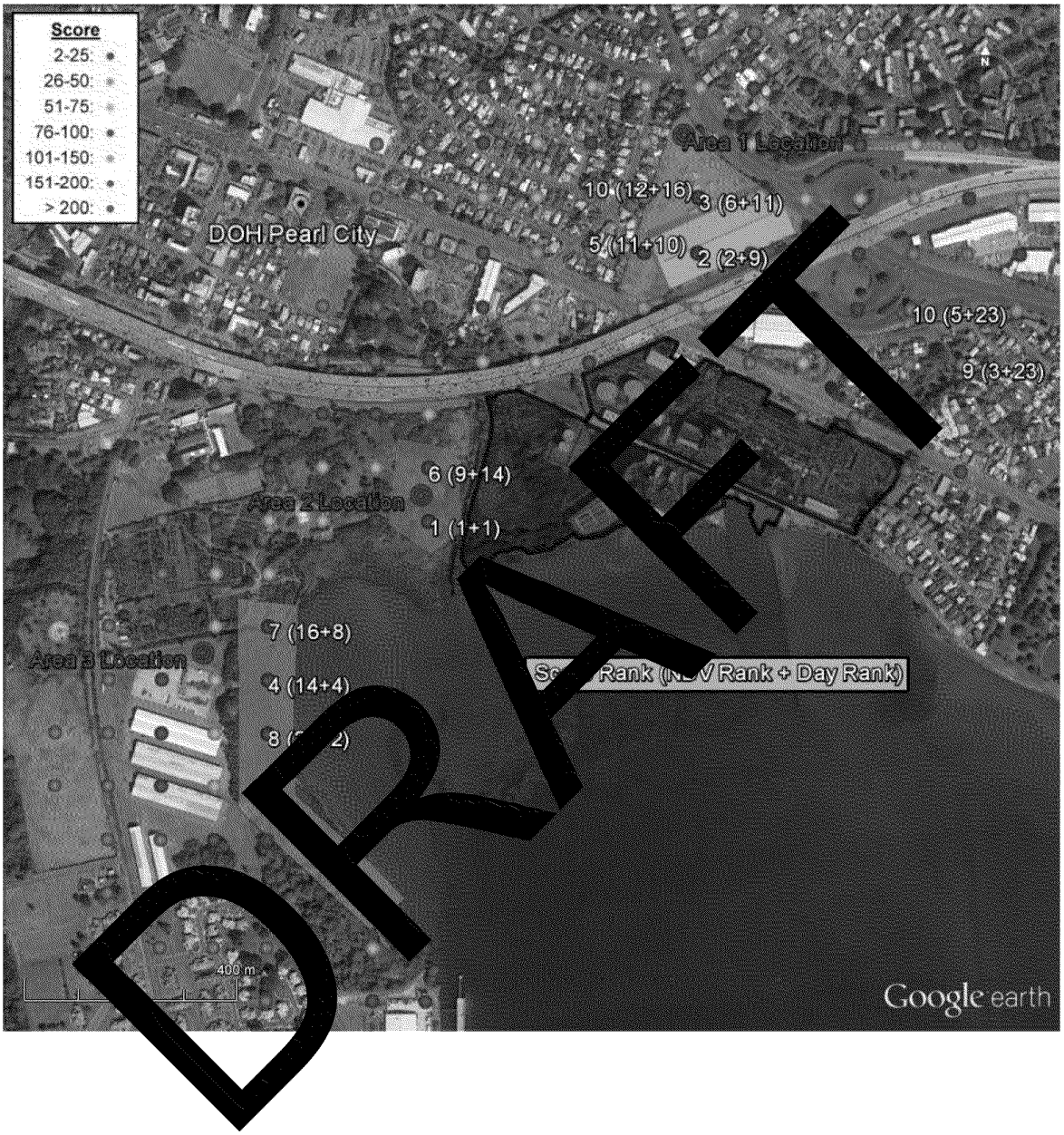

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FIGURE 3.2-2 AREA 1 POTENTIAL MONITOR LOCATION

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FIGURE 3.2-3 AREA 2 POTENTIAL MONITOR LOCATION

Wetlands:

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FIGURE 3.2-4 AREA 3 POTENTIAL MONITOR LOCATION

Wetlands:

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40 CFR 51 - Appendix W. Guideline on Air Quality Models.

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Appendix A: Modeling Files Catalogue

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TABLE A-1 AERMINUTE PROCESSING FILES

Filename*	File Type	Description
64050PHNLYYYYMM.dat	Input	1-minute ASOS wind data
AERMINUTE_HNL_YY.INP	Input	Control input file
HNL_1MIN_YY.DAT	Output	Hourly averaged winds (AERMET Stage 2 input file)
HNL_1MIN_YY_COMP.DAT	Output	Standard observation[illegible]s. 1-minute data file
HNL_1MIN_YY_SUMM.DAT	Output	[illegible]ry file
aerminute_YY.log	Output	Run Lo[illegible]
bad_records_YY.dat	Output	"Bad" d[illegible] that was not used to [illegible]culate hourly averages
check_records_YY.dat	Output	[illegible]a that may [illegible] suitable for use, once QAed
good_records_YY.dat	Output	"Goo[illegible] used to calculate hourly averages

* YYYY is the 4-digit modeled year, YY is the 2-digit [illegible]deled year, and MM [illegible]he modeled month.

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TABLE A-2 AERMET PROCESSING FILES

Filename*	File Type	Description
HNL_YYYY_S1.INP	Input	Stage 1 input file
HNL_YYYY_S2.INP	Input	Stage 2 input file
HNL_YYYY_S3.INP	Input	Stage 3 input file
22536_YY.FSL	Input	Upper Air Observations from Līhu'e Airport
911820-22521_YY	Input	HNL Airport surface data
HNL_YYYY_S1.MSG	Output	Stage 1 processing information
HNL_YYYY_S1.RPT	Output	Stage 1 summary report
SFEXOUT_YYYY.DSK	Output	Extracted surface observations
SFQAOUT_YYYY.DSK	Output	QAed surface observations
UAEXOUT_YYYY.DSK	Output	Extracted NWS upper air data
UAQAOUT_YYYY.DSK	Output	QAed upper air data
HNL_YYYY_S2.MSG	Output	Stage 2 processing information
HNL_YYYY_S2.RPT	Output	Stage 2 summary report
MERGE_YYYY.DSK	Output	Merged upper air and surface data
HNL_YYYY_S3.MSG	Output	Stage 3 processing information
HNL_YYYY_S3.RPT	Output	Stage 3 summary report
HNL_YYYY.SFC	Output	AERMOD input met. surface data (single year)
HNL_YYYY.PFL	Output	AERMOD input met. profile data (single year)
HNL_2012-2014.SFC	Output	AERMOD input met. surface data (2012-2014)
HNL_2012-2014.PFL	Output	AERMOD input met. profile data (2012-2014)

* YYYY is the 4-digit modeled year and YY is the 2-digit modeled year.

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TABLE A-3 AERMAP PROCESSING FILES

Filename	File Type	Description
Oahu_44626486.tif	Input	USGS 1/3 Degree NED covering O'ahu, downloaded June 20, 2012
WAIAU_SO2.INP	Input	AERMAP input file
WAIAU_SO2.xy	Input	List of receptor locations
WAIAU_SO2.out	Output	AERMAP output file
WAIAU_SO2.RE	Output	AERMAP output file
WAIAU_SO2_LAND_NoFENCE.xlsx	--	Spreadsheet used to filter/sort WAIAU_SO2.RE receptors
WAIAU_SO2_LAND_NoFENCE.RE	Output	File of receptors located in feasible locations

TABLE A-4 BPIPPRM PROCESSING FILES

Filename	File Type	Description
WAIAU_BPIPPRM.INP	Input	Input to BPIPPRM file without EBDs
WAIAU_BPIPPRM.OUT	Output	BPIPPRM output information without EBDs
WAIAU_BPIPPRM.SUM	Output	BPIPPRM summary file without EBDs
WAIAU_BPIPPRM_EBD.[illegible]	Output	BPIPPRM output information with EBDs; Input file for AERMOD

TABLE A-5 AERMOD MODELING RUN LOG

Run ID	Averaging Period	Comments
WAIAU_N2SO2_NoFENCE	1-hr	Modeled impacts based on normalized 2012-2014 actual SO2 emissions and all receptors
WAIAU_TOP200_NoFENCE	1-hr	Modeled impacts based on normalized 2012-2014 actual SO2 emissions and receptors with top 200 NDVs

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Appendix B: Detailed Scoring Calculations

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TABLE B-1 DETAILED SCORING CALCULATIONS

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		Score
Easting	Northing	Elevation	Height Scale	Rank			
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
607100.00	2365400.00	2.11	2.11	1	163	1	2
607600.00	2365900.00	20.03	20.03	2	29	9	11
607600.00	2366000.00	25.55	25.55	6	19	11	17
606800.00	2365100.00	1.00	1.00	14	88	4	18
607500.00	2365900.00	21.80	21.80	11	24	10	21
607100.00	2365500.00	4.23	4.23	9	18	14	23
606800.00	2365200.00	1.00	1.00	16	37	8	24
606800.00	2365000.00	1.00	1.00	23	134	2	25
608100.00	2365700.00	6.00	6.00	3	[illegible]	23	26
607500.00	2366000.00	26.89	26.89	12	[illegible]	16	28
608000.00	2365800.00	13.95	26.02	5	8	[illegible]	28
608100.00	2365900.00	24.97	24.97	8	10	[illegible]	29
608100.00	2365800.00	12.96	27.01	10	10	21	31
607400.00	2366000.00	23.17	23.17	[illegible]	12	18	33
606900.00	2364800.00	1.00	1.00	[illegible]	[illegible]	3	34
607400.00	2365900.00	19.45	19.45	[illegible]	14	16	35
606800.00	2364900.00	1.00	1.00	36	84	5	41
608000.00	2365900.00	23.94	25.03	24	11	20	44
608100.00	2365600.00	5.38	5.[illegible]	22	8	23	45
607400.00	2365800.00	12.44	17.[illegible]	28	[illegible]	18	46
608000.00	2365700.00	6.46	6.4[illegible]	[illegible]	[illegible]	43	50
608200.00	2365800.00	10.97	28.0[illegible]	[illegible]	2	43	56
607000.00	2364700.00	1.00	1.00	52	59	6	58
607600.00	2365800.00	13.7[illegible]	13.73	21	3	37	58
607700.00	2366000.00	2[illegible]	21.95	48	19	11	59
608200.00	2365700.00	[illegible].95	7.95	17	2	43	60
608000.00	2365600.00	4.00	4.00	18	2	43	61
607500.00	2366100.00	31.04	[illegible]	20	2	43	63
607600.00	2366100.00	[illegible].94	30.[illegible]	26	2	43	69
607500.00	2365800.00	[illegible]	15.73	34	3	37	71
607300.00	2[illegible]	16.[illegible]	16.50	29	2	43	72
608000.00	[illegible]66000.00	27.88	27.88	50	8	23	73
608200.0[illegible]	2366000.00	8.41	28.41	30	2	43	73
6079[illegible]	2365700.00	[illegible]60	12.44	32	2	43	75
608300.[illegible]	2365700.00	[illegible]10	11.10	43	4	33	76
608200.00	[illegible]365600.00	[illegible]6	7.56	40	3	37	77
608100.00	2[illegible]000.00	[illegible].16	30.16	42	3	37	79
607700.00	23[illegible]0.00	18.55	18.55	57	7	27	84
607000.00	23654[illegible]	1.00	1.00	4	0	82	86
606800.00	2364800.[illegible]	1.00	1.00	45	2	43	88
607900.00	2365900.00	21.08	21.08	53	3	37	90
607200.00	2365600.00	5.00	5.00	60	4	33	93
607900.00	2365800.00	15.62	16.47	51	2	43	94
606900.00	2364700.00	1.00	1.00	64	5	31	95
607100.00	2364600.00	0.20	0.20	88	57	7	95
608200.00	2365900.00	20.57	28.01	38	1	59	97

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TABLE B-1 DETAILED SCORING CALCULATIONS (CONTINUED)

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		Score
Easting	Northing	Elevation	Height Scale	Rank			
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
607400.00	2366100.00	28.05	28.05	39	1	59	98
607800.00	2366000.00	21.00	21.00	71	5	31	102
607900.00	2366000.00	24.00	24.00	75	6	29	104
606800.00	2365300.00	1.00	1.00	25	0	82	107
606900.00	2365400.00	1.00	1.00	27	0	82	109
607700.00	2366100.00	26.11	30.35	55	1	59	114
607000.00	2365500.00	3.22	3.22	33	0	82	115
607800.00	2365900.00	21.00	21.00	89	7	27	116
608300.00	2365800.00	13.47	15.52	35	0	82	117
608100.00	2365200.00	1.00	1.00	103	[illegible]	15	118
606700.00	2365100.00	1.00	1.00	37	0	82	119
607100.00	2365600.00	6.01	6.01	61	1	[illegible]	120
607600.00	2366200.00	34.51	34.51	62	1	5[illegible]	121
608200.00	2365500.00	6.00	6.00	9[illegible]	6	29	122
608300.00	2365600.00	9.11	9.11	[illegible]	[illegible]	59	122
607300.00	2366000.00	19.47	19.47	[illegible]	[illegible]	82	123
607500.00	2366200.00	36.48	36.48	4[illegible]	0	82	126
607000.00	2364600.00	1.00	1.00	95	4	33	128
608300.00	2365900.00	11.99	29.99	46	0	82	128
606700.00	2365000.00	1.00	1[illegible]	47	0	82	129
607700.00	2365800.00	17.48	17.[illegible]	70	[illegible]	59	129
607300.00	2365800.00	8.19	14.0[illegible]	[illegible]	2	43	130
606700.00	2365200.00	1.00	1.00	[illegible]9	0	82	131
607800.00	2366100.00	23.17	23.17	74	1	59	133
607300.00	2366100.00	26.[illegible]	26.03	54	0	82	136
606700.00	2365300.00	[illegible]00	1.00	56	0	82	138
606800.00	2365400.00	[illegible]1.97	1.97	58	0	82	140
607400.00	2366200.0[illegible]	36.50	36.50	59	0	82	141
607800.00	2365700.00	[illegible]13.02	[illegible]	109	4	33	142
608000.00	2366100.00	[illegible]7[illegible]	30.72	83	1	59	142
607300.00	2366[illegible]00.00	3[illegible]	36.39	65	0	82	147
606700.00	[illegible]	1.0[illegible]	1.00	66	0	82	148
606900.0[illegible]	2365500.00	[illegible]3.00	3.00	67	0	82	149
607200[illegible]	2365700.00	[illegible].00	5.00	90	1	59	149
6072[illegible]	2366000.00	[illegible]47	17.47	68	0	82	150
607300.0[illegible]	2365700.00	[illegible]7	4.47	107	2	43	150
608100.00	[illegible]6100.00	[illegible]73	34.73	69	0	82	151
608200.00	2[illegible]00.00	[illegible]1.14	31.14	72	0	82	154
607100.00	2364[illegible]00	1.00	1.00	144	19	11	155
608300.00	23661[illegible]	29.20	29.20	73	0	82	155
608400.00	2365900.00	21.46	23.00	76	0	82	158
606700.00	2364800.00	1.15	1.15	77	0	82	159
607400.00	2366300.00	35.95	37.59	78	0	82	160
606800.00	2364700.00	1.00	1.00	79	0	82	161
607000.00	2365600.00	5.25	5.25	80	0	82	162
607200.00	2365800.00	9.08	9.08	104	1	59	163

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TABLE B-1 DETAILED SCORING CALCULATIONS (CONTINUED)

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		
Easting	Northing	Elevation	Height Scale	Rank			Score
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
607500.00	2366300.00	37.00	37.00	81	0	82	163
607200.00	2366100.00	24.99	24.99	82	0	82	164
608100.00	2365500.00	4.00	4.00	105	1	59	164
608300.00	2366000.00	23.00	23.00	84	0	82	166
606600.00	2365100.00	1.95	1.95	85	0	82	167
606600.00	2365200.00	2.00	2.00	86	0	82	168
608100.00	2366200.00	40.94	42.85	113	1	59	172
607700.00	2366200.00	32.89	32.89	91	0	82	173
606600.00	2365000.00	2.00	2.00	92	0	82	174
608400.00	2365800.00	20.40	23.97	94	[illegible]	82	176
607900.00	2366100.00	24.01	24.01	96	0	82	178
607200.00	2365900.00	13.10	13.10	97	0	[illegible]	179
607800.00	2365800.00	18.49	18.49	136	2	[illegible]	179
607400.00	2365700.00	5.01	12.09	[illegible]	1	59	180
607800.00	2366200.00	29.91	33.77	[illegible]	[illegible]	82	180
607200.00	2366200.00	31.95	31.95	[illegible]	[illegible]	82	181
608000.00	2365300.00	1.00	1.00	[illegible]	3	37	182
608400.00	2366000.00	25.50	25.50	100	0	82	182
607100.00	2365700.00	6.51	6.51	101	0	82	183
607100.00	2365800.00	6.00	[illegible]	140	2	43	183
608400.00	2365700.00	11.01	29.[illegible]	102	[illegible]	82	184
606600.00	2364900.00	2.00	2.00	[illegible]	0	82	188
606900.00	2364600.00	1.00	1.00	[illegible]	0	82	190
606700.00	2364700.00	2.00	2.00	110	0	82	192
607300.00	2366300.00	27.[illegible]	39.00	111	0	82	193
608400.00	2365600.00	[illegible]	7.98	112	0	82	194
607600.00	2366300.00	[illegible]	36.56	114	0	82	196
607000.00	2364500.00	1.00	1.00	138	1	59	197
608200.00	2366200.00	[illegible]	[illegible]	115	0	82	197
606900.00	2365600.00	[illegible]	5.00	116	0	82	198
606700.00	2365[illegible]	[illegible]	2.51	117	0	82	199
606800.00	[illegible]	3.07	3.07	118	0	82	200
608300.00	2365500.00	7.12	7.12	119	0	82	201
606600	2365300.00	[illegible]	2.00	120	0	82	202
6083[illegible]	2366200.00	[illegible]	52.92	122	0	82	204
607400.0[illegible]	2366400.00	[illegible]	30.18	123	0	82	205
607700.00	[illegible]6300.00	[illegible]	35.81	124	0	82	206
607900.00	[illegible]	[illegible]	50.05	125	0	82	207
606600.00	2364[illegible]	2.00	2.00	126	0	82	208
607100.00	2366[illegible]	22.42	36.04	127	0	82	209
607500.00	2366400.00	32.00	32.00	128	0	82	210
607000.00	2365700.00	8.00	8.00	129	0	82	211
606800.00	2364600.00	2.00	2.00	130	0	82	212
608000.00	2366200.00	35.51	35.51	131	0	82	213
606800.00	2364500.00	2.43	2.43	171	2	43	214
608100.00	2366300.00	47.44	48.93	155	1	59	214

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TABLE B-1 DETAILED SCORING CALCULATIONS (CONTINUED)

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		
Easting	Northing	Elevation	Height Scale	Rank			Score
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
608400.00	2366100.00	27.88	50.12	132	0	82	214
606500.00	2365000.00	2.00	2.00	133	0	82	215
608400.00	2366200.00	33.49	52.02	134	0	82	216
607800.00	2366300.00	38.25	49.97	135	0	82	217
607100.00	2366000.00	15.75	15.75	137	0	82	219
608200.00	2366300.00	49.48	49.48	139	0	82	221
607100.00	2366200.00	30.05	36.04	141	0	82	223
606500.00	2365200.00	3.00	3.00	142	0	82	224
607900.00	2365600.00	5.02	5.02	166	1	59	225
608500.00	2365900.00	27.99	27.99	143	[illegible]	82	225
606900.00	2364500.00	1.04	1.04	167	1	59	226
607200.00	2366300.00	25.39	36.04	146	0	[illegible]	228
606600.00	2364700.00	2.00	2.00	147	0	82	229
607300.00	2366400.00	31.20	31.20	14[illegible]	0	82	230
608500.00	2366000.00	31.07	31.07	[illegible]	[illegible]	82	231
606500.00	2364900.00	2.00	2.00	[illegible]	[illegible]	82	232
606500.00	2365100.00	2.00	2.00	[illegible]	0	82	233
607100.00	2365900.00	11.01	11.48	152	0	82	234
606500.00	2364800.00	2.00	2.00	176	1	59	235
608500.00	2365700.00	10.94	29[illegible]	153	0	82	235
606700.00	2364600.00	3.00	3.[illegible]	154	[illegible]	82	236
606600.00	2364600.00	3.00	3.00	[illegible]	1	59	237
607600.00	2366400.00	34.94	34.94	[illegible]6	0	82	238
608400.00	2365500.00	6.90	6.90	157	0	82	239
607000.00	2365800.00	7.[illegible]	7.51	158	0	82	240
607900.00	2366300.00	[illegible]41	50.05	159	0	82	241
606900.00	2365700.00	[illegible]7.18	7.18	160	0	82	242
607100.00	2366300.00	23.17	36.04	161	0	82	243
607700.00	2366400.00	38.46	[illegible]	162	0	82	244
608500.00	2365800.00	[illegible]27	29.04	163	0	82	245
606800.00	2365600.00	5[illegible]	5.11	164	0	82	246
607700.00	[illegible]	12.4[illegible]	12.44	187	1	59	246
606700.00	2365500.00	[illegible]4.00	4.00	165	0	82	247
607800[illegible]	2366400.00	[illegible]5.45	49.97	168	0	82	250
6085[illegible]	2365600.00	[illegible]50	28.79	169	0	82	251
607200.0[illegible]	2366400.00	2[illegible]54	27.54	170	0	82	252
607900.00	[illegible]6400.00	[illegible]90	48.90	194	1	59	253
607500.00	2[illegible]00.00	[illegible]0.00	30.00	172	0	82	254
606600.00	2365[illegible]00	3.09	3.09	173	0	82	255
608000.00	2366630[illegible]	36.56	50.82	174	0	82	256
607400.00	2366500.00	34.95	34.95	175	0	82	257
608000.00	2365500.00	2.47	2.47	200	1	59	259
608300.00	2366300.00	49.01	49.01	177	0	82	259
607800.00	2365600.00	8.89	8.89	179	0	82	261
606400.00	2365000.00	2.00	2.00	180	0	82	262
608400.00	2366300.00	39.06	53.06	181	0	82	263

DRAFT

ED_001261_00023090

TABLE B-1 DETAILED SCORING CALCULATIONS (CONTINUED)

Receptor Location		Receptor	Receptor	NDV	Cumulative Number of Days		Score
Easting	Northing	Elevation	Height Scale	Rank			
X (m)	Y (m)	Z_{elev} (m)	Z_{hill} (m)	(A)	Count	Rank (B)	(A+B)
606500.00	2365300.00	2.99	2.99	182	0	82	264
607000.00	2365900.00	7.98	7.98	183	0	82	265
608500.00	2366100.00	36.46	36.46	183	0	82	265
607000.00	2366200.00	15.98	36.04	185	0	82	267
607300.00	2366500.00	35.01	35.01	186	0	82	268
608600.00	2365700.00	6.50	30.90	188	0	82	270
606900.00	2365800.00	10.00	10.00	189	0	82	271
608300.00	2366400.00	52.00	52.00	190	0	82	272
608600.00	2366000.00	32.00	32.00	191	0	82	273
607000.00	2366000.00	13.23	13.23	192	0	82	274
608500.00	2366200.00	38.51	38.51	193	0	82	275
607000.00	2366100.00	15.01	36.04	195	0	82	277
606800.00	2365700.00	8.49	8.49	196	0	82	278
607600.00	2366500.00	32.54	32.54	197	0	82	279
606500.00	2364700.00	2.00	2.00	[illegible]	[illegible]	82	280
606400.00	2364900.00	2.00	2.00	[illegible]	[illegible]	82	281

DRAFT

ED_001261_00023090

********** ATTACHMENT REMOVED **********

This message contained an attachment which the administrator has caused to be removed.

********** ATTACHMENT REMOVED **********

Attachment name: [image001.jpg]
Attachment type: [image/jpeg]

To: lisa.young@doh.hawaii.gov[lisa.young@doh.hawaii.gov]; susan.kihara@doh.hawaii.gov[susan.kihara@doh.hawaii.gov]
Cc: Vallano, Dena[Vallano.Dena@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
From: CHANG, RANDALL
Sent: Tue 8/18/2015 6:44:24 PM
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi Lisa,

I think it will need to be 12 noon, since we have a call that runs until noon.

Randy

Randall Chang

U.S. EPA, Pacific Southwest (Region 9)

Air Quality Analysis Office

75 Hawthorne Street (AIR-7)

San Francisco, CA 94105

phone: 415.947.4180

email: chang.randall@epa.gov

From: Young, Lisa Y L [mailto:lisa.young@doh.hawaii.gov]
Sent: Tuesday, August 18, 2015 11:40 AM
To: CHANG, RANDALL; susan.kihara@doh.hawaii.gov
Cc: Vallano, Dena; YOSHIMURA, GWEN; Bohnenkamp, Carol
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi Randall,

How about 11:30 am (HST) if not then 12 noon?

Thanks,

Lisa

From: CHANG, RANDALL [mailto:Chang.Randall@epa.gov]
Sent: Tuesday, August 18, 2015 4:46 AM
To: Young, Lisa Y L; Kihara, Susan
Cc: Vallano, Dena; YOSHIMURA, GWEN; Bohnenkamp, Carol
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi Lisa and Susan,

Would noon-1 pm (HST) today work for you two?

Randy

Randall Chang

U.S. EPA, Pacific Southwest (Region 9)

Air Quality Analysis Office

75 Hawthorne Street (AIR-7)

San Francisco, CA 94105

phone: 415.947.4180

email: chang.randall@epa.gov

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Cc: Vallano, Dena; YOSHIMURA, GWEN; Bohnenkamp, Carol
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

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Cc: Vallano, Dena; YOSHIMURA, GWEN; 'Bohnenkamp.Carol@epamail.epa.gov' (Bohnenkamp.Carol@epamail.epa.gov)
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Thanks,

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Sent: Tuesday, August 11, 2015 5:11 AM
To: Yee, Henry H. Y.; Young, Lisa Y L
Cc: Vallano, Dena; YOSHIMURA, GWEN
Subject: FW: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today
Importance: High

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- 7/1/2016

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•□□□□□□□□ A. Monitoring → Annual Network Plan is due on this date, and must include these monitors.

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- **1/1/2017**

- **A. Monitors required to be installed and operational by January 1, 2017.**

- 1/13/2017

- B. Modeling is due to EPA*

- C. Documentation demonstrating that the source has permanent and federally enforceable

emissions limits that brings the source below 2,000 tpy due to EPA.

- **12/31/2017**

- **B. EPA promulgates designations for modeled areas**

- **12/31/2020**

- **A. EPA promulgates designations for all remaining areas**

*Note: If an area is designated attainment based on actual emissions (as opposed to allowables), states are required to address the situation (i.e. assess whether the existing modeling is adequate) by July 1st of each year.

These timeframes and the Data Requirements Rule will be further discussed during a webinar on August 19th, 1:00 – 2:30 **ET**. See below for details.

Please feel free to contact Gwen Yoshimura (yoshimura.gwen@epa.gov) if you have further questions. Thanks!

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San Francisco, CA 94105

phone: 415.947.4180

email: chang.randall@epa.gov

From: Drake, Kerry
Sent: Monday, August 10, 2015 1:20 PM
To: darwin.henry@azdeq.gov; massey.eric@azdeq.gov; rcorey@arb.ca.gov; Karperos, Kurt@ARB; Alan Abbs; nolan.hirai@doh.hawaii.gov; demme@ndep.nv.gov; pshoopman@ndep.nv.gov
Cc: YOSHIMURA, GWEN; McKaughan, Colleen; Zimpfer, Amy; Adams, Elizabeth; Busterud, Gretchen; Kelly, Johnj; Kurpius, Meredith; Lakin, Matt; Wallace, Larry
Subject: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

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If you have any questions, please contact me or ask your staff to contact:

Gwen Yoshimura at (415) 947-4134 at yoshimura.gwen@epa.gov or

Larry Wallace at (919) 541-0906 or at wallace.larry@epa.gov.

With regards,

Kerry Drake

Associate Director, Air Division

U.S. EPA, Region 9

(415) 947-4157

Webinar: Overview of the Final SO_2 Data Requirements Rule

Date: August 19, 2015

Time: 1:00-2:30 PM ET (includes time for Q&A)

Intended Audience: State, Local, and Tribal Air Agencies

Webinar Link: To join the webinar, go to
https://epa.connectsolutions.com/so2naaqs/

Description: On August 10, the EPA finalized the Data Requirements Rule (DRR) which directs air agencies to characterize sulfur dioxide (SO_2) air quality in areas across the country with sources of SO_2 emissions greater than 2,000 tons per year. This data requirements rule for the 2010 1-hour SO_2 standard lays out a common sense approach that focuses on characterizing current air quality in areas with the largest sources of SO_2 emissions. This action finalizes a reasonable schedule for air agencies to characterize air quality and provide that air quality data to the EPA. In developing the rule, the EPA carefully considered stakeholder feedback obtained during an extensive outreach process.

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http://admin.adobeconnect.com/common/help/en/support/meeting_test.htm

To: CHANG, RANDALL[Chang.Randall@epa.gov]; susan.kihara@doh.hawaii.gov[susan.kihara@doh.hawaii.gov]
Cc: Vallano, Dena[Vallano.Dena@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
From: Young, Lisa Y L
Sent: Tue 8/18/2015 2:35:53 AM
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi Randy,

I just wanted to let you know that this Friday is a holiday for us, if we can't schedule a call this week I'd like to send the questions to EPA. We need to respond to the questions by next week.

Thanks,

Lisa

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Cc: Vallano, Dena; YOSHIMURA, GWEN; 'Bohnenkamp.Carol@epamail.epa.gov' (Bohnenkamp.Carol@epamail.epa.gov)
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Lisa

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Sent: Tuesday, August 11, 2015 5:11 AM
To: Yee, Henry H. Y.; Young, Lisa Y L
Cc: Vallano, Dena; YOSHIMURA, GWEN
Subject: FW: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today
Importance: High

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Air Quality Analysis Office

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San Francisco, CA 94105

phone: 415.947.4180

email: chang.randall@epa.gov

From: Drake, Kerry
Sent: Monday, August 10, 2015 1:20 PM
To: darwin.henry@azdeq.gov; massey.eric@azdeq.gov; rcorey@arb.ca.gov; Karperos, Kurt@ARB; Alan Abbs; nolan.hirai@doh.hawaii.gov; demme@ndep.nv.gov; pshoopman@ndep.nv.gov
Cc: YOSHIMURA, GWEN; McKaughan, Colleen; Zimpfer, Amy; Adams, Elizabeth; Busterud, Gretchen; Kelly, Johnj; Kurpius, Meredith; Lakin, Matt; Wallace, Larry
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To: lisa.young@doh.hawaii.gov[lisa.young@doh.hawaii.gov]; susan.kihara@doh.hawaii.gov[susan.kihara@doh.hawaii.gov]
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From: CHANG, RANDALL
Sent: Tue 8/18/2015 2:45:47 PM
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

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Webinar Link: To join the webinar, go to
https://epa.connectsolutions.com/so2naaqs/

Description: On August 10, the EPA finalized the Data Requirements Rule (DRR) which directs air agencies to characterize sulfur dioxide (SO_2) air quality in areas across the country with sources of SO_2 emissions greater than 2,000 tons per year. This data requirements rule for the 2010 1-hour SO_2 standard lays out a common sense approach that focuses on characterizing current air quality in areas with the largest sources of SO_2 emissions. This action finalizes a reasonable schedule for air agencies to characterize air quality and provide that air quality data to the EPA. In developing the rule, the EPA carefully considered stakeholder feedback obtained during an extensive outreach process.

Logistics: You will listen to the audio via your computer. We highly recommend running a connect test on your system before logging into the webinar to ensure that the proper add-ins are enabled and the audio is working properly:
http://admin.adobeconnect.com/common/help/en/support/meeting_test.htm

To: CHANG, RANDALL[Chang.Randall@epa.gov]; susan.kihara@doh.hawaii.gov[susan.kihara@doh.hawaii.gov]
Cc: Vallano, Dena[Vallano.Dena@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
From: Young, Lisa Y L
Sent: Tue 8/18/2015 6:39:49 PM
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi Randall,

How about 11:30 am (HST) if not then 12 noon?

Thanks,

Lisa

From: CHANG, RANDALL [mailto:Chang.Randall@epa.gov]
Sent: Tuesday, August 18, 2015 4:46 AM
To: Young, Lisa Y L; Kihara, Susan
Cc: Vallano, Dena; YOSHIMURA, GWEN; Bohnenkamp, Carol
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi Lisa and Susan,

Would noon-1 pm (HST) today work for you two?

Randy

Randall Chang

U.S. EPA, Pacific Southwest (Region 9)

Air Quality Analysis Office

75 Hawthorne Street (AIR-7)

San Francisco, CA 94105

phone: 415.947.4180

email: chang.randall@epa.gov

From: Young, Lisa Y L [mailto:lisa.young@doh.hawaii.gov]
Sent: Monday, August 17, 2015 7:36 PM
To: CHANG, RANDALL; susan.kihara@doh.hawaii.gov
Cc: Vallano, Dena; YOSHIMURA, GWEN; Bohnenkamp, Carol
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi Randy,

I just wanted to let you know that this Friday is a holiday for us, if we can't schedule a call this week I'd like to send the questions to EPA. We need to respond to the questions by next week.

Thanks,

Lisa

From: Young, Lisa Y L
Sent: Friday, August 14, 2015 12:00 PM
To: 'CHANG, RANDALL'; Kihara, Susan
Cc: Vallano, Dena; YOSHIMURA, GWEN; 'Bohnenkamp.Carol@epamail.epa.gov' (Bohnenkamp.Carol@epamail.epa.gov)
Subject: RE: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Hi,

Is it possible to have a conference call Monday, Tuesday or Wednesday (any time after 10 am) of next week regarding the DRR? We have some questions related to the EPA's approval of the monitoring sites that we would like run by you. There are great challenges in trying to set up a monitoring station by the timelines in the DRR.

Thanks,

Lisa

From: CHANG, RANDALL [mailto:Chang.Randall@epa.gov]
Sent: Tuesday, August 11, 2015 5:11 AM
To: Yee, Henry H. Y.; Young, Lisa Y L
Cc: Vallano, Dena; YOSHIMURA, GWEN
Subject: FW: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today
Importance: High

Hi Lisa and Henry

See email below regarding the just-signed SO2 Data Requirements Rule.

Please note the following deadlines included in the Data Requirements Rule, as the first few will come up very quickly (Bold = included in the March 2015 consent decree)**:**

- 1/15/2016

- States submit list of sources subject to the DRR (>2,000 tpy SO2).

- 7/1/2016

- For each applicable source, states let EPA know what path they've chosen and submit the associated documentation:

- A. Monitoring → Annual Network Plan is due on this date, and must include these monitors.

- B. Modeling → Modeling protocol is due on this date.

•□□□□□□□□ C. Commit to having federally permanent and enforceable emissions limits to bring the source below 2,000 tpy by January 13, 2017.

- **1/1/2017**

  - **A. Monitors required to be installed and operational by January 1, 2017.**

- 1/13/2017

  - B. Modeling is due to EPA*

  - C. Documentation demonstrating that the source has permanent and federally enforceable emissions limits that brings the source below 2,000 tpy due to EPA.

- **12/31/2017**

  - **B. EPA promulgates designations for modeled areas**

- **12/31/2020**

  - **A. EPA promulgates designations for all remaining areas**

*Note: If an area is designated attainment based on actual emissions (as opposed to allowables), states are required to address the situation (i.e. assess whether the existing modeling is adequate) by July 1st of each year.

These timeframes and the Data Requirements Rule will be further discussed during a webinar on August 19th, 1:00 – 2:30 **ET**. See below for details.

Please feel free to contact Gwen Yoshimura (yoshimura.gwen@epa.gov) if you have further questions. Thanks!

Randy

Randall Chang

U.S. EPA, Pacific Southwest (Region 9)

Air Quality Analysis Office

75 Hawthorne Street (AIR-7)

San Francisco, CA 94105

phone: 415.947.4180

email: chang.randall@epa.gov

From: Drake, Kerry
Sent: Monday, August 10, 2015 1:20 PM
To: darwin.henry@azdeq.gov; massey.eric@azdeq.gov; rcorey@arb.ca.gov; Karperos, Kurt@ARB; Alan Abbs; nolan.hirai@doh.hawaii.gov; demme@ndep.nv.gov; pshoopman@ndep.nv.gov
Cc: YOSHIMURA, GWEN; McKaughan, Colleen; Zimpfer, Amy; Adams, Elizabeth; Busterud, Gretchen; Kelly, Johnj; Kurpius, Meredith; Lakin, Matt; Wallace, Larry
Subject: Final Data Requirements Rule for the 2010 1-hour SO2 Standard Signed Today

Dear Colleagues,

I wanted to let you know that EPA Administrator Gina McCarthy signed the Data Requirements Rule for the 2010 1-Hour SO2 NAAQS on Monday, August 10, 2015. A fact sheet is attached, and the rule will be posted on the http://www.epa.gov/airquality/sulfurdioxide/implement.html. We anticipate publication of this rule in the *Federal Register* in approximately 2-3 weeks.

A webinar covering the contents of the final Data Requirements Rule is scheduled for Wednesday, August 19. Details for the webinar are located at the end of this email. Materials will not be distributed prior to the webinar. We will post a link to the recording

at http://www.epa.gov/airquality/sulfurdioxide/implement.html as soon as we can after the webinar. Participants will have the opportunity to ask questions during the webinar. Please pass this along to your staff.

If you have any questions, please contact me or ask your staff to contact:

Gwen Yoshimura at (415) 947-4134 at yoshimura.gwen@epa.gov or

Larry Wallace at (919) 541-0906 or at wallace.larry@epa.gov.

With regards,

Kerry Drake

Associate Director, Air Division

U.S. EPA, Region 9

(415) 947-4157

Webinar: Overview of the Final SO_2 Data Requirements Rule

Date: August 19, 2015

Time: 1:00-2:30 PM ET (includes time for Q&A)

Intended Audience: State, Local, and Tribal Air Agencies

Webinar Link: To join the webinar, go to
https://epa.connectsolutions.com/so2naaqs/

Description: On August 10, the EPA finalized the Data Requirements Rule (DRR) which directs air agencies to characterize sulfur dioxide (SO_2) air quality in areas across the country with sources of SO_2 emissions greater than 2,000 tons per year. This data requirements rule for the 2010 1-hour SO_2 standard lays out a common sense approach that focuses on characterizing current air quality in areas with the largest sources of SO_2 emissions. This action finalizes a reasonable schedule for air agencies to characterize air quality and provide that air quality data to the EPA. In developing the rule, the EPA

carefully considered stakeholder feedback obtained during an extensive outreach process.

Logistics: You will listen to the audio via your computer. We highly recommend running a connect test on your system before logging into the webinar to ensure that the proper add-ins are enabled and the audio is working properly: http://admin.adobeconnect.com/common/help/en/support/meeting_test.htm

From: YOSHIMURA, GWEN
Location: R9SF-Room-18323-6-Twenty-Nine Palms; R9SF-ConferenceLine-AIR-Card1
Importance: Normal
Subject: Guam SO2 regroup - please call 866-299-3188, code: Ex. 6 - Personal Privacy
Start Date/Time: Tue 1/24/2017 10:00:00 PM
End Date/Time: Tue 1/24/2017 11:00:00 PM

Hello,

We are aiming to have this call next week, when Michael Mann is still in Guam. Please let me know if this time works for you.

Thanks,

Gwen

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Thursday, January 12, 2017 9:14 PM
To: Lee, Anita <Lee.Anita@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>
Cc: Conchita Taitano <conchita.taitano@epa.guam.gov>; Yvette Cruz <yvette.cruz@epa.guam.gov>; Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>
Subject: SO2 Modeling Report

Gwen,

Attached you will find the SO2 Modeling Report required by the DRR for the One -Hour SO2 NAAQS. The hard copy is in the mail. Please review and advise when we can have a conference call to discuss the results, ramifications and the way forward to attainment for the Cabra/Piti Power Plants.

Sincerely,

Roland T. Gutierrez Jr., MPA

EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov

Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

From: Viswanathan, Krishna
Location: R9SF-Room-18220-6-Reno-Sparks <R9SF-Room-18220-6-Reno-Sparks@epa.gov>; R9SF-ConferenceLine-AIR-Card2 <R9SF-ConferenceLine-AIR-Card2@epa.gov>
Importance: Normal
Subject: Discussion of Modeling Protocol for Tanguisson - SO2 DRR
Start Date/Time: Mon 9/26/2016 10:00:00 PM
End Date/Time: Mon 9/26/2016 11:00:00 PM
Excerpt (Background Air Quality Concentrations for Guam).pdf

Call In Number: 1-866-299-3188

Code: **Ex. 6 - Personal Privacy**

Agenda

Introductions

Review of Protocol Issues and EPA Review

Methods to address EPA comments on issue #2

Next Steps

Email Excerpt:**********

Please advise if the response to these comments are sufficient.

1. Section 5: Please clarify how Guam EPA/EPA will be notified of re-located receptors, and whether an explanation of the reasons for relocation (characteristics of the locations, etc) will be included.

In response to item #1: We are not proposing to relocate receptors that, according to the EPA guidance, would not be practical locations for monitor placement. Those receptors will continue to be evaluated for potential site access, and if it is determined that safe and practical access to those locations cannot be achieved, we will add receptors to the nearest points where access is possible. all receptors in the modeling analyses that are judged to be non-representative for potential monitor locations will be clearly identified by UTM coordinates and on topographical maps, showing the original and relocated receptor position. The criteria relied upon to relocate each receptor will be documented in a memorandum and submitted to GEPA and USEPA for

review and concurrence before the final modeling analyses and design concentration is determined.

2. Section 7: We have reviewed Section 7: Background Concentrations and Appendix D. and we continue to have concerns about the supporting information that was provided in the protocol.

- Shipping emissions: As discussed in the protocol, the allowable sulfur content in fuel may not be reduced if fuels are not reasonable available. Therefore, the background concentration should account for the effect of shipping emissions.

- Ambient air monitoring: Although there may be are a number of hours with values of zero, the data in Appendix D. shows that there are high short term (3 hour) values that were measured at some of the monitoring site. Since the standard looks at 1-hour concentrations, specifically the 99th percentile of 1-hour daily maximum concentrations averaged over 3 years, the analysis should discuss the appropriate background for 1 hour maximum concentrations (99th percentile per year).

In Response to item #2: Please see attached excerpt from a draft report on "Assessment of background air quality concentration on Guam". Section 2.0 elaborates in more detail sulfur dioxide Background Concentrations.

1.0 INTRODUCTION

The air quality concentrations on Guam are dominated by emissions from on-island permitted sources as contributions from off-island sources are small. Guam is located at about 13 degrees north latitude in the western North Pacific tropical trade wind belt with prevailing northeast to east-southeast winds (see Figure 1). Winds from other directions occur infrequently and for short durations, generally during passing storms, and thus there is little if any influence from Asiatic emission sources (e.g. China, Japan, Philippines) on background concentrations. Upwind (eastward) from Guam the Pacific is sparsely populated for over 1,000 miles and thus background concentrations attributable to off-island sources are expected to be low.

There is little air quality monitoring data available on Guam or in the western Pacific within the trade wind belt. Nonetheless, some historical monitoring data on Guam are available and are included in this analysis. In addition, satellite remote sensing data are available for the region as well as ship-borne and aircraft observations of pollutant concentrations as reported in the technical literature. This report reviews the available information for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter less than or equal to 10 microns in diameter (PM_{10}) and particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$) and provides recommendations for background concentrations.

2.0 SULFUR DIOXIDE

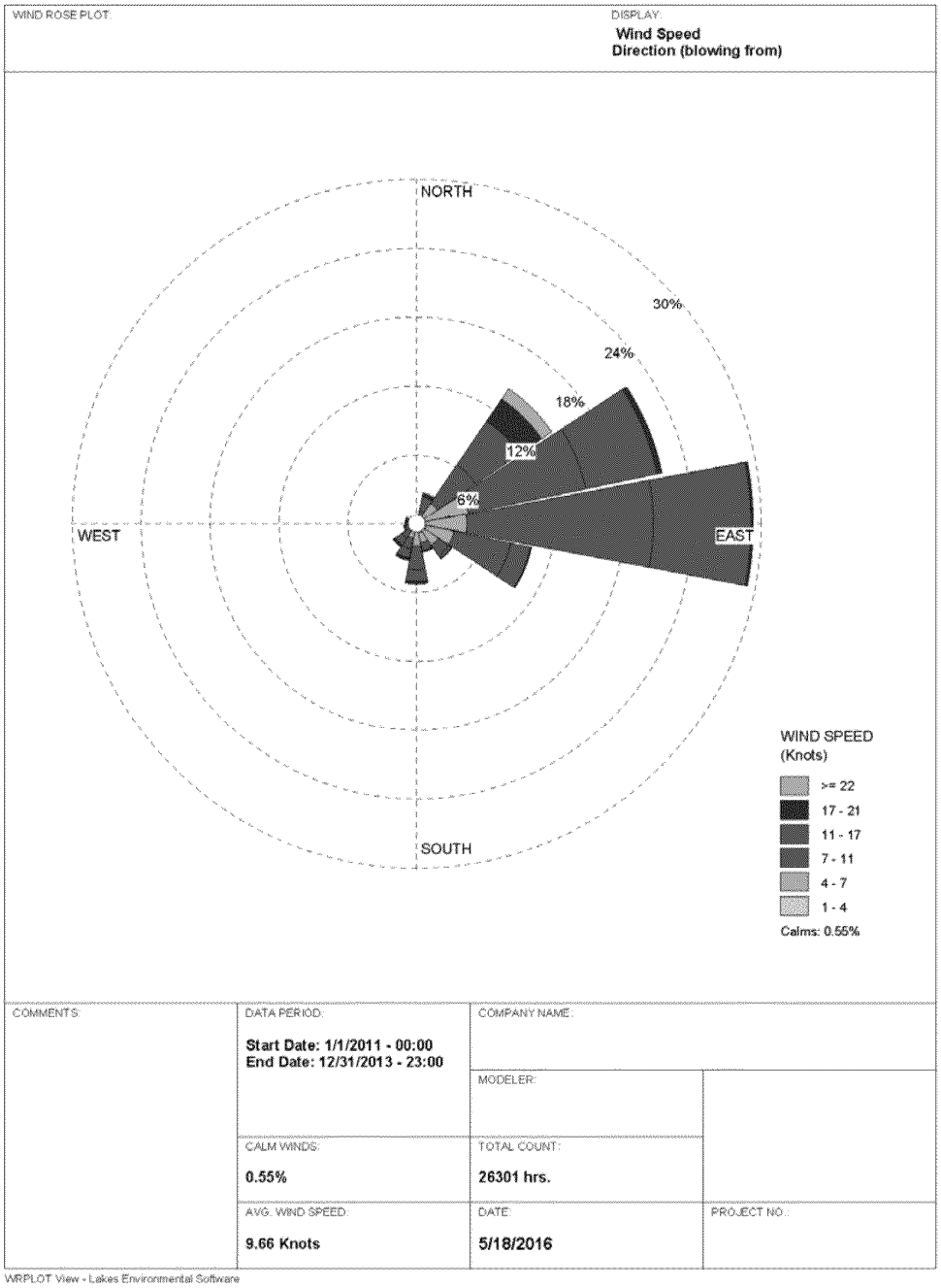
2.1 Ocean Measurements

As noted above and shown in Figure 1, Guam lies in the easterly trade wind zone and there are no major stationary upwind SO_2 sources for hundreds of miles. Due to its isolated location, the background SO_2 concentrations are likely to be near the global SO_2 background concentration. The most significant source of SO_2 from the oceans is the oxidation of dimethylsulfide[1]. EPA has found that the Pacific Ocean SO_2 background concentrations may be on the order of 0.025 ppb, or 0.065 $\mu g/m^3$ [2], an insignificant contribution. Further, ships' emissions are subject to the International Maritime Organization's (IMO) Prevention of Pollution from ships (*MARPOL*) Annex VI, which reduces allowable sulfur in fuel content from 4.5% to 0.5% (if such fuels become reasonably available) in 2020. The EPA and Coast Guard have adopted MARPOL requirements

[1] Barnes, I (editor), Global Atmospheric Change and its Impact on Regional Air Quality, NATO Science Series, Kluwer Academic Publishers, 2002.
[2] EPA, Integrated Science Assessment for Sulfur Oxides-Health Criteria, EPA/600/R-08/047F, 2008.

ED_001261_00023174

Figure 1 Windrose for 2011-2013 60 Meter Wind as Measured at the Piti/Cabras Meteorological Tower with GUM Airport Data Substituted for Missing Hours



in their regulations. Thus maritime sulfur dioxide emissions will be reduced prior to the adoption of an SO_2 SIP, further reducing current potential background concentration.

The Guam and CNMI Military Relocation (2012 Roadmap Adjustments) Supplemental Environmental Impact Statement (http://www.guambuildupeis.us/documents, see Appendix I Air Impact Study) prepared for the U.S. Department of the Navy assumed that the background concentration was zero for all pollutants for their air quality modeling.

2.2 Guam Measurements

Also, the most recent air quality monitoring on the island conducted in 1999-2000 by GPA (Otte Consulting, Ambient Air Quality Monitoring Network Annual Data Report for October 1999-September 2000) confirms the low concentration background with the monitors reporting "0" SO_2 concentrations for the vast majority of the hours (see Appendix A, reproduced from best copy available). A reported value of "0"indicates that the concentration is below the minimum detection limit for the Model 100A Advanced Pollution Instrumentation SO_2 monitors of 0.4 ppb (1.04 $\mu g/m^3$) (http://www.teledyne-api.com/manuals/02164h_100a.pdf).

2.3 Satellite Measurements

The earth observing system (EOS) Aura spacecraft has a downward pointing hyper-spectral imaging sensor (Ozone Monitoring Sensor, OMI) that records daily global measurements of earth-atmosphere back scattered radiances. These measurements are analyzed by the National Aeronautics and Space Administration (NASA) to retrieve column amount of SO_2 among other pollutants. The SO_2 data is accessible from NASA servers[3] with measurements available on a 0.1 x 0.1 degree grid and represent a near-instantaneous "snap-shot" of the tropospheric column. This data was downloaded and plotted in NASA's geospatial analysis tool, Panoply, to extract satellite measurements of column amount SO_2 over Guam. Four scans from each of the latest available four years, 2012 through 2015, selected from a month in each calendar quarter (March, June, September, and December), were sampled and evaluated (16 scans total). Since the values represent a density of SO_2 molecules over the visible 0.1x0.1 degree area, to determine a volume concentration (e.g., µg/m3) from the measured value requires assuming a well-mixed troposphere (a feasible assumption in the low latitude tropics), and a troposphere height. In the tropics, the

[3] http://avdc.gsfc.nasa.gov/pub/data/satellite/Aura/OMI/V03/L3/OMSO2m/OMSO2_0.1x0.1_daily/

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tropopause is lifted higher than in mid and upper latitudes due to heating and convergence typified in the Intertropical Convergence Zone (ITCZ). A reasonable height for the tropical tropopause was chosen to be 15 km[4]. Converting the column density to a volume concentration led to a range of 0.0 to 4.58 $\mu g/m^3$ of SO_2 at Guam with an overall average value of 1.49 $\mu g/m^3$ (see Table 1), in reasonable agreement with the concentrations noted above. Given the assumptions needed to convert tropospheric satellite observations to ground-level concentrations, satellite concentration estimates are less reliable than the direct observations reported for the other measurement approaches, but do provide supporting evidence of generally low SO_2 concentrations.

2.4 Aircraft Measurements

The NASA Transport and Chemical Evolution over the Pacific (TRACE-P) project comprised the third of three planned Pacific exploratory missions in the central and western regions of the Pacific Ocean basin. TRACE-P was conducted in March/April 2001 as part of NASA's Tropospheric Chemistry Program and had as one of its major objectives to determine the chemical composition of the Asian outflow over the western Pacific. The data is in the form of measurements taken from an aircraft: the P-3B mission landed and took off from Guam (Anderson Airforce Base) during its flight. The P-3B data had measurements of SO_2 included in its suite of observations. The data was accessed from NASA's servers[5] and plotted in GIS software (see Figure 2) to extract measured concentrations over Guam and at points nearby. It was found that within a 1,000 km radius of Guam, the maximum measured SO_2 concentration was 173.549 pptv (parts per trillion by volume). This equates to 0.5 $\mu g/m^3$ of SO_2.

2.5 Selected Background Concentration

Given the isolation of Guam from upwind anthropogenic SO_2 sources, the very low oceanic background contribution, and the variety of sources described above with a concurring range of values, it is proposed that modeling the nearby sources and adding a background of 1.0 $\mu g/m^3$ SO_2 for all averaging periods based on the results of the Guam air quality measurement program will yield representative predictions of SO_2 design values.

---

[4] An Introduction to Dynamic Meteorology, Holton, p402.

[5] http://www-gte.larc.nasa.gov/GTE2/missions/Aircraft_Based_Missions/Aircraft_Based_Missions.htm

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Table 1 Tropospheric SO_2 Concentration for Guam Based on Satellite Data

Aura/OMI PBL SO_2 Tropospheric Vertical Column Density Measurements

Year / Month	Measured Value, DU (1 DU = 2.69E16 molecules/cm^2)				SO_2 concentration (well mixed assumption) ($\mu g/m^3$)			
	March	June	September	December	March	June	September	December
2012	0	0.5	0.5	2.4	0.00	0.95	0.95	4.58
2013	0.1	0.2	1.5	1	0.19	0.38	2.86	1.91
2014	0.3	1.9	1.2	0.9	0.57	3.62	2.29	1.72
2015	0.7	0.5	0.4	0.4	1.34	0.95	0.76	0.76

MAX	4.58
MIN	0.00
AVG	1.49

Well-mixed Tropopause Assumption

Height of Tropopause at 13.5° N lat. 15 km

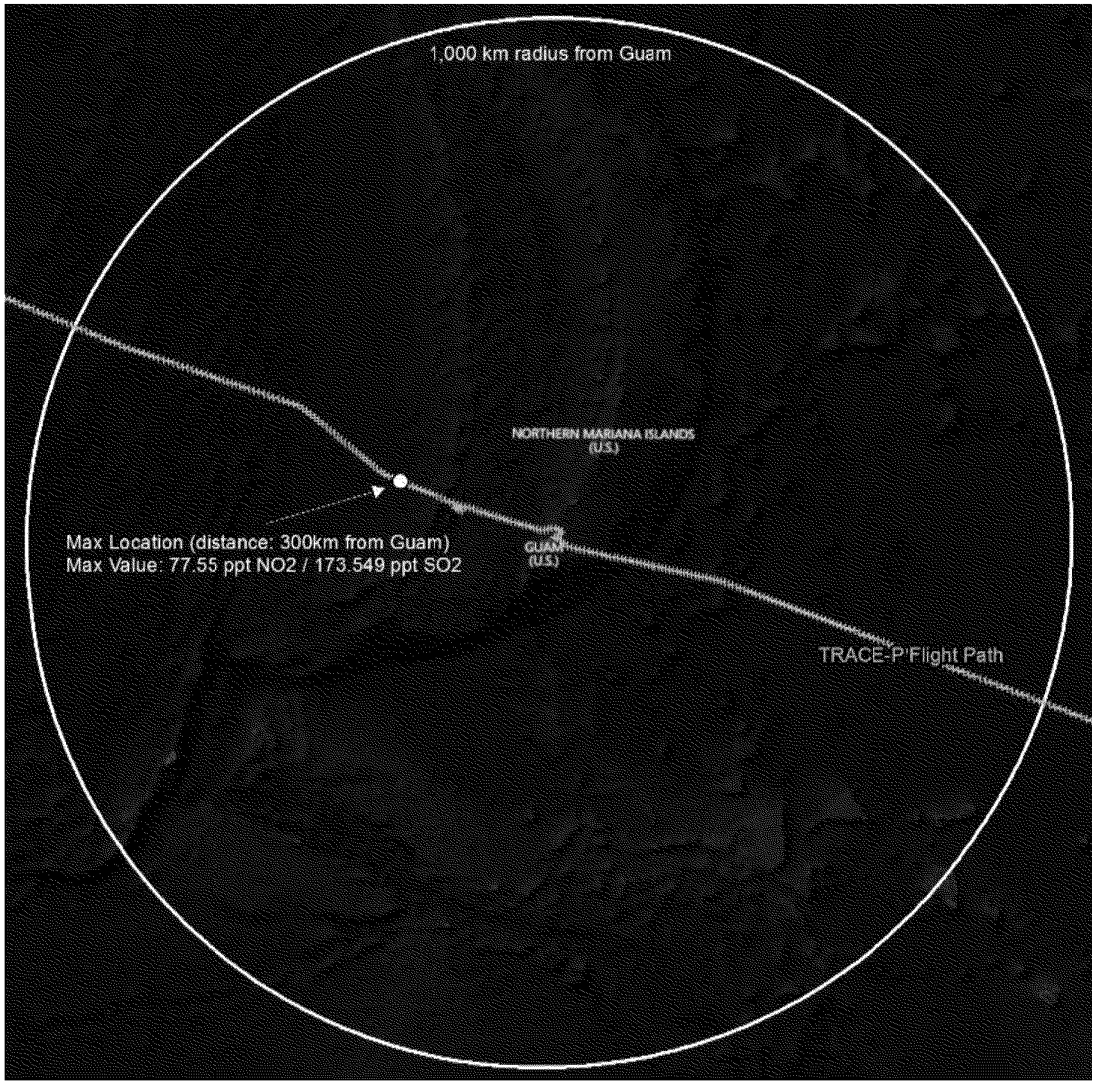
Development of a conversion factor from DU to $\mu g/m^3$ SO_2

$$\frac{2.69E+16 \text{ molecules}}{cm^2} \times \frac{\text{height of column}}{cm} \times \frac{64.0638 \text{ g}}{\text{molecules } SO_2} \times \frac{1E+06 \ \mu g}{g} \times \frac{1E+06 \ cm^3}{m^3} = \frac{1.91 \ \mu g}{m^3}$$

$1.50E+06$ $6.02E+23$

1 DU SO_2 =	1.9	$\mu g/m^3$ SO_2

Figure 2 Aircraft flight path for NASA TRACE-P Experiment within 1,000 kilometers of Guam



ED_001261_00023174

From: Drake, Kerry
Location: 866-299-3188, access code: Ex. 6 - Personal Privacy
Importance: Normal
Subject: Discuss Guam SO2 Modeling Protocol
Start Date/Time: Mon 5/9/2016 11:00:00 PM
End Date/Time: Tue 5/10/2016 12:00:00 AM

Please see the call-in number. Thank you!

To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]
Cc: Lee, Anita[Lee.Anita@epa.gov]
Sent: Mon 3/27/2017 10:33:51 PM
Subject: RE: New Methodology

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, March 26, 2017 6:22 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>
Cc: Lee, Anita <Lee.Anita@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Subject: Re: New Methodology

Hi Gwen,

Just following up on the responses we sent. We wanted to see if we have approval to begin the updated modeling with the revised modeling methodology. Please advise soonest.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
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On Tue, Mar 21, 2017 at 12:30 AM, YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov> wrote:

Thank you Roland. We'll take a look and get back to you.

-Gwen

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, March 19, 2017 5:02 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Subject: New Methodology

Gwen/Anita

Here is the response. Sorry it took a while.

- On page 3. Please clarify what [0.0015 (Sulfur % wt)] / [1000 gallons] means in the equation:

We had erroneously used AP42 Table 1.3-1 which is for External Combustion Sources. The correct AP42 Factor to use is Table 3.1-2a Stationary Gas Turbines

The Correct formula is

SO2 Emissions (lbs/hr) = [Fuel Use (1000 gallons/hour)] * [139 MMBtu/gallons]*[1.01 * 0.0015 lb/MMBtu]

= [Fuel Use (1000 gallons/hour)] * [0.211 (lb/1000 gallon)]

- Page 5, Item 3.C "date received".

This is now item 4.C. A step was added that improves data accuracy

Here is the situation for Cabras. Fuel is transferred from the ship to the bulk storage tank (1934 & 1935). After transfer, a sample is taken from the bulk storage tank for analysis. This analysis now gives us the current sulfur concentration of the fuel. We normally have daily deliveries of fuel from the Bulk Storage to the Day Tanks at the power plant. So whatever is in the Bulk Storage Tanks will start to fill into the Day Tanks at the plant and completely replace the old fuel within 3 - 4 days.

We may also have to consider that it may take a while for the fuel in the Bulk Storage to be fully mixed. Using the sulfur analysis for the following month. So we may want to delay using the new sulfur analysis by one month.

Attached is the revised Procedures.

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
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To: Katherine Hoag[khoag@baaqmd.gov]
Sent: Wed 3/22/2017 4:03:47 PM
Subject: RE: Additional information supporting SO2 DRR approach

From: Katherine Hoag [mailto:khoag@baaqmd.gov]
Sent: Wednesday, October 05, 2016 1:18 PM
To: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Cc: Mebust, Anna <Mebust.Anna@epa.gov>; gsweiger@arb.ca.gov; estevenson@baaqmd.gov; Lee, Anita <Lee.Anita@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>
Subject: RE: Additional information supporting SO2 DRR approach

Hi Carol –

Attached is the modeling protocol and source parameter data you asked for when we talked last Wednesday. Let me know if anything else is needed to support the summary document sent on 10/29.

Thanks again!

Kate

Katherine Hoag, Ph.D.

QA Officer / Principal Air Quality Engineer

Bay Area Air Quality Management District

375 Beale Street, Suite 600 | San Francisco, CA 94105

(415) 749-4619

khoag@baaqmd.gov

From: Katherine Hoag
Sent: Tuesday, October 4, 2016 1:55 PM
To: Eric Stevenson <EStevenson@baaqmd.gov>; 'YOSHIMURA, GWEN' <Yoshimura.Gwen@epa.gov>; 'Lee, Anita' <Lee.Anita@epa.gov>
Cc: 'Bohnenkamp, Carol' <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; 'gsweiger@arb.ca.gov' <gsweiger@arb.ca.gov>
Subject: RE: Additional information supporting SO2 DRR approach

Also – more out of curiosity…does it matter too much if it is PTE or actuals if we are looking at normalized results of the model? It seemed to me that the normalized distribution of Cmax would probably look pretty similar – if not the same. I can see that it would matter if the modeling results were used to predict that the actual ambient concentrations were going to be below a certain level, but maybe I'm missing something??

Katherine Hoag, Ph.D.

QA Officer / Principal Air Quality Engineer

Bay Area Air Quality Management District

375 Beale Street, Suite 600 | San Francisco, CA 94105

(415) 749-4619

khoag@baaqmd.gov

From: Katherine Hoag
Sent: Tuesday, October 4, 2016 1:52 PM
To: Eric Stevenson <EStevenson@baaqmd.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; gsweiger@arb.ca.gov
Subject: RE: Additional information supporting SO2 DRR approach

Hi guys –

I got the modeling protocol from our engineering staff and am going through it today before forwarding to you – I should get that to you by tomorrow at the latest. But I did want to catch this one thing first – the SO_2 emission values are 1-hour max PTE values for 30 emission sources, determined in 2010. The info I will send has this description as well as an excel file that has the actual numbers.

Kate

Katherine Hoag, Ph.D.

QA Officer / Principal Air Quality Engineer

Bay Area Air Quality Management District

375 Beale Street, Suite 600 | San Francisco, CA 94105

(415) 749-4619

khoag@baaqmd.gov

From: Eric Stevenson
Sent: Tuesday, October 4, 2016 12:07 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Katherine Hoag <khoag@baaqmd.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; gsweiger@arb.ca.gov
Subject: RE: Additional information supporting SO2 DRR approach

Gwen –

They are based on submitted rates on which fees are based (actual use).

Eric

From: YOSHIMURA, GWEN [mailto:Yoshimura.Gwen@epa.gov]
Sent: Tuesday, October 4, 2016 11:01 AM
To: Katherine Hoag <khoag@baaqmd.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; Eric Stevenson <EStevenson@baaqmd.gov>; gsweiger@arb.ca.gov
Subject: RE: Additional information supporting SO2 DRR approach

Thanks Kate!

Carol is out till the 12th, but I wanted to ask: the document says "SO2 emission rates used in the model were considered to be maximum values." Do you know where the emission rates came from? i.e. are they based on actuals from particular year(s), are they based on permitted PTE, etc? There's been a lot of focus on what emissions folks use, so that'll be good for us to know.

Thanks!

-Gwen

Gwen M. Yoshimura
Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency

Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Katherine Hoag [mailto:khoag@baaqmd.gov]
Sent: Thursday, September 29, 2016 4:30 PM
To: Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Mebust, Anna <Mebust.Anna@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; estevenson@baaqmd.gov; gsweiger@arb.ca.gov
Subject: Additional information supporting SO2 DRR approach

Hi Anita -

The attached cover letter and supplemental information supporting our decision that the Air District will be complying with the monitoring approach of the SO_2 DRR using existing SO_2 monitoring at Martinez. The hard copy of these documents have been mailed. This document is also on our website for public comment until October 31 (http://www.baaqmd.gov/research-and-data/air-quality-measurement/ambient-air-monitoring-network).

Let me know if you have any questions!

Kate

Katherine Hoag, Ph.D.

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To: Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
Cc: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]; Lee, Anita[Lee.Anita@epa.gov]
From: Roland Gutierrez
Sent: Wed 4/26/2017 12:24:22 AM
Subject: Re: New Methodology
Modeling report revision DRAFT 04 24 2017.pdf

All,
Attached is the revised modeling report for the DRR. Please review and provide comments.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531
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On Thu, Apr 6, 2017 at 12:42 AM, Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov> wrote:

Roland,

Thank you for your timely responses. Based on the clarifications you provided, we believe the revised procedures "Proposed Hourly Varying Emissions for Guam Power Authority Data Requirements Rule SO_2 NAAQS Designation Modeling; Revised March 3, 2017," which you provided to use on March 19, 2017, are appropriate and represent your determination for the most appropriate method for estimating sulfur content of fuel burned. Our understanding is that you will be using this version as the final protocol, but please send us the final version if anything further has changed.

Carol Bohnenkamp

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Thursday, March 30, 2017 6:12 PM
To: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Cc: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>; Lee, Anita <Lee.Anita@epa.gov>
Subject: Re: New Methodology

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Here is the response in blue:

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GPA: Annual average based on monthly analysis. See attached sulfur content summary.

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
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Ph. 1-671-300-4751/2/3
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On Tue, Mar 28, 2017 at 8:32 AM, Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov> wrote:

Roland,

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Carol Bohnenkamp

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, March 26, 2017 6:22 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>
Cc: Lee, Anita <Lee.Anita@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Subject: Re: New Methodology

Hi Gwen,

Just following up on the responses we sent. We wanted to see if we have approval to begin the updated modeling with the revised modeling methodology. Please advise soonest.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
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On Tue, Mar 21, 2017 at 12:30 AM, YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov> wrote:

> Thank you Roland. We'll take a look and get back to you.
>
> -Gwen

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, March 19, 2017 5:02 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Subject: New Methodology

Gwen/Anita

Here is the response. Sorry it took a while.

- On page 3. Please clarify what [0.0015 (Sulfur % wt)] / [1000 gallons] means in the equation:

We had erroneously used AP42 Table 1.3-1 which is for External Combustion Sources. The correct AP42 Factor to use is Table 3.1-2a Stationary Gas Turbines

The Correct formula is

SO2 Emissions (lbs/hr) = [Fuel Use (1000 gallons/hour)] * [139 MMBtu/gallons]*[1.01 * 0.0015 lb/MMBtu]

= [Fuel Use (1000 gallons/hour)] * [0.211 (lb/1000 gallon)]

- Page 5, Item 3.C “date received”.

This is now item 4.C. A step was added that improves data accuracy

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We may also have to consider that it may take a while for the fuel in the Bulk Storage to be fully mixed. Using the sulfur analysis for the following month. So we may want to delay using the new sulfur analysis by one month.

Attached is the revised Procedures.

Roland T. Gutierrez Jr., MPA
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To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
Cc: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]
From: Lee, Anita
Sent: Fri 3/31/2017 7:15:40 PM
Subject: RE: New Methodology

Thank you very much Roland!

Carol is out of the office today, but hopefully we can get back to you sometime early next week.

Anita

Anita Lee, PhD

Environmental Scientist

US EPA | Region 9 | Air Planning Office | 75 Hawthorne Street (Air-2) | San Francisco, CA 94105

(415) 972-3958

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Thursday, March 30, 2017 6:12 PM
To: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Cc: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>; Lee, Anita <Lee.Anita@epa.gov>
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EHS Supervisor, Air Pollution Control Program - Guam EPA
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Sent: Sunday, March 26, 2017 6:22 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>
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Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
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From: Roland Gutierrez
Sent: Fri 3/31/2017 1:12:20 AM
Subject: Re: New Methodology
Monthly Sulfur 2011-2013.xlsx

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a. How much does the sulfur content of HSFO vary? Do you have a known range for the HSFO? If the sulfur content doesn't vary much, then we would recommend just using the highest value of the range. Otherwise, we would recommend figuring out some method for determining the average sulfur content. (See 2.b. below for a clarifying question, and one method that might provide a representative estimate of the sulfur content of the bulk storage

tanks.)

b. We understand that you are trying to determine the sulfur content of the fuel when it is burned, based on records of the sulfur content of the fuel when it is added to the bulk storage tanks.

i. We are curious how often the Residual Fuel Oil Receiving Reports are received?

ii. Would an average of sulfur content over the 30 day time period (or another time period, maybe based on the residence time of fuel in the tank?) more accurately reflect the sulfur content of the fuel being burned, if you are assuming that fuel oil in the tank gets well-mixed?

Carol Bohnenkamp

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, March 26, 2017 6:22 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>
Cc: Lee, Anita <Lee.Anita@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Subject: Re: New Methodology

Hi Gwen,

Just following up on the responses we sent. We wanted to see if we have approval to begin the updated modeling with the revised modeling methodology. Please advise soonest.

Thank you,

Roland T. Gutierrez Jr., MPA

EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

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On Tue, Mar 21, 2017 at 12:30 AM, YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov> wrote:

Thank you Roland. We'll take a look and get back to you.

-Gwen

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, March 19, 2017 5:02 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>

Subject: New Methodology

Gwen/Anita

Here is the response. Sorry it took a while.

- On page 3. Please clarify what [0.0015 (Sulfur % wt)] / [1000 gallons] means in the equation:

We had erroneously used AP42 Table 1.3-1 which is for External Combustion Sources. The correct AP42 Factor to use is Table 3.1-2a Stationary Gas Turbines

The Correct formula is

SO2 Emissions (lbs/hr) = [Fuel Use (1000 gallons/hour)] * [139 MMBtu/gallons]*[1.01 * 0.0015 lb/MMBtu]

= [Fuel Use (1000 gallons/hour)] * [0.211 (lb/1000 gallon)]

- Page 5, Item 3.C "date received".

This is now item 4.C. A step was added that improves data accuracy

Here is the situation for Cabras. Fuel is transferred from the ship to the bulk storage tank (1934 & 1935). After transfer, a sample is taken from the bulk storage tank for analysis. This analysis now gives us the current sulfur concentration of the fuel. We normally have daily deliveries of fuel from the Bulk Storage to the Day Tanks at the power plant. So whatever is in the Bulk Storage Tanks will start to fill into the Day Tanks at the plant and completely replace the old fuel within 3 - 4 days.

We may also have to consider that it may take a while for the fuel in the Bulk Storage to be fully mixed. Using the sulfur analysis for the following month. So we may want to delay using the new sulfur analysis by one month.

Attached is the revised Procedures.

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA

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To: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]
Cc: Lee, Anita[Lee.Anita@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
From: Roland Gutierrez
Sent: Mon 3/27/2017 1:21:30 AM
Subject: Re: New Methodology

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Roland T. Gutierrez Jr., MPA
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Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

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Attached is the revised Procedures.

Roland T. Gutierrez Jr., MPA
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To: Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
From: Katherine Hoag
Sent: Wed 3/22/2017 11:06:41 PM
Subject: RE: SO2 Modeling Documentation

Hi Carol,

Thanks for sending this list – it's very helpful! I'll check in with Eric, Jean and our modelers and we will get back to you early next week or sooner with our expected timeframe of getting you this information.

Thanks again for your continued assistance and patience!

Kate

Katherine Hoag, Ph.D.

QA Officer / Principal Air Quality Engineer

Bay Area Air Quality Management District

375 Beale Street, Suite 600 | San Francisco, CA 94105

(415) 749-4619

khoag@baaqmd.gov

From: Bohnenkamp, Carol [mailto:Bohnenkamp.Carol@epa.gov]
Sent: Wednesday, March 22, 2017 12:57 PM
To: Katherine Hoag <khoag@baaqmd.gov>
Subject: SO2 Modeling Documentation

Kate,

It was good to talk to you this morning. Here is a list of the modeling documentation that we discussed. I think these issues should be fairly straightforward to address, but call me if you have any questions.

Modeling Documentation

- ○ Upper air station (and justification).
- ○ Surface roughness, albedo, and Bowen ratio calculation methodology.
- ○ AERMET processing methodology (list reference document).
- ○ Downwash calculation methodology (BPIP).
- ○ How the determination of urban versus rural was made.
- ○ UTM of one of the corners of the 16 km x 16 km modeled area (We have the center UTM and dimensions, but need a corner to determine the orientation).
- ○ Verify the version of AERMOD used
- ○ Provide a wind rose for the primary meteorological station.

There may be one or two additional items that we may request, but we are still discussing. We hope to have those thoughts ready to convey to you in a week or two. If you need to wait until then before you check in with your modelers about the above list, please let us know.

Carol Bohnenkamp

Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4130

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]; Lee, Anita[Lee.Anita@epa.gov]
Cc: Walter Leon Guerrero[walter.leonguerrero@epa.guam.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Kurpius, Meredith[Kurpius.Meredith@epa.gov]; Mann, Michael[Mann.Michael@epa.gov]
From: YOSHIMURA, GWEN
Sent: Thur 2/23/2017 7:07:58 PM
Subject: RE: DRR SO2 Modeling Report

Hi Roland,

We've reviewed the February 14, 2017 proposed methodology for estimating hourly varying emissions. The proposed methodology looks acceptable. However, there are two items that we would like Guam EPA to clarify.

1. On page 3. Please clarify what [0.0015 (Sulfur % wt)] / [1000 gallons] means in the equation:

   SO_2 Emissions (lbs/hr) = [Fuel Use (gallons/hour)] * [142 (lb/1000 gallon)]* [0.0015 (Sulfur % wt)] / [1000 gallons]

2. On page 5. 3. C. It states that it is assumed that the "date received" is also the start date for that oil being burned in the turbines. The appropriateness of this assumption depends on how much oil is maintained on site. Please clarify how the sulfur content of each "batch" is matched up with the delivery records. (e.g., is there a way It would be best if they have some way of knowing which type of fuel they were burning in closer to real time.

If you could get back to us on these two points, that'd be great.

Thanks Roland! As always, let us know if you have any questions.

-Gwen

Gwen M. Yoshimura
Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Tuesday, February 14, 2017 8:33 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>; Conchita Taitano

<conchita.taitano@epa.guam.gov>
Subject: Re: DRR SO2 Modeling Report

Gwen,

We are intending to remodel using the estimated hourly varying emissions as was suggested in our previous conference call. Before doing that and expending time and resources, we wanted to get approval on the methodology we intend to use. Attached you will find the proposed methodology. Is this acceptable. Please advise your comments as we want to start or amend asap.

Thank you,

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On Fri, Jan 13, 2017 at 3:20 PM, Roland Gutierrez <roland.gutierrez@epa.guam.gov> wrote:
Gwen,

Attached you will find the SO2 Modeling Report required by the DRR for the One -Hour SO2 NAAQS. The hard copy is in the mail. Please review and advise when we can have a conference call to discuss the results, ramifications and the way forward to attainment for the Cabra/Piti Power Plants.

Sincerely,
Roland T. Gutierrez Jr., MPA
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To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]; Lee, Anita[Lee.Anita@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
Cc: Walter Leon Guerrero[walter.leonguerrero@epa.guam.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]
From: YOSHIMURA, GWEN
Sent: Wed 2/15/2017 3:19:14 PM
Subject: RE: DRR SO2 Modeling Report

Hi Roland,

Thanks, we will get back to you and let you know when we'll get you comments.

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
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75 Hawthorne Street
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From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Tuesday, February 14, 2017 8:33 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>
Subject: Re: DRR SO2 Modeling Report

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To: Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
Cc: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]
From: Lee, Anita
Sent: Wed 2/15/2017 2:45:46 PM
Subject: FW: DRR SO2 Modeling Report
Hourly Varying Emissions for Guam Power Authority Sources 021417.docx
Fwd: 30 Stay on Final Regulations

Hi Carol – FYI! Also attaching another email from Roland asking about the 30 day stay of effectiveness of the Appendix W revisions and whether that affects their remodeling . . .

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Tuesday, February 14, 2017 8:33 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>
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To: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Lee, Anita[Lee.Anita@epa.gov]; Flagg, MichaelA[Flagg.MichaelA@epa.gov]; Nguyen, Thien Khoi[nguyen.thien@epa.gov]
From: Roland Gutierrez
Sent: Wed 2/15/2017 4:35:06 AM
Subject: Fwd: 30 Stay on Final Regulations
Delay of effective dates 2017-01822.pdf

Gwen,

Can you provide any insight on the following: In today's Federal Register (see attachment) the new administration has published a final rule that will stay 30 recently published final regulations, including the final revisions to Appendix W to 40 CFR 51 (Modeling Guideline) until at least 3/21/2017. Will the stay have any impact on the proposed re-modeling of the DRR analyses and report?

Regards,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
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---------- Forwarded message ----------
From: **Roger U. Pabunan** <rpabunan@gpagwa.com>
Date: Fri, Jan 27, 2017 at 3:52 PM
Subject: 30 Stay on Final Regulations
To: Roland Gutierrez <roland.gutierrez@epa.guam.gov>
Cc: Sylvia L Ipanag <sipanag@gpagwa.com>, "Noel P. Cruz" <ncruz1@gpagwa.com>, "Norbert M. Madrazo" <nmadrazo@gpagwa.com>, Hanna Jugo <hanna.jugo@epa.guam.gov>, Luong Truong <luong.truong@epa.guam.gov>

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Thank you very much, Sir.

Regards,

Roger

Rules and Regulations

Federal Register
Vol. 82, No. 16
Thursday, January 26, 2017

This section of the FEDERAL REGISTER contains regulatory documents having general applicability and legal effect, most of which are keyed to and codified in the Code of Federal Regulations, which is published under 50 titles pursuant to 44 U.S.C. 1510.

The Code of Federal Regulations is sold by the Superintendent of Documents. Prices of new books are listed in the first FEDERAL REGISTER issue of each week.

SMALL BUSINESS ADMINISTRATION

13 CFR Part 107

RIN 3245–AG67

Small Business Investment Companies: Passive Business Expansion and Technical Clarifications

AGENCY: U.S. Small Business Administration.

ACTION: Final rule; delay of effective date and opportunity for public comment.

SUMMARY: On December 28, 2016, the Small Business Administration (SBA) published a final rule to expand permitted investments in passive businesses and provide further clarification with regard to investments in such businesses for the Small Business Investment Company (SBIC) Program, with an effective date of January 27, 2017. In the meantime, a memorandum dated January 20, 2017 from the Assistant to the President and Chief of Staff, entitled ''Regulatory Freeze Pending Review'' calls for agencies to temporarily postpone the effective date of rules not yet effective and invite new public comment. In view of this development, SBA is delaying the effective date of this rule until March 21, 2017, and is inviting additional public comment on the final rule. Any timely public comments received will be considered and any changes to the final rule will be published in the **Federal Register**.

DATES: The effective date of the SBA final rule published December 28, 2016 (81 FR 95419) is delayed until March 21, 2017. Comments must be received on or before February 19, 2017.

ADDRESSES: You may submit comments, identified by RIN 3245–AG67, by any of the following methods:

Federal eRulemaking Portal: http://www.regulations.gov. Follow the instructions for submitting comments.

Mail, Hand Delivery/Courier: Theresa Jamerson, Office for Investment and Innovation, U.S. Small Business Administration, 409 Third Street SW., Washington, DC 20416.

SBA will post comments on *http://www.regulations.gov.* If you wish to submit confidential business information (CBI) as defined in the User Notice at *http://www.regulations.gov,* please submit the information to Theresa Jamerson, Office of Investment and Innovation, 409 Third Street SW., Washington, DC 20416. Highlight the information that you consider to be CBI and explain why you believe this information should be held confidential. SBA will review the information and make the final determination of whether it will publish the information or not.

FOR FURTHER INFORMATION CONTACT: Theresa Jamerson, Office of Investment and Innovation, (202) 205–7563 or *sbic@sba.gov.*

SUPPLEMENTARY INFORMATION: The U.S. Small Business Administration (SBA) is revising the regulations for the Small Business Investment Company (SBIC) program to expand permitted investments in passive businesses and provide further clarification with regard to investments in such businesses. SBICs are generally prohibited from investing in passive businesses under the Small Business Investment Act of 1958, as amended (Act). SBIC program regulations provide for two exceptions that allow an SBIC to structure an investment utilizing a passive small business as a pass-through. The first exception provides conditions under which an SBIC may structure an investment through up to two levels of passive entities to make an investment in a non-passive business that is a subsidiary of the passive business directly financed by the SBIC. The second exception, prior to this final rule, enabled a partnership SBIC, with SBA's prior approval, to provide financing to a small business through a passive, wholly-owned C corporation (commonly known as a blocker corporation), but only if a direct financing would cause the SBIC's investors to incur Unrelated Business Taxable Income (UBTI). This final rule clarifies several aspects of the first exception and in the second exception eliminates the prior approval requirement and expands the purposes for which a blocker corporation may be formed. The final rule also adds new reporting and other requirements for passive investments to help protect SBA's financial interests and ensure adequate oversight and makes minor technical amendments. Finally, this rule makes a conforming change to the regulations regarding the amount of leverage available to SBICs under common control. This change is necessary for consistency with the Consolidated Appropriations Act, 2016, which increased the maximum amount of such leverage to $350 million.

Dated: January 23, 2017.

Michele Schimpp,

Deputy Associate Administrator, Office of Investment and Innovation.

[FR Doc. 2017–01809 Filed 1–25–17; 8:45 am]

BILLING CODE 8025–01–P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 22, 51, 52, 61, 68, 80, 81, 124, 147, 171, 239, 259, 300, and 770

[FRL–9958–87–OP]

Delay of Effective Date for 30 Final Regulations Published by the Environmental Protection Agency Between October 28, 2016 and January 17, 2017

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule; delay of effective dates.

SUMMARY: In accordance with the Presidential directive as expressed in the memorandum of January 20, 2017, from the Assistant to the President and Chief of Staff, entitled ''Regulatory Freeze Pending Review,'' this action temporarily delays until March 21, 2017, the effective date of the regulations listed in the table below. EPA identified 30 regulations that meet those criteria.

DATES: This regulation is effective January 26, 2017. The effective date of each regulation listed in the table below is delayed to a new effective date of March 21, 2017.

FOR FURTHER INFORMATION CONTACT: Sarah Rees, Director, Office of Regulatory Policy and Management, Office of Policy, Mail code 1804, U.S. Environmental Protection Agency, 1200 Pennsylvania Ave NW., Washington, DC

20460; (202) 564–1986; *rees.sarah@epa.gov*.

SUPPLEMENTARY INFORMATION: EPA bases this action on the Presidential directive as expressed in the memorandum of January 20, 2017, from the Assistant to the President and Chief of Staff, entitled ''Regulatory Freeze Pending Review.'' That memorandum directed the heads of Executive Departments and Agencies to temporarily postpone for sixty days from the date of the memorandum the effective dates of all regulations that had been published in the **Federal Register** but had not yet taken effect. The memorandum also noted certain exceptions that do not apply here. EPA identified 30 regulations that meet those criteria. Those regulations are listed in the table below. The new effective date for all 30 regulations is March 21, 2017.

The Agency's implementation of this action without opportunity for public comment is based on the good cause exceptions in 5 U.S.C. 553(b)(B) and 553(d)(3), in that seeking public comment is impracticable, unnecessary and contrary to the public interest. The temporary delay in effective dates until March 21, 2017, is necessary to give Agency officials the opportunity for further review and consideration of new regulations, consistent with the memorandum of the Assistant to the President and Chief of Staff, dated January 20, 2017. Given the imminence of these effective dates, seeking prior public comment on this temporary delay would have been impractical, as well as contrary to the public interest in the orderly promulgation and implementation of regulations. In addition, to the extent any regulation below is a procedural rule, it is exempt from notice and comment under 5 U.S.C. 553(b)(A).

Some of the regulations listed below would not have taken effect until late February or March. For those regulations, the length of today's delay is necessarily shorter than the delay established for regulations that would have taken effect in January or early February. The good cause exception applies here as well, because soliciting comment would be contrary to the public interest. First, by announcing today that all eligible regulations would be delayed until a single fixed date (March 21, 2017), the Agency provides immediate notice of its intention to further review and consider those regulations in addition to the others that would have taken effect sooner. This allows the later-published regulations to be considered more easily in context of the earlier-published regulations. Second, by focusing its attention on the substance of those later regulations rather than soliciting comment on a decision to delay their effective date until March 21, 2017, the Agency can minimize or obviate the need for further temporary delays beyond March 21. Third, as a practical matter, the new effective date for these regulations would extend by only a few weeks their original effective dates.

For the foregoing reasons, the good cause exceptions in 5 U.S.C. 553(b)(B) and 553(d)(3) also apply to EPA's decision to make today's action effectively immediately.

Federal Register citation	Title	Publication date	Original effective date	New effective date
81 FR 74927 ..	State of Kentucky Section 1425 Underground Injection Control (UIC) Program Primacy Approval.	10/28/16	1/26/2017	3/21/2017
81 FR 95047 ..	Approval and Promulgation of Implementation Plans; New York Prevention of Significant Deterioration of Air Quality and Nonattainment New Source Review; Infrastructure State Implementation Plan Requirements.	12/27/16	1/26/2017	3/21/2017
81 FR 95041 ..	Air Plan Approval; KY; RACM Determination for the KY Portion of the Louisville Area 1997 Annual $PM_{2.5}$.	12/27/16	1/26/2017	3/21/2017
81 FR 95043 ..	Air Plan Approval; Wisconsin; Infrastructure SIP Requirements for the 2012 $PM_{2.5}$ NAAQS.	12/27/16	1/26/2017	3/21/2017
81 FR 95051 ..	Approval and Promulgation of Implementation Plans and Designation of Areas for Air Quality Planning Purposes; Louisiana; Redesignation of Baton Rouge 2008 8-Hour Ozone Nonattainment Area to Attainment.	12/27/16	1/26/2017	3/21/2017
81 FR 95480 ..	State of Kentucky Underground Injection Control (UIC) Class II Program; Primacy Approval.	12/28/16	1/27/2017	3/21/2017
81 FR 95475 ..	Air Plan Approval; Illinois; Volatile Organic Compounds Definition	12/28/16	1/27/2017	3/21/2017
81 FR 95473 ..	Approval of California Air Plan Revisions, Great Basin Unified Air Pollution Control District.	12/28/16	1/27/2017	3/21/2017
81 FR 95472 ..	Approval of California Air Plan Revisions, South Coast Air Quality Management District.	12/28/16	1/27/2017	3/21/2017
82 FR 729	Partial Approval and Partial Disapproval of Attainment Plan for the Idaho Portion of the Logan, Utah/Idaho $PM_{2.5}$ Nonattainment Area.	1/4/17	2/3/2017	3/21/2017
82 FR 2760	Addition of a Subsurface Intrusion Component to the Hazard Ranking System.	1/9/17	2/8/2017	3/21/2017
82 FR 2237	Approval and Promulgation of Implementation Plans; Rhode Island; Clean Air Act Infrastructure State and Federal Implementation Plans.	1/9/17	2/8/2017	3/21/2017
81 FR 89746 ..	Renewable Fuel Standard Program: Standards for 2017 and Biomass-Based Diesel Volume for 2018.	12/12/16	2/10/2017	3/21/2017
81 FR 89674 ..	Formaldehyde Emission Standards for Composite Wood Products	12/12/16	2/10/2017	3/21/2017
82 FR 3171	Approval and Promulgation of Implementation Plans; Texas; Control of Air Pollution from Visible Emissions and Particulate Matter.	1/11/17	2/10/2017	3/21/2017
81 FR 89868 ..	Determination of Attainment of the 2012 Annual Fine Particulate Matter Standard; Pennsylvania; Delaware County Nonattainment Area.	12/13/16	2/13/2017	3/21/2017
82 FR 3639	Air Plan Approval; TN Infrastructure Requirements for the 2010 NO_2 NAAQS.	1/12/17	2/13/2017	3/21/2017
82 FR 3637	Approval and Promulgation of Implementation Plans; Alabama; Infrastructure Requirements for the 2010 Sulfur Dioxide National Ambient Air Quality Standard.	1/12/17	2/13/2017	3/21/2017
82 FR 5182	Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter.	1/17/17	2/16/2017	3/21/2017

Federal Register citation	Title	Publication date	Original effective date	New effective date
81 FR 91839 ..	Air Plan Approval; Michigan; Part 9 Miscellaneous Rules	12/19/16	2/17/2017	3/21/2017
81 FR 94262 ..	National Oil and Hazardous Substances Pollution Contingency Plan; National Priorities List: Partial Deletion of the North Penn Area 6 Superfund Site.	12/23/16	2/21/2017	3/21/2017
81 FR 93624 ..	Determination of Attainment of the 2008 Ozone National Ambient Air Quality Standards; Mariposa County, California.	12/21/16	2/21/2017	3/21/2017
81 FR 85438 ..	Adequacy of Washington Municipal Solid Waste Landfill Permit Program—Direct Final Rule.	11/28/16	2/27/2017	3/21/2017
81 FR 95477 ..	Approval and Promulgation of Implementation Plans; Louisiana; State Boards.	12/28/16	2/27/2017	3/21/2017
82 FR 952	Pesticides; Certification of Pesticide Applicators	1/4/17	3/6/2017	3/21/2017
82 FR 1206	Air Plan Approval; Georgia: Procedures for Testing and Monitoring Sources of Air Pollutants.	1/5/17	3/6/2017	3/21/2017
82 FR 2230	Consolidated Rules of Practice Governing the Administrative Assessment of Civil Penalties, Issuance of Compliance or Corrective Action Orders, and the Revocation/Termination or Suspension of Permits; Procedures for Decisionmaking.	1/9/17	3/10/2017	3/21/2017
82 FR 2239	Approval of Arizona Air Plan Revisions; Ajo and Morenci, Arizona; Second 10-Year Sulfur Dioxide Maintenance Plans and Technical Correction.	1/9/17	3/10/2017	3/21/2017
82 FR 4594	Accidental Release Prevention Requirements: Risk Management Programs Under the Clean Air Act.	1/13/17	3/14/2017	3/21/2017
82 FR 5142	Revisions to National Emission Standards for Radon Emissions from Operating Mill Tailings.	1/17/17	3/20/2017	3/21/2017

Where appropriate, the Agency may consider delaying the effective dates of the above-referenced regulations beyond March 21, 2017. If the Agency were to do so, consistent with the memorandum of the Assistant to the President and Chief of Staff, the Agency would propose any later effective date for public comment.

Dated: January 23, 2017.

Catherine McCabe,

Acting Administrator.

[FR Doc. 2017–01822 Filed 1–24–17; 11:15 am]

BILLING CODE 6560–50–P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–HQ–ES–2015–0171; FF09E40000 167 FXES11150900000]

RIN 1018–BB25

Endangered and Threatened Wildlife and Plants; Revisions to the Regulations for Candidate Conservation Agreements With Assurances

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule; delay of effective date.

SUMMARY: In accordance with a January 20, 2017, memo from the White House, we, the U.S. Fish and Wildlife Service, are delaying the effective date of a rule we published on December 27, 2016.

DATES: The effective date of the rule that published on December 27, 2016, at 81 FR 95053, is delayed from January 26, 2017, to March 21, 2017.

FOR FURTHER INFORMATION CONTACT: Jeff Newman, Chief, Division of Recovery and Restoration, U.S. Fish and Wildlife Service Headquarters, MS: ES, 5275 Leesburg Pike, Falls Church, VA 22041–3803; telephone 703–358–2171.

SUPPLEMENTARY INFORMATION: On December 27, 2016, we published a rule to revise the regulations concerning enhancement-of-survival permits issued under the Endangered Species Act of 1973, as amended, associated with Candidate Conservation Agreements with Assurances. We added the term ''net conservation benefit'' to the Candidate Conservation Agreements with Assurances regulations, and eliminated references to ''other necessary properties'' to clarify the level of conservation effort we require each agreement to include in order for us to approve a Candidate Conservation Agreement with Assurances. The rule was to be effective on January 26, 2017.

On January 20, 2017, the White House issued a memo instructing Federal agencies to temporarily postpone the effective date for 60 days after January 20, 2017, of any regulations that have published in the **Federal Register** but not yet taken effect, for the purpose of ''reviewing questions of fact, law, and policy they raise.'' We are, therefore, delaying the effective date of our rule published on December 27, 2016, at 81 FR 95053 (see **DATES**, above).

Authority: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

Dated: January 23, 2017.

Tina A. Campbell,

Chief, Division of Policy, Performance, and Management Programs, U.S. Fish and Wildlife Service.

[FR Doc. 2017–01841 Filed 1–25–17; 8:45 am]

BILLING CODE 4333–15–P

Proposed Hourly Varying Emissions for Guam Power Authority Data Requirements Rule SO_2 NAAQS Designation Modeling

The "Data Requirements Rule for the 2010 1-hour Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS)" (DRR) allows use of hourly emissions data for dispersion modeling for area compliance demonstrations. The SO_2 NAAQS Designations Modeling Technical Assistance Document (TAD) describes approaches for calculating temporally varying emissions appropriate for inclusion in an hourly emission file for AERMOD dispersion model input. As stated in the TAD, the use of production data and AP-42 emission factors is an acceptable approach when hourly emissions data (e.g. Continuous Emission Monitoring System [CEMS] data) are not readily available.

CEMS monitored SO_2 emissions data are not available for Cabras, MEC or TEMES generating stations. Previous modeling submitted for the area designation (SO_2 NAAQS Designations Modeling Analyses, Results, and Documentation for the Guam Power Authority Piti and Cabras Power Stations, November 2016) conservatively used permitted, full load SO_2 emissions for these sources for the entire modeling period (2011-2013). Since submittal of the previous modeling analyses and report, Guam Power Authority (GPA) has worked diligently to compile the data needed to calculate hourly emission rates based on AP-42 emission factors, hourly production data, and kilowatt-hours (kWh) for each unit included in the modeling. Electronic files containing the hourly production rates (Generation Loading Reports)[1], the annual unit efficiencies (kWh/gallon of fuel consumed)[2], the monthly fuel oil receiving reports[3], and the low sulfur fuel oil (LSFO) firing events reports (hours and minutes)[4] for the modeling period have been developed.

1. The Generation Loading Reports provide hourly megawatt (MW) production figures for each unit in GPA's portfolio. These files are generally in the format of an hourly production spreadsheet for each day of the month. Each month in years 2012 and 2013 is contained in a separate Excel compatible workbook; year 2011 hourly production data is contained in a single workbook.

2. The unit efficiencies spreadsheet provides the unit identification, the rated capacity of each unit (MW), the total annual kWh produced, fuel consumption (gallons) and efficiency of each unit (kWh/gal). These data are provided in a single spreadsheet.

3. The Fuel Receiving Reports list the date of receipt or date of sampling for each shipment of Low Sulfur Fuel Oil (LSFO) and High Sulfur Fuel Oil (HSFO), together with the vessel delivering the fuel, the weight percent of sulfur in the delivered fuel, the barrels of fuel delivered, the sulfur content of the fuel storage tank before and after delivery and the volume of fuel in the storage tank before and after delivery. These data are provided on monthly spreadsheets.

4. The Cabras and MEC units automatically switch from HSFO to LSFO when the wind direction changes from offshore (easterly) to onshore (westerly) flow. These events are recorded in the LSFO Firing Events spreadsheets which report the start and end time of each LSFO firing event and the cumulative hours and minutes of each event for each unit. These spreadsheets also document when the units are offline. Firing event data are combined in quarterly Excel workbooks for the Cabras and MEC facilities.

The Proposed Hourly Sulfur Dioxide Emission Calculation Methodologies presented below describe the approach used to determine the production rate and apply the AP-42 emission factor to determine the hourly SO_2 emission rate. Separate methods are presented for TEMES-7, which uses only ultra-low sulfur diesel (ULSD), and Cabras and MEC which use both LSFO and HSFO.

If the data needed to calculate an SO_2 emission rate for a unit in a given hour is not available, and the unit is determined to be online or its operating status is unknown, the maximum firing rate will be used to calculate the SO_2 emission rate for that hour. If the use of LSFO or HSFO for Cabras or MEC cannot be determined for a given hour, HSFO firing will be assumed. TEMES-7 fires only ULSD, thus that fuel will be used in all calculations for this unit.

The proposed methodology to derive hourly SO_2 emission rates for the modeling period of 2011 through 2013 for the GPA generating units subject to the DRR, is intended to replace the modeled overly conservative emission rates that are based on permitted emission rates for each unit and assumed to operate at such rates continuously. The proposed methodology is expected to provide a conservative representation of actual SO_2 emissions during the modeled period, and therefore result in conservatively high predicted SO_2 impacts, but less conservative than the previous modeling analyses.

TRC is providing this proposed methodology summary for GPA review and comment. We suggest that before additional effort and time is expanded in performing the calculations for each unit and then incorporating the “actual” emission hourly varying files in the AERMOD DRR modeling files and the modeling analyses are re-run, that concurrence from GEPA and/or USEPA be obtained. To minimize cost and time, we recommend that any comments or questions should be resolved before the next round of modeling and report revision are undertaken.

Please review this summary and let us know if you have any comments or would like to discuss via teleconference.

Guam Power Authority
Proposed Hourly Sulfur Dioxide Emission Calculation Methodology; ULSD Facilities
Calendar Year 2011-2013

Objective:
Using electric power production rates and the AP-42 emission factor for sulfur dioxide (SO_2) calculate Hourly Sulfur Dioxide Emissions from the Temes-7 Guam Power Authority (GPA) plant for the period calendar year 2011-2013

Given:
GPA maintains multiple records, including the following:

- Hourly Burn Rate: The hourly burn rate for each turbine is provided on an annual basis for each individual turbine.
- Type of Fuel Burned: The facilities listed above only burn ULSD; sulfur content is assumed to be 15 ppm
- The Generation Loading Reports (GLR) track megawatt (MW) generation per hour per turbine.

Procedure:
The following procedure was developed to determine hourly sulfur dioxide emissions of TEMES-7. This process can be replicated and scripted for other GPA turbine units that burn solely ULSD.

1. **Determine Hourly Gallons of Fuel Burned**
    a. Extract TEMES 7 hourly MW generation from the GLR data for the timeframe January 1, 2011 at 12 AM through December 31, 2013 at 11 PM.
    b. Import the Hourly Burn Rate for the unit based on the corresponding year.
    c. Calculate the gallons of oil used per hour using the MW generated per hour and the hourly burn rate:

    Gallons of Fuel = [ACTUAL_MW] * [1000 kW / MW] * [1 Hour] / [Efficiency (kWh/gallon)]
2. **Evaluate Sulfur Content of Fuel**
    a. This facility only burns ULSD. Assume that sulfur content is 15 ppm; or 0.0015% by weight.
3. **Calculate SO_2 Emissions**
    a. Calculate the pounds of SO_2 emissions per hour
        i. Use AP-42 factor for SO_2 for No. 2 oil fired; 142*S lb/1000 gallons where S = percent sulfur by weight (Table 1.3-1)
        ii. Assume S = 0.0015%
        iii. SO_2 Emissions (lbs/hr) = [Fuel Use (gallons/hour)] * [142 (lb/1000 gallon)]* [0.0015 (Sulfur % wt)] / [1000 gallons]

Guam Power Authority
Proposed Hourly Sulfur Dioxide Emission Calculation Methodology; Cabras and MEC
Calendar Year 2011-2013

Objective:

Using electric power production rates and the AP-42 emission factor for sulfur dioxide (SO_2) calculate Hourly Sulfur Dioxide Emissions from the following Guam Power Authority (GPA) plants for the period calendar year 2011-2013

- Cabras (Units #1, #2, #3, and #4)
- MEC (Units #8 and #9)

Given:

GPA maintains multiple records, including the following:

- Hourly Burn Rate: The hourly burn rate for each turbine is provided on an annual basis for each individual turbine.
- Type of Fuel Burned: For the MEC and Cabras facilities, GPA tracks the hours of low-sulfur fuel oil (LSFO) use and high-sulfur fuel oil (HSFO) on a monthly basis.
- Sulfur Content: GPA maintains records of the sulfur content of fuel oil received and the date that the fuel oil is received. Fuel oil is accepted at one terminal and distributed to each facility.
- The Generation Loading Reports (GLR) track megawatt (MW) generation per hour per turbine.

Procedure:

The following procedure was developed to determine hourly sulfur dioxide emissions from Cabras Unit #1. This process can be replicated and scripted for other GPA turbine units.

1. **Determine Hourly Gallons of Fuel Burned**
    a. Extract Cabras #1 MW generation from the GLR data for the timeframe January 1, 2011 at 12 AM through December 31, 2013 at 11 PM.
    b. Import the Hourly Burn Rate for the unit based on the corresponding year.
    c. Calculate the gallons of oil used per hour using the MW generated per hour and the hourly burn rate:

    Gallons of Fuel = [ACTUAL_MW] * [1000 kW / MW] * [1 Hour] / [Efficiency (kWh/gallon)]

2. **Determine Type of Fuel Burned During Each Hour**
    a. Using the Firing Events data logs, for each hour of the appropriate model period, determine whether Cabras #1 was firing LSFO or was offline.
    b. Assume all other hours not found in the Firing Events log were hours that Cabras #1 fired HSFO.
    c. If a one-hour period includes both a fuel burn (LSFO or HSFO) and OFFLINE status, the type of fuel burned will be LSFO or HSFO as appropriate; no matter the length of time the unit was OFFLINE.

d. If a one-hour period includes both LSFO and HSFO firing, assume HSFO was burned for the entire hour (as a conservative estimate of SO_2 emissions during that hour).

3. **Evaluate Sulfur Content of Fuel**
   a. Extract fuel sulfur content from fuel oil shipment records for both LSFO and HSFO.
   b. The fuel oil content can be obtained from the Residual Fuel Oil Receiving Report.
   c. Assumed that the "date received" is also the start date for that oil being burned in the turbines.
4. **Calculate SO_2 Emissions**
   a. Calculate the pounds of SO_2 emissions per hour
      i. Use AP-42 factor for SO_2 for No. 6 oil; 157*S lb/1000 gallons, where S = percent sulfur by weight (Table 1.3-1)
      ii. If the "Type of Fuel Burned" indicates HSFO, the sulfur content of HSFO shall be used. If the "Type of Fuel Burned" indicates LSFO, the sulfur content of LSFO shall be used. If the unit was OFFLINE for the entire one-hour period, the sulfur content is assumed to be 0%.
      iii. SO_2 Emissions (lbs/hr) = [Fuel Use (gallons/hour)] * [157 (lb/1000 gallon)]* [Sulfur (% wt)] / [1000 gallons]

To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]
Cc: Conchita Taitano[conchita.taitano@epa.guam.gov]; Yvette Cruz[yvette.cruz@epa.guam.gov]; Walter Leon Guerrero[walter.leonguerrero@epa.guam.gov]; Mann, Michael[Mann.Michael@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Kurpius, Meredith[Kurpius.Meredith@epa.gov]; Lee, Anita[Lee.Anita@epa.gov]; Lo, Doris[Lo.Doris@epa.gov]; Chen, Eugene[Chen.Eugene@epa.gov]
From: YOSHIMURA, GWEN
Sent: Mon 1/23/2017 3:12:15 PM
Subject: RE: Guam SO2 regroup - please call 866-299-3188, Ex. 6 - Personal Privacy

As indicated in the subject line of the meeting, the call in number is 866-299-3188, Ex. 6 - Personal Privacy Ex. 6 - Personal Privacy

Thanks,

Gwen

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, January 22, 2017 7:50 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>
Cc: Conchita Taitano <conchita.taitano@epa.guam.gov>; Yvette Cruz <yvette.cruz@epa.guam.gov>; Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>; Mann, Michael <Mann.Michael@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Kurpius, Meredith <Kurpius.Meredith@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>; Lo, Doris <Lo.Doris@epa.gov>; Chen, Eugene <Chen.Eugene@epa.gov>
Subject: Re: Guam SO2 regroup - please call 866-299-3188, Ex. 6 - Personal Privacy

Gwen.

Will you be providing a call in number?

Regards,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

epa.guam.gov - facebook.com/Guam EPA - twitter.com/GuamEPA

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On Sat, Jan 21, 2017 at 2:08 AM, YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov> wrote:

> Hello,
>
> We are aiming to have this call next week, when Michael Mann is still in Guam. Please let me know if this time works for you.
>
> Thanks,
>
> Gwen

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Thursday, January 12, 2017 9:14 PM
To: Lee, Anita <Lee.Anita@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>
Cc: Conchita Taitano <conchita.taitano@epa.guam.gov>; Yvette Cruz <yvette.cruz@epa.guam.gov>; Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>
Subject: SO2 Modeling Report

Gwen,

Attached you will find the SO2 Modeling Report required by the DRR for the One -Hour SO2 NAAQS. The hard copy is in the mail. Please review and advise when we can have a conference call to discuss the results, ramifications and the way forward to attainment for the Cabra/Piti Power Plants.

Sincerely,

Roland T. Gutierrez Jr., MPA

EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

To: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]
Cc: Conchita Taitano[conchita.taitano@epa.guam.gov]; Yvette Cruz[yvette.cruz@epa.guam.gov]; Walter Leon Guerrero[walter.leonguerrero@epa.guam.gov]; Mann, Michael[Mann.Michael@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Kurpius, Meredith[Kurpius.Meredith@epa.gov]; Lee, Anita[Lee.Anita@epa.gov]; Lo, Doris[Lo.Doris@epa.gov]; Chen, Eugene[Chen.Eugene@epa.gov]
From: Roland Gutierrez
Sent: Mon 1/23/2017 3:49:59 AM
Subject: Re: Guam SO2 regroup - please call 866-299-3188, code Ex. 6 - Personal Privacy

Gwen.
Will you be providing a call in number?

Regards,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
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epa.guam.gov - facebook.com/Guam EPA - twitter.com/GuamEPA

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On Sat, Jan 21, 2017 at 2:08 AM, YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov> wrote:

Hello,

We are aiming to have this call next week, when Michael Mann is still in Guam. Please let me know if this time works for you.

Thanks,

Gwen

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Thursday, January 12, 2017 9:14 PM
To: Lee, Anita <Lee.Anita@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>
Cc: Conchita Taitano <conchita.taitano@epa.guam.gov>; Yvette Cruz <yvette.cruz@epa.guam.gov>; Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>
Subject: SO2 Modeling Report

Gwen,

Attached you will find the SO2 Modeling Report required by the DRR for the One -Hour SO2 NAAQS. The hard copy is in the mail. Please review and advise when we can have a conference call to discuss the results, ramifications and the way forward to attainment for the Cabra/Piti Power Plants.

Sincerely,

Roland T. Gutierrez Jr., MPA

EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]
Cc: Lee, Anita[Lee.Anita@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]; Yvette Cruz[yvette.cruz@epa.guam.gov]; Walter Leon Guerrero[walter.leonguerrero@epa.guam.gov]; Mann, Michael[Mann.Michael@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Kurpius, Meredith[Kurpius.Meredith@epa.gov]
From: YOSHIMURA, GWEN
Sent: Thur 1/19/2017 5:56:23 PM
Subject: RE: SO2 Modeling Report

Hi Roland,

Also, if you're okay waiting till the following week (the week of Mon Jan 30th) we could probably have a fuller contingency on the line then. Options for that week:

- Tuesday 1/31 2:30 – 3:30pm CA; Wednesday 2/1 8:30 – 9:30am Guam
- Tuesday 1/31 2pm or 2:30pm CA; Wednesday 2/1 8am or 8:30am Guam

Thanks,

Gwen

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: YOSHIMURA, GWEN
Sent: Wednesday, January 18, 2017 7:35 AM
To: Roland Gutierrez <roland.gutierrez@epa.guam.gov>
Cc: Lee, Anita <Lee.Anita@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>;

Yvette Cruz <yvette.cruz@epa.guam.gov>; Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>; Mann, Michael <Mann.Michael@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Kurpius, Meredith <Kurpius.Meredith@epa.gov>
Subject: Re: SO2 Modeling Report

Would Tuesday 1/24, 2-3pm California time / Wednesday 1/25, 8-9am Guam work for folks? (Meredith, fyi)

-Gwen

From: Roland Gutierrez <roland.gutierrez@epa.guam.gov>
Sent: Tuesday, January 17, 2017 5:22 PM
To: YOSHIMURA, GWEN
Cc: Lee, Anita; Conchita Taitano; Yvette Cruz; Walter Leon Guerrero; Mann, Michael; Bohnenkamp, Carol
Subject: Re: SO2 Modeling Report

Gwen,

My apologies for the late reply, but can we schedule a conference call for next week? I have scheduled meetings this week and they are all in the morning. I have nothing scheduled for next week. Please let me know when you are available for a conference call.

Regards,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
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On Sat, Jan 14, 2017 at 4:20 AM, YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov> wrote:

Hi Roland,

Thank you for your submittal. We'd be happy to talk with you – would you be free your Thursday morning? I'm not sure about Michael Mann, but the folks in the office look free at 2 or 2:30 pm Wednesday 1/18 California time (which I believe would be 8 or 8:30 am Thursday 1/19 for you).

Thanks,
Gwen

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
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Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Thursday, January 12, 2017 9:14 PM

To: Lee, Anita <Lee.Anita@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>
Cc: Conchita Taitano <conchita.taitano@epa.guam.gov>; Yvette Cruz <yvette.cruz@epa.guam.gov>; Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>
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Sincerely,

Roland T. Gutierrez Jr., MPA

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Cc: Lee, Anita[Lee.Anita@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]; Yvette Cruz[yvette.cruz@epa.guam.gov]; Walter Leon Guerrero[walter.leonguerrero@epa.guam.gov]; Mann, Michael[Mann.Michael@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Kurpius, Meredith[Kurpius.Meredith@epa.gov]
From: YOSHIMURA, GWEN
Sent: Wed 1/18/2017 3:34:50 PM
Subject: Re: SO2 Modeling Report

Would Tuesday 1/24, 2-3pm California time / Wednesday 1/25, 8-9am Guam work for folks? (Meredith, fyi)

-Gwen

From: Roland Gutierrez <roland.gutierrez@epa.guam.gov>
Sent: Tuesday, January 17, 2017 5:22 PM
To: YOSHIMURA, GWEN
Cc: Lee, Anita; Conchita Taitano; Yvette Cruz; Walter Leon Guerrero; Mann, Michael; Bohnenkamp, Carol
Subject: Re: SO2 Modeling Report

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Regards,

Roland T. Gutierrez Jr., MPA
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Thanks,
Gwen

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
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From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
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To: Lee, Anita <Lee.Anita@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>
Cc: Conchita Taitano <conchita.taitano@epa.guam.gov>; Yvette Cruz <yvette.cruz@epa.guam.gov>; Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>
Subject: SO2 Modeling Report

Gwen,

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Sincerely,

Roland T. Gutierrez Jr., MPA

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To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]
Cc: Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Kurpius, Meredith[Kurpius.Meredith@epa.gov]; Lee, Anita[Lee.Anita@epa.gov]; Mann, Michael[Mann.Michael@epa.gov]
From: YOSHIMURA, GWEN
Sent: Thur 1/12/2017 7:21:26 PM
Subject: RE: DRR Modeling Results

Hello Roland,

I just called your number but was unable to get through. As you say, the modeling is due tomorrow. Please submit as described in Carol's 12/16/2016 email (copied below).

Please give me a call if you'd like to discuss further – we can talk through what this means, revisit our previous discussions about how it puts you on an efficient path to address both the 1971 and 2010 standards in one action, and perhaps address some of the statements you made in your email. I'm at 415-947-4134. You can also talk to Meredith Kurpius, our acting Associate Division Director, at 415-947-4534.

Thanks,

Gwen

Email from Carol Bohnenkamp, sent 12/16/2016:

Dear Mr. Gutierrez,

This is a friendly reminder that the modeling for the SO2 Data Requirements Rule is due to EPA by January 13, 2017. The cover letter transmitting the modeling should be addressed to Elizabeth Adams, Acting Director, Air Division, with an electronic copy to Gwen Yoshimura (Gwen Yoshimura <yoshimura.gwen@epa.gov>) and Anita Lee (Anita Lee <lee.anita@epa.gov>).

The SO2 Technical Assistance Document also provides information on the documentation that should accompany your submittal (see especially, page 33).

This is available at web page:

Technical information supporting SO2 designations to be completed by July 2, 2016

https://www.epa.gov/sulfur-dioxide-designations/technical-information-supporting-so2-designations-be-completed-july-2

Direct link is:

Technical Assistance Document: SO2 NAAQS Designations Modeling (PDF)(71 pp, 2 MB)

https://www.epa.gov/sites/production/files/2016-04/documents/so2modelingtad.pdf

As you know, EPA must complete Round 3 designations of the 2010 SO2 NAAQS by December 31, 2017. Although Clean Air Act section 107(d) does not require states, territories, or tribes to submit updated recommendations for Round 3, we are inviting such air agencies to submit updated designation recommendations for the EPA to consider. Air agencies that wish to update their recommendations should do so no later than January 13, 2017, addressed to Alexis Strauss, Acting Regional Administrator, EPA Region 9 with an electronic copy to Gwen and Anita.

Please let me know if you have any questions or concerns.

Happy Holidays!

Carol Bohnenkamp

Carol Bohnenkamp

Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4130

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Wednesday, January 11, 2017 9:00 PM
To: BECKHAM, LISA <BECKHAM.LISA@EPA.GOV>; Nguyen, Thien Khoi <nguyen.thien@epa.gov>
Subject: DRR Modeling Results

All,

We are preparing to submit the modeling results for the SO2 NAAQS. As we predicted, the modeling does not show attainment. However, as we stated we and our contractors believe we can show attainment through ambient air quality monitoring.

We do we stand now with the modeling results showing non-attainment? What can we do moving forward? Can we now do the monitoring that we wanted to do? USEPA pushed us to do modeling instead of monitoring insisting that we could model attainment.

Since the results show that we cannot model attainment when we believe we are at attainment with the use of ULSD and fuel switching protocol. Please advise as we will be submitting the results tomorrow and want to know what the ramifications are for not having modeled attainment.

Sincerely,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

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To: Viswanathan, Krishna[Viswanathan.Krishna@epa.gov]; Lee, Anita[Lee.Anita@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
Cc: Roland Gutierrez[roland.gutierrez@epa.guam.gov]; Sylvia L Ipanag[sipanag@gpagwa.com]; Conchita Taitano[conchita.taitano@epa.guam.gov]; Noel P. Cruz[ncruz1@gpagwa.com]; Norbert M. Madrazo[nmadrazo@gpagwa.com]; Luong Truong[luong.truong@epa.guam.gov]; Wehling, Jefferson[Wehling.Jefferson@epa.gov]; Mann, Michael[Mann.Michael@epa.gov]; Maurin, Lawrence[Maurin.Lawrence@epa.gov]
From: Roger U. Pabunan
Sent: Wed 11/2/2016 11:58:11 PM
Subject: RE: Discussion of Modeling Protocol for Tanguisson - SO2 DRR
Addendum to DRR modeling protocol of 6-14-16.pdf

Good day All.

In response to EPA comments on the Modeling Protocol, please see attached:

"Addendum to DRR modeling protocol of 6-14-16.pdf"

Regards,

Roger U. Pabunan

Engineer Supervisor

Planning & Regulatory

Guam Power Authority

rpabunan@gpagwa.com

Tel: (671) 648-3032

Fax: (671) 648-3290

I-connect: 671*11*20152

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Friday, October 14, 2016 11:24 AM

To: Roger U. Pabunan; Sylvia L Ipanag; Conchita Taitano; Noel P. Cruz; Norbert M. Madrazo; Luong Truong
Subject: Fwd: Discussion of Modeling Protocol for Tanguisson - SO2 DRR

As per below, the modeling protocol was approved. Please ensure that when we have completed the estimation of shipping emissions and monitoring data per approach, please share those with USEPA Region 9.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

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---------- Forwarded message ----------
From: **Viswanathan, Krishna** <Viswanathan.Krishna@epa.gov>
Date: Fri, Oct 14, 2016 at 1:25 AM
Subject: RE: Discussion of Modeling Protocol for Tanguisson - SO2 DRR
To: Roland Gutierrez <roland.gutierrez@epa.guam.gov>
Cc: R9SF-Room-18220-6-Reno-Sparks <R9SF-Room-18220-6-Reno-Sparks@epa.gov>, "YOSHIMURA, GWEN" <Yoshimura.Gwen@epa.gov>, "Wehling, Jefferson" <Wehling.Jefferson@epa.gov>, "Bohnenkamp, Carol" <Bohnenkamp.Carol@epa.gov>, "Mann, Michael" <Mann.Michael@epa.gov>, "Maurin, Lawrence" <Maurin.Lawrence@epa.gov>, R9SF-ConferenceLine-AIR-Card2 <R9SF-ConferenceLine-AIR-Card2@epa.gov>, Conchita Taitano <conchita.taitano@epa.guam.gov>, "Lee, Anita" <Lee.Anita@epa.gov>

Hello Roland,

Both your proposed approaches look reasonable to us. Please proceed with the modeling. When you have completed the estimation of shipping emissions and monitoring data per approach below, please share those with us.

In another staffing change, Anita Lee of our office will be taking on my role starting next week.

Please let me know if you have questions

Thanks,

Krishna

Krishna Viswanathan

520.999.7880

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Tuesday, October 11, 2016 8:55 PM
To: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Cc: R9SF-Room-18220-6-Reno-Sparks <R9SF-Room-18220-6-Reno-Sparks@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Wehling, Jefferson <Wehling.Jefferson@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Mann, Michael <Mann.Michael@epa.gov>; Maurin, Lawrence <Maurin.Lawrence@epa.gov>; R9SF-ConferenceLine-AIR-Card2 <R9SF-ConferenceLine-AIR-Card2@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>

Subject: RE: Discussion of Modeling Protocol for Tanguisson - SO2 DRR

This is the reponse we received from the contractor:

In response to the last two comments:

Item #1, Shipping Emissions – this will be addressed by analyzing the tonnage that goes through the Port. The tonnage can be used to estimate the emissions from shipping. We have the tonnage report for the past 3 years.

Item#2, Monitoring – TRC will make the adjustments to use the 99th percentile per year for the 1-hour maximum concentrations.

Please advise if the responses are sufficient.

Sincerely,

On 6 Oct 2016 12:39 a.m., "Viswanathan, Krishna" <Viswanathan.Krishna@epa.gov> wrote:

Thanks Gwen.

That is my recollection also. In response to a question from you on whether you should go ahead and start the modeling, we mentioned our preference that you get back to us quickly on how you would address our comments before starting the modeling.

Please do let us know if this is not what you heard or if you have further questions.

Thanks,

Krishna

Krishna Viswanathan

520.999.7880

From: YOSHIMURA, GWEN
Sent: Tuesday, October 4, 2016 9:56 AM
To: Roland Gutierrez <roland.gutierrez@epa.guam.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; R9SF-Room-18220-6-Reno-

Sparks <R9SF-Room-18220-6-Reno-Sparks@epa.gov>; R9SF-ConferenceLine-AIR-Card2 <R9SF-ConferenceLine-AIR-Card2@epa.gov>; Wehling, Jefferson <Wehling.Jefferson@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>; Maurin, Lawrence <Maurin.Lawrence@epa.gov>; Mann, Michael <Mann.Michael@epa.gov>
Subject: RE: Discussion of Modeling Protocol for Tanguisson - SO2 DRR

Hi Roland,

I do not think you should be waiting on us. By the end of the call, GPA said they would work to address our comments and follow up with us if questions arise or if they run into issues. Some of the points we made on the call:

1. Shipping emissions. Our original comment remains unaddressed. [Shipping emissions: As discussed in the protocol, the allowable sulfur content in fuel may not be reduced if fuels are not reasonable available. Therefore, the background concentration should account for the effect of shipping emissions.] The document provided says that ships' emissions are subject to a rule which will reduce allowable sulfur in fuel content in 2020, if such fuels become reasonably available. The SO2 modeling being done is for current emissions, therefore, we are looking for a reasonable estimate or range of concentrations attributable to current shipping emissions.

2. Monitoring. Our original comment remains unaddressed. [Ambient air monitoring: Although there may be are a number of hours with values of zero, the data in Appendix D. shows that there are high short term (3 hour) values that were measured at some of the monitoring site. Since the standard looks at 1-hour concentrations, specifically the 99th percentile of 1-hour daily maximum concentrations averaged over 3 years, the analysis should discuss the appropriate background for 1 hour maximum concentrations (99th percentile per year).] The documentation sent discussed satellite and aircraft measurements, which is interesting additional information but does not address the specific request. We also note that the satellite section concludes with the statement that "satellite estimates are less reliable than the direct observations reported for the other measurement approaches…", and that the aircraft measurements were conducted in March/April 2001.

Again, as previously stated, because the form of the standard is a 1-hour daily maximum concentration averaged over 3 years, we are interested in what concentrations you'd see as a 99th percentile 1-hour daily maximum concentration. We ask that you take your monitoring data, and calculate what the 99th percentile of the 1-hour maximum concentrations per year are.

Carol did say that she would check with other EPA regions and see if they have examples of shipping emission estimates, but she also indicated she had already done so and had not received any responses. So we recommend that you do not wait on that, but instead move forward with addressing our comments as you can, and let us know if you run into issues. And you should submit any revised discussions to us when they become available. This is where things were left at the end of the call, to my recollection.

-Gwen

Gwen M. Yoshimura
Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Monday, October 03, 2016 8:55 PM
To: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; R9SF-Room-18220-6-Reno-Sparks <R9SF-Room-18220-6-Reno-Sparks@epa.gov>; R9SF-ConferenceLine-AIR-Card2 <R9SF-ConferenceLine-AIR-Card2@epa.gov>; Wehling, Jefferson <Wehling.Jefferson@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>; Maurin, Lawrence <Maurin.Lawrence@epa.gov>; Mann, Michael <Mann.Michael@epa.gov>
Subject: Re: Discussion of Modeling Protocol for Tanguisson - SO2 DRR

Alcon,

Just to follow up on the conference call. Please advise the next steps. As per the call, USEPA was going to provide further guidance on what we needed to submit to finalize the the modeling protocol and begin the modeling. I think it would be best to email us written guidance so that we may adequately inform the consultant who will be doing the modeling.

Please advise soonest as we are in October and we have barely 3 months to complete.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

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On Wed, Sep 21, 2016 at 9:52 AM, Viswanathan, Krishna <Viswanathan.Krishna@epa.gov> wrote:

Call In Number: 1-866-299-3188

Code: Ex. 6 - Personal Privacy

Agenda

Introductions

Review of Protocol Issues and EPA Review

Methods to address EPA comments on issue #2

Next Steps

Email Excerpt:**********

Please advise if the response to these comments are sufficient.

1. Section 5: Please clarify how Guam EPA/EPA will be notified of re-located receptors, and whether an explanation of the reasons for relocation (characteristics of the locations, etc) will be included.

In response to item #1: We are not proposing to relocate receptors that, according to the EPA guidance, would not be practical locations for monitor placement. Those receptors will continue to be evaluated for potential site access, and if it is determined that safe and practical access to those locations cannot be achieved, we will add receptors to the nearest points where access is possible. all receptors in the modeling analyses that are judged to be non-representative for potential monitor locations will be clearly identified by UTM coordinates and on topographical maps, showing the original and relocated receptor position. The criteria relied upon to relocate each receptor will be documented in a memorandum and submitted to GEPA and USEPA for review and concurrence before the final modeling analyses and design concentration is determined.

2. Section 7: We have reviewed Section 7: Background Concentrations and Appendix D. and we continue to have concerns about the supporting information that was provided in the protocol.

- Shipping emissions: As discussed in the protocol, the allowable sulfur content in fuel may not be reduced if fuels are not reasonable available. Therefore, the background concentration should account for the effect of shipping emissions.

- Ambient air monitoring: Although there may be are a number of hours with values of zero, the data in Appendix D. shows that there are high short term (3 hour) values that were measured at some of the monitoring site. Since the standard looks at 1-hour concentrations, specifically the 99th percentile of 1-hour daily maximum concentrations averaged over 3 years, the analysis should discuss the appropriate background for 1 hour maximum concentrations (99th percentile per year).

In Response to item #2: Please see attached excerpt from a draft report on "Assessment of background air quality concentration on Guam". Section 2.0 elaborates in more detail sulfur dioxide Background Concentrations.

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ADDENDUM TO: SO_2 NAAQS DESIGNATIONS MODELING PROTOCOL FOR THE GUAM POWER AUTHORITY

Prepared for

Guam Power Authority

Prepared by

TRC

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1.0 INTRODUCTION

In accordance with the "Data Requirements for Characterizing Air Quality for the Primary [sulfur dioxide] SO_2 NAAQS[1]" (Data Requirements Rule - DRR) the Piti and Cabras Guam Power Authority (GPA) electrical generating stations are "applicable sources" and thus subject to an air quality review either by dispersion modeling or air quality monitoring. The purpose of the air quality review is to support the U.S. Environmental Protection Agency (EPA) and the Guam EPA (GEPA) in establishing the National Ambient Air Quality Standard (NAAQS) area designation for the Territory of Guam. GPA was advised by GEPA that the preferred path to complying with the DRR is through a dispersion modeling analysis. EPA has also established a schedule for the modeling demonstration which required submittal of a modeling protocol to EPA no later than July 1, 2016. GPA and GEPA submitted a timely modeling protocol to EPA. Subsequently during the modeling protocol review, GEPA and EPA have requested clarification and further documentation related to items and data proposed in the modeling protocol. Those requests have been addressed and concurrence on the modeling protocol to be applied for the final DRR modeling analyses has been achieved. This Addendum to the original modeling protocol, dated June 2016, has been prepared to document agreed upon revisions to the original modeling protocol related to the comments provided by GEPA and EPA.

Comments and requests from GEPA and EPA regarding the proposed modeling protocol included the following items:

- Comment: 1. Section 5: Please clarify how Guam EPA/EPA will be notified of re-located receptors, and whether an explanation of the reasons for relocation (characteristics of the locations, etc.) will be included.
- Comment: 2. Section 7: We have reviewed Section 7: Background Concentrations and Appendix D. and we continue to have concerns about the supporting information that was provided in the protocol.
    a) Shipping emissions: As discussed in the protocol, the allowable sulfur content in fuel may not be reduced if fuels are not reasonably available. Therefore, the background concentration should account for the effect of shipping emissions.
    b) Ambient air monitoring: Although there are a number of hours with values of zero, the data in Appendix D. shows that there are high short term (3 hour) values that were measured at some of the monitoring site. Since the standard looks at 1-hour concentrations, specifically the 99th percentile of 1-hour daily maximum concentrations averaged over 3 years, the analysis

[1] 40 CFR 51.1200.

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should discuss the appropriate background for 1 hour maximum concentrations (99th percentile per year).

2.0 RESPONSE TO COMMENTS

Comments and concerns expressed by GEPA and EPA regarding the proposed modeling protocol were addressed in several email messages and submittals proposing alternative methods and data to be used in the modeling analyses to represent "background sources" and modeling receptors. The agreed upon resolution to the noted comments in section 1.0 above are as follows:

Response to Comment 1: We are not proposing to relocate receptors that, according to the EPA guidance, would not be practical locations for monitor placement. Those receptors will continue to be evaluated for potential site access, and if it is determined that safe and practical access to those locations cannot be achieved, we will add receptors to the nearest points where access is possible. All receptors in the modeling analyses that are judged to be non-representative for potential monitor locations will be clearly identified by UTM coordinates and on topographical maps, showing the original and additional receptor positions. The criteria relied upon to add receptors will be documented in a memorandum and submitted to GEPA and USEPA for review and concurrence before the final modeling analyses and design concentration is determined. TRC will be available to discuss the memorandum and recommendations therein via conference call if necessary.

Response to Comment: 2. GEPA and EPA concerns regarding the appropriate representation of shipping emissions associated with the nearby Port of Guam and the Naval Base Guam (Comment 2a) and appropriate 1-hour average background values (Comment 2b) to be included in the modeling analyses were addressed in separate memorandum submitted by GPA and provided here as Attachments A and B, respectively.

Attachment A provides a discussion of vessel emissions and estimated emissions of SO_2 that will be included in the modeling analyses to assess their potential contribution to ambient air concentrations. Conservative estimates of emissions from maneuvering, auxiliary power and hoteling have been developed for vessels assumed to be at the Port of Guam and Naval Base Guam and will be included in the modeling analyses.

Attachment B presents the assessment of available SO_2 monitored data at three monitors on Guam that are representative of ambient air concentration near the emission sources of interest for these analyses. These data have been processed in accordance with EPA modeling guidance and the 99th percentile concentration value have been determined. The resulting 99th percentile of

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the daily maximum one-hour observed SO_2 concentrations with downwind hours censored per EPA guidance are as follows:

Station	SO_2 ppb	SO_2 µg/m^3
Dededo	**8**	**21**
Orote Point	**20**	**52**
Nimitz Hill	**11**	**29**

For modeling purposes, Dededo is the recommended background monitoring station for sources in the northern portion of the island and Nimitz Hill is the recommended background station for the southern portion of the island. Orote Point monitor is likely impacted by vessel traffic in the port, and if vessels are included in the emission inventory, the Orote Point observations will "double count" the port's maritime emissions.

3.0 ADDENDUM TO PROTOCOL

This addendum is intended to amend and update Sections 5.0 and 7.0 of the original proposed modeling protocol dated June 2016. The above sections and attachments provide clarification of:

- The method that will be applied to assess modeling receptors reviewed due to design value impact at locations that may not be accessible for monitoring purposes,
- Provide representative emission inventory of vessel emissions that will be included in the modeling analyses to represent emissions of SO_2 from vessels calling or hoteling at the nearby Port of Guam and Naval Base Guam and
- Background values based on the 99th percentile values at representative monitoring sites that will be applied to the model emission sources to calculate the total ambient air concentration at each modeled receptor.

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ATTACHMENT A

MARITIME SULFUR DIOXIDE EMISSION – PORT OF GUAM

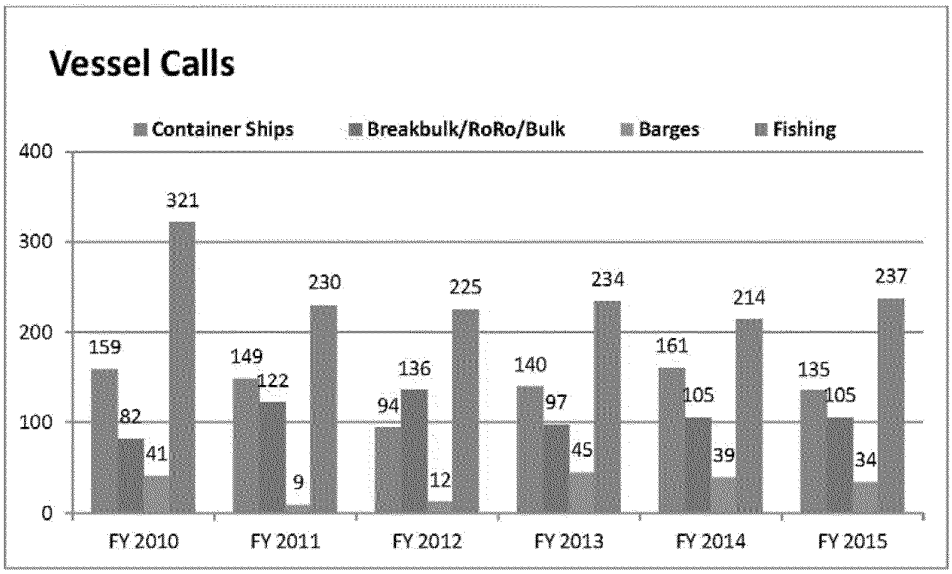
ATTACHMENT 1

MARITIME SULFUR DIOXIDE EMISSION – PORT OF GUAM

The Port of Guam handles the bulk of the maritime traffic for the Territory of Guam and neighbors the Piti-Cabras and MEC power plants owned by the Guam Power Authority (GPA). Both vessel traffic and the power plants emit sulfur dioxide (SO_2). The permitted SO_2 emissions from the GPA facilities are known, however the vessel emissions have not been estimated to date. EPA has requested an analysis of the possible SO_2 emissions from marine vessels calling at the port.

The Port of Guam reports vessel calls on an annual basis (http://portguam.com/about-us/financial-information-and-statistics/cargo-statistics-and-graphs) and for the most recent year available, 2015, tallied 511 vessel calls. These can be roughly divided between large vessels (container ships, breakbulk, roll-on/roll-off and bulk carriers) and fishing vessels, reporting 274 large vessels and 237 smaller fishing vessels (likely purse seiners). The large vessels are generally in the range of 100 meters (m) to 225 m in length, and over 10,000 dead weight tons (dwt). Purse seiners are generally less than 30 m in length. The Port of Guam, on average, handles approximately one large vessel call and one fishing vessel call per day.

PORT OF GUAM VESSEL CALLS



In addition to the Port of Guam, the Naval Base Guam receives port calls from military vessels. Vessel calls for both Port of Guam and Naval Base Guam are recorded by Marine Traffic's Automated Information System tracking data (http://www.marinetraffic.com/en/ais/details/ports/20289). The site shows approximately two weeks of vessel arrival and departure data, and based on information available at this time, there were 4 military vessels in port during the period:

- Charles Drew, cargo vessel, 42,785 dwt, 210 m, in port 3 days
- USNS PFC Dewayne T. Williams, military operations vessel, 44,543 dwt, 205 m, in port at time of writing
- USNS 1st Lt. Jack Lummus, cargo vessel, 26,949 dwt, 205 m, in port 8 days
- Luta, off-shore cargo supply vessel, 450 dwt, 48 m, in port 3 days

The Charles Drew, USNS 1st Lt. Jack Lummus and Luta were in port at the same time. This is likely representative of typical activity at the Navy base.

Vessel activities in port can be divided into two operating scenarios:

- "Maneuvering" during which a vessel is moving within the port using its prime mover engine and auxiliary power supplied by smaller onboard generators and boilers. For safety reasons, vessels within the port operate at low speeds for maneuvering purposes.

- "Hoteling" during which a vessel is secured at its berth and only the auxiliary units are online.

The combined commercial and military ports support a moderate number of vessel calls. On an annual basis an estimated 500 large vessels call on both facilities combined, which is a conservative estimate that assumes a substantial amount of traffic at the military port in addition to the 274 commercial vessels reported in 2015 at the commercial port. Given the total number of large vessel port calls, it is likely that only one vessel is in transit at any given time, however to be conservative, emissions estimates have been prepared based on two large vessels underway in the port (one at the commercial port and one at the Navy base) at maneuvering speed. EPA reported that maneuvering engine loads typical of in-port operations for large vessels range from 10% to 20% of prime mover engine capacity (https://www3.epa.gov/otaq/models/nonrdmdl/c-marine/r00002.pdf). Based on reported vessel port calls (three general cargo, one roll-on/roll-off, one container and two tanker vessels), the average cruising fuel consumption rate is 377 gallons/hour and the maximum cruising fuel consumption is 937 gallons per hour for a large container ship. Short-term emissions are estimated assuming one vessel at maximum fuel

consumption (i.e., a large container ship at 937 gallons per hour times 20% maneuvering speed fuel consumption factor) and one average vessel fuel consumption (377 gallons per hour times 20% maneuvering speed fuel consumption factor). Annual large vessel emission rates are based on the average fuel consumption rates at maneuvering speed. During maneuvering, auxiliary power requirements are 1,250 kW. Annual and short-term hoteling emissions are estimated for three vessels hoteling at each facility. EPA reported that auxiliary power requirements for all large vessels while hoteling are 1000 kW. Auxiliary power is assumed to be evenly divided between steam boilers (external combustion) and diesel engines (e.g. diesel electric generators).

The reported 237 fishing vessel calls on the commercial port are representative of typical usage. Fishing vessel in-transit emissions are estimated based on one vessel in transit. From survey data EPA calculated the average engine size for fishing vessels as 1,106 horse power (HP) with estimated engine power level of 20% to 40% for maneuvering and slow cruise. 40% power level is conservatively used for fishing vessel emission calculations. There are no hoteling emissions from small fishing vessels.

Various fuels are used in the Oceana marine trade. Current fuels sold in the area include:

- Intermediate Fuel Oil (IFO), 3.5% sulfur content
- Marine Diesel Oil (MDO), 2% sulfur content
- Marine Gas Oil (MGO), 1.5% sulfur content

It is assumed all large vessels use IFO for the prime mover engines and MDO for auxiliary power (generators and smaller boilers). Fishing vessels are assumed to use MDO.

The attached spreadsheet presents the calculated emissions. The top portion of the sheet presents conversion factors and assumptions regarding the vessels and usage. Key conservative assumptions for the one-hour maximum emission rates include first that two large vessels will be at maneuvering speed simultaneously in the port for two hours per day (i.e. two simultaneous arrivals and two simultaneous departures from port daily). Second, a single fishing vessel, operating at higher low cruise speed than the large vessels, will also be operating simultaneously at a conservatively high power level. Finally, it is conservatively assumed that three large vessels are hoteling at the docks while the other vessels are maneuvering. This results in the conservative maximum estimated hourly SO_2 emission rate of 224 lb/hour.

The annual emissions assume five hundred (500) large vessel calls at both the Port of Guam and the Navy Base each year. Two hundred thirty-seven (237) fishing vessel calls are included, based on the 2015 Port of Guam data. One thousand five hundred large vessel hoteling days per

year are assumed (essentially three-days in port on average for each large vessel). This result is the conservatively estimated annual average SO_2 emission rate of 339 tons per year.

Given the differences in plume heights and the dispersed nature of the vessel emissions, it is unlikely that the vessel emissions contribute a large fraction to the observed or predicted GPA SO_2 impacts on Guam.

Maritime Sulfur Dioxide Emissions

Port of Guam and Naval Base Guam

Conversion factors								
						Hr/Day*	Vessel Days/Year	
1	kW	=	3412	Btu/hr	Large Vessel Maneuver	2	500	(Port of Guam and Naval Base)
1	hp	=	2544.4	Btu/hr	Large Vessel Aux	2	500	(Port of Guam and Naval Base)
	Sulfur MW	=	32		Small Vessel Maneuver	2	237	(Port of Guam only)
	SO2 MW	=	64		Large Vessel Hotel	24	1500	(Port of Guam and Naval Base)
	Density fuel oil	=	7.05	lb/gal				
	Heat value fuel oil	=	140,000	Btu/gal	*Assume each vessel per call maneuvers/aux power for one hour coming in to port, and one hour leaving port			
	S% IFO	=	3.5	%				
	S% MDO	=	2.0	%				
In-port engine % large vessels		=	20.0	%				
In-port engine % small vessels		=	40.0	%				
Aux / Hoteling engine efficiency		=	40.0	%				

Find: **Hourly SO2 emissions**

Large Vessel Maneuver - Short Term Avg

SO2 lb/hr = fuel (gal/hr) * fuel density (lb/gal) * % engine in-port * %S IFO* (MW SO2 / MW S)

SO2 lb/hr = 37.21

Large Vessel Maneuver - Short Term Max

SO2 lb/hr = fuel (gal/hr) * fuel density (lb/gal) * % engine in-port * %S IFO* (MW SO2 / MW S)

SO2 lb/hr = 92.48

Large Vessel Aux Power

SO2 lb/hr = power (kW) * BTU/hr/KW * (1/fuel oil heat value (btu/gal)* fuel density (lb/gal) * (1/engine efficiency) * %S MDO* (MW SO2 / MW S)

SO2 lb/hr = 21.48

Small Vessel Maneuver

SO2 lb/hr = power (hp) * BTU/hr/hp * (1/fuel oil heat value (btu/gal))* fuel density (lb/gal) * % engine in port * %S MDO* (MW SO2 / MW S)

SO2 lb/hr = 2.27

Large Vessel Hoteling

SO2 lb/hr = power (kW) * BTU/hr/KW * (1/fuel oil heat value (btu/gal)* fuel density (lb/gal) * (1/engine efficiency) * %S MDO* (MW SO2 / MW S)

SO2 lb/hr = 17.18

Total S02 emissions in lb/hour are conservatively estimated assuming: 2 large vessels maneuvering (one large vessel avg, one large vessel max, both vessels on aux power) and 3 large vessels hoteling.

Total SO2 emissions; lb/hr

SO2 lb/hr = 224.19

Find: **Annual SO2 emissions**

Large Vessel Maneuver - Long Term Avg

SO2 TPY = SO2 (lb/hr) * hours per day * vessel days/year * (ton/2000 lbs)

SO2 TPY = 18.60

Large Vessel Aux Power

SO2 TPY = SO2 (lb/hr) * hours per day * vessel days/year * (ton/2000 lbs)

SO2 TPY = 10.74

Small Vessel Maneuver

SO2 TPY = SO2 (lb/hr) * hours per day * vessel days/year * (ton/2000 lbs)

SO2 TPY = 0.54

Large Vessel Hoteling

SO2 TPY = SO2 (lb/hr) * hours per day * vessel days/year * (ton/2000 lbs)

SO2 TPY = 309.27

Total SO2 emissions; TPY

SO2 TPY = 339.15

ATTACHMENT B

GUAM ONE-HOUR SULFUR DIOXIDE BACKGROUND CONCENTRATIONS

Attachment B

Guam One-Hour Sulfur Dioxide Background Concentrations

On August 18 Carol Bohnenkamp and Gwen Yoshimura from US EPA made the following comment regarding the sulfur dioxide (SO_2) modeling protocol:

> Ambient air monitoring: Although there may be are a number of hours with values of zero, the data in Appendix D. shows that there are high short term (3 hour) values that were measured at some of the monitoring site. Since the standard looks at 1-hour concentrations, specifically the 99th percentile of 1-hour daily maximum concentrations averaged over 3 years, the analysis should discuss the appropriate background for 1 hour maximum concentrations (99th percentile per year).

The purpose of including background concentrations in the modeling analyses is to include concentrations attributable to small and unaccounted for emission sources, not large permitted sources whose emissions are known and can be explicitly accounted for in the modeling inventory.

The SO_2 monitors with data reported in the Ambient Air Quality Monitoring Network, Annual Data Report for October 1999-September 2000 were sited to measure impacts from existing power plants during the period of report. Figure 1 shows the locations of the existing power generating facilities, contemporary meteorological sites reporting hourly wind data and the SO_2 monitoring stations included and referenced in this report. The raw 99th percentile concentrations reported by these monitors likely represents periods of direct plume impacts from permitted sources, rather than true background concentrations. Use of monitoring data representing direct plume impacts would result in "double counting" the concentrations predicted in the dispersion modeling (i.e. adding the monitored plume impact to the modeled plume impact from the same source). EPA recognizes this possibility and in the "Guideline on Air Quality Models" Section 8.2.2 (2005) recommends using data at monitors not in the area of impact by the modeled sources. To accomplish this, EPA recommends identifying periods when the monitor is inside a 90° downwind sector from sources and eliminating those periods from the background assessment.

The SO_2 monitoring stations were selected based on their proximity to the GPA sources and their elevations. The Dededo monitor is the closest monitor to Tanguisson, Macheche, Dededo and Marbo Annex generating units and all lie in the relatively flat northern portion of the island.

The Orote Point monitor is closer to the Cabras, Piti/Temes, Tenjo Vista. These units are also close to the Nimitz Hill monitor, along with the Manenggon units. Orote generating units and Orote Point is near sea-level while the Nimitz Hill monitor is on high terrain, thus covering a range of possible plume heights in the more mountainous southern part of the island. The Apra Heights and Piti Mayor's Office monitoring sites were considered, but the 99th percentile SO_2 concentrations at these sites were already quite low (26 $\mu g/m^3$ and 34 $\mu g/m^3$, respectively) and thus likely did not experience direct plume impact and were of less concern.

Hourly meteorological data for the monitoring period were available from the Guam International Airport (GUM) and from the Anderson Air Force Base. Wind direction data for the monitoring period were downloaded from the National Centers for Environmental Information website (https://gis.ncdc.noaa.gov/maps/ncei/cdo/hourly). GUM hourly and special observations were used to characterize the wind direction for all generating stations except Marbo Annex. The Anderson Air Force Base hourly wind direction data were used to characterize the Marbo Annex generating station site because the Anderson Air Force base meteorological site is closer to the Marbo Annex generating station and more representative than GUM for the Marbo station and elevation. Wind direction data capture for the two meteorological monitoring sites is presented in Tables 1 and 2 below. Quarterly data capture rates exceed EPA data capture requirements.

Table 1: Guam International Airport (GUM) wind direction data capture

Quarter	Good Wind Direction Observations	Capture Rate
Y1999Q4	1872	85%
Y2000Q1	2078	95%
Y2000Q2	2058	94%
Y2000Q3	1806	82%

Table 2: Anderson Air Force Base wind direction data capture

Quarter	Good Wind Direction Observations	Capture Rate
Y1999Q4	2036	92%
Y2000Q1	2100	96%
Y2000Q2	2061	94%
Y2000Q3	1926	87%

Figure 1: Electric generating facilities and meteorological and SO_2 monitoring stations circa 1999-2000

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Figure 2 shows the straight-line wind direction from each generating unit to the Dededo monitoring station and Table 3 shows the range of wind directions for which the monitor readings are downwind (per EPA Guideline characterization) of each station and thus excluded from the background determination. Likewise, Figure 3 shows the direction from each generating unit to the Orote Point monitoring station and Table 4 shows the range of wind directions for which the monitor readings are downwind of each station and thus excluded from the background determination. Finally, Figure 4 shows the direction from each generating unit to the Nimitz Hill monitoring station and Table 5 shows the range of wind directions for which the monitor readings are downwind of each station and thus excluded from the background determination.

The monitoring data were subsequently processed to remove hourly observations when each station was in the 90 degree downwind sector from the generating units as shown in Tables 3 through 5. The 99th percentile of the resulting maximum daily one-hour values are presented in Table 6.

Table 6: 99th percentile of the daily maximum one-hour observed SO_2 concentrations with downwind hours censored per EPA guidance

Station	SO_2 ppb	SO_2 µg/m^3
Dededo	8	21
Orote Point	20	52
Nimitz Hill	11	29

Note that the 99th percentile concentrations at the Dededo and Nimitz Hill monitoring stations with the downwind sector hours removed are similar in magnitude to the 99th percentile concentrations at Apra Heights (26 µg/m^3) and the Piti Mayor's Office (34 µg/m^3), monitors that are less frequently impacted by direct power plant plumes. For modeling purposes, Dededo is the recommended background monitoring station for sources in the northern portion of the island and Nimitz Hill is the recommended background station for the southern portion of the island. Orote Point monitor is likely impacted by vessel traffic in the port, and if vessels are included in the emission inventory, the Orote Point observations will "double count" the port's maritime emissions.

Figure 2: Dededo SO_2 monitor and downwind direction from each generating unit

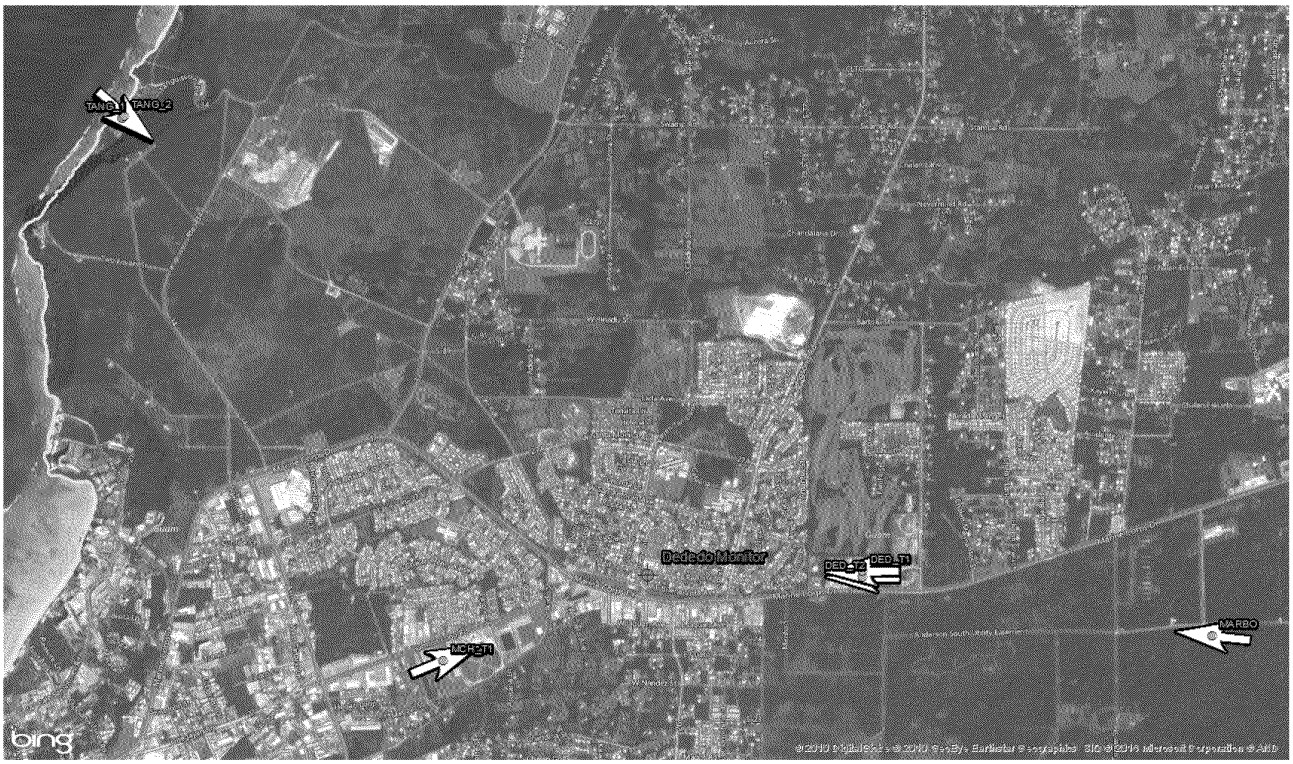

Table 3: 90 degree downwind sectors for generating units near Dededo SO_2 monitoring station

DEDEDO MONITOR

Source Name	Source Group ID	X	Y	Met Dir	90° Sector Low	90° Sector High
MARBO	MARBO	269704.1	1494811	96.2	51.2	141.2
DED_T2	DEDEDO	267470.3	1495188	90.5	45.5	135.5
DED_T1		267471.3	1495227	88.9	43.9	133.9
MCH_T1	MACHECHE	264790.78	1494651.47	247.3	202.3	292.3
TANG_1	TANG	262737.8	1498125	311.0	266.0	356.0
TANG_2		262748.7	1498137	311.2	266.2	356.2
Dededo Monitor		266100	1495200	-	-	-

Figure 3: Orote Point SO_2 monitor and downwind direction from each generating unit

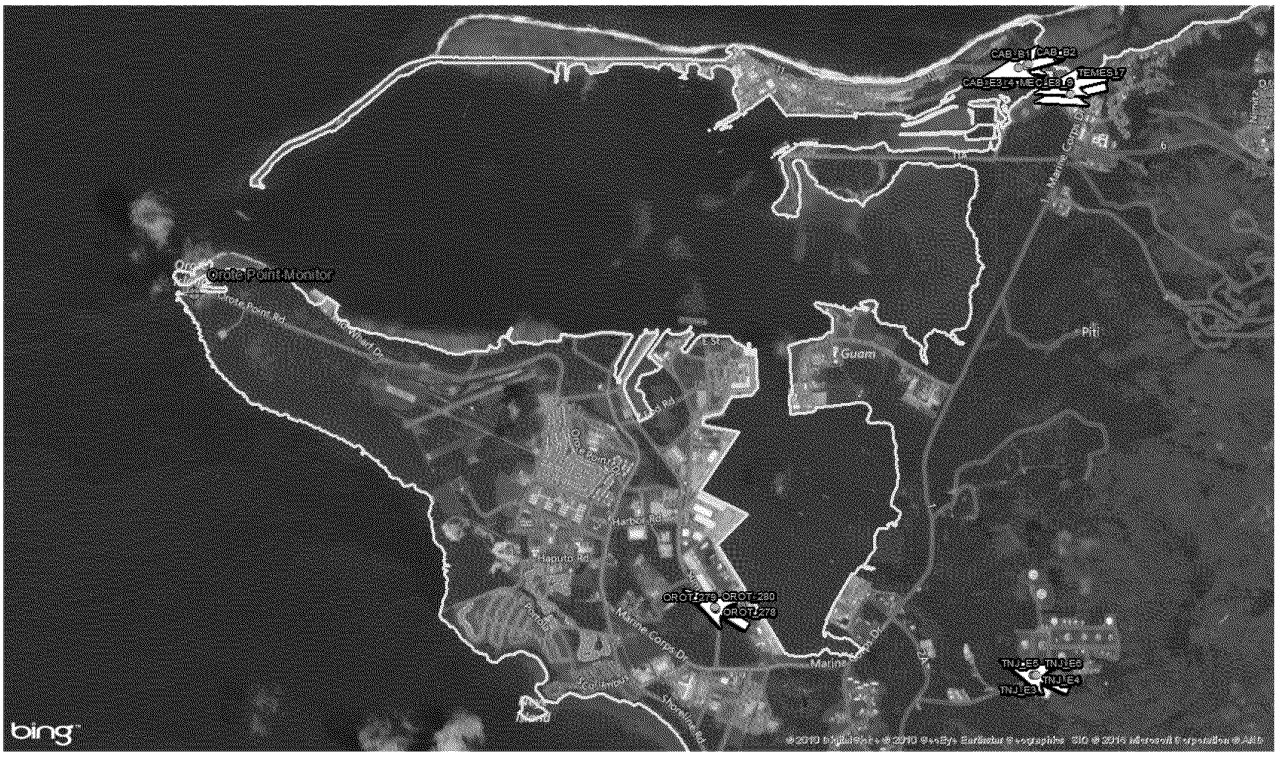

Table 4: 90 degree downwind sectors for generating units near Orote Point SO_2 monitoring station

Orote Point						
Source Name	Source Group ID	X	Y	Met Dir	90° Sector Low	90° Sector High
CAB_B1	CABRAS	249454.6	1489682.1	74.7	30	120
CAB_B2		249479.2	1489697.18	74.6	30	120
CAB_E3_4		249395.07	1489668.61	74.7	30	120
TEMES_7	PITI	249838.8	1489522	76.6	32	122
MEC_E8_9		249840.4	1489439	77.2	32	122
OROT_278	OROTE	246785	1484999	121.2	76	166
OROT_279		246780.4	1485006	121.1	76	166
OROT_280		246774.9	1485015	121.1	76	166
TNJ_E1_2	TENJO	249518.1	1484427.08	114.5	69	159
TNJ_E3		249526.37	1484427.08	114.5	69	159
TNJ_E4		249532.22	1484427.08	114.5	69	159
TNJ_E5		249535.96	1484426.98	114.4	69	159
TNJ_E6		249544.02	1484426.98	114.4	69	159
Orote Point Monitor		242290.2	1487720	-	-	-

Figure 4: Nimitz Hill SO_2 monitor and downwind direction from each generating unit

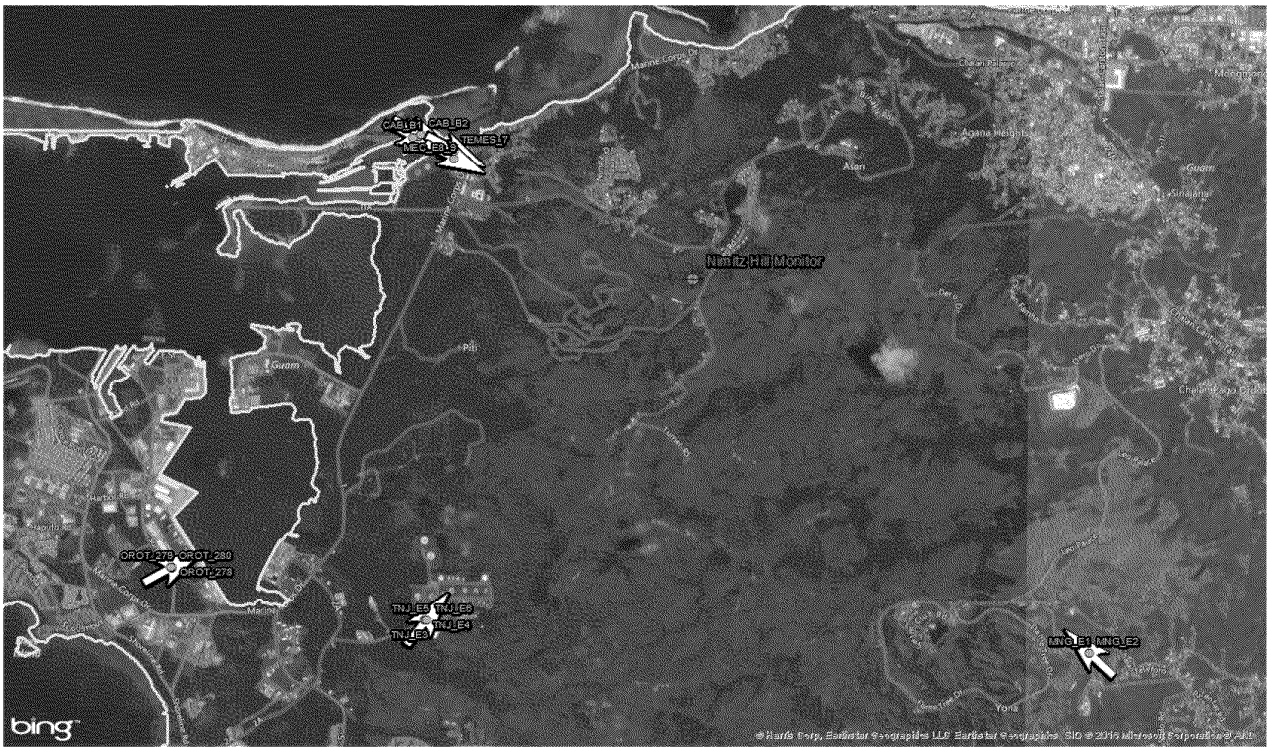

Table 5: 90 degree downwind sectors for generating units near Nimitz Hill SO_2 monitoring station

Nimitz Hill						
Source Name	Source Group ID	X	Y	Met Dir	90° Sector Low	90° Sector High
CAB_B1	CABRAS	249454.6	1489682.1	297.5	253	343
CAB_B2		249479.2	1489697.18	297.9	253	343
CAB_E3_4		249395.07	1489668.61	296.8	252	342
TEMES_7	PITI	249838.8	1489522	298.2	253	343
MEC_E8_9		249840.4	1489439	296.8	252	342
MNG_E1	MANENGGON	256726.42	1484071.87	133.4	88	178
MNG_E2		256727.96	1484065.81	133.4	88	178
OROT_278	OROTE	246785	1484999	241.0	196	286
OROT_279		246780.4	1485006	241.1	196	286
OROT_280		246774.9	1485015	241.2	196	286
TNJ_E1_2	TENJO	249518.1	1484427.08	218.2	173	263
TNJ_E3		249526.37	1484427.08	218.2	173	263
TNJ_E4		249532.22	1484427.08	218.1	173	263
TNJ_E5		249535.96	1484426.98	218.1	173	263
TNJ_E6		249544.02	1484426.98	218.0	173	263
Nimitz Hill Monitor		252435.6	1488130	-	-	-

To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]
Cc: R9SF-Room-18220-6-Reno-Sparks[R9SF-Room-18220-6-Reno-Sparks@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Wehling, Jefferson[Wehling.Jefferson@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Mann, Michael[Mann.Michael@epa.gov]; Maurin, Lawrence[Maurin.Lawrence@epa.gov]; R9SF-ConferenceLine-AIR-Card2[R9SF-ConferenceLine-AIR-Card2@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]; Lee, Anita[Lee.Anita@epa.gov]
From: Viswanathan, Krishna
Sent: Thur 10/13/2016 3:25:13 PM
Subject: RE: Discussion of Modeling Protocol for Tanguisson - SO2 DRR

Hello Roland,

Both your proposed approaches look reasonable to us. Please proceed with the modeling. When you have completed the estimation of shipping emissions and monitoring data per approach below, please share those with us.

In another staffing change, Anita Lee of our office will be taking on my role starting next week.

Please let me know if you have questions

Thanks,

Krishna

Krishna Viswanathan

520.999.7880

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Tuesday, October 11, 2016 8:55 PM
To: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Cc: R9SF-Room-18220-6-Reno-Sparks <R9SF-Room-18220-6-Reno-Sparks@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Wehling, Jefferson <Wehling.Jefferson@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Mann, Michael <Mann.Michael@epa.gov>; Maurin, Lawrence <Maurin.Lawrence@epa.gov>; R9SF-

ConferenceLine-AIR-Card2 <R9SF-ConferenceLine-AIR-Card2@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>
Subject: RE: Discussion of Modeling Protocol for Tanguisson - SO2 DRR

This is the reponse we received from the contractor:

In response to the last two comments:

Item #1, Shipping Emissions – this will be addressed by analyzing the tonnage that goes through the Port. The tonnage can be used to estimate the emissions from shipping. We have the tonnage report for the past 3 years.

Item#2, Monitoring – TRC will make the adjustments to use the 99th percentile per year for the 1-hour maximum concentrations.

Please advise if the responses are sufficient.

Sincerely,

On 6 Oct 2016 12:39 a.m., "Viswanathan, Krishna" <Viswanathan.Krishna@epa.gov> wrote:

Thanks Gwen.

That is my recollection also. In response to a question from you on whether you should go ahead and start the modeling, we mentioned our preference that you get back to us quickly on how you would address our comments before starting the modeling.

Please do let us know if this is not what you heard or if you have further questions.

Thanks,

Krishna

Krishna Viswanathan

520.999.7880

From: YOSHIMURA, GWEN
Sent: Tuesday, October 4, 2016 9:56 AM
To: Roland Gutierrez <roland.gutierrez@epa.guam.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; R9SF-Room-18220-6-Reno-Sparks <R9SF-Room-18220-6-Reno-Sparks@epa.gov>; R9SF-ConferenceLine-AIR-Card2 <R9SF-ConferenceLine-AIR-Card2@epa.gov>; Wehling, Jefferson <Wehling.Jefferson@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>; Maurin, Lawrence <Maurin.Lawrence@epa.gov>; Mann, Michael <Mann.Michael@epa.gov>
Subject: RE: Discussion of Modeling Protocol for Tanguisson - SO2 DRR

Hi Roland,

I do not think you should be waiting on us. By the end of the call, GPA said they would work to address our comments and follow up with us if questions arise or if they run into issues. Some of the points we made on the call:

1. Shipping emissions. Our original comment remains unaddressed. [Shipping emissions: As discussed in the protocol, the allowable sulfur content in fuel may not be reduced if fuels are not reasonable available. Therefore, the background concentration should account for the effect of shipping emissions.] The document provided says that ships' emissions are subject to a rule which will reduce allowable sulfur in fuel content in 2020, if such fuels become reasonably available. The SO2 modeling being done is for current emissions, therefore, we are looking for a reasonable estimate or range of concentrations attributable to current shipping emissions.

2. Monitoring. Our original comment remains unaddressed. [Ambient air monitoring: Although there may be are a number of hours with values of zero, the data in Appendix D. shows that there are high short term (3 hour) values that were measured at some of the monitoring site. Since the standard looks at 1-hour concentrations, specifically the 99th percentile of 1-hour daily maximum concentrations averaged over 3 years, the analysis should discuss the appropriate background for 1 hour maximum concentrations (99th percentile per year).] The documentation sent discussed satellite and aircraft measurements, which is interesting additional information but does not address the specific

request. We also note that the satellite section concludes with the statement that "satellite estimates are less reliable than the direct observations reported for the other measurement approaches…", and that the aircraft measurements were conducted in March/April 2001.

Again, as previously stated, because the form of the standard is a 1-hour daily maximum concentration averaged over 3 years, we are interested in what concentrations you'd see as a 99th percentile 1-hour daily maximum concentration. We ask that you take your monitoring data, and calculate what the 99th percentile of the 1-hour maximum concentrations per year are.

Carol did say that she would check with other EPA regions and see if they have examples of shipping emission estimates, but she also indicated she had already done so and had not received any responses. So we recommend that you do not wait on that, but instead move forward with addressing our comments as you can, and let us know if you run into issues. And you should submit any revised discussions to us when they become available. This is where things were left at the end of the call, to my recollection.

-Gwen

Gwen M. Yoshimura
Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Monday, October 03, 2016 8:55 PM
To: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; R9SF-Room-18220-6-Reno-Sparks <R9SF-Room-18220-6-Reno-Sparks@epa.gov>; R9SF-ConferenceLine-AIR-Card2 <R9SF-ConferenceLine-AIR-Card2@epa.gov>; Wehling, Jefferson <Wehling.Jefferson@epa.gov>; Conchita Taitano

<conchita.taitano@epa.guam.gov>; Maurin, Lawrence <Maurin.Lawrence@epa.gov>; Mann, Michael <Mann.Michael@epa.gov>
Subject: Re: Discussion of Modeling Protocol for Tanguisson - SO2 DRR

Alcon,

Just to follow up on the conference call. Please advise the next steps. As per the call, USEPA was going to provide further guidance on what we needed to submit to finalize the the modeling protocol and begin the modeling. I think it would be best to email us written guidance so that we may adequately inform the consultant who will be doing the modeling.

Please advise soonest as we are in October and we have barely 3 months to complete.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

epa.guam.gov - facebook.com/Guam EPA - twitter.com/GuamEPA

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On Wed, Sep 21, 2016 at 9:52 AM, Viswanathan, Krishna <Viswanathan.Krishna@epa.gov> wrote:

Call In Number: 1-866-299-3188

Code: Ex. 6 - Personal Privacy

Agenda

Introductions

Review of Protocol Issues and EPA Review

Methods to address EPA comments on issue #2

Next Steps

Email Excerpt:**********

Please advise if the response to these comments are sufficient.

1. Section 5: Please clarify how Guam EPA/EPA will be notified of re-located receptors, and whether an explanation of the reasons for relocation (characteristics of the locations, etc) will be included.

In response to item #1: We are not proposing to relocate receptors that, according to the EPA guidance, would not be practical locations for monitor placement. Those receptors will continue to be evaluated for potential site access, and if it is determined that safe and practical access to those locations cannot be achieved, we will add receptors to the nearest points where access is possible. all receptors in the modeling analyses that are judged to be non-representative for potential monitor locations will be clearly identified by UTM coordinates and on topographical maps, showing the original and relocated receptor position. The criteria relied upon to relocate each receptor will be documented in a memorandum and submitted to GEPA and USEPA for review and concurrence before the final modeling analyses and design concentration is determined.

2. Section 7: We have reviewed Section 7: Background Concentrations and Appendix D. and we continue to have concerns about the supporting information that was provided in the protocol.

- Shipping emissions: As discussed in the protocol, the allowable sulfur content in fuel may not be reduced if fuels are not reasonable available. Therefore, the background concentration should account for the effect of shipping emissions.

- Ambient air monitoring: Although there may be are a number of hours with values of zero, the data in Appendix D. shows that there are high short term (3 hour) values that were measured at some of the monitoring site. Since the standard looks at 1-hour concentrations, specifically the 99th percentile of 1-hour daily maximum concentrations averaged over 3 years, the analysis should discuss the appropriate background for 1 hour maximum concentrations (99th percentile per year).

In Response to item #2: Please see attached excerpt from a draft report on "Assessment of background air quality concentration on Guam". Section 2.0 elaborates in more detail sulfur dioxide Background Concentrations.

To: Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
Cc: Mebust, Anna[Mebust.Anna@epa.gov]; gsweiger@arb.ca.gov[gsweiger@arb.ca.gov]; estevenson@baaqmd.gov[estevenson@baaqmd.gov]; Lee, Anita[Lee.Anita@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]
From: Katherine Hoag
Sent: Wed 10/5/2016 8:18:28 PM
Subject: RE: Additional information supporting SO2 DRR approach
BAAQMD-SO2DRR-ModelProtocol-SourceParam_20101003.pdf

Hi Carol –

Attached is the modeling protocol and source parameter data you asked for when we talked last Wednesday. Let me know if anything else is needed to support the summary document sent on 10/29.

Thanks again!

Kate

Katherine Hoag, Ph.D.

QA Officer / Principal Air Quality Engineer

Bay Area Air Quality Management District

375 Beale Street, Suite 600 | San Francisco, CA 94105

(415) 749-4619

khoag@baaqmd.gov

From: Katherine Hoag
Sent: Tuesday, October 4, 2016 1:55 PM
To: Eric Stevenson <EStevenson@baaqmd.gov>; 'YOSHIMURA, GWEN' <Yoshimura.Gwen@epa.gov>; 'Lee, Anita' <Lee.Anita@epa.gov>

Cc: 'Bohnenkamp, Carol' <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; 'gsweiger@arb.ca.gov' <gsweiger@arb.ca.gov>
Subject: RE: Additional information supporting SO2 DRR approach

Also – more out of curiosity…does it matter too much if it is PTE or actuals if we are looking at normalized results of the model? It seemed to me that the normalized distribution of Cmax would probably look pretty similar – if not the same. I can see that it would matter if the modeling results were used to predict that the actual ambient concentrations were going to be below a certain level, but maybe I'm missing something??

Katherine Hoag, Ph.D.

QA Officer / Principal Air Quality Engineer

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khoag@baaqmd.gov

From: Katherine Hoag
Sent: Tuesday, October 4, 2016 1:52 PM
To: Eric Stevenson <EStevenson@baaqmd.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; gsweiger@arb.ca.gov
Subject: RE: Additional information supporting SO2 DRR approach

Hi guys –

I got the modeling protocol from our engineering staff and am going through it today before forwarding to you – I should get that to you by tomorrow at the latest. But I did want to catch

this one thing first – the SO_2 emission values are 1-hour max PTE values for 30 emission sources, determined in 2010. The info I will send has this description as well as an excel file that has the actual numbers.

Kate

Katherine Hoag, Ph.D.

QA Officer / Principal Air Quality Engineer

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khoag@baaqmd.gov

From: Eric Stevenson
Sent: Tuesday, October 4, 2016 12:07 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Katherine Hoag <khoag@baaqmd.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; gsweiger@arb.ca.gov
Subject: RE: Additional information supporting SO2 DRR approach

Gwen –

They are based on submitted rates on which fees are based (actual use).

Eric

From: YOSHIMURA, GWEN [mailto:Yoshimura.Gwen@epa.gov]
Sent: Tuesday, October 4, 2016 11:01 AM
To: Katherine Hoag <khoag@baaqmd.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; Eric Stevenson <EStevenson@baaqmd.gov>; gsweiger@arb.ca.gov
Subject: RE: Additional information supporting SO2 DRR approach

Thanks Kate!

Carol is out till the 12th, but I wanted to ask: the document says "SO2 emission rates used in the model were considered to be maximum values." Do you know where the emission rates came from? i.e. are they based on actuals from particular year(s), are they based on permitted PTE, etc? There's been a lot of focus on what emissions folks use, so that'll be good for us to know.

Thanks!

-Gwen

Gwen M. Yoshimura
Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
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Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Katherine Hoag [mailto:khoag@baaqmd.gov]
Sent: Thursday, September 29, 2016 4:30 PM
To: Lee, Anita <Lee.Anita@epa.gov>

Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Mebust, Anna <Mebust.Anna@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; estevenson@baaqmd.gov; gsweiger@arb.ca.gov
Subject: Additional information supporting SO2 DRR approach

Hi Anita -

The attached cover letter and supplemental information supporting our decision that the Air District will be complying with the monitoring approach of the SO_2 DRR using existing SO_2 monitoring at Martinez. The hard copy of these documents have been mailed. This document is also on our website for public comment until October 31 (http://www.baaqmd.gov/research-and-data/air-quality-measurement/ambient-air-monitoring-network).

Let me know if you have any questions!

Kate

Katherine Hoag, Ph.D.

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Bay Area Air Quality Management District

375 Beale Street, Suite 600 | San Francisco, CA 94105

(415) 749-4619

khoag@baaqmd.gov

INTEROFFICE MEMORANDUM
October 3, 2016

TO: **Katherine Hoag**

FROM: **Ted Hull**

SUBJECT: **1-Hour SO2 Modeling Protocol**

I. **Introduction:** Air dispersion modeling was conducted for the Shell and Tesoro Refineries; and the Rhodia Sulfuric Acid Plant in an attempt to determine where in the Martinez area the highest 1-hour sulfur dioxide (SO2) impacts are likely to occur . Modeling was limited to the combined impacts from large stationary sources of SO2 at the three facilities. The purpose of the modeling project was to identify potential locations for a ground level monitoring system for SO2. The modeling does not attempt to establish compliance or non-compliance with any ambient air quality standard.

II. **Emissions:** Modeled SO2 emission rates were based on the maximum 1 -hour potential to emit (PTE) for each source as determined by BAAQMD in 2010In total, 30 emissions sources were included, with a combined SO2 PTE of 2,269.4 lb/hour. A list of the modeled sources including sou rce parameters and maximum hourly SO2 emissions is included as an attachment to this memo.

III. **Air Dispersion Model:** The US EPA AERMOD air dispersion model Version 15181 was used in the analysis. The model was set to use default options and does not cons ider plume depletion or any reactions that may occur in the plume that would reduce the SO2 concentration. The modeled area includes 256 square kilometers centered on UTM (580124, 4208805), with receptors arranged in a nested grid with side lengths of 4, 8, 12, and 16 kilometers and corresponding lateral spacing of 75, 100, 150, and 200 meters; for a total of 16,640 receptors. Elevations for sources, buildings, and receptors were processed w ith AERMAP Version 11103, using one third arc second (10 meter) resolution NED terrain files. All source, building, and receptor locations are referenced in UTM NAD 83 coordinates. All included emissions sources were modeled as point sources. The model was set to calculate maximum 1-hour averages.

IV. **Meteorological Data:** Three separate sets of meteorological data were considered in the evaluation: Golden Eagle Refinery (UTM: 580898, 4209689), Shell East (578680, 4207790), and Shell West (576387, 4209051). Each set includes 5 consecutive years of data (2009 - 2013) and were processed by BAAQMD meteorology staff using AERMET Version 14134. Modeled results from each set were presented for your evaluation.

V. **Presentation of Results:** Highest modeled results for each meteorological data set are presented graphically as Google Earth .KMZ files. The results are normalized on a 0 to 1 scale and display values from 0.5 to 1.0. The max value of 1.0 is set specific and is equivalent to a modeled max concentration as follows:

- Golden Eagle: 1690.0 ug/m^3 = 1.0
- Shell East: 1249.5 ug/m^3 = 1.0
- Shell West: 2827.7 ug/m^3 =1.0

Martinez Area 1-Hour SO2 Modeling
Shell, Tesoro, Rhodia
Modeled Emission Points

Source ID	Source Description	Easting	Northing	Base Elevation	Stack Height	Temperature	Exit Velocity	Stack Diameter	Emission Rate		*SO2 PTE*
		(x)	(y)	(m)	(m)	(K)	(m/s)	(m)	(g/s)		*(lb/hr)*
SHELLP11P23	Chimney 1 heaters	578055	4207832	16.62	107	622.04	5.712	5.300	18.396		*145.998*
SHELLP11P24	Chimney 2 heaters	577770	4207829	32.08	107	594.26	3.701	5.300	11.844		*93.998*
SHELLP11P25	Chimney 3 heaters and SRU 1/2	577947	4207890	22.37	107	644.26	5.380	2.900	2.520		*20.000*
SHELLP112678	COB1, COB2, COB3	577766	4207908	36.7	49.1	572.04	19.347	2.410	35.909		*284.995*
SHELLP11P176	F-104 HP2	577532	4208430	27.5	54.9	410.93	7.498	2.590	7.308		*57.999*
SHELLP11P416	F-101 HP3	578390	4208549	10.84	46	422.04	7.322	3.990	9.072		*71.999*
SHELLP11P418	SRU4	577621	4208359	25.32	46	422.04	11.372	1.190	2.268		*18.000*
SHELLP11F126	F-126 Crude Heater	578137	4207848	11.68	67.1	538.71	4.201	2.590	2.772		*22.000*
SHELLP11SRU3	SRU3	577606	4208347	27.12	46	788.71	24.224	0.610	1.008		*8.000*
SHELLP11P419	COGEN1	577850	4208034	22.98	61	422.04	8.900	3.810	2.394		*19.000*
SHELLP11COG2	COGEN2	577892	4208034	22.7	61	422.04	8.900	3.810	2.394		*19.000*
SHELLP11F102	F-102	577600	4208250	29.44	46	527.59	2.005	2.190	1.008		*8.000*
SHELLP11F128	F-128	577977	4207844	19.86	57	438.71	4.804	2.010	1.386		*11.000*
SHELLP11P400	F-13425A/B DCU Heaters	578312	4208457	15.28	75.9	422.04	3.703	3.290	0.630		*5.000*
SHELLP11P30	Boiler 4	577726	4207878	38.33	75.9	388.71	5.225	2.190	1.260		*10.000*
SHELLP11P403	HGHT	578395	4208332	14.23	45	422.04	8.732	1.600	0.145		*1.150*
SHELLP11P40	FXG Flare- treated as flare	577632	4208498	24.51	22.9	1273	20.000	6.355	0.113		*0.900*
TE914628S1	FCC and 7BH	582410	4208800	4.04	106.7	560.93	22.146	3.650	106.846		*847.986*
TE914628S10	6BH	581935	4208532	7.47	106.7	477.59	9.495	4.570	29.987		*237.996*
TE914628S14	F8	582431	4208873	3.79	40	616.48	31.730	1.520	0.769		*6.100*
TE914628S15	F9	582337	4208849	4.29	30.5	783.15	22.142	1.680	0.491		*3.900*
TE914628S18	F12	582339	4208828	4.52	24.9	713.71	13.910	1.800	0.466		*3.700*
TE914628S25	F22	582251	4208727	4.98	61	533.15	4.493	2.560	0.441		*3.500*
TE914628S28	F34 and F35	582240	4209167	2.59	22.9	755.37	8.007	4.100	1.033		*8.200*
TE914628S29	F37	582212	4209138	3.82	41.1	560.93	9.614	3.000	2.520		*20.000*
TE914628S35	F50	581314	4209479	7.46	38.4	644.26	13.122	2.100	1.512		*12.000*
TE914628S76	F53 and F54	582054	4209154	5.31	76.2	527.59	13.343	2.400	1.172		*9.300*
TE914628S87	SRU	582773	4208997	3.99	106.7	694.26	15.790	1.830	3.549		*28.170*
TE914628S140	SAP	582772	4208993	4.01	106.7	366.48	1.878	2.800	15.543		*123.358*
RHP11661P1	Sulfuric Acid Plant, Tank T-1 & T-3	577597	4209884	19.97	31.09	303.15	9.291	2.108	21.183		*168.117*
											2269.362

ED_001261_00024069

To: Katherine Hoag[khoag@baaqmd.gov]
Cc: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Lee, Anita[Lee.Anita@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Mebust, Anna[Mebust.Anna@epa.gov]; gsweiger@arb.ca.gov[gsweiger@arb.ca.gov]
From: Eric Stevenson
Sent: Tue 10/4/2016 8:53:27 PM
Subject: Re: Additional information supporting SO2 DRR approach

Thank goodness for Kate!!

Eric

Sent from my iPhone

On Oct 4, 2016, at 1:51 PM, Katherine Hoag <khoag@baaqmd.gov> wrote:

Hi guys –

I got the modeling protocol from our engineering staff and am going through it today before forwarding to you – I should get that to you by tomorrow at the latest. But I did want to catch this one thing first – the SO_2 emission values are 1-hour max PTE values for 30 emission sources, determined in 2010. The info I will send has this description as well as an excel file that has the actual numbers.

Kate

Katherine Hoag, Ph.D.

QA Officer / Principal Air Quality Engineer

Bay Area Air Quality Management District

375 Beale Street, Suite 600 | San Francisco, CA 94105

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khoag@baaqmd.gov

From: Eric Stevenson
Sent: Tuesday, October 4, 2016 12:07 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Katherine Hoag <khoag@baaqmd.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; gsweiger@arb.ca.gov
Subject: RE: Additional information supporting SO2 DRR approach

Gwen –

They are based on submitted rates on which fees are based (actual use).

Eric

From: YOSHIMURA, GWEN [mailto:Yoshimura.Gwen@epa.gov]
Sent: Tuesday, October 4, 2016 11:01 AM
To: Katherine Hoag <khoag@baaqmd.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; Eric Stevenson <EStevenson@baaqmd.gov>; gsweiger@arb.ca.gov
Subject: RE: Additional information supporting SO2 DRR approach

Thanks Kate!

Carol is out till the 12th, but I wanted to ask: the document says "SO2 emission rates used in the model were considered to be maximum values." Do you know where the emission rates came from? i.e. are they based on actuals from particular year(s), are they based on permitted PTE, etc? There's been a lot of focus on what emissions folks use, so that'll be good for us to know.

Thanks!

-Gwen

Gwen M. Yoshimura
Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Katherine Hoag [mailto:khoag@baaqmd.gov]
Sent: Thursday, September 29, 2016 4:30 PM
To: Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Mebust, Anna <Mebust.Anna@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; estevenson@baaqmd.gov; gsweiger@arb.ca.gov
Subject: Additional information supporting SO2 DRR approach

Hi Anita -

The attached cover letter and supplemental information supporting our decision that the Air District will be complying with the monitoring approach of the SO_2 DRR using existing SO_2 monitoring at Martinez. The hard copy of these documents have been mailed. This document is also on our website for public comment until October 31 (http://www.baaqmd.gov/research-and-data/air-quality-measurement/ambient-air-monitoring-network).

Let me know if you have any questions!

Kate

Katherine Hoag, Ph.D.

QA Officer / Principal Air Quality Engineer

Bay Area Air Quality Management District

375 Beale Street, Suite 600 | San Francisco, CA 94105

(415) 749-4619

khoag@baaqmd.gov

To: estevenson@baaqmd.gov[estevenson@baaqmd.gov]; Katherine Hoag[khoag@baaqmd.gov]; Lee, Anita[Lee.Anita@epa.gov]
Cc: Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Mebust, Anna[Mebust.Anna@epa.gov]; gsweiger@arb.ca.gov[gsweiger@arb.ca.gov]
From: YOSHIMURA, GWEN
Sent: Tue 10/4/2016 7:42:42 PM
Subject: RE: Additional information supporting SO2 DRR approach

Ah! Great, thanks!!

Gwen M. Yoshimura
Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Eric Stevenson [mailto:EStevenson@baaqmd.gov]
Sent: Tuesday, October 04, 2016 12:07 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Katherine Hoag <khoag@baaqmd.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Mebust, Anna <Mebust.Anna@epa.gov>; gsweiger@arb.ca.gov
Subject: RE: Additional information supporting SO2 DRR approach

Gwen –

They are based on submitted rates on which fees are based (actual use).

Eric

From: YOSHIMURA, GWEN [mailto:Yoshimura.Gwen@epa.gov]
Sent: Tuesday, October 4, 2016 11:01 AM
To: Katherine Hoag <khoag@baaqmd.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Anna Mebust <mebust.anna@epa.gov>; Eric Stevenson <EStevenson@baaqmd.gov>; gsweiger@arb.ca.gov
Subject: RE: Additional information supporting SO2 DRR approach

Thanks Kate!

Carol is out till the 12th, but I wanted to ask: the document says "SO2 emission rates used in the model were considered to be maximum values." Do you know where the emission rates came from? i.e. are they based on actuals from particular year(s), are they based on permitted PTE, etc? There's been a lot of focus on what emissions folks use, so that'll be good for us to know.

Thanks!

-Gwen

Gwen M. Yoshimura
Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
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khoag@baaqmd.gov

To: Viswanathan, Krishna[Viswanathan.Krishna@epa.gov]
Cc: Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; R9SF-Room-18220-6-Reno-Sparks[R9SF-Room-18220-6-Reno-Sparks@epa.gov]; R9SF-ConferenceLine-AIR-Card2[R9SF-ConferenceLine-AIR-Card2@epa.gov]; Wehling, Jefferson[Wehling.Jefferson@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]; Maurin, Lawrence[Maurin.Lawrence@epa.gov]; Mann, Michael[Mann.Michael@epa.gov]
From: Roland Gutierrez
Sent: Tue 10/4/2016 3:54:59 AM
Subject: Re: Discussion of Modeling Protocol for Tanguisson - SO2 DRR

Alcon,
Just to follow up on the conference call. Please advise the next steps. As per the call, USEPA was going to provide further guidance on what we needed to submit to finalize the the modeling protocol and begin the modeling. I think it would be best to email us written guidance so that we may adequately inform the consultant who will be doing the modeling.

Please advise soonest as we are in October and we have barely 3 months to complete.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531
epa.guam.gov - facebook.com/Guam EPA - twitter.com/GuamEPA

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On Wed, Sep 21, 2016 at 9:52 AM, Viswanathan, Krishna <Viswanathan.Krishna@epa.gov> wrote:

Call In Number: 1-866-299-3188

Code: Ex. 6 - Personal Privacy

Agenda

Introductions

Review of Protocol Issues and EPA Review

Methods to address EPA comments on issue #2

Next Steps

Email Excerpt:**********

Please advise if the response to these comments are sufficient.

1. Section 5: Please clarify how Guam EPA/EPA will be notified of re-located receptors, and whether an explanation of the reasons for relocation (characteristics of the locations, etc) will be included.

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- Shipping emissions: As discussed in the protocol, the allowable sulfur content in fuel may not be reduced if fuels are not reasonable available. Therefore, the background concentration should account for the effect of shipping emissions.

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concentrations (99th percentile per year).

In Response to item #2: Please see attached excerpt from a draft report on "Assessment of background air quality concentration on Guam". Section 2.0 elaborates in more detail sulfur dioxide Background Concentrations.

From: Viswanathan, Krishna
Location: R9SF-Room-18220-6-Reno-Sparks <R9SF-Room-18220-6-Reno-Sparks@epa.gov>; R9SF-ConferenceLine-AIR-Card2 <R9SF-ConferenceLine-AIR-Card2@epa.gov>
Importance: Normal
Subject: Discussion of Modeling Protocol for Tanguisson - SO2 DRR
Start Date/Time: Mon 9/26/2016 10:00:00 PM
End Date/Time: Mon 9/26/2016 11:00:00 PM
Excerpt (Background Air Quality Concentrations for Guam).pdf

Call In Number: 1-866-299-3188

Code: Ex. 6 - Personal Privacy

Agenda

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In Response to item #2: Please see attached excerpt from a draft report on "Assessment of background air quality concentration on Guam". Section 2.0 elaborates in more detail sulfur dioxide Background Concentrations.

1.0 INTRODUCTION

The air quality concentrations on Guam are dominated by emissions from on-island permitted sources as contributions from off-island sources are small. Guam is located at about 13 degrees north latitude in the western North Pacific tropical trade wind belt with prevailing northeast to east-southeast winds (see Figure 1). Winds from other directions occur infrequently and for short durations, generally during passing storms, and thus there is little if any influence from Asiatic emission sources (e.g. China, Japan, Philippines) on background concentrations. Upwind (eastward) from Guam the Pacific is sparsely populated for over 1,000 miles and thus background concentrations attributable to off-island sources are expected to be low.

There is little air quality monitoring data available on Guam or in the western Pacific within the trade wind belt. Nonetheless, some historical monitoring data on Guam are available and are included in this analysis. In addition, satellite remote sensing data are available for the region as well as ship-borne and aircraft observations of pollutant concentrations as reported in the technical literature. This report reviews the available information for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter less than or equal to 10 microns in diameter (PM_{10}) and particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$) and provides recommendations for background concentrations.

2.0 SULFUR DIOXIDE

2.1 Ocean Measurements

As noted above and shown in Figure 1, Guam lies in the easterly trade wind zone and there are no major stationary upwind SO_2 sources for hundreds of miles. Due to its isolated location, the background SO_2 concentrations are likely to be near the global SO_2 background concentration. The most significant source of SO_2 from the oceans is the oxidation of dimethylsulfide[1]. EPA has found that the Pacific Ocean SO_2 background concentrations may be on the order of 0.025 ppb, or 0.065 $\mu g/m^3$ [2], an insignificant contribution. Further, ships' emissions are subject to the International Maritime Organization's (IMO) Prevention of Pollution from ships (*MARPOL*) Annex VI, which reduces allowable sulfur in fuel content from 4.5% to 0.5% (if such fuels become reasonably available) in 2020. The EPA and Coast Guard have adopted MARPOL requirements

[1] Barnes, I (editor), Global Atmospheric Change and its Impact on Regional Air Quality, NATO Science Series, Kluwer Academic Publishers, 2002.
[2] EPA, Integrated Science Assessment for Sulfur Oxides-Health Criteria, EPA/600/R-08/047F, 2008.

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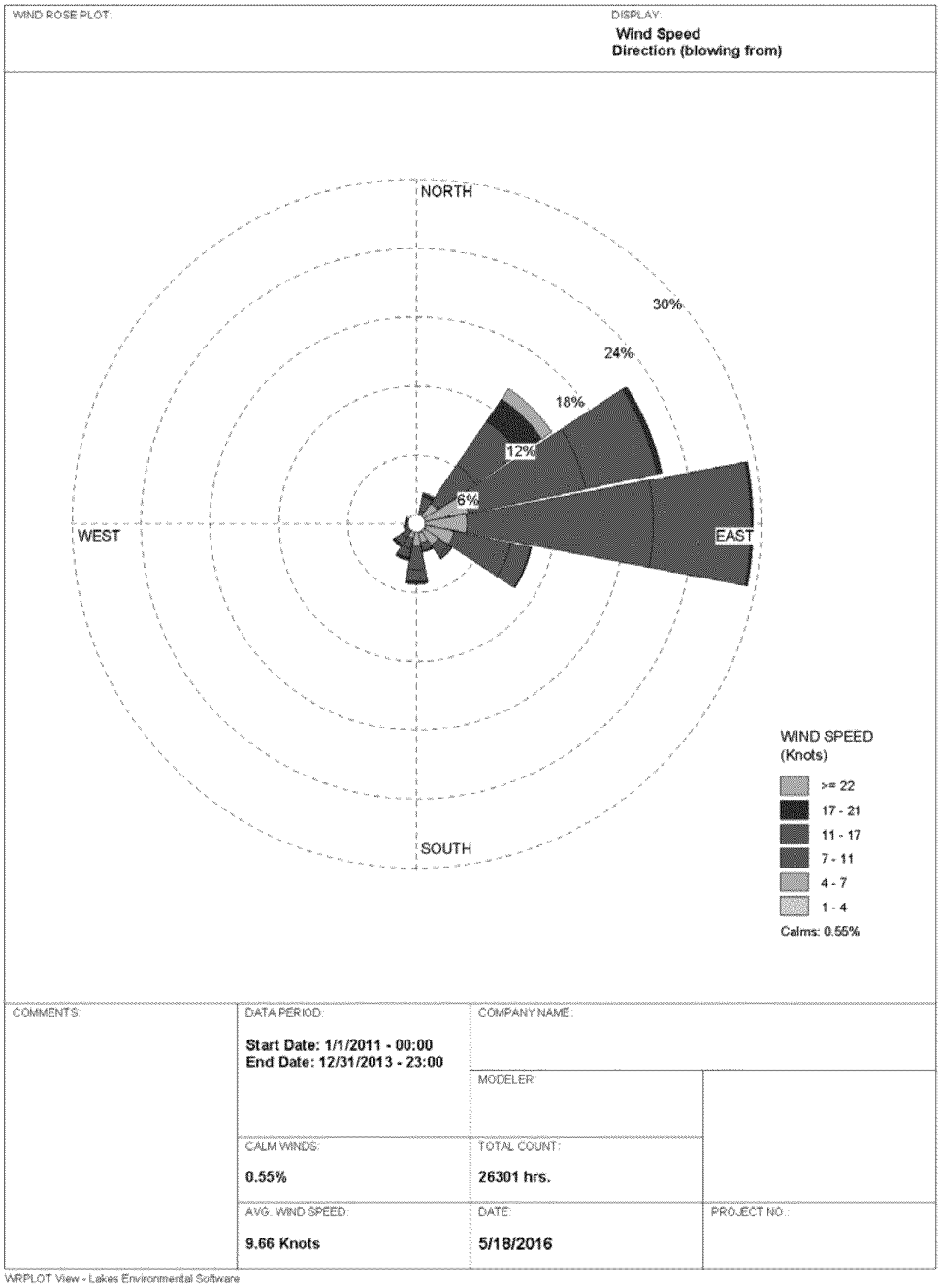
Figure 1 Windrose for 2011-2013 60 Meter Wind as Measured at the Piti/Cabras Meteorological Tower with GUM Airport Data Substituted for Missing Hours



in their regulations. Thus maritime sulfur dioxide emissions will be reduced prior to the adoption of an SO_2 SIP, further reducing current potential background concentration.

The Guam and CNMI Military Relocation (2012 Roadmap Adjustments) Supplemental Environmental Impact Statement (http://www.guambuildupeis.us/documents, see Appendix I Air Impact Study) prepared for the U.S. Department of the Navy assumed that the background concentration was zero for all pollutants for their air quality modeling.

2.2 Guam Measurements

Also, the most recent air quality monitoring on the island conducted in 1999-2000 by GPA (Otte Consulting, Ambient Air Quality Monitoring Network Annual Data Report for October 1999-September 2000) confirms the low concentration background with the monitors reporting "0" SO_2 concentrations for the vast majority of the hours (see Appendix A, reproduced from best copy available). A reported value of "0"indicates that the concentration is below the minimum detection limit for the Model 100A Advanced Pollution Instrumentation SO_2 monitors of 0.4 ppb (1.04 $\mu g/m^3$) (http://www.teledyne-api.com/manuals/02164h_100a.pdf).

2.3 Satellite Measurements

The earth observing system (EOS) Aura spacecraft has a downward pointing hyper-spectral imaging sensor (Ozone Monitoring Sensor, OMI) that records daily global measurements of earth-atmosphere back scattered radiances. These measurements are analyzed by the National Aeronautics and Space Administration (NASA) to retrieve column amount of SO_2 among other pollutants. The SO_2 data is accessible from NASA servers[3] with measurements available on a 0.1 x 0.1 degree grid and represent a near-instantaneous "snap-shot" of the tropospheric column. This data was downloaded and plotted in NASA's geospatial analysis tool, Panoply, to extract satellite measurements of column amount SO_2 over Guam. Four scans from each of the latest available four years, 2012 through 2015, selected from a month in each calendar quarter (March, June, September, and December), were sampled and evaluated (16 scans total). Since the values represent a density of SO_2 molecules over the visible 0.1x0.1 degree area, to determine a volume concentration (e.g., µg/m3) from the measured value requires assuming a well-mixed troposphere (a feasible assumption in the low latitude tropics), and a troposphere height. In the tropics, the

[3] http://avdc.gsfc.nasa.gov/pub/data/satellite/Aura/OMI/V03/L3/OMSO2m/OMSO2_0.1x0.1_daily/

ED_001261_00024135

tropopause is lifted higher than in mid and upper latitudes due to heating and convergence typified in the Intertropical Convergence Zone (ITCZ). A reasonable height for the tropical tropopause was chosen to be 15 km[4]. Converting the column density to a volume concentration led to a range of 0.0 to 4.58 $\mu g/m^3$ of SO_2 at Guam with an overall average value of 1.49 $\mu g/m^3$ (see Table 1), in reasonable agreement with the concentrations noted above. Given the assumptions needed to convert tropospheric satellite observations to ground-level concentrations, satellite concentration estimates are less reliable than the direct observations reported for the other measurement approaches, but do provide supporting evidence of generally low SO_2 concentrations.

2.4 Aircraft Measurements

The NASA Transport and Chemical Evolution over the Pacific (TRACE-P) project comprised the third of three planned Pacific exploratory missions in the central and western regions of the Pacific Ocean basin. TRACE-P was conducted in March/April 2001 as part of NASA's Tropospheric Chemistry Program and had as one of its major objectives to determine the chemical composition of the Asian outflow over the western Pacific. The data is in the form of measurements taken from an aircraft: the P-3B mission landed and took off from Guam (Anderson Airforce Base) during its flight. The P-3B data had measurements of SO_2 included in its suite of observations. The data was accessed from NASA's servers[5] and plotted in GIS software (see Figure 2) to extract measured concentrations over Guam and at points nearby. It was found that within a 1,000 km radius of Guam, the maximum measured SO_2 concentration was 173.549 pptv (parts per trillion by volume). This equates to 0.5 $\mu g/m^3$ of SO_2.

2.5 Selected Background Concentration

Given the isolation of Guam from upwind anthropogenic SO_2 sources, the very low oceanic background contribution, and the variety of sources described above with a concurring range of values, it is proposed that modeling the nearby sources and adding a background of 1.0 $\mu g/m^3$ SO_2 for all averaging periods based on the results of the Guam air quality measurement program will yield representative predictions of SO_2 design values.

[4] An Introduction to Dynamic Meteorology, Holton, p402.

[5] http://www-gte.larc.nasa.gov/GTE2/missions/Aircraft_Based_Missions/Aircraft_Based_Missions.htm

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Table 1 Tropospheric SO_2 Concentration for Guam Based on Satellite Data

Aura/OMI PBL SO_2 Tropospheric Vertical Column Density Measurements

Year / Month	Measured Value, DU (1 DU = 2.69E16 molecules/cm^2)				SO_2 concentration (well mixed assumption) (µg/m^3)			
	March	June	September	December	March	June	September	December
2012	0	0.5	0.5	2.4	0.00	0.95	0.95	4.58
2013	0.1	0.2	1.5	1	0.19	0.38	2.86	1.91
2014	0.3	1.9	1.2	0.9	0.57	3.62	2.29	1.72
2015	0.7	0.5	0.4	0.4	1.34	0.95	0.76	0.76

MAX	4.58
MIN	0.00
AVG	1.49

Well-mixed Tropopause Assumption

Height of Tropopause at 13.5° N lat. 15 km

Development of a conversion factor from DU to µg/m^3 SO_2

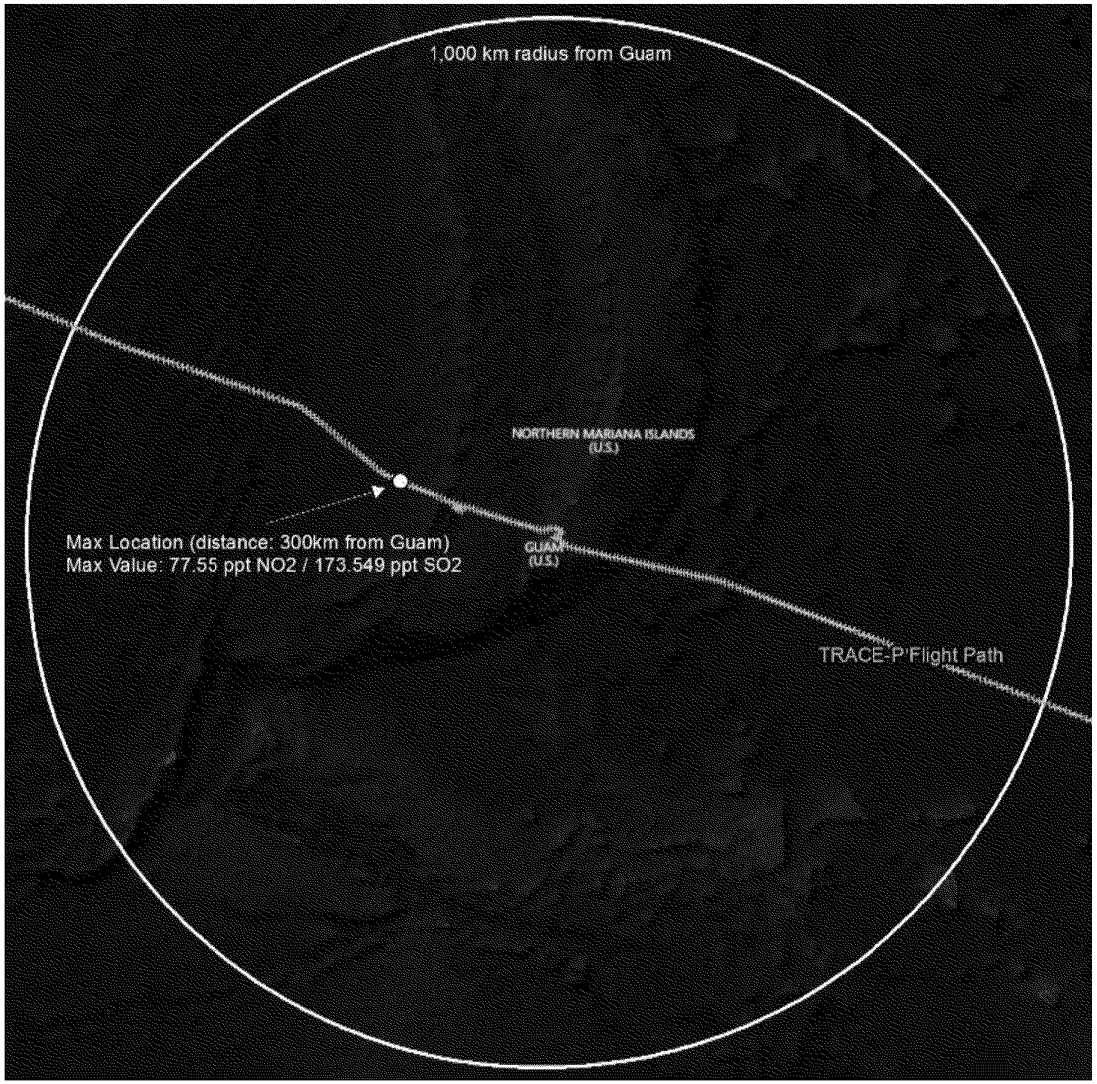
$$\frac{2.69E+16 \text{ molecules}}{\text{cm}^2} \times \frac{\text{height of column}}{\text{cm}} \times \frac{64.0638 \text{ g}}{\text{molecules } SO_2} \times \frac{1E+06 \ \mu\text{g}}{\text{g}} \times \frac{1E+06 \text{ cm}^3}{\text{m}^3} = \frac{1.91 \ \mu\text{g}}{\text{m}^3}$$

1.50E+06

6.02E+23

1 DU SO_2 = 1.9 µg/m^3 SO_2

Figure 2 Aircraft flight path for NASA TRACE-P Experiment within 1,000 kilometers of Guam



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To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]
Cc: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]; Wehling, Jefferson[Wehling.Jefferson@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
From: Viswanathan, Krishna
Sent: Tue 9/20/2016 11:42:36 PM
Subject: RE: U.S. EPA - Updated Guidance on Round 3 Designations for the SO2 Data Requirements Rule

OK, I'll send you an invitation.

Krishna Viswanathan

520.999.7880

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Tuesday, September 20, 2016 4:20 PM
To: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Cc: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>; Wehling, Jefferson <Wehling.Jefferson@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Subject: RE: U.S. EPA - Updated Guidance on Round 3 Designations for the SO2 Data Requirements Rule

Let's do your Monday at 3 pm, our Tuesday 9 am. I have a scheduled meeting tomorrow.

Thank you,

On 21 Sep 2016 9:07 a.m., "Viswanathan, Krishna" <Viswanathan.Krishna@epa.gov> wrote:

> Ah, thanks!
>
> We are available this Friday anytime from 2-4 pm, or next Monday or Tuesday 3-4 pm. We probably only need a half hour.
>
> Let us know if any of those times work for you.

Thank you,

Krishna

Krishna Viswanathan

520.999.7880

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Tuesday, September 20, 2016 3:53 PM
To: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Cc: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Wehling, Jefferson <Wehling.Jefferson@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>
Subject: RE: U.S. EPA - Updated Guidance on Round 3 Designations for the SO2 Data Requirements Rule

We are Chamorro standard time. 6 hours back from SF time. One day ahead. 9 am here is 3 pm there.

On 21 Sep 2016 7:36 a.m., "Viswanathan, Krishna" <Viswanathan.Krishna@epa.gov> wrote:

Hi Roland,

After review of your responses our modeler mentioned that your response to Item #1 is adequate. However the response to Item #2 did not address our concerns; we will need to continue to work with you to support reasonable assumptions about shipping emissions and background concentrations.

I'd like to set up a call to go over our thoughts on how you could address Item #2. What is your time zone?

Thanks,

Krishna

Krishna Viswanathan

520.999.7880

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Monday, September 19, 2016 9:53 PM
To: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Kurpius, Meredith <Kurpius.Meredith@epa.gov>; Wehling, Jefferson <Wehling.Jefferson@epa.gov>
Subject: Re: U.S. EPA - Updated Guidance on Round 3 Designations for the SO2 Data Requirements Rule

Hafa Adai Krishna,

Just following up to see if the response to comments was sufficient to begin the modeling protocol. Please advise soonest.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

epa.guam.gov - facebook.com/Guam EPA - twitter.com/GuamEPA

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On Wed, Sep 14, 2016 at 9:39 AM, Viswanathan, Krishna <Viswanathan.Krishna@epa.gov> wrote:

Hi Roland,

We'll take a quick look and get back to you whether these are sufficient for us to approve the modeling protocol.

Thanks,

Krishna

Krishna Viswanathan

520.999.7880

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Fax: 1-671-300-4531

epa.guam.gov - facebook.com/Guam EPA - twitter.com/GuamEPA

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On Wed, Sep 14, 2016 at 4:55 AM, Viswanathan, Krishna <Viswanathan.Krishna@epa.gov> wrote:

Hi Roland,

You may have met with or are probably meeting with GPA as you receive this message. As I mentioned earlier, I am transitioning into the role as the

main planning point of contact for SO2 SIPs for EPA Region 9 and as such for Guam also. Unfortunately, due to staff and management transitions some responses are taking more time than usual but this will improve. I hope these responses are helpful and timely but if you have questions please just call me.

In response to your queries.

1. We are meeting with GPA tomorrow and would like to know if the final submission to the USEPA comments for the DRR were sufficient to approve the modeling plan. We are almost half way through December and want to start the modeling to meet the next submission deadline.

a. EPA sent you an email (Michael Mann dated August 16, 2016) that forwarded comments on the modeling protocol from Carol Bohnenkamp. Addressing those comments will advance your interest in seeing the modeling protocol approved and modeling started. See email attached.

2. Additionally, are the comments to our request for re-designation of Tanguisson approved or is there a way to get unofficial comments to us? We would like to discuss with GPA.

a. The email from Meredith Kurpius, September 2, 2016 communicated that EPA cannot act on Guam EPA's redesignation request until a maintenance plan is received. See email attached.

3. Lastly, I am requesting for a sample or samples of approved SIP maintenance plans we can model are submission after.

a. The general requirements for redesignations are described in the attached 1992 Calcagni memo and our policy regarding redesignation without monitoring for single-source SO2 NAAs are described in the attached 2000 Seitz memo.

b. There are a few of examples of previous R9 redesignations relying on the Seitz policy. I think this one for Douglas, AZ is the most recent and may be a good model: http://www.regulations.gov/#!documentDetail;D=EPA-R09-OAR-2005-AZ-0008-0002

c. Lastly, based on your situation the modeling GPA will perform for the Data Requirements Rule due in January will give you an idea of the modeled ambient values of SO2 in the area at present. This will be helpful

for you as you develop the redesignation request and maintenance plan. Please check in with us to discuss the best and most efficient way to develop a maintenance plan.

Again, if you have questions, please call me at the number below.

Thanks and looking forward to working with you,

Krishna

Krishna Viswanathan

520.999.7880

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, September 11, 2016 9:34 PM
To: Nazmi, Niloufar <Nazmi.Niloufar@epa.gov>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>; Kurpius, Meredith <Kurpius.Meredith@epa.gov>
Subject: Re: U.S. EPA - Updated Guidance on Round 3 Designations for the SO2 Data Requirements Rule

All,

We are meeting with GPA tomorrow and would like to now if the final submission to the USEPA comments for the DRR were sufficient to approve the modeling plan. We are almost half way through December and want to start the modeling to meet the next submission deadline.

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We would like to discuss with GPA.

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Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

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On Sat, Sep 10, 2016 at 7:17 AM, Nazmi, Niloufar <Nazmi.Niloufar@epa.gov> wrote:

> Dear Colleagues,
>
> As the next step in the implementation of the SO2 Data Requirements Rule (DRR), you chose to either model or monitor to characterize air quality in support of Round 3 designations for the 2010 SO2 NAAQS per the DRR. Your chosen pathway was published at the "SO2 Data Requirements Rule State Pathway Notifications" website at https://www.epa.gov/so2-pollution/so2-data-requirements-rule-state-pathway-notifications.
>
> As you are aware, agencies that chose monitoring are required to have

new monitors installed and operational by January 1, 2017. For air agencies that chose modeling to comply with the DRR, we have been working with you to support your submission of modeling analyses to the EPA by January 13, 2017.

The attached guidance provides more detail on the schedule and process for area designations for Round 3 of the 2010 SO2 NAAQS, which EPA will designate by December 31, 2017. It also clarifies that although Clean Air Act section 107(d) does not require states, tribes or territories to submit updated recommendations, we are inviting such air agencies to submit updated designation recommendations for the EPA to consider in Round 3 of designations. Air agencies that wish to update their recommendations should do so no later than January 13, 2017, and address them to Alexis Strauss, Acting Regional Administrator, EPA Region 9 with an electronic copy to Gwen Yoshimura (yoshimura.gwen@epa.gov) and Krishna Viswanathan (viswanathan.krishna@epa.gov).

Please contact Krishna Viswanathan (520-999-7880) or Gwen Yoshimura (415-947-4134) of our office if you have questions about this guidance.

Thank you,

Niloufar

Niloufar Nazmi

Air Division, EPA Region 9

Desk: 415-972-3684; Cell: 415-328-1143

To: Katherine Hoag[khoag@baaqmd.gov]; estevenson@baaqmd.gov[estevenson@baaqmd.gov]; gayle.sweigert@arb.ca.gov[gayle.sweigert@arb.ca.gov]
Cc: Mebust, Anna[Mebust.Anna@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]
From: YOSHIMURA, GWEN
Sent: Wed 8/24/2016 11:23:29 PM
Subject: The latest - if using an existing monitor to satisfy DRR, designate by Dec 2017

Hello,

We just had a national EPA workgroup call on SO2 designations. They stated that if an area is using an existing monitor to satisfy DRR requirements, the area would be designated in this upcoming round of designations – ie by December 31, 2017.

If BAAQMD's analysis shows that existing monitoring is appropriate to characterize the three BAAQMD sources, EPA would utilize the information available to designate by Dec 2017. We would likely rely on the monitoring data for our 120 day letters and have an intended designation of attainment (or unclassifiable/attainment depending on how that policy discussion goes at HQ).

As this is different than what we had previously understood, I wanted to give you a heads up.

Thanks,

Gwen

SO2 Designations Guidance Memos

•□□□□□□□□ Round 3, July 22, 2016 Guidance: https://www.epa.gov/sites/production/files/2016-07/documents/areadesign.pdf

•□□□□□□□□ March 20, 2015 Guidance: https://www.epa.gov/sites/production/files/2016-

04/documents/20150320so2designations.pdf

Gwen M. Yoshimura
Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

To: Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Holladay, Cleveland[Holladay.Cleveland@epa.gov]
From: Ryan C. Templeton
Sent: Tue 6/28/2016 10:47:19 PM
Subject: RE: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

Sounds good Carol thanks for keeping the information flowing. Cleve, thank you for contacting me last week, I appreciate the information you sent. I'm sorry for not responding before now, it has been a busy start to the week. We have definitely tried to take all of the information you all provided into consideration when drafting the modeling protocols, especially for AEPCO. Please continue to stay in touch, especially if you need more information in the review of the protocols.

Ryan Templeton

Environmental Program Supervisor

Arizona Department of Environmental Quality

rct@azdeq.gov

(602) 771-4230

From: Bohnenkamp, Carol [mailto:Bohnenkamp.Carol@epa.gov]
Sent: Tuesday, June 28, 2016 3:30 PM
To: Ryan C. Templeton <Templeton.Ryan@azdeq.gov>
Subject: RE: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

Thanks Ryan,

I forwarded your email to Cleve Holladay as well.

Carol

From: Ryan C. Templeton [mailto:Templeton.Ryan@azdeq.gov]
Sent: Tuesday, June 28, 2016 2:54 PM
To: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Subject: RE: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

Hey Carol,

I'm a little late on my follow up, but I just wanted to say thank you for forwarding along the below information. We made sure to include a discussion of this information in our modeling protocol for the AEPCO Apache Generating Station, where we are requesting EPA concurrence of the use of the ADJ_U* AERMET option. We appreciate your help.

Ryan Templeton

Environmental Program Supervisor

Arizona Department of Environmental Quality

rct@azdeq.gov

(602) 771-4230

From: Bohnenkamp, Carol [mailto:Bohnenkamp.Carol@epa.gov]
Sent: Thursday, June 23, 2016 11:13 AM
To: Danilo Dragoni <ddragoni@ndep.nv.gov>; Adele Malone <amalone@ndep.nv.gov>; Brenda Harpring <bharprin@ndep.nv.gov>; eugeniaquintana@navajo-nsn.gov; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Gaurav Rajen <rajenwnr@gmail.com>; Frank Forsgren <fforsgre@ndep.nv.gov>; Mike Elges <melges@ndep.nv.gov>; ransel@clarkcountynv.gov; Zheng Li <zli@clarkcountynv.gov>; huys@clarkcountynv.gov; Steve M. Calderon <Calderon.Steve@azdeq.gov>; Diane Arnst <Arnst.Diane@azdeq.gov>; Feng Mao <Mao.Feng@azdeq.gov>; Jo Crumbaker <jcrumbak@mail.maricopa.gov>; Taejoo Shin <tshin@mag.maricopa.gov>; Lindy Bauer <lbauer@mag.maricopa.gov>; Farah Mohammadesmaeili <Mohammadesmaeili.Farah@azdeq.gov>; Ryan C. Templeton <Templeton.Ryan@azdeq.gov>
Subject: FW: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

From: Bridgers, George
Sent: Monday, June 20, 2016 3:40 PM
To: Avey, Lance <Avey.Lance@epa.gov>; Biton, Leiran <biton.leiran@epa.gov>; Blakley, Pamela <blakley.pamela@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; Colecchia, Annamaria <Colecchia.Annamaria@epa.gov>; Cox, Kyndall <Cox.Kyndall@epa.gov>; Dresser, Chris <Dresser.Chris@epa.gov>; Feldman, Michael <Feldman.Michael@epa.gov>; Fry, Jessica <fry.jessica@epa.gov>; Gillam, Rick <Gillam.Rick@epa.gov>; Hawkins, Andy <hawkins.andy@epa.gov>; Holladay, Cleveland <Holladay.Cleveland@epa.gov>; Howard, Chris <Howard.Chris@epa.gov>; Imhoff, Robert <imhoff.robert@epa.gov>; Kay, Rynda <Kay.Rynda@epa.gov>; Krivo, Stan <Krivo.Stanley@epa.gov>; Langman, Michael <langman.michael@epa.gov>; Leon-Guerrero, Tim <Leon-Guerrero.Tim@epa.gov>; Leslie, Michael <leslie.michael@epa.gov>; Liljegren, Jennifer <Liljegren.Jennifer@epa.gov>; Lusky, Katy <Lusky.Kathleen@epa.gov>; Matichuk, Rebecca <Matichuk.Rebecca@epa.gov>; Mohr, Ashley <Mohr.Ashley@epa.gov>; Monteith, Richard <Monteith.Richard@epa.gov>; Nguyen, Phuong <Nguyen.Phuong@epa.gov>; Carlton-Carew, Njeri <carlton-carew.njeri@epa.gov>; Persoon, Carolyn <persoon.carolyn@epa.gov>; Portanova, Mary <portanova.mary@epa.gov>; Robinson, Randall <robinson.randall@epa.gov>; schmidt, howard <schmidt.howard@epa.gov>; Schwartz, Colin <Schwartz.Colin@epa.gov>; Snyder, Erik <snyder.erik@epa.gov>; Tonnesen, Gail <Tonnesen.Gail@epa.gov>; Walther, Katherine <Walther.Katherine@epa.gov>; Wiley, Adina <Wiley.Adina@epa.gov>; Worstell, Aaron <Worstell.Aaron@epa.gov>
Cc: Wayland, Richard <Wayland.Richard@epa.gov>; Wood, Anna <Wood.Anna@epa.gov>; Rao, Raj <Rao.Raj@epa.gov>; baanderson02@fs.fed.us; Buckler, Charles <Buckler.Charles@epa.gov>; cnicholl@blm.gov; Deroeck, Dan <Deroeck.Dan@epa.gov>; Hawes, Todd <Hawes.Todd@epa.gov>; Jill_Webster@fws.gov; john_notar@nps.gov; Misenis, Chris <Misenis.Chris@epa.gov>; Montanez, Jessica <Montanez.Jessica@epa.gov>; Rick Graw <rgraw@fs.fed.us>; Shaltanis, Jennifer <Shaltanis.Jennifer@epa.gov>; Tim_Allen@fws.gov; Timin, Brian <Timin.Brian@epa.gov>; Tom Coulter <ccoulter@blm.gov>; Baker, Thomas <Baker.Thomas@epa.gov>; Brode, Roger <Brode.Roger@epa.gov>; Fox, Tyler <Fox.Tyler@epa.gov>; Owen, Chris <Owen.Chris@epa.gov>; Thurman, James <Thurman.James@epa.gov>
Subject: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

Regional Office Dispersion Modeling Contacts,

The Model Clearinghouse has formally concurred with a Region 3 request to approve an alternative modeling demonstration for the use of the ADJ_U* beta option in AERMET for the modeling demonstration of the Herbert A. Wagner Generating Station (Wagner) located near the City of Baltimore, MD. This is the third Model Clearinghouse concurrence on the use of the ADJ_U* beta option in AERMET for regulatory applications… one PSD, one SIP / Title V related, and now one CD SO2 Source / SIP. In the case of the Wagner facility, excessive 1-hour SO2 concentrations on terrain at elevations above the lowest effective stack height at distances of 20 km to 34-37 km from the source were predicted by the regulatory default version of the AERMOD Modeling System, specifically during low wind/stable conditions when u* values were relatively small. This parallels similar excessive 1-hour SO2 concentrations predicted on distant terrain during similar low wind/stable conditions for the Region 1 Schiller Station situation. In both of these circumstances, well-reasoned justifications and thorough documentation of ADJ_U* beta option modeling sensitivities are provided and demonstrate the appropriateness and applicability of the beta option. This third Model Clearinghouse concurrence on the use of the ADJ_U* beta option should solidify a template for other facilities with similar issues and permit reviewing authorities that are interested in developing an ADJ_U* alternative modeling request for EPA consideration.

A formal record, 16-III-01, has been created in the MCHISRS database with PDF scans of the Region 3 request memorandum and the Model Clearinghouse concurrence / response memorandum. The direct link to the MCHISRS record is: https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-III-01. A message about this Model Clearinghouse action has also been included on the SCRAM website under the Recent Additions section and announced through SCRAM's RSS feed.

As noted in the previous ADJ_U* beta option concurrences and not an issue with the Wagner facility modeling demonstration, we continue to evaluate the potential that the use of the ADJ_U* beta option in combination with site-specific meteorological data that includes the sigma-theta and/or sigma-w turbulence parameters may introduce a bias toward concentration underprediction and caution anyone considering the use of both the ADJ_U* beta option and meteorological data that includes the derived sigma-theta and/or sigma-w turbulence parameters in regulatory applications without consultation and approval from the appropriate permitting authority and the respective EPA Regional Office.

Please share this announcement information with your respective state, local, and tribal agencies and with any interested colleagues in a timely manner. Do not hesitate to contact me if there are any questions or needed clarification on this particular application of ADJ_U* or its use elsewhere.

My regards,

George

George M. Bridgers, CPM, Environmental Scientist
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
AQAD - Air Quality Modeling Group
109 TW Alexander Drive
Room C431B - Mail Drop C439-01
Research Triangle Park, NC 27711
Phone: 919-541-5563
Fax: 919-541-0044

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From: Ryan C. Templeton
Sent: Tue 6/28/2016 9:54:03 PM
Subject: RE: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

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Environmental Program Supervisor

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Cc: Wayland, Richard <Wayland.Richard@epa.gov>; Wood, Anna <Wood.Anna@epa.gov>; Rao, Raj <Rao.Raj@epa.gov>; baanderson02@fs.fed.us; Buckler, Charles <Buckler.Charles@epa.gov>; cnicholl@blm.gov; Deroeck, Dan <Deroeck.Dan@epa.gov>; Hawes, Todd <Hawes.Todd@epa.gov>; Jill_Webster@fws.gov; john_notar@nps.gov; Misenis, Chris <Misenis.Chris@epa.gov>; Montanez, Jessica <Montanez.Jessica@epa.gov>; Rick Graw <rgraw@fs.fed.us>; Shaltanis, Jennifer <Shaltanis.Jennifer@epa.gov>; Tim_Allen@fws.gov; Timin, Brian <Timin.Brian@epa.gov>; Tom Coulter <ccoulter@blm.gov>; Baker, Thomas <Baker.Thomas@epa.gov>; Brode, Roger <Brode.Roger@epa.gov>; Fox, Tyler <Fox.Tyler@epa.gov>; Owen, Chris <Owen.Chris@epa.gov>; Thurman, James <Thurman.James@epa.gov>
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My regards,

George

George M. Bridgers, CPM, Environmental Scientist
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
AQAD - Air Quality Modeling Group
109 TW Alexander Drive
Room C431B - Mail Drop C439-01
Research Triangle Park, NC 27711
Phone: 919-541-5563
Fax: 919-541-0044

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To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]; Drake, Kerry[Drake.Kerry@epa.gov]; Lo, Doris[Lo.Doris@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; LIMAYE, VIJAY[Limaye.Vijay@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]; McCarroll, John[McCarroll.John@epa.gov]; Yvette Cruz[yvette.cruz@epa.guam.gov]; Luong Truong[luong.truong@epa.guam.gov]
From: Mann, Michael
Sent: Fri 6/24/2016 1:11:21 AM
Subject: RE: Modeling Protocol for the Data Requirements Rule for 1-hour Sulfur Dioxide Primary National Ambient Air Quality Standard

Thanks Roland! We'll review and be in touch if we need additional info.

Michael

Michael Mann

Guam Program Manager
U.S. EPA Region 9
Tel.: (415) 972-3505

Guam cell: (671) 929-1348
E-mail: mann.michael@epa.gov

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Thursday, June 23, 2016 5:45 PM
To: Mann, Michael <Mann.Michael@epa.gov>; Drake, Kerry <Drake.Kerry@epa.gov>; Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; LIMAYE, VIJAY <Limaye.Vijay@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>; Yvette Cruz <yvette.cruz@epa.guam.gov>; Luong Truong <luong.truong@epa.guam.gov>
Subject: Modeling Protocol for the Data Requirements Rule for 1-hour Sulfur Dioxide Primary National Ambient Air Quality Standard

Michael,

Please find the attached Final Modeling Protocol in which notifies EPA that the Guam EPA intends to characterize 1-hour SO2 air quality through air modeling as required by 40 CFR Section 51.1203(a).

The hard copy is being mailed to the Acting Regional Administrator. Please advise if there is anything else Guam EPA need to do to meet our responsibities in reards to the Data Requirements Rule.

Sincerely,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

epa.guam.gov - facebook.com/Guam EPA - twitter.com/GuamEPA

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Cc: Noel P. Cruz[ncruz1@gpagwa.com]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Roland Gutierrez[roland.gutierrez@epa.guam.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; Drake, Kerry[Drake.Kerry@epa.gov]; Sylvia L Ipanag[sipanag@gpagwa.com]; Roger U. Pabunan[rpabunan@gpagwa.com]; Norbert M. Madrazo[nmadrazo@gpagwa.com]; Luong Truong[luong.truong@epa.guam.gov]; Paz A Tison[mtison@gpagwa.com]
To: LIMAYE, VIJAY[Limaye.Vijay@epa.gov]
From: Conchita GEPA
Sent: Wed 6/15/2016 9:37:20 PM
Subject: Re: Discuss Guam SO2 Modeling Protocol

Håfa Ådai Vijay,

Thank you for your guidance. We will prepare a draft letter with a similar template and discuss it further to ensure we adequately capture the information required.

Kindest Regards,
Conchita

Sent from my IPad

On Jun 16, 2016, at 6:43 AM, LIMAYE, VIJAY <Limaye.Vijay@epa.gov> wrote:

Hi Conchita,

Just to follow up briefly on the upcoming 7/1/2016 SO2 DRR deadline, we recently learned that EPA intends to post the correspondence conveying how the air agencies will be characterizing their DRR sources, similar to how the source list letters & responses were posted here: https://www.epa.gov/airquality/sulfurdioxide/drr.html

In light of this, and to satisfy 40 CFR 51.1203(b), we believe that a letter from Guam EPA to EPA Region 9 Acting Regional Administrator Alexis Strauss (cc'ing Kerry Drake, Doris Lo, Gwen Yoshimura, Carol Bohnenkamp, and myself) listing the Piti-Cabras source and indicating that it will be characterized through modeling is appropriate. Please let me know if you have any questions. We will be responding about the protocol GPA sent shortly.

Thanks for all of your work on this effort!

Best,

Vijay

Vijay Limaye, Ph.D.

U.S. Environmental Protection Agency, Region 9

Air Planning Office (AIR-2)

75 Hawthorne St. San Francisco, CA 94105

Limaye.Vijay@epa.gov / 415.972.3086

From: Noel P. Cruz [mailto:ncruz1@gpagwa.com]
Sent: Tuesday, June 14, 2016 3:40 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Roland Gutierrez <roland.gutierrez@epa.guam.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; conchita.taitano@epa.guam.gov; Drake, Kerry <Drake.Kerry@epa.gov>; LIMAYE, VIJAY <Limaye.Vijay@epa.gov>; Sylvia L Ipanag <sipanag@gpagwa.com>; Roger U. Pabunan <rpabunan@gpagwa.com>; Norbert M. Madrazo <nmadrazo@gpagwa.com>; Luong Truong <luong.truong@epa.guam.gov>; Paz A Tison <mtison@gpagwa.com>
Subject: Discuss Guam SO2 Modeling Protocol

Hi Gwen / Roland,

Please see our consultant's reply to the question 2 below.

Question 2: Please clarify how Guam EPA/EPA will be notified of re-located receptors, and whether an explanation of the reasons for relocation (characteristics of the locations, etc) will be included.

Reply: TRC will run the modeling analyses as proposed in the modeling protocol and will determine the appropriate design value resulting from the analyses. The receptor where the design value concentration is predicted to occur will be viewed on a satellite map of the area to determine if the specific point is accessible and appropriate for monitor siting. If it is, the design concentration will be reported as modeled.

In the event that the receptor is located on a water body, inaccessible location, or a point where a monitor cannot physically be located, a new receptor will be placed at the nearest point where a monitor can be located and the concentration at that receptor will be determined consistent with the modeling protocol. TRC will document any receptor determined to be inaccessible and will discuss the receptors in question with GEPA and USEPA before finalizing the modeling report.

With regards to question 1, the Final Modeling Protocol was emailed to you yesterday with Appendices C and D.

Please let us know if you have any comments or further questions.

Noel P. Cruz *CESCO,CWMP*

Engineer II (Environmental)

Planning & Regulatory

Guam Power Authority

Ncruz1@gpagwa.com

Tel: (671) 648-3030

Fax: (671) 648-3167

From: Noel P. Cruz
Sent: Tuesday, June 14, 2016 2:56 PM
To: 'YOSHIMURA, GWEN' <Yoshimura.Gwen@epa.gov>; 'Roland Gutierrez' <roland.gutierrez@epa.guam.gov>
Cc: 'Bohnenkamp, Carol' <Bohnenkamp.Carol@epa.gov>; 'conchita.taitano@epa.guam.gov' <conchita.taitano@epa.guam.gov>; 'Drake, Kerry' <Drake.Kerry@epa.gov>; 'LIMAYE, VIJAY' <Limaye.Vijay@epa.gov>; Sylvia L Ipanag <sipanag@gpagwa.com>; Roger U. Pabunan <rpabunan@gpagwa.com>; Norbert M. Madrazo <nmadrazo@gpagwa.com>; 'Luong Truong' <luong.truong@epa.guam.gov>
Subject: Discuss Guam SO2 Modeling Protocol

Gwen/Roland,

Appendix D …last email attachment.

-noel

From: Noel P. Cruz
Sent: Tuesday, June 14, 2016 2:46 PM
To: 'YOSHIMURA, GWEN' <Yoshimura.Gwen@epa.gov>; 'Roland Gutierrez' <roland.gutierrez@epa.guam.gov>
Cc: 'Bohnenkamp, Carol' <Bohnenkamp.Carol@epa.gov>; 'conchita.taitano@epa.guam.gov' <conchita.taitano@epa.guam.gov>; 'Drake, Kerry' <Drake.Kerry@epa.gov>; 'LIMAYE, VIJAY' <Limaye.Vijay@epa.gov>; Sylvia L Ipanag <sipanag@gpagwa.com>; Roger U. Pabunan <rpabunan@gpagwa.com>; Norbert M. Madrazo <nmadrazo@gpagwa.com>; 'Luong Truong' <luong.truong@epa.guam.gov>
Subject: Discuss Guam SO2 Modeling Protocol

Gwen/Roland,

Appendix C attached.

-noel

From: Noel P. Cruz
Sent: Tuesday, June 14, 2016 2:41 PM
To: 'YOSHIMURA, GWEN' <Yoshimura.Gwen@epa.gov>; Roland Gutierrez <roland.gutierrez@epa.guam.gov>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Conchita Taitano (conchita.taitano@epa.guam.gov) <conchita.taitano@epa.guam.gov>; Drake, Kerry <Drake.Kerry@epa.gov>; LIMAYE, VIJAY <Limaye.Vijay@epa.gov>; Sylvia L Ipanag <sipanag@gpagwa.com>; Roger U. Pabunan <rpabunan@gpagwa.com>; Norbert M. Madrazo <nmadrazo@gpagwa.com>; Luong Truong <luong.truong@epa.guam.gov>
Subject: RE: Discuss Guam SO2 Modeling Protocol

Hafa Adai Gwen/Roland,

Please see attached copy of FINAL Guam SO2 Modeling Protocol. I'm sending 2 more emails with attachment i.e. Appendices C and D, respectively. Let us know if you have other questions or need futher clarification.

Si' Yu'us Ma'ase.

Noel P. Cruz

Engineer II (Environmental)

Planning & Regulatory

Guam Power Authority

Ncruz1@gpagwa.com

Tel: (671) 648-3030

Fax: (671) 648-3167

From: YOSHIMURA, GWEN [mailto:Yoshimura.Gwen@epa.gov]
Sent: Tuesday, June 14, 2016 8:32 AM
To: Roland Gutierrez <roland.gutierrez@epa.guam.gov>; Roger U. Pabunan <rpabunan@gpagwa.com>
Cc: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Conchita Taitano (conchita.taitano@epa.guam.gov) <conchita.taitano@epa.guam.gov>; Drake, Kerry <Drake.Kerry@epa.gov>; LIMAYE, VIJAY <Limaye.Vijay@epa.gov>; Sylvia L Ipanag <sipanag@gpagwa.com>; Noel P. Cruz <ncruz1@gpagwa.com>; Norbert M. Madrazo <nmadrazo@gpagwa.com>; Luong Truong <luong.truong@epa.guam.gov>
Subject: RE: Discuss Guam SO2 Modeling Protocol

Hi Roland,

Thanks for checking in. A few comments on the latest Draft Modeling Protocol:

1. We did not receive Appendix C or Appendix D.

2. Section 5: Please clarify how Guam EPA/EPA will be notified of re-located receptors, and whether an explanation of the reasons for relocation (characteristics of the locations, etc) will be included.

3. Section 7: When we receive Appendix D, we can verify the appropriate background concentration.

That's it. Overall, we think the protocol is in good shape. Thanks, and please let Carol know if you have any questions.

-Gwen

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, June 12, 2016 4:17 PM
To: Roger U. Pabunan <rpabunan@gpagwa.com>
Cc: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Conchita Taitano (conchita.taitano@epa.guam.gov) <conchita.taitano@epa.guam.gov>; Drake, Kerry <Drake.Kerry@epa.gov>; LIMAYE, VIJAY <Limaye.Vijay@epa.gov>; Sylvia L Ipanag <sipanag@gpagwa.com>; Noel P. Cruz <ncruz1@gpagwa.com>; Norbert M. Madrazo <nmadrazo@gpagwa.com>; Luong Truong <luong.truong@epa.guam.gov>
Subject: Re: Discuss Guam SO2 Modeling Protocol

Gwen,

We are almost halfway through June and we wanted to follow up with USEPA to determine if there were any more comments, questions or concerns on the latest submission (attached) of the Draft Modeling Protocol. Please advise and we look forward to submitting the final Modeling Protocol in a timely manner for the island of Guam.

Sincerely,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

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On Fri, May 27, 2016 at 9:33 AM, Roger U. Pabunan <rpabunan@gpagwa.com> wrote:

Good day Gwen.

Please see attached current version of the DRR Protocol for Guam. This is Revision 3, which includes responses to comments from Carol Bohnenkamp's May 9th Email.

Regards,

Roger U. Pabunan

Engineer Supervisor

Planning & Regulatory

Guam Power Authority

rpabunan@gpagwa.com

Tel: (671) 648-3032

Fax: (671) 648-3290

I-connect: 671*11*20152

From: YOSHIMURA, GWEN [mailto:Yoshimura.Gwen@epa.gov]
Sent: Friday, May 27, 2016 6:58 AM
To: Conchita San Nicolas Taitano; Sylvia L Ipanag; Roland Gutierrez - Air Program Supervisor
Cc: Bohnenkamp, Carol; Drake, Kerry; LIMAYE, VIJAY

Subject: RE: Discuss Guam SO2 Modeling Protocol

Hello,

We are nearing the end of the month, with about a month to go before the SO2 modeling protocol is due on July 1st. Carol has not received any questions concerning our May 9th modeling protocol comments. As a reminder, should questions arise, please feel free to contact her at the number provided below.

Thanks!

-Gwen

From: Bohnenkamp, Carol
Sent: Tuesday, May 10, 2016 8:11 AM
To: Drake, Kerry <Drake.Kerry@epa.gov>; Conchita San Nicolas Taitano <conchita.taitano@epa.guam.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Sylvia Ipanag <sipanag@gpagwa.com>; Roland Gutierrez - Air Program Supervisor <roland.gutierrez@epa.guam.gov>

Subject: RE: Discuss Guam SO2 Modeling Protocol

Here are the notes from yesterday's call about the SO2 NAAQS Designation Modeling for Guam. Please feel free to call me at (415) 947-4130 if you have any questions.

- 2.0 Emission and Source Data

- Please provide an emission inventory.
- List which sources will be explicitly modeled when you have completed that analysis.

- 5.0 Receptor Array.

- Clarify the process for editing out high concentrations.

- 6.0 Meteorological data

- Please clarify the hierarchy for data use for the surface data.
- Discuss the quality assurance and data completeness for each year.
- Please discuss other available surface data, if any.

- 7.0 Background concentration

- After determining which nearby sources will be explicitly modeled, please select a background concentration at will account for the point sources that are not modeled, as well as ships, etc.

- See SO2 Modeling TAD, page 30, regarding selecting background concentration

- 8.0 Modeling Results

- Explain why " For comparison to the 1 hour SO2 NAAQS, the maximum five year average of the 99th th percentile of the annual distribution of the maximum daily 1-hour predicted concentration determined for each receptor will be reported using three years of meteorological data."

Carol Bohnenkamp

US EPA Region 9 (AIR-7)

75 Hawthorne St.

San Francisco, CA 94105

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To: lisa.young@doh.hawaii.gov[lisa.young@doh.hawaii.gov]; Madsen, Michael A[michael.madsen@doh.hawaii.gov]
Cc: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; LIMAYE, VIJAY[Limaye.Vijay@epa.gov]
From: CHANG, RANDALL
Sent: Tue 5/17/2016 9:30:00 PM
Subject: 1-Hour SO2 Data Requirements Rule Amendment 1 to Final Report

Hi Lisa and Michael,

We have reviewed your May 2016 revised final report *Modeling for Monitor Placement Data Requirements Rule for 1-Hour Sulfur Dioxide Primary National Ambient Air Quality Standard*, with addendum 1 for the alternate Waiau sites. Based on the discussion and analysis presented for the proposed alternate monitoring sites 1A and 1B for Waiau, both of the sites are acceptable.

Thanks.

Randy

Randall Chang

U.S. EPA, Pacific Southwest (Region 9)

Air Quality Analysis Office

75 Hawthorne Street (AIR-7)

San Francisco, CA 94105

phone: 415.947.4180

email: chang.randall@epa.gov

To: Conchita GEPA[conchita.taitano@epa.guam.gov]
Cc: Sylvia Ipanag[sipanag@gpagwa.com]; Roland Gutierrez - Air Program Supervisor[roland.gutierrez@epa.guam.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]
From: Drake, Kerry
Sent: Wed 4/13/2016 7:30:37 PM
Subject: RE: SO2 NAAQS Designations Modeling Protocol for Guam Power Authority (DRAFT v. Mar 2016)

Hi Conchita,

I just sent an invitation for Monday, May 9 at 4:00 PM San Francisco time. I think that translates to Tuesday, May 10 at 9:00 AM Guam time, but hopefully the calendar will translate that for us. Please let me know if that works.

Thanks,

Kerry

From: Conchita GEPA [mailto:conchita.taitano@epa.guam.gov]
Sent: Wednesday, April 13, 2016 12:07 PM
To: Drake, Kerry <Drake.Kerry@epa.gov>
Cc: Sylvia Ipanag <sipanag@gpagwa.com>; Roland Gutierrez - Air Program Supervisor <roland.gutierrez@epa.guam.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>
Subject: Re: SO2 NAAQS Designations Modeling Protocol for Guam Power Authority (DRAFT v. Mar 2016)

Hi Kerry,

Thank you for your assistance. I will be on travel around April 24 and will be back around the first week of May.

With that said, the second week in May would be good. GPA also has their contractor available to present the information in advance if needed.

Conchita

Sent from my IPad

On Apr 14, 2016, at 4:54 AM, Drake, Kerry <Drake.Kerry@epa.gov> wrote:

Hi Conchita,

We agree we should schedule a technical conference, but would need until the first week of May, or so, to be able to study the document in order to provide useful feedback. Is there a day the first or second week of May that would work for you? We usually need to meet with you first thing in your morning (and late in our afternoon the day before).

Thanks,

Kerry

From: Conchita San Nicolas Taitano [mailto:conchita.taitano@epa.guam.gov]
Sent: Monday, April 11, 2016 7:42 PM
To: Drake, Kerry <Drake.Kerry@epa.gov>
Cc: Sylvia Ipanag <sipanag@gpagwa.com>; Roland Gutierrez - Air Program Supervisor <roland.gutierrez@epa.guam.gov>
Subject: SO2 NAAQS Designations Modeling Protocol for Guam Power Authority (DRAFT v. Mar 2016)

Håfa Ådai!

For your review and comment is a copy of the subject document.

If possibly, I would like to schedule a technical conference call next week with USEPA, Guam EPA and GPA representatives to discuss the adequacy of this document.

Your assistance in this matter is greatly appreciated.

Kindest Regards,

CONCHITA SAN NICOLAS TAITANO, MSEM
Division Administrator, Air and Land Division - Guam EPA
Email: conchita.taitano@epa.guam.gov

Tel. No. *671.300.4751*

Fax No. *671.300.4531*

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Cc: Sylvia Ipanag[sipanag@gpagwa.com]; Roland Gutierrez - Air Program Supervisor[roland.gutierrez@epa.guam.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]
To: Drake, Kerry[Drake.Kerry@epa.gov]
From: Conchita GEPA
Sent: Wed 4/13/2016 7:06:31 PM
Subject: Re: SO2 NAAQS Designations Modeling Protocol for Guam Power Authority (DRAFT v. Mar 2016)

Hi Kerry,

Thank you for your assistance. I will be on travel around April 24 and will be back around the first week of May.

With that said, the second week in May would be good. GPA also has their contractor available to present the information in advance if needed.

Conchita

Sent from my IPad

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Thanks,

Kerry

From: Conchita San Nicolas Taitano [mailto:conchita.taitano@epa.guam.gov]
Sent: Monday, April 11, 2016 7:42 PM
To: Drake, Kerry <Drake.Kerry@epa.gov>
Cc: Sylvia Ipanag <sipanag@gpagwa.com>; Roland Gutierrez - Air Program Supervisor <roland.gutierrez@epa.guam.gov>
Subject: SO2 NAAQS Designations Modeling Protocol for Guam Power Authority (DRAFT v. Mar 2016)

Håfa Ådai!

For your review and comment is a copy of the subject document.

If possibly, I would like to schedule a technical conference call next week with USEPA, Guam EPA and GPA representatives to discuss the adequacy of this document.

Your assistance in this matter is greatly appreciated.

Kindest Regards,

CONCHITA SAN NICOLAS TAITANO, MSEM
Division Administrator, Air and Land Division - Guam EPA
Email: conchita.taitano@epa.guam.gov

Tel. No. *671.300.4751*

Fax No. *671.300.4531*

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To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]; luong.truong@epa.guam.gov[luong.truong@epa.guam.gov]; Mann, Michael[Mann.Michael@epa.gov]; Conchita San Nicolas Taitano[conchita.taitano@epa.guam.gov]
Cc: McNaughton, Eugenia[McNaughton.Eugenia@epa.gov]; Bohnenkamp, Carol[Bohnenkamp.Carol@epa.gov]; CHANG, RANDALL[Chang.Randall@epa.gov]; LIMAYE, VIJAY[Limaye.Vijay@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]
From: YOSHIMURA, GWEN
Sent: Mon 2/29/2016 9:40:23 PM
Subject: Deliverables & timelines associated with Modeling vs Monitoring, + SO2 QAPP
20160229_guam_modelingVSmonitoringRequirements.docx
ADEQFINAL SO2 QAPP.pdf

Hello,

Thanks for the good discussion last week. Please read below for some of EPA's follow-up action items:

Attached

- New write-up that contains information for the monitoring route (basically what I provided last week, with a few modifications) and the modeling route (new).
  - You will note that the modeling route has considerably less deliverables and ongoing required activities.
  - Also, the activities required under the modeling route are already underway (GPA has a draft modeling protocol already, and the modeling they're doing to determine where monitors would need to be located could be used to develop the modeling assessment instead).
- Example SO_2 monitoring Quality Assurance Project Plan (QAPP) from Arizona Department of Environmental Quality.

Not attached

- GPA provided a draft modeling protocol with their 2012 submittal to EPA. EPA is not providing an example, as GPA's modeling protocol should simply be reviewed and updated to reflect the information available in SO2 Modeling TAD (see below).
- The Modeling TAD is available at https://www3epa.gov/airquality/sulfurdioxide/pdfs/SO2ModelingTAD.pdf
- The Monitoring Technical Assistance Document (TAD) is available at https://www3epa.gov/airquality/sulfurdioxide/pdfs/SO2ModelingTAD.pdf
- I'll send the monitoring Annual Network Plan information in my next email.

Also, so that we are clear:

- SO2 monitoring conducted to comply with the Data Requirements Rule (DRR) would not be appropriate for PSD use, nor is it certain that PSD monitoring would even be required.

- We are not aware of any SO2 SIP element that requires monitoring. If you have something specific in mind that you think requires monitoring, let us know so that we can directly address this concern.
- While the DRR affords a choice between monitoring and modeling for compliance with the Data Requirements Rule, it is Guam EPA's decision. We encourage you to consider what path would best use your limited resources, especially as this could impact time and resources for years to come.

Thanks! Please let us know if you have any questions.

-Gwen

From: Roland Gutierrez
Sent: Tuesday, February 23, 2016 5:34 PM
To: Roland Gutierrez; luong.truong@epa.guam.gov; Mann, Michael; Conchita San Nicolas Taitano; YOSHIMURA, GWEN
Subject: Invitation: Notification: Call re: GPA monitoring @ Wed Feb 24, 2016 ... @ Fri Feb 26, 2016 10am - 11am (roland.gutierrez@epa.guam.gov)
When: Thursday, February 25, 2016 4:00 PM-5:00 PM.
Where: Guam EPA/USEPA

more details »

roland.gutierrez@epa.guam.gov

epa.guam.gov facebook.com/Guam twitter.com/GuamEPA

map

https://plus.google.com/hangouts/_/epa.guam.gov/roland-gutierre

Yes **Maybe** **No** more options »

Google Calendar

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SO_2 Monitoring:

Requirements to fulfill Data Requirements Rule

There are a number of requirements an agency must fulfill in order to perform regulatory monitoring. Some are required to be in place prior to such monitoring starting; others are ongoing requirements. Guam EPA has stated it would have an oversight role.

Some of the basic deliverables are:

- Annual Monitoring Network Plan (ANP)
    - To include information to inform EPA's review of SO2 DRR monitoring location(s), including modeling.
- Quality Management Plan (QMP), Quality Assurance Project Plan (QAPP), and Standard Operating Procedures (SOPs)
    - Include Roles & Responsibilities agreement between Guam EPA and GPA
    - Describe how Guam EPA will fulfill its oversight responsibilities
- Funding mechanisms for required audits

<u>Breakdown of Required Items</u>

Annual Performance Audits & Technical Systems Audits: Guam EPA's 105 Grant

- Starting Oct 2016, EPA would withhold:
    - About $6,000 annually for annual performance audits.
- Every three years, EPA would withhold:
    - About $30,000 for performing a Technical Systems Audit

Annual Monitoring Network Plan (ANP)

- Required to be submitted every year to EPA by July 1st
    - 30 day public comment period before that.
- 40 CFR 51.1203 addresses specific Data Requirements Rule aspects; 40 CFR 58.10 addresses general requirements.
    - SO2-specific modeling and monitoring should address the SO2 Modeling TAD and the SO2 Monitoring TAD.
- EPA can send:
    - Example ANP
    - The checklist we use to review whether ANPs have provided the required information.
    - Modeling & Monitoring Technical Assistance Document (TAD)

Quality Management Plan (QMP), Quality Assurance Project Plan (QAPP), Standard Operating Procedures (SOPs)

- Submit drafts to EPA by July 1st
- Finalize before January 1, 2017 (prior to the start of monitoring). EPA approval is required.
- Include document defining Roles & Responsibilities between Guam EPA and GPA (and any other

relevant organization)

- Could include request to form a new PQAO (this request must be approved by EPA before January 1, 2017).
- Items to address include:
    - AQS data submittal (quarterly at a minimum)
    - Annual data certification
    - Annual ANPs
    - QA/QC independence
    - What role Guam EPA has in data review/QC/audits & oversight
- EPA can send an example QAPP & additional information.

<u>Timeline for meeting DRR monitoring</u>

By mid-May, 2016 (and every year thereafter):

- Put ANP out for 30-day public comment & inspection.
- Must contain information regarding DRR monitors.

By July 1, 2016 (and every year thereafter):

- Submit ANP to EPA for approval

By July 1, 2016:

- Submit draft QMP to EPA for review
- Submit draft QAPP to EPA for review
- Submit draft SOP to EPA for review

By October 1, 2016 (and every year thereafter):

- Finalize 105 grant, with appropriate monitoring funds withheld/allocated

Before January 1, 2017:

- Obtain EPA approval of finalized QMP
- Obtain EPA approval of finalized QAPP
- Obtain EPA approval of finalized SOP
- Gain access to AQS and receive training.

By January 1, 2017:

- Have required SO2 monitor(s) installed and operational.

Quarterly (every quarter the monitor runs):

- Data submitted to AQS
- Data validated, data completeness verified

By May 1, 2017 (and every year thereafter):

- Certify CY2016 AQS data

Notes: a) Monitoring would be required to run indefinitely into the future (dependent upon concentrations levels measured and other factors).

b) If Guam EPA contracts out review of data or other such responsibilities, the contracts must be in place prior to January 1, 2017 and should be reviewed by EPA before being finalized.

SO_2 Modeling:

Requirements to fulfill Data Requirements Rule

Breakdown of Required Items

Modeling Protocol

- Draft submitted to EPA with 2012 GPA package.
- Revise to reflect Modeling Technical Assistance Document, available at https://www3.epa.gov/airquality/sulfurdioxide/pdfs/SO2ModelingTAD.pdf

Modeling Assessment

- Created following the modeling protocol.

Timeline for meeting DRR modeling

By July 1, 2016:

- Submit modeling protocol to EPA for review

By January 13, 2017:

- Submit modeling to EPA

If you model attainment and are designated attainment using actual emissions, by July 1st each year:

- After making available for public inspection, submit to EPA a document assessing emissions from applicable sources.
- This requirement is not required:
  - If modeling shows zero receptors over 50% of NAAQS
  - If you model attainment using allowables

Note: The modeling protocol and modeling assessment required to satisfy the Data Requirements Rule for Modeling should be nearly identical to efforts already underway in support of modeling to inform monitoring locations.

QUALITY ASSURANCE PROGRAM PLAN

for the

SULFUR DIOXIDE (SO_2)
AMBIENT AIR MONITORING NETWORK

FINAL

Prepared by:

Arizona Department of Environmental Quality
Air Quality Division
1110 W. Washington Street
Phoenix, AZ 85007

October 2013

A.1 TITLE AND APPROVAL PAGE

Title: Quality Assurance Program Plan for the Sulfur Dioxide (SO_2) Ambient Air Monitoring Network

The Arizona Department of Environmental Quality has prepared this Quality Assurance Program Plan following the *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5)* dated March 2001, the *EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5)* dated December 2002, the *EPA Region 9 Requirements for Quality Assurance Program Plan (R9QA/03.2)* dated March 2012, and the ADEQ Quality Management Plan dated August 2010.

This QAPP is hereby recommended for approval and commits the Department to follow the elements described within.

Arizona Department of Environmental Quality

Eric C. Massey, Director, Air Quality Division

Signature: _____ Date: _____

Theresa Rigney, Manager, Air Assessment Section

Signature: _____ Date: _____

Mark Carrel, Manager, Air Monitoring Unit

Signature: _____ Date: _____

Heather Colson, Manager, Data Management & Quality Assurance Unit

Signature: _____ Date: _____

Ceresa Stewart, DM&QA Lead, Data Management & Quality Assurance

Signature: _____ Date: _____

Becky Soter, Safety and Quality Management Specialist, ADEQ

Signature: _____ Date: _____

EPA Region 9

Eugenia McNaughton, Quality Assurance Manager, EPA Region 9

Signature: _____ Date: _____

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A.2.C MASTER LIST OF ACRONYMS AND DEFINISITONS

AAAD	(ADEQ) Air Assessment Ambient Database
AA-PGVP	Ambient Air-Protocol Gas Verification Program
AAS	(ADEQ) Air Assessment Section
AC	actual conditions (aka, local conditions)
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
ADQ	audit of data quality
AFL	(ADEQ) Air Filter Laboratory
AgBMP	Agricultural Best Management Practices
AMU	(ADEQ) Air Monitoring Unit
AMTIC	Ambient Monitoring Technical Information Center
ANP	Annual Network Plan
ANSI	American National Standards Institute
APTI	Air Pollution Training Institute
AQD	(ADEQ) Air Quality Division
AQS	(EPA) Air Quality System
ASARCO	American Smelting and Refining Company
BAM	beta attenuation monitor
CA	corrective action
CAA	Clean Air Act
CAP	corrective action process/program
CAFDF	custody and field data form
CBSA	core-based statistical area
CFM	cubic feet per minute
CFR	*Code of Federal Regulations*
CL	confidence limit
COC	chain-of-custody
CEDES	(Mexico) Commission for Ecology and Sustainable Development
CV	coefficient of variation
DAS	data acquisition system
DCS	data collection system
DL	detection limit
DMT	(ADEQ) Data Management Team
DM&QA	(ADEQ) Data Management & Quality Assurance (Unit)
DQA	data quality assessment
DQO	data quality objectives
EBAM	environmental beta attenuation monitor
EDO	environmental data operation
EDXRF	energy-dispersive X-ray fluorescence
EER	Exceptional Events Rule
EPA	Environmental Protection Agency
EQL	estimated quantitation limit

ERG	Eastern Research Group, Inc.
EU	(ADEQ) Evaluation Unit
FCC	filter/canister/cartridge samples
FEM	federal equivalent method
FIP	Federal Implementation Plan
FMMI	Freeport-McMoRan Copper and Gold Inc.
FR	*Federal Register* or flow rate (depending on context)
FRM	federal reference method
FS	full scale
GIS	Geographical Information Systems
GLP	good laboratory practice
h	hour
HC	hydrocarbon
IAF	internal audit finding
ICP-MS	inductively coupled plasma mass spectrometry
IGA	intergovernmental agreement
ISO	International Organization for Standardization
ISTU	(ADEQ) Information Systems Development Unit
IT	information technology
IUPAC	International Union of Pure and Applied Chemistry
JLG	John L. Guyton Supersite (aka, PXSS, Phoenix Supersite – a monitoring site)
LAN	local area network
LC	local conditions (aka, actual conditions)
LCD	liquid crystal display
LDL	lower detection level
LIMS	laboratory information management system
L/min	liters per minute
m^3	cubic meter
MAG	(Arizona) Maricopa Association of Governments
max./min.	maximum/minimum (thermometer)
MDL	method detection limit
$\mu g/m^3$	micrograms per cubic meter
µm	micrometer
mm	millimeter
mmHg	millimeters of mercury
min	minute
mL	milliliter
mo	month
MO	monitoring organization
MQO	measurement quality objective
MSA	metropolitan statistical area
MSR	management systems review
NAAQS	National Ambient Air Quality Standard

NAREL	National Air and Radiation Environmental Laboratory
NATTS	National Air Toxics Trends Stations
NBS	National Bureau of Standards (no longer in existence – currently NIST)
NCore	National Core (monitoring network)
NIST	National Institute of Standards and Technology
nm	nanometer
NPAP	(EPA) National Performance Audit Program (gaseous pollutants)
NPEP	(EPA) National Performance Evaluation Program (covers PEP and NPAP as well as other QA programs)
NPS	National Park Service
OAQPS	(EPA) Office of Air Quality Planning and Standards
OAR	(EPA) Office of Air and Radiation
ORD	(EPA) Office of Research and Development
ORIA	(EPA) Office of Radiation and Indoor Air
P&A	precision & accuracy
P&B	precision & bias
Pb	lead, a NAAQS criteria pollutant
PE	performance evaluation
PEP	Performance Evaluation Program (for PM2.5/Pb)
PM	project manager or particulate matter (depends on context)
PM_{10}	particulate matter, aerometric diameter ≤ 10 micrometers
$PM_{10-2.5}$ (PM coarse)	particulate matter, aerometric diameter 10 – 2.5 micrometers
$PM_{2.5}$	particulate matter, aerometric diameter ≤ 2.5 micrometers
PO	project officer
PQAO	Primary Quality Assurance Organization
PQL	practical quantitation limit
PSD	prevention of significant deterioration
PT	proficiency test
PXSS	Phoenix Supersite (aka, PXSS, JLG Supersite - a monitoring site)
Q_{avg}	average flow rate
QA	quality assurance
QA/QC	quality assurance/quality control
QAHBV2	*Quality Assurance Handbook for Air Pollution Measurement Systems: Volume II: Ambient Air Quality Monitoring Program (QAHBV2)* (ed. 2013 or current)
QAM	quality assurance manager
QAPP	Quality Assurance Program or Project Plan
QAL	quality assurance lead or leader
QC	quality control
QMP	Quality Management Plan
RH	relative humidity
RPD	relative percent difference

RO	reporting organization
RTI	Research Triangle Institute (North Carolina)
RTP	Research Triangle Park (North Carolina)
R&P	Rupprecht and Patashnick Co. (no longer in existence – currently Thermo)
SEMARNAT	Secretariat of Environment and Natural Resources (Mexico)
SCCM	standard cubic centimeter
SD	standard deviation
SIP	State Implementation Plan
SLAMS	state and local air monitoring station
SLB	site logbook
SOP	standard operating procedure
S/T/L	state, tribal, and local
TEOM	tapered element oscillating microbalance
TSA	technical systems audit
TSP	total suspended particulate (any size limit)
TTP	through-the-probe
T&RH	temperature & relative humidity
USEPA	United States Environmental Protection Agency
UTM	universal transverse mercator
VSCC	very sharp cut cyclone
XRF	X-ray fluorescence
ºC	degree Celsius or centigrade
ºF	degree Fahrenheit

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A.3 DISTRIBUTION LIST

For the Arizona Department of Environmental Quality – Air Quality Division

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All AMU Air Monitoring Technicians

Heather Colson, Manager, Data Management & Quality Assurance (DM&QA) Unit

Ceresa Stewart, DM&QA Lead, DM&QA

Teresa (Qinyue) Mackey, Lead, Continuous Data Reviewer, DM&QA

Vacant, Annual Network Plan Coordinator, DM&QA

Andy Clifton, QA Auditor, DM&QA

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SECTION A. PROGRAM MANAGEMENT

A.4 PROGRAM ORGANIZATION

Arizona Department of Environmental Quality (ADEQ) is responsible for collecting and reporting measurements of airborne sulfur dioxide (SO_2) that meet required and approved EPA quality assurance (QA) practices beginning with field operations and continuing through data validation, and reporting. ADEQ's SO_2 network collects SO_2 measurements near sources, typically mines, and in central Phoenix at ADEQ's NCore station. ADEQ personnel strive to maintain positive, collaborative working relationships with representatives from other governmental agencies, manufacturers of air monitoring instruments, producers of standard/reference materials that support the SO_2 program to ensure any concern can be addressed in an expedient manner and that accurate SO_2 measurements are collected and reported.

The primary objective for collecting SO_2 measurements is to determine whether or not locations in Arizona under ADEQ's air monitoring jurisdiction are in compliance with the National Ambient Air Quality Standards (NAAQS) for SO_2. This Final SO_2 Quality Assurance Program Plan (QAPP) communicates to all parties the specifications for implementing and operating the SO_2 monitoring program in one clear, concise, and complete document. It details ADEQ's plan for operating the compliance-driven SO_2 monitors and the management of data generated and reported to the EPA's national database, the Air Quality System (AQS). It focuses on the quality system and quality assurance activities in-place for the SO_2 measurements collected directly by ADEQ for compliance purposes. It also provides information on SO_2 air monitoring conducted by the sources.

The effectiveness of a QA program and its specific quality control (QC) requirements depends on field and data collection, transmittal, and validation procedures being followed as specified. QA/QC principles and practices meet or exceed EPA's requirements and will be stringently applied throughout this environmental data operation (EDO). ADEQ's QAPP and associated standard operating procedures (SOP) have been carefully developed to ensure they provide sound and practical processes. Contact information for key personnel is provided in the event questions arise or additional information is needed regarding elements of the SO_2 air monitoring program such as: the sampling plan, instrumentation operation and QC requirements, data and measurement quality objectives, assessments, reports to management, or data management. It provides information regarding the types of air monitoring methods currently used or planned for use in the field. The following information summarizes ADEQ's SO_2 air monitoring network.

- No laboratory services are needed for SO_2,
- Measurements from continuous analyzers used for comparison to the NAAQS,
- ADEQ participates in the EPA National Performance Audit Program (NPAP) for gaseous pollutant analyzers. Periodically, EPA will compare gas concentrations values measured by an ADEQ analyzer with those measured by a collocated EPA SO_2 analyzer. EPA selects the SO_2 station prior to each audit. Currently, ICF Consultants conducts the

NPAP tests, acting on behalf of the EPA Office of Air Quality Planning and Standards (OAQPS),

- ADEQ will participate in the voluntary Ambient Air-Protocol Gas Verification Program (AA-PGVP) when possible. This assessment identifies specialty gas producers used by air monitoring organization and determines how well the gases produced meet the EPA's gas protocol requirements. ADEQ participated in the program in 2011 by submitting an NO cylinder from Praxair for testing at the EPA Region 7 laboratory.

The ADEQ Air Assessment Section (AAS) is responsible for the SO_2 air monitoring networks. Personnel from several Units within the AAS are involved with the SO_2 networks and all AAS personnel work together as a team. Key responsibilities for each Unit are:

Evaluation Unit (EU) – Air modelers identify potential air monitoring sites that best meet the purpose for establishing each site, such as measuring the highest expected SO_2 concentrations in an area. A senior environmental engineer may assist the Air Monitoring Unit (AMU) in finding physical locations for other SO_2 sites that meet EPA criteria. EPA Region 9 representatives approve final site selection.

Air Monitoring Unit (AMU) – The Unit manager and lead technicians are responsible for selecting, testing, installing, and operating SO_2 air monitoring stations. Technicians test new monitors in-house before deployment to the air monitoring sites. Once installed at the sites, the technicians evaluate the air monitors' performance by conducting regularly scheduled quality control (QC) checks and maintain the air monitors in proper operating condition according to their standard operating procedures (SOP). The AMU is also responsible for the collection of SO_2 measurements from the continuous SO_2 analyzers using a data collection system, which uploads the data to our in-house database. The continuous data lead, or their designee, performs the initial QA data review on a daily basis and promotes the data to the QA Level 2.

Data Management & Quality Assurance Unit (DM&QA) – Site selection and modeling results are reviewed by the Unit manager, the network plan coordinator, and potentially SO_2 data reviewers as necessary. The network plan coordinator prepares the agency's annual and five-year network plans for EPA Region 9. The SO_2 data reviewer(s) are responsible for quarterly SO_2 data validation, reporting the NAAQS-required SO_2 data to the EPA's Air Quality System (AQS), providing internal reports regarding data outcomes, and developing SOPs for the validation and reporting procedures. The QA Auditor is responsible for performance evaluation (PE) audits on the SO_2 analyzers, the associated SOPs, and coordinating the EPA NPAP audits. The QA/QC Lead is responsible for maintaining the official, approved QAPP and serving as a backup field auditor. Both the QA Auditor and the QA/QC Lead are responsible for additional QA assessments, such as technical system audits (TSA) and audits of data quality. To help develop this QAPP and the associated SOPs, the DM/QA Lead worked with key SO_2 team players from DM&QA and AMU.

Air Assessment Section (AAS) Manager – Responsible for securing program funding, serving as a liaison to EPA Region 9, and providing leadership and guidance to all Unit personnel involved with the SO_2 network.

Table A.1 shows ADEQ personnel involved with the SO_2 air monitoring program and their responsibilities. Figures A.1 and A.2 provide organizational charts of the ADEQ Air Quality Division (AQD) personnel involved with the SO_2 program. As shown on the chart, the QA Team is housed in the DM&QA Unit and is independent from AMU, which generates the SO_2 measurements.

EPA is responsible for establishing program regulations, guidance, and funding.

EPA Region 9 - Personnel are responsible for activities that include: reviewing, providing assistance with and approving this QAPP, responding to requests for technical and policy information and interpretations, evaluating quality system performance through TSA, performance evaluations (PE), network reviews as appropriate, and making the ADEQ aware of any unmet QA needs in a timely manner.

EPA Office of Air Quality Planning and Standards (OAQPS) - Personnel are responsible for activities that include: ensuring that the methods and procedures used to collect SO_2 air pollution measurements adequately meet the program objectives and that the resulting data are of satisfactory quality, operating the National Performance Evaluation Program (NPEP) that includes the NPAP and protocol gas verification assessments, making the technical and quality assurance information developed by EPA available to organizations making air pollution measurements, evaluating the performance of air monitoring organizations through quality assurance assessments such data reviews and metrics, and TSAs and management systems reviews as appropriate, ensuring that guidance pertaining to the QA aspects of the ambient SO_2 air monitoring program are written and revised as necessary, and rendering technical assistance to the EPA Regional Offices and air pollution monitoring community.

Table A.1 ADEQ Air Quality Division (AQD) SO_2 Network Personnel

Contact Information for the SO_2 Ambient Air Monitoring Team			
Name and Title	**Role**	**Responsibilities**	**Contact Information**
Theresa Rigney, Environmental Program Manager	Air Assessment Section Manager	Program manager and liaison to Region 9 program lead	602-771-2274 tr3@azdeq.gov
Kami Budhu, Program and Project Specialist I	Administrative Assistant	Procurement of goods and services	602-711-2370 kb2@azdeq.gov
Bradley Busby, Environmental Program Supervisor	Evaluation Unit Manager	Trends analysis of data and evaluation unit operations and deliverables	602-771-7676 bb4@azdeq.gov
Randy Redman, Environmental Engineer	Field services Site establishment support		602-771-2278 rrr@azdeq.gov
Mark Carrel, Environmental Program Supervisor	Air Monitoring Unit Manager	Air Monitoring Unit operations and deliverables	602-771-2359 mwc@azdeq.gov
Richard Montenegro, Environmental Program Specialist Lead	Lead Data Collection Administrator	DCS, AAAD, and AirVision™ operations and reporting, Level 2 data validator for continuous SO_2 data	602-771-2389 rvm@azdeq.gov
AMU Air Monitoring Technicians	Field services	Operation/performance of SO_2 air monitors at assigned sites, sites, and QA Level 2 review	
	Ralph Lucero, Environmental Program Specialist		602-771-2390 rvl@azdeq.gov
	Terry Taflinger, Environmental Program Specialist AMU Service Report Reviewer		602-771-2392 tkt@azdeq.gov
	Brant Englund, Environmental Program Specialist		602-771-4481 bae@azdeq.gov
	Craig Pearson, Environmental Program Specialist		602-771-2394 crp@azdeq.gov
	Mike Hatounian, Environmental Program Specialist		602-771-2298 msh@azdeq.gov
	Greg Kendall, Environmental Program Specialist		602-771-2258 gwk@azdeq.gov
	Harold Monteith, Environmental Engineering Specialist		602-771-2336 hm3@azdeq.gov
Heather Colson, Environmental Program Supervisor	DM&QA Unit Manager	QA and Data Management Unit program operations and deliverables	602-771-4488 hc2@azdeq.gov
Ceresa Stewart, Environmental Program Specialist, Lead	Lead, DM&QA Coordinator	Data management, QAPP development, QA oversight	602-771-2297 cs5@azdeq.gov
Teresa (Qinyue) Mackey, Environmental Program Specialist	SO_2 Continuous Data Reviewer	QA Level 3 SO_2 data reviewer and AQS data entry	602-771-4109 qm1@azdeq.gov
Vacant, Environmental Program Specialist	Network Plan Coordinator	Network plan development and reviews	
Andy Clifton, Environmental Health Specialist, II	QA Auditor	QA Team, air monitoring instrument audits and TSA support	602-711-4382 agc@azdeq.gov

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Figure A.1 SO_2 Air Monitoring Program Organizational Chart

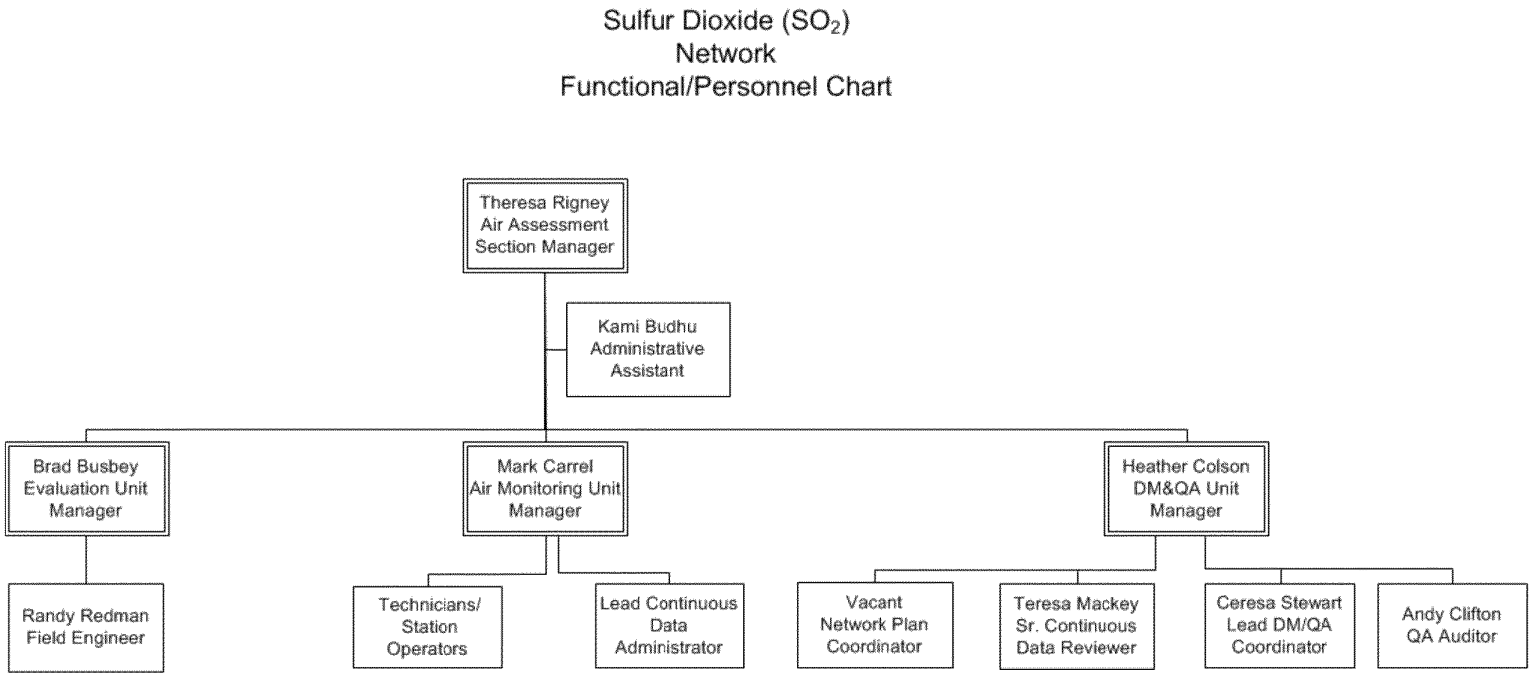

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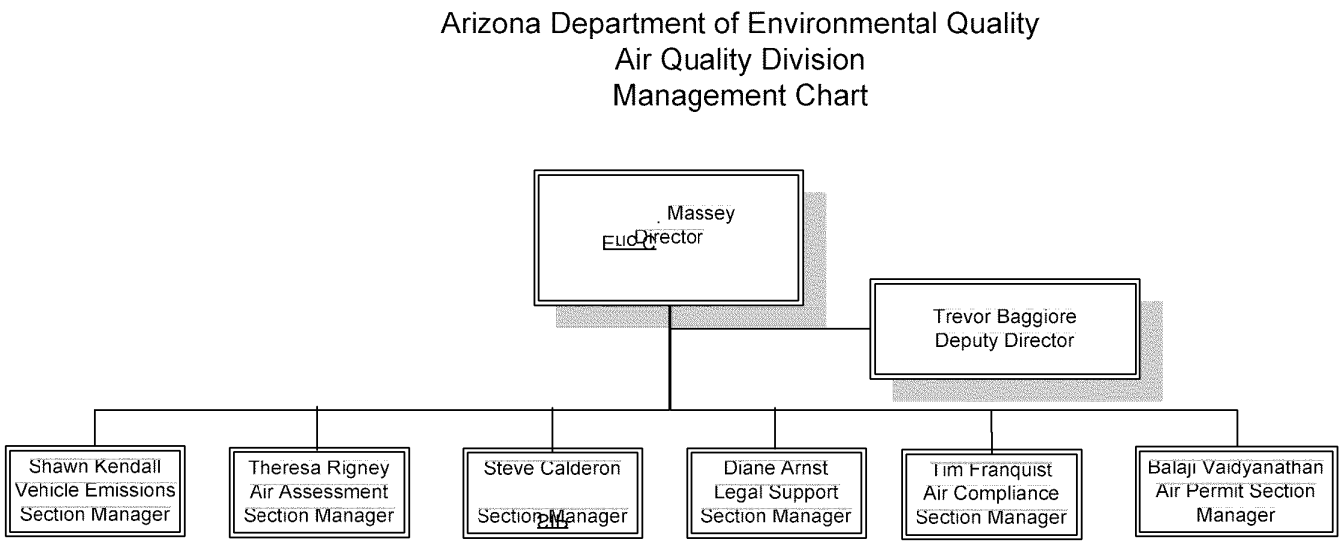
Figure A.2 ADEQ Air Quality Division Organizational Chart



A.5 PROBLEM DEFINITION/BACKGROUND

In Arizona, the principal source of SO_2 emissions has been the smelting of sulfide copper ore. SO_2 is a colorless gas with a pungent irritating odor at elevated concentrations, and it is emitted largely from burning high sulfur coal, oil, and diesel fuel. Most fuels contain trace quantities of sulfur and their combustion releases both gaseous SO_2 and particulate sulfate. Since SO_2 is usually found in association with particulate pollution, and SO_2 is the precursor for fine sulfate particles, separating the health effects of these two pollutants is considered to be difficult. The primary route of entry into the body is by inhalation. SO_2 contributes to respiratory illness, particularly in children and the elderly, and aggravates existing heart and lung diseases. SO_2 contributes to the formation of acid rain, and it contributes to the formation of atmospheric particles that causes visibility impairment, most noticeably in national parks. SO_2 and other pollutants formed from SO_2, such as sulfate particles, can be transported over large distances and deposited far from the point of origin.

Currently, most of the state of Arizona is in attainment for SO_2. SO_2 concentrations in the Phoenix metropolitan area have been measured well below the 1971 and 2010 NAAQS standards for years. However, elevated SO_2 concentrations do occur in several more rural locations in Arizona. The EPA 2011 National Emissions Inventory report shows the estimated quantity of SO_2 emitted from various sources in Arizona. The majority of SO_2 emissions are produced by coal-based electricity generation, the smelting of non-ferrous (iron) ore from mines, and wildfires. See Attachment A for an excerpt from the NEI report on SO_2 emissions.

SO_2 is removed from the atmosphere through dry deposition on plants and is converted to sulfuric acid, and eventually sulfate. Both contribute to public health problems and negatively impact the environment. Major controls were installed in Arizona's copper smelters in the 1980s, which reduced SO_2 emissions substantially. In addition, most of the copper ore smelters that used to operate have been shutdown, which reduced SO_2 emissions in localized areas and around the state. As of 2013, the only smelters operating in locations regulated by ADEQ are located east of the Phoenix Metropolitan area, in Miami and Hayden. Vehicular emissions of SO_2 and sulfate have been significantly reduced over the years through lowering the sulfur content in diesel fuel and gasoline.

At ADEQ's SO_2 monitoring stations, SO_2 measurements are taken continuously, year-round using pulsed fluorescence analyzers. The siting of SO_2 monitors is based on judgmental sampling, as is the case for most ambient air monitoring networks. Judgmental sampling uses data from existing monitoring networks, knowledge of source emissions, population distribution, and weather information to select the best monitoring location(s) that best achieves the basic monitoring objectives.

Historically, ADEQ has required several of the major point sources in the state to conduct ambient monitoring for selected pollutants in and around specific facilities. Monitoring may be required prior to the startup of a new source/facility for prevention of significant

deterioration (PSD). Other monitoring requirements are typically established in each source's permit when issued or renewed. ADEQ's oversight activities of the source-generated SO_2 measurements has been limited to PE audits on some source-operated SO_2 analyzers and review of ambient data submitted according to permit requirements.

Sources are required to review and validate their data and submit data summaries or data and quality assurance documents to ADEQ according to the permit requirements. ADEQ personnel have been in communication with personnel from American Smelting and Refining Company, LLC (ASARCO) and Freeport McMoRan Copper and Gold Inc. (FMMI) regarding ADEQ acquiring the responsibility of SO_2 data collection and reporting to the EPA AQS database in its entirety. To better satisfy EPA's current requirements for air monitoring organizations to have primary quality assurance organization (PQAO) status to efficiently and effectively collect and report quality SO_2 (and PM_{10}) data to EPA's AQS database. ADEQ may assume some or all of the SO_2 monitoring responsibilities or collaborate with the sources to establish collocated SO_2 monitors. ADEQ has been negotiating with FMMI to change operator status at existing FMMI sites. ADEQ has contacted ASARCO to discuss similar changes as well. For the most current information regarding SO_2 monitoring in Arizona, reference ADEQ's Annual Network Plan (ANP). ADEQ plans to continue performing the annual PE audits on the sources' SO_2 monitors; however, this may change if ADEQ assumes the responsibility of monitoring and reporting SO_2 measurements to AQS.

In 2005, Congress identified a need to account for events that result in exceedances of the NAAQS that are exceptional in nature (i.e., not expected to reoccur or caused by acts of nature beyond man-made controls). In response, the EPA promulgated the Exceptional Events Rule (EER) to address exceptional events in 40 CFR Parts 50 and 51 on March 22, 2007 (72 FR 13560). In an attempt to clarify this rule, the EPA released draft guidance documents on the implementation of the EER to state, tribal and local (S/T/L) air agencies for review on May 2, 2011 and July 12, 2012. To date, ADEQ has not submitted an exceptional event requests for any SO_2 exceedances.

The NAAQS limits for SO_2 are evaluated periodically by the Clean Air Scientific Advisory Committee (CASAC) and potentially other advisory groups. These reviews have resulted in the NAAQS being lowered in recent years to better protect public health and welfare. In June 2010, EPA revised the primary SO_2 standard by establishing a new one-hour standard at a level of 75 parts per billion (ppb). The new standard is based on the three-year average of the 99th percentile of the annual distribution of daily maximum one-hour concentrations. The two existing primary standards of 140 ppb evaluated over 24 hours and the 30 ppb evaluated over a year were revoked; however, they remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plan to attain or maintain the 2010 standard are approved. Additionally, the EPA required changes to data reporting requirements to include reporting the maximum five-minute concentration for each hour in addition to the hourly averaged concentrations.

ADEQ began collecting and processing hourly maximum five-minute SO_2 concentrations in July and August 2010. New monitoring requirements for placement of monitors were also issued, and the new monitors were required to be operational by January 2013. The new monitoring requirements did not result in any SO_2 monitoring changes in ADEQ's network; however, population-oriented monitoring is primarily covered by Maricopa and Pima Counties' air monitoring units while the source-operated monitors have been established for years.

At the beginning of 2011, the EPA's National Core Monitoring Network (NCore) air monitoring program went into effect and ADEQ's SO_2 measurements at the JLG Supersite satisfy part of the NCore program's requirement. NCore stations are classified as being a subset of state and local air monitoring stations (SLAMS), and the data are reported to AQS. See Figures A.3 to see the map of ADEQ's SO_2 network.

ED_001261_00024838

Figure A.3 The ADEQ SO_2 Network

Source: AAAD

ADEQ Arizona Department of Environmental Quality
Janice K. Brewer, Governor
Henry R. Darwin, Director

April 26, 2013 Author - N Caroli

Source: The ADEQ 2013 Annual Network Plan (*final draft)*

A.6 PROGRAM DESCRIPTION

Detailed information regarding the SO_2 monitoring methods is provided in Section B of this document; however, becoming familiar with a few terms will assist a reader less familiar with ambient air monitoring. The term "method" can refer to an analytical process employed by a laboratory or a particular manufacturer's make/model of air monitor. The term "monitor" is a generic term that refers to both "samplers", which collect a sample of air either onto a specific type of filter media or into a specific type of container usually over a 24-hour period, or "analyzers", which ascertain a pollutant's concentration on an hourly, or "continuous" basis without producing a physical sample that can be subjected to further analysis at a later date. Samplers have been used to primarily collect particulate matter samples rather than gaseous samples. In addition, samplers are referred to as "manual" methods, while analyzers are referred to as "continuous" or "automated" methods.

Prior to being used to collect data for comparison to the NAAQS, air monitors must pass testing and receive either a federal reference method (FRM) or federal equivalent method (FEM) designation and unique alphanumeric identifier by the EPA. Continuous analyzers are designated as FEMs. The EPA allows states or regions to test and designate monitors as an approved regional method (ARM), but ADEQ does not currently use or plan to use any ARMs in the SO_2 Network. For the source-oriented SO_2 monitors, unless otherwise allowed in the future permits, we anticipate the sources will continue to operate SO_2 analyzers that hold the FEM designation. More information concerning the various SO_2 networks is found in Section B. The *List of Approved Reference and Equivalent Methods* is updated by EPA on a regular basis and made available at:
http://www.epa.gov/ttn/amtic/files/ambient/criteria/reference-equivalent-methods-list.pdf.

Currently, SO_2 measurements are collected on a continuous schedule. EPA does not require continuous, gaseous analyzers to be collocated at the PQAO level or the national level as with other air monitoring networks such as particulate matter and lead. In the future, ADEQ may decide to operate a second SO_2 analyzer at a particular site. This may be useful for quality assurance purposes at locations where SO_2 compliance determinations are outstanding or scheduled for review.

The sources have been operating SO_2 monitors at selected sites for a number of years. As described earlier, ADEQ has suggested to ASARCO and FMMI that ADEQ assume responsibility for collecting SO_2 measurements in the Hayden and Miami area. The sources' data have been used for either NAAQS comparison and/or SIP support to further gauge the SO_2 concentration.

The NCore-required trace-level SO_2 measurements are primarily used to characterize SO_2 trends and assist in understanding SO_2 transport across representative areas in urban or rural locations and are also used for comparison to the SO2 NAAQS. Since the ADEQ's NCore station is located in a CSBA with minimum monitoring requirements the SO_2 monitor JLG Supersite can be counted toward the minimum monitoring requirements and the

measurements are reported to EPA's AQS database. NCore is a multi-pollutant network that integrates several advanced measurement systems for particles, pollutant gases, and meteorology, and an NCore station is required for CBSAs where the population is greater than 500,000 people.

The objectives established by EPA for the NCore network are:

> Timely reporting of data to public by supporting AIRNow, air quality forecasting, and other public reporting mechanisms;
> Support for development of emission strategies through air quality model evaluation and other observational methods;
> Accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors;
> Support for long-term health assessments that contribute to ongoing reviews of the NAAQS;
> Compliance through establishing nonattainment/attainment areas through comparison with the NAAQS;
> Support to scientific studies ranging across technological, health, and atmospheric process disciplines; and
> Support to ecosystem assessments recognizing that national air quality networks benefit ecosystem assessments and, in turn, benefit from data specifically designed to address ecosystem analyses.

ADEQ monitors will meet EPA quality control criteria for SO_2 monitors as found in *40 CFR Part 58*. These criteria include, but are not limited to: siting specifications, quality control checks, and collocation requirements. ADEQ will address any challenges with meeting these requirements as they arise in an expedient manner. Section B of this QAPP describes ADEQ's network design and information regarding the sources' air monitoring.

Ultimately, ADEQ plans to collect meteorological measurements of wind speed, wind direction, relative humidity, and temperature at most, if not all, SO_2 sites. Data generated from these instruments may provide useful information regarding the origin of SO_2 in ambient air. Please note that ADEQ plans on covering the monitoring methods and objectives for meteorological monitoring in the NATTS/ATMP/PAMS QAPP update, which is scheduled for update in early 2014.

A.7 QUALITY OBJECTIVES AND CRITERIA

Quality objectives and associated criteria establish the foundation upon which air monitoring data collection operations are conducted. Many decisions regarding data collection and evaluation must be made before an air monitoring organization can consistently and confidently report representative data. Quality objectives must be well defined for an air monitoring organization to produce data of a known quality, which is suitable for comparison to another air monitoring organization's (MO) data. These decisions are continually evaluated and adjusted over time, based on the network's performance and objectives. Statistical goals and a host of operational criteria are established for field, laboratory, and data validation operations. As air monitoring instruments become more sophisticated and regulatory limits for pollutants potentially decrease, these goals and criteria are reviewed and adjusted as needed by air quality professionals from EPA and the MOs to ensure high quality data are produced for use by decision makers.

Two types of quality objectives are commonly developed and applied to ambient air monitoring programs: data quality objectives (DQOs) and measurement quality objectives (MQOs). These objectives are defined below. In general, they establish and provide a means to control the error in data at or below a level determined to be acceptable or tolerable, to the decision maker (customer); who uses the data to make decisions regarding public health and welfare. If data were to contain a level of error that exceeds what is tolerable, the decisions made could either invoke compliance actions that were not necessary or fail to invoke appropriate compliance actions to protect publics' health and welfare; neither produces a desirable outcome. The basic idea is that if we follow established MQOs the data are expected to meet the established DQOs. But, to truly know if DQOs are being achieved, an assessment must be performed where the data produced are evaluated against the DQOs. Additional information on assessments is provided in Section C of this document. It is important to note that this comparison of data to the DQOs is the final step in completing the quality system cycle for an ambient air monitoring operation. DQOs are evaluated and amended over time as needed to reflect realistic goals. Figure A.4 shows the quality assurance life cycle's stages that are applied to ambient air monitoring programs to help ensure the data produced meet their objectives.

Figure A.4 The Ambient Air Quality Monitoring QA Program

Figure 1.3 Ambient Air Monitoring Quality Monitoring QA Program

Source: The EPA *Quality Assurance Handbook for Air Pollution Measurement Systems: Volume II: Ambient Air Quality Monitoring Program* (2013 version)

Data Quality Objectives

The DQOs are defined as *the qualitative and quantitative statements derived from the DQO planning process that clarify the purpose of the study, define the most appropriate type of information (data) to collect, determine the most appropriate conditions from which to collect that information, and specify the tolerable levels of potential decision errors*. DQOs are based on the requirements of the data user, or decision maker. By meeting these objectives, a high level of confidence is established regarding the quality of data used to make environmental decisions. DQOs assess the adequacy of data (new or existing) in relation to the intended use.

The EPA publishes DQOs for air monitoring programs collecting data used for comparison to the NAAQS, as well as other types of air monitoring programs. EPA uses the DQO process to determine the appropriate precision and bias MQOs for various air monitoring

programs. ADEQ plans on following the MQO requirements provided in *40 CFR Parts 50 and 58* to evaluate the SO_2 network's performance.

The EPA DQO for SO_2:

There were no DQOs found for SO_2 at the AMTIC website or on *40 CFR Part 50 or 58*.

ADEQ's supplemental DQOs for the SO_2 network are:

ADEQ developed the following in-house data quality objectives for the SO_2 data. The objectives are to:

- Determine concentrations of airborne SO_2 for comparison to the NAAQS,
- Determine the level of ambient airborne SO_2 occurring at the NCore station (JLG Supersite) in the Phoenix Metropolitan area,
- Evaluate the representativeness of selected SO_2 sites based on air shed models and to adjust site locations as needed,
- Ascertain the impact regulated sources have on air quality in their vicinity where applicable,
- Support the development and enforcement of SIPs (if required), and
- Produce high quality data for decision makers (data users) such as public health officials assessing the potential ill health effects associated with SO_2.

Measurement Quality Objectives

MQOs are designed to evaluate and control various phases of the measurement process to ensure that total measurement uncertainty is within the range prescribed by the DQOs and/or the *40 CFR Part 58 Appendix A*. The following precision and bias tests estimate measurement uncertainty, potentially introduced into the measurement collection process. ADEQ will adhere to the MQOs developed by the EPA and may add additional supplemental in-house objectives as well. EPA recommends the following data goals be assessed quarterly, annually, and every three years at the PQAO level of aggregation. There are standard reports in AQS that can generate most, if not all, of these statistics. ADEQ will adhere to current AQS requirements as changes occur to the inputting of quality control data.

For SO_2, measurement uncertainty statements are published in the *40 CFR Part 58 Appendix A 4.1:*

> Statistics for the assessment of QC checks for SO_2, NO_2, O_3, and CO use percent difference values.
> 4.1.1 *Percent Difference*. All measurement quality checks start with a comparison of an audit concentration, or value, (flowrate) to the concentration/value measured by the analyzer and use percent difference as the comparison statistic as described in

Equation 1 of this section. For each single point check, calculate the percent difference, d_i, as follows:

Equation 1

$$d_i = \frac{\text{meas} - \text{audit}}{\text{audit}} \times 100$$

where, *meas* is the concentration indicated by the monitoring organization's instrument and *audit* is the audit concentration of the standard used in the QC check being measured.

4.1.2 *Precision Estimate*. The precision estimate is used to assess the one-point QC checks for SO_2, NO_2, O_3, or CO described in section 3.2.1 of Appendix A. The precision estimator is the coefficient of variation upper bound and is calculated using Equation 2 of this section:

Equation 2

$$CV = \sqrt{\frac{n \cdot \sum_{i=1}^{n} d_i^2 - \left(\sum_{i=1}^{n} d_i\right)^2}{n(n-1)}} \cdot \sqrt{\frac{n-1}{X^2_{0.1,n-1}}}$$

where, $X^2_{0.1,n-1}$ is the 10th percentile chi-squared distribution with n-1 degrees of freedom.

As previously described, EPA does not require collocation for SO_2 analyzers by monitoring organizations. ADEQ gaseous analyzers are subjected to an annual performance assessment by the EPA National Performance Audit Program (NPAP), which is used to estimate the total measurement system bias.

The EPA's MQOs for the SO_2 program are:

- The goal for acceptable measurement uncertainty for precision is defined as an upper 90% confidence limit for the coefficient of variation (CV) of 10%, and
- The goal for bias as an upper 95% confidence limit for the absolute bias of 10%.

In addition to the EPA's MQOs, ADEQ may evaluate additional information from data routinely collected in the SO_2 network to further evaluate how well other QC checks perform over time. ADEQ plans to use the statistics provided by EPA's AQS database to determine how well we meet these metrics.

EPA and ADEQ will evaluate these MQO goals periodically. It is anticipated that EPA will assess and report on the nationwide MQO goals on three years of data at the PQAO level of

aggregation for both the SO_2 networks. ADEQ plans to assess these goals both annually by way of the data certification process, and on a three-year basis, by way of the EPA's reports. As QA/QC data are collected and evaluated, ADEQ may develop additional MQO goals for the NAAQS SO_2 monitoring based on future findings. ADEQ plans on adhering the EPA's DQOs and MQOs goals when assessing the validity of the data.

Data Quality Indicators

Data quality indicators (DQI) are used to assess how well NAAQS-oriented SO_2 data compare to the established DQOs and/or MQOs. DQIs provide additional information for evaluating the quality of data. EPA's AQS provides statistical software that evaluates the DQIs of precision, bias, and completeness. For the AQS to develop statistical reports, the data from routine verifications and PE audits are entered into the AQS by ADEQ, and the data from SO_2 NPAP audits are enter by EPA. The AQS statistical reports include: the AMP 255, AMP 600, and AMP 450NC; additionally, EPA uploads an annual DQI report to AMTIC at: http://www.epa.gov/ttn/amtic/qareport.html. On a regular basis, other DQIs are assessed manually by technical personnel, and ADEQ reports on these results in the ANP or Five-Year Network Assessment. ADEQ uses the combination of statistics and observations to ensure SO_2 data are of high quality and meet decision makers' needs.

DQIs for the SO_2 program are:

- ***Representativeness*** – is a measure of the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is controlled largely by the site location.
- ***Precision*** – is the measure of mutual agreement among individual measurements of the same property usually under prescribed similar conditions. This is the random component of error. Precision is estimated by various statistical techniques using some derivation of the standard deviation (based upon monitoring calibration and verifications). Precision is determined using routine verifications (zero/span/precision) and NPAP sampling results.
- ***Bias*** – is the systematic or persistent distortion of a measurement process, which causes error in one direction. Bias will be determined by estimating the positive and negative deviation from the true value as a percentage of the true value. There are different ways to assess bias. Bias can be determined by an assessment of the comparability between routine verifications and routine performance evaluation (PE) audits. The SO_2 NPAP also provides a measure of bias.
- ***Detectability*** – is the determination of the low range critical value of a characteristic that a method specific procedure can reliably discern. The method sensitivity for both the Ecotech and Thermo SO_2analyzers is adequate for determining SO_2 levels that are <5% of the NAAQS. For both analyzers, the lower detection limit is 2.0 ppb for the standard range, e.g. non-trace-level, and 1.0 ppb for the lower range, e.g. trace-level.

- ***Comparability*** (reporting units and analysis) – SO_2 concentrations will be reported in parts per million (ppm) or parts per billion (ppb) as required by EPA for SLAMS and NCore networks, respectively. Monitoring measurement uncertainty also ensures data are comparable with other agencies. To keep measurement uncertainty at a minimum, ADEQ will only use monitors approved by the EPA for collection of SO_2 data.
- ***Completeness*** – a measure of the amount of valid data obtained from the measurement system compared to the potential amount expected to be obtained under correct, normal conditions. The minimum data completeness requirement set by EPA is 75% for each calendar quarter and annually for the SO_2 network. ADEQ is targeting 85% completeness to ensure the minimum requirement is met for each SO_2 network. If any instrument fails its verification, calibration, or performance evaluation (PE) audit, AMU will take the appropriate actions to correct instrument performance as quickly as possible to prevent any loss of data.

A variety or errors can result in a loss of sample collection or measurement not being available. These include, but are not necessarily limited to:

1. Sampling error such as instrument failure or malfunction
2. Communication (information technology) system errors
3. Collection error such as loose connection from sample line to analyzer
4. QA/QC error such as a monitor not operating within the acceptance criteria

All monitoring instruments will meet or exceed the minimum EPA operating requirements as defined in ADEQ's acceptance criteria. Section B of this QAPP provides detailed information concerning ADEQ's SO_2 air monitoring activities by site and by objective. Operating criteria for the continuous SO_2 FEM analyzers are found in Section B. ADEQ plans on following the EPA's "SO_2 Validation Template" as provided in the *QAHBV2*. The template is also found in Section D of this QAPP.

A.8 SPECIAL TRAINING/CERTIFICATIONS

ADEQ conducts on-the-job training as the primary means of training personnel. AMU plans for new personnel to train with experienced personnel for a period of one to three months as required. New personnel must exhibit, to a senior technician the knowledge, skill, and ability needed to successfully operate the air monitoring instrument(s) before working independently. Personnel have adequate time to review instrument manuals, monitoring literature, and EPA regulations. Technical personnel have access to the ADEQ QMP, QAPPs, and SOPs as well as other guidance such as the manufacturer's operating manuals. Management will provide sufficient time for personnel to read and understand these documents. AQD strives to provide professional development to employees whenever possible. Training includes EPA courses, workshops, conferences, or trade shows. In addition, employees participate in webinars provided by EPA and complete self-instructional courses available through EPA's Air Pollution Training Institute (APTI). The AAS is in the

process of developing a training plan for personnel. The relevant Unit manager will annually review each employee's professional development.

AMU technicians are proficient with the current fleet of SO_2 analyzers and ADEQ has been successfully monitoring for SO_2 for many years. ADEQ recently upgraded our current fleet with newer, digital monitors, but are staying with same type of analyzer, e.g. pulsed fluorescence FEM. Therefore, we do not anticipate needing any additional specialized training for personnel. If operating challenges arise with a monitor, AMU technicians consult with the manufacturer's representatives.

In the event ADEQ provides some of the retired SO_2 analyzers to another MO, they accept full responsibility for the care and calibration of the instrument. To date, the QA Auditor's professional services have been occasionally requested by other MOs in Arizona such as the counties and rarely the tribes. Services typically performed include PE audits and assistance with troubleshooting. It is possible that our senior technicians may also be contacted for technical help with getting these monitors operational.

A.9 DOCUMENTATION AND RECORDS

Personnel within the AAS use our shared computer network for storing documents electronically in addition to maintaining hard copies of program-related documents. ADEQ Information Technology (IT) backs the network drive up daily. Documents are stored for a minimum of five years. See Table A.5 for storage information.

Modeling reports will be made available to the SO_2 air monitoring team. These reports may be developed by the EU or the permitted sources. The permitted sources' modeling reports are reviewed and approved by ADEQ.

AMU service documents and forms, otherwise known as "field sheets", related to the operation of air monitoring sites and instruments are generated and stored in hardcopy site files and electronically in each site's folder on the shared computer network. Field sheets include: site logs, instrument logs, communication logs, instrument verification and calibration sheets, site and instrument change forms, and field service reports. The hardcopy reports are reviewed and approved by the AMU Manager and/or the field service report reviewer then routed to the DM&QA Unit for the SO_2 data reviewer(s) for QA Level 3 data verification and validation.

The QA Auditor submits the PE audit reports to DM&QA for use by the SO_2 data reviewer(s). The reports are also stored in hardcopy site files and electronically in each site's folder on the shared computer network. The AMU technicians may use these reports to assess a monitor's performance during their routine service checks. In addition, the QA Team will perform audits of data quality and TSA and submit reports to the DM&QA Unit Manager as well as the AAS Manager and the AMU Manager.

Section D contains more detailed information regarding how data will be managed from ADEQ's SO_2 network. The SO_2 concentration data and its associated QC data will be archived in ADEQ's database for future reference by the agency and other interested parties. The Oracle-based Air Assessment Ambient Database (AAAD) is currently in-use; however, it will be replaced with AirVision™ in the near future. Information concerning source monitoring data and which data will be uploaded to EPA's AQS database is found in Section D of this document. See the current ADEQ SOP for the most up-to-date procedure to upload data to the AQS database. Table A.2 shows a summary of documents stored by ADEQ and their locations.

Table A.2. Summary of ADEQ Documents and Records

Type of Record	Medium	Data Storage Location(s)	Responsibility
AQS Reports	Electronic	J:\AQD\AQD\ASSESS\DATA MANAGEMENT AND QA UNIT\DM\Programs\NAAQS\SO2	DM&QA
Calibration and Verification Records	Hardcopy and Electronic	DM&QA Site File or J:\AQD\AQD\ASSESS\MONITORING UNIT\SITE_LOG\ADEQ Active Sites and DM&QA Site File	AMU and DM&QA
Certificates for all instruments and standards	Hardcopy and/or Electronic	DM&QA Site File, AMU instrument files J:\AQD\AQD\ASSESS\MONITORING UNIT\SITE_LOG\ADEQ Active Sites	AMU and DM&QA
Corrective Action Reports	Hardcopy and Electronic	DM&QA Site Files or J:\AQD\AQD\ASSESS\QUALITY ASSURANCE DOCUMENTS\Corrective_Action_Process	QA Team
Maintenance and Service Records	Hardcopy and/or Electronic	AMU Instrument File, AMU Site File J:\AQD\AQD\ASSESS\MONITORING UNIT\SITE_LOG\ADEQ Active Sites And DM&QA Site Files	AMU and DM&QA
SO_2 NAAQS QAPP	Hardcopy and electronic	Hardcopies provided to AMU and DM&QA staff and J:\AQD\AQD\ASSESS\QUALITY ASSURANCE DOCUMENTS\QAPPs & SOPs\QAPPs	QA Team
Quality Assurance Audit Records (including all audit reports, e.g., PE audit, TSA, ADQ, etc.)	Hardcopy and electronic	For PE Audit reports, see: DM&QA Site Files and J:\AQD\AQD\ASSESS\MONITORING UNIT\SITE_LOG\ADEQ Active Sites For TSA & ADQ reports, see J:\AQD\AQD\ASSESS\DATA MANAGEMENT AND QA UNIT\AUDITS For NPAP Audit Results – hardcopy QA files	DM&QA
Raw SO_2 Data	Electronic	DCS files	AMU
Shipping and Receiving Records	Hardcopy	AMU Shipping File	AMU

Type of Record	Medium	Data Storage Location(s)	Responsibility
Site and Instrument Logbooks	Hardcopy	Site logbooks (SLB) remain at the site until closure unless storage space is not available – then retired SLBs will be stored at AMU; and a copy of SLB entries is stored in DM&QA site folders. Instrument logbook travels with monitor or other instrument until retired – then stored in AMU	AMU and DM&QA
Site Information	Hardcopy and Electronic	Network Plan found at: J:\AQD\AQD\ASSESS\DATA MANAGEMENT AND QA UNIT\DM\Docs\AQD\Reports and J:\AQD\AQD\ASSESS\MONITORING UNIT\SITE_LOG	AMU and DM&QA
Site Photographs	Hardcopy and Electronic	J:\AQD\AQD\ASSESS\MONITORING UNIT\SITE_LOG	AMU and DM&QA
SOPs	Hardcopy and Electronic	Hardcopies provided to AMU and DM&QA staff and J:\AQD\AQD\ASSESS\QUALITY ASSURANCE DOCUMENTS\QAPPs & SOPs\SOPs\ADEQ Final SOPs	Unit Managers and QA Team
Training Records	Hardcopy	Unit Manager's Staff Files and J:\AQD\AQD\ASSESS\QUALITY ASSURANCE DOCUMENTS\TRAINING_RECORDS\Internal (Employee)	AAS
Validation Documents and Notes	Electronic	J:\AQD\AQD\ASSESS\DATA MANAGEMENT AND QA UNIT\DM\Programs\NAAQS\SO2 and J:\AQD\AQD\ASSESS\DATA MANAGEMENT AND QA UNIT\DM\Docs\AQD\Reports\Quarterly Data Review	DM&QA

SECTION B. DATA GENERATION AND ACQUISITION

B.1 SAMPLING PROCESS (NETWORK) DESIGN

As stated in Section A, this QAPP covers the operation of ADEQ's SO_2 network operating for compliance purposes with the NAAQS and provides information on the SO_2 monitoring conducted by the ASARCO and FMMI. For this section of the QAPP, there are several helpful definitions to become familiar with regarding ambient air monitoring. As per *40 CFR Part 58*, a "station" means a single monitor, or a group of monitors with a shared objective, located at a particular site. A "site" means a geographic location, and one or more stations may be at the same site. A "network" means all stations of a given type or types.

In practice, personnel may refer to stations monitoring for SO_2 to be in the "SO_2 Network", because they are measuring the same pollutant whether data is compared to the NAAQS or not. In turn, one could also consider the different types of SO_2 measurements collected to be a network of their own, i.e., an "SO_2 NAAQS network", or an "SO_2 NCore network", since each is dedicated to measuring two different concentrations of SO_2. Sources may describe their monitoring network as a "SIP" or "Permit-required SO_2 network".

Airborne SO_2 measurements, or "samples", are collected with continuous analyzers using pulsed fluorescence technology. Although, these continuous monitors do not actually produce physical samples that can be referenced again in the future for further analysis, the process is commonly referred to as "sample collection" or "sampling the air".

To generate measurements, ambient air is drawn into a sampling train, or system, which includes the inlet, sample line, scrubbers, and analyzer. To not interfere with the SO_2 concentration, the system must be made up of materials that do not react significantly with SO_2, and chemicals used for servicing instrumentation must not react with SO_2. For inlet and sample lines, borosilicate glass, or Pyrex®, and/or polytetrafluoroethylene, or Teflon®, materials are commonly used. In addition, scrubbers plumbed into the sample line to remove SO_2 reactive compounds from the air, and the sample residence time is kept to less than 20 seconds. Note that in ambient air monitoring, "residence time" is defined as the amount of time that it takes for a sample of air to travel through the sampling system. Residence time is measured from the inlet to the bulkhead of the analyzer, and nearly all ADEQ SO_2 stations are well under 10 seconds. See the attached ADEQ job aid for residence times calculations and Table B.1 for more technical information on SO_2 stations.

SO_2 concentrations are reported by ADEQ's database, currently AAAD, in ppm values and in hourly, 3-hour, and 24-hour values that relate to the 1971 and 2010 NAAQS limits. ADEQ strives to make preliminary data available to the public the day after collection and once the data have passed the QA Level 2 review. This aligns with EPA's goal of making data available to customers and stakeholders as soon as possible; e.g., near real-time. ADEQ is in the process of upgrading the in-house database used to collect and store SO_2 data from the analyzers.

Figure B.1. Example of AAAD Daily SO_2 Report

Arizona Department of Environmental Quality
AIR QUALITY DIVISION
MAXIMUM OBSERVED SO2 (ppm)
FOR 10/08/2013
Preliminary Data QA LEVEL - 2

AAASO2DLY
10/09/2013 15:41:52

Place ID	Name	Network	POC	* Hour	1-Hour ppm	1-Hour Exc	3-Hour Block	3-Hour Avg ppm	3-Hour Exc	24-Hour Average ***	24-Hour Exc	Category	1-Hour AQI
16632	MIAMI TOWNSITE	ADEQ	1	0600	.001		0800	.001		0		Good	1
16631	MIAMI JONES RANCH	ADEQ	1	0300	.001		0800	.001		0		Good	1
16326	HAYDEN OLD JAIL	ADEQ	3	1100	.068		1100	.041		.012		Moderate	91
16382	MIAMI RIDGELINE	ADEQ	1	0700	.005		0200	.004		.003		Good	7
16328	JLG SUPERSITE	ADEQ	1	2200	.001		2300	0		0		Good	2
16328	JLG SUPERSITE	ADEQ	2										

Over time, changes to existing air monitoring sites become necessary for various reasons. Changes to stations or sites are usually planned and communicated to EPA in advance, and documented annually in the ANP. ADEQ obtains EPA's approval prior to relocating a site or changing the type of monitor at a station. In the event a sudden, catastrophic, or unusual event precludes the use of a site and the stations it houses, ADEQ will respond expeditiously and alert EPA Region 9 representatives of any change as soon as possible.

SO_2 Station Classifications

It is worth noting that SO_2 air monitoring stations can have several different classifications. A SO_2 station's classification is largely determined by the underlying purpose for collecting the data, and the definitions regarding the various station classifications are found in *40 CFR Part 58*. Although SO_2 data used for NAAQS compliance are usually collected at ADEQ SLAMS, it is worth noting that ASARCO and FMMI are currently conducting SO_2 monitoring as non-SLAMS to satisfy their air quality permits. ADEQ currently compares source data to the NAAQS limits. As stated earlier, ADEQ is in the process of negotiating with these sources to try and assume some, or all, air monitoring responsibilities primarily due to EPA's strengthening of a MO's quality assurance responsibilities. A brief overview of the potential SO_2 station classifications is provided below.

State and Local Air Monitoring Stations (SLAMS)

The stations operated by ADEQ are most often SLAMS, which gather data for comparison to the NAAQS. "SLAMS" make up the ambient air quality monitoring sites that are primarily needed for NAAQS comparisons, but may serve other data purposes as well. SLAMS exclude special purpose monitors (SPM) and Prevention of Significant Deterioration (PSD) monitors, but include air monitors for specialized programs that are considered a subset of SLAMS such as the NCore station. See Table B.1 for ADEQ's SO_2 SLAMS and the NCore station.

Table B.1. ADEQ SLAMS and NCore SO_2 Network

NAAQS - SLAMS - SO_2					
Local Site Name	Hayden Old Jail	JLG Supersite	Miami Jones Ranch	Miami Ridgeline	Miami Townsite
Pollutant (POC)	SO_2 (1)	SO_2 (1)	SO_2 (1)	SO_2 (1)	SO_2 (1)
Parameter code	42401	42401	42401	42401	42401
Basic monitoring objective	NAAQS Comparison	NAAQS Comparison	NAAQS Comparison	NAAQS Comparison	NAAQS Comparison
Site type(s)	Source Oriented	Population Exposure	Source Oriented	Source Oriented	Source Oriented
Monitor type(s)	SLAMS	SLAMS, NCore	SLAMS	SLAMS	SLAMS
Instrument manufacturer and model	Ecotech EC9850T	Ecotech EC9850T	Ecotech EC9850T	Thermo 43C	Ecotech EC9850T
Method code	592	592	592	060	592
FRM/FEM/ARM/other	FEM	FEM	FEM	FEM	FEM
Collecting Agency	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ
Analytical Lab (weight, toxics, other)	--	--	--	--	--
Reporting Agency	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ
Spatial Scale (micro, neighborhood)	Neighborhood	Neighborho od	Neighborho od	Neighborho od	Neighborho od
Monitoring start date (MM/DD/YYYY)	01/01/1975	03/03/2005	01/01/2013	10/05/1995	01/01/2013
Current sampling frequency (1:3, continuous)	Continuous	Continuous	Continuous	Continuous	Continuous
Calculated sampling frequency (1:3 / 1:1)	--	--	--	--	--
Sampling season (MM/DD-MM/DD)	01/01-12/31	01/01-12/31	01/01-12/31	01/01-12/31	01/01-12/31
Probe height (meters)	5	5	4.5	4	5
Distance from supporting structure (meters)	--	--	--	--	--
Distance from obstructions on roof (meters)	--	--	--	--	--
Distance from obstructions not on roof (meters)	--	2	--	2	25
Distance from trees (meters)	12	8	--	9	15
Distance to furnace or incinerator flue (meters)	280	--	3081	1411	2300
Distance between collocated monitors (meters)	--	--	--	--	--
Unrestricted airflow (degrees)	360	210	360	180	220
Probe material for reactive gases	Teflon	Glass, Teflon	Teflon	Teflon	Teflon
Residence time for reactive gases (seconds)	4.75	0.51	4.08	4.88	3.96
Changes within the next 18 months? (Y/N)	N	N	N	Y	N

NAAQS - SLAMS - SO_2					
Comparison against the annual PM2.5? (Y/N)	--	--	--	--	--
Frequency of flow rate verification manual PM samplers	--	--	--	--	--
Frequency of flow rate verification automated PM analyzers	--	--	--	--	--
Frequency of one-point QC check gaseous instruments	Bi-Weekly	Bi-Weekly	Bi-Weekly	Bi-Weekly	Bi-Weekly
Last Annual PE audit for gaseous parameters	01/23/2013	05/16/2013	07/30/2013	05/15/2013	03/19/2013
Last two semi-annual flow rate audits PM	--	--	--	--	--

Source: *ADEQ 2013 State of Arizona Air Monitoring Network Plan (final draft)*

Special Purpose Monitor (SPM) Stations

As defined by *40 CFR Part 58*, an "SPM station" means a monitor included in an agency's network that the agency has designated as a special purpose monitor station in its monitoring network plan and in the AQS. The agency does not count SMP monitor toward showing compliance with the minimum requirements for quality assurance, siting, and for the quantity of monitors needed for a particular criteria pollutant. SPMs are not required to meet the rigorous QA/QC requirements applied to SLAMS monitors. Often SPMs are used to quickly gather and report preliminary information regarding air quality in a local area. It is important to reference EPA requirements regarding the operation of an SPM monitor.

It is important to note that if an SPM station uses an FRM, FEM, or ARM method and meets the siting requirements in *40 CFR Part 58 Appendix E* (same as those applied to SLAMS), then the agency can be limited to its removal without EPA approval. Removal depends upon the particular criteria pollutant concentrations derived and the monitor's operating duration. Usually, if the monitor operates for more than two years, removing it will need prior approval by EPA. In the event the population of a geographical area increases or air quality data indicate a SLAMS is more appropriate, an SPM station may be reclassified to a SLAMS and potentially outfitted with a different model FEM monitor. ADEQ plans to work with EPA regarding SPMs in our network and information regarding SPMs is also found in the ANP.

Prevention of Significant Deterioration (PSD) Monitoring Stations

Another station classification that may be operated by ADEQ or permitted sources is a Prevention of Significant Deterioration (PSD) station. A "PSD station" means any station operated for the purpose of establishing the effect on air quality of the emissions from a proposed source for purposes of prevention of significant deterioration as required by *40 CFR §51.24(n)*. By way of the air quality permitting process, ADEQ can require an industrial

operation that desires to open a plant in a certain geographic area to operate PSD monitors. PSD stations are generally operated prior to construction of a new facility and data from PSD monitors do not count toward showing compliance with the NAAQS. However, it may be possible for a station to be considered a PSD after a facility starts operating and such information will be available in the ANP. Often stations are established in or near state or national parks, forests, and wilderness areas and have more stringent operating requirements than SLAMS.

Source-Oriented Monitoring Stations

Historically, ADEQ has required source-oriented ambient air monitoring for SO_2 by major, and some minor, point sources operating in Arizona. Usually, the sources are facilities/industrial operations regulated under Title V of the CAA and this monitoring is conducted to meet the requirements of the air quality permit issued by ADEQ. In turn, the ADEQ AQD Compliance, Evaluation and/or Permits Sections may refer to this data to gauge how air quality relates to the NAAQS in the area of interest. For instance, the data may be used to compare the actual emissions of a regulated source to the PSD air monitoring or modeling emissions estimates developed prior to a new facility's start-up.

It is possible that source-generated air surveillance data has been or is being collected inside the fence line around the permitted facility. In this case, the data do not meet the definition of "ambient air", which is defined in *40 CFR Part 50* as" …that portion of the atmosphere, external to buildings, to which the general public has access". Often, this definition is interpreted as air outside of an industrial operation's fence line. Furthermore, these data may not meet all the ambient air quality requirements as established in *40 CFR Part 50, 53, and 58*. Any users of source-oriented data are responsible for verifying that the data are of adequate quality for the intended use.

ADEQ reviews each permitted sources' data requirements with the renewal of their air quality permit. Changes to this network may occur over time. The purpose for a source's data collection may vary from source to source, and the use of a particular source's data may potentially change over time. Source SO_2 data have been used for SIP support or emissions monitoring once facilities are operational. AQD personnel review the source's ambient monitoring quality assurance documents, including the required QC verification, calibration, and PE audit checks. To date, ADEQ QA activities with respect to the source SO_2 has been largely limited to PE audits on some air monitoring instruments and review of ambient data summaries submitted by the individual sources.

In 2012, ADEQ submitted proposals to ASARCO and FMMI suggesting changes in the collection of source-generated SO_2 data obtained at the facilities in Hayden and Miami, Arizona. The changes primarily involve ADEQ assuming the collection of this data since we are an EPA-approved, primary quality assurance organization (PQAO), which is a key component of assuring that data being used for compliance purposes and reported to the AQS are of consistent and suitable quality. This change was triggered by the 2006 amendments to

the *40 CFR Parts 50 and 58*. At that time, the PQAO designation and associated requirements for a MO to obtain the designation were promulgated by EPA. To be an approved PQAO, there are certain quality system components that must be in-place such as a QAPP, SOPs, technical system audits, etc. Currently, FMMI has agreed to have ADEQ assume data collection for SO_2 and we are in the process of establishing monitors at selected sites. FMMI will continue to operate their monitors until enough data have been compared for quality assurance purposes. ADEQ is still in negotiation with ASARCO about SO_2 monitoring.

Table B.2 shows the source-oriented monitoring occurring in Arizona for SO_2, as well as other pollutants, in 2012.

Table B.2 Source Monitoring Network for SO_2

Site Name	City	Pollutant(s)	AQS Submittal
Globe Highway	Winkelman	SO_2	No
ASARCO – Hayden – Garfield Ave.	Hayden	SO_2	No
ASARCO – Montgomery Ranch	Hayden	SO_2	No
ASARCO – Hayden Junction	Hayden Junction	SO_2	No
Hayden Old Jail [1]	Hayden	SO_2	No
Chemical Lime Plant	Nelson	Meteorology	No
Drake Cement	Sycamore Canyon	PM_{10}, $PM_{2.5}$ mass and ammonium speciation, Meteorology	No
Miami Ridgeline	Miami	PM_{10} mass and metals speciation	Yes (PM_{10} mass only)
Miami Golf Course	Miami	PM_{10} mass and metals speciation, collocated	Yes (PM_{10} mass only)
Miami Jones Ranch [1]	Miami	SO_2	No
Miami Townsite [1]	Miami	SO_2	No
PCC – Clarkdale NW	Clarkdale	PM_{10} mass and metals speciation, Meteorology	No
PCC – Clarkdale SE	Clarkdale	PM_{10} mass and metals speciation, Meteorology	No
Carlota Mine – Sanctuary Globe		PM_{10}, H_2SO_4, Meteorology	No

[1] ADEQ also operates an SO_2 monitor at this site. The ADEQ data are submitted to AQS while the facility data are not.

Source: *ADEQ 2013 State of Arizona Air Monitoring Network Plan (final draft)*

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State Implementation Plans

ADEQ may submit both source-generated and agency-generated data to the EPA AQS database to evaluate compliance our SO_2 state implementation plan(s) (SIPs). If a source operates a regular SLAMS, SPM, or PSD monitor, they are required to review and validate their data and submit quality assurance documents to ADEQ along with the data.

Table B.3 shows SIP-related monitoring locations, including SO_2, throughout Arizona.

Table B.3 SIP Network Monitoring

Area and County	Pollutant	Classification	ADEQ SIP Sites
Phoenix, Maricopa	CO	Maintenance/ Attainment	*JLG Supersite*
Phoenix, Maricopa	O_3 1-hr	Maintenance/ Attainment	*JLG Supersite, Tonto National Monument*
Phoenix-Apache Junction, Maricopa and Pinal	O_3 8-hr	"Basic" Non-attainment	Alamo Lake, *JLG Supersite*, Queen Valley, *Tonto National Monument*
Ajo, Pima	PM_{10}	Moderate Non-attainment	*Ajo*
Bullhead City, Mohave	PM_{10}	Maintenance/ Attainment	*Bullhead City (Post Office)*
Douglas-Paul Spur, Cochise	PM_{10}	Moderate Non-attainment	Douglas Red Cross, *Paul Spur Chemical Lime Plant*
Hayden, Gila and Pinal	PM_{10}	Moderate Nonattainment	*Hayden Old Jail*
Miami, Gila	PM_{10}	Moderate Non-attainment	*Freeport McMoRan sites: Golf Course & Miami Ridgeline*
Nogales, Santa Cruz	PM_{10}	Moderate Nonattainment	*Nogales Post Office*
Payson, Gila	PM_{10}	Maintenance/ Attainment	*Payson Well Site*
Phoenix, Maricopa, and Pinal (Apache Junction portion) Phoenix (Salt River Area)	PM_{10}	Serious Non-attainment	*JLG Supersite*
Rillito, Pima	PM_{10}	Moderate Non-attainment	*Rillito*
Yuma, Yuma	PM_{10}	Moderate Non-attainment	Yuma Supersite
Nogales, Santa Cruz	$PM_{2.5}$	Non-attainment	Nogales Post Office
Ajo, Pima	SO_2	Maintenance/ Attainment	No network or commitment
Douglas, Cochise	SO_2	Maintenance/ Attainment	No network or commitment
Hayden, Gila and Pinal	SO_2	Non-attainment – Primary	*ADEQ (SO_2, MET): Hayden Old Jail ASARCO (5 SO_2, 3 MET [no met at Jail or Garfield]): Globe Hwy, Garfield Ave., Montgomery Ranch, Hayden Old Jail, Hayden Junction*

Area and County	Pollutant	Classification	ADEQ SIP Sites
Miami, Gila	SO_2	Maintenance/ Attainment	*ADEQ: Miami Ridgeline Freeport McMoRan (SO_2, MET) Miami Jones Ranch, Miami Townsite*
Morenci, Greenlee	SO_2	Maintenance/ Attainment	No network or commitment
San Manuel, Pima and Pinal	SO_2	Maintenance/ Attainment	No network or commitment
Regional Haze, 12 Class 1 areas	Visibility Impairing pollutants (VOC, NOx, SO_2, PM_{10}, $PM_{2.5}$, $PM_{2.5}$ species)	Statewide – IMPROVE monitors	ADEQ Protocol sites: Douglas Red Cross, Organ Pipe National Monument, JLG Supersite, Queen Valley, Saguaro West National Monument, Meadview NPS / USFS sites: Chiricahua Entrance Station, Greer Water Treatment Plant, Grand Canyon - Indian Gardens, Grand Canyon - Hance Camp, Ike's Backbone, Meadview, Petrified Forest National Park, Pleasant Valley Ranger Station, Saguaro National Park-East, Sycamore Canyon, Tonto National Monument

Site Selection and Information

Site selection is a key factor to assuring SO_2 measurements are representative of the area of concern. Detailed information regarding site selection using design values and associated monitoring frequency for each site is covered in detail in the ANP. Therefore, a summary of this information is provided due to the quantity of SO_2 network sites and the potential for annual changes to occur.

The siting of SO_2 monitors meets *40 CFR Part 58 Appendix E*. SLAMS collecting SO_2 measurements are selected based upon the expected high SO_2 values, the potential for population exposures, and the feasibility of operating monitors. To determine locations that represent the highest concentrations of airborne SO_2, dispersion modeling and/or existing air monitoring data are typically used. The history of siting rationales and site changes can be found in the ANP beginning with 1999. Tables B.3 and B.4 are excerpts from the 2013 draft ANP that show ADEQ's SO_2 SLAMS, the supporting information regarding siting, and the type of monitors currently in-use. To view the current SO_2 stations being operated by ADEQ, and the sources, see Table B.1 and Table B.2, respectively.

Changes to Air Monitors in the SO_2 Network

As stated previously, ADEQ is transitioning from the Thermo 43C analyzer to the Ecotech 9850T analyzer. Currently, all but one of ADEQ's SO_2 stations operate recently acquired Ecotech analyzers for NAAQS-compliance determination. However, it is possible a Thermo analyzer could be used as back-up in the event if an Ecotech analyzer needs to be removed for repair. This change is occurring because:

The Thermo 43C analyzers are aging and nearly the end of their useful life
data maintain the high level of quality produced by ADEQ
it is anticipated to be more cost effective

Furthermore, air monitoring sites as well as stations tend to be dynamic over time. It is possible that a site could move, instrumentation could change, or additional air monitoring instruments could be added to measure other pollutants. To view the most current information for a site's configuration and the air monitoring instruments being operated by ADEQ, see ADEQ's ANP, which is posted on ADEQ's website at: http://www.azdeq.gov/environ/air/assessment/links.html.

Monitoring Plan

As stated under the program's description, the monitoring plan is to measure airborne SO_2 near regulated sources and cities with populations that meet the limits set forth in the CFRs. ADEQ's plan to keep measurement error at a minimum is to follow the established acceptance criteria for SO_2 air monitors found in *40 CFR Parts 50, 53, and 58*. These criteria are also shown discussed more in Sections B.7 and B.8. There is no anticipated end date for the SO_2 monitoring network. The plan is to collect meteorological data at most sites and meteorological instruments are being gradually implemented.

It is worth noting that Maricopa, Pima, and Pinal County Counties are each designated as a PQAO with Region 9 EPA. In Indian Country, the tribes are responsible for the collection of pollutant data on their reservation and may join forces with other tribes to form a PQAO. EPA directly oversees Air monitoring operations in Indian Country. ADEQ may provide support by exchange of technical services and/or knowledge when problems are encountered with instrumentation or may collect pollutant measurements for a special purpose. ADEQ is not responsible for the counties' air monitoring operations or quality of any pollutant data generated by another PQAO.

Site Accessibility

Most SO_2 sites are located near or adjacent to major roadways making them easily accessible for service and sample collection. However, it is possible that SO_2 measurements from a continuous analyzer could be interrupted if a site becomes temporarily inaccessible due to a variety of unusual circumstances that may include: road closures, wildfires, or hazardous conditions that were not previously present. If this occurs, ADEQ personnel will not attempt to access a site for sample collection or any other purpose until the area has been cleared and reopened by the proper authorities. Field personnel will report the site closure information to their direct supervisor and the program manager will be alerted to the incident. Each incident of site inaccessibility and the need for possibly establishing an alternate site or relocating an existing site will be handled on a case-by-base basis.

B.2 SAMPLING METHODS

To ascertain the levels of airborne SO_2 to be compared to the NAAQS, continuous analyzers will be used. SO_2 concentrations are scheduled for collection hourly and daily unless a monitor is out-of-service. There are no EPA required minimum collocation requirements for these analyzers. Although ADEQ does not plan to voluntarily operated collocated SO_2 analyzers at a particular ADEQ station, ADEQ may choose to exceed these requirements, albeit temporarily, at selected stations for quality assurance purposes.

SO_2 Analyzers

SO_2 analyzers collect and report readings in actual conditions. These analyzers will be operated and audit according to EPA requirements for NAAQS and NCore stations, and ADEQ SOPs. See Section D for more information on the management and review of these data.

B.3 SAMPLE HANDLING AND CUSTODY

Continuous analyzers are located within secured sites to protect the SO_2 sampling train from tampering and to ensure that an air sample's history and integrity are known. Security measures have been taken to prevent unauthorized persons from tampering with a site or the air monitoring instruments. Site access is limited to authorized MO or source personnel. Site configurations vary, but each site is protected from trespassers or unauthorized persons using some combination of security mechanisms such as signage / no trespassing posts, fencing that may have an upper perimeter barrier such as barb or razor wire, or a raised platform with locked door or chain. If a site is gated; it is padlocked. In the event security becomes an issue at a site, ADEQ will implement more stringent security mechanisms or consider site relocation.

Currently, the data derived from analyzers are communicated to the ADEQ database through the DCS. The safeguarding of the data is handled by software that prohibits data tampering. To prevent SO_2 measurements from being affected by reactive compounds or elements, the AMU technicians keep shelters and the sample lines clean and free of dusts. Non-reactive materials are used for the sample inlet and line, and funnels and tubing are checked for dust or other buildup of residue during service visits. Shelter temperatures are routinely kept between 20 ºC and 30ºC; however, shelter temperatures may exceed this range based on the manufacturer's recommendations for a specific analyzer. Also, sample lines are changed-out or cleaned annually, or more often if needed based on each site's conditions. The analyzers are cleaned and services by the AMU technicians on a regular basis. Although SO_2 is not affected significantly by automobile exhaust, the SO_2 stations are established away from point source emissions of SO_2 so that true ambient air concentrations are measured as close as possible to the projected maximum concentration area based upon monitoring, and/or modeling information.

B.4 ANALYTICAL METHODS

Laboratory Analyses

The SO_2 sampling process does not require laboratory analysis. The SO_2 analyzers are approved for producing SO_2 concentration values in the field.

B.5 QUALITY CONTROL

Quality control (QC) is the overall system of technical activities that measure the attributes and performance of a process against established standards to verify that performance meets the stated requirements established by the decision maker or data user. Information on data validation and verification can be found in Section D.

To assure the quality of data from air monitoring measurements, two distinct and important interrelated functions must be performed. The first function is the control of the measurement process through broad quality assurance (QA) activities such as establishing policies and procedures, developing DQOs and MQOs, assigning roles and responsibilities, conducting QA oversight and technical system reviews, and implementing corrective actions.

The second function is the control of measurement error by implementing specific quality control checks at established frequencies to ensure the monitors operate within specified criteria. QC procedures include, but are not limited to: periodic (typically annual) NIST-traceable certification of calibration standards/references (aka, calibrators) used for testing monitors and supporting meteorological instruments; regularly scheduled calibrations, verifications, and PE audits; and participation in the national EPA NPAP assessment program.

This section contains supporting QA/QC information regarding the specifications and performance criteria for the SO_2 analyzers. This information is derived from the *40 CFR Parts 50 and 58*. To ensure the accuracy of SO_2 concentrations released to the public and used for NAAQS compliance purposes, ADEQ plans on following the "SO_2 Validation Template" found in the most current version of the EPA's *QAHBV2* and provided in Section D of this QAPP. This template is similar to Table B.5 which shows ADEQ's operating criteria for the SO_2 analyzers, but the template is geared toward data validation versus instrument operation. Based on experience gained from field and data management operations; ADEQ can work with EPA Region 9 to develop an agency-specific validation template(s) if needed however, we do not believe this is necessary for the SO_2 network at this time.

B.6 INSTRUMENT TESTING, INSPECTION, AND MAINTENANCE

The purpose of this element is to discuss the procedures planned for verifying that all instruments and equipment are properly maintained and operate within acceptable performance levels. Prior to being deployed to a site, air monitoring instruments are tested in the AMU Shop to verify that they are working properly and that they meet the operating criteria. Monitors may be calibrated in the AMU Shop and then installed and verified at a station, or AMU may perform the calibration at the station after installation. In Arizona, sites that vary significantly elevation which directly affects barometric pressure; therefore, the AMU technicians will determine how best to manager the monitors at each station.

The main component of ensuring correct instrument operation is through routine verifications. The frequency of performing verifications, also known as zero/span/precision (Z/S/P) checks, once every other week is expected to remain the same. ADEQ may implement daily remote verifications in the future. For the most current procedure, see the ADEQ Annual Network Plan and the most up-to-date ADEQ SOP for each analyzer.

For specifications of SO_2 monitors, see *40 CFR Part 53*. Air monitoring instruments must meet strict criteria in order to obtain the FRM or FEM designation from EPA. ADEQ plans on using only EPA-protocol gas and NIST-certified calibrators for conducting the Z/S/P checks on the SO_2 analyzers and multi-point calibrators. ADEQ technicians and operators possess a strong understanding of how to operate these analyzers because the instruments have been used by ADEQ for the collection of SO_2 samples for many years. Refer to the AMU's SOPs for details pertaining to the verification and calibration processes.

Inspection and acceptance of the sample train media is also performed. To prevent an interruption in the collection of SO_2 filter samples and to ensure DQIs are met, ADEQ strives to keep critical supplies and consumables in stock such as Teflon® tubing, NIST-certified calibrators (standards/references), and EPA-protocol test gas, and desiccant/scrubber materials, spare parts for instrumentation, and if possible, backup analyzers. Supplies and consumables are inspected for defects prior to use and their availability in-house is monitored by the AMU personnel.

Inspection of Field Items

There are several items that are routinely inspected in the field during service visits by AMU and the QA Auditor to prevent the loss of SO_2 data.

Preventative Maintenance of Field Items

There are many preventative maintenance (PM) tasks associated with the operation of a successful "field" program. Adjustments to the frequencies of routine QC checks and preventative maintenance tasks will be made as needed based on each site's conditions. For PM information, see ADEQ's SOPs. In addition, ADEQ references the manufacturer's

operating manuals for additional, supporting information when needed. As needed, ADEQ personnel contact the manufacturer's representatives for additional support.

B.7 INSTRUMENT CALIBRATION AND FREQUENCY

"Calibration" is defined as the comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustment. Use of the term "calibration" indicates that an adjustment either in the instrument or the software occurred. EPA recommends that adjustments be minimized to prevent introducing measurement uncertainty and that verifications, "checks without correction", be used to confirm whether or not an instrument is operating within its acceptance range.

The purpose of calibration is to minimize bias. Typically, calibration activities follow a two-step process.

1. Certifying the calibration standards (bench) and/or transfer (working) standard against an authoritative standard, usually the NIST.
2. Comparing the routine sampling or analytical instrument against a calibration or transfer standard.

Verifications and/or calibrations are frequently performed on SO_2 analyzers in the field at the air monitoring station. ADEQ keeps current NIST-certified multi-gas calibrators at each SO_2 station. However, the calibrator may be brought in from the field for certification of its mass flow controller(s) (MFC) and annual maintenance in the AMU Shop or QA Shop, respectively.

- Verification/calibration of each SO_2 analyzer by comparing the values reported in ppm or ppb against a NIST-traceable EPA-protocol gas standard (compressed gas cylinder) using a multi-gas calibrator with a MFC that is certified in-house annually using a NIST-traceable flow meter; and
- Verification/calibration of each analyzer's internal clock against a NIST-traceable timepiece such as a cell phone, GPS, or atomic watch.

Table B.4 shows the standard materials and apparatus used for verifications, calibrations, and audits on the SO_2 monitors.

Table B.4 Standard Materials and/or Apparatus used for Verifying and Calibrating SO_2 Monitors

Parameter M=Material A=Apparatus	**Std. Material**	**Std. Apparatus**	**Mfr. Name**	**Model#**	**Acceptance Criteria**	**Variable Control Settings**
Mass Flow Controller (dilution system) A	NA	Digital flow meter with 0-30 L/m capability	BIOS or comparable manufacturer	DryCal® or equivalent digital standard	Annually, NIST-traceable certification (in-house)	Yes
EPA-protocol Gas Cylinder *SLAMS* M	SO_2 test gas	50 ppm	Praxair	Reference Batch#	Within certification date	Yes
NCore M	"	12 ppm	Praxair	"	"	Yes
Sample Chain *Inlet* M	Kimax® (borosilicate glass)	Funnel	Any	NA	1/4" OD	No
Line M	Teflon® (polytetrafluoro-ethylene)	Tubing	Any	NA	1/4" ID	No

NOTE: The vendor for the EPA-protocol gas may vary over time as well as the concentration of the SO_2 gas cylinders acquired for use by ADEQ.

The requirements for EPA-protocol compressed gas cylinders are provided in the EPA Office of Research and Development's publication, *Traceability Protocol for Assay and Certification of Gaseous Calibration Standards*, EPA 600/R-12/531, May 2012. ADEQ's gas vendor(s) provide a "Certificate of Analysis" for each compressed gas cylinder acquired for use by the AMU technicians or the QA Auditor. See Figures B.1 and B.2 to view examples of certificates for two different concentrations of SO_2 gas cylinders frequently used by ADEQ.

Figure B.2 Certificate of Analysis for an SO_2 12 PPM Gas Cylinder

PRAXAIR

Praxair
5700 South Alameda Street
Los Angeles, CA 90058
Telephone: (323) 585-2154
Facsimile: (714) 542-6689

DocNumber: 000033724

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:
PRAXAIR WHSE PHOENIX HUB
3918 W LINCOLN ST
PHOENIX AZ 850095

Praxair Order Number: 18888292
Customer P. O. Number: 03684190
Customer Reference Number:

Fill Date: 4/25/2011
Part Number: AI SD12ME-AS
Lot Number: 109111807
Cylinder Style & Outlet: AS CGA 660
Cylinder Pressure & Volume: 1800 psig 112 cu. ft.

Certified Concentration:

Expiration Date:	1/20/2014		NIST Traceable
Cylinder Number:	CC155750		Analytical Uncertainty:
12.8	ppm	SULFUR DIOXIDE	± 2 %
	Balance	AIR	

Certification Information: *Certification Date:* 1/20/2012 *Term:* 24 Months *Expiration Date:* 1/20/2014
This cylinder was certified according to the 1997 EPA Traceability Protocol, Document #EPA-600/R-97/121, using Procedure G1
Do Not Use this Standard if Pressure is less than 150 PSIG
Last certified concentration was 12.8 ppm on 5/11/2011. PGVP I.D.# F22012

Analytical Data: *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

1. Component: SULFUR DIOXIDE

Requested Concentration: 12 ppm
Certified Concentration: 12.8 ppm
Instrument Used: Ametek 921CE S/N AW-921-S321
Analytical Method: Ultraviolet Absorption
Last Multipoint Calibration: 1/10/2012

Reference Standard Type: GMIS
Ref. Std. Cylinder # : CC19046
Ref. Std. Conc: 60.2 ppm
Ref. Std. Traceable to SRM # : 1693a
SRM Sample # : 96-K-40
SRM Cylinder # : CAL015390

First Analysis Data:						Date: 1/20/2012
Z: 0	R: 506.6	C: 129.2	Conc: 12.8			
R: 506.1	Z: 0	C: 129.3	Conc: 12.8			
Z: 0	C: 129.2	R: 506.3	Conc: 12.8			
UOM: ppm		Mean Test Assay: 12.8 ppm				

Second Analysis Data:						Date:
Z: 0	R: 0	C: 0	Conc: 0			
R: 0	Z: 0	C: 0	Conc: 0			
Z: 0	C: 0	R: 0	Conc: 0			
UOM: ppm		Mean Test Assay: 0 ppm				

Analyzed by: Ying Yu

Certified by: Jack Fu

Information contained herein has been prepared at your request by qualified experts within Praxair Distribution, Inc. While we believe that the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall the liability of Praxair Distribution, Inc., arising out of the use of the information con tained herein exceed the fee established for providing such information.

Figure B.3 Certificate of Analysis for an SO_2 50 PPM Gas Cylinder

PRAXAIR

Praxair
5700 South Alameda Street
Los Angeles, CA 90058
Tel: (323) 585-2154 Fax:(714) 542-6689
PGVPID: F22013

DocNumber: 000052398

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

PRAXAIR WHSE PHOENIX HUB
3918 W LINCOLN ST
PHOENIX AZ 850095

Praxair Order Number: 23248649
Customer P. O. Number: 04336486
Customer Reference Number:

Fill Date: 3/25/2013
Part Number: NI SD90ME-AS
Lot Number: 109308411
Cylinder Style & Outlet: AS CGA 660
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

Certified Concentration:

Expiration Date:		4/12/2017	NIST Traceable
Cylinder Number:		SA11075	Analytical Uncertainty:
50.2	ppm	SULFUR DIOXIDE	± 1 %
	Balance	NITROGEN	

Certifcation Information: *Certification Date:* 4/12/2013 *Term:* 48 Months *Expiration Date:* 4/12/2017

This cylinder was certified according to the 1997 EPA Traceability Protocol, Document #EPA-600/R-97/121, using Procedure G1. The certification expiration date was assigned using the May 2012 revision of the EPA Traceability Protocol document.Do Not Use this Standard if Pressure is less than 150 PSIG.

Analytical Data: *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

1. Component: SULFUR DIOXIDE

Requested Concentration: 50 ppm
Certified Concentration: 50.2 ppm
Instrument Used: Ametek 921CE S/N AW-921-S321
Analytical Method: Ultraviolet Absorption
Last Multipoint Calibration: 8/11/2013

Reference Standard Type: GMIS
Ref. Std. Cylinder # : SA20899
Ref. Std. Conc: 50.7 ppm
Ref. Std. Traceable to SRM # : 1694a
SRM Sample # : 85-46-E
SRM Cylinder # : CLM-004741

First Analysis Data:						Date:	4/4/2013
Z:	0	R:	504.3	C:	496.9	Conc:	50
R:	503.7	Z:	0	C:	499.8	Conc:	50.3
Z:	0	C:	499.9	R:	504.1	Conc:	50.3
UOM:	mV			Mean Test Assay:			50.2 ppm

Second Analysis Data:						Date:	4/11/2013
Z:	0	R:	503.2	C:	496.7	Conc:	50
R:	502.6	Z:	0	C:	497	Conc:	50.1
Z:	0	C:	496.9	R:	502.8	Conc:	50.1
UOM:	mV			Mean Test Assay:			50.1 ppm

Analyzed by: Diego Mestanza

Certified by: Jack Fu

Information contained herein has been prepared at your request by qualified experts within Praxair Distribution, Inc. While we believe that the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall the liability of Praxair Distribution, Inc., arising out of the use of the information contained herein exceed the fee established for providing such information.

ADEQ plans on following the most current EPA-required acceptance criteria for SO_2 analyzers. Table B.11 shows the acceptance criteria for SO_2 analyzers used by ADEQ. The associated AMU and QA SOPs include this information as well. Parameters of the SO_2 analyzers and sampling trains that are subject to routine calibrations, verifications, and audits in the field include:

- Gas concentration value comparisons
- Date/Time
- Gas sample residence time check

Table B.5 Acceptance Criteria for Operating the SO_2 Analyzers in Actual Conditions

Criteria	Frequency	Acceptance Range	Corrective Actions
Monitoring Instrument			
Shelter Temperature Range	Hourly avg values	20□ - 30□ C (Hourly avg) **OR** per manufacturers specifications to a wider temperature range	Adjust or Service as needed
Shelter Temperature Control	Hourly values	≤± 2□C SD over 24 hours	Adjust/Replace as needed
Shelter Temperature Device Check	Once every six months	± 2□C of standard	Adjust/Replace as needed
Standards (References)			
Gaseous Standards (EPA-Protocol NIST-traceable compressed gas cylinders)	Each service visit	Current certification date	Replace/ Recertify as needed
Multi-Gas Calibrator (Gas Dilution System)	Annually OR Once every year or after failure of 1-point QC check or performance evaluation	±2% diff	Replace filters, firmware upgrade, and/or adjustment MFC as needed
Zero Air/Zero Air Check	Review EPA-specifications once every year and verify quality	Concentrations below LDL <0.1 aromatic hydrocarbons	Service/Calibration
Scrubbers	All scrubbers as needed	Colorimetric indicators comparison	Replace

Criteria	Frequency	Acceptance Range	Corrective Actions
Sample Residence Time Verification	Once every year OR following sample line change-out	<20 seconds	Replace pump/shorten sample line
Verification/Calibration			
One-Point QC Check	Once every two weeks	≤ +10% diff	Multipoint calibration
Zero/span check	Once every two weeks	Zero drift ≤ + 1.5 ppb Span drift ≤ +10% diff	Multipoint calibration
Multi-point Verification/Calibration	Upon receipt / adjustment / repair / installation / moving Once every six months if manual zero/span performed biweekly Once every year if continuous zero/span performed weekly	All points within ± 2% of calibration range of best-fit straight line	Multi-point calibration/ Replace parts as needed
Noise	Periodically	1.0 ppb (Standard Range) 0.5 ppb (Lower Range)	Repair/Replace
Lower Detectable Level	Once every year	2.0 ppb (Standard Range) 1.0 ppb (Lower Range)	Repair/Replace
Performance Evaluations			
PE Audit of Analyzer	Annual; Near beginning of monitor startup; upon instrument change-out; following corrective action; and prior to monitor removal	Levels 3-10 ≤± 15% diff Levels 1 & 2 ≤± 15% diff OR < ± 30 ppb of audit std.	If analyzer fails audit, submit a audit report and follow SOP instructions

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B.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

The purpose of this element is to establish and document a system for inspecting and accepting all supplies and consumables that may directly or indirectly affect the quality of the SO_2 network. The ADEQ SO_2 monitoring network relies on various supplies and consumables that are critical to its operation. This section details the supplies/consumables, their acceptance criteria, and the required documentation for tracking this process are included in ADEQ SOP and outlined below. Table B.11 shows the critical, consumable field supplies for the SO_2 network.

Table B.6 Critical Field Supplies and Consumables

Area	Item	Description	Vendor
Calibration Supplies	EPA-protocol SO_2 gas	Used for verifying and calibrating SO_2 analyzer readings	Praxair (as of 2013)
General Supplies	Millipore 5 Micron Filter	Used for sample line particulate removal	Grainger, Costco, Home Depot, Tritec, Manufacturer, etc.
	Canned Air	Used for cleaning - debris removal and/or drying apparatus/material	
	Iso-propanol or Ethanol		
	Paper Towels		
	Powder-free anti-static gloves	Used to protect sample integrity during filter change-out and operator from exposure to settle dust components	
General Field Equipment	Multimeter	Used during calibration/verification/ troubleshooting process	Grainger, Home Depot, Manufacturer, etc.
	Air compressor		
	Funnels and Tubing		

NOTE: Listing of specific suppliers or trade names does not constitute endorsement by ADEQ.

B.9 NON-DIRECT MEASUREMENTS (DATA FROM OTHER SOURCE S)

This element addresses data to be used in the SO_2 program that is not obtained by direct measurement from the ADEQ SO_2 network or was not generated for comparison to the NAAQS. These data may be obtained from non-direct measurement sources such as the regulated sources, the EPA, and historical data from scientific studies not under the direct control of ADEQ.

Chemical and Physical Properties Data

Chemical and physical properties and values of fundamental constants are often needed in ambient air studies. Examples of acceptable sources for fundamental units and constants and the relationships between the International Organization of Standardization (ISO), aka, metric system, and U.S. and/or British units are:

- National Institute of Standards and Technology (available online at www.nist.gov)
- International Organization for Standardization (ISO) (available online at www.iso.ch), International Union of Pure and Applied Chemistry (IUPAC) (available online at www.iupac.org), American National Standards Institute (ANSI) (www.ansi.org), and other national and international standards organizations
- U.S. Environmental Protection Agency (available online at www.epa.gov) sources
- Current editions of handbooks on chemistry and physics such as the *Handbook of Chemistry and Physics* (CRC Press).

Monitor Operation and Manufacturers' Literature

Important information is found in the manufacturers' literature and operating manuals. Operating manuals for the SO_2 monitors and calibrators, data acquisition devices (laptop computers and software), and test gases used in the field will be made available to personnel.

Geographic Location

Another type of data that will commonly be used is geographic information. For identifying the location of sampling sites, conventional longitude and latitude coordinates, or universal transverse mercators (UTMs) are reported in EPA's AQS database.

Historical Monitoring Information

Historical monitoring data and summary information derived from previous ADEQ data may be used in conjunction with current monitoring results to calculate and report trends in pollutant concentrations. In calculating historical trends, it is important to verify that

historical data are fully comparable to current monitoring data. If different methodologies were used to gather the historical data, the biases and other inaccuracies will be described in reports using those data.

External Monitoring Databases

Data from the EPA's AQS database may be used in published reports with appropriate caution. Care must be taken in reviewing/using any data that contain flags or data qualifiers. If data are flagged, such data shall not be utilized unless it is clear that the data still meet critical QA/QC requirements. It is impossible to assure that a database such as AQS is completely free from errors including outliers and biases, so caution and skepticism is called for in comparing data from other reporting agencies as reported in AQS. Users should review available QA/QC information to assure that the external data are comparable with the ADEQ measurements and that the original data generator had an acceptable QA program in-place.

Meteorological Data from Other Sources

Meteorological data from sources such as the National Weather Service, National Climate Data Center, and other regional climate centers may be used to provide information required when developing monitoring sites, computing corrections needed to convert form standard conditions to actual conditions, and to support analysis and monitoring efforts. These data are not reported to AQS and are identified if they are used in monitoring or reporting.

Data Used to Establish the SO_2 Networks

To ascertain the geographical areas where the highest concentration of airborne SO_2 is expected to occur, ADEQ used SO_2 air monitoring data in lieu of modeling. ADEQ has been monitoring for SO_2 in the Miami and Hayden areas since the 1970's. Initially, SO_2 monitors were staged in various locations to better identify where the highest SO_2 concentrations were occurring. Then, ADEQ established SO_2 stations as close as possible to the highest concentrations detected by the monitors. Also, ADEQ often uses meteorological data collected by the National Weather Service (NWS) to aid in the understanding of the relationship between ambient air quality concentrations and meteorological phenomena. AAS personnel have reviewed the QA/QC measures associated with NWS data and have found them to be acceptable.

In addition, future siting of SO_2 monitors may use EPA-approved dispersion modeling to determine the most likely area for maximum SO_2 concentrations to occur in lieu of monitoring. ADEQ strives to use environmental data and computer software models that meet established QA requirements where applicable, though sometimes data of lesser quality are the only information available. For these cases, the limitations and precautions are considered throughout the decision making process.

B.10 DATA MANAGEMENT

Data management (DM) describes how the data are handled through the collection, analysis, validation, and reporting processes; and, it identifies responsibilities and requirements during each process. DM begins with sampling activities and includes any or all of the following operations and their documentation: data recording, transformation, transmittal, reduction, validation, analysis, storage, and retrieval. DM also includes an overview of any mathematical operations and analyses performed on raw ("as-collected") data. The handling of data is covered in ADEQ SOPs found as attachments to this QAPP.

Data Flow and Management

Data collected from ADEQ-operated instruments in the SO_2 network will consist of measurements from continuous analyzers operating daily, and from meteorological instruments generating hourly measurements. The DM&QA Unit will apply accepted QA/QC procedures to the SO_2 and meteorological data. The collection of meteorological data is covered in the NATTS/ATMP/PAMS QAPP to be updated in late 2013.

For SO_2 analyzers:

Analyzer operating data are collected by the DSC system and reported to the Air Assessment Ambient Database (AAAD), or current database. The QA Level 1 check is performed electronically by a software program that is designed to verify that the analyzer operated within acceptance criteria. The analyzers provide near real-time measurements of SO_2; however, these measurements are reported as being preliminary until the Level 3 check is completed.

Each day, AMU is scheduled to perform verification and validation on the SO_2 concentration data prior to elevating results to QA Level 2. The AMU Level 2 data reviewer amends the Level 1 flag or assigns the appropriate validation flag to data as needed. The preliminary data are usually available in AAAD the same day of collection. These data are then reviewed by the DM&QA SO_2 continuous data reviewer who performs Level 3 validation on the data. Upon completion of the Level 3 validation, DM&QA reports any discrepancies noted in an internal report, the DM&QA continuous data reviewer usually loads the data to the EPA AQS database quarterly. Figure B.1 shows the data collection system hardware architecture for retrieving continuous data.

Other measurements

If secondary SO_2 or meteorological data are used, DM&QA will be responsible for determining if it meets EPA and/or internal standards for quality. ADEQ has assessed the quality of data from the National Weather Service (NWS) meteorological data which is typically generated near airports. The quality assurance performed on this data has been considered satisfactory for use to date.

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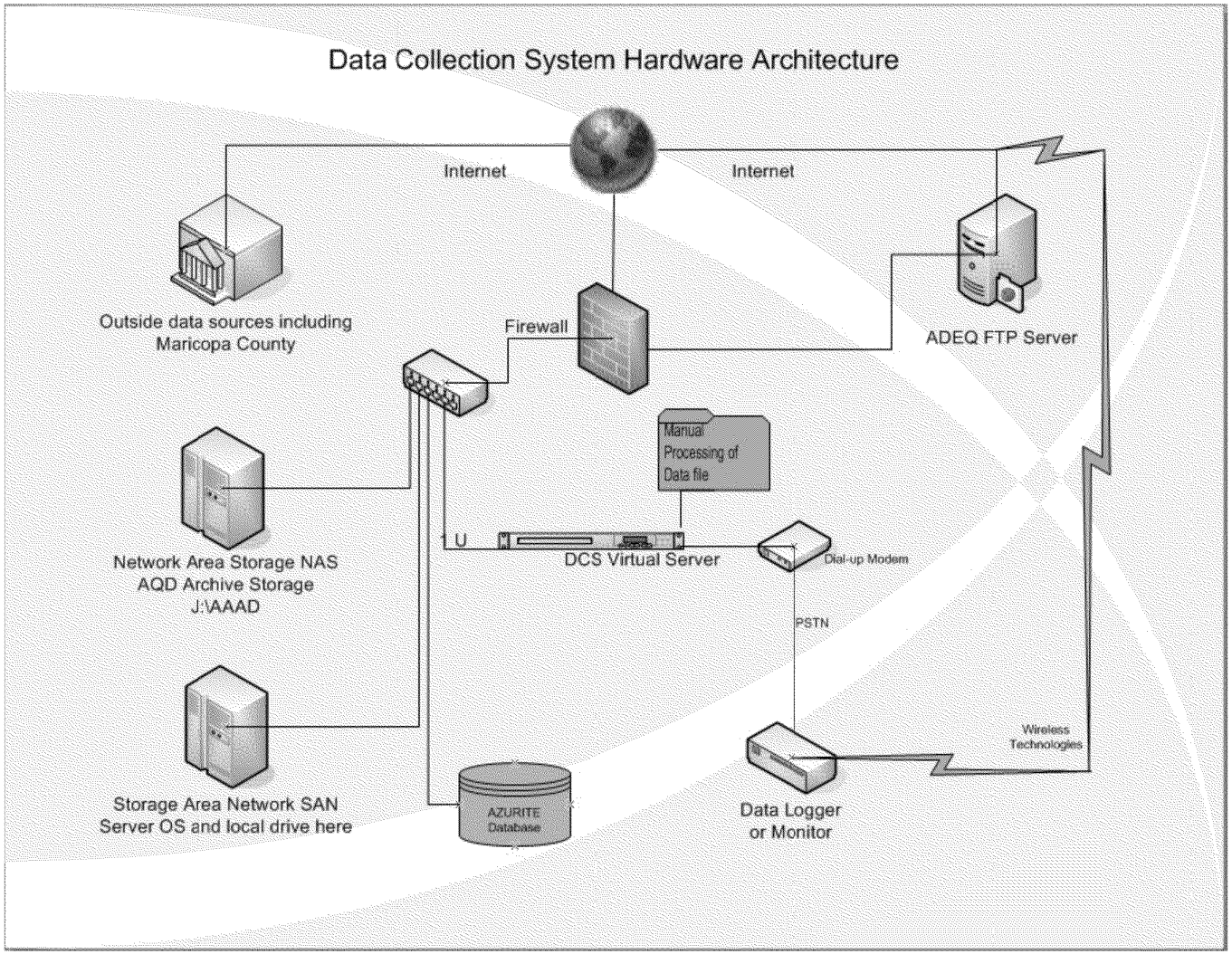
Figure B.4 Continuous Data Collection System Hardware Architecture



Data Management Responsibilities by Entity

This information applies to SO_2 NAAQS air monitors operating within ADEQ's jurisdiction in the State of Arizona. DM activities and responsibilities at ADEQ for the SO_2 network will be shared by the AMU and the DM&QA Units.

Air Monitoring Unit Responsibilities

The AMU is responsible for:

- set-up, operation, maintenance, and take-down of the ADEQ air monitoring and meteorological instruments at ADEQ's SO_2 monitoring stations
- overseeing the automated QA Level 1 procedures performed within the AAAD
- performing QA Level 2 review on SO_2 data
- documenting all instrument verifications, calibrations, maintenance, change-outs, instrument and site log books, site information forms; and, providing such reports to DM&QA for QA purposes
- establishing communication with stations
- ordering and managing air monitoring instruments, supplies and consumables
- responding to corrective action reports and failed PE audits
- site maintenance unless the site is not owned by ADEQ – then ADEQ will work with site owner regarding any changes or upgrades needed
- reporting and documenting any changes to a monitoring site to management

The AMU will follow good data practices by:

- filling out all hand-recorded documents completely, accurately, and legibly
- verifying all hand-recorded documents
- maintaining the site and instrument logbooks
- using consistent naming conventions for each site
- storing electronic and hard copy documents in AMU and/or with DM&QA
- communicating status of air monitoring to management
- adhering to procedures found in SOPs and keeping procedures current

Good data management practices also include personnel accountability for completion of specific tasks. Therefore, field sheets, ADEQ air sampling records, shipping documents, etc., will be reviewed by the appropriate AAS personnel member for correctness and completeness, including any required signatures or initials.

Data Management & Quality Assurance Unit Responsibilities

The DM&QA Unit is responsible for conducting PE audits on monitors and internal TSAs, reviewing instrument field sheets, managing and reviewing data, performing final validation of data and reporting data to EPA's AQS database. Specific responsibilities for the SO_2 network are:

- collecting site and instrument metadata and entering it into AAAD
-
- performing QA Levels 2 and 3 of the meteorological data in
- performing and/or QA Level 3 on SO_2 concentration data results
- loading of NAAQS-related SO_2 concentration data into AQS
- reporting to the ADEQ program manager when review, loading, and reporting of each batch of data is completed
- maintaining files containing all hard copy field sheets, instrument checks, audit reports, site and instrument change forms, etc.
- PE audits of SO_2 analyzers as well as meteorological equipment
- tracking and assisting with any corrective actions for monitoring instruments and data
- preparing metadata and quality assured data summaries for delivery to the program managers
- overseeing and evaluating PE and NPAP results to ensure high degree of data quality

As stated above, good data management practices also include personnel accountability for completion of specific tasks. DM&QA will follow good data practices and document the data management processes by:

- verifying any electronic data entry of files during loading into ADEQ's database and other software applications for analysis
- developing and using consistent naming conventions for each data set
- storing hard copy documents from the AMU personnel
- providing reports to management
- adhering to procedures found in SOPs and keeping procedures current

Data Management Responsibilities by Activity

This information applies to SO_2 air monitors being operated by ADEQ or ADEQ-permitted sources for NAAQS or SIP compliance purposes within ADEQ's jurisdiction in the State of Arizona.

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Pre-sampling and Start-up Activities

For ADEQ stations, the AMU will set-up and configure air monitoring instruments for the SO_2 measurements to be collected at monitoring sites, perform initial and subsequent calibrations, and verify analyzer readings every two weeks. AMU will set-up the meteorological instruments needed at the sites and perform initial and subsequent calibrations and precision checks. AMU personnel will configure and test the DCS system, which collects the required data and then transfers the data to the AAAD, or current database.

The DM&QA will conduct routine PE audits on SO_2 air monitors on an annual basis at minimum. PE audits will be conducted after instrument change-outs or following corrective actions as required. If a new monitoring station is established a PE audit will be conducted near the beginning of monitoring activities; then annually thereafter. Meteorological instruments will be audited annually unless EPA requirements change or ADEQ feels the need to increase this frequency. DM&QA personnel will perform site evaluations on an annual basis. The DM&QA data reviewers will upload SO_2 data and all required supporting data to the AAAD (or current in-house database) and/or AQS as well as establish file folders for the final, reviewed hard copy field sheets.

Sample Collection Activities

As describe earlier, AMU will perform routine maintenance, verifications, and calibrations. AMU will collect via DCS the SO_2 concentration measurements daily from each station. The technicians will also monitor the performance of SO_2 analyzers at the site to which they are currently assigned. The DM&QA QA Auditor will perform routine PE audits on air monitoring instruments on a regular basis and coordinate with the EPA auditor for the NPAP assessments.

Post Sample Collection Activities

The AMU lead continuous data collector will review QA Level 1 results and perform QA Level 2 on the data files. The DM&QA continuous data reviewer(s) will perform QA Level 3 validation on the SO_2 data on a monthly or quarterly basis. DM&QA will verify presence of field documents for completion of QA Level 3 review and load the final data into ADEQ's database and into AQS.

When stations close, the DM&QA Auditor will perform final PE audits on monitors and any meteorological instruments prior to their shutdown. AMU will remove equipment from monitoring sites.

Data Management Practices

This section describes the data handling practices that will be followed by ADEQ. Field records are reviewed for completeness and accuracy and initialed by the lead service report reviewer and the SO_2 data reviewer(s).

Manual Data

In general, whenever data are recorded by hand, manually copied or entered into an electronic medium, the personnel member performing the operation and, if possible, the personnel member receiving the data, must verify that the operation was performed correctly. Manual data checks include:

- verifying that the information was recorded or copied correctly (i.e., from instrument screens to field sheets)
- verifying that handwriting is legible and handwritten numbers are clearly identifiable
- verifying that documents have been dated and signed or initialed as required
- verifying that the documents have been filed in the appropriate location

Electronic Data

All electronic files must be visually inspected by opening the files and viewing the records. This includes files downloaded from monitors and dataloggers. The purpose of this inspection is to:

- verify that the file can be opened and is readable
- verify that all deliverables have been received per the contract
- verify that the dataloggers have been correctly programmed
- identify the format of the data prior to loading into a database or software application

It is best to inspect these files as soon as possible after receiving the files, especially if data review will not occur immediately. Any questions or problems that arise during this inspection can be resolved in a timely manner.

In general, when electronic data are copied or saved to another file format or loaded from one software application to another, the person performing the operation must verify that the data have transferred correctly. Checks on electronic data operations include:

- verifying that the data are in the correct fields
- verifying that the old and new files have the same number of records
- verifying that formats are correct (i.e., leading zeroes are included and the data are rounded or truncated to the correct number of decimal places)
- verifying that the files are in the correct locations

Sample and Data Tracking and Documentation

The following information and documents are used by ADEQ to track and control the movement and handling of samples and data, to ensure proper procedures are followed, and to support the data review and validation processes.

Site and Metadata Information

The representativeness of a site or monitor can be the most important factor when making decisions about the data collected from that site or monitor. The metadata associated with the site or monitor serves as the documentation of this representativeness. All necessary site and instrument information, e.g., site location, sampler siting information, date(s) of sampler installation and/or removal, etc., is recorded in a Site Information and Metadata File, which is maintained by the DM&QA Unit. Site and instrument change forms are used to document changes. In addition, logbooks are kept at each site and with each SO_2 monitor for use by the field technicians to record all activities at each site visit and note any problems. Site and metadata information for the SO_2 sites is found in the ANP.

Chain-of-Custody & Field Data Forms

No chain-of-custody (COC) will be used with SO_2 sampling.

Shipping and Handling Records

The ADEQ AMU or DM&QA Units will maintain their respective shipment records for EPA-protocol gas cylinders, analyzers, and calibrators.

Data Corrections

Following good data management practices helps to ensure that mistakes will either be avoided or found and corrected early in the process. Occasionally, however, errors will be made and overlooked, or problems discovered at a later date. In such cases, it may be necessary to change data after it has been uploaded to ADEQ's database or EPA's AQS database. The DM&QA Unit is responsible for making the changes in these databases for the SO_2 data collected by ADEQ, and data from ASARCO and FMMI if it has been loaded to AQS.

Data Storage and Retrieval

Data management includes storing and archiving all data, data files and any related documents needed to ensure data quality. Table B.16 summarizes the specific ADEQ records and documents and the Unit responsible for storing them. The analyzed data will be kept in AAAD, or AirVision™ once implemented and fully operational. A brief description of the AAAD database is provided below.

ADEQ Database

Again, ADEQ is currently in the process of transferring to a new SQL database, AirVision™. The AAAD is currently the central data repository for data collected and used by the AAS; however, that will be changing in 2014 when it is replaced with the AirVision™ database system. The AAAD is an Oracle relational database built by ADEQ's Information Systems Development Unit (ISDU) and put into production in July 2002. It contains both continuous data from the DCS and non-continuous data from Pb and PM filter samples. The AAAD also contains instrument information and has graphics capability to assist users in quality assurance data review. AAAD is linked to the ADEQ AZURITE database, which contains place information for the monitoring sites.

Access to the AAAD is controlled by a valid User ID and password. There are also six user roles which control user privileges including table access, screen access, and the ability to insert, update and delete data and metadata. User roles are assigned by the database administer (the DM&QA Unit Manager). In addition, the AAAD is linked to ADEQ's central AZURITE database which contains 'Place' and 'Customer' information. The user role to access the 'Place' information required for the AAAD is assigned by ADEQ's Information Technology Section (ITS) after the user has completed an in-house training course.

The AAAD database is housed on the ADEQ Oracle server kept in the ITS server room. The ITS has daily, weekly, and monthly back up procedures as well as back-up power support to the server room. The Oracle server is inside the ADEQ firewall and protected with antivirus and other security software. The ITS has Oracle database administrators with 24-hour/7-day access to identify any server issues. ITS back-up and security procedures are described in the ADEQ QMP.

Table B.7 Summary of Data Records Stored at ADEQ

Type of Record	Medium	Data Storage Location or Responsibility
Site and instrument logbooks	Hardcopy	DM&QA
Shipping and receiving records	Hardcopy	AMU
Certificates for all instruments and standards (e.g., NIST or manufacturer's certificate)	Hardcopy	AMU and DM&QA
Instrument calibration and verification records	Hardcopy	AMU and DM&QA
Instrument maintenance and service records	Hardcopy	AMU and DM&QA
Downloaded files from monitors with QC data	Electronic	AMU (computer - network drive)
QA records, including PE audit and technical system audit reports	Hardcopy and electronic	DM&QA
Data Review forms	Hardcopy and electronic	DM&QA
Quality Assured Data	Electronic (AAAD)	DM&QA
AQS Reports	Hardcopy and electronic	DM&QA
Purchasing records	Hardcopy	AMU, DM&QA, and AAS
Correspondence between ADEQ and the sources	Hardcopy and electronic	AMU and DM&QA
Correspondence and business records with subcontractors involved with the program	Hardcopy and electronic	AMU and AAS
Training records	Hardcopy	AAS
Correspondence and reports with subcontractors performing data analysis (if applicable)	Hardcopy and electronic	DM&QA and AAS

SECTION C. ASSESSMENT AND OVERSIGHT

C.1 ASSESSMENTS AND RESPONSE ACTIONS

This element describes the external and internal checks planned for the SO_2 network to ensure that:

- elements of the QAPP are correctly implemented as prescribed,
- the data generated are of high quality and meet the needs of users, and
- response/corrective actions, when needed, are implemented in a timely manner and their effectiveness is confirmed.

An assessment, for this QAPP, is defined as an evaluation process used to measure the performance or effectiveness of the quality system for a monitoring network, its sites, and various measurement phases of the EDO. The results of assessments indicate whether the QC efforts are adequate or need to be improved. To ensure the adequate performance of the quality system, ADEQ and EPA Region 9 plan to perform assessments on the ADEQ's various air monitoring networks periodically.

Assessments of External, Auxiliary Organizations

As stated in Section A, ADEQ does not plan to independently perform assessments of the contract laboratories, but technical personnel will work with EPA as needed to evaluate the laboratories practices. ADEQ plans to review assessment reports generated by other government agencies as a means to evaluating laboratory performance periodically.

Assessments of ADEQ Program Activities

Surveillance

Surveillance is the continual monitoring and analysis of records to ensure that specified requirements are being fulfilled. On a routine basis, AMU and DM&QA personnel review log books and instrument service reports (calibrations, verifications, PE audits, instrument change forms, and corrective action reports, etc.) generated from the operation and maintenance of the SO_2 monitors to verify that the acceptance criteria are being met. In addition, ADEQ plans to review the electronic data files from the SO_2 monitors regularly to ensure that the monitors operated correctly.

Technical Systems Audits (TSAs)

A TSA is a thorough and systematic on-site qualitative audit, where facilities, equipment, personnel, training, procedures, and record keeping are examined for conformance to the QAPP and governing EPA regulations. *40 CFR Part 58* requires EPA to conduct TSAs on air

monitoring organizations under their jurisdiction. EPA may opt to use the services of a third party contractor for external TSAs. The EPA Region 9 plans to conduct a comprehensive TSA on ADEQ's air monitoring program every three years. ADEQ also plans on conducting a comprehensive internal TSA on a three year schedule. However, an internal TSA may be conducted more frequently or a may be conducted on a specific air monitoring network if requested by management or if the QA Team has reason to believe an assessment is needed.

Typically, the AAS QA Team, which is usually comprised of the QA/QC Lead and QA Auditor, conducts TSAs as a joint effort, but it is possible that the TSA may be conducted by one QA Team member. In addition, the QA Team anticipates that other AAS personnel or technical experts will want to participate on internal TSAs and may be needed as participants on occasion. Therefore, the members of an Audit Team may vary for each TSA.

To increase uniformity of an internal TSA, the QA Team plans on using a checklist and/or questionnaire. The checklist and/or questionnaire may be amended overtime to ascertain information more precisely. Although the internal TSA is comprehensive, each TSA may be tailored toward specific issues currently under focus. These items may include emerging issues at a local or national level or requests for more information regarding a specific air monitoring network from management or the EPA.

TSA activities commonly involve:

- visiting air monitoring sites,
- reviewing records such as logbooks, service reports on air monitoring instruments and NIST-traceable certifications of calibration standards/references,
- interviewing key personnel (individuals involved with planning, laboratory and field operations, QA/QC, data management, and reporting), and
- evaluating data for accuracy.

For the SO_2 network, there are two distinct service areas that will be reviewed:

- Field – station and analyzer siting and operation, data collection and reporting, EPA audits of protocol gas vendors, and NPAP results
- Data Management – metadata and pollutant data collection, flagging, editing, validation, security, archiving, and uploading to ADEQ and AQS databases.

ADEQ's air monitoring program and its quality system are ultimately evaluated against the EPA regulations, *40 CFR Parts 50 and 58*, any applicable State of Arizona rules and regulations, and ADEQ's QAPPs and QMP. The QA Team is available to help identify solutions to audit findings and usually meets with the audited group as needed to help identify solutions that will yield a positive result for all concerned. Findings and recommendations identified during both the external and internal TSAs are reported in a formal report. Usually findings and

recommendations derived from the TSA process fall into major and minor categories. These findings and recommendations as well as the solutions implemented are recorded. This preserves valuable historical information pertaining to the air monitoring program's networks.

Any deficiencies that are deemed "serious" meaning there is reason to believe that the quality of pollutant data is being significantly compromised and the matter needs immediate attention from management, will be identified using a specific form. The ADEQ Internal TSA Finding (IAF) form will be used to present such findings to the audited group and their management at the internal TSA debriefing (See Figure C.1). An IAF form will be generated for a serious deficiency and it will clearly identify pertinent information such as: pollutant(s) impacted, estimated time period of deficiency, site(s) affected, and reason of action. During the debriefing discussion, evidence may be presented that reduces the significance of the finding; in which case, the finding may be removed. If the audited group is in agreement with the finding, the discussion is documented and the form is signed by the organization's director, or their designee, during the exit interview. If a disagreement occurs, the Audit Team will record the opinions of the audited group and set a time at some later date to address the finding at issue. The Audit Team and the audited group may work together to solve required corrective actions. An ADEQ Internal TSA Finding Response form (See Figure C.2) will be initiated by the audited group's unit or section managers in response to an ADEQ generated IAF that can not be resolved at the debriefing.

It is customary for both external and internal TSAs to end with a closing or debriefing meeting with key personnel and management. This provides a forum for discussion with auditors regarding positive observations as well as the findings and recommendations geared toward the continuous improvement of an air monitoring network and the data it produces. If needed, an attempt will be made to rank the findings in order of their potential impact on data quality if needed.

The major post-audit activity is the preparation of the TSA report. The Audit Team will prepare the TSA report that includes a written executive summary of findings covering the following service areas: field and data management. To prepare the TSA report, the Audit Team will compare observations with collected documents and results of interviews and discussions with key personnel. The audit findings, both accomplishments and deficiencies, will be discussed in adequate detail in the written report. ADEQ plans to use information gleaned from TSAs, both external and internal, as well as other types of audits to improve QAPPs and SOPs in order to produce the highest quality data possible. See Section C.2 for more on the internal TSA report.

Figure C.1. ADEQ Internal TSA Finding Form

ADEQ Internal TSA Finding

Audited Unit/Team: _____

Audited Activity: _____ **Audit Date**: _____ **Finding #**:_____

Finding:

_____

Discussion:

Audit Team Lead Signature: _____ **Date:** _____

Audited Unit Supervisor Signature:_____ **Date:** _____

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Figure C.2 ADEQ Internal TSA Response Form

ADEQ Internal TSA Finding Response Form

Audited Unit/Team:_____

Audited Activity: _____ **Audit Date:** _____ **Finding #:**_____

Finding:

Cause of the problem:

Actions taken or planned for correction:

Responsibilities and timetable for the above actions:

Prepared by: _____ **Title**_____ **Date:** _____

Audited Unit Supervisor: _____ **Title** _____ **Date:** _____

Audit Team Lead: _____ **Date:** _____

Remarks:

Is this audit finding closed? _____ **When?**

File with official audit records. Send copy to Auditee

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Audits of Data Quality

An audit of data quality (ADQ) reveals how the data are handled, what judgments were made, and whether uncorrected mistakes were made. An ADQ can often identify the means to correct systematic data reduction errors and they may help to identify improvements needed in a network's operations. ADQ are detailed evaluations of a small percentage of the data reported to the EPA's AQS database and include an evaluation of both the raw data and the supporting documentation. The QA Team plans on conducting an ADQ once every six months on the various types of data generated by the AAS's air monitoring program or more frequency if requested by management.

The auditor or QA Team will devote sufficient time and effort to this activity to ensure a clear and complete understanding of data flow and the associated documentation is well-founded. Pertinent ADQ questions will appear on the TSA checklist or questionnaire to ensure that the data maintain their integrity at each level of validation. The ADQ may serve as an effective tool for organizing the extensive amount of information to be gathered during a TSA from the laboratory, field, and data management functions. The ADQ will have the same reporting/corrective action requirements as the TSA. The QA Team plans to conduct an ADQ in conjunction with an internal TSA unless an ADQ was recently been performed just prior to the TSA. The EPA Region 9 QA Office may also conduct ADQs. The ADQ should not be confused with the data quality assessment (DQA).

Data Quality Assessments

A DQA is a statistical analysis of air quality, or other environmental data, that is used to determine whether data generated by a particular air monitoring network have met the established DQOs and MQOs, and in doing so, are of adequate quality for use by decision makers. The DQA process is discussed in detail in Section D.3 of this QAPP.

Management Systems Review

A management systems review (MSR) is a qualitative assessment of a data collection operation or organization to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate for ensuring the type and quality of data needed are obtained. At ADEQ, the plan has been for MSRs to be conducted or lead by the ADEQ Safety and Quality Management Specialist every three years. The plan is for the ADEQ Office of Administrative Counsel to report the findings to the AAS Manager within 60 days of completion of the MSR. However, AQD may use another approach such as having an MSR conducted by internal AQD personnel and/or contractors. The reviewer(s) will ensure that sufficient management controls are in-place and carried out by the organization to adequately plan, implement, and assess the results of the program. The QA activities for all criteria pollutants should be considered as part of the MSR. The report will be appropriately issued to ADEQ

Directors. Follow-up and progress on corrective action(s) will be tracked, documented, and filed appropriately as per AAS's corrective action process.

Performance Evaluations

The EPA defines a performance evaluation (PE) as a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst, or laboratory. This definition is extrapolated to include site operators, or technicians, and analytical instruments operating within ambient air monitoring programs. The following PE audits or evaluations are currently in-place for the SO_2 network.

ADEQ PE Audits

The DM&QA QA Auditor performs independent PE audits, or QC checks (verifications), using different NIST-traceable calibration standards, or references, on ADEQ and source-operated SO_2 monitors. ADEQ PE audits are conducted once a quarter by the QA Auditor. These checks do generate quality assurance data, but routine SO_2 measurements are not generated while the instrument is being audited. The audits primary purpose is to provide assurance that air monitoring instruments are performing as shown during regular verification checks performed by the AMU technicians. The main components audited are: site conditions and an air monitor's analytical performance regarding SO_2 values reported.

EPA PE Audits

ADEQ's criteria pollutant gaseous monitors, including SO_2, are required to participate in the EPA's National Performance Audit Program (NPAP), which is part of the EPA's National Performance Evaluation Program (NPEP). ADEQ could conduct the NPAP audits, but this would require personnel from DM&QA to be trained by EPA OAQPS on a regular basis. To date, ADEQ has opted to pay for EPA auditors to conduct the NPAP audits, which has alleviated the need for training and certifying personnel on this process. If ADEQ opts to start conducting these audits in-house, personnel will be trained and certified by EPA as required prior to assuming the NPAP audit responsibility.

The *QAHBV2* provides the following list of benefits derived from the NPEP:

- Allows one to determine data comparability and usability across sites, monitoring networks (Tribes, States, and geographic regions), instrument and laboratories;
- Provides a level of confidence that monitoring systems are operating within an acceptable level of data quality so data users can make decisions with acceptable levels of certainty;
- Helps verify the precision and bias estimates performed by monitoring organizations;

- Identifies where improvements (technology/training) are needed; and
- Assures the public of non-biased assessments of data quality.

An independent field auditor (either EPA personnel or contractor) tests a pre-selected ADEQ SO_2 analyzer for measurement bias at the monitoring station. Currently, each ADEQ SO_2 analyzer is tested once per year; however, the scheduling of NPAP tests may vary from quarterly to annually depending upon the auditor's schedule. It is possible that all ADEQ SO_2 analyzers will be tested during the same trip to Arizona; depending upon the current quantity of SO_2 stations being operated and NPAP requirements.

The NPAP uses a "through-the-probe" (TTP) approach where a known concentrations of NIST-traceable SO_2 gas is injected directly into the SO_2 sample line inlet. ADEQ's analyzer measurements, or readings, are compared to the known gas concentrations. Results from the NPAP are reported by EPA and made available to air monitoring agencies by way of AQS. Since the QA Auditor is present at the site during the audit, the qualitative results, e.g. pass/fail and bias high/bias low, are usually known by ADEQ's auditor as soon as the test is completed.

Table C.1. Summary of Assessments Planned by External Agencies

Assessing Agency	Type of Assessment	Agency Assessed	Frequency
EPA	NPAP - EPA-generated SO_2 TTP measurements	ADEQ	Annually, each analyzer/year
EPA	DQA report	ADEQ	Once every three years
EPA Region 9	MSR or TSA	ADEQ	Once every three years
EPA Region 7 Lab	*AA-PGVP for CO, O_3, SO_2, and NO_2	ADEQ	Periodically (~ once/2 years)

* - voluntary participation

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Table C.2. Summary of Internal Assessments Planned by ADEQ

Units Responsible	Type of Assessment	Frequency
ADEQ QA/QC Unit	MSR	Once every three years
DM&QA	TSA DQAs (all data) ADQ PE Audits	Once every three years Annually Semi-annually Semi-annually or quarterly
DM&QA, AMU	Surveillance	Ongoing
DM&QA, AMU	Network Plan	Annually
DM&QA, AMU, and Evaluation	Network Assessment	Once every five years beginning 2010

C.2 REPORTS TO MANAGEMENT

Effective communication among all personnel is also an integral part of a quality system. Reports to management provide the opportunity to alert management of data quality problems, to propose viable solutions to problems, and to procure necessary additional resources. Routine reporting also provides a means for tracking the following:

- adherence to scheduled delivery of data and reports;
- documentation of deviations from approved QA and test plans, and the impact of these deviations on data quality; and
- analysis of the potential uncertainties in decisions based on the data.

The following sections describe the quality-related reports and communications to management necessary to support the SO_2 network operations and the associated data acquisition, validation, assessment, and reporting.

Quarterly and Annual QA Summary Reports

Data summary reports will be distributed quarterly to management to brief them on the status of the operations of the instrumentation as well as the status of data summary metrics in comparison to the NAAQS. These quarterly reports are based on quality assured Level 3 data.

Periodic assessments of the SO_2 data quality are required to be reported to EPA (*40 CFR 58 Appendix A*). This requirement is fulfilled by the reporting of precision and bias data to the AQS. These precision and bias data are also taken into consideration when certifying the ambient SO_2 data as documented in the annual data certification package to EPA. The precision and bias data are obtained from:

- AMU zero/span/precision verifications (precision and bias checks)
- QA audits (bias checks)
- EPA SO_2 NPAP audits (bias estimates)

Data from the AMU Z/S/P checks and DM&QA audits are uploaded to the EPA's AQS once a quarter for the previous quarter. All precision and bias data for the calendar year must be entered before the annual certification deadline of the following year.

DM&QA personnel produce a quarterly report for SO_2 data. The report documents the data validation process and provides data summaries for the SO_2 network. Information such as data completeness, NAAQS comparisons, and a summary of quality assurance issues are contained within this report, which is reviewed by the DM&QA Unit manager.

Annual reports to management primarily include the annual data certification letter and the annual audit report. The data certification letter is a requirement that is due to EPA by May 1 of the following year for which the data have been collected. ADEQ's DM&QA Unit includes an overall assessment of the data from all of the monitoring networks as an attachment to the annual data certification letter. This letter and accompanying report focuses on the quality assurance and data review aspects that are associated with ambient air quality monitoring. DM&QA personnel utilize the AQS AMP600 Data Evaluation and Concurrence Report, aka, the data certification report, to summarize and assess completeness and bias information for each monitor ADEQ operates. If any significant issues arise throughout the year or during the annual review of the QA data, this is documented in the certification letter.

Following each calendar year, an annual audit report is developed by the ADEQ QA Team and distributed as above. This document describes the quality objectives for measurement data and how those objectives have been met. The Annual Audit Report includes, but is not limited to, the following QA information:

- monitoring program overviews and updates on any changes to the audit program,
- a summary of the flow rate and performance audits performed in that year for each network, and
- a summary of any internal or EPA TSAs conducted during the year and any corrective actions taken in response

For reporting measurement uncertainties, the Annual Audit Report contains the annual AQS QA summary report and summary statistics of the following for each monitoring network or program:

- Precision
- Bias
- Completeness
- Timeliness

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Annual Network Plan and Five-Year Network Assessment

Effective December 18, 2006, *40 CFR 58.10* requires states to complete an annual monitoring network plan and submit it to the EPA Regional Administrator for approval by July 1st of the following year. The monitoring network plan identifies the purpose of each monitor and provides evidence that the siting and operation of each monitor meets EPA requirements. It is used to determine how well a particular air monitoring network is achieving its required air monitoring objective(s) and what modifications are needed for it to continue or to better meet its objective(s).

The annual monitoring network plan must be made available for public inspection (website, hardcopy posting in libraries and public offices, and/or newspaper listing) for at least 30 days prior to submission to EPA. Although not required, EPA recommends soliciting comments during the public comment period. If an opportunity for public comment is provided, any comments received must be included in the network plan, and any changes made to the plan after the public comment period must be identified.

Every five years, in addition to the ANP, an assessment of the air quality network must be submitted to EPA Region 9. The first Five-Year Network Assessment was completed under these new regulations in July 1, 2010.This network assessment must determine:

1. if the network meets the monitoring objectives defined in *40 CFR 58 Appendix D,*
2. whether new sites are needed,
3. whether existing sites are no longer needed and can be terminated, and
4. whether new technologies are appropriate for incorporation into the ambient air monitoring network.

This assessment must also include a review of existing and proposed sites to determine if areas with relatively high populations of susceptible individuals, i.e., populations with sensitivities such as children with asthma, are characterized. In addition to the requirements above, the five-year network assessment may also include:

1. re-evaluation of the objectives and budget for air monitoring,
2. evaluation of a network's effectiveness and efficiency relative to its objectives and costs, and
3. development of recommendations for network reconfigurations and improvements.

Technical System Audit Reports

External TSAs are scheduled to be conducted at least every three years by the EPA Region 9 Office as required by *40 CFR Part 58*. The report with the audit findings will be provided to the ADEQ AQD Director and forwarded to the AAS Manager. ADEQ reviews the EPA TSA report for accuracy and responds to EPA with any corrections needed to the findings. Within 60 days after receiving the final TSA report, ADEQ prepares a corrective action report that is submitted to EPA Region 9.

Internal TSA reports provided by the DM&QA QA Team will be provided to the AAS unit managers, AAS section manager, and made available to EPA personnel when they audit ADEQ or provided upon request. The reports will be filed appropriately.

The internal TSA report will include:

- audit title and any other identifying information such as an audit ID number;
- audit team leaders, audit team participants and audited participants;
- background information about the project, purpose of the audit, dates of the audit; particular measurement phase or parameters that were audited, and a brief description of the audit process;
- summary and conclusions of the audit and corrective action requires; and
- attachments or appendices that include all audit evaluations and audit finding forms.

The goal is to have the TSA draft audit report prepared within thirty days (30) following the debriefing. The report will be made available to the audited group for comment. The audited group will have at least two (2) weeks to review the report and make comments. If the audited group has written comments or questions concerning the audit report, the Audit Team will review and incorporate them as appropriate, and subsequently prepare and resubmit a final report. The final report should be ready for distribution about sixty (60) days following the TSA debriefing. The report will include an agreed-upon schedule for corrective action implementation or follow-up meetings will be held to develop a schedule.

Corrective Action Process and Performance-Related Records

A corrective action process (CAP) is in-place for the AAS. The program ensures personnel have a means of communicating any perceived problems involving potential safety issues that may present a risk to the site technicians, operators, and auditors, or, operational or procedural problems that may adversely affect data in a number of ways. The CAP is geared toward problems, or deficiencies, to which no prescribed corrective action has been identified in SOPs or QAPPs. The CAP is a closed-loop system and is geared toward preventing recurrence of a problem by addressing its root cause. Failed

PE audits may fall under the CAP. For more information on the CAP, see the ADM:003 Corrective Action Process SOP, which is inc luded in the attachments.

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SECTION D. DATA VALIDATION AND USABILITY

D.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUI REMENTS

Data review is the set of verification and validation procedures used to examine the products of data collection and data processing to determine their quality and usability. It spans a wide scope of tests from low level checks on sample identity to high level checks on spatial and temporal comparability. The main goal of the review is to determine if the data products (measurements) are representative of their environment. This is accomplished through verification and validation of the preliminary data using collection event details such as monitor operations and laboratory results. In general, whenever an operation affects the data product, verification and validation procedures are defined and implemented to assure the operation was done correctly.

Data review also provides feedback on the field and laboratory analysis activities; it identifies those data points that may indicate the need for corrective action to a field or laboratory procedure. Data are only invalidated when evidence supports a clear cause for the invalidation, i.e., a failed flow verification. Outliers or other values needing further QA analysis that are not explained by instrument or processing errors are considered valid from an operations' standpoint and require further investigation with meteorological, climatological, and other environmental information to determine what event they represent. However, if there is supporting information that indicates environmental data are not representative of the ambient environment, the data may be invalidated through a weight of evidence approach as long as it is thoroughly documented. More information regarding this approach is provided in data review SOPs. Ideally, data review is to be performed as soon as possible after data collection and on a regular schedule during the project to enable timely investigation of questionable data, to meet data reporting requirements, and to take corrective action.

Data verification and validation are defined as follows:

- **Data Verification** techniques confirm through provision of objective evidence that *specified requirements* have been fulfilled. Data verification ensures and documents that the data are what they purport to be, i.e., it verifies what was actually done and documents that the data fulfill applicable requirements. Data not meeting the requirements are to be identified and documented with the cause of the insufficiency.

- **Data Validation** techniques confirm by examination and through provision of objective evidence that the particular requirements for a specific *intended use* are fulfilled. Data validation focuses on the particular data needs for a project and ensures that reported values meet the quality goals of the environmental data operations. The purpose of data validation is to verify that data values are representative of air quality conditions at a

sampling station and to detect those data values that do not represent actual air quality conditions.

Data verification and data validation are typically sequential steps performed by different persons. Data validation begins with the outputs from data verification and, ideally, it is performed by a data reviewer independent of the data collector, data processor, and data user. In general, data verification techniques occur during the sample collection and processing phases of the project. Data validation techniques are then applied on the resulting data product, which requires review of information generated throughout the entire sample collection, sample analysis, and data handling process. Additional verification and validation checks can be created as necessary to check the results of any operation affecting the data product.

Data review is not the same as data quality assessment or evaluation of the DQOs. Only after the data set has been reviewed, verified, and validated can it be fully assessed and/or used to address the specific scientific and regulatory questions embodied in the DQOs. The following sections describe ADEQ's data review processes and requirements. The specific data review procedures used by the contract laboratories are not included in this section, but their QMP and/or QAPP as well as SOPs are included as attachments to this document when possible. A brief overview is covered in this section.

Process Overview

This section's information is considered "complete" for describing ADEQ's current process for managing the SO_2 data. ADEQ personnel perform data verification and validation for the SO_2 measurements collected by the agency. In addition, ADEQ personnel work with representatives from ASARCO and FMMI to ensure the SO_2 data have been validated using accepted techniques and rules.

Since air monitoring programs are inherently dynamic and ADEQ is in the process of making significant upgrades to air monitoring instruments and our internal database, consult the most current version of ADEQ's SOPs for up-to-date information regarding the collection and management of SO_2 data. ADEQ plans to develop new or revise existing SOPs as needed to reflect current processes. The new AirVision™ software is expected to add value to the data review and validation process by automating data verification and validation checks, which will reduce the amount of time needed by personnel for lower level QA reviews.

Data verification and validation will be performed on data generated by ADEQ. AMU personnel will review analyzer data and verify that any written field data information matches the analyzer's record. These verification procedures constitute the QA Level 1 and 2 review and validation.

Data Review, Validation, and the ADEQ Database

For the SO_2 measurements, much of the data review and validation process is done within the ADEQ database. As discussed in Section B, AAAD offers some tools to assist data reviewers and validators throughout the data review and validation process. The degree to which each datum has been reviewed is documented in AAAD through the QA Levels. The QA Levels range from raw to final. The raw data are considered to be the original data derived from the instrumentation, or laboratory analysis if applicable. Occasionally, transformations of the data are performed by DM&QA within AAAD. These data transformations typically occur during the AAAD automated upload and validation processes and only occur so that data reported from various instruments, laboratories, and agencies are of a common data format. While these data transformations may occasionally occur, the raw data files are always archived.

Levels of Data Review

The data review procedure at ADEQ requires all data measurements to move through multiple levels of QA. The following describes how data flow within the current AAAD; however, the flow of data relative to the current QA levels is expected to similar in the new AirVision™ database. When each level of data review is completed, the data are assigned a QA Level that is entered into the AAAD, along with the status (valid, invalid, or suspect) of the data at that level and a code or flag that further describes the status. The primary objective of each level of QA is to examine the data results, to verify the measurements are what they purport to be, and to validate their quality in relation to the requirements of conformance to procedures, equipment operations, and environmental effects. Those measurements not meeting the requirements are assigned an invalid or suspect status with a reason code describing the nonconformance.

AAAD flagging protocol requires a "reason code" for each sample value at each QA level. The reason code format consists of a letter followed by a number or another letter depending on the code type. The data validation code types are shown in Table D.1. The unique combination of letters and numbers creates specific reason codes that further explain the status code. If additional explanation is needed, the comment field can be utilized. Each data record is comprised of a data value field, a QA status field, a reason code field, and a comment field.

Table D.1 Data Validation Codes

Data Field Letter	Number or Letter	QA Status	Meaning
Null	B Number	Invalid	Sample not processed or determined invalid
Data Value	V Number	Valid	QA complete
Data Value	S Number	Suspect	Requires further QA
Data Value	Q Number or Letter	Valid	Letter or number following 'Q' is the AQS qualifier code

In general, data are corrected, flagged, or invalidated based on the best assessment of the individual situation. Data corrections and flagging are noted in regular QC reports to management. Systematic problems that lead to unacceptably large biases are investigated and documented by DM&QA. Corrective actions are initiated as needed.

Data completing three levels of review and considered to be valid can be loaded to EPA's AQS database. The data are certified on an annual basis and the certification includes an overall review of QA/QC results and activities that occurred throughout the given year. The primary documentation of this process occurs via the data certification letter and accompanying report(s). A description of ADEQ's QA Levels is shown in Table D.2.

Table D.2 ADEQ Quality Assurance Levels for Continuous Measurements

QA Level	QA Objective	QA Results
Raw	Original unchanged sample data recorded at sampler or produced by laboratory analysis; to be archived.	None
1	Data are reviewed (either manually or programmatically) to determine if: • sample value produced came from proper and assumed instrument • instrument producing sample value came from proper and assumed site • instrumentation problems occurred, as documented by instrument flags or error log	Flag data as valid, invalid, or suspect. Add comments. Corrective actions taken if necessary.
2	Review Level 1 data to: • identify outliers or anomalous data (typically temporal-based) and make a preliminary validation decision. • identify media preparation problems, laboratory transformation problems, etc.	Flag Level 1 data as valid, invalid, or suspect. Add qualifiers to valid and suspect data if necessary. If necessary, add comments to data values further explaining issues at hand. Initiate Corrective Action if necessary.

QA Level	QA Objective	QA Results
3	Review Level 2 data over longer periods of time (≥ one month for continuous data and ≥ three months for filter-based data). Additionally, Level 3 data review is intended to: • compare data both spatially and temporally • incorporate and verify the field generated QC results into the data review process • make a final determination on the validity of outliers identified during the QA Level 1-3 process • identify environmental events (natural or human-caused) with appropriate flagging protocol	Flag Level 2 data as valid or invalid. Add qualifiers to valid data if necessary. If necessary, add comments that help explain validation rationale. Initiate corrective action if necessary.
Certified	Field generated QC data associated with environmental data are reviewed annually for precision, bias, and completeness. This occurs as part of the data certification procedures. Certified data are considered to be Final.	Annual data certification letter

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D.2 VERIFICATION AND VALIDATION METHODS

All data collected by the AAS must be reviewed and quality assured to the appropriate QA Level for the data type. The objective of each of these QA levels is to identify those measurements influenced by monitor problems, collection errors, or laboratory analysis errors. The remaining data are considered representative of their ambient environment; measurements above or below expected values are investigated to determine the nature of the environmental conditions they represent.

Data verification and validation requirements and the multiple levels of QA have been previously described in Section D.1. This section will describe the data review methods employed to verify and validate data at these levels and ensure that QA requirements have been met. These QA levels segregate the verification and validation checks to focus the data review in a particular way. QA Level 1 reviews the data from an individual sample at a single site. QA Level 2 focuses on internal and between sample consistency on a site by site basis; data may be reviewed over a week (continuous data) or to examine the behavior of the data through time. QA Level 3 reviews the data over longer periods of time, investigating data behavior seasonally or annually or in comparison with historic data. QA Level 3 also reviews the data spatially, looking at regional patterns and performs a final validation based on all information that was collected and documented during the sample collection and analysis process.

Data Verification and Validation Processes

The complete data review process spans a wide scope of tests from low level verification checks on sample identity to high level validation checks on temporal and spatial comparability. For continuous measurements collected by the DCS, ADEQ is solely responsible for the data validation. DCS data are stored in the AAAD, the data repository for the AAS. As discussed in Section D.1, AAAD, and the tools within AAAD, is used to perform certain data review checks and to move the data through the QA Levels. The data review methods used by ADEQ are described in the following sections.

Data Collection System and Data Review Methods

SO_2 and meteorological measurements are collected using the DCS. Each monitoring instrument is connected to a data logger that continuously records and calculates hourly averages. The DCS will poll each site daily, download data from the dataloggers, and store both raw data files and AAAD formatted data files on the ADEQ network server(s) for loading to the AAAD. When data are loaded to the AAAD, the database is programmed to identify the presence and accuracy of all timestamps, all site and instrument metadata and initial flagging of outliers. The database can convert measurement units if necessary.

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DCS QA Level 1 Review:

Loading data into the AAAD from the DCS is a two-step operation consisting of automated checks as follows:

1. Data Upload from DCS to AAAD using Oracle SQL Loader:

   The upload process verifies correct formatting of each data record coming from DCS; i.e., correct number of fields and valid data type in each field. If the record is incorrect, a file containing the invalid record is written back to the DCS. The AMU Level 2 continuous data reviewer, or their designee, checks the file and makes corrections and uploads the file or deletes the record. Valid records enter the AAAD staging table.

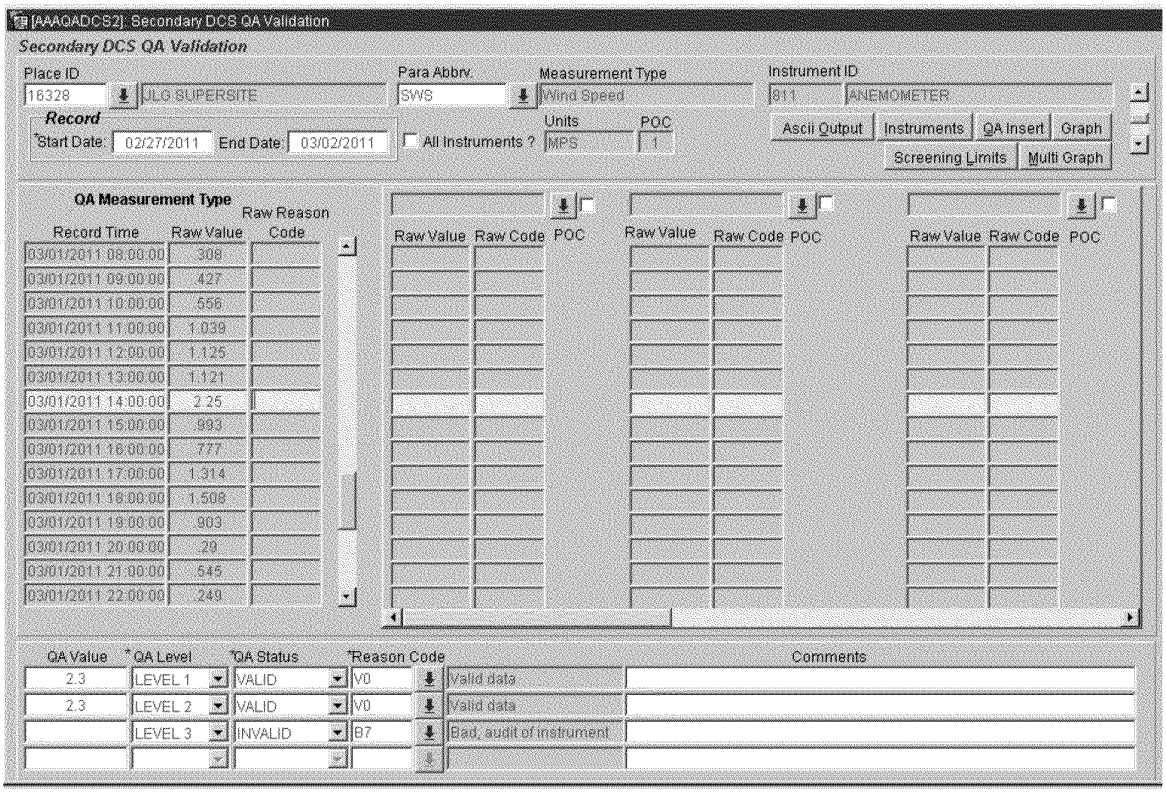
2. Data Validation:

   The data in the staging tables are validated and moved to the database where they are accessed with the DCS Quality Assurance screen or the DCS Secondary Quality Assurance screen (Figure D.1). The original DCS value is displayed in the Raw Data section of the screen; the validated data are displayed in the lower portion of the screen at QA Level 1 with a QA status and QA reason code assigned.

   Then, the following automated validation checks are performed:

   - check for missing observations and fill-in the time period with a null value assigned for the raw value and the QA value at Level 1. A preliminary determination of the QA status and reason code is assigned
   - check for hour beginning or hour ending; adjust all data from hour ending instruments to hour beginning
   - convert English unit measurements to metric units
   - check screening limits for the parameter and assign Level 1 QA status of Suspect if outside the limits

Figure D.1 AAAD DCS Secondary Quality Assurance Screen



<u>QA Level 2 Review</u>

QA Level 2 data validation is done as soon as possible to identify any problems with the data caused by the instruments (instrument failures, clock errors, power outages, etc.) All data are assigned data validation codes (flags) at each QA level. The comment field within AAAD is often utilized as a means of communication between the various data reviewers and QA levels. This field is also used to further clarify the use of flags during the QA process.

QA Level 2 review will be done by the AMU lead continuous data collection administrator or their designee as soon as possible after the data are loaded into AAAD. The QA Level 2 is performed to verify data collection by DCS and AAAD, to identify any values that are not representative of ambient conditions, i.e., data influenced by instrument checks or other outages, and to identify any problems in data collection. In addition to the data collection verification, Level 2 review includes a manual review of data on a temporal scale of three to nine days. Typically, criteria pollutant data undergo Level 2 quality assurance procedures on a daily basis, while meteorological data and non-criteria pollutant data undergo Level 2 data review on a weekly or monthly or quarterly basis. The Level 2 review includes the following steps:

1. Check the AAAD DCS Upload Validation screen to verify upload and begin the validation process. Records appearing in this screen are in the AAAD staging tables and have *not* met the automated verification requirements. The deficiency will be identified, the records corrected or deleted, and the validation process run.

2. Using the DCS Secondary QA screen, graph data and evaluate for outliers. Pay particular attention to data that were flagged and suspect during the Level 1 review. If invalid, enter the Level 2 status of invalid and assign the appropriate 'B' code using information from field reports, verbal communication, or email communication. Check flagged data and if valid, copy the data to Level 2 and assign the V1 flag. Promote the remaining data to Level 2 using the appropriate reason code.

QA Level 3 Review

QA Level 3 incorporates the QC field checks into the data validation process. Historical data review is incorporated at QA Level 3. Please note that at this time, the QA Level 3 data reviewer does not perform the standard Level 3 data review procedure(s) on meteorological data.

The QA Level 3 review is completed by the DM&QA continuous data reviewer(s). Level 3 data review includes an evaluation of the data on longer temporal scales, usually on the order of months. The Level 3 data review process also serves as a final validation of data and incorporates the official ADEQ field activity reports and the instrument QC data into the validation decision-making process. It is also during the Level 3 data review process that data are flagged with the appropriate qualifier flag, if needed. Most often, this includes flagging of data that have been influenced by natural or exceptional events.

The data review steps are:

1. Review all field activity reports from the AMU and the QA auditor associated with the parameters of concern. Verify that all instruments passed their verification, aka, QC checks, conducted by the AMU technicians. The verification checks that are considered during the Level 3 data review process are found in the critical criteria section of the validation templates used for the SO_2. If a verification failure occurs, data are usually invalidated back to the last successful verification check unless the QC data or ambient pollutant or meteorological data indicate an exact point in time the instrument's performance began to fail.

2. Using the DCS Secondary QA screen or other graphical software, examine the parameters for a period of one to three months worth of measurements. Graph the Level 2 data and examine. The AAAD graphing tool will identify any data that were determined suspect during the Level 2 validation process. Evaluate all data that are represented in the graphical plot. Check flagged and suspect data.

3. Identify any additional anomalous data that were not identified during the previous QA level reviews. Communicate and coordinate with other data reviewers, air quality forecasters, and instrument technicians to determine validity of data. Other data sources may be utilized, such as the data from the NWS, to assist with the validation process.

4. Perform spatial comparisons of the data parameters, when applicable.

5. When completed, promote values in AAAD to QA Level 3 with appropriate status and reason codes.

D.3 RECONCILIATION AND USER REQUIREMENTS

On an annual basis and in conjunction with the data certification process, the ambient data collected by ADEQ and their associated QA/QC data are subjected to a data quality assessment (DQA). This DQA includes a final review of the ambient data (via a data summary review), a review of data completeness, and a review of the QA/QC data in comparison with the DQOs and/or MQOs that have been established for each SO_2 monitoring network. This DQA serves two primary purposes:

1. To act as a final validation of the ambient data which typically results in official certification of the data
2. To serve as an overall assessment of data quality for a particular program or network by comparing the desired objectives with the actual results

For criteria pollutant data, EPA's Data Quality Indicator Report (AMP 255) and Data Certification Report (AMP 600) are the primary statistical tools for relating the QA/QC results to each monitoring program's DQOs and/or MQOs. If it is determined that ADEQ is continuously not meeting the DQOs and/or MQOs established in this QAPP for the SO_2 networks, the AAS will re-evaluate any internal objectives for the SO_2 network. Based upon this evaluation, AAS will identify improvements that can be made to the affected SO_2 network and/or determine if any internal DQOs or MQOs are too stringent for the monitoring methodologies in-use. If AAS determines that any internal DQOs or MQOs are too stringent, then AAS personnel will develop and implement more realistic internal objectives. If the national DQOs established by the EPA are not met, AAS personnel will work with the EPA as needed to develop more realistic DQOs for the national SO_2 networks.

Once it has been determined that the SO_2 data collected by ADEQ meet the EPA's requirements, the data will be certified by ADEQ and can then be used to determine compliance with the NAAQS.

Measurement Quality Objectives and Validation Templates

ADEQ expects EPA to provide feedback regarding how well air monitoring agencies around the country met the established SO_2 DQOs and/or MQOs. In the event the SO_2 MQOs are revised in the future, ADEQ plans to follow the most current MQO goals provided by EPA. As always, ADEQ will work with EPA to resolve any concerns that may arise from this plan and the SO_2 program.

Any other reports from EPA regarding how well other SO_2 program DQOs and/or MQOs are being met will also be reviewed and handled as stated with the SO_2 review. If changes occur to the air monitoring regulations that affect the acceptable operating criteria for instruments and data validation practices outlined in this QAPP, we plan to review, amend, and obtain EPA approval for our supporting documents as needed.

In addition, ADEQ will work with EPA regarding improvement to QA requirements or guidance as done in the past. ADEQ plans to use the SO_2 validation template provided in the most current *QAHBV2* edition along with this QAPP (see Figure D.2.)

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Figure D.2. EPA QAHBV2 SO2 Validation Template

SO_2 Validation Template

1) Requirement (SO_2)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA- SO_2			
One Point QC Check Single analyzer	*1/ 2 weeks*	≤ ±10% (percent difference)	1 and 2) 40 CFR Part 58 App A Sec 3.2 3) Recommendation based on DQO in 40 CFR Part 58 App A Sec 2.3.1.2 QC Check Conc range 0.01 - 0.10 ppm Relative to routine concentrations
Zero/span check	1/ 2 weeks	Zero drift ≤ ± 1.5 ppb Span drift ≤ ± 10 %	1 and 2) QA Handbook Volume 2 Section 12.3 3) Recommendation and related to DQO
OPERATIONAL CRITERIA- SO_2			
Shelter Temperature Range	**Daily** (hourly values)	20 to 30° C. (Hourly avg) or per manufacturers specifications if designated to a wider temperature range	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2 Generally the 20-30 ° C range will apply but the most restrictive operable range of the instruments in the shelter may also be used as guidance. FRM/FEM list found on AMTIC provides temp. range for given instrument.FRM/FEM monitor testing is required at 20-30 ° C range per 40 CFR Part 53.32
Shelter Temperature Control	Daily (hourly values)	≤ ± 2° C SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Shelter Temperature Device Check	1/6 mo	± 2° C of standard	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Annual Performance Evaluation Single Analyzer	*Every site 1/year 25 % of sites quarterly*	Percent difference of audit levels 3-10 ≤ ±15% Audit levels 1&2 ± 1.5 ppb difference or ±15%	1 and 2) 40 CFR Part 58 App A sec 3.2.2 3) Recommendation - 3-audit concentrations not including zero. AMTIC guidance 2/17/2011 http://www.epa.gov/ttn/amtic/cpreldoc.html
Federal Audits (NPAP)	1/year at selected sites 20% of sites audited	Audit levels 1&2 ± 1.5 ppb difference all other levels percent difference ± 15%	1) 40 CFR Part 58 App A sec 2.4 2) NPAP adequacy requirements on AMTIC 3) NPAP QAPP/SOP
Verification/Calibration	Upon receipt/adjustment/repair/ installation/moving 1/6 months if manual zero/span performed biweekly 1/year if continuous zero/span performed daily	All points within ± 2 % of calibration range of best-fit straight line	1) 40 CFR Part 50 App A-1 Section 4 2 and 3) Recommendation Multi-point calibration (0 and 4 upscale points)
Gaseous Standards	*All gas cylinders*	*NIST Traceable* *(e.g., EPA Protocol Gas)*	1) 40 CFR Part 50 App A-1 Section 4.1.6.1 2) NA Green book 3) 40 CFR Part 50 App F Section 1.3.1 Producers must participate in Ambient Air Protocol Gas Verification Program 40 CFR Part 58 App A sec 2.6.1
Zero Air/ Zero Air Check	1/year	Concentrations below LDL < 0.1 ppm aromatic hydrocarbons	1) 40 CFR Part 50 App A-1 Section 4.1.6.2 2) Recommendation

1) Requirement (SO_2)	2) Frequency	3) Acceptance Criteria	Information /Action
			3) Recommendation and 40 CFR Part 50 App A-1 Section 4.1.6.2
Gas Dilution Systems	1/year or after failure of 1 point QC check or performance evaluation	*Accuracy ± 2 %*	1) 40 CFR Part 50 App A-1sec 4.1.2 2) Recommendation 3) 40 CFR Part 50 App A-1 sec 4.1.2
Detection (FEM/FRMs)			
Noise	NA	*0.001 ppm (standard range)* *0.0005 ppm (lower range)*	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) NA 3)) 40 CFR Part 53.20 Table B-1
Lower detectable level	1/year	*0.002 ppm (standard range)* *0.001 ppm (lower range)*	1) 40 CFR Part 53.23 (c) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA- SO_2			
Sampler/Monitor	NA	*Meets requirements listed in FRM/FEM designation*	1) 40 CFR Part 58 App C Section 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Standard Reporting Units	*All data*	*ppb (final units in AQS)*	1, 2 and 3) 40 CFR Part 50 App T Sec 2 (c)
Rounding convention for data reported to AQS	*All data*	*1 place after decimal with digits to right truncated*	1, 2 and 3) 40 CFR Part 50 App T Sec 2 (c)
Completeness	*1 hour standard*	*Hour – 75% of hour* *Day- 75% hourly Conc* *Quarter- 75% complete days* *Years- 4 complete quarters* *5-min value reported only for valid hours*	1, 2 and 3) 40 CFR Part 50 App T Section 3 (b), (c) More details in CFR on acceptable completeness. 5-min values or 5-min max value only reported for the valid portion of the hour reported. If the hour is incomplete no 5-min or 5-min max reported.
Sample Residence Time Verification	1/year	*< 20 seconds*	1) 40 CFR Part 58 App E, section 9 (c) 2) Recommendation 3) 40 CFR Part 58 App E, section 9 (c)
Sample Probe, Inlet, Sampling train	*All sites*	*Borosilicate glass (e.g., Pyrex®) or Teflon®*	1, 2 and 3) 40 CFR Part 58 App E sec 9 (a) FEP and PFA have been accepted as equivalent material to Teflon. Replacement or cleaning is suggested as 1/year and more frequent if pollutant load or contamination dictate
Siting	1/year	*Meets siting criteria or waiver documented*	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5
Precision(using 1-point QC checks)	*Calculated annually and as appropriate for design value estimates*	*90% CL CV ≤ 10%*	1) 40 CFR Part 58 App A sec 2.3.1.6 & 3.2.1 2) 40 CFR Part 58 App A sec 4 (b) 3) 40 CFR Part 58 App A sec 4.1.2
Bias (using 1-point QC checks)	*Calculated annually and as appropriate for design value estimates*	*95% CL ≤ ±10%*	1) 40 CFR Part 58 App A sec 2.3.1.6 & 3.2.1 2) 40 CFR Part 58 App A sec 4 (b) 3) 40 CFR Part 58 App A sec 4.1.3
Annual PE Primary QA Organization (PQAO) Evaluation	1/year	*95% of audit percent differences fall within the one point QC check 95% probability intervals at PQAO level of aggregation*	1) 40 CFR Part 58 App A Section 3.2.2 2) Recommendation 3) 40 CFR Part 58 App A sec 4.1.4 and 4.1.5

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To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]
Cc: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]; Lee, Anita[Lee.Anita@epa.gov]
From: Bohnenkamp, Carol
Sent: Thur 4/27/2017 8:15:22 PM
Subject: RE: New Methodology

Dear Roland,

Thank you for providing the draft revised modeling report based on the use of AERMOD version 16216r and estimated actual emissions. From our preliminary review, the report looks good. We have a few requests:

1. Can you please also include the UTM of the center of the 6,074 meter circle described in the report (as shown in Figure 10)?
2. When you submit the final revised modeling report to EPA, in the cover letter from Guam EPA, please also include Guam EPA's recommended designation and the boundaries for that designated area. In 2011, Guam EPA recommended an unclassifiable designation for the whole island. Now that these modeling analyses have been completed, it would also be helpful to provide an updated recommendation. The summary of the TRC report does contain a recommendation and boundary suggestion, but it would be best for the recommendation to come from Guam EPA.
3. Assuming that Guam EPA's designation recommendation applies to a limited part of the island, please also include a recommended designation for the remaining areas of Guam. There are a couple possibilities for the rest of Guam (Unclassifiable or Unclassifiable/Attainment) that we can talk through together.

If it would be helpful to discuss by phone, please let me know and we can work to set up a call.

Thank you,

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Tuesday, April 25, 2017 5:24 PM
To: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Cc: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>; Lee, Anita <Lee.Anita@epa.gov>
Subject: Re: New Methodology

All,

Attached is the revised modeling report for the DRR. Please review and provide comments.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

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On Thu, Apr 6, 2017 at 12:42 AM, Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov> wrote:

Roland,

Thank you for your timely responses. Based on the clarifications you provided, we believe the revised procedures "Proposed Hourly Varying Emissions for Guam Power Authority Data Requirements Rule SO_2 NAAQS Designation Modeling; Revised March 3, 2017," which you provided to use on March 19, 2017, are appropriate and represent your determination for the most appropriate method for estimating sulfur content of fuel burned. Our understanding is that you will be using this version as the final protocol, but please

send us the final version if anything further has changed.

Carol Bohnenkamp

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Thursday, March 30, 2017 6:12 PM
To: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Cc: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>; Lee, Anita <Lee.Anita@epa.gov>
Subject: Re: New Methodology

Carol,

Here is the response in blue:

1. To simplify the calculation when LSFO is used, the standard sulfur content for LSFO (0.0015) can be used for periods when LSFO is burned.

GPA: This is actually ULSD, not LSFO as it is referring to the TEMES #7 CT which burns ULSD exclusively. We will use 0.0015 in the calculations

2. Regarding the HSFO calculations, in lieu of the one-month offset you suggested in your revised methodology, we are considering a couple of alternative options.

a. How much does the sulfur content of HSFO vary? Do you have a known range for the HSFO? If the sulfur content doesn't vary much, then we would recommend just using the highest value of the range. Otherwise, we would recommend figuring out some method for determining the average sulfur content. (See 2.b. below for a clarifying question, and one method that might provide a representative estimate of the sulfur content of the bulk storage tanks.)

GPA: Our sulfur content varies a lot. See attached monthly analysis. We receive LSFO less often, so you will see LSFO remain constant for a few months at a time.

b. We understand that you are trying to determine the sulfur content of the fuel when it is

burned, based on records of the sulfur content of the fuel when it is added to the bulk storage tanks.

i. We are curious how often the Residual Fuel Oil Receiving Reports are received?

GPA: We normally receive RFO shipments on a monthly basis. Analysis is performed every time a new shipment arrives. The sample is taken from the bulk storage tanks after fuel has been transferred from the ship.

ii. Would an average of sulfur content over the 30 day time period (or another time period, maybe based on the residence time of fuel in the tank?) more accurately reflect the sulfur content of the fuel being burned, if you are assuming that fuel oil in the tank gets well-mixed?

GPA: Annual average based on monthly analysis. See attached sulfur content summary.

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
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On Tue, Mar 28, 2017 at 8:32 AM, Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov> wrote:

Roland,

Thank you for providing the additional information and clarifications – it looks good! We have a just few questions/suggestions related to 4.c.

1. To simplify the calculation when LSFO is used, the standard sulfur content for LSFO (0.0015) can be used for periods when LSFO is burned.

2. Regarding the HSFO calculations, in lieu of the one-month offset you suggested in your revised methodology, we are considering a couple of alternative options.

a. How much does the sulfur content of HSFO vary? Do you have a known range for the HSFO? If the sulfur content doesn't vary much, then we would recommend just using the highest value of the range. Otherwise, we would recommend figuring out some method for determining the average sulfur content. (See 2.b. below for a clarifying question, and one method that might provide a representative estimate of the sulfur content of the bulk storage tanks.)

b. We understand that you are trying to determine the sulfur content of the fuel when it is burned, based on records of the sulfur content of the fuel when it is added to the bulk storage tanks.

i. We are curious how often the Residual Fuel Oil Receiving Reports are received?

ii. Would an average of sulfur content over the 30 day time period (or another time period, maybe based on the residence time of fuel in the tank?) more accurately reflect the sulfur content of the fuel being burned, if you are assuming that fuel oil in the tank gets well-mixed?

Carol Bohnenkamp

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, March 26, 2017 6:22 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano

<conchita.taitano@epa.guam.gov>
Cc: Lee, Anita <Lee.Anita@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Subject: Re: New Methodology

Hi Gwen,

Just following up on the responses we sent. We wanted to see if we have approval to begin the updated modeling with the revised modeling methodology. Please advise soonest.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
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On Tue, Mar 21, 2017 at 12:30 AM, YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov> wrote:

> Thank you Roland. We'll take a look and get back to you.

-Gwen

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, March 19, 2017 5:02 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Subject: New Methodology

Gwen/Anita

Here is the response. Sorry it took a while.

- On page 3. Please clarify what [0.0015 (Sulfur % wt)] / [1000 gallons] means in the equation:

We had erroneously used AP42 Table 1.3-1 which is for External Combustion Sources. The correct AP42 Factor to use is Table 3.1-2a Stationary Gas Turbines

The Correct formula is

SO2 Emissions (lbs/hr) = [Fuel Use (1000 gallons/hour)] * [139 MMBtu/gallons]*[1.01 * 0.0015 lb/MMBtu]

= [Fuel Use (1000 gallons/hour)] * [0.211 (lb/1000 gallon)]

- Page 5, Item 3.C “date received”.

This is now item 4.C. A step was added that improves data accuracy

Here is the situation for Cabras. Fuel is transferred from the ship to the bulk storage tank (1934 & 1935). After transfer, a sample is taken from the bulk storage tank for analysis. This analysis now gives us the current sulfur concentration of the fuel. We normally have daily deliveries of fuel from the Bulk Storage to the Day Tanks at the power plant. So whatever is in the Bulk Storage Tanks will start to fill into the Day Tanks at the plant and completely replace the old fuel within 3 - 4 days.

We may also have to consider that it may take a while for the fuel in the Bulk Storage to be fully mixed. Using the sulfur analysis for the following month. So we may want to delay using the new sulfur analysis by one month.

Attached is the revised Procedures.

Roland T. Gutierrez Jr., MPA
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roland.gutierrez@epa.guam.gov
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To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]
Cc: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]; Lee, Anita[Lee.Anita@epa.gov]
From: Bohnenkamp, Carol
Sent: Wed 4/5/2017 2:42:43 PM
Subject: RE: New Methodology

Roland,

Thank you for your timely responses. Based on the clarifications you provided, we believe the revised procedures "Proposed Hourly Varying Emissions for Guam Power Authority Data Requirements Rule SO_2 NAAQS Designation Modeling; Revised March 3, 2017," which you provided to use on March 19, 2017, are appropriate and represent your determination for the most appropriate method for estimating sulfur content of fuel burned. Our understanding is that you will be using this version as the final protocol, but please send us the final version if anything further has changed.

Carol Bohnenkamp

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Sent: Thursday, March 30, 2017 6:12 PM
To: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Cc: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>; Lee, Anita <Lee.Anita@epa.gov>
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Roland T. Gutierrez Jr., MPA
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information is strictly PROHIBITED. If you received this transmission in error, please notify us immediately by e-mail or telephone to arrange for the return of this email and any files to us or to verify it has been deleted from your system.

On Tue, Mar 28, 2017 at 8:32 AM, Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov> wrote:

Roland,

Thank you for providing the additional information and clarifications – it looks good! We have a just few questions/suggestions related to 4.c.

1. To simplify the calculation when LSFO is used, the standard sulfur content for LSFO (0.0015) can be used for periods when LSFO is burned.

2. Regarding the HSFO calculations, in lieu of the one-month offset you suggested in your revised methodology, we are considering a couple of alternative options.

a. How much does the sulfur content of HSFO vary? Do you have a known range for the HSFO? If the sulfur content doesn't vary much, then we would recommend just using the highest value of the range. Otherwise, we would recommend figuring out some method for determining the average sulfur content. (See 2.b. below for a clarifying question, and one method that might provide a representative estimate of the sulfur content of the bulk storage tanks.)

b. We understand that you are trying to determine the sulfur content of the fuel when it is burned, based on records of the sulfur content of the fuel when it is added to the bulk storage tanks.

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accurately reflect the sulfur content of the fuel being burned, if you are assuming that fuel oil in the tank gets well-mixed?

Carol Bohnenkamp

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, March 26, 2017 6:22 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Conchita Taitano <conchita.taitano@epa.guam.gov>
Cc: Lee, Anita <Lee.Anita@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Subject: Re: New Methodology

Hi Gwen,

Just following up on the responses we sent. We wanted to see if we have approval to begin the updated modeling with the revised modeling methodology. Please advise soonest.

Thank you,

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

epa.guam.gov - facebook.com/Guam EPA - twitter.com/GuamEPA

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notify us immediately by e-mail or telephone to arrange for the return of this email and any files to us or to verify it has been deleted from your system.

On Tue, Mar 21, 2017 at 12:30 AM, YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov> wrote:

Thank you Roland. We'll take a look and get back to you.

-Gwen

Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

From: Roland Gutierrez [mailto:roland.gutierrez@epa.guam.gov]
Sent: Sunday, March 19, 2017 5:02 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Subject: New Methodology

Gwen/Anita

Here is the response. Sorry it took a while.

- On page 3. Please clarify what [0.0015 (Sulfur % wt)] / [1000 gallons] means in the equation:

We had erroneously used AP42 Table 1.3-1 which is for External Combustion Sources. The correct AP42 Factor to use is Table 3.1-2a Stationary Gas Turbines

The Correct formula is

SO2 Emissions (lbs/hr) = [Fuel Use (1000 gallons/hour)] * [139 MMBtu/gallons]*[1.01 * 0.0015 lb/MMBtu]

= [Fuel Use (1000 gallons/hour)] * [0.211 (lb/1000 gallon)]

- Page 5, Item 3.C "date received".

This is now item 4.C. A step was added that improves data accuracy

Here is the situation for Cabras. Fuel is transferred from the ship to the bulk storage tank (1934 & 1935). After transfer, a sample is taken from the bulk storage tank for analysis. This analysis now gives us the current sulfur concentration of the fuel. We normally have daily deliveries of fuel from the Bulk Storage to the Day Tanks at the power plant. So whatever is in the Bulk Storage Tanks will start to fill into the Day Tanks at the plant and completely replace the old fuel within 3 - 4 days.

We may also have to consider that it may take a while for the fuel in the Bulk Storage to be fully mixed. Using the sulfur analysis for the following month. So we may want to delay using the new sulfur analysis by one month.

Attached is the revised Procedures.

Roland T. Gutierrez Jr., MPA
EHS Supervisor, Air Pollution Control Program - Guam EPA
roland.gutierrez@epa.guam.gov
Ph. 1-671-300-4751/2/3
Fax: 1-671-300-4531

epa.guam.gov - facebook.com/Guam EPA - twitter.com/GuamEPA

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To: Roland Gutierrez[roland.gutierrez@epa.guam.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Conchita Taitano[conchita.taitano@epa.guam.gov]
Cc: Lee, Anita[Lee.Anita@epa.gov]
From: Bohnenkamp, Carol
Sent: Mon 3/27/2017 10:32:04 PM
Subject: RE: New Methodology

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Cc: Lee, Anita <Lee.Anita@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
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Gwen M. Yoshimura

Acting Manager, Air Quality Analysis Office
Environmental Protection Agency, Region 9
Phone: 415.947.4134
Email: yoshimura.gwen@epa.gov

mailing address:
U.S. Environmental Protection Agency
Air Quality Analysis Office (AIR-7)
75 Hawthorne Street
San Francisco, CA 94105

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Subject: New Methodology

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Roland T. Gutierrez Jr., MPA
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To: Katherine Hoag[khoag@baaqmd.gov]
Cc: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Lakin, Matt[Lakin.Matthew@epa.gov]; Mebust, Anna[mebust.anna@epa.gov]; estevenson@baaqmd.gov[estevenson@baaqmd.gov]; Sanjeev Kamboj[skamboj@baaqmd.gov]; Irma Salinas[ISalinas@baaqmd.gov]
From: Bohnenkamp, Carol
Sent: Thur 3/23/2017 11:44:42 PM
Subject: RE: Additional background information about SO2 DRR analysis

Thanks Kate, for your very quick response.

From: Katherine Hoag [mailto:khoag@baaqmd.gov]
Sent: Thursday, March 23, 2017 3:35 PM
To: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Cc: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lakin, Matt <Lakin.Matthew@epa.gov>; Mebust, Anna <Mebust.Anna@epa.gov>; estevenson@baaqmd.gov; Sanjeev Kamboj <skamboj@baaqmd.gov>; Irma Salinas <ISalinas@baaqmd.gov>
Subject: Additional background information about SO2 DRR analysis

Hi Carol,

These two attachments have the remaining information you requested about the modeling protocol that was used as part of the analysis for our monitor placement for the SO2 DRR requirements. It's my understanding that these describe general methodologies and practices that are typically used at the Air District for many modeling applications, including the runs used in our analysis from September 29, 2016.

Thanks for keeping us posted on the SO_2 designations process – let us know if there is anything else you need from us after your ongoing discussions with HQ.

Kate

Katherine Hoag, Ph.D.

QA Officer / Principal Air Quality Engineer

Bay Area Air Quality Management District

375 Beale Street, Suite 600 | San Francisco, CA 94105

(415) 749-4619

khoag@baaqmd.gov

To: Brenda Harpring[bharprin@ndep.nv.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]; Raju Bisht[rbisht@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]; Gaurav Rajen[rajenwnr@gmail.com]; Frank Forsgren[fforsgre@ndep.nv.gov]; Mike Elges[melges@ndep.nv.gov]; ransel@clarkcountynv.gov[ransel@clarkcountynv.gov]; Zheng Li[zli@ClarkCountyNV.gov]; huys@clarkcountynv.gov[huys@clarkcountynv.gov]; Steven M. Calderon[smc@azdeq.gov]; Feng Mao[mf8@azdeq.gov]; Jo Crumbaker[jcrumbak@mail.maricopa.gov]; Taejoo Shin[tshin@mag.maricopa.gov]; Lindy Bauer[lbauer@mag.maricopa.gov]; Farah Mohammadesmaeili[Mohammadesmaeili.Farah@azdeq.gov]; Ryan C. Templeton[Templeton.Ryan@azdeq.gov]; Melissa Sheffer[msheffer@aqmd.gov]; Jillian Wong[jwong1@aqmd.gov]; leland.villalvazo@valleyair.org[leland.villalvazo@valleyair.org]; McFall, Keith[Keith.McFall@doh.hawaii.gov]; Wong, David Tien Lun[david.wong@doh.hawaii.gov]; Danilo Dragoni[ddragoni@ndep.nv.gov]
From: Bohnenkamp, Carol
Sent: Tue 8/2/2016 2:59:10 PM
Subject: FW: Model Clearinghouse Concurrence with Region 8 Approval of ADJ_U* AERMET Option for Heskett Facility near Bismarck, ND

From: Bridgers, George
Sent: Monday, August 01, 2016 3:36 PM
To: Avey, Lance <Avey.Lance@epa.gov>; Biton, Leiran <biton.leiran@epa.gov>; Blakley, Pamela <blakley.pamela@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; Colecchia, Annamaria <Colecchia.Annamaria@epa.gov>; Cox, Kyndall <Cox.Kyndall@epa.gov>; Dresser, Chris <Dresser.Chris@epa.gov>; Feldman, Michael <Feldman.Michael@epa.gov>; Fry, Jessica <fry.jessica@epa.gov>; Gillam, Rick <Gillam.Rick@epa.gov>; Hawkins, Andy <hawkins.andy@epa.gov>; Holladay, Cleveland <Holladay.Cleveland@epa.gov>; Howard, Chris <Howard.Chris@epa.gov>; Imhoff, Robert <imhoff.robert@epa.gov>; Kay, Rynda <Kay.Rynda@epa.gov>; Krivo, Stan <Krivo.Stanley@epa.gov>; Langman, Michael <langman.michael@epa.gov>; Leon-Guerrero, Tim <Leon-Guerrero.Tim@epa.gov>; Leslie, Michael <leslie.michael@epa.gov>; Liljegren, Jennifer <Liljegren.Jennifer@epa.gov>; Lusky, Katy <Lusky.Kathleen@epa.gov>; Matichuk, Rebecca <Matichuk.Rebecca@epa.gov>; Mohr, Ashley <Mohr.Ashley@epa.gov>; Monteith, Richard <Monteith.Richard@epa.gov>; Nguyen, Phuong <Nguyen.Phuong@epa.gov>; Carlton-Carew, Njeri <carlton-carew.njeri@epa.gov>; Persoon, Carolyn <persoon.carolyn@epa.gov>; Portanova, Mary <portanova.mary@epa.gov>; Rinck, Todd <Rinck.Todd@epa.gov>; Robinson, Randall <robinson.randall@epa.gov>; schmidt, howard <schmidt.howard@epa.gov>; Schwartz, Colin <Schwartz.Colin@epa.gov>; Snyder, Erik <snyder.erik@epa.gov>; Tonnesen, Gail <Tonnesen.Gail@epa.gov>; Walther, Katherine <Walther.Katherine@epa.gov>; Wiley, Adina <Wiley.Adina@epa.gov>; Worstell, Aaron <Worstell.Aaron@epa.gov>
Cc: baanderson02@fs.fed.us; Buckler, Charles <Buckler.Charles@epa.gov>; cnicholl@blm.gov; Deroeck, Dan <Deroeck.Dan@epa.gov>; Hawes, Todd <Hawes.Todd@epa.gov>; Jill_Webster@fws.gov; john_notar@nps.gov; Misenis, Chris <Misenis.Chris@epa.gov>; Montanez, Jessica <Montanez.Jessica@epa.gov>; Rick Graw

<rgraw@fs.fed.us>; Shaltanis, Jennifer <Shaltanis.Jennifer@epa.gov>; Tim_Allen@fws.gov; Timin, Brian <Timin.Brian@epa.gov>; Tom Coulter <ccoulter@blm.gov>; Baker, Thomas <Baker.Thomas@epa.gov>; Brode, Roger <Brode.Roger@epa.gov>; Fox, Tyler <Fox.Tyler@epa.gov>; Owen, Chris <Owen.Chris@epa.gov>; Thurman, James <Thurman.James@epa.gov>
Subject: Model Clearinghouse Concurrence with Region 8 Approval of ADJ_U* AERMET Option for Heskett Facility near Bismarck, ND

Regional Office Dispersion Modeling Contacts,

The Model Clearinghouse has formally concurred with a Region 8 request to approve an alternative modeling demonstration for the use of the ADJ_U* beta option in AERMET for the modeling demonstration of the the Montana-Dakota Utilities Company's R.M. Heskett Station (Heskett) facility located about 10 km northwest of Bismarck. In the case of the Heskett facility, excessive 1-hour SO2 concentrations on terrain (Crown Butte) approximately 15 km from the source at elevations above the lowest effective stack height were predicted by the regulatory default version of the AERMOD Modeling System, specifically during low-wind/stable conditions when u* values were relatively small. This parallels similar excessive 1-hour SO2 concentrations predicted on distant terrain during similar low wind/stable conditions for the Region 1 Schiller and Region 3 Wagner situations. Given this model response, the Region 8 technical report and associated alternative model justification package from the NDDH, and our similar concurrences of ADJ_U* for a nearly identical circumstances that were also appropriately justified, we agree that it was appropriate for the ADJ_U* Beta option in AERMET to be considered for this regulatory modeling demonstration at the Heskett facility. This fourth Model Clearinghouse concurrence on the use of the ADJ_U* beta option should continue solidifying the template for other facilities with similar issues and permit reviewing authorities that are interested in developing an ADJ_U* alternative modeling request for EPA consideration.

A formal record, 16-VIII-01, has been created in the MCHISRS database with PDF scans of the Region 8 concurence request memorandum package and the Model Clearinghouse concurrence response memorandum. The direct link to the MCHISRS record is: https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-VIII-01. A message about this Model Clearinghouse action has also been included on the SCRAM website under the Recent Additions section and announced through SCRAM's RSS feed.

As noted in the previous ADJ_U* beta option concurrences and not an issue with this particular

case, we continue to evaluate the potential that the use of the ADJ_U* beta option in combination with site-specific meteorological data that includes the sigma-theta and/or sigma-w turbulence parameters may introduce a bias toward concentration underprediction and caution anyone considering the use of both the ADJ_U* beta option and meteorological data that includes the derived sigma-theta and/or sigma-w turbulence parameters in regulatory applications without consultation and approval from the appropriate permitting authority and the respective EPA Regional Office.

Please share this announcement information with your respective state, local, and tribal agencies and with any interested colleagues in a timely manner. Do not hesitate to contact me if there are any questions or needed clarification on this particular application of ADJ_U* or its use elsewhere.

My regards,

George

George M. Bridgers, CPM, Environmental Scientist
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
AQAD - Air Quality Modeling Group
109 TW Alexander Drive
Room C431B - Mail Drop C439-01
Research Triangle Park, NC 27711
Phone: 919-541-5563
Fax: 919-541-0044

To: Ryan C. Templeton[Templeton.Ryan@azdeq.gov]
From: Bohnenkamp, Carol
Sent: Tue 6/28/2016 10:29:42 PM
Subject: RE: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

Thanks Ryan,

I forwarded your email to Cleve Holladay as well.

Carol

From: Ryan C. Templeton [mailto:Templeton.Ryan@azdeq.gov]
Sent: Tuesday, June 28, 2016 2:54 PM
To: Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>
Subject: RE: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

Hey Carol,

I'm a little late on my follow up, but I just wanted to say thank you for forwarding along the below information. We made sure to include a discussion of this information in our modeling protocol for the AEPCO Apache Generating Station, where we are requesting EPA concurrence of the use of the ADJ_U* AERMET option. We appreciate your help.

Ryan Templeton

Environmental Program Supervisor

Arizona Department of Environmental Quality

rct@azdeq.gov

(602) 771-4230

From: Bohnenkamp, Carol [mailto:Bohnenkamp.Carol@epa.gov]
Sent: Thursday, June 23, 2016 11:13 AM
To: Danilo Dragoni <ddragoni@ndep.nv.gov>; Adele Malone <amalone@ndep.nv.gov>; Brenda Harpring <bharprin@ndep.nv.gov>; eugeniaquintana@navajo-nsn.gov; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Gaurav Rajen <rajenwnr@gmail.com>; Frank Forsgren <fforsgre@ndep.nv.gov>; Mike Elges <melges@ndep.nv.gov>; ransel@clarkcountynv.gov; Zheng Li <zli@clarkcountynv.gov>; huys@clarkcountynv.gov; Steve M. Calderon <Calderon.Steve@azdeq.gov>; Diane Arnst <Arnst.Diane@azdeq.gov>; Feng Mao <Mao.Feng@azdeq.gov>; Jo Crumbaker <jcrumbak@mail.maricopa.gov>; Taejoo Shin <tshin@mag.maricopa.gov>; Lindy Bauer <lbauer@mag.maricopa.gov>; Farah Mohammadesmaeili <Mohammadesmaeili.Farah@azdeq.gov>; Ryan C. Templeton <Templeton.Ryan@azdeq.gov>
Subject: FW: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

From: Bridgers, George
Sent: Monday, June 20, 2016 3:40 PM
To: Avey, Lance <Avey.Lance@epa.gov>; Biton, Leiran <biton.leiran@epa.gov>; Blakley, Pamela <blakley.pamela@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; Colecchia, Annamaria <Colecchia.Annamaria@epa.gov>; Cox, Kyndall <Cox.Kyndall@epa.gov>; Dresser, Chris <Dresser.Chris@epa.gov>; Feldman, Michael <Feldman.Michael@epa.gov>; Fry, Jessica <fry.jessica@epa.gov>; Gillam, Rick <Gillam.Rick@epa.gov>; Hawkins, Andy <hawkins.andy@epa.gov>; Holladay, Cleveland <Holladay.Cleveland@epa.gov>; Howard, Chris <Howard.Chris@epa.gov>; Imhoff, Robert <imhoff.robert@epa.gov>; Kay, Rynda <Kay.Rynda@epa.gov>; Krivo, Stan <Krivo.Stanley@epa.gov>; Langman, Michael <langman.michael@epa.gov>; Leon-Guerrero, Tim <Leon-Guerrero.Tim@epa.gov>; Leslie, Michael <leslie.michael@epa.gov>; Liljegren, Jennifer <Liljegren.Jennifer@epa.gov>; Lusky, Katy <Lusky.Kathleen@epa.gov>; Matichuk, Rebecca <Matichuk.Rebecca@epa.gov>; Mohr, Ashley <Mohr.Ashley@epa.gov>; Monteith, Richard <Monteith.Richard@epa.gov>; Nguyen, Phuong <Nguyen.Phuong@epa.gov>; Carlton-Carew, Njeri <carlton-carew.njeri@epa.gov>; Persoon, Carolyn <persoon.carolyn@epa.gov>; Portanova, Mary <portanova.mary@epa.gov>; Robinson, Randall <robinson.randall@epa.gov>; schmidt, howard <schmidt.howard@epa.gov>; Schwartz, Colin <Schwartz.Colin@epa.gov>; Snyder, Erik <snyder.erik@epa.gov>; Tonnesen, Gail <Tonnesen.Gail@epa.gov>; Walther, Katherine <Walther.Katherine@epa.gov>; Wiley, Adina <Wiley.Adina@epa.gov>; Worstell, Aaron <Worstell.Aaron@epa.gov>
Cc: Wayland, Richard <Wayland.Richard@epa.gov>; Wood, Anna <Wood.Anna@epa.gov>;

Rao, Raj <Rao.Raj@epa.gov>; baanderson02@fs.fed.us; Buckler, Charles <Buckler.Charles@epa.gov>; cnicholl@blm.gov; Deroeck, Dan <Deroeck.Dan@epa.gov>; Hawes, Todd <Hawes.Todd@epa.gov>; Jill_Webster@fws.gov; john_notar@nps.gov; Misenis, Chris <Misenis.Chris@epa.gov>; Montanez, Jessica <Montanez.Jessica@epa.gov>; Rick Graw <rgraw@fs.fed.us>; Shaltanis, Jennifer <Shaltanis.Jennifer@epa.gov>; Tim_Allen@fws.gov; Timin, Brian <Timin.Brian@epa.gov>; Tom Coulter <ccoulter@blm.gov>; Baker, Thomas <Baker.Thomas@epa.gov>; Brode, Roger <Brode.Roger@epa.gov>; Fox, Tyler <Fox.Tyler@epa.gov>; Owen, Chris <Owen.Chris@epa.gov>; Thurman, James <Thurman.James@epa.gov>
Subject: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

Regional Office Dispersion Modeling Contacts,

The Model Clearinghouse has formally concurred with a Region 3 request to approve an alternative modeling demonstration for the use of the ADJ_U* beta option in AERMET for the modeling demonstration of the Herbert A. Wagner Generating Station (Wagner) located near the City of Baltimore, MD. This is the third Model Clearinghouse concurrence on the use of the ADJ_U* beta option in AERMET for regulatory applications… one PSD, one SIP / Title V related, and now one CD SO2 Source / SIP. In the case of the Wagner facility, excessive 1-hour SO2 concentrations on terrain at elevations above the lowest effective stack height at distances of 20 km to 34-37 km from the source were predicted by the regulatory default version of the AERMOD Modeling System, specifically during low wind/stable conditions when u* values were relatively small. This parallels similar excessive 1-hour SO2 concentrations predicted on distant terrain during similar low wind/stable conditions for the Region 1 Schiller Station situation. In both of these circumstances, well-reasoned justifications and thorough documentation of ADJ_U* beta option modeling sensitivities are provided and demonstrate the appropriateness and applicability of the beta option. This third Model Clearinghouse concurrence on the use of the ADJ_U* beta option should solidify a template for other facilities with similar issues and permit reviewing authorities that are interested in developing an ADJ_U* alternative modeling request for EPA consideration.

A formal record, 16-III-01, has been created in the MCHISRS database with PDF scans of the Region 3 request memorandum and the Model Clearinghouse concurrence / response memorandum. The direct link to the MCHISRS record is: https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-III-01. A message about this Model Clearinghouse action has also been included on the SCRAM website under the Recent Additions section and announced through SCRAM's RSS feed.

As noted in the previous ADJ_U* beta option concurrences and not an issue with the Wagner facility modeling demonstration, we continue to evaluate the potential that the use of the ADJ_U* beta option in combination with site-specific meteorological data that includes the sigma-theta and/or sigma-w turbulence parameters may introduce a bias toward concentration underprediction and caution anyone considering the use of both the ADJ_U* beta option and meteorological data that includes the derived sigma-theta and/or sigma-w turbulence parameters in regulatory applications without consultation and approval from the appropriate permitting authority and the respective EPA Regional Office.

Please share this announcement information with your respective state, local, and tribal agencies and with any interested colleagues in a timely manner. Do not hesitate to contact me if there are any questions or needed clarification on this particular application of ADJ_U* or its use elsewhere.

My regards,

George

George M. Bridgers, CPM, Environmental Scientist
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
AQAD - Air Quality Modeling Group
109 TW Alexander Drive
Room C431B - Mail Drop C439-01
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To: Danilo Dragoni[ddragoni@ndep.nv.gov]; Adele Malone[amalone@ndep.nv.gov]; Brenda Harpring[bharprin@ndep.nv.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]; Raju Bisht[rbisht@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]; Gaurav Rajen[rajenwnr@gmail.com]; Frank Forsgren[fforsgre@ndep.nv.gov]; Mike Elges[melges@ndep.nv.gov]; ransel@clarkcountynv.gov[ransel@clarkcountynv.gov]; Zheng Li[zli@ClarkCountyNV.gov]; huys@clarkcountynv.gov[huys@clarkcountynv.gov]; Steven M. Calderon[smc@azdeq.gov]; Diane L. Arnst[arnst.diane@azdeq.gov]; Feng Mao[mf8@azdeq.gov]; Jo Crumbaker[jcrumbak@mail.maricopa.gov]; Taejoo Shin[tshin@mag.maricopa.gov]; Lindy Bauer[lbauer@mag.maricopa.gov]; Farah Mohammadesmaeili[Mohammadesmaeili.Farah@azdeq.gov]; Ryan C. Templeton[Templeton.Ryan@azdeq.gov]
From: Bohnenkamp, Carol
Sent: Thur 6/23/2016 6:13:12 PM
Subject: FW: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD
16-III-01_MCResponse_Region3_Wagner-06202016.pdf

From: Bridgers, George
Sent: Monday, June 20, 2016 3:40 PM
To: Avey, Lance <Avey.Lance@epa.gov>; Biton, Leiran <biton.leiran@epa.gov>; Blakley, Pamela <blakley.pamela@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; Colecchia, Annamaria <Colecchia.Annamaria@epa.gov>; Cox, Kyndall <Cox.Kyndall@epa.gov>; Dresser, Chris <Dresser.Chris@epa.gov>; Feldman, Michael <Feldman.Michael@epa.gov>; Fry, Jessica <fry.jessica@epa.gov>; Gillam, Rick <Gillam.Rick@epa.gov>; Hawkins, Andy <hawkins.andy@epa.gov>; Holladay, Cleveland <Holladay.Cleveland@epa.gov>; Howard, Chris <Howard.Chris@epa.gov>; Imhoff, Robert <imhoff.robert@epa.gov>; Kay, Rynda <Kay.Rynda@epa.gov>; Krivo, Stan <Krivo.Stanley@epa.gov>; Langman, Michael <langman.michael@epa.gov>; Leon-Guerrero, Tim <Leon-Guerrero.Tim@epa.gov>; Leslie, Michael <leslie.michael@epa.gov>; Liljegren, Jennifer <Liljegren.Jennifer@epa.gov>; Lusky, Katy <Lusky.Kathleen@epa.gov>; Matichuk, Rebecca <Matichuk.Rebecca@epa.gov>; Mohr, Ashley <Mohr.Ashley@epa.gov>; Monteith, Richard <Monteith.Richard@epa.gov>; Nguyen, Phuong <Nguyen.Phuong@epa.gov>; Carlton-Carew, Njeri <carlton-carew.njeri@epa.gov>; Persoon, Carolyn <persoon.carolyn@epa.gov>; Portanova, Mary <portanova.mary@epa.gov>; Robinson, Randall <robinson.randall@epa.gov>; schmidt, howard <schmidt.howard@epa.gov>; Schwartz, Colin <Schwartz.Colin@epa.gov>; Snyder, Erik <snyder.erik@epa.gov>; Tonnesen, Gail <Tonnesen.Gail@epa.gov>; Walther, Katherine <Walther.Katherine@epa.gov>; Wiley, Adina <Wiley.Adina@epa.gov>; Worstell, Aaron <Worstell.Aaron@epa.gov>
Cc: Wayland, Richard <Wayland.Richard@epa.gov>; Wood, Anna <Wood.Anna@epa.gov>; Rao, Raj <Rao.Raj@epa.gov>; baanderson02@fs.fed.us; Buckler, Charles <Buckler.Charles@epa.gov>; cnicholl@blm.gov; Deroeck, Dan <Deroeck.Dan@epa.gov>; Hawes, Todd <Hawes.Todd@epa.gov>; Jill_Webster@fws.gov; john_notar@nps.gov; Misenis, Chris <Misenis.Chris@epa.gov>; Montanez, Jessica <Montanez.Jessica@epa.gov>; Rick Graw <rgraw@fs.fed.us>; Shaltanis, Jennifer <Shaltanis.Jennifer@epa.gov>; Tim_Allen@fws.gov; Timin, Brian <Timin.Brian@epa.gov>; Tom Coulter <ccoulter@blm.gov>; Baker, Thomas

<Baker.Thomas@epa.gov>; Brode, Roger <Brode.Roger@epa.gov>; Fox, Tyler <Fox.Tyler@epa.gov>; Owen, Chris <Owen.Chris@epa.gov>; Thurman, James <Thurman.James@epa.gov>
Subject: Model Clearinghouse Concurrence with Region 3 Approval of ADJ_U* AERMET Option for Wagner Facility near Balitmore, MD

Regional Office Dispersion Modeling Contacts,

The Model Clearinghouse has formally concurred with a Region 3 request to approve an alternative modeling demonstration for the use of the ADJ_U* beta option in AERMET for the modeling demonstration of the Herbert A. Wagner Generating Station (Wagner) located near the City of Baltimore, MD. This is the third Model Clearinghouse concurrence on the use of the ADJ_U* beta option in AERMET for regulatory applications… one PSD, one SIP / Title V related, and now one CD SO2 Source / SIP. In the case of the Wagner facility, excessive 1-hour SO2 concentrations on terrain at elevations above the lowest effective stack height at distances of 20 km to 34-37 km from the source were predicted by the regulatory default version of the AERMOD Modeling System, specifically during low wind/stable conditions when u* values were relatively small. This parallels similar excessive 1-hour SO2 concentrations predicted on distant terrain during similar low wind/stable conditions for the Region 1 Schiller Station situation. In both of these circumstances, well-reasoned justifications and thorough documentation of ADJ_U* beta option modeling sensitivities are provided and demonstrate the appropriateness and applicability of the beta option. This third Model Clearinghouse concurrence on the use of the ADJ_U* beta option should solidify a template for other facilities with similar issues and permit reviewing authorities that are interested in developing an ADJ_U* alternative modeling request for EPA consideration.

A formal record, 16-III-01, has been created in the MCHISRS database with PDF scans of the Region 3 request memorandum and the Model Clearinghouse concurrence / response memorandum. The direct link to the MCHISRS record is: https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-III-01. A message about this Model Clearinghouse action has also been included on the SCRAM website under the Recent Additions section and announced through SCRAM's RSS feed.

As noted in the previous ADJ_U* beta option concurrences and not an issue with the Wagner facility modeling demonstration, we continue to evaluate the potential that the use of the ADJ_U* beta option in combination with site-specific meteorological data that includes the sigma-theta and/or sigma-w turbulence parameters may introduce a bias toward concentration underprediction and caution anyone considering the use of both the ADJ_U* beta option and

meteorological data that includes the derived sigma-theta and/or sigma-w turbulence parameters in regulatory applications without consultation and approval from the appropriate permitting authority and the respective EPA Regional Office.

Please share this announcement information with your respective state, local, and tribal agencies and with any interested colleagues in a timely manner. Do not hesitate to contact me if there are any questions or needed clarification on this particular application of ADJ_U* or its use elsewhere.

My regards,

George

George M. Bridgers, CPM, Environmental Scientist
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
AQAD - Air Quality Modeling Group
109 TW Alexander Drive
Room C431B - Mail Drop C439-01
Research Triangle Park, NC 27711
Phone: 919-541-5563
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

MEMORANDUM

JUN 20 2016

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

SUBJECT: Model Clearinghouse Review of the Use of the ADJ_U* Beta Option in the AERMET Meteorological Processor (Version 15181) for the Herbert A. Wagner Generating Station Modeling Demonstration

FROM: George Bridgers, Model Clearinghouse Director
Air Quality Modeling Group, C439-01

TO: Tim Leon-Guerrero, Meteorologist
Office of Air Monitoring & Analysis, EPA Region 3

Alice Chow, Associate Director
Office of Air Monitoring & Analysis, EPA Region 3

INTRODUCTION

In response to your May 13, 2016 concurrence request memorandum, the Model Clearinghouse has reviewed Region 3's position on the proposed use of the ADJ_U* Beta option in the AERMET meteorological processor (version 15181) for the Herbert A. Wagner Generating Station (Wagner) facility located near the City of Baltimore, Maryland. As noted in our February 10, 2016 response memorandum to Region 10 regarding the Donlin Mine Compliance Demonstration[1] and in our April 29, 2015 response memorandum to Region 1 regarding the Schiller Station Modeling Demonstration[2], the ADJ_U* Beta option was incorporated in AERMET to address concerns regarding potential underprediction of the surface friction velocity (u*) during low-wind/stable conditions that could contribute to overprediction of ambient air impacts by the AERMOD dispersion model (version 15181) for some applications. In the case of the Wagner facility, excessive 1-hour SO_2 concentrations on terrain at elevations above the lowest effective stack height at distances of 20 km to 34-37 km from the source were predicted by the regulatory default version of the AERMOD Modeling System, specifically during low-wind/stable conditions when u* values were relatively small. This parallels similar excessive 1-hour SO_2 concentrations predicted on distant terrain during similar low wind/stable conditions for the Region 1 Schiller Station situation. Given this model response and our similar concurrence of ADJ_U* for a nearly identical circumstance, we agree that it was appropriate for the ADJ_U* Beta option in AERMET to be considered for this regulatory modeling application at the Wagner facility.

[1] http://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-X-01
[2] https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-I-01

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MODEL CLEARINGHOUSE RESPONSE

Application of ADJ_U* Beta Option in AERMET

Appendix W, Section 3.2.2 provides three different conditions for which an alternative model is approvable. These three conditions are briefly summarized as:

1) The alternative and preferred model provide equivalent estimates;
2) The alternative model outperforms the preferred model when comparing the results to actual air quality data; or
3) The preferred model is less appropriate or there is no preferred model for the given scenario.

In reviewing the May 13, 2016 concurrence request memorandum from Region 3 and the attached material from the Maryland Department of the Environment (MDE), it is noted that MDE chose to follow the third condition[3] of Appendix W, Section 3.2.2 for the basis of this alternative model justification. Additionally, Region 3 summarized this approach and provided additional context for a third condition approval in concurrence request memorandum. The third condition includes five criteria that must be addressed in the development of a comprehensive alternative model justification package. These criteria are as follows:

i) The model has received a scientific peer review;
ii) The model can be demonstrated to be applicable to the problem on a theoretical basis;
iii) The data bases which are necessary to perform the analysis are available and adequate;
iv) Appropriate performance evaluation of the model have shown that the model is not biased toward underestimates; and
v) A protocol on methods and procedures to be followed has been established.

While the Model Clearinghouse concurs that a well-reasoned justification following this third condition was thoroughly documented by MDE and subsequently Region 3, we feel that our concurrence with Region 3's approval for the use of the ADJ_U* Beta option in AERMET in the Wagner facility modeling demonstration is also appropriately aligned with the second condition[4] of Section 3.2.2 mentioned above. In the MDE alternative model justification package, there is a reasonable demonstration that the ADJ_U* Beta option performs better than the default regulatory version of AERMET for the given application where high modeled concentrations are likely to occur under low wind, stable conditions. In this case, distant terrain features are located at around 20 km and between 34 and 37 km northwest of the Wagner facility with a peak elevation approximately 200m above the stack base, with relatively flat or gradually sloping terrain between the source and these terrain features.

This said, there is substantial and important information contained in the MDE discussion of each of the five criteria of the third condition that is germane to our concurrence of the Region 3

[3] Appendix W to 40 CFR, Part 51, Section 3.2.2.b(3).

[4] Appendix W to 40 CFR, Part 51, Section 3.2.2.b(2).

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request. In particular, we appreciate the specific reference of the foundational peer reviewed scientific work of Qian and Venkatram[5] and highlight of additional evaluation databases, namely the Lovett[6] and Mercer County, ND[7], that more directly represent the Wagner facility and surrounding terrain circumstances. MDE appropriately established that the Lovett evaluation demonstrates an improvement of the modeled concentrations with the use of the ADJ_U* Beta option for a facility with tall stacks located near complex terrain, particularly during low wind, stable conditions. While the Wagner facility is located at further distances from the higher terrain features than in the Lovett evaluation, we feel that the comparisons with respect to the application of the ADJ_U* Beta option are adequate for this circumstance. Combined with additional journal article references in the MDE alternative model submittal that support the scientific basis for the adjustment to u*, there is sufficient justification for the application of the ADJ_U* Beta option in the Wagner facility modeling demonstration.

The MDE alternative model submittal package included a source specific model sensitivity and monitor evaluation that is worth noting in our concurrence memorandum. As with the previously referenced Region 1 Schiller Station alternative model concurrence, a model sensitivity analysis was performed by MDE to demonstrate the appropriateness and applicability of the ADJ_U* Beta option in this modeling demonstration for the Wagner facility. The sensitivity analysis indicated that the most critical impacts at receptors on the distant terrain were only occurring at hours when the u* values were substantially low, which is indicative of low wind, stable conditions. These receptors were all at or above the lowest effective emissions release height at the Wagner facility. The application of the ADJ_U* Beta option resulted in comparable increases in the u* values and reductions to the concentrations at these receptors as demonstrated in the representative Lovett evaluation. For these nearby controlling receptors not associated with the distant terrain features, the critical impacts were occurring at times of much higher u* values, and these u* values were relatively unchanged with the application of the ADJ_U* Beta option. Therefore, we support that the model sensitivity analysis is providing further evidence of the relevance and appropriateness of the ADJ_U* Beta option for the Wagner facility modeling demonstration.

Lastly, there was indication in our aforementioned February 10, 2016 and April 29, 2016 response memorandums to Region 10 and Region 1, respectively, that EPA has concerns that the use of the ADJ_U* Beta option in combination with site-specific meteorological data that includes the sigma-theta and/or sigma-w turbulence parameters may introduce a bias toward concentration underprediction. We continue to evaluate the potential for this concentration underprediction bias and caution anyone considering the use of both the ADJ_U* Beta option and meteorological data that includes the derived sigma-theta and/or sigma-w turbulence parameters in regulatory applications without consultation and approval from the appropriate

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[5] Qian, W. and A. Venkatram. 2010. "Performance of Steady-State Dispersion Models Under Low Wind-Speed Conditions." Boundary-Layer Meteorology (2011) 138:475–491 DOI 10.1007/s10546-010-9565-1. Published online December 3, 2010. Accessed August 24, 2015.

[6] EPA's Addendum: User's Guide for the AMS/EPA Regulatory Model – AERMOD. September 2004, updated June 2015. EPA-454/B-03-001. Appendix F. Evaluation of Low Wind Beta Options.

[7] Paine. R., O. Samani. M. Kaplan, E. Knipping and N. Kumar. 2015. Evaluation of low wind modeling approaches for two tall-stack databases", Journal of the Air & Waste Management Association, 65:11, 1341-1353, DOI: 10.1080/10962247.2015.1085924.

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permitting authority and the respective EPA Regional Office. However, it is noted that the meteorological data used in the Wagner facility modeling application were not site-specific and did not include any derived sigma-theta or sigma-w turbulence information. So, the underprediction bias concern is not a factor in this case.

cc: Richard Wayland, C304-02
Anna Wood, C504-01
Tyler Fox, C439-01
Raj Rao, C504-01
EPA Air Program Managers
EPA Regional Modeling Contacts

ED_001261_00025214

To: Conchita San Nicolas Taitano[conchita.taitano@epa.guam.gov]; Drake, Kerry[Drake.Kerry@epa.gov]
Cc: Mann, Michael[Mann.Michael@epa.gov]; Luong Truong - Air Program[luong.truong@epa.guam.gov]; Chen, Eugene[Chen.Eugene@epa.gov]; Maurin, Lawrence[Maurin.Lawrence@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Vallano, Dena[Vallano.Dena@epa.gov]; vincent.pereira@epa.guam.gov[vincent.pereira@epa.guam.gov]; Sylvia Ipanag[sipanag@gpagwa.com]; Kurpius, Meredith[Kurpius.Meredith@epa.gov]; CHANG, RANDALL[Chang.Randall@epa.gov]; Biland, Larry[Biland.Larry@epa.gov]; Zabel, Allan[Zabel.Allan@epa.gov]; LIMAYE, VIJAY[Limaye.Vijay@epa.gov]
From: Bohnenkamp, Carol
Sent: Thur 9/17/2015 2:41:58 PM
Subject: RE: FW: AAQMS - Status of Workplan for Monitoring Stations - correction

I misspelled Vijay's name in my previous emails.

Carol Bohnenkamp

Gwen Yoshimura

Vijay **Limaye**

Randall Chang

And of course Michael Mann

From: Bohnenkamp, Carol
Sent: Thursday, September 17, 2015 7:37 AM
To: 'Conchita San Nicolas Taitano'; Drake, Kerry
Cc: Mann, Michael; Luong Truong - Air Program; Chen, Eugene; Maurin, Lawrence; YOSHIMURA, GWEN; Vallano, Dena; vincent.pereira@epa.guam.gov; Sylvia Ipanag; Kurpius, Meredith; CHANG, RANDALL; Biland, Larry; Zabel, Allan; LIMAYE, VIJAY
Subject: RE: FW: AAQMS - Status of Workplan for Monitoring Stations

The attendees from EPA were

Carol Bohnenkamp

Gwen Yoshimura

Vijay Lamaye

Randall Chang

And of course Michael Mann

From: Conchita San Nicolas Taitano [mailto:conchita.taitano@epa.guam.gov]
Sent: Wednesday, September 16, 2015 4:48 PM
To: Drake, Kerry
Cc: Mann, Michael; Luong Truong - Air Program; Chen, Eugene; Maurin, Lawrence; YOSHIMURA, GWEN; Vallano, Dena; vincent.pereira@epa.guam.gov; Sylvia Ipanag; Bohnenkamp, Carol; Kurpius, Meredith; CHANG, RANDALL; Biland, Larry; Zabel, Allan; LIMAYE, VIJAY
Subject: Re: FW: AAQMS - Status of Workplan for Monitoring Stations

Håfa Ådai!

Thank you Carol for leading this morning's call. The attendees from Guam are as follows:

Conchita Taitano

Vincent Pereira

Luong Truong

Michael Mann (he came in shortly after we started the call)

Kindest Regards,

CONCHITA SAN NICOLAS TAITANO, MSEM
Division Administrator, Air and Land Division - Guam EPA
Email: conchita.taitano@epa.guam.gov

Tel. No. *671.300.4751*

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On Wed, Sep 16, 2015 at 7:00 AM, Drake, Kerry <Drake.Kerry@epa.gov> wrote:

HI Conchita,

Hope all is well.

We can tentatively meet with you on this date. If this is more about SO2 (rather than permitting), the potential EPA attendees are: Carol Bohnenkamp, Meredith Kurpius, Gwen Yoshimura, Dena Vallano, Michael Mann, Randall Chang, Larry Biland, Allan Zabel, and Vijay Limaye. I've copied them here. Eugene and Lawrence would likely not need to be on this call unless there are permitting issues you would like to discuss.

Thanks,

Kerry

From: Conchita San Nicolas Taitano [mailto:conchita.taitano@epa.guam.gov]
Sent: Monday, September 14, 2015 4:54 PM
To: Mann, Michael
Cc: Luong Truong - Air Program; Chen, Eugene; Maurin, Lawrence; YOSHIMURA, GWEN; Vallano, Dena; Drake, Kerry; vincent.pereira@epa.guam.gov; Sylvia Ipanag
Subject: Re: FW: AAQMS - Status of Workplan for Monitoring Stations

Håfa Ådai Michael!

Thank you for the information below, in addition to the SO2 Final Rule, which you sent earlier. I have been working with Sylvia Ipanag on the SO2 information for Guam, which is due to USEPA in January 2016.

I would like to recommend a conference call GPA's Conference Room on Tuesday, September 22 at 9:00 am (Guam Time).

I contacted Sylvia and she will be sending the call-in number.

Kindest Regards,

CONCHITA SAN NICOLAS TAITANO, MSEM
Division Administrator, Air and Land Division - Guam EPA
Email: conchita.taitano@epa.guam.gov

Tel. No. 671.300.4751

Fax No. 671.300.4531

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On Mon, Sep 14, 2015 at 4:32 PM, Mann, Michael <Mann.Michael@epa.gov> wrote:

Hafa Adai Conchita,

I'm attaching what was the latest correspondence on this issue, from February. We may want to schedule a call this week to discuss.

Thanks,

Michael

Michael Mann

Guam Program Manager
U.S. EPA Region 9
Tel.: (415) 972-3505

Guam cell: (671) 929-1324
E-mail: mann.michael@epa.gov

From: Michael Mann [mailto:mann.michael.epa@gmail.com]
Sent: Sunday, September 13, 2015 11:20 PM

To: Mann, Michael
Subject: Fwd: AAQMS - Status of Workplan for Monitoring Stations

---------- Forwarded message ----------
From: **Conchita San Nicolas Taitano** <conchita.taitano@epa.guam.gov>
Date: Wednesday, September 2, 2015
Subject: AAQMS - Status of Workplan for Monitoring Stations
To: Michael Mann <mann.michael.epa@gmail.com>
Cc: "Maurin, Lawrence" <Maurin.Lawrence@epa.gov>, "Chen, Eugene" <Chen.Eugene@epa.gov>, Luong Truong <luong.truong@epa.guam.gov>, Jordan.deborah@epa.gov

Håfa Ådai Michael!

I am following up on the status of the subject above. As mentioned in our previous discussion, Guam's work plan was submitted for review to USEPA, Region IX about 3 years ago.

In my discussions with GPA representatives, it is my understanding that Dena Vallano was the point of contact. However, GPA has not received any input from Ms. Vallano. Could you please contact Ms. Vallano and inquire whether GPA may proceed with work plan. As you know, the data generated from this project is directly linked to the SIP and SO2 rule.

Your assistance in this matter is greatly appreciated.

Kindest Regards,

CONCHITA SAN NICOLAS TAITANO, MSEM
Division Administrator, Air and Land Division - Guam EPA
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Tel. No. *671.300.4751*

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From: LIMAYE, VIJAY
Location: R9SF-Room-18324-8-Rincon; R9SF-ConferenceLine-AIR-Card1
Importance: Normal
Subject: Navajo SO2/DRR discussion
Categories: meeting
Start Date/Time: Thur 6/16/2016 4:00:00 PM
End Date/Time: Thur 6/16/2016 5:00:00 PM

We will use this call to discuss updates on Navajo's SO2 modeling plans.

Call info:
866-299-3188
CONFERENCE CODE: **Ex. 6 - Personal Privacy**

To: Lee, Anita[Lee.Anita@epa.gov]
Cc: Tennille B. Begay[tbbegay@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]; Prashanth Subburam[psubburam@navajo-nsn.gov]; McKaughan, Colleen[McKaughan.Colleen@epa.gov]; Bohning, Scott[Bohning.Scott@epa.gov]
From: Raju Bisht
Sent: Mon 4/3/2017 8:41:57 PM
Subject: RE: 2011 Guidance Document about Designating Separate Areas of Indian country

Great. Thanks for the update.

Raju

From: Lee, Anita [mailto:Lee.Anita@epa.gov]
Sent: Monday, April 3, 2017 2:39 PM
To: Raju Bisht <rbisht@navajo-nsn.gov>
Cc: Tennille B. Begay <tbbegay@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>
Subject: RE: 2011 Guidance Document about Designating Separate Areas of Indian country

Hi Raju,

Colleen, Scott, and I just chatted. We think we can move forward with our internal process without bothering you all with another call. =) Thanks again for your responsiveness to our questions!

Anita

From: Lee, Anita
Sent: Friday, March 31, 2017 3:16 PM
To: 'Raju Bisht' <rbisht@navajo-nsn.gov>
Cc: Tennille B. Begay <tbbegay@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>; McKaughan, Colleen <mckaughan.colleen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>

Subject: RE: 2011 Guidance Document about Designating Separate Areas of Indian country

Thanks so much for the update, Raju!

I think that sounds reasonable. I am thinking it might be good to touch base again on the phone next week to get some additional feedback from you all on general boundary concepts for these various U/A and U areas. But, I'll check in with Colleen and Scott next week, and if another call sounds good to them too, then I can suggest some times for next week. Thank you again for getting back to us so quickly!

Have a great weekend!

Anita

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Friday, March 31, 2017 2:13 PM
To: Lee, Anita <Lee.Anita@epa.gov>
Cc: Tennille B. Begay <tbbegay@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>
Subject: RE: 2011 Guidance Document about Designating Separate Areas of Indian country

Hi Anita,

Just got back from the meeting with Eugenia. So yes, we would like Navajo Nation to be designated separately from the surrounding area. Based on the modeling submitted for NGS, NNEPA understands that there may be two separate different designations for the FCPP area and Page area. We understand that for all practical purposes, there is no real difference between a Unclassifiable/Attainment and Unclassifiable status. After all, the Navajo is unclassifiable for all the other pollutants anyway. When the notice comes out in August and if the President's office or the Council has concerns, NNEPA will try and clarify matters to them. If there are still concerns, we will submit comments and request to hold making designation for the NGS area until we are able to submit new modeling reports using the actual emission data. I also told her

about a small area in southeastern Navajo which might be unclassifiable because of the emissions from Escalante. We are fine as long as there are no Non-Attainment areas on the Nation!

Let me know if I missed something that I need to get back to you with. Again, thanks for all your help.

Raju

From: Lee, Anita [mailto:Lee.Anita@epa.gov]
Sent: Friday, March 31, 2017 1:11 PM
To: Raju Bisht <rbisht@navajo-nsn.gov>
Subject: RE: 2011 Guidance Document about Designating Separate Areas of Indian country

Thanks for the update Raju! Have a great weekend!

Anita

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Friday, March 31, 2017 10:52 AM
To: Lee, Anita <Lee.Anita@epa.gov>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>
Subject: RE: 2011 Guidance Document about Designating Separate Areas of Indian country

Thank you Anita. Eugenia is not in and I am not sure if she will be in this afternoon. I will update her as soon as I get a chance and let you know what she thinks about what we discussed on the call yesterday.

Thanks again for giving us a heads up about these issues. Have a great weekend!

Raju

From: Lee, Anita [mailto:Lee.Anita@epa.gov]
Sent: Friday, March 31, 2017 11:26 AM
To: Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>
Subject: 2011 Guidance Document about Designating Separate Areas of Indian country

Hi Raju, Mike, Tennille, and Prashanth,

Attached is the 2011 guidance document from EPA that I summarized during our call yesterday. Thanks again for your availability to talk, and for the good discussion! We look forward to continuing the dialogue on SO2 designations.

Thanks very much, and happy Friday,

Anita

Anita Lee, PhD

Environmental Scientist

US EPA | Region 9 | Air Planning Office | 75 Hawthorne Street (Air-2) | San Francisco, CA 94105

(415) 972-3958

To: Michael Z. King[mzking@navajo-nsn.gov]; McKaughan, Colleen[McKaughan.Colleen@epa.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]
Cc: YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohning, Scott[Bohning.Scott@epa.gov]
From: Lee, Anita
Sent: Tue 3/28/2017 2:10:06 PM
Subject: RE: Discussion about SO2 Designations

Hi Michael,

I believe Colleen is out of the office today. I'm glad Thursday works - I will send out an invite shortly with a call in number for 3PM (mountain) / 2PM pacific on Thursday.

Thank you,
Anita

Anita Lee, PhD
Environmental Scientist
US EPA | Region 9 | Air Planning Office | 75 Hawthorne Street (Air-2) | San Francisco, CA 94105
(415) 972-3958

-----Original Message-----
From: Michael Z. King [mailto:mzking@navajo-nsn.gov]
Sent: Monday, March 27, 2017 9:15 PM
To: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; eugeniaquintana@navajo-nsn.gov
Cc: Lee, Anita <Lee.Anita@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>
Subject: RE: Discussion about SO2 Designations

Hello Colleen,

Thursday at 3pm would work for us.

Thank you,

Mike

From: McKaughan, Colleen [McKaughan.Colleen@epa.gov]
Sent: Wednesday, March 22, 2017 1:46 PM
To: Eugenia Quintana; Michael Z. King
Cc: Lee, Anita; YOSHIMURA, GWEN; Bohning, Scott
Subject: Discussion about SO2 Designations

Hi, Eugenia,

We are interested in talking with you, Mike, and any others involved in the SO2 Data Requirements Rule at NNEPA, to update you all about the SO2 designations process. We're hoping to talk with you either next Monday, March 27, or Thursday March 30. Are you available at any of the following times? Let us know if other days or times work better for you all.

* Monday 3/27, 11AM (10AM Pacific)
* Monday 3/27, 1 PM (noon Pacific)
* Thursday 3/30, 2PM (1PM Pacific)

* Thursday 3/30, 3PM (2PM Pacific)

Here's a draft agenda of what we'd like to cover:

1. Update on designations schedule
2. Recap of 2011 Tribal Designations policy
3. Modeling received
4. Discussion of potential designations and boundaries

Thanks very much, and hope all is well with you!

Colleen

To: Raju Bisht[rbisht@navajo-nsn.gov]
From: Bohning, Scott
Sent: Thur 3/16/2017 7:47:14 PM
Subject: RE: SO2 Modeling NGS

Raju -

Thanks for looking into this.

Yes, I got that file, able to open it fine. That is the one I was looking for!

(NGS Near-Field Air Modeling Report_Final_July 2016.pdf)

- Scott B.

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, March 16, 2017 12:29 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Subject: SO2 Modeling NGS

Hi Scott,

Kyle tells me it should have been posted with the EIS documents but somehow got omitted. He is reaching out to BOR to see if it can be uploaded now. Did you get the Final Report that I sent out to you a little while ago? It was 13 MB.

Raju

To: Raju Bisht[rbisht@navajo-nsn.gov]
From: Bohning, Scott
Sent: Thur 3/16/2017 4:53:14 PM
Subject: RE: latest NGS EIS copy?

Raju -

Thanks for getting back to me. No, this is not a rush. I'm assuming there is little change from the non-public release version, just want to be sure we have a public version at some point if we need it for our docket. Mid-May is the earliest we might need it.

- Scott B.

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, March 16, 2017 9:25 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Michael Z. King <mzking@navajo-nsn.gov>
Subject: RE: latest NGS EIS copy?

Hi Scott,

Sorry for the late reply. Was caught up with other things. Mike is on leave. I am on travel all next week. So, you want see the copy of the "Near-Field Air Dispersion and Deposition Modeling Report for Navajo Generating Station National Environmental Policy Act Environmental Impact Statement and Endangered Species Act Compliance, Draft REPORT" that was actually released for the public? If that is what you are looking for, we will work on trying to get hold of that document. I hope there is no rush though as we might not be able to work on this till the end of the month.

Thanks. Raju

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Tuesday, March 14, 2017 3:59 PM
To: Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>
Subject: latest NGS EIS copy?

Raju & Michael -

Can you help me find latest version of near-field AERMOD modeling for the NGS EIS?

Your SO_2 modeling submittal for NGS referred to the "2015 Navajo Generating Station – Kayenta Mine Complex EIS study", and Appendix A referred to "**July 2016 Final Near-field AERMOD modeling**" report prepared for the DEIS (including Table 2-2 for stack parameters).

I do have a file "NGS Near-Field Air Modeling Draft Report Nov 7 2015.pdf" that has such a table, and has other useful information about the modeling, including some figures similar to your submittal, and seems to match the modeling files you provided. This document ii:

"Near-Field Air Dispersion and Deposition Modeling Report for Navajo Generating Station National Environmental Policy Act Environmental Impact Statement and Endangered Species Act Compliance, Draft REPORT", Ramboll Environ, November 2015

This was one of the files AECOM provided on a download web site back in the first part of 2016.

However, this document is marked "Draft for Planning and Discussion Purposes only – Not for Public Release", so if there is a later version, I would prefer we rely on that for the public record.

But I have not been able to find it searching the web. There is an EIS web site:

https://ngskmc-eis.net/documents/

which lists various files, including:

NGS Near Field Visibility Final Report -- not want we need

KMC_AQ TSD Modeling Report January 2016_Final -- report by McVehil-Monnett Associates, Inc., mainly concerns the mine and PM_{10}, not much on SO_2 modeling of NGS itself

The DEIS site

https://ngskmc-eis.net/draft-eis-files/

has

3.1_AirQuality.pdf

which has lots of stuff, looks like modeling from AECOM, but is not same as the modeling as for Navajo SO2 DRR.

Thanks for any assistance on this.

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

To: Michael Z. King[mzking@navajo-nsn.gov]; Raju Bisht[rbisht@navajo-nsn.gov]; Snyder, Erik[snyder.erik@epa.gov]; Heath, David, NMENV[david.heath@state.nm.us]; Hollenberg, Cindy, NMENV[Cindy.Hollenberg@state.nm.us]; Bates, Rita, NMENV[Rita.Bates@state.nm.us]
Cc: Singleton,Kerwin, NMENV[Kerwin.Singleton@state.nm.us]; Mustafa, Sufi A., NMENV[sufi.mustafa@state.nm.us]; Imhoff, Robert[imhoff.robert@epa.gov]; Lee, Anita[Lee.Anita@epa.gov]
From: Bohning, Scott
Sent: Fri 2/24/2017 12:19:51 AM
Subject: FCPP 2015 emissions from APS
FCPP_2015_emissions.zi

All -

APS has provided 2015 SO_2 emissions for Four Corners Power Plant, attached spreadsheets. The data is hourly stack flow (scfh), temperature (deg. F), moisture (%), and SO_2 (lb/hr). Note that it has a bunch of missing values, so considerable massaging will still be needed before it can be used for modeling. I am including a version with some reformatting, etc., but otherwise not done any thorough checking or data substitution.

(Please rename attached "FCPP_2015_emissions.zi" to have .zip extension -- our email system strips .zip files from emails)

Contents of attached FCPP_2015_emissions.zip

Four Corners 2015 eml 170219.txt

text of email from Chas Spells, APS

Four Corners 2015.xls

Original emissions data spreadsheet

Four Corners 2015 edited.xls

same data reformatted for legibility; and added sheets/columns that convert units (acfh, K g/s), and merge the stacks for modeling

(copied stuff from AECOM's July 2016 "Unit 45_2012_2013_2014.xlsx")

- Scott B.

P.S. Out Fri. 7/24

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Bohning, Scott
Sent: Thursday, February 16, 2017 7:01 AM
To: Snyder, Erik <snyder.erik@epa.gov>; 'Heath, David, NMENV' <david.heath@state.nm.us>; 'Hollenberg, Cindy, NMENV' <Cindy.Hollenberg@state.nm.us>; 'Bates, Rita, NMENV' <Rita.Bates@state.nm.us>
Cc: 'Singleton,Kerwin, NMENV' <Kerwin.Singleton@state.nm.us>; 'Mustafa, Sufi A., NMENV' <sufi.mustafa@state.nm.us>; Imhoff, Robert <imhoff.robert@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Subject: FCPP 2015 emissions in prep

Erik / Dave / Rita /Cindy -

FYI, on yesterday (2/15) I spoke with Chas Spells & others at Arizona Public Service (APS), operator of Four Corners Power Plant (FCPP), about their SO_2 emissions data. He said he will be sending me 2015 hourly emissions data in a few days, which I will pass along to you all in case you still want to use it. It will likely require some massaging for missing or anomalous data. (He said he thought he had already sent 2015 data at the end of last year, but I do not think so -- my memory of it is that they were too busy at that time to provide, and you folks did not absolutely need it, so I did not press for it.)

Also, you may recall I was concerned about their emissions data, since it did not match what I downloaded from on the EPA CAMD web site and also there had reportedly been errors in the

emissions calculations. Under 40 CFR 75 CEMS reporting requirements, various adjustments and data substitutions are applied when data is missing or the monitoring system is biased low relative to previous testing. For example, maximum flow rate may be assumed. These make the emissions higher, sometimes unrealistically so, so that the CAMD data is not necessarily suitable for modeling of what we would call “actual” emissions. Independent of that, for several years an APS contractor incorrectly assumed that flow rate was measured on a dry basis rather than wet, so the reported data was off to begin with. However, per APS none of this affects the emissions data they provided to AECOM for SO_2 modeling, and which I sent to you previously. That data does not have the Part 75 adjustments applied, but is more directly from their CEMS instruments. So, the hourly emissions that you & Navajo Nation & I used in modeling FCPP for the SO_2 DRR, and potentially for the SO_2 designation itself, is OK.

Best of luck on the SO_2 work, and stay tuned for the 2015 FCPP emissions data.

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Charles.Spell@aps.com [mailto:Charles.Spell@aps.com]
Sent: Sunday, February 19, 2017 9:47 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>; mzking@navajo-nsn.gov; rbisht@navajo-nsn.gov; Mark.Hajduk@aps.com
Cc: Eric.Massey@aps.com
Subject: FCPP SO2 emissions discussion

Hello Scott,

During our meeting you requested 2015 SO2 related emissions data from Four Corners units 4 and 5. Attached is a spreadsheet that contains the data I believe you are seeking. If you need additional data or clarification on the attached data, please let me know.

Chas

To: Raju Bisht[rbisht@navajo-nsn.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Lee, Anita[Lee.Anita@epa.gov]
Cc: Michael Z. King[mzking@navajo-nsn.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]; Prashanth Subburam[psubburam@navajo-nsn.gov]
From: Bohning, Scott
Sent: Tue 1/17/2017 3:44:20 PM
Subject: RE: SO2 DRR Submissions for NGS and FCPP

Raju -

I just wanted to confirm that we received this and can open the attachments OK.

I've only taken a quick glance, but this is looking good. Our thanks to you and Michael and Eugenia and to others involved in this. Also, we appreciate your patience and responsiveness on the last minute arrangements.

We look forward to working with you on this.

Thanks again!

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, January 12, 2017 4:10 PM
To: YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>
Cc: Bohning, Scott <Bohning.Scott@epa.gov>; Michael Z. King <mzking@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>
Subject: SO2 DRR Submissions for NGS and FCPP

Good Evening,

Please find attached copies of the letters and the Modeling Protocol and Analysis Results done by NNEPA for Navajo Generating Station and Four Corner Power Plants as required by the SO2 Data Reporting Rule. The originals as well as the digital copies of the modeling files have been mailed out to Ms. Elizabeth Adams.

Thank you. Raju

To: Michael Z. King[mzking@navajo-nsn.gov]
Cc: Raju Bisht[rbisht@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]; Prashanth Subburam[psubburam@navajo-nsn.gov]; Christopher A. Yazzie[cayazzie@navajo-nsn.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]
From: Bohning, Scott
Sent: Tue 1/10/2017 5:43:13 PM
Subject: RE: FCPP SO2 modeling option

Michael -

FYI, I replotted area nearer to FCPP and included locations of some of the highs. Now my version shows that although there is a lobe of high concentrations off to the west, the very highest values are to the southeast, so mine does look consistent with yours.

- Scott B.

From: Bohning, Scott
Sent: Monday, January 09, 2017 7:17 AM
To: 'Michael Z. King' <mzking@navajo-nsn.gov>
Cc: Raju Bisht <rbisht@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>; Christopher A. Yazzie <cayazzie@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov
Subject: RE: FCPP SO2 modeling option

Michael -

Thanks for this, looks good. I also got 163.3 as highest DV.

I did a rough plot back in October that makes it looks as if the highest concentration area is just west of FCPP, even though my output file said that the 163.3 max location was a bit southeast. I may have plotted the wrong thing... I will check on that this evening (my plotting software is at home), and let you know if I find out anything.

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Michael Z. King [mailto:mzking@navajo-nsn.gov]
Sent: Saturday, January 07, 2017 12:41 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Raju Bisht <rbisht@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>; Christopher A. Yazzie <cayazzie@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov
Subject: RE: FCPP SO2 modeling option

Good Afternoon,

I was able to run the model using the input files I have and those that your provided below (see attached). I got similar results from my previous model that I ran and have included into our modeling result analysis summary to EPA. That summary will be forthcoming soon. I appreciate all your assistance.

Thanks,

Michael King

Sr. Environmental Specialist

Navajo EPA Air Quality Control Program

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Tuesday, December 20, 2016 9:41 AM
To: Michael Z. King <mzking@navajo-nsn.gov>
Cc: Raju Bisht <rbisht@navajo-nsn.gov>
Subject: FCPP SO2 modeling option

Michael -

I know this is rather last minute -- But t occurs to me that you may want to do the Four Corners modeling yourself. Back in September you shared some graphics of modeling results using Lakes AERMOD view, so maybe you would want to take this on.

Do let me know as soon as possible if you want to do this, in which case I won't complete the modeling I started, and won't don the write-up . I know the time is growing short!

If you do a short write-up summarizing what you did and the modeling result (and referring to the AECOM work), then that would be a true SO2 DRR submittal from NNEPA rather than just sending us back something. (Plus you guys are supposed to be the ones doing this anyway...)

There would also need to be a separate write-up for NGS, summarizing the EIS SO_2 results.

In case you want to do this, I have attached the San Juan Generating Station (SJGS) emissions files that I received from NMED (Dave Heath, email address "Heath, David, NMENV" david.heath@state.nm.us), plus email he sent and a spreadsheet I made from stack parameters he provided.

Also attached is an AERMOD input I made back in October from those emissions and the files from AECOM. (I ran it but have not done much checking of it; I added auxiliary boiler and SJGS to the input AECOM provided.)

Attachments (rename to have ".zip" file name extension.)

SJGS_emissions_from_NMED.zi

SJGS_AERMOD_em_NMED_eml_161024.txt

2012_SJGS_and_4CPP_SO2_emissions.txt

2013_SJGS_and_4CPP_SO2_emissions.txt

2014_SJGS_and_4CPP_SO2_emissions.txt

2015_SJGS SO2_emissions.prn

SJGS_stack_parms.xlsx

FCPP_modeling_EPA_Oct2016.zi

FCPP_with_SJGSact.inp

fcpp_sjgs_2012-2014.soh

- Scott B.

P.S. Out 12/26 - 12/30

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

To: Bohning, Scott[Bohning.Scott@epa.gov]
Cc: Raju Bisht[rbisht@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]; Prashanth Subburam[psubburam@navajo-nsn.gov]; Christopher A. Yazzie[cayazzie@navajo-nsn.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]
From: Michael Z. King
Sent: Sat 1/7/2017 8:41:27 PM
Subject: RE: FCPP SO2 modeling option
FCPP_SJGS_AERMOD Results_1-7-17.png

Good Afternoon,

I was able to run the model using the input files I have and those that your provided below (see attached). I got similar results from my previous model that I ran and have included into our modeling result analysis summary to EPA. That summary will be forthcoming soon. I appreciate all your assistance.

Thanks,

Michael King

Sr. Environmental Specialist

Navajo EPA Air Quality Control Program

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Tuesday, December 20, 2016 9:41 AM
To: Michael Z. King <mzking@navajo-nsn.gov>
Cc: Raju Bisht <rbisht@navajo-nsn.gov>
Subject: FCPP SO2 modeling option

Michael -

I know this is rather last minute -- But t occurs to me that you may want to do the Four Corners modeling yourself. Back in September you shared some graphics of modeling results using Lakes AERMOD view, so maybe you would want to take this on.

Do let me know as soon as possible if you want to do this, in which case I won't complete the modeling I started, and won't don the write-up . I know the time is growing short!

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Attachments (rename to have ".zip" file name extension.)

SJGS_emissions_from_NMED.zi

SJGS_AERMOD_em_NMED_eml_161024.txt

2012_SJGS_and_4CPP_SO2_emissions.txt

2013_SJGS_and_4CPP_SO2_emissions.txt

2014_SJGS_and_4CPP_SO2_emissions.txt

2015_SJGS SO2_emissions.prn

SJGS_stack_parms.xlsx

FCPP_modeling_EPA_Oct2016.zi

FCPP_with_SJGSact.inp

fcpp_sjgs_2012-2014.soh

- Scott B.

P.S. Out 12/26 - 12/30

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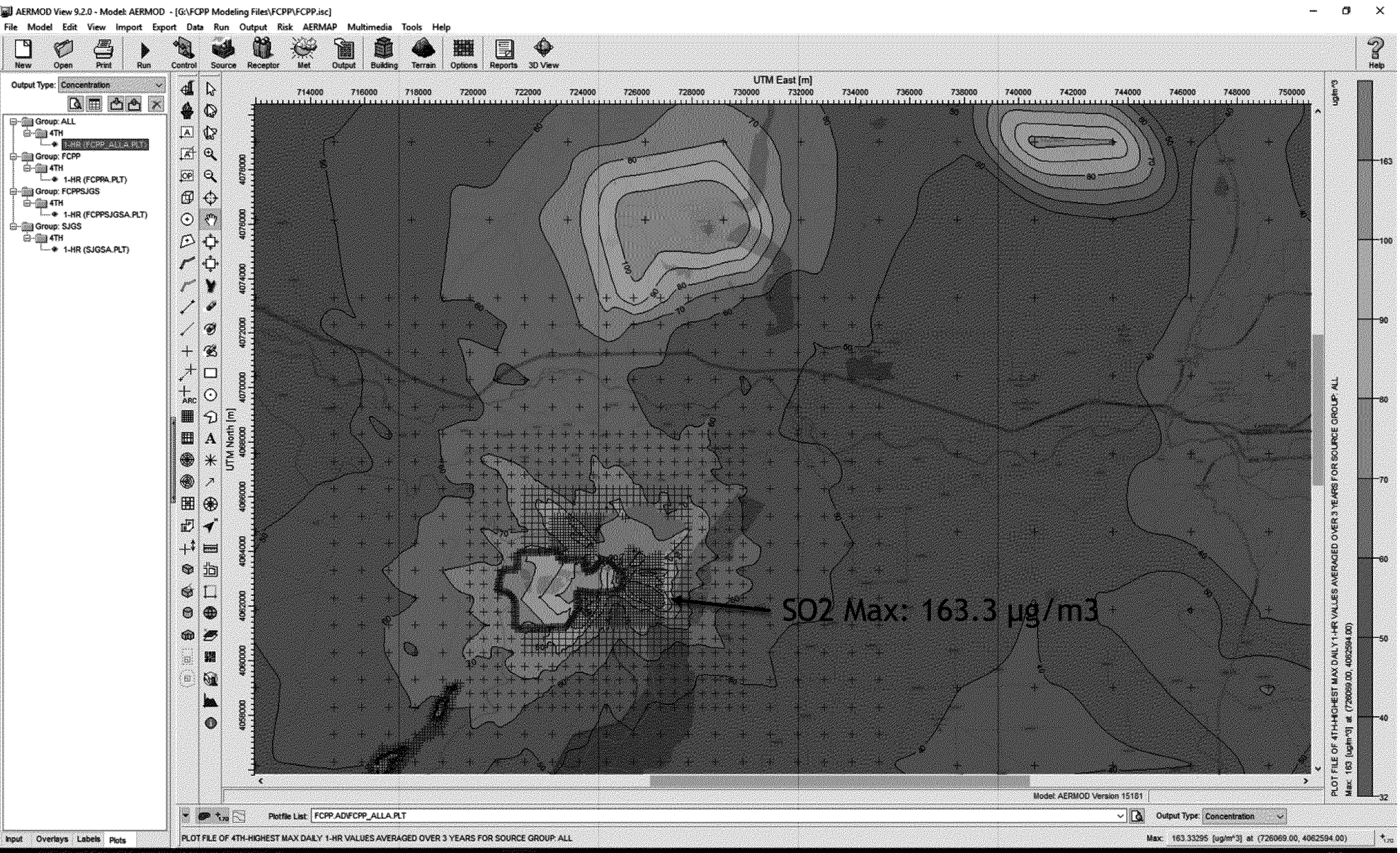
"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579



ED_001261_00026201

To: Hollenberg, Cindy, NMENV[Cindy.Hollenberg@state.nm.us]
Cc: Singleton,Kerwin, NMENV[Kerwin.Singleton@state.nm.us]; Mustafa, Sufi A., NMENV[sufi.mustafa@state.nm.us]; Heath, David, NMENV[david.heath@state.nm.us]; Bates, Rita, NMENV[Rita.Bates@state.nm.us]
From: Bohning, Scott
Sent: Fri 1/6/2017 5:31:45 PM
Subject: RE: 4 Corners Power Plant

Cindy & others...

Navajo Nation confirmed that the PNM substation is the nearest site.

Second nearest site is run by Navajo Nation, AQS ID 35-045-1233, Shiprock station

I have not plotted that out on a map yet... and have to run to a meeting right now.

- Scott B.

From: Hollenberg, Cindy, NMENV [mailto:Cindy.Hollenberg@state.nm.us]
Sent: Friday, January 06, 2017 8:18 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Singleton,Kerwin, NMENV <Kerwin.Singleton@state.nm.us>; Mustafa, Sufi A., NMENV <sufi.mustafa@state.nm.us>; Heath, David, NMENV <david.heath@state.nm.us>; Bates, Rita, NMENV <Rita.Bates@state.nm.us>
Subject: RE: 4 Corners Power Plant

Thank you. We really do appreciate your effort on our behalf.

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Friday, January 06, 2017 9:02 AM
To: Hollenberg, Cindy, NMENV <Cindy.Hollenberg@state.nm.us>
Cc: Singleton,Kerwin, NMENV <Kerwin.Singleton@state.nm.us>; Mustafa, Sufi A., NMENV <sufi.mustafa@state.nm.us>; Heath, David, NMENV <david.heath@state.nm.us>; Bates, Rita, NMENV <Rita.Bates@state.nm.us>

Subject: RE: 4 Corners Power Plant

Cindy -

To my knowledge, there is not a nearer air quality monitor (there is on-site meteorology only), but I will double check on that.

- Scott B.

From: Hollenberg, Cindy, NMENV [mailto:Cindy.Hollenberg@state.nm.us]
Sent: Thursday, January 05, 2017 3:07 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Singleton,Kerwin, NMENV <Kerwin.Singleton@state.nm.us>; Mustafa, Sufi A., NMENV <sufi.mustafa@state.nm.us>; Heath, David, NMENV <david.heath@state.nm.us>; Bates, Rita, NMENV <Rita.Bates@state.nm.us>
Subject: RE: 4 Corners Power Plant

We really appreciate your quick response, Scott. Dave advises us that the data on the spreadsheet is actually the Substation data near PNM. Does this mean that the 4 Corners Power Plant does not have another monitor nearer the plant?

Thanks in advance for this clarification.

Cindy

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Thursday, January 05, 2017 2:48 PM
To: Bates, Rita, NMENV <Rita.Bates@state.nm.us>; Hollenberg, Cindy, NMENV <Cindy.Hollenberg@state.nm.us>
Cc: Singleton,Kerwin, NMENV <Kerwin.Singleton@state.nm.us>; Mustafa, Sufi A., NMENV <sufi.mustafa@state.nm.us>; Heath, David, NMENV <david.heath@state.nm.us>
Subject: RE: 4 Corners Power Plant

Rita -

Attached is spreadsheet of monitor data that AECOM included in their modeling archive for SO_2 DRR modeling of FCPP.

It looks to be pulled from AQS, for site 35-045-1005 ("USBR SHIPROCK SUBSTATION (FARMINGTON)")

I also attached an excerpt about background concentration from their EIS (including significant concentration gradient analysis, which we are not relying on).

Attachments

Shiprock Substation Season Hour-of-Day.xlsx

NAAQS_Report_FCPP_EIS_8-2014_background_excerpt.pdf

- Scott B.

P.S. Happy New Year

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

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From: Bates, Rita, NMENV [mailto:Rita.Bates@state.nm.us]
Sent: Thursday, January 05, 2017 1:09 PM
To: Hollenberg, Cindy, NMENV <Cindy.Hollenberg@state.nm.us>; Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Singleton,Kerwin, NMENV <Kerwin.Singleton@state.nm.us>; Mustafa, Sufi A., NMENV <sufi.mustafa@state.nm.us>; Heath, David, NMENV <david.heath@state.nm.us>
Subject: RE: 4 Corners Power Plant

Hi Scott,

We are looking for SO2 monitoring data for 2014 and 2015, if it is available near 4CPP.

Rita

Rita Bates

Planning Section Chief

Air Quality Bureau – New Mexico Environment Department

525 Camino de los Marquez, Suite 1

Santa Fe, New Mexico 87505

Phone: 505-476-4304

Fax: 505-476-4375

From: Hollenberg, Cindy, NMENV
Sent: Thursday, January 05, 2017 2:03 PM
To: 'Bohning, Scott' <Bohning.Scott@epa.gov>
Cc: Bates, Rita, NMENV <Rita.Bates@state.nm.us>; Singleton,Kerwin, NMENV <Kerwin.Singleton@state.nm.us>; Mustafa, Sufi A., NMENV <sufi.mustafa@state.nm.us>; Heath, David, NMENV <david.heath@state.nm.us>
Subject: 4 Corners Power Plant

Hi Scott,

We have just run into a snag in our modeling. Does 4 Corners have a monitor for which you have 2014 and 2015 data? If so, could we have that data ASAP?

Thank you so much,

Cindy

To: Bohning, Scott[Bohning.Scott@epa.gov]; Raju Bisht[rbisht@navajo-nsn.gov]; Charles.Spell@aps.com[Charles.Spell@aps.com]
From: Michael Z. King
Sent: Fri 1/6/2017 5:01:46 PM
Subject: RE: Any monitoring data near FCPP?

Hello Scott,

Happy New Year! The Substation monitoring site is the closest to the FCPP and our air monitoring station (AQS ID: 35-045-1233) would be the second closest to the FCPP. We monitor SO2, NO2, and O3 at our Shiprock air monitoring station.

Thanks,

Michael King

Sr. Environmental Specialist

Navajo EPA Air Quality Control Program

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Friday, January 6, 2017 9:47 AM
To: Michael Z. King <mzking@navajo-nsn.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Charles.Spell@aps.com
Subject: Any monitoring data near FCPP?

Michael / Raju / Chas -

Is there any SO_2 monitoring data near FCPP besides the monitor listed below? This a somewhat urgent request from NMED, trying to get their modeling done by next week's deadline

As far as I know, the SO_2 monitor nearest to FCPP is that near Public Service of New Mexico

San Jan Generating Station substation, AQS ID 35-045-1005 ("USBR SHIPROCK SUBSTATION (FARMINGTON)"), at lat, long: 36.796667, -108.473138, operated by NMED

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

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To: Raju Bisht[rbisht@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]
Cc: Lee, Anita[Lee.Anita@epa.gov]
From: Bohning, Scott
Sent: Thur 12/22/2016 6:35:35 PM
Subject: RE: Final Revision to EPA's Guideline on Air Quality Models

Raju -

Thanks for the reply, and glad to hear Mike is willing to work on this. And yes, as long as we get some kind of letters by the deadline, other work can be done later, so we do not have to rush.

After the new year starts, I think it would be good to have a call with APS (Chas Spell) to see what is the status of their emissions fixes, and to check if that would affect any modeling we need to do (see my 12/12 email to him that I cc'd you on).

- Scott B.

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, December 22, 2016 9:56 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>; Michael Z. King <mzking@navajo-nsn.gov>
Subject: RE: Final Revision to EPA's Guideline on Air Quality Models

Scott,

Mike is on vacation and will be back next week. We have discussed this and Mike is willing to take on the challenge and will start working on this next week. We will submit whatever we are able to complete by the deadline. My understanding from our conversation is that even after the deadline, we will be allowed supplement our work or revise the work as per your requirements to our submission. We will also try and update you regarding our progress the first week of January.

Again, thanks for all your help regarding this matter. Raju

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Thursday, December 22, 2016 10:45 AM
To: Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>
Subject: RE: Final Revision to EPA's Guideline on Air Quality Models

Raju -

By the way, any thoughts on the idea (my 12/20 email) of you folks taking on more of the SO_2 modeling / write-up?

I know there is not much time to do that before the Jan. 13 DRR deadline, so that could affect how much you want to take on. However, I was just speaking with my (interim) supervisor about this. We were thinking that for purposes of the Jan. 13 DRR deadline, you could still just send in two letters, referring to the NGS modeling for the EIS, and the more recent APS/AECOM modeling of FCPP, which have already been provided to us. Any additional write-ups and remodeling (including SJGS with FCPP, and any APS fixes to FCPP emissions) could be provided later as supplemental material or as a replacement. So that would give you more time.

- Scott B.

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, December 22, 2016 8:17 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>; Michael Z. King <mzking@navajo-nsn.gov>
Subject: RE: Final Revision to EPA's Guideline on Air Quality Models

Thanks Scott. Happy Holidays!

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Wednesday, December 21, 2016 4:24 PM
To: Michael Z. King <mzking@navajo-nsn.gov>
Cc: Raju Bisht <rbisht@navajo-nsn.gov>
Subject: FW: Final Revision to EPA's Guideline on Air Quality Models
Importance: High

Michael & Raju, FYI.

Significance of this for the SO_2 DRR modeling is that the modeling done for the NGS relied on the "ADJ_U*" option in AERMET, which is now OK under the guidelines. Formerly, we were supposed to go through a headquarters "Model Clearinghouse" process to be allowed to use that. So this makes the issue go away for NGS. (Does not affect FCPP, which did not use this option in the modeling.)

Happy Holidays!

- Scott B.

P.S. Out 12/26 - 12/30

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"Scott Bohning" <bohning.scott@epa.gov>

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From: Bridgers, George
Sent: Wednesday, December 21, 2016 3:08 PM

To: Timin, Brian <Timin.Brian@epa.gov>; Hawkins, Andy <hawkins.andy@epa.gov>; Arnold, Anne <Arnold.Anne@epa.gov>; Kelly, Bob <Kelly.Bob@epa.gov>; Stackhouse, Butch <Stackhouse.Butch@epa.gov>; Bohnenkamp, Carol <Bohnenkamp.Carol@epa.gov>; Doty, Edward <Doty.Edward@epa.gov>; Snyder, Erik <snyder.erik@epa.gov>; Tonnesen, Gail <Tonnesen.Gail@epa.gov>; Simon, Heather <Simon.Heather@epa.gov>; Feingersh, Henry <Feingersh.Henry@epa.gov>; Kelly, James <kelly.james@epa.gov>; Summerhays, John <Summerhays.John@epa.gov>; Pepple, Karl <Pepple.Karl@epa.gov>; Baker, Kirk <Baker.Kirk@epa.gov>; South, Mia <South.Mia@epa.gov>; Feldman, Michael <Feldman.Michael@epa.gov>; Possiel, Norm <Possiel.Norm@epa.gov>; Dolwick, Pat <Dolwick.Pat@epa.gov>; Robinson, Randall <robinson.randall@epa.gov>; Matichuk, Rebecca <Matichuk.Rebecca@epa.gov>; Damberg, Rich <Damberg.Rich@epa.gov>; Burkhart, Richard <burkhart.richard@epa.gov>; Monteith, Richard <Monteith.Richard@epa.gov>; Gillam, Rick <Gillam.Rick@epa.gov>; Elleman, Robert <Elleman.Robert@epa.gov>; Kotchenruther, Robert <Kotchenruther.Robert@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; Leon-Guerrero, Tim <Leon-Guerrero.Tim@epa.gov>; ellsworth, todd <ellsworth.todd@epa.gov>; Hawes, Todd <Hawes.Todd@epa.gov>; Misenis, Chris <Misenis.Chris@epa.gov>; Persoon, Carolyn <persoon.carolyn@epa.gov>; Fox, Tyler <Fox.Tyler@epa.gov>; Jones, Rhea <Jones.Rhea@epa.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>; Simcox, Alison <simcox.alison@epa.gov>; Biton, Leiran <biton.leiran@epa.gov>; Liljegren, Jennifer <Liljegren.Jennifer@epa.gov>; Kay, Rynda <Kay.Rynda@epa.gov>; Avey, Lance <Avey.Lance@epa.gov>; Lessard, Patrick <Lessard.Patrick@epa.gov>; Herrington, Leigh <Herrington.Leigh@epa.gov>; Imhoff, Robert <imhoff.robert@epa.gov>; Carlton-Carew, Njeri <carlton-carew.njeri@epa.gov>; Kayin, Serpil <Kayin.Serpil@epa.gov>
Subject: Final Revision to EPA's Guideline on Air Quality Models
Importance: High

Regional Office Modeling Contacts (Photochemical Modelers' List),

On December 20, 2016, the Administrator signed a final rule that revises the Guideline on Air Quality Models. The Guideline provides EPA-recommended models and other techniques, as well as guidance for their use, for predicting ambient concentrations of air pollutants. EPA's finalized changes enhance the formulation and application of the agency's AERMOD dispersion model, prescribe modeling techniques for secondarily formed fine particle and ozone pollution for single sources and makes various editorial improvements.

A Fact Sheet for the final rule and the pre-Federal Register version of the Final Rule are attached to this email for easy reference. Additionally, there is an informational 2016 Appendix W Final Rule webpage available on the EPA's SCRAM website at the following link: https://www3.epa.gov/ttn/scram/appendix_w-2016.htm. This webpage provides access to updated model code, documentation, and technical guidance related to this final action.

The EPA will be scheduling webinars and other outreach to the stakeholder community in January 2017. Information on these webinars and other engagements will be posted to the EPA's SCRAM website once scheduled. In the interim, direct all questions to Mr. George M. Bridgers, email: Bridgers.George@epa.gov.

Please share this announcement and information with your respective tribal, state, and local air agencies and any other colleagues and interested parties as soon as possible.

Happy Holidays!

George Bridgers

George M. Bridgers, CPM, Environmental Scientist
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
AQAD - Air Quality Modeling Group
109 TW Alexander Drive
Room C431B - Mail Drop C439-01
Research Triangle Park, NC 27711
Phone: 919-541-5563
Fax: 919-541-0044

To: Michael Z. King[mzking@navajo-nsn.gov]
Cc: Raju Bisht[rbisht@navajo-nsn.gov]
From: Bohning, Scott
Sent: Tue 12/20/2016 4:40:38 PM
Subject: FCPP SO2 modeling option
SJGS_emissions_from_NMED.zi
FCPP_modeling_EPA_Oct2016.zi

Michael -

I know this is rather last minute -- But t occurs to me that you may want to do the Four Corners modeling yourself. Back in September you shared some graphics of modeling results using Lakes AERMOD view, so maybe you would want to take this on.

Do let me know as soon as possible if you want to do this, in which case I won't complete the modeling I started, and won't don the write-up . I know the time is growing short!

If you do a short write-up summarizing what you did and the modeling result (and referring to the AECOM work), then that would be a true SO2 DRR submittal from NNEPA rather than just sending us back something. (Plus you guys are supposed to be the ones doing this anyway...)

There would also need to be a separate write-up for NGS, summarizing the EIS SO_2 results.

In case you want to do this, I have attached the San Juan Generating Station (SJGS) emissions files that I received from NMED (Dave Heath, email address "Heath, David, NMENV" david.heath@state.nm.us), plus email he sent and a spreadsheet I made from stack parameters he provided.

Also attached is an AERMOD input I made back in October from those emissions and the files from AECOM. (I ran it but have not done much checking of it; I added auxiliary boiler and SJGS to the input AECOM provided.)

Attachments (rename to have ".zip" file name extension.)

SJGS_emissions_from_NMED.zi

SJGS_AERMOD_em_NMED_eml_161024.txt

2012_SJGS_and_4CPP_SO2_emissions.txt

2013_SJGS_and_4CPP_SO2_emissions.txt

2014_SJGS_and_4CPP_SO2_emissions.txt

2015_SJGS SO2_emissions.prn

SJGS_stack_parms.xlsx

FCPP_modeling_EPA_Oct2016.zi

FCPP_with_SJGSact.inp

fcpp_sjgs_2012-2014.soh

- Scott B.

P.S. Out 12/26 - 12/30

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"Scott Bohning" <bohning.scott@epa.gov>

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SO HOUREMIS 2012 1 1 1 SJGS1 0.548342838 327.59 20.239
SO HOUREMIS 2012 1 1 1 SJGS2 25.29836012 327.59 21.488
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SO HOUREMIS 2012 1 1 1 SJGS4 36.95530681 327.59 17.678
SO HOUREMIS 2012 1 1 1 STACK4&5 303.3653846 324.4361826 19.05048028
SO HOUREMIS 2012 1 1 2 SJGS1 0.427510846 327.59 20.239
SO HOUREMIS 2012 1 1 2 SJGS2 24.50243146 327.59 21.488
SO HOUREMIS 2012 1 1 2 SJGS3 32.10678152 327.59 17.678
SO HOUREMIS 2012 1 1 2 SJGS4 32.60081977 327.59 17.678
SO HOUREMIS 2012 1 1 2 STACK4&5 291.4207742 324.3248693 18.12481329
SO HOUREMIS 2012 1 1 3 SJGS1 3.674098586 327.59 20.239
SO HOUREMIS 2012 1 1 3 SJGS2 24.57122631 327.59 21.488
SO HOUREMIS 2012 1 1 3 SJGS3 37.5904634 327.59 17.678
SO HOUREMIS 2012 1 1 3 SJGS4 41.89606203 327.59 17.678
SO HOUREMIS 2012 1 1 3 STACK4&5 298.7790574 324.277477 17.83028715
SO HOUREMIS 2012 1 1 4 SJGS1 11.66034873 327.59 20.239
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SO HOUREMIS 2012 1 1 4 SJGS3 24.92994281 327.59 17.678
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SO HOUREMIS 2012 1 1 4 STACK4&5 299.9634386 324.2281637 17.21705601
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SO HOUREMIS 2012 1 1 5 STACK4&5 290.7655846 324.1283782 16.63616361
SO HOUREMIS 2012 1 1 6 SJGS1 14.82969914 327.59 20.239
SO HOUREMIS 2012 1 1 6 SJGS2 22.50133299 327.59 21.488
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SO HOUREMIS 2012 1 1 6 SJGS4 31.49745626 327.59 17.678
SO HOUREMIS 2012 1 1 6 STACK4&5 299.3334486 324.1062056 16.59764307
SO HOUREMIS 2012 1 1 7 SJGS1 19.47549297 327.59 20.239
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SO HOUREMIS 2012 1 1 8 STACK4&5 325.7930286 324.240018 17.42576012
SO HOUREMIS 2012 1 1 9 SJGS1 12.9147838 327.59 20.239
SO HOUREMIS 2012 1 1 9 SJGS2 25.42864194 327.59 21.488
SO HOUREMIS 2012 1 1 9 SJGS3 24.9364947 327.59 17.678
SO HOUREMIS 2012 1 1 9 SJGS4 32.39859316 327.59 17.678
SO HOUREMIS 2012 1 1 9 STACK4&5 327.1286074 324.2706201 18.03172736
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SO HOUREMIS 2012 1 1 10 SJGS3 31.85680171 327.59 17.678
SO HOUREMIS 2012 1 1 10 SJGS4 36.54946761 327.59 17.678
SO HOUREMIS 2012 1 1 10 STACK4&5 313.2184282 324.3700842 18.63416259
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SO HOUREMIS 2012 1 1 11 STACK4&5 290.8285836 324.3659744 18.74967809
SO HOUREMIS 2012 1 1 12 SJGS1 10.90625163 327.59 20.239

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SO HOUREMIS 2012 1 1 12 SJGS3 36.6729457 327.59 17.678
SO HOUREMIS 2012 1 1 12 SJGS4 35.10351584 327.59 17.678
SO HOUREMIS 2012 1 1 12 STACK4&5 271.1980952 324.4444158 18.94508031
SO HOUREMIS 2012 1 1 13 SJGS1 10.70553648 327.59 20.239
SO HOUREMIS 2012 1 1 13 SJGS2 22.81897367 327.59 21.488
SO HOUREMIS 2012 1 1 13 SJGS3 35.52233475 327.59 17.678
SO HOUREMIS 2012 1 1 13 SJGS4 33.87730438 327.59 17.678
SO HOUREMIS 2012 1 1 13 STACK4&5 249.8792336 324.4143671 19.0205951
SO HOUREMIS 2012 1 1 14 SJGS1 10.90625163 327.59 20.239
SO HOUREMIS 2012 1 1 14 SJGS2 22.59570541 327.59 21.488
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SO HOUREMIS 2012 1 1 14 SJGS4 33.1303889 327.59 17.678
SO HOUREMIS 2012 1 1 14 STACK4&5 228.5981714 324.2767053 17.90257746
SO HOUREMIS 2012 1 1 15 SJGS1 10.90083373 327.59 20.239
SO HOUREMIS 2012 1 1 15 SJGS2 22.65769637 327.59 21.488
SO HOUREMIS 2012 1 1 15 SJGS3 28.46897101 327.59 17.678
SO HOUREMIS 2012 1 1 15 SJGS4 33.82652723 327.59 17.678
SO HOUREMIS 2012 1 1 15 STACK4&5 249.3878414 324.2209106 17.6415186
SO HOUREMIS 2012 1 1 16 SJGS1 12.28731415 327.59 20.239
SO HOUREMIS 2012 1 1 16 SJGS2 14.57392381 327.59 21.488
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SO HOUREMIS 2012 1 1 16 STACK4&5 258.5100966 324.302627 17.63534557
SO HOUREMIS 2012 1 1 17 SJGS1 16.72810952 327.59 20.239
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SO HOUREMIS 2012 1 1 17 SJGS4 30.41941832 327.59 17.678
SO HOUREMIS 2012 1 1 17 STACK4&5 256.2673322 324.2470993 17.70982647
SO HOUREMIS 2012 1 1 18 SJGS1 25.86434181 327.59 20.239
SO HOUREMIS 2012 1 1 18 SJGS2 26.51827168 327.59 21.488
SO HOUREMIS 2012 1 1 18 SJGS3 45.5910751 327.59 17.678
SO HOUREMIS 2012 1 1 18 SJGS4 56.87393507 327.59 17.678
SO HOUREMIS 2012 1 1 18 STACK4&5 268.8419326 324.344356 18.95538783
SO HOUREMIS 2012 1 1 19 SJGS1 37.6957962 327.59 20.239
SO HOUREMIS 2012 1 1 19 SJGS2 23.7183466 327.59 21.488
SO HOUREMIS 2012 1 1 19 SJGS3 53.56926457 327.59 17.678
SO HOUREMIS 2012 1 1 19 SJGS4 75.97622301 327.59 17.678
SO HOUREMIS 2012 1 1 19 STACK4&5 257.854907 324.3846452 19.04336762
SO HOUREMIS 2012 1 1 20 SJGS1 37.64590103 327.59 20.239
SO HOUREMIS 2012 1 1 20 SJGS2 23.21637101 327.59 21.488
SO HOUREMIS 2012 1 1 20 SJGS3 53.54658495 327.59 17.678
SO HOUREMIS 2012 1 1 20 SJGS4 70.84546298 327.59 17.678
SO HOUREMIS 2012 1 1 20 STACK4&5 257.4895128 324.3027095 19.11688732
SO HOUREMIS 2012 1 1 21 SJGS1 38.00096386 327.59 20.239
SO HOUREMIS 2012 1 1 21 SJGS2 23.8079311 327.59 21.488
SO HOUREMIS 2012 1 1 21 SJGS3 49.93447467 327.59 17.678
SO HOUREMIS 2012 1 1 21 SJGS4 72.00250159 327.59 17.678
SO HOUREMIS 2012 1 1 21 STACK4&5 255.7003412 324.3323452 19.14123338
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Memorandum

To	Scott Bohning (EPA)	Page	1
CC	Charles Spell (APS)		
Subject	Four Corners Power Plant SO_2 Data Requirements Rule Modeling Summary		
From	Bob Paine and Olga Samani (AECOM)		
Date	September 23, 2016		

Executive Summary

Per your request, AECOM has prepared a summary of the Four Corners Power Plant (FCPP) SO_2 Data Requirements Rule (DRR) modeling procedures and results. AECOM previously provided the supporting modeling files to you via AECOM's file sharing system on August 8, 2016.

In August 2014, AECOM also submitted "Four Corners Power Plant and Navajo Mine Energy Project Environmental Impact Statement NAAQS Modeling Study" to EPA. The current SO_2 DRR modeling presented here followed the procedures described in the 2014 EIS NAAQS study with a few updates summarized in Table 1 below.

Table 1: Differences Between 2014 EIS NAAQS and 2016 SO2 DRR Modeling

EIS NAAQS Modeling (September 2014)	SO_2 DRR Modeling (August 2016)
2009-2011 actual SO2 emissions, actual temperature and velocity	2012-2014 actual SO2 emissions, actual temperature and velocity
2009-2011 Met Tower I surface observations	2012-2014 Met Tower I surface observations
AERMOD/AERMET version 13350 with Beta ADJ_U* option	AERMOD/AERMET version 15181 with default option
Receptors placed over Morgan Lake and excluded from the Navajo Mine area	Receptors excluded from Morgan Lake and placed over the Navajo Mine area

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The 1-hour SO_2 modeling of FCPP Units 4 and 5 with 2012-2014 actual hourly emissions and with the regulatory default options shows compliance with the 1-hour SO_2 NAAQS. We provide this information to EPA in support of a NAAQS attainment designation.

Emissions Data

With the actual closure of Units 1, 2, and 3 at the end of 2013, modeling of the operating Units 4 and 5 was conducted using 2012-2014 hourly SO_2 emissions, hourly exit temperatures, and hourly exit velocities. Table 2 summarizes exhaust parameters for the FCPP Units 4 and 5 stack. The exit velocity and temperature are not listed in the table because they vary on the hourly basis, just like the emissions. FCPP Units 4 and 5 have separate flues that exhaust into a common stack. Therefore, the emissions from these two units were combined and modeled as a single stack with an effective diameter equivalent to the combined area circle. Then for each modeled hour, the exhaust flows were combined to calculate a flow-weighted exit velocity and temperature.

Table 1: Units 4 and 5 Exhaust Parameters

UTM X, Zone 12, NAD83	725350
UTM Y, Zone 12, NAD83	4063099
Actual Stack Height (m)	115.8
Stack Base Elevation (m)	1632.1
Effective Diameter (m)	12.28
Stack Temperature (K)	Vary by hour
Exit Velocity (m/s)	Vary by hour

Meteorological Data

Three years (2012-2014) of the hourly surface meteorological data from the on-site surface station (Navajo Met Tower 1) were processed with AERMET (v 15181) with the regulatory default options. Concurrent upper air soundings were provided from Albuquerque, NM. The latest version of AERSURFACE (13016) was used to determine surface characteristics around the meteorological site. In AERSURFACE, we used the following seasons and corresponding months.

- Late autumn after frost and harvest, orwinter with no snow: December- March
- Winter with continuous snow on the ground: none
- Transitional spring (partial green coverage, short annuals): April and May
- Midsummer with lush vegetation: June- September
- Autumn with unharvested cropland: October andNovember

Receptors

Modeled receptors were set up along the plant fence line 50 meters apart. Additional receptors were set out as follows:

Every 100 meters out to a distance of 2 km beyond the fence line

- Every 250 meters out to a distance of 5kilometers from the center of the plant,
- Every 500 meters out to a distance of 10 kilometers from the center of the plant,

- Every 1000 meters out to a distance of 20 kilometers from the center of the plant,
- Every 2500 meters out to a distance of 30 kilometers from the center of the plant.

Additional 100-meter spaced receptors were placed on the Hogback Ridge and no receptors were placed on the lake/reservoir north of the stacks.

The total number of receptors included in the modeling network was 4,034. Terrain elevations from National Elevation Data (NED) from USGS were processed with AERMAP to develop the receptor terrain elevations required by AERMOD.

Downwash Analysis

According to the EPA's Technical Assistance Document guidance on the 1-hour SO_2 NAAQS (http://www3.epa.gov/airquality/sulfurdioxide/pdfs/SO2ModelingTAD.pdf), which is applicable for characterizing actual concentrations of criteria pollutants, "EPA recommends the use of actual stack heights so that the modeling analysis can most closely represent the actual ambient air quality conditions as influenced by the source". Also, "for both actual and GEP stack heights, if building downwash is being considered, the BPIPPRIME program should be used to input building parameters for AERMOD". The actual stack heights, listed in Table 1, were used in the modeling. Wind direction-specific building dimensions for input to AERMOD were developed with the EPA's Building Profile Input Processor (BPIPPRIME) for input to AERMOD.

Modeling Approach

The AERMOD (v 15181) modeling analysis was conducted using the latest regulatory default options.

Ambient Background Concentration

Our review of the 2012-2014 1-hour SO_2 monitoring data in New Mexico indicated that the closest and most representative SO_2 monitor is at Shiprock Substation in Farmington, NM. The 1-hour SO_2 design concentrations at this monitor is relatively low (21 ppb) and the data were processed for hourly and seasonal 99th percentile values to be added to the predicted concentrations. No other background sources were included in the modeling, as discussed in the concentration gradient analysis (Appendix E) of the 2014 EIS NAAQS study report.

Modeling Results

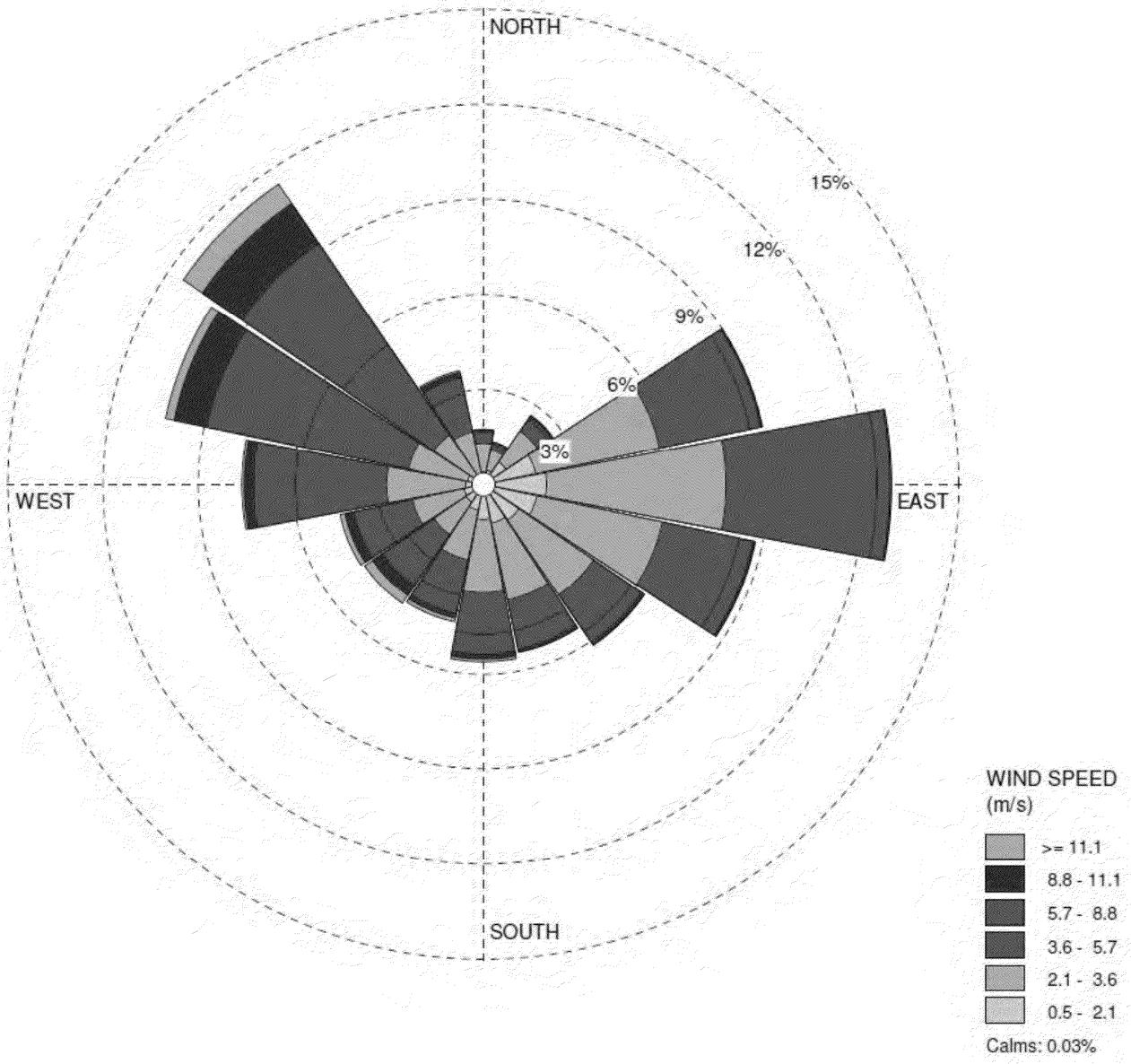
The modeling results of 99th percentile maximum daily 1-hour average concentrations over the 3 years modeled are equal to 163.1 $\mu g/m^3$, which is below the 1-hour SO_2 NAAQS. The peak impact occurs in an area covered by 100-meter spaced receptors less than a kilometer to the southeast of the Units 4 and 5 stack. We provide this information to EPA in support of a NAAQS attainment designation.

WIND ROSE PLOT:

Four Corners Power Plant - Navajo Met 1 Station
Wind Rose for April 2006 - March 2011

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2006 - 00:00 **End Date: 12/31/2010 - 23:00**	MODELER:	
	CALM WINDS: **0.03%**	TOTAL COUNT: **43460 hrs.**	
	AVG. WIND SPEED: **4.17 m/s**	DATE: **3/6/2013**	PROJECT NO.: **60221977**

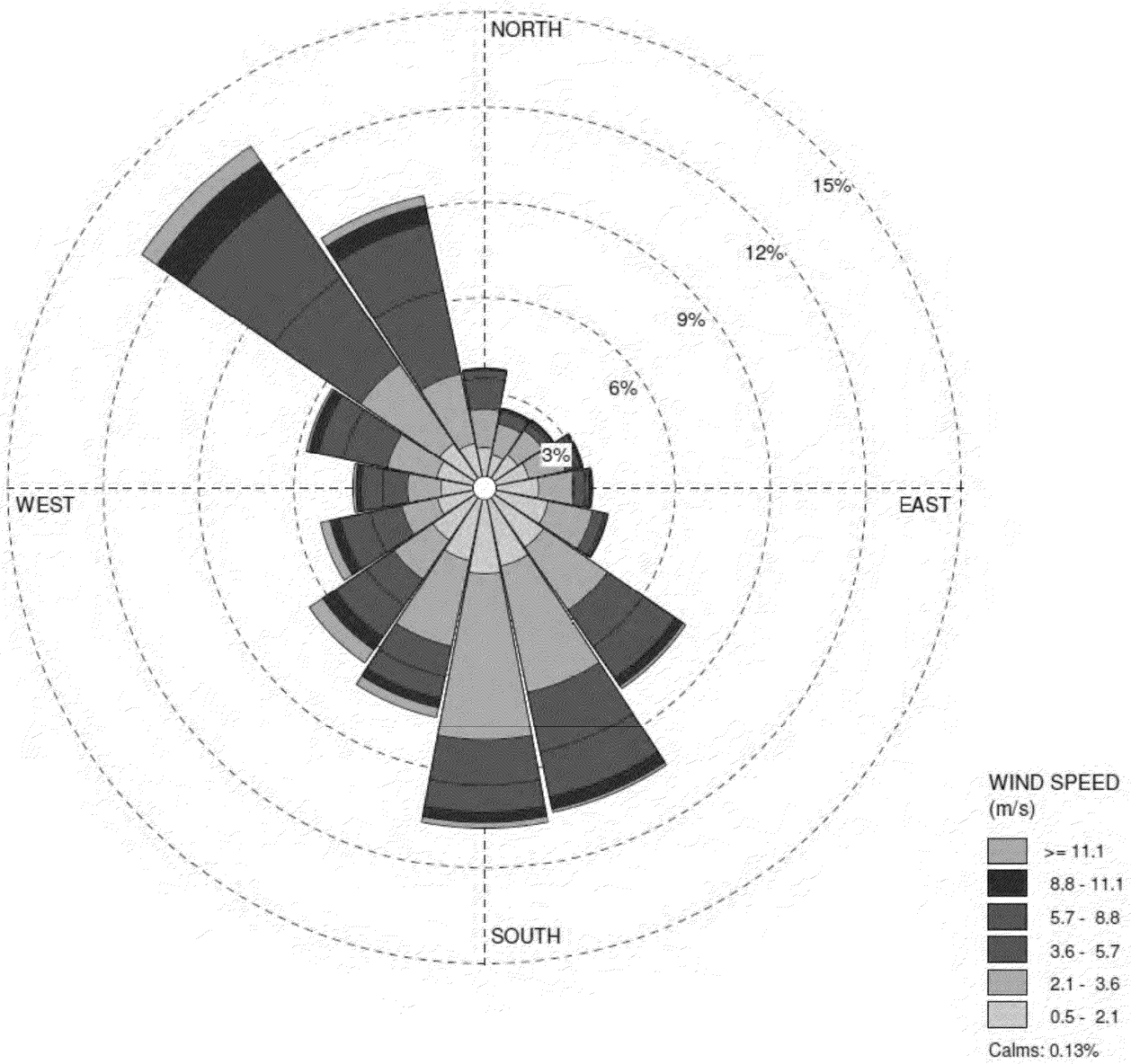
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Four Corners Power Plant - Navajo Met 3 Station
Wind Rose for April 2006 - March 2011

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2006 - 00:00 **End Date: 12/31/2010 - 23:00**	MODELER:	
	CALM WINDS: **0.13%**	TOTAL COUNT: **43700 hrs.**	
	AVG. WIND SPEED: **3.90 m/s**	DATE: **3/6/2013**	PROJECT NO.: **60221977**

WRPLOT View - Lakes Environmental Software

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From: Bohning, Scott
Sent: Thur 9/29/2016 7:34:12 PM
Subject: RE: SO2 Modeling Results for Four Corners Power Plant
NAAQS_Report_APS_FCPP_and_Navajo_Mine_EIS_8-2014.pdf

Mike -

Thanks for this, it looks really good....

FYI, the very end if the attached file has AECOM Significant Concentration Gradient (SCG) analysis for FCPP vs. SJGS (just one page and 2 maps). I found it fairly convincing when I looked at version of it in 2013, but I'm hoping to compare to some recent ones for other sources shortly.

- Scott B.

Attached: NAAQS_Report_APS_FCPP_and_Navajo_Mine_EIS_8-2014.pdf

--

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Michael Z. King [mailto:mzking@navajo-nsn.gov]
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Subject: SO2 Modeling Results for Four Corners Power Plant

Hello Team,

I just wanted to share with you all the modeling results I derived using Lakes Environmental AERMOD View and the AERMOD input files provided to us from AECOM for the Four Corners Power Plant. To my understanding, AECOM provided a concentration gradient analysis for San Juan Generating Station and this analysis was submitted to US EPA Region 9. According to the analysis, the concentration gradient for SJGS was flat therefore excluded this source from the model. I would like to review this analysis and I believe AECOM may have already provided this to us. I appreciate all your assistance.

Thanks,

Michael King

Sr. Environmental Specialist

Navajo Nation Environmental Protection Agency

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Phoenix, AZ

Prepared by:
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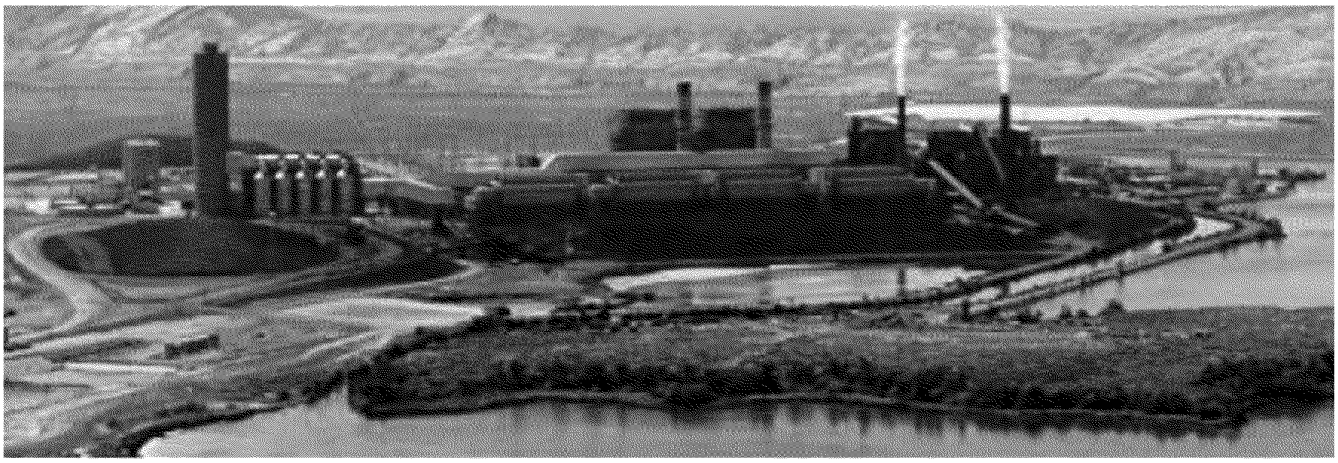
Chelmsford, MA
August 2014

Four Corners Power Plant and Navajo Mine Energy Project Environmental Impact Statement NAAQS Modeling Study



AECOM Environment

Prepared for:
Arizona Public Service
Phoenix, AZ

Prepared by:
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Chelmsford, MA
August 2014

Four Corners Power Plant and Navajo Mine Energy Project Environmental Impact Statement NAAQS Modeling Study

Prepared By Mary Kaplan

Reviewed By Robert J. Paine

List of Acronyms

$\mu g/m^3$	micrograms per cubic meter
µm	micrograms
AERMAP	AERMOD Terrain Preprocessor
AERMET	AERMOD Meteorological Preprocessor
AERMOD	AMS/EPS Regulatory Model
AERSURFACE	AERMET Surface Characteristics Preprocessor
AIG	AERMOD Implementation Guide
APS	Arizona Public Service
BART	Best Available Retrofit Technology
BIA	Bureau of Indian Affairs
BNCC	BHP Navajo Coal Company
BPIP	Building Profile Input Program
BPIPPRM	Building Profile Input Program with PRIME algorithm
CAQB	City of Albuquerque Air Quality Bureau
CFR	Code of Federal Regulations
CO	carbon monoxide
DFADA	Dry Fly Ash Disposal Area
EIS	Environmental Impact Statement
FCPP	Four Corners Power Plant
g/cm^3	grams per cubic centimeter
g/s	grams per second
GAQM	Guideline on Air Quality Models
GEP	Good Engineering Practice
H_2SO_4	Sulfuric Acid Mist
m/s	meters per second
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NAD	North American Datum
NED	National Elevation Dataset
NEPA	National Environmental Policy Act
NMED	New Mexico Environment Department
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
OAQPS	Office of Air Quality Planning and Standards

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Pb	lead
PM	particulate matter
PM_{10}	particulate matter less than 10 microns
$PM_{2.5}$	particulate matter less than 2.5 microns
ppb	parts per billion
ROW	right-of-way
SCR	Selective Catalytic Reduction
SJGS	San Juan Generating Station
SMCRA	Surface Mining Control and Reclamation Act of 1977
SO_2	sulfur dioxide
SRMG	Salt River Materials Group
tpy	tons per year
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTM	Universal Transverse Mercator

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1.0 Introduction

1.1 Project Overview

The Arizona Public Service Company (APS) operates the Four Corners Power Plant (FCPP), a privately owned and operated coal-fired power plant located on the Navajo Nation, about 25 miles west of Farmington, New Mexico. The facility currently consists of five boiler electric generating units (Units 1 through 5), with a total capacity of approximately 2,060 megawatts (MW). This modeling demonstration does not include Units 1, 2, and 3, which will be permanently retired prior to the FCPP lease expiration. Units 4 and 5 with a total capacity of 1,500 MW will continue to operate after 2016.

APS contracted AECOM to provide support in preparation for the environmental impact statement (EIS) to address the renewal of the lease and rights-of-way (ROWs) for the FCPP and associated transmission lines for the 25-year period of 2016 through 2041. The current FCPP lease expires in 2016. During the National Environmental Policy Act (NEPA) process, the following APS actions will be evaluated in the EIS:

- Lease Approval: The Bureau of Indian Affairs (BIA) would evaluate whether to approve a lease extension to 2041 allowing for continued operation of the FCPP and the associated transmission lines across the Navajo Nation.
- Grant Issuance: The BIA would evaluate whether to approve the issuance of federal grants of rights-of-way, pursuant to 25 United States Code § 323, for the plant, associated transmission lines, and ancillary facilities.

Concurrent with the proposed FCPP lease amendment approval and renewed ROWs grant actions, Navajo Transitional Energy Company (NTEC), LLC proposes to develop a new permit area, called the Pinabete Permit, which is located adjacent to the existing Navajo Mine and FCPP on tribal trust lands on the Navajo Reservation. The new Pinabete Permit area would, in conjunction with the mining of any reserves remaining within the existing Navajo Mine Permit area (federal Surface Mining Control and Reclamation Act [SMCRA] Permit NM0003F), supply low-sulfur coal to the FCPP at a rate of approximately 5.8 million tons per year (tpy). Development of the Pinabete Permit area and associated coal reserves would use surface mining methods and, based on current projected customer needs, would supply coal to FCPP for up to 25 years beginning in 2016. The proposed Pinabete Permit area would include previously permitted but undeveloped coal reserves within Area IV North of the Navajo Mine Lease, and unpermitted and undeveloped coal reserves in a portion of Area IV South of the existing Navajo Mine Lease. Full implementation of the proposed Pinabete Permit is expected to require specific federal actions that will be addressed in the EIS, including:

- Approval from Office of Surface Mining Reclamation and Enforcement (OSM) of the new SMCRA permit.
- Approval from the Bureau of Land Management of a revised Mine Plan developed for the proposed maximum economic recovery of coal reserves.
- Approval of a Section 404 Individual Permit from the U.S. Army Corps of Engineers for the impacts to waters of the U.S. from proposed mining activities.
- Approval of a Section 402 National Pollutant Discharge Elimination System permit from the U.S. Environmental Protection Agency (USEPA).
- Approval by the BIA of a proposed realignment for approximately 2.8 miles of BIA 3005/Navajo Road N-5082 (Burnham Road) in Area IV South to avoid proposed mining areas.
- Approval or grant of other associated facilities, permits, or ROWs for access and haul roads, power supply for operations, and related facilities.

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One technical study required as part of the NEPA process involves determining whether the criteria pollutant emissions from the FCPP, Navajo Mine, and Pinabete permit area meet the National Ambient Air Quality Standards (NAAQS). This analysis is particularly important because the NAAQS for sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) have recently been strengthened. In addition to SO_2 and NO_2, comparison to the NAAQS has been assessed for particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$), particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}), carbon monoxide (CO), and lead (Pb). Ozone NAAQS modeling was addressed using photochemical modeling and documented in a separate report.

1.2 Purpose of Modeling Study

The purpose of this document is to present the modeling procedures and results for the NAAQS modeling that will support the NEPA process and associated EIS being conducted for the FCPP and Navajo Mine Energy Project. Emissions calculations, modeling methods and assumptions, including model selection and options, meteorological data and source parameters used in the modeling analysis are presented in this document.

Since submitting the NAAQS modeling report to OSM in February, 2014, APS selected urea as an ammonia source for the Selective Catalytic Reduction (SCR) that will be installed as part of the Best Available Retrofit Technology (BART) agreement. APS subsequently refined the NAAQS modeling to incorporate urea and Dry Sorbent Injection (DSI) handling to be consistent with the associated PSD permit application. The NAAQS model also was updated to include coal, overburden, and topsoil stockpile locations within the proposed Pinabete mine area.

1.3 Contents of the Modeling Study Report

This report consists of six sections and five appendices. Section 1 provides an introductory presentation. Section 2 contains a project description, including information regarding the FCPP and Navajo Mine equipment, locations and modeled air pollutant emissions. Sections 3 and 4 present a detailed description of the modeling procedures used in evaluating whether the FCPP meets the NAAQS, including model selection criteria, good engineering practice stack height determination, refined modeling analyses, and ambient air quality. Section 5 presents the modeling results submitted as part of the EIS. References are provided in Section 6.

Appendix A contains emissions calculations for the equipment at FCPP and associated mining activities. **Appendix B** cites text from the March 1, 2011 Clarification Memo. **Appendix C** contains the Alternative Model Justification for Low Wind Speed Beta Options: AERMOD Meteorological Preprocessor (AERMET) and AMS/EPS Regulatory Model (AERMOD). **Appendix D** contains the 30 years of monthly precipitation used to determine if each month is wet, dry, or average for Bowen ratio calculations. **Appendix E** describes a significant concentration gradient for a background source considered for modeling. **Appendix F** contains the modeling files and archive for the NAAQS analysis provided under separate cover in electronic form.

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2.0 Description of Power Plant and Mine Sources

2.1 Source Location

The FCPP and Navajo Mine are located 5 miles south of State Route 64, approximately 13 miles southeast of Shiprock, New Mexico, and 15 miles west-southwest of Farmington, New Mexico. A topographical map of the site region is shown in **Figure 2-1**.

2.2 Emission Sources

The criteria pollutant air emissions associated with the FCPP and Navajo Mine primarily occur due to the combustion of coal in the main coal-fired boilers, Units 4 and 5, and the material handling operations of coal, lime, and ash. Smaller amounts of NAAQS pollutant air emissions are emitted from the ancillary equipment such as vehicle exhaust.

2.2.1 Point Sources at FCPP

2.2.1.1 Units 4 and 5

Units 4 and 5 are cell burner, pulverized coal-fired boilers equipped with lime spray towers and baghouses for SO_2 and particulate matter (PM) control. SCR will be installed as part of the Best Available Retrofit Technology (BART) agreement. The exhaust gases from Units 4 and 5 are ducted into one stack containing two flues. **Table 2-1** summarizes the current exhaust stack parameters for Units 4 and 5 that will be used for the criteria pollutant NAAQS assessment. The temperature and exhaust velocity are based on actual hourly data from 2009 through 2011.

Table 2-1 Unit 4 and 5 Stack Parameters[1]

	Units	Units 4-5 Merged Stack
UTM-X, Zone 12, NAD83	Meters	725349.5
UTM-Y, Zone 12, NAD83	Meters	4063098.5
Stack Height	Meters	115.824
Base Elevation	Meters	1631.29
Effective Diameter	Meters	12.28
Gas Exit Velocity	m/s*	20.60
Stack Gas Exit Temperature	deg K	327.00

[1] The exhaust parameters coincide with a 99th percentile heat input rate of 7,411 million British thermal units per hour for each of Units 4 and 5.

* m/s = meters per second

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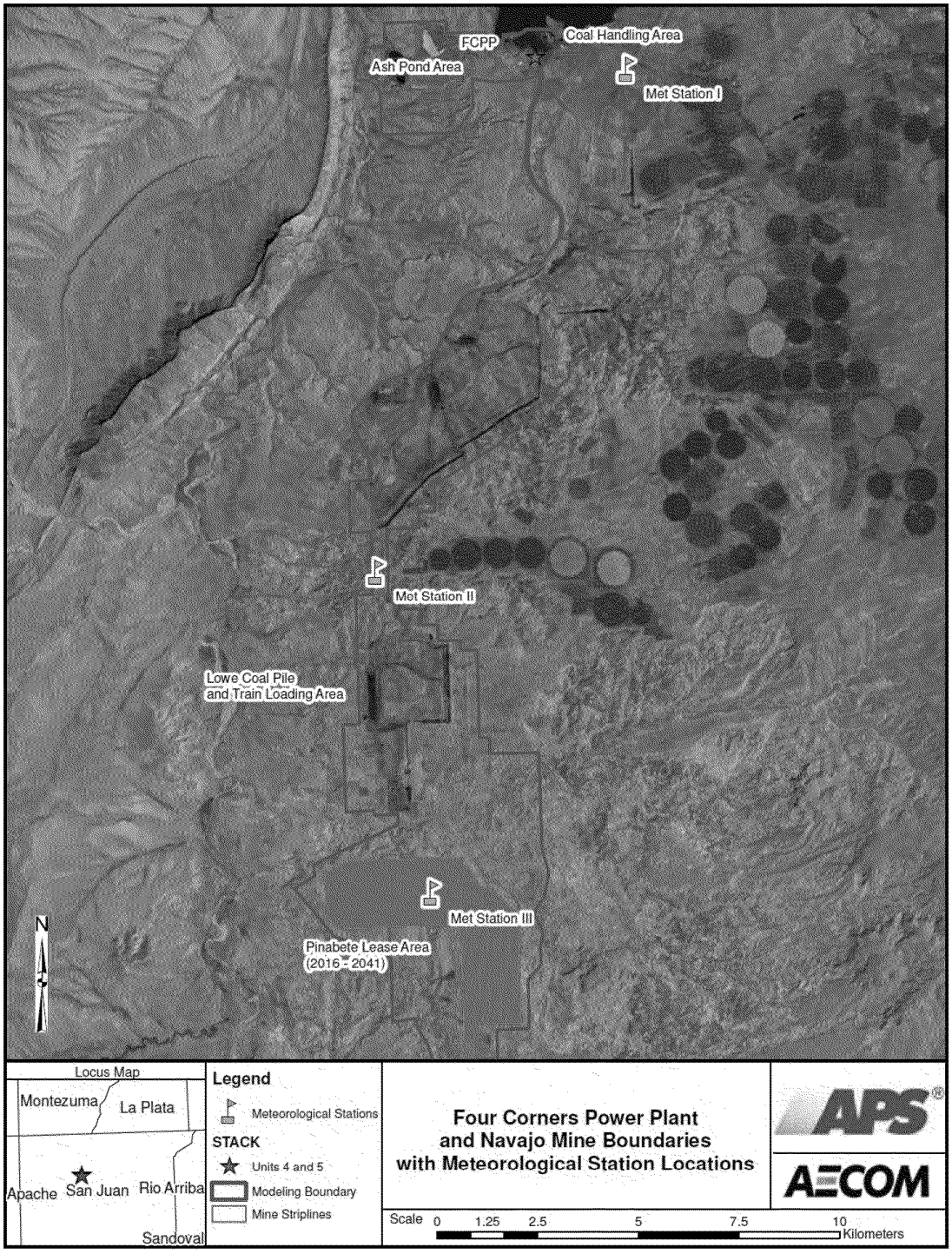

Figure 2-1 FCPP and Navajo Mine Location

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Emission rates from the Units 4 and 5 stack are derived from consideration of actual hourly data, the current Title V operating permit[1] for FCPP, as well as from the final BART rule[2] for oxides of nitrogen (NO_X) and PM. **Table 2-2** provides a list of the emission rates. Per USEPA guidance[3] issued on February 7, 2013, AECOM modeled 3 years of actual 1-hour SO_2 emissions from Units 4 and 5 with concurrent exhaust temperature and velocity. Since the BART emission rate for NO_X is based upon a 30-day rolling average (which is appropriate for visibility impacts), we provide both a 30-day and 1-hour average emission rate for NO_X. In addition, the PM_{10} and $PM_{2.5}$ emission rates used in the modeling include condensable emissions consistent with increased sulfuric acid mist (H_2SO_4) emissions from future planned SCR operation.

2.2.1.2 Coal, Lime, DSI, Urea and Ash Handling Point Sources at FCPP

FCPP maintains two lime storage silos which process dry lime into a slurry used in the scrubbers for Units 4 and 5. Each lime silo is equipped with a baghouse for particulate control, and two lime dust scrubbers for particulate control on each silo. Currently, the lime dust scrubbers exhaust horizontally but will be modified to discharge vertically. These scrubbers operate 12 hours per day, from 7 am to 7 pm. Emissions are estimated using the outlet grain loading (grains/acf) of the baghouses and the volumetric displacement of the air from the lime loaded into the silo.

The coal processed and stored by the Navajo Mine is transported on a series of conveyors to FCPP. The North and South Surge Bins hold coal coming from the processing area. The South Surge Bin currently services Units 1, 2, and 3, but will be repurposed to feed Units 4 and 5 with the North Surge Bin. The North Surge Bin baghouse and South Surge Bin rotoclone control particulate from these sources. From these bins, the coal is transported via open conveyor belts to a tripper deck, where it is separated and transported via open conveyor to, one of nine coal silos. Transfer of coal from the coal silos to the pulverizers is in closed piping. A surfactant is applied at the bottom of the surge bins to mitigate fugitive dust on the open conveyor leading to the tripper deck. Additionally, a project is currently underway to install an additional surfactant dust suppression system at the tripper deck to further reduce fugitive dust. The coal is conveyed from the tripper deck to nine storage bunkers with two rotoclones installed for particulate control. Emissions from the coal handling sources are estimated using the AP-42[4] "drop equation" from Section 13.2.4 and applying appropriate control factors as mitigation.

The fly ash waste disposal area has five silos, all equipped with baghouses. Two silos are for ash storage, one for fly ash sales/export, and two for on-site fly ash disposal. In addition to the silos, there are three pug mills with scrubbers for processing fly ash. These are not currently operated but are including in the dispersion modeling should they be used in the future. These sources would operate 12 hours per day, 7 am to 7 pm. The locations and release parameters are listed in **Table 2-3**. The emissions calculations for all sources are presented in **Appendix A**. Baghouse and scrubber emissions are estimating using the outlet grain loading for each control device and the airflow through each piece of equipment.

The installation of the SCR will include a new silo for storage of hydrated lime and, if urea is used for the SCR system, a second silo for urea storage. Emissions from the silos occur during pneumatic transfer of delivered materials from the delivery trucks to the silos. The sorbent and urea silos are small emission sources with low flow rates, at or below 5,000 acfm. The new silos will have bin vent filter/baghouses for control of PM10 and PM2.5 emissions.

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[1] NNEPA 2008. Arizona Public Service Four Corners Power Plant Title V Operating Permit (August 1, 2008). http://www.navajonationepa.org/airqty/Pdf_files/FCPPpermit8-1-2008.pdf.

[2] USEPA 2012a. Source Specific Federal Implementation Plan for Implementing **Best Available Retrofit Technology** for Four Corners Power Plant. 77FR 51620, August 24, 2012.

[3] USEPA 2013a. http://www.epa.gov/airquality/sulfurdioxide/pdfs/20130207SO2StrategyPaper.pdf, (pages 2-3).

[4] USEPA 1995. AP-42, Compilation of Air Pollutant Emission Factors, Fifth Edition. (January 1995).

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Table 2-2 Emission Rates for Units 4 and 5

Criteria Pollutant	Factor lb/ mmBTU	Factor Reference Notes	Unit 4		Unit 5		Combined	
			mmBTU/ hr	lbs/hr	mmBTU/ hr	lbs/hr	lbs/hr	g/s
Sulfur Dioxide (SO_2)[1]	0.190	1-hour Average Emission Rate; actual hourly emissions used in the modeling	7,411	1,408	7,411	1,408	2,816	**354.83**
Nitrogen Oxides (NO_X)	0.098	40 Code of Federal Regulations (CFR) 49 BART Rule, 30-day Rolling Average	7,411	726	7,411	726	1,453	**183.02**
Nitrogen Oxides (NO_X)	0.20	1-hour average	7,411	1,482	7,411	1,482	2,964	**373.51**
Carbon Monoxide (CO)	0.028	AP-42 Table 1.1-3; 17.632 mmBTU/ton	7,411	208	7,411	208	415	**52.29**
Lead (Pb)	1.2E-06	40 CFR 63 Subpart UUUUU Table 2	7,411	0.01	7,411	0.01	0.02	**0.0022**
Filterable Particulate (PM)[2]	0.01500	40 CFR 49 BART Rule	7,411	111.17	7,411	111.17	222	28.01
Total Filterable $_{PM10}$	0.01380	AP-42 Table 1.1-6; 92% of filterable PM	7,411	102.27	7,411	102.27	205	25.77
"Coarse" Filterable PM_{10}	0.00585	difference (total filterable - fine filterable)	7,411	43.35	7,411	43.35	87	10.93
Fine Filterable $_{PM2.5}$	0.00795	AP-42 Table 1.1-6; 53% of filterable PM	7,411	58.92	7,411	58.92	118	14.85
Fine "Soil" $_{PM2.5}$	0.00766	difference (fine filterable - fine elemental carbon)	7,411	56.74	7,411	56.74	113	14.30
Fine Elemental Carbon $PM_{2.5}$	0.00029	EPA 68-D-98-046 Table 6; 3.7% of $PM_{2.5}$	7,411	2.18	7,411	2.18	4	0.55
Total Condensable PM_{10} / $PM_{2.5}$	0.00835	sum (sulfuric acid + organics)	7,411	61.91	7,411	61.91	124	15.60
Condensable Sulfuric Acid (H_2SO_4)	0.00435	Stack Test and EPRI Removal (%)	7,411	32.26	7,411	32.26	65	8.13
Condensable Organics	0.00400	AP-42 Table 1.1-5; 20% of 0.02 lb/mmBTU	7,411	29.64	7,411	29.64	59	7.47
Grand Total $_{PM10}$	0.02215	Total Filterable + Total Condensable	7,411	164.18	7,411	164.18	328	**41.373**
Grand Total $_{PM2.5}$	0.01630	Fine Filterable + Total Condensable	7,411	120.83	7,411	120.83	242	**30.448**

[1] 1-hour SO_2 NAAQS compliance determined by modeling actual hourly emission rate and stack parameters over 3 years.

[2] PM modeling results are dominated by near-surface releases, which are composed primarily of direct PM emissions and have minimal precursor PM emissions. Secondary PM emissions from the FCPP stack are already accounted for in the conservative background monitoring concentration. Note that with future emission reductions at FCPP and area-wide sources, the secondary PM emission component that is part of the background concentration will be reduced, so the current background overestimates this future component of PM concentrations.

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Table 2-3 Emission Rates and Source Parameters for Lime, Coal, Ash, DSI and Urea Handling Point Sources

ID	Orientation	UTM E (NAD83)	UTM N (NAD83)	Stack Height (m)	Stack Diameter (m)	Velocity (m/s)	Temperature (K)	PM_{10} ST (g/s)	$PM_{2.5}$ ST (g/s)	$PM_{2.5}$ Ann (g/s)	Comments
DSI_SILO	Horizontal	725119.5	4063303.1	24.384	0.243	0.001	Amb.	0.0108	0.0108	0.0108	12 hrs/day
UREASILO	Vertical	725185.5	4062785.8	9.144	0.385	16.256	Amb.	0.0270	0.0270	0.0270	12 hrs/day
EU20_8L	Down Facing	725274.3	4062992.5	21.641	0.628	0.001	Amb.	0.0222	0.0222	0.0203	
EU21_11L	Down Facing	725246.3	4062968.4	21.641	0.628	0.001	Amb.	0.0222	0.0222	0.0203	
EU22_6L	Will be vertical	725268.4	4063001.3	12.192	0.330	18.11	366.483	0.2371	0.2371	0.2371	12 hrs/day
EU22_7L	Will be vertical	725280.5	4062983.9	12.192	0.330	18.11	366.483	0.2371	0.2371	0.2371	12 hrs/day
EU24_9L	Will be vertical	725240.6	4062977.4	12.192	0.330	18.11	366.483	0.2371	0.2371	0.2371	12 hrs/day
EU25_10L	Will be vertical	725251.9	4062959.2	12.192	0.330	18.11	366.483	0.2371	0.2371	0.2371	12 hrs/day
SRMGBH	Horizontal	725177.3	4063271.3	22.860	0.330	0.001	16.7 + Ambient	0.1893	0.1893	0.1893	
EU29_15A	Horizontal	725159.9	4063263.6	32.918	0.330	0.001	16.7 + Ambient	0.1893	0.1893	0.1798	
EU28_14A	Horizontal	725155.2	4063253.8	32.918	0.330	0.001	16.7 + Ambient	0.1893	0.1893	0.1798	
EU27_13A	Horizontal	725152.5	4063232.0	25.298	0.330	0.001	16.7 + Ambient	0.1893	0.1893	0.1798	
EU26_12A	Horizontal	725153.0	4063233.1	25.298	0.330	0.001	16.7 + Ambient	0.1893	0.1893	0.1798	
EU30_16A	Horizontal	725165.2	4063229.2	11.278	1.219	0.001	Amb.	0.1058	0.1058	0.1058	12 hrs/day
EU31_17A	Horizontal	725168.1	4063221.5	11.278	1.219	0.001	Amb.	0.1058	0.1058	0.1058	12 hrs/day
EU32_18A	Horizontal	725172.9	4063231.4	11.278	1.219	0.001	Amb.	0.1058	0.1058	0.1058	12 hrs/day
NSURGEBH	Horizontal	725021.6	4063493.4	5.000	0.300	0.001	Amb.	0.0081	0.0081	0.0081	
SSRGERTC	Horizontal	725038.4	4063473.4	19.668	0.200	0.001	Amb.	8.63E-5	1.307E-05	1.307E-05	
CROTO1	Horizontal	725005.0	4063308.6	19.290	0.200	0.001	Amb.	5.75E-5	8.711E-06	8.711E-06	
CROTO2	Horizontal	725034.0	4063275.0	19.290	0.200	0.001	Amb.	5.75E-5	8.711E-06	8.711E-06	

2.2.2 Coal, Ash, and Lime Handling Volume Sources at FCPP

As part of the lime slurry mixing process, lime grit that settles out is dropped into one of two bins and then dropped onto one of two piles. These drops are modeled as volume sources. Open transfer points as part of the coal transport from the surge bins to the nine silos also are modeled as volume sources. Saleable fly ash truck loading and on-site disposal fly ash truck loading are drops into trucks for transport at the bottom of each of these silos. Fly ash truck loading occurs from 7 am to 7 pm. The locations and source parameters are summarized in **Table 2-4**. The emissions calculations for all sources are presented in **Appendix A**. Lime pile drops, coal transfer point, and ash load out emissions are estimated using the AP-42 "drop equation" from Section 13.2.4.

2.2.3 Vehicular Traffic at FCPP

Paved and unpaved road sources were developed to represent vehicular traffic at FCPP. The roads are represented by lines of volume sources, each having the following characteristics, calculated using the haul road configuration tool based on the *Haul Road Workgroup Final Report Submission to EPA-OAQPS* (March 2012)[5] in the Lakes Environmental AERMOD View software:

- The sources are assumed to be adjacent, elevated sources.
- Vehicle height is a weighted average based on vehicles traveling on each road segment.
- Plume height, equal to vehicle height x 1.7 (top of plume height per haul road report).
- Release height = Plume height / 2.
- Initial Sigma-z = Plume height / 2.15.
- Lane type = Most roads are characterized as two lanes.
- Plume width = Road width + 6m.
- Initial Sigma-Y = Plume width / 2.15.

AECOM accounted for fly ash haul trucks, saleable fly ash haul trucks, lime delivery trucks, SCR catalyst deliver trucks, watering trucks, and company and employee vehicles. The road segments are listed in **Table 2-5** and the calculations are provided in **Appendix A**. Vehicular traffic during overnight hours is minimal and this was accounted for in the modeling as fly ash disposal and deliveries occur during daylight hours. Roads are watered between 4 am and 8 pm, daily, and during high wind periods are watered during overnight hours as well. Emissions are calculated using AP-42 Section 13.2.1 for paved roads and Section 13.2.2 for unpaved roads.

2.2.4 Lime and Ash Piles at FCPP

Area sources at FCPP consist of stockpiles located at the lime processing area and the ash disposal area. The stockpile base areas were derived from the reported annual average surface area of each pile, and the actual area modeled was a best-fit polygon or circle over the plot plan stockpile "footprint." The average heights of the stockpiles were from estimates provided by plant personnel.

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[5] USEPA 2012b. Haul Road Workgroup Final Report (March 2, 2012) http://www.epa.gov/ttn/scram/reports/Haul_Road_Workgroup-Final_Report_Package-20120302.pdf.

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Table 2-4 Emission Rates and Source Parameters for Lime, Coal, and Ash Handling Volume Sources

Volume Source Name	Source ID	UTM E (NAD83)	UTM N (NAD83)	Release Height (m)	Sigma-y (m)	Sigma-z (m)	PM_{10} ST (g/s)	$PM_{2.5}$ ST (g/s)	$PM_{2.5}$ Ann (g/s)	Controls
Drop into Lime Grit Bin	GRTDRP1A	725276.24	4062930.5	2.438	0.425	0.709	1.04E-03	1.57E-04	1.57E-04	
Drop into Lime Grit Bin	GRTDRP2A	725276.24	4062930.5	1.219	0.425	0.425	1.04E-03	1.57E-04	1.57E-04	
Drop onto Lime Grit Piles	GRTDRP1B	725311.10	4062960.1	2.438	0.425	0.709	1.04E-03	1.57E-04	1.57E-04	
Drop onto Lime Grit Piles	GRTDRP2B	725311.10	4062960.1	1.219	0.425	0.425	1.04E-03	1.57E-04	1.57E-04	
North Surge Bin onto Conveyor 1	TP1A	725032.76	4063489.3	2.000	0.465	5.671	5.75E-04	8.71E-05	8.71E-05	Surfactant
South Surge Bin onto Conveyor 1	TP1B	725042.52	4063476.7	2.000	0.465	5.671	5.75E-04	8.71E-05	8.71E-05	
Transfer from Conveyor 1 to 2	TP2	725081.64	4063426.8	2.000	1.151	0.930	5.75E-04	8.71E-05	8.71E-05	
Conveyor 2 to Tripper Deck	TP3	724973.63	4063342.6	17.000	1.509	0.930	5.75E-04	8.71E-05	8.71E-05	Surfactant
Tripper Deck to Enclosed System (9 Silos)	TP4	724979.50	4063336.4	18.000	1.221	0.930	5.75E-04	8.71E-05	8.71E-05	
Fly Ash Truck Loading 1	FAT_1	725150.56	4063227.9	3.000	0.472	1.395	5.55E-03	8.40E-04	8.40E-04	
Fly Ash Truck Loading 2	FAT_2	725154.75	4063237.2	3.000	0.472	1.395	5.55E-03	8.40E-04	8.40E-04	
Saleable Fly Ash Truck Loading	SFAT	725180.77	4063270.3	3.000	0.472	1.395	3.23E-03	4.89E-04	4.89E-04	

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Table 2-5 Emission Rates and Source Parameters for Vehicular Traffic

Road Location	Road ID	# Volumes	24-hour PM_{10} g/s / volume	24-hour $PM_{2.5}$ g/s / volume	Annual $PM_{2.5}$ g/s / volume	Release Height (m)	Sigma-y (m)	Sigma-z (m)
Plant Area	1 to 2	3	3.73E-03	9.16E-04	7.29E-04	4.25	7.91	1.98
Plant Area	2 to 3	24	4.60E-03	1.13E-03	8.82E-04	4.25	7.91	1.98
Plant Area	3 Loop	26	2.64E-03	6.47E-04	5.15E-04	4.25	5.58	1.98
Plant Area	3 to 4	5	8.05E-04	1.98E-04	1.67E-04	4.25	5.58	1.98
Plant Area	1 to 5	7	9.81E-04	2.41E-04	2.06E-04	4.25	6.98	1.98
Plant Area	5 to 2	8	1.07E-03	2.64E-04	2.13E-04	4.25	6.98	1.98
Plant Area	5 to 6	15	3.98E-04	9.77E-05	9.04E-05	4.25	6.98	1.98
Plant Area	1 to 7	41	3.68E-03	9.02E-04	7.43E-04	4.25	7.91	1.98
Fly Ash Area	7 to 8	75	3.65E-03	8.95E-04	7.37E-04	4.25	7.91	1.98
Fly Ash Area	8 to 9	43	3.69E-03	9.05E-04	7.45E-04	4.25	7.91	1.98
Fly Ash Area	9 Loop	111	7.13E-03	7.13E-04	5.87E-04	4.25	5.58	1.98
Fly Ash Area	8 to 10	17	1.38E-03	1.38E-04	1.38E-04	2.55	7.91	1.19
Fly Ash Area	10 to 11	46	1.40E-03	1.40E-04	1.40E-04	3.40	7.91	1.58
Fly Ash Area	11 to 12	69	1.39E-03	1.39E-04	1.39E-04	3.40	7.91	1.58
Fly Ash Area	11 to 13	44	1.40E-03	1.40E-04	1.40E-04	3.40	7.91	1.58
Fly Ash Area	12 to 13	29	1.38E-03	1.38E-04	1.38E-04	3.40	7.91	1.58
Fly Ash Area	12 to 14	123	1.39E-03	1.39E-04	1.39E-04	3.40	7.91	1.58
Fly Ash Area	13 to 14	39	9.68E-04	9.68E-05	9.68E-05	3.40	7.91	1.58
Fly Ash Area	14 to 15	54	9.76E-04	9.76E-05	9.76E-05	3.40	7.91	1.58
Fly Ash Area	10 to 16	77	9.64E-04	9.64E-05	9.64E-05	3.40	7.91	1.58
Fly Ash Area	15 to 7	56	5.63E-03	5.63E-04	4.63E-04	3.40	7.91	1.58
Fly Ash Area	15 Loop	36	3.90E-03	3.90E-04	3.21E-04	4.25	5.58	1.98

The fly ash has a high moisture content when transported and unloaded by the haul trucks. Over time, it dries into a cement-like solid. Surfactant is applied regularly to reduce the amount of fugitive dust that can become airborne during high-wind events. In general, wind erosion from stock piles is highly intermittent due to the high threshold wind speeds involved. Consideration of triggering wind events can be accomplished simply by inspection of the available meteorological data, since the onset of windblown dust is based upon threshold friction velocity guidance as listed in AP-42 Section 13.2.5. For the potential surface pile emission sources, the AP-42 threshold friction velocity values will be used to determine appropriate fastest mile velocities from Farmington Airport for an anemometer[6] height of 10 meters. The threshold velocity for the ash piles is 19.25 m/s. To be conservative, AECOM modeled this source such that the piles generated emissions when the wind speed is greater than 12.49 m/s. The lime grit piles are much smaller in scale and are subject to wind erosion at all wind speeds. Emissions from the lime grit piles are estimated using the Mojave Desert Air Quality District equation for wind erosion from stockpiles from their emissions inventory guidance for mineral handling and processing industries.

Fly ash from Units 4 and 5 is transported and unloaded in the Dry Fly Ash Disposal Area (DFADA) and compacted using bulldozers. Unloading and bulldozing activities occur 8 hours per day. Another byproduct of combustion, cenospheres, are transported and unloaded in a different area. This material accumulates until it is sold and transported off-site. Unloading and bulldozing activities occur less frequently at the cenosphere pile.

The older ash disposal ponds are inspected and maintained on a regular basis to determine if additional surfactant needs to be applied to reduce fugitive dust emissions. Source parameters and emission rates for each pile are listed in **Table 2-6**. The fastest mile emission calculations are in **Appendix A**.

2.2.5 Auxiliary Boiler

The recently permitted natural gas fired auxiliary boiler will primarily run when Units 4 and 5 are in start-up mode, and the hours of operation are limited to 876 hours per year. AECOM conservatively modeled the auxiliary boiler as operating every hour, concurrently with Units 4 and 5 (see **Table 2-7**).

2.2.6 Navajo Mine North Sources

The Navajo Mine coal preparation plant in the northern portion of the mine lease, is adjacent to FCPP on the east side. A train transports coal from the mine to the processing area where the train cars are unloaded into one of two hoppers. Water sprays located inside each receiving hopper are activated when coal from a railcar is being unloaded into the hopper. This activity, however, is not representative of a traditional “transfer point” because air inside the hopper is displaced by the incoming coal, resulting in some coal particles being entrained in that air as it exits the top of the hopper. Due to this, particulate emissions from the hoppers have been estimated by first applying the standard drop equation from AP-42, § 13.2.4.3 and then multiplying the resultant emission rate by an “activity factor” of 10, i.e., a subjective, but conservative, approximation of the amount of hopper emissions compared to the amount from a “standard drop.” In addition, it is conservatively assumed that the water sprays inside the hoppers provide no more than 50 percent particulate removal.

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[6] Because fastest mile information is not available from the on-site meteorological stations, it is obtained from Farmington airport for the purpose of determining the frequency of windblown dust events.

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Table 2-6 Emission Rates and Source Parameters for Lime and Ash Pile Area Sources

Area Source Name	Source ID	UTM E (NAD83)	UTM N (NAD83)	Area (m^2)	Release Height (m)	$PM_{2.5}$ (ton/yr)	$PM_{2.5}$ (lb/time)	PM_{10} (lb/hr)	PM_{10} (lb/time)	Annual $PM_{2.5}$ ($g/m^2/s$)	24-hour $PM_{2.5}$ ($g/m^2/s$)	24-hour PM_{10} ($g/m^2/s$)
Lime Grit Pile 1	GRITPIL1	725276.1	4062929	4.0	1.0	2.65E-05	N/A	0.000176	N/A	1.27E-06	1.9E-07	1.9E-07
Lime Grit Pile 2	GRITPIL2	725310.8	4062959	4.0	1.0	2.65E-05	N/A	0.000176	N/A	1.27E-06	1.9E-07	1.9E-07
Ash Pond 6	ASHPOND6	722426.4	4063915	527205.4	1.0	0.126943	244.2714	N/A	1074.794	3.46E-10	1.22E-07	5.35E-07
Ash Pond 5	ASHPOND5	722932.4	4063102	90268.07	1.0	0.021735	41.82413	N/A	184.0262	3.46E-10	1.22E-07	5.35E-07
Lined Decant Water Pond	LDWPNRTH	722302.8	4062912	61088.24	1.0	0.014709	28.30416	N/A	124.5383	3.46E-10	1.22E-07	5.35E-07
Lined Decant Water Pond	LDWPSTH	722282.2	4062406	194640.8	1.0	0.046867	90.18338	N/A	396.8069	3.46E-10	1.22E-07	5.35E-07
Lined Ash Impoundment	LAIPOND	722734.1	4062402	347518.8	1.0	0.083678	161.0168	N/A	708.4737	3.46E-10	1.22E-07	5.35E-07
Dry Fly Ash Disposal Area	DFADA	722689.0	4062225	162430.6	3.0	3.376536	483.6055	N/A	2127.864	4.19E-07	1.09E-05	4.81E-05
Cenospheres	CENOSPHR	723471.5	4062645	2922.47	5.0	0.017717	3.2605	N/A	4.347333	4.36E-08	1.46E-06	1.95E-06
DFADA Unloading	DFADA_MH	722689	4062225	162430.6	3.0	0.036868	0.202018	13.34084		1.31E-08	1.31E-08	8.62E-07
Cenosphere Unloading	CENOS_MH	723471.5	4062645	2922.47	5.0	0.000552	0.003023	0.199632		1.09E-08	1.09E-08	7.17E-07
DFADA Bulldozing	DFADA_B	722689	4062225	162430.6	3.0	2.401746	1.649551	5.398529		4.25E-07	1.28E-06	4.19E-06
Cenosphere Bulldozing	CENOSP_B	723471.5	4062645	2922.47	5.0	0.031906	0.613582	2.008087		3.14E-07	2.65E-05	8.66E-05

Table 2-7 Emission Rates and Source Parameters for Auxiliary Boiler

	Units	Auxiliary Boiler Stack
UTM-X, Zone 12, NAD83	Meters	724946.16
UTM-Y, Zone 12, NAD83	Meters	4063357.81
Stack Height	Meters	57.912
Base Elevation	Meters	1624.58
Effective Diameter	Meters	1.929
Gas Exit Velocity	m/s	15.24
Stack Gas Exit Temperature	deg K	422.039
24-hour $PM_{10}/PM_{2.5}$ Emission Rate	g/s	0.2772
Annual $PM_{10}/PM_{2.5}$ Emission Rate	g/s	0.0276
1-hour NO_X Emission Rate	g/s	1.008
Annual NO_X Emission Rate	g/s	0.101
Short-term SO_2 Emission Rate	g/s	0.0164
Short-term CO Emission Rate	g/s	1.023

There is a substantial drop with the transfer of coal from the hopper/feeder to the inclined reclaim conveyor (transfer points TP1 and TP7). This height is greater than the typical “drop” height for conveyor-to-conveyor transfers. Consequently, uncontrolled particulate emissions from this atypical transfer point were again first estimated by applying the standard drop equation from AP-42, § 13.2.4.3 and then multiplying the resultant emission rate by an “activity factor” of 10, a subjective, but conservative, approximation of the amount of emissions from this atypical drop compared to the amount from a “standard drop.”

There also are two particulate controls (enclosure and water spray) at the transfer from the hopper/feeder to the inclined reclaim conveyor. The Texas Natural Resource Conservation Commission’s CHEER Manual estimates that control efficiencies for water sprays on transfer points range from 30 percent to 70 percent. Because this drop height is atypical, Navajo Mine conservatively used 30 percent as the control efficiency. This atypical drop is fully enclosed in an underground vault. The CHEER Manual (page 34) identifies 90 percent as the estimated control efficiency for fugitive PM emissions from enclosed transfer points. Combining the efficiencies of the two controls gives a factor of 10 * (1-0.3) * (1-0.9) = 0.7. This factor has been applied as the overall control factor for TP1 and TP7.

The two inclined reclaim conveyors transfer raw coal to the crusher towers where two fully enclosed secondary crushers reduce the size of the coal to meet product specifications. The CHEER Manual identifies 90 percent as the estimated control efficiency for fugitive PM emissions from fully enclosed crushing equipment. In addition to the enclosure, a foam-binder mixture is applied to the coal at the crusher. The CHEER Manual identifies 98 percent as the estimated control for an enclosed crusher with foam addition. Therefore, for crusher emission estimates a control value of 98 percent has been used for emission points TP2/CR1 (CRUSHER1) and TP8/CR2 (CRUSHER2).

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Through a system of transfer towers, conveyors and flop gates, crushed coal is stacked onto one of ten open storage piles. The binder which had been added at the crusher provides residual dust suppression in the stockpiles. The CHEER Manual suggests an estimated control efficiency of 30 percent to 50 percent for stacking operations with "wet" material. A value in the middle of this range, 40 percent, is selected. When the coal is ready to be conveyed to FCPP, it is reclaimed from the appropriate storage piles by two bucket wheel reclaimers which drop the product coal onto collection conveyors that in turn feed two parallel conveyor systems that transport the coal to the north and south surge bins described in Section 2.2.1.2. With the planned shutdown of Units 1, 2, and 3, the future throughput for the Navajo Mine will be 6 million tpy of coal, down from the current 8.2 million tpy of coal.

As described in Section 2.2.4, particulate emissions due to wind erosion of open stockpiles is highly intermittent due to the high threshold wind speeds involved. Consideration of triggering wind events can be accomplished simply by inspection of the available meteorological data, since the onset of windblown dust is based upon threshold friction velocity guidance as listed in AP-42 Section 13.2.5. The threshold velocity for the coal piles has been calculated to be 21.15 m/s. To be conservative, AECOM modeled this source such that the piles generated emissions when the wind speed is greater than 12.49 m/s. Emissions and source parameters are listed in **Tables 2-8** and **2-9**.

2.2.7 Navajo Mine South Sources

Sources in the southern portion of the Navajo Mine will include the mining in the Pinabete permit area, transport of coal from the Pinabete permit area to the coal stockpile, unloading at the pile and loading onto the train, blasting, Pinabete East coal, topsoil and overburden storage piles, and overburden replacement. It is assumed that active mining will occur in two locations within the permit area at any time, labeled as Pinabete East and Pinabete North. Emission factors, control efficiencies, and equipment were supplied by the Navajo Mine. Modeling parameters for these sources are summarized in **Table 2-10** and **Table 2-11**.

2.2.7.1 Proposed Active Mining Sources

Proposed mining in the Pinabete East and Pinabete North areas are characterized as open pit sources consistent with previous modeling for the Navajo Mine performed by Class One Technical Services in July 2011[7]. These sources include mining operations such as: drilling, dragline activity, bulldozing, loading coal into trucks with front end loaders, scraping, road grading and blasting for PM_{10} and $PM_{2.5}$. Coal and overburden blasting also emits CO, NO_X, and SO_2. Emission factors from AP-42 Section 13.3 (1995) were used to calculate emissions, with the exception of SO_2. The Navajo Mine uses ultra-low sulfur diesel fuel in its ammonium nitrate/fuel oil, therefore the SO_2 emissions are significantly less than that cited in the 1995 emission factors. Coal blasting can occur between 11 am and 3 pm, Monday through Friday, and typically occurs 3 times per week. Although all blasting emissions would occur within 1 hour each day and 3 times per week, the full blast emission rate was conservatively modeled in each hour for this 4-hour period each weekday (20 hours per week) to simplify the modeling. Each blast is in a different location in the mine and meteorological conditions will vary, therefore the modeled concentrations are conservative. Over-burden blasting occurs once per month over a larger area and does not occur in the same location twice. Due to the infrequent and unscheduled nature of overburden blasting, it was not included in the modeling based upon guidance for intermittent sources as noted in USEPA's March 1, 2011 memo[5] cited above. The applicable text in the memo is provided in **Appendix B**.

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[7] Class One Technical Services 2011. BNCC Navajo Mine Area 3 and 4 Modeling, Four Corners Area, NM. Environmental Assessment Dispersion Modeling. (July 2011).

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Table 2-8 Emission Rates and Area Source Parameters for Navajo Mine North

Area Source Name	Source ID	UTM E (NAD83)	UTM N (NAD83)	24-hour PM_{10} (g/s/m²)	24-hour $PM_{2.5}$ (g/s/m²)	Annual $PM_{2.5}$ (g/s/m²)	Release Height (m)	X (m)	Y (m)	Angle from North (degrees)
System 2 Hopper	TL2TP7	725565.74	4063328.12	8.65E-05	1.31E-05	1.31E-05	0.305	3.048	29.108	50.35
System 1 Hopper	TL1TP1	725502.93	4063308.44	2.27E-04	3.43E-05	3.43E-05	0.305	3.048	25.908	48.32
Stacker, Hopper, Reclaim	PILES12	725293.99	4063302.39	5.03E-07	7.62E-08	7.62E-08	5.258	59.74	255.118	-41.135
Stacker, Hopper, Reclaim	PILES34	725339.21	4063342.18	5.05E-07	7.65E-08	7.65E-08	5.258	59.741	255.118	-41.135
Stacker, Hopper, Reclaim	PILES56	725384.44	4063381.72	5.06E-07	7.66E-08	7.66E-08	5.258	59.741	255.118	-41.135
Stacker, Hopper, Reclaim	PILES78	725429.36	4063421.55	3.96E-07	6.00E-08	6.00E-08	5.258	59.741	255.118	-41.135
Stacker, Hopper, Reclaim	PILES910	725474.89	4063461.08	5.03E-07	7.61E-08	7.61E-08	5.258	59.741	255.118	-41.135
Piles 1 and 2 Wind Erosion	PILES12W	725293.99	4063302.39	6.58E-05	9.87E-06	2.04E-07	5.258	59.74	255.118	-41.135
Piles 3 and 4 Wind Erosion	PILES34W	725339.21	4063342.18	6.58E-05	9.87E-06	2.04E-07	5.258	59.741	255.118	-41.135
Piles 5 and 6 Wind Erosion	PILES56W	725384.44	4063381.72	6.58E-05	9.87E-06	2.04E-07	5.258	59.741	255.118	-41.135
Piles 7 and 8 Wind Erosion	PILES78W	725429.36	4063421.55	6.58E-05	9.87E-06	2.04E-07	5.258	59.741	255.118	-41.135
Piles 9 and 10 Wind Erosion	PILE910W	725474.89	4063461.08	6.58E-05	9.87E-06	2.04E-07	5.258	59.741	255.118	-41.135

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Table 2-9 Emission Rates and Volume Source Parameters for Navajo Mine North

Area Source Name	Source ID	UTM E (NAD83)	UTM N (NAD83)	24-hour PM_{10} (g/s)	24-hour $PM_{2.5}$ (g/s)	Annual $PM_{2.5}$ (g/s)	Release Height (m)	Sigma-y (m)	Sigma-z (m)
System 1 Crusher	CRUSHER1	725465.23	4063369.75	3.35E-03	2.97E-03	2.97E-03	5.334	2.147	2.481
System 2 Crusher	CRUSHER2	725514.31	4063405.82	1.44E-03	1.27E-03	1.27E-03	4.724	2.147	2.197
Sample Tower	SAMPTWR	725371.61	4063286.30	3.20E-03	4.84E-04	4.84E-04	4.877	1.665	2.268
Tower 1	TOWER1	725358.33	4063274.71	2.56E-03	3.87E-04	3.87E-04	3.658	1.665	1.701
Tower 1A	TOWER1A	725351.83	4063284.89	3.20E-03	4.84E-04	4.84E-04	1.829	1.665	0.851
Tower 2	TOWER2	725394.69	4063320.58	2.56E-03	3.87E-04	3.87E-04	2.896	1.389	1.347
Tower 3	TOWER3	725440.27	4063360.33	1.92E-03	2.90E-04	2.90E-04	2.134	1.205	0.992
Tower 4	TOWER4	725485.86	4063399.14	1.27E-03	1.93E-04	1.93E-04	2.896	1.205	1.347
Tower 5	TOWER5	725531.73	4063438.13	6.39E-04	9.70E-05	9.70E-05	2.134	1.134	0.992
Transfer Point	TP57	725142.02	4063521.53	6.39E-04	9.70E-05	9.70E-05	0.305	0.567	0.284
Transfer Point	TP58	725187.09	4063561.42	6.42E-04	9.70E-05	9.70E-05	0.305	0.567	0.284
Transfer Point	TP59	725232.40	4063600.51	6.43E-04	9.70E-05	9.70E-05	0.305	0.567	0.284
Transfer Point	TP60	725277.33	4063639.60	6.34E-04	9.60E-05	9.60E-05	0.305	0.567	0.284
Transfer Point	TP61	725322.63	4063678.88	6.39E-04	9.70E-05	9.70E-05	0.305	0.567	0.284
Transfer Point	TP62TP70	725246.72	4063613.79	2.56E-03	3.87E-04	3.87E-04	2.134	1.163	1.985
Tower 6	TOWER6	725219.48	4063643.93	2.56E-03	3.87E-04	3.87E-04	2.743	1.205	1.276
Tower 7	TOWER7	725145.94	4063580.78	2.56E-03	3.87E-04	3.87E-04	2.896	1.205	1.347
Flop Gate A/B	FLPGTEAB	725037.56	4063482.96	2.56E-03	3.87E-04	3.87E-04	12.192	1.205	5.671
Drop into N. Surge	NSURGE	725032.78	4063489.34	1.29E-03	1.95E-04	1.95E-04	18.668	1.205	5.671
Drop into S. Surge	SSURGE	725042.53	4063476.62	1.28E-03	1.94E-04	1.94E-04	18.668	1.205	5.671

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Table 2-10 Emission Rates and Source Parameters for Navajo Mine South

Area Source Name	Source ID	Type	UTM E (NAD83)	UTM N (NAD83)	24-hour PM_{10} (g/s/m²)	24-hour $PM_{2.5}$ (g/s/m²)	Annual $PM_{2.5}$ (g/s/m²)	Release Height (m)	X (m)	Y (m)	Pit Volume (m³)	Angle from North (degrees)
Pinabete North Pit Strip	STRIP1	OPENPIT	724454	4039298	2.17E-05	2.65E-06	9.63E-07	4.0	106.4	2490	7935003.8	-1.45
Pinabete East Pit Strip	STRIP2	OPENPIT	720558.9	4042970	2.17E-05	2.65E-06	9.63E-07	4.0	2943.6	90	7934632.8	-2.01
Lowe Coal Pile Wind Erosion	COALPILE	AREA	721204.7	4046534	7.07E-05	1.06E-05	2.19E-07	2.0	190	1160	N/A	0
Lowe Coal Pile Loading/Unloading	COALPLLU	AREA	721204.7	4046534	1.63E-06	5.11E-07	9.03E-08	2.0	190	1160	N/A	0
Pinabete East Coal Pile Wind Erosion	PECOALPL	AREA	725126.4	4040367	5.99E-05	8.99E-06	2.26E-07	2.0	Multiple Vertices		N/A	0
Pinabete East Coal Pile Loading/Unloading	PECOALLU	AREA	725126.4	4040367	7.56E-07	2.38E-07	4.20E-08	2.0			N/A	0
Topsoil Pile – 401	TS401	AREA	721972.5	4044056	1.65E-05	1.24E-05	3.68E-07	2.0			N/A	0
Topsoil Pile – 402	TS402	AREA	722961.3	4043802	1.65E-05	1.24E-05	3.68E-07	2.0			N/A	0
Topsoil Pile – 403	TS403	AREA	720134.4	4042462	1.65E-05	1.24E-05	3.68E-07	2.0	333.29	97.25	N/A	-91.521
Topsoil Pile – 404	TS404	AREA	723882.4	4038611	1.65E-05	1.24E-05	3.68E-07	2.0	Multiple Vertices		N/A	0
Topsoil Pile – 405	TS405	AREA	723236.3	4043504	1.65E-05	1.24E-05	3.68E-07	2.0			N/A	0
Topsoil Pile – 406	TS406	AREA	724090.6	4042605	1.65E-05	1.24E-05	3.68E-07	2.0			N/A	0
Pinabete Overburden Pile	PBOVRBDN	AREA	722347.8	4040635	1.87E-05	2.81E-06	1.12E-08	2.0	586.74	807.7	N/A	-2.01
Pinabete North Reclamation	PNRECLAM	AREA	723210.3	4043269	2.21E-06	3.32E-07	1.33E-08	2.0	274.932	2208	N/A	-91.85
Pinabete East Reclamation	PERECLAM	AREA	724670.8	4039508	2.21E-06	3.32E-07	1.33E-08	2.0	274.932	2208	N/A	-1.28

Table 2-11 Emission Rates and Source Parameters for Navajo Mine South Road Sources

Road Name	Road ID	# Volumes	24-hour PM_{10} g/s/ volume	24-hour $PM_{2.5}$ g/s/ volume	Annual $PM_{2.5}$ g/s/ volume	Release Height (m)	Sigma -Y (m)	Sigma-Z (m)
Lowe Coal Pile to Split	LOWESPLT	101	4.795E-02	1.016E-02	3.953E-03	5.64	13.95	2.23
Split to Pinabete North	SPLT2PN	202	2.448E-02	5.190E-03	1.995E-03	5.64	13.95	2.23
Split to Pinabete East	SPLT2PE	215	2.346E-02	4.973E-03	1.957E-03	5.64	13.95	2.23

In the case of overburden blasting at the mine, this event occurs only 1 hour per month, and not in the same location ever. Given that there is only one emission event per year from any given location, this intermittent event cannot contribute significantly to affect meeting the NAAQS for any standard, even the annual distribution of daily maximum 1-hour concentrations for either the NO_2 or SO_2 NAAQS. This is true not only due to the non-stationary aspect of the source, but also because the 1-hour NAAQS is a statistical standard that would involve a number of different days of emissions as well as the fact that the wind would not be expected blow in the same direction each emission event.

2.2.7.2 Vehicular Traffic

Traffic from coal haul trucks, watering trucks, scrapers, end dump trucks, and pick-up trucks on the roads between the active mining areas and the Lowe coal stock pile are characterized in the modeling. The roads are represented in the model as discussed in Section 2.2.3. Traffic between the mining areas and the stockpile can occur 24 hours per day. Watering trucks apply water to the unpaved roads to control fugitive dust. A Chemical suppressant also is applied to major unpaved roads annually.

2.2.7.3 Stockpiles and Wind Erosion

Coal from the active mining areas is transported and unloaded onto the Pinabete East or Lowe stockpile and compacted using bulldozers. Unloading and bulldozing activities occur 24 hours per day. The coal is loaded from the PE pile by truck to the Lowe coal pile or from the Lowe pile onto a train for transport to the Navajo Mine Coal Preparation Plant. As described in Section 2.2.4, wind erosion from stock piles is highly intermittent due to the high threshold wind speeds involved. Consideration of triggering wind events can be accomplished simply by inspection of the available meteorological data, since the onset of windblown dust is based upon threshold friction velocity guidance as listed in AP-42 Section 13.2.5. Using the AP-42 approach, the threshold velocity for wind erosion of the field stockpiles is estimated to be 21.15 m/s. To be conservative, AECOM modeled this source such that the piles generated emissions when the wind speed is greater than 12.49 m/s (the highest default wind speed category in AERMOD).

Wind erosion from over-burden and topsoil storage and reclaim piles are also calculated using AP-42 Section 13.2.5. The threshold velocity for the over-burden, topsoil, and reclaim piles is 19.25 m/s. To be conservative, AECOM modeled these sources such that the piles generate emissions when the wind speed is greater than 12.49 m/s (the highest default wind speed category in AERMOD).

Figures 2-2 and **2-3** show the configurations of the FCPP/Navajo Mine North and Navajo Mine South sources, respectively.

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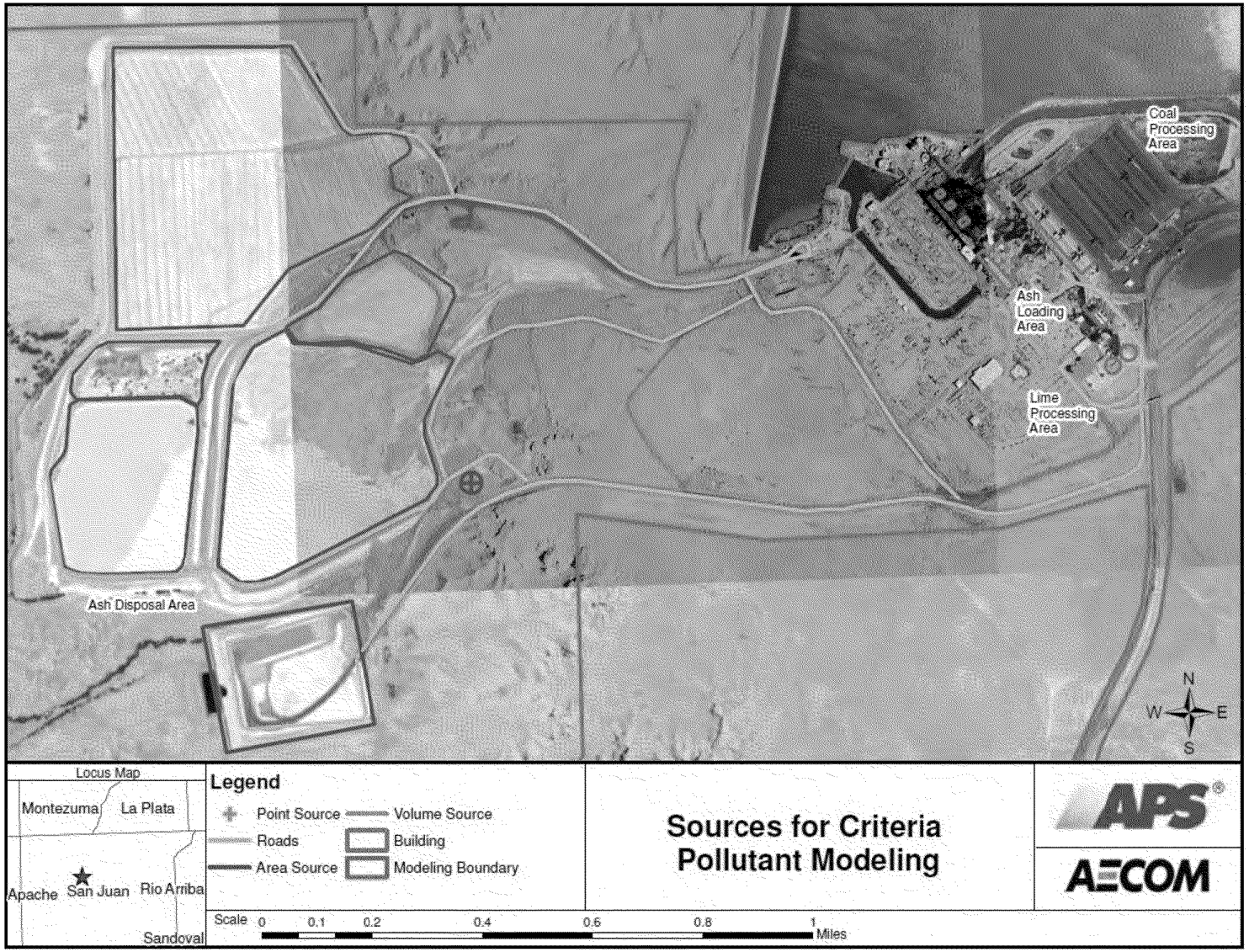

Figure 2-2 FCPP/Navajo Mine North Source Locations

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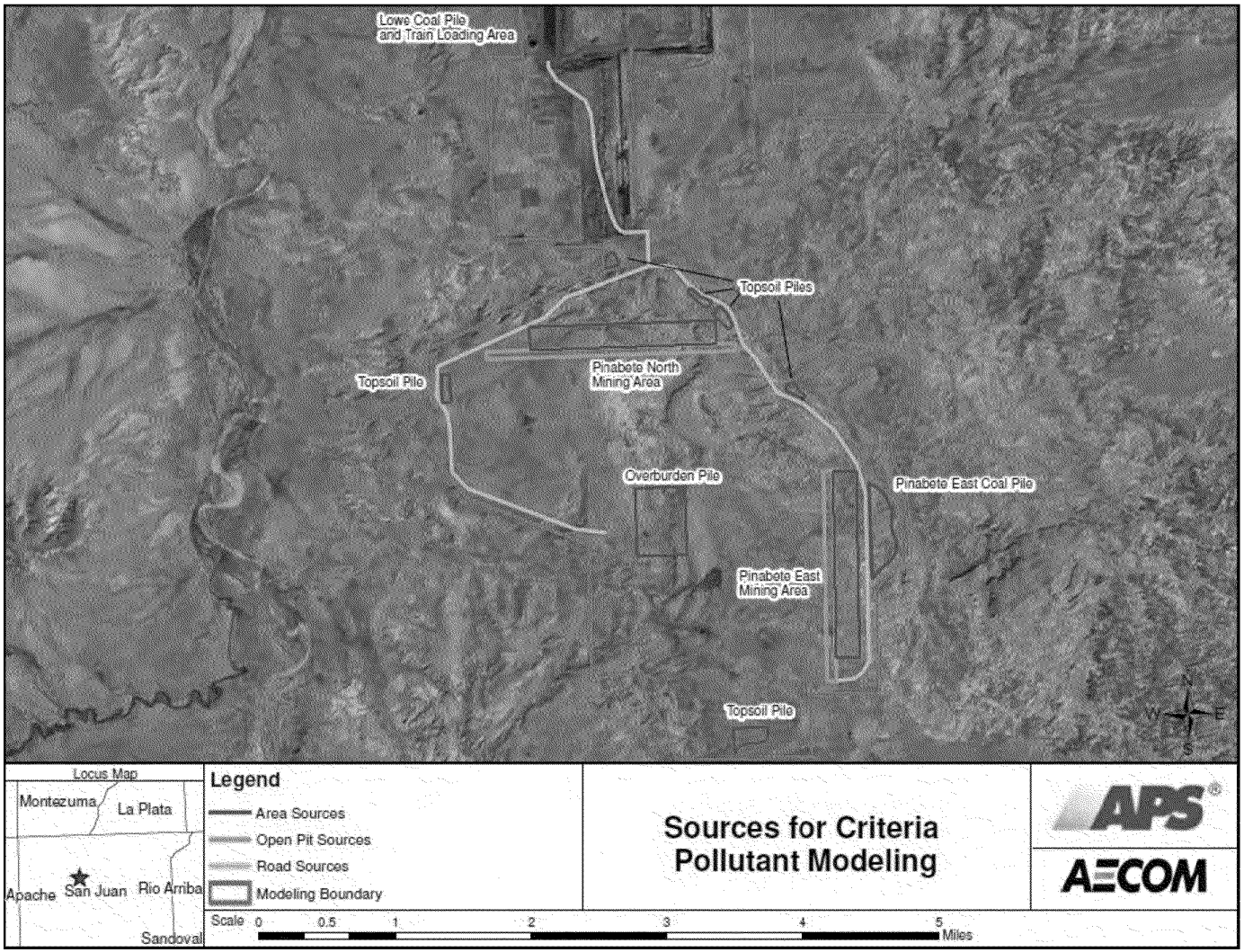

Figure 2-3 Navajo Mine South Source Locations

3.0 Modeling Procedures

The dispersion modeling analyses conducted for the FCPP and Navajo Mine are based on certain procedures referenced in the USEPA "Guideline on Air Quality Models" (GAQM, which is contained in 40 CFR Part 51, Appendix W) (USEPA 2005)[8]. USEPA is currently considering procedures for determining compliance with the 1-hour SO_2 NAAQS, and suggestions provided in the previously mentioned February 7, 2013 draft guidance[4] also have been considered for this analysis. The following sections present the procedure for assessing whether the FCPP meets the NAAQS and the standards to which the predicted impacts are compared.

3.1 Model Selection

The suitability of an air quality dispersion model for a particular application is dependent upon several factors. The following selection criteria were evaluated:

- Stack height relative to nearby structures;
- Dispersion environment;
- Local terrain; and
- Representative meteorological data.

The USEPA GAQM prescribes a set of approved models for regulatory applications for a wide range of source types and dispersion environments. Based on a review of the factors discussed below, the latest version of AERMOD (version 13350)[9] is used to assess whether the FCPP and Navajo Mine meet the NAAQS.

3.1.1 Low Wind Speed Improvements for AERMOD

In 2010, the results of an evaluation[10] of low wind speed databases for short-range modeling applications were provided to USEPA. The reason for the study was that some of the most restrictive dispersion conditions and the highest model predictions occur under low wind speed conditions, but there had been very little model evaluation for these conditions. The results of the evaluation indicated that in low wind conditions, the friction velocity formulation in AERMOD results in under-predictions of this important planetary boundary layer parameter. There were multiple outcomes of this under-prediction: mechanical mixing heights that were very low (less than 10 meters), very low effective dilution wind speeds, and very low turbulence in stable conditions. In addition, the evaluation study concluded that the minimum lateral turbulence (as parameterized using sigma-v) was too low by at least a factor of 2.

After these issues were once again stated at the 10th USEPA Modeling Conference in March 2012, USEPA made some revisions in late 2012 to the AERMOD[11] modeling system to correct the model deficiencies in this area. This culminated in USEPA releasing AERMET and AERMOD Versions 12345, which include "beta" options in AERMET for a revised u_* formulation under stable conditions and two

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[8] USEPA 2005. Guideline on Air Quality Models (Revised). Codified in the Appendix W to 40 CFR Part 51. (November 2005).

[9] USEPA 2004a. User's Guide for the AMS/EPA Regulatory Model (AERMOD). EPA-454/B-03-001 (September 2004 – Addendum December 2013).

[10] Paine, R.J., J.A. Connors, and C.D. Szembek. AERMOD Low Wind Speed Evaluation Study: Results and Implementation. Paper 2010-A-631-AWMA, presented at the 103rd Annual Conference, Air & Waste Management Association, Calgary, Alberta, Canada. 2010.

[11] USEPA 2004b. User's Guide for the AERMOD Meteorological Preprocessor (AERMET). (EPA-454/B-03-002, November 204 – Addendum December 2012)

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different low wind speed options in AERMOD. These updates are included in AERMET and AERMOD versions 13350, as well. During the USEPA webinar[12] on January 14, 2014, USEPA staff stated that they are generally in favor of the AERMET beta u* option as it is based on peer-reviewed activities.

Because the beta options constitute a non-guideline application of AERMOD, an alternative model demonstration has been provided for justification of the use of the beta option. This discussion is provided in **Appendix C**.

3.1.2 Plume Depletion and Secondary Particulate Modeling

To be consistent with previous modeling performed by Class One Technical Services for the Navajo Mine[13], AECOM modeled PM_{10} and $PM_{2.5}$ emission sources using the plume depletion option. Plume depletion simulates the deposition of particles form the plume to the ground as the plume travels. Therefore, the farther the plume travels from the emission point to the receptor, the greater the effect of plume depletion. Particle size distribution, particle mass fraction and particle density are required inputs to AERMOD for this option.

The particle size distribution data used in AERMOD for the material handling sources are based on data from the City of Albuquerque Air Quality Bureau (CAQB) "Air Dispersion Modeling Guidelines for Air Quality Permitting" (01/21/10, Table 1)[14]. Particle size distribution for paved and unpaved roads were obtained from the particle size *k* factors found in the AP-42 13.2.1 and 13.2.2 emission equations for paved and unpaved roads, respectively. Particle size distribution for combustion emissions assumes all particles are less than 10 micrograms (µm).

The mass-mean particle diameter was calculated using the formula below:

$$d = ((d^3_1 + d^2_1 d_2 + d_1 d^2_2 + d^3_2) / 4)^{1/3}$$

Where: d = mass-mean particle diameter

d_1 = low end of particle size category range

d_2 = high end of particle size category range

An average particle density for soil is 2.5 g/cm³ as obtained from the "Handbook of Chemistry and Physics," published by the CRC. The size distribution and densities are summarized in **Tables 3-1** and **3-2**.

PM modeling results are dominated by near-surface releases, which are composed primarily of direct PM emissions and have minimal precursor PM emissions. Secondary PM emissions from the FCPP stack are already accounted for in the conservative background monitoring concentration. Note that with future emission reductions at FCPP and area-wide sources, the secondary PM emission component that is part of the background concentration will be reduced, so the current background overestimates this future component of PM concentrations.

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[12] USEPA 2014. Webinar: AERMOD Modeling System Update. (January 14, 2014). https://epa.connectsolutions.com/p166mjb0h19/?launcher=false&fcsContent=true&pbMode=normal . [Accessed 1/23/2014].

[13] Class One Technical Services 2011. BNCC Navajo Mine Area 3 and 4 Modeling, Four Corners Area, New Mexico. Environmental Assessment Dispersion Modeling (July 2011).

[14] CAQB 2010. Air Dispersion Modeling Guidelines for Air Quality Permitting. (January 21, 2010). http://www.cabq.gov/airquality/documents/pdf/agd_model_guidelines.pdf . [Accessed 11/15/2012].

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Table 3-1 Material Handling Depletion Parameters

Particle Size Category (µm)	Mass Mean Particle Diameter (µm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
2.5 – 5	3.88	22.6	2.5
5 – 10	7.77	77.4	2.5

Table 3-2 Vehicle Fugitive Dust Depletion Parameters

Particle Size Category (µm)	Mass Mean Particle Diameter(µm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
0 – 2.5	1.57	10.0	2.5
2.5 – 10	6.92	90.0	2.5

3.2 Meteorological Data for AERMOD

There are several factors that need to be weighed when selecting the source of meteorological data to be used in a dispersion modeling study. For AERMOD, the most important factor to consider is site representativeness with respect to terrain considerations and land use between the AERMOD application site and the meteorological measurement site, as these parameters potentially have a large effect on the predominant wind direction and boundary layer parameterization of the meteorological inputs into AERMOD. Other factors such as data capture, quality of data, elevation differences, and distance from the measurement site and the application site need also to be considered. For this application, since the meteorological measurements come from a meteorological tower less than 4 kilometers from the FCPP, site representativeness is not in question. Therefore, the meteorological data processing discussion is focused on data capture and quality of data.

Meteorological data required for AERMOD include hourly values of wind speed, wind direction, and ambient temperature. Since the AERMOD dispersion algorithms are based on atmospheric boundary layer dispersion theory, additional boundary layer variables are derived by parameterization formulas, which are computed by the AERMOD meteorological preprocessor, AERMET. These parameters include sensible heat flux, surface friction velocity, convective velocity scale, vertical potential temperature gradient, convective and mechanical mixing heights, Monin-Obukhov length, surface roughness length, Bowen ratio, and albedo.

3.2.1 Available Meteorological Data

The AERMOD modeling for FCPP and Navajo Mine was conducted with data available from nearby 10-meter meteorological towers, referred to as Navajo Met Tower 1, 2, and 3. The database was provided by APS and Navajo Mine and is of sufficient quality for air dispersion modeling applications. The data and instrumentation are routinely maintained to the quality that would be required for modeling in support of a New Source Review permit according to USEPA's ambient monitoring guidance.

The locations of Navajo Met Towers 1, 2, and 3 are shown in **Figure 2-1**. The meteorological towers include an instrumented 10-meter meteorological tower. Specifically, the tower records the following measurements (all at 10 meters except for precipitation):

1. Wind speed
2. Wind direction
3. Sigma Theta (standard deviation of the wind direction)

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4. Temperature
5. Relative Humidity
6. Precipitation

The 5 years of meteorological data chosen for this analysis were April 2006 through March 2011. Temperature data for Navajo Met 1 in 2007 did not meet USEPA's ambient monitoring guidance relative to quarterly data capture (as shown in **Table 3-3** in red); therefore, temperature data from Navajo Met 2 was substituted for this period. Navajo Met 3 data meets the guidance relative to quarterly data capture for all parameters in all quarters used in in the modeling (April 2006 through March 2011) shown in **Table 3-4**. The last quarter of 2011 data, shown in red in **Table 3-4**, was not used because it did not meet the guidance.

Upper air data for the concurrent period was obtained from Albuquerque International Airport, New Mexico. The Albuquerque upper air data was provided by Eric Peters of New Mexico Environment Department (NMED). The missing wind speed and direction data were not filled given the low number of missing hours. Variables not available from the Navajo Met Tower 1 (such as cloud cover) were taken from the Farmington Regional Airport, New Mexico.

Table 3-3 Data Capture for Navajo Met 1

Quarter	10-meter Wind Speed	10-meter Wind Direction	10-meter Sigma-Theta	10-meter Temperature	EPA Threshold
2006					
1st Qtr	100%	100%	100%	100%	90%
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	96%	96%	96%	93%	90%
2007					
1st Qtr	95%	95%	95%	95%	90%
2nd Qtr	100%	100%	100%	44%	90%
3rd Qtr	100%	100%	100%	64%	90%
4th Qtr	93%	100%	100%	100%	90%
2008					
1st Qtr	100%	100%	100%	100%	90%
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	100%	100%	100%	100%	90%
2009					
1st Qtr	100%	100%	100%	100%	90%
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	100%	100%	100%	100%	90%

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Table 3-3 Data Capture for Navajo Met 1

Quarter	10-meter Wind Speed	10-meter Wind Direction	10-meter Sigma-Theta	10-meter Temperature	EPA Threshold
2010					
1st Qtr	100%	100%	100%	100%	90%
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	100%	100%	100%	100%	90%
2011					
1st Qtr	100%	100%	100%	100%	90%
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	100%	100%	100%	100%	90%

Table 3-4 Data Capture for Navajo Met III

Quarter	10-meter Wind Speed	10-meter Wind Direction	10-meter Sigma-Theta	10-meter Temperature	EPA Threshold
2006					
1st Qtr	N/A	N/A	N/A	N/A	90%
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	100%	100%	100%	100%	90%
2007					
1st Qtr	99%	99%	99%	99%	90%
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	100%	100%	100%	100%	90%
2008					
1st Qtr	98%	100%	100%	100%	90%
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	100%	100%	100%	100%	90%
2009					
1st Qtr	96%	96%	96%	96%	90%

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Table 3-4 Data Capture for Navajo Met III

Quarter	10-meter Wind Speed	10-meter Wind Direction	10-meter Sigma-Theta	10-meter Temperature	EPA Threshold
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	100%	100%	100%	100%	90%
2010					
1st Qtr	100%	100%	100%	100%	90%
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	100%	100%	100%	100%	90%
2011					
1st Qtr	100%	100%	100%	100%	90%
2nd Qtr	100%	100%	100%	100%	90%
3rd Qtr	100%	100%	100%	100%	90%
4th Qtr	77%	77%	77%	77%	90%

Table 3-5 Meteorological Data Used in Running AERMET

Met Site	Latitude	Longitude	Base Elevation (m)	Data Source	Data Format
Albuquerque International Airport, New Mexico	35.05N	106.62W	1619.0	NMENV	FSL
Farmington Regional Airport, New Mexico	36.744N	108.229W	1678.0	NMENV	ISHD
Navajo Met 1 Monitoring Station, New Mexico	36.680N	108.450W	1646.0	APS/Navajo Mine	Free Format
Navajo Met 3 Monitoring Station, New Mexico	36.499N	108.512W	1656.6	APS/Navajo Mine	Free format

3.2.2 AERMET Processing

The 5 years of hourly surface meteorological data from Navajo Met Tower 1 and 3 along with concurrent upper air data from Albuquerque International Airport, New Mexico, were processed with AERMET (USEPA 2013) with the beta option discussed above. **Table 3-5** gives site locations and information on these data sets.

AECOM utilized the latest version of AERMET (13350), the meteorological preprocessor, to create AERMOD-ready meteorological inputs. Since wind data from Farmington Regional Airport, New Mexico, is not being substituted during Stage 3 of the AERMET processing, the incorporation of 1-minute

Automated System Observing Station data from Farmington and AERMINUTE is not necessary for this application.

AERMET creates two output files for input to AERMOD:

- SURFACE: a file with boundary layer parameters such as sensible heat flux, surface friction velocity, convective velocity scale, vertical potential temperature gradient in the 500-meter layer above the planetary boundary layer, and convective and mechanical mixing heights. Also provided are values of Monin-Obukhov length, surface roughness, albedo, Bowen ratio, wind speed, wind direction, temperature, and heights at which measurements were taken.
- PROFILE: a file containing multi-level meteorological data with wind speed, wind direction, temperature, sigma-theta (σ_θ) and sigma-w (σ_w) when such data are available. For this application involving representative data from the nearest National Weather Service station, the PROFILE file will contain a single level of wind data (10.0 meters) and the temperature data (2 meters).

The AERMOD Implementation Guide (AIG) recommends that the surface characteristics be determined based on digitized land cover data. USEPA has developed a tool called AERSURFACE (USEPA 2008a)[15] that can be used to determine the site characteristics based on digitized land cover data in accordance with the recommendations from the AIG discussed above. AERSURFACE incorporates look-up tables of representative surface characteristic values by land cover category and seasonal category. AERSURFACE will be applied with the instructions provided in the AERSURFACE User's Guide.

AECOM utilized AERSURFACE (Version 13016) which supports the use of land cover data from the U.S. Geological Survey (USGS) National Land Cover Data 1992 archives[16] (NLCD92). The NLCD92 archive provides data at a spatial resolution of 30 meters based upon a 21-category classification scheme applied over the continental U.S. The AIG recommends that the surface characteristics be determined based on the land use surrounding the site where the surface meteorological data were collected, in this case around Navajo Met Tower 1 and 3.

As recommended in the AIG for surface roughness, the 1-km radius circular area centered at the meteorological station site can be divided into sectors for the analysis; each chosen sector has a mix of land uses that is different from that of other selected sectors. Sectors used to define the meteorological surface characteristics for Navajo Met 1 and 3 are shown in **Figures 3-1** and **3-2**.

In AERSURFACE, the various land cover categories are linked to a set of seasonal surface characteristics. As such, AERSURFACE requires specification of the seasonal category for each month of the year. The following five seasonal categories are supported by AERSURFACE, with the applicable months of the year specified for this site.

- Mid-summer with lush vegetation (June-September);
- Autumn with un-harvested cropland (October-November);
- Late autumn after frost and harvest, or winter with no snow (December – March);
- Winter with continuous snow on ground (none); and
- Transitional spring with partial green coverage or short annuals (April – May).

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[15] USEPA 2013a. AERSURFACE User's Guide. (EPA-454/B-08-001, January 2013). Office of Air Quality Planning and Standards, Research Triangle Park, NC.

[16] USGS 1992. USGS Landcover Institute. http://edcftp.cr.usgs.gov/pub/data/landcover/states/ [Accessed 07/15/2012]

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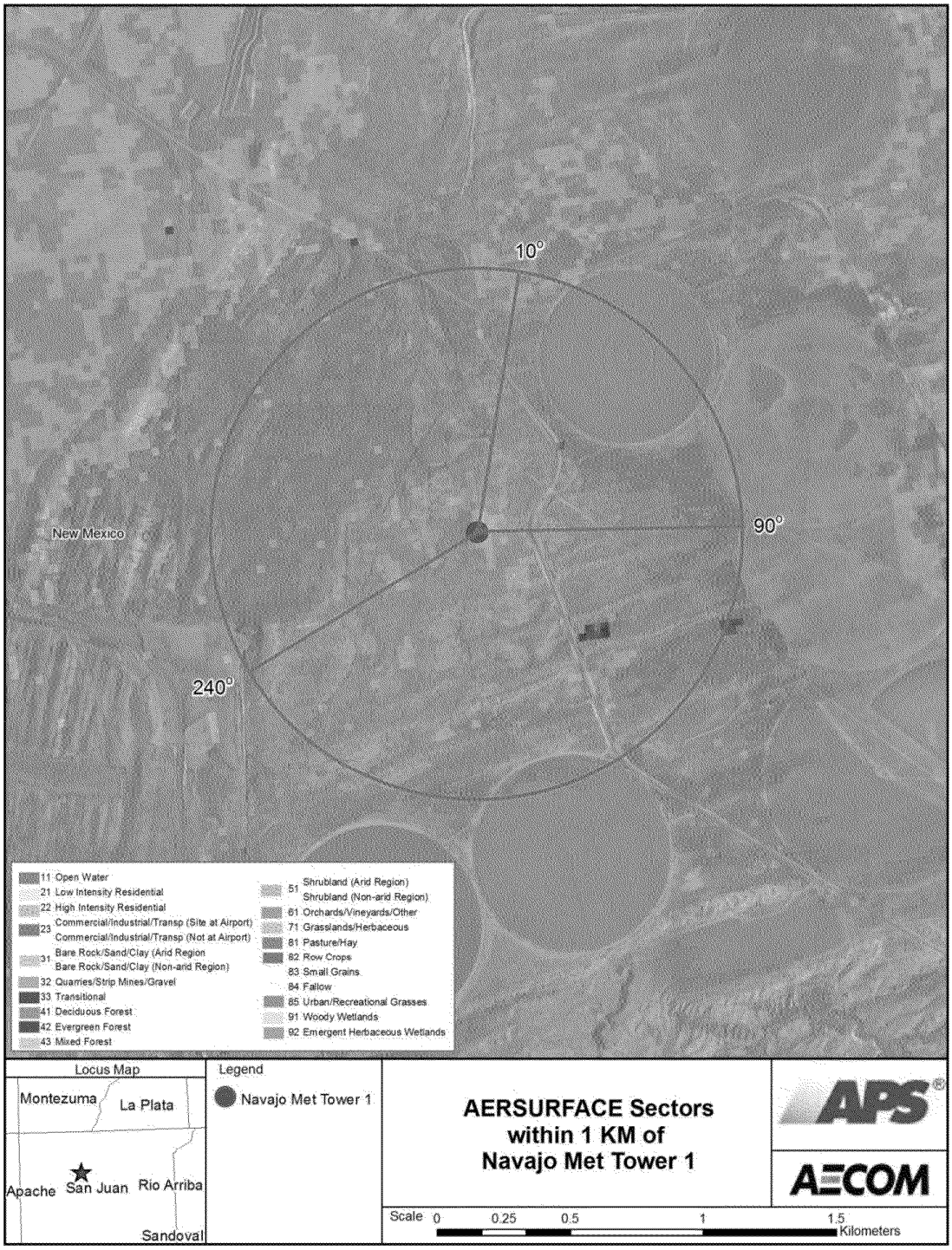

Figure 3-1 Land Use Sectors for Navajo Met 1

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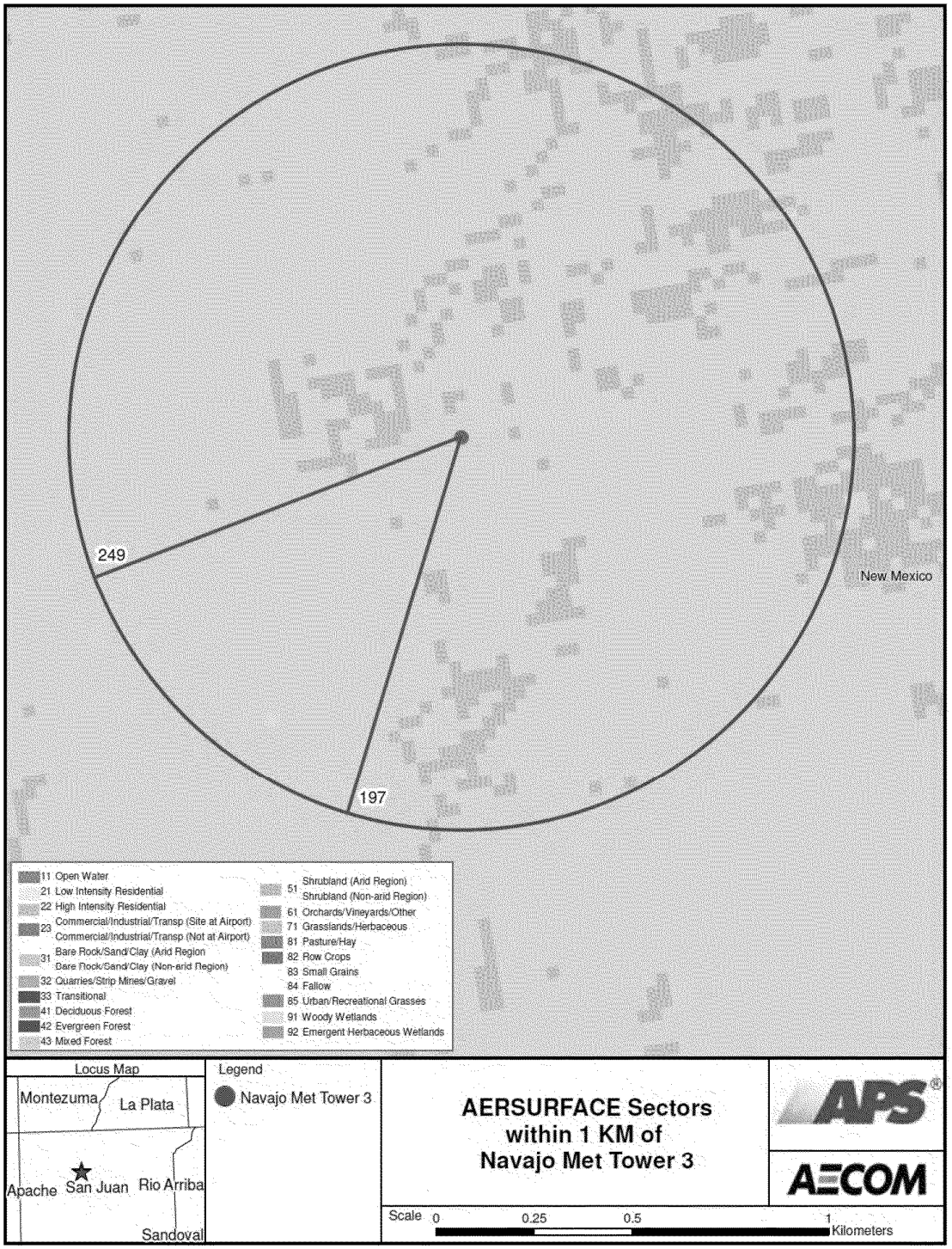

Figure 3-2 Land Use Sectors for Navajo Met 3

For Bowen ratio, the land use values are linked to three categories of surface moisture corresponding to average, wet and dry conditions. The surface moisture condition for the site may vary depending on the meteorological data period for which the surface characteristics will be applied. AERSURFACE applies the surface moisture condition for the entire data period. Therefore, if the surface moisture condition varies significantly across the data period, then AERSURFACE can be applied multiple times to account for those variations. As recommended in AERSURFACE User's Guide, the surface moisture condition for each month is determined by comparing precipitation for the period of data to be processed to the 30-year climatological record, selecting "wet" conditions if precipitation is in the upper 30th-percentile, "dry" conditions if precipitation is in the lower 30th-percentile, and "average" conditions if precipitation is in the middle 40th-percentile. The 30-year precipitation data set used in this modeling is taken from Farmington Regional Airport, New Mexico. **Appendix D** contains the 30 years of monthly precipitation data obtained from National Climatic Data Center. The 30-year period of record used to establish the 30-year average monthly precipitation totals include 1981 through 2010.

The monthly designations of surface moisture input to AERSURFACE are summarized in **Table 3-6**. Wind roses for Navajo Met 1 and Navajo Met 3 are shown in **Figures 3-3** and **3-4**.

Table 3-6 AERSURFACE Bowen Ratio Condition Designations

Month	2005	2006	2008	2009	2010
Jan	Wet	Average	Wet	Average	Wet
Feb	Wet	Dry	Average	Average	Wet
Mar	Average	Wet	Dry	Average	Average
Apr	Wet	Average	Dry	Average	Average
May	Average	Dry	Average	Wet	Dry
Jun	Average	Average	Average	Wet	Average
Jul	Average	Wet	Dry	Dry	Average
Aug	Wet	Dry	Wet	Dry	Wet
Sep	Dry	Wet	Dry	Dry	Average
Oct	Average	Wet	Average	Average	Average
Nov	Dry	Dry	Average	Average	Dry
Dec	Dry	Wet	Wet	Average	Wet

3.3 Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height analysis[17] was performed based on the current geometry of stacks and buildings at the FCPP to determine the potential for building-induced aerodynamic downwash for all modeled stacks. The analysis procedures described in USEPA's Guidelines for Determination of Good Engineering Practice Stack Height (USEPA 1985), Stack Height Regulations (40 CRF 51), and current Model Clearing house guidance was used.

[17] USEPA 1985. Guideline for the Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) – Revised. EPA-450/4-80-023R, USEPA, Research Triangle Park, NC 27711.

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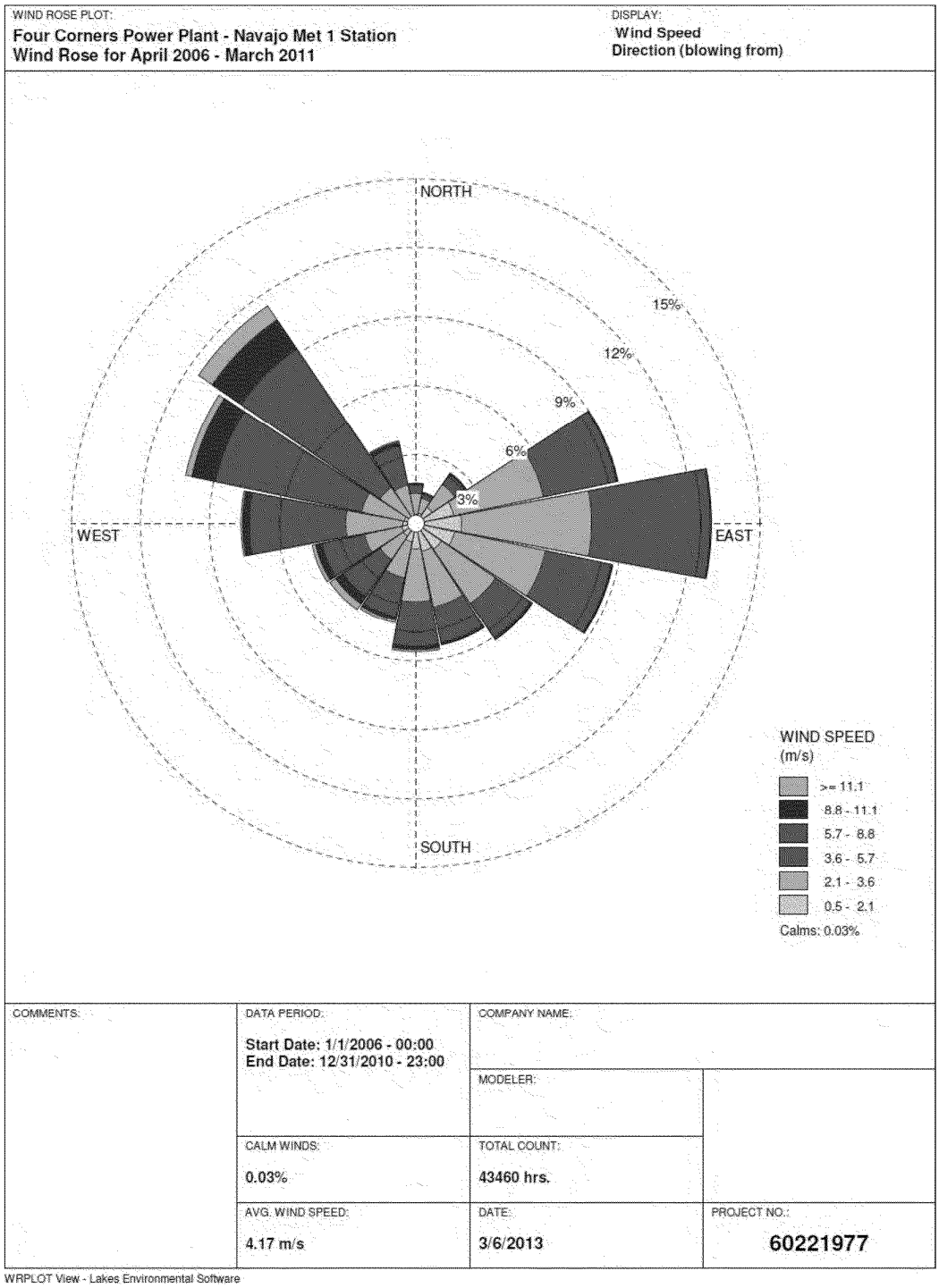

Figure 3-3 Wind Rose for Navajo Met 1 Station

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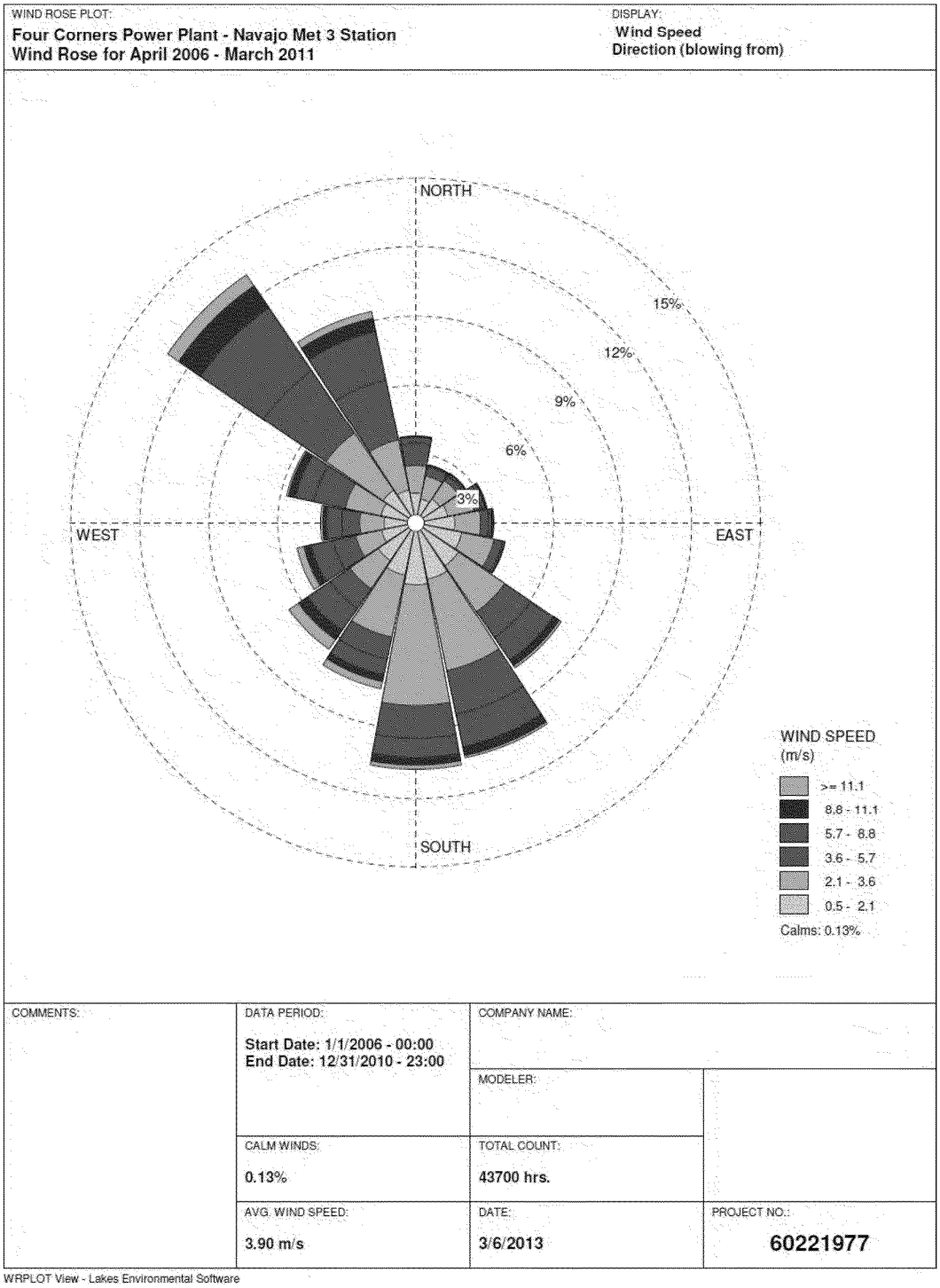

Figure 3-4 Wind Rose for Navajo Met 3 Station

The GEP formula height is based on the observed phenomena of disturbed atmospheric flow in the immediate vicinity of a structure resulting in higher ground level concentrations at a closer proximity to the building than would otherwise occur. It identifies the minimum stack height at which significant aerodynamic downwash is avoided. The GEP formula stack height, as defined in the 1985 final regulations, is calculated from:

$$H_{GEP} = H_{BLDG} + 1.5L$$

Where:

- H_{GEP} is the maximum GEP stack height;
- H_{BLDG} is the height of the nearby structure; and
- L is the lesser dimension (height or projected width) of the nearby structure.

For a squat structure, i.e., height less than projected width, the formula reduces to:

$$H_{GEP} = 2.5H_B$$

Both the height and width of the structure are determined from the frontal area of the structure projected onto a plane perpendicular to the direction of the wind. In all instances, the GEP stack height is based on the plane projections of any nearby building which result in the greatest justifiable height. For purposes of the GEP analysis, nearby refers to the “sphere of influence,” defined as five times the height or width of the building, whichever is less, downwind from the trailing edge of the structure. In the case where a stack is not influenced by nearby structures, the maximum GEP stack height is defined as 65 meters.

The Units 4 and 5 dual-flue stack and other point sources at the FCPP are all greater than 65 meters, but are all below the GEP formula stack height based on the formula shown above. As such, all stacks are modeled with their actual stack height. In addition, the USEPA’s Building Profile Input Program (BPIP-Version 04274) version that is appropriate for use with PRIME algorithms in AERMOD is used to incorporate downwash effects in the model for all modeled stacks. The building dimensions of each structure are input in BPIPPRM program to determine direction specific building data. PRIME addresses the entire structure of the wake, from the cavity immediately downwind of the building, to the far wake. **Figure 3-5** shows the buildings and stacks input to BPIPPRM and included in AERMOD.

3.4 Receptor Grid and AERMAP Processing

The receptor grid developed for the FCPP and Navajo Mine NAAQS modeling consists of the following levels in a Cartesian grid:

- 100-meter spacing out to 2 kilometers;
- 250-meter spacing out to 3 kilometers;
- 500-meter spacing out to 5 kilometers;
- 1,000-meter spacing out to 10 kilometers; and
- 3,000-meter spacing out to 15 kilometers for $PM_{2.5}$ and PM_{10}, 30 kilometers for all other pollutants.

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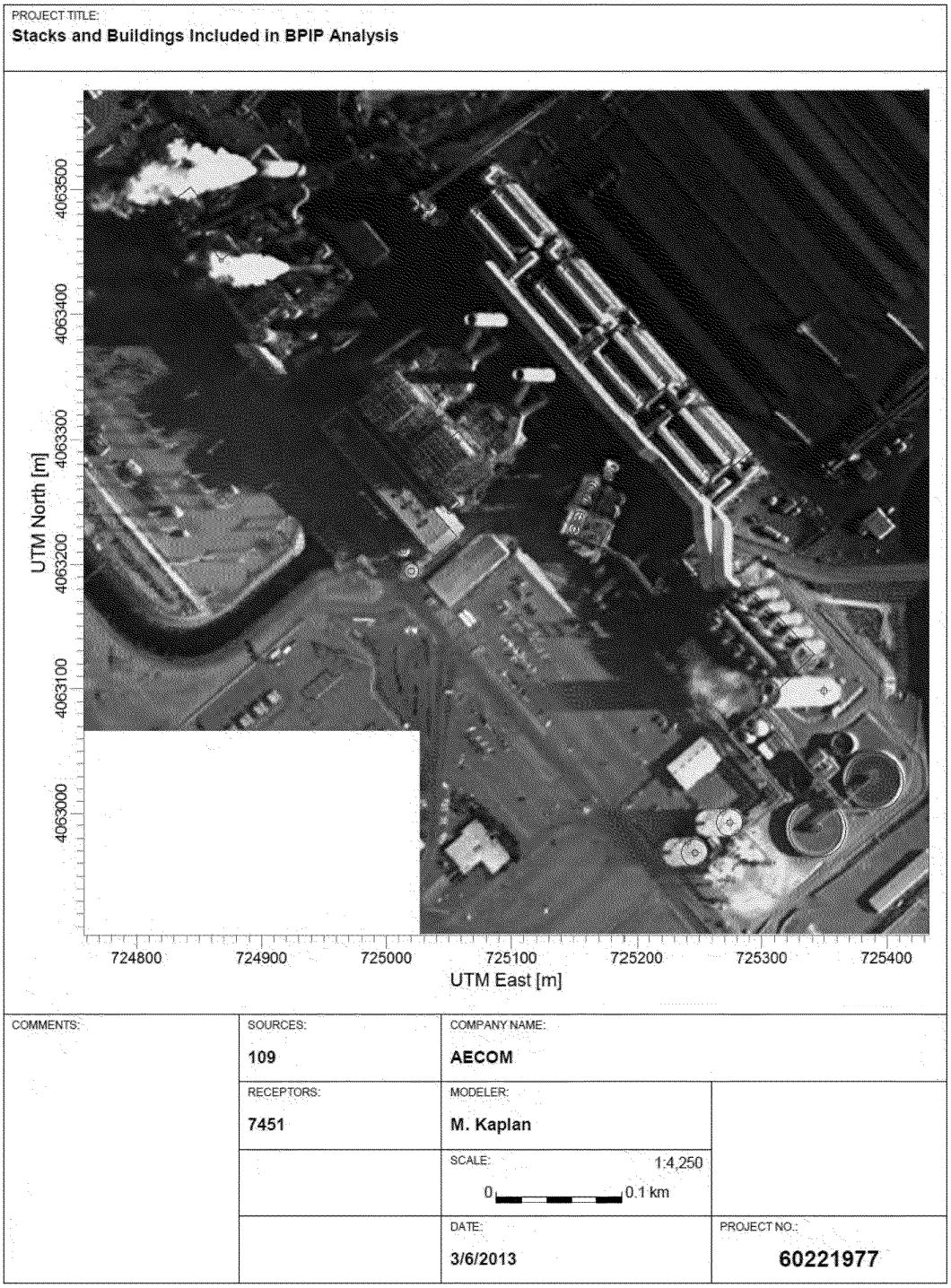

Figure 3-5 Buildings and Stacks Included in GEP Analysis

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In addition, receptors spaced at 50 meters were placed along the FCPP and Navajo Mine boundary and also were placed at 100-meter spacing on the high-terrain Hogback Ridge in areas where the terrain elevations were equal to or greater than stack top (5,660 feet/1,724 meters). The receptor grid used in the modeling analysis is based on NAD 83 datum and in UTM Zone 12.

The extent of this grid was sufficient to capture maximum impacts near the FCPP. To refine the levels of the peak predictions, 100-meter spaced receptors were used to resolve the highest concentrations if the receptor spacing was more than 100-meter at the maximum impact locations. **Figures 3-6** and **3-7** show the locations of the near- and far-field receptors for the FCPP and Navajo Mine NAAQS modeling.

AERMAP (version 11103) (USEPA 2004c)[18], AERMOD terrain preprocessor program, was used to calculate terrain elevations and critical hill heights for the modeled receptors (NAD83 datum and Zone 12) using National Elevation Data (NED)[19]. The dataset downloaded from the USGS website consists of 1 arc second (~30-meter resolution) NED. As per the AERMAP User's Guide (USEPA 2004a), the domain is sufficient to ensure that all significant nodes are included such that all terrain features that exceed a 10 percent elevation slope from any given receptor are considered.

3.5 Class II Area Modeling Analyses

A refined modeling analysis was conducted using AERMOD (version 13350) in default mode with beta AERMET option to determine whether the FCPP and Navajo Mine meets the NAAQS. Impacts from sources other than FCPP and the Navajo Mine and the use of monitoring data are discussed in Section 4. The modeled concentrations for the NAAQS modeling (that were added to regional background values for the total concentration) were calculated as follows:

- For lead, a rolling 3-month average was compared to the NAAQS[20].
- The short-term modeled concentrations of PM_{10} (24-hour) was based on the highest sixth highest (H6H) concentrations over all the modeled receptors and 5 years of meteorological data. The FCPP and Navajo North sources were modeled with Navajo Met I and the Navajo South sources were modeled with Navajo Met III at all receptors. The H6H at each receptor from each model run were summed for the total modeled impact.
- The 24-hour $PM_{2.5}$ modeled concentration was based on highest ranked modeled concentration at each receptor per year averaged over 5 years per the March 23, 2010 memo issued by USEPA/Stephen Page. This procedure has been recently proposed to be replaced by USEPA's draft $PM_{2.5}$ modeling procedures posted on March 4, 2013[21]. In that draft guidance, USEPA indicates that the 98th percentile modeled 24-hour concentration should be added to the 98th percentile background concentration when emissions are largely due to fugitive or non-combustion sources. Due to the fact that the peak modeled $PM_{2.5}$ concentration is due to non-combustion sources with no precursor emissions, the modeling results using the 2010 USEPA/Stephen Page memo are very conservative. The FCPP and Navajo North sources were modeled with Navajo Met I and the Navajo South sources were modeled with Navajo Met III at all receptors. The highest 5-year average at each receptor from the two model runs were summed for the total modeled impact.
- The annual $PM_{2.5}$ concentration was based on the highest 5-year average concentration. The FCPP and Navajo North sources were modeled with Navajo Met I and the Navajo South sources were modeled with Navajo Met III at all receptors. The highest 5-year average at each receptor from the two model runs were summed for the total modeled impact.

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[18] USEPA 2004c. User's Guide for the AERMOD Terrain Preprocessor (AERMAP). (EPA-454/B-03-003, October 2004 – Addendum March 2011) Office of Air Quality Planning and Standards, Research Triangle Park, NC.

[19] USGS. National Elevation Dataset. (http://seamless.usgs.gov/) [Accessed 07/15/2012]

[20] USEPA 2012. National Ambient Air Quality Standards (40CFR50). http://www.epa.gov/air/criteria.html

[21] http://www.epa.gov/ttn/scram/guidance/guide/Draft_Guidance_for_PM25_Permit_Modeling.pdf

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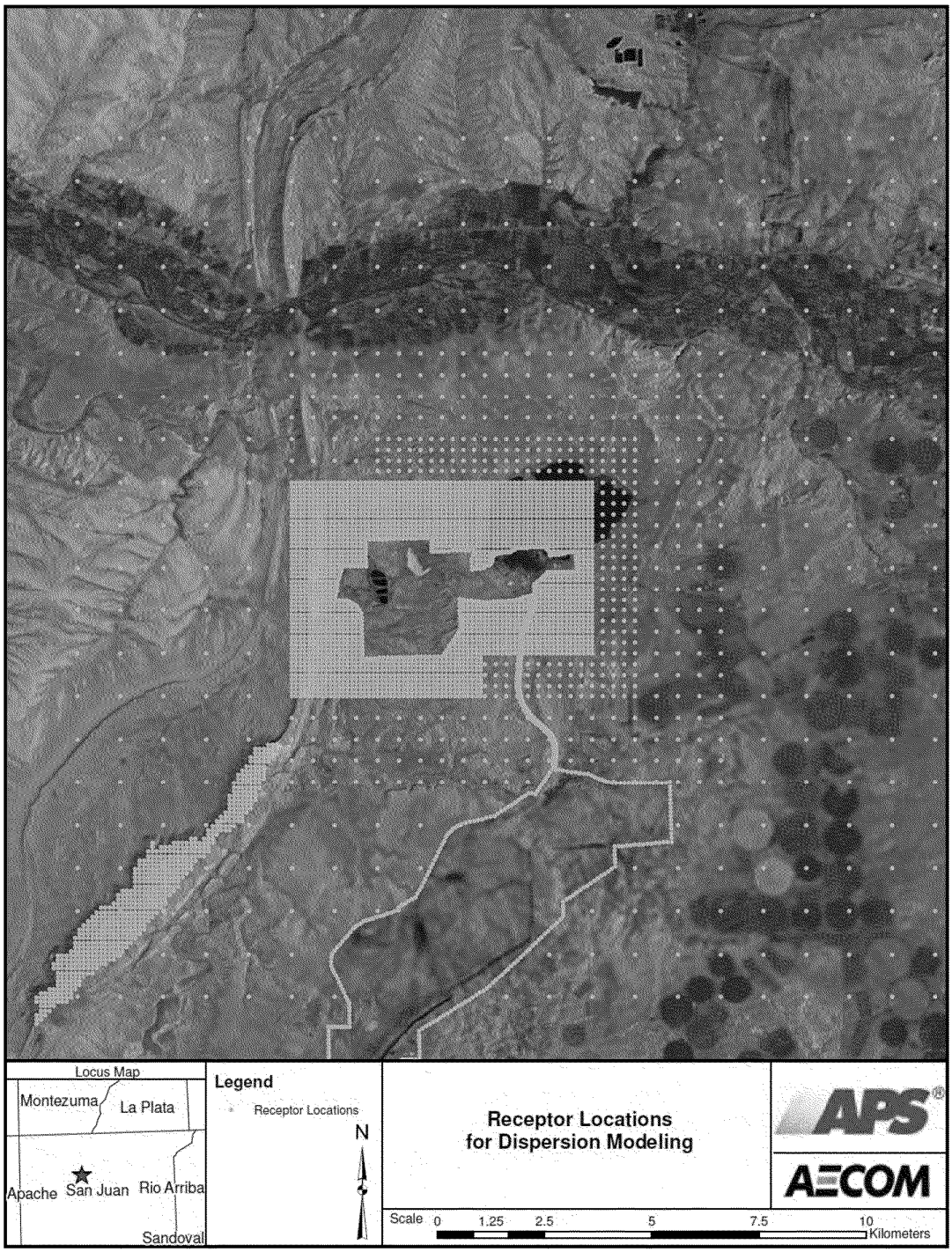

Figure 3-6 Near-Field Receptor Locations

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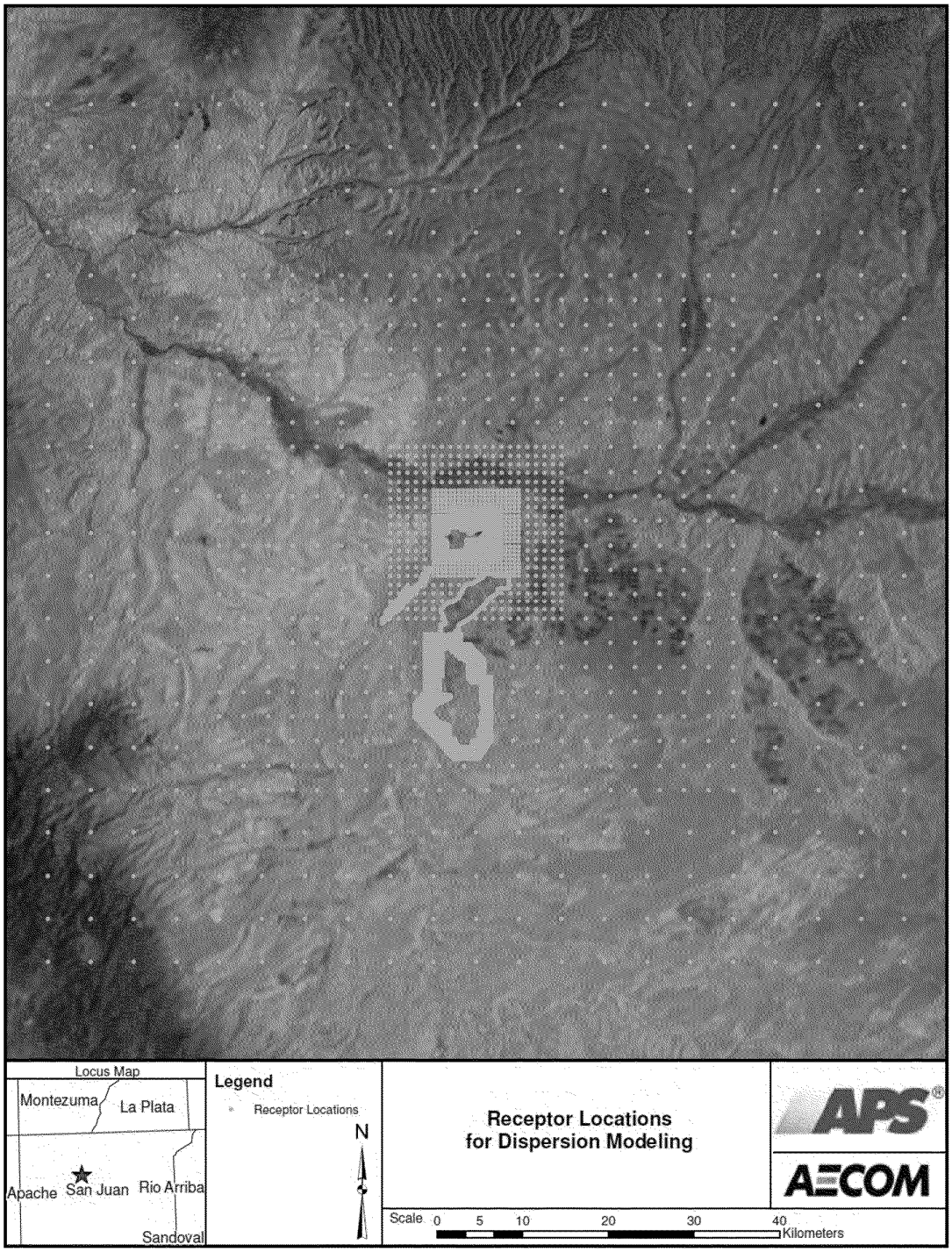

Figure 3-7 Far-Field Receptor Locations

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- The 1-hour SO_2 modeled concentration was based on the 99th percentile peak daily 1-hour concentration averaged over 5 years including hourly seasonal background The FCPP and Navajo North sources were modeled with Navajo Met I and the Navajo South sources were modeled with Navajo Met III at all receptors. The 99th percentile peak daily 1-hour concentration at each receptor from the two model runs were summed for the total modeled impact.
- The 1-hour NO_2 modeled concentration was based on the 98th percentile peak daily 1-hour concentration averaged over 5 years including hourly seasonal background The modeling of NO_2 impacts is subject to application of a tiered approach, as mentioned in USEPA's March 1, 2011 guidance on NO_2 modeling. A Tier 2 approach (ambient ratio method) multiplies the model impacts by a conversion factor of nitric oxide to NO_2 by 80 percent. Because hourly seasonal background is being added concurrently in AERMOD, AECOM multiplied the emission rate by 80 percent such that the hourly background would not have to be subtracted from the design concentration, convert the modeled impact, then add background again. The FCPP and Navajo North sources were modeled with Navajo Met I and the Navajo South sources were modeled with Navajo Met III at all receptors. The 98th percentile peak daily 1-hour concentration at each receptor from the two model runs were summed for the total modeled impact.
- The annual modeled concentrations of NO_2 were based on the highest concentration over all modeled receptors and 5 years of meteorological data. The FCPP and Navajo North sources were modeled with Navajo Met I and the Navajo South sources were modeled with Navajo Met III at all receptors. The annual average at each receptor from the two model runs were summed for the total modeled impact.
- The short-term modeled concentrations of CO (1- and 8-hour) were based on the highest second highest (H2H) concentrations over all modeled receptors and 5 years of meteorological data. The FCPP and Navajo North sources were modeled with Navajo Met I and the Navajo South sources were modeled with Navajo Met III at all receptors. The H2H at each receptor from each model run were summed for the total modeled impact.

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4.0 Background Concentrations

4.1 Regional Ambient Background

AECOM utilized ambient background monitors for SO_2, NO_2, $PM_{2.5}$, and PM_{10} in the Farmington vicinity as shown in **Figure 4-1**. NMED does not maintain any lead monitors in the State of New Mexico. The closest monitor, which was used in the analysis, is located in Denver, Colorado.

For 1-hour SO_2 and NO_2, AECOM developed hourly seasonal background values, shown in **Table 4-1** and **Table 4-2** from the Substation (SLAMS network) monitor. Use of this monitor is conservative as it may double-count emissions from the FCPP. For PM_{10}, $PM_{2.5}$, CO, annual NO_2 and 3-hour SO_2, AECOM reviewed the available data for the nearest SLAMS network monitors, summarized in **Table 4-3**.

The USEPA Air Data website[22] (USEPA 2013b) does not currently report quarterly lead concentrations for comparison with the NAAQS. The highest 24-hour value at a SLAMS network monitor in Denver in 2011 is 0.02 µg/m³. The most recent Colorado Monitoring Report from 2009[23] lists the highest quarterly value as 0.006 µg/m³.

4.2 Nearby Sources

AECOM reviewed the locations of large emission sources (e.g., with emissions exceeding 250 tpy) out to distances as large as 40 km from Four Corners Power Plant. Of the two sources located, San Juan Generating Station (SJGS) and the San Juan River Gas Plant, the latter has retired their major emissions source, a Sulfur Recovery Unit[24]. Therefore, we concluded that the only background source to be evaluated (determining whether it would have a significant concentration gradient) for modeling is the SJGS, located about 13 km from FCPP. It is noteworthy that our monitored background data uses a monitor close to that facility, so the impacts from SJGS are already included in the monitored background. SJGS will be reducing emissions within the next 5 years therefore the use of this monitored background is a conservative estimate of future ambient background.

To determine if there is a significant concentration gradient beyond the FCPP location from SJGS emissions, AECOM modeled impacts from that facility along a line of receptors passing through and beyond the FCPP. The analysis, described in **Appendix E**, indicates that the relative change in modeled concentrations between the location of FCPP and the peak impact location of FCPP along the same direction would be too small to be detected by an array of SO_2 monitors along that same line. Therefore, the concentration gradient is insignificant, and impacts from that the source impact from that source are accommodated within the monitored background.

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[22] USEPA 2013b. EPA Air Data website: (http://www.epa.gov/airdata/ad_rep_mon.html)

[23] CDPHE 2010. 2009 Air Quality Data Report. http://colorado.gov/airquality/tech_doc_repository.aspx?action=open&file=2009AnnualDataReport.pdf

[24] See http://www.docstoc.com/docs/106180605/Public-Notice-Western-Gas-R-San-Juan-River-Gas-Plant-2013-M3-28July10; the resulting SO_2 annual emissions would be less than 150 tpy, and the facility would be screened out with a "20D" rule due to its distance of over 12 km from FCPP.

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Table 4-1 1-hour SO_2 Season and Hour of Day Background Concentrations (ppb)

3-yr Average	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00
Winter	1.7	1.3	1.3	1.0	3.0	1.7	1.0	1.3
Spring	1.0	1.3	1.0	1.7	2.0	1.3	2.7	4.0
Summer	3.3	3.7	4.3	3.3	3.0	3.0	3.7	13.0
Fall	2.7	2.3	2.0	3.7	5.0	6.0	3.7	5.7

3-yr Average	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00
Winter	3.7	3.7	6.3	8.3	8.7	8.7	8.3	5.0
Spring	6.0	5.3	4.0	1.7	1.3	3.0	1.3	1.3
Summer	10.0	11.0	9.0	5.0	3.3	2.3	2.0	2.0
Fall	7.3	10.7	16.7	13.0	9.3	8.0	7.7	7.0

3-yr Average	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Winter	5.0	2.7	3.0	3.0	2.0	1.7	1.3	1.7
Spring	1.7	1.7	2.0	1.0	0.7	2.0	1.0	1.0
Summer	2.3	2.3	3.3	2.3	4.0	5.7	4.3	3.7
Fall	5.3	5.0	3.7	3.3	2.7	2.0	3.0	1.7

Table 4-2 1-hour NO_2 Season and Hour of Day Background Concentrations (ppb)

3-yr Average	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00
Winter	28.0	28.7	31.3	32.0	31.7	32.7	33.0	31.3
Spring	16.7	20.3	25.7	24.7	22.3	22.3	24.0	26.7
Summer	18.0	17.0	18.3	17.0	19.3	18.7	20.3	26.7
Fall	23.7	22.0	23.0	23.3	25.0	24.7	25.0	22.7

3-yr Average	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00
Winter	27.7	26.0	26.0	28.7	29.0	29.3	27.3	25.7
Spring	34.0	28.3	23.0	21.0	19.3	17.7	15.0	15.3
Summer	30.7	31.0	30.0	25.3	19.0	15.3	13.0	13.7
Fall	21.0	22.3	27.7	27.3	26.3	21.7	23.3	20.3

3-yr Average	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Winter	28.3	30.3	31.7	31.3	29.3	31.7	30.0	29.0
Spring	17.3	19.0	22.0	16.3	16.3	19.3	18.3	19.7
Summer	14.0	15.7	16.7	14.0	18.0	21.7	22.3	16.7
Fall	23.0	21.0	19.7	20.7	19.0	21.0	20.7	23.3

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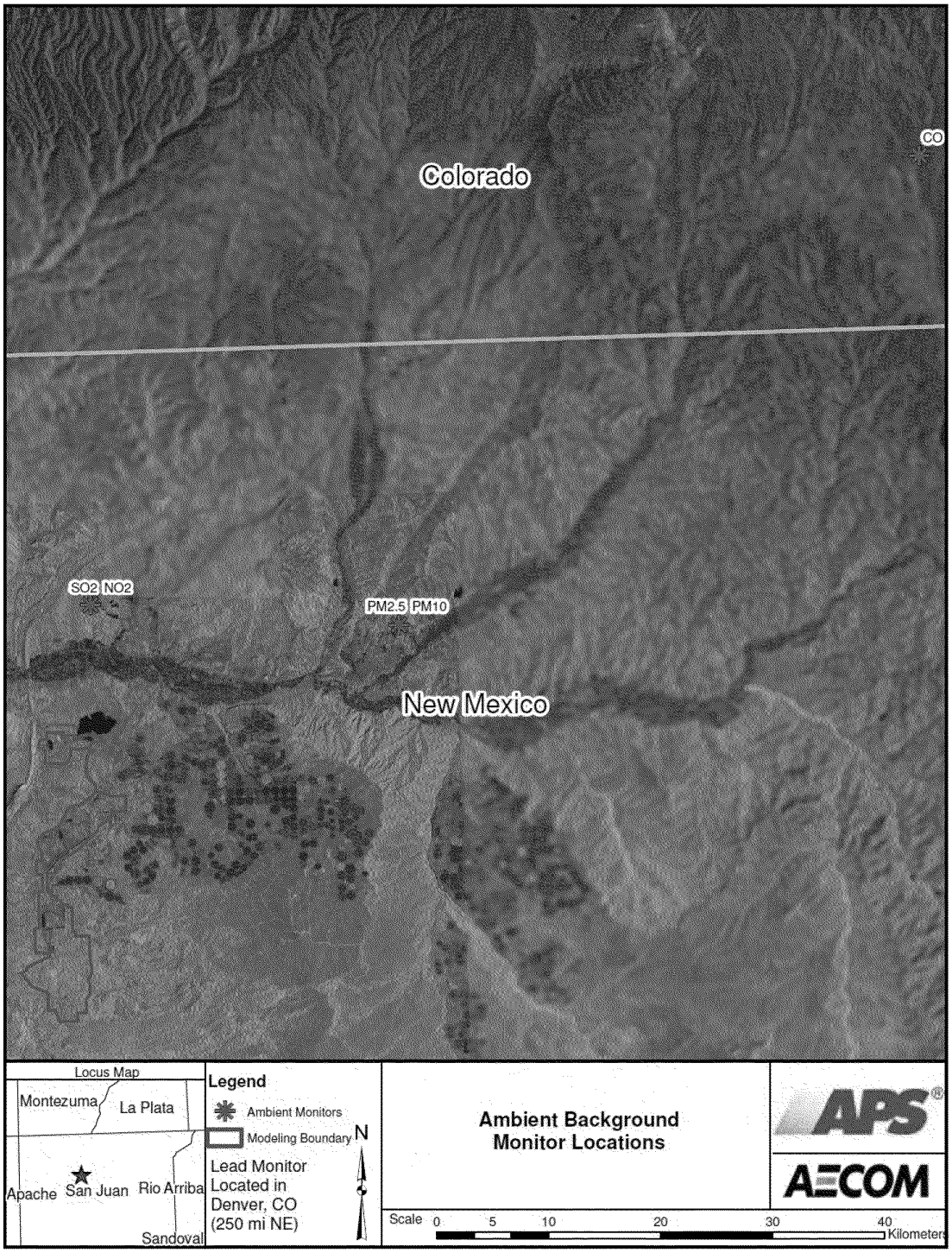

Figure 4-1 Ambient Background Monitor Locations

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Table 4-3 Monitored Background Concentrations for CO, PM_{10} and $PM_{2.5}$, Lead, 3-hour SO_2, and Annual NO_2

Pollutant	Averaging Period	Ranking	Year	Concentration[1] (µg/m³)	Units	Monitor ID	Monitor Address	County/City	State
PM_{10}	24-hour	H2H	2009	**44.0**	µg/m³	35|45|0019	3400 Messina Drive	Farmington	NM
		H2H	2010	19.0	µg/m³				
		H2H	2011	29.0	µg/m³				
$PM_{2.5}$	24-hour	98th p'tile	2009	10.4	µg/m³	35|45|0019	3400 Messina Drive	Farmington	NM
		98th p'tile	2010	18.0	µg/m³				
		98th p'tile	2011	12.3	µg/m³				
		3-year AVG	**2009-2011**	**13.6**	µg/m³				
	Annual	H	2009	4.4	µg/m³				
		H	2010	4.8	µg/m³				
		H	2011	4.1	µg/m³				
		3-year AVG	**2009-2011**	**4.4**	µg/m³				
Lead	Quarterly	H	2009	0.006	µg/m³			Denver	CO
SO_2	3-hour	H2H	2009	15	ppb	35|45|01005	USBR Shiprock Substation (Farmington)	San Juan County	NM
		H2H	2010	9.6	ppb				
		H2H	2011	**17 (44.5)**	ppb (µg/m³)				
NO_2	Annual	H	2009	18.2	ppb	35|45|01005	USBR Shiprock Substation (Farmington)	San Juan County	NM
		H	2010	**19.9 (37.4)**	ppb (µg/m³)				
		H	2011	19.3	ppb				
CO	1-hour	H2H	2009	**1.4 (1610)**	ppm (µg/m³)	08|67|7001	1 MI. NE OF IGNACIO ON COUNTY RD. 517	La Plata County	CO
		H2H	2010	1.2	ppm				
		H2H	2011	1.3	ppm				
	8-hour	H2H	2009	**0.9 (1035)**	ppm (µg/m³)				
		H2H	2010	0.7	ppm				
		H2H	2011	0.7	ppm				

(1) Bold shaded values indicate for each pollutant and averaging period the background concentrations that are used in the NAAQS modeling analysis.

- PM_{10} 24-hr used the highest 2nd highest over 3 years.
- $PM_{2.5}$ 24-hr used the 3-year average 98th percentile.
- $PM_{2.5}$ Annual used the 3-year annual average.
- SO_2 3-hr used the highest 2nd highest over three years.
- NO_2 Annual used the highest annual average over the last 3 years.

5.0 Modeling Results

AECOM conducted dispersion modeling with AERMOD for 1-hour and 3-hour SO_2, 1-hour and annual NO_2, 24-hour and annual $PM_{2.5}$, 24-hour PM_{10}, 1-hour and 8-hour CO and quarterly rolling average for Lead. **Table 5-1** summarizes the modeling impacts for all pollutants with the additional of ambient background concentrations as described in Section 3.5. Total concentrations for all pollutants and averaging periods are below the NAAQS. The maximum impact locations are shown in **Figure 5-1**.

Twenty-four-hour and annual $PM_{2.5}$ impacts are dominated by low level sources such as coal preparation, lime and ash handling and roadway emissions. Quarterly lead impacts are from the Units 4 and 5 stack, and the 1-hour and 3-hour SO_2, 1-hour and annual NO_2 impacts are from the Units 4 and 5 stack and Auxiliary Boiler. Active mining and mine vehicle traffic emissions dominate the impact for 24-hour PM_{10}. One-hour and 8-hour CO impacts are controlled by the coal blasting emissions, which was modeled for 4 hours per day at the full blasting rate although these emissions will occur in only 1 hour per day. The modeling archive is presented in **Appendix F**.

The reported concentrations are 192.6 $\mu g/m^3$ for 1-hour SO_2 (the NAAQS is 196.5 $\mu g/m^3$) and 33.90 $\mu g/m^3$ for 24-hour $PM_{2.5}$ (the NAAQS is 35 $\mu g/m^3$), which are close to the respective NAAQS. However, the modeling procedures used for both 1-hour SO_2 and 24-hour $PM_{2.5}$ have inherent conservative features, as explained below.

For SO_2, the principle issue is that the highest predicted concentrations are caused by building downwash in high winds due to the influence of the Unit 4 and 5 boiler buildings. However, those boiler buildings are not solid structures, although the modeling treats them as being solid. For a solid building, the modeled (and actual) plume rise would be depressed over that from a porous structure, and the modeling would then result in a plume rise that is too low and a modeled impact that is too high. We note that aside from a narrow area of downwash impacts due to northwest winds, the remaining design 1-hour SO_2 concentrations are under 150 $\mu g/m^3$, well below the NAAQS.

For $PM_{2.5}$, as explained in Section 3.5, AECOM followed the guidance in the March 23, 2010 USEPA/Stephen Page memo for adding modeled to background concentrations. This guidance indicates that the peak 24-hour modeled concentration should be added to the 98th percentile background concentration. However, the new USEPA 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 $\mu g/m^3$ to about 26 $\mu g/m^3$.

Therefore, for both SO_2 and $PM_{2.5}$, the design concentrations are on the order of 75 percent of the NAAQS, leaving considerable room for uncertainties in background concentrations.

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Table 5-1 NAAQS Modeling Results

Pollutant	Avg. Period	Standard	Modeled Impact (µg/m³)	Background (µg/m³)	Total Impact (µg/m³)	NAAQS (µg/m³)
CO	1-hour	High-2nd High	932.43	1610.00	2542.43	40,000.00
	8-hour	High-2nd High	182.53	1035.00	1217.53	10,000.00
NO_2	1-hour	98th-percentile of Daily Max Over 5 Years			175.21	188.00
	Annual	High-1st-High	3.25	37.40	40.65	100.00
$PM_{2.5}$	24-hour	Highest of 5-yr Average	20.30	13.60	33.90	35.00
	Annual	Highest of 5-yr Average	3.89	4.40	8.29	12.00
PM_{10}	24-hour	High-6th-High Over 5 Years	75.43	44.00	119.43	150.00
SO_2	1-hour	99th-percentile of Daily Max Over 5 Years			192.59	196.50
	3-hour	High-2nd High	184.68	44.50	229.18	1,300.00
Lead	Rolling 3-month Average	High-1st-High	0.001	0.006	0.007	0.15

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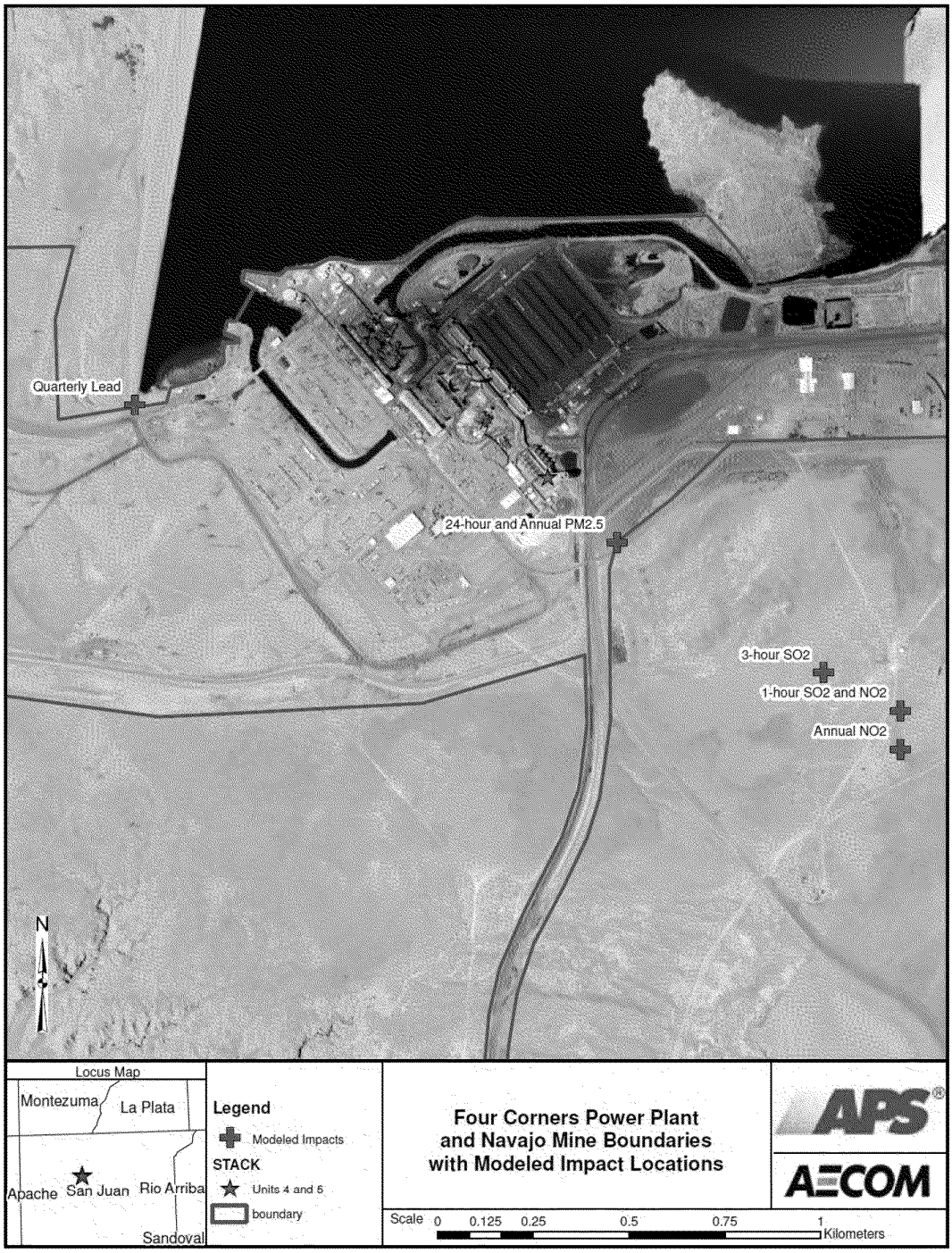

Figure 5-1 Maximum Modeled Impact Locations (North)

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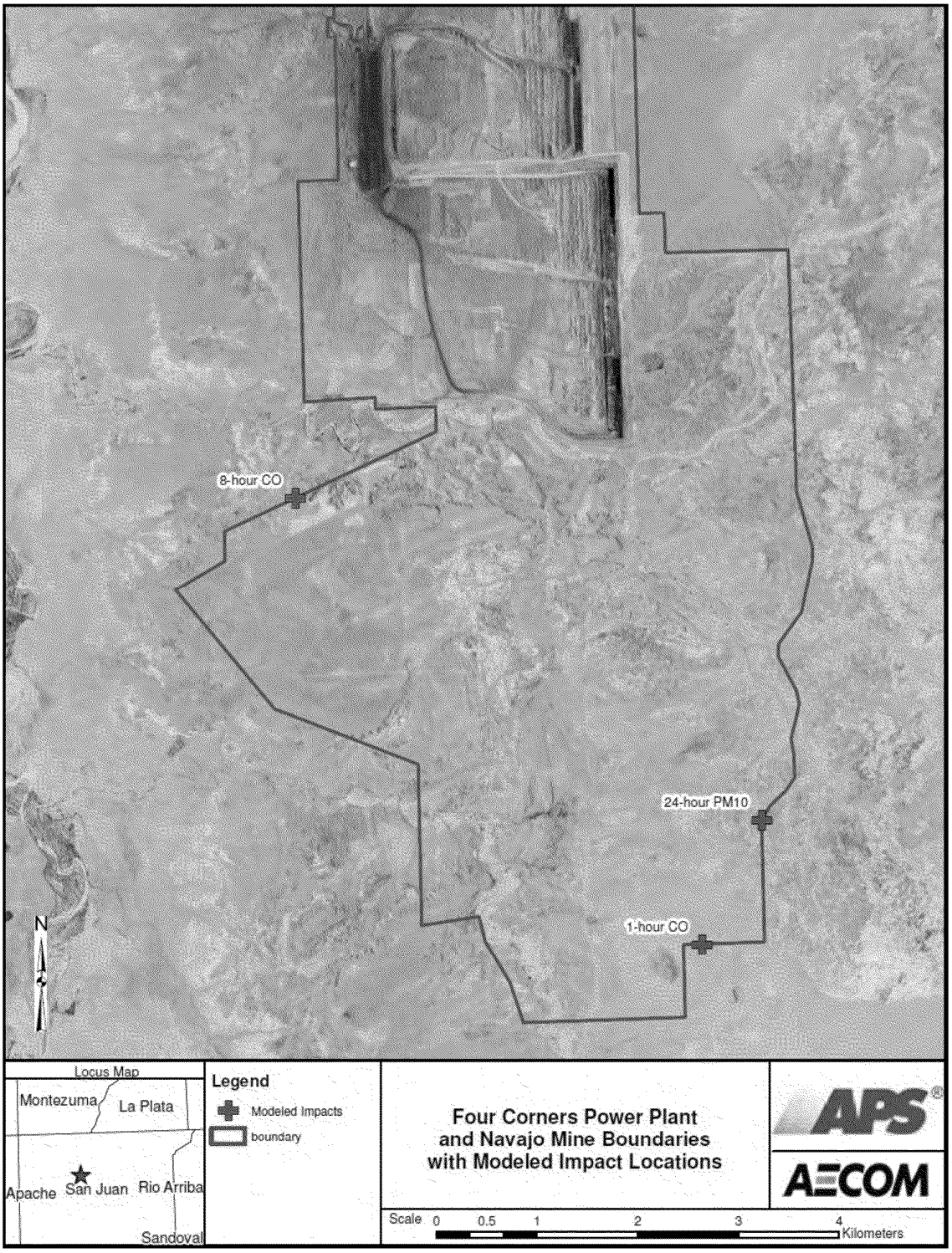

Figure 5-2 Maximum Modeled Impact Locations (South)

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Appendix A

Emissions Calculations

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Appendix A

Part I – APS Sources and Fastest Mile Calculations for Wind Erosion of All Piles

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Source Name	ID	Orientation	UTM E (NAD83)	UTM N (NAD83)	Stack Height (m)	Stack Diameter (m)	Velocity (m/s)	Temperature (K)	PM10 ST (g/s)	PM2.5 ST (g/s)	PM2.5 Ann (g/s)	Comments
Unit 4 Lime Storage Silo BH	EU20_8L	Down Facing	725274.3	4062992.5	21.641	0.628	0.001	Amb.	0.0222	0.0222	0.0203	
Unit 5 Lime Storage Silo BH	EU21_11L	Down Facing	725246.3	4062968.4	21.641	0.628	0.001	Amb.	0.0222	0.0222	0.0203	
Unit 4 Lime Dust Scrubber North	EU22_6L	Will be turned vertical	725268.4	4063001.3	12.192	0.330	18.11	366.483	0.2371	0.2371	0.2371	12 hours/day
Unit 4 Lime Dust Scrubber South	EU22_7L	Will be turned vertical	725280.5	4062983.9	12.192	0.330	18.11	366.483	0.2371	0.2371	0.2371	12 hours/day
Unit 5 Lime Dust Scrubber North	EU24_9L	Will be turned vertical	725240.6	4062977.4	12.192	0.330	18.11	366.483	0.2371	0.2371	0.2371	12 hours/day
Unit 5 Lime Dust Scrubber South	EU25_10L	Will be turned vertical	725251.9	4062959.2	12.192	0.330	18.11	366.483	0.2371	0.2371	0.2371	12 hours/day
SRMG Ash Storage Silo	SRMGBH	Horizontal	725177.3	4063271.3	22.860	0.330	0.001	16.7 + Ambient	0.1893	0.1893	0.1893	
Ash Storage Bin	EU29_15A	Horizontal	725159.9	4063263.6	32.918	0.330	0.001	16.7 + Ambient	0.1893	0.1893	0.1798	
Ash Storage Bin	EU28_14A	Horizontal	725155.2	4063253.8	32.918	0.330	0.001	16.7 + Ambient	0.1893	0.1893	0.1798	
Fly Ash Storage Silo	EU27_13A	Horizontal	725152.5	4063232.0	25.298	0.330	0.001	16.7 + Ambient	0.1893	0.1893	0.1798	
Fly Ash Storage Silo	EU26_12A	Horizontal	725153.0	4063233.1	25.298	0.330	0.001	16.7 + Ambient	0.1893	0.1893	0.1798	
Pug Mill 1 Scrubber	EU30_16A	Horizontal	725165.2	4063229.2	11.278	1.219	0.001	Amb.	0.1058	0.1058	0.1058	12 hours/day
Pug Mill 2 Scrubber	EU31_17A	Horizontal	725168.1	4063221.5	11.278	1.219	0.001	Amb.	0.1058	0.1058	0.1058	12 hours/day
Pug Mill 3 Scrubber	EU32_18A	Horizontal	725172.9	4063231.4	11.278	1.219	0.001	Amb.	0.1058	0.1058	0.1058	12 hours/day
North Surge Bin Baghouse	NSURGEBH	Horizontal	725021.6	4063493.4	5.000	0.300	0.001	Amb.	0.0081	0.0081	0.0081	
South Surge Bin Rotoclone	SSRGERTC	Horizontal	725038.4	4063473.4	19.668	0.200	0.001	Amb.	8.629E-05	1.307E-05	1.307E-05	
Coal Silo Rotoclone 1	CROTO1	Horizontal	725005.0	4063308.6	19.290	0.200	0.001	Amb.	5.752E-05	8.711E-06	8.711E-06	
Coal Silo Rotoclone 2	CROTO2	Horizontal	725034.0	4063275.0	19.290	0.200	0.001	Amb.	5.752E-05	8.711E-06	8.711E-06	

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Volume Source Name	Source ID	UTM E (NAD83)	UTM N (NAD83)	Release Height (m)	Sigma-y (m)	Sigma-z (m)	PM10 ST (lb/hr)	PM10 ST (g/s)	PM2.5 ST (lb/hr)	PM2.5 ST (g/s)	PM2.5 Ann (lb/hr)	PM2.5 Ann (g/s)	Controls
Drop into Lime Grit Bin	GRTDRP1A	725276.24	4062930.5	2.438	0.425	0.709	8.23E-03	1.04E-03	1.25E-03	1.57E-04	1.25E-03	1.57E-04	
Drop into Lime Grit Bin	GRTDRP2A	725276.24	4062930.5	1.219	0.425	0.425	8.23E-03	1.04E-03	1.25E-03	1.57E-04	1.25E-03	1.57E-04	
Drop onto Lime Grit Piles	GRTDRP1B	725311.1	4062960.1	2.438	0.425	0.709	8.23E-03	1.04E-03	1.25E-03	1.57E-04	1.25E-03	1.57E-04	
Drop onto Lime Grit Piles	GRTDRP2B	725311.1	4062960.1	1.219	0.425	0.425	8.23E-03	1.04E-03	1.25E-03	1.57E-04	1.25E-03	1.57E-04	
North Surge Bin onto Conveyor 1	TP1A	725032.76	4063489.3	2.000	0.465	5.671	0.004565	5.75E-04	0.000691	8.71E-05	0.000691	8.71E-05	Surfactant
South Surge Bin onto Conveyor 1	TP1B	725042.52	4063476.7	2.000	0.465	5.671	0.004565	5.75E-04	0.000691	8.71E-05	0.000691	8.71E-05	
Transfer from Conveyor 1 to 2	TP2	725081.64	4063426.8	2.000	1.151	0.930	0.004565	5.75E-04	0.000691	8.71E-05	0.000691	8.71E-05	
Conveyor 2 to Tripper Deck	TP3	724973.63	4063342.6	17.000	1.509	0.930	0.004565	5.75E-04	0.000691	8.71E-05	0.000691	8.71E-05	Surfactant
Tripper Deck to Enclosed System (9 Silos)	TP4	724979.5	4063336.4	18.000	1.221	0.930	0.004565	5.75E-04	0.000691	8.71E-05	0.000691	8.71E-05	
Fly Ash Truck Loading 1	FAT_1	725150.56	4063227.9	3.000	0.472	1.395	0.0440	5.55E-03	0.0067	8.40E-04	0.00667	8.40E-04	
Fly Ash Truck Loading 2	FAT_2	725154.75	4063237.2	3.000	0.472	1.395	0.0440	5.55E-03	0.0067	8.40E-04	0.00667	8.40E-04	
Saleable Fly Ash Truck Loading	SFAT	725180.77	4063270.3	3.000	0.472	1.395	0.0256	3.23E-03	0.0039	4.89E-04	0.003881	4.89E-04	

Area Source Name	Source ID	UTM E (NAD83)	UTM N (NAD83)	Release Height (m)			PM10 ST (lb/hr)	PM10 ST (g/s/m2)	PM2.5 ST (lb/hr)	PM2.5 ST (g/s/m2)	PM2.5 Ann (lb/hr)	PM2.5 Ann (g/s/m2)
Grit Pile 1	GRITPIL1						4.03E-05	1.27E-06	6.04E-06	1.90E-07	6.04E-06	1.90E-07
Grit Pile 2	GRITPIL2						4.03E-05	1.27E-06	6.04E-06	1.90E-07	6.04E-06	1.90E-07

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Road Location	Road ID	# Volumes	PM10 g/s / volume	24-hour PM2.5 g/s / volume	Annual PM2.5 g/s / volume
Plant Area	1 to 2	3	3.73E-03	9.16E-04	7.29E-04
Plant Area	2 to 3	24	4.60E-03	1.13E-03	8.82E-04
Plant Area	3 Loop	26	2.64E-03	6.47E-04	5.15E-04
Plant Area	3 to 4	5	8.05E-04	1.98E-04	1.67E-04
Plant Area	1 to 5	7	9.81E-04	2.41E-04	2.06E-04
Plant Area	5 to 2	8	1.07E-03	2.64E-04	2.13E-04
Plant Area	5 to 6	15	3.98E-04	9.77E-05	9.04E-05
Plant Area	1 to 7	41	3.68E-03	9.02E-04	7.43E-04
Fly Ash Area	7 to 8	75	3.65E-03	8.95E-04	7.37E-04
Fly Ash Area	8 to 9	43	3.69E-03	9.05E-04	7.45E-04
Fly Ash Area	9 Loop	111	7.13E-03	7.13E-04	5.87E-04
Fly Ash Area	8 to 10	17	1.38E-03	1.38E-04	1.38E-04
Fly Ash Area	10 to 11	46	1.40E-03	1.40E-04	1.40E-04
Fly Ash Area	11 to 12	69	1.39E-03	1.39E-04	1.39E-04
Fly Ash Area	11 to 13	44	1.40E-03	1.40E-04	1.40E-04
Fly Ash Area	12 to 13	29	1.38E-03	1.38E-04	1.38E-04
Fly Ash Area	12 to 14	123	1.39E-03	1.39E-04	1.39E-04
Fly Ash Area	13 to 14	39	9.68E-04	9.68E-05	9.68E-05
Fly Ash Area	14 to 15	54	9.76E-04	9.76E-05	9.76E-05
Fly Ash Area	10 to 16	77	9.64E-04	9.64E-05	9.64E-05
Fly Ash Area	15 to 7	56	5.63E-03	5.63E-04	4.63E-04
Fly Ash Area	15 Loop	36	3.90E-03	3.90E-04	3.21E-04

Area Source Name	Source ID	UTM E (NAD83)	UTM N (NAD83)	Area (m²)	Release Height (m)	PM2.5 (ton/yr)	PM2.5 (lb/time)	PM10 (lb/hr)	PM10 (lb/time)	Annual PM2.5 (g/m²/s)	24-hour PM2.5 (g/m²/s)	24-hour PM10 (g/m²/s)
Lime Grit Pile 1	GRITPIL1	725276.1	4062929	4	1.0	2.65E-05	N/A	0.000176	N/A	1.27E-06	1.9E-07	1.9E-07
Lime Grit Pile 2	GRITPIL2	725310.8	4062959	4	1.0	2.65E-05	N/A	0.000176	N/A	1.27E-06	1.9E-07	1.9E-07
Ash Pond 6	ASHPOND6	722426.4	4063915	527205.4	1.0	0.126943	244.2714	N/A	1074.794	3.46E-10	1.22E-07	5.35E-07
Ash Pond 5	ASHPOND5	722932.4	4063102	90268.07	1.0	0.021735	41.82413	N/A	184.0262	3.46E-10	1.22E-07	5.35E-07
Lined Decant Water Pond	LDWPNRTH	722302.8	4062912	61088.24	1.0	0.014709	28.30416	N/A	124.5383	3.46E-10	1.22E-07	5.35E-07
Lined Decant Water Pond	LDWPSTH	722282.2	4062406	194640.8	1.0	0.046867	90.18338	N/A	396.8069	3.46E-10	1.22E-07	5.35E-07
Lined Ash Impoundment	LAIPOND	722734.1	4062402	347518.8	1.0	0.083678	161.0168	N/A	708.4737	3.46E-10	1.22E-07	5.35E-07
Dry Fly Ash Disposal Area	DFADA	722689	4062225	162430.6	3.0	3.376536	483.6055	N/A	2127.864	4.19E-07	1.09E-05	4.81E-05
Cenospheres	CENOSPHR	723471.5	4062645	2922.47	5.0	0.017717	3.2605	N/A	4.347333	4.36E-08	1.46E-06	1.95E-06
Area Source Name	**Source ID**	**UTM E (NAD83)**	**UTM N (NAD83)**	**Area (m²)**	**Release Height (m)**	**PM2.5 (ton/yr)**	**PM2.5 (lb/day)**	**PM10 (lb/day)**		**Annual PM2.5 (g/m²/s)**	**24-hour PM2.5 (g/m²/s)**	**24-hour PM10 (g/m²/s)**
DFADA Unloading	DFADA_MH	722689	4062225	162430.6	3.0	0.036868	0.202018	13.34084		1.31E-08	1.31E-08	8.62E-07
Cenosphere Unloading	CENOS_MH	723471.5	4062645	2922.47	5.0	0.000552	0.003023	0.199632		1.09E-08	1.09E-08	7.17E-07
Area Source Name	**Source ID**	**UTM E (NAD83)**	**UTM N (NAD83)**	**Area (m²)**	**Release Height (m)**	**PM2.5 (ton/yr)**	**PM2.5 (lb/hr)**	**PM10 (lb/hr)**		**Annual PM2.5 (g/m²/s)**	**24-hour PM2.5 (g/m²/s)**	**24-hour PM10 (g/m²/s)**
DFADA Bulldozing	DFADA_B	722689	4062225	162430.6	3.0	2.401746	1.649551	5.398529		4.25E-07	1.28E-06	4.19E-06
Cenosphere Bulldozing	CENOSP_B	723471.5	4062645	2922.47	5.0	0.031906	0.613582	2.008087		3.14E-07	2.65E-05	8.66E-05

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	Lime Unloading (per silo)	Dust Scrubbers/Slakers (4)	Drop into Lime Grit Bin	Drop onto Lime Grit Piles	Lime Grit Pile
Equation type	Displacement	Outlet grain loading	AP-42 Drop equation	AP-42 Drop equation	MDAQMD Eq. G
Unloading time per truck (hours)	1				
Trucks per day	10				
Hours per day	12	12	10	10	
Hours per year			8760	8760	8760
Tons Lime per truck	20				
Silo capacity (tons)	6000				
Scrubber Inlet (gr/ACFM)		9.8			
Scrubber Control		99.8%			
Baghouse/Scrubber Outlet (gr/ACF)	0.018	0.0196			
ACFM		11200			
Temperature ºF		200			
Bulk density of lime lb/cf	35				
Tons per hour processed			200	200	
Mean Wind Speed (m/s)			4.7	4.7	
Moisture Content (%)			20	20	20
PM10 k/J factor			0.35	0.35	0.35
PM2.5 k/J factor			0.053	0.053	0.053
Silt Content (%)					1.5
Area (acres)					9.88E-04
Percent of time with wind speed > 12 mph					13.3
Days > 0.01 inches of precipitation					60
Emissions are calculated	Per Silo	Toal for 2 slaker scrubbers	Per Bin	Per Pile	Per Pile
PM10 (lb/hr)	0.176	3.76	8.23E-03	8.23E-03	4.03E-05
PM10 (ton/yr)	0.322	8.24	3.60E-02	3.60E-02	1.76E-04
PM2.5 (lb/hr)	0.176	3.76	1.25E-03	1.25E-03	6.04E-06
PM2.5 (ton/yr)	0.322	8.24	5.46E-03	5.46E-03	2.65E-05

Displacement Equation

Emissions (lb/hr) = (Baghouse gr/acf / 7,000 gr/lb) * (truck unloading hrs/truck) * (tons lime/truck * 2,000 lb/ton) / lime lb/cf

Emissions (ton/yr) = (Emissions lb/hr * truck unloading hrs/truck * trucks/day * 365 days/yr) / 2,000 lb/ton

Outlet Grain Loading Equation

Emissions (lb/hr) = (Scrubber gr/acf / 7,000 gr/lb) * acfm * 60 min/hr

Emissions (ton/yr) = (Emissions lb/hr * hours/day * 365 days/yr) / 2,000 lb/ton

AP-42 Drop Equation (Section 13.2.4, eq 1.) http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf

Emissions (lb/hr) = tons processed * 0.0032 * k factor * (mean wind speed / 5)^1.3 / (moisture content / 2)^1.4

Emissions (ton/yr) = (Emissions lb/hr * hours/yr) / 2,000 lb/ton

MDAQMD Equation G - For Wind Erosion from Stockpiles http://www.mdaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=3416

Emissions (lb/hr) = (Emissions ton/yr * 2,000 lb/ton) / hours/year

Emissions (ton/yr) = J factor * 1.7 * (silt loading / 1.5) * ((365 - days > 0.01 in precip) / 235) * (wind speed > 12 mph / 15) * (365/2000)

	Drop into N Surge Bin	Drop into S Surge Bin	Surge Bin Drop to Conveyor 1	Conveyor 1 to Conveyor 2	Conveyor 2 Drop to Tripper Deck	Tripper Deck into Silos	Tripper Deck into Silos
Equation type	AP-42 Drop equation	Outlet grain loading	AP-42 Drop equation	AP-42 Drop equation	AP-42 Drop equation	AP-42 Drop equation	AP-42 Drop equation
Capacity (tons)	1500	1500					
Type of Control	Rotoclone	Baghouse	Surfactant	Surfactant	Surfactant	Surfactant	Surfactant & Rotoclones
Control Efficiency	99%		90%	90%	90%	90%	99%
tons/hr capacity	1200		800	800	800	800	800
Moisture Content (%)	4.8		4.8	4.8	4.8	4.8	4.8
wind speed	1.3		1.3	1.3	1.3	1.3	1.3
rated capacity (gr/cf)		0.005					
airflow (cf/min)		1500					
Emissions are calculated	North Bin	South Bin	Per surge bin	Per surge bin	Per surge bin	Per surge bin	Total for two rotoclones
PM10 lb/hr	0.0007	0.0643	0.0046	0.0046	0.0046	0.0046	0.0005
PM10 ton/yr	0.0030	0.2816	0.0200	0.0200	0.0200	0.0200	0.0020
PM2.5 lb/hr	0.0001	0.0643	0.0007	0.0007	0.0007	0.0007	0.0001
PM2.5 ton/yr	0.0005	0.2816	0.0030	0.0030	0.0030	0.0030	0.0003

AP-42 Drop Equation (Section 13.2.4, eq 1.) http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf

Controlled Emissions (lb/hr) = (1 - % control efficiency) * tons processed * 0.0032 * k factor * (mean wind speed / 5)^1.3 / (moisture content / 2)^1.4

Controlled Emissions (ton/yr) = (Emissions lb/hr * 8,760 hours/yr) / 2,000 lb/ton

Outlet Grain Loading Equation

Emissions (lb/hr) = (Baghouse gr/acf / 7,000 gr/lb) * acfm * 60 min/hr

Emissions (ton/yr) = (Emissions lb/hr * 8,760 hours/yr) / 2,000 lb/ton

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	Storage Bins (2) per bin	Ash Silos (2) per silo	SRMG Saleable FA Silo	Ash Loadout	SRMG Ash Loadout	Pug Mills (3)
Equation type	Outlet grain loading	Outlet grain loading	Outlet grain loading	AP-42 Drop equation	AP-42 Drop equation	Outlet grain loading
ACFM	17524	17524	17524			5000
Baghouse/Scrubber Outlet (gr/ACFM)	0.01	0.01	0.01			0.0196
Moisture Content (%)				12	12	
Ash Thruput Tons/Hour	73	73				256
Hours per Day	24	24	12	12	12	12
Hours per Year	8322	8322	4380	8760	8760	4380
Total Ash Hauled/Day (tons)				5155	1500	
AnnualAverage Wind Speed (mile/hr)				9.328	9.328	
Emissions are calculated	Per Bin	Per Silo	Per Silo	Per Loadout	Per Loadout	Total for 2 Pug Mills
PM10 lb/hr	1.502	1.502	1.502	0.0881	0.0256	1.68
PM10 ton/yr	6.250	6.250	3.289	0.1929	0.0561	3.68
PM2.5 lb/hr	1.502	1.502	1.502	0.0133	0.0039	1.68
PM2.5 ton/yr	6.250	6.250	3.289	0.0292	0.0085	3.68

Outlet Grain Loading Equation

Emissions (lb/hr) = (Baghouse gr/acf / 7,000 gr/lb) * acfm * 60 min/hr

Emissions (ton/yr) = (Emissions lb/hr * hours/yr) / 2,000 lb/ton

AP-42 Drop Equation (Section 13.2.4, eq 1.) http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf

Controlled Emissions (lb/hr) = tons processed * 0.0032 * k factor * (mean wind speed / 5)^1.3 / (moisture content / 2)^1.4

Controlled Emissions (ton/yr) = (Emissions lb/hr * 8,760 hours/yr) / 2,000 lb/ton

ID	Desc	Type	Vehicle Type	Trucks/Day	Trips/Day	Empty (tons)	Full (tons)	Average (tons)	Hours/Day	Length (m)	Length (miles)	Total Length (Miles/day)	weighted average hrs/day	Width (m)	# Volumes	Avg vehicle weight (tons)	Silt: paved (g/m^2), unpaved (%)
1to2	FA Road Section	Paved	FA Haul (100 ton capacity)	21	42	75	175	125	12	50.2	0.03	6.8	12.7	11	3	58.8	9.7
			FA Haul (70 ton capacity)	19	38	40	110	75	12								
			FA Haul (65 ton capacity)	20	40	35	100	67.5	12								
			FA Haul (25 ton capacity)	17	34	15	40	27.5	12								
			Company Vehicles	20	40	3	3	3	16								
			Watering Trucks	12	24	40	40	40	12								
2to3	FA Road Section	Paved	FA Haul (100 ton capacity)	21	42	75	175	125	12	400.4	0.25	79.1	12.5	11	24	49.1	9.7
			FA Haul (70 ton capacity)	19	38	40	110	75	12								
			FA Haul (65 ton capacity)	20	40	35	100	67.5	12								
			FA Haul (25 ton capacity)	17	34	15	40	27.5	12								
			Company Vehicles	20	40	3	3	3	16								
			Watering Trucks	12	24	40	40	40	12								
			SRMG Trucks	50	100	13	43	28	12								
3Loop	FA Loop (one way)	Paved	FA Haul (100 ton capacity)	21	42	75	175	125	12	307.3	0.19	41.6	12.7	6	26	58.8	9.7
			FA Haul (70 ton capacity)	19	38	40	110	75	12								
			FA Haul (65 ton capacity)	20	40	35	100	67.5	12								
			FA Haul (25 ton capacity)	17	34	15	40	27.5	12								
			Company Vehicles	20	40	3	3	3	16								
			Watering Trucks	12	24	40	40	40	12								
3to4	FA to SRMG Silo	Paved	SRMG Trucks	50	100	15	43	29	12	63.0	0.04	6.4	13.6	6	5	24.3	9.7
			Watering Trucks	12	24	40	40	40	16								
			Company Vehicles	20	40	3	3	3	16								
1to5	Entry to SR/Lime Br	Paved	Lime Trucks	20	40	12.5	32.5	22.5	12	112.4	0.07	46.1	20.6	9	7	8.9	9.7
			SRMG Trucks	50	100	15	43	29	12								
			Urea/SCR Catalyst Delivery	3	6	12	24	18	12								
			Watering Trucks	12	24	40	40	40	16								
			Company Vehicles	20	40	3	3	3	16								
			Employee Veh.	450	450	2	2	2	24								
5to2	SRMG Truck Entry	Paved	SRMG Trucks	50	100	15	43	29	12	125.0	0.08	13.2	12.9	9	8	24.0	9.7
			Urea/SCR Catalyst Delivery	3	6	12	24	18	12								
			Company Vehicles	20	40	3	3	3	16								
			Watering Trucks	12	24	40	40	40	12								
5to6	Lime	Paved	Lime Trucks	20	40	12.5	32.5	22.5	12	218.0	0.14	75.0	22.2	9	15	5.2	9.7
			Company Vehicles	20	40	3	3	3	16								
			Watering Trucks	12	24	40	40	40	16								
			Employee Veh.	450	450	2	2	2	24								
1to7	Bridge to Ash1	Paved	FA Haul (100 ton capacity)	21	42	75	175	125	12	699.0	0.43	94.7	13.2	11	41	58.8	9.7
			FA Haul (70 ton capacity)	19	38	40	110	75	12								
			FA Haul (65 ton capacity)	20	40	35	100	67.5	12								
			FA Haul (25 ton capacity)	17	34	15	40	27.5	12								
			Company Vehicles	20	40	3	3	3	16								
			Watering Trucks	12	24	40	40	40	16								
7to8	Ash1 to Ash2	Paved	FA Haul (100 ton capacity)	21	42	75	175	125	12	1268.7	0.79	171.9	13.2	11	75	58.8	9.7
			FA Haul (70 ton capacity)	19	38	40	110	75	12								
			FA Haul (65 ton capacity)	20	40	35	100	67.5	12								
			FA Haul (25 ton capacity)	17	34	15	40	27.5	12								
			Watering Trucks	12	24	40	40	40	16								
			Company Vehicles	20	40	3	3	3	16								
8to9	Ash2 to Ash3	Paved	FA Haul (100 ton capacity)	21	42	75	175	125	12	735.4	0.46	99.6	13.2	11	43	58.8	9.7
			FA Haul (70 ton capacity)	19	38	40	110	75	12								
			FA Haul (65 ton capacity)	20	40	35	100	67.5	12								
			FA Haul (25 ton capacity)	17	34	15	40	27.5	12								
			Watering Trucks	12	24	40	40	40	16								
			Company Vehicles	20	40	3	3	3	16								

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85.0% Control for watering

													Short Term			Annual
ID	Desc	Type	Vehicle Type	PM10 lb/VMT	uncontrolled PM10 lb/hr	controlled PM10 lb/hr	PM10 g/s / volume	uncontrolled PM10 ton/yr	controlled PM10 ton/yr	PM2.5 lb/VMT	Uncontrolled PM2.5 lb/hr	controlled PM2.5 lb/hr	PM2.5 g/s / volume	uncontrolled PM2.5 ton/yr	controlled PM2.5 ton/yr	PM2.5 g/s / volume
1to2	FA Road Section	Paved	FA Haul (100 ton capacity)	1.1	0.6	0.1	3.732E-03	1.4	0.2	0.3	0.1	0.02	9.160E-04	0.3	0.05	7.290E-04
			FA Haul (70 ton capacity)													
			FA Haul (65 ton capacity)													
			FA Haul (25 ton capacity)													
			Company Vehicles													
			Watering Trucks													
2to3	FA Road Section	Paved	FA Haul (100 ton capacity)	0.9	5.8	0.9	4.601E-03	13.3	2.0	0.2	1.4	0.22	1.129E-03	3.3	0.49	8.824E-04
			FA Haul (70 ton capacity)													
			FA Haul (65 ton capacity)													
			FA Haul (25 ton capacity)													
			Company Vehicles													
			Watering Trucks													
			SRMG Trucks													
3Loop	FA Loop (one way)	Paved	FA Haul (100 ton capacity)	1.1	3.6	0.5	2.636E-03	8.4	1.3	0.3	0.9	0.13	6.470E-04	2.1	0.31	5.149E-04
			FA Haul (70 ton capacity)													
			FA Haul (65 ton capacity)													
			FA Haul (25 ton capacity)													
			Company Vehicles													
			Watering Trucks													
3to4	FA to SRMG Silo	Paved	SRMG Trucks	0.4	0.2	0.0	8.051E-04	0.5	0.1	0.1	0.1	0.01	1.976E-04	0.1	0.02	1.675E-04
			Watering Trucks													
			Company Vehicles													
1to5	Entry to SR/Lime Br	Paved	Lime Trucks	0.2	0.4	0.1	9.809E-04	1.4	0.2	0.0	0.1	0.01	2.408E-04	0.3	0.05	2.063E-04
			SRMG Trucks													
			Urea/SCR Catalyst Delivery													
			Watering Trucks													
			Company Vehicles													
			Employee Veh.													
5to2	SRMG Truck Entry	Paved	SRMG Trucks	0.4	0.5	0.1	1.074E-03	1.1	0.2	0.1	0.1	0.02	2.637E-04	0.3	0.04	2.133E-04
			Urea/SCR Catalyst Delivery													
			Company Vehicles													
			Watering Trucks													
5to6	Lime	Paved	Lime Trucks	0.1	0.3	0.0	3.979E-04	1.3	0.2	0.0	0.1	0.01	9.766E-05	0.3	0.05	9.037E-05
			Company Vehicles													
			Watering Trucks													
			Employee Veh.													
1to7	Bridge to Ash1	Paved	FA Haul (100 ton capacity)	1.1	8.0	1.2	3.675E-03	19.2	2.9	0.3	2.0	0.29	9.020E-04	4.7	0.71	7.427E-04
			FA Haul (70 ton capacity)													
			FA Haul (65 ton capacity)													
			FA Haul (25 ton capacity)													
			Company Vehicles													
			Watering Trucks													
7to8	Ash1 to Ash2	Paved	FA Haul (100 ton capacity)	1.1	14.5	2.2	3.646E-03	34.8	5.2	0.3	3.6	0.53	8.950E-04	8.5	1.28	7.370E-04
			FA Haul (70 ton capacity)													
			FA Haul (65 ton capacity)													
			FA Haul (25 ton capacity)													
			Watering Trucks													
			Company Vehicles													
8to9	Ash2 to Ash3	Paved	FA Haul (100 ton capacity)	1.1	8.4	1.3	3.687E-03	20.2	3.0	0.3	2.1	0.31	9.049E-04	4.9	0.74	7.451E-04
			FA Haul (70 ton capacity)													
			FA Haul (65 ton capacity)													
			FA Haul (25 ton capacity)													
			Watering Trucks													
			Company Vehicles													

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ID	Desc	Type	Vehicle Type	Trucks/Day	Trips/Day	Empty (tons)	Full (tons)	Average (tons)	Hours/Day	Length (m)	Length (miles)	Total Length (Miles/day)	weighted average hrs/day	Width (m)	# Volumes	Avg vehicle weight (tons)	Silt: paved (g/m^2), unpaved (%)
9Loop	DFADA Loop	Unpaved	FA Haul (100 ton capacity)	21	42	75	175	125	12	1327.8	0.83	179.9	13.2	6	111	58.8	6.0
			FA Haul (70 ton capacity)	19	38	40	110	75	12								
			FA Haul (65 ton capacity)	20	40	35	100	67.5	12								
			FA Haul (25 ton capacity)	17	34	15	40	27.5	12								
			Company Vehicles	20	40	3	3	3	16								
			Watering Trucks	12	24	40	40	40	16								
8 to 10		Unpaved	Company Vehicles	20	40	3	3	3	16	286.5	0.18	11.39	16.0	11	17	16.9	6.0
			Watering Trucks	12	24	40	40	40	16								
10 to 11		Unpaved	Company Vehicles	20	40	3	3	3	16	785.2	0.49	31.23	16.0	11	46	16.9	6.0
			Watering Trucks	12	24	40	40	40	16								
11 to 12		Unpaved	Company Vehicles	20	40	3	3	3	16	1171.1	0.73	46.57	16.0	11	69	16.9	6.0
			Watering Trucks	12	24	40	40	40	16								
11 to 13		Unpaved	Company Vehicles	20	40	3	3	3	16	752.2	0.47	29.91	16.0	11	44	16.9	6.0
			Watering Trucks	12	24	40	40	40	16								
12 to 13		Unpaved	Company Vehicles	20	40	3	3	3	16	486.5	0.30	19.35	16.0	11	29	16.9	6.0
			Watering Trucks	12	24	40	40	40	16								
12 to 14		Unpaved	Company Vehicles	20	40	3	3	3	16	2086.5	1.30	82.98	16.0	11	123	16.9	6.0
			Watering Trucks	12	24	40	40	40	16								
13 to 14		Unpaved Oiled	Company Vehicles	20	40	3	3	3	16	662.1	0.41	26.33	16.0	11	39	16.9	4.0
			Watering Trucks	12	24	40	40	40	16								
14 to 15		Unpaved Oiled	Company Vehicles	20	40	3	3	3	16	924.5	0.57	36.77	16.0	11	54	16.9	4.0
			Watering Trucks	12	24	40	40	40	16								
10 to 16		Unpaved Oiled	Company Vehicles	20	40	3	3	3	16	1302.0	0.81	51.78	16.0	11	77	16.9	4.0
			Watering Trucks	12	24	40	40	40	16								
15 to 7		Unpaved Oiled	Company Vehicles	20	40	3	3	3	16	960.2	0.60	130.07	13.17	11	56	35.14	4.0
			Watering Trucks	12	24	40	40	40	16								
		Empty Only	FA Haul (100 ton capacity)	21	42	75		75	12								
			FA Haul (70 ton capacity)	19	38	40		40	12								
			FA Haul (65 ton capacity)	20	40	35		35	12								
			FA Haul (25 ton capacity)	17	34	15		15	12								
15LOOP		Unpaved Oiled	Company Vehicles	20	40	3	3	3	16	428.3	0.27	58.02	13.17	6	36	35.14	4.0
			Watering Trucks	12	24	40	40	40	16								
		Empty Only	FA Haul (100 ton capacity)	21	42	75		75	12								
			FA Haul (70 ton capacity)	19	38	40		40	12								
			FA Haul (65 ton capacity)	20	40	35		35	12								
			FA Haul (25 ton capacity)	17	34	15		15	12								
LoweSplt			Lowe Pile to Split							3032.2	1.88				101		
Spt2PN			Split to PN							6069.5	3.77				202		
Spt2PE			Split to PE							6446.6	4.01				215		

Paved Roadway Equation (AP-42 Section 13.2.1)

$E\ (lb/VMT) = k * sL^{0.91} * W^{1.02}$

k = 0.0022 for PM_{10}, 0.00054 for $PM_{2.5}$

sL = silt loading (g/m^2)

W = average vehicle weight

Unpaved Roadway Equation (AP-42 Section 13.2.1)

$E\ (lb/VMT) = k * (s/12)^a * (W/3)^b$

k = 1.5 for PM_{10}, 0.15 for $PM_{2.5}$

a = 0.9 for PM_{10}, 0.9 for $PM_{2.5}$

b = 0.45 for PM_{10}, 0.45 for $PM_{2.5}$

s = silt content (%)

W = average vehicle weight

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85.0% Control for watering

ID	Desc	Type	Vehicle Type	PM10 lb/VMT	uncontrolled PM10 lb/hr	controlled PM10 lb/hr	PM10 g/s / volume	uncontrolled PM10 ton/yr	controlled PM10 ton/yr	PM2.5 lb/VMT	Uncontrolled PM2.5 lb/hr	controlled PM2.5 lb/hr	Short Term PM2.5 g/s / volume	uncontrolled PM2.5 ton/yr	controlled PM2.5 ton/yr	Annual PM2.5 g/s / volume
9Loop	DFADA Loop	Unpaved	FA Haul (100 ton capacity)	3.1	41.9	6.3	7.128E-03	100.7	15.1	0.3	4.2	0.63	7.128E-04	10.1	1.51	5.869E-04
			FA Haul (70 ton capacity)													
			FA Haul (65 ton capacity)													
			FA Haul (25 ton capacity)													
			Company Vehicles													
			Watering Trucks													
8 to 10		Unpaved	Company Vehicles	1.75	1.25	0.19	1.384E-03	3.64	0.55	0.17	0.12	0.02	1.384E-04	0.36	0.05	1.384E-04
			Watering Trucks													
10 to 11		Unpaved	Company Vehicles	1.75	3.41	0.51	1.402E-03	9.97	1.49	0.17	0.34	0.05	1.402E-04	1.00	0.15	1.402E-04
			Watering Trucks													
11 to 12		Unpaved	Company Vehicles	1.75	5.09	0.76	1.394E-03	14.86	2.23	0.17	0.51	0.08	1.394E-04	1.49	0.22	1.394E-04
			Watering Trucks													
11 to 13		Unpaved	Company Vehicles	1.75	3.27	0.49	1.404E-03	9.55	1.43	0.17	0.33	0.05	1.404E-04	0.95	0.14	1.404E-04
			Watering Trucks													
12 to 13		Unpaved	Company Vehicles	1.75	2.11	0.32	1.378E-03	6.17	0.93	0.17	0.21	0.03	1.378E-04	0.62	0.09	1.378E-04
			Watering Trucks													
12 to 14		Unpaved	Company Vehicles	1.75	9.07	1.36	1.393E-03	26.48	3.97	0.17	0.91	0.14	1.393E-04	2.65	0.40	1.393E-04
			Watering Trucks													
13 to 14		Unpaved Oiled	Company Vehicles	1.21	2.00	0.30	9.682E-04	5.83	0.88	0.12	0.20	0.03	9.682E-05	0.58	0.09	9.682E-05
			Watering Trucks													
14 to 15		Unpaved Oiled	Company Vehicles	1.21	2.79	0.42	9.764E-04	8.15	1.22	0.12	0.28	0.04	9.764E-05	0.81	0.12	9.764E-05
			Watering Trucks													
10 to 16		Unpaved Oiled	Company Vehicles	1.21	3.93	0.59	9.643E-04	11.47	1.72	0.12	0.39	0.06	9.643E-05	1.15	0.17	9.643E-05
			Watering Trucks													
15 to 7		Unpaved Oiled	Company Vehicles	1.69	16.67	2.50	5.627E-03	40.09	6.01	0.17	1.67	0.25	5.627E-04	4.01	0.60	4.633E-04
			Watering Trucks													
		Empty Only	FA Haul (100 ton capacity)													
			FA Haul (70 ton capacity)													
			FA Haul (65 ton capacity)													
			FA Haul (25 ton capacity)													
15LOOP		Unpaved Oiled	Company Vehicles	1.69	7.44	1.12	3.904E-03	17.88	2.68	0.17	0.74	0.11	3.904E-04	1.79	0.27	3.215E-04
			Watering Trucks													
		Empty Only	FA Haul (100 ton capacity)													
			FA Haul (70 ton capacity)													
			FA Haul (65 ton capacity)													
			FA Haul (25 ton capacity)													
LoweSplt			Lowe Pile to Split		109.81	38.43	4.795E-02				23.28	8.15	1.016E-02		13.88	3.953E-03
Spt2PN			Split to PN		112.13	39.25	2.448E-02				23.77	8.32	5.190E-03		14.01	1.995E-03
Spt2PE			Split to PE		114.36	40.03	2.346E-02				24.24	8.49	4.973E-03		14.62	1.957E-03

Paved Roadway Equation (AP-42 Section 13.2.1)

$E\ (lb/VMT) = k * sL^{0.91} * W^{1.82}$

k = 0.0022 for PM_{10}, 0.00054 for $PM_{2.5}$

sL = silt loading (g/m^2)

W = average vehicle weight

Unpaved Roadway Equation (AP-42 Section 13.2.1)

$E\ (lb/VMT) = k * (s/12)^a * (W/3)^b$

k = 1.5 for PM_{10}, 0.15 for $PM_{2.5}$

a = 0.9 for PM_{10}, 0.9 for $PM_{2.5}$

b = 0.45 for PM_{10}, 0.45 for $PM_{2.5}$

s = silt content (%)

W = average vehicle weight

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Name	Area (m^2)	Area (acres)	Pile Type [1]	Control [2]	Uncontrolled [3]			Controlled [4]			m^2	annual $PM_{2.5}$ emission rate g/m^2	short term $PM_{2.5}$ emission rate g/m^2	short term PM_{10} emission rate g/m^2	Notes
					$PM_{2.5}$ ton/yr	$PM_{2.5}$ lb/time	PM_{10} lb/time	annual $PM_{2.5}$ $g/m^2/s$	short-term $PM_{2.5}$ $g/m^2/s$	short-term PM_{10} $g/m^2/s$					
ASHPOND6	527,205	130.28	Large Flat	95%	0.13	244.3	1074.8	3.463.E-10	1.216.E-07	5.351.E-07	527,205	0.22	0.21	0.92	used overburden as material
ASHPOND5	90,268	22.31	Large Flat	95%	0.02	41.8	184.0	3.463.E-10	1.216.E-07	5.351.E-07	90,268	0.22	0.21	0.92	used overburden as material
LDWPNRTH	61,088	15.10	Large Flat	95%	0.01	28.3	124.5	3.463.E-10	1.216.E-07	5.351.E-07	61,088	0.22	0.21	0.92	used overburden as material
LDWPSTH	194,641	48.10	Large Flat	95%	0.05	90.2	396.8	3.463.E-10	1.216.E-07	5.351.E-07	194,641	0.22	0.21	0.92	used overburden as material
LAIPOND	347,519	85.87	Large Flat	95%	0.08	161.0	708.5	3.463.E-10	1.216.E-07	5.351.E-07	347,519	0.22	0.21	0.92	used overburden as material
DFADA	162,431	40.14	Large Flat &	30%	3.38	483.6	2127.9	4.186.E-07	1.094.E-05	4.814.E-05	95,200	31.36	1.98	8.70	large flat portion
			sloped sides								44,600	1.74	0.70	3.07	sloped sides portion
CENOSPHR	2,922	0.72	Conical (A)	75%	0.02	3.26	4.35	4.360.E-08	1.464.E-06	1.952.E-06	1,600	10.045	0.924	1.232	
PILES12W	15,241	3.77	Ovalish (B3)		0.11	28.7	191.1	2.040.E-07	9.872.E-06	6.581.E-05	12,000	8.173	1.083	7.222	
PILES34W	15,241	3.77	Ovalish (B3)		0.11	28.7	191.1	2.040.E-07	9.872.E-06	6.581.E-05	12,000	8.173	1.083	7.222	
PILES56W	15,241	3.77	Ovalish (B3)		0.11	28.7	191.1	2.040.E-07	9.872.E-06	6.581.E-05	12,000	8.173	1.083	7.222	
PILES78W	15,241	3.77	Ovalish (B3)		0.11	28.7	191.1	2.040.E-07	9.872.E-06	6.581.E-05	12,000	8.173	1.083	7.222	
PILE910W	15,241	3.77	Ovalish (B3)		0.11	28.7	191.1	2.040.E-07	9.872.E-06	6.581.E-05	12,000	8.173	1.083	7.222	
COALPILE	220,400	54.46	Ovalish (B3)		1.68	445.16	2967.73	2.192.E-07	1.060.E-05	7.069.E-05	186,400	8.173	1.083	7.222	
PERCLAIM	607,050	150.01	Ovalish (B3)		0.28	38.36	255.74	1.334.E-08	3.317.E-07	2.212.E-06	12,000	21.284	1.450	9.667	
PNRCLAIM	607,050	150.01	Ovalish (B3)		0.28	38.36	255.74	1.334.E-08	3.317.E-07	2.212.E-06	12,000	21.284	1.450	9.667	
PECOALPL	237069.2	58.58	Ovalish (B1)		1.86	405.86	2705.76	2.255.E-07	8.988.E-06	5.992.E-05	250,645	6.727	0.734	4.897	
PBOVRBDN	473921.6	117.11	Large Flat &		0.18	253.5	1690.2	1.122.E-08	2.809.E-06	1.872.E-05	390,595	0.218	0.210	1.401	large flat portion
			sloped sides								98,305	0.837	0.335	2.232	sloped sides portion
TS-401	20672.6	5.11	Conical (A)		0.26	48.64	64.86	3.678.E-07	1.235.E-05	1.647.E-05	23,871	10.045	0.924	1.232	used overburden as material
TS-402	22629.4	5.59	Conical (A)		0.29	53.25	71.00	3.678.E-07	1.235.E-05	1.647.E-05	26,130	10.045	0.924	1.232	used overburden as material
TS-403	32412	8.01	Conical (A)		0.41	76.27	101.69	3.678.E-07	1.235.E-05	1.647.E-05	37,426	10.045	0.924	1.232	used overburden as material
TS-404	76584.3	18.92	Conical (A)		0.98	180.21	240.28	3.678.E-07	1.235.E-05	1.647.E-05	88,432	10.045	0.924	1.232	used overburden as material
TS-405	28242.4	6.98	Conical (A)		0.36	66.46	88.61	3.678.E-07	1.235.E-05	1.647.E-05	32,612	10.045	0.924	1.232	used overburden as material
TS-406	21512.1	5.32	Conical (A)		0.28	50.62	67.49	3.678.E-07	1.235.E-05	1.647.E-05	24,840	10.045	0.924	1.232	used overburden as material

[1] Pile Type categorized as large flat from AP-42 Page 13.2.5-5 discussion following Equation 4, or from Figure 13.2.5-2. Sloped side is approximated using us/ur = 0.6 from the B piles in Figure 13.2.5-2.
[2] Control of the inactive ash piles (ASHPOND6, ASHPOND5, LDWPNRTH, and LDWPSTH) approximated as 95% to account for long term inactivity of the piles and dust suppressant supplied.
Control of DFADA estimated as 30% due to application of dust suppressant.
Control of CENOSPHR estimated as 75% to account for high moisture content (~40%) of material.
[3] Uncontrolled ton/yr calculated by pile m^2 * emission rate g/m^2 / (453.59 g/lb * 2,000 lb/ton) ; uncontrolled short-term lb/time calculated by pile m2 * emission rate g/m2 / (453.59 g/lb)
[4] Controlled annual calculated by (1 - control %) * uncontrolled ton/yr * 453.59 g/lb * 2,000 lb/ton / (pile m^2 * 8,760 hr/yr * 2,000 lb/ton * 3600 s/hr) ; controlled short-term calculated by (1 - control %) * uncontrolled lb/time * 453.59 g/lb / (pile m2 * 24 hr/day * 3600 s/hr)
[5] Annual $PM_{2.5}$ emission rate determined using AP-42 Section 13.2.5 methodology. Value determined by summing the 5 years of daily results and dividing by 5.
[6] Short-term PM2.5 and PM10 emission rates determined using AP-42 Section 13.2.5 methodology. Value determined by taking maximum value over 5-years of daily results.
[7] $PM_{2.5}$ and PM_{10} speciation uses k factor from AP-42 Section 13.2.5 ($PM_{2.5}$ = 0.075, PM_{10} = 0.5) except DFADA and inactive ash piles (ASHPOND6, ASHPOND5, LDWPNRTH, and LDWPSTH) use PM_{10} = 0.33 based on ash particle size analyses.

Material Handling Emissions

	Ash Tons Handled/day	Moisture %	Mean Wind Speed	PM2.5 ton/yr	PM2.5 lb/day	PM10 lb/day	annual PM2.5 g/m2/s	short-term PM2.5 g/m2/s	short-term PM10 g/m2/s
DFADA_MH	5155	50	9.3	3.69E-02	2.02E-01	13.34	1.306E-08	1.306E-08	8.624E-07
CENOS_MH	103.1	40	9.3	5.52E-04	3.02E-03	0.20	1.086E-08	1.086E-08	7.172E-07
COALPILU							9.025E-08	5.114E-07	1.627E-06
PILES12							7.623E-08	7.623E-08	5.034E-07
PILES34							7.654E-08	7.654E-08	5.054E-07
PILES56							7.663E-08	7.663E-08	5.060E-07
PILES78							6.003E-08	6.003E-08	3.964E-07
PILES910							7.614E-08	7.614E-08	5.028E-07

AP-42 Drop Equation (Section 13.2.4, eq 1.) http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf
Emissions (lb/day) = tons processed/day * 0.0032 * k factor * (mean wind speed / 5)^1.3 / (moisture content / 2)^1.4
Emissions (ton/yr) = 365 day/yr * ton/2,000 lb * tons processed/day * 0.0032 * k factor * (mean wind speed / 5)^1.3 / (moisture content / 2)^1.4

Model Input Emissions
Short-term Emissions ($g/s/m^2$) = lb/day * 453.59 g/lb / (12 hr/day * 3600 s/hr * pile m^2)
Annual Emissions ($g/s/m^2$) = ton/yr * 2,000 lb/ton * 453.59 g/lb / (12 hr/day * 365 day/yr * 3600 s/hr * pile m^2)

Bulldozer emissions

	bulldozing hours/week	Silt loading%	Moisture %	k $PM_{2.5}$	k PM_{10}	PM2.5 ton/yr	PM2.5 lb/hr	PM10 lb/hr	annual PM2.5 g/m2/s	short-term PM2.5 g/m2/s	short-term PM10 g/m2/s
DFADA_B	56	75	50	0.11	0.36	2.40	1.65	5.40	4.253E-07	1.280E-06	4.188E-06
CENOSP_B	2	50	40	0.11	0.36	0.03	1.23	4.02	3.141E-07	2.645E-05	8.658E-05

DFADA_B represents emissions from two bulldozers working 8 hours/day, 7 days/week
MDAQMD Equation D - For Bulldozing, Scraping, and Grading of Materials http://www.mdaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=3416
Emissions (lb/hr) = # of bulldozers * 2.76 * k factor * [(silt loading $^{1.1}$) / (moisture content $^{1.4}$)]
Emissions (ton/yr) = lb/hr * hrs/wk * 52 wk/yr / 2,000 lb/ton

												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	81	8.1	W	2006	4	1	4/1/2006	10.06	0.0006	8.10		0.43	-	-
-108.229	76	7.6	W	2006	4	2	4/2/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	72	7.2	W	2006	4	3	4/3/2006	10.06	0.0006	7.20		0.38	-	-
-108.229	98	9.8	W	2006	4	4	4/4/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	165	16.5	W	2006	4	5	4/5/2006	10.06	0.0006	16.49		0.87	10.09	-
-108.229	130	13.0	W	2006	4	6	4/6/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	89	8.9	W	2006	4	7	4/7/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	63	6.3	W	2006	4	8	4/8/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	107	10.7	W	2006	4	9	4/9/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	107	10.7	W	2006	4	10	4/10/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	89	8.9	W	2006	4	11	4/11/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	67	6.7	W	2006	4	12	4/12/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	76	7.6	W	2006	4	13	4/13/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	148	14.8	W	2006	4	14	4/14/2006	10.06	0.0006	14.79		0.78	5.66	-
-108.229	206	20.6	W	2006	4	15	4/15/2006	10.06	0.0006	20.59		1.09	24.65	2.07
-108.229	81	8.1	W	2006	4	16	4/16/2006	10.06	0.0006	8.10		0.43	-	-
-108.229	157	15.7	W	2006	4	17	4/17/2006	10.06	0.0006	15.69		0.83	7.89	-
-108.229	130	13.0	W	2006	4	18	4/18/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	67	6.7	W	2006	4	19	4/19/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	107	10.7	W	2006	4	20	4/20/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	54	5.4	W	2006	4	21	4/21/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	139	13.9	W	2006	4	23	4/23/2006	10.06	0.0006	13.89		0.74	3.69	-
-108.229	130	13.0	W	2006	4	24	4/24/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	45	4.5	W	2006	4	25	4/25/2006	10.06	0.0006	4.50		0.24	-	-
-108.229	67	6.7	W	2006	4	26	4/26/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	143	14.3	W	2006	4	27	4/27/2006	10.06	0.0006	14.29		0.76	4.53	-
-108.229	112	11.2	W	2006	4	28	4/28/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	139	13.9	W	2006	4	29	4/29/2006	10.06	0.0006	13.89		0.74	3.69	-
-108.229	134	13.4	W	2006	4	30	4/30/2006	10.06	0.0006	13.39		0.71	2.71	-
-108.229	116	11.6	W	2006	5	1	5/1/2006	10.06	0.0006	11.59		0.61	-	-
-108.229	112	11.2	W	2006	5	2	5/2/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	94	9.4	W	2006	5	3	5/3/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	107	10.7	W	2006	5	4	5/4/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	125	12.5	W	2006	5	5	5/5/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	81	8.1	W	2006	5	6	5/6/2006	10.06	0.0006	8.10		0.43	-	-
-108.229	107	10.7	W	2006	5	7	5/7/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	125	12.5	W	2006	5	8	5/8/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	165	16.5	W	2006	5	9	5/9/2006	10.06	0.0006	16.49		0.87	10.09	-
-108.229	125	12.5	W	2006	5	10	5/10/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	81	8.1	W	2006	5	11	5/11/2006	10.06	0.0006	8.10		0.43	-	-
-108.229	98	9.8	W	2006	5	12	5/12/2006	10.06	0.0006	9.79		0.52	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	89	8.9	W	2006	5	13	5/13/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	139	13.9	W	2006	5	14	5/14/2006	10.06	0.0006	13.89		0.74	3.69	-
-108.229	125	12.5	W	2006	5	15	5/15/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	148	14.8	W	2006	5	16	5/16/2006	10.06	0.0006	14.79		0.78	5.66	-
-108.229	130	13.0	W	2006	5	17	5/17/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	103	10.3	W	2006	5	18	5/18/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	112	11.2	W	2006	5	19	5/19/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	98	9.8	W	2006	5	20	5/20/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	130	13.0	W	2006	5	21	5/21/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	192	19.2	W	2006	5	22	5/22/2006	10.06	0.0006	19.19		1.02	19.06	-
-108.229	89	8.9	W	2006	5	23	5/23/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	67	6.7	W	2006	5	24	5/24/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	81	8.1	W	2006	5	25	5/25/2006	10.06	0.0006	8.10		0.43	-	-
-108.229	98	9.8	W	2006	5	26	5/26/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	125	12.5	W	2006	5	27	5/27/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	130	13.0	W	2006	5	28	5/28/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	58	5.8	W	2006	5	29	5/29/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	76	7.6	W	2006	5	30	5/30/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	67	6.7	W	2006	5	31	5/31/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	98	9.8	W	2006	6	1	6/1/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	81	8.1	W	2006	6	2	6/2/2006	10.06	0.0006	8.10		0.43	-	-
-108.229	98	9.8	W	2006	6	3	6/3/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2006	6	4	6/4/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	112	11.2	W	2006	6	5	6/5/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	179	17.9	W	2006	6	6	6/6/2006	10.06	0.0006	17.89		0.95	14.45	-
-108.229	107	10.7	W	2006	6	7	6/7/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	139	13.9	W	2006	6	8	6/8/2006	10.06	0.0006	13.89		0.74	3.69	-
-108.229	94	9.4	W	2006	6	9	6/9/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	76	7.6	W	2006	6	10	6/10/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	76	7.6	W	2006	6	11	6/11/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	76	7.6	W	2006	6	12	6/12/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	103	10.3	W	2006	6	13	6/13/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	161	16.1	W	2006	6	14	6/14/2006	10.06	0.0006	16.09		0.85	8.96	-
-108.229	107	10.7	W	2006	6	15	6/15/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	134	13.4	W	2006	6	16	6/16/2006	10.06	0.0006	13.39		0.71	2.71	-
-108.229	98	9.8	W	2006	6	17	6/17/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	72	7.2	W	2006	6	18	6/18/2006	10.06	0.0006	7.20		0.38	-	-
-108.229	94	9.4	W	2006	6	19	6/19/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	98	9.8	W	2006	6	20	6/20/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	89	8.9	W	2006	6	21	6/21/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	107	10.7	W	2006	6	22	6/22/2006	10.06	0.0006	10.69		0.57	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	76	7.6	W	2006	6	23	6/23/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	98	9.8	W	2006	6	24	6/24/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	125	12.5	W	2006	6	25	6/25/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	201	20.1	W	2006	6	26	6/26/2006	10.06	0.0006	20.09		1.06	22.58	1.23
-108.229	107	10.7	W	2006	6	27	6/27/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	183	18.3	W	2006	6	28	6/28/2006	10.06	0.0006	18.29		0.97	15.81	-
-108.229	116	11.6	W	2006	6	29	6/29/2006	10.06	0.0006	11.59		0.61	-	-
-108.229	94	9.4	W	2006	6	30	6/30/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	130	13.0	W	2006	7	1	7/1/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	94	9.4	W	2006	7	2	7/2/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	103	10.3	W	2006	7	3	7/3/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	112	11.2	W	2006	7	4	7/4/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	98	9.8	W	2006	7	5	7/5/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	139	13.9	W	2006	7	6	7/6/2006	10.06	0.0006	13.89		0.74	3.69	-
-108.229	72	7.2	W	2006	7	7	7/7/2006	10.06	0.0006	7.20		0.38	-	-
-108.229	201	20.1	W	2006	7	8	7/8/2006	10.06	0.0006	20.09		1.06	22.58	1.23
-108.229	89	8.9	W	2006	7	9	7/9/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	183	18.3	W	2006	7	10	7/10/2006	10.06	0.0006	18.29		0.97	15.81	-
-108.229	89	8.9	W	2006	7	11	7/11/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	98	9.8	W	2006	7	12	7/12/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2006	7	13	7/13/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	94	9.4	W	2006	7	14	7/14/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	107	10.7	W	2006	7	15	7/15/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	130	13.0	W	2006	7	16	7/16/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	116	11.6	W	2006	7	17	7/17/2006	10.06	0.0006	11.59		0.61	-	-
-108.229	130	13.0	W	2006	7	18	7/18/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	103	10.3	W	2006	7	19	7/19/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	72	7.2	W	2006	7	20	7/20/2006	10.06	0.0006	7.20		0.38	-	-
-108.229	170	17.0	W	2006	7	21	7/21/2006	10.06	0.0006	16.99		0.90	11.57	-
-108.229	125	12.5	W	2006	7	22	7/22/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	89	8.9	W	2006	7	23	7/23/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	125	12.5	W	2006	7	24	7/24/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	112	11.2	W	2006	7	25	7/25/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	107	10.7	W	2006	7	26	7/26/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	116	11.6	W	2006	7	27	7/27/2006	10.06	0.0006	11.59		0.61	-	-
-108.229	81	8.1	W	2006	7	28	7/28/2006	10.06	0.0006	8.10		0.43	-	-
-108.229	103	10.3	W	2006	7	29	7/29/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	112	11.2	W	2006	7	30	7/30/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	134	13.4	W	2006	7	31	7/31/2006	10.06	0.0006	13.39		0.71	2.71	-
-108.229	130	13.0	W	2006	8	1	8/1/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	107	10.7	W	2006	8	2	8/2/2006	10.06	0.0006	10.69		0.57	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	98	9.8	W	2006	8	3	8/3/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2006	8	4	8/4/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	89	8.9	W	2006	8	5	8/5/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	89	8.9	W	2006	8	6	8/6/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	89	8.9	W	2006	8	7	8/7/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	63	6.3	W	2006	8	8	8/8/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	112	11.2	W	2006	8	9	8/9/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	72	7.2	W	2006	8	10	8/10/2006	10.06	0.0006	7.20		0.38	-	-
-108.229	134	13.4	W	2006	8	11	8/11/2006	10.06	0.0006	13.39		0.71	2.71	-
-108.229	89	8.9	W	2006	8	12	8/12/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	98	9.8	W	2006	8	13	8/13/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	98	9.8	W	2006	8	14	8/14/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	107	10.7	W	2006	8	15	8/15/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	89	8.9	W	2006	8	16	8/16/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	103	10.3	W	2006	8	17	8/17/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	103	10.3	W	2006	8	18	8/18/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	98	9.8	W	2006	8	19	8/19/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	116	11.6	W	2006	8	20	8/20/2006	10.06	0.0006	11.59		0.61	-	-
-108.229	103	10.3	W	2006	8	21	8/21/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	98	9.8	W	2006	8	22	8/22/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	58	5.8	W	2006	8	23	8/23/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	103	10.3	W	2006	8	24	8/24/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	67	6.7	W	2006	8	25	8/25/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	89	8.9	W	2006	8	26	8/26/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	107	10.7	W	2006	8	27	8/27/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	54	5.4	W	2006	8	28	8/28/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	67	6.7	W	2006	8	29	8/29/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	76	7.6	W	2006	8	30	8/30/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	76	7.6	W	2006	8	31	8/31/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	112	11.2	W	2006	9	1	9/1/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	161	16.1	W	2006	9	2	9/2/2006	10.06	0.0006	16.09		0.85	8.96	-
-108.229	103	10.3	W	2006	9	3	9/3/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	103	10.3	W	2006	9	4	9/4/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	139	13.9	W	2006	9	5	9/5/2006	10.06	0.0006	13.89		0.74	3.69	-
-108.229	107	10.7	W	2006	9	6	9/6/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	72	7.2	W	2006	9	7	9/7/2006	10.06	0.0006	7.20		0.38	-	-
-108.229	58	5.8	W	2006	9	8	9/8/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	98	9.8	W	2006	9	9	9/9/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	103	10.3	W	2006	9	10	9/10/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	63	6.3	W	2006	9	11	9/11/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2006	9	12	9/12/2006	10.06	0.0006	5.40		0.29	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	103	10.3	W	2006	9	13	9/13/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	130	13.0	W	2006	9	14	9/14/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	125	12.5	W	2006	9	15	9/15/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	112	11.2	W	2006	9	16	9/16/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	125	12.5	W	2006	9	17	9/17/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	76	7.6	W	2006	9	18	9/18/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	67	6.7	W	2006	9	19	9/19/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	134	13.4	W	2006	9	20	9/20/2006	10.06	0.0006	13.39		0.71	2.71	-
-108.229	98	9.8	W	2006	9	21	9/21/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	89	8.9	W	2006	9	22	9/22/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	63	6.3	W	2006	9	23	9/23/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2006	9	24	9/24/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	63	6.3	W	2006	9	25	9/25/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	94	9.4	W	2006	9	26	9/26/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	107	10.7	W	2006	9	27	9/27/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	76	7.6	W	2006	9	28	9/28/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	103	10.3	W	2006	9	29	9/29/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	72	7.2	W	2006	9	30	9/30/2006	10.06	0.0006	7.20		0.38	-	-
-108.229	58	5.8	W	2006	10	1	10/1/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2006	10	2	10/2/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	125	12.5	W	2006	10	3	10/3/2006	10.06	0.0006	12.49		0.66	1.16	-
-108.229	170	17.0	W	2006	10	4	10/4/2006	10.06	0.0006	16.99		0.90	11.57	-
-108.229	89	8.9	W	2006	10	5	10/5/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	112	11.2	W	2006	10	6	10/6/2006	10.06	0.0006	11.19		0.59	-	-
-108.229	76	7.6	W	2006	10	7	10/7/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	98	9.8	W	2006	10	8	10/8/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	81	8.1	W	2006	10	9	10/9/2006	10.06	0.0006	8.10		0.43	-	-
-108.229	72	7.2	W	2006	10	10	10/10/2006	10.06	0.0006	7.20		0.38	-	-
-108.229	107	10.7	W	2006	10	11	10/11/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	94	9.4	W	2006	10	12	10/12/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	45	4.5	W	2006	10	13	10/13/2006	10.06	0.0006	4.50		0.24	-	-
-108.229	98	9.8	W	2006	10	14	10/14/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2006	10	15	10/15/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	63	6.3	W	2006	10	16	10/16/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	165	16.5	W	2006	10	17	10/17/2006	10.06	0.0006	16.49		0.87	10.09	-
-108.229	107	10.7	W	2006	10	18	10/18/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	89	8.9	W	2006	10	19	10/19/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	89	8.9	W	2006	10	20	10/20/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	107	10.7	W	2006	10	21	10/21/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	89	8.9	W	2006	10	22	10/22/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	40	4.0	W	2006	10	23	10/23/2006	10.06	0.0006	4.00		0.21	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	54	5.4	W	2006	10	24	10/24/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	165	16.5	W	2006	10	25	10/25/2006	10.06	0.0006	16.49		0.87	10.09	-
-108.229	143	14.3	W	2006	10	26	10/26/2006	10.06	0.0006	14.29		0.76	4.53	-
-108.229	40	4.0	W	2006	10	27	10/27/2006	10.06	0.0006	4.00		0.21	-	-
-108.229	45	4.5	W	2006	10	28	10/28/2006	10.06	0.0006	4.50		0.24	-	-
-108.229	45	4.5	W	2006	10	29	10/29/2006	10.06	0.0006	4.50		0.24	-	-
-108.229	67	6.7	W	2006	10	30	10/30/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	58	5.8	W	2006	10	31	10/31/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	76	7.6	W	2006	11	1	11/1/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	54	5.4	W	2006	11	2	11/2/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	58	5.8	W	2006	11	3	11/3/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	76	7.6	W	2006	11	4	11/4/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	107	10.7	W	2006	11	5	11/5/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	94	9.4	W	2006	11	6	11/6/2006	10.06	0.0006	9.39		0.50	-	-
-108.229	58	5.8	W	2006	11	7	11/7/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2006	11	8	11/8/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	107	10.7	W	2006	11	9	11/9/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	107	10.7	W	2006	11	10	11/10/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	81	8.1	W	2006	11	11	11/11/2006	10.06	0.0006	8.10		0.43	-	-
-108.229	107	10.7	W	2006	11	12	11/12/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	67	6.7	W	2006	11	13	11/13/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	174	17.4	W	2006	11	14	11/14/2006	10.06	0.0006	17.39		0.92	12.82	-
-108.229	63	6.3	W	2006	11	15	11/15/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	45	4.5	W	2006	11	16	11/16/2006	10.06	0.0006	4.50		0.24	-	-
-108.229	54	5.4	W	2006	11	17	11/17/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	98	9.8	W	2006	11	18	11/18/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	54	5.4	W	2006	11	19	11/19/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	58	5.8	W	2006	11	20	11/20/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	58	5.8	W	2006	11	21	11/21/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	63	6.3	W	2006	11	22	11/22/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	58	5.8	W	2006	11	23	11/23/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	76	7.6	W	2006	11	24	11/24/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	54	5.4	W	2006	11	25	11/25/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	58	5.8	W	2006	11	26	11/26/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	98	9.8	W	2006	11	27	11/27/2006	10.06	0.0006	9.79		0.52	-	-
-108.229	134	13.4	W	2006	11	28	11/28/2006	10.06	0.0006	13.39		0.71	2.71	-
-108.229	116	11.6	W	2006	11	29	11/29/2006	10.06	0.0006	11.59		0.61	-	-
-108.229	72	7.2	W	2006	11	30	11/30/2006	10.06	0.0006	7.20		0.38	-	-
-108.229	63	6.3	W	2006	12	1	12/1/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	107	10.7	W	2006	12	2	12/2/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	40	4.0	W	2006	12	3	12/3/2006	10.06	0.0006	4.00		0.21	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	45	4.5	W	2006	12	4	12/4/2006	10.06	0.0006	4.50		0.24	-	-
-108.229	63	6.3	W	2006	12	5	12/5/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2006	12	6	12/6/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2006	12	7	12/7/2006	10.06	0.0006	4.50		0.24	-	-
-108.229	58	5.8	W	2006	12	8	12/8/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	63	6.3	W	2006	12	9	12/9/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	130	13.0	W	2006	12	10	12/10/2006	10.06	0.0006	12.99		0.69	1.99	-
-108.229	103	10.3	W	2006	12	11	12/11/2006	10.06	0.0006	10.29		0.55	-	-
-108.229	58	5.8	W	2006	12	12	12/12/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	58	5.8	W	2006	12	13	12/13/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	40	4.0	W	2006	12	14	12/14/2006	10.06	0.0006	4.00		0.21	-	-
-108.229	63	6.3	W	2006	12	15	12/15/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	72	7.2	W	2006	12	16	12/16/2006	10.06	0.0006	7.20		0.38	-	-
-108.229	45	4.5	W	2006	12	17	12/17/2006	10.06	0.0006	4.50		0.24	-	-
-108.229	81	8.1	W	2006	12	18	12/18/2006	10.06	0.0006	8.10		0.43	-	-
-108.229	89	8.9	W	2006	12	19	12/19/2006	10.06	0.0006	8.89		0.47	-	-
-108.229	170	17.0	W	2006	12	20	12/20/2006	10.06	0.0006	16.99		0.90	11.57	-
-108.229	76	7.6	W	2006	12	21	12/21/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	76	7.6	W	2006	12	22	12/22/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	40	4.0	W	2006	12	23	12/23/2006	10.06	0.0006	4.00		0.21	-	-
-108.229	107	10.7	W	2006	12	24	12/24/2006	10.06	0.0006	10.69		0.57	-	-
-108.229	67	6.7	W	2006	12	25	12/25/2006	10.06	0.0006	6.70		0.35	-	-
-108.229	58	5.8	W	2006	12	26	12/26/2006	10.06	0.0006	5.80		0.31	-	-
-108.229	63	6.3	W	2006	12	27	12/27/2006	10.06	0.0006	6.30		0.33	-	-
-108.229	116	11.6	W	2006	12	28	12/28/2006	10.06	0.0006	11.59		0.61	-	-
-108.229	54	5.4	W	2006	12	29	12/29/2006	10.06	0.0006	5.40		0.29	-	-
-108.229	76	7.6	W	2006	12	30	12/30/2006	10.06	0.0006	7.60		0.40	-	-
-108.229	45	4.5	W	2006	12	31	12/31/2006	10.06	0.0006	4.50		0.24	-	-
-108.229	67	6.7	W	2007	1	1	1/1/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	54	5.4	W	2007	1	2	1/2/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2007	1	3	1/3/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	63	6.3	W	2007	1	4	1/4/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	107	10.7	W	2007	1	5	1/5/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	58	5.8	W	2007	1	6	1/6/2007	10.06	0.0006	5.80		0.31	-	-
-108.229	112	11.2	W	2007	1	7	1/7/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	54	5.4	W	2007	1	8	1/8/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2007	1	9	1/9/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2007	1	10	1/10/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	89	8.9	W	2007	1	11	1/11/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	130	13.0	W	2007	1	12	1/12/2007	10.06	0.0006	12.99		0.69	1.99	-
-108.229	67	6.7	W	2007	1	13	1/13/2007	10.06	0.0006	6.70		0.35	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	103	10.3	W	2007	1	14	1/14/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	40	4.0	W	2007	1	15	1/15/2007	10.06	0.0006	4.00		0.21	-	-
-108.229	45	4.5	W	2007	1	16	1/16/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	63	6.3	W	2007	1	17	1/17/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	40	4.0	W	2007	1	18	1/18/2007	10.06	0.0006	4.00		0.21	-	-
-108.229	54	5.4	W	2007	1	19	1/19/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	81	8.1	W	2007	1	20	1/20/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	54	5.4	W	2007	1	21	1/21/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2007	1	22	1/22/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2007	1	23	1/23/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	45	4.5	W	2007	1	24	1/24/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	45	4.5	W	2007	1	25	1/25/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	67	6.7	W	2007	1	26	1/26/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	45	4.5	W	2007	1	27	1/27/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	58	5.8	W	2007	1	28	1/28/2007	10.06	0.0006	5.80		0.31	-	-
-108.229	67	6.7	W	2007	1	29	1/29/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	63	6.3	W	2007	1	30	1/30/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	67	6.7	W	2007	1	31	1/31/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	81	8.1	W	2007	2	1	2/1/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	89	8.9	W	2007	2	2	2/2/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	76	7.6	W	2007	2	3	2/3/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	58	5.8	W	2007	2	4	2/4/2007	10.06	0.0006	5.80		0.31	-	-
-108.229	45	4.5	W	2007	2	5	2/5/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	58	5.8	W	2007	2	6	2/6/2007	10.06	0.0006	5.80		0.31	-	-
-108.229	45	4.5	W	2007	2	7	2/7/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	67	6.7	W	2007	2	8	2/8/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	54	5.4	W	2007	2	9	2/9/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2007	2	10	2/10/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	81	8.1	W	2007	2	11	2/11/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	112	11.2	W	2007	2	12	2/12/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	63	6.3	W	2007	2	13	2/13/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	143	14.3	W	2007	2	14	2/14/2007	10.06	0.0006	14.29		0.76	4.53	-
-108.229	165	16.5	W	2007	2	15	2/15/2007	10.06	0.0006	16.49		0.87	10.09	-
-108.229	125	12.5	W	2007	2	16	2/16/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	103	10.3	W	2007	2	17	2/17/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	72	7.2	W	2007	2	18	2/18/2007	10.06	0.0006	7.20		0.38	-	-
-108.229	103	10.3	W	2007	2	19	2/19/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	98	9.8	W	2007	2	20	2/20/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	54	5.4	W	2007	2	21	2/21/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	72	7.2	W	2007	2	22	2/22/2007	10.06	0.0006	7.20		0.38	-	-
-108.229	143	14.3	W	2007	2	23	2/23/2007	10.06	0.0006	14.29		0.76	4.53	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	179	17.9	W	2007	2	24	2/24/2007	10.06	0.0006	17.89		0.95	14.45	-
-108.229	72	7.2	W	2007	2	25	2/25/2007	10.06	0.0006	7.20		0.38	-	-
-108.229	58	5.8	W	2007	2	26	2/26/2007	10.06	0.0006	5.80		0.31	-	-
-108.229	139	13.9	W	2007	2	27	2/27/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	148	14.8	W	2007	2	28	2/28/2007	10.06	0.0006	14.79		0.78	5.66	-
-108.229	125	12.5	W	2007	3	1	3/1/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	165	16.5	W	2007	3	2	3/2/2007	10.06	0.0006	16.49		0.87	10.09	-
-108.229	103	10.3	W	2007	3	3	3/3/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	54	5.4	W	2007	3	4	3/4/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2007	3	5	3/5/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	89	8.9	W	2007	3	6	3/6/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	67	6.7	W	2007	3	7	3/7/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	103	10.3	W	2007	3	8	3/8/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	63	6.3	W	2007	3	9	3/9/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	107	10.7	W	2007	3	10	3/10/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	76	7.6	W	2007	3	11	3/11/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	89	8.9	W	2007	3	12	3/12/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	125	12.5	W	2007	3	13	3/13/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	112	11.2	W	2007	3	14	3/14/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	125	12.5	W	2007	3	15	3/15/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	98	9.8	W	2007	3	16	3/16/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	63	6.3	W	2007	3	17	3/17/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	98	9.8	W	2007	3	18	3/18/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	63	6.3	W	2007	3	19	3/19/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	134	13.4	W	2007	3	20	3/20/2007	10.06	0.0006	13.39		0.71	2.71	-
-108.229	139	13.9	W	2007	3	21	3/21/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	67	6.7	W	2007	3	22	3/22/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	116	11.6	W	2007	3	23	3/23/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	76	7.6	W	2007	3	24	3/24/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	45	4.5	W	2007	3	25	3/25/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	54	5.4	W	2007	3	26	3/26/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	179	17.9	W	2007	3	27	3/27/2007	10.06	0.0006	17.89		0.95	14.45	-
-108.229	103	10.3	W	2007	3	28	3/28/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	103	10.3	W	2007	3	29	3/29/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	107	10.7	W	2007	3	30	3/30/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	125	12.5	W	2007	3	31	3/31/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	81	8.1	W	2007	4	1	4/1/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	125	12.5	W	2007	4	2	4/2/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	81	8.1	W	2007	4	3	4/3/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	81	8.1	W	2007	4	4	4/4/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	107	10.7	W	2007	4	5	4/5/2007	10.06	0.0006	10.69		0.57	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	67	6.7	W	2007	4	6	4/6/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	112	11.2	W	2007	4	7	4/7/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	107	10.7	W	2007	4	8	4/8/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	157	15.7	W	2007	4	9	4/9/2007	10.06	0.0006	15.69		0.83	7.89	-
-108.229	183	18.3	W	2007	4	10	4/10/2007	10.06	0.0006	18.29		0.97	15.81	-
-108.229	107	10.7	W	2007	4	11	4/11/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	94	9.4	W	2007	4	12	4/12/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	98	9.8	W	2007	4	13	4/13/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	58	5.8	W	2007	4	14	4/14/2007	10.06	0.0006	5.80		0.31	-	-
-108.229	148	14.8	W	2007	4	15	4/15/2007	10.06	0.0006	14.79		0.78	5.66	-
-108.229	112	11.2	W	2007	4	16	4/16/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	112	11.2	W	2007	4	17	4/17/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	174	17.4	W	2007	4	18	4/18/2007	10.06	0.0006	17.39		0.92	12.82	-
-108.229	81	8.1	W	2007	4	19	4/19/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	112	11.2	W	2007	4	20	4/20/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	157	15.7	W	2007	4	21	4/21/2007	10.06	0.0006	15.69		0.83	7.89	-
-108.229	103	10.3	W	2007	4	22	4/22/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	143	14.3	W	2007	4	23	4/23/2007	10.06	0.0006	14.29		0.76	4.53	-
-108.229	170	17.0	W	2007	4	24	4/24/2007	10.06	0.0006	16.99		0.90	11.57	-
-108.229	116	11.6	W	2007	4	25	4/25/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	81	8.1	W	2007	4	26	4/26/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	76	7.6	W	2007	4	27	4/27/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	76	7.6	W	2007	4	28	4/28/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	125	12.5	W	2007	4	29	4/29/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	130	13.0	W	2007	4	30	4/30/2007	10.06	0.0006	12.99		0.69	1.99	-
-108.229	139	13.9	W	2007	5	1	5/1/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	89	8.9	W	2007	5	2	5/2/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	139	13.9	W	2007	5	3	5/3/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	165	16.5	W	2007	5	4	5/4/2007	10.06	0.0006	16.49		0.87	10.09	-
-108.229	103	10.3	W	2007	5	5	5/5/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	89	8.9	W	2007	5	6	5/6/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	40	4.0	W	2007	5	7	5/7/2007	10.06	0.0006	4.00		0.21	-	-
-108.229	67	6.7	W	2007	5	8	5/8/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	103	10.3	W	2007	5	9	5/9/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	81	8.1	W	2007	5	10	5/10/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	81	8.1	W	2007	5	11	5/11/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	76	7.6	W	2007	5	12	5/12/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	134	13.4	W	2007	5	13	5/13/2007	10.06	0.0006	13.39		0.71	2.71	-
-108.229	107	10.7	W	2007	5	14	5/14/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	134	13.4	W	2007	5	15	5/15/2007	10.06	0.0006	13.39		0.71	2.71	-
-108.229	130	13.0	W	2007	5	16	5/16/2007	10.06	0.0006	12.99		0.69	1.99	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	67	6.7	W	2007	5	17	5/17/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	112	11.2	W	2007	5	18	5/18/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	143	14.3	W	2007	5	19	5/19/2007	10.06	0.0006	14.29		0.76	4.53	-
-108.229	107	10.7	W	2007	5	20	5/20/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	112	11.2	W	2007	5	21	5/21/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	112	11.2	W	2007	5	22	5/22/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	81	8.1	W	2007	5	23	5/23/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	58	5.8	W	2007	5	24	5/24/2007	10.06	0.0006	5.80		0.31	-	-
-108.229	89	8.9	W	2007	5	25	5/25/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	89	8.9	W	2007	5	26	5/26/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	76	7.6	W	2007	5	27	5/27/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	76	7.6	W	2007	5	28	5/28/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	112	11.2	W	2007	5	29	5/29/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	107	10.7	W	2007	5	30	5/30/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	98	9.8	W	2007	5	31	5/31/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	112	11.2	W	2007	6	1	6/1/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	89	8.9	W	2007	6	2	6/2/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	112	11.2	W	2007	6	3	6/3/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	112	11.2	W	2007	6	4	6/4/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	103	10.3	W	2007	6	5	6/5/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	192	19.2	W	2007	6	6	6/6/2007	10.06	0.0006	19.19		1.02	19.06	-
-108.229	107	10.7	W	2007	6	7	6/7/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	81	8.1	W	2007	6	8	6/8/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	134	13.4	W	2007	6	9	6/9/2007	10.06	0.0006	13.39		0.71	2.71	-
-108.229	67	6.7	W	2007	6	10	6/10/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	103	10.3	W	2007	6	11	6/11/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	130	13.0	W	2007	6	12	6/12/2007	10.06	0.0006	12.99		0.69	1.99	-
-108.229	125	12.5	W	2007	6	13	6/13/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	116	11.6	W	2007	6	14	6/14/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	107	10.7	W	2007	6	15	6/15/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	103	10.3	W	2007	6	16	6/16/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	98	9.8	W	2007	6	17	6/17/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	112	11.2	W	2007	6	18	6/18/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	72	7.2	W	2007	6	19	6/19/2007	10.06	0.0006	7.20		0.38	-	-
-108.229	67	6.7	W	2007	6	20	6/20/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	89	8.9	W	2007	6	21	6/21/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	89	8.9	W	2007	6	22	6/22/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	76	7.6	W	2007	6	23	6/23/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	81	8.1	W	2007	6	24	6/24/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	94	9.4	W	2007	6	25	6/25/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	76	7.6	W	2007	6	26	6/26/2007	10.06	0.0006	7.60		0.40	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	103	10.3	W	2007	6	27	6/27/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	112	11.2	W	2007	6	28	6/28/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	94	9.4	W	2007	6	29	6/29/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	94	9.4	W	2007	6	30	6/30/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2007	7	1	7/1/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	94	9.4	W	2007	7	2	7/2/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	98	9.8	W	2007	7	3	7/3/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	143	14.3	W	2007	7	4	7/4/2007	10.06	0.0006	14.29		0.76	4.53	-
-108.229	143	14.3	W	2007	7	5	7/5/2007	10.06	0.0006	14.29		0.76	4.53	-
-108.229	134	13.4	W	2007	7	6	7/6/2007	10.06	0.0006	13.39		0.71	2.71	-
-108.229	103	10.3	W	2007	7	7	7/7/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	116	11.6	W	2007	7	8	7/8/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	107	10.7	W	2007	7	9	7/9/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	139	13.9	W	2007	7	10	7/10/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	161	16.1	W	2007	7	11	7/11/2007	10.06	0.0006	16.09		0.85	8.96	-
-108.229	116	11.6	W	2007	7	12	7/12/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	76	7.6	W	2007	7	13	7/13/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	107	10.7	W	2007	7	14	7/14/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	125	12.5	W	2007	7	15	7/15/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	134	13.4	W	2007	7	16	7/16/2007	10.06	0.0006	13.39		0.71	2.71	-
-108.229	107	10.7	W	2007	7	17	7/17/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	103	10.3	W	2007	7	18	7/18/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	76	7.6	W	2007	7	19	7/19/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	130	13.0	W	2007	7	20	7/20/2007	10.06	0.0006	12.99		0.69	1.99	-
-108.229	107	10.7	W	2007	7	21	7/21/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	89	8.9	W	2007	7	22	7/22/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	134	13.4	W	2007	7	23	7/23/2007	10.06	0.0006	13.39		0.71	2.71	-
-108.229	112	11.2	W	2007	7	24	7/24/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	94	9.4	W	2007	7	25	7/25/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	165	16.5	W	2007	7	26	7/26/2007	10.06	0.0006	16.49		0.87	10.09	-
-108.229	139	13.9	W	2007	7	27	7/27/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	107	10.7	W	2007	7	28	7/28/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	139	13.9	W	2007	7	29	7/29/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	148	14.8	W	2007	7	30	7/30/2007	10.06	0.0006	14.79		0.78	5.66	-
-108.229	98	9.8	W	2007	7	31	7/31/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	116	11.6	W	2007	8	1	8/1/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	103	10.3	W	2007	8	2	8/2/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	107	10.7	W	2007	8	3	8/3/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	89	8.9	W	2007	8	4	8/4/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	103	10.3	W	2007	8	5	8/5/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	161	16.1	W	2007	8	6	8/6/2007	10.06	0.0006	16.09		0.85	8.96	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	67	6.7	W	2007	8	7	8/7/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	54	5.4	W	2007	8	8	8/8/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	107	10.7	W	2007	8	9	8/9/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	81	8.1	W	2007	8	10	8/10/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	76	7.6	W	2007	8	11	8/11/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	81	8.1	W	2007	8	12	8/12/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	103	10.3	W	2007	8	13	8/13/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	98	9.8	W	2007	8	14	8/14/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	72	7.2	W	2007	8	15	8/15/2007	10.06	0.0006	7.20		0.38	-	-
-108.229	165	16.5	W	2007	8	16	8/16/2007	10.06	0.0006	16.49		0.87	10.09	-
-108.229	107	10.7	W	2007	8	17	8/17/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	76	7.6	W	2007	8	18	8/18/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	72	7.2	W	2007	8	19	8/19/2007	10.06	0.0006	7.20		0.38	-	-
-108.229	94	9.4	W	2007	8	20	8/20/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	89	8.9	W	2007	8	21	8/21/2007	10.06	0.0006	8.89		0.47	-	-
-108.229	98	9.8	W	2007	8	22	8/22/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	81	8.1	W	2007	8	23	8/23/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	94	9.4	W	2007	8	24	8/24/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	63	6.3	W	2007	8	25	8/25/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	94	9.4	W	2007	8	26	8/26/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	179	17.9	W	2007	8	27	8/27/2007	10.06	0.0006	17.89		0.95	14.45	-
-108.229	63	6.3	W	2007	8	28	8/28/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	72	7.2	W	2007	8	29	8/29/2007	10.06	0.0006	7.20		0.38	-	-
-108.229	76	7.6	W	2007	8	30	8/30/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	103	10.3	W	2007	8	31	8/31/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	125	12.5	W	2007	9	1	9/1/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	40	4.0	W	2007	9	2	9/2/2007	10.06	0.0006	4.00		0.21	-	-
-108.229	63	6.3	W	2007	9	3	9/3/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	67	6.7	W	2007	9	4	9/4/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	98	9.8	W	2007	9	5	9/5/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	98	9.8	W	2007	9	6	9/6/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	98	9.8	W	2007	9	7	9/7/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	54	5.4	W	2007	9	8	9/8/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	94	9.4	W	2007	9	9	9/9/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2007	9	10	9/10/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	112	11.2	W	2007	9	11	9/11/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	116	11.6	W	2007	9	12	9/12/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	116	11.6	W	2007	9	13	9/13/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	54	5.4	W	2007	9	14	9/14/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	125	12.5	W	2007	9	15	9/15/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	139	13.9	W	2007	9	16	9/16/2007	10.06	0.0006	13.89		0.74	3.69	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	148	14.8	W	2007	9	17	9/17/2007	10.06	0.0006	14.79		0.78	5.66	-
-108.229	139	13.9	W	2007	9	18	9/18/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	103	10.3	W	2007	9	19	9/19/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	94	9.4	W	2007	9	20	9/20/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	63	6.3	W	2007	9	21	9/21/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	157	15.7	W	2007	9	22	9/22/2007	10.06	0.0006	15.69		0.83	7.89	-
-108.229	116	11.6	W	2007	9	23	9/23/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	76	7.6	W	2007	9	24	9/24/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	76	7.6	W	2007	9	25	9/25/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	76	7.6	W	2007	9	26	9/26/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	54	5.4	W	2007	9	27	9/27/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	103	10.3	W	2007	9	28	9/28/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	170	17.0	W	2007	9	29	9/29/2007	10.06	0.0006	16.99		0.90	11.57	-
-108.229	139	13.9	W	2007	9	30	9/30/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	116	11.6	W	2007	10	1	10/1/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	98	9.8	W	2007	10	2	10/2/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	63	6.3	W	2007	10	3	10/3/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	139	13.9	W	2007	10	4	10/4/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	125	12.5	W	2007	10	5	10/5/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	165	16.5	W	2007	10	6	10/6/2007	10.06	0.0006	16.49		0.87	10.09	-
-108.229	81	8.1	W	2007	10	7	10/7/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	54	5.4	W	2007	10	8	10/8/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	107	10.7	W	2007	10	9	10/9/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	81	8.1	W	2007	10	10	10/10/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	63	6.3	W	2007	10	11	10/11/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	81	8.1	W	2007	10	12	10/12/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	107	10.7	W	2007	10	13	10/13/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	76	7.6	W	2007	10	14	10/14/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	107	10.7	W	2007	10	15	10/15/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	103	10.3	W	2007	10	16	10/16/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	130	13.0	W	2007	10	17	10/17/2007	10.06	0.0006	12.99		0.69	1.99	-
-108.229	116	11.6	W	2007	10	18	10/18/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	67	6.7	W	2007	10	19	10/19/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	139	13.9	W	2007	10	20	10/20/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	143	14.3	W	2007	10	21	10/21/2007	10.06	0.0006	14.29		0.76	4.53	-
-108.229	116	11.6	W	2007	10	22	10/22/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	157	15.7	W	2007	10	23	10/23/2007	10.06	0.0006	15.69		0.83	7.89	-
-108.229	45	4.5	W	2007	10	24	10/24/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	76	7.6	W	2007	10	25	10/25/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	63	6.3	W	2007	10	26	10/26/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2007	10	27	10/27/2007	10.06	0.0006	5.40		0.29	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	54	5.4	W	2007	10	28	10/28/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	63	6.3	W	2007	10	29	10/29/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	134	13.4	W	2007	10	30	10/30/2007	10.06	0.0006	13.39		0.71	2.71	-
-108.229	76	7.6	W	2007	10	31	10/31/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	45	4.5	W	2007	11	1	11/1/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	63	6.3	W	2007	11	2	11/2/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2007	11	3	11/3/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	63	6.3	W	2007	11	4	11/4/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	45	4.5	W	2007	11	5	11/5/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	81	8.1	W	2007	11	6	11/6/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	58	5.8	W	2007	11	7	11/7/2007	10.06	0.0006	5.80		0.31	-	-
-108.229	67	6.7	W	2007	11	8	11/8/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	45	4.5	W	2007	11	9	11/9/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	125	12.5	W	2007	11	10	11/10/2007	10.06	0.0006	12.49		0.66	1.16	-
-108.229	143	14.3	W	2007	11	11	11/11/2007	10.06	0.0006	14.29		0.76	4.53	-
-108.229	40	4.0	W	2007	11	12	11/12/2007	10.06	0.0006	4.00		0.21	-	-
-108.229	81	8.1	W	2007	11	13	11/13/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	94	9.4	W	2007	11	14	11/14/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	130	13.0	W	2007	11	15	11/15/2007	10.06	0.0006	12.99		0.69	1.99	-
-108.229	103	10.3	W	2007	11	16	11/16/2007	10.06	0.0006	10.29		0.55	-	-
-108.229	98	9.8	W	2007	11	17	11/17/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	58	5.8	W	2007	11	18	11/18/2007	10.06	0.0006	5.80		0.31	-	-
-108.229	72	7.2	W	2007	11	19	11/19/2007	10.06	0.0006	7.20		0.38	-	-
-108.229	54	5.4	W	2007	11	20	11/20/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	112	11.2	W	2007	11	21	11/21/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	94	9.4	W	2007	11	22	11/22/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2007	11	23	11/23/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	98	9.8	W	2007	11	24	11/24/2007	10.06	0.0006	9.79		0.52	-	-
-108.229	58	5.8	W	2007	11	25	11/25/2007	10.06	0.0006	5.80		0.31	-	-
-108.229	67	6.7	W	2007	11	26	11/26/2007	10.06	0.0006	6.70		0.35	-	-
-108.229	161	16.1	W	2007	11	27	11/27/2007	10.06	0.0006	16.09		0.85	8.96	-
-108.229	107	10.7	W	2007	11	28	11/28/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	130	13.0	W	2007	11	29	11/29/2007	10.06	0.0006	12.99		0.69	1.99	-
-108.229	81	8.1	W	2007	11	30	11/30/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	174	17.4	W	2007	12	1	12/1/2007	10.06	0.0006	17.39		0.92	12.82	-
-108.229	112	11.2	W	2007	12	2	12/2/2007	10.06	0.0006	11.19		0.59	-	-
-108.229	107	10.7	W	2007	12	3	12/3/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	148	14.8	W	2007	12	4	12/4/2007	10.06	0.0006	14.79		0.78	5.66	-
-108.229	139	13.9	W	2007	12	5	12/5/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	72	7.2	W	2007	12	6	12/6/2007	10.06	0.0006	7.20		0.38	-	-
-108.229	76	7.6	W	2007	12	7	12/7/2007	10.06	0.0006	7.60		0.40	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	94	9.4	W	2007	12	8	12/8/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	130	13.0	W	2007	12	9	12/9/2007	10.06	0.0006	12.99		0.69	1.99	-
-108.229	94	9.4	W	2007	12	10	12/10/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2007	12	11	12/11/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	76	7.6	W	2007	12	12	12/12/2007	10.06	0.0006	7.60		0.40	-	-
-108.229	36	3.6	W	2007	12	13	12/13/2007	10.06	0.0006	3.60		0.19	-	-
-108.229	143	14.3	W	2007	12	14	12/14/2007	10.06	0.0006	14.29		0.76	4.53	-
-108.229	94	9.4	W	2007	12	15	12/15/2007	10.06	0.0006	9.39		0.50	-	-
-108.229	45	4.5	W	2007	12	16	12/16/2007	10.06	0.0006	4.50		0.24	-	-
-108.229	157	15.7	W	2007	12	17	12/17/2007	10.06	0.0006	15.69		0.83	7.89	-
-108.229	174	17.4	W	2007	12	18	12/18/2007	10.06	0.0006	17.39		0.92	12.82	-
-108.229	143	14.3	W	2007	12	19	12/19/2007	10.06	0.0006	14.29		0.76	4.53	-
-108.229	54	5.4	W	2007	12	20	12/20/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	130	13.0	W	2007	12	21	12/21/2007	10.06	0.0006	12.99		0.69	1.99	-
-108.229	130	13.0	W	2007	12	22	12/22/2007	10.06	0.0006	12.99		0.69	1.99	-
-108.229	116	11.6	W	2007	12	23	12/23/2007	10.06	0.0006	11.59		0.61	-	-
-108.229	63	6.3	W	2007	12	24	12/24/2007	10.06	0.0006	6.30		0.33	-	-
-108.229	139	13.9	W	2007	12	25	12/25/2007	10.06	0.0006	13.89		0.74	3.69	-
-108.229	54	5.4	W	2007	12	26	12/26/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	161	16.1	W	2007	12	27	12/27/2007	10.06	0.0006	16.09		0.85	8.96	-
-108.229	81	8.1	W	2007	12	28	12/28/2007	10.06	0.0006	8.10		0.43	-	-
-108.229	54	5.4	W	2007	12	29	12/29/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2007	12	30	12/30/2007	10.06	0.0006	5.40		0.29	-	-
-108.229	107	10.7	W	2007	12	31	12/31/2007	10.06	0.0006	10.69		0.57	-	-
-108.229	40	4.0	W	2008	1	1	1/1/2008	10.06	0.0006	4.00		0.21	-	-
-108.229	76	7.6	W	2008	1	2	1/2/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	54	5.4	W	2008	1	3	1/3/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	72	7.2	W	2008	1	4	1/4/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	98	9.8	W	2008	1	5	1/5/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	89	8.9	W	2008	1	6	1/6/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	94	9.4	W	2008	1	7	1/7/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	54	5.4	W	2008	1	8	1/8/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	103	10.3	W	2008	1	9	1/9/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	67	6.7	W	2008	1	10	1/10/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	45	4.5	W	2008	1	11	1/11/2008	10.06	0.0006	4.50		0.24	-	-
-108.229	54	5.4	W	2008	1	12	1/12/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2008	1	13	1/13/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	40	4.0	W	2008	1	14	1/14/2008	10.06	0.0006	4.00		0.21	-	-
-108.229	58	5.8	W	2008	1	15	1/15/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	130	13.0	W	2008	1	16	1/16/2008	10.06	0.0006	12.99		0.69	1.99	-
-108.229	54	5.4	W	2008	1	17	1/17/2008	10.06	0.0006	5.40		0.29	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	76	7.6	W	2008	1	18	1/18/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	45	4.5	W	2008	1	19	1/19/2008	10.06	0.0006	4.50		0.24	-	-
-108.229	58	5.8	W	2008	1	20	1/20/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	157	15.7	W	2008	1	21	1/21/2008	10.06	0.0006	15.69		0.83	7.89	-
-108.229	54	5.4	W	2008	1	22	1/22/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2008	1	23	1/23/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2008	1	24	1/24/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	36	3.6	W	2008	1	25	1/25/2008	10.06	0.0006	3.60		0.19	-	-
-108.229	58	5.8	W	2008	1	26	1/26/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	72	7.2	W	2008	1	27	1/27/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	206	20.6	W	2008	1	28	1/28/2008	10.06	0.0006	20.59		1.09	24.65	2.07
-108.229	116	11.6	W	2008	1	29	1/29/2008	10.06	0.0006	11.59		0.61	-	-
-108.229	139	13.9	W	2008	1	30	1/30/2008	10.06	0.0006	13.89		0.74	3.69	-
-108.229	94	9.4	W	2008	1	31	1/31/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	58	5.8	W	2008	2	1	2/1/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	72	7.2	W	2008	2	2	2/2/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	103	10.3	W	2008	2	3	2/3/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	67	6.7	W	2008	2	4	2/4/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	130	13.0	W	2008	2	5	2/5/2008	10.06	0.0006	12.99		0.69	1.99	-
-108.229	58	5.8	W	2008	2	6	2/6/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	45	4.5	W	2008	2	7	2/7/2008	10.06	0.0006	4.50		0.24	-	-
-108.229	72	7.2	W	2008	2	8	2/8/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	54	5.4	W	2008	2	9	2/9/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	72	7.2	W	2008	2	10	2/10/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	103	10.3	W	2008	2	11	2/11/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	134	13.4	W	2008	2	12	2/12/2008	10.06	0.0006	13.39		0.71	2.71	-
-108.229	103	10.3	W	2008	2	13	2/13/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	112	11.2	W	2008	2	14	2/14/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	76	7.6	W	2008	2	15	2/15/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	139	13.9	W	2008	2	16	2/16/2008	10.06	0.0006	13.89		0.74	3.69	-
-108.229	112	11.2	W	2008	2	17	2/17/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	94	9.4	W	2008	2	18	2/18/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	54	5.4	W	2008	2	19	2/19/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	63	6.3	W	2008	2	20	2/20/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	76	7.6	W	2008	2	21	2/21/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	63	6.3	W	2008	2	22	2/22/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	94	9.4	W	2008	2	23	2/23/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	76	7.6	W	2008	2	24	2/24/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	125	12.5	W	2008	2	25	2/25/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	54	5.4	W	2008	2	26	2/26/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	58	5.8	W	2008	2	27	2/27/2008	10.06	0.0006	5.80		0.31	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	67	6.7	W	2008	2	28	2/28/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	40	4.0	W	2008	2	29	2/29/2008	10.06	0.0006	4.00		0.21	-	-
-108.229	107	10.7	W	2008	3	1	3/1/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	157	15.7	W	2008	3	2	3/2/2008	10.06	0.0006	15.69		0.83	7.89	-
-108.229	98	9.8	W	2008	3	3	3/3/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	76	7.6	W	2008	3	4	3/4/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	112	11.2	W	2008	3	5	3/5/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	143	14.3	W	2008	3	6	3/6/2008	10.06	0.0006	14.29		0.76	4.53	-
-108.229	130	13.0	W	2008	3	7	3/7/2008	10.06	0.0006	12.99		0.69	1.99	-
-108.229	89	8.9	W	2008	3	8	3/8/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	45	4.5	W	2008	3	9	3/9/2008	10.06	0.0006	4.50		0.24	-	-
-108.229	81	8.1	W	2008	3	10	3/10/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	67	6.7	W	2008	3	11	3/11/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	116	11.6	W	2008	3	12	3/12/2008	10.06	0.0006	11.59		0.61	-	-
-108.229	107	10.7	W	2008	3	13	3/13/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	201	20.1	W	2008	3	14	3/14/2008	10.06	0.0006	20.09		1.06	22.58	1.23
-108.229	161	16.1	W	2008	3	15	3/15/2008	10.06	0.0006	16.09		0.85	8.96	-
-108.229	161	16.1	W	2008	3	16	3/16/2008	10.06	0.0006	16.09		0.85	8.96	-
-108.229	89	8.9	W	2008	3	17	3/17/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	130	13.0	W	2008	3	18	3/18/2008	10.06	0.0006	12.99		0.69	1.99	-
-108.229	58	5.8	W	2008	3	19	3/19/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	81	8.1	W	2008	3	20	3/20/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	103	10.3	W	2008	3	21	3/21/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	107	10.7	W	2008	3	22	3/22/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	67	6.7	W	2008	3	23	3/23/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	63	6.3	W	2008	3	24	3/24/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	72	7.2	W	2008	3	25	3/25/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	107	10.7	W	2008	3	26	3/26/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	125	12.5	W	2008	3	27	3/27/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	54	5.4	W	2008	3	28	3/28/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	98	9.8	W	2008	3	29	3/29/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	174	17.4	W	2008	3	30	3/30/2008	10.06	0.0006	17.39		0.92	12.82	-
-108.229	139	13.9	W	2008	3	31	3/31/2008	10.06	0.0006	13.89		0.74	3.69	-
-108.229	161	16.1	W	2008	5	1	5/1/2008	10.06	0.0006	16.09		0.85	8.96	-
-108.229	125	12.5	W	2008	5	2	5/2/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	76	7.6	W	2008	5	3	5/3/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	63	6.3	W	2008	5	4	5/4/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	67	6.7	W	2008	5	5	5/5/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	125	12.5	W	2008	5	6	5/6/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	112	11.2	W	2008	5	7	5/7/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	165	16.5	W	2008	5	8	5/8/2008	10.06	0.0006	16.49		0.87	10.09	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	107	10.7	W	2008	5	9	5/9/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	130	13.0	W	2008	5	10	5/10/2008	10.06	0.0006	12.99		0.69	1.99	-
-108.229	89	8.9	W	2008	5	11	5/11/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	143	14.3	W	2008	5	12	5/12/2008	10.06	0.0006	14.29		0.76	4.53	-
-108.229	107	10.7	W	2008	5	13	5/13/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	130	13.0	W	2008	5	14	5/14/2008	10.06	0.0006	12.99		0.69	1.99	-
-108.229	89	8.9	W	2008	5	15	5/15/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	72	7.2	W	2008	5	16	5/16/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	76	7.6	W	2008	5	17	5/17/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	107	10.7	W	2008	5	18	5/18/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	112	11.2	W	2008	5	19	5/19/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	134	13.4	W	2008	5	20	5/20/2008	10.06	0.0006	13.39		0.71	2.71	-
-108.229	201	20.1	W	2008	5	21	5/21/2008	10.06	0.0006	20.09		1.06	22.58	1.23
-108.229	161	16.1	W	2008	5	22	5/22/2008	10.06	0.0006	16.09		0.85	8.96	-
-108.229	112	11.2	W	2008	5	23	5/23/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	72	7.2	W	2008	5	24	5/24/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	107	10.7	W	2008	5	25	5/25/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	116	11.6	W	2008	5	26	5/26/2008	10.06	0.0006	11.59		0.61	-	-
-108.229	89	8.9	W	2008	5	27	5/27/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	139	13.9	W	2008	5	28	5/28/2008	10.06	0.0006	13.89		0.74	3.69	-
-108.229	103	10.3	W	2008	5	29	5/29/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	81	8.1	W	2008	5	30	5/30/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	63	6.3	W	2008	5	31	5/31/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2008	6	1	6/1/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	98	9.8	W	2008	6	2	6/2/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	103	10.3	W	2008	6	3	6/3/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	148	14.8	W	2008	6	4	6/4/2008	10.06	0.0006	14.79		0.78	5.66	-
-108.229	148	14.8	W	2008	6	5	6/5/2008	10.06	0.0006	14.79		0.78	5.66	-
-108.229	67	6.7	W	2008	6	6	6/6/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	116	11.6	W	2008	6	7	6/7/2008	10.06	0.0006	11.59		0.61	-	-
-108.229	134	13.4	W	2008	6	8	6/8/2008	10.06	0.0006	13.39		0.71	2.71	-
-108.229	81	8.1	W	2008	6	9	6/9/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	125	12.5	W	2008	6	10	6/10/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	139	13.9	W	2008	6	11	6/11/2008	10.06	0.0006	13.89		0.74	3.69	-
-108.229	125	12.5	W	2008	6	12	6/12/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	89	8.9	W	2008	6	13	6/13/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	98	9.8	W	2008	6	14	6/14/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	112	11.2	W	2008	6	15	6/15/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	98	9.8	W	2008	6	16	6/16/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	107	10.7	W	2008	6	17	6/17/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	98	9.8	W	2008	6	18	6/18/2008	10.06	0.0006	9.79		0.52	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	112	11.2	W	2008	6	19	6/19/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	81	8.1	W	2008	6	20	6/20/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	67	6.7	W	2008	6	21	6/21/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	98	9.8	W	2008	6	22	6/22/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	157	15.7	W	2008	6	23	6/23/2008	10.06	0.0006	15.69		0.83	7.89	-
-108.229	89	8.9	W	2008	6	24	6/24/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	94	9.4	W	2008	6	25	6/25/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	98	9.8	W	2008	6	26	6/26/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	107	10.7	W	2008	6	27	6/27/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	103	10.3	W	2008	6	28	6/28/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	67	6.7	W	2008	6	29	6/29/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	112	11.2	W	2008	6	30	6/30/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	112	11.2	W	2008	7	1	7/1/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	157	15.7	W	2008	7	2	7/2/2008	10.06	0.0006	15.69		0.83	7.89	-
-108.229	112	11.2	W	2008	7	3	7/3/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	76	7.6	W	2008	7	4	7/4/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	170	17.0	W	2008	7	5	7/5/2008	10.06	0.0006	16.99		0.90	11.57	-
-108.229	157	15.7	W	2008	7	6	7/6/2008	10.06	0.0006	15.69		0.83	7.89	-
-108.229	112	11.2	W	2008	7	7	7/7/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	103	10.3	W	2008	7	8	7/8/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	103	10.3	W	2008	7	9	7/9/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	130	13.0	W	2008	7	10	7/10/2008	10.06	0.0006	12.99		0.69	1.99	-
-108.229	161	16.1	W	2008	7	11	7/11/2008	10.06	0.0006	16.09		0.85	8.96	-
-108.229	125	12.5	W	2008	7	12	7/12/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	94	9.4	W	2008	7	13	7/13/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	134	13.4	W	2008	7	14	7/14/2008	10.06	0.0006	13.39		0.71	2.71	-
-108.229	98	9.8	W	2008	7	15	7/15/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2008	7	16	7/16/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	94	9.4	W	2008	7	17	7/17/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	89	8.9	W	2008	7	18	7/18/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	134	13.4	W	2008	7	19	7/19/2008	10.06	0.0006	13.39		0.71	2.71	-
-108.229	112	11.2	W	2008	7	20	7/20/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	76	7.6	W	2008	7	21	7/21/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	134	13.4	W	2008	7	22	7/22/2008	10.06	0.0006	13.39		0.71	2.71	-
-108.229	76	7.6	W	2008	7	23	7/23/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	134	13.4	W	2008	7	24	7/24/2008	10.06	0.0006	13.39		0.71	2.71	-
-108.229	112	11.2	W	2008	7	25	7/25/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	81	8.1	W	2008	7	26	7/26/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	107	10.7	W	2008	7	27	7/27/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	112	11.2	W	2008	7	28	7/28/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	94	9.4	W	2008	7	29	7/29/2008	10.06	0.0006	9.39		0.50	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	89	8.9	W	2008	7	30	7/30/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	76	7.6	W	2008	7	31	7/31/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	72	7.2	W	2008	8	1	8/1/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	89	8.9	W	2008	8	2	8/2/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	94	9.4	W	2008	8	3	8/3/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	130	13.0	W	2008	8	4	8/4/2008	10.06	0.0006	12.99		0.69	1.99	-
-108.229	94	9.4	W	2008	8	5	8/5/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	107	10.7	W	2008	8	6	8/6/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	103	10.3	W	2008	8	7	8/7/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	112	11.2	W	2008	8	8	8/8/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	89	8.9	W	2008	8	9	8/9/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	125	12.5	W	2008	8	10	8/10/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	98	9.8	W	2008	8	11	8/11/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	107	10.7	W	2008	8	12	8/12/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	94	9.4	W	2008	8	13	8/13/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	107	10.7	W	2008	8	14	8/14/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	125	12.5	W	2008	8	15	8/15/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	112	11.2	W	2008	8	16	8/16/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	112	11.2	W	2008	8	17	8/17/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	94	9.4	W	2008	8	18	8/18/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	89	8.9	W	2008	8	19	8/19/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	94	9.4	W	2008	8	20	8/20/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2008	8	21	8/21/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	72	7.2	W	2008	8	22	8/22/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	134	13.4	W	2008	8	23	8/23/2008	10.06	0.0006	13.39		0.71	2.71	-
-108.229	134	13.4	W	2008	8	24	8/24/2008	10.06	0.0006	13.39		0.71	2.71	-
-108.229	112	11.2	W	2008	8	25	8/25/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	81	8.1	W	2008	8	26	8/26/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	58	5.8	W	2008	8	27	8/27/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	112	11.2	W	2008	8	28	8/28/2008	10.06	0.0006	11.19		0.59	-	-
-108.229	103	10.3	W	2008	8	29	8/29/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	107	10.7	W	2008	8	30	8/30/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	130	13.0	W	2008	8	31	8/31/2008	10.06	0.0006	12.99		0.69	1.99	-
-108.229	76	7.6	W	2008	9	1	9/1/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	76	7.6	W	2008	9	2	9/2/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	81	8.1	W	2008	9	3	9/3/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	94	9.4	W	2008	9	4	9/4/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	116	11.6	W	2008	9	5	9/5/2008	10.06	0.0006	11.59		0.61	-	-
-108.229	116	11.6	W	2008	9	6	9/6/2008	10.06	0.0006	11.59		0.61	-	-
-108.229	94	9.4	W	2008	9	7	9/7/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	134	13.4	W	2008	9	8	9/8/2008	10.06	0.0006	13.39		0.71	2.71	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	161	16.1	W	2008	9	9	9/9/2008	10.06	0.0006	16.09		0.85	8.96	-
-108.229	116	11.6	W	2008	9	10	9/10/2008	10.06	0.0006	11.59		0.61	-	-
-108.229	94	9.4	W	2008	9	11	9/11/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	107	10.7	W	2008	9	12	9/12/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	103	10.3	W	2008	9	13	9/13/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	58	5.8	W	2008	9	14	9/14/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	67	6.7	W	2008	9	15	9/15/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	54	5.4	W	2008	9	16	9/16/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	58	5.8	W	2008	9	17	9/17/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	76	7.6	W	2008	9	18	9/18/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	67	6.7	W	2008	9	19	9/19/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	103	10.3	W	2008	9	20	9/20/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	89	8.9	W	2008	9	21	9/21/2008	10.06	0.0006	8.89		0.47	-	-
-108.229	107	10.7	W	2008	9	22	9/22/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	58	5.8	W	2008	9	23	9/23/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2008	9	24	9/24/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	58	5.8	W	2008	9	25	9/25/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	63	6.3	W	2008	9	26	9/26/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	98	9.8	W	2008	9	27	9/27/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	103	10.3	W	2008	9	28	9/28/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	63	6.3	W	2008	9	29	9/29/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	63	6.3	W	2008	9	30	9/30/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	63	6.3	W	2008	10	1	10/1/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	58	5.8	W	2008	10	2	10/2/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	125	12.5	W	2008	10	3	10/3/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	148	14.8	W	2008	10	4	10/4/2008	10.06	0.0006	14.79		0.78	5.66	-
-108.229	94	9.4	W	2008	10	5	10/5/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	98	9.8	W	2008	10	6	10/6/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	54	5.4	W	2008	10	7	10/7/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2008	10	8	10/8/2008	10.06	0.0006	4.50		0.24	-	-
-108.229	94	9.4	W	2008	10	9	10/9/2008	10.06	0.0006	9.39		0.50	-	-
-108.229	125	12.5	W	2008	10	10	10/10/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	210	21.0	W	2008	10	11	10/11/2008	10.06	0.0006	20.99		1.11	26.37	2.80
-108.229	81	8.1	W	2008	10	12	10/12/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	63	6.3	W	2008	10	13	10/13/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	81	8.1	W	2008	10	14	10/14/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	54	5.4	W	2008	10	15	10/15/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	63	6.3	W	2008	10	16	10/16/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	45	4.5	W	2008	10	17	10/17/2008	10.06	0.0006	4.50		0.24	-	-
-108.229	58	5.8	W	2008	10	18	10/18/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	63	6.3	W	2008	10	19	10/19/2008	10.06	0.0006	6.30		0.33	-	-

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												Large Flat Piles (DFADA)			
													Scraper tracks	Overburden	
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02	
									% of pile surface area from AP-42			100%	100%	100%	
-108.229	161	16.1	W	2008	10	20	10/20/2008	10.06	0.0006	16.09		0.85	8.96	-	
-108.229	143	14.3	W	2008	10	21	10/21/2008	10.06	0.0006	14.29		0.76	4.53	-	
-108.229	134	13.4	W	2008	10	22	10/22/2008	10.06	0.0006	13.39		0.71	2.71	-	
-108.229	134	13.4	W	2008	10	23	10/23/2008	10.06	0.0006	13.39		0.71	2.71	-	
-108.229	116	11.6	W	2008	10	24	10/24/2008	10.06	0.0006	11.59		0.61	-	-	
-108.229	107	10.7	W	2008	10	25	10/25/2008	10.06	0.0006	10.69		0.57	-	-	
-108.229	63	6.3	W	2008	10	26	10/26/2008	10.06	0.0006	6.30		0.33	-	-	
-108.229	63	6.3	W	2008	10	27	10/27/2008	10.06	0.0006	6.30		0.33	-	-	
-108.229	63	6.3	W	2008	10	28	10/28/2008	10.06	0.0006	6.30		0.33	-	-	
-108.229	45	4.5	W	2008	10	29	10/29/2008	10.06	0.0006	4.50		0.24	-	-	
-108.229	45	4.5	W	2008	10	30	10/30/2008	10.06	0.0006	4.50		0.24	-	-	
-108.229	63	6.3	W	2008	10	31	10/31/2008	10.06	0.0006	6.30		0.33	-	-	
-108.229	58	5.8	W	2008	11	1	11/1/2008	10.06	0.0006	5.80		0.31	-	-	
-108.229	81	8.1	W	2008	11	2	11/2/2008	10.06	0.0006	8.10		0.43	-	-	
-108.229	58	5.8	W	2008	11	3	11/3/2008	10.06	0.0006	5.80		0.31	-	-	
-108.229	179	17.9	W	2008	11	4	11/4/2008	10.06	0.0006	17.89		0.95	14.45	-	
-108.229	170	17.0	W	2008	11	5	11/5/2008	10.06	0.0006	16.99		0.90	11.57	-	
-108.229	125	12.5	W	2008	11	6	11/6/2008	10.06	0.0006	12.49		0.66	1.16	-	
-108.229	81	8.1	W	2008	11	7	11/7/2008	10.06	0.0006	8.10		0.43	-	-	
-108.229	40	4.0	W	2008	11	8	11/8/2008	10.06	0.0006	4.00		0.21	-	-	
-108.229	72	7.2	W	2008	11	9	11/9/2008	10.06	0.0006	7.20		0.38	-	-	
-108.229	107	10.7	W	2008	11	10	11/10/2008	10.06	0.0006	10.69		0.57	-	-	
-108.229	81	8.1	W	2008	11	11	11/11/2008	10.06	0.0006	8.10		0.43	-	-	
-108.229	130	13.0	W	2008	11	12	11/12/2008	10.06	0.0006	12.99		0.69	1.99	-	
-108.229	139	13.9	W	2008	11	13	11/13/2008	10.06	0.0006	13.89		0.74	3.69	-	
-108.229	161	16.1	W	2008	11	14	11/14/2008	10.06	0.0006	16.09		0.85	8.96	-	
-108.229	45	4.5	W	2008	11	15	11/15/2008	10.06	0.0006	4.50		0.24	-	-	
-108.229	45	4.5	W	2008	11	16	11/16/2008	10.06	0.0006	4.50		0.24	-	-	
-108.229	40	4.0	W	2008	11	17	11/17/2008	10.06	0.0006	4.00		0.21	-	-	
-108.229	54	5.4	W	2008	11	18	11/18/2008	10.06	0.0006	5.40		0.29	-	-	
-108.229	54	5.4	W	2008	11	19	11/19/2008	10.06	0.0006	5.40		0.29	-	-	
-108.229	98	9.8	W	2008	11	20	11/20/2008	10.06	0.0006	9.79		0.52	-	-	
-108.229	94	9.4	W	2008	11	21	11/21/2008	10.06	0.0006	9.39		0.50	-	-	
-108.229	45	4.5	W	2008	11	22	11/22/2008	10.06	0.0006	4.50		0.24	-	-	
-108.229	125	12.5	W	2008	11	23	11/23/2008	10.06	0.0006	12.49		0.66	1.16	-	
-108.229	45	4.5	W	2008	11	24	11/24/2008	10.06	0.0006	4.50		0.24	-	-	
-108.229	54	5.4	W	2008	11	25	11/25/2008	10.06	0.0006	5.40		0.29	-	-	
-108.229	58	5.8	W	2008	11	26	11/26/2008	10.06	0.0006	5.80		0.31	-	-	
-108.229	67	6.7	W	2008	11	27	11/27/2008	10.06	0.0006	6.70		0.35	-	-	
-108.229	103	10.3	W	2008	11	28	11/28/2008	10.06	0.0006	10.29		0.55	-	-	
-108.229	143	14.3	W	2008	11	29	11/29/2008	10.06	0.0006	14.29		0.76	4.53	-	

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	134	13.4	W	2008	11	30	11/30/2008	10.06	0.0006	13.39		0.71	2.71	-
-108.229	125	12.5	W	2008	12	1	12/1/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	63	6.3	W	2008	12	2	12/2/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	125	12.5	W	2008	12	3	12/3/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	45	4.5	W	2008	12	4	12/4/2008	10.06	0.0006	4.50		0.24	-	-
-108.229	116	11.6	W	2008	12	5	12/5/2008	10.06	0.0006	11.59		0.61	-	-
-108.229	40	4.0	W	2008	12	6	12/6/2008	10.06	0.0006	4.00		0.21	-	-
-108.229	54	5.4	W	2008	12	7	12/7/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	81	8.1	W	2008	12	8	12/8/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	98	9.8	W	2008	12	9	12/9/2008	10.06	0.0006	9.79		0.52	-	-
-108.229	72	7.2	W	2008	12	10	12/10/2008	10.06	0.0006	7.20		0.38	-	-
-108.229	36	3.6	W	2008	12	11	12/11/2008	10.06	0.0006	3.60		0.19	-	-
-108.229	63	6.3	W	2008	12	12	12/12/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	157	15.7	W	2008	12	13	12/13/2008	10.06	0.0006	15.69		0.83	7.89	-
-108.229	179	17.9	W	2008	12	14	12/14/2008	10.06	0.0006	17.89		0.95	14.45	-
-108.229	81	8.1	W	2008	12	15	12/15/2008	10.06	0.0006	8.10		0.43	-	-
-108.229	103	10.3	W	2008	12	16	12/16/2008	10.06	0.0006	10.29		0.55	-	-
-108.229	63	6.3	W	2008	12	17	12/17/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	143	14.3	W	2008	12	18	12/18/2008	10.06	0.0006	14.29		0.76	4.53	-
-108.229	58	5.8	W	2008	12	19	12/19/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	63	6.3	W	2008	12	20	12/20/2008	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2008	12	21	12/21/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	76	7.6	W	2008	12	22	12/22/2008	10.06	0.0006	7.60		0.40	-	-
-108.229	116	11.6	W	2008	12	23	12/23/2008	10.06	0.0006	11.59		0.61	-	-
-108.229	67	6.7	W	2008	12	24	12/24/2008	10.06	0.0006	6.70		0.35	-	-
-108.229	107	10.7	W	2008	12	25	12/25/2008	10.06	0.0006	10.69		0.57	-	-
-108.229	157	15.7	W	2008	12	26	12/26/2008	10.06	0.0006	15.69		0.83	7.89	-
-108.229	125	12.5	W	2008	12	27	12/27/2008	10.06	0.0006	12.49		0.66	1.16	-
-108.229	54	5.4	W	2008	12	28	12/28/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2008	12	29	12/29/2008	10.06	0.0006	5.40		0.29	-	-
-108.229	40	4.0	W	2008	12	30	12/30/2008	10.06	0.0006	4.00		0.21	-	-
-108.229	58	5.8	W	2008	12	31	12/31/2008	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2009	1	1	1/1/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	67	6.7	W	2009	1	2	1/2/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	54	5.4	W	2009	1	3	1/3/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2009	1	4	1/4/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	58	5.8	W	2009	1	5	1/5/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	98	9.8	W	2009	1	6	1/6/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	81	8.1	W	2009	1	7	1/7/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	58	5.8	W	2009	1	8	1/8/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	116	11.6	W	2009	1	9	1/9/2009	10.06	0.0006	11.59		0.61	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	81	8.1	W	2009	1	10	1/10/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	112	11.2	W	2009	1	11	1/11/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	112	11.2	W	2009	1	12	1/12/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	125	12.5	W	2009	1	13	1/13/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	54	5.4	W	2009	1	14	1/14/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2009	1	15	1/15/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	36	3.6	W	2009	1	16	1/16/2009	10.06	0.0006	3.60		0.19	-	-
-108.229	36	3.6	W	2009	1	17	1/17/2009	10.06	0.0006	3.60		0.19	-	-
-108.229	54	5.4	W	2009	1	18	1/18/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	58	5.8	W	2009	1	19	1/19/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2009	1	20	1/20/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2009	1	21	1/21/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2009	1	22	1/22/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	40	4.0	W	2009	1	23	1/23/2009	10.06	0.0006	4.00		0.21	-	-
-108.229	45	4.5	W	2009	1	24	1/24/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	89	8.9	W	2009	1	25	1/25/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	116	11.6	W	2009	1	26	1/26/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	143	14.3	W	2009	1	27	1/27/2009	10.06	0.0006	14.29		0.76	4.53	-
-108.229	98	9.8	W	2009	1	28	1/28/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	107	10.7	W	2009	1	29	1/29/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	36	3.6	W	2009	1	30	1/30/2009	10.06	0.0006	3.60		0.19	-	-
-108.229	63	6.3	W	2009	1	31	1/31/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	112	11.2	W	2009	2	1	2/1/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	103	10.3	W	2009	2	2	2/2/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	40	4.0	W	2009	2	3	2/3/2009	10.06	0.0006	4.00		0.21	-	-
-108.229	54	5.4	W	2009	2	4	2/4/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	72	7.2	W	2009	2	5	2/5/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	58	5.8	W	2009	2	6	2/6/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	94	9.4	W	2009	2	7	2/7/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	134	13.4	W	2009	2	8	2/8/2009	10.06	0.0006	13.39		0.71	2.71	-
-108.229	143	14.3	W	2009	2	9	2/9/2009	10.06	0.0006	14.29		0.76	4.53	-
-108.229	112	11.2	W	2009	2	10	2/10/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	58	5.8	W	2009	2	11	2/11/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	116	11.6	W	2009	2	12	2/12/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	54	5.4	W	2009	2	13	2/13/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	98	9.8	W	2009	2	14	2/14/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	58	5.8	W	2009	2	15	2/15/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2009	2	16	2/16/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	103	10.3	W	2009	2	17	2/17/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	98	9.8	W	2009	2	18	2/18/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2009	2	19	2/19/2009	10.06	0.0006	9.39		0.50	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	76	7.6	W	2009	2	20	2/20/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	58	5.8	W	2009	2	21	2/21/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	58	5.8	W	2009	2	22	2/22/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	139	13.9	W	2009	2	23	2/23/2009	10.06	0.0006	13.89		0.74	3.69	-
-108.229	58	5.8	W	2009	2	24	2/24/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	103	10.3	W	2009	2	25	2/25/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	94	9.4	W	2009	2	26	2/26/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	157	15.7	W	2009	2	27	2/27/2009	10.06	0.0006	15.69		0.83	7.89	-
-108.229	45	4.5	W	2009	2	28	2/28/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	54	5.4	W	2009	3	1	3/1/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2009	3	2	3/2/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	67	6.7	W	2009	3	3	3/3/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	130	13.0	W	2009	3	4	3/4/2009	10.06	0.0006	12.99		0.69	1.99	-
-108.229	130	13.0	W	2009	3	5	3/5/2009	10.06	0.0006	12.99		0.69	1.99	-
-108.229	165	16.5	W	2009	3	6	3/6/2009	10.06	0.0006	16.49		0.87	10.09	-
-108.229	139	13.9	W	2009	3	7	3/7/2009	10.06	0.0006	13.89		0.74	3.69	-
-108.229	67	6.7	W	2009	3	8	3/8/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	107	10.7	W	2009	3	9	3/9/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	112	11.2	W	2009	3	10	3/10/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	98	9.8	W	2009	3	11	3/11/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2009	3	12	3/12/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2009	3	13	3/13/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	58	5.8	W	2009	3	14	3/14/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	89	8.9	W	2009	3	15	3/15/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	58	5.8	W	2009	3	16	3/16/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	67	6.7	W	2009	3	17	3/17/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	76	7.6	W	2009	3	18	3/18/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	58	5.8	W	2009	3	19	3/19/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	58	5.8	W	2009	3	20	3/20/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	89	8.9	W	2009	3	21	3/21/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	206	20.6	W	2009	3	22	3/22/2009	10.06	0.0006	20.59		1.09	24.65	2.07
-108.229	148	14.8	W	2009	3	23	3/23/2009	10.06	0.0006	14.79		0.78	5.66	-
-108.229	125	12.5	W	2009	3	24	3/24/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	112	11.2	W	2009	3	25	3/25/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	161	16.1	W	2009	3	26	3/26/2009	10.06	0.0006	16.09		0.85	8.96	-
-108.229	103	10.3	W	2009	3	27	3/27/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	125	12.5	W	2009	3	28	3/28/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	134	13.4	W	2009	3	29	3/29/2009	10.06	0.0006	13.39		0.71	2.71	-
-108.229	148	14.8	W	2009	3	30	3/30/2009	10.06	0.0006	14.79		0.78	5.66	-
-108.229	94	9.4	W	2009	3	31	3/31/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	165	16.5	W	2009	4	1	4/1/2009	10.06	0.0006	16.49		0.87	10.09	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	81	8.1	W	2009	4	2	4/2/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	174	17.4	W	2009	4	3	4/3/2009	10.06	0.0006	17.39		0.92	12.82	-
-108.229	139	13.9	W	2009	4	4	4/4/2009	10.06	0.0006	13.89		0.74	3.69	-
-108.229	103	10.3	W	2009	4	5	4/5/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	45	4.5	W	2009	4	6	4/6/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	72	7.2	W	2009	4	7	4/7/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	161	16.1	W	2009	4	8	4/8/2009	10.06	0.0006	16.09		0.85	8.96	-
-108.229	116	11.6	W	2009	4	9	4/9/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	179	17.9	W	2009	4	10	4/10/2009	10.06	0.0006	17.89		0.95	14.45	-
-108.229	179	17.9	W	2009	4	11	4/11/2009	10.06	0.0006	17.89		0.95	14.45	-
-108.229	161	16.1	W	2009	4	12	4/12/2009	10.06	0.0006	16.09		0.85	8.96	-
-108.229	63	6.3	W	2009	4	13	4/13/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	148	14.8	W	2009	4	14	4/14/2009	10.06	0.0006	14.79		0.78	5.66	-
-108.229	170	17.0	W	2009	4	15	4/15/2009	10.06	0.0006	16.99		0.90	11.57	-
-108.229	98	9.8	W	2009	4	16	4/16/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	143	14.3	W	2009	4	17	4/17/2009	10.06	0.0006	14.29		0.76	4.53	-
-108.229	112	11.2	W	2009	4	18	4/18/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	67	6.7	W	2009	4	19	4/19/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	112	11.2	W	2009	4	20	4/20/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	103	10.3	W	2009	4	21	4/21/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	98	9.8	W	2009	4	22	4/22/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2009	4	23	4/23/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	134	13.4	W	2009	4	24	4/24/2009	10.06	0.0006	13.39		0.71	2.71	-
-108.229	170	17.0	W	2009	4	25	4/25/2009	10.06	0.0006	16.99		0.90	11.57	-
-108.229	76	7.6	W	2009	4	26	4/26/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	72	7.2	W	2009	4	27	4/27/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	116	11.6	W	2009	4	28	4/28/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	63	6.3	W	2009	4	29	4/29/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	76	7.6	W	2009	4	30	4/30/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	67	6.7	W	2009	5	1	5/1/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	112	11.2	W	2009	5	2	5/2/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	72	7.2	W	2009	5	3	5/3/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	112	11.2	W	2009	5	4	5/4/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	98	9.8	W	2009	5	5	5/5/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	103	10.3	W	2009	5	6	5/6/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	116	11.6	W	2009	5	7	5/7/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	130	13.0	W	2009	5	8	5/8/2009	10.06	0.0006	12.99		0.69	1.99	-
-108.229	76	7.6	W	2009	5	9	5/9/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	116	11.6	W	2009	5	10	5/10/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	112	11.2	W	2009	5	11	5/11/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	116	11.6	W	2009	5	12	5/12/2009	10.06	0.0006	11.59		0.61	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	125	12.5	W	2009	5	13	5/13/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	98	9.8	W	2009	5	14	5/14/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	107	10.7	W	2009	5	15	5/15/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	81	8.1	W	2009	5	16	5/16/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	67	6.7	W	2009	5	17	5/17/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	125	12.5	W	2009	5	18	5/18/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	134	13.4	W	2009	5	19	5/19/2009	10.06	0.0006	13.39		0.71	2.71	-
-108.229	116	11.6	W	2009	5	20	5/20/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	103	10.3	W	2009	5	21	5/21/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	112	11.2	W	2009	5	22	5/22/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	72	7.2	W	2009	5	23	5/23/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	125	12.5	W	2009	5	24	5/24/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	143	14.3	W	2009	5	25	5/25/2009	10.06	0.0006	14.29		0.76	4.53	-
-108.229	116	11.6	W	2009	5	26	5/26/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	94	9.4	W	2009	5	27	5/27/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	125	12.5	W	2009	5	28	5/28/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	81	8.1	W	2009	5	29	5/29/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	130	13.0	W	2009	5	30	5/30/2009	10.06	0.0006	12.99		0.69	1.99	-
-108.229	130	13.0	W	2009	5	31	5/31/2009	10.06	0.0006	12.99		0.69	1.99	-
-108.229	89	8.9	W	2009	6	1	6/1/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	143	14.3	W	2009	6	2	6/2/2009	10.06	0.0006	14.29		0.76	4.53	-
-108.229	76	7.6	W	2009	6	3	6/3/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	107	10.7	W	2009	6	4	6/4/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	143	14.3	W	2009	6	5	6/5/2009	10.06	0.0006	14.29		0.76	4.53	-
-108.229	98	9.8	W	2009	6	6	6/6/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	125	12.5	W	2009	6	7	6/7/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	94	9.4	W	2009	6	8	6/8/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	125	12.5	W	2009	6	9	6/9/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	81	8.1	W	2009	6	10	6/10/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	81	8.1	W	2009	6	11	6/11/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	89	8.9	W	2009	6	12	6/12/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	165	16.5	W	2009	6	13	6/13/2009	10.06	0.0006	16.49		0.87	10.09	-
-108.229	98	9.8	W	2009	6	14	6/14/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	67	6.7	W	2009	6	15	6/15/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	54	5.4	W	2009	6	16	6/16/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	107	10.7	W	2009	6	17	6/17/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	94	9.4	W	2009	6	18	6/18/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2009	6	19	6/19/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	116	11.6	W	2009	6	20	6/20/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	81	8.1	W	2009	6	21	6/21/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	67	6.7	W	2009	6	22	6/22/2009	10.06	0.0006	6.70		0.35	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	125	12.5	W	2009	6	23	6/23/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	94	9.4	W	2009	6	24	6/24/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	125	12.5	W	2009	6	25	6/25/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	174	17.4	W	2009	6	26	6/26/2009	10.06	0.0006	17.39		0.92	12.82	-
-108.229	67	6.7	W	2009	6	27	6/27/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	112	11.2	W	2009	6	28	6/28/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	89	8.9	W	2009	6	29	6/29/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	72	7.2	W	2009	6	30	6/30/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	107	10.7	W	2009	7	1	7/1/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	125	12.5	W	2009	7	2	7/2/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	94	9.4	W	2009	7	3	7/3/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	89	8.9	W	2009	7	4	7/4/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	107	10.7	W	2009	7	5	7/5/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	107	10.7	W	2009	7	6	7/6/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	94	9.4	W	2009	7	7	7/7/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	98	9.8	W	2009	7	8	7/8/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2009	7	9	7/9/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	139	13.9	W	2009	7	10	7/10/2009	10.06	0.0006	13.89		0.74	3.69	-
-108.229	112	11.2	W	2009	7	11	7/11/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	94	9.4	W	2009	7	12	7/12/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	161	16.1	W	2009	7	13	7/13/2009	10.06	0.0006	16.09		0.85	8.96	-
-108.229	98	9.8	W	2009	7	14	7/14/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	125	12.5	W	2009	7	15	7/15/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	81	8.1	W	2009	7	16	7/16/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	76	7.6	W	2009	7	17	7/17/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	116	11.6	W	2009	7	18	7/18/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	125	12.5	W	2009	7	19	7/19/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	130	13.0	W	2009	7	20	7/20/2009	10.06	0.0006	12.99		0.69	1.99	-
-108.229	112	11.2	W	2009	7	21	7/21/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	130	13.0	W	2009	7	22	7/22/2009	10.06	0.0006	12.99		0.69	1.99	-
-108.229	134	13.4	W	2009	7	23	7/23/2009	10.06	0.0006	13.39		0.71	2.71	-
-108.229	76	7.6	W	2009	7	24	7/24/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	98	9.8	W	2009	7	25	7/25/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	125	12.5	W	2009	7	26	7/26/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	81	8.1	W	2009	7	27	7/27/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	183	18.3	W	2009	7	28	7/28/2009	10.06	0.0006	18.29		0.97	15.81	-
-108.229	192	19.2	W	2009	7	29	7/29/2009	10.06	0.0006	19.19		1.02	19.06	-
-108.229	134	13.4	W	2009	7	30	7/30/2009	10.06	0.0006	13.39		0.71	2.71	-
-108.229	116	11.6	W	2009	7	31	7/31/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	107	10.7	W	2009	8	1	8/1/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	76	7.6	W	2009	8	2	8/2/2009	10.06	0.0006	7.60		0.40	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	94	9.4	W	2009	8	3	8/3/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2009	8	4	8/4/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	139	13.9	W	2009	8	5	8/5/2009	10.06	0.0006	13.89		0.74	3.69	-
-108.229	107	10.7	W	2009	8	6	8/6/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	112	11.2	W	2009	8	7	8/7/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	76	7.6	W	2009	8	8	8/8/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	58	5.8	W	2009	8	9	8/9/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	67	6.7	W	2009	8	10	8/10/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	94	9.4	W	2009	8	11	8/11/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	72	7.2	W	2009	8	12	8/12/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	98	9.8	W	2009	8	13	8/13/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	81	8.1	W	2009	8	14	8/14/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	107	10.7	W	2009	8	15	8/15/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	107	10.7	W	2009	8	16	8/16/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	67	6.7	W	2009	8	17	8/17/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	107	10.7	W	2009	8	18	8/18/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	125	12.5	W	2009	8	19	8/19/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	72	7.2	W	2009	8	20	8/20/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	67	6.7	W	2009	8	21	8/21/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	125	12.5	W	2009	8	22	8/22/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	94	9.4	W	2009	8	23	8/23/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2009	8	24	8/24/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	76	7.6	W	2009	8	25	8/25/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	81	8.1	W	2009	8	26	8/26/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	81	8.1	W	2009	8	27	8/27/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	54	5.4	W	2009	8	28	8/28/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	76	7.6	W	2009	8	29	8/29/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	98	9.8	W	2009	8	30	8/30/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2009	8	31	8/31/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	89	8.9	W	2009	9	1	9/1/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	103	10.3	W	2009	9	2	9/2/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	116	11.6	W	2009	9	3	9/3/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	125	12.5	W	2009	9	4	9/4/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	139	13.9	W	2009	9	5	9/5/2009	10.06	0.0006	13.89		0.74	3.69	-
-108.229	81	8.1	W	2009	9	6	9/6/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	67	6.7	W	2009	9	7	9/7/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	112	11.2	W	2009	9	8	9/8/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	112	11.2	W	2009	9	9	9/9/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	103	10.3	W	2009	9	10	9/10/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	116	11.6	W	2009	9	11	9/11/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	89	8.9	W	2009	9	12	9/12/2009	10.06	0.0006	8.89		0.47	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	103	10.3	W	2009	9	13	9/13/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	103	10.3	W	2009	9	14	9/14/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	81	8.1	W	2009	9	15	9/15/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	107	10.7	W	2009	9	16	9/16/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	89	8.9	W	2009	9	17	9/17/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	89	8.9	W	2009	9	18	9/18/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	81	8.1	W	2009	9	19	9/19/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	161	16.1	W	2009	9	20	9/20/2009	10.06	0.0006	16.09		0.85	8.96	-
-108.229	161	16.1	W	2009	9	21	9/21/2009	10.06	0.0006	16.09		0.85	8.96	-
-108.229	72	7.2	W	2009	9	22	9/22/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	107	10.7	W	2009	9	23	9/23/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	76	7.6	W	2009	9	24	9/24/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	125	12.5	W	2009	9	25	9/25/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	76	7.6	W	2009	9	26	9/26/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	89	8.9	W	2009	9	27	9/27/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	116	11.6	W	2009	9	28	9/28/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	107	10.7	W	2009	9	29	9/29/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	170	17.0	W	2009	9	30	9/30/2009	10.06	0.0006	16.99		0.90	11.57	-
-108.229	98	9.8	W	2009	10	1	10/1/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	63	6.3	W	2009	10	2	10/2/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2009	10	3	10/3/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	143	14.3	W	2009	10	4	10/4/2009	10.06	0.0006	14.29		0.76	4.53	-
-108.229	143	14.3	W	2009	10	5	10/5/2009	10.06	0.0006	14.29		0.76	4.53	-
-108.229	45	4.5	W	2009	10	6	10/6/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	81	8.1	W	2009	10	7	10/7/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	98	9.8	W	2009	10	8	10/8/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	89	8.9	W	2009	10	9	10/9/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	54	5.4	W	2009	10	10	10/10/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	94	9.4	W	2009	10	11	10/11/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	72	7.2	W	2009	10	12	10/12/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	125	12.5	W	2009	10	13	10/13/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	107	10.7	W	2009	10	14	10/14/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	103	10.3	W	2009	10	15	10/15/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	72	7.2	W	2009	10	16	10/16/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	63	6.3	W	2009	10	17	10/17/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	58	5.8	W	2009	10	18	10/18/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	89	8.9	W	2009	10	19	10/19/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	148	14.8	W	2009	10	20	10/20/2009	10.06	0.0006	14.79		0.78	5.66	-
-108.229	58	5.8	W	2009	10	21	10/21/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	112	11.2	W	2009	10	22	10/22/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	98	9.8	W	2009	10	23	10/23/2009	10.06	0.0006	9.79		0.52	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	116	11.6	W	2009	10	24	10/24/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	125	12.5	W	2009	10	25	10/25/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	63	6.3	W	2009	10	26	10/26/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	134	13.4	W	2009	10	27	10/27/2009	10.06	0.0006	13.39		0.71	2.71	-
-108.229	72	7.2	W	2009	10	28	10/28/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	125	12.5	W	2009	10	29	10/29/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	139	13.9	W	2009	10	30	10/30/2009	10.06	0.0006	13.89		0.74	3.69	-
-108.229	40	4.0	W	2009	10	31	10/31/2009	10.06	0.0006	4.00		0.21	-	-
-108.229	63	6.3	W	2009	11	1	11/1/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	76	7.6	W	2009	11	2	11/2/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	58	5.8	W	2009	11	3	11/3/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2009	11	4	11/4/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2009	11	5	11/5/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	63	6.3	W	2009	11	6	11/6/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2009	11	7	11/7/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2009	11	8	11/8/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	45	4.5	W	2009	11	9	11/9/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	94	9.4	W	2009	11	10	11/10/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	58	5.8	W	2009	11	11	11/11/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	98	9.8	W	2009	11	12	11/12/2009	10.06	0.0006	9.79		0.52	-	-
-108.229	125	12.5	W	2009	11	13	11/13/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	94	9.4	W	2009	11	14	11/14/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	112	11.2	W	2009	11	15	11/15/2009	10.06	0.0006	11.19		0.59	-	-
-108.229	36	3.6	W	2009	11	16	11/16/2009	10.06	0.0006	3.60		0.19	-	-
-108.229	36	3.6	W	2009	11	17	11/17/2009	10.06	0.0006	3.60		0.19	-	-
-108.229	40	4.0	W	2009	11	18	11/18/2009	10.06	0.0006	4.00		0.21	-	-
-108.229	63	6.3	W	2009	11	19	11/19/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2009	11	20	11/20/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2009	11	21	11/21/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2009	11	22	11/22/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	116	11.6	W	2009	11	23	11/23/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	40	4.0	W	2009	11	24	11/24/2009	10.06	0.0006	4.00		0.21	-	-
-108.229	45	4.5	W	2009	11	25	11/25/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	45	4.5	W	2009	11	26	11/26/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	58	5.8	W	2009	11	27	11/27/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	103	10.3	W	2009	11	28	11/28/2009	10.06	0.0006	10.29		0.55	-	-
-108.229	76	7.6	W	2009	11	29	11/29/2009	10.06	0.0006	7.60		0.40	-	-
-108.229	45	4.5	W	2009	11	30	11/30/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	116	11.6	W	2009	12	1	12/1/2009	10.06	0.0006	11.59		0.61	-	-
-108.229	107	10.7	W	2009	12	2	12/2/2009	10.06	0.0006	10.69		0.57	-	-
-108.229	125	12.5	W	2009	12	3	12/3/2009	10.06	0.0006	12.49		0.66	1.16	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	94	9.4	W	2009	12	4	12/4/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	67	6.7	W	2009	12	5	12/5/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	125	12.5	W	2009	12	6	12/6/2009	10.06	0.0006	12.49		0.66	1.16	-
-108.229	89	8.9	W	2009	12	7	12/7/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	179	17.9	W	2009	12	8	12/8/2009	10.06	0.0006	17.89		0.95	14.45	-
-108.229	67	6.7	W	2009	12	9	12/9/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	54	5.4	W	2009	12	10	12/10/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	58	5.8	W	2009	12	11	12/11/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	45	4.5	W	2009	12	12	12/12/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	179	17.9	W	2009	12	13	12/13/2009	10.06	0.0006	17.89		0.95	14.45	-
-108.229	54	5.4	W	2009	12	14	12/14/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	63	6.3	W	2009	12	15	12/15/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	63	6.3	W	2009	12	16	12/16/2009	10.06	0.0006	6.30		0.33	-	-
-108.229	67	6.7	W	2009	12	17	12/17/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	45	4.5	W	2009	12	18	12/18/2009	10.06	0.0006	4.50		0.24	-	-
-108.229	54	5.4	W	2009	12	19	12/19/2009	10.06	0.0006	5.40		0.29	-	-
-108.229	40	4.0	W	2009	12	20	12/20/2009	10.06	0.0006	4.00		0.21	-	-
-108.229	58	5.8	W	2009	12	21	12/21/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	72	7.2	W	2009	12	22	12/22/2009	10.06	0.0006	7.20		0.38	-	-
-108.229	94	9.4	W	2009	12	23	12/23/2009	10.06	0.0006	9.39		0.50	-	-
-108.229	139	13.9	W	2009	12	24	12/24/2009	10.06	0.0006	13.89		0.74	3.69	-
-108.229	130	13.0	W	2009	12	25	12/25/2009	10.06	0.0006	12.99		0.69	1.99	-
-108.229	67	6.7	W	2009	12	26	12/26/2009	10.06	0.0006	6.70		0.35	-	-
-108.229	40	4.0	W	2009	12	27	12/27/2009	10.06	0.0006	4.00		0.21	-	-
-108.229	58	5.8	W	2009	12	28	12/28/2009	10.06	0.0006	5.80		0.31	-	-
-108.229	40	4.0	W	2009	12	29	12/29/2009	10.06	0.0006	4.00		0.21	-	-
-108.229	81	8.1	W	2009	12	30	12/30/2009	10.06	0.0006	8.10		0.43	-	-
-108.229	89	8.9	W	2009	12	31	12/31/2009	10.06	0.0006	8.89		0.47	-	-
-108.229	58	5.8	W	2010	1	1	1/1/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	67	6.7	W	2010	1	2	1/2/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	45	4.5	W	2010	1	3	1/3/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	40	4.0	W	2010	1	4	1/4/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	40	4.0	W	2010	1	5	1/5/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	58	5.8	W	2010	1	6	1/6/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	45	4.5	W	2010	1	7	1/7/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	45	4.5	W	2010	1	8	1/8/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	40	4.0	W	2010	1	9	1/9/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	54	5.4	W	2010	1	10	1/10/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	40	4.0	W	2010	1	11	1/11/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	40	4.0	W	2010	1	12	1/12/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	58	5.8	W	2010	1	13	1/13/2010	10.06	0.0006	5.80		0.31	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	63	6.3	W	2010	1	14	1/14/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2010	1	15	1/15/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	36	3.6	W	2010	1	16	1/16/2010	10.06	0.0006	3.60		0.19	-	-
-108.229	58	5.8	W	2010	1	17	1/17/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2010	1	18	1/18/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	98	9.8	W	2010	1	19	1/19/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	98	9.8	W	2010	1	20	1/20/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	89	8.9	W	2010	1	21	1/21/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	116	11.6	W	2010	1	22	1/22/2010	10.06	0.0006	11.59		0.61	-	-
-108.229	89	8.9	W	2010	1	23	1/23/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	148	14.8	W	2010	1	24	1/24/2010	10.06	0.0006	14.79		0.78	5.66	-
-108.229	58	5.8	W	2010	1	25	1/25/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2010	1	26	1/26/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	89	8.9	W	2010	1	27	1/27/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	63	6.3	W	2010	1	28	1/28/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	58	5.8	W	2010	1	29	1/29/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	40	4.0	W	2010	1	30	1/30/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	58	5.8	W	2010	1	31	1/31/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	63	6.3	W	2010	2	1	2/1/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	63	6.3	W	2010	2	2	2/2/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	54	5.4	W	2010	2	3	2/3/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	76	7.6	W	2010	2	4	2/4/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	58	5.8	W	2010	2	5	2/5/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	58	5.8	W	2010	2	6	2/6/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	103	10.3	W	2010	2	7	2/7/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	67	6.7	W	2010	2	8	2/8/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	40	4.0	W	2010	2	9	2/9/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	72	7.2	W	2010	2	10	2/10/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	116	11.6	W	2010	2	11	2/11/2010	10.06	0.0006	11.59		0.61	-	-
-108.229	103	10.3	W	2010	2	12	2/12/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	94	9.4	W	2010	2	13	2/13/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	107	10.7	W	2010	2	14	2/14/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	45	4.5	W	2010	2	15	2/15/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	76	7.6	W	2010	2	16	2/16/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	40	4.0	W	2010	2	17	2/17/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	98	9.8	W	2010	2	18	2/18/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	72	7.2	W	2010	2	19	2/19/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	94	9.4	W	2010	2	20	2/20/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	72	7.2	W	2010	2	21	2/21/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	116	11.6	W	2010	2	22	2/22/2010	10.06	0.0006	11.59		0.61	-	-
-108.229	72	7.2	W	2010	2	23	2/23/2010	10.06	0.0006	7.20		0.38	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	63	6.3	W	2010	2	24	2/24/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	134	13.4	W	2010	2	25	2/25/2010	10.06	0.0006	13.39		0.71	2.71	-
-108.229	45	4.5	W	2010	2	26	2/26/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	76	7.6	W	2010	2	27	2/27/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	107	10.7	W	2010	2	28	2/28/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	58	5.8	W	2010	3	1	3/1/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	40	4.0	W	2010	3	2	3/2/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	45	4.5	W	2010	3	3	3/3/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	125	12.5	W	2010	3	4	3/4/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	81	8.1	W	2010	3	5	3/5/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	72	7.2	W	2010	3	6	3/6/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	98	9.8	W	2010	3	7	3/7/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	134	13.4	W	2010	3	8	3/8/2010	10.06	0.0006	13.39		0.71	2.71	-
-108.229	112	11.2	W	2010	3	9	3/9/2010	10.06	0.0006	11.19		0.59	-	-
-108.229	72	7.2	W	2010	3	10	3/10/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	148	14.8	W	2010	3	11	3/11/2010	10.06	0.0006	14.79		0.78	5.66	-
-108.229	72	7.2	W	2010	3	12	3/12/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	98	9.8	W	2010	3	13	3/13/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2010	3	14	3/14/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	67	6.7	W	2010	3	15	3/15/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	63	6.3	W	2010	3	16	3/16/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	40	4.0	W	2010	3	17	3/17/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	63	6.3	W	2010	3	18	3/18/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	148	14.8	W	2010	3	19	3/19/2010	10.06	0.0006	14.79		0.78	5.66	-
-108.229	107	10.7	W	2010	3	20	3/20/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	94	9.4	W	2010	3	21	3/21/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	76	7.6	W	2010	3	22	3/22/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	125	12.5	W	2010	3	23	3/23/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	107	10.7	W	2010	3	24	3/24/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	67	6.7	W	2010	3	25	3/25/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	161	16.1	W	2010	3	26	3/26/2010	10.06	0.0006	16.09		0.85	8.96	-
-108.229	107	10.7	W	2010	3	27	3/27/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	81	8.1	W	2010	3	28	3/28/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	45	4.5	W	2010	3	29	3/29/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	103	10.3	W	2010	3	30	3/30/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	148	14.8	W	2010	3	31	3/31/2010	10.06	0.0006	14.79		0.78	5.66	-
-108.229	165	16.5	W	2010	4	1	4/1/2010	10.06	0.0006	16.49		0.87	10.09	-
-108.229	116	11.6	W	2010	4	2	4/2/2010	10.06	0.0006	11.59		0.61	-	-
-108.229	58	5.8	W	2010	4	3	4/3/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	103	10.3	W	2010	4	4	4/4/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	183	18.3	W	2010	4	5	4/5/2010	10.06	0.0006	18.29		0.97	15.81	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	161	16.1	W	2010	4	6	4/6/2010	10.06	0.0006	16.09		0.85	8.96	-
-108.229	98	9.8	W	2010	4	7	4/7/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	54	5.4	W	2010	4	8	4/8/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	81	8.1	W	2010	4	9	4/9/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	58	5.8	W	2010	4	10	4/10/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	67	6.7	W	2010	4	11	4/11/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	170	17.0	W	2010	4	12	4/12/2010	10.06	0.0006	16.99		0.90	11.57	-
-108.229	72	7.2	W	2010	4	13	4/13/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	94	9.4	W	2010	4	14	4/14/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	58	5.8	W	2010	4	15	4/15/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	116	11.6	W	2010	4	16	4/16/2010	10.06	0.0006	11.59		0.61	-	-
-108.229	81	8.1	W	2010	4	17	4/17/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	103	10.3	W	2010	4	18	4/18/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	94	9.4	W	2010	4	19	4/19/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	63	6.3	W	2010	4	20	4/20/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	157	15.7	W	2010	4	21	4/21/2010	10.06	0.0006	15.69		0.83	7.89	-
-108.229	94	9.4	W	2010	4	22	4/22/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	143	14.3	W	2010	4	23	4/23/2010	10.06	0.0006	14.29		0.76	4.53	-
-108.229	139	13.9	W	2010	4	24	4/24/2010	10.06	0.0006	13.89		0.74	3.69	-
-108.229	107	10.7	W	2010	4	25	4/25/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	130	13.0	W	2010	4	26	4/26/2010	10.06	0.0006	12.99		0.69	1.99	-
-108.229	103	10.3	W	2010	4	27	4/27/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	179	17.9	W	2010	4	28	4/28/2010	10.06	0.0006	17.89		0.95	14.45	-
-108.229	157	15.7	W	2010	4	29	4/29/2010	10.06	0.0006	15.69		0.83	7.89	-
-108.229	125	12.5	W	2010	4	30	4/30/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	130	13.0	W	2010	5	1	5/1/2010	10.06	0.0006	12.99		0.69	1.99	-
-108.229	107	10.7	W	2010	5	2	5/2/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	112	11.2	W	2010	5	3	5/3/2010	10.06	0.0006	11.19		0.59	-	-
-108.229	130	13.0	W	2010	5	4	5/4/2010	10.06	0.0006	12.99		0.69	1.99	-
-108.229	112	11.2	W	2010	5	5	5/5/2010	10.06	0.0006	11.19		0.59	-	-
-108.229	139	13.9	W	2010	5	6	5/6/2010	10.06	0.0006	13.89		0.74	3.69	-
-108.229	89	8.9	W	2010	5	7	5/7/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	98	9.8	W	2010	5	8	5/8/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	148	14.8	W	2010	5	9	5/9/2010	10.06	0.0006	14.79		0.78	5.66	-
-108.229	143	14.3	W	2010	5	10	5/10/2010	10.06	0.0006	14.29		0.76	4.53	-
-108.229	179	17.9	W	2010	5	11	5/11/2010	10.06	0.0006	17.89		0.95	14.45	-
-108.229	103	10.3	W	2010	5	12	5/12/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	58	5.8	W	2010	5	13	5/13/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	139	13.9	W	2010	5	14	5/14/2010	10.06	0.0006	13.89		0.74	3.69	-
-108.229	94	9.4	W	2010	5	15	5/15/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	94	9.4	W	2010	5	16	5/16/2010	10.06	0.0006	9.39		0.50	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	107	10.7	W	2010	5	17	5/17/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	125	12.5	W	2010	5	18	5/18/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	116	11.6	W	2010	5	19	5/19/2010	10.06	0.0006	11.59		0.61	-	-
-108.229	81	8.1	W	2010	5	20	5/20/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	116	11.6	W	2010	5	21	5/21/2010	10.06	0.0006	11.59		0.61	-	-
-108.229	148	14.8	W	2010	5	22	5/22/2010	10.06	0.0006	14.79		0.78	5.66	-
-108.229	157	15.7	W	2010	5	23	5/23/2010	10.06	0.0006	15.69		0.83	7.89	-
-108.229	112	11.2	W	2010	5	24	5/24/2010	10.06	0.0006	11.19		0.59	-	-
-108.229	72	7.2	W	2010	5	25	5/25/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	94	9.4	W	2010	5	26	5/26/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	125	12.5	W	2010	5	27	5/27/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	134	13.4	W	2010	5	28	5/28/2010	10.06	0.0006	13.39		0.71	2.71	-
-108.229	98	9.8	W	2010	5	29	5/29/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	81	8.1	W	2010	5	30	5/30/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	89	8.9	W	2010	5	31	5/31/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	98	9.8	W	2010	6	1	6/1/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	94	9.4	W	2010	6	2	6/2/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2010	6	3	6/3/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	81	8.1	W	2010	6	4	6/4/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	107	10.7	W	2010	6	5	6/5/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	81	8.1	W	2010	6	6	6/6/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	107	10.7	W	2010	6	7	6/7/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	76	7.6	W	2010	6	8	6/8/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	94	9.4	W	2010	6	9	6/9/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	107	10.7	W	2010	6	10	6/10/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	94	9.4	W	2010	6	11	6/11/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	148	14.8	W	2010	6	12	6/12/2010	10.06	0.0006	14.79		0.78	5.66	-
-108.229	72	7.2	W	2010	6	13	6/13/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	94	9.4	W	2010	6	14	6/14/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	67	6.7	W	2010	6	15	6/15/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	139	13.9	W	2010	6	16	6/16/2010	10.06	0.0006	13.89		0.74	3.69	-
-108.229	67	6.7	W	2010	6	17	6/17/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	81	8.1	W	2010	6	18	6/18/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	81	8.1	W	2010	6	19	6/19/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	103	10.3	W	2010	6	20	6/20/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	103	10.3	W	2010	6	21	6/21/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	89	8.9	W	2010	6	22	6/22/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	72	7.2	W	2010	6	23	6/23/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	76	7.6	W	2010	6	24	6/24/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	148	14.8	W	2010	6	25	6/25/2010	10.06	0.0006	14.79		0.78	5.66	-
-108.229	107	10.7	W	2010	6	26	6/26/2010	10.06	0.0006	10.69		0.57	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	89	8.9	W	2010	6	27	6/27/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	174	17.4	W	2010	6	28	6/28/2010	10.06	0.0006	17.39		0.92	12.82	-
-108.229	81	8.1	W	2010	6	29	6/29/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	103	10.3	W	2010	6	30	6/30/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	103	10.3	W	2010	7	1	7/1/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	107	10.7	W	2010	7	3	7/3/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	157	15.7	W	2010	7	4	7/4/2010	10.06	0.0006	15.69		0.83	7.89	-
-108.229	94	9.4	W	2010	7	5	7/5/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	67	6.7	W	2010	7	6	7/6/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	139	13.9	W	2010	7	7	7/7/2010	10.06	0.0006	13.89		0.74	3.69	-
-108.229	107	10.7	W	2010	7	8	7/8/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	116	11.6	W	2010	7	9	7/9/2010	10.06	0.0006	11.59		0.61	-	-
-108.229	116	11.6	W	2010	7	10	7/10/2010	10.06	0.0006	11.59		0.61	-	-
-108.229	143	14.3	W	2010	7	11	7/11/2010	10.06	0.0006	14.29		0.76	4.53	-
-108.229	130	13.0	W	2010	7	12	7/12/2010	10.06	0.0006	12.99		0.69	1.99	-
-108.229	134	13.4	W	2010	7	13	7/13/2010	10.06	0.0006	13.39		0.71	2.71	-
-108.229	98	9.8	W	2010	7	14	7/14/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	81	8.1	W	2010	7	15	7/15/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	76	7.6	W	2010	7	16	7/16/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	98	9.8	W	2010	7	17	7/17/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	98	9.8	W	2010	7	18	7/18/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	98	9.8	W	2010	7	19	7/19/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	98	9.8	W	2010	7	20	7/20/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	165	16.5	W	2010	7	21	7/21/2010	10.06	0.0006	16.49		0.87	10.09	-
-108.229	94	9.4	W	2010	7	22	7/22/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	148	14.8	W	2010	7	23	7/23/2010	10.06	0.0006	14.79		0.78	5.66	-
-108.229	125	12.5	W	2010	7	24	7/24/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	103	10.3	W	2010	7	25	7/25/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	76	7.6	W	2010	7	26	7/26/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	112	11.2	W	2010	7	27	7/27/2010	10.06	0.0006	11.19		0.59	-	-
-108.229	81	8.1	W	2010	7	28	7/28/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	98	9.8	W	2010	7	29	7/29/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	125	12.5	W	2010	7	30	7/30/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	72	7.2	W	2010	7	31	7/31/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	143	14.3	W	2010	8	1	8/1/2010	10.06	0.0006	14.29		0.76	4.53	-
-108.229	63	6.3	W	2010	8	2	8/2/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	58	5.8	W	2010	8	3	8/3/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	89	8.9	W	2010	8	4	8/4/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	89	8.9	W	2010	8	5	8/5/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	134	13.4	W	2010	8	6	8/6/2010	10.06	0.0006	13.39		0.71	2.71	-
-108.229	148	14.8	W	2010	8	7	8/7/2010	10.06	0.0006	14.79		0.78	5.66	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	81	8.1	W	2010	8	8	8/8/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	81	8.1	W	2010	8	9	8/9/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	67	6.7	W	2010	8	10	8/10/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	130	13.0	W	2010	8	11	8/11/2010	10.06	0.0006	12.99		0.69	1.99	-
-108.229	179	17.9	W	2010	8	12	8/12/2010	10.06	0.0006	17.89		0.95	14.45	-
-108.229	40	4.0	W	2010	8	13	8/13/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	81	8.1	W	2010	8	14	8/14/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	94	9.4	W	2010	8	15	8/15/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	148	14.8	W	2010	8	16	8/16/2010	10.06	0.0006	14.79		0.78	5.66	-
-108.229	63	6.3	W	2010	8	17	8/17/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	125	12.5	W	2010	8	18	8/18/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	130	13.0	W	2010	8	19	8/19/2010	10.06	0.0006	12.99		0.69	1.99	-
-108.229	94	9.4	W	2010	8	20	8/20/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	54	5.4	W	2010	8	21	8/21/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	103	10.3	W	2010	8	22	8/22/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	89	8.9	W	2010	8	23	8/23/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	125	12.5	W	2010	8	24	8/24/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	54	5.4	W	2010	8	25	8/25/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	63	6.3	W	2010	8	26	8/26/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	58	5.8	W	2010	8	27	8/27/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	103	10.3	W	2010	8	28	8/28/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	98	9.8	W	2010	8	29	8/29/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	103	10.3	W	2010	8	30	8/30/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	58	5.8	W	2010	8	31	8/31/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	72	7.2	W	2010	9	1	9/1/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	89	8.9	W	2010	9	2	9/2/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	81	8.1	W	2010	9	3	9/3/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	76	7.6	W	2010	9	4	9/4/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	81	8.1	W	2010	9	5	9/5/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	107	10.7	W	2010	9	6	9/6/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	103	10.3	W	2010	9	7	9/7/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	98	9.8	W	2010	9	8	9/8/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	76	7.6	W	2010	9	9	9/9/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	89	8.9	W	2010	9	10	9/10/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	54	5.4	W	2010	9	11	9/11/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	54	5.4	W	2010	9	12	9/12/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2010	9	13	9/13/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	76	7.6	W	2010	9	14	9/14/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	72	7.2	W	2010	9	15	9/15/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	67	6.7	W	2010	9	16	9/16/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	54	5.4	W	2010	9	17	9/17/2010	10.06	0.0006	5.40		0.29	-	-

												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	58	5.8	W	2010	9	18	9/18/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	98	9.8	W	2010	9	19	9/19/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	139	13.9	W	2010	9	20	9/20/2010	10.06	0.0006	13.89		0.74	3.69	-
-108.229	54	5.4	W	2010	9	21	9/21/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	94	9.4	W	2010	9	22	9/22/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	81	8.1	W	2010	9	23	9/23/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	45	4.5	W	2010	9	24	9/24/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	45	4.5	W	2010	9	25	9/25/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	76	7.6	W	2010	9	26	9/26/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	45	4.5	W	2010	9	27	9/27/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	89	8.9	W	2010	9	28	9/28/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	58	5.8	W	2010	9	29	9/29/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2010	9	30	9/30/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	72	7.2	W	2010	10	1	10/1/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	63	6.3	W	2010	10	2	10/2/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	81	8.1	W	2010	10	3	10/3/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	63	6.3	W	2010	10	4	10/4/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	98	9.8	W	2010	10	5	10/5/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	125	12.5	W	2010	10	6	10/6/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	107	10.7	W	2010	10	7	10/7/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	72	7.2	W	2010	10	8	10/8/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	103	10.3	W	2010	10	9	10/9/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	67	6.7	W	2010	10	10	10/10/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	89	8.9	W	2010	10	11	10/11/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	63	6.3	W	2010	10	12	10/12/2010	10.06	0.0006	6.30		0.33	-	-
-108.229	58	5.8	W	2010	10	13	10/13/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	72	7.2	W	2010	10	14	10/14/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	81	8.1	W	2010	10	15	10/15/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	45	4.5	W	2010	10	16	10/16/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	67	6.7	W	2010	10	17	10/17/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	76	7.6	W	2010	10	18	10/18/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	40	4.0	W	2010	10	19	10/19/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	107	10.7	W	2010	10	20	10/20/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	67	6.7	W	2010	10	21	10/21/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	107	10.7	W	2010	10	22	10/22/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	98	9.8	W	2010	10	23	10/23/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	67	6.7	W	2010	10	24	10/24/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	170	17.0	W	2010	10	25	10/25/2010	10.06	0.0006	16.99		0.90	11.57	-
-108.229	94	9.4	W	2010	10	26	10/26/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	107	10.7	W	2010	10	27	10/27/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	67	6.7	W	2010	10	28	10/28/2010	10.06	0.0006	6.70		0.35	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	58	5.8	W	2010	10	29	10/29/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	125	12.5	W	2010	10	30	10/30/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	76	7.6	W	2010	10	31	10/31/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	72	7.2	W	2010	11	1	11/1/2010	10.06	0.0006	7.20		0.38	-	-
-108.229	40	4.0	W	2010	11	2	11/2/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	45	4.5	W	2010	11	3	11/3/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	40	4.0	W	2010	11	4	11/4/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	54	5.4	W	2010	11	5	11/5/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2010	11	6	11/6/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	54	5.4	W	2010	11	7	11/7/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	89	8.9	W	2010	11	8	11/8/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	103	10.3	W	2010	11	9	11/9/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	67	6.7	W	2010	11	10	11/10/2010	10.06	0.0006	6.70		0.35	-	-
-108.229	81	8.1	W	2010	11	11	11/11/2010	10.06	0.0006	8.10		0.43	-	-
-108.229	98	9.8	W	2010	11	12	11/12/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	103	10.3	W	2010	11	13	11/13/2010	10.06	0.0006	10.29		0.55	-	-
-108.229	130	13.0	W	2010	11	14	11/14/2010	10.06	0.0006	12.99		0.69	1.99	-
-108.229	125	12.5	W	2010	11	15	11/15/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	112	11.2	W	2010	11	16	11/16/2010	10.06	0.0006	11.19		0.59	-	-
-108.229	76	7.6	W	2010	11	17	11/17/2010	10.06	0.0006	7.60		0.40	-	-
-108.229	58	5.8	W	2010	11	18	11/18/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	45	4.5	W	2010	11	19	11/19/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	125	12.5	W	2010	11	20	11/20/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	165	16.5	W	2010	11	21	11/21/2010	10.06	0.0006	16.49		0.87	10.09	-
-108.229	94	9.4	W	2010	11	22	11/22/2010	10.06	0.0006	9.39		0.50	-	-
-108.229	89	8.9	W	2010	11	23	11/23/2010	10.06	0.0006	8.89		0.47	-	-
-108.229	116	11.6	W	2010	11	24	11/24/2010	10.06	0.0006	11.59		0.61	-	-
-108.229	112	11.2	W	2010	11	25	11/25/2010	10.06	0.0006	11.19		0.59	-	-
-108.229	45	4.5	W	2010	11	26	11/26/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	54	5.4	W	2010	11	27	11/27/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	125	12.5	W	2010	11	28	11/28/2010	10.06	0.0006	12.49		0.66	1.16	-
-108.229	112	11.2	W	2010	11	29	11/29/2010	10.06	0.0006	11.19		0.59	-	-
-108.229	98	9.8	W	2010	11	30	11/30/2010	10.06	0.0006	9.79		0.52	-	-
-108.229	40	4.0	W	2010	12	1	12/1/2010	10.06	0.0006	4.00		0.21	-	-
-108.229	45	4.5	W	2010	12	2	12/2/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	58	5.8	W	2010	12	3	12/3/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	54	5.4	W	2010	12	4	12/4/2010	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2010	12	5	12/5/2010	10.06	0.0006	4.50		0.24	-	-
-108.229	58	5.8	W	2010	12	6	12/6/2010	10.06	0.0006	5.80		0.31	-	-
-108.229	107	10.7	W	2010	12	7	12/7/2010	10.06	0.0006	10.69		0.57	-	-
-108.229	40	4.0	W	2010	12	8	12/8/2010	10.06	0.0006	4.00		0.21	-	-

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												Large Flat Piles (DFADA)			
													Scraper tracks	Overburden	
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02	
									% of pile surface area from AP-42			100%	100%	100%	
-108.229	45	4.5	W	2010	12	9	12/9/2010	10.06	0.0006	4.50		0.24	-	-	
-108.229	63	6.3	W	2010	12	10	12/10/2010	10.06	0.0006	6.30		0.33	-	-	
-108.229	130	13.0	W	2010	12	11	12/11/2010	10.06	0.0006	12.99		0.69	1.99	-	
-108.229	130	13.0	W	2010	12	12	12/12/2010	10.06	0.0006	12.99		0.69	1.99	-	
-108.229	45	4.5	W	2010	12	13	12/13/2010	10.06	0.0006	4.50		0.24	-	-	
-108.229	45	4.5	W	2010	12	14	12/14/2010	10.06	0.0006	4.50		0.24	-	-	
-108.229	45	4.5	W	2010	12	15	12/15/2010	10.06	0.0006	4.50		0.24	-	-	
-108.229	40	4.0	W	2010	12	16	12/16/2010	10.06	0.0006	4.00		0.21	-	-	
-108.229	45	4.5	W	2010	12	17	12/17/2010	10.06	0.0006	4.50		0.24	-	-	
-108.229	40	4.0	W	2010	12	18	12/18/2010	10.06	0.0006	4.00		0.21	-	-	
-108.229	45	4.5	W	2010	12	19	12/19/2010	10.06	0.0006	4.50		0.24	-	-	
-108.229	67	6.7	W	2010	12	20	12/20/2010	10.06	0.0006	6.70		0.35	-	-	
-108.229	67	6.7	W	2010	12	21	12/21/2010	10.06	0.0006	6.70		0.35	-	-	
-108.229	67	6.7	W	2010	12	22	12/22/2010	10.06	0.0006	6.70		0.35	-	-	
-108.229	81	8.1	W	2010	12	23	12/23/2010	10.06	0.0006	8.10		0.43	-	-	
-108.229	45	4.5	W	2010	12	24	12/24/2010	10.06	0.0006	4.50		0.24	-	-	
-108.229	54	5.4	W	2010	12	25	12/25/2010	10.06	0.0006	5.40		0.29	-	-	
-108.229	76	7.6	W	2010	12	26	12/26/2010	10.06	0.0006	7.60		0.40	-	-	
-108.229	40	4.0	W	2010	12	27	12/27/2010	10.06	0.0006	4.00		0.21	-	-	
-108.229	36	3.6	W	2010	12	28	12/28/2010	10.06	0.0006	3.60		0.19	-	-	
-108.229	58	5.8	W	2010	12	29	12/29/2010	10.06	0.0006	5.80		0.31	-	-	
-108.229	139	13.9	W	2010	12	30	12/30/2010	10.06	0.0006	13.89		0.74	3.69	-	
-108.229	103	10.3	W	2010	12	31	12/31/2010	10.06	0.0006	10.29		0.55	-	-	
-108.229	45	4.5	W	2011	1	1	1/1/2011	10.06	0.0006	4.50		0.24	-	-	
-108.229	54	5.4	W	2011	1	2	1/2/2011	10.06	0.0006	5.40		0.29	-	-	
-108.229	54	5.4	W	2011	1	3	1/3/2011	10.06	0.0006	5.40		0.29	-	-	
-108.229	67	6.7	W	2011	1	4	1/4/2011	10.06	0.0006	6.70		0.35	-	-	
-108.229	54	5.4	W	2011	1	5	1/5/2011	10.06	0.0006	5.40		0.29	-	-	
-108.229	40	4.0	W	2011	1	6	1/6/2011	10.06	0.0006	4.00		0.21	-	-	
-108.229	40	4.0	W	2011	1	7	1/7/2011	10.06	0.0006	4.00		0.21	-	-	
-108.229	45	4.5	W	2011	1	8	1/8/2011	10.06	0.0006	4.50		0.24	-	-	
-108.229	67	6.7	W	2011	1	9	1/9/2011	10.06	0.0006	6.70		0.35	-	-	
-108.229	107	10.7	W	2011	1	10	1/10/2011	10.06	0.0006	10.69		0.57	-	-	
-108.229	40	4.0	W	2011	1	11	1/11/2011	10.06	0.0006	4.00		0.21	-	-	
-108.229	58	5.8	W	2011	1	12	1/12/2011	10.06	0.0006	5.80		0.31	-	-	
-108.229	40	4.0	W	2011	1	13	1/13/2011	10.06	0.0006	4.00		0.21	-	-	
-108.229	45	4.5	W	2011	1	14	1/14/2011	10.06	0.0006	4.50		0.24	-	-	
-108.229	58	5.8	W	2011	1	15	1/15/2011	10.06	0.0006	5.80		0.31	-	-	
-108.229	81	8.1	W	2011	1	16	1/16/2011	10.06	0.0006	8.10		0.43	-	-	
-108.229	76	7.6	W	2011	1	17	1/17/2011	10.06	0.0006	7.60		0.40	-	-	
-108.229	67	6.7	W	2011	1	18	1/18/2011	10.06	0.0006	6.70		0.35	-	-	

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	107	10.7	W	2011	1	19	1/19/2011	10.06	0.0006	10.69		0.57	-	-
-108.229	89	8.9	W	2011	1	20	1/20/2011	10.06	0.0006	8.89		0.47	-	-
-108.229	107	10.7	W	2011	1	21	1/21/2011	10.06	0.0006	10.69		0.57	-	-
-108.229	103	10.3	W	2011	1	22	1/22/2011	10.06	0.0006	10.29		0.55	-	-
-108.229	63	6.3	W	2011	1	23	1/23/2011	10.06	0.0006	6.30		0.33	-	-
-108.229	89	8.9	W	2011	1	24	1/24/2011	10.06	0.0006	8.89		0.47	-	-
-108.229	89	8.9	W	2011	1	25	1/25/2011	10.06	0.0006	8.89		0.47	-	-
-108.229	45	4.5	W	2011	1	26	1/26/2011	10.06	0.0006	4.50		0.24	-	-
-108.229	40	4.0	W	2011	1	27	1/27/2011	10.06	0.0006	4.00		0.21	-	-
-108.229	36	3.6	W	2011	1	28	1/28/2011	10.06	0.0006	3.60		0.19	-	-
-108.229	89	8.9	W	2011	1	29	1/29/2011	10.06	0.0006	8.89		0.47	-	-
-108.229	54	5.4	W	2011	1	30	1/30/2011	10.06	0.0006	5.40		0.29	-	-
-108.229	98	9.8	W	2011	1	31	1/31/2011	10.06	0.0006	9.79		0.52	-	-
-108.229	103	10.3	W	2011	2	1	2/1/2011	10.06	0.0006	10.29		0.55	-	-
-108.229	72	7.2	W	2011	2	2	2/2/2011	10.06	0.0006	7.20		0.38	-	-
-108.229	45	4.5	W	2011	2	3	2/3/2011	10.06	0.0006	4.50		0.24	-	-
-108.229	54	5.4	W	2011	2	4	2/4/2011	10.06	0.0006	5.40		0.29	-	-
-108.229	143	14.3	W	2011	2	5	2/5/2011	10.06	0.0006	14.29		0.76	4.53	-
-108.229	143	14.3	W	2011	2	6	2/6/2011	10.06	0.0006	14.29		0.76	4.53	-
-108.229	45	4.5	W	2011	2	7	2/7/2011	10.06	0.0006	4.50		0.24	-	-
-108.229	125	12.5	W	2011	2	8	2/8/2011	10.06	0.0006	12.49		0.66	1.16	-
-108.229	89	8.9	W	2011	2	9	2/9/2011	10.06	0.0006	8.89		0.47	-	-
-108.229	89	8.9	W	2011	2	10	2/10/2011	10.06	0.0006	8.89		0.47	-	-
-108.229	54	5.4	W	2011	2	11	2/11/2011	10.06	0.0006	5.40		0.29	-	-
-108.229	81	8.1	W	2011	2	12	2/12/2011	10.06	0.0006	8.10		0.43	-	-
-108.229	54	5.4	W	2011	2	13	2/13/2011	10.06	0.0006	5.40		0.29	-	-
-108.229	45	4.5	W	2011	2	14	2/14/2011	10.06	0.0006	4.50		0.24	-	-
-108.229	54	5.4	W	2011	2	15	2/15/2011	10.06	0.0006	5.40		0.29	-	-
-108.229	76	7.6	W	2011	2	16	2/16/2011	10.06	0.0006	7.60		0.40	-	-
-108.229	125	12.5	W	2011	2	17	2/17/2011	10.06	0.0006	12.49		0.66	1.16	-
-108.229	98	9.8	W	2011	2	18	2/18/2011	10.06	0.0006	9.79		0.52	-	-
-108.229	174	17.4	W	2011	2	19	2/19/2011	10.06	0.0006	17.39		0.92	12.82	-
-108.229	103	10.3	W	2011	2	20	2/20/2011	10.06	0.0006	10.29		0.55	-	-
-108.229	36	3.6	W	2011	2	21	2/21/2011	10.06	0.0006	3.60		0.19	-	-
-108.229	54	5.4	W	2011	2	22	2/22/2011	10.06	0.0006	5.40		0.29	-	-
-108.229	63	6.3	W	2011	2	23	2/23/2011	10.06	0.0006	6.30		0.33	-	-
-108.229	103	10.3	W	2011	2	24	2/24/2011	10.06	0.0006	10.29		0.55	-	-
-108.229	67	6.7	W	2011	2	25	2/25/2011	10.06	0.0006	6.70		0.35	-	-
-108.229	72	7.2	W	2011	2	26	2/26/2011	10.06	0.0006	7.20		0.38	-	-
-108.229	134	13.4	W	2011	2	27	2/27/2011	10.06	0.0006	13.39		0.71	2.71	-
-108.229	54	5.4	W	2011	2	28	2/28/2011	10.06	0.0006	5.40		0.29	-	-

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												Large Flat Piles (DFADA)		
													Scraper tracks	Overburden
LONGITUD	WSF2	Fastest 2-minute Wind Speed (m/s) u^+	Source F	DATE				anemometer height as measured m	Roughness height (m), z_o	Fastest wind speed at 10 m height (m/s) u_{10}^+		Equivalent Friction Velocity (m/s) u*	ut*= 0.62	ut*= 1.02
									% of pile surface area from AP-42			100%	100%	100%
-108.229	54	5.4	W	2011	3	1	3/1/2011	10.06	0.0006	5.40		0.29	-	-
-108.229	72	7.2	W	2011	3	2	3/2/2011	10.06	0.0006	7.20		0.38	-	-
-108.229	98	9.8	W	2011	3	3	3/3/2011	10.06	0.0006	9.79		0.52	-	-
-108.229	179	17.9	W	2011	3	4	3/4/2011	10.06	0.0006	17.89		0.95	14.45	-
-108.229	45	4.5	W	2011	3	5	3/5/2011	10.06	0.0006	4.50		0.24	-	-
-108.229	76	7.6	W	2011	3	6	3/6/2011	10.06	0.0006	7.60		0.40	-	-
-108.229	94	9.4	W	2011	3	7	3/7/2011	10.06	0.0006	9.39		0.50	-	-
-108.229	139	13.9	W	2011	3	8	3/8/2011	10.06	0.0006	13.89		0.74	3.69	-
-108.229	98	9.8	W	2011	3	9	3/9/2011	10.06	0.0006	9.79		0.52	-	-
-108.229	40	4.0	W	2011	3	10	3/10/2011	10.06	0.0006	4.00		0.21	-	-
-108.229	58	5.8	W	2011	3	11	3/11/2011	10.06	0.0006	5.80		0.31	-	-
-108.229	89	8.9	W	2011	3	12	3/12/2011	10.06	0.0006	8.89		0.47	-	-
-108.229	107	10.7	W	2011	3	13	3/13/2011	10.06	0.0006	10.69		0.57	-	-
-108.229	58	5.8	W	2011	3	14	3/14/2011	10.06	0.0006	5.80		0.31	-	-
-108.229	63	6.3	W	2011	3	15	3/15/2011	10.06	0.0006	6.30		0.33	-	-
-108.229	72	7.2	W	2011	3	16	3/16/2011	10.06	0.0006	7.20		0.38	-	-
-108.229	134	13.4	W	2011	3	17	3/17/2011	10.06	0.0006	13.39		0.71	2.71	-
-108.229	67	6.7	W	2011	3	18	3/18/2011	10.06	0.0006	6.70		0.35	-	-
-108.229	125	12.5	W	2011	3	19	3/19/2011	10.06	0.0006	12.49		0.66	1.16	-
-108.229	76	7.6	W	2011	3	20	3/20/2011	10.06	0.0006	7.60		0.40	-	-
-108.229	197	19.7	W	2011	3	21	3/21/2011	10.06	0.0006	19.69		1.04	20.99	0.62
-108.229	103	10.3	W	2011	3	22	3/22/2011	10.06	0.0006	10.29		0.55	-	-
-108.229	67	6.7	W	2011	3	23	3/23/2011	10.06	0.0006	6.70		0.35	-	-
-108.229	161	16.1	W	2011	3	24	3/24/2011	10.06	0.0006	16.09		0.85	8.96	-
-108.229	134	13.4	W	2011	3	25	3/25/2011	10.06	0.0006	13.39		0.71	2.71	-
-108.229	134	13.4	W	2011	3	26	3/26/2011	10.06	0.0006	13.39		0.71	2.71	-
-108.229	107	10.7	W	2011	3	27	3/27/2011	10.06	0.0006	10.69		0.57	-	-
-108.229	116	11.6	W	2011	3	28	3/28/2011	10.06	0.0006	11.59		0.61	-	-
-108.229	107	10.7	W	2011	3	29	3/29/2011	10.06	0.0006	10.69		0.57	-	-
-108.229	165	16.5	W	2011	3	30	3/30/2011	10.06	0.0006	16.49		0.87	10.09	-
-108.229	161	16.1	W	2011	3	31	3/31/2011	10.06	0.0006	16.09		0.85	8.96	-
											MAXIMUM		26.37	2.80
											MAX* %		26.37	2.80
											SUM		2090.56	14.56
											SUM / 5		418.11	2.91
											SUM * %		2090.56	14.56
											SUM * % / 5		418.11	2.91

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	24.09		-	-	24.09	56.40	5.63
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	13.40		-	-	13.40	36.54	3.34
-	8.07	61.05		-	8.07	61.05	120.96	17.74
-	-	-		-	-	-	-	-
-	-	18.72		-	-	18.72	46.55	4.48
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	7.87	0.31
-	-	8.83		-	-	8.83	27.67	2.34
-	-	6.62		-	-	6.62	23.23	1.86
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	5.32	0.21
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	3.24		-	-	3.24	16.13	1.10
-	-	24.09		-	-	24.09	56.40	5.63
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	3.24		-	-	3.24	16.13	1.10
-	-	13.40		-	-	13.40	36.54	3.34
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	1.62	0.06
-	-	5.02		-	-	5.02	19.94	1.50
-	4.28	46.66		-	4.28	46.66	96.27	12.70
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	3.24		-	-	3.24	16.13	1.10
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	7.87	0.31
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	-		-	-	-	5.32	0.21
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	5.32	0.21
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	3.24		-	-	3.24	16.13	1.10
-	6.62	55.70		-	6.62	55.70	111.83	15.85
-	-	-		-	-	-	5.32	0.21
-	2.28	38.38		-	2.28	38.38	81.84	9.88
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	0.34	0.01
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	1.62	0.06
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	6.62	55.70		-	6.62	55.70	111.83	15.85
-	-	-		-	-	-	-	-
-	2.28	38.38		-	2.28	38.38	81.84	9.88
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	5.32	0.21
-	-	5.02		-	-	5.02	19.94	1.50
-	-	0.62		-	-	0.62	10.16	0.49
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	27.76		-	-	27.76	63.01	6.41
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	5.32	0.21
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	7.87	0.31
-	-	6.62		-	-	6.62	23.23	1.86
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	5.32	0.21

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	1.62	0.06
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	3.54	0.14
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	3.54	0.14
-	-	5.02		-	-	5.02	19.94	1.50
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	7.87	0.31
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	27.76		-	-	27.76	63.01	6.41
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	24.09		-	-	24.09	56.40	5.63
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	24.09		-	-	24.09	56.40	5.63
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	0.62	30.86		-	0.62	30.86	68.55	7.39
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	6.62		-	-	6.62	23.23	1.86
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	27.76		-	-	27.76	63.01	6.41
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	10.77		-	-	10.77	31.48	2.77
-	-	24.09		-	-	24.09	56.40	5.63
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	10.77		-	-	10.77	31.48	2.77

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	13.40		-	-	13.40	36.54	3.34
-	-	3.24		-	-	3.24	16.13	1.10
-	-	24.09		-	-	24.09	56.40	5.63
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	7.87	0.31
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	5.32	0.21
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	5.32	0.21
-	-	18.72		-	-	18.72	46.55	4.48
-	2.28	38.38		-	2.28	38.38	81.84	9.88
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	7.87	0.31
-	0.62	30.86		-	0.62	30.86	68.55	7.39
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	3.54	0.14
-	-	10.77		-	-	10.77	31.48	2.77
-	-	27.76		-	-	27.76	63.01	6.41
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	5.02		-	-	5.02	19.94	1.50
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	24.09		-	-	24.09	56.40	5.63
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	5.32	0.21
-	-	6.62		-	-	6.62	23.23	1.86
-	-	5.02		-	-	5.02	19.94	1.50

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	3.54	0.14
-	4.28	46.66		-	4.28	46.66	96.27	12.70
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	5.02		-	-	5.02	19.94	1.50
-	-	3.24		-	-	3.24	16.13	1.10
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	1.62	0.06
-	-	10.77		-	-	10.77	31.48	2.77
-	-	10.77		-	-	10.77	31.48	2.77
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	3.54	0.14
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	5.32	0.21
-	-	8.83		-	-	8.83	27.67	2.34
-	-	21.33		-	-	21.33	51.37	5.04
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	3.24		-	-	3.24	16.13	1.10
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	0.34	0.01
-	-	24.09		-	-	24.09	56.40	5.63
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	5.32	0.21
-	-	8.83		-	-	8.83	27.67	2.34
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	1.62	0.06
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	21.33		-	-	21.33	51.37	5.04

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	24.09		-	-	24.09	56.40	5.63
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	0.62		-	-	0.62	10.16	0.49
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	8.83		-	-	8.83	27.67	2.34

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	13.40		-	-	13.40	36.54	3.34
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	18.72		-	-	18.72	46.55	4.48
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	27.76		-	-	27.76	63.01	6.41
-	-	8.83		-	-	8.83	27.67	2.34
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	3.24		-	-	3.24	16.13	1.10
-	-	24.09		-	-	24.09	56.40	5.63
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	3.54	0.14
-	-	5.02		-	-	5.02	19.94	1.50
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	10.77		-	-	10.77	31.48	2.77
-	-	0.62		-	-	0.62	10.16	0.49
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	5.32	0.21
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	0.62	30.86		-	0.62	30.86	68.55	7.39
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	5.32	0.21
-	-	13.40		-	-	13.40	36.54	3.34
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	0.34	0.01
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	18.72		-	-	18.72	46.55	4.48
-	0.62	30.86		-	0.62	30.86	68.55	7.39
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	5.02		-	-	5.02	19.94	1.50
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	8.07	61.05		-	8.07	61.05	120.96	17.74
-	-	0.62		-	-	0.62	10.16	0.49
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	10.77		-	-	10.77	31.48	2.77
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	5.32	0.21
-	6.62	55.70		-	6.62	55.70	111.83	15.85
-	-	21.33		-	-	21.33	51.37	5.04
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	0.62	30.86		-	0.62	30.86	68.55	7.39
-	-	8.83		-	-	8.83	27.67	2.34
-	-	21.33		-	-	21.33	51.37	5.04
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	7.87	0.31
-	-	24.09		-	-	24.09	56.40	5.63

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	5.32	0.21
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	5.32	0.21
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	7.87	0.31
-	-	6.62		-	-	6.62	23.23	1.86
-	6.62	55.70		-	6.62	55.70	111.83	15.85
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	3.54	0.14
-	-	13.40		-	-	13.40	36.54	3.34
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	8.83		-	-	8.83	27.67	2.34
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	1.62	0.06

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	7.87	0.31
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	27.76		-	-	27.76	63.01	6.41
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	3.54	0.14
-	-	5.02		-	-	5.02	19.94	1.50
-	-	21.33		-	-	21.33	51.37	5.04
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	0.34	0.01
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	0.34	0.01

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	5.32	0.21
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	5.32	0.21
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	0.62		-	-	0.62	10.16	0.49
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	0.34	0.01
-	-	6.62		-	-	6.62	23.23	1.86

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	21.33		-	-	21.33	51.37	5.04
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	3.24		-	-	3.24	16.13	1.10
-	9.30	65.50		-	9.30	65.50	128.52	19.33
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	21.33		-	-	21.33	51.37	5.04
-	-	10.77		-	-	10.77	31.48	2.77
-	-	6.62		-	-	6.62	23.23	1.86
-	-	6.62		-	-	6.62	23.23	1.86
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	27.76		-	-	27.76	63.01	6.41
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	8.83		-	-	8.83	27.67	2.34
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	10.77		-	-	10.77	31.48	2.77

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	6.62		-	-	6.62	23.23	1.86
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	18.72		-	-	18.72	46.55	4.48
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	18.72		-	-	18.72	46.55	4.48
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	7.87	0.31
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	6.62		-	-	6.62	23.23	1.86
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	0.34	0.01
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	5.02		-	-	5.02	19.94	1.50
-	-	24.09		-	-	24.09	56.40	5.63
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	8.07	61.05		-	8.07	61.05	120.96	17.74
-	-	13.40		-	-	13.40	36.54	3.34
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	7.87	0.31
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	3.54	0.14
-	-	3.24		-	-	3.24	16.13	1.10
-	-	6.62		-	-	6.62	23.23	1.86
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	0.34	0.01
-	-	24.09		-	-	24.09	56.40	5.63

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	0.62	30.86		-	0.62	30.86	68.55	7.39
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	21.33		-	-	21.33	51.37	5.04
-	-	0.62		-	-	0.62	10.16	0.49
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	-	-
-	-	13.40		-	-	13.40	36.54	3.34
-	-	27.76		-	-	27.76	63.01	6.41
-	-	-		-	-	-	1.62	0.06
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	6.62		-	-	6.62	23.23	1.86
-	-	27.76		-	-	27.76	63.01	6.41
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	3.54	0.14
-	-	0.62		-	-	0.62	10.16	0.49
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	7.87	0.31
-	-	0.62		-	-	0.62	10.16	0.49

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	6.62		-	-	6.62	23.23	1.86
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	10.77		-	-	10.77	31.48	2.77
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	0.34	0.01
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	1.62	0.06
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	0.34	0.01
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	24.09		-	-	24.09	56.40	5.63
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	0.34	0.01
-	-	3.24		-	-	3.24	16.13	1.10
-	0.62	30.86		-	0.62	30.86	68.55	7.39
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	0.34	0.01
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	1.62	0.06
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	3.24		-	-	3.24	16.13	1.10
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	7.87	0.31
-	-	5.02		-	-	5.02	19.94	1.50
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	2.28	38.38		-	2.28	38.38	81.84	9.88
-	4.28	46.66		-	4.28	46.66	96.27	12.70
-	-	6.62		-	-	6.62	23.23	1.86
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	0.62		-	-	0.62	10.16	0.49
-	-	3.24		-	-	3.24	16.13	1.10
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	3.54	0.14
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	21.33		-	-	21.33	51.37	5.04
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	5.32	0.21
-	-	27.76		-	-	27.76	63.01	6.41
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	10.77		-	-	10.77	31.48	2.77
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	1.62	0.06

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	0.62		-	-	0.62	10.16	0.49
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	5.32	0.21
-	-	3.24		-	-	3.24	16.13	1.10

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	8.83		-	-	8.83	27.67	2.34
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	13.40		-	-	13.40	36.54	3.34
-	-	24.09		-	-	24.09	56.40	5.63
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	2.28	38.38		-	2.28	38.38	81.84	9.88

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	21.33		-	-	21.33	51.37	5.04
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	27.76		-	-	27.76	63.01	6.41
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	0.34	0.01
-	-	10.77		-	-	10.77	31.48	2.77
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	5.32	0.21
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	3.54	0.14
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	18.72		-	-	18.72	46.55	4.48
-	-	3.24		-	-	3.24	16.13	1.10
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	7.87	0.31
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	7.87	0.31
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	13.40		-	-	13.40	36.54	3.34
-	-	10.77		-	-	10.77	31.48	2.77
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	0.34	0.01

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	5.32	0.21
-	-	3.24		-	-	3.24	16.13	1.10
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	13.40		-	-	13.40	36.54	3.34
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	3.24		-	-	3.24	16.13	1.10
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	0.34	0.01
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	5.32	0.21

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	0.62	30.86		-	0.62	30.86	68.55	7.39
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	5.32	0.21
-	-	18.72		-	-	18.72	46.55	4.48
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	5.32	0.21
-	-	0.62		-	-	0.62	10.16	0.49
-	-	0.62		-	-	0.62	10.16	0.49
-	-	10.77		-	-	10.77	31.48	2.77
-	-	5.02		-	-	5.02	19.94	1.50
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	1.62	0.06
-	-	24.09		-	-	24.09	56.40	5.63
-	-	-		-	-	-	0.34	0.01
-	-	13.40		-	-	13.40	36.54	3.34
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	13.40		-	-	13.40	36.54	3.34

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	13.40		-	-	13.40	36.54	3.34
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	27.76		-	-	27.76	63.01	6.41
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	3.54	0.14
-	-	5.02		-	-	5.02	19.94	1.50
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	24.09		-	-	24.09	56.40	5.63
-	-	-		-	-	-	0.34	0.01
-	-	-		-	-	-	-	-
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	7.87	0.31
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	5.02		-	-	5.02	19.94	1.50
-	-	5.02		-	-	5.02	19.94	1.50
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	10.77		-	-	10.77	31.48	2.77
-	-	10.77		-	-	10.77	31.48	2.77
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	1.62	0.06
-	0.62	30.86		-	0.62	30.86	68.55	7.39
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	-	-

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Conical Piles (DFADA Slope, CENOSPHERES, Overburden, Topsoil)				Overburden piles Flat topped ovalish pile (B-3 in Figure 13.2.5-2)				
ut*= 1.02				ut*= 1.02				
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90		us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum
40%	48%	12%		28%	54%	14%	4%	100%
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	1.62	0.06
-	1.50	34.94		-	1.50	34.94	75.80	8.73
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	0.34	0.01
-	-	8.83		-	-	8.83	27.67	2.34
-	-	-		-	-	-	1.62	0.06
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	5.32	0.21
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	-		-	-	-	-	-
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	-	-
-	-	3.24		-	-	3.24	16.13	1.10
-	-	-		-	-	-	-	-
-	5.54	51.59		-	5.54	51.59	104.77	14.41
-	-	-		-	-	-	3.54	0.14
-	-	-		-	-	-	-	-
-	-	21.33		-	-	21.33	51.37	5.04
-	-	6.62		-	-	6.62	23.23	1.86
-	-	6.62		-	-	6.62	23.23	1.86
-	-	-		-	-	-	5.32	0.21
-	-	0.62		-	-	0.62	10.16	0.49
-	-	-		-	-	-	5.32	0.21
-	-	24.09		-	-	24.09	56.40	5.63
-	-	21.33		-	-	21.33	51.37	5.04
0.00	9.30	65.50		0.00	9.30	65.50	128.52	19.33
0.00	4.46	7.86		0.00	5.02	9.17	5.14	19.33
0.00	116.30	5115.53		0.00	116.30	5115.53	15999.16	1418.94
0.00	23.26	1023.11		0.00	23.26	1023.11	3199.83	283.79
0.00	55.82	613.86		0.00	62.80	716.17	639.97	1418.94
0.00	11.16	122.77		0.00	12.56	143.23	127.99	283.79
0	40	445		0	40	445	926	926

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	1.59	0.06	4	-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	3.65	49.47	104.60	13.08		-	3.65	49.47	104.60	8.75	
-	-	-	-	-		-	-	-	-	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06	13	-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	5.28	0.21	2	-	-	-	5.28	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72	2	-	-	1.37	13.27	0.19	
-	0.84	36.54	81.69	8.84		-	0.84	36.54	81.69	5.54	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	9	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	6	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	2.55	44.64	96.11	11.47		-	2.55	44.64	96.11	7.53	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	29.20	68.42	6.82		-	-	29.20	68.42	4.09	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-	11	-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	2.55	44.64	96.11	11.47		-	2.55	44.64	96.11	7.53	
-	-	-	-	-		-	-	-	-	-	
-	-	29.20	68.42	6.82	11	-	-	29.20	68.42	4.09	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	19.93	51.25	4.84		-	-	19.93	51.25	2.79	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	3.50	0.14	5	-	-	-	3.50	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	1.59	0.06		-	-	-	1.59	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14	1	-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	19.93	51.25	4.84		-	-	19.93	51.25	2.79	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	5	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	-	1.59	0.06	4	-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	22.61	56.28	5.42		-	-	22.61	56.28	3.17	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	5	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	19.93	51.25	4.84		-	-	19.93	51.25	2.79	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	5	-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	16.79	45.27	4.16	4	-	-	16.79	45.27	2.35	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	-	-	-	6	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	26.18	62.88	6.18	6	-	-	26.18	62.88	3.66	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	29.20	68.42	6.82		-	-	29.20	68.42	4.09	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	3.50	0.14	7	-	-	-	3.50	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	22.61	56.28	5.42		-	-	22.61	56.28	3.17	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	19.93	51.25	4.84		-	-	19.93	51.25	2.79	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-	5	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	1.37	13.27	0.72	1	-	-	1.37	13.27	0.19	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	0.32	0.01	0	-	-	-	0.32	-	
-	0.84	36.54	81.69	8.84		-	0.84	36.54	81.69	5.54	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	1.59	0.06	9	-	-	-	1.59	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	5.76	23.15	1.73	2	-	-	5.76	23.15	0.81	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	0.11	10.10	0.42	4	-	-	0.11	10.10	0.02	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	6	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	5.28	0.21	0	-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	-	5.28	0.21	3	-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	19.93	51.25	4.84		-	-	19.93	51.25	2.79	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	5	-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06	4	-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	12.25	36.44	3.17	3	-	-	12.25	36.44	1.72	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	22.61	56.28	5.42		-	-	22.61	56.28	3.17	
-	-	-	3.50	0.14	5	-	-	-	3.50	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	22.61	56.28	5.42		-	-	22.61	56.28	3.17	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	1.37	13.27	0.72	5	-	-	1.37	13.27	0.19	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	12.25	36.44	3.17	3	-	-	12.25	36.44	1.72	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	3.65	49.47	104.60	13.08		-	3.65	49.47	104.60	8.75	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-	13	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06	0	-	-	-	1.59	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	3	-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	2.55	44.64	96.11	11.47		-	2.55	44.64	96.11	7.53	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01	11	-	-	-	0.32	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	22.61	56.28	5.42		-	-	22.61	56.28	3.17	
-	-	4.24	19.86	1.39	5	-	-	4.24	19.86	0.59	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	1.37	13.27	0.72	4	-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	2.55	16.06	1.00	2	-	-	2.55	16.06	0.36	
-	2.55	44.64	96.11	11.47		-	2.55	44.64	96.11	7.53	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-	11	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-	2	-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	3.50	0.14	1	-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-	3	-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	19.93	51.25	4.84		-	-	19.93	51.25	2.79	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	0.32	0.01	5	-	-	-	0.32	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00	4	-	-	2.55	16.06	0.36	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-	1	-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	3.50	0.14	1	-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14	1	-	-	-	3.50	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	4.60	53.51	111.65	14.44		-	4.60	53.51	111.65	9.79	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	14	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	19.93	51.25	4.84		-	-	19.93	51.25	2.79	
-	-	0.11	10.10	0.42	6	-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01	6	-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	12.25	36.44	3.17	3	-	-	12.25	36.44	1.72	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	16.79	45.27	4.16	4	-	-	16.79	45.27	2.35	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	3.65	49.47	104.60	13.08		-	3.65	49.47	104.60	8.75	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	14.45	40.75	3.65	13	-	-	14.45	40.75	2.02	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	-	-		-	-	-	-	-	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	22.61	56.28	5.42		-	-	22.61	56.28	3.17	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	0.32	0.01	5	-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	19.93	51.25	4.84	6	-	-	19.93	51.25	2.79	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	19.93	51.25	4.84	5	-	-	19.93	51.25	2.79	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06	1	-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	5.76	23.15	1.73	2	-	-	5.76	23.15	0.81	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06	2	-	-	-	1.59	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-	0	-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	22.61	56.28	5.42		-	-	22.61	56.28	3.17	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	5	-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	-	-	4	-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	29.20	68.42	6.82		-	-	29.20	68.42	4.09	
-	0.84	36.54	81.69	8.84		-	0.84	36.54	81.69	5.54	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-	9	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01	0	-	-	-	0.32	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-	1	-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	-	-	4	-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	19.93	51.25	4.84		-	-	19.93	51.25	2.79	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	5	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14	2	-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21	0	-	-	-	5.28	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	6	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	6	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20	2	-	-	7.87	27.58	1.10	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	7.87	27.58	2.20	4	-	-	7.87	27.58	1.10	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	29.20	68.42	6.82		-	-	29.20	68.42	4.09	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	7	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	19.93	51.25	4.84		-	-	19.93	51.25	2.79	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	5	-	-	-	-	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	0.11	10.10	0.42	6	-	-	0.11	10.10	0.02	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	5.76	23.15	1.73	2	-	-	5.76	23.15	0.81	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	-	-	6	-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	3	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	1.59	0.06		-	-	-	1.59	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	22.61	56.28	5.42		-	-	22.61	56.28	3.17	
-	-	-	-	-	5	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	12.25	36.44	3.17		-	-	12.25	36.44	1.72	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	5.28	0.21	3	-	-	-	5.28	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42	4	-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	7.87	27.58	2.20		-	-	7.87	27.58	1.10	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	1.37	13.27	0.72	6	-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	19.93	51.25	4.84		-	-	19.93	51.25	2.79	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-	5	-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	4	-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	3.50	0.14		-	-	-	3.50	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06	0	-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	1.37	13.27	0.72		-	-	1.37	13.27	0.19	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	0	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	5.76	23.15	1.73	2	-	-	5.76	23.15	0.81	
-	-	5.76	23.15	1.73		-	-	5.76	23.15	0.81	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	2	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	-	22.61	56.28	5.42		-	-	22.61	56.28	3.17	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-	5	-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	

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Coal piles at power plant Flat topped ovalish pile (B-3 in Figure 13.2.5-2)						Coal pile at mine Flat topped ovalish pile (B-1 in Figure 13.2.5-2)					
ut*= 1.12						ut*= 1.12					
us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	10-day Disturb	us/ur = 0.20	us/ur = 0.60	us/ur = 0.90	us/ur = 1.10	Daily sum	
28%	54%	14%	4%	100%	P_{adjust}	36%	50%	14%	0%	100%	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	26.18	62.88	6.18		-	-	26.18	62.88	3.66	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-	6	-	-	-	-	-	
-	-	4.24	19.86	1.39		-	-	4.24	19.86	0.59	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
-	-	2.55	16.06	1.00	1	-	-	2.55	16.06	0.36	
-	-	-	-	-		-	-	-	-	-	
-	-	0.11	10.10	0.42		-	-	0.11	10.10	0.02	
-	-	-	-	-		-	-	-	-	-	
-	1.75	40.95	89.56	10.26		-	1.75	40.95	89.56	6.61	
-	-	-	0.32	0.01		-	-	-	0.32	-	
-	-	-	-	-		-	-	-	-	-	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	2.55	16.06	1.00		-	-	2.55	16.06	0.36	
-	-	-	1.59	0.06	10	-	-	-	1.59	-	
-	-	-	5.28	0.21		-	-	-	5.28	-	
-	-	-	1.59	0.06		-	-	-	1.59	-	
-	-	16.79	45.27	4.16		-	-	16.79	45.27	2.35	
-	-	14.45	40.75	3.65		-	-	14.45	40.75	2.02	
0.00	4.60	53.51	111.65	14.44		0.00	4.60	53.51	111.65	9.79	
0.00	2.49	7.49	4.47	14.44	14.44	0.00	2.30	7.49	0.00	9.79	
0.00	30.04	3096.25	11165.32	896.31		0.00	30.04	3096.25	11165.32	448.49	
0.00	6.01	619.25	2233.06	179.26		0.00	6.01	619.25	2233.06	89.70	
0.00	16.22	433.48	446.61	896.31	544.86	0.00	15.02	433.48	0.00	448.49	
0.00	3.24	86.70	89.32	179.26	108.97	0.00	3.00	86.70	0.00	89.70	
0	12	385	733	733	170	0	12	385	733	385	

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UT*	=	1.12	(m/s) threshold friction velocity for coal pile	
UT* = 0.053 * UT10+		Equation 4 from AP-42 Section 13.2.5		
UT10+ =		21.13208	threshold wind speed (m/s) at anemonmeter height of 10 meters	
UTZ+ = UT10+			ln (Z/0.003)	Correction from 10 meters to actual anemometer height, based on Equation 5 from AP-42 Section 13.2.5
			ln (10/0.003)	
	Z = actual anemometer height (10.06 meters)			
	0.3	= typical surface roughness height (cm)		
21.15		UT10.06 = UT10	ln (10.06/0.003)	Threshold wind velocity (m/s) at 10.06 m anemometer height
0 days			ln (10/0.003)	

UT*	=	1.02	(m/s) threshold friction velocity for overburden pile	
UT* = 0.053 * UT10+		Equation 4 from AP-42 Section 13.2.5		
UT10+ =		19.24528	threshold wind speed (m/s) at anemonmeter height of 10 meters	
UTZ+ = UT10+			ln (Z/0.003)	Correction from 10 meters to actual anemometer height, based on Equation 5 from AP-42 Section 13.2.5
			ln (10/0.003)	
	Z = actual anemometer height (10.4 meters)			
	0.3	= typical surface roughness height (cm)		
19.26		UT10.4 = UT10	ln (10.4/0.003)	Threshold wind velocity (m/s) at 10.06 m anemometer height
9 days			ln (10/0.003)	

UT*	=	1.02	(m/s) threshold friction velocity for ash pile	
UT* = 0.053 * UT10+		Equation 4 from AP-42 Section 13.2.5		
UT10+ =		19.24528	threshold wind speed (m/s) at anemonmeter height of 10 meters	
UTZ+ = UT10+			ln (Z/0.003)	Correction from 10 meters to actual anemometer height, based on Equation 5 from AP-42 Section 13.2.5
			ln (10/0.003)	
	Z = actual anemometer height (10.4 meters)			
	0.3	= typical surface roughness height (cm)		
19.26		UT10.4 = UT10	ln (10.06/0.003)	Threshold wind velocity (m/s) at 10.06 m anemometer height
9 days			ln (10/0.003)	

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Appendix A

Part II – BNCC Coal Handling Plant

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	Annual Throughput	6,000,000
Fraction Flop 3 > Conv 7165	0.8	
Fraction Flop 5 > Stacker 5/6	0.55	
Fraction Flop 5 > Conv 7166	0.45	

Navajo Mine Coal Processing Inventory

Source Description	CTS Source Number	Annual tpy	Calculation Basis	Control Facto (total)	Emission Factor	Source	Actual Emissions PM10 lbs/hr	PM10 tpy	PM2.5 lbs/hr	PM2.5 tpy
System 1										
Train Unloading	TL1	4,200,000		0.5	AP42-13.2.4.3		0.088803	0.388958	0.013447	0.058899
Hopper/Feeder to Conv 5124 TP	TP1	4,200,000		0.7	AP42-13.2.4.3		0.053282	0.233375	0.008068	0.035340
Conv 5124 to Distributor Bin TP	TP2	4,200,000		0.98	AP42-13.2.4.3		0.003552	0.015558	0.000538	0.002356
Crusher #1 (including input to crusher from Distrbutors 5128/5129, output from crusher to Conv 5135)	CR1	4,200,000		0.98	AP42-11.19.2-2		0.023014	0.100800	0.023014	0.100800
Conv 5135 to Conv 7153 TP	TP3	4,200,000		0.9	AP42-13.2.5-2		0.017761	0.077792	0.002689	0.011780
Flop Gate #2 (Conv 7153)/1 to Conv 63105 TP	TP4	840,000		0.9	AP42-13.2.4.3		0.003552	0.015558	0.000538	0.002356
Flop Gate # 2 (Conv 7153)/2 to Conv 7154 TP	TP5	2,520,000		0.9	AP42-13.2.4.3		0.010656	0.046675	0.001614	0.007068
Flop Gate #2 (Conv 7153)/3 to Conv 7155 TP	TP6	840,000		0.9	AP42-13.2.4.3		0.003552	0.015558	0.000538	0.002356
System 2										
Train Unloading	TL2	1,800,000		0.5	AP42-13.2.4.3		0.038059	0.166696	0.005763	0.025243
Hopper/Feeder to Conv 5103 TP	TP7	1,800,000		0.7	AP42-13.2.4.3		0.022835	0.100018	0.003458	0.015146
Conv 5103 > Distribution Bin TP	TP8	1,800,000		0.98	AP42-13.2.4.3		0.001522	0.006668	0.000231	0.001010
Crusher # 2 (including input to crusher from Distributors 5106,5107, output from crusher to Conv 5115)	CR2	1,800,000		0.98	AP42-11.19.2-2		0.009863	0.043200	0.009863	0.043200
Conv 5115 to Conv 7151 TP	TP9	1,800,000		0.9	AP42-13.2.4.3		0.007612	0.033339	0.001153	0.005049
Flop Gate #1 (Conv 7151)/1 to Conv 7154 TP	TP10	540,000		0.9	AP42-13.2.4.3		0.002284	0.010002	0.000346	0.001515
Flop Gate #1 (Conv 7151)/2 to Conv 63105 TP	TP11	360,000		0.9	AP42-13.2.4.3		0.001522	0.006668	0.000231	0.001010
Flop Gate #1 (Conv 7151)/3 to Conv 7155 TP	TP12	900,000		0.9	AP42-13.2.4.3		0.003806	0.016670	0.000576	0.002524
Combined System										
Conv 63105 to 63110 Stacker Trailer 1/2(tripper) TP	TP13	1,200,000		0.9	AP42-13.2.4.3		0.00507447	0.02222619	0.00076842	0.00336568
63110 Stacker Trailer 1/2 to Feed Hopper 1/2TP	TP14	1,200,000		0.9	AP42-13.2.4.3		0.00507447	0.02222619	0.00076842	0.00336568
Feed Hopper 1/2 to Stacker 1/2 Conv 1 TP	TP15	600,000		0.9	AP42-13.2.4.3		0.00253724	0.01111309	0.00038421	0.00168284
Feed Hopper 1/2 to Stacker 1/2 Conv 2 TP	TP16	600,000		0.9	AP42-13.2.4.3		0.00253724	0.01111309	0.00038421	0.00168284
Stacker 1/2 Conv 1 to Piles 1 or 2	TP17	600,000		0.4	AP42-13.2.4.3		0.01522342	0.06667856	0.00230526	0.010097039
Stacker 1/2 Conv 2 to Piles 1 or 2	TP18	600,000		0.4	AP42-13.2.4.3		0.01522342	0.06667856	0.00230526	0.010097039
Conv 7154 to Conv 7156 TP	TP19	3,060,000		0.9	AP42-13.2.4.3		0.0129399	0.05667678	0.00195947	0.008582483
Flop Gate #4 (Conv 7156) /1 to Conv 5161 TP	TP20	856,800		0.9	AP42-13.2.4.3		0.00362317	0.0158695	0.00054865	0.002403095
Flop Gate #3 (Conv 7164)/1 to Conv 5161 TP	TP21	348,000		0.9	AP42-13.2.4.3		0.0014716	0.00644559	0.00022284	0.000976047
Conv 5161 to 5165 Stacker Trailer 3/4 (tripper) TP	TP22	1,204,800		0.9	AP42-13.2.4.3		0.00509477	0.02231509	0.00077149	0.003379142
5165 Stacker Trailer 3/4 to Feed Hopper 3/4TP	TP23	1,204,800		0.9	AP42-13.2.4.3		0.00509477	0.02231509	0.00077149	0.003379142
Feed Hopper 3/4 to Stacker 3/4 Conv 1 TP	TP24	602,400		0.9	AP42-13.2.4.3		0.00254738	0.01115755	0.00038575	0.001689571
Feed Hopper to Stacker 3/4 Conv 2 TP	TP25	602,400		0.9	AP42-13.2.4.3		0.00254738	0.01115755	0.00038575	0.001689571
Stacker 3/4 Conv 1 to Piles 3 or 4	TP26	602,400		0.4	AP42-13.2.4.3		0.01528431	0.06694528	0.00231448	0.010137427
Stacker 3/4 Conv 2 to Piles 3 or 4	TP27	602,400		0.4	AP42-13.2.4.3		0.01528431	0.06694528	0.00231448	0.010137427
Flop Gate #4 (Conv 7156)/2 to Conv 7157 TP	TP28	2,203,200		0.9	AP42-13.2.4.3		0.00931673	0.04080728	0.00141082	0.006179388
Flop Gate #6 (Conv 7157)/1 to Conv 7158 TP	TP29	1,762,560		0.9	AP42-13.2.4.3		0.00745338	0.03264582	0.00112866	0.00494351
Flop Gate #7(Conv 7158)/1 to Conv 7159 TP	TP30	1,198,541		0.9	AP42-13.2.4.3		0.0050683	0.02219916	0.00076749	0.003361587
Conv 7159 to Conv 7160 TP	TP31	1,198,541		0.9	AP42-13.2.4.3		0.0050683	0.02219916	0.00076749	0.003361587
Conv 7160 to 63110A Stacker Trailer 9/10 (tripper) TP	TP32	1,198,541		0.9	AP42-13.2.4.3		0.0050683	0.02219916	0.00076749	0.003361587
63110A Stacker Trailer 9/10 to Feed Hopper 9/10 TP	TP33	1,198,541		0.9	AP42-13.2.4.3		0.0050683	0.02219916	0.00076749	0.003361587
Feed Hopper 9/10 to Stacker 9/10 Conv 1 TP	TP34	599,270		0.9	AP42-13.2.4.3		0.00253415	0.01109958	0.00038374	0.001680794
Feed Hopper 9/10 to Stacker 9/10 Conv 2 TP	TP35	599,270		0.9	AP42-13.2.4.3		0.00253415	0.01109958	0.00038374	0.001680794
Stacker 9/10 Conv 1 to Piles 9 or 10	TP36	599,270		0.4	AP42-13.2.4.3		0.0152049	0.06659748	0.00230246	0.010084761
Stacker 9/10 Conv 2 to Piles 9 or 10	TP37	599,270		0.4	AP42-13.2.4.3		0.0152049	0.06659748	0.00230246	0.010084761

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	Annual Throughput	6,000,000	**Navajo Mine Coal Processing Inventory**							
Fraction Flop 3 > Conv 7165	0.8							**Actual Emissions**		
Fraction Flop 5 > Stacker 5/6	0.55									
Fraction Flop 5 > Conv 7166	0.45		Calculation Basis	Control Facto	Emission	PM10		PM2.5		
				(total)	Factor	lbs/hr	tpy	lbs/hr	tpy
Source Description	CTS	Annual			Source				
Flop Gate 6 (Conv 7157)/2 To Conv 5162 TP	TP38	440,640		0.9	AP42-13.2.4.3	0.00186335	0.00816146	0.00028216	0.001235878
Flop Gate #5 (Conv 7165)/1 to Conv 5162 TP	TP39	765,600		0.9	AP42-13.2.4.3	0.00323751	0.01418031	0.00049025	0.002147304
Conv 5162 to 5166 Stacker Trailer 5/6 (tripper) TP	TP40	1,206,240		0.9	AP42-13.2.4.3	0.00510086	0.02234176	0.00077242	0.003383181
5166 Stacker Trailer 5/6 to Feed Hopper 5/6 TP	TP41	1,206,240		0.9	AP42-13.2.4.3	0.00510086	0.02234176	0.00077242	0.003383181
Feed Hopper 5/6 to Stacker 5/6 Conv 1	TP42	603,120		0.9	AP42-13.2.4.3	0.00255043	0.01117088	0.00038621	0.001691591
Feed Hopper 5/6 to Stacker 5/6 Conv 2	TP43	603,120		0.9	AP42-13.2.4.3	0.00255043	0.01117088	0.00038621	0.001691591
Stacker 5/6 Conv 1 to Piles 5 or 6	TP44	603,120		0.4	AP42-13.2.4.3	0.01530258	0.06702529	0.00231725	0.010149544
Stacker 5/6 Conv 2 to Piles 5 or 6	TP45	603,120		0.4	AP42-13.2.4.3	0.01530258	0.06702529	0.00231725	0.010149544
Conv 7155 to Conv 7164 TP	TP46	1,740,000		0.9	AP42-13.2.4.3	0.00735798	0.03222797	0.00111421	0.004880236
Flop Gate #3 (Conv 7164)/2 to Conv 7165 TP	TP47	1,392,000		0.9	AP42-13.2.4.3	0.00588639	0.02578238	0.00089137	0.003904189
Flop Gate #5 (Conv 7165)/2 to Conv 7166 TP	TP48	626,400		0.9	AP42-13.2.4.3	0.00264887	0.01160207	0.00040112	0.001756885
Flop Gate #7 (Conv 7158)/2 to Conv 5163 TP	TP49	564,019		0.9	AP42-13.2.4.3	0.00238508	0.01044666	0.00036117	0.001581923
Conv 7166 to Conv 5163 TP	TP50	626,400		0.9	AP42-13.2.4.3	0.00264887	0.01160207	0.00040112	0.001756885
Conv 5163 to 5176 Stacker Trailer 7/8 (tripper) TP	TP51	1,190,419		0.9	AP42-13.2.4.3	0.00503396	0.02204873	0.00076228	0.003338808
5176 Stacker Trailer 7/8 to Feed Hopper 7/8 TP	TP52	1,190,419		0.9	AP42-13.2.4.3	0.00503396	0.02204873	0.00076228	0.003338808
Feed Hopper 7/8 to Stacker 7/8 Conv 1 TP	TP53	595,210		0.9	AP42-13.2.4.3	0.00251698	0.01102437	0.00038114	0.001669404
Feed Hopper 7/8 to Stacker 7/8 Conv 2 TP	TP54	595,210		0.9	AP42-13.2.4.3	0.00251698	0.01102437	0.00038114	0.001669404
Stacker 7/8 Conv 1 to Piles 7 or 8	TP55	595,210		0.4	AP42-13.2.4.3	0.01510187	0.0661462	0.00228685	0.010016425
Stacker 7/8 Conv 2 to Piles 7 or 8	TP56	595,210		0.4	AP42-13.2.4.3	0.01510187	0.0661462	0.00228685	0.010016425
Reclaimer Pile 1 or 2 to Conv 63105	RC1/2	1,200,000		0	AP42-13.2.4.3	0.01522342	0.06667856	0.00230526	0.010097039
Conv 63105 to Conv 7177	TP57	1,200,000		0.9	AP42-13.2.4.3	0.00507447	0.02222619	0.00076842	0.00336568
Reclaimer Pile 3 or 4 to Conv 5161	RC3/4	1,204,800		0	AP42-13.2.4.3	0.01528431	0.06694528	0.00231448	0.010137427
Conv 5161 to Conv 7177	TP58	1,204,800		0.9	AP42-13.2.4.3	0.00509477	0.02231509	0.00077149	0.003379142
Reclaimer Pile 5 or 6 to Conv 5162	RC5/6	1,206,240		0	AP42-13.2.4.3	0.01530258	0.06702529	0.00231725	0.010149544
Conv 5162 to Conv 7177	TP59	1,206,240		0.9	AP42-13.2.4.3	0.00510086	0.02234176	0.00077242	0.003383181
Reclaimer Pile 7 or 8 to Conv 5163	RC7/8	1,190,419		0	AP42-13.2.4.3	0.01510187	0.0661462	0.00228685	0.010016425
Conv 5163 to Conv 7179	TP60	1,190,419		0.9	AP42-13.2.4.3	0.00503396	0.02204873	0.00076228	0.003338808
Reclaimer Piles 9 or 10 to Conv 7160	RC9/10	1,198,541		0	AP42-13.2.4.3	0.0152049	0.06659748	0.00230246	0.010084761
Conv 7160 to Conv 7179	TP61	1,198,541		0.9	AP42-13.2.4.3	0.0050683	0.02219916	0.00076749	0.003361587
Conv 7177 to Conv 7181	TP62	2,411,040		0.9	AP42-13.2.4.3	0.01019563	0.04465686	0.00154391	0.006762324
Flop #8 (Conv 7181)/1 to Conv 7184	TP63	2,411,040		0.9	AP42-13.2.4.3	0.01019563	0.04465686	0.00154391	0.006762324
Flop #8 (Conv 7181/2 to Conv 7186	TP64	0		0.9	AP42-13.2.4.3	0	0	0	0
Conv 7184 to Conv 5185	TP65	2,411,040		0.9	AP42-13.2.4.3	0.01019563	0.04465686	0.00154391	0.006762324
Conv 5185 to Conv 1B North	TP66	1,205,520		0.9	AP42-13.2.4.3	0.00509781	0.02232843	0.00077195	0.003381162
Conc 5185 to Conv 1B South	TP67	1,205,520		0.9	AP42-13.2.4.3	0.00509781	0.02232843	0.00077195	0.003381162
Conv 1B North to N Surge Bin	TP68	1,205,520		0.9	AP42-13.2.4.3	0.00509781	0.02232843	0.00077195	0.003381162
Conv 1B South to S Surge Bin	TP69	1,205,520		0.9	AP42-13.2.4.3	0.00509781	0.02232843	0.00077195	0.003381162
Conv 7179 to Conv 7183	TP70	2,388,960		0.9	AP42-13.2.4.3	0.01010226	0.04424789	0.00152977	0.006700395
Flop #9(Conv 7183)/1 to Conv 7186	TP71	2,388,960		0.9	AP42-13.2.4.3	0.01010226	0.04424789	0.00152977	0.006700395
Flop #9 (Conv 7183)/2 to Conv 7184	TP72	0		0.9	AP42-13.2.4.3	0	0	0	0
Conv 7186 to Conv 5187	TP73	2,388,960		0.9	AP42-13.2.4.3	0.01010226	0.04424789	0.00152977	0.006700395
Conv 5187 to Conv 1A North	TP74	1,194,480		0.9	AP42-13.2.4.3	0.00505113	0.02212395	0.00076489	0.003350198
Conv 5187 to Conv 1A South	TP75	1,194,480		0.9	AP42-13.2.4.3	0.00505113	0.02212395	0.00076489	0.003350198
Conv 1A North to N Surge Bin	TP76	1,194,480		0.9	AP42-13.2.4.3	0.00505113	0.02212395	0.00076489	0.003350198
Conv 1A South to S Surge Bin	TP77	1,194,480		0.9	AP42-13.2.4.3	0.00505113	0.02212395	0.00076489	0.003350198
						lbs/hr	tpy	lbs/hr	tpy
							Actual Emissions		
TOTAL EMISSIONS						0.79	3.48	0.15	0.65
Cross check - total sent to stackers		6,000,000							
to stacker 1/2		1,200,000							
to stacker 3/4		1,204,800							
to stacker 5/6		1,206,240							
to stacker 7/8		1,190,419							
to stacker 9/10		1,198,541							

Control
Systems 1 and 2 have dust suppression and vent systems: used 95 % control as a conservative control value
Also Systems 1 and 2 have low dust transfer chutes
Hoppers 1 and 2 have dust suppression sprays so we should add control for train unloading - used 50% control
Transfer into "bins" may have a higher control value if the transfer point is sealed and the bins are vented through a filter
No control is assumed for loading onto piles and reclaiming off piles. All other transfer points downstream of the crushers uses 0.6 to indicate enclosure.

Crushers
Crusher systems defined to include the "distributors". This is based on distributors and feed from them to the crushers being transfers in totally inclosed chutes that act as a single feed system to the crushers, not multiple transfer points arhead of the drop to the crushers.

Reclaimers
Emissions for Reclaimers to conveyor transfer point include 0.3 activity factor

Flop Gate Fractions – where cross over is possible

1	Fraction Flop 8 to 7184
0	Fraction Flop 8 to 7186
1	Fraction Flop 9 to 7186
0	Fraction Flop 9 to 7184

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Source Description	CTS Source #	PM10 lbs/hr	PM2.5 lbs/hr	Height ft	Volume Rel Ht (ft)	Area Rel Ht (ft)	Area Length (ft)	Area Width (ft)	Area (m^2)	PM10 g/s	PM2.5 g/s	PM10 g/s/m2	PM2.5 g/s/m2	Volume Rel Ht (m)	Area Rel Ht (m)
System 1															
Train Unloading	TL1	0.088803	0.013447							0.011189	0.001694366				
Hopper/Feeder to Conv 5124 TP	TP1	0.053282	0.008068							0.006714	0.00101662				
	SUM	0.142085	0.021516	2		1	85	10	79.0	0.017903	0.002710986	0.0002267	3.43304E-05		0.3048
CRUSHER 1															
Conv 5124 to Distributor Bin TP	TP2	0.003552	0.000538												
Crusher #1 (including input to crusher from Distrbutors 5128/5129, output from crusher to Conv 5135)	CR1	0.023014	0.023014												
	SUM	0.026566	0.023552	35	17.5					0.003347	0.002967501			5.334	
System 2															
Train Unloading	TL2	0.038059	0.005763												
Hopper/Feeder to Conv 5103 TP	TP7	0.022835	0.003458												
	SUM	0.060894	0.009221	2		1	95.5	10	88.7	0.007673	0.001161851	8.648E-05	1.30954E-05		0.3048
CRUSHER 2															
Conv 5103 > Distribution Bin TP	TP8	0.001522	0.000231												
Crusher # 2 (including input to crusher from Distributors 5106,5107, output from crusher to Conv 5115)	CR2	0.009863	0.009863												
	SUM	0.011385	0.010094	31	15.5					0.001435	0.001271786			4.7244	
SAMPLE TOWER															
Conv 5135 to Conv 7153 TP	TP3	0.017761	0.002689												
Conv 5115 to Conv 7151 TP	TP9	0.007612	0.001153												
	SUM	0.025372	0.003842	32	16					0.003197	0.000484105			4.8768	
TOWER1															
Flop Gate # 2 (Conv 7153)/2 to Conv 7154 TP	TP5	0.010656	0.001614												
Flop Gate #2 (Conv 7153)/3 to Conv 7155 TP	TP6	0.003552	0.000538												
Flop Gate #1 (Conv 7151)/1 to Conv 7154 TP	TP10	0.002284	0.000346												
Flop Gate #1 (Conv 7151)/3 to Conv 7155 TP	TP12	0.003806	0.000576												
	SUM	0.020298	0.003074	24	12					0.002558	0.000387284			3.6576	
TOWER1A															
Flop Gate #2 (Conv 7153)/1 to Conv 63105 TP	TP4	0.003552	0.000538												
Flop Gate #1 (Conv 7151)/2 to Conv 63105 TP	TP11	0.001522	0.000231												
Conv 7154 to Conv 7156 TP	TP19	0.01294	0.001959												
Conv 7155 to Conv 7164 TP	TP46	0.007358	0.001114												
	SUM	0.025372	0.003842	12	6					0.003197	0.000484105			1.8288	
PILES1-2															
Conv 63105 to 63110 Stacker Trailer 1/2(tripper) TP	TP13	0.005074	0.000768												
63110 Stacker Trailer 1/2 to Feed Hopper 1/2TP	TP14	0.005074	0.000768												
Feed Hopper 1/2 to Stacker 1/2 Conv 1 TP	TP15	0.002537	0.000384												
Feed Hopper 1/2 to Stacker 1/2 Conv 2 TP	TP16	0.002537	0.000384												
Stacker 1/2 Conv 1 to Piles 1 or 2	TP17	0.015223	0.002305												
Stacker 1/2 Conv 2 to Piles 1 or 2	TP18	0.015223	0.002305												
Reclaimer Pile 1 or 2 to Conv 63105	RC1/2	0.015223	0.002305												
	SUM	0.060894	0.009221	34.5		17.25	837	196	15240.9	0.007673	0.001161851	5.034E-07	7.62323E-08		5.2578
Reclaim 1-2															
Conv 63105 to Conv 7177	**TP57**	0.005074	0.000768	2	1					0.000639	9.68209E-05			0.3048	

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Source Description	CTS Source #	PM10 lbs/hr	PM2.5 lbs/hr	Height ft	Volume Rel Ht (ft)	Area Rel Ht (ft)	Area Length (ft)	Area Width (ft)	Area (m^2)	PM10 g/s	PM2.5 g/s	PM10 g/s/m2	PM2.5 g/s/m2	Volume Rel Ht (m)	Area Rel Ht (m)
TOWER 2															
Flop Gate #4 (Conv 7156) /1 to Conv 5161 TP	TP20	0.003623	0.000549												
Flop Gate #3 (Conv 7164)/1 to Conv 5161 TP	TP21	0.001472	0.000223												
Flop Gate #4 (Conv 7156)/2 to Conv 7157 TP	TP28	0.009317	0.001411												
Flop Gate #3 (Conv 7164)/2 to Conv 7165 TP	TP47	0.005886	0.000891												
	SUM	0.020298	0.003074	19	9.5					0.002558	0.000387284			2.8956	
PILES 3-4															
Conv 5161 to 5165 Stacker Trailer 3/4 (tripper) TP	TP22	0.005095	0.000771												
5165 Stacker Trailer 3/4 to Feed Hopper 3/4TP	TP23	0.005095	0.000771												
Feed Hopper 3/4 to Stacker 3/4 Conv 1 TP	TP24	0.002547	0.000386												
Feed Hopper to Stacker 3/4 Conv 2 TP	TP25	0.002547	0.000386												
Stacker 3/4 Conv 1 to Piles 3 or 4	TP26	0.015284	0.002314												
Stacker 3/4 Conv 2 to Piles 3 or 4	TP27	0.015284	0.002314												
Reclaimer Pile 3 or 4 to Conv 5161	RC3/4	0.015284	0.002314												
	SUM	0.061137	0.009258	34.5		17.25	837	196	15240.9	0.007703	0.001166499	5.054E-07	7.65372E-08		5.2578
Reclaim 3-4															
Conv 5161 to Conv 7177	**TP58**	0.005095	0.000771	2	1					0.000642	9.72082E-05			0.3048	
TOWER 3															
Flop Gate #6 (Conv 7157)/1 to Conv 7158 TP	TP29	0.007453	0.001129												
Flop Gate 6 (Conv 7157)/2 To Conv 5162 TP	TP38	0.001863	0.000282												
Flop Gate #5 (Conv 7165)/1 to Conv 5162 TP	TP39	0.003238	0.00049												
Flop Gate #5 (Conv 7165)/2 to Conv 7166 TP	TP48	0.002649	0.000401												
	SUM	0.015203	0.002302	14	7					0.001916	0.000290075			2.1336	
PILES 5-6															
Conv 5162 to 5166 Stacker Trailer 5/6 (tripper) TP	TP40	0.005101	0.000772												
5166 Stacker Trailer 5/6 to Feed Hopper 5/6 TP	TP41	0.005101	0.000772												
Feed Hopper 5/6 to Stacker 5/6 Conv 1	TP42	0.00255	0.000386												
Feed Hopper 5/6 to Stacker 5/6 Conv 2	TP43	0.00255	0.000386												
Stacker 5/6 Conv 1 to Piles 5 or 6	TP44	0.015303	0.002317												
Stacker 5/6 Conv 2 to Piles 5 or 6	TP45	0.015303	0.002317												
Reclaimer Pile 5 or 6 to Conv 5162	RC5/6	0.015303	0.002317												
	SUM	0.06121	0.009269	34.5		17.25	837	196	15240.9	0.007712	0.001167893	5.06E-07	7.66287E-08		5.2578
Reclaim 5-6															
Conv 5162 to Conv 7177	**TP59**	0.005101	0.000772	2	1					0.000643	9.73244E-05			0.3048	
TOWER 4															
Flop Gate #7(Conv 7158)/1 to Conv 7159 TP	TP30	0.005068	0.000767												
Flop Gate #7 (Conv 7158)/2 to Conv 5163 TP	TP49	0.002385	0.000361												
Conv 7166 to Conv 5163 TP	TP50	0.002649	0.000401												
	SUM	0.010102	0.00153	19	9.5					0.001273	0.000192751			2.8956	
PILES 7-8															
Conv 5163 to 5176 Stacker Trailer 7/8 (tripper) TP	TP51	0.002649	0.000401												
5176 Stacker Trailer 7/8 to Feed Hopper 7/8 TP	TP52	0.005034	0.000762												
Feed Hopper 7/8 to Stacker 7/8 Conv 1 TP	TP53	0.005034	0.000762												
Feed Hopper 7/8 to Stacker 7/8 Conv 2 TP	TP54	0.002517	0.000381												
Stacker 7/8 Conv 1 to Piles 7 or 8	TP55	0.002517	0.000381												
Stacker 7/8 Conv 2 to Piles 7 or 8	TP56	0.015102	0.002287												
Reclaimer Pile 7 or 8 to Conv 5163	RC7/8	0.015102	0.002287												
	SUM	0.047954	0.007262	34.5		17.25	837	196	15240.9	0.006042	0.000914972	3.964E-07	6.00339E-08		5.2578

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Source Description	CTS Source #	PM10 lbs/hr	PM2.5 lbs/hr	Height ft	Volume Rel Ht (ft)	Area Rel Ht (ft)	Area Length (ft)	Area Width (ft)	Area (m^2)	PM10 g/s	PM2.5 g/s	PM10 g/s/m2	PM2.5 g/s/m2	Volume Rel Ht (m)	Area Rel Ht (m)
Reclaim 7-8															
Conv 5163 to Conv 7179	**TP60**	0.005034	0.000762	2	1					0.000634	9.60479E-05			0.3048	
TOWER 5															
Conv 7159 to Conv 7160 TP	TP31	0.005068	0.000767	14	7					0.000639	9.67032E-05			2.1336	
PILES 9-10															
Conv 7160 to 63110A Stacker Trailer 9/10 (tripper) TP	TP32	0.005068	0.000767												
63110A Stacker Trailer 9/10 to Feed Hopper 9/10 TP	TP33	0.005068	0.000767												
Feed Hopper 9/10 to Stacker 9/10 Conv 1 TP	TP34	0.002534	0.000384												
Feed Hopper 9/10 to Stacker 9/10 Conv 2 TP	TP35	0.002534	0.000384												
Stacker 9/10 Conv 1 to Piles 9 or 10	TP36	0.015205	0.002302												
Stacker 9/10 Conv 2 to Piles 9 or 10	TP37	0.015205	0.002302												
Reclaimer Piles 9 or 10 to Conv 7160	RC9/10	0.015205	0.002302												
	SUM	0.06082	0.00921	34.5		17.25	837	196	15240.9	0.007663	0.001160438	5.028E-07	7.61396E-08		5.2578
Reclaim 9-10															
Conv 7160 to Conv 7179	**TP61**	0.005068	0.000767	2	1					0.000639	9.67032E-05			0.3048	
RECLAIM DROP BIN															
Conv 7177 to Conv 7181	TP62	0.010196	0.001544												
Conv 7179 to Conv 7183	TP70	0.010102	0.00153												
	SUM	0.020298	0.003074	14	7					0.002558	0.000387284			2.1336	
TOWER 6															
Flop #8 (Conv 7181)/1 to Conv 7184	TP63	0.010196	0.001544												
Flop #9(Conv 7183)/1 to Conv 7186	TP71	0.010102	0.00153												
	SUM	0.020298	0.003074	18	9					0.002558	0.000387284			2.7432	
TOWER 7															
Conv 7184 to Conv 5185	TP65	0.010196	0.001544												
Conv 7186 to Conv 5187	TP73	0.010102	0.00153												
	SUM	0.020298	0.003074	19	9.5					0.002558	0.000387284			2.8956	
FLOP GATES 1A/1B															
Conv 5185 to Conv 1B North	TP66	0.005098	0.000772												
Conc 5185 to Conv 1B South	TP67	0.005098	0.000772												
Conv 5187 to Conv 1A North	TP74	0.005051	0.000765												
Conv 5187 to Conv 1A South	TP75	0.005051	0.000765												
	SUM	0.020298	0.003074	40						0.002558	0.000387284			12.192	
DROP TO COAL SILOS															
Conv 1B North to N Surge Bin	TP68	0.005098	0.000772												
Conv 1A North to N Surge Bin	TP76	0.005098	0.000772												
	SUM	0.010196	0.001544	35						0.001285	0.000194533			10.668	
Conv 1B South to S Surge Bin	TP69	0.005098	0.000772												
Conv 1A South to S Surge Bin	TP77	0.005051	0.000765												
	SUM	0.010149	0.001537	35						0.001279	0.000193642			10.668	

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Appendix A

Part III – BNCC Mine Area

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Table D-1

PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM

PINABETE NORTH - COAL MINE EQUIPMENT AND OPERATIONS - PREFERRED ALTERNATIVE

Tons Coal Produced 3000000 **Cubic Yds Overburden + Interburden** **4851000**

	Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor Units	Emission Factor			Representative Uncontrolled Hourly Emisson Rate (lb/hr)			Operating Schedule		Annual Emission Rate without Controls (ton per year)			Control Efficiency	Controlled Emission Rates (No Hourly Average for Blasting)					
					PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	Hours/ Week	Weeks/ Year	PM	PM_{10}	$PM_{2.5}$	%	PM (Typ. lb/hr)	PM (tpy)	PM_{10} (Typ. lb/hr)	PM_{10} (tpy)	$PM_{2.5}$ (Typ. lb/hr)	$PM_{2.5}$ (tpy)
	Drilling - Overburden + Interburden [1]	6,903	Holes/yr		1.3	0.676	0.195	1.415	0.736	0.212	122	52	4.49	2.33	0.67	50.0%	0.71	2.24	0.368	1.17	0.106	0.337
	Drilling - Coal [1]	51,697	Holes/yr		0.22	0.114	0.033	21.513	11.187	3.356	122	52	5.69	2.96	0.85	50.0%	10.76	2.84	5.59	1.48	1.68	0.427
	Overburden Blasting [2,4]	7	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.03	0.02	0.01	0.00%	N/A	0.03	0.00	0.02	0.00	0.005
	Coal Blasting [2,4]	89	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.43	0.22	0.07	0.00%	N/A	0.43	0.05	0.22	0.02	0.067
	Overburden Dragline [3]	4.85E+06	cu.yds/yr		0.048	0.0092	8.09E-04	39.31	7.56	0.67	113	52	115.50	22.22	1.96	0.00%	39.31	115.50	7.56	22.22	0.67	1.963
	Overburden Dozers [4]	1156	hrs/month	lb/hr/dozer (12 dozers/hr)	3.00	0.54	6.60E-02	36.02	6.43	0.79	175	52	20.82	3.72	0.46	60.00%	14.41	8.33	2.57	1.49	0.32	0.183
	Dozers - Maint and Replace [4]	2895	hrs/month	lb/hr/dozer (12 dozers/hr)	24.95	5.94	0.55	299.39	71.26	6.59	1330	52	433.37	103.14	9.53	60.00%	119.8	173.3	28.5	41.3	2.63	3.81
	Truck Loading Coal with Payloader [3]	3.00E+06	tons/yr	lb/ton (7 Loaders)	0.05	0.0089	0.0010	4.311	0.716	0.082	715	52	80.13	13.31	1.52	50.00%	2.16	40.07	0.36	6.655	0.107	2.00
	Scrapers [6]	231	hrs/month	lb/VMT (3 Scapers)	2.26E-01	1.22E-01	7.01E-03	0.326	0.176	0.010	74	52	0.63	0.34	0.02	50.00%	0.16	0.31	0.09	0.170	0.0051	0.010
	Road Graders [6]	1,617	hrs/month	lb/VMT (4 Graders)	2.26E-01	1.22E-01	7.01E-03	2.282	1.234	0.071	74	52	4.39	2.38	0.14	50.00%	1.14	2.20	0.62	1.188	0.0354	0.068
	CATEGORY SUBTOTAL: Overburden Drill/Blast																	2.278		1.184		0.342
	CATEGORY SUBTOTAL: Coal Drill/Blast																	3.275		1.703		0.494
	CATEGORY SUBTOTAL: Mine Extraction Oper.																	224.253		50.755		6.071
																TOTAL		345.30	45.72	75.86	5.57	8.87
																		g/s	5.76		0.70	0.26
																	STRIP2	g/s/m²	2.174E-05		2.65E-06	9.63E-07

NOTES:

1 - Emission factor is for uncontrolled drilling for either overburden or coal from AP-42, Western Surface Coal Mining, Table 11.1-4 (7/98). Holes per cu.yd. overburden = 702; holes per ton coal = 58; PM10 = 0.52, PM2.5 = 0.15 x PM (Company data)

2 - The emission factor for overburden/coal seam blasting is in units of lb/blast. Calculation is based on surface area per blast, which is estimated as follows:

Blasted material /yr = 29,449,000 cu. Yds/133 blasts/yr * 27 cu.ft / 1 cu.yd. = 5,978,000 cu.ft./blast

Area = 5,978,000 cu.ft./blast / 400 ft avg. depth = 149,460 sq.ft./blast

Emission Factor PM (lb/blast) = Area^1.5 x 0.000014 = (5,978,000)^1.5 x 0.000014 = 9.7 lb/blast; AP-42, Table 11.9-1, PM_{10} is 52% of the PM Emission Factor

3 - Overburden dragline removal factor (TSP) = 0.0021 * D ^ 1.1 / M ^ 0.3 ; (< 15 micron PM) = 0.0021 * D ^ 0.7 / M ^ 0.3; Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: Drop Height (D) = 30 ft; M = 7.9% moisture

4 - Coal Bulldozing factor (TSP) = 78.4 * s ^ 1.2 / M ^ 1.3 ; (< 15 micron PM) = 18.6 * s ^ 1.5 / M ^ 1.4; Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: s = 5.5 % Silt; M = 7.9% moisture

5 - Truck loading of coal with Front-End Loaders (TSP) = 1.16 /M ^ 1.2; (< 15 micron) = 0.119 / M ^ 0.9 Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: M = 7.9% moisture

6 - Emission factor for scrapers and graders from Document AP-42, Western Surface Coal Mining, Section 11.9, Table 11.9-1 (7/98). EF(grading, TSP) = 0.4 S ^ 2.5; EF(PM10) = 0.051 S ^ 2.0 Veh. Avg working speed (S) = 2 mph for emission factor correlation.

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Table D-2

PARTICULATE MATTER EMISSION ESTIMATION FUGITIVE EMISSIONS FROM

PINABETE EAST – COAL MINE EQUIPMENT AND OPERATIONS - PREFFERED ALTERNATIVE

Tons Coal Produced 3000000 **Cubic Yds Overburden + Interburden** **4851000**

	Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor Units	Emission Factor			Representative Uncontrolled Houry Emisson Rate (lb/hr)			Operating Schedule		Annual Emission Rate without Controls (ton per year)			Control Efficiency	Controlled Emission Rates (No Hourly Average for Blasting)					
					PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	Hours/ Week	Weeks/ Year	PM	PM_{10}	$PM_{2.5}$	%	PM (Typ. lb/hr)	PM (tpy)	PM_{10} (Typ. lb/hr)	PM_{10} (tpy)	$PM_{2.5}$ (Typ. lb/hr)	$PM_{2.5}$ (tpy)
	Drilling - Overburden + Interburden[1]	6,903	Holes/yr		1.3	0.676	0.195	1.415	0.736	0.212	122	52	4.49	2.33	0.67	50.0%	0.71	2.24	0.368	1.17	0.106	0.337
	Drilling - Coal [1]	51,697	Holes/yr		0.22	0.114	0.033	21.513	11.187	3.356	122	52	5.69	2.96	0.85	50.0%	10.76	2.84	5.59	1.48	1.68	0.427
	Overburden Blasting[2,4]	7	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.03	0.02	0.01	0.00%	N/A	0.03	0.00	0.02	0.00	0.005
	Coal Blasting[2,4]	89	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.43	0.22	0.07	0.00%	N/A	0.43	0.05	0.22	0.02	0.067
	Overburden Dragline[3]	4.85E+06	cu.yds/yr		0.048	0.0092	8.09E-04	39.31	7.56	0.67	113	52	115.50	22.22	1.96	0.00%	39.31	115.50	7.56	22.22	0.67	1.963
	Overburden Dozers[4]	1156	hrs/month	lb/hr/dozer (12 dozers/hr)	3.00	0.54	6.60E-02	36.02	6.43	0.79	175	52	20.82	3.72	0.46	60.00%	14.41	8.33	2.57	1.49	0.32	0.183
	Dozers - Maint and Replace[4]	2895	hrs/month	lb/hr/dozer (12 dozers/hr)	24.95	5.94	0.55	299.39	71.26	6.59	1330	52	433.37	103.14	9.53	60.00%	119.8	173.3	28.5	41.3	2.63	3.81
	Truck Loading Coal with Payloader[5]	3.00E+06	tons/yr	lb/ton (7 Loaders)	0.05	0.0089	0.0010	4.311	0.716	0.082	715	52	80.13	13.31	1.52	50.00%	2.16	40.07	0.36	6.655	0.107	2.00
	Scrapers [6]	231	hrs/month	lb/VMT (3 Scapers)	2.26E-01	1.22E-01	7.01E-03	0.326	0.176	0.010	74	52	0.63	0.34	0.02	50.00%	0.16	0.31	0.09	0.170	0.0051	0.010
	Road Graders [6]	1,617	hrs/month	lb/VMT (4 Graders)	2.26E-01	1.22E-01	7.01E-03	2.282	1.234	0.071	74	52	4.39	2.38	0.14	50.00%	1.14	2.20	0.62	1.188	0.0354	0.068
	CATEGORY SUBTOTAL: Overburden Drill/Blast																	2.278		1.184		0.342
	CATEGORY SUBTOTAL: Coal Drill/Blast																	3.275		1.703		0.494
	CATEGORY SUBTOTAL: Mine Extraction Oper.																	339.748		72.977		8.034
																TOTAL	188.40	345.30	45.72	75.86	5.57	8.87
																		g/s	5.76		0.70	0.26
																	STRIP1	g/s/m²	2.17E-05		2.65E-06	9.63E-07

NOTES:

1 - Emission factor is for uncontrolled drilling for either overburden or coal from AP-42, Western Surface Coal Mining, Table 11.1-4 (7/98). Holes per cu.yd. overburden = 702; holes per ton coal = 58; PM10 = 0.52, PM2.5 = 0.15 x PM (Company data)

2 - The emission factor for overburden/coal seam blasting is in units of lb/blast. Calculation is based on surface area per blast, which is estimated as follows:

Blasted material /yr = 29,449,000 cu. Yds/133 blasts/yr * 27 cu.ft / 1 cu.yd. = 5,978,000 cu.ft./blast

Area = 5,978,000 cu.ft./blast / 400 ft avg. depth = 149,460 sq.ft./blast

Emission Factor PM (lb/blast) = Area^1.5 x 0.000014 = (5,978,000)^1.5 x 0.000014 = 9.7 lb/blast; AP-42, Table 11.9-1, PM_{-10} is 52% of the PM Emission Factor

3 - Overburden dragline removal factor (TSP) = 0.0021 * D ^ 1.1 / M ^ 0.3 ; (< 15 micron PM) = 0.0021 * D ^ 0.7 / M ^ 0.3; Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: Drop Height (D) = 30 ft; M = 7.9% moisture

4 - Coal Bulldozing factor (TSP) = 78.4 * s ^ 1.2 / M ^ 1.3 ; (< 15 micron PM) = 18.6 * s ^ 1.5 / M ^ 1.4; Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: s = 5.5 % Silt; M = 7.9% moisture

5 - Truck loading of coal with Front-End Loaders (TSP) = 1.16 /M ^ 1.2; (< 15 micron) = 0.119 / M ^ 0.9 Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: M = 7.9% moisture

6 - Emission factor for scrapers and graders from Document AP-42, Western Surface Coal Mining, Section 11.9, Table 11.9-1 (7/98). EF(grading, TSP) = 0.4 S ^ 2.5; EF(PM10) = 0.051 S ^ 2.0 Veh. Avg working speed (S) = 2 mph for emission factor correlation.

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Table D-3

PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM

PINABETE NORTH - COAL MINE AND PLANT VEHICLES - PREFERRED ALTERNATIVE

Total Coal 3000000 **tons/yr**

Mine and Plant Vechicles	Gross Vehicle Weight[4]	Emission factor [1] (lb/VMT)			Avg. Speed (MPH)	Oper. Hours/Month[2]	Annual VMT [3] (miles/yr)	Max. Uncontrolled Emisson Rate (lb/hr)			Max. Uncontrolled Emission Rate (tpy)			Control Measure	Control Efficiency [4] (%)	Controlled Emission Rate		
	tons	PM	PM_{10}	$PM_{2.5}$				PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$			PM (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
Coal Haulage, Stockpile and Roadway Maintenance																		
Coal Haul Trucks (230-ton capacity)	115	16.32	4.64	0.46	35	4216	147,567	57.1227	16.2436	3.4436	1204.20	342.43	34.24	Chem. Suppressant and Water Application	65.00%	421.47	119.85	11.99
Water Trucks	62	12.36	3.51	0.35	10	356	21,360	74.16	21.09	4.47	132.00	37.54	3.75		65.00%	46.20	13.14	1.31
Scrapers (Travel Mode)	62	12.36	3.51	0.35	15	216	19,440	139.04	39.54	8.38	120.13	34.16	3.42		65.00%	42.05	11.96	1.20
End Dump Trucks	175	19.71	5.61	0.56	18.5	500	55,500	273.54	77.79	16.49	547.09	155.57	15.56		65.00%	191.48	54.45	5.45
Light/Medium Veh (e.g., Pick-ups)	3	3.16	0.90	0.09	25	452	67,800	47.45	13.49	2.86	107.23	30.49	3.05		65.00%	37.53	10.67	1.07
Total Plant Vehicle travel																738.73	210.07	21.01
							Uncontrolled lb/hr	591.3168	168.1492	35.6476								

NOTES:

1 Emission Factors for the coal haul road from AP-42, Section 13.2.2 Equation 1a, with constants from Table 13.2.2-2 - See results below
*Assumed quarry surface silt content = 8.3% (Mean value for stone quarrying and processing, AP-42 Table 13.2.2-1)
*Assumed days per year with > 0.01 inch moisture = 60, Figure 13.2.2-1
2 Total vehicle category hours per month based on facility estimates for continuing operations with two areas of production.
3 Total Vehicle Miles Traveled (VMT) estimated by the capacity of coal haul trucks, distance to/from Lowe stockpile (5.66 miles one way). For other categories, VMT estimated from average speed and hours per month
4 Control efficiency for BNCC control measures estimated from guidance in AP-42, Section 13.2 for unpaved industrial roads

For Unpaved Roads within Area IV North:
7 Gross vehicle weight is an average of loaded (21.3 tons) and partially loaded with water (13.05 tons) weights
8 Gross vehicle weight is an average of loaded (33 tons) and unloaded (13 tons) weights
9 The loading time of each bulk cement truck is estimated to be 17.14 min. There will be 2 simultaneous loading spouts.
- Gross vehicle weight is an average of loaded (40 tons) and unloaded (14.41 tons) weights

For Unpaved Roads within Area IV North:

AP-42 13.2.2, Eqns 1a (11/06) $EF = k (s/12)^a (W/3)^b$

WHERE:

AP-42 13.2.2, Eqns 1a (11/06) $EF = k (s/12)^a (W/3)^b$

EF = Size specific emission factor (lb/VMT)

k = particle size multiplier = 4.9 for PM and 1.5 for PM_{10}, Table 13.2.2-2

S = road surface silt content = 8.3% (obtained from facility data)

W = fleet average vehicle weight for given service (tons) as listed for each category in table above

a = empirical constant, 0.7 for PM and 0.9 for PM_{10}, Table 13.2.2-2

b = empirical constant, 0.45 for PM, PM_{10} and $PM_{2.5}$, Table 13.2.2-2

p = ave. days per year with precipitation greater than 0.01 inches, obtained from Figure 13.2.2-1

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Table D-4

PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM

PINABETE EAST -COAL MINE AND PLANT VEHICLES - PREFERRED ALTERNATIVE

Total Coal 3000000 **tons/yr**

Mine and Plant Vechicles	Gross Vehicle Weight[4]	Emission factor[1] (lb/VMT)			Avg. Speed (MPH)	Oper. Hours/Month[2]	Annual VMT[3] (miles/yr)	Max. Uncontrolled Emisson Rate (lb/hr)			Max. Uncontrolled Emission Rate (tpy)			Control Measure	Control Efficiency[4] (%)	Controlled Emission Rate		
	tons	PM	PM_{10}	$PM_{2.5}$				PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$			PM (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
Coal Haulage, Stockpile and Roadway Maintenance																		
Coal Haul Trucks FULL (230-ton capacity)	115	16.32	4.64	0.46	35	4391	153,681	57.1227	16.2436	3.4436	1254.10	356.62	35.66	Chem. Suppressant and Water Application	65.00%	438.93	124.82	12.48
Water Trucks	62	12.36	3.51	0.35	10	356	21,360	74.16	21.09	4.47	132.00	37.54	3.75		65.00%	46.20	13.14	1.31
Scrapers (Travel Mode)	62	12.36	3.51	0.35	15	216	19,440	139.04	39.54	8.38	120.13	34.16	3.42		65.00%	42.05	11.96	1.20
End Dump Trucks	175	19.71	5.61	0.56	18.5	500	55,500	273.54	77.79	16.49	547.09	155.57	15.56		65.00%	191.48	54.45	5.45
Light/Medium Veh (e.g., Pick-ups)	3	3.16	0.90	0.09	25	452	67,800	47.45	13.49	2.86	107.23	30.49	3.05		65.00%	37.53	10.67	1.07
Total Plant Vehicle travel																756.19	215.03	21.50
								Uncontrolled lb/hr	591.3168	168.1492	35.6476							

NOTES:

1 Emission Factors for the coal haul road from AP-42, Section 13.2.2 Equation 1a, with constants from Table 13.2.2-2 - See results below
*Assumed quarry surface silt content = 8.3% (Mean value for stone quarrying and processing, AP-42 Table 13.2.2-1) *Assumed days per year with > 0.01 inch moisture = 60, Figure 13.2.2-1
2 Total vehicle category hours per month based on facility estimates for continuing operations with two areas of production.
3 Total Vehicle Miles Traveled (VMT) estimated by the capacity of coal haul trucks, distance to/from Lowe stockpile (5.89 miles one way). For other categories, VMT estimated from average speed and hours per month
4 Control efficiency for BNCC control measures estimated from guidance in AP-42, Section 13.2 for unpaved industrial roads

For Unpaved Roads within Area IV North:

AP-42 13.2.2, Eqns 1a (11/06) $EF = k (s/12)^a (W/3)^b$

EF = Size specific emission factor (lb/VMT)
k = particle size multiplier = 4.9 for PM and 1.5 for PM_{10}, Table 13.2.2-2
S = road surface silt content = 8.3% (obtained from facility data)
W = fleet average vehicle weight for given service (tons) as listed for each category in table above
a = empirical constant, 0.7 for PM and 0.9 for PM_{10}, Table 13.2.2-2
b = empirical constant, 0.45 for PM, PM_{10} and $PM_{2.5}$, Table 13.2.2-2
p = ave. days per year with precipitation greater than 0.01 inches, obtained from Figure 13.2.2-1

1 round trip/hr

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Table D-10

PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM

COAL ADDITION TO STOCKPILES AND RAILCAR LOADING OPERATIONS – PREFERRED ALTERNATIVE

Tons Coal/Yr Area III	PN	PE
	3000000	3000000

Fugitive Emission ID Number	Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor[1] (lb/ton)			Max. Hourly Emisson Rate (lb/hr)			Max. Annual Emission Rate (ton per year)			Control Efficiency[3]	Controlled Emission Rates					
				PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	%	PM (max. lb/hr)	PM (tpy)	PM_{10} (max. lb/hr)	PM_{10} (tpy)	$PM_{2.5}$ (max. lb/hr)	$PM_{2.5}$ (tpy)
Area PN	Coal Addition to Stockpile[4]	8,500	Max.tons/hr[2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
	Train Loading from Stockpile[5]	8,500	Max.tons/hr[2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
Area PE	Coal Addition to Stockpile[4]	8,500	Max.tons/hr[2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
	Train Loading from Stockpile[5]	8,500	Max.tons/hr[2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
																2.85		**0.89**	**0.16**

NOTES:
1 - Emission factors for excavation from AP-42, from batch drop equation AP-42, Aggregate Handling and Storage Piles (Sect. 13.2), Equation 13.2-4 (11/06), as calculated below with parameters estimated from samples at mine site.

2 - The mine haul and load operations estimated to move typical value of 8,500 tons per hour, and this value used to set maximum hourly emission rate.
3 - Control efficiency based on water sprays at transfer points, as required, due to high moisture in mined coal.
4 - Coal haul to Lowe Stockpile will be accomplished by 230 ton capacity, end-dump coal haul trucks. The addition to Stockpile emissions are based on Batch Drop equation for unloading of the end dump truck. Emission factor from AP-42 Equation 13.2-4 is
5 - Railcar loading from the Lowe Stockpile assumed to match the coal addition rate (8,500 tons/hr). Emission factros from batch drop correlation used for addition to stockpiles.

g/sm2	1.627E-06		5.114E-07	9.025E-08
COALPLLU - Loading and unloading at Lowe pile				

Coal Addition to Stockpile and Railcar Coal Loading	**E (PM_{10}) =**	**1.67E-04**
	E (PM) =	**3.54E-04**
	E ($PM_{2.5}$) =	**5.26E-05**
U for coal railcar load and exposed stockpile loading areas = 8.7 mph, facility data for 1-hour averages per day.		
Moisture (M) is taken as as-mined average of 13% based on sampling at the mine site.		

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Table D-10

PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM

COAL ADDITION TO STOCKPILES AND RAILCAR LOADING OPERATIONS – PREFERRED ALTERNATIVE

Tons Coal/Yr Area III		PE
		3000000

Fugitive Emission ID Number	Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor [1] (lb/ton)			Max. Hourly Emisson Rate (lb/hr)			Max. Annual Emission Rate (ton per year)			Control Efficiency [3]	Controlled Emission Rates					
				PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	%	PM (max. lb/hr)	PM (tpy)	PM_{10} (max. lb/hr)	PM_{10} (tpy)	$PM_{2.5}$ (max. lb/hr)	$PM_{2.5}$ (tpy)
Area PE	Coal Addition to Stockpile [4]	8,500	Max.tons/hr [2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
	Train Loading from Stockpile [5]	8,500	Max.tons/hr [2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
																1.42		**0.45**	**0.08**

NOTES:

1 - Emission factors for excavation from AP-42, from batch drop equation AP-42, Aggregate Handling and Storage Piles (Sect. 13.2), Equation 13.2-4 (11/06), as calculated below with parameters estimated from samples at mine site.

2 - The mine haul and load operations estimated to move typical value of 8,500 tons per hour, and this value used to set maximum hourly emission rate.

3 - Control efficiency based on water sprays at transfer points, as required, due to high moisture in mined coal.

4 - Coal haul to Lowe Stockpile will be accomplished by 230 ton capacity, end-dump coal haul trucks. The addition to Stockpile emissions are based on Batch Drop equation for unloading of the end dump truck. Emission factor from AP-42 Equation 13.2-4 is

5 - Railcar loading from the Lowe Stockpile assumed to match the coal addition rate (8,500 tons/hr). Emission factros from batch drop correlation used for addition to stockpiles.

g/s/m2	7.564E-07		2.377E-07	4.195E-08
PECOALLU - Loading and unloading at PE pile				

Coal Addition to Stockpile and Railcar Coal Loading	**E (PM_{10}) =**	**1.67E-04**
	E (PM) =	**3.54E-04**
	E ($PM_{2.5}$) =	**5.26E-05**
U for coal railcar load and exposed stockpile loading areas = 8.7 mph, facility data for 1-hour averages per day.		
Moisture (M) is taken as as-mined average of 13% based on sampling at the mine site.		

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Table D-11

PARTICULATE MATTER EMISSION ESTIMATION - WIND EROSION OF STOCKPILES AND UNRECLAIMED OPEN AREAS -PREFERRED ALTERNATIVE

Total Stockpile Areas (Acres)	Area PN	Area PE
Overburden	154	154
Coal	51	51

Total Unrecl Area	Area PN	Area PE
(Acres/yr)	150	150

Construction Emission Sources		Particulate Control	Nominal Surface Areas [2]		Controlled Emission Factor[3] (ton/Area Unit)			Additional Control Efficiency [4]	Controlled Emission Rates (ton/yr) [5]		
	Description [1]		Value	Units	PM	PM10	PM2.5	%	PM	PM10	PM2.5
	Soil/Overburden Stockpiles	Contour and Compact	675974.4	m2				Incl in Emiss. Fct	36.9	18.5	2.8
	Area PN Unreclaimed Open Area	Water/Stabilize	150	acres	0.1718	0.0859	0.0344	50%	12.9	6.4	2.6
	Area PE Coal Stockpile	Contour and Compact	237069.2	m2				Incl in Emiss. Fct	25.2	12.6	1.9
	Area PE Unreclaimed Open Area	Water/Stabilize	150	acres	0.1718	0.0859	0.0344	50%	12.9	6.4	2.6
								Total Wind Erosion	87.9	43.9	9.8

1 - Sources are for windblown dust from idle areas of stockpiles and from disturbed mine areas prior to reclaim activities
2 - Areas estimated for stockpiles and unreclaimed areas. Some of these areas will offset reductions in stockpile and disturbed areas in other Navajo Mine areas. Stockpiles converted to square meters by convertion 4,088 m2 = 1 acre
3 - Controlled emission factor reflect windblown emissions model from AP-42 as determined by facility emissions for existing Navajo Mine stockpiles of known surface areas. Emissions factors for stockpiles include indicated control measure - no additional controls.

4 - Controls for the Pinabete stockpiles that represent additional measures for those areas.

5 - Controlled emissions from assumed annual areas for total stockpile and unreclaimed areas during each operating year. Ratio of PM2.5 and PM10 to PM obtained from AP-42 Section 13.2.5 industrial wind erosion.

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Table D-12
PARTICULATE MATTER EMISSION ESTIMATION - CONSTRUCTION VEHICLES AND EARTHMOVING FOR RECLAMATION OF MINED AREAS - PREFERRED ACTION

Construction Emission Sources		Particulate Control	Nominal Area or Material [2]		PM_{10} Uncontrolled Emission Factor [3]		PM Control Efficiency [4]	Controlled PM10 Emission Rates [5]	Ratio: PM2.5 to PM10 [6]	Controlled PM2.5 Emission Rates
	Description [1]		Value	Units	Value	Units	%	PM10 (ton/yr)	Frac of PM10	PM2.5 (ton/yr)
Area PN	General Construction - Contouring	Watering, Veh. Speeds	167	acres	0.19	ton PM10/acre-month	50%	15.9	0.2	3.2
	Overburden Replacement	Watering, Veh. Speeds	1.60E+07	Tons	0.012	lb PM/ton	50%	48.0	0.2	9.60
	Total Reclamation Emissions - Area PN							63.9		12.77
Area PE	General Construction - Contouring	Watering, Veh. Speeds	167	acres	0.19	ton PM10/acre-month	50%	15.9	0.2	3.2
	Overburden Replacement	Watering, Veh. Speeds	1.60E+07	Tons	0.012	lb PM/ton	50%	48.0	0.2	9.60
	Total Reclamation Emissions - Area PE							63.9		12.77
								per area 1.20E-05		2.40E-06

NOTES:

1 - Sources are for construction operations involved in reclaim of mined areas. These emission source categories include earthmoving, surface shaping, soil handling and vehicle operation.

2 - Areas and overburden quantity estimated for unreclaimed areas.

Stockpiles converted to square meters by convertion 4,088 m2 = 1 acre

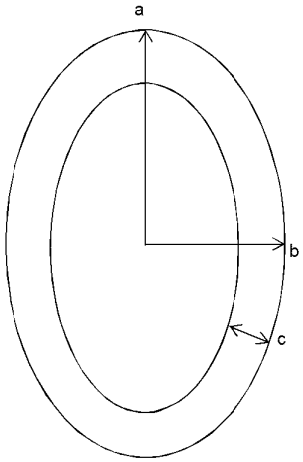
3 - Controlled emission factors from various studies. General Construction factor more recent than latest AP-42 section on Heavy Construction (MRI 1996, EPA 2001, EPA 2006.) Overburden replacement from factor given in Western Surface Coal Mining, AP-42 Section 11.9.

4 - Controls for activities represent range of control measures utilized for current Mining Permit in other Navajo Mine areas.

5 - Controlled emissions from assumed annual reclaim areas and overburden replacement for each operating year of the Preferred Action.

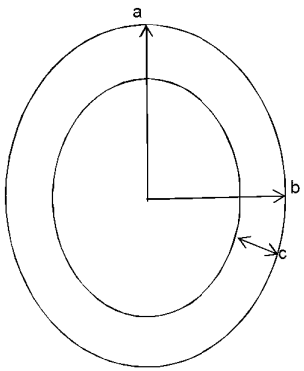
6 - Ratio of PM2.5 to PM10 conservatively set for the range of construction operations. For geologic dusts, typical raio in AP-42 is 20% of PM10 is PM2.5.

Pile Name	Lakes Area (m²)	Acres		surfacae area m2	conical radius (m)	conical height at 30° slope (m)	surface area (m2)
PECOALPL	237,069	58.58					
PBOVRBDN	473,922	117.11	Replaces two previous Overburden piles				
TS-401 (Top Soil)	20,673	5.11			81.1	46.8	11,935
TS-402	22,629	5.59			84.9	49.0	13,065
TS-403	32,412	8.01			101.6	58.6	18,713
TS-404	76,584	18.92			156.1	90.1	44,216
TS-405	28,242	6.98			94.8	54.7	16,306
TS-406	21,512	5.32			82.7	47.8	12,420
OB+TS Acres		167.04					



PECOALPL

A	237,069	m2
A	PI * a * b	
	75,461	= a b
	a / b =	5
	614.25	a
	123	b
P	=2 PI SQRT ((a^2 + b^2) / 2)	
	2,783	m
side slope	30	°
c	23	m
pile height	13.3	m
side length	26.6	m
side area	73,914	m2
top area	185,470	m2



PBOVRBDN

A	473,922	m2
A	PI * a * b	
	150,854	= a b
	a / b =	2
	549.28	a
	275	b
P	=2 PI SQRT ((a^2 + b^2) / 2)	
	2,728	m
side slope	30	°
c	35	m
pile height	20.2	m
side length	40.4	m
side area	110,268	m2
top area	387,175	m2

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Appendix A

Part II – BNCC Coal Handling Plant

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	Annual Throughput	6,000,000	**Navajo Mine Coal Processing Inventory**							
Fraction Flop 3 > Conv 7165	0.8						**Actual Emissions**			
Fraction Flop 5 > Stacker 5/6	0.55									
Fraction Flop 5 > Conv 7166	0.45		Calculation Basis	Control Facto (total)	Emission Factor		PM10 lbs/hr	PM10 tpy	PM2.5 lbs/hr	PM2.5 tpy
Source Description	CTS Source Number	Annual tpy			Source					
System 1										
Train Unloading	TL1	4,200,000		0.5	AP42-13.2.4.3		0.088803	0.388958	0.013447	0.058899
Hopper/Feeder to Conv 5124 TP	TP1	4,200,000		0.7	AP42-13.2.4.3		0.053282	0.233375	0.008068	0.035340
Conv 5124 to Distributor Bin TP	TP2	4,200,000		0.98	AP42-13.2.4.3		0.003552	0.015558	0.000538	0.002356
Crusher #1 (including input to crusher from Distrbutors 5128/5129, output from crusher to Conv 5135)	CR1	4,200,000		0.98	AP42-11.19.2-2		0.023014	0.100800	0.023014	0.100800
Conv 5135 to Conv 7153 TP	TP3	4,200,000		0.9	AP42-13.2.5-2		0.017761	0.077792	0.002689	0.011780
Flop Gate #2 (Conv 7153)/1 to Conv 63105 TP	TP4	840,000		0.9	AP42-13.2.4.3		0.003552	0.015558	0.000538	0.002356
Flop Gate # 2 (Conv 7153)/2 to Conv 7154 TP	TP5	2,520,000		0.9	AP42-13.2.4.3		0.010656	0.046675	0.001614	0.007068
Flop Gate #2 (Conv 7153)/3 to Conv 7155 TP	TP6	840,000		0.9	AP42-13.2.4.3		0.003552	0.015558	0.000538	0.002356
System 2										
Train Unloading	TL2	1,800,000		0.5	AP42-13.2.4.3		0.038059	0.166696	0.005763	0.025243
Hopper/Feeder to Conv 5103 TP	TP7	1,800,000		0.7	AP42-13.2.4.3		0.022835	0.100018	0.003458	0.015146
Conv 5103 > Distribution Bin TP	TP8	1,800,000		0.98	AP42-13.2.4.3		0.001522	0.006668	0.000231	0.001010
Crusher # 2 (including input to crusher from Distributors 5106,5107, output from crusher to Conv 5115)	CR2	1,800,000		0.98	AP42-11.19.2-2		0.009863	0.043200	0.009863	0.043200
Conv 5115 to Conv 7151 TP	TP9	1,800,000		0.9	AP42-13.2.4.3		0.007612	0.033339	0.001153	0.005049
Flop Gate #1 (Conv 7151)/1 to Conv 7154 TP	TP10	540,000		0.9	AP42-13.2.4.3		0.002284	0.010002	0.000346	0.001515
Flop Gate #1 (Conv 7151)/2 to Conv 63105 TP	TP11	360,000		0.9	AP42-13.2.4.3		0.001522	0.006668	0.000231	0.001010
Flop Gate #1 (Conv 7151)/3 to Conv 7155 TP	TP12	900,000		0.9	AP42-13.2.4.3		0.003806	0.016670	0.000576	0.002524
Combined System										
Conv 63105 to 63110 Stacker Trailer 1/2(tripper) TP	TP13	1,200,000		0.9	AP42-13.2.4.3		0.00507447	0.02222619	0.00076842	0.00336568
63110 Stacker Trailer 1/2 to Feed Hopper 1/2TP	TP14	1,200,000		0.9	AP42-13.2.4.3		0.00507447	0.02222619	0.00076842	0.00336568
Feed Hopper 1/2 to Stacker 1/2 Conv 1 TP	TP15	600,000		0.9	AP42-13.2.4.3		0.00253724	0.01111309	0.00038421	0.00168284
Feed Hopper 1/2 to Stacker 1/2 Conv 2 TP	TP16	600,000		0.9	AP42-13.2.4.3		0.00253724	0.01111309	0.00038421	0.00168284
Stacker 1/2 Conv 1 to Piles 1 or 2	TP17	600,000		0.4	AP42-13.2.4.3		0.01522342	0.06667856	0.00230526	0.010097039
Stacker 1/2 Conv 2 to Piles 1 or 2	TP18	600,000		0.4	AP42-13.2.4.3		0.01522342	0.06667856	0.00230526	0.010097039
Conv 7154 to Conv 7156 TP	TP19	3,060,000		0.9	AP42-13.2.4.3		0.0129399	0.05667678	0.00195947	0.008582483
Flop Gate #4 (Conv 7156) /1 to Conv 5161 TP	TP20	856,800		0.9	AP42-13.2.4.3		0.00362317	0.0158695	0.00054865	0.002403095
Flop Gate #3 (Conv 7164)/1 to Conv 5161 TP	TP21	348,000		0.9	AP42-13.2.4.3		0.0014716	0.00644559	0.00022284	0.000976047
Conv 5161 to 5165 Stacker Trailer 3/4 (tripper) TP	TP22	1,204,800		0.9	AP42-13.2.4.3		0.00509477	0.02231509	0.00077149	0.003379142
5165 Stacker Trailer 3/4 to Feed Hopper 3/4TP	TP23	1,204,800		0.9	AP42-13.2.4.3		0.00509477	0.02231509	0.00077149	0.003379142
Feed Hopper 3/4 to Stacker 3/4 Conv 1 TP	TP24	602,400		0.9	AP42-13.2.4.3		0.00254738	0.01115755	0.00038575	0.001689571
Feed Hopper to Stacker 3/4 Conv 2 TP	TP25	602,400		0.9	AP42-13.2.4.3		0.00254738	0.01115755	0.00038575	0.001689571
Stacker 3/4 Conv 1 to Piles 3 or 4	TP26	602,400		0.4	AP42-13.2.4.3		0.01528431	0.06694528	0.00231448	0.010137427
Stacker 3/4 Conv 2 to Piles 3 or 4	TP27	602,400		0.4	AP42-13.2.4.3		0.01528431	0.06694528	0.00231448	0.010137427
Flop Gate #4 (Conv 7156)/2 to Conv 7157 TP	TP28	2,203,200		0.9	AP42-13.2.4.3		0.00931673	0.04080728	0.00141082	0.006179388
Flop Gate #6 (Conv 7157)/1 to Conv 7158 TP	TP29	1,762,560		0.9	AP42-13.2.4.3		0.00745338	0.03264582	0.00112866	0.00494351
Flop Gate #7(Conv 7158)/1 to Conv 7159 TP	TP30	1,198,541		0.9	AP42-13.2.4.3		0.0050683	0.02219916	0.00076749	0.003361587
Conv 7159 to Conv 7160 TP	TP31	1,198,541		0.9	AP42-13.2.4.3		0.0050683	0.02219916	0.00076749	0.003361587
Conv 7160 to 63110A Stacker Trailer 9/10 (tripper) TP	TP32	1,198,541		0.9	AP42-13.2.4.3		0.0050683	0.02219916	0.00076749	0.003361587
63110A Stacker Trailer 9/10 to Feed Hopper 9/10 TP	TP33	1,198,541		0.9	AP42-13.2.4.3		0.0050683	0.02219916	0.00076749	0.003361587
Feed Hopper 9/10 to Stacker 9/10 Conv 1 TP	TP34	599,270		0.9	AP42-13.2.4.3		0.00253415	0.01109958	0.00038374	0.001680794
Feed Hopper 9/10 to Stacker 9/10 Conv 2 TP	TP35	599,270		0.9	AP42-13.2.4.3		0.00253415	0.01109958	0.00038374	0.001680794
Stacker 9/10 Conv 1 to Piles 9 or 10	TP36	599,270		0.4	AP42-13.2.4.3		0.0152049	0.06659748	0.00230246	0.010084761
Stacker 9/10 Conv 2 to Piles 9 or 10	TP37	599,270		0.4	AP42-13.2.4.3		0.0152049	0.06659748	0.00230246	0.010084761

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	Annual Throughput	6,000,000	**Navajo Mine Coal Processing Inventory**
Fraction Flop 3 > Conv 7165	0.8		
Fraction Flop 5 > Stacker 5/6	0.55		
Fraction Flop 5 > Conv 7166	0.45		

Source Description	CTS	Annual	Calculation Basis	Control Facto (total)	Emission Factor	Source	PM10 lbs/hr	PM10 tpy	PM2.5 lbs/hr	PM2.5 tpy
							Actual Emissions			
Flop Gate 6 (Conv 7157)/2 To Conv 5162 TP	TP38	440,640		0.9	AP42-13.2.4.3		0.00186335	0.00816146	0.00028216	0.001235878
Flop Gate #5 (Conv 7165)/1 to Conv 5162 TP	TP39	765,600		0.9	AP42-13.2.4.3		0.00323751	0.01418031	0.00049025	0.002147304
Conv 5162 to 5166 Stacker Trailer 5/6 (tripper) TP	TP40	1,206,240		0.9	AP42-13.2.4.3		0.00510086	0.02234176	0.00077242	0.003383181
5166 Stacker Trailer 5/6 to Feed Hopper 5/6 TP	TP41	1,206,240		0.9	AP42-13.2.4.3		0.00510086	0.02234176	0.00077242	0.003383181
Feed Hopper 5/6 to Stacker 5/6 Conv 1	TP42	603,120		0.9	AP42-13.2.4.3		0.00255043	0.01117088	0.00038621	0.001691591
Feed Hopper 5/6 to Stacker 5/6 Conv 2	TP43	603,120		0.9	AP42-13.2.4.3		0.00255043	0.01117088	0.00038621	0.001691591
Stacker 5/6 Conv 1 to Piles 5 or 6	TP44	603,120		0.4	AP42-13.2.4.3		0.01530258	0.06702529	0.00231725	0.010149544
Stacker 5/6 Conv 2 to Piles 5 or 6	TP45	603,120		0.4	AP42-13.2.4.3		0.01530258	0.06702529	0.00231725	0.010149544
Conv 7155 to Conv 7164 TP	TP46	1,740,000		0.9	AP42-13.2.4.3		0.00735798	0.03222797	0.00111421	0.004880236
Flop Gate #3 (Conv 7164)/2 to Conv 7165 TP	TP47	1,392,000		0.9	AP42-13.2.4.3		0.00588639	0.02578238	0.00089137	0.003904189
Flop Gate #5 (Conv 7165)/2 to Conv 7166 TP	TP48	626,400		0.9	AP42-13.2.4.3		0.00264887	0.01160207	0.00040112	0.001756885
Flop Gate #7 (Conv 7158)/2 to Conv 5163 TP	TP49	564,019		0.9	AP42-13.2.4.3		0.00238508	0.01044666	0.00036117	0.001581923
Conv 7166 to Conv 5163 TP	TP50	626,400		0.9	AP42-13.2.4.3		0.00264887	0.01160207	0.00040112	0.001756885
Conv 5163 to 5176 Stacker Trailer 7/8 (tripper) TP	TP51	1,190,419		0.9	AP42-13.2.4.3		0.00503396	0.02204873	0.00076228	0.003338808
5176 Stacker Trailer 7/8 to Feed Hopper 7/8 TP	TP52	1,190,419		0.9	AP42-13.2.4.3		0.00503396	0.02204873	0.00076228	0.003338808
Feed Hopper 7/8 to Stacker 7/8 Conv 1 TP	TP53	595,210		0.9	AP42-13.2.4.3		0.00251698	0.01102437	0.00038114	0.001669404
Feed Hopper 7/8 to Stacker 7/8 Conv 2 TP	TP54	595,210		0.9	AP42-13.2.4.3		0.00251698	0.01102437	0.00038114	0.001669404
Stacker 7/8 Conv 1 to Piles 7 or 8	TP55	595,210		0.4	AP42-13.2.4.3		0.01510187	0.0661462	0.00228685	0.010016425
Stacker 7/8 Conv 2 to Piles 7 or 8	TP56	595,210		0.4	AP42-13.2.4.3		0.01510187	0.0661462	0.00228685	0.010016425
Reclaimer Pile 1 or 2 to Conv 63105	RC1/2	1,200,000		0	AP42-13.2.4.3		0.01522342	0.06667856	0.00230526	0.010097039
Conv 63105 to Conv 7177	TP57	1,200,000		0.9	AP42-13.2.4.3		0.00507447	0.02222619	0.00076842	0.00336568
Reclaimer Pile 3 or 4 to Conv 5161	RC3/4	1,204,800		0	AP42-13.2.4.3		0.01528431	0.06694528	0.00231448	0.010137427
Conv 5161 to Conv 7177	TP58	1,204,800		0.9	AP42-13.2.4.3		0.00509477	0.02231509	0.00077149	0.003379142
Reclaimer Pile 5 or 6 to Conv 5162	RC5/6	1,206,240		0	AP42-13.2.4.3		0.01530258	0.06702529	0.00231725	0.010149544
Conv 5162 to Conv 7177	TP59	1,206,240		0.9	AP42-13.2.4.3		0.00510086	0.02234176	0.00077242	0.003383181
Reclaimer Pile 7 or 8 to Conv 5163	RC7/8	1,190,419		0	AP42-13.2.4.3		0.01510187	0.0661462	0.00228685	0.010016425
Conv 5163 to Conv 7179	TP60	1,190,419		0.9	AP42-13.2.4.3		0.00503396	0.02204873	0.00076228	0.003338808
Reclaimer Piles 9 or 10 to Conv 7160	RC9/10	1,198,541		0	AP42-13.2.4.3		0.0152049	0.06659748	0.00230246	0.010084761
Conv 7160 to Conv 7179	TP61	1,198,541		0.9	AP42-13.2.4.3		0.0050683	0.02219916	0.00076749	0.003361587
Conv 7177 to Conv 7181	TP62	2,411,040		0.9	AP42-13.2.4.3		0.01019563	0.04465686	0.00154391	0.006762324
Flop #8 (Conv 7181)/1 to Conv 7184	TP63	2,411,040		0.9	AP42-13.2.4.3		0.01019563	0.04465686	0.00154391	0.006762324
Flop #8 (Conv 7181/2 to Conv 7186	TP64	0		0.9	AP42-13.2.4.3		0	0	0	0
Conv 7184 to Conv 5185	TP65	2,411,040		0.9	AP42-13.2.4.3		0.01019563	0.04465686	0.00154391	0.006762324
Conv 5185 to Conv 1B North	TP66	1,205,520		0.9	AP42-13.2.4.3		0.00509781	0.02232843	0.00077195	0.003381162
Conc 5185 to Conv 1B South	TP67	1,205,520		0.9	AP42-13.2.4.3		0.00509781	0.02232843	0.00077195	0.003381162
Conv 1B North to N Surge Bin	TP68	1,205,520		0.9	AP42-13.2.4.3		0.00509781	0.02232843	0.00077195	0.003381162
Conv 1B South to S Surge Bin	TP69	1,205,520		0.9	AP42-13.2.4.3		0.00509781	0.02232843	0.00077195	0.003381162
Conv 7179 to Conv 7183	TP70	2,388,960		0.9	AP42-13.2.4.3		0.01010226	0.04424789	0.00152977	0.006700395
Flop #9(Conv 7183)/1 to Conv 7186	TP71	2,388,960		0.9	AP42-13.2.4.3		0.01010226	0.04424789	0.00152977	0.006700395
Flop #9 (Conv 7183)/2 to Conv 7184	TP72	0		0.9	AP42-13.2.4.3		0	0	0	0
Conv 7186 to Conv 5187	TP73	2,388,960		0.9	AP42-13.2.4.3		0.01010226	0.04424789	0.00152977	0.006700395
Conv 5187 to Conv 1A North	TP74	1,194,480		0.9	AP42-13.2.4.3		0.00505113	0.02212395	0.00076489	0.003350198
Conv 5187 to Conv 1A South	TP75	1,194,480		0.9	AP42-13.2.4.3		0.00505113	0.02212395	0.00076489	0.003350198
Conv 1A North to N Surge Bin	TP76	1,194,480		0.9	AP42-13.2.4.3		0.00505113	0.02212395	0.00076489	0.003350198
Conv 1A South to S Surge Bin	TP77	1,194,480		0.9	AP42-13.2.4.3		0.00505113	0.02212395	0.00076489	0.003350198

	lbs/hr	tpy	lbs/hr	tpy
	Actual Emissions			
TOTAL EMISSIONS	0.79	3.48	0.15	0.65

Cross check - total sent to stackers	6,000,000
to stacker 1/2	1,200,000
to stacker 3/4	1,204,800
to stacker 5/6	1,206,240
to stacker 7/8	1,190,419
to stacker 9/10	1,198,541

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Control
Systems 1 and 2 have dust suppression and vent systems: used 95 % control as a conservative control value
Also Systems 1 and 2 have low dust transfer chutes
Hoppers 1 and 2 have dust suppression sprays so we should add control for train unloading - used 50% control
Transfer into "bins" may have a higher control value if the transfer point is sealed and the bins are vented through a filter
No control is assumed for loading onto piles and reclaiming off piles. All other transfer points downstream of the crushers uses 0.6 to indicate enclosure.

Crushers
Crusher systems defined to include the "distributors". This is based on distributors and feed from them to the crushers being transfers in totally inclosed chutes that act as a single feed system to the crushers, not multiple transfer points arhead of the drop to the crushers.

Reclaimers
Emissions for Reclaimers to conveyor transfer point include 0.3 activity factor

Flop Gate Fractions – where cross over is possible

1	Fraction Flop 8 to 7184
0	Fraction Flop 8 to 7186
1	Fraction Flop 9 to 7186
0	Fraction Flop 9 to 7184

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Source Description	CTS Source #	PM10 lbs/hr	PM2.5 lbs/hr	Height ft	Volume Rel Ht (ft)	Area Rel Ht (ft)	Area Length (ft)	Area Width (ft)	Area (m^2)	PM10 g/s	PM2.5 g/s	PM10 g/s/m2	PM2.5 g/s/m2	Volume Rel Ht (m)	Area Rel Ht (m)
System 1															
Train Unloading	TL1	0.088803	0.013447							0.011189	0.001694366				
Hopper/Feeder to Conv 5124 TP	TP1	0.053282	0.008068							0.006714	0.00101662				
	SUM	0.142085	0.021516	2		1	85	10	79.0	0.017903	0.002710986	0.0002267	3.43304E-05		0.3048
CRUSHER 1															
Conv 5124 to Distributor Bin TP	TP2	0.003552	0.000538												
Crusher #1 (including input to crusher from Distrbutors 5128/5129, output from crusher to Conv 5135)	CR1	0.023014	0.023014												
	SUM	0.026566	0.023552	35	17.5					0.003347	0.002967501			5.334	
System 2															
Train Unloading	TL2	0.038059	0.005763												
Hopper/Feeder to Conv 5103 TP	TP7	0.022835	0.003458												
	SUM	0.060894	0.009221	2		1	95.5	10	88.7	0.007673	0.001161851	8.648E-05	1.30954E-05		0.3048
CRUSHER 2															
Conv 5103 > Distribution Bin TP	TP8	0.001522	0.000231												
Crusher # 2 (including input to crusher from Distributors 5106,5107, output from crusher to Conv 5115)	CR2	0.009863	0.009863												
	SUM	0.011385	0.010094	31	15.5					0.001435	0.001271786			4.7244	
SAMPLE TOWER															
Conv 5135 to Conv 7153 TP	TP3	0.017761	0.002689												
Conv 5115 to Conv 7151 TP	TP9	0.007612	0.001153												
	SUM	0.025372	0.003842	32	16					0.003197	0.000484105			4.8768	
TOWER1															
Flop Gate # 2 (Conv 7153)/2 to Conv 7154 TP	TP5	0.010656	0.001614												
Flop Gate #2 (Conv 7153)/3 to Conv 7155 TP	TP6	0.003552	0.000538												
Flop Gate #1 (Conv 7151)/1 to Conv 7154 TP	TP10	0.002284	0.000346												
Flop Gate #1 (Conv 7151)/3 to Conv 7155 TP	TP12	0.003806	0.000576												
	SUM	0.020298	0.003074	24	12					0.002558	0.000387284			3.6576	
TOWER1A															
Flop Gate #2 (Conv 7153)/1 to Conv 63105 TP	TP4	0.003552	0.000538												
Flop Gate #1 (Conv 7151)/2 to Conv 63105 TP	TP11	0.001522	0.000231												
Conv 7154 to Conv 7156 TP	TP19	0.01294	0.001959												
Conv 7155 to Conv 7164 TP	TP46	0.007358	0.001114												
	SUM	0.025372	0.003842	12	6					0.003197	0.000484105			1.8288	
PILES1-2															
Conv 63105 to 63110 Stacker Trailer 1/2(tripper) TP	TP13	0.005074	0.000768												
63110 Stacker Trailer 1/2 to Feed Hopper 1/2TP	TP14	0.005074	0.000768												
Feed Hopper 1/2 to Stacker 1/2 Conv 1 TP	TP15	0.002537	0.000384												
Feed Hopper 1/2 to Stacker 1/2 Conv 2 TP	TP16	0.002537	0.000384												
Stacker 1/2 Conv 1 to Piles 1 or 2	TP17	0.015223	0.002305												
Stacker 1/2 Conv 2 to Piles 1 or 2	TP18	0.015223	0.002305												
Reclaimer Pile 1 or 2 to Conv 63105	RC1/2	0.015223	0.002305												
	SUM	0.060894	0.009221	34.5		17.25	837	196	15240.9	0.007673	0.001161851	5.034E-07	7.62323E-08		5.2578
Reclaim 1-2															
Conv 63105 to Conv 7177	**TP57**	0.005074	0.000768	2	1					0.000639	9.68209E-05			0.3048	

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Source Description	CTS Source #	PM10 lbs/hr	PM2.5 lbs/hr	Height ft	Volume Rel Ht (ft)	Area Rel Ht (ft)	Area Length (ft)	Area Width (ft)	Area (m^2)	PM10 g/s	PM2.5 g/s	PM10 g/s/m2	PM2.5 g/s/m2	Volume Rel Ht (m)	Area Rel Ht (m)
TOWER 2															
Flop Gate #4 (Conv 7156) /1 to Conv 5161 TP	TP20	0.003623	0.000549												
Flop Gate #3 (Conv 7164)/1 to Conv 5161 TP	TP21	0.001472	0.000223												
Flop Gate #4 (Conv 7156)/2 to Conv 7157 TP	TP28	0.009317	0.001411												
Flop Gate #3 (Conv 7164)/2 to Conv 7165 TP	TP47	0.005886	0.000891												
	SUM	0.020298	0.003074	19	9.5					0.002558	0.000387284			2.8956	
PILES 3-4															
Conv 5161 to 5165 Stacker Trailer 3/4 (tripper) TP	TP22	0.005095	0.000771												
5165 Stacker Trailer 3/4 to Feed Hopper 3/4TP	TP23	0.005095	0.000771												
Feed Hopper 3/4 to Stacker 3/4 Conv 1 TP	TP24	0.002547	0.000386												
Feed Hopper to Stacker 3/4 Conv 2 TP	TP25	0.002547	0.000386												
Stacker 3/4 Conv 1 to Piles 3 or 4	TP26	0.015284	0.002314												
Stacker 3/4 Conv 2 to Piles 3 or 4	TP27	0.015284	0.002314												
Reclaimer Pile 3 or 4 to Conv 5161	RC3/4	0.015284	0.002314												
	SUM	0.061137	0.009258	34.5		17.25	837	196	15240.9	0.007703	0.001166499	5.054E-07	7.65372E-08		5.2578
Reclaim 3-4															
Conv 5161 to Conv 7177	**TP58**	0.005095	0.000771	2	1					0.000642	9.72082E-05			0.3048	
TOWER 3															
Flop Gate #6 (Conv 7157)/1 to Conv 7158 TP	TP29	0.007453	0.001129												
Flop Gate 6 (Conv 7157)/2 To Conv 5162 TP	TP38	0.001863	0.000282												
Flop Gate #5 (Conv 7165)/1 to Conv 5162 TP	TP39	0.003238	0.00049												
Flop Gate #5 (Conv 7165)/2 to Conv 7166 TP	TP48	0.002649	0.000401												
	SUM	0.015203	0.002302	14	7					0.001916	0.000290075			2.1336	
PILES 5-6															
Conv 5162 to 5166 Stacker Trailer 5/6 (tripper) TP	TP40	0.005101	0.000772												
5166 Stacker Trailer 5/6 to Feed Hopper 5/6 TP	TP41	0.005101	0.000772												
Feed Hopper 5/6 to Stacker 5/6 Conv 1	TP42	0.00255	0.000386												
Feed Hopper 5/6 to Stacker 5/6 Conv 2	TP43	0.00255	0.000386												
Stacker 5/6 Conv 1 to Piles 5 or 6	TP44	0.015303	0.002317												
Stacker 5/6 Conv 2 to Piles 5 or 6	TP45	0.015303	0.002317												
Reclaimer Pile 5 or 6 to Conv 5162	RC5/6	0.015303	0.002317												
	SUM	0.06121	0.009269	34.5		17.25	837	196	15240.9	0.007712	0.001167893	5.06E-07	7.66287E-08		5.2578
Reclaim 5-6															
Conv 5162 to Conv 7177	**TP59**	0.005101	0.000772	2	1					0.000643	9.73244E-05			0.3048	
TOWER 4															
Flop Gate #7(Conv 7158)/1 to Conv 7159 TP	TP30	0.005068	0.000767												
Flop Gate #7 (Conv 7158)/2 to Conv 5163 TP	TP49	0.002385	0.000361												
Conv 7166 to Conv 5163 TP	TP50	0.002649	0.000401												
	SUM	0.010102	0.00153	19	9.5					0.001273	0.000192751			2.8956	
PILES 7-8															
Conv 5163 to 5176 Stacker Trailer 7/8 (tripper) TP	TP51	0.002649	0.000401												
5176 Stacker Trailer 7/8 to Feed Hopper 7/8 TP	TP52	0.005034	0.000762												
Feed Hopper 7/8 to Stacker 7/8 Conv 1 TP	TP53	0.005034	0.000762												
Feed Hopper 7/8 to Stacker 7/8 Conv 2 TP	TP54	0.002517	0.000381												
Stacker 7/8 Conv 1 to Piles 7 or 8	TP55	0.002517	0.000381												
Stacker 7/8 Conv 2 to Piles 7 or 8	TP56	0.015102	0.002287												
Reclaimer Pile 7 or 8 to Conv 5163	RC7/8	0.015102	0.002287												
	SUM	0.047954	0.007262	34.5		17.25	837	196	15240.9	0.006042	0.000914972	3.964E-07	6.00339E-08		5.2578

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Source Description	CTS Source #	PM10 lbs/hr	PM2.5 lbs/hr	Height ft	Volume Rel Ht (ft)	Area Rel Ht (ft)	Area Length (ft)	Area Width (ft)	Area (m^2)	PM10 g/s	PM2.5 g/s	PM10 g/s/m2	PM2.5 g/s/m2	Volume Rel Ht (m)	Area Rel Ht (m)
Reclaim 7-8															
Conv 5163 to Conv 7179	**TP60**	0.005034	0.000762	2	1					0.000634	9.60479E-05			0.3048	
TOWER 5															
Conv 7159 to Conv 7160 TP	TP31	0.005068	0.000767	14	7					0.000639	9.67032E-05			2.1336	
PILES 9-10															
Conv 7160 to 63110A Stacker Trailer 9/10 (tripper) TP	TP32	0.005068	0.000767												
63110A Stacker Trailer 9/10 to Feed Hopper 9/10 TP	TP33	0.005068	0.000767												
Feed Hopper 9/10 to Stacker 9/10 Conv 1 TP	TP34	0.002534	0.000384												
Feed Hopper 9/10 to Stacker 9/10 Conv 2 TP	TP35	0.002534	0.000384												
Stacker 9/10 Conv 1 to Piles 9 or 10	TP36	0.015205	0.002302												
Stacker 9/10 Conv 2 to Piles 9 or 10	TP37	0.015205	0.002302												
Reclaimer Piles 9 or 10 to Conv 7160	RC9/10	0.015205	0.002302												
	SUM	0.06082	0.00921	34.5		17.25	837	196	15240.9	0.007663	0.001160438	5.028E-07	7.61396E-08		5.2578
Reclaim 9-10															
Conv 7160 to Conv 7179	**TP61**	0.005068	0.000767	2	1					0.000639	9.67032E-05			0.3048	
RECLAIM DROP BIN															
Conv 7177 to Conv 7181	TP62	0.010196	0.001544												
Conv 7179 to Conv 7183	TP70	0.010102	0.00153												
	SUM	0.020298	0.003074	14	7					0.002558	0.000387284			2.1336	
TOWER 6															
Flop #8 (Conv 7181)/1 to Conv 7184	TP63	0.010196	0.001544												
Flop #9(Conv 7183)/1 to Conv 7186	TP71	0.010102	0.00153												
	SUM	0.020298	0.003074	18	9					0.002558	0.000387284			2.7432	
TOWER 7															
Conv 7184 to Conv 5185	TP65	0.010196	0.001544												
Conv 7186 to Conv 5187	TP73	0.010102	0.00153												
	SUM	0.020298	0.003074	19	9.5					0.002558	0.000387284			2.8956	
FLOP GATES 1A/1B															
Conv 5185 to Conv 1B North	TP66	0.005098	0.000772												
Conc 5185 to Conv 1B South	TP67	0.005098	0.000772												
Conv 5187 to Conv 1A North	TP74	0.005051	0.000765												
Conv 5187 to Conv 1A South	TP75	0.005051	0.000765												
	SUM	0.020298	0.003074	40						0.002558	0.000387284			12.192	
DROP TO COAL SILOS															
Conv 1B North to N Surge Bin	TP68	0.005098	0.000772												
Conv 1A North to N Surge Bin	TP76	0.005098	0.000772												
	SUM	0.010196	0.001544	35						0.001285	0.000194533			10.668	
Conv 1B South to S Surge Bin	TP69	0.005098	0.000772												
Conv 1A South to S Surge Bin	TP77	0.005051	0.000765												
	SUM	0.010149	0.001537	35						0.001279	0.000193642			10.668	

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Appendix A

Part III – BNCC Mine Area

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Table D-1

PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM

PINABETE NORTH - COAL MINE EQUIPMENT AND OPERATIONS - PREFERRED ALTERNATIVE

Tons Coal Produced 3000000 **Cubic Yds Overburden + Interburden** **4851000**

	Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor Units	Emission Factor			Representative Uncontrolled Hourly Emisson Rate (lb/hr)			Operating Schedule		Annual Emission Rate without Controls (ton per year)			Control Efficiency	Controlled Emission Rates (No Hourly Average for Blasting)					
					PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	Hours/ Week	Weeks/ Year	PM	PM_{10}	$PM_{2.5}$	%	PM (Typ. lb/hr)	PM (tpy)	PM_{10} (Typ. lb/hr)	PM_{10} (tpy)	$PM_{2.5}$ (Typ. lb/hr)	$PM_{2.5}$ (tpy)
	Drilling - Overburden + Interburden [1]	6,903	Holes/yr		1.3	0.676	0.195	1.415	0.736	0.212	122	52	4.49	2.33	0.67	50.0%	0.71	2.24	0.368	1.17	0.106	0.337
	Drilling - Coal [1]	51,697	Holes/yr		0.22	0.114	0.033	21.513	11.187	3.356	122	52	5.69	2.96	0.85	50.0%	10.76	2.84	5.59	1.48	1.68	0.427
	Overburden Blasting [2,4]	7	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.03	0.02	0.01	0.00%	N/A	0.03	0.00	0.02	0.00	0.005
	Coal Blasting [2,4]	89	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.43	0.22	0.07	0.00%	N/A	0.43	0.05	0.22	0.02	0.067
	Overburden Dragline [3]	4.85E+06	cu.yds/yr		0.048	0.0092	8.09E-04	39.31	7.56	0.67	113	52	115.50	22.22	1.96	0.00%	39.31	115.50	7.56	22.22	0.67	1.963
	Overburden Dozers [4]	1156	hrs/month	lb/hr/dozer (12 dozers/hr)	3.00	0.54	6.60E-02	36.02	6.43	0.79	175	52	20.82	3.72	0.46	60.00%	14.41	8.33	2.57	1.49	0.32	0.183
	Dozers - Maint and Replace [4]	2895	hrs/month	lb/hr/dozer (12 dozers/hr)	24.95	5.94	0.55	299.39	71.26	6.59	1330	52	433.37	103.14	9.53	60.00%	119.8	173.3	28.5	41.3	2.63	3.81
	Truck Loading Coal with Payloader [3]	3.00E+06	tons/yr	lb/ton (7 Loaders)	0.05	0.0089	0.0010	4.311	0.716	0.082	715	52	80.13	13.31	1.52	50.00%	2.16	40.07	0.36	6.655	0.107	2.00
	Scrapers [6]	231	hrs/month	lb/VMT (3 Scapers)	2.26E-01	1.22E-01	7.01E-03	0.326	0.176	0.010	74	52	0.63	0.34	0.02	50.00%	0.16	0.31	0.09	0.170	0.0051	0.010
	Road Graders [6]	1,617	hrs/month	lb/VMT (4 Graders)	2.26E-01	1.22E-01	7.01E-03	2.282	1.234	0.071	74	52	4.39	2.38	0.14	50.00%	1.14	2.20	0.62	1.188	0.0354	0.068
	CATEGORY SUBTOTAL: Overburden Drill/Blast																	2.278		1.184		0.342
	CATEGORY SUBTOTAL: Coal Drill/Blast																	3.275		1.703		0.494
	CATEGORY SUBTOTAL: Mine Extraction Oper.																	224.253		50.755		6.071
																TOTAL		345.30	45.72	75.86	5.57	8.87
																		g/s	5.76		0.70	0.26
																	STRIP2	g/s/m²	2.174E-05		2.65E-06	9.63E-07

NOTES:

1 - Emission factor is for uncontrolled drilling for either overburden or coal from AP-42, Western Surface Coal Mining, Table 11.1-4 (7/98). Holes per cu.yd. overburden = 702; holes per ton coal = 58; PM10 = 0.52, PM2.5 = 0.15 x PM (Company data)

2 - The emission factor for overburden/coal seam blasting is in units of lb/blast. Calculation is based on surface area per blast, which is estimated as follows:

Blasted material /yr = 29,449,000 cu. Yds/133 blasts/yr * 27 cu.ft / 1 cu.yd. = 5,978,000 cu.ft./blast

Area = 5,978,000 cu.ft./blast / 400 ft avg. depth = 149,460 sq.ft./blast

Emission Factor PM (lb/blast) = Area^1.5 x 0.000014 = (5,978,000)^1.5 x 0.000014 = 9.7 lb/blast; AP-42, Table 11.9-1, PM_{10} is 52% of the PM Emission Factor

3 - Overburden dragline removal factor (TSP) = 0.0021 * D ^ 1.1 / M ^ 0.3 ; (< 15 micron PM) = 0.0021 * D ^ 0.7 / M ^ 0.3; Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: Drop Height (D) = 30 ft; M = 7.9% moisture

4 - Coal Bulldozing factor (TSP) = 78.4 * s ^ 1.2 / M ^ 1.3 ; (< 15 micron PM) = 18.6 * s ^ 1.5 / M ^ 1.4; Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: s = 5.5 % Silt; M = 7.9% moisture

5 - Truck loading of coal with Front-End Loaders (TSP) = 1.16 /M ^ 1.2; (< 15 micron) = 0.119 / M ^ 0.9 Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: M = 7.9% moisture

6 - Emission factor for scrapers and graders from Document AP-42, Western Surface Coal Mining, Section 11.9, Table 11.9-1 (7/98). EF(grading, TSP) = 0.4 S ^ 2.5; EF(PM10) = 0.051 S ^ 2.0 Veh. Avg working speed (S) = 2 mph for emission factor correlation.

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Table D-2

PARTICULATE MATTER EMISSION ESTIMATION FUGITIVE EMISSIONS FROM

PINABETE EAST – COAL MINE EQUIPMENT AND OPERATIONS - PREFFERED ALTERNATIVE

Tons Coal Produced 3000000 **Cubic Yds Overburden + Interburden** **4851000**

	Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor Units	Emission Factor			Representative Uncontrolled Houry Emisson Rate (lb/hr)			Operating Schedule		Annual Emission Rate without Controls (ton per year)			Control Efficiency	Controlled Emission Rates (No Hourly Average for Blasting)					
					PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	Hours/ Week	Weeks/ Year	PM	PM_{10}	$PM_{2.5}$	%	PM (Typ. lb/hr)	PM (tpy)	PM_{10} (Typ. lb/hr)	PM_{10} (tpy)	$PM_{2.5}$ (Typ. lb/hr)	$PM_{2.5}$ (tpy)
	Drilling - Overburden + Interburden[1]	6,903	Holes/yr		1.3	0.676	0.195	1.415	0.736	0.212	122	52	4.49	2.33	0.67	50.0%	0.71	2.24	0.368	1.17	0.106	0.337
	Drilling - Coal [1]	51,697	Holes/yr		0.22	0.114	0.033	21.513	11.187	3.356	122	52	5.69	2.96	0.85	50.0%	10.76	2.84	5.59	1.48	1.68	0.427
	Overburden Blasting[2,4]	7	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.03	0.02	0.01	0.00%	N/A	0.03	0.00	0.02	0.00	0.005
	Coal Blasting[2,4]	89	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.43	0.22	0.07	0.00%	N/A	0.43	0.05	0.22	0.02	0.067
	Overburden Dragline[3]	4.85E+06	cu.yds/yr		0.048	0.0092	8.09E-04	39.31	7.56	0.67	113	52	115.50	22.22	1.96	0.00%	39.31	115.50	7.56	22.22	0.67	1.963
	Overburden Dozers[4]	1156	hrs/month	lb/hr/dozer (12 dozers/hr)	3.00	0.54	6.60E-02	36.02	6.43	0.79	175	52	20.82	3.72	0.46	60.00%	14.41	8.33	2.57	1.49	0.32	0.183
	Dozers - Maint and Replace[4]	2895	hrs/month	lb/hr/dozer (12 dozers/hr)	24.95	5.94	0.55	299.39	71.26	6.59	1330	52	433.37	103.14	9.53	60.00%	119.8	173.3	28.5	41.3	2.63	3.81
	Truck Loading Coal with Payloader[5]	3.00E+06	tons/yr	lb/ton (7 Loaders)	0.05	0.0089	0.0010	4.311	0.716	0.082	715	52	80.13	13.31	1.52	50.00%	2.16	40.07	0.36	6.655	0.107	2.00
	Scrapers [6]	231	hrs/month	lb/VMT (3 Scapers)	2.26E-01	1.22E-01	7.01E-03	0.326	0.176	0.010	74	52	0.63	0.34	0.02	50.00%	0.16	0.31	0.09	0.170	0.0051	0.010
	Road Graders [6]	1,617	hrs/month	lb/VMT (4 Graders)	2.26E-01	1.22E-01	7.01E-03	2.282	1.234	0.071	74	52	4.39	2.38	0.14	50.00%	1.14	2.20	0.62	1.188	0.0354	0.068
	CATEGORY SUBTOTAL: Overburden Drill/Blast																	2.278		1.184		0.342
	CATEGORY SUBTOTAL: Coal Drill/Blast																	3.275		1.703		0.494
	CATEGORY SUBTOTAL: Mine Extraction Oper.																	339.748		72.977		8.034
																TOTAL	188.40	345.30	45.72	75.86	5.57	8.87
																		g/s	5.76		0.70	0.26
																	STRIP1	g/s/m²	2.17E-05		2.65E-06	9.63E-07

NOTES:

1 - Emission factor is for uncontrolled drilling for either overburden or coal from AP-42, Western Surface Coal Mining, Table 11.1-4 (7/98). Holes per cu.yd. overburden = 702; holes per ton coal = 58; PM10 = 0.52, PM2.5 = 0.15 x PM (Company data)

2 - The emission factor for overburden/coal seam blasting is in units of lb/blast. Calculation is based on surface area per blast, which is estimated as follows:

Blasted material /yr = 29,449,000 cu. Yds/133 blasts/yr * 27 cu.ft / 1 cu.yd. = 5,978,000 cu.ft./blast

Area = 5,978,000 cu.ft./blast / 400 ft avg. depth = 149,460 sq.ft./blast

Emission Factor PM (lb/blast) = Area^1.5 x 0.000014 = (5,978,000)^1.5 x 0.000014 = 9.7 lb/blast; AP-42, Table 11.9-1, PM_{-10} is 52% of the PM Emission Factor

3 - Overburden dragline removal factor (TSP) = 0.0021 * D ^ 1.1 / M ^ 0.3 ; (< 15 micron PM) = 0.0021 * D ^ 0.7 / M ^ 0.3; Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: Drop Height (D) = 30 ft; M = 7.9% moisture

4 - Coal Bulldozing factor (TSP) = 78.4 * s ^ 1.2 / M ^ 1.3 ; (< 15 micron PM) = 18.6 * s ^ 1.5 / M ^ 1.4; Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: s = 5.5 % Silt; M = 7.9% moisture

5 - Truck loading of coal with Front-End Loaders (TSP) = 1.16 /M ^ 1.2; (< 15 micron) = 0.119 / M ^ 0.9 Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facitliy data: M = 7.9% moisture

6 - Emission factor for scrapers and graders from Document AP-42, Western Surface Coal Mining, Section 11.9, Table 11.9-1 (7/98). EF(grading, TSP) = 0.4 S ^ 2.5; EF(PM10) = 0.051 S ^ 2.0 Veh. Avg working speed (S) = 2 mph for emission factor correlation.

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Table D-3

PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM

PINABETE NORTH - COAL MINE AND PLANT VEHICLES - PREFERRED ALTERNATIVE

Total Coal 3000000 **tons/yr**

Mine and Plant Vechicles	Gross Vehicle Weight[4]	Emission factor [1] (lb/VMT)			Avg. Speed (MPH)	Oper. Hours/Month[2]	Annual VMT [3] (miles/yr)	Max. Uncontrolled Emisson Rate (lb/hr)			Max. Uncontrolled Emission Rate (tpy)			Control Measure	Control Efficiency [4] (%)	Controlled Emission Rate		
	tons	PM	PM_{10}	$PM_{2.5}$				PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$			PM (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
Coal Haulage, Stockpile and Roadway Maintenance																		
Coal Haul Trucks (230-ton capacity)	115	16.32	4.64	0.46	35	4216	147,567	57.1227	16.2436	3.4436	1204.20	342.43	34.24	Chem. Suppressant and Water Application	65.00%	421.47	119.85	11.99
Water Trucks	62	12.36	3.51	0.35	10	356	21,360	74.16	21.09	4.47	132.00	37.54	3.75		65.00%	46.20	13.14	1.31
Scrapers (Travel Mode)	62	12.36	3.51	0.35	15	216	19,440	139.04	39.54	8.38	120.13	34.16	3.42		65.00%	42.05	11.96	1.20
End Dump Trucks	175	19.71	5.61	0.56	18.5	500	55,500	273.54	77.79	16.49	547.09	155.57	15.56		65.00%	191.48	54.45	5.45
Light/Medium Veh (e.g., Pick-ups)	3	3.16	0.90	0.09	25	452	67,800	47.45	13.49	2.86	107.23	30.49	3.05		65.00%	37.53	10.67	1.07
Total Plant Vehicle travel																738.73	210.07	21.01
							Uncontrolled lb/hr	591.3168	168.1492	35.6476								

NOTES:

1 Emission Factors for the coal haul road from AP-42, Section 13.2.2 Equation 1a, with constants from Table 13.2.2-2 - See results below
*Assumed quarry surface silt content = 8.3% (Mean value for stone quarrying and processing, AP-42 Table 13.2.2-1)
*Assumed days per year with > 0.01 inch moisture = 60, Figure 13.2.2-1
2 Total vehicle category hours per month based on facility estimates for continuing operations with two areas of production.
3 Total Vehicle Miles Traveled (VMT) estimated by the capacity of coal haul trucks, distance to/from Lowe stockpile (5.66 miles one way). For other categories, VMT estimated from average speed and hours per month
4 Control efficiency for BNCC control measures estimated from guidance in AP-42, Section 13.2 for unpaved industrial roads

For Unpaved Roads within Area IV North:
7 Gross vehicle weight is an average of loaded (21.3 tons) and partially loaded with water (13.05 tons) weights
8 Gross vehicle weight is an average of loaded (33 tons) and unloaded (13 tons) weights
9 The loading time of each bulk cement truck is estimated to be 17.14 min. There will be 2 simultaneous loading spouts.
- Gross vehicle weight is an average of loaded (40 tons) and unloaded (14.41 tons) weights

For Unpaved Roads within Area IV North:

AP-42 13.2.2, Eqns 1a (11/06) $EF = k (s/12)^a (W/3)^b$

WHERE:

AP-42 13.2.2, Eqns 1a (11/06) $EF = k (s/12)^a (W/3)^b$

EF = Size specific emission factor (lb/VMT)

k = particle size multiplier = 4.9 for PM and 1.5 for PM_{10}, Table 13.2.2-2

S = road surface silt content = 8.3% (obtained from facility data)

W = fleet average vehicle weight for given service (tons) as listed for each category in table above

a = empirical constant, 0.7 for PM and 0.9 for PM_{10}, Table 13.2.2-2

b = empirical constant, 0.45 for PM, PM_{10} and $PM_{2.5}$, Table 13.2.2-2

p = ave. days per year with precipitation greater than 0.01 inches, obtained from Figure 13.2.2-1

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Table D-4

PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM

PINABETE EAST -COAL MINE AND PLANT VEHICLES - PREFERRED ALTERNATIVE

Total Coal 3000000 **tons/yr**

Mine and Plant Vechicles	Gross Vehicle Weight[4]	Emission factor[1] (lb/VMT)			Avg. Speed (MPH)	Oper. Hours/Month[2]	Annual VMT[3] (miles/yr)	Max. Uncontrolled Emisson Rate (lb/hr)			Max. Uncontrolled Emission Rate (tpy)			Control Measure	Control Efficiency[4] (%)	Controlled Emission Rate		
	tons	PM	PM_{10}	$PM_{2.5}$				PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$			PM (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
Coal Haulage, Stockpile and Roadway Maintenance																		
Coal Haul Trucks FULL (230-ton capacity)	115	16.32	4.64	0.46	35	4391	153,681	57.1227	16.2436	3.4436	1254.10	356.62	35.66	Chem. Suppressant and Water Application	65.00%	438.93	124.82	12.48
Water Trucks	62	12.36	3.51	0.35	10	356	21,360	74.16	21.09	4.47	132.00	37.54	3.75		65.00%	46.20	13.14	1.31
Scrapers (Travel Mode)	62	12.36	3.51	0.35	15	216	19,440	139.04	39.54	8.38	120.13	34.16	3.42		65.00%	42.05	11.96	1.20
End Dump Trucks	175	19.71	5.61	0.56	18.5	500	55,500	273.54	77.79	16.49	547.09	155.57	15.56		65.00%	191.48	54.45	5.45
Light/Medium Veh (e.g., Pick-ups)	3	3.16	0.90	0.09	25	452	67,800	47.45	13.49	2.86	107.23	30.49	3.05		65.00%	37.53	10.67	1.07
Total Plant Vehicle travel																756.19	215.03	21.50
								Uncontrolled lb/hr	591.3168	168.1492	35.6476							

NOTES:

1 Emission Factors for the coal haul road from AP-42, Section 13.2.2 Equation 1a, with constants from Table 13.2.2-2 - See results below
*Assumed quarry surface silt content = 8.3% (Mean value for stone quarrying and processing, AP-42 Table 13.2.2-1) *Assumed days per year with > 0.01 inch moisture = 60, Figure 13.2.2-1
2 Total vehicle category hours per month based on facility estimates for continuing operations with two areas of production.
3 Total Vehicle Miles Traveled (VMT) estimated by the capacity of coal haul trucks, distance to/from Lowe stockpile (5.89 miles one way). For other categories, VMT estimated from average speed and hours per month
4 Control efficiency for BNCC control measures estimated from guidance in AP-42, Section 13.2 for unpaved industrial roads

For Unpaved Roads within Area IV North:

AP-42 13.2.2, Eqns 1a (11/06) $EF = k (s/12)^a (W/3)^b$

EF = Size specific emission factor (lb/VMT)
k = particle size multiplier = 4.9 for PM and 1.5 for PM_{10}, Table 13.2.2-2
S = road surface silt content = 8.3% (obtained from facility data)
W = fleet average vehicle weight for given service (tons) as listed for each category in table above
a = empirical constant, 0.7 for PM and 0.9 for PM_{10}, Table 13.2.2-2
b = empirical constant, 0.45 for PM, PM_{10} and $PM_{2.5}$, Table 13.2.2-2
p = ave. days per year with precipitation greater than 0.01 inches, obtained from Figure 13.2.2-1

1 round trip/hr

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Table D-10

PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM

COAL ADDITION TO STOCKPILES AND RAILCAR LOADING OPERATIONS – PREFERRED ALTERNATIVE

Tons Coal/Yr Area III	PN	PE
	3000000	3000000

Fugitive Emission ID Number	Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor[1] (lb/ton)			Max. Hourly Emisson Rate (lb/hr)			Max. Annual Emission Rate (ton per year)			Control Efficiency[3]	Controlled Emission Rates					
				PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	%	PM (max. lb/hr)	PM (tpy)	PM_{10} (max. lb/hr)	PM_{10} (tpy)	$PM_{2.5}$ (max. lb/hr)	$PM_{2.5}$ (tpy)
Area PN	Coal Addition to Stockpile[4]	8,500	Max.tons/hr[2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
	Train Loading from Stockpile[5]	8,500	Max.tons/hr[2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
Area PE	Coal Addition to Stockpile[4]	8,500	Max.tons/hr[2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
	Train Loading from Stockpile[5]	8,500	Max.tons/hr[2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
																2.85		**0.89**	**0.16**

NOTES:
1 - Emission factors for excavation from AP-42, from batch drop equation AP-42, Aggregate Handling and Storage Piles (Sect. 13.2), Equation 13.2-4 (11/06), as calculated below with parameters estimated from samples at mine site.

2 - The mine haul and load operations estimated to move typical value of 8,500 tons per hour, and this value used to set maximum hourly emission rate.
3 - Control efficiency based on water sprays at transfer points, as required, due to high moisture in mined coal.
4 - Coal haul to Lowe Stockpile will be accomplished by 230 ton capacity, end-dump coal haul trucks. The addition to Stockpile emissions are based on Batch Drop equation for unloading of the end dump truck. Emission factor from AP-42 Equation 13.2-4 is
5 - Railcar loading from the Lowe Stockpile assumed to match the coal addition rate (8,500 tons/hr). Emission factros from batch drop correlation used for addition to stockpiles.

g/sm2	1.627E-06		5.114E-07	9.025E-08
COALPLLU - Loading and unloading at Lowe pile				

Coal Addition to Stockpile and Railcar Coal Loading	**E (PM_{10}) =**	**1.67E-04**
	E (PM) =	**3.54E-04**
	E ($PM_{2.5}$) =	**5.26E-05**
U for coal railcar load and exposed stockpile loading areas = 8.7 mph, facility data for 1-hour averages per day.		
Moisture (M) is taken as as-mined average of 13% based on sampling at the mine site.		

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Table D-10

PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM

COAL ADDITION TO STOCKPILES AND RAILCAR LOADING OPERATIONS – PREFERRED ALTERNATIVE

Tons Coal/Yr Area III		PE
		3000000

Fugitive Emission ID Number	Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor [1] (lb/ton)			Max. Hourly Emisson Rate (lb/hr)			Max. Annual Emission Rate (ton per year)			Control Efficiency [3]	Controlled Emission Rates					
				PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$	%	PM (max. lb/hr)	PM (tpy)	PM_{10} (max. lb/hr)	PM_{10} (tpy)	$PM_{2.5}$ (max. lb/hr)	$PM_{2.5}$ (tpy)
Area PE	Coal Addition to Stockpile [4]	8,500	Max.tons/hr [2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
	Train Loading from Stockpile [5]	8,500	Max.tons/hr [2]	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.531	0.251	0.079	0.50	1.50	0.266	0.712	0.13	0.224	0.039
																1.42		**0.45**	**0.08**

NOTES:

1 - Emission factors for excavation from AP-42, from batch drop equation AP-42, Aggregate Handling and Storage Piles (Sect. 13.2), Equation 13.2-4 (11/06), as calculated below with parameters estimated from samples at mine site.

2 - The mine haul and load operations estimated to move typical value of 8,500 tons per hour, and this value used to set maximum hourly emission rate.

3 - Control efficiency based on water sprays at transfer points, as required, due to high moisture in mined coal.

4 - Coal haul to Lowe Stockpile will be accomplished by 230 ton capacity, end-dump coal haul trucks. The addition to Stockpile emissions are based on Batch Drop equation for unloading of the end dump truck. Emission factor from AP-42 Equation 13.2-4 is

5 - Railcar loading from the Lowe Stockpile assumed to match the coal addition rate (8,500 tons/hr). Emission factros from batch drop correlation used for addition to stockpiles.

g/s/m2	7.564E-07		2.377E-07	4.195E-08
PECOALLU - Loading and unloading at PE pile				

Coal Addition to Stockpile and Railcar Coal Loading	**E (PM_{10}) =**	**1.67E-04**
	E (PM) =	**3.54E-04**
	E ($PM_{2.5}$) =	**5.26E-05**
U for coal railcar load and exposed stockpile loading areas = 8.7 mph, facility data for 1-hour averages per day.		
Moisture (M) is taken as as-mined average of 13% based on sampling at the mine site.		

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Table D-11

PARTICULATE MATTER EMISSION ESTIMATION - WIND EROSION OF STOCKPILES AND UNRECLAIMED OPEN AREAS -PREFERRED ALTERNATIVE

Total Stockpile Areas (Acres)	Area PN	Area PE
Overburden	154	154
Coal	51	51

Total Unrecl Area	Area PN	Area PE
(Acres/yr)	150	150

Construction Emission Sources		Particulate Control	Nominal Surface Areas [2]		Controlled Emission Factor[3] (ton/Area Unit)			Additional Control Efficiency [4]	Controlled Emission Rates (ton/yr) [5]		
	Description [1]		Value	Units	PM	PM10	PM2.5	%	PM	PM10	PM2.5
	Soil/Overburden Stockpiles	Contour and Compact	675974.4	m2				Incl in Emiss. Fct	36.9	18.5	2.8
	Area PN Unreclaimed Open Area	Water/Stabilize	150	acres	0.1718	0.0859	0.0344	50%	12.9	6.4	2.6
	Area PE Coal Stockpile	Contour and Compact	237069.2	m2				Incl in Emiss. Fct	25.2	12.6	1.9
	Area PE Unreclaimed Open Area	Water/Stabilize	150	acres	0.1718	0.0859	0.0344	50%	12.9	6.4	2.6
								Total Wind Erosion	87.9	43.9	9.8

1 - Sources are for windblown dust from idle areas of stockpiles and from disturbed mine areas prior to reclaim activities
2 - Areas estimated for stockpiles and unreclaimed areas. Some of these areas will offset reductions in stockpile and disturbed areas in other Navajo Mine areas. Stockpiles converted to square meters by convertion 4,088 m2 = 1 acre
3 - Controlled emission factor reflect windblown emissions model from AP-42 as determined by facility emissions for existing Navajo Mine stockpiles of known surface areas. Emissions factors for stockpiles include indicated control measure - no additional controls.

4 - Controls for the Pinabete stockpiles that represent additional measures for those areas.

5 - Controlled emissions from assumed annual areas for total stockpile and unreclaimed areas during each operating year. Ratio of PM2.5 and PM10 to PM obtained from AP-42 Section 13.2.5 industrial wind erosion.

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Table D-12
PARTICULATE MATTER EMISSION ESTIMATION - CONSTRUCTION VEHICLES AND EARTHMOVING FOR RECLAMATION OF MINED AREAS - PREFERRED ACTION

Construction Emission Sources		Particulate Control	Nominal Area or Material [2]		PM_{10} Uncontrolled Emission Factor [3]		PM Control Efficiency [4]	Controlled PM10 Emission Rates [5]	Ratio: PM2.5 to PM10 [6]	Controlled PM2.5 Emission Rates
	Description [1]		Value	Units	Value	Units	%	PM10 (ton/yr)	Frac of PM10	PM2.5 (ton/yr)
Area PN	General Construction - Contouring	Watering, Veh. Speeds	167	acres	0.19	ton PM10/acre-month	50%	15.9	0.2	3.2
	Overburden Replacement	Watering, Veh. Speeds	1.60E+07	Tons	0.012	lb PM/ton	50%	48.0	0.2	9.60
	Total Reclamation Emissions - Area PN							63.9		12.77
Area PE	General Construction - Contouring	Watering, Veh. Speeds	167	acres	0.19	ton PM10/acre-month	50%	15.9	0.2	3.2
	Overburden Replacement	Watering, Veh. Speeds	1.60E+07	Tons	0.012	lb PM/ton	50%	48.0	0.2	9.60
	Total Reclamation Emissions - Area PE							63.9		12.77
								per area 1.20E-05		2.40E-06

NOTES:

1 - Sources are for construction operations involved in reclaim of mined areas. These emission source categories include earthmoving, surface shaping, soil handling and vehicle operation.

2 - Areas and overburden quantity estimated for unreclaimed areas.

Stockpiles converted to square meters by convertion 4,088 m2 = 1 acre

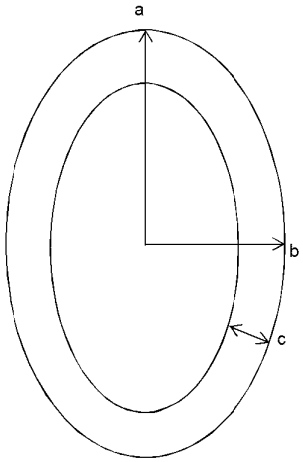
3 - Controlled emission factors from various studies. General Construction factor more recent than latest AP-42 section on Heavy Construction (MRI 1996, EPA 2001, EPA 2006.) Overburden replacement from factor given in Western Surface Coal Mining, AP-42 Section 11.9.

4 - Controls for activities represent range of control measures utilized for current Mining Permit in other Navajo Mine areas.

5 - Controlled emissions from assumed annual reclaim areas and overburden replacement for each operating year of the Preferred Action.

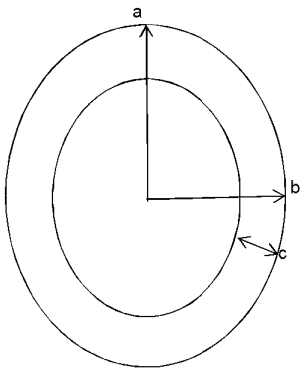
6 - Ratio of PM2.5 to PM10 conservatively set for the range of construction operations. For geologic dusts, typical raio in AP-42 is 20% of PM10 is PM2.5.

Pile Name	Lakes Area (m²)	Acres		surfacae area m2	conical radius (m)	conical height at 30° slope (m)	surface area (m2)
PECOALPL	237,069	58.58					
PBOVRBDN	473,922	117.11	Replaces two previous Overburden piles				
TS-401 (Top Soil)	20,673	5.11			81.1	46.8	11,935
TS-402	22,629	5.59			84.9	49.0	13,065
TS-403	32,412	8.01			101.6	58.6	18,713
TS-404	76,584	18.92			156.1	90.1	44,216
TS-405	28,242	6.98			94.8	54.7	16,306
TS-406	21,512	5.32			82.7	47.8	12,420
OB+TS Acres		167.04					



PECOALPL

A	237,069	m2
A	PI * a * b	
	75,461	= a b
	a / b =	5
	614.25	a
	123	b
P	=2 PI SQRT ((a^2 + b^2) / 2)	
	2,783	m
side slope	30	°
c	23	m
pile height	13.3	m
side length	26.6	m
side area	73,914	m2
top area	185,470	m2



PBOVRBDN

A	473,922	m2
A	PI * a * b	
	150,854	= a b
	a / b =	2
	549.28	a
	275	b
P	=2 PI SQRT ((a^2 + b^2) / 2)	
	2,728	m
side slope	30	°
c	35	m
pile height	20.2	m
side length	40.4	m
side area	110,268	m2
top area	387,175	m2

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Appendix B

2011 USEPA Clarification Memo

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On pages 8 and 9 of the memo, EPA notes the following regarding intermittent sources such as emergency generators:

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

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

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

Appendix C

Alternative Model Justification for Low Wind Speed Beta Options: AERMET and AERMOD

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Appendix C

Alternative Model Justification for Low Wind Speed Beta Options: AERMET and AERMOD

Appendix W, Section 3.2.2 provides an approach for approval of an alternative model to determine whether it is more appropriate for the modeling application discussed here (Four Corners Power Plant and mine sources). These sources involve both low-level non-buoyant sources as well as tall stack buoyant releases.

EPA indicates that for this purpose, an alternative refined model may be used provided that:

i. The model has received a scientific peer review;

ii. The model can be demonstrated to be applicable to the problem on a theoretical basis;

iii. The data bases which are necessary to perform the analysis are available and adequate;

iv. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates; and

v. A protocol on methods and procedures to be followed has been established.

These five points are discussed below.

The model selected for this modeling application is the low wind beta option provided in AERMET, while using the default option in AERMOD. One update done for the beta AERMET application was the scaling of theta-star as the AERMOD formulation document[1] specifies. This update is also discussed in an evaluation paper[2] given at an Air & Waste Management Association specialty conference in March 2013.

<u>i. The model has received a scientific peer review</u>

The AERMET beta changes[3] reference a Boundary-Layer Meteorology peer-reviewed paper[4] that is the source of the AERMET formulation for changes in the friction velocity computation for low wind speeds.

<u>ii. The model can be demonstrated to be applicable to the problem on a theoretical basis.</u>

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[1] http://www.epa.gov/ttn/scram/7thconf/aermod/aermod_mfd.pdf, page 20.

[2] Connors. J. A., R. J. Paine, and S. R. Hanna, 2013. AERMOD Low Wind Speed Issues: Review of New Model Release. Control #3, presented at the Air & Waste Management Association specialty conference, Raleigh, NC, March 19-21, 2013.

[3] http://www.epa.gov/ttn/scram/models/aermod/aermod_mcb8.txt.

[4] Qian, W., and A. Venkatram. Performance of Steady-State Dispersion Models Under Low Wind-Speed Conditions. Boundary-Layer Meteorology 138:475–491. (2011)

There is no known limitation to the AERMET changes – they are generally applicable.

iii. The data bases which are necessary to perform the analysis are available and adequate.

Routine meteorological databases are sufficient for exercising this meteorological option.

iv. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates.

The two studies[2,4] cited above provide this demonstration.

v. A protocol on methods and procedures to be followed has been established.

This report documents the methods and procedures followed.

Appendix D

30-year Precipitation Data

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AERSURFACE Worksheet - 2006

Monthly Averaged Precipitation (inches) at Farmington, NM

Values are specified by the user.

Year	Precipitation (inches) Amount for 30 Years at APS Four Corners Power Plant, NM- 2006												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1977	1.67	0.08	0.04	0.01	1.17	0.08	0.58	1.58	0.51	0.63	0.57	1.78	8.70
1978	0.71	0.69	1.12	0.62	0.74	0.00	0.08	0.18	1.48	1.49	1.85	0.60	9.56
1979	0.23	0.23	0.04	0.33	0.58	0.46	1.00	0.40	0.05	1.10	0.74	0.71	5.87
1980	1.06	1.16	0.56	0.06	0.18	0.00	0.09	0.77	0.89	0.81	0.00	0.08	5.66
1981	0.00	0.14	1.28	0.37	1.04	0.47	0.71	0.23	0.75	0.92	0.58	0.09	6.58
1982	0.22	0.83	0.79	0.59	0.72	0.00	0.96	3.69	1.25	0.11	0.00	0.00	9.16
1983	0.94	0.58	1.58	0.30	0.04	0.34	1.63	0.63	0.51	0.30	1.10	1.01	8.96
1984	0.03	0.31	0.28	0.68	0.05	0.50	0.47	0.26	0.10	2.00	0.30	0.60	5.58
1985	0.30	0.20	1.70	1.90	0.40	0.00	1.20	0.40	1.30	1.20	0.60	0.30	9.50
1986	0.10	0.70	0.60	1.00	0.20	1.00	3.50	0.90	2.00	0.90	2.40	0.70	14.00
1987	0.20	1.70	0.70	0.20	0.60	0.00	0.20	1.10	0.20	1.00	1.30	0.70	7.90
1988	0.60	0.90	0.10	0.60	1.00	0.30	0.40	1.80	0.20	0.20	0.60	0.30	7.00
1989	1.00	0.40	0.00	0.00	0.00	0.00	2.10	0.50	0.10	0.40	0.00	0.00	4.50
1990	0.60	0.50	0.60	0.70	0.90	0.10	0.30	1.10	1.80	1.00	0.70	0.60	8.90
1991	0.50	0.50	0.50	0.00	0.50	0.40	0.30	0.50	1.30	0.20	2.00	0.80	7.50
1992	0.20	0.40	0.80	0.20	1.60	0.00	0.90	1.20	0.80	0.40	0.30	0.60	7.40
1993	2.20	1.20	0.70	0.30	0.40	0.00	0.00	2.10	0.70	1.20	0.50	0.10	9.40
1994	0.10	0.50	0.20	0.50	1.20	0.00	0.20	0.60	1.60	0.50	0.90	0.70	7.00
1995	0.40	0.00	1.10	1.10	0.60	0.00	0.00	1.80	2.00	0.00	0.10	0.30	7.40
1996	0.30	0.20	0.10	0.10	0.00	0.50	0.40	1.00	0.60	2.10	0.60	0.30	6.20
1997	1.00	0.50	0.00	2.50	0.00	0.40	1.20	1.60	1.80	0.20	0.60	0.80	10.60
1998	0.20	0.60	0.20	0.00	0.00	0.00	1.10	1.50	0.60	2.00	1.10	0.10	7.40
1999	0.10	0.10	0.00	1.10	1.20	0.20	2.10	0.80	0.20	0.00	0.00	0.00	5.80
2000	0.60	0.20	2.10	0.10	0.00	0.30	1.00	1.10	0.40	1.80	0.60	0.10	8.30
2001	0.40	0.90	1.30	0.60	0.90	0.00	0.70	0.70	0.00	0.20	0.40	0.50	6.60
2002	0.00	0.00	0.10	0.30	0.00	0.00	0.40	0.20	3.20	0.00	0.70	0.50	5.40
2003	0.20	1.10	0.00	0.10	0.10	0.00	0.10	1.00	0.80	0.70	0.80	0.40	5.30
2004	0.40	0.80	0.00	2.00	0.00	0.20	0.20	0.10	2.70	0.40	0.60	0.70	8.10
2005	1.33	1.70	0.40	0.80	0.50	0.00	0.50	1.70	0.40	0.90	0.00	0.00	8.23
2006	0.46	0.01	0.84	0.60	0.03	0.12	2.41	0.18	1.68	2.61	0.05	0.80	9.79
30-Year Avg	**0.54**	**0.57**	**0.59**	**0.59**	**0.49**	**0.18**	**0.82**	**0.99**	**1.00**	**0.84**	**0.67**	**0.47**	**7.74**

2006	0.46	0.01	0.84	0.60	0.03	0.12	2.41	0.18	1.68	2.61	0.05	0.80	9.79
30th percentile	0.20	0.22	0.10	0.20	0.05	0.00	0.30	0.50	0.48	0.37	0.37	0.24	6.59
70th percentile	0.60	0.73	0.79	0.64	0.73	0.30	1.00	1.13	1.35	1.03	0.71	0.70	8.76
Average / Dry / Wet ?	Average	Dry	Wet	Average	Dry	Average	Wet	Dry	Wet	Wet	Dry	Wet	Wet

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AERSURFACE Worksheet - 2007

Monthly Averaged Precipitation (inches) at Farmington, NM

Values are specified by the user.

Year	Precipitation (inches) Amount for 30 Years at APS Four Corners Power Plant, NM - 2007												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1978	0.71	0.69	1.12	0.62	0.74	0.00	0.08	0.18	1.48	1.49	1.85	0.60	9.56
1979	0.23	0.23	0.04	0.33	0.58	0.46	1.00	0.40	0.05	1.10	0.74	0.71	5.87
1980	1.06	1.16	0.56	0.06	0.18	0.00	0.09	0.77	0.89	0.81	0.00	0.08	5.66
1981	0.00	0.14	1.28	0.37	1.04	0.47	0.71	0.23	0.75	0.92	0.58	0.09	6.58
1982	0.22	0.83	0.79	0.59	0.72	0.00	0.96	3.69	1.25	0.11	0.00	0.00	9.16
1983	0.94	0.58	1.58	0.30	0.04	0.34	1.63	0.63	0.51	0.30	1.10	1.01	8.96
1984	0.03	0.31	0.28	0.68	0.05	0.50	0.47	0.26	0.10	2.00	0.30	0.60	5.58
1985	0.30	0.20	1.70	1.90	0.40	0.00	1.20	0.40	1.30	1.20	0.60	0.30	9.50
1986	0.10	0.70	0.60	1.00	0.20	1.00	3.50	0.90	2.00	0.90	2.40	0.70	14.00
1987	0.20	1.70	0.70	0.20	0.60	0.00	0.20	1.10	0.20	1.00	1.30	0.70	7.90
1988	0.60	0.90	0.10	0.60	1.00	0.30	0.40	1.80	0.20	0.20	0.60	0.30	7.00
1989	1.00	0.40	0.00	0.00	0.00	0.00	2.10	0.50	0.10	0.40	0.00	0.00	4.50
1990	0.60	0.50	0.60	0.70	0.90	0.10	0.30	1.10	1.80	1.00	0.70	0.60	8.90
1991	0.50	0.50	0.50	0.00	0.50	0.40	0.30	0.50	1.30	0.20	2.00	0.80	7.50
1992	0.20	0.40	0.80	0.20	1.60	0.00	0.90	1.20	0.80	0.40	0.30	0.60	7.40
1993	2.20	1.20	0.70	0.30	0.40	0.00	0.00	2.10	0.70	1.20	0.50	0.10	9.40
1994	0.10	0.50	0.20	0.50	1.20	0.00	0.20	0.60	1.60	0.50	0.90	0.70	7.00
1995	0.40	0.00	1.10	1.10	0.60	0.00	0.00	1.80	2.00	0.00	0.10	0.30	7.40
1996	0.30	0.20	0.10	0.10	0.00	0.50	0.40	1.00	0.60	2.10	0.60	0.30	6.20
1997	1.00	0.50	0.00	2.50	0.00	0.40	1.20	1.60	1.80	0.20	0.60	0.80	10.60
1998	0.20	0.60	0.20	0.00	0.00	0.00	1.10	1.50	0.60	2.00	1.10	0.10	7.40
1999	0.10	0.10	0.00	1.10	1.20	0.20	2.10	0.80	0.20	0.00	0.00	0.00	5.80
2000	0.60	0.20	2.10	0.10	0.00	0.30	1.00	1.10	0.40	1.80	0.60	0.10	8.30
2001	0.40	0.90	1.30	0.60	0.90	0.00	0.70	0.70	0.00	0.20	0.40	0.50	6.60
2002	0.00	0.00	0.10	0.30	0.00	0.00	0.40	0.20	3.20	0.00	0.70	0.50	5.40
2003	0.20	1.10	0.00	0.10	0.10	0.00	0.10	1.00	0.80	0.70	0.80	0.40	5.30
2004	0.40	0.80	0.00	2.00	0.00	0.20	0.20	0.10	2.70	0.40	0.60	0.70	8.10
2005	1.33	1.70	0.40	0.80	0.50	0.00	0.50	1.70	0.40	0.90	0.00	0.00	8.23
2006	0.46	0.01	0.84	0.60	0.03	0.12	2.41	0.18	1.68	2.61	0.05	0.80	9.79
2007	0.44	0.81	0.83	0.34	1.31	0.12	0.45	0.93	0.47	0.23	0.13	0.97	7.03
30-Year Avg	**0.49**	**0.60**	**0.62**	**0.60**	**0.49**	**0.18**	**0.82**	**0.97**	**1.00**	**0.83**	**0.65**	**0.45**	**7.69**
2007	0.44	0.81	0.83	0.34	1.31	0.12	0.45	0.93	0.47	0.23	0.13	0.97	7.03
30th percentile	0.20	0.29	0.17	0.27	0.05	0.00	0.30	0.50	0.45	0.28	0.30	0.24	6.59
70th percentile	0.60	0.80	0.81	0.64	0.73	0.30	1.00	1.10	1.35	1.03	0.71	0.70	8.48
Average / Dry / Wet ?	Average	Wet	Wet	Average	Wet	Average	Average	Average	Average	Dry	Dry	Wet	Average

ED_001261_00026270

AERSURFACE Worksheet - 2008

Monthly Averaged Precipitation (inches) at Farmington, NM

Values are specified by the user.

Year	Precipitation (inches) Amount for 30 Years at APS Four Corners Power Plant, NM- 2008												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1979	0.23	0.23	0.04	0.33	0.58	0.46	1.00	0.40	0.05	1.10	0.74	0.71	5.87
1980	1.06	1.16	0.56	0.06	0.18	0.00	0.09	0.77	0.89	0.81	0.00	0.08	5.66
1981	0.00	0.14	1.28	0.37	1.04	0.47	0.71	0.23	0.75	0.92	0.58	0.09	6.58
1982	0.22	0.83	0.79	0.59	0.72	0.00	0.96	3.69	1.25	0.11	0.00	0.00	9.16
1983	0.94	0.58	1.58	0.30	0.04	0.34	1.63	0.63	0.51	0.30	1.10	1.01	8.96
1984	0.03	0.31	0.28	0.68	0.05	0.50	0.47	0.26	0.10	2.00	0.30	0.60	5.58
1985	0.30	0.20	1.70	1.90	0.40	0.00	1.20	0.40	1.30	1.20	0.60	0.30	9.50
1986	0.10	0.70	0.60	1.00	0.20	1.00	3.50	0.90	2.00	0.90	2.40	0.70	14.00
1987	0.20	1.70	0.70	0.20	0.60	0.00	0.20	1.10	0.20	1.00	1.30	0.70	7.90
1988	0.60	0.90	0.10	0.60	1.00	0.30	0.40	1.80	0.20	0.20	0.60	0.30	7.00
1989	1.00	0.40	0.00	0.00	0.00	0.00	2.10	0.50	0.10	0.40	0.00	0.00	4.50
1990	0.60	0.50	0.60	0.70	0.90	0.10	0.30	1.10	1.80	1.00	0.70	0.60	8.90
1991	0.50	0.50	0.50	0.00	0.50	0.40	0.30	0.50	1.30	0.20	2.00	0.80	7.50
1992	0.20	0.40	0.80	0.20	1.60	0.00	0.90	1.20	0.80	0.40	0.30	0.60	7.40
1993	2.20	1.20	0.70	0.30	0.40	0.00	0.00	2.10	0.70	1.20	0.50	0.10	9.40
1994	0.10	0.50	0.20	0.50	1.20	0.00	0.20	0.60	1.60	0.50	0.90	0.70	7.00
1995	0.40	0.00	1.10	1.10	0.60	0.00	0.00	1.80	2.00	0.00	0.10	0.30	7.40
1996	0.30	0.20	0.10	0.10	0.00	0.50	0.40	1.00	0.60	2.10	0.60	0.30	6.20
1997	1.00	0.50	0.00	2.50	0.00	0.40	1.20	1.60	1.80	0.20	0.60	0.80	10.60
1998	0.20	0.60	0.20	0.00	0.00	0.00	1.10	1.50	0.60	2.00	1.10	0.10	7.40
1999	0.10	0.10	0.00	1.10	1.20	0.20	2.10	0.80	0.20	0.00	0.00	0.00	5.80
2000	0.60	0.20	2.10	0.10	0.00	0.30	1.00	1.10	0.40	1.80	0.60	0.10	8.30
2001	0.40	0.90	1.30	0.60	0.90	0.00	0.70	0.70	0.00	0.20	0.40	0.50	6.60
2002	0.00	0.00	0.10	0.30	0.00	0.00	0.40	0.20	3.20	0.00	0.70	0.50	5.40
2003	0.20	1.10	0.00	0.10	0.10	0.00	0.10	1.00	0.80	0.70	0.80	0.40	5.30
2004	0.40	0.80	0.00	2.00	0.00	0.20	0.20	0.10	2.70	0.40	0.60	0.70	8.10
2005	1.33	1.70	0.40	0.80	0.50	0.00	0.50	1.70	0.40	0.90	0.00	0.00	8.23
2006	0.46	0.01	0.84	0.60	0.03	0.12	2.41	0.18	1.68	2.61	0.05	0.80	9.79
2007	0.44	0.81	0.83	0.34	1.31	0.12	0.45	0.93	0.47	0.23	0.13	0.97	7.03
2008	1.60	0.77	0.07	0.12	0.55	0.02	0.13	1.34	0.33	0.57	0.65	0.98	7.13
30-Year Avg	**0.52**	**0.60**	**0.58**	**0.58**	**0.49**	**0.18**	**0.82**	**1.00**	**0.96**	**0.80**	**0.61**	**0.46**	**7.61**

2008	1.60	0.77	0.07	0.12	0.55	0.02	0.13	1.34	0.33	0.57	0.65	0.98	7.13
30th percentile	0.20	0.29	0.10	0.20	0.05	0.00	0.30	0.57	0.40	0.28	0.30	0.24	6.59
70th percentile	0.60	0.80	0.79	0.62	0.64	0.30	1.00	1.13	1.30	1.00	0.70	0.70	8.25
Average / Dry / Wet ?	Wet	Average	Dry	Dry	Average	Average	Dry	Wet	Dry	Average	Average	Wet	Average

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AERSURFACE Worksheet - 2009

Monthly Averaged Precipitation (inches) at Farmington, NM

Values are specified by the user.

Year	Precipitation (inches) Amount for 30 Years at APS Four Corners Power Plant, NM- 2009												
	.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	1.06	1.16	0.56	0.06	0.18	0.00	0.09	0.77	0.89	0.81	0.00	0.08	5.66
1981	0.00	0.14	1.28	0.37	1.04	0.47	0.71	0.23	0.75	0.92	0.58	0.09	6.58
1982	0.22	0.83	0.79	0.59	0.72	0.00	0.96	3.69	1.25	0.11	0.00	0.00	9.16
1983	0.94	0.58	1.58	0.30	0.04	0.34	1.63	0.63	0.51	0.30	1.10	1.01	8.96
1984	0.03	0.31	0.28	0.68	0.05	0.50	0.47	0.26	0.10	2.00	0.30	0.60	5.58
1985	0.30	0.20	1.70	1.90	0.40	0.00	1.20	0.40	1.30	1.20	0.60	0.30	9.50
1986	0.10	0.70	0.60	1.00	0.20	1.00	3.50	0.90	2.00	0.90	2.40	0.70	14.00
1987	0.20	1.70	0.70	0.20	0.60	0.00	0.20	1.10	0.20	1.00	1.30	0.70	7.90
1988	0.60	0.90	0.10	0.60	1.00	0.30	0.40	1.80	0.20	0.20	0.60	0.30	7.00
1989	1.00	0.40	0.00	0.00	0.00	0.00	2.10	0.50	0.10	0.40	0.00	0.00	4.50
1990	0.60	0.50	0.60	0.70	0.90	0.10	0.30	1.10	1.80	1.00	0.70	0.60	8.90
1991	0.50	0.50	0.50	0.00	0.50	0.40	0.30	0.50	1.30	0.20	2.00	0.80	7.50
1992	0.20	0.40	0.80	0.20	1.60	0.00	0.90	1.20	0.80	0.40	0.30	0.60	7.40
1993	2.20	1.20	0.70	0.30	0.40	0.00	0.00	2.10	0.70	1.20	0.50	0.10	9.40
1994	0.10	0.50	0.20	0.50	1.20	0.00	0.20	0.60	1.60	0.50	0.90	0.70	7.00
1995	0.40	0.00	1.10	1.10	0.60	0.00	0.00	1.80	2.00	0.00	0.10	0.30	7.40
1996	0.30	0.20	0.10	0.10	0.00	0.50	0.40	1.00	0.60	2.10	0.60	0.30	6.20
1997	1.00	0.50	0.00	2.50	0.00	0.40	1.20	1.60	1.80	0.20	0.60	0.80	10.60
1998	0.20	0.60	0.20	0.00	0.00	0.00	1.10	1.50	0.60	2.00	1.10	0.10	7.40
1999	0.10	0.10	0.00	1.10	1.20	0.20	2.10	0.80	0.20	0.00	0.00	0.00	5.80
2000	0.60	0.20	2.10	0.10	0.00	0.30	1.00	1.10	0.40	1.80	0.60	0.10	8.30
2001	0.40	0.90	1.30	0.60	0.90	0.00	0.70	0.70	0.00	0.20	0.40	0.50	6.60
2002	0.00	0.00	0.10	0.30	0.00	0.00	0.40	0.20	3.20	0.00	0.70	0.50	5.40
2003	0.20	1.10	0.00	0.10	0.10	0.00	0.10	1.00	0.80	0.70	0.80	0.40	5.30
2004	0.40	0.80	0.00	2.00	0.00	0.20	0.20	0.10	2.70	0.40	0.60	0.70	8.10
2005	1.33	1.70	0.40	0.80	0.50	0.00	0.50	1.70	0.40	0.90	0.00	0.00	8.23
2006	0.46	0.01	0.84	0.60	0.03	0.12	2.41	0.18	1.68	2.61	0.05	0.80	9.79
2007	0.44	0.81	0.83	0.34	1.31	0.12	0.45	0.93	0.47	0.23	0.13	0.97	7.03
2008	1.60	0.77	0.07	0.12	0.55	0.02	0.13	1.34	0.33	0.57	0.65	0.98	7.13
2009	0.37	0.56	0.29	0.38	0.93	0.46	0.04	0.17	0.08	0.81	0.35	0.46	4.90
30-Year Avg	**0.53**	**0.61**	**0.59**	**0.58**	**0.50**	**0.18**	**0.79**	**1.00**	**0.96**	**0.79**	**0.60**	**0.45**	**7.57**

2009	0.37	0.56	0.29	0.38	0.93	0.46	0.04	0.17	0.08	0.81	0.35	0.46	4.90
30th percentile	0.20	0.37	0.17	0.20	0.05	0.00	0.27	0.57	0.40	0.28	0.30	0.24	6.59
70th percentile	0.60	0.80	0.79	0.62	0.77	0.30	0.97	1.13	1.30	0.94	0.67	0.70	8.25
Average / Dry / Wet ?	Average	Average	Average	Average	Wet	Wet	Dry	Dry	Dry	Average	Average	Average	Dry

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AERSURFACE Worksheet - 2010

Monthly Averaged Precipitation (inches) at Farmington, NM

Values are specified by the user.

Year	Precipitation (inches) Amount for 30 Years at APS Four Corners Power Plant, NM - 2010												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1981	0.00	0.14	1.28	0.37	1.04	0.47	0.71	0.23	0.75	0.92	0.58	0.09	6.58
1982	0.22	0.83	0.79	0.59	0.72	0.00	0.96	3.69	1.25	0.11	0.00	0.00	9.16
1983	0.94	0.58	1.58	0.30	0.04	0.34	1.63	0.63	0.51	0.30	1.10	1.01	8.96
1984	0.03	0.31	0.28	0.68	0.05	0.50	0.47	0.26	0.10	2.00	0.30	0.60	5.58
1985	0.30	0.20	1.70	1.90	0.40	0.00	1.20	0.40	1.30	1.20	0.60	0.30	9.50
1986	0.10	0.70	0.60	1.00	0.20	1.00	3.50	0.90	2.00	0.90	2.40	0.70	14.00
1987	0.20	1.70	0.70	0.20	0.60	0.00	0.20	1.10	0.20	1.00	1.30	0.70	7.90
1988	0.60	0.90	0.10	0.60	1.00	0.30	0.40	1.80	0.20	0.20	0.60	0.30	7.00
1989	1.00	0.40	0.00	0.00	0.00	0.00	2.10	0.50	0.10	0.40	0.00	0.00	4.50
1990	0.60	0.50	0.60	0.70	0.90	0.10	0.30	1.10	1.80	1.00	0.70	0.60	8.90
1991	0.50	0.50	0.50	0.00	0.50	0.40	0.30	0.50	1.30	0.20	2.00	0.80	7.50
1992	0.20	0.40	0.80	0.20	1.60	0.00	0.90	1.20	0.80	0.40	0.30	0.60	7.40
1993	2.20	1.20	0.70	0.30	0.40	0.00	0.00	2.10	0.70	1.20	0.50	0.10	9.40
1994	0.10	0.50	0.20	0.50	1.20	0.00	0.20	0.60	1.60	0.50	0.90	0.70	7.00
1995	0.40	0.00	1.10	1.10	0.60	0.00	0.00	1.80	2.00	0.00	0.10	0.30	7.40
1996	0.30	0.20	0.10	0.10	0.00	0.50	0.40	1.00	0.60	2.10	0.60	0.30	6.20
1997	1.00	0.50	0.00	2.50	0.00	0.40	1.20	1.60	1.80	0.20	0.60	0.80	10.60
1998	0.20	0.60	0.20	0.00	0.00	0.00	1.10	1.50	0.60	2.00	1.10	0.10	7.40
1999	0.10	0.10	0.00	1.10	1.20	0.20	2.10	0.80	0.20	0.00	0.00	0.00	5.80
2000	0.60	0.20	2.10	0.10	0.00	0.30	1.00	1.10	0.40	1.80	0.60	0.10	8.30
2001	0.40	0.90	1.30	0.60	0.90	0.00	0.70	0.70	0.00	0.20	0.40	0.50	6.60
2002	0.00	0.00	0.10	0.30	0.00	0.00	0.40	0.20	3.20	0.00	0.70	0.50	5.40
2003	0.20	1.10	0.00	0.10	0.10	0.00	0.10	1.00	0.80	0.70	0.80	0.40	5.30
2004	0.40	0.80	0.00	2.00	0.00	0.20	0.20	0.10	2.70	0.40	0.60	0.70	8.10
2005	1.33	1.70	0.40	0.80	0.50	0.00	0.50	1.70	0.40	0.90	0.00	0.00	8.23
2006	0.46	0.01	0.84	0.60	0.03	0.12	2.41	0.18	1.68	2.61	0.05	0.80	9.79
2007	0.44	0.81	0.83	0.34	1.31	0.12	0.45	0.93	0.47	0.23	0.13	0.97	7.03
2008	1.60	0.77	0.07	0.12	0.55	0.02	0.13	1.34	0.33	0.57	0.65	0.98	7.13
2009	0.37	0.56	0.29	0.38	0.93	0.46	0.04	0.17	0.08	0.81	0.35	0.46	4.90
2010	1.93	1.08	0.76	0.40	0.03	0.19	0.66	1.97	0.99	0.91	0.11	1.18	10.21
30-Year Avg	**0.56**	**0.61**	**0.60**	**0.60**	**0.49**	**0.19**	**0.81**	**1.04**	**0.96**	**0.79**	**0.60**	**0.49**	**7.73**

2010	1.93	1.08	0.76	0.40	0.03	0.19	0.66	1.97	0.99	0.91	0.11	1.18	10.21
30th percentile	0.20	0.37	0.17	0.27	0.04	0.00	0.30	0.57	0.40	0.28	0.30	0.30	6.88
70th percentile	0.60	0.80	0.79	0.62	0.77	0.30	0.97	1.24	1.30	0.94	0.67	0.70	8.48
Average / Dry / Wet ?	Wet	Wet	Average	Average	Dry	Average	Average	Wet	Average	Average	Dry	Wet	Wet

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AERSURFACE Worksheet - 2011

Monthly Averaged Precipitation (inches) at Farmington, NM

Values are specified by the user.

Year	Precipitation (inches) Amount for 30 Years at APS Four Corners Power Plant, NM - 2011												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1982	0.22	0.83	0.79	0.59	0.72	0.00	0.96	3.69	1.25	0.11	0.00	0.00	9.16
1983	0.94	0.58	1.58	0.30	0.04	0.34	1.63	0.63	0.51	0.30	1.10	1.01	8.96
1984	0.03	0.31	0.28	0.68	0.05	0.50	0.47	0.26	0.10	2.00	0.30	0.60	5.58
1985	0.30	0.20	1.70	1.90	0.40	0.00	1.20	0.40	1.30	1.20	0.60	0.30	9.50
1986	0.10	0.70	0.60	1.00	0.20	1.00	3.50	0.90	2.00	0.90	2.40	0.70	14.00
1987	0.20	1.70	0.70	0.20	0.60	0.00	0.20	1.10	0.20	1.00	1.30	0.70	7.90
1988	0.60	0.90	0.10	0.60	1.00	0.30	0.40	1.80	0.20	0.20	0.60	0.30	7.00
1989	1.00	0.40	0.00	0.00	0.00	0.00	2.10	0.50	0.10	0.40	0.00	0.00	4.50
1990	0.60	0.50	0.60	0.70	0.90	0.10	0.30	1.10	1.80	1.00	0.70	0.60	8.90
1991	0.50	0.50	0.50	0.00	0.50	0.40	0.30	0.50	1.30	0.20	2.00	0.80	7.50
1992	0.20	0.40	0.80	0.20	1.60	0.00	0.90	1.20	0.80	0.40	0.30	0.60	7.40
1993	2.20	1.20	0.70	0.30	0.40	0.00	0.00	2.10	0.70	1.20	0.50	0.10	9.40
1994	0.10	0.50	0.20	0.50	1.20	0.00	0.20	0.60	1.60	0.50	0.90	0.70	7.00
1995	0.40	0.00	1.10	1.10	0.60	0.00	0.00	1.80	2.00	0.00	0.10	0.30	7.40
1996	0.30	0.20	0.10	0.10	0.00	0.50	0.40	1.00	0.60	2.10	0.60	0.30	6.20
1997	1.00	0.50	0.00	2.50	0.00	0.40	1.20	1.60	1.80	0.20	0.60	0.80	10.60
1998	0.20	0.60	0.20	0.00	0.00	0.00	1.10	1.50	0.60	2.00	1.10	0.10	7.40
1999	0.10	0.10	0.00	1.10	1.20	0.20	2.10	0.80	0.20	0.00	0.00	0.00	5.80
2000	0.60	0.20	2.10	0.10	0.00	0.30	1.00	1.10	0.40	1.80	0.60	0.10	8.30
2001	0.40	0.90	1.30	0.60	0.90	0.00	0.70	0.70	0.00	0.20	0.40	0.50	6.60
2002	0.00	0.00	0.10	0.30	0.00	0.00	0.40	0.20	3.20	0.00	0.70	0.50	5.40
2003	0.20	1.10	0.00	0.10	0.10	0.00	0.10	1.00	0.80	0.70	0.80	0.40	5.30
2004	0.40	0.80	0.00	2.00	0.00	0.20	0.20	0.10	2.70	0.40	0.60	0.70	8.10
2005	1.33	1.70	0.40	0.80	0.50	0.00	0.50	1.70	0.40	0.90	0.00	0.00	8.23
2006	0.46	0.01	0.84	0.60	0.03	0.12	2.41	0.18	1.68	2.61	0.05	0.80	9.79
2007	0.44	0.81	0.83	0.34	1.31	0.12	0.45	0.93	0.47	0.23	0.13	0.97	7.03
2008	1.60	0.77	0.07	0.12	0.55	0.02	0.13	1.34	0.33	0.57	0.65	0.98	7.13
2009	0.37	0.56	0.29	0.38	0.93	0.46	0.04	0.17	0.08	0.81	0.35	0.46	4.90
2010	1.93	1.08	0.76	0.40	0.03	0.19	0.66	1.97	0.99	0.91	0.11	1.18	10.21
2011	0.03	0.18	0.36	1.20	0.72	0.00	0.51	0.14	2.39	1.72	0.76	0.37	8.38
30-Year Avg	**0.56**	**0.61**	**0.57**	**0.62**	**0.48**	**0.17**	**0.80**	**1.03**	**1.02**	**0.82**	**0.61**	**0.50**	**7.79**

2011	0.03	0.18	0.36	1.20	0.72	0.00	0.51	0.14	2.39	1.72	0.76	0.37	8.38
30th percentile	0.20	0.37	0.17	0.27	0.04	0.00	0.30	0.57	0.40	0.28	0.30	0.30	7.00
70th percentile	0.60	0.80	0.77	0.69	0.72	0.23	0.97	1.24	1.39	1.00	0.70	0.70	8.54
Average / Dry / Wet ?	Dry	Dry	Average	Wet	Average	Average	Average	Dry	Wet	Wet	Wet	Average	Average

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Appendix E

Significant Concentration Gradient Analysis

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In recent memoranda[25], USEPA has acknowledged its 1990 Draft New Source Review Workshop Manual procedures[26] for determining background sources to include in NAAQS compliance demonstrations may be overly conservative, especially regarding the short-term 1-hour SO_2 and NO_2 standards. For example, USEPA states in its March 1, 2011 memo that : "Our main concern is that following such procedures in a literal and uncritical manner may in many cases result in cumulative assessments that are overly conservative and could unnecessarily complicate the permitting process in some cases."

EPA's modeling guidance in Appendix W identifies "a significant concentration gradient in the vicinity" of a source as the main criterion for determining which nearby sources should be included in a cumulative impact assessment. An analysis of concentration gradients can help evaluate the potential for monitored background concentrations to double count the impacts from background sources that are explicitly modeled.

The USEPA March 1, 2011 memo states that: "a general "rule of thumb" for estimating the distance to maximum 1-hour impact and the region of significant concentration gradients that may apply in relatively flat terrain is approximately 10 times the source release height. Even accounting for some terrain influences on the location and gradients of maximum 1-hour concentrations, these considerations suggest that the emphasis on determining which nearby sources to include in the modeling analysis should focus on the area within about 10 kilometers of the project location in most cases. The routine inclusion of all sources within 50 kilometers of the project location, the nominal distance for which AERMOD is applicable, is likely to produce an overly conservative result in most cases."

To determine if there is a significant concentration gradient beyond the FCPP location from San Juan Generating Station (SJGS) emissions, AECOM modeled impacts from that facility along a line of receptors passing through and beyond the Four Corners Power Plant (assuming a perfect 1-hour line-up) with a unit emission rate as shown in **Figure E-1**. The peak impact from the FCPP is located in a direction that does not line up with SJGS, as discussed in the modeling results in Section 5.

The uncertainty in monitored concentrations is +/- 15 percent (a total uncertainty of 30 percent), based upon USEPA's monitoring guidelines[27]. That means that for identical actual concentrations along a path (no concentration gradient), there could be a change in the reported values from monitors of up to 30 percent, which would still within monitoring tolerance. This indicates that a change in concentration of 30 percent is within the "noise" level of valid instruments, and cannot be distinguished from an actual zero gradient. Therefore, relative concentration changes up to 30 percent should be regarded as insignificant.

We determined the change in predicted concentrations from SJGS along a line with a perfect lineup through the location of FCPP from the location of FCPP to its peak impact along this line in a direction away from SJGS. The "chi/q" (concentration per emission unit) modeled impact of SJGS at FCPP is 0.211 $\mu g/m^3/g/s$. The relative change in the predicted concentration from SJGS along this line segment is a small fraction of 30 percent between FCPP and the distance to the FCPP modeled maximum concentration for 1-hour SO_2 (1,100 meters) as shown in **Figure E-2.** Therefore, SJGS does not have

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[25] For example, the March 1, 2011 Clarification Memo available at http://www.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf.

[26] http://www.epa.gov/NSR/ttnnsr01/gen/wkshpman.pdf

[27] USEPA 2008b. (http://www.epa.gov/ttnamti1/files/ambient/pm25/qa/QA-Handbook-Vol-II.pdf; see Table 10-3 for audit tolerances)

ED_001261_00026270

a detectable (significant) concentration gradient in the vicinity of FCPP, and was not included in the modeling. Its impact is accounted for in the monitored background.

ED_001261_00026270

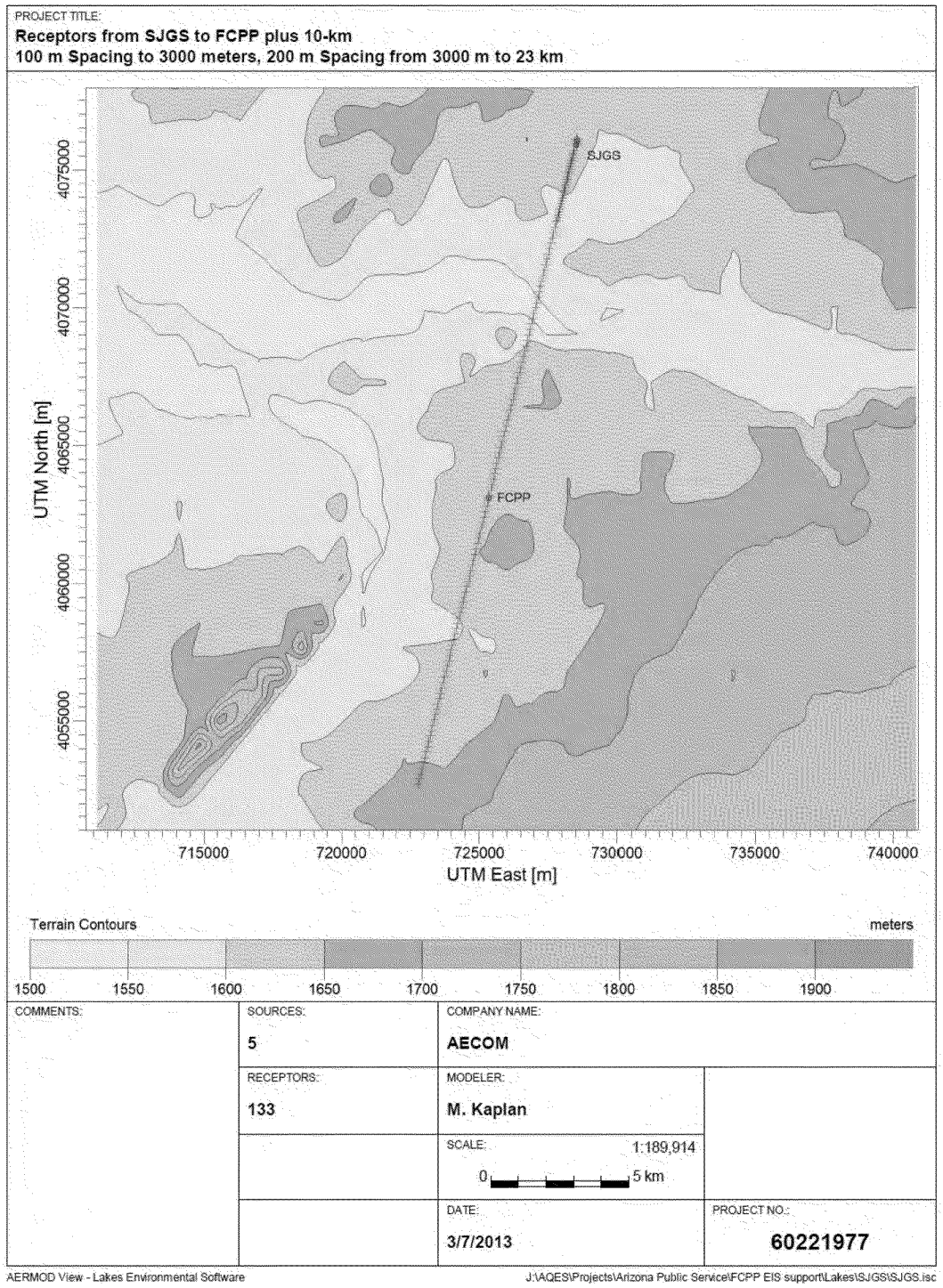

Figure E-1 SJGS Unit Emission Modeling Set Up

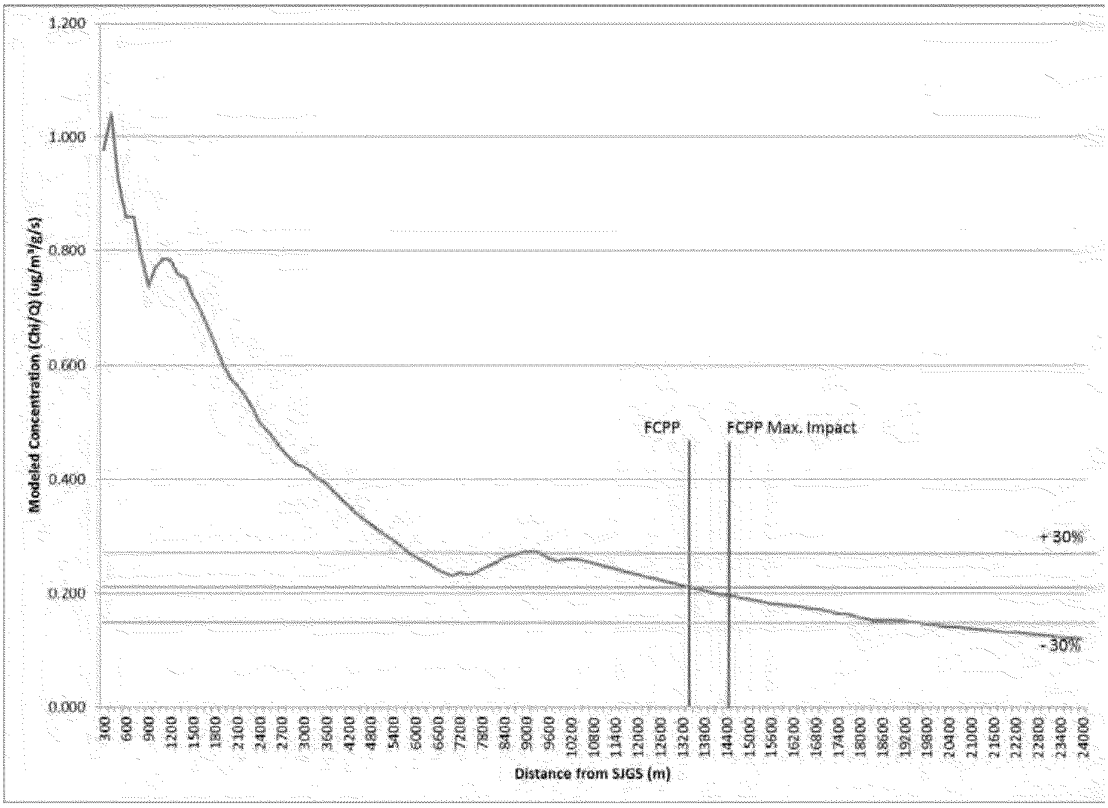

Figure E-2 SJGS Unit Emission Rate Modeled Impacts

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Appendix F

Modeling Archive

(Provided on DVD under separate cover.)

ED_001261_00026270

To: Raju Bisht[rbisht@navajo-nsn.gov]
Cc: Michael Z. King[mzking@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]; prashanth subburam[subburamp1@gmail.com]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]
From: Bohning, Scott
Sent: Mon 9/19/2016 3:03:25 PM
Subject: RE: FCPP SO2 modeling files

(I found this in my "out box" from last week, not sure if it got sent... my apologies if this is a duplicate - sb)

Raju -

FYI, Jeanne Geselbracht and I have seen modeling reports for the EIS for NGS, including in June, but no actual modeling input files.

Bruce Macdonald of SLR consulting, which is working on the EIS, had provided us a link to a temporary AECOM web site with the modeling reports; one report was some written by Ramboll ENVIRON, and a later one by McVehil-Monnett Associates.

- Scott B.

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, September 15, 2016 2:37 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; prashanth subburam <subburamp1@gmail.com>; eugeniaquintana@navajo-nsn.gov
Subject: RE: FCPP SO2 modeling files

Hi Scott,

I have been in touch with NGS regarding this. They are also interested in what needs to be done on top of what has been done for the EIS study. They say that Jeanne Geselbracht at Region 9 is their point of contact for the EIS and would have access to

the study. I believe they used their PTE calculations for the EIS modeling study. The EIS is scheduled to be public noticed in about a month. They are more than happy to provide you access to additional files on top of what is already with Region 9, as a cooperating agency for EIS, after they are public noticed.

Thanks. Raju

From: Bohning, Scott <Bohning.Scott@epa.gov>
Sent: Thursday, September 15, 2016 2:44 PM
To: Raju Bisht
Cc: Michael Z. King; Tennille B. Begay; prashanth subburam; Eugenia Quintana; Samani, Olga
Subject: RE: FCPP SO2 modeling files

Raju -

I apologize for the delay in pursuing this call. Could your folks be available for a call next week, Tuesday or Thursday afternoon (9/20 or 9/22)?

Also could you pass this along to your APS contacts to check on their availability?

Although our latest emails have been about FCPP, we are also interested in NGS. We check in to make sure we're all in agreement about status and who is doing what for the SO2 Data Requirement Rule modeling for both sources. (if needed we could do more than one call)

At our end we would have at least myself and our SO2 planning lead Krishna Viswanathan, and hopefully Colleen McKaughan as well.

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Monday, September 12, 2016 8:02 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Michael Z. King <mzking@navajo-nsn.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; prashanth subburam <subburamp1@gmail.com>; eugeniaquintana@navajo-nsn.gov
Subject: RE: FCPP SO2 modeling files

Scott,

Let us know when you want the call to happen and we can reach out to APS or provide you with their contact info to set this up. Since none of us here at NNEPA or APS have extensive knowledge of modeling, I would prefer to have the folks at AECOM that did the work on the call as well so that we don't miss anything that you are requiring us to do moving forward if it is fine with you.

Thanks. Raju

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Sunday, September 11, 2016 8:40 PM
To: Samani, Olga <Olga.samani@aecom.com>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>
Cc: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Subject: FCPP SO2 modeling files

Olga -

Thanks for your reply & for the files. I guess I have missed something here. The link to these files was originally sent to me in late July, and that was just after communication with Navajo Nation about how we were thinking SO2 DRR modeling could mainly follow EIS work, so I assumed the modeling files were from the EIS.

But looking back at a 7/20 email from Raju (see thread below), I see "I know APS has carried out some modeling using the 2012-2014 emissions and have agreed to share that with us. I will share that with you once I hear from them." so I guess these files are what that email referred to, and is new work relevant to the SO2 DRR.

It seems like EPA will have to have a call soon with Navajo Nation (& APS) so we're all clear on the status and what needs to happen next.

- Scott B.

To: Bates, Rita, NMENV[Rita.Bates@state.nm.us]
From: Bohning, Scott
Sent: Fri 9/16/2016 4:34:25 PM
Subject: RE: Four Corners Power Plant SO2 Modeling

Rita -

An additional piece of information for you. It turns out the modeling files I sent you were NOT for the EIS. Rather, APS hired AECOM to do new modeling consistent with requirements of the SO2 DRR. (I misunderstand message from NNEPA, though I had wondered about the recent file dates!) AECOM produced these modeling files, but was not hired to produce a report about the effort.

We have a call with Navajo Nation & APS next week to clarify what next steps are needed and who is doing what.

- Scott B.

From: Bohning, Scott
Sent: Thursday, September 08, 2016 2:13 PM
To: 'Bates, Rita, NMENV' <Rita.Bates@state.nm.us>
Subject: RE: Four Corners Power Plant SO2 Modeling

Rita -

AECOM made their modeling files available; I have not looked at them yet. I have attached the ones you may find of most interest, including Readme, 2013-2015 emissions spreadsheet, AERMOD input with stack parameters (units 4&5 only), and AERMOD receptors (.ROU). If you want the full zip file, I could forward you the AECOM download link.

Attached (7 MB): FCPP 1-hr SO2 Modeling Archive July 2016 excerpt.zi

(rename attached .zi Zip file to have ".zip" extension, and change .zix to ".zipx" - our e-mail system strips all incoming and outgoing ".zip" and ".jpg" files on the dubious grounds that they may contain a virus!)

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Bates, Rita, NMENV [mailto:Rita.Bates@state.nm.us]
Sent: Thursday, September 08, 2016 6:56 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Subject: RE: Four Corners Power Plant SO2 Modeling

Hi Scott,

Thanks for the quick response. As you probably know, our modeling is due in January. We are trying to finalize this by the end of November based on staff leave schedules.

Rita

Rita Bates

Planning Section Chief

Air Quality Bureau – New Mexico Environment Department

525 Camino de los Marquez, Suite 1

Santa Fe, New Mexico 87505

Phone: 505-476-4304

Fax: 505-476-4375

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Wednesday, September 07, 2016 9:45 PM
To: Bates, Rita, NMENV <Rita.Bates@state.nm.us>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Subject: Re: Four Corners Power Plant SO2 Modeling

Rita -

Colleen forwarded this to me... I would be the contact person for this. But I do not have anything I can send you immediately.

FYI, when I spoke to Region 6 about this a few weeks ago (Erik was not on the line), we had thought that the two power plants, San Juan and Four Corners, might not need to include each other (though no harm in doing so). For a recent EIS, a contractor for Four Corners did a "Significant Concentration Gradient" (SCG) analysis showing SJGS was far enough away not to include. I still need to look at that again, and compare to some recent SCG analyses done in other EPA Regional Offices.

We're still a little on clear on whether Navajo Nation is going to undertake the modeling, or possibly the source itself. We had thought to base the modeling on that done for an EIS a few years ago, just replacing the emissions to fit the SO2 DRR. AECOM sent Navajo Nation a link

to their SO2 AERMOD modeling archive, but that link has now expired; I will try to get that so that we can see what stack parameters were used. I will let you know when I have that.

Meanwhile, we have a question in to our headquarters about the calculation of Potential To Emit (PTE) for this source, given that the SO2 limit is a percent reduction rather than a mass rate, and also on whether the shutdown of some units counts as a "limit" within the meaning of the DRR. I need to re-ask since answer has not been forthcoming.

On actual emissions, you may as well get from CAMD, I have not done so pending resolution of the other issues. Not clear to us whether actuals or 2017 PTE would be lower.

Sorry we're a bit in disarray on this. I will plan on keeping you in the loop in what I find out.

APS retired FCPP Units 1, 2, and 3 on January 2, 2014 to comply with EPA FIP for Regional Haze

existing FIP SO2 requirements:

40 CFR 49.5512 Federal Implementation Plan Provisions for Four Corners Power Plant, Navajo Nation.

http://www.ecfr.gov/cgi-bin/text-idx?SID=a4c6710e155239c6a60b1f4c33a273cb&mc=true&node=se40.1.49_15512&rgn=div8

(d) Emissions Standards and Control Measures—(1) Sulfur Dioxide. No owner or operator shall discharge or cause the discharge of sulfur dioxide (SO2) into the atmosphere in excess of:

(i) 12.0 percent of the potential combustion concentration assuming all of the sulfur in the coal is

converted to SO_2. This percent emitted is determined by a daily calculation of the plant-wide heat-input weighted annual average.

(ii) 17,900 pounds of total SO_2 emissions per hour averaged over any consecutive three (3) hour period, determined on a plant-wide basis.

From 2013 presentation on proposed modeling for PSD permit (for installation of SCR to meet EPA Regional Haze FIP). May have changed, will check against the actual modeling files when I get them.

Point Sources	**X (m)**	**Y (m)**	**Base El. (m)**	**$PM_{2.5}$ emissions (g/s)**	**Stack Ht. (m)**	**Stack Temp. (K)**	**Velocity (m/s)**	**Diamete (m)**
STACK4&5	725350	4063099	1629.3	6.6	115.8	327	20.60	12.28
AUXBOIL	724946	4063358	1624.6	0.28	57.9	422	15.24	1.92
DSI_SILO	725120	4063303	1624.6	0.011	24.4	Ambient	Horizontal	0.24
UREASILO	725378	4062982	1635.9	0.027	9.1	Ambient	16.26	0.39

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Bates, Rita, NMENV [mailto:Rita.Bates@state.nm.us]
Sent: Wednesday, September 07, 2016 2:10 PM
To: McKaughan, Colleen <McKaughan.Colleen@epa.gov>
Subject: Four Corners Power Plant SO2 Modeling

Hi Colleen,

We received comments from Region 6 regarding our modeling protocol for the SO2 modeling for San Juan Generating Station. Erik Snyder's comment was:

The Four Corners Electric Generating station will also be undergoing DRR attainment modeling. We recommend contacting Region 9 to obtain the hourly emission rate or download actual data from CAMD, if available, the stack parameters to be used for their modeling. This will increase the realism of the simulation for San Juan and make sure that the two proximate sources are treated in a consistent way. If there are any reductions that are enforceable and in place before 2017, those could be potentially modeled but may require updated stack parameters.

Are you able to point us to the EPA Region 9 contact person to obtain this information?

Thanks for your help!

Rita

Rita Bates

Planning Section Chief

Air Quality Bureau – New Mexico Environment Department

525 Camino de los Marquez, Suite 1

Santa Fe, New Mexico 87505

Phone: 505-476-4304

Fax: 505-476-4375

To: Bohning, Scott[Bohning.Scott@epa.gov]
Cc: Michael Z. King[mzking@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]; prashanth subburam[subburamp1@gmail.com]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]
From: Raju Bisht
Sent: Thur 9/15/2016 9:04:24 PM
Subject: Re: FCPP SO2 modeling files

Hi Scott,

That is fine. Tuesday does not work for some of us here. We are fine with Thursday. I will pass on this information to APS. Since you have cc'd Olga on this, I am assuming that you are fine with AECOM being on the call.

Thanks. Raju

Sent from my Verizon Wireless 4G LTE DROID

"Bohning, Scott" <Bohning.Scott@epa.gov> wrote:

Raju -

I apologize for the delay in pursuing this call. Could your folks be available for a call next week, Tuesday or Thursday afternoon (9/20 or 9/22)?

Also could you pass this along to your APS contacts to check on their availability?

Although our latest emails have been about FCPP, we are also interested in NGS. We check in to make sure we're all in agreement about status and who is doing what for the SO2 Data Requirement Rule modeling for both sources. (if needed we could do more than one call)

At our end we would have at least myself and our SO2 planning lead Krishna Viswanathan, and hopefully Colleen McKaughan as well.

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Monday, September 12, 2016 8:02 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Michael Z. King <mzking@navajo-nsn.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; prashanth subburam <subburamp1@gmail.com>; eugeniaquintana@navajo-nsn.gov
Subject: RE: FCPP SO2 modeling files

Scott,

Let us know when you want the call to happen and we can reach out to APS or provide you with their contact info to set this up. Since none of us here at NNEPA or APS have extensive knowledge of modeling, I would prefer to have the folks at AECOM that did the work on the call as well so that we don't miss anything that you are requiring us to do moving forward if it is fine with you.

Thanks. Raju

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Sunday, September 11, 2016 8:40 PM
To: Samani, Olga <Olga.samani@aecom.com>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>
Cc: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Subject: FCPP SO2 modeling files

Olga -

Thanks for your reply & for the files. I guess I have missed something here. The link to these files was originally sent to me in late July, and that was just after communication with Navajo Nation about how we were thinking SO2 DRR modeling could mainly follow EIS work, so I assumed the modeling files were from the EIS.

But looking back at a 7/20 email from Raju (see thread below), I see "I know APS has carried out some modeling using the 2012-2014 emissions and have agreed to share that with us. I will share that with you once I hear from them." so I guess these files are what that email referred to, and is new work relevant to the SO2 DRR.

It seems like EPA will have to have a call soon with Navajo Nation (& APS) so we're all clear on the status and what needs to happen next.

- Scott B.

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From: Bohning, Scott
Sent: Thur 9/15/2016 8:44:08 PM
Subject: RE: FCPP SO2 modeling files

Raju -

I apologize for the delay in pursuing this call. Could your folks be available for a call next week, Tuesday or Thursday afternoon (9/20 or 9/22)?

Also could you pass this along to your APS contacts to check on their availability?

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- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Monday, September 12, 2016 8:02 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Michael Z. King <mzking@navajo-nsn.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; prashanth subburam <subburamp1@gmail.com>; eugeniaquintana@navajo-nsn.gov
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From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Sunday, September 11, 2016 8:40 PM
To: Samani, Olga <Olga.samani@aecom.com>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>
Cc: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Subject: FCPP SO2 modeling files

Olga -

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It seems like EPA will have to have a call soon with Navajo Nation (& APS) so we're all clear on the status and what needs to happen next.

- Scott B.

To: Samani, Olga[Olga.samani@aecom.com]; Raju Bisht[rbisht@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]
Cc: Viswanathan, Krishna[Viswanathan.Krishna@epa.gov]
From: Bohning, Scott
Sent: Mon 9/12/2016 2:40:04 AM
Subject: FCPP SO2 modeling files

Olga -

Thanks for your reply & for the files. I guess I have missed something here. The link to these files was originally sent to me in late July, and that was just after communication with Navajo Nation about how we were thinking SO2 DRR modeling could mainly follow EIS work, so I assumed the modeling files were from the EIS.

But looking back at a 7/20 email from Raju (see thread below), I see "I know APS has carried out some modeling using the 2012-2014 emissions and have agreed to share that with us. I will share that with you once I hear from them." so I guess these files are what that email referred to, and is new work relevant to the SO2 DRR.

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- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Samani, Olga [mailto:Olga.samani@aecom.com]
Sent: Friday, September 09, 2016 10:19 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>

Subject: RE: Notification: Olga Samani has sent you files

Scott,

No, the 1-hour SO2 DRR modeling was not based on the EIS we did in 2014. There were many updates since 2014, such as emissions, met years, fenceline. So the modeling files are not the same.

Olga Samani

Air Quality Specialist

Environment

Direct 978.905.2275

olga.samani@aecom.com

AECOM

250 Apollo Drive,

Chelmsford, MA 01824

Phone 978.905.2100

www.aecom.com

Please consider the environment before printing this e-mail

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Wednesday, July 20, 2016 3:51 PM
To: LIMAYE, VIJAY <Limaye.Vijay@epa.gov>
Cc: Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen

<McKaughan.Colleen@epa.gov>; eugeniaquintana@navajo-nsn.gov; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>; CHANG, RANDALL <Chang.Randall@epa.gov>
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hi Vijay,

I have little or practically no experience regarding modeling. Gaurav worked on developing those protocols and he and Mike were on the call on June 9th and 16th. Gaurav has since moved on and is no longer with NNEPA. I know APS has carried out some modeling using the 2012-2014 emissions and have agreed to share that with us. I will share that with you once I hear from them. Is it fine if I share the contents of your email with FCPP and NGS so that they have an idea as to what is required for the SO2 DRR and the difference as to what was done for EIS and what is now required. I would prefer setting up a call the first week of August if that is not a problem at your end.

Thanks. Raju

From: LIMAYE, VIJAY [mailto:Limaye.Vijay@epa.gov]
Sent: Tuesday, July 19, 2016 5:50 PM
To: Raju Bisht <rbisht@navajo-nsn.gov>
Cc: Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Eugenia Quintana <eugeniaquintana@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>; CHANG, RANDALL <Chang.Randall@epa.gov>
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hi Raju,

EPA Region 9 does have the modeling protocols for both FCPP and NGS, and we believe that most of the procedures followed would be appropriate for modeling performed for the SO2 DRR, though there would have to be some differences to address emissions and AERMOD model options.

The June 6th draft protocol sent by Gaurav Rajen covered many of the AERMOD inputs,

borrowing from the EIS protocol; either an updated version of the draft or an abbreviated version that just cited the EIS protocols would be suitable as the basis for a protocol. However, per our previous conversations (including conference calls on June 9th and June 16th), we believe that the emission scenarios used in the EIS protocols may not be appropriate for the SO2 DRR. Under the SO2 DRR, modeled emissions are required to be either actual emissions for recent years (e.g. 2012-2014, or 2013-2015), or else allowed emissions under federally enforceable limits in place and effective by January 13, 2017. The emissions to be modeled should be spelled out in protocol(s) for the two facilities.

In addition, for the EIS reports, the "adjusted u-star" beta option in AERMOD was used. At this time, until the Guideline on Air Quality Models ("GAQM", 40 CFR Part 51, Appendix W) is updated, the use of the adjusted u-star for modeling for permits or SIPs requires an alternative model demonstration under GAQM 3.2, which must be approved by the EPA Model Clearinghouse. It would be simpler not to go through that procedure, so we recommend that the protocol(s) for the two facilities reflect the standard AERMOD model. This could be revisited at a later date if necessary.

We would like to set up a call with you and your team for next week to discuss the emissions limits, to make sure that we are all on the same page--please let us know a good time to reach you.

Best,

Vijay

Vijay Limaye, Ph.D.

U.S. Environmental Protection Agency, Region 9

Air Planning Office (AIR-2)

75 Hawthorne St. San Francisco, CA 94105

Limaye.Vijay@epa.gov / 415.972.3086

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, July 14, 2016 10:03 AM
To: LIMAYE, VIJAY <Limaye.Vijay@epa.gov>

Cc: Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; Strauss, Alexis <Strauss.Alexis@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; eugeniaquintana@navajo-nsn.gov; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hello Vijay,

I would like to follow up on our effort to meet the DRR for NGS. The facility has informed us that Region 9 should have the protocol and the final report for the near field modeling conducted for the EIS. I believe Jeanne Geselbracht is the Region 9 contact for the EIS study. If you don't have access to these documents, please let us know and we will provide them to you. Would the protocol and the report done for the EIS be sufficient to make a determination for the SO2 DRR? If not, could you provide us with some guidance on what changes you would like to see be made before running the model again so that we could start having a dialogue with the facility and their consultants to see how they can help us with this moving forward.

Thanks. Raju

To: Bates, Rita, NMENV[Rita.Bates@state.nm.us]
From: Bohning, Scott
Sent: Thur 9/8/2016 9:24:28 PM
Subject: RE: Four Corners Power Plant SO2 Modeling
FCPP 1-hr SO2 Modeling Archive July 2016 excerpt.zi

Rita -

AECOM made their modeling files available; I have not looked at them yet. I have attached the ones you may find of most interest, including Readme, 2013-2015 emissions spreadsheet, AERMOD input with stack parameters (units 4&5 only), and AERMOD receptors (.ROU). If you want the full zip file, I could forward you the AECOM download link.

Attached (7 MB): FCPP 1-hr SO2 Modeling Archive July 2016 excerpt.zi

(rename attached .zi Zip file to have ".zip" extension, and change .zix to ".zipx" - our e-mail system strips all incoming and outgoing ".zip" and ".jpg" files on the dubious grounds that they may contain a virus!)

- Scott B.

--

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=

"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Bates, Rita, NMENV [mailto:Rita.Bates@state.nm.us]
Sent: Thursday, September 08, 2016 6:56 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>

Subject: RE: Four Corners Power Plant SO2 Modeling

Hi Scott,

Thanks for the quick response. As you probably know, our modeling is due in January. We are trying to finalize this by the end of November based on staff leave schedules.

Rita

Rita Bates

Planning Section Chief

Air Quality Bureau – New Mexico Environment Department

525 Camino de los Marquez, Suite 1

Santa Fe, New Mexico 87505

Phone: 505-476-4304

Fax: 505-476-4375

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Wednesday, September 07, 2016 9:45 PM
To: Bates, Rita, NMENV <Rita.Bates@state.nm.us>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>
Subject: Re: Four Corners Power Plant SO2 Modeling

Rita -

Colleen forwarded this to me... I would be the contact person for this. But I do not have anything I can send you immediately.

FYI, when I spoke to Region 6 about this a few weeks ago (Erik was not on the line), we had thought that the two power plants, San Juan and Four Corners, might not need to include each other (though no harm in doing so). For a recent EIS, a contractor for Four Corners did a "Significant Concentration Gradient" (SCG) analysis showing SJGS was far enough away not to include. I still need to look at that again, and compare to some recent SCG analyses done in other EPA Regional Offices.

We're still a little on clear on whether Navajo Nation is going to undertake the modeling, or possibly the source itself. We had thought to base the modeling on that done for an EIS a few years ago, just replacing the emissions to fit the SO2 DRR. AECOM sent Navajo Nation a link to their SO2 AERMOD modeling archive, but that link has now expired; I will try to get that so that we can see what stack parameters were used. I will let you know when I have that.

Meanwhile, we have a question in to our headquarters about the calculation of Potential To Emit (PTE) for this source, given that the SO2 limit is a percent reduction rather than a mass rate, and also on whether the shutdown of some units counts as a "limit" within the meaning of the DRR. I need to re-ask since answer has not been forthcoming.

On actual emissions, you may as well get from CAMD, I have not done so pending resolution of the other issues. Not clear to us whether actuals or 2017 PTE would be lower.

Sorry we're a bit in disarray on this. I will plan on keeping you in the loop in what I find out.

APS retired FCPP Units 1, 2, and 3 on January 2, 2014 to comply with EPA FIP for Regional Haze

existing FIP SO2 requirements:

40 CFR 49.5512 Federal Implementation Plan Provisions for Four Corners Power Plant, Navajo Nation.

http://www.ecfr.gov/cgi-bin/text-idx?SID=a4c6710e155239c6a60b1f4c33a273cb&mc=true&node=se40.1.49_15512&rgn=div8

(d) Emissions Standards and Control Measures—(1) Sulfur Dioxide. No owner or operator shall discharge or cause the discharge of sulfur dioxide (SO2) into the atmosphere in excess of:

(i) 12.0 percent of the potential combustion concentration assuming all of the sulfur in the coal is converted to SO2. This percent emitted is determined by a daily calculation of the plant-wide heat-input weighted annual average.

(ii) 17,900 pounds of total SO2 emissions per hour averaged over any consecutive three (3) hour period, determined on a plant-wide basis.

From 2013 presentation on proposed modeling for PSD permit (for installation of SCR to meet EPA Regional Haze FIP). May have changed, will check against the actual modeling files when I get them.

Point Sources	**X (m)**	**Y (m)**	**Base El. (m)**	**$PM_{2.5}$ emissions (g/s)**	**Stack Ht. (m)**	**Stack Temp. (K)**	**Velocity (m/s)**	**Diamete (m)**
STACK4&5	725350	4063099	1629.3	6.6	115.8	327	20.60	12.28
AUXBOIL	724946	4063358	1624.6	0.28	57.9	422	15.24	1.92
DSI_SILO	725120	4063303	1624.6	0.011	24.4	Ambient	Horizontal	0.24
UREASILO	725378	4062982	1635.9	0.027	9.1	Ambient	16.26	0.39

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Bates, Rita, NMENV [mailto:Rita.Bates@state.nm.us]
Sent: Wednesday, September 07, 2016 2:10 PM
To: McKaughan, Colleen <McKaughan.Colleen@epa.gov>
Subject: Four Corners Power Plant SO2 Modeling

Hi Colleen,

We received comments from Region 6 regarding our modeling protocol for the SO2 modeling for San Juan Generating Station. Erik Snyder's comment was:

The Four Corners Electric Generating station will also be undergoing DRR attainment modeling. We recommend contacting Region 9 to obtain the hourly emission rate or download actual data from CAMD, if available, the stack parameters to be used for their modeling. This will increase the realism of the simulation for San Juan and make sure that the two proximate sources are treated in a consistent way. If there are any reductions that are enforceable and in place before 2017, those could be potentially modeled but may require updated stack parameters.

Are you able to point us to the EPA Region 9 contact person to obtain this information?

Thanks for your help!

Rita

Rita Bates

Planning Section Chief

Air Quality Bureau – New Mexico Environment Department

525 Camino de los Marquez, Suite 1

Santa Fe, New Mexico 87505

Phone: 505-476-4304

Fax: 505-476-4375

```
**
**
****************************************
** AERMOD Control Pathway
****************************************
**
**
CO STARTING
   TITLEONE Arizona Public Service FCPP 1-hr SO2 DDR
   TITLETWO 2012-2014 Actual Emissions
   MODELOPT DFAULT CONC
   AVERTIME 1
   POLLUTID SO2
   RUNORNOT RUN
CO FINISHED
**
****************************************
** AERMOD Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION STACK4&5     POINT      725349.500  4063098.500     1632.060

** Source Parameters **
** Units 1-2-3 shut down end of 2013, no emissions in 2014
   SRCPARAM STACK4&5          0.0   115.824    325.93   19.21   12.28

   HOUREMIS ..\..\FCPP_Stack4&5_2012-2014.prn STACK4&5

** Building Downwash **
   BUILDHGT STACK4&5   37.49   37.49   24.38   24.38    0.00   37.49
   BUILDHGT STACK4&5   37.49   37.49   37.49   37.49   37.49   67.97
   BUILDHGT STACK4&5   67.97   37.49   37.49   37.49   37.49   37.49
   BUILDHGT STACK4&5   37.49   37.49    0.00    0.00    0.00   37.49
   BUILDHGT STACK4&5   37.49   37.49   37.49   37.49   37.49   37.49
   BUILDHGT STACK4&5   37.49   37.49   37.49   37.49   37.49   37.49
   BUILDWID STACK4&5   89.80   90.83   32.86   27.29    0.00   88.43
   BUILDWID STACK4&5   90.70   90.22   86.99   81.12   72.79   65.56
   BUILDWID STACK4&5   51.85   47.13   59.90   70.85   79.65   86.03
   BUILDWID STACK4&5   89.80   90.83    0.00    0.00    0.00   88.43
   BUILDWID STACK4&5   90.70   90.22   86.99   81.12   72.79   62.24
   BUILDWID STACK4&5   49.80   47.13   59.90   70.85   79.65   86.03
   BUILDLEN STACK4&5   81.12   72.79   55.38   57.62    0.00   59.90
   BUILDLEN STACK4&5   70.85   79.65   86.03   89.80   90.83   98.03
   BUILDLEN STACK4&5   96.09   83.47   88.43   90.70   90.22   86.99
   BUILDLEN STACK4&5   81.12   72.79    0.00    0.00    0.00   59.90
   BUILDLEN STACK4&5   70.85   79.65   86.03   89.80   90.83   89.11
   BUILDLEN STACK4&5   84.68   83.47   88.43   90.70   90.22   86.99
   XBADJ    STACK4&5   -6.72  -12.99 -174.68 -176.74    0.00  -51.97
   XBADJ    STACK4&5  -68.00  -81.95  -93.42 -102.05 -107.58 -423.96
   XBADJ    STACK4&5 -421.03 -107.27 -106.88 -103.24  -96.46  -86.75
   XBADJ    STACK4&5  -74.41  -59.80    0.00    0.00    0.00   -7.93
   XBADJ    STACK4&5   -2.85    2.30    7.39   12.25   16.74   20.72
```

```
  XBADJ    STACK4&5   24.08   23.80   18.45   12.54    6.24   -0.24
  YBADJ    STACK4&5   57.15   62.16   18.26   -7.54    0.00   62.66
  YBADJ    STACK4&5   57.89   51.35   43.25   33.85   23.41   21.54
  YBADJ    STACK4&5  -43.90  -10.81  -22.02  -32.57  -42.13  -50.40
  YBADJ    STACK4&5  -57.15  -62.16    0.00    0.00    0.00  -62.66
  YBADJ    STACK4&5  -57.89  -51.35  -43.25  -33.85  -23.41  -12.26
  YBADJ    STACK4&5   -0.74   10.81   22.02   32.57   42.13   50.40


**2012-2014 Farmington Shiprock, NM
  BACKGRND SEASHR  2.62  1.75  1.75  3.49  0.87  2.62  2.62  1.75  1.75  11.35 14.85 22.71 27.07
27.07 27.95 14.85 13.97 9.61  10.48 6.99  5.24  4.37  3.49  2.62
  BACKGRND SEASHR  2.62  2.62  5.24  3.49  1.75  3.49  5.24  11.35 12.23 23.58 15.72 9.61  7.86
6.99  5.24  4.37  4.37  5.24  2.62  3.49  2.62  2.62  3.49  1.75
  BACKGRND SEASHR  6.11  3.49  5.24  5.24  5.24  1.75  9.61  31.44 23.58 22.71 18.34 7.86  6.99
5.24  4.37  4.37  4.37  6.11  11.35 17.47 14.85 12.23 15.72 9.61
  BACKGRND SEASHR  2.62  1.75  1.75  2.62  2.62  0.87  0.87  0.87  5.24  11.35 25.33 20.09 15.72
11.35 9.61  14.85 6.99  6.99  6.99  5.24  3.49  2.62  2.62  4.37

  BACKUNIT UG/M3

  SRCGROUP BKGRD BACKGROUND
  SRCGROUP STACK4&5 STACK4&5
  SRCGROUP ALL BACKGROUND
SO FINISHED
**
****************************************
** AERMOD Receptor Pathway
****************************************
**
**
RE STARTING
  INCLUDED ..\..\FCPP_with_Hogback_Ridge.ROU
RE FINISHED
**
****************************************
** AERMOD Meteorology Pathway
****************************************
**
**
ME STARTING
**Navajo Met Tower I at 10.4 meters, cloud cover from Farmington
  SURFFILE ..\..\..\AERMET\default\METI_12-14.SFC
  PROFFILE ..\..\..\AERMET\default\METI_12-14.PFL
  SURFDATA 23090  2012 Farmington
  UAIRDATA 23050  2012 Albuquerque
  SITEDATA 99999 2012
  PROFBASE 1656.6 METERS
ME FINISHED
**
****************************************
** AERMOD Output Pathway
****************************************
**
**
OU STARTING
```

```
   RECTABLE ALLAVE 4
   MAXTABLE ALLAVE 50
   PLOTFILE 1 ALL 4 FCPP_1hr_SO2_Default.PLT
OU FINISHED

**
****************************************
** AERMOD Output Pathway
****************************************
**
**
OU STARTING
   RECTABLE 1 4TH
OU FINISHED
**
****************************************
** Project Parameters
****************************************
** PROJCTN  CoordinateSystemUTM
** DESCPTN  UTM: Universal Transverse Mercator
** DATUM    North American Datum 1983
** DTMRGN   CONUS
** UNITS    m
** ZONE     12
** ZONEINX  0
**
```

To: Raju Bisht[rbisht@navajo-nsn.gov]; Samani, Olga[Olga.samani@aecom.com]
From: Bohning, Scott
Sent: Thur 9/8/2016 3:29:57 AM
Subject: RE: Notification: Olga Samani has sent you files

Raju & Olga -

My apologies, I neglected to download this! Any chance it could be made available again?

- Scott B.

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, July 21, 2016 2:10 PM
To: LIMAYE, VIJAY <Limaye.Vijay@epa.gov>
Cc: Bohning, Scott <Bohning.Scott@epa.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov
Subject: FW: Notification: Olga Samani has sent you files

Hi Vijay,

Please see below the that AECOM has provided to the FCPP modeling archive using the data for 2012-2014.. It says the files are available for download only until 7/28/2016. I wanted to share this with you as we keep our conversation on this subject ongoing.

Thanks. Raju

From: Olga.samani@aecom.com [mailto:Olga.samani@aecom.com]
Sent: Thursday, July 21, 2016 10:48 AM
To: Raju Bisht <rbisht@navajo-nsn.gov>
Subject: Notification: Olga Samani has sent you files

Olga Samani has sent you 1 file using AECOM's File Transfer System.

Olga Samani says:

Raju,

I am providing you a link to the Four Corners Power Plant 1-hour SO2 AERMOD modeling archive. It includes a read me file. If you have any questions, do not hesitate to contact me directly.

Olga

Olga Samani
Air Quality Specialist
Environment
Direct 978.905.2275
olga.samani@aecom.com

AECOM
250 Apollo Drive,
Chelmsford, MA 01824
Phone 978.905.2100
www.aecom.com

This file will be available for download until 7/28/2016

File	Description	Size
FCPP 1-hr SO2 Modeling Archive July 2016.zip	modeling archive	31,728KB

Download all files (.zip)

If you are having trouble accessing the links in this email, you can view this message as a web page by copying the following link and pasting it into your browser:

Ex. 6 - Personal Privacy

If you have any questions, please contact your project manager.

To: Bohning, Scott[Bohning.Scott@epa.gov]; kyle.heckel@srpnet.com[kyle.heckel@srpnet.com]
From: Raju Bisht
Sent: Wed 11/16/2016 4:00:51 PM
Subject: RE: Resending: NGS 1-hour SO2 modeling Files

Thank you Kyle. You are right Scott, this is indeed a great help for us here at NNEPA. We appreciate all the help from you folks.

Raju

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Wednesday, November 16, 2016 8:46 AM
To: kyle.heckel@srpnet.com
Cc: Raju Bisht <rbisht@navajo-nsn.gov>
Subject: RE: Resending: NGS 1-hour SO2 modeling Files

Kyle -

Thank you, I was able to download and open all the files, looks very thorough.

Thanks also to you and SRP and Environ for making the effort to put this together, I appreciate it. This is a help to Navajo EPA as well.

As I mentioned, my main intention is just to check against description of the modeling as laid out in the EIS. I am pursuing HQ approval of the ADJ_U* beta option in AERMOD, just in case our proposed "Guideline on Air Quality Models" ("Appendix W") does not get finalized in time. (If I have time may also rerun with latest version of AERMOD, but likely using just a subset of all the receptors in the various zones.)

It is possible I will have some questions, but at this point, I think we have everything we need. Thanks again.

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: kyle.heckel@srpnet.com [mailto:kyle.heckel@srpnet.com]
Sent: Wednesday, November 16, 2016 6:52 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: rbisht@navajo-nsn.gov
Subject: Resending: NGS 1-hour SO2 modeling Files

You have received 3 secure files from kyle.heckel@srpnet.com.

Use the secure links below to download.

Scott,

Enclosed are links where you can download the compiled modeling files and readme files for the NGS EIS 1-hour SO2 modeling. If you have any trouble accessing the files, please let me know.

Thanks,

Kyle

Secure File Downloads:

Available until: **30 November 2016**

Click links to download:

SRP NGS EIS SO2 Modeling Archive Readme.docx

100.64 KB

SRP NGS EIS SO2 modeling archive listing.docx

77.75 KB

so2_request_10-28-2016.zip

130.60 MB

You have received attachment link(s) within this email sent via SRP Secure File Transfer. To retrieve the attachment(s), please click on the link(s).

Secured by Accellion

To: Bohning, Scott[Bohning.Scott@epa.gov]
Cc: rbisht@navajo-nsn.gov[rbisht@navajo-nsn.gov]
From: Heckel Kyle C
Sent: Wed 11/16/2016 3:51:28 PM
Subject: RE: Resending: NGS 1-hour SO2 modeling Files

Happy to help. If any questions do come up, please let me know.

Kyle

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Wednesday, November 16, 2016 8:46 AM
To: Heckel Kyle C <Kyle.Heckel@srpnet.com>
Cc: rbisht@navajo-nsn.gov
Subject: RE: Resending: NGS 1-hour SO2 modeling Files

***SRP EXTERNAL EMAIL WARNING: WERE YOU EXPECTING THIS? IS IT CREDIBLE? IF NOT- REPORT IT! ***

Kyle -

Thank you, I was able to download and open all the files, looks very thorough.

Thanks also to you and SRP and Environ for making the effort to put this together, I appreciate it. This is a help to Navajo EPA as well.

As I mentioned, my main intention is just to check against description of the modeling as laid out in the EIS. I am pursuing HQ approval of the ADJ_U* beta option in AERMOD, just in case our proposed "Guideline on Air Quality Models" ("Appendix W") does not get finalized in time. (If I have time may also rerun with latest version of AERMOD, but likely using just a subset of all the receptors in the various zones.)

It is possible I will have some questions, but at this point, I think we have everything we need. Thanks again.

- Scott B.

--

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=

"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: kyle.heckel@srpnet.com [mailto:kyle.heckel@srpnet.com]
Sent: Wednesday, November 16, 2016 6:52 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: rbisht@navajo-nsn.gov
Subject: Resending: NGS 1-hour SO2 modeling Files

You have received 3 secure files from kyle.heckel@srpnet.com.

Use the secure links below to download.

Scott,

Enclosed are links where you can download the compiled modeling files and readme files for the NGS EIS 1-hour SO2 modeling. If you have any trouble accessing the files, please let me know.

Thanks,

Kyle

Secure File Downloads:

Available until: **30 November 2016**

Click links to download:

SRP NGS EIS SO2 Modeling Archive Readme.docx

100.64 KB

SRP NGS EIS SO2 modeling archive listing.docx

77.75 KB

so2_request_10-28-2016.zip

130.60 MB

You have received attachment link(s) within this email sent via SRP Secure File Transfer. To retrieve the attachment(s), please click on the link(s).

Secured by Accellion

To: Raju Bisht[rbisht@navajo-nsn.gov]
Cc: Heckel Kyle C[Kyle.Heckel@srpnet.com]; Viswanathan, Krishna[Viswanathan.Krishna@epa.gov]; Lee, Anita[Lee.Anita@epa.gov]; Michael Z. King[mzking@navajo-nsn.gov]; Prashanth Subburam[psubburam@navajo-nsn.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]
From: Bohning, Scott
Sent: Tue 10/25/2016 6:30:27 PM
Subject: RE: NGS_SO2_DRR_Modeling

Raju -

Thanks for your email, sounds like we are on the same page for the most part.

FYI, I mainly sent AECOM FCPP information as an example of information that it would be good to have so we can better document our action for the SO2 DRR (& also enable us to re-run it if needed)... did not intend it to be directions to anyone on how modeling needs to be done for NGS. I think relying as much as possible on the existing EIS work for NGS is still the way to go, and we are not asking SRP to do any new modeling.

Per previous discussions here in R9, we are OK with using the existing modeled meteorology years per the EIS, rather than redoing to the most recent years. There is flexibility under the SO2 modeling Technical Assistance Document ("TAD") on that, and also additional flexibility given that this is a tribal area. We don't see much benefit to redoing all the meteorological data processing. As for emission rate, one can use actual or allowable emissions, and since here the EIS modeling used the allowable 0.1 lb/MMbtu SO2 emission limit, that is OK, too.

The only problem I see at this point is that the EIS modeling used the AERMOD "ADJ_U*" beta option. That may get approved very soon in our final revisions to "Appendix W" (Guideline on Air Quality Models, 40 CFR 51 App. W), but is not guaranteed. So, the fall-back options are 1) get case-by-case approval via official Model Clearinghouse memo & documentation to EPA OAQPS, or 2) remodel with default, non-beta model options. I will pursue #1, but would like to be able to pursue #2 if needed -- that might actually be easier than #1 if I have the files used in the EIS modeling.

Kyle left me a voice message yesterday, and I spoke with him this morning (Tues. 10/25). I passed along some of the above to him, and he said he would speak with SRP's consultant about putting some modeling files and documentation together for all of us.

Sorry if I have not been clear on our thinking as things unfold... but it looks like we're actually in pretty good shape for both FCPP and NGS.

- Scott B.

P.S. FYI, I will be on leave mostly out of town starting Thurs. 10/27 - Fri. 11/4 (returning Mon 11/7)

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Monday, October 24, 2016 3:17 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Heckel Kyle C <Kyle.Heckel@srpnet.com>; Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov
Subject: RE: NGS_SO2_DRR_Modeling

Hi Scott,

I have cc'd Kyle on this email so that SRP is also clear as to what you are requiring them to do at this time. I was informed that for the NGS EIS modeling, the MET data used was for the years 2008 to 2012 I believe. The emissions used was the max permitted lb/MMBTU limits. So, if you believe that these data would be comparable to what would be required for the SO2 DRR requirements, they could probably work on providing you with what you are requesting for but would differ from what AECOM did for FCCP since the actual hourly emissions for the recent years was not used. I believe they are requesting clarification on if anything needs to be done differently for SO2 DRR than what has been done for the EIS study.

Please feel free to request any more information from Kyle. Kyle, please feel free to correct me if I have not interpreted what we talked about correctly.

Thank you. Raju

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Thursday, October 20, 2016 9:51 AM
To: Raju Bisht <rbisht@navajo-nsn.gov>
Cc: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>; Eugenia Quintana <eugeniaquintana@navajo-nsn.gov>
Subject: RE: NGS_SO2_DRR_Modeling

Raju -

Thanks for looking into this!

- Scott B.

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, October 20, 2016 7:50 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
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Scott,

The person coordinating these modeling studies at SRP will only be back at work on Monday. We won't know till next week what they have to say.

Thanks.

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Sent: Wednesday, October 19, 2016 5:32 PM
To: Raju Bisht <rbisht@navajo-nsn.gov>
Cc: Viswanathan, Krishna <Viswanathan.Krishna@epa.gov>; Lee, Anita <Lee.Anita@epa.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>; Eugenia Quintana <eugeniaquintana@navajo-nsn.gov>
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It would be nice to get something comparable to the attached for NGS.

Attached is a "readme" and listing of zipped modeling file archive that AECOM provided for Four Corners Power Plant. It includes the hourly emissions data, the original meteorological data used before it was processed, and also the inputs & outputs to terrain and meteorological data and building dimension (BPIP) processing steps.

- Scott B.

Attachments

FCPP Modeling Archive Readme.doc

FCPP_archive_listing.txt

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Wednesday, October 19, 2016 12:52 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>
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Subject: RE: NGS_SO2_DRR_Modeling

Hi Scott,

Please see if this works for you and let me know if there are any more specific files that you require. I will wait for your reply before I reach out to SRP.

Thanks. Raju

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Raju -

I guess Anita called you about the additional modeling files.... Thanks for these, and actually I think I just had the ".recs" and ".in" files.

By the way, the attachment "2008-2012_aermet.zip" was removed... - our e-mail system strips all incoming and outgoing ".zip" and ".jpg" files on the dubious grounds that they may contain a

virus. I'd appreciate if you'd resend that, but with renamed to have a different extension, like ".zi".

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From: Raju Bisht
Sent: Mon 10/24/2016 10:17:28 PM
Subject: RE: NGS_SO2_DRR_Modeling

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To: Raju Bisht[rbisht@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]
Cc: Prashanth Subburam[psubburam@navajo-nsn.gov]; Viswanathan, Krishna[Viswanathan.Krishna@epa.gov]
From: Bohning, Scott
Sent: Tue 9/27/2016 11:21:17 PM
Subject: RE: SO2 DRR Modeling for NGS

Raju / Mike -

Thanks for these files. I guess next step is to check these against documentation in the EIS itself... hopefully there are some notes about what all the individual sources in the input file are & on how their various parameters were derived, and the emission levels used. For SO2 DRR, supposed to use actual emissions or allowable emissions, not sure whether emission scenario used in the EIS matches what is needed for DRR. In general we'll have to think about what else might be needed, & how to proceed...

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Tuesday, September 27, 2016 3:11 PM
To: Michael Z. King <mzking@navajo-nsn.gov>
Cc: Bohning, Scott <Bohning.Scott@epa.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>
Subject: FW: SO2 DRR Modeling for NGS

Hi Mike,

Could you please coordinate with Kyle and Scott regarding these modeling studies.

Thanks. Raju

From: Heckel Kyle C [mailto:Kyle.Heckel@srpnet.com]
Sent: Tuesday, September 27, 2016 3:54 PM
To: Raju Bisht <rbisht@navajo-nsn.gov>
Cc: Michael Z. King <mzking@navajo-nsn.gov>; Eugenia Quintana <eugeniaquintana@navajo-nsn.gov>; Prashanth Subburam <psubburam@navajo-nsn.gov>; Ostapuk Paul M <Paul.Ostapuk@srpnet.com>
Subject: RE: SO2 DRR Modeling for NGS

Hi Raju,

Please find attached the following modeling input files for the NGS EIS. These are for the 1-hour SO2 NAAQS modeling for the 2020 B2 emissions scenario.

- so2.1hr.2008.st.in: AERMOD input file for 1-h SO2
- naaqs.recs: Receptor file referenced in the input file

Due to the very large number of receptors (19,629 receptors), to reduce runtime, our consultant (Ramboll Environ) split the receptor grid into 49 zones with approximately 400 receptors, each. They ran each zone separately and then re-combined results. The .in file provided here is the composite input file with all receptors.

Also referenced in the input file but not attached here are the meteorology (SFC and PFL) files for 2008-2012 and the BPIP building downwash files. Let me know if these are needed or if you have any questions on the attached files.

Thanks,

Kyle

To: Bohning, Scott[Bohning.Scott@epa.gov]
From: Raju Bisht
Sent: Thur 3/16/2017 4:55:08 PM
Subject: RE: latest NGS EIS copy?

;;;;
Ok , thanks! I will get working on this once I get back.

Raju

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Thursday, March 16, 2017 10:53 AM
To: Raju Bisht
Subject: RE: latest NGS EIS copy?

Raju -

Thanks for getting back to me. No, this is not a rush. I'm assuming there is little change from the non-public release version, just want to be sure we have a public version at some point if we need it for our docket. Mid-May is the earliest we might need it.

- Scott B.

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, March 16, 2017 9:25 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Michael Z. King <mzking@navajo-nsn.gov>
Subject: RE: latest NGS EIS copy?

Hi Scott,

Sorry for the late reply. Was caught up with other things. Mike is on leave. I am on travel all next week. So, you want see the copy of the "Near-Field Air Dispersion and Deposition Modeling Report for Navajo Generating Station National Environmental Policy Act Environmental Impact Statement and Endangered Species Act Compliance, Draft REPORT" that was actually released for the public? If that is what you are looking for, we will work on trying to get hold of that document. I hope there is no rush though as we might not be able to work on this till the end of the month.

Thanks. Raju

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Tuesday, March 14, 2017 3:59 PM
To: Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>
Subject: latest NGS EIS copy?

Raju & Michael -

Can you help me find latest version of near-field AERMOD modeling for the NGS EIS?

Your SO_2 modeling submittal for NGS referred to the "2015 Navajo Generating Station – Kayenta Mine Complex EIS study", and Appendix A referred to "**July 2016 Final Near-field AERMOD modeling**" report prepared for the DEIS (including Table 2-2 for stack parameters).

I do have a file "NGS Near-Field Air Modeling Draft Report Nov 7 2015.pdf" that has such a table, and has other useful information about the modeling, including some figures similar to your submittal, and seems to match the modeling files you provided. This document ii:

"Near-Field Air Dispersion and Deposition Modeling Report for Navajo Generating Station National Environmental Policy Act Environmental Impact Statement and Endangered Species Act Compliance, Draft REPORT", Ramboll Environ, November 2015

This was one of the files AECOM provided on a download web site back in the first part of 2016.

However, this document is marked "Draft for Planning and Discussion Purposes only – Not for Public Release", so if there is a later version, I would prefer we rely on that for the public record.

But I have not been able to find it searching the web. There is an EIS web site:

https://ngskmc-eis.net/documents/

which lists various files, including:

NGS Near Field Visibility Final Report -- not want we need

KMC_AQ TSD Modeling Report January 2016_Final -- report by McVehil-Monnett Associates, Inc., mainly concerns the mine and PM_{10}, not much on SO_2 modeling of NGS itself

The DEIS site

https://ngskmc-eis.net/draft-eis-files/

has

3.1_AirQuality.pdf

which has lots of stuff, looks like modeling from AECOM, but is not same as the modeling as for Navajo SO2 DRR.

Thanks for any assistance on this.

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

To: Brenda Harpring[bharprin@ndep.nv.gov]
Cc: Danilo Dragoni[ddragoni@ndep.nv.gov]; Adele Malone[amalone@ndep.nv.gov]; LIMAYE, VIJAY[Limaye.Vijay@epa.gov]
From: Bohning, Scott
Sent: Wed 6/1/2016 11:23:53 PM
Subject: RE: Draft Modeling Protocol for North Valmy Generating Station, NV for the 2010 SO2 NAAQS Designation

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,,,,,,,,,
Brenda -

Again, I apologize for not getting back to you sooner on the Valmy protocol.

I don't think we are issuing "official approvals" for SO2 DRR protocols, that just occurs with EPA action on the submittals, but nevertheless it is very helpful to get a chance to look them over in advance.

I think you folks have done a good job on the protocol for the North Valmy Generating Station, and my view is that it will form an adequate basis for modeling conducted for the SO2 Data Requirements Rule. There are just two issues for which I think some expanded documentation would be helpful in a final version.

The first concerns the meteorological data; three stations are mentioned, with the focus on station #1, so I assume that is the one actually being used. Its being the nearest is a good reason for selecting it over the other two, but the protocol does not discuss any process for choosing between them, e.g. on the basis for representativeness or data availability. So I think the station selection should be addressed with some text and any analyses that may have been undertaken.

The second issue is how nearby sources are handled. The protocol does not explicitly state whether any sources other than Valmy will be included in the modeling, though TS Power Plant, Barrick Goldstrike Mine, and Newmont Mining Corporation's Gold Quarry are mentioned. It would be most conservative to include them, due to the possible overlap of their impacts with that of Valmy. However, if you were planning on excluding them, I think they are small enough and far enough away that a good case can be made for that. The time-varying background concentrations were developed in a conservative way, and seem like they would serve the purpose of accounting for emission sources not explicitly included in the model. My recommendation would be to address this issue explicitly with some text in the protocol.

Thank you for the opportunity to comment on the protocol.

- Scott B.

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"Scott Bohning"

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Brenda Harpring [mailto:bharprin@ndep.nv.gov]
Sent: Thursday, May 26, 2016 3:38 PM
To: Bohning, Scott
Cc: Danilo Dragoni ; Adele Malone
Subject: RE: Draft Modeling Protocol for North Valmy Generating Station, NV for the 2010 SO2 NAAQS Designation

Hi Scott,

We are wondering how your review is coming along? Can you give us any indication if your comments will be extensive and will require a lot of effort on our part (or not)?

Thank you,

Brenda

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Tuesday, May 17, 2016 4:28 PM
To: Brenda Harpring
Cc: Danilo Dragoni; Adele Malone
Subject: RE: Draft Modeling Protocol for North Valmy Generating Station, NV for the 2010 SO2 NAAQS Designation

Brenda & others -

Just to let you know I have not forgotten this... but I am behind on a few things. I am hoping to finish this by the end of the week, but may extend a bit longer, sorry about that.

- Scott B.

From: Brenda Harpring [mailto:bharprin@ndep.nv.gov]
Sent: Friday, April 29, 2016 4:52 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: Danilo Dragoni <ddragoni@ndep.nv.gov>; Adele Malone <amalone@ndep.nv.gov>
Subject: Draft Modeling Protocol for North Valmy Generating Station, NV for the 2010 SO2 NAAQS Designation

Happy Friday Scott,

As promised here is the pre-DRAFT version of the Modeling Protocol for North Valmy Generating Station, NV.

Please let us know what you think and if you have any questions.

Thank you,

Brenda

Brenda Harpring

Planning and Modeling Branch
Bureau of Air Quality Planning
Nevada Division of Environmental Protection
901 South Stewart Street, Suite 4001
Carson City NV 89701
Phone: (775) 687-9498

Fax: (775) 687-6396

E-mail; bharprin@ndep.nv.gov

please consider the environment before printing this e-mail

To: Brenda Harpring[bharprin@ndep.nv.gov]; Bohning, Scott[Bohning.Scott@epa.gov]
Cc: Adele Malone[amalone@ndep.nv.gov]
From: Danilo Dragoni
Sent: Fri 4/22/2016 10:05:22 PM
Subject: RE: Nevada SO2 Valmy modeling

Hi Scott,

So it seems that my question at the WESTAR meeting had an expected ripple effect. It was not my intention, and I spoke with Colleen McKaughan right after, on the same day, and told her that we had been already in contact with you and clarified most of the points.

My question was intended to be more general (given the audience), and pointing out the fact that for the SO2 DRR modeling we should go through approval of the beta options, even though the new Appendix W may come out and make some of those options regulatory the day after we submitted the modeling protocol. Also, while the deadline of July 1st is a firm deadline for the states to decide which route to take (modeling or monitoring), the modeling exercise will not be required until the end of 2016, i.e. very likely with the new Appendix W already ruling.

For Valmy, we are not currently planning to use any beta options, our preliminary tests show that we are ok even without it. But, the same tests show that we are overestimating the concentrations with the model. We know that because there are 3 SO2 monitors around the facility that can be used for testing the model results. Ideally, as we would like to get the best representation of the SO2 concentrations around the facility, we would like to have the model get close(r) to the monitor readings. This is not just for designation purpose, but also for public and stakeholders information.

It is very likely that we will provide such comparison with our modeling results and it is also likely that we may additionally run the model with some 'old' beta options (by then, regulatory) even though it won't be written in the modeling protocol (and hence we won't need formal approval). Clearly, we are planning to work together with Region 9 about this.

Hope this clarifies.

Have a great weekend

Danilo

****

Danilo Dragoni, PhD

Bureau Chief - Air Quality Planning

Nevada Division of Environmental Protection

901 S. Stewart Street, Suite 4001

Carson City, NV 89701

Phone (775) 687 9340

****

From: Brenda Harpring
Sent: Thursday, April 21, 2016 10:51 AM
To: 'Bohning, Scott'
Cc: Adele Malone; Danilo Dragoni
Subject: RE: Nevada SO2 Valmy modeling

Scott,

This reply will be in two parts. Danilo said he will reply to you re: the AERMOD adjusted u star beta option question (it was Danilo that brought the question up at the WESTAR meeting).

1) I plan to have the DRAFT version of Valmy's Modeling Protocol to you by the end of April, I guess that is next week. And that would mean mid-May request for you to complete the review. Thanks.

2) Re: the Valmy closure --- We included the most current Valmy closure information in a 3/25/2016 SIP submittal to Region (2008 O3 NAQAQS i-SIP, transport analysis supplement). Currently, it looks like the plan is to shut down both units at Valmy in 2025. NV Energy is planning an update in 2016 to a Life Span Analysis Process for Valmy Unit 1, so we'll see if the

2025 date changes in that update. We can let you know. (Thanks to Adele for this information)

Thanks and let me know if there are any other questions.

Brenda

please consider the environment before printing this e-mail

From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Wednesday, April 20, 2016 1:03 PM
To: Brenda Harpring
Subject: Nevada SO2 Valmy modeling

Brenda -

- I originally misread your email, I thought it was saying mid-May would be the target for me to *start* review, but it actually is saying that would be target for me to complete the review... is that correct? Either way is fine, I'm just trying to plan some things.

- I heard indirectly about WESTART meeting that someone from Nevada brought up AERMOD adjusted u star beta option (maybe that was you?), and also that Chet Wayland made it sound pretty easy to get EPA buy-in for that.... I think that is true, but per my 3/3 email to you, there is still Appendix W sec. 3.2.2 alternative model demonstration needed to feed into that buy-in, so maybe not quite as simple as impression he may have given. On a related note, we were cautioned today that it would be risky to just wait till amended App. W comes out (with adjusted

u start in it), since at this point no guarantee on the specifics of what it would contain.

- One other question for you... someone here had heard Valmy was going to close down... do you know the scoop on that, and how it might figure into the SO2 DRR/designations process?

Thanks..

- Scott B.

--

=+=

"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Bohning, Scott
Sent: Wednesday, April 13, 2016 2:22 PM
To: 'Brenda Harpring'
Subject: RE: Nevada

Brenda -

Yes, thanks, it would be good to get an initial draft, and I think my calendar then is open enough that I could give a quick turnaround.

- Scott B.

--

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Brenda Harpring [mailto:bharprin@ndep.nv.gov]
Sent: Wednesday, April 13, 2016 1:55 PM
To: Bohning, Scott
Subject: Nevada

Hi Scott,

I just wanted to give you a heads-up that we will be sending you a pre-DRAFT of Nevada's Modeling Protocol for the SO2 DRR modeling for Valmy in a couple of weeks / by the end of April.

Should I send it just to you? We are wondering if you might be able to take a quick read, and let us know if there is anything obvious missing or problematic? By "quick read" – could you get us your input within two weeks of receipt? (approx. May 13) Perhaps we could get in the queue?

Thanks so much,

Brenda

Brenda Harpring

Planning and Modeling Branch
Bureau of Air Quality Planning
Nevada Division of Environmental Protection
901 South Stewart Street, Suite 4001
Carson City NV 89701
Phone: (775) 687-9498

Fax: (775) 687-6396

E-mail; bharprin@ndep.nv.gov

please consider the environment before printing this e-mail

To: Bohning, Scott[Bohning.Scott@epa.gov]
Cc: Adele Malone[amalone@ndep.nv.gov]; Danilo Dragoni[ddragoni@ndep.nv.gov]
From: Brenda Harpring
Sent: Thur 4/21/2016 5:51:10 PM
Subject: RE: Nevada SO2 Valmy modeling

Scott,

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NDEP

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From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Wednesday, April 20, 2016 1:03 PM
To: Brenda Harpring
Subject: Nevada SO2 Valmy modeling

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- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Bohning, Scott
Sent: Wednesday, April 13, 2016 2:22 PM
To: 'Brenda Harpring'
Subject: RE: Nevada

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- Scott B.

--

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Brenda Harpring [mailto:bharprin@ndep.nv.gov]
Sent: Wednesday, April 13, 2016 1:55 PM
To: Bohning, Scott
Subject: Nevada

Hi Scott,

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Thanks so much,

Brenda

Brenda Harpring

Planning and Modeling Branch
Bureau of Air Quality Planning
Nevada Division of Environmental Protection
901 South Stewart Street, Suite 4001
Carson City NV 89701
Phone: (775) 687-9498

Fax: (775) 687-6396

E-mail; bharprin@ndep.nv.gov

please consider the environment before printing this e-mail

To: Kurpius, Meredith[Kurpius.Meredith@epa.gov]; Danilo Dragoni[ddragoni@ndep.nv.gov]
Cc: Adele Malone[amalone@ndep.nv.gov]; Bohning, Scott[Bohning.Scott@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]
From: Brenda Harpring
Sent: Wed 1/27/2016 12:43:39 AM
Subject: RE: SO2 DRR Modeling for Valmy

Thanks Meredith,

I'm looking forward to working with Scott and everyone on Valmy.

Best Regards,

Brenda

Brenda Harpring

Environmental Scientist

Bureau of Air Quality

Nevada Division of Environmental Protection

901 S. Stewart St., Suite 4001

Carson City, NV 89701

p: 775-687-9498 f:775-687-6396

From: Kurpius, Meredith [mailto:Kurpius.Meredith@epa.gov]
Sent: Tuesday, January 26, 2016 2:21 PM
To: Danilo Dragoni
Cc: Adele Malone; Brenda Harpring; Bohning, Scott; YOSHIMURA, GWEN
Subject: RE: SO2 DRR Modeling for Valmy

Danilo,

Very nice to meet you, too! I appreciate the proactive approach that NDEP is taking on the

development of the modeling protocol for Valmy. Scott Bohning is the modeler in the EPA/Region 9 office who focuses on Nevada modeling. I have cc'd Scott so Brenda and Scott are now connected. Please don't hesitate to get in touch if issues emerge that need additional attention.

Regards,

Meredith

From: Danilo Dragoni [mailto:ddragoni@ndep.nv.gov]
Sent: Friday, January 22, 2016 4:12 PM
To: Kurpius, Meredith <Kurpius.Meredith@epa.gov>
Cc: Adele Malone <amalone@ndep.nv.gov>; Brenda Harpring <bharprin@ndep.nv.gov>
Subject: SO2 DRR Modeling for Valmy

Hi Meredith,

It was very nice to meet you in Las Vegas and thanks for all the inputs you provided.

I am sending this message as a 'first contact' for the SO2 DRR modeling. As you know, our only facility is the Valmy Generation Station.

Brenda Harpring (copied here) will be our main reference for the development of the modeling protocol and modeling itself.

As we discussed during the meeting, it would be great if we could use the EPA Region 9 input in the development of the protocol, so to get to the July deadline with a good understanding and agreement of what we need to do.

Again, very nice meeting you and have a great weekend

Danilo

****

Danilo Dragoni, PhD

Bureau Chief - Air Quality Planning

Nevada Division of Environmental Protection

901 S. Stewart Street, Suite 4001

Carson City, NV 89701

Phone (775) 687 9340

****

To: Brenda Harpring[bharprin@ndep.nv.gov]
From: Bohning, Scott
Sent: Thur 3/3/2016 7:03:38 PM
Subject: RE: Use of Beta Options for North Valmy Generating Station SO2 NAAQS modeling

Brenda -

I still have not fully heard back from folks here, but OAQPS confirmed we do need to follow the memo listed under SCRAM recent items:

12/10/15 A Clarification on the Approval Process for Regulatory Application of the AERMOD Modeling System Beta Options memorandum is now available. This memo discusses the appropriate process for the approval of the AERMOD Modeling System with the use of various beta options for regulatory applications.

https://www.epa.gov/ttn/scram/guidance/clarification/AERMOD_Beta_Options_Memo-20151210.pdf

That is, we need to provide a demonstration under 40 CFR 51 App. W sec. 3.2.2, parallel to the one for Donlin mining in the Model Clearinghouse system at

https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-X-01

However, since Valmy does not have a low-level stack as that Donlin facility did, the theoretical justification provided as part of the demonstration would instead focus on past evaluations for a regular height stack, such as was done for North Dakota. I think the attached is an example of that.

I will let you know when I find out more, but I remain hopeful that the MCH process can be a fairly quick turnaround, since the ground has already been broken on that for the Donlin facility.

Attachment:

Evaluation of low wind modeling approaches for two tall stack databases.pdf

http://www.tandfonline.com/doi/pdf/10.1080/10962247.2015.1085924

Robert Paine, Olga Samani, Mary Kaplan, Eladio Knipping & Naresh Kumar (2015) Evaluation of low wind modeling approaches for two tall-stack databases, Journal of the Air & Waste Management Association, 65:11, 1341-1353, DOI: 10.1080/10962247.2015.1085924

- Scott B.

From: Bohning, Scott
Sent: Monday, February 29, 2016 8:32 AM
To: 'Brenda Harpring'
Subject: RE: Use of Beta Options for North Valmy Generating Station SO2 NAAQS modeling

Brenda -

I will check with others on this and get back to you soon, including on process.

My understanding has been that use of adjusted u_star option was to be a low hurdle, but on reading my notes it is not so clear, some kind of performance evaluation for an alternative model appears to be expected.

The process would be that the rationale/justification for its use provided by the state/local agency would be evaluated by the EPA Regional Office; if the application of the model is sufficiently different from past decisions, then we need to request a Model Clearinghouse ("MCH") concurrence memo. I am hopeful that is not the case here, since that seems to take months; but OAQPS has directed the Regions to at least consult with them about ADJ_U* uses/approvals, hopefully that would be weeks instead of months. Assuming we can get a preliminary OK, then I think justification can be concurrent with protocol.

There is some material about this under "Recent Additions" on the SCRAM web site http://www.epa.gov/ttn/scram/ Includes a recent MCH concurrence with use of ADJ-U*, though not including LOWWIND option. For Valmy we will probably be needing a performance

comparison similar to that one. But again, I will check more on that.

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Brenda Harpring [mailto:bharprin@ndep.nv.gov]
Sent: Friday, February 26, 2016 11:22 AM
To: Bohning, Scott
Subject: Use of Beta Options for North Valmy Generating Station SO2 NAAQS modeling

Hi Scott,

Happy Friday!

We have a few questions regarding the modeling protocol we are writing for the North Valmy Station SO2 NAAQS analysis. We are considering running a couple of the AERMOD beta options, possibly ADJ_U* and the LOWWIND option in our modeling analysis.

1. Will we need approval to run AERMET and AERMOD with these options?

2. What would be the process to request approval?

3. And if so who (Region, OAQPS or the Model Clearinghouse) will be able to make that approval?

4. Will we need to provide our justification for use of the Beta Options prior to the July 1 deadline for submittal of the modeling protocol, such that there is adequate time for review and approval by EPA by July 1?

5. Approximately how long would be the approval process by EPA for the Beta Options?

Thank you very much.

Brenda

Brenda Harpring

Planning and Modeling Branch
Bureau of Air Quality Planning
Nevada Division of Environmental Protection
901 South Stewart Street, Suite 4001
Carson City NV 89701
Phone: (775) 687-9498

Fax: (775) 687-6396

E-mail; bharprin@ndep.nv.gov

please consider the environment before printing this e-mail

To: Farah Mohammadesmaeili[Mohammadesmaeili.Farah@azdeq.gov]
Cc: Holladay, Cleveland[Holladay.Cleveland@epa.gov]; Ryan Templeton[Templeton.Ryan@azdeq.gov]; Marina Mejia[Mejia.Marina@azdeq.gov]; LIMAYE, VIJAY[Limaye.Vijay@epa.gov]; Withey, Charlotte[Withey.Charlotte@epa.gov]
From: Bohning, Scott
Sent: Thur 5/5/2016 9:06:11 PM
Subject: RE: Apache SO2 projected actuals

Farah -

We did some additional thinking and also discussion with OAQPS on idea of "projected actuals". We now have a pretty resounding "no": no adjustment of data. Rather, the modeled emissions must be past actual emissions, or else allowable emissions. The TAD, and the rule text and FR notice preamble envisage only those two options.

Sorry if I got your hopes up with my previous email!

- Scott B.

From: Bohning, Scott
Sent: Wednesday, May 04, 2016 1:16 PM
To: 'Farah Mohammadesmaeili'
Cc: Holladay, Cleveland; 'Ryan Templeton'; LIMAYE, VIJAY
Subject: Apache SO2 projected actuals

Farah -

I hope you will forgive my inserting myself on this, but I was interested your suggestion (4/29 email below) for modeling for the SO2 initial designation of the area containing AEPCO Apache. If I am understanding, it would be modeling of "projected actuals". I suppose that would involve using hourly CEMS emissions data from 2013-2015, and somehow modifying that to reflect controls/limits that will be in place during 2017, so that the modeled concentration would be comparable to what a monitor would see during 2017 ("virtual monitor"). The "SO2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) allows the

use of actual hourly emissions for modeling, since that better approximates what a monitor would see.

Our current thinking is that a plain reading of the SO2 Data Requirements Rule (DRR) at 40 CFR 51.1203(d)(2) requires either actuals or allowables; literally speaking, projected actuals does not fit into either. In other contexts actual emissions refers to one more years in the past (e.g. at 51.165(a)(1)(xii)(B) "In general, actual emissions as of a particular date shall equal the average rate, in tons per year, at which the unit actually emitted the pollutant during a consecutive 24-month period which precedes the particular date and which is representative of normal source operation.")

Nevertheless, we might explore this a bit more within EPA, if there is some benefit. But we are confused about whether the upcoming limits would be useful in modeling projected actuals. The limits that go into effect December 2017 would not be useful for modeling what a "virtual monitor" would see during 2017. And the Dec. 2016 limits we thought were intended to reflect existing controls, and so would not be expected to be much different than 2013-2015 actuals, in which case no need to address projected actuals.

So, can you clarify what you had in mind for the emission rates? I may be missing something, I have not been part of the discussion much.

As an aside, if the monitoring route is followed instead of modeling, then the 2017 limits (putting Apache below 2000 tpy) do not in themselves mean the monitoring requirement immediately goes away thereafter; there are separate requirements on that at 51.1203(c)(2) and (3).

- Scott B.

P.S. On 5/4, leaving for the day at 2 pm PDT

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Farah Mohammadcsmacili [mailto:Mohammadcsmacili.Farah@azdcq.gov]
Sent: Friday, April 29, 2016 10:00 AM
To: LIMAYE, VIJAY <Limaye.Vijay@epa.gov>
Cc: Ryan C. Templeton <Templeton.Ryan@azdeq.gov>
Subject: RE: APS-Cholla SO2 Data Requirement Rule Modeling Methodology

Hi Vijay,

Thank you for getting back to us. Actually I called you to ask an additional question regarding AEPCO SO2 modeling. We are performing preliminary modeling using the SO2 emission limits for unit 2 and 3 based on the emission limits that the facility needs to meet by Dec.-05-2016. Based on the significant permit revision (Issued on May-13-2014), those emission limits are 0.15 lb/MMBtu heat input for both units.

I obtained the heat input information from a previous visibility modeling study (however, I am not sure if those are the heat inputs that must be used for this case) and calculated the emission rates as lb/hr and performed preliminary modeling with a constant emission rate for each unit. Using this approach, the preliminary results don't show attainment. I've been thinking of an alternative to perform modeling and thought maybe we could obtain an hourly emission profile from the facility with projected hourly emissions for Dec.-05-2016, when the controls are in place and use it in the model instead of using a constant emission rate. However, before we request that information from AEPCO, we would like to make sure that this approach is acceptable by EPA. In the SO2 designation guidance it is stated that the modeling should be done using 3 years of actual data or allowable emission rates, but it does not mention if a projected hourly emission profile can be used.

I would highly appreciate your help and clarification on this.

Thank you,

Farah

To: Raju Bisht[rbisht@navajo-nsn.gov]
Cc: Lo, Doris[Lo.Doris@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohning, Scott[Bohning.Scott@epa.gov]; McKaughan, Colleen[McKaughan.Colleen@epa.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]; Withey, Charlotte[Withey.Charlotte@epa.gov]; CHANG, RANDALL[Chang.Randall@epa.gov]
From: LIMAYE, VIJAY
Sent: Thur 7/21/2016 3:41:32 PM
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hi Raju,

Thank you for your message and for the update on Gaurav. It is fine with us if you share my email with the facilities to explain the DRR requirements. The first week of August will be fine for a call—I will be in touch on that.

Best,

Vijay

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Wednesday, July 20, 2016 3:51 PM
To: LIMAYE, VIJAY <Limaye.Vijay@epa.gov>
Cc: Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; eugeniaquintana@navajo-nsn.gov; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>; CHANG, RANDALL <Chang.Randall@epa.gov>
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hi Vijay,

I have little or practically no experience regarding modeling. Gaurav worked on developing those protocols and he and Mike were on the call on June 9th and 16th. Gaurav has since moved on and is no longer with NNEPA. I know APS has carried out some modeling using the 2012-2014 emissions and have agreed to share that with us. I will share that with you once I hear from them. Is it fine if I share the contents of your email with FCPP and NGS so that they have an idea as to what is required for the SO2 DRR and the difference as to what was done for EIS and what is now required. I would prefer setting up a call the first week of August if that is not a problem at your end.

Thanks. Raju

From: LIMAYE, VIJAY [mailto:Limaye.Vijay@epa.gov]
Sent: Tuesday, July 19, 2016 5:50 PM
To: Raju Bisht <rbisht@navajo-nsn.gov>
Cc: Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Eugenia Quintana <eugeniaquintana@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>; CHANG, RANDALL <Chang.Randall@epa.gov>
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hi Raju,

EPA Region 9 does have the modeling protocols for both FCPP and NGS, and we believe that most of the procedures followed would be appropriate for modeling performed for the SO2 DRR, though there would have to be some differences to address emissions and AERMOD model options.

The June 6th draft protocol sent by Gaurav Rajen covered many of the AERMOD inputs, borrowing from the EIS protocol; either an updated version of the draft or an abbreviated version that just cited the EIS protocols would be suitable as the basis for a protocol. However, per our previous conversations (including conference calls on June 9th and June 16th), we believe that the emission scenarios used in the EIS protocols may not be appropriate for the SO2 DRR. Under the SO2 DRR, modeled emissions are required to be either actual emissions for recent years (e.g. 2012-2014, or 2013-2015), or else allowed emissions under federally enforceable limits in place and effective by January 13, 2017. The emissions to be modeled should be spelled out in protocol(s) for the two facilities.

In addition, for the EIS reports, the "adjusted u-star" beta option in AERMOD was used. At this time, until the Guideline on Air Quality Models ("GAQM", 40 CFR Part 51, Appendix W) is updated, the use of the adjusted u-star for modeling for permits or SIPs requires an alternative model demonstration under GAQM 3.2, which must be approved by the EPA Model Clearinghouse. It would be simpler not to go through that procedure, so we recommend that the protocol(s) for the two facilities reflect the standard AERMOD model. This could be revisited at a later date if necessary.

We would like to set up a call with you and your team for next week to discuss the emissions limits, to make sure that we are all on the same page--please let us know a good time to reach you.

Best,

Vijay

Vijay Limaye, Ph.D.

U.S. Environmental Protection Agency, Region 9

Air Planning Office (AIR-2)

75 Hawthorne St. San Francisco, CA 94105

Limaye.Vijay@epa.gov / 415.972.3086

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, July 14, 2016 10:03 AM
To: LIMAYE, VIJAY <Limaye.Vijay@epa.gov>
Cc: Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; Strauss, Alexis <Strauss.Alexis@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; eugeniaquintana@navajo-nsn.gov; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hello Vijay,

I would like to follow up on our effort to meet the DRR for NGS. The facility has informed us that Region 9 should have the protocol and the final report for the near field modeling conducted for the EIS. I believe Jeanne Geselbracht is the Region 9 contact for the EIS study. If you don't have access to these documents, please let us know and we will provide them to you. Would the protocol and the report done for the EIS be sufficient to make a determination for the SO2 DRR? If not, could you provide us with some guidance on what changes you would like to see be made before running the model again so that we could start having a dialogue with the facility and their consultants to see how they can help us with this moving forward.

Thanks. Raju

From: LIMAYE, VIJAY [mailto:Limaye.Vijay@epa.gov]
Sent: Wednesday, June 29, 2016 12:19 PM
To: Eugenia Quintana <eugeniaquintana@navajo-nsn.gov>; Strauss, Alexis <Strauss.Alexis@epa.gov>
Cc: Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hi Eugenia,

Thank you for this communication and for Navajo Nation's continuing efforts on these SO2 sources.

Best,

Vijay

Vijay Limaye, Ph.D.

U.S. Environmental Protection Agency, Region 9

Air Planning Office (AIR-2)

75 Hawthorne St. San Francisco, CA 94105

Limaye.Vijay@epa.gov / 415.972.3086

From: Eugenia Quintana [mailto:eugeniaquintana@navajo-nsn.gov]
Sent: Wednesday, June 29, 2016 11:13 AM
To: Strauss, Alexis <Strauss.Alexis@epa.gov>
Cc: LIMAYE, VIJAY <Limaye.Vijay@epa.gov>; Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA,

GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>
Subject: Implementation of SO2 DRR on Navajo Nation

Hello.

Please find attached a letter informing USEPA of the Navajo Nation's selected approach to meet the DRR for the two SO2 sources on the Navajo Nation.

Thank you.

Eugenia Quintana

Environmental Department Manager

Air & Toxics Department

Navajo Nation Environmental Protection Agency

Box 339

Window Rock, AZ 86515

T: 928-871-7800

F: 928-871-6757

To: Raju Bisht[rbisht@navajo-nsn.gov]
Cc: Lo, Doris[Lo.Doris@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohning, Scott[Bohning.Scott@epa.gov]; McKaughan, Colleen[McKaughan.Colleen@epa.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]; Withey, Charlotte[Withey.Charlotte@epa.gov]; CHANG, RANDALL[Chang.Randall@epa.gov]
From: LIMAYE, VIJAY
Sent: Tue 7/19/2016 11:50:29 PM
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hi Raju,

EPA Region 9 does have the modeling protocols for both FCPP and NGS, and we believe that most of the procedures followed would be appropriate for modeling performed for the SO2 DRR, though there would have to be some differences to address emissions and AERMOD model options.

The June 6th draft protocol sent by Gaurav Rajen covered many of the AERMOD inputs, borrowing from the EIS protocol; either an updated version of the draft or an abbreviated version that just cited the EIS protocols would be suitable as the basis for a protocol. However, per our previous conversations (including conference calls on June 9th and June 16th), we believe that the emission scenarios used in the EIS protocols may not be appropriate for the SO2 DRR. Under the SO2 DRR, modeled emissions are required to be either actual emissions for recent years (e.g. 2012-2014, or 2013-2015), or else allowed emissions under federally enforceable limits in place and effective by January 13, 2017. The emissions to be modeled should be spelled out in protocol(s) for the two facilities.

In addition, for the EIS reports, the "adjusted u-star" beta option in AERMOD was used. At this time, until the Guideline on Air Quality Models ("GAQM", 40 CFR Part 51, Appendix W) is updated, the use of the adjusted u-star for modeling for permits or SIPs requires an alternative model demonstration under GAQM 3.2, which must be approved by the EPA Model Clearinghouse. It would be simpler not to go through that procedure, so we recommend that the protocol(s) for the two facilities reflect the standard AERMOD model. This could be revisited at a later date if necessary.

We would like to set up a call with you and your team for next week to discuss the emissions limits, to make sure that we are all on the same page--please let us know a good time to reach you.

Best,

Vijay

Vijay Limaye, Ph.D.

U.S. Environmental Protection Agency, Region 9

Air Planning Office (AIR-2)

75 Hawthorne St. San Francisco, CA 94105

Limaye.Vijay@epa.gov / 415.972.3086

From: Raju Bisht [mailto:rbisht@navajo-nsn.gov]
Sent: Thursday, July 14, 2016 10:03 AM
To: LIMAYE, VIJAY <Limaye.Vijay@epa.gov>
Cc: Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; Strauss, Alexis <Strauss.Alexis@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; eugeniaquintana@navajo-nsn.gov; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hello Vijay,

I would like to follow up on our effort to meet the DRR for NGS. The facility has informed us that Region 9 should have the protocol and the final report for the near field modeling conducted for the EIS. I believe Jeanne Geselbracht is the Region 9 contact for the EIS study. If you don't have access to these documents, please let us know and we will provide them to you. Would the protocol and the report done for the EIS be sufficient to make a determination for the SO2 DRR? If not, could you provide us with some guidance on what changes you would like to see be made before running the model again so that we could start having a dialogue with the facility and their consultants to see how they can help us with this moving forward.

Thanks. Raju

From: LIMAYE, VIJAY [mailto:Limaye.Vijay@epa.gov]

Sent: Wednesday, June 29, 2016 12:19 PM
To: Eugenia Quintana <eugeniaquintana@navajo-nsn.gov>; Strauss, Alexis <Strauss.Alexis@epa.gov>
Cc: Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hi Eugenia,

Thank you for this communication and for Navajo Nation's continuing efforts on these SO2 sources.

Best,

Vijay

Vijay Limaye, Ph.D.

U.S. Environmental Protection Agency, Region 9

Air Planning Office (AIR-2)

75 Hawthorne St. San Francisco, CA 94105

Limaye.Vijay@epa.gov / 415.972.3086

From: Eugenia Quintana [mailto:eugeniaquintana@navajo-nsn.gov]
Sent: Wednesday, June 29, 2016 11:13 AM
To: Strauss, Alexis <Strauss.Alexis@epa.gov>
Cc: LIMAYE, VIJAY <Limaye.Vijay@epa.gov>; Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>
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Eugenia Quintana

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To: LIMAYE, VIJAY[Limaye.Vijay@epa.gov]
Cc: Lo, Doris[Lo.Doris@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohning, Scott[Bohning.Scott@epa.gov]; Strauss, Alexis[Strauss.Alexis@epa.gov]; McKaughan, Colleen[McKaughan.Colleen@epa.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]; Withey, Charlotte[Withey.Charlotte@epa.gov]
From: Raju Bisht
Sent: Thur 7/14/2016 5:02:58 PM
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hello Vijay,

I would like to follow up on our effort to meet the DRR for NGS. The facility has informed us that Region 9 should have the protocol and the final report for the near field modeling conducted for the EIS. I believe Jeanne Geselbracht is the Region 9 contact for the EIS study. If you don't have access to these documents, please let us know and we will provide them to you. Would the protocol and the report done for the EIS be sufficient to make a determination for the SO2 DRR? If not, could you provide us with some guidance on what changes you would like to see be made before running the model again so that we could start having a dialogue with the facility and their consultants to see how they can help us with this moving forward.

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From: LIMAYE, VIJAY [mailto:Limaye.Vijay@epa.gov]
Sent: Wednesday, June 29, 2016 12:19 PM
To: Eugenia Quintana <eugeniaquintana@navajo-nsn.gov>; Strauss, Alexis <Strauss.Alexis@epa.gov>
Cc: Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>
Subject: RE: Implementation of SO2 DRR on Navajo Nation

Hi Eugenia,

Thank you for this communication and for Navajo Nation's continuing efforts on these SO2 sources.

Best,

Vijay

Vijay Limaye, Ph.D.

U.S. Environmental Protection Agency, Region 9

Air Planning Office (AIR-2)

75 Hawthorne St. San Francisco, CA 94105

Limaye.Vijay@epa.gov / 415.972.3086

From: Eugenia Quintana [mailto:eugeniaquintana@navajo-nsn.gov]
Sent: Wednesday, June 29, 2016 11:13 AM
To: Strauss, Alexis <Strauss.Alexis@epa.gov>
Cc: LIMAYE, VIJAY <Limaye.Vijay@epa.gov>; Lo, Doris <Lo.Doris@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; Tennille B. Begay <tbbegay@navajo-nsn.gov>
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Thank you.

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Environmental Department Manager

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T: 928-871-7800

F: 928-871-6757

To: Gaurav Rajen[rajenwnr@gmail.com]; Raju Bisht[rbisht@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]
Cc: McKaughan, Colleen[McKaughan.Colleen@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Bohning, Scott[Bohning.Scott@epa.gov]
From: LIMAYE, VIJAY
Sent: Wed 6/15/2016 8:20:24 PM
Subject: Requesting letter for July 1 SO2 DRR deadline

Hi Eugenia,

Just to follow up briefly on the upcoming 7/1/2016 SO2 DRR deadline, we recently learned that EPA intends to post the correspondence conveying how the air agencies will be characterizing their DRR sources, similar to how the source list letters & responses were posted here: https://www.epa.gov/airquality/sulfurdioxide/drr.html

In light of this, and to satisfy 40 CFR 51.1203(b), we believe that a letter from NNEPA to EPA Region 9 acting RA Alexis Strauss (cc'ing Doris Lo, Gwen Yoshimura, Scott Bohning, and myself) listing the two DRR sources for Navajo Nation and indicating that they will both be characterized through modeling is appropriate. We can continue to work through the details of the modeling protocol after 7/1, but it would be helpful for us to have the letter by then.

Please let me know if you have any questions, and thanks for all of your work on this effort!

Best,

Vijay

Vijay Limaye, Ph.D.

U.S. Environmental Protection Agency, Region 9

Air Planning Office (AIR-2)

75 Hawthorne St. San Francisco, CA 94105

Limaye.Vijay@epa.gov / 415.972.3086

From: Gaurav Rajen [mailto:rajenwnr@gmail.com]
Sent: Monday, June 13, 2016 12:40 PM

To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>; Chen, Eugene <Chen.Eugene@epa.gov>; YOSHIMURA, GWEN <Yoshimura.Gwen@epa.gov>; LIMAYE, VIJAY <Limaye.Vijay@epa.gov>
Subject: A very balanced approach and eminently fair and reasonable

Thanks Scott:

We all appreciate your responses. These responses will help in framing the letters we send this week to FCPP and NGS, which I am currently drafting. There is an electronic Appendix in the FCPP's EIS that contains all the needed input files; hopefully, NGS will also provide these. Mike King had previously worked with Lakes Environmental while doing his research at Purdue on NOx and SOx transport in the Four Corners region; and they (Lakes Environmental), too, have input files set up.

Your approach seems very balanced, fair, and reasonable.

My take-aways are - 1) the July 1 deadline is met with our having sent in a draft protocol; we will finalize this in coming weeks; 2) we will use federally enforceable limits (from FIPs etc.) and could really benefit from EPA's help in making sure we have the right estimates to set the DRR-specified source terms; 3) we will do a parametric study on the effects of higher emissions, flow rates and changed temperatures to bound any future modeling work and determine if the EIS studies are truly conservative; 4) using the existing AERMET and AERMOD input data files from the existing EISs we will re-run the AERMOD models (if deemed required by (3) above) - re-running to be done using the existing met data, geophysical domain, receptor grids, etc., while changing the source emissions input data based on (2) above.

Best regards,

Gaurav

PS: I am fairly new at this - do we (as a team) have the correct numbers to use for SO2 emissions in lbs/hr that would be the federally enforceable limit in effect before January 2017? I went through several documents and came up with what seemed to be the limits. The EIS numbers are clearly stated and appear higher than the limits being enforced. The right numbers to use for the DRR limits will help in my doing an accurate parametric study as in (3) above.

On Mon, Jun 13, 2016 at 1:10 PM, Bohning, Scott <Bohning.Scott@epa.gov> wrote:

Guarav -

Thanks for the reply... I have to work on some other things today, hopefully we can discuss more Thursday 6/16 call, but here is a response for now.

- It does makes sense to quantitatively assess how much the emission rates change the stack temperature and exit velocity. That helps with the qualitative arguments about how the model reacts and the conservativeness of the EIS modeling. That stack parameter assessment would also help with just going ahead and remodeling. (Assuming we can get the original AERMOD input files and the AERMET output & hopefully input files, that would just be a matter of changing the stack parameter input lines to match what we think they are; changing either a few emission lines to reflect allowable emissions or a lot of emission lines to reflect actual emissions; and running the program. Avoids qualitative arguments on stack effects, ADJ_U* option, AERMOD version.)

- SO2 DRR says to use actual emissions of recent three year period, e.g. 2012-2014 or 2013-2015; or, allowable emissions reflecting federally enforceable emission limits in effect before Jan. 2017. It is not clear to us that the emission rates you stated are the appropriate ones to use for DRR modeling and/or to compare to the EIS; those would need to be spelled out more. (Charlotte noted that FCPP Consent Decree 90% control is not relative to the existing allowable emissions, but instead is relative to other assumptions.)

- On what I think you suggested in 6/10 email, re-running model later since already periodically required: that is not necessarily required under the DRR but instead is just discretionary, so we don't think the remodeling later should substitute for modeling now (if we find that it is needed due to EIS modeling not enough or not allowed to be substituted).

- Scott B.

From: Gaurav Rajen [mailto:rajenwnr@gmail.com]
Sent: Monday, June 13, 2016 11:00 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>
Subject: Further clarifications and many thanks again Re: AERMOD model approaches

regarding plume lofting etc.

Dear Scott:

Many thanks for your very helpful and valuable exchanges. It would be good to keep this exchange as informative as possible so we can have as productive a call on Thursday as possible. We all appreciate your help and that of others at the EPA Region 9 very, very much.

I apologize for being unclear - the way I see this is as follows: for selecting the source terms, the DRR does not solely specify a set of years alone - i.e. the past three years; it also specifies that a federally enforceable limit should set the source term - in our case the FIPs and the operating permits. The Table I sent you (re-pasted below) gives the lbs/hr of SO2 assumed in the EISs and what the DRR would require. As you see below, the DRR would require 1722 and 1790 lbs/hr for the NGS and FCPP respectively. The EISs use 2245 lbs/hr and 2816 lbs/hr respectively. The source terms are higher and should lead to higher levels at the maximally-impacted receptor locations. What I was pointing out is that the temperatures will not change appreciably - however, higher SO2 content in lbs/hr implies higher coal burning rates (though one could also assume higher sulfur content, this content having a maximum allowable being set by the FIP and permits we have to assume higher quantities of coal being burned) which would imply higher gas exit velocities. Therefore, one would have to deal with the possibility of partial plume entry into the Stable Boundary Layer out of the Convective Boundary Layer and later re-entry and the possibility that the higher source emission rate is not automatically conservativen at the maximally-impacted loactions. There are some non-dimensional numbers (Reynold's number, Rayleigh number, Peclet number, Grashof number, etc.) that help us determine which effects predominate. Given the ranges we are dealing with, we can easily show that the higher source terms lead to higher levels at the maximally-impacted receptor locations even with higher stack exit velocities (that are associated with higher emission rates). Perhaps I have misunderstood these issues and am happy to be corrected.

Given the conservative assumptions inherent in the higher source terms used (see table below), I am suggesting that we hold off on re-running the models till we can build a local capability using our existing personnel and resources (e.g. Mike King has tremendous knowledge of modeling and fate and transport, he will be sending you a set of slides of his research at Purdue that you will find informative) and local Navajo colleges that have environmental programs. Getting the resources earmarked is also important and may be best done with more time available. For example, we could seek funding and assistance from EPA HQ and EPA research laboratories (in the Research Triangle Park for instance) - they may like the concept of building local Navajo capability using Navajo colleges to re-run the models. We always have the fall-back option of re-running with the help of the FCPP and the NGS and consultants, such as AECOM.

It just seems to me that as we have existing models and results that use higher conservative

source terms and show NAAQS attainment, the fact that we will re-run again as required by the DRR (given the fact that the modeled results are within the %difference to the standards for which the DRR specifies periodic re-runs), we may have more time available to develop local capabilities. So, for the January of 2017 deadline we use the existing model results and further state that the models will be re-run as required by the DRR within a specified time-frame. Just a thought for consideration - again, using the existing modeled results seems justified as the source terms are higher than required by the DRR.

It is good to know that the draft protocol has allowed us to meet our July 1 deadline.

Thank you again,

Gaurav Rajen

Appendix B

B 1.0 Comparisons of input data required by the DRR and used in the EISs (source emissions, stack velocities, temperatures, beta versions of software to convert meteorological low-wind speed data into planetary boundary layer model parameters, and years selected for meteorological data)

The DRR states that –

…Modeling analyses shall characterize air quality based on either actual SO2 emissions from the most recent 3 years, or on any federally enforceable allowable emission limit or limits established by the air agency or the EPA and that are effective and require compliance by January 13, 2017.

Table B.1 provides the major differences between source emissions used as inputs from the requirements of the DRR and the source emissions factors used in the existing modeling

studies done for Environmental Impact Statements by the FCPP and the NGS. Attachments provide copies of the text in the DRR, the Federal Implementation Plans and existing compliance documents that describe the applicable federally enforceable limits; as well as copies of the relevant pages from the EISs.

Table B.1

Source emissions data required by the DRR and used in the EISs

Plant	NGS		FCPP	
References from which data are derived	DRR	EIS - NGS	DRR	EIS - FCPP
Years for which data required/ or basis of quantities used	2014, 2015, 2016/ federally enforceable limits	As used in EIS – total SO2 from all sources, burners, boilers, mines, on and off-road equipment, emergency generators, etc.	2014, 2015, 2016/ federally enforceable limit	As used in EIS - emission rates from the Units 4 and 5 stack are derived from consideration of actual hourly data, and the current Title V operating permit for FCPP
Average SO2 lbs/hr over any 1-hour period	**Approximately 1722 lbs/hr** – derived from 7544 tons/year allowed as a federally enforceable limit in the FIP	**2245 lbs/hr**	**1790 lbs/hr** (from draft FIP and federally enforceable limit – 10% of allowable SO2 generated; drops to 5% (i.e. lesser) in 2018	**2816 lbs/hr**

B 2.0 Considerations of stack exit velocities, temperatures and wind speed

When the source term used in the model is varied, there will also be a variation in the assumed stack gases' exit velocity and temperatures of the stack gases. Higher assumed quantities of SO2 released will be linked to higher coal burning rates and hence higher exit stack gas velocities and marginally higher temperatures. The 1-hour concentrations of SO2 at receptor sites in the near-field will be first order dependent on the quantities of SO2 released per hour and with a second to third –order dependence on the exit velocities and temperatures. Higher exit velocities and temperatures may cause some dilution of concentrations at far-field locations, but these effects will be substantially reduced and negligible in comparison to the increase in concentrations from increased SO2 releases in

the near-field receptor locations with the maximum SO2 1-hour levels. This leads to the conclusions that the modeling studies conducted in the EISs are conservative in the derived SO2 1-hour concentrations as they use higher SO2 release terms.

Wind speeds will also be critical in determining the concentrations at receptor locations. The FCPP study used a beta version for deriving critical boundary layer parameters for low wind speeds – the following discussion taken from the FCPP EIS describes the rationale for doing so.

[] Low Wind Speed Improvements for AERMOD

In 2010, the results of an evaluation of low wind speed databases for short-range modeling applications were provided to USEPA. The reason for the study was that some of the most restrictive dispersion conditions and the highest model predictions occur under low wind speed conditions, but there had been very little model evaluation for these conditions. The results of the evaluation indicated that in low wind conditions, the friction velocity formulation in AERMOD results in under-predictions of this important planetary boundary layer parameter. There were multiple outcomes of this under-prediction: mechanical mixing heights that were very low (less than 10 meters), very low effective dilution wind speeds, and very low turbulence in stable conditions. In addition, the evaluation study concluded that the minimum lateral turbulence (as parameterized using sigma-v) was too low by at least a factor of 2. After these issues were once again stated at the 10th USEPA Modeling Conference in March 2012, USEPA made some revisions in late 2012 to the AERMOD11 modeling system to correct the model deficiencies in this area. This culminated in USEPA releasing AERMET and AERMOD Versions 12345, which include "beta" options in AERMET for a revised u* formulation under stable conditions and two different low wind speed options in AERMOD. These updates are included in AERMET and AERMOD versions 13350, as well. During the USEPA webinar12 on January 14, 2014, USEPA staff stated that they are generally in favor of the AERMET beta u* option as it is based on peer-reviewed activities.

B 3.0 Issues related to variations in meteorological data used in the models from that suggested in the DRR

In development – we will trend data from our meteorological station in Shiprock to

demonstrate that variations between the years of data used in the EIS and the most current trends are not significant.

On Mon, Jun 13, 2016 at 11:07 AM, Bohning, Scott <Bohning.Scott@epa.gov> wrote:

Gaurav -

I do not follow your argument -- cooler stack temperatures for this source would be same for EIS & new modeling, so that in itself would not tend to make EIS conservative... unless I am misunderstanding altogether.... we can talk more on Thurs. 6/16 call if needed on this.

Meanwhile, on your previous email about what issues need to get resolved in a protocol. Ideally a protocol would spell out pretty much the full procedure to be followed in the modeling, though some narrow issues might be left open. The big issue of what current actual emissions or what will be allowable emissions by the end of 2016 (and how those compare to the EIS emissions) is such a key one that we don't think a protocol can really be considered complete without that issue being decided. The related issue of whether new modeling will be done at all is also certainly important enough that it should be set out in the protocol.

However, I would note that July 1st deadline is mainly to get a decision on choice between modeling and monitoring, so as long as there is *some* form of protocol sent in, like the draft one you have already done, that deadline is met. I do not think EPA is issuing official approval of protocols anyway; approval is relative to the actual submitted modeling later on. So we do still have time to figure out emissions and other issues. Although it's good to get as much agreement as possible early on, we agree that we should take the time to get that issue right.

- Scott B.

--

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Gaurav Rajen [mailto:rajenwnr@gmail.com]
Sent: Friday, June 10, 2016 3:55 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov; Tennille B. Begay <tbbegay@navajo-nsn.gov>
Subject: AERMOD model approaches regarding plume lofting etc.

Dear Scott:

Just a quick note to share some more thoughts - I have been reviewing the EPA document (AERMOD: DESCRIPTION OF MODEL FORMULATION) available at - https://www3.epa.gov/scram001/7thconf/aermod/aermod_mfd.pdf

From the document..

"AERMOD is designed to treat the effects on dispersion from vertical variations in wind and turbulence. Consideration of the vertical variation in meteorology is important for properly modeling releases in layers with strong gradients, for capturing

the effects of meteorology in layers into which the plume may be vertically dispersing, and to provide a mechanism (in the Convective Boundary Layer, CBL) by which sources that are released into or penetrate into an elevated stable layer can eventually re-enter the mixed layer....

Fundamental to this approach is the concept that **the primary layer of importance, relative to receptor concentration, is the one through which plume material travels directly from source to receptor**."

The model does account for plume lofting and entry out of and back into the CBL Therefore, when the source emissions term changes and the exit gas velocities and temperature change the momentum flux and buoyancy forces also change and the plume averaging over heights could change - I looked closely at the terms used to estimate the stack momentum and buoyancy-induced fluxes in AERMOD. In our case, the stack gases are cooled and scrubbed before exit so temperature increases will be lessened, hence buoyancy-induced fluxes are not appreciably changed. Exit velocities will be higher, but not sufficient to make a major difference in lessening concentrations at the maximum level receptor location. The last sentence in the quote presented above reinforces that the higher source terms used in the EISs lead to higher concentrations - thus the EIS results being conservative in their level estimates. In this regard it is also important to note that AERMOD does not use coupled equations for fate and transport and so the concentration of SO2 does not modify any of the transport parameters, densities, etc.. or change based on chemical reactions. This is why it seems reasonable (given that we can address momentum and buoyancy-induced fluxes at the stack) that higher emission sources will lead to more conservative and higher levels at receptor sites.

As you suggested, it does make sense to run the model again for various reasons that you laid out - I would like you all to consider the re-running of the model to happen at a later date in 2017, allowing us to develop more in-house capability, seek additional supplemental funding, and work with local universities and colleges to develop programs that bring modeling capabilities to the Navajo Nation and train more of our staff and graduate students. Such options could be Navajo Technical University, and Dine College, both of which have environmental programs. If we award a contract to an outside consultant in a rush to meet a deadline we will remain tied to the use of outside consultants. This is something to think through as we progress farther in this effort. Michael King for example has a master's from Purdue in atmospheric physics and has run versions of AERMOD and even more complex fate and transport models. We also have an opportunity when we run AERMOD to use our data to do model validation. Re-running at a later date of course will require us to accept the EIS

models' data and results as a first step. Before this decision is made, however, we should first settle on the modeling protocol we will use.

Many thanks for your thoughts on this matter,

Gaurav

To: Bohning, Scott[Bohning.Scott@epa.gov]
Cc: McKaughan, Colleen[McKaughan.Colleen@epa.gov]; Raju Bisht[rbisht@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]; Withey, Charlotte[Withey.Charlotte@epa.gov]; Chen, Eugene[Chen.Eugene@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; LIMAYE, VIJAY[Limaye.Vijay@epa.gov]
From: Gaurav Rajen
Sent: Mon 6/13/2016 7:40:20 PM
Subject: A very balanced approach and eminently fair and reasonable

Thanks Scott:

We all appreciate your responses. These responses will help in framing the letters we send this week to FCPP and NGS, which I am currently drafting. There is an electronic Appendix in the FCPP's EIS that contains all the needed input files; hopefully, NGS will also provide these. Mike King had previously worked with Lakes Environmental while doing his research at Purdue on NOx and SOx transport in the Four Corners region; and they (Lakes Environmental), too, have input files set up.

Your approach seems very balanced, fair, and reasonable.

My take-aways are - 1) the July 1 deadline is met with our having sent in a draft protocol; we will finalize this in coming weeks; 2) we will use federally enforceable limits (from FIPs etc.) and could really benefit from EPA's help in making sure we have the right estimates to set the DRR-specified source terms; 3) we will do a parametric study on the effects of higher emissions, flow rates and changed temperatures to bound any future modeling work and determine if the EIS studies are truly conservative; 4) using the existing AERMET and AERMOD input data files from the existing EISs we will re-run the AERMOD models (if deemed required by (3) above) - re-running to be done using the existing met data, geophysical domain, receptor grids, etc., while changing the source emissions input data based on (2) above.

Best regards,

Gaurav

PS: I am fairly new at this - do we (as a team) have the correct numbers to use for SO2 emissions in lbs/hr that would be the federally enforceable limit in effect before January 2017? I went through several documents and came up with what seemed to be the limits. The EIS numbers are clearly stated and appear higher than the limits being enforced. The right numbers to use for the DRR limits will help in my doing an accurate parametric study as in (3) above.

On Mon, Jun 13, 2016 at 1:10 PM, Bohning, Scott <Bohning.Scott@epa.gov> wrote:

Guarav -

Thanks for the reply... I have to work on some other things today, hopefully we can discuss more Thursday 6/16 call, but here is a response for now.

- It does makes sense to quantitatively assess how much the emission rates change the stack temperature and exit velocity. That helps with the qualitative arguments about how the model reacts and the conservativeness of the EIS modeling. That stack parameter assessment would also help with just going ahead and remodeling. (Assuming we can get the original AERMOD input files and the AERMET output & hopefully input files, that would just be a matter of changing the stack parameter input lines to match what we think they are; changing either a few emission lines to reflect allowable emissions or a lot of emission lines to reflect actual emissions; and running the program. Avoids qualitative arguments on stack effects, ADJ_U* option, AERMOD version.)

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Sent: Monday, June 13, 2016 11:00 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>
Cc: McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov; Tennille B. Begay <tbbegay@navajo-nsn.gov>; Withey, Charlotte <Withey.Charlotte@epa.gov>
Subject: Further clarifications and many thanks again Re: AERMOD model approaches regarding plume lofting etc.

Dear Scott:

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further state that the models will be re-run as required by the DRR within a specified time-frame. Just a thought for consideration - again, using the existing modeled results seems justified as the source terms are higher than required by the DRR.

It is good to know that the draft protocol has allowed us to meet our July 1 deadline.

Thank you again,

Gaurav Rajen

Appendix B

B 1.0 Comparisons of input data required by the DRR and used in the EISs (source emissions, stack velocities, temperatures, beta versions of software to convert meteorological low-wind speed data into planetary boundary layer model parameters, and years selected for meteorological data)

The DRR states that –

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Table B.1

Source emissions data required by the DRR and used in the EISs

Plant	NGS		FCPP	
References from which data are derived	DRR	EIS - NGS	DRR	EIS - FCPP
Years for which data required/ or basis of quantities used	2014, 2015, 2016/ federally enforceable limits	As used in EIS – total SO2 from all sources, burners, boilers, mines, on and off-road equipment, emergency generators, etc.	2014, 2015, 2016/ federally enforceable limit	As used in EIS - emission rates from the Units 4 and 5 stack are derived from consideration of actual hourly data, and the current Title V operating permit for FCPP
Average SO2 lbs/hr over any 1-hour period	**Approximately 1722 lbs/hr** – derived from 7544 tons/year allowed as a federally enforceable limit in the FIP	**2245 lbs/hr**	**1790 lbs/hr** (from draft FIP and federally enforceable limit – 10% of allowable SO2 generated; drops to 5% (i.e. lesser) in 2018	**2816 lbs/hr**

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When the source term used in the model is varied, there will also be a variation in the assumed stack gases' exit velocity and temperatures of the stack gases. Higher assumed quantities of SO2 released will be linked to higher coal burning rates and hence higher exit stack gas velocities and marginally higher temperatures. The 1-hour concentrations of SO2 at receptor sites in the near-field will be first order dependent on the quantities of SO2 released per hour and with a second to third –order dependence on the exit velocities and temperatures. Higher exit velocities and temperatures may cause some dilution of concentrations at far-field locations, but these effects will be substantially reduced and negligible in comparison to the increase in concentrations from increased SO2 releases in the near-field receptor locations with the maximum SO2 1-hour levels. This leads to the conclusions that the modeling studies conducted in the EISs are conservative in the derived SO2 1-hour concentrations as they use higher SO2 release terms.

Wind speeds will also be critical in determining the concentrations at receptor locations. The FCPP study used a beta version for deriving critical boundary layer parameters for low wind speeds – the following discussion taken from the FCPP EIS describes the rationale for doing so.

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In 2010, the results of an evaluation of low wind speed databases for short-range modeling applications were provided to USEPA. The reason for the study was that some of the most restrictive dispersion conditions and the highest model predictions occur under low wind speed conditions, but there had been very little model evaluation for these conditions. The results of the evaluation indicated that in low wind conditions, the friction velocity formulation in AERMOD results in under-predictions of this important planetary boundary layer parameter. There were multiple outcomes of this under-prediction: mechanical mixing heights that were very low (less than 10 meters), very low effective dilution wind speeds, and very low turbulence in stable conditions. In addition, the evaluation study concluded that the minimum lateral turbulence (as parameterized using sigma-v) was too low by at least a factor of 2. After these issues were once again stated at the 10th USEPA Modeling Conference in March 2012, USEPA made some revisions in late 2012 to the AERMOD11 modeling system to correct the model deficiencies in this area. This culminated in USEPA releasing AERMET and AERMOD Versions 12345, which include "beta" options in AERMET for a revised u* formulation under stable conditions and two different low wind speed options in AERMOD. These updates are included in AERMET and AERMOD versions 13350, as well. During the USEPA webinar12 on January 14, 2014, USEPA staff stated that they are generally in favor of the AERMET beta u* option as it is based on peer-reviewed activities.

B 3.0 Issues related to variations in meteorological data used in the models from that suggested in the DRR

In development – we will trend data from our meteorological station in Shiprock to demonstrate that variations between the years of data used in the EIS and the most current trends are not significant.

On Mon, Jun 13, 2016 at 11:07 AM, Bohning, Scott <Bohning.Scott@epa.gov> wrote:

Gaurav -

I do not follow your argument -- cooler stack temperatures for this source would be same for EIS & new modeling, so that in itself would not tend to make EIS conservative... unless I am misunderstanding altogether.... we can talk more on Thurs. 6/16 call if needed on this.

Meanwhile, on your previous email about what issues need to get resolved in a protocol. Ideally a protocol would spell out pretty much the full procedure to be followed in the modeling, though some narrow issues might be left open. The big issue of what current actual emissions or what will be allowable emissions by the end of 2016 (and how those compare to the EIS emissions) is such a key one that we don't think a protocol can really be considered complete without that issue being decided. The related issue of whether new modeling will be done at all is also certainly important enough that it should be set out in the protocol.

However, I would note that July 1st deadline is mainly to get a decision on choice between modeling and monitoring, so as long as there is *some* form of protocol sent in, like the draft one you have already done, that deadline is met. I do not think EPA is issuing official approval of protocols anyway; approval is relative to the actual submitted modeling later on. So we do still have time to figure out emissions and other issues. Although it's good to get as much agreement as possible early on, we agree that we should take the time to get that issue right.

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Gaurav Rajen [mailto:rajenwnr@gmail.com]
Sent: Friday, June 10, 2016 3:55 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov; Tennille B. Begay <tbbegay@navajo-nsn.gov>
Subject: AERMOD model approaches regarding plume lofting etc.

Dear Scott:

Just a quick note to share some more thoughts - I have been reviewing the EPA document (AERMOD: DESCRIPTION OF MODEL FORMULATION) available at - https://www3.epa.gov/scram001/7thconf/aermod/aermod_mfd.pdf

From the document..

"AERMOD is designed to treat the effects on dispersion from vertical variations in wind and turbulence. Consideration of the vertical variation in meteorology is important for properly modeling releases in layers with strong gradients, for capturing the effects of meteorology in layers into which the plume may be vertically dispersing, and to provide a mechanism (in the Convective Boundary Layer, CBL) by which sources that are released into or penetrate into an elevated stable layer can eventually

re-enter the mixed layer....

Fundamental to this approach is the concept that **the primary layer of importance, relative to receptor concentration, is the one through which plume material travels directly from source to receptor**."

The model does account for plume lofting and entry out of and back into the CBL Therefore, when the source emissions term changes and the exit gas velocities and temperature change the momentum flux and buoyancy forces also change and the plume averaging over heights could change - I looked closely at the terms used to estimate the stack momentum and buoyancy-induced fluxes in AERMOD. In our case, the stack gases are cooled and scrubbed before exit so temperature increases will be lessened, hence buoyancy-induced fluxes are not appreciably changed. Exit velocities will be higher, but not sufficient to make a major difference in lessening concentrations at the maximum level receptor location. The last sentence in the quote presented above reinforces that the higher source terms used in the EISs lead to higher concentrations - thus the EIS results being conservative in their level estimates. In this regard it is also important to note that AERMOD does not use coupled equations for fate and transport and so the concentration of SO2 does not modify any of the transport parameters, densities, etc.. or change based on chemical reactions. This is why it seems reasonable (given that we can address momentum and buoyancy-induced fluxes at the stack) that higher emission sources will lead to more conservative and higher levels at receptor sites.

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From: Bohning, Scott
Sent: Mon 6/13/2016 7:10:51 PM
Subject: RE: Further clarifications and many thanks again Re: AERMOD model approaches regarding plume lofting etc.

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Meanwhile, on your previous email about what issues need to get resolved in a protocol. Ideally a protocol would spell out pretty much the full procedure to be followed in the modeling, though some narrow issues might be left open. The big issue of what current actual emissions or what will be allowable emissions by the end of 2016 (and how those compare to the EIS emissions) is such a key one that we don't think a protocol can really be considered complete without that issue being decided. The related issue of whether new modeling will be done at all is also certainly important enough that it should be set out in the protocol.

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- Scott B.

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=+=+=+=+=+=+=+=+=+=+=+=+=+=+=

"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Gaurav Rajen [mailto:rajenwnr@gmail.com]
Sent: Friday, June 10, 2016 3:55 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov; Tennille B. Begay <tbbegay@navajo-nsn.gov>
Subject: AERMOD model approaches regarding plume lofting etc.

Dear Scott:

Just a quick note to share some more thoughts - I have been reviewing the EPA document (AERMOD: DESCRIPTION OF MODEL FORMULATION) available at - https://www3.epa.gov/scram001/7thconf/aermod/aermod_mfd.pdf

From the document..

"AERMOD is designed to treat the effects on dispersion from vertical variations in wind and turbulence. Consideration of the vertical variation in meteorology is important for

properly modeling releases in layers with strong gradients, for capturing the effects of meteorology in layers into which the plume may be vertically dispersing, and to provide a mechanism (in the Convective Boundary Layer, CBL) by which sources that are released into or penetrate into an elevated stable layer can eventually re-enter the mixed layer....

Fundamental to this approach is the concept that **the primary layer of importance, relative to receptor concentration, is the one through which plume material travels directly from source to receptor**."

The model does account for plume lofting and entry out of and back into the CBL Therefore, when the source emissions term changes and the exit gas velocities and temperature change the momentum flux and buoyancy forces also change and the plume averaging over heights could change - I looked closely at the terms used to estimate the stack momentum and buoyancy-induced fluxes in AERMOD. In our case, the stack gases are cooled and scrubbed before exit so temperature increases will be lessened, hence buoyancy-induced fluxes are not appreciably changed. Exit velocities will be higher, but not sufficient to make a major difference in lessening concentrations at the maximum level receptor location. The last sentence in the quote presented above reinforces that the higher source terms used in the EISs lead to higher concentrations - thus the EIS results being conservative in their level estimates. In this regard it is also important to note that AERMOD does not use coupled equations for fate and transport and so the concentration of SO2 does not modify any of the transport parameters, densities, etc.. or change based on chemical reactions. This is why it seems reasonable (given that we can address momentum and buoyancy-induced fluxes at the stack) that higher emission sources will lead to more conservative and higher levels at receptor sites.

As you suggested, it does make sense to run the model again for various reasons that you laid out - I would like you all to consider the re-running of the model to happen at a later date in 2017, allowing us to develop more in-house capability, seek additional supplemental funding, and work with local universities and colleges to develop programs that bring modeling capabilities to the Navajo Nation and train more of our staff and graduate students. Such options could be Navajo Technical University, and Dine College, both of which have environmental programs. If we award a contract to an outside consultant in a rush to meet a deadline we will remain tied to the use of outside consultants. This is something to think through as we progress farther in this effort. Michael King for example has a master's from Purdue in atmospheric physics and has run versions of AERMOD and even more complex fate and transport models. We also have an opportunity when we run AERMOD to use our data to do model validation. Re-running at a later date of course will require us to accept the EIS models' data and results as a first step. Before this decision is made, however, we should first settle on the modeling protocol we will use.

Many thanks for your thoughts on this matter,

Gaurav

To: Bohning, Scott[Bohning.Scott@epa.gov]
Cc: McKaughan, Colleen[McKaughan.Colleen@epa.gov]; Raju Bisht[rbisht@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]; eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]; Tennille B. Begay[tbbegay@navajo-nsn.gov]; Withey, Charlotte[Withey.Charlotte@epa.gov]
From: Gaurav Rajen
Sent: Mon 6/13/2016 6:00:06 PM
Subject: Further clarifications and many thanks again Re: AERMOD model approaches regarding plume lofting etc.

Dear Scott:

Many thanks for your very helpful and valuable exchanges. It would be good to keep this exchange as informative as possible so we can have as productive a call on Thursday as possible. We all appreciate your help and that of others at the EPA Region 9 very, very much.

I apologize for being unclear - the way I see this is as follows: for selecting the source terms, the DRR does not solely specify a set of years alone - i.e. the past three years; it also specifies that a federally enforceable limit should set the source term - in our case the FIPs and the operating permits. The Table I sent you (re-pasted below) gives the lbs/hr of SO2 assumed in the EISs and what the DRR would require. As you see below, the DRR would require 1722 and 1790 lbs/hr for the NGS and FCPP respectively. The EISs use 2245 lbs/hr and 2816 lbs/hr respectively. The source terms are higher and should lead to higher levels at the maximally-impacted receptor locations. What I was pointing out is that the temperatures will not change appreciably - however, higher SO2 content in lbs/hr implies higher coal burning rates (though one could also assume higher sulfur content, this content having a maximum allowable being set by the FIP and permits we have to assume higher quantities of coal being burned) which would imply higher gas exit velocities. Therefore, one would have to deal with the possibility of partial plume entry into the Stable Boundary Layer out of the Convective Boundary Layer and later re-entry and the possibility that the higher source emission rate is not automatically conservativen at the maximally-impacted loactions. There are some non-dimensional numbers (Reynold's number, Rayleigh number, Peclet number, Grashof number, etc.) that help us determine which effects predominate. Given the ranges we are dealing with, we can easily show that the higher source terms lead to higher levels at the maximally-impacted receptor locations even with higher stack exit velocities (that are associated with higher emission rates). Perhaps I have misunderstood these issues and am happy to be corrected.

Given the conservative assumptions inherent in the higher source terms used (see table below), I am suggesting that we hold off on re-running the models till we can build a local capability using our existing personnel and resources (e.g. Mike King has tremendous knowledge of modeling and fate and transport, he will be sending you a set of slides of his research at Purdue that you will find informative) and local Navajo colleges that have environmental programs. Getting the resources earmarked is also important and may be best done with more time available. For example, we could seek funding and assistance from EPA HQ and EPA research laboratories (in the Research Triangle Park for instance) - they may like the concept of building local Navajo capability using Navajo colleges to re-run the models. We always have the fall-back option of re-running with the help of the FCPP and the NGS and consultants, such as AECOM.

It just seems to me that as we have existing models and results that use higher conservative

source terms and show NAAQS attainment, the fact that we will re-run again as required by the DRR (given the fact that the modeled results are within the %difference to the standards for which the DRR specifies periodic re-runs), we may have more time available to develop local capabilities. So, for the January of 2017 deadline we use the existing model results and further state that the models will be re-run as required by the DRR within a specified time-frame. Just a thought for consideration - again, using the existing modeled results seems justified as the source terms are higher than required by the DRR.

It is good to know that the draft protocol has allowed us to meet our July 1 deadline.

Thank you again,

Gaurav Rajen

Appendix B

B 1.0 Comparisons of input data required by the DRR and used in the EISs (source emissions, stack velocities, temperatures, beta versions of software to convert meteorological low-wind speed data into planetary boundary layer model parameters, and years selected for meteorological data)

The DRR states that –

…Modeling analyses shall characterize air quality based on either actual SO2 emissions from the most recent 3 years, or on any federally enforceable allowable emission limit or limits established by the air agency or the EPA and that are effective and require compliance by January 13, 2017.

Table B.1 provides the major differences between source emissions used as inputs from the requirements of the DRR and the source emissions factors used in the existing modeling studies done for Environmental Impact Statements by the FCPP and the NGS. Attachments provide copies of the text in the DRR, the Federal Implementation Plans and existing compliance documents that describe the applicable federally enforceable limits; as well as copies of the relevant pages from the EISs.

Table B.1

Source emissions data required by the DRR and used in the EISs

Plant	NGS		FCPP	
References from which data are derived	DRR	EIS - NGS	DRR	EIS - FCPP
Years for which data required/ or basis of quantities used	2014, 2015, 2016/ federally enforceable limits	As used in EIS – total SO2 from all sources, burners, boilers, mines, on and off-road equipment, emergency generators, etc.	2014, 2015, 2016/ federally enforceable limit	As used in EIS - emission rates from the Units 4 and 5 stack are derived from consideration of actual hourly data, and the current Title V operating permit for FCPP
Average SO2 lbs/hr over any 1-hour period	**Approximately 1722 lbs/hr** – derived from 7544 tons/year allowed as a federally enforceable limit in the FIP	**2245 lbs/hr**	**1790 lbs/hr** (from draft FIP and federally enforceable limit – 10% of allowable SO2 generated; drops to 5% (i.e. lesser) in 2018	**2816 lbs/hr**

B 2.0 Considerations of stack exit velocities, temperatures and wind speed

When the source term used in the model is varied, there will also be a variation in the assumed stack gases' exit velocity and temperatures of the stack gases. Higher assumed quantities of SO2 released will be linked to higher coal burning rates and hence higher exit stack gas velocities and marginally higher temperatures. The 1-hour concentrations of SO2 at receptor sites in the near-field will be first order dependent on the quantities of SO2 released per hour and with a second to third –order dependence on the exit velocities and temperatures. Higher exit velocities and temperatures may cause some dilution of concentrations at far-field locations, but these effects will be substantially reduced and negligible in comparison to the increase in concentrations from increased SO2 releases in the near-field receptor locations with the maximum SO2 1-hour levels. This leads to the conclusions that the modeling studies conducted in the EISs are conservative in the derived SO2 1-hour concentrations as they use higher SO2 release terms.

Wind speeds will also be critical in determining the concentrations at receptor locations. The FCPP study used a beta version for deriving critical boundary layer parameters for

low wind speeds – the following discussion taken from the FCPP EIS describes the rationale for doing so.

[] Low Wind Speed Improvements for AERMOD

In 2010, the results of an evaluation of low wind speed databases for short-range modeling applications were provided to USEPA. The reason for the study was that some of the most restrictive dispersion conditions and the highest model predictions occur under low wind speed conditions, but there had been very little model evaluation for these conditions. The results of the evaluation indicated that in low wind conditions, the friction velocity formulation in AERMOD results in under-predictions of this important planetary boundary layer parameter. There were multiple outcomes of this under-prediction: mechanical mixing heights that were very low (less than 10 meters), very low effective dilution wind speeds, and very low turbulence in stable conditions. In addition, the evaluation study concluded that the minimum lateral turbulence (as parameterized using sigma-v) was too low by at least a factor of 2. After these issues were once again stated at the 10th USEPA Modeling Conference in March 2012, USEPA made some revisions in late 2012 to the AERMOD11 modeling system to correct the model deficiencies in this area. This culminated in USEPA releasing AERMET and AERMOD Versions 12345, which include “beta” options in AERMET for a revised u* formulation under stable conditions and two different low wind speed options in AERMOD. These updates are included in AERMET and AERMOD versions 13350, as well. During the USEPA webinar12 on January 14, 2014, USEPA staff stated that they are generally in favor of the AERMET beta u* option as it is based on peer-reviewed activities.

B 3.0 Issues related to variations in meteorological data used in the models from that suggested in the DRR

In development – we will trend data from our meteorological station in Shiprock to demonstrate that variations between the years of data used in the EIS and the most current trends are not significant.

On Mon, Jun 13, 2016 at 11:07 AM, Bohning, Scott <Bohning.Scott@epa.gov> wrote:

Gaurav -

I do not follow your argument -- cooler stack temperatures for this source would be same for EIS & new modeling, so that in itself would not tend to make EIS conservative... unless I am misunderstanding altogether.... we can talk more on Thurs. 6/16 call if needed on this.

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U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

From: Gaurav Rajen [mailto:rajenwnr@gmail.com]
Sent: Friday, June 10, 2016 3:55 PM
To: Bohning, Scott <Bohning.Scott@epa.gov>; McKaughan, Colleen <McKaughan.Colleen@epa.gov>; Raju Bisht <rbisht@navajo-nsn.gov>; Michael Z. King <mzking@navajo-nsn.gov>; eugeniaquintana@navajo-nsn.gov; Tennille B. Begay <tbbegay@navajo-nsn.gov>
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Many thanks for your thoughts on this matter,

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To: eugeniaquintana@navajo-nsn.gov[eugeniaquintana@navajo-nsn.gov]; Raju Bisht[rbisht@navajo-nsn.gov]; Michael Z. King[mzking@navajo-nsn.gov]; Gaurav Rajen[rajenwnr@gmail.com]
Cc: McKaughan, Colleen[McKaughan.Colleen@epa.gov]; LIMAYE, VIJAY[Limaye.Vijay@epa.gov]; YOSHIMURA, GWEN[Yoshimura.Gwen@epa.gov]; Withey, Charlotte[Withey.Charlotte@epa.gov]
From: Bohning, Scott
Sent: Fri 6/10/2016 3:49:15 PM
Subject: links for SO2 TAD and AERMOD beta memos

All -

Thanks for a very productive call yesterday (6/9), we look forward to working with you.

One of the action items was for me to send links to a few documents. It sounded like you already have 1. Modeling TAD, but I included it for completeness below. Also included 2. AERMOD beta options memo, and the main one of interest, 3. Donlin Modeling Clearinghouse (MCH) memo for the Donlin facility. That relied on AERMOD adjusted u-star (ADJ_U*) beta option, as did the EIS modeling for FCPP and NGS.

My thinking at this point is that we should plan on rerunning AERMOD with updated emissions. Relying on the EIS modeling, even if its emissions are acceptable, would require an Alternative Model demonstration (see notes in #3 below), since the EIS modeling used the ADJ_U* beta option. That demonstration would involve rerunning the model anyway (with and without the beta option), so we might as well plan on remodeling without the beta option, and skipping the demonstration. A benefit of that is that we'd be on more solid ground using up-to-date emissions and the latest model version. A downside is that, since FCPP was pretty close to the SO2 NAAQS even using the beta option, later on we might end up having to do the beta demonstration for it after all.

- Scott B.

1. Modeling TAD

Air Quality Designations for Sulfur Dioxide page

https://www.epa.gov/sulfur-dioxide-designations

Sulfur Dioxide Implementation - Programs and Requirements for Reducing Sulfur Dioxide

https://www3.epa.gov/airquality/sulfurdioxide/implement.html

About half way down on implementation page there is link to Modeling TAD:

Sulfur Dioxide (SO2) National Ambient Air Quality Standards Designations Modeling Technical Assistance Document (February 2016 Draft)

direct link: https://www3.epa.gov/airquality/sulfurdioxide/pdfs/SO2ModelingTAD.pdf

2. AERMOD beta options memo

2015 Beta options memo

SCRAM - Clarification Memos page

https://www3.epa.gov/scram001/guidance_clarificationmemos.htm

Clarification on the Approval Process for Regulatory Application of the AERMOD Modeling System Beta Options (12-10-2015)

Direct link:
https://www.epa.gov/ttn/scram/guidance/clarification/AERMOD_Beta_Options_Memo-20151210.pdf

Memorandum, "Clarification on the Approval Process for Regulatory Application of the AERMOD Modeling System Beta Options", Richard A. Wayland, Director, Air Quality Assessment Division, EPA, December 10, 2015

The 2015 memo basically says all AERMOD beta options have to get official approval from the Modeling Clearinghouse (within EPA OAQPS). That involves a demonstration under 40 CFR 51 Appendix W ("Guideline on Air Quality Models", referred to for short as Appendix W or GAQM) section 3.2, "Use of Alternative Models" submitted to EPA Regional Office, which sends with explanatory memo to MCH, which evaluates and then issues concurrence memo.

Exceptions are the POINTCAP and POINTHOR options (for capped and for horizontal stacks), for which the Regional Office can issue the approval. The demonstration required can vary, for some of the newer options it would be expected to be fairly involved. For the ADJ_U* (adjusted u-star, friction velocity) beta option, or others for which an MCH concurrence has already been issued, it would be less involved and could rely at least somewhat on the previous concurrence memo. While some of the beta options are expected to be incorporated into the upcoming update to Appendix W, after which there would be no need for the MCH process, that is still uncertain at this point, and we have been advised to always go through the process to be able to defend against any possible challenges to the work later on.

3. Donlin Modeling Clearinghouse (MCH) memo record

Model Clearinghouse page

https://www3.epa.gov/ttn/scram/guidance_clearinghouse.htm

Model Clearinghouse Information Storage and Retrieval System (MCHISRS)

http://cfpub.epa.gov/oarweb/MCHISRS/

The MCHISRS record for the Donlin memo is included below, and includes links to the MCH concurrence memo, the original request, and its supporting documentation (the App. W 3.2 demonstration). The Donline gold mine is in Alaska, in EPA Region 10.

Note that the MCH concurrence memo mentions only sources with low release heights (such as the fugitive PM that dominate the Donlin impacts), so I believe that a parallel demonstration would be needed to use ADJ_U* for tall stacks such as at FCPP and NGS. The Donlin demonstration pulled together information from past ADJ_U* option reviews and evaluations for similar sources, and also included a model performance comparison to monitored data, with and without the option. It is 100 pages long. (By contrast, the justification included by AECOM for the FCP EIS was only 1 and 1/2 pages, but it did not go through the MCH process.) I think a parallel demonstration for tall stacks would be doable, but I doubt it is worth the effort for the SO2 from the FCPP and NGS tall stacks. In order to do the demonstration, the model would have to be run with the beta option turned off, so you might as well run it that way in the first place and skip the beta option and demonstration. If one of the sources ended up being close to the NAAQS, then the option could be pursued later.

"Use of the ADJ_U* Beta Option in the AERMET Meteorological Processor as an Alternative Model", 2016-02-10

Model Clearinghouse Information Storage and Retrieval System Record Details (16_X_01)

http://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-X-01

===== begin 2016 Donlin MCHSR record 16-X-01 =====

Use of the ADJ_U* Beta Option in the AERMET Meteorological Processor as an Alternative Model

Record No: 16-X-01 Last Update: 02/10/2016

EPA Region: 10 Fiscal Year: 2016

States: AK

Record Type: Action

Pollutants: PM-10 Sources: Mine

Models: AERMOD Urban/Rural: Both Urban & Rural

Terrain: Both High & Low Regulations: PSD

Guideline: Guideline Database: Both

Oral/Written: Written Involvement: Review and Comment

Subjects: Technical Credibility of Nonguideline Techniques

Comments:

Issue: Region X is seeking concurrence from the Model Clearinghouse for the approval of an alternative modeling demonstration for the use of the beta adjusted surface friction velocity (ADJ_U*) modeling technique in the AERMET meteorological

preprocessor. The ADJ_U* technique will be applied in a compliance demonstration for a PSD permit at the Donlin mine facility located on the western slopes of the Kuskokwin Mountains in the Yukon-Kuskokwin region of southwestern Alaska.

C/H Response:

The Model Clearinghouse concurs that a well-reasoned justification was thoroughly documented and demonstrates that the ADJ_U* Beta option in AERMET selected for the Donlin mine facility compliance demonstration performs better for the given application, i.e., surface mining operations, than the default regulatory version of AERMET and, therefore, is approvable per the second condition of Appendix W, Section 3.2.2. We also concur with the decision to exclude the sigma-theta turbulence parameter when processing the site-specific meteorological data with the ADJ_U* Beta option and with the decision to not include any of the LOW_WIND Beta options in AERMOD for this alternative model approval. Finally, the Model Clearinghouse agrees with the use of the POINTCAP and POINTHOR Beta options for capped and horizontal releases in AERMOD for the Donlin mine facility compliance demonstration and further recommend their use as the best available options for all capped and horizontal stacks subject or not subject to downwash, consistent with our proposed revisions to Appendix W.

Memoranda:

http://www.epa.gov/ttn/scram/guidance/mch/new_mch/16-X-01_MCResponse_Region10_Donlin-02102016.pdf

Memo: Model Clearinghouse Review of the Use of the ADJ_U* Beta

Option in the AERMET Meteorological Processor (Version 15181)

for the Donlin Mine Compliance Demonstration

Dated: February 10, 2016

From: George Bridgers, Model Clearinghouse Director

Air Quality Modeling Group, EPA

To: Janis Hastings, Acting Director

Office of Air, Waste, and Toxics, Region 10, EPA

http://www.epa.gov/ttn/scram/guidance/mch/new_mch/16-X-01_Donlin_ADJU_MCHRequest-12012015.pdf

Memo: Model Clearinghouse Concurrence Request - Surface Friction

Velocity (u*) Non-Default/Beta Option in AERMET Version 15181;

Alternative Refined Model Demonstration

Dated: December 1, 2015

From: Kate Kelly, Director

Office of Air, Waste, and Toxics, Region 10, EPA

To: Tyler Fox, Lead

Air Quality Modeling Group, EPA

http://www.epa.gov/ttn/scram/guidance/mch/new_mch/16-X-01_Region10_Approval_Donlin_ADJU_10202015.pdf

Memo: Supporting Documentation - Surface Friction Velocity (u*)

Non-Default/Beta Option in AERMET Version 15181; Alternative

Refined Model Demonstration

Dated: December 1, 2015

From: Herman Wong, Region 10 Modeling Contact

Office of Air, Waste, and Toxics, Region 10, EPA

To: Alan Schuler, Engineer, P.E.

Alaska Department of Enviromental Conservation

===== end 2016 Donlin MCHSR record 16-X-01 =====

- Scott B.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

To: Charles.Spell@aps.com[Charles.Spell@aps.com]; mzking@navajo-nsn.gov[mzking@navajo-nsn.gov]; rbisht@navajo-nsn.gov[rbisht@navajo-nsn.gov]; Mark.Hajduk@aps.com[Mark.Hajduk@aps.com]
Cc: Eric.Massey@aps.com[Eric.Massey@aps.com]
From: Bohning, Scott
Sent: Wed 2/22/2017 4:21:54 PM
Subject: RE: FCPP SO2 emissions discussion

Chas -

Thanks for this! I will try to read through it today or tomorrow.

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"Scott Bohning" <bohning.scott@epa.gov>

U.S. EPA Region 9, AIR-7

415/947-4127 fax-3579

P.S.

Sorry for delay in replying, this is 1st time I've had EPA email access since Thu. 2/16...

From: Charles.Spell@aps.com [mailto:Charles.Spell@aps.com]
Sent: Sunday, February 19, 2017 9:47 AM
To: Bohning, Scott <Bohning.Scott@epa.gov>; mzking@navajo-nsn.gov; rbisht@navajo-nsn.gov; Mark.Hajduk@aps.com
Cc: Eric.Massey@aps.com
Subject: FCPP SO2 emissions discussion

Hello Scott,

During our meeting you requested 2015 SO2 related emissions data from Four Corners units 4 and 5. Attached is a spreadsheet that contains the data I believe you are seeking. If you need

additional data or clarification on the attached data, please let me know.

Chas

-----Original Appointment-----
From: Bohning, Scott [mailto:Bohning.Scott@epa.gov]
Sent: Thursday, February 09, 2017 3:28 PM
To: Bohning, Scott; Spell, Charles M; Michael Z. King; Raju Bisht; Hajduk, Mark B
Cc: Massey, Eric; Lee, Anita
Subject: FCPP SO2 emissions discussion
When: Wednesday, February 15, 2017 2:00 PM-3:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: R9SF-ConferenceLine-AIR-Card1; R9SF-Room-18230-4-Ely

USE CAUTION - EXTERNAL SENDER:(Bohning.Scott@epa.gov)

Do not click on links or open attachments that are not expected.

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Discussion of FCPP SO_2 emissions for modeling

Wednesday, February 15

3 pm MST (2 pm PST)

call-in number: Ex. 6 - Personal Privacy

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will send agenda suggestion later

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Cc: Martha Sims[Martha.Sims@ipaper.com]; Billy J Scott[Billy.Scott@ipaper.com]
From: Chuck Doyno
Sent: Fri 12/9/2016 10:25:27 PM
Subject: International Paper - Prattville, AL Mill SO2 DRR Modeling Report
IP Prattville SO2 DRR Modeling Report 12-9-16.pdf

All – Attached please find the SO2 DRR modeling report for International Paper's (IP's) Prattville, AL mill. The corresponding air dispersion modeling and modeling report was prepared based upon the modeling protocol submitted in June 2016 to satisfy the requirements of 40 CFR Part 51, Subpart BB. Please review and let myself or Martha Sims (Martha.sims@ipaper.com) know if you have any comments or questions.

We have also uploaded the electronic air dispersion modeling files and hourly calculation inventory, which you can download here:
https://www.hightail.com/download/cUJVa0ZSSU9BNkYzZU1UQw

Enjoy your weekend,

Chuck

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SO2 Data Requirements Rule (DRR) Air Quality Modeling Report

International Paper – Prattville, AL Mill

December 2016

Submitted by:

INTERNATIONAL PAPER

International Paper
Prattville Mill
100 Jensen Road
Prattville, AL 36067

Submitted to:

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1. INTRODUCTION

On June 2, 2010, the U.S. Environmental Protection Agency (U.S. EPA) issued the final 1-hour National Ambient Air Quality Standard (NAAQS) for sulfur dioxide (SO_2). U.S. EPA subsequently promulgated 40 CFR Part 51, Subpart BB (Data Requirements for Characterizing Air Quality for the Primary SO_2 NAAQS, also known as the SO_2 DRR) on August 21, 2015 in 80 Federal Register (FR) 51051, which requires air agencies such as the Alabama Department of Environmental Management (ADEM) to develop and submit air quality data characterizing the maximum 1-hour ambient concentrations of SO_2 through either ambient air quality monitoring or air quality modeling evaluation. As part of the 1-hour SO_2 NAAQS designation process, International Paper (IP) is assisting ADEM in evaluating the designation for the area immediately surrounding its unbleached Kraft linerboard mill in Prattville, Alabama (Prattville Mill or Mill).

Via a January 14, 2016 letter to U.S. EPA Region 4, ADEM identified the Prattville Mill as subject to the DRR based its calendar year 2014 SO_2 emissions (3,691 tons). By July 1, 2016, ADEM was required to provide a formal submittal to U.S. EPA declaring whether ambient monitoring or dispersion modeling will be used for the designation evaluation in areas surrounding DRR-subject facilities. The submittal required modeling protocols for areas relying on dispersion modeling. In addition, monitoring details were required to be submitted to U.S. EPA by July 1, 2016 as part of ADEM's annual Consolidated Network Review submission. IP submitted an air dispersion modeling protocol to ADEM on June 2, 2016.

IP used dispersion modeling to support designation of the attainment status for the 2010 SO_2 NAAQS. This report summarizes the air dispersion modeling for the DRR designation evaluation as described in the air dispersion modeling protocol submitted on June 2, 2016. IP conducted the air quality modeling consistent with the procedures outlined in U.S. EPA's December 2013 Draft "Sulfur Dioxide (SO_2) National Ambient Air Quality Standards Designations Modeling Technical Assistance Document" (Modeling TAD; U.S. EPA 2013). Additional sections of this report contain the following information:

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- **Section 2 – Mill Overview** – provides an overview of the Mill's current configuration and operations.

- **Section 3 – SO_2 Emissions Inventory Summary** – provides a detailed description of the hourly SO_2 emissions inventory comprising the actual emissions data input for the modeling evaluation.

- **Section 4 – Air Quality Modeling Approach and Technical Information** – outlines the technical approach that was used to conduct the SO_2 DRR modeling evaluation.

- **Section 5 – Presentation of Ai r Quality Modeling Results** – provides a summary of results for the SO_2 DRR air quality modeling evaluation.

- **Section 6 – References** – provides a detailed list of the reference documents utilized for the SO_2 DRR air quality modeling evaluation.

- **Appendix A – ADEM Response to EPA Technical Review Comments** – provides the ADEM response to EPA Technical Review Comments on the SO_2 DRR Modeling Protocol document.

- **Appendix B – Sensitivity Analysis of ADJ U* Option for SO_2 DRR Modeling** – provides a sensitivity analysis of the beta ADJ_U* option, comparing concentrations output from the regulatory default air quality modeling to concentrations output from air quality modeling using the ADJ_U* option.

- **Electronic Appendix** – provides hourly production, fuel usage, operating hours, SO_2 emissions factors, emissions data, and background concentration calculations. Available at https://www.hightail.com/download/cUJVa0ZSSU9BNkYzZU1UQw.

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2. MILL OVERVIEW

This section of the report contains a description of the Mill. A description of the geographic and topographic setting of the Mill is also provided.

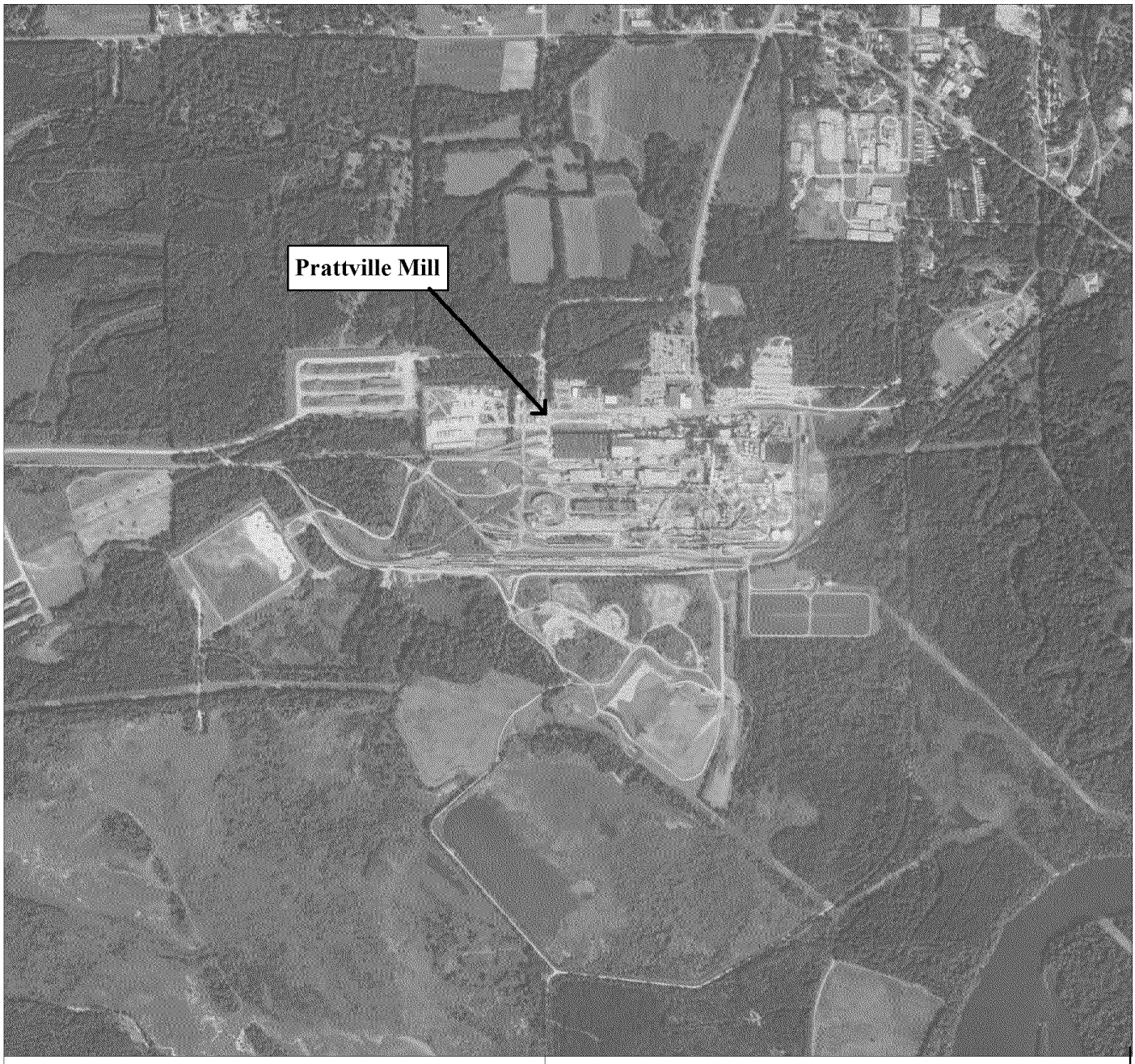
2.1 FACILITY LOCATION

The Mill is located south of dow ntown Prattville in Autauga Cou nty, Alabama. The location of the Mill is depicted in Figure 2-1 on a section of U.S. Geological Survey (USGS) quadrangle. The geographical coordinates for the approximate center of the processing area of the Mill are:

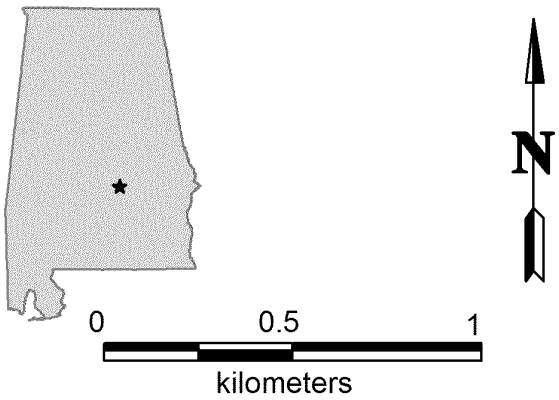
- Universal Transverse Mercator (UTM) Easting: 549,407 meters (m)
- UTM Northing: 3,586,896 m
- UTM Zone: 16
- North American Datum (NAD): 1983
- Longitude (degrees, minutes, seconds): 86° 28′ 28.32″ W
- Latitude (degrees, minutes, seconds): 32° 25′ 4.97″ N

The Prattville Mill is located in the Columbus (Ge orgia) – Phen ix City (Alabama) Interstate Air Quality Control Region (AQCR) (40 CFR §81.58). Autauga County is in attainment or unclassifiable/attainment for all criteria pollutants (40 CFR § 81.301) as of the date of this submittal.

The Mill elevation is approximately 62 m [203.5 feet (ft)] above mean sea level (amsl). The Mill is located approximately 1.5 kilometers (km) northwest of the Alabama River.



approximate quadrangle location



Based of USGS 1:24,000 topopgraphical map for Prattville, AL 2013 and Forester, AL 2013.

Figure 2-1
Mill Location Map

International Paper
Prattville, AL Mill

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2.2 MILL PROCESS DESCRIPTION

The Prattville Mill consists of the pulp mill, evaporator area, caustic area, non-condensable gas (NCG) collection system, hydrapulper, paper mill, power house area, recovery area, and numerous miscellaneous activities. Wood chips are continuously fed into the pulp mill's three Kamyr digesters. The pulp is transferred from the digesters to five wash plants to reduce and screen out rejects and to wash liquor from the pulp stock. Additional pulp is produced from recovered paper and old corrugated cardboard (OCC) in the hydrapulper. The pulp is transferred to the paper mill where it is further processed in the Mill's two paper machines. The paper machines convert pulp into various grades of unbleached two-ply linerboard.

The evaporator area consists of three evaporators and a condensate stripping system. The evaporators process weak black liquor generated from the pulping process. The condensate stripping system treats process condensates to reduce hazardous air pollutant (HAP) emissions.

The recovery area reclaims spent cooking chemicals from the pulp mill. "Black liquor" from the Kraft cooking process in the pulp area is combusted in either of the two recovery furnaces (Emissions Unit IDs RF1 and RF2). The combustion of black liquor results in a molten smelt which is formed at the bottom of the recovery furnaces. The molten smelt is then discharged from the furnaces into three smelt dissolving tanks (Emissions Unit IDs SDT1 and SDT2) each associated with a recovery furnace. Emissions Unit SDT1 consists of two smelt dissolving tanks. In the smelt dissolving tanks, a water based solution is added to the molten smelt to form green liquor. The green liquor is sent to the caustic area for further processing.

The purpose of the caustic area is to convert unclarified green liquor to white liquor, which is used in the pulp cooking (e.g., digester) process in the pulp mill. Green liquor is received from the recovery area and further processed in the green liquor clarifiers. The green liquor is mixed with lime and the causticizing reaction beings, forming a calcium carbonate and white liquor slurry. The calcium carbonate and white liquor are then separated and the calcium carbonate is converted into lime in the two lime kilns (Emission Unit IDs LK1 and LK2) operated by the Mill. The white liquor is delivered to the pulp mill to begin the pulp cooking process again.

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The power house area generates and distributes steam, electrici ty, chilled water, instrument air, and demineralized water for use throughout the Mill. The Pratt ville Mill operates two Power Boilers. Power Boiler No. 1 (Emissions Unit ID PB1) burns unad ulterated biomass (bark), creosote treated rail ties, and natural gas. In addition, PB1 is also used as a control device by burning low volume/high concentration (LVHC) NCGs, high volume/ low concentration (HVLC) NCGs, and condensate stripping sy stem off gases (SOGs). Power Boiler No. 2 (Emissions Unit ID PB2) burns unadulterated biomass (bark), creosote treated rail ties, coal, and natural gas. PB2 is also used as a control device by burning HVLC NCGs and SOGs.

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3. SO_2 EMISSIONS INVENTORY SUMMARY

This section of the report discusses the SO_2 emissions inventory and the physical stack characteristics that were used as part of the air quality modeling evaluation.

3.1 HOURLY SO_2 EMISSIONS INVENTORY

The modeling evaluation was based on actual hourly SO_2 emissions from the 2012, 2013, and 2014 calendar years (since the basis of the designation as an affected facility for the Prattville Mill was calendar year 2014 emissions). The following emissions units at the Mill emit SO_2 and were considered in the emissions inventory:

- No. 1 Recovery Furnace (RF1)
- No. 1 Lime Kiln (LK1)
- No. 1 Power Boiler (PB1)
- No. 1 Smelt Dissolving Tank (RF1SDT)
- No. 2 Lime Kiln (LK2)
- No. 2 Smelt Dissolving Tank (RF2SDT)
- Combined Stack (CS) [includes the No. 2 Recovery Furnace and the No. 2 Power Boiler]

Note that the IDs listed above indicate the Stack ID references that were used in the modeling files. The emissions units listed above exhaust to various stacks at the Mill. Each emissions unit vents to its own individual stack, except for PB1 and RF1SDT, which each vents to two separate stacks.

Because there are no continuous emissions monitoring systems (CEMS) installed on the SO_2 emissions units identified in Section 2.2, hourly SO_2 emissions were quantified using various emissions factor methodologies as described in this section:

1. Where available, IP relied on site-specific emissions factors developed through historic stack testing.
2. If no site specific emissions factors were available, IP relied on industry accepted emissions factors from the National Council for Air and Stream Improvement (NCASI) or U.S. EPA's AP-42.

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The emissions factors were then paired with hourly production, fuel usage, or operating hour information, as appropriate, to quantify actual hourly emissions of SO_2. IP utilized emissions factors consistent with the Mill's annual emissions statement reporting submittals, except for RF1. The Mill has previously relied on a historic SO_2 stack test from 1998 to quantify emissions from RF1. A more recent stack testing program was completed on RF1 in 2015 that indicates that SO_2 emissions are lower than the 1998 emissions information. The decrease in SO_2 emissions is sustainable and is attributed to a number of projects such as air handling system modifications that improved the combustion efficiency of RF1 and reduced SO_2 emissions since the previous stack test was conducted. Therefore, IP utilized the more recent stack test information to quantify hourly SO_2 emissions from RF1.

When hourly production, fuel usage, or operating hours data were missing, it was assumed that the missing hourly throughput data were equal to the average of the hours directly before and after the event. Per Comment No. 1 of U.S. EPA's Technical Review comments of the air dispersion modeling protocol, a copy of which has been included in Appendix A, a summary of hourly production, fuel usage, operating hours, SO_2 emissions factors, and actual pounds per hour (lb/hr) emissions is provided in the electronic appendix to this document. References for each emissions factor and all production data used are also provided in the electronic appendix.

3.2 PHYSICAL STACK INVENTORY

The physical stack characteristics that will be used for this air quality modeling evaluation are provided in Table 3-1 below:

Table 3-1
Physical Stack Characteristics

Emissions Unit	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height (m)	Stack Diameter (m)
RF1	549,694	3,586,945	62.03	62.48	3.20
LK1	549,839	3,586,894	62.03	45.72	1.88

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Table 3-1
Physical Stack Characteristics

Emissions Unit	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height (m)	Stack Diameter (m)
PB1 A Stack	549,673	3,586,982	62.03	66.75	1.83
PB1 B Stack	549,673	3,586,979	62.03	66.75	1.83
RF1SDT A Stack	549,685	3,586,994	62.03	60.35	1.19
RF1SDT B Stack	549,685	3,586,971	62.03	60.35	1.19
LK2	549,844	3,586,884	62.03	45.72	1.89
RF2SDT	549,653	3,587,029	62.03	76.20	1.83
CS	549,719	3,587,032	62.03	76.20	4.57

Temperature and flow rate were varied annually based on availab le stack test data. Hourly emissions, temperature, and flow rate are provided in an hourly emissions file included as part of the electronic appendix.

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4. AIR QUALITY MODELING APPROACH AND TECHNICAL INFORMATION

This section of the report outlines information on the technical approach that was followed in the air quality modeling evaluation and described in the air dispersion modeling protocol submitted to ADEM on June 2, 2016.

The air dispersion model selection is discussed as well as the model options that were used. The supporting information, including land use determinations, building downwash analyses, meteorological data, and terrain data is presented. Whenever possible, the guidance provided in 40 CFR Part 51 Appendix W "Guideline on Air Quality Models" (U.S. EPA 2005) and U.S. EPA 2013 was used to conduct the air quality modeling evaluation.

4.1 AIR DISPERSION MODEL SELECTION

The AERMOD (**AER**MIC **MOD**el) air dispersion model was used to estimate ambient air concentrations from the Mill. It is an Appendix W air dispersion model approved for regulatory modeling applications. The current version of AERMOD is 15181.

The AERMOD modeling system consists of two pre-processors and the dispersion model. AERMAP (Version 11103) is the terrain data pre-processor component and AERMET (Version 15181) is the meteorological data pre-processor component. The AERMAP pre-processor characterizes the surrounding terrain and generates receptor elevations. The AERMET pre-processor is used to generate an hourly profile of the atmosphere and uses a pre-processor, AERSURFACE (Version 13016), to process land use data for determining micrometeorological variables that are inputs to AERMET.

The AERMOD air dispersion model has various user selectable options that must be considered. U.S. EPA has recommended that certain options be selected whenperforming air quality modeling studies for regulatory purposes. The following regulatory default options were used in the AERMOD air quality modeling study:

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- Stack-Tip Downwash
- Model Accounts for Elevated Terrain Effects
- Calms Processing Routine Used
- No Exponential Decay for Rural Mode and
- Missing Data Processing

4.2 LAND USE ANALYSIS

A land use analysis for the area surrounding the Mill was compled. The land use analysis is based on USGS electronic land use data for the area. Following U.S. EPA guidance (U.S. EPA 2005), the land use designation was based on the scheme developed by A uer (Auer 1978). Using the Auer land use classifications, industrial, commercial, and residential areas were classified as urban land use while agricultural, undeveloped, and common residentia l areas were considered to be rural land use. If more than 50% of the land use within a 3 km radius of the Mill is rural, then a rural designation should be used in the air dispersion model.

To perform the land use analysis, geographical information syst em (GIS) software was used to summarize the various land use types contained in the USGS elec tronic land use dataset. Based on the GIS summary, the land use within a 3-km radius of the Mill is approximately 96% rural, with the remaining percentage of land use being urban. Therefo re, the urban option was not selected in the AERMOD air dispersion model. The 3-km radius l and use summary for the area surrounding the Mill is shown in Figure 4-1.

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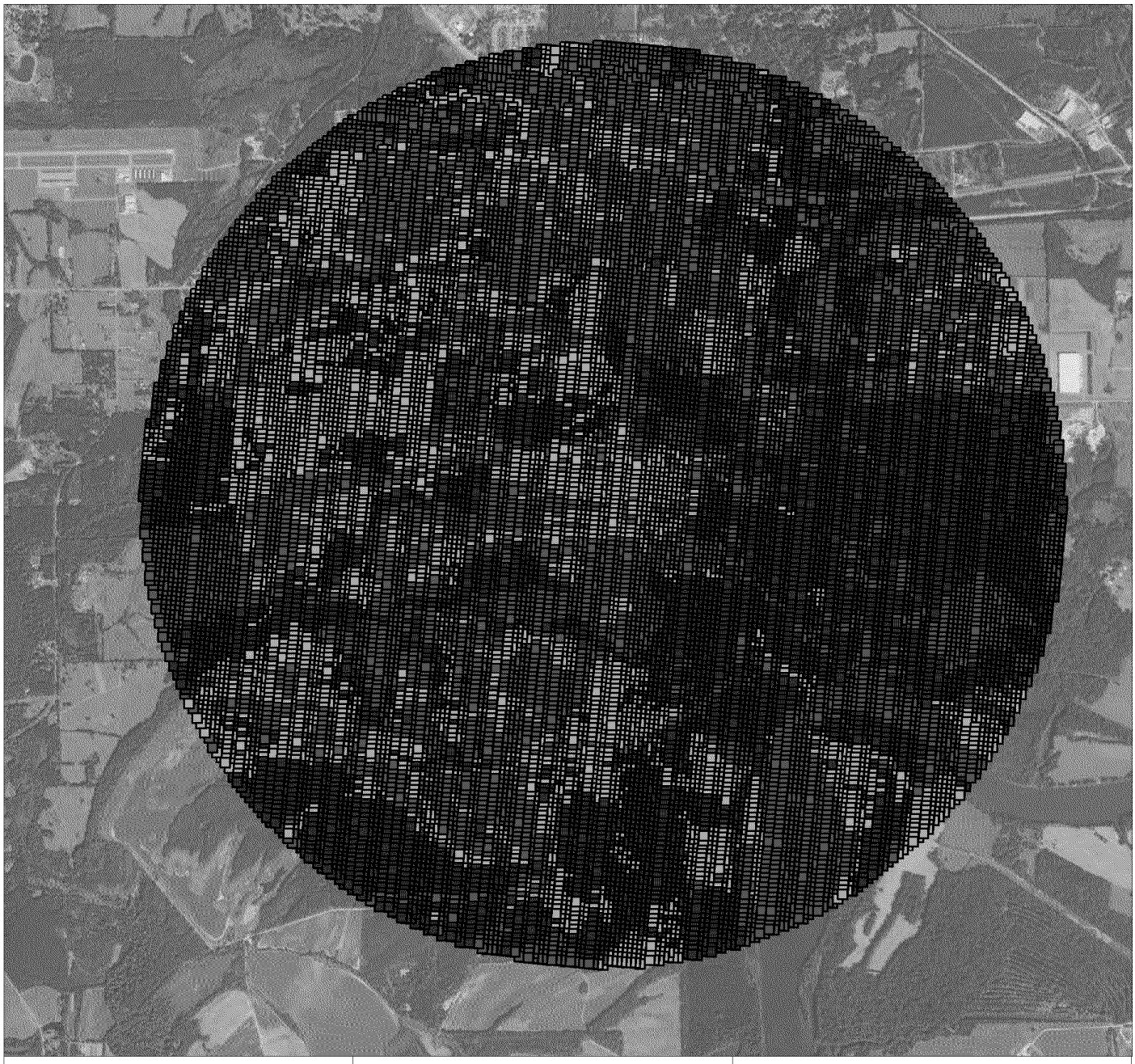
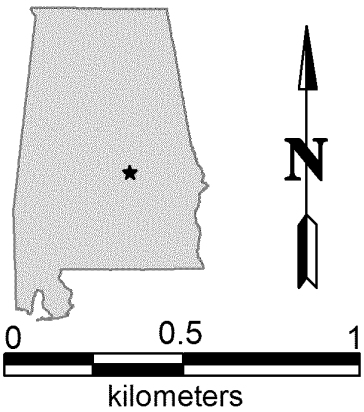


approximate quadrangle location



Based of USGS 1:24,000 topopgraphical map for Prattville, AL 2013 and Forester, AL 2013.

Figure 4-1
Prattville Mill
3-km Land Use Analysis

International Paper
Prattville, AL Mill

2011 National Land Cover Dataset

- 11 - Open Water (6%)
- 21 - Developed, Open Space (8%)
- 22 - Developed, Low Intensity (5%)
- 23 - Developed, Medium Intensity (3%)
- 24 - Developed, High Intensity (1%)
- 31 - Barren Land (Rock/Sand/Clay) (1%)
- 41 - Deviduous Forest (7%)
- 42 - Evergreen Forest (20%)
- 43 - Mixed Forest (9%)
- 52 - Shrub/Scrub (7%)
- 71 - Grassland/Herbaceous (1%)
- 81 - Pasture/Hay (16%)
- 82 - Cultivated Crops (6%)
- 90 - Woody Wetlands (10%)
- 95 - Emergent Herbaceous Wetlands (2%)

4.3 RECEPTOR GRID

A receptor grid for the AERMOD evaluation was developed to cover a 20-by-20 km square area centered on the Mill. All receptors were referenced to the UTM coordinate system, Zone 16, using NAD 83 datum. Rectangular coordinates were used to identify each receptor location. The rectangular receptor grid extends from the Mill property line and has the following grid spacing:

- 100 m out to ± 3 km
- 200 m out to ± 5 km
- 500 m out to ± 7 km and
- 1,000 m out to ± 10 km

In addition to the main rectangular coordinate receptor grid, property line receptors were used in the air quality modeling evaluation. The property line receptors were spaced approximately every 100 m. Plots of the inner portion of the receptor grid and the full receptor grid are shown in Figure 4-2 and Figure 4-3, respectively. Per Comment No. 2 of U.S. EPA's Technical Review Comments provided in Appendix A, IP limits public access to the areas of the property that do not restrict access using fences, gates, or no trespassing signs by patrolling the property routinely. Therefore, IP does not consider this area ambient air and will not include receptors in these locations. IP's site security, manned 24/7, patrols the property. IP has detailed the areas of their property line that are fenced, gated, or contain no trespassing signs in Figure 4-4.

Terrain elevations were assigned to all receptors. The AERMAP terrain pre-processor and USGS 1:24,000 National Elevation Dataset (NED) files were used to determine representative terrain elevations for all of the receptors. The horizontal resolution of the NED data is every 10 m.

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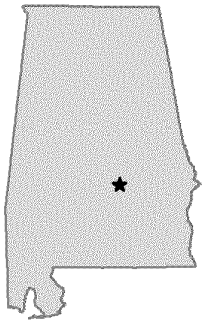
approximate quadrangle location



Based of USGS 1:24,000 topopgraphical map for Prattville, AL 2013 and Forester, AL 2013.

Figure 4-2
Inner Portion of the Receptor Grid

International Paper
Prattville, AL Mill

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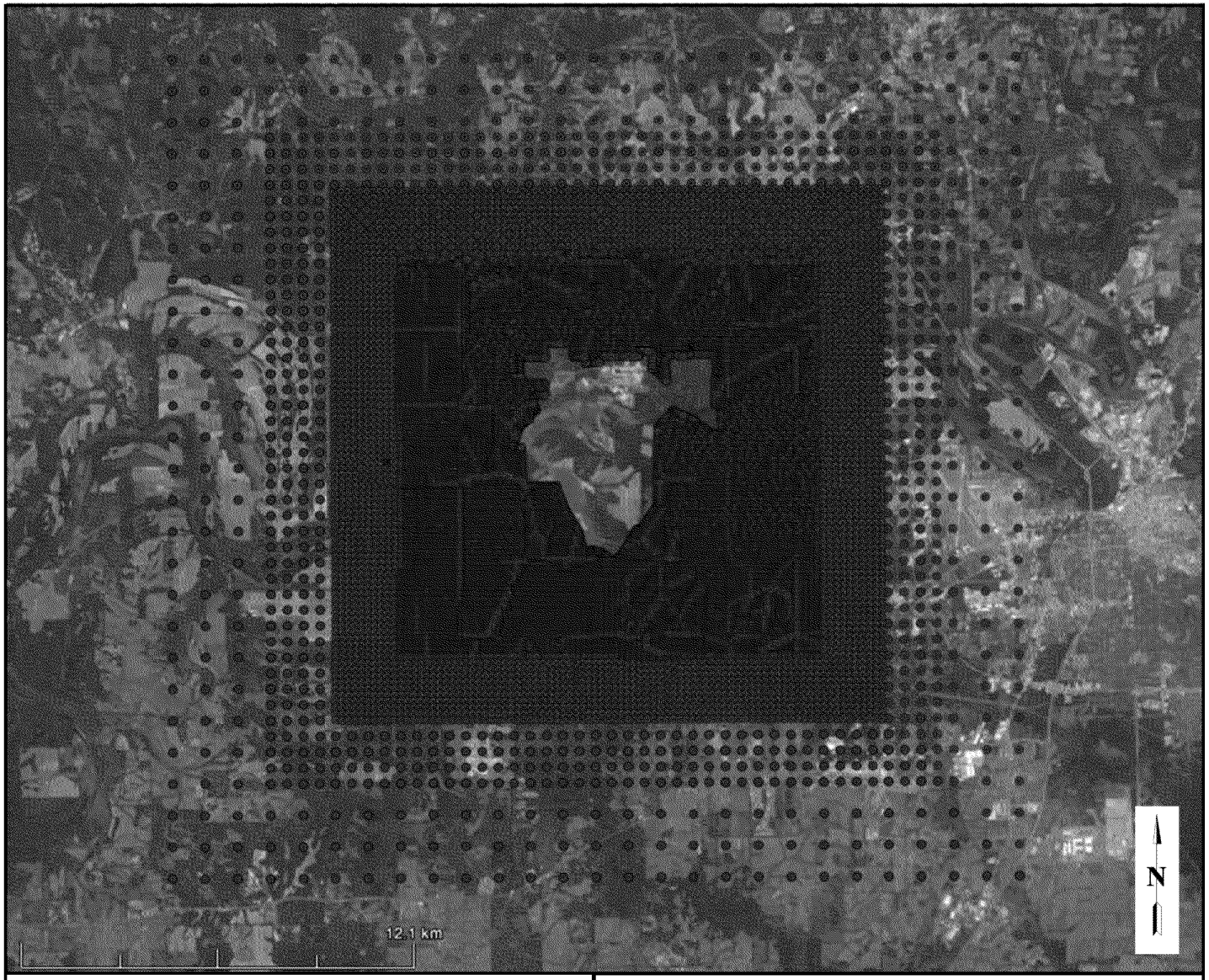

International Paper Prattville, AL Mill	Figure 4-3 Full Receptor Grid

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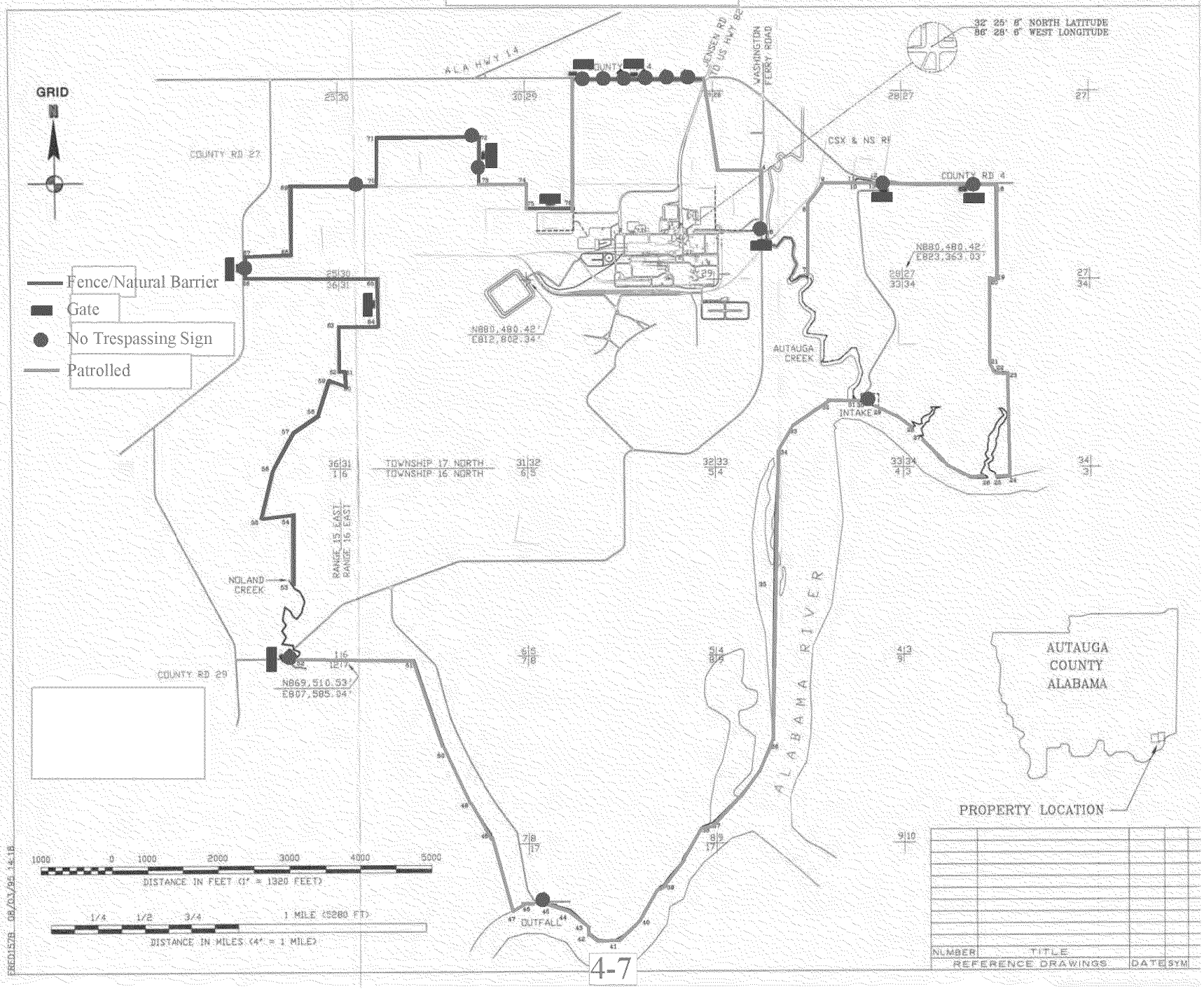
Figure 4-4
Mill Property Lines



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4.4 LOCAL SOURCES

Based on an initial screening analysis provided by ADEM, local sources were evaluated using a "20D" approach for local sources within 20 km of the Mill. Local sources were excluded from the analysis if the 2014 annual emissions rates for the local source are less than 20 times the distance between the source and the Mill. Based on ADEM's analysis, no local sources met the 20D analysis for the Mill. As such, no additional analysis for local sources was necessary. Per U.S. EPA's Technical Review Comments, additional details regarding the screening of local sources is provided by ADEM in the response to Comment No. 3 included in Appendix A.

4.5 METEOROLOGICAL DATA

The meteorological data for the air quality modeling study consisted of three years of processed meteorological data provided by ADEM. The surface data were collected from Dannelly Field (MGM) National Weather Service (NWS) station in Montgomery, AL(Meteorological Station ID: 13895). The upper air (UA) data were collected from the Shelby County Airport (KEET) NWS station in Alabaster, AL (U.S. Station ID: 72230). The Mill obtained the meteorological data from ADEM for January 1, 2012 through December 31, 2014, which coincides with the timeframe for the actual SO_2 emissions data. Per U.S. EPA's Technical Review Comments, additional details regarding the meteorological representativeness of the data used to conduct this air quality modeling study is provided by ADEM in the response to Comment No. 4 included in Appendix A.

IP utilized the Adjust U-star (ADJ_U*) beta option in the AERMET meteorological processor (Version 15181). The ADJ_U* beta option addresses concerns of under-prediction of surface friction velocity (u*) during stable, low-wind conditions that contribute to over-prediction of ground level impacts (U.S. EPA 2016). The use of the ADJ_U* option is included as a beta option in AERMOD version 15181 and is currently proposed to become a regulatory default option as a part of the 40 CFR Part 51 Appendix W (Guideline on Air Quality Models) amendments proposed on July 29, 2015. Additionally, the ADJ_U* option meets the five conditions listed in 40 CFR

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Part 51, Appendix W, Section 3.2.2(e) demonstrating that the default option is less appropriate for the IP SO_2 DRR analysis.

- *The model has received significant scientific peer review*, including the following:
  - Qian, W. and A. Venkatram, 2011. "Performance of Steady-State Dispersion Models Under Low Wind Speed Conditions." Boundary Layer Meteorology, 138:475-491.
  - Luhar AK and Rayner KN, 2010. "Methods to Estimate Surface Fluxes of Momentum and Heat from Routine Weather Observations for Dispersion Application under Stable Stratification." Boundary Layer Meteo rology, 132:437-454.
- *The model can be demonstrated to be applicable to the problem on a theoretical basis*. Several studies (sited above) have demonstrated that AERMET with default options tends to significantly underestimate u* for low wind speed conditions which results in underestimations of turbulence and mixing height in AERMOD for stable conditions, which in turn reduces dispersion and leads to over-predicted co ncentrations. These same studies (sited above) conclude that use of ADJ_U* in AERMET improves the accuracy of predicted concentrations.
- *The databases which are necessary to perform the analysis are available and adequate*. Three years of representative meteorological data from the MGM NWS station for the period of 2012-2014 coincide with hourly actual SO_2 emissions from the Mill are available.
- *Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates*. The June 2015 Addendum to the AERMOD User's Guide (U.S. EPA 2015) included an evaluation of low wind beta options inclu ding ADJ_U*. The Addendum provided evaluations of the Oak Ridge and Idaho Falls tracer studies and the Lovett Power Plant study and found that the ADJ_U* option improved model performance as compared to the default method and did not show a bias toward underestimates.
- *A protocol on methods and procedures to be followed is summarized as part of this air quality modeling protocol*.

In addition, the Model Clearinghouse has made two recent determinations that using the ADJ_U* option was acceptable for the Donlin Mine Compliance Demonstrat ion (February 10, 2016) and for the Schiller Station Compliance Demonstration (April 7, 2016). The releases from IP are best characterized as buoyant plumes emitted from tall stacks in a r egion with complex terrain. The Oak Ridge and Idaho Falls studies and the Donlin Mine Demonstration are less directly applicable because the release heights are characterized as low-level and non-buoyant (U.S. EPA 2016). The Schiller Station Demonstration is directly applicable because the releases are characterized as

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buoyant plumes from tall stacks in complex terrain (U.S. EPA 2016a). In addition, the terrain surrounding the IP Mill is similar to the Schiller Station in that there is discrete complex terrain (i.e., rolling hills) surrounding each facility. The Schiller Station Model Clearinghouse determination demonstrated the use of ADJ_U* resulted in better model performance than without the use of ADJ_U*. In addition to the applicability of the recently approved Schiller Station Demonstration, the Mercer County, ND evaluation (Paine et al. 2015) is also directly applicable. The Mercer County evaluation compared modeled ground level concentrations from a tall stack in complex terrain to ambient monitoring data. The evaluation found that modeled ground level concentrations were closer to the actual monitor data when the ADJ_U* beta option was utilized. Per Comment No. 5 of U.S. EPA's Technical Review Comments included in Appendix A, IP has also provided a sensitivity study to support the use of the ADJ_U* option for this air quality modeling study which is included in Appendix B.

Per the ADJ_U* sensitivity analysis, because the ADJ_U* beta option improves model performance, is proposed to become a regulatory default option, and because the recently approved Schiller Station Demonstration is directly applicable to the Mill, IP concluded that this option was appropriate for this modeling evaluation

4.6 GOOD ENGINEERING PRACTICE (GEP) STACK HEIGHT ANALYSIS

An analysis was conducted to determine the potential for building downwash at the Mill. Guidance contained in the U.S. EPA "Guideline for Determination of Good Engineering Practice (GEP) Stack Height (Revised)" (U.S. EPA 1985) and the U.S. EPA Building Profile Input Program Plume Rise Model Enhancements (BPIP-PRIME) (Version 04274) was followed. To perform the building downwash analysis, a Mill plot plan showing the Mill buildings, structures, and stacks was digitized using GIS software. For this evaluation, the actual stack height was used. This approach is consistent with the requirements in the SO_2 DRR and the Modeling TAD. The GIS digitization of the Mill is presented in Figure 4-5.

To determine which buildings to include, the Mill utilized the guidance presented in the GEP Stack Height Guidance (U.S. EPA 1985). Specifically, the Mill included buildings that lie within a 5L

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radius of a stack, where L is the lesser of the building height or building width. Details regarding the building analysis are included in Table 4-1, which correspo nd to the building IDs in Figure 4-5.

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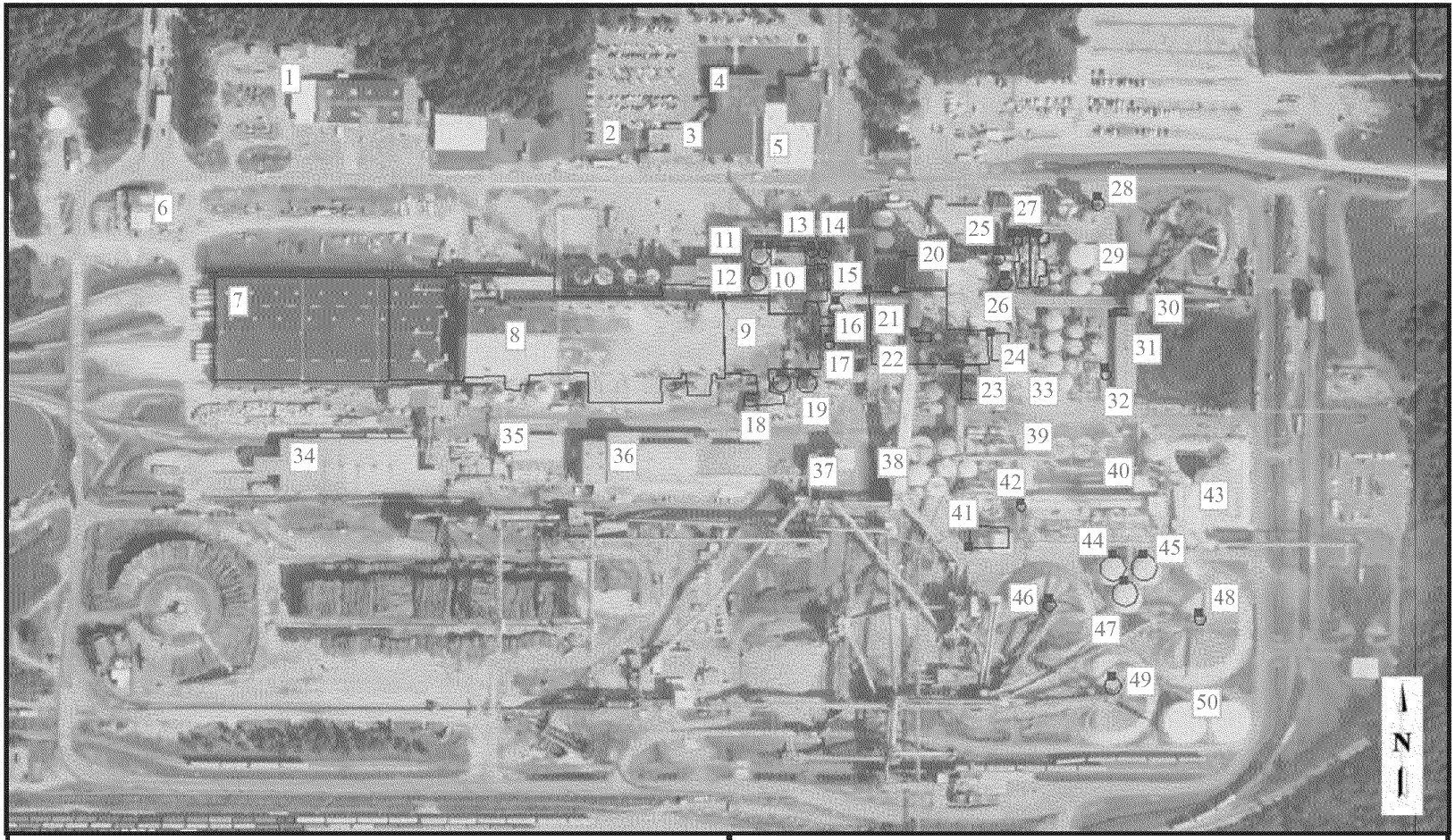

International Paper
Prattville, AL Mill

Figure 4-5
Building Downwash Image

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Table 4-1
Building Downwash Analysis

Building ID	Building Height (m) or Reason for Excluding
1	Greater than 5L from the stacks
2	Greater than 5L from the stacks
3	Greater than 5L from the stacks
4	Greater than 5L from the stacks
5	Greater than 5L from the stacks
6	Greater than 5L from the stacks
7	Greater than 5L from the stacks
8	Greater than 5L from the stacks
9	Greater than 5L from the stacks
10	10.5
11	24.8
12	Greater than 5L from the stacks
13	Greater than 5L from the stacks
14	Greater than 5L from the stacks
15	Greater than 5L from the stacks
16	Greater than 5L from the stacks
17	25.6
18	25.6
19	23.9
20	20.3
21	64.5
22	44.7
23	24.4
24	24.4
25	12.2
26	12.2
27	Greater than 5L from the stacks
28	53.5
29	44.2
30	9.8
31	40.5
32	18.6
33	18.7
34	14.3
35	17.4
36	18.0
37	Greater than 5L from the stacks
38	Greater than 5L from the stacks

Table 4-1
Building Downwash Analysis

Building ID	Building Height (m) or Reason for Excluding
39	Greater than 5L from the stacks
40	Greater than 5L from the stacks
41	Greater than 5L from the stacks
42	Greater than 5L from the stacks
43	Greater than 5L from the stacks
44	24.8
45	Greater than 5L from the stacks
46	10.4
47	15.8
48	44.3
49	Greater than 5L from the stacks
50	Greater than 5L from the stacks
51	Greater than 5L from the stacks
52	Greater than 5L from the stacks
53	Greater than 5L from the stacks
54	Greater than 5L from the stacks
55	Greater than 5L from the stacks
56	12.2
57	12.2
58	12.2
59	12.2
60	12.2
61	19.2
62	12.2
63	12.2
64	12.2
65	17.1
66	Greater than 5L from the stacks
67	Greater than 5L from the stacks
68	14.2
69	14.2
70	27.4
71	20.3
72	12.2
73	12.2
74	12.2
75	12.2
76	12.2

Table 4-1
Building Downwash Analysis

Building ID	Building Height (m) or Reason for Excluding
77	60.5
78	Greater than 5L from the stacks
79	81.2
80	25.6
81	25.6
82	Greater than 5L from the stacks
83	Greater than 5L from the stacks
84	Greater than 5L from the stacks
85	Greater than 5L from the stacks
86	Greater than 5L from the stacks
87	Greater than 5L from the stacks
88	Greater than 5L from the stacks
89	Greater than 5L from the stacks
90	Greater than 5L from the stacks
91	Greater than 5L from the stacks

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4.7 BACKGROUND AMBIENT AIR DATA

Ambient background 1-hour SO_2 concentrations were considered in this evaluation. The ambient background concentrations were added to the cumulative modeled concentrations resulting from the Mill sources. IP followed guidance contained in U.S. EPA's March 1, 2011 memorandum (U.S. EPA 2011), which outlines a "Tier 2" approach to including background ambient SO_2 concentrations. The "Tier 2" approach incorporates background concentrations by season and hour-of-day. Specifically, the second highest SO_2 monitored concentration for each hour (0-23) from each day over four seasons from the last three years was calculated and the appropriate value was added to the modeled concentrations. The seasons are: winter (December, January, and February), spring (March, April, and May), summer (June, July, and August), and autumn (September, October, and November). A summary of these calculations is provided in the electronic appendix to this document.

IP utilized background data from the South Eastern Aerosol Research and Characterization (SEARCH) network for the 2012, 2013, and 2014 calendar years. The data are from Centreville monitor located in Centreville, AL. The background data are summarized in Table 4-2, below.

Table 4-2
Diurnal Seasonal Average SO_2 Concentrations (ppb)

Hour	Winter	Spring	Summer	Autumn
0	3.396	2.130	1.736	1.508
1	3.974	2.326	2.582	1.993
2	2.978	1.909	2.803	2.646
3	2.503	1.920	2.548	3.851
4	3.492	1.502	2.322	6.509
5	5.092	1.653	3.230	7.785
6	6.867	1.880	5.426	7.729
7	6.200	2.730	7.592	8.770
8	5.493	5.505	7.393	9.785
9	3.519	3.832	5.777	10.714

Table 4-2
Diurnal Seasonal Average SO_2 Concentrations (ppb)

Hour	Winter	Spring	Summer	Autumn
10	4.049	3.149	6.527	4.930
11	4.714	2.647	2.667	3.495
12	3.126	2.351	3.205	4.111
13	2.879	3.078	3.005	2.447
14	3.217	3.263	2.473	1.960
15	3.312	2.791	1.806	2.049
16	3.727	2.875	1.477	2.508
17	2.740	2.987	1.738	2.887
18	3.272	2.632	1.868	2.558
19	2.346	2.349	1.906	1.914
20	2.514	2.327	2.402	2.110
21	2.839	1.771	1.541	1.941
22	3.671	2.676	1.731	2.308
23	3.433	2.590	1.241	2.335

IP proposes that the ambient SO_2 measurements from the Centreville, AL monitor site are representative of background conditions at the Mill. The Centreville, AL monitor is located approximately 80 km northwest of the Mill. Per U.S. EPA's Technical Review Comments, further discussion regarding the representativeness of the Centreville, AL monitor is provided by ADEM in the response to Comment No. 6 included in Appendix A.

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5. PRESENTATION OF AIR QUALITY MODELING RESULTS

This section outlines the results of the air quality modeling analysis. Table 5-1 presents a summary of the results of the SO_2 DRR analysis.

Table 5-1
SO_2 DRR Analysis Results

Pollutant	Averaging Period	Form	NAAQS (µg/m^3)	Modeled Concentration (µg/m^3)[(a)]	Total Concentration Less Than NAAQS
SO_2	1-Hour	Three Year Average of 98th Percentile of Daily Maximum 1-Hour Concentrations	196	179.9	Yes

[(a)] The model results include background concentrations which were incorporated using the methodologies discussed in Section 4.7.

As shown in the result summary table, the air quality dispersion modeling conducted in accordance with the U.S. EPA's SO_2 DRR demonstrates that the area surrounding the Mill is in attainment with the SO_2 NAAQS. The Mill understands that no further evaluation (i.e., ambient monitoring) is required at this time.

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6. REFERENCES

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APPENDIX A – ADEM RESPONSE TO EPA TECHNICAL REVIEW COMMENTS

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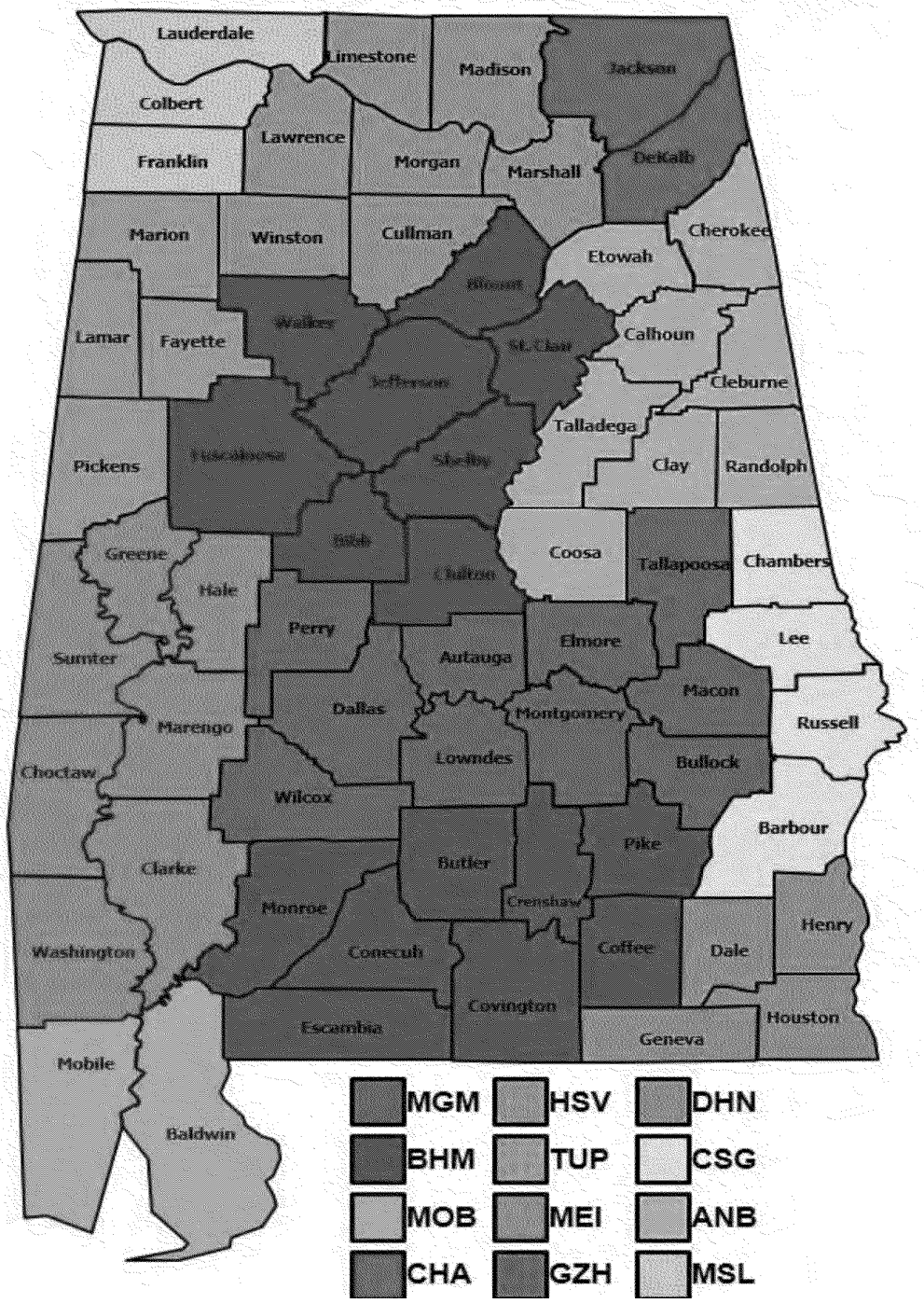

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APPENDIX B – SENSITIVITY ANALYSIS OF ADJ_U* OPTION FOR SO_2 DRR MODELING

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)LJXUH ¶ VKRZV WKH 0LOO CRFDWLRQ DQG WKH LPPHGLDWH DUHD VXUURXQGLQJ WKH 0LOO

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GLIIHUHQFH EHWZHHQ WKH IRXUWK KLJKHVW DQQXDO PRQWKOH[PRGHOHG RYHU D WKUHH
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UHFDLQLQJ UHFHSWRUV KLJKOLJKWLQJ VSHFLILF CRFDWLRQV LQ WKH DUHD VXUURXQGLQJ WKH
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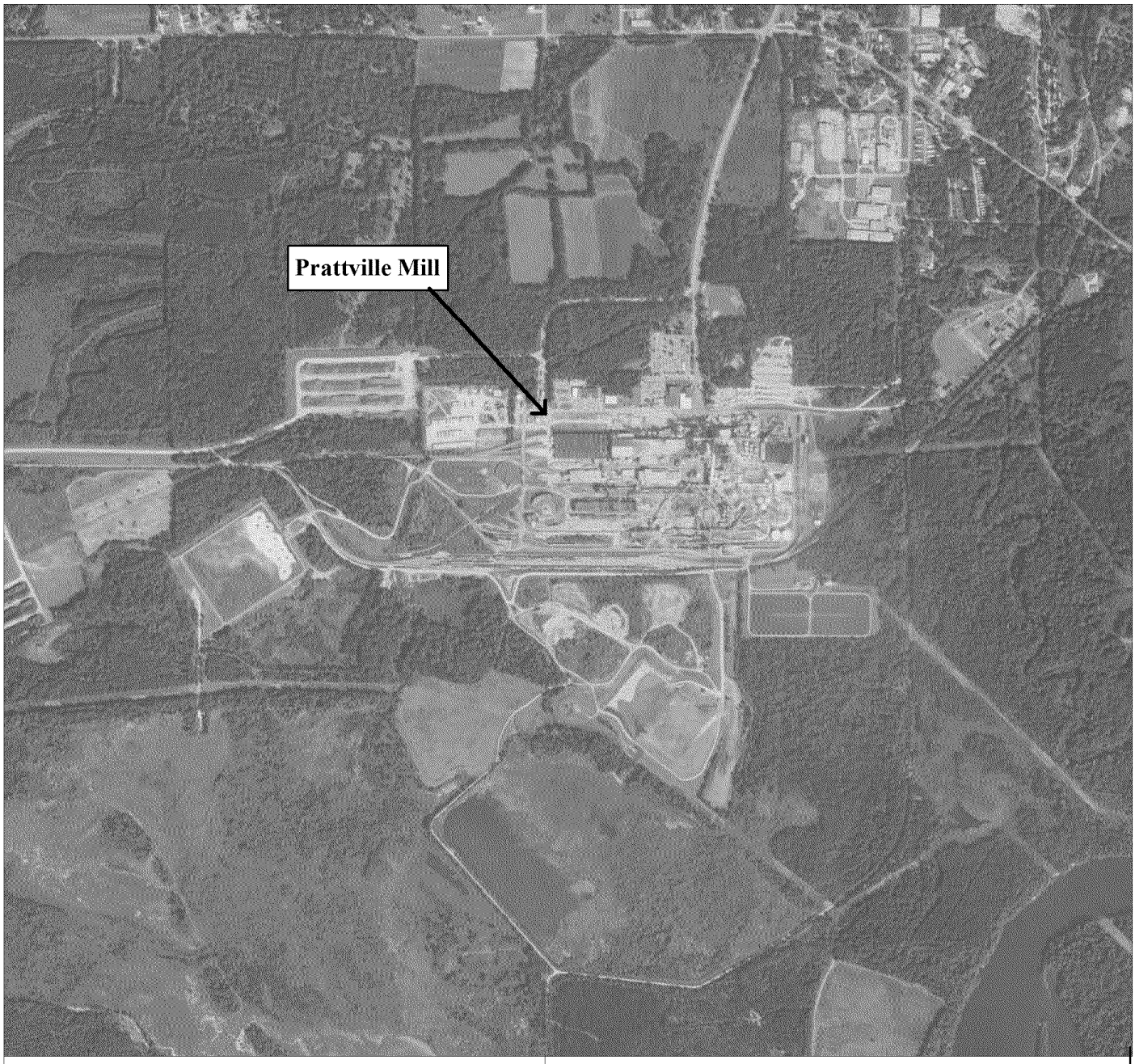

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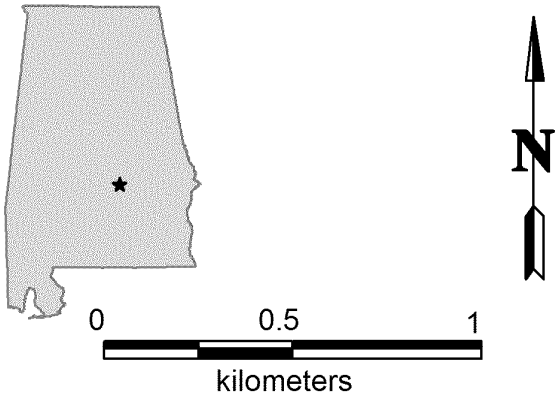

Based of USGS 1:24,000 topopgraphical map for Prattville, AL 2013 and Forester, AL 2013.

Figure 1
Mill Location Map

International Paper
Prattville, AL Mill

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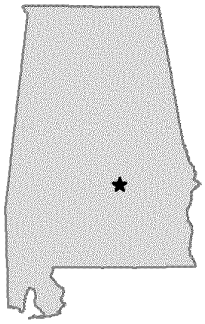
approximate quadrangle location



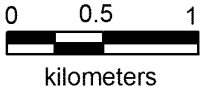


Figure 2
Receptor Grid and Selected Receptors

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Prattville, AL Mill

Based of USGS 1:24,000 topopgraphical map for Prattville, AL 2013 and Forester, AL 2013.

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7DEOH ¶

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		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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ED_001261_00027490

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FRQGLWLRQV└ ZKHQ└ WKH└ ZLQG└ VSHHG└ DQG└ IULFWLRQ└ YHORFLW\└ DUH└ ORZ◄└ └ 7KH└ $(502'└ GL
KDV└ EHHQ└ VKRZQ└ WR└ RYHU├ SUHGLFW└ FRQFHQWUDWLRQV└ LQ└ SUHFLVHO\└ WKHVH└ PHWHRURORJLFDO└
(3$└ ┴ ‼ ¶ ├ □☼└ DQG└ LW└ ZDV└ IRU└ WKHVH└ FRQGLWLRQV└ WKDW└ WKH└ $'-B8└ RSWLRQ└ KDV└ EH
SUHGLFW└ JURXQG├ OHYHO└ FRQFHQWUDWLRQV◄└

7KLV└ VHQVLWLYLW\└ VWXG\└ KDV└ H[DPLQHG└ WKH└ PHWHRURORJLFDO└ FRQGLWLRQV└ SUHVHQW└ ZKH
PRGHOHG└ DYHUDJH└ IRXUWK└ KLJKHVW└ ¶├ ├FRQFHQWUDWLRQV└ LQ└ WKH└ DUHD└ VXUURXQGLQJ└ WKH└ 3UDW
0LOO└ DUH└ SUHGLFWHG◄└ └ ,Q└ HYHU\└ VLWXDWLRQ└ H[DPLQHG└ RYHU└ WKH└ PRGHOHG└ SHULRG└ RI└ \
FRQFHQWUDWLRQV└ DUH└ SUHGLFWHG└ GXULQJ└ WDEOH└ FRQGLWLRQV└ ZLWK└ YHU\└ ORZ└ ZLQG└ VSH
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8◄ 6◄└ (3$└ ┴ ‼ ¶ ├ D└ ±└ ≥0RGHO└ &CHDULQJKRXVH└ 5HYLHZ└ RI└ WKH└ 8VH└ RI└ WKH└ $'-B8└
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3ODQQLQJ└ DQG└ 6WDQGDUGV☼└ $LU└ 4XDOLW\└ 0RGHOLQJ└ *URXS☼└ 5HVHDUFK└ 7ULDQJOH└ 3DUN☼└ 1

ELECTRONIC APPENDIX – EMISSIONS INVENTORY AND BACKGROUND SUPPORTING INFORMATION

https://www.hightail.com/download/cUJVa0ZSSU9BNkYzZU1UQw

To: glassjp@dhec.sc.gov[glassjp@dhec.sc.gov]
Cc: Rinck, Todd[Rinck.Todd@epa.gov]; Howard, Chris[Howard.Chris@epa.gov]; Worley, Gregg[Worley.Gregg@epa.gov]; Bradley, Twunjala[Bradley.Twunjala@epa.gov]; Scofield, Steven[Scofield.Steve@epa.gov]; Davis, Scott[Davis.ScottR@epa.gov]; Kemker, Carol[Kemker.Carol@epa.gov]; Banister, Beverly[Banister.Beverly@epa.gov]
From: Gillam, Rick
Sent: Fri 3/17/2017 4:43:33 PM
Subject: Use of LOWWIND3 Alternative Model Option for the SCE&G Wateree Station and IP Eastover Mill SO2 Modeling

Hello John,

As we discussed on our phone conversation on March 13, 2017, EPA has reviewed the sulfur dioxide (SO2) modeling documentation submitted by South Carolina Electric and Gas Wateree Station (SCG&E Wateree) and International Paper Eastover Mill (IP Eastover Mill) pursuant to the SO2 Data Requirements Rule (DRR). This modeling includes use of the LOWWIND3 beta option in AERMOD, which constitutes an alternative modelling approach subject to Section 3.2.2 of EPA's Guideline on Air Quality Models (GAQM) contained in 40 CFR Part 51, Appendix W. The information submitted by SCE&G Wateree and IP Eastover Mill also included a document that contains information to justify use of LOWWIND3. Following a thorough review of the information that was provided, EPA has determined that we are not able to accept the use of the LOWWIND3 alternative model option for this modeling demonstration.

We are not able to accept use of LOWWIND3 for the following reasons:

•□□□□□□□□ Appendix A to EPA's GAQM specifies that AERMOD is the preferred air dispersion model for regulatory applications. Based upon the SCE&G Wateree and IP Eastover Mill source configurations, surrounding topography and land use, EPA has determined that the regulatory version of the AERMOD Modeling System run with default-regulatory options is the preferred model for this modeling demonstration.

•□□□□□□□□ During EPA's recent rulemaking process to update the GAQM contained in 40 CFR Part 51, Appendix W, we received comments on the proposal to incorporate LOWWIND3 into AERMOD as a regulatory default option. Some of the comments provided information that indicates the potential for a bias toward under-prediction when testing LOWWIND3 with some of the historical AERMOD validation databases. In response to these comments, EPA performed further evaluations using a large set of model validation databases. The results of these analysis are presented in Appendix A of EPA's Response to Comments on the Revisions to the Guideline on Air Quality Models, dated December 20, 2016 (available

here: https://www.regulations.gov/document?D=EPA-HQ-OAR-2015-0310-0156). Based upon EPA's extensive evaluation of model performance, EPA concluded that the public cannot be assured that the proposed LOWWIND3 option does not have a tendency to bias model predictions towards underestimation, and therefore deferred final action on the LOWWIND3 option pending further analysis and evaluation. Due to the possible bias towards under-prediction, EPA believes that the only option for approval of the use of LOWWIND3 for a specific application would be to perform a site-specific performance evaluation using ambient monitoring in the area of the specific emissions source(s) being evaluated. Any alternative model demonstration would need to meet the requirements of Section 3.2.2(a)(2) of Appendix W.

•□□□□□□□□ In order for EPA to accept an alternative modelling approach pursuant to Section 3.2.2(a)(2) of Appendix W, a demonstration would be needed that the alternative model performs better than the preferred model for the specific modeling application. The information submitted by SCE&G Wateree and IP Eastover Mill is not adequate to justify that AERMOD with the LOWWIND3 beta option performs better than AERMOD run with regulatory default options, for this modeling demonstration. In order to adequately demonstrate superior performance, a statistical performance evaluation would be needed that shows LOWWIND3 improves performance based upon a comparison with site-specific ambient air monitoring data from actual ambient-air monitors located near the SCE&G Wateree and IP Eastover Mill facilities. Also, the performance evaluation would need to demonstrate that LOWWIND3 is not biased toward under-prediction of the actual measured values. SCE&G Wateree and IP Eastover Mill did not present a site-specific evaluation using nearby monitoring data and, to our knowledge, no nearby ambient air monitoring data is available for such a site-specific performance evaluation to be completed.

•□□□□□□□□ The information provided by SCE&G Wateree and IP Eastover Mill attempts to demonstrate that an existing model performance evaluation for the Gibson Generating Station, located in southwest Indiana, can be used in-lieu-of a site-specific model performance evaluation, because Gibson is a similar site located in a similar setting. However, for the reasons given above regarding the potential for an under-prediction bias, EPA is not able to approve the alternative model request based only upon a model performance evaluation for a similar facility.

•□□□□□□□□ SCE&G Wateree and IP Eastover Mill's justification documentation states that EPA has accepted similar sensitivity studies when approving alternative model requests for use of the ADJ_U* option in AERMET, and therefore they used a similar sensitivity analysis for the LOWWIND3 proposal. The primary difference between ADJ_U* and LOWWIND3 is that in EPA's evaluation of model performance of ADJ_U*, only certain limited situations were found where ADJ_U* shows a bias toward under-prediction. Specifically, EPA concluded that the ADJ_U* option shows a bias for under-prediction only when applied with site-specific meteorological data that includes turbulence parameters, i.e., sigma-theta (the standard deviation

of horizontal wind direction fluctuations) and/or sigma-w (the standard deviation of the vertical wind speed fluctuations). Details of EPA's analysis are included in Appendix A to of EPA's Response to Comments document referenced above. Based upon these extensive analyses, EPA incorporated the ADJ_U* option in latest regulatory version of AERMET (version 16216) as a regulatory option for use with AERMOD for modeling applications using standard National Weather Service airport meteorological data, site-specific meteorological data without turbulence parameters, or prognostic meteorological inputs derived from prognostic meteorological models. For these reasons, EPA cannot approve an alternative model request for use of LOWWIND3 that is based only upon the same sensitivity analysis procedure which has been approved previously for ADJ_U*.

Pursuant to your request, we will also prepare a formal letter which incorporates the information presented in this email. This letter will be prepared for signature by the Director of the EPA Region 4, Air, Pesticides and Toxics Management Division, and therefore will likely take a few additional days to route through the signature chain. Please let us know if you have any questions regarding this response.

Regards,

Rick Gillam

Rick Gillam
Environmental Engineer/Air Modeler
U.S. Environmental Protection Agency Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth St., SW, Atlanta, GA 30303
phone: (404) 562-9049
fax: (404) 562-9019
email: gillam.rick@epa.gov

To: Gillam, Rick[Gillam.Rick@epa.gov]
Cc: Rinck, Todd[Rinck.Todd@epa.gov]; Bradley, Twunjala[Bradley.Twunjala@epa.gov]
From: Anderson, Tom
Sent: Tue 1/17/2017 3:23:14 PM
Subject: RE: SO2 Data Requirements Rule Air Quality Characterization Submittal

Rick,

I'm currently loading the files to our fpt site due to the amount of data. I will provide you with login info. as soon as it's completed.

TA

From: Gillam, Rick [mailto:Gillam.Rick@epa.gov]
Sent: Friday, January 13, 2017 2:43 PM
To: Anderson, Tom <tom.anderson@ncdenr.gov>
Cc: Rinck, Todd <Rinck.Todd@epa.gov>; Bradley, Twunjala <Bradley.Twunjala@epa.gov>
Subject: FW: SO2 Data Requirements Rule Air Quality Characterization Submittal

Hi Tom,

Shelia's email indicates that the electronic modeling files are available by contacting you. Please provide copies of all the modeling files to me on a CD or DVD or make them available for download via ftp or some cloud-based service as soon as possible. You can mail them to:

Rick Gillam

Air Data and Analysis Section

U.S. EPA Region 4

Sam Nunn Atlanta Federal Center

61 Forsyth St., SW

Atlanta, GA 30303

Thanks!

-Rick

From: Holman, Sheila [mailto:sheila.holman@ncdenr.gov]
Sent: Friday, January 13, 2017 12:34 PM
To: McTeerToney, Heather <McTeerToney.Heather@epa.gov>; banister.beverly@ep.gov
Cc: Kemker, Carol <Kemker.Carol@epa.gov>; barnetwm@forsyth.cc; david.brigman@buncombecounty.org; Rhodes, Leslie <leslie.rhodes@mecklenburgcountync.gov>; Gillam, Rick <Gillam.Rick@epa.gov>; Bradley, Twunjala <Bradley.Twunjala@epa.gov>; Benjamin, Lynorae <benjamin.lynorae@epa.gov>; davis.scott@epa.gov; Rinck, Todd <Rinck.Todd@epa.gov>; Garver, Daniel <Garver.Daniel@epa.gov>; sushma.masemore@ncdenr.gov; Willets, William <william.willets@ncdenr.gov>; Anderson, Tom <tom.anderson@ncdenr.gov>; michael.abraczinskas@ncdenr.gov; Mather, Tom <tom.mather@ncdenr.gov>; Woods, Vickie <vickie.woods@ncdenr.gov>
Subject: RE: SO2 Data Requirements Rule Air Quality Characterization Submittal

Dear Heather and Beverly,

I am attaching the reports for the modeling analyses performed under the SO2 Data Requirements Rule for four facilities in North Carolina. Please find attached the cover letter and the four reports. The digital modeling files for each facility are available by contacting Tom Anderson at tom.anderson@ncdenr.gov. Let me know if you have any questions or need additional information.

Sheila

Sheila Holman

Director

NCDEQ, Division of Air Quality

1641 Mail Service Center

Raleigh, NC 27699-1641

Phone/Fax: 919-707-8430

www.ncair.org

Sheila.holman@ncdenr.gov

To: Tom Anderson [tom.anderson@ncdenr.gov]
Cc: Rinck, Todd[Rinck.Todd@epa.gov]; Bradley, Twunjala[Bradley.Twunjala@epa.gov]
From: Gillam, Rick
Sent: Fri 1/13/2017 7:43:23 PM
Subject: FW: SO2 Data Requirements Rule Air Quality Characterization Submittal
Attachment A Belews Creek DRR Modeling2.pdf
Attachment B Marshall Modeling Report2..pdf
Attachment C Mayo DRR Modeling2.pdf
Attachment D Allen Modeling Report 2.pdf
01132017 Holman to McTeer Toney SO2 Modeling Analyses.pdf

Hi Tom,

Shelia's email indicates that the electronic modeling files are available by contacting you. Please provide copies of all the modeling files to me on a CD or DVD or make them available for download via ftp or some cloud-based service as soon as possible. You can mail them to:

Rick Gillam

Air Data and Analysis Section

U.S. EPA Region 4

Sam Nunn Atlanta Federal Center

61 Forsyth St., SW

Atlanta, GA 30303

Thanks!

-Rick

From: Holman, Sheila [mailto:sheila.holman@ncdenr.gov]
Sent: Friday, January 13, 2017 12:34 PM
To: McTeerToney, Heather <McTeerToney.Heather@epa.gov>; banister.beverly@ep.gov
Cc: Kemker, Carol <Kemker.Carol@epa.gov>; barnetwm@forsyth.cc;

david.brigman@buncombecounty.org; Rhodes, Leslie <leslie.rhodes@mecklenburgcountync.gov>; Gillam, Rick <Gillam.Rick@epa.gov>; Bradley, Twunjala <Bradley.Twunjala@epa.gov>; Benjamin, Lynorae <benjamin.lynorae@epa.gov>; davis.scott@epa.gov; Rinck, Todd <Rinck.Todd@epa.gov>; Garver, Daniel <Garver.Daniel@epa.gov>; sushma.masemore@ncdenr.gov; Willets, William <william.willets@ncdenr.gov>; Anderson, Tom <tom.anderson@ncdenr.gov>; michael.abraczinskas@ncdenr.gov; Mather, Tom <tom.mather@ncdenr.gov>; Woods, Vickie <vickie.woods@ncdenr.gov>
Subject: RE: SO2 Data Requirements Rule Air Quality Characterization Submittal

Dear Heather and Beverly,

I am attaching the reports for the modeling analyses performed under the SO2 Data Requirements Rule for four facilities in North Carolina. Please find attached the cover letter and the four reports. The digital modeling files for each facility are available by contacting Tom Anderson at tom.anderson@ncdenr.gov. Let me know if you have any questions or need additional information.

Sheila

Sheila Holman

Director

NCDEQ, Division of Air Quality

1641 Mail Service Center

Raleigh, NC 27699-1641

Phone/Fax: 919-707-8430

www.ncair.org

Sheila.holman@ncdenr.gov

To: Myers, James[myersjm@dhec.sc.gov]
Cc: Barringer, Veronica[barrinv@dhec.sc.gov]; Ceron, Heather[Ceron.Heather@epa.gov]; Bradley, Twunjala[Bradley.Twunjala@epa.gov]
From: Purvis, James
Sent: Thur 1/12/2017 4:44:32 PM
Subject: RE: Data Requirements (40 CFR 51, Subpart BB) Minor Modification

James,

Per our telephone discussion, EPA has no adverse comment on this minor modification at this time. It should be noted, however, that pending review of the submission of SC's DRR Modeling information, should the modeling limits included need to be adjusted, this permit would need to be revised at that time.

Regards,

James Purvis

US EPA Region IV

Air, Pesticides & Toxics Management Division - Air Permitting Section

404 562 9139

From: Myers, James [mailto:myersjm@dhec.sc.gov]
Sent: Thursday, January 12, 2017 11:33 AM
To: Purvis, James <Purvis.James@epa.gov>
Cc: Barringer, Veronica <barrinv@dhec.sc.gov>
Subject: Data Requirements (40 CFR 51, Subpart BB) Minor Modification

Hi James,

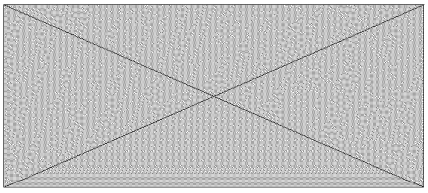
I have attached the updated Title V permit for the SCE&G Wateree facility (1900-0013) with modeling limits on two stacks to limit SO2 emissions for 40 CFR 60 Subpart BB.

Thanks,

James M. Myers, Permitting
Coastal Plains and Power Section
Bureau of Air Quality - Engineering Services Division

S.C. Dept. of Health & Environmental Control
2600 Bull Street, Columbia, SC 29201
Office: (803) 898-4621
myersjm@dhec.sc.gov

Connect: www.scdhec.gov Facebook Twitter



To: Purvis, James[Purvis.James@epa.gov]; Bradley, Twunjala[Bradley.Twunjala@epa.gov]
From: Myers, James
Sent: Mon 1/9/2017 5:44:44 PM
Subject: Data Requirements (40 CFR 51, Subpart BB)
1900-0013.5tv.docx
1900-0013.5tvStatement of Basis.docx

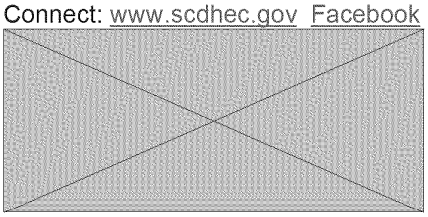
Hi James,

I have attached minor modification to a Title V permit and statement of basis for the SCE&G Wateree facility (1900-0013) with modeling limits on two stacks to limit SO2 emissions for 40 CFR 60 Subpart BB. The language used is similar to what was contained in the West Rock (1040-0003-CN) construction project sent for your review earlier this year. The difference is this facility has taken modeling limits rather than the 2,000 TPY avoidance limit. Your expedited review would be most appreciated since the deadline for the rule is this Friday.

Thanks,

James M. Myers, Permitting
Coastal Plains and Power Section
Bureau of Air Quality - Engineering Services Division

S.C. Dept. of Health & Environmental Control
2600 Bull Street, Columbia, SC 29201
Office: (803) 898-4621
myersjm@dhec.sc.gov
Connect: www.scdhec.gov Facebook Twitter



To: Bradley, Twunjala[Bradley.Twunjala@epa.gov]; Purvis, James[Purvis.James@epa.gov]
Cc: Barringer, Veronica[barrinv@dhec.sc.gov]
From: Myers, James
Sent: Mon 11/28/2016 4:18:05 PM
Subject: Data Requirements (40 CFR 51, Subpart BB)
1560-0003ck.docx
1560-0003ckStatement of Basis.docx

I have attached a construction permit and statement of basis for the SCE&G McMeekin facility (1560-0003) with a 2,000 tpy SO2 limit for 40 CFR 60 Subpart BB. The language used is similar to what was contained in the West Rock (1040-0003-CN) construction project sent for your review earlier this year.

This construction application was submitted under our expedited program. If you could complete your review by this Thursday, it would be most appreciated.

Thanks,

James M. Myers, Associate Engineer
Coastal Plains and Power Section
Bureau of Air Quality - Engineering Services Division

S.C. Dept. of Health & Environmental Control
2600 Bull Street, Columbia, SC 29201
Office: (803) 898-4621
myersjm@dhec.sc.gov
Connect: www.scdhec.gov Facebook Twitter

To: Gillam, Rick[Gillam.Rick@epa.gov]
Cc: Rinck, Todd[Rinck.Todd@epa.gov]; Tian, Di[Di.Tian@dnr.ga.gov]; Kim, Yunhee[Yunhee.Kim@dnr.ga.gov]; Howard, Chris[Howard.Chris@epa.gov]; Bradley, Twunjala[Bradley.Twunjala@epa.gov]
From: Boylan, James
Sent: Fri 10/28/2016 7:52:47 PM
Subject: RE: SO2 DRR Modeling

Rick,

Thanks for sending your response. I will pass this information along to Georgia Power and Georgia Pacific.

Jim

James W. Boylan, Ph.D.

Manager, Planning & Support Program

Georgia Department of Natural Resources

Environmental Protection Division - Air Protection Branch

4244 International Parkway, Suite 120

Atlanta, GA 30354

Office: 404-363-7014 Fax: 404-363-7100

E-mail: James.Boylan@dnr.ga.gov

From: Gillam, Rick [mailto:Gillam.Rick@epa.gov]
Sent: Friday, October 28, 2016 3:42 PM

To: Boylan, James
Cc: Rinck, Todd; Tian, Di; Kim, Yunhee; Howard, Chris; Bradley, Twunjala
Subject: RE: SO2 DRR Modeling

Hello Jim,

In response to your request for a written response regarding proposed revisions to the SO2 Data Requirements Rule (DRR) modeling approaches for Plant Bowen, Plant Wansley, and Plant McIntosh/Savannah River Mill, that were provided in emails dated September 27, 2016 and October 18, 2016, we have the following comments.

Plant Bowen

The proposed use of the 2013-2015 measured design value for the Rome monitor (13-115-0003) to account for potential impacts from Plant Hammond and International Paper-Rome is acceptable.

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The proposed approach contained in your October 18, 2016, email of using a combination of the measured SO2 concentrations at the Lathrop & Augusta SO2 Monitor (13-051-1002) along with the modeled concentration from the International Paper-Savannah facility for addressing the

contributions from nearby sources in the Plant McIntosh/Savannah Mill modeling is acceptable. In addition to the information that was provided with your October 18th email, we recommend that a 2012-2014 wind rose and corresponding discussion of the wind patterns be included with the modeling report that must be submitted to EPA by January 13, 2017. This information will help support the analysis and help justify use of the Lathrop & Augusta monitored background data to account for impacts from all the sources in the area with the exception of IP-Savannah.

Please let me know if you have any further questions about these issues.

Regards,

Rick

Rick Gillam
Environmental Engineer/Air Modeler
U.S. Environmental Protection Agency Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth St., SW, Atlanta, GA 30303
phone: (404) 562-9049
fax: (404) 562-9019
email: gillam.rick@epa.gov

From: Boylan, James [mailto:James.Boylan@dnr.ga.gov]
Sent: Tuesday, October 18, 2016 5:07 PM
To: Gillam, Rick <Gillam.Rick@epa.gov>
Cc: Rinck, Todd <Rinck.Todd@epa.gov>; Tian, Di <Di.Tian@dnr.ga.gov>; Kim, Yunhee <Yunhee.Kim@dnr.ga.gov>
Subject: RE: SO2 DRR Modeling

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In response to EPA's written and verbal comments on the modeling protocol for Georgia Power Plant McIntosh and Georgia Pacific Savannah River Mill, I have attached an alternative

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Also, we would like to request an official EPA response in writing to our alternative modeling approaches for Plant Bowen, Plant Wansley, and Plant McIntosh/Savannah River Mill. If you have any questions, please let me know.

Thanks!!

Jim

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Office: 404-363-7014 Fax: 404-363-7100

E-mail: James.Boylan@dnr.ga.gov

From: Boylan, James
Sent: Friday, October 14, 2016 9:16 AM
To: 'Gillam, Rick'
Subject: RE: SO2 DRR Modeling

Rick,

Can we get your official response in writing to our alternative modeling approaches for Plant Bowen, Plant Wansley, and Plant McIntosh/Savannah River Mill?

Thanks!!

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From: Gillam, Rick [mailto:Gillam.Rick@epa.gov]
Sent: Thursday, October 06, 2016 7:52 AM
To: Boylan, James
Subject: RE: SO2 DRR Modeling - Plant Bowen and Plant Wansley

Good Morning Jim,

I will call you this morning to discuss. I had planned to call you yesterday afternoon but other things came up.

-Rick

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From: Boylan, James [mailto:James.Boylan@dnr.ga.gov]
Sent: Wednesday, October 05, 2016 8:11 PM
To: Gillam, Rick <Gillam.Rick@epa.gov>
Subject: RE: SO2 DRR Modeling - Plant Bowen and Plant Wansley

Rick,

Any updates from your call with HQ?

Thanks!!

Jim

From: Gillam, Rick [mailto:Gillam.Rick@epa.gov]
Sent: Wednesday, September 28, 2016 9:56 AM
To: Boylan, James
Subject: RE: SO2 DRR Modeling - Plant Bowen and Plant Wansley

I have arranged a call with HQ next Tuesday to discuss Plant Wansley/Plant Yates. I will give you a call after to give you a status update. We may not have a final position then, but I'll let you know where we are.

Rick Gillam
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From: Boylan, James [mailto:James.Boylan@dnr.ga.gov]

Sent: Wednesday, September 28, 2016 9:43 AM
To: Gillam, Rick <Gillam.Rick@epa.gov>; Howard, Chris <Howard.Chris@epa.gov>
Cc: Rinck, Todd <Rinck.Todd@epa.gov>; Tian, Di <Di.Tian@dnr.ga.gov>; Kim, Yunhee <Yunhee.Kim@dnr.ga.gov>
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To: Boylan, James; Howard, Chris
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From: Gillam, Rick
Sent: Fri 10/28/2016 7:41:30 PM
Subject: RE: SO2 DRR Modeling

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Office: 404-363-7014 Fax: 404-363-7100

E-mail: James.Boylan@dnr.ga.gov

To: Bradley, Twunjala[Bradley.Twunjala@epa.gov]
Cc: Purvis, James[Purvis.James@epa.gov]; Hardee, Christopher[hardeecd@dhec.sc.gov]; Hollis, Andrew[HOLLISAO@dhec.sc.gov]
From: Basil, Elizabeth
Sent: Fri 9/9/2016 12:54:12 PM
Subject: RE: SO2 Data Requirements Rule follow up on Enforceability Questions

Twunjala

We appreciate the discussion yesterday. Our review of the rule indicates the 2000 tpy should be a flat annual emissions limit. The Data Requirements Rule (DRR) establishes a threshold for 1-hour SO2 facility modeling or monitoring based on the annual SO2 emission rate of 2,000 tons per year. This rate does not in any way take into account a facility's short term emission rates. As such, facilities should only need to demonstrate that they have a federally enforceable permit limit that restricts them to emitting less than 2,000 tons per year on an annual basis to be precluded from modeling or monitoring for the DRR. This is consistent with the applicablility threshold and is consistent with the final Data Requirements Rule.

Regarding permit limits for the rule, Section 51.1204(e)(2) - "*Federally enforceable requirement to limit SO2 emissions to under 2,000 tons per year"* states: (1) Require the applicable sources in the area to **emit less than 2,000 tons of SO2 per year for calendar year 2017 and thereafter**; or (2) Document that the applicable sources in the area have permanently shut down by January 13, 2017.

There is no specification for a short-term limit in the rule. Additionally, EPA has responded to these comments in the final rule, and notes in the preamble that an annual rate below 2,000 tons per year is appropriate (51067-51068):

"However, the final rule also allows the air agency to meet the requirements of this rule by submitting a federally enforceable emissions limitation (e.g., sourcespecific SIP revision or minor NSR permit revision) to the EPA by January 13, 2017, that requires the affected source to reduce allowable emissions at the source to an **annual rate** below the 2,000 tpy threshold level by January 13, 2017..." This clearly indicates an intent to allow for annual emission limitations below 2,000 tons per year.

Applicability to permitting regulations such as PSD and MACT are based on a tpy emissions threshold. Synthetic minor permits limits, in tpy, have been consistently given in annual or 12-month rolling sums. The PSD program's primary purpose is NAAQS protection, yet facilities taking avoidance limits have not been required to base limits on a NAAQS short term averaging-time.

From our discussion, you were going to forward the guidance used to suggest averaging a short

term limit. Because we are on the tail end of completing our review of the construction permit that will allow the source to operate under the 2000 tpy limit, we would appreciate a quick turnaround on this issue.

Thanks

Liz

From: Davis, Scott [mailto:Davis.ScottR@epa.gov]
Sent: Thursday, September 1, 2016 6:16 PM
To: Gore, Ron <RWG@adem.alabama.gov>; Brown, Larry <LWB@adem.alabama.gov>; Bacon, Leigh <LBB@adem.alabama.gov>; Green, Justin B. <Justin.B.Green@dep.state.fl.us>; jeff.koerner@dep.state.fl.us; McLane, Preston <Preston.McLane@dep.state.fl.us>; Hays, Karen <Karen.Hays@dnr.ga.gov>; Kuoh, Dika <Dika.Kuoh@dnr.ga.gov>; Boylan, James <James.Boylan@dnr.ga.gov>; sean.alteri@ky.gov; Duff, Melissa (EEC) <melissa.duff@ky.gov>; Dallas_Baker@deq.state.ms.us; keith_head@deq.state.ms.us; Holman, Sheila <sheila.holman@ncdenr.gov>; michael.abraczinskas@ncdenr.gov; sushma.masemore@ncdenr.gov; david.brigman@buncombecounty.org; Thompson, Rhonda <thompsrb@dhec.sc.gov>; Brown, Robbie <brownrj@dhec.sc.gov>; Basil, Elizabeth <basilej@dhec.sc.gov>; Hollis, Andrew <HOLLISAO@dhec.sc.gov>; Michelle B. Walker <Michelle.B.Walker@tn.gov>; Quincy Styke <Quincy.Styke@tn.gov>; James Johnston <James.Johnston@tn.gov>; bob.rogers@shelbycountytn.gov
Cc: benjamin.lynorae@epa.gov; Ceron, Heather <Ceron.Heather@epa.gov>; Bradley, Twunjala <Bradley.Twunjala@epa.gov>; Scofield, Steven <Scofield.Steve@epa.gov>; Gettle, Jeaneanne <Gettle.Jeaneanne@epa.gov>; Kemker, Carol <Kemker.Carol@epa.gov>; Fite, Mark <Fite.Mark@epa.gov>
Subject: SO2 Data Requirements Rule follow up on Enforceability Questions

Dear Region 4 State Directors:

Thank you for providing the required information related to the data requirements rule (DRR) on July 1, 2016, on how you intend to characterize sources of sulfur dioxide (SO_2) within your respective states that are subject to the 2,000 tons per year (tpy) threshold through modeling, monitoring or emission limits described in the DRR to inform the next round of SO2 designations. Most of you should have already received specific feedback on your modeling protocols and/or monitoring network plans. For those specific DRR sources that seek to restrict emissions to below 2,000 tpy through a federally enforceable requirement or permanently shutdown by January 13, 2017, in lieu of characterization (pursuant to section 51.1203(e)), please refer to the requirements below for submitting your final documentation for these sources.

Should you have any questions regarding these requirements, please contact any of our SO2 staff, Twunjala Bradley or Steve Scofield, or my section chiefs Lynorae Benjamin or Heather Ceron. We will continue to work closely with you and your SO2 staff to follow up on any questions you may have and provide additional information or clarifications, so please do not hesitate to contact EPA Region 4 throughout this current characterization process.

Here is the follow up information we currently are providing:

- For those DRR sources subject to a federally-enforceable control measure (such as a fuel switch or other control measures that may restrict emissions or shutdown certain units) lowering emissions below 2,000 tpy, the air agency can either establish an explicit SO_2 emission limit and/or provide specific permit conditions that result in a potential to emit (PTE) to below the DRR threshold. Any explicit SO_2 limit established should be based on a short term averaging-time (1-hour not to exceed 30-day) and cannot simply be an annual cap on emissions. The air agency must ensure that the limit is practicably enforceable (with appropriate compliance parameters).

- The air agency should thoroughly document in the permit how the explicit SO_2 limit or PTE reflect any permit conditions lowering emissions below 2,000 tpy. This includes documenting the permanent shutdown of specific units (i.e. demonstrating the portion of the permit authorizing operation of these units have been rescinded/revoked resulting in a zero PTE). These emission restrictions should be federally enforceable and effective by January 13, 2017. Additionally, where possible, Region 4 requests the review of any permit revisions/modifications.

- For those DRR sources that have indicated a permanent source-wide shutdown by January 13, 2017, explicit documentation through a federally-enforceable mechanism is required to show that the operating permit for that source has been rescinded and/or revoked, resulting in zero PTE.

R. Scott Davis

Chief, Air Planning and Implementation Branch

U.S. Environmental Protection Agency, Region 4

Sam Nunn Atlanta Federal Center, 61 Forsyth Street, SW

Atlanta, GA 30303-8960

Telephone: (404) 562-9127

email: davis.scottr@epa.gov

http://www.epa.gov/aboutepa/region4

http://www.southeastdiesel.org

To: Bradley, Twunjala[Bradley.Twunjala@epa.gov]
Cc: Hollis, Andrew[HOLLISAO@dhec.sc.gov]; Wall, Mary Peyton[wallmp@dhec.sc.gov]; Hardee, Christopher[hardeecd@dhec.sc.gov]; Glass, John[glassjp@dhec.sc.gov]; Barringer, Veronica[barrinv@dhec.sc.gov]; Purvis, James[Purvis.James@epa.gov]; Akers, Brad[Akers.Brad@epa.gov]
From: Basil, Elizabeth
Sent: Wed 9/7/2016 4:13:49 PM
Subject: Re: SO2 Data Requirements Rule follow up on Enforceability Questions

Twunjala,
Let's make it at 1:00. Should we call your #?
Liz

Sent from my iPhone

On Sep 7, 2016, at 9:18 AM, Bradley, Twunjala <Bradley.Twunjala@epa.gov> wrote:

Hi Elizabeth,

Yes, I'm available tomorrow 1:00-1:30 and 4-6.

Twunjala

From: Basil, Elizabeth [mailto:basilej@dhec.sc.gov]
Sent: Tuesday, September 06, 2016 10:32 AM
To: Bradley, Twunjala <Bradley.Twunjala@epa.gov>
Cc: Hollis, Andrew <HOLLISAO@dhec.sc.gov>; Wall, Mary Peyton <wallmp@dhec.sc.gov>; Hardee, Christopher <hardeecd@dhec.sc.gov>; Glass, John <glassjp@dhec.sc.gov>; Barringer, Veronica <barrinv@dhec.sc.gov>
Subject: RE: SO2 Data Requirements Rule follow up on Enforceability Questions

Twunjala

Thanks for the heads up on Scott's email. Do you have some time this Thursday afternoon to talk about the details, especially on the short term averaging time reflecting an annual limit?

Thanks

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Here is the follow up information we currently are providing:

•□□□□□□□ For those DRR sources subject to a federally-enforceable control measure (such as a fuel switch or other control measures that may restrict emissions or shutdown certain units) lowering emissions below 2,000 tpy, the air agency can either establish an explicit SO_2 emission limit and/or provide specific permit conditions that result in a potential to emit (PTE) to below the DRR threshold. Any explicit SO_2 limit established should be based on a short term averaging-time (1-hour not to exceed 30-day) and cannot simply be an annual cap on emissions. The air agency must ensure that the limit is practicably enforceable (with appropriate compliance parameters).

•□□□□□□□ The air agency should thoroughly document in the permit how the explicit SO_2 limit or PTE reflect any permit conditions lowering emissions below 2,000 tpy. This includes documenting the permanent shutdown of specific units (i.e. demonstrating the portion of the permit authorizing operation of these units have been rescinded/revoked resulting in a zero PTE). These emission restrictions should be federally enforceable and effective by January 13, 2017. Additionally, where possible, Region 4 requests the review of any permit revisions/modifications.

•□□□□□□□ For those DRR sources that have indicated a permanent source-wide shutdown by January 13, 2017, explicit documentation through a federally-enforceable mechanism is required to show that the operating permit for that source has been rescinded and/or revoked, resulting in zero PTE.

R. Scott Davis

Chief, Air Planning and Implementation Branch

U.S. Environmental Protection Agency, Region 4

Sam Nunn Atlanta Federal Center, 61 Forsyth Street, SW

Atlanta, GA 30303-8960

Telephone: (404) 562-9127

email: davis.scottr@epa.gov

http://www.epa.gov/aboutepa/region4

http://www.southeastdiesel.org

To: Bradley, Twunjala[Bradley.Twunjala@epa.gov]
Cc: Hollis, Andrew[HOLLISAO@dhec.sc.gov]; Wall, Mary Peyton[wallmp@dhec.sc.gov]; Hardee, Christopher[hardeecd@dhec.sc.gov]; Glass, John[glassjp@dhec.sc.gov]; Barringer, Veronica[barrinv@dhec.sc.gov]
From: Basil, Elizabeth
Sent: Tue 9/6/2016 2:31:54 PM
Subject: RE: SO2 Data Requirements Rule follow up on Enforceability Questions

Twunjala

Thanks for the heads up on Scott's email. Do you have some time this Thursday afternoon to talk about the details, especially on the short term averaging time reflecting an annual limit?

Thanks

Liz

From: Davis, Scott [mailto:Davis.ScottR@epa.gov]
Sent: Thursday, September 1, 2016 6:16 PM
To: Gore, Ron <RWG@adem.alabama.gov>; Brown, Larry <LWB@adem.alabama.gov>; Bacon, Leigh <LBB@adem.alabama.gov>; Green, Justin B. <Justin.B.Green@dep.state.fl.us>; jeff.koerner@dep.state.fl.us; McLane, Preston <Preston.McLane@dep.state.fl.us>; Hays, Karen <Karen.Hays@dnr.ga.gov>; Kuoh, Dika <Dika.Kuoh@dnr.ga.gov>; Boylan, James <James.Boylan@dnr.ga.gov>; sean.alteri@ky.gov; Duff, Melissa (EEC) <melissa.duff@ky.gov>; Dallas_Baker@deq.state.ms.us; keith_head@deq.state.ms.us; Holman, Sheila <sheila.holman@ncdenr.gov>; michael.abraczinskas@ncdenr.gov; sushma.masemore@ncdenr.gov; david.brigman@buncombecounty.org; Thompson, Rhonda <thompsrb@dhec.sc.gov>; Brown, Robbie <brownrj@dhec.sc.gov>; Basil, Elizabeth <basilej@dhec.sc.gov>; Hollis, Andrew <HOLLISAO@dhec.sc.gov>; Michelle B. Walker <Michelle.B.Walker@tn.gov>; Quincy Styke <Quincy.Styke@tn.gov>; James Johnston <James.Johnston@tn.gov>; bob.rogers@shelbycountytn.gov
Cc: benjamin.lynorae@epa.gov; Ceron, Heather <Ceron.Heather@epa.gov>; Bradley, Twunjala <Bradley.Twunjala@epa.gov>; Scofield, Steven <Scofield.Steve@epa.gov>; Gettle, Jeaneanne <Gettle.Jeaneanne@epa.gov>; Kemker, Carol <Kemker.Carol@epa.gov>; Fite, Mark <Fite.Mark@epa.gov>
Subject: SO2 Data Requirements Rule follow up on Enforceability Questions

Dear Region 4 State Directors:

Thank you for providing the required information related to the data requirements rule (DRR) on July 1, 2016, on how you intend to characterize sources of sulfur dioxide (SO_2) within your respective states that are subject to the 2,000 tons per year (tpy)

threshold through modeling, monitoring or emission limits described in the DRR to inform the next round of SO2 designations. Most of you should have already received specific feedback on your modeling protocols and/or monitoring network plans. For those specific DRR sources that seek to restrict emissions to below 2,000 tpy through a federally enforceable requirement or permanently shutdown by January 13, 2017, in lieu of characterization (pursuant to section 51.1203(e)), please refer to the requirements below for submitting your final documentation for these sources.

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R. Scott Davis

Chief, Air Planning and Implementation Branch

U.S. Environmental Protection Agency, Region 4

Sam Nunn Atlanta Federal Center, 61 Forsyth Street, SW

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Telephone: (404) 562-9127

email: davis.scottr@epa.gov

http://www.epa.gov/aboutepa/region4

http://www.southeastdiesel.org

To: Glass, John[glassjp@dhec.sc.gov]
Cc: Howard, Chris[Howard.Chris@epa.gov]; Rinck, Todd[Rinck.Todd@epa.gov]; Bradley, Twunjala[Bradley.Twunjala@epa.gov]
From: Gillam, Rick
Sent: Fri 8/26/2016 11:23:51 AM
Subject: RE: EPA Comments on SO2 DRR Modeling Protocols for Century Aluminum, Santee Cooper Generating Station and Resolute Forest Products

We can use the following EPA Conf Line for our call this morning at 9:00 am.

Ex. 6 - Personal Privacy

Talk to you then.

-Rick

Rick Gillam
Environmental Engineer/Air Modeler
U.S. Environmental Protection Agency Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth St., SW, Atlanta, GA 30303
phone: (404) 562-9049
fax: (404) 562-9019
email: gillam.rick@epa.gov

From: Glass, John [mailto:glassjp@dhec.sc.gov]
Sent: Wednesday, August 24, 2016 8:35 AM
To: Gillam, Rick <Gillam.Rick@epa.gov>
Cc: Howard, Chris <Howard.Chris@epa.gov>; Rinck, Todd <Rinck.Todd@epa.gov>; Bradley, Twunjala <Bradley.Twunjala@epa.gov>
Subject: Re: EPA Comments on SO2 DRR Modeling Protocols for Century Aluminum, Santee Cooper Generating Station and Resolute Forest Products

That sounds good. What number should we call?

Thanks,

John

John P. Glass, Jr.
Air Modeling Section Manager
Bureau of Air Quality
S.C. Dept. of Health & Environmental Control
Office: (803)898-4074
Connect: www.scdhec.gov Facebook Twitter

From: Gillam, Rick <Gillam.Rick@epa.gov>
Sent: Tuesday, August 23, 2016 9:12:31 PM
To: Glass, John
Cc: Howard, Chris; Rinck, Todd; Bradley, Twunjala
Subject: RE: EPA Comments on SO2 DRR Modeling Protocols for Century Aluminum, Santee Cooper Generating Station and Resolute Forest Products

I am available Friday morning. How about 9:00? I have another appointment at 11:00.

-Rick

Rick Gillam
Environmental Engineer/Air Modeler
U.S. Environmental Protection Agency Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth St., SW, Atlanta, GA 30303
phone: (404) 562-9049
fax: (404) 562-9019
email: gillam.rick@epa.gov

From: Glass, John [mailto:glassjp@dhec.sc.gov]
Sent: Tuesday, August 23, 2016 4:33 PM
To: Gillam, Rick <Gillam.Rick@epa.gov>
Cc: Howard, Chris <Howard.Chris@epa.gov>; Rinck, Todd <Rinck.Todd@epa.gov>; Bradley, Twunjala <Bradley.Twunjala@epa.gov>
Subject: Re: EPA Comments on SO2 DRR Modeling Protocols for Century Aluminum, Santee Cooper Generating Station and Resolute Forest Products

Rick,

Could we get together on a call to discuss your comments sometime Friday morning?

Thanks,

John

John P. Glass, Jr.
Air Modeling Section Manager
Bureau of Air Quality
S.C. Dept. of Health & Environmental Control
Office: (803)898-4074
Connect: www.scdhec.gov Facebook Twitter

From: Gillam, Rick <Gillam.Rick@epa.gov>
Sent: Wednesday, August 17, 2016 11:02:59 AM
To: Glass, John
Cc: Howard, Chris; Rinck, Todd; Bradley, Twunjala
Subject: EPA Comments on SO2 DRR Modeling Protocols for Century Aluminum, Santee Cooper Generating Station and Resolute Forest Products

Hello John,

The attached documents provide our comments on the Sulfur Dioxide Data Requirements Rule (DRR) Modeling Protocols for the Century Aluminum of South Carolina, Inc., Santee Cooper Cross Generating Station, and Resolute Forest Products US, Inc., facilities in South Carolina. Additionally, we request that the following comments be addressed by SCDHEC when the modeling reports are submitted to EPA no later than January 13, 2017.

1. A rationale for the choice of area of analysis or modeling domain should be provided for each area. Specifically, explain why South Carolina believes that the area of analysis chosen adequately represents the area where maximum concentrations of SO_2 are expected and includes all those sources which might contribute to those concentrations. Consider providing an explanation for why sources within the area of analysis are not explicitly included in the modeling analysis as well as any necessary documentation for those sources deemed to be controlled or shutdown. The protocol addresses these issues, but we are asking States to specifically explain their rationale to help inform the next round of designations that will occur in 2017. Some of the specific comments in the attached files also address these issues.

2. Please be aware that the state's boundary recommendation provided to EPA for the next round of designations in 2017 should take into consideration the area of analysis and modeling domain for each area discussed in Comment 1.

3. The state should ensure that the monitored background concentrations used for each modeling analysis are based on complete and valid air quality monitoring data.

If you have any questions about our comments, please let us know.

Regards,

Rick Gillam

EPA Region 4 Air Modeler

404/562-9049

Rick Gillam
Environmental Engineer/Air Modeler
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