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JAN 13 2017

Elizabeth Adams
Acting Director
Environmental Protection Agency
Pacific Southwest Region (Region 9)
75 Hawthorne Street
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Hafa Adai, Ms. Strauss,

The Guam Environmental Protection Agency is pleased to submit to you the SO_2 National Ambient Air Quality Standards (NAAQS) Designations Modeling, Analyses, results and Documentation for the Island of Guam. Unfortunately, as we predicted, the implications from the modeling analyses presented in the report to characterize the potential impacts of sources subject to the Data Requirements Rule is that the Orote Peninsula , elevated terrain to the southeast of the Cabras/Piti plants, and elevated terrain to the northeast are in modeled non-attainment of the one-hour average SO_2 NAAQS.

We are hopeful that this submission satisfies the requirements under 40 CFR 51.1203(d). If you have any questions, please contact Mr. Roland Gutierrez, the Air Pollution Control Program Manager at (671) 300-4751/2 or by email at roland.gutierrez@epa.guam.gov.

Sincerely,

WALTER S. LEON GUERRERO
Administrator

CC: Gwen Yoshimura (By Email)
Anita Lee (By Email)
Michael Mann (By Email)

SO_2 NAAQS DESIGNATIONS MODELING ANALYSES, RESULTS AND DOCUMENTATION FOR THE ISLAND OF GUAM

Submitted by:

The Guam Environmental Protection Agency

TODO Y NILALA Y TANO MAN UNO
ALL LIVING THINGS OF THE EARTH ARE ONE

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1.0 INTRODUCTION

In accordance with the "Data Requirements for Characterizing Air Quality for the Primary 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 sulfur dioxide (SO_2) National Ambient Air Quality Standard (NAAQS) attainment status for the areas on the Territory of Guam that may be significantly impacted by SO_2 emissions from these applicable sources. 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 and modeling results analyses no later than January 13, 2017. GPA asked TRC Environmental Corporation (TRC) to assist with preparation of the required modeling protocol, subsequent performance of the modeling analyses and preparation of this modeling analyses report in compliance with the applicable DRR requirements. A timely modeling protocol was submitted by GPA in June 2016. It was reviewed and commented on by GEPA and EPA. Comments were considered and concurrence on a final modeling protocol was achieved as documented in an Addendum to the modeling protocol dated October 2016. This document provides a summary of the modeling analyses performed per the agreed upon modeling protocol, the results of the analyses and related supporting modeling files.

On March 24, 2011 EPA issued "Modeling Guidance for SO_2 NAAQS Designations" as part of the "Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards" (Modeling Guidance) and subsequently issued the DRAFT SO_2 NAAQS Designations Modeling Technical Assistance Document (TAD, December 2013, February 2016 and August 2016), Data Requirements Rule for the 1-Hour Sulfur Dioxide (SO_2) Primary NAAQS (Proposed Rule May 13, 2014; Final Rule August 21, 2015), and Updated Guidance for Area Designations for the 2010 Primary Sulfur Dioxide NAAQS (March 20, 2015). The modeling protocol followed the above guidance and established the methodology used and data applied to model the impacts from the applicable sources. The modeling analyses performed and

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[1] 40 CFR 51.1200.

presented herein are in conformance with the agreed upon modeling protocol and considered the following influencing factors:

- Emission inventory: in addition to the sources considered "applicable sources" at the Piti and Cabras power plants, at the request of EPA nearby vessels at the Port of Guam and the Naval Base Guam that may contribute to ambient air SO_2 concentrations were also included.
- The modeling domain included the entire Island of Guam.
- The recommended air dispersion modeling system, AERMOD, and related modeling processors and implementation guidance were used and applied as discussed in the modeling protocol and the protocol addendum.
- The entire Island of Guam was overlaid with model receptors as appropriate and recommended in the EPA TAD.
- Three contiguous years of on-site meteorological data were used for the modeling analyses.
- Appropriate background concentration values were developed and applied to the modeled design values to determine total ambient concentrations at each receptor.
- Modeling results are presented in tabular form and illustrated in figures presented herein. Modeling input and output files are provided in digital media attached to this report.

The modeling analyses results, based on allowable emission rates and conservative modeling assumptions, indicate modeled violations of the one-hour SO_2 NAAQS. Details of the above modeling factors and modeling results are provided in the following sections of this report.

2.0 EMISSION INVENTORY AND SOURCE DATA

GPA owns a number of power generation facilities on Guam, including the plants associated with the 1971 SO_2 NAAQS non-attainment area and subject to the DRR: two (2) Cabras Power Plants as well as six (6) other power plants on the island, Dededo, Macheche, Manenggon, Talofofo, Tenjo, and Yigo. Energy Conversion Agreements between GPA and Independent Power Producers are in place for two other power plants that are also located in the 1971 SO_2 NAAQS non-attainment area and subject to the DRR: MEC and TEMES plants, both located at Piti. On Guam, virtually all of the SO_2 emissions are produced by fuel oil combustion. The bulk of those emissions are produced by stationary sources, the largest of which are power generating facilities. Additional sources of SO_2 emissions include fuel combustion in transportation vessels calling on the Port of Guam and the Naval Base Guam and motor vehicles. There are only a few industrial facilities with fuel burning sources of SO_2 emissions. Most of these sources use ultra-low sulfur (15 ppm) diesel oil (ULSD). The two largest sources of SO_2 emissions on Guam are the Cabras and Piti power generating facilities which are located in close proximity to each other on the west side of the island. The largest emission units at those facilities are permitted to fire residual oil. ULSD is fired in the TEMES #7 Unit at Piti and at all other relatively small power generating units at other locations on Guam.

Hourly actual SO_2 emissions data are not available for the DRR applicable sources, and thus, following guidance, the permit allowable SO_2 emissions rates have been conservatively modeled for all hours. Table 1 summarizes the stationary emission source inventory included in this modeling analysis. Although the actual hourly emission data are not available, annual summaries of actual emissions in tons per year (tpy) are available for the Cabras sources. Table 8, presented in Section 8.0, shows the annual permitted emission rates and the actual emission rates for each year modeled as well as the percentage of actual to permit allowable emissions in each modeled year. Note that the actual emissions are a fraction of the model input allowable emissions and thus the modeling is expected to be conservative.

Table 1: Modeled Stack Parameters

GPA Point Sources

Facility	Source Name	Model ID	Easting Zone 55	Northing Zone 55	Elevation [4]	Stack Height	Stack Height	Diameter or Equivalent	Diameter or Equivalent	Flow Rate	Exit Velocity	Exit Velocity	Temperature	Temperature	Emission Rates	Notes
			(m)	(m)	(m)	(ft)	(m)	(ft)	(m)	(ACFM)	(fps)	(m/s)	(F)	(K)	(g/s)	[2]
	Cabras #1	CAB_B1	249455	1489682	0.7	200.1	61.0	8.5	2.6	175268	51.5	15.7	300	422.0	159.8	[2]
	Cabras #2	CAB_B2	249479	1489697	0.6	200.1	61.0	8.5	2.6	175268	51.5	15.7	300	422.0	159.8	[3]
Cabras	DEG-3 and DEG-4	CAB_E3_4	249395	1489669	1.1	202.0	61.6	8.0	2.4	211115	70.0	21.3	343	445.7	186.0	[3]
MEC	#8 and #9	MEC_E8_9	249840	1489439	2.8	203.1	61.9	17.5	5.3	341846	23.8	7.3	1003	812.6	195.0	[1], [3]
TEMES	Piti #7	TEMES_7	249839	1489522	2.4	69.6	21.2	13.4	4.1	773186	86.4	26.3	1038	831.8	28.9	[3]

[1] Flow rate and temperature not provided, assumed to be similar to Yigo.

[2] Rate taken from permit. Potential to emit.

[3] Rate taken from permit. Emission limit.

[4] Values revised from protocol using AERMAP output. Values in Table 1 of the protocol were a typo and not reflective of evaluated source elevations presented in the protocol appendicies.

Marine Volume Sources

Source Description	Model ID	Easting Zone 55	Northing Zone 55	Elevation	Release Height	Release Height	Initial Horizontal Dimension	Initial Horizontal Dimension	Initial Vertical Dimension	Initial Vertical Dimension	Emission Rates
		(m)	(m)	(m)	(ft)	(m)	(ft)	(m)	(ft)	(m)	(g/s)
Commercial port hoteling vessel	HOTELC1	246877	1489122	0.0	82.0	25.0	45.8	14.0	38.1	11.6	2.2
Navy port hoteling vessel	HOTELN2	246778	1486660	0.0	82.0	25.0	45.8	14.0	38.1	11.6	2.2
Navy port hoteling vessel	HOTELN3	247504	1486606	0.0	82.0	25.0	45.8	14.0	38.1	11.6	2.2

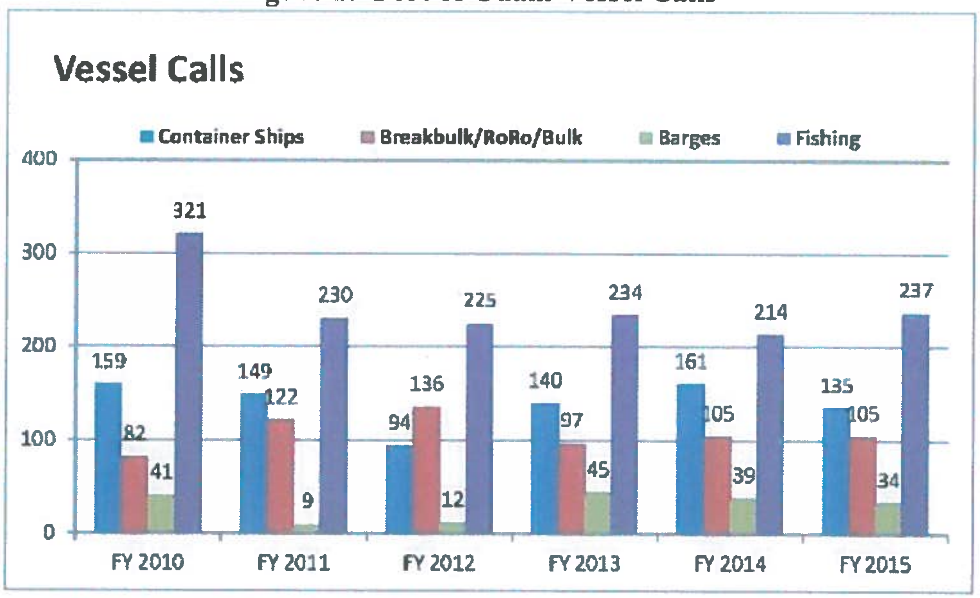
Note:

Dimensions based on a 120m x 30m vessel in these harbors. Init. Horizontal dimension = sqrt(120x30)/4.3 = 60/4.3 = 14.0. Release height estimated at 25m. Init. Vertical dimension = 25/2.15.

Marine Emission Inventory and Source Data

The Port of Guam handles the bulk of the commercial maritime traffic for the Territory of Guam and neighbors the Piti-Cabras and MEC power plants. 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, see Figure 1. 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.

Figure 1: 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 the time of the vessel emission estimate, 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 maneuvering speed at any given time. 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). During maneuvering, auxiliary power requirements are 1,250 kW. 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.

Table 2 presents the calculated emissions for the vessels considered for this modeling analysis. For the purposes of this modeling analysis, the stationary marine sources are modeled conservatively assuming that three large vessels are hoteling at the docks.

Other than the identified sources, Guam is very isolated and natural background SO_2 concentrations are negligible. It is expected that the identified emission sources comprise the SO_2 sources. Figure 2 depicts the locations of the GPA power generation facilities, the Port of Guam and Naval Base Guam marine source representations, 1971 SO_2 non-attainment areas, and meteorological data sources considered in the modeling analyses.

The modeling analyses were conservatively performed assuming permitted emission rates for the Piti and Cabras SO_2 emission sources for the most recent three contiguous years of available meteorological data, e.g., 2011, 2012 and 2013. Figure 3 presents a windrose, or the wind direction and wind speed frequency distribution of the meteorological observations for the three year period modeled. Note that, as expected, the prevailing easterly trade winds dominate the local wind flow, and that the winds from the west, flow that can advect plumes inland and toward the elevated terrain where the controlling design value concentrations are predicted, are extremely infrequent.

TRC has compiled stack parameters for the applicable sources and typical source parameters for the hoteling marine vessel sources that are included in the modeling analyses and these are summarized in Table 2. Short term permitted emission rates for the sources modeled are also provided in Table 2.

Table 2: Maritime Sulfur Dioxide Emissions

Port of Guam and Naval Base Guam

Conversion factors

1	kW	=	3412	Btu/hr
1	hp	=	2544.4	Btu/hr
Sulfur MW		=	32	
SO2 MW		=	64	
Density fuel oil		=	7.05	lb/gal
Heat value fuel oil		=	140,000	Btu/gal
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	%

	Hr/Day*	Vessel Days/Year	
Large Vessel Maneuver	2	500	(Port of Guam and Naval Base)
Large Vessel Aux	2	500	(Port of Guam and Naval Base)
Small Vessel Maneuver	2	237	(Port of Guam only)
Large Vessel Hotel	24	1500	(Port of Guam and Naval Base)

*Assume each vessel per call maneuvers/aux power for one hour coming in to port, and one hour leaving port

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 SO2 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

Figure 2: Guam Power Authority GPA Plants, Marine Hoteling Sources, and 1971 SO_2 Non-attainment Areas

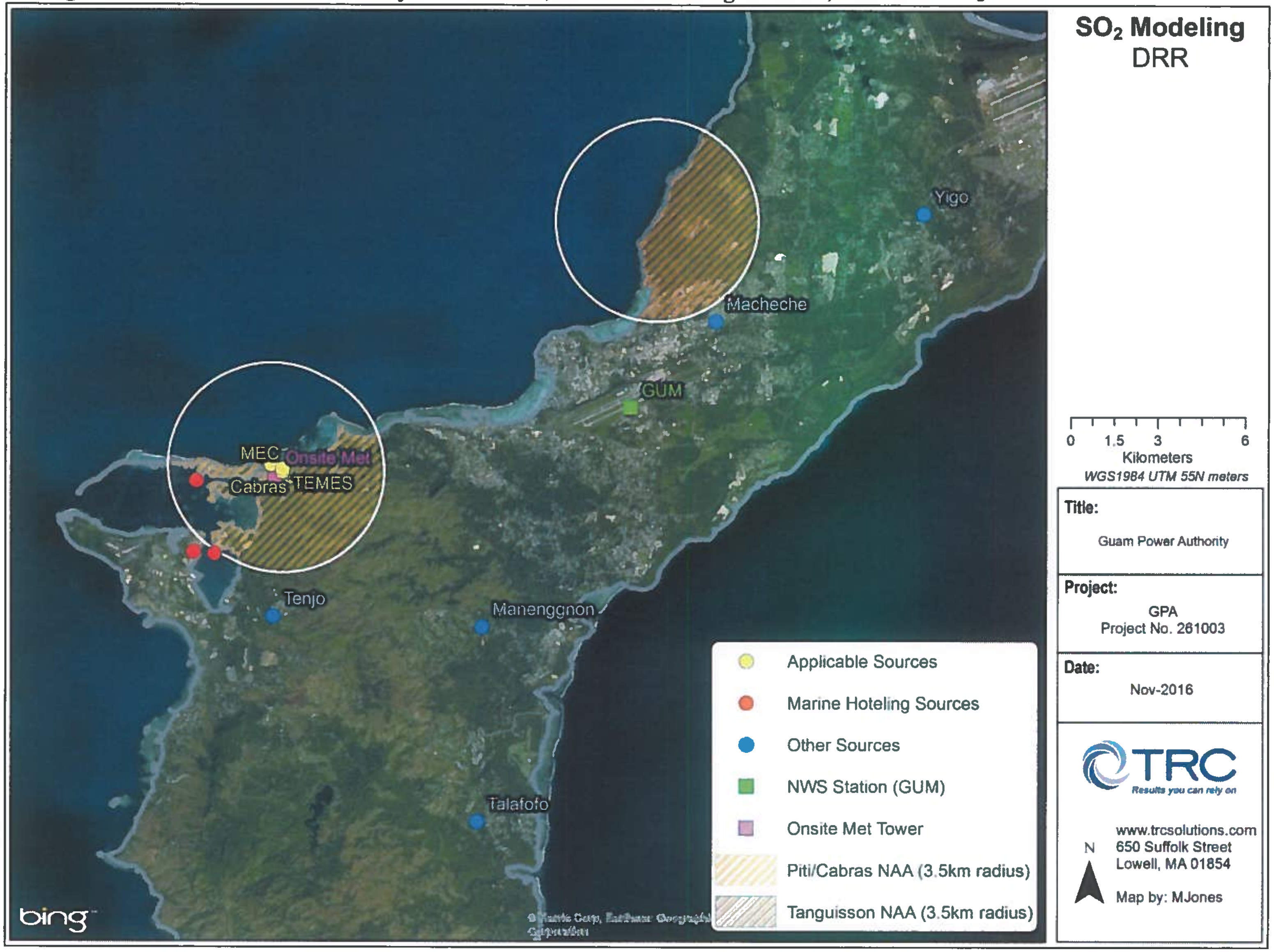
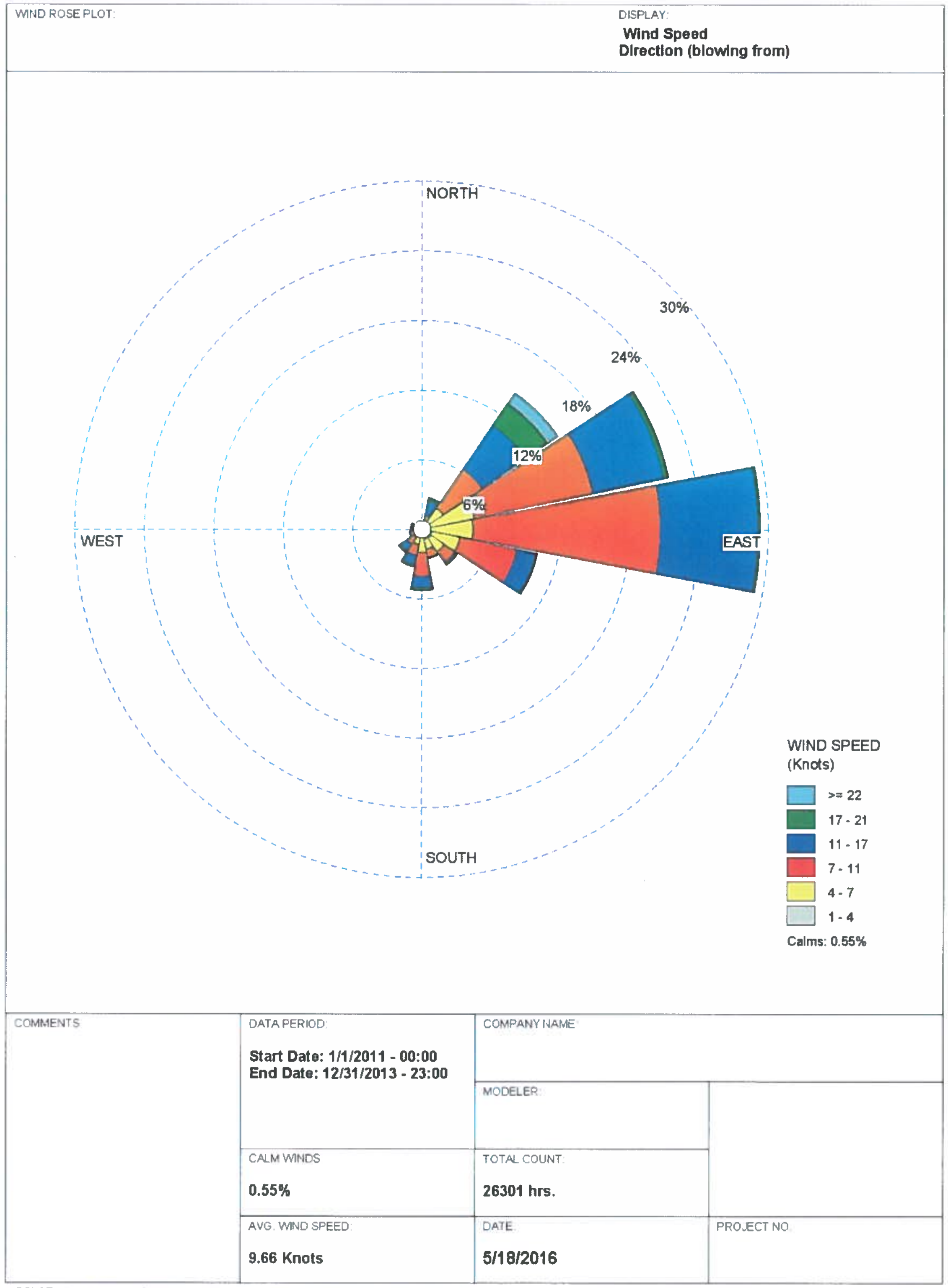


Figure 3: Windrose for 2011-2013 AERMET Processed Onsite and GUM ASOS Data



3.0 MODELING DOMAIN

The modeling domain covers the Territory of Guam, however following the guidance contained in the modeling TAD, modeling for the purpose of area designation is a surrogate for monitoring. Model receptors are placed only in areas where it is feasible to place a monitoring station, i.e., publicly accessible locations and areas that are not water bodies or otherwise impractical for monitoring, e.g. a cliff or otherwise inaccessible terrain. Thus the land area of Guam, but not the surrounding waters or areas within the fence lines of the GPA facilities have modeling receptors. A discussion of the proposed model receptors and illustration of the modeling domain are provided in Section 5 below.

4.0 MODEL SELECTION

The Modeling TAD cites the "Guideline on Air Quality Models" (40 CFR 51, Appendix W) for model selection. The Guideline, as well as the TAD, recommend the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) as the preferred model for near-field (generally considered as distance less than or equal to 50 km from the source) dispersion modeling. The most recent version of AERMOD (version number 15181), issued by EPA, together with its various pre-processor programs were used for the modeling analysis, including the following additional support programs:

- AERMINUTE version 14337 (sample input file included in Appendix B-1)
- AERSURFACE (methodology and input values described below)
- AERMET version 15181 (sample input file included in Appendix B-2)
- AERMAP version 11103 (sample input file included in Appendix B-3)
- AERMOD version 15181 (sample input file included in Appendix B-4)

The USEPA is currently in the process of completing its review of proposed revisions to the Guideline on Air Quality Models and the final revisions are expected to be promulgated within the next few months. The expected revisions will likely include changes and updates to the currently approved models and may include as default options model enhancements currently available in AERMOD as Beta or case-by-case options. These Beta model options include "ADJ_U*" and "LOWWIND3" enhancements which have been demonstrated to improve the model performance of modeled emissions from tall stacks under low wind speed conditions. If the expected Appendix W revisions are promulgated prior to submittal date of the final modeling compliance demonstration and these model enhancements are incorporated into the recommended model, TRC will use the new model version for the proposed analyses. Should the final Appendix W revisions become effective after submittal of the final report, the analyses presented herein will be updated and a revised report will be submitted.

5.0 RECEPTOR ARRAY

The proposed modeling domain is designed to capture the maximum daily one-hour average SO_2 impacts from the modeled emission sources. The guidance memorandum specifies a relatively dense receptor array as follows:

- 50 meter spacing within 1 km of the source
- 100 meter spacing between 1 and 2 km from the source
- 250 meter spacing between 2 and 10 km from the source
- 500 meter spacing beyond 10 km from the source

The distances were measured from each applicable source and a single receptor network was developed and presented in the modeling protocol. No receptors were placed within the GPA facility fence lines or over water. The receptor locations were processed through the current version of the AERMAP pre-processor (11103). Figures 4 and 5 show the initial near-field and far-field receptor arrays around Piti and Cabras.

Figure 6 shows the 100 meter spaced receptors that were added to further define the maximum design concentration over the terrain to the southeast of the applicable sources. Finally, discreet receptors were added to assess the design value at previously proposed monitor locations (see Figure 6).

Figure 4: Far Field Receptors

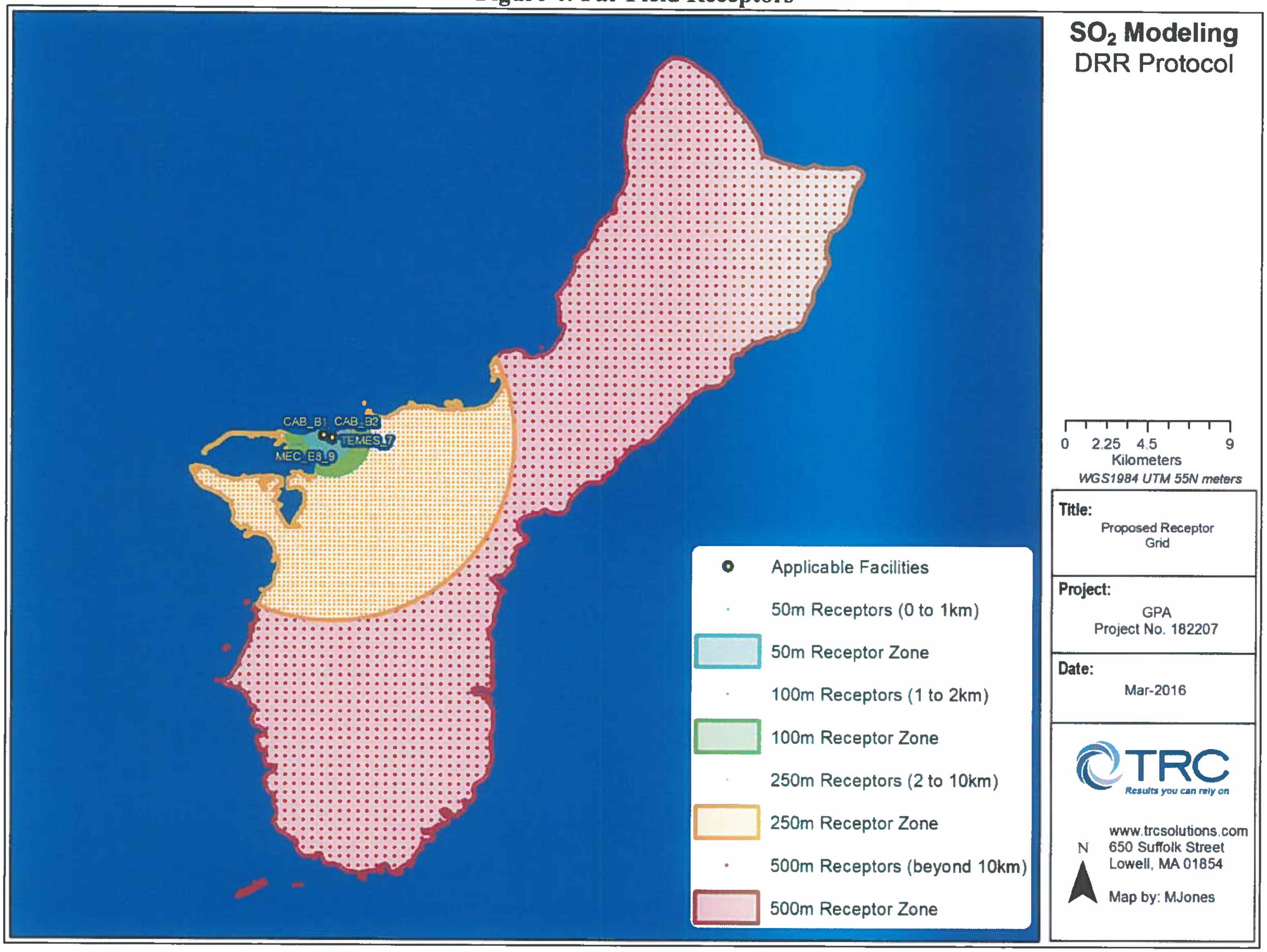


Figure 5: Near Field Receptors

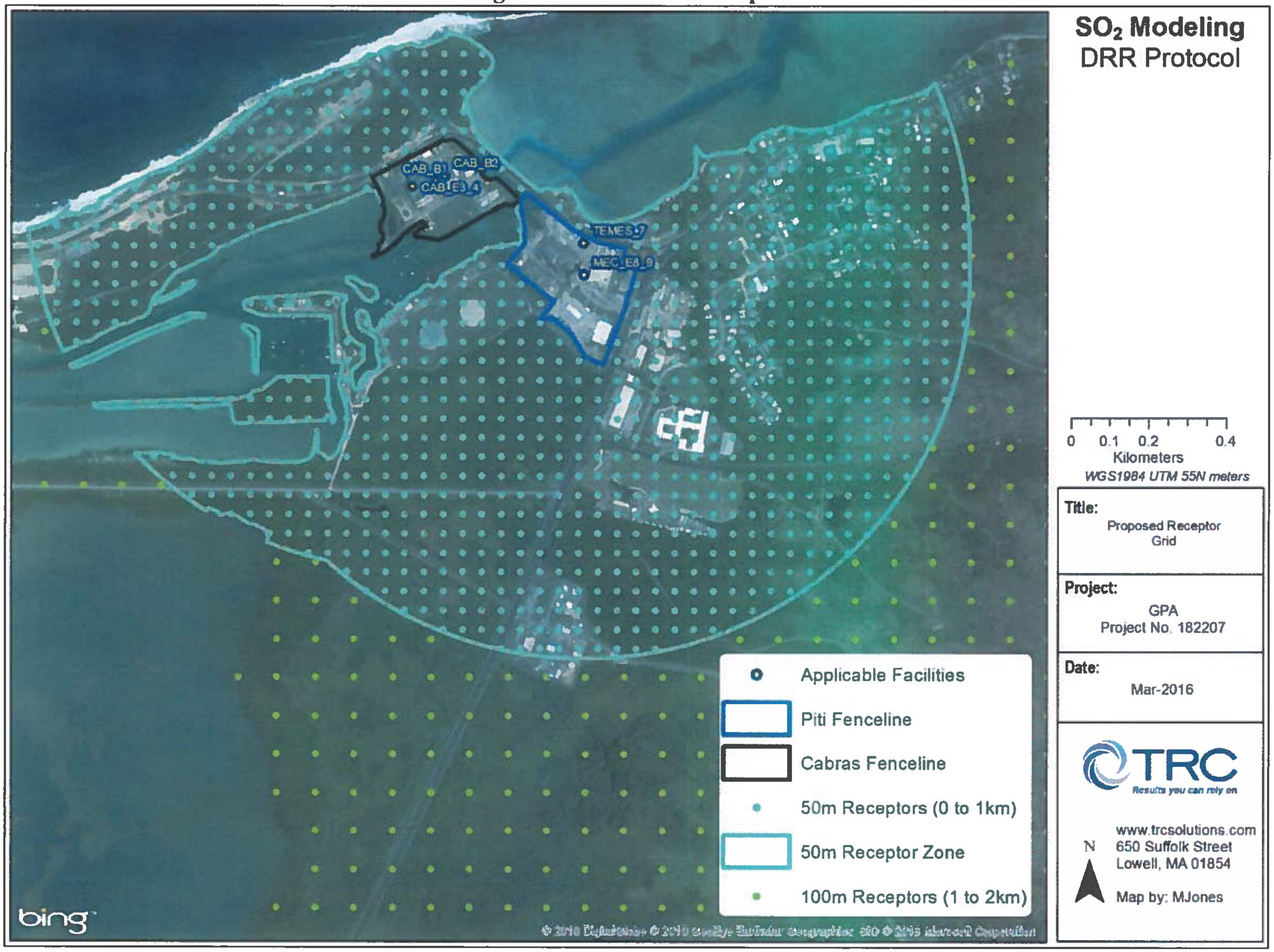
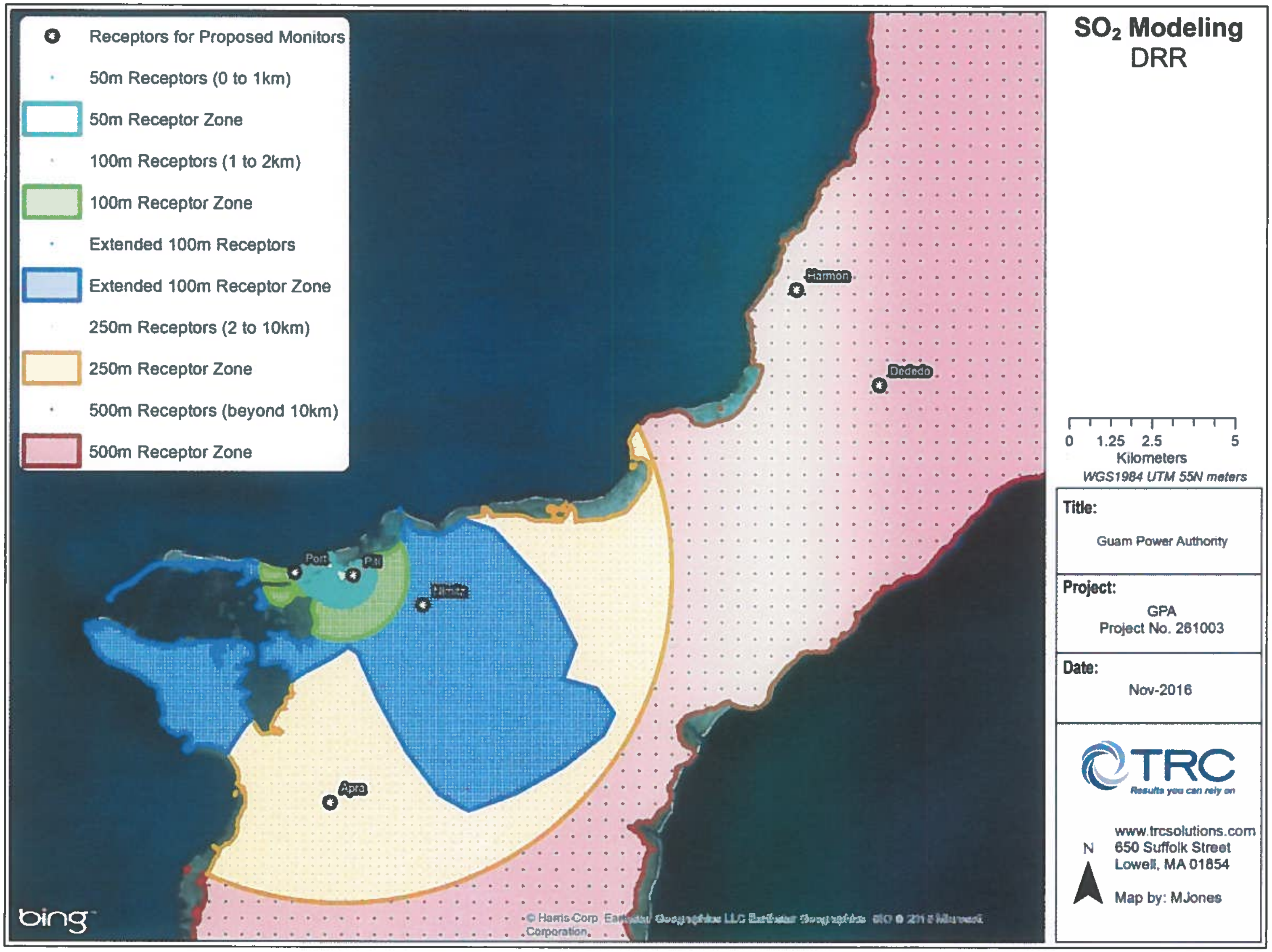


Figure 6: Additional Receptors – 100m Receptors over Maximum Design Value Regions (blue) and Discreet Receptors Placed at Proposed MonitorLocations (white)



6.0 METEOROLOGICAL DATA

The AERMOD dispersion model requires a vertical "profile" and a "surface" meteorological data file as inputs which are created by the AERMET meteorological preprocessor. AERMET requires surface and upper air meteorological data files, together with micrometeorological characteristics to create the files for AERMOD input. Meteorological data collected on-site is generally preferred and considered most representative of wind flow conditions affecting emission sources. However representative meteorological data from off-site or other monitoring stations, such as National Weather Service station at the Guam airport (GUM) are also acceptable. For this modeling analyses, the available meteorological data from the Piti site were used as the primary surface observation data for wind and temperature and the GUM data for all other variables were used consistent with the modeling protocol. While there are other meteorological observing stations on the island of Guam, i.e., Andersen Air Force Base, the Piti on-site 60 meter level wind data and the surface temperature data combined with the GUM data are the most representative data available for this analysis. Figure 2 illustrates the locations of the onsite meteorological tower and the NWS Station.

TRC obtained surface data in Integrated Surface Hourly Data (ISHD) format and upper air data in FSL format for GUM from 2011 through 2015 for analysis. Review of the data indicated that observations of cloud cover and other stability-type data necessary to run AERMOD were missing for a significant portion of the year 2014 and this year did not meet minimum data collection requirements. Thus the three-year consecutive data period of 2011 through 2013 was used in this analysis, as approved in the protocol.

The three years of data have been processed with the AERMET processor for input to the AERMOD modeling system. Also included in the NWS data processing were the 1-minute Automated Station Observing System (ASOS) data. The 1-minute ASOS data is used to supplement the hourly NWS data when the wind is calm or variable. The AERMINUTE pre-processor was used to process these 1-minute data for input into AERMET.

The onsite meteorological data of wind speed and direction from the 60 meter tower level located at the Piti Plant was used as the primary source of surface wind data for the analysis. The onsite data observations are available for the same data period of 2011 through 2013 as 15-minute average data. These data were subjected to data validity and capture requirements to ascertain that these are good quality and valid data to be used in dispersion modeling analyses. The Quality Control & Quality Assurance Manual for the Cabras Power Plant Meteorological

Monitoring Program applied to the collection of the data was provided with the modeling protocol. Routine semiannual instrument performance audits were conducted on the meteorological monitoring system and the Quality Assurance Audit Reports indicate that the instruments were in compliance and collected good quality data for the period of interest.

The onsite 15-minute average data were processed to create 1-hr average values. These onsite data were used as the primary data for the AERMET meteorological data processing, with substitution from the GUM surface observations for any missing hourly periods.

Micrometeorological Characteristics

Micrometeorological surface characteristics of albedo, Bowen ratio, and surface roughness are input into the AERMET preprocessor to create meteorological input files that can be read by AERMOD. For areas that are covered by the National Land Cover Dataset (NLCD) 1992, those characteristics are typically determined by the AERSURFACE preprocessor. NLCD 1992 data are not available for Guam; therefore the Coastal Change Analysis Program (C-CAP) data for the territory of Guam from 2005 (http://www.data.gov/geodata/g621716) were used to determine the surface micrometeorological characteristics. These data were developed via a remote sensing project by the National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Coastal Services Center (CSC). The C-CAP data cannot directly be processed by the AERSURFACE processor. Therefore TRC developed a process to extract the necessary micrometeorological characteristics from the C-CAP data. The output from that process was used as input in the AERMET meteorological preprocessor. The methodology and process applied to derive the needed micrometeorological parameters were discussed in detail in the modeling protocol. The final micrometeorological parameters input to AERMET are found in Table 3 and Table 4 for the primary station average and wet year, respectively and in Table 5 and Table 6 for the secondary station average and wet year, respectively.

Table 3: Micrometeorological Parameter Input, Onsite Primary Station, and Average Moisture Condition

Surface Characteristics for Onsite, Average Moisture Condition- Input for AERMET

Sector	Deg1	Deg2	Season	Albedo	Bowen Ratio (Average Moisture)	Roughness Length (m)
1	0	45	3	0.127	0.226	0.004
2	45	90	3	0.127	0.226	0.054
3	90	135	3	0.127	0.226	0.184
4	135	180	3	0.127	0.226	0.343
5	180	225	3	0.127	0.226	0.373
6	225	270	3	0.127	0.226	0.019
7	270	315	3	0.127	0.226	0.013
8	315	360	3	0.127	0.226	0.018

Table 4: Micrometeorological Parameter Input, Onsite Primary Station, and Wet Moisture Condition

Surface Characteristics for Onsite, Wet Moisture Condition - Input for AERMET

Sector	Deg1	Deg2	Season	Albedo	Bowen Ratio Wet Moisture)	Roughness Length (m)
1	0	45	3	0.127	0.179	0.004
2	45	90	3	0.127	0.179	0.054
3	90	135	3	0.127	0.179	0.184
4	135	180	3	0.127	0.179	0.343
5	180	225	3	0.127	0.179	0.373
6	225	270	3	0.127	0.179	0.019
7	270	315	3	0.127	0.179	0.013
8	315	360	3	0.127	0.179	0.018

Table 5: Micrometeorological Parameter Input, GUM Secondary Station, and Average Moisture Condition

Surface Characteristics for GUM, Average Moisture Condition- Input for AERMET

Sector	Deg1	Deg2	Season	Albedo	Bowen Ratio (Average Moisture)	Roughness Length (m)
1	0	45	3	0.137	0.371	0.064
2	45	90	3	0.137	0.371	0.076
3	90	135	3	0.137	0.371	0.142
4	135	180	3	0.137	0.371	0.178
5	180	225	3	0.137	0.371	0.156
6	225	270	3	0.137	0.371	0.116
7	270	315	3	0.137	0.371	0.068
8	315	360	3	0.137	0.371	0.061

Table 6: Micrometeorological Parameter Input, GUM Secondary Station, and Wet Moisture Condition

Surface Characteristics for GUM, Wet Moisture Condition - Input for AERMET

Sector	Deg1	Deg2	Season	Albedo	Bowen Ratio (Wet Moisture)	Roughness Length (m)
1	0	45	3	0.137	0.269	0.064
2	45	90	3	0.137	0.269	0.076
3	90	135	3	0.137	0.269	0.142
4	135	180	3	0.137	0.269	0.178
5	180	225	3	0.137	0.269	0.156
6	225	270	3	0.137	0.269	0.116
7	270	315	3	0.137	0.269	0.068
8	315	360	3	0.137	0.269	0.061

7.0 BACKGROUND CONCENTRATIONS

As noted above and shown in the windrose in Figure 3, Guam lies in the easterly trade wind zone and there are no major stationary upwind SO_2 sources for hundreds or thousands 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 dimethyl sulfide[2]. EPA has found that the Pacific Ocean SO_2 background concentrations may be on the order of 0.025 ppb, or 0.065 $\mu g/m^3$ [3], an insignificant contribution. It is also expected that the one-hour critical design concentrations from the Piti/Cabras sources will be on the elevated terrain to the east of the plants, During these flow events, there are virtually no sources of emissions upwind of Guam and the background contribution is expected to be insignificant.

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 SO_2 background concentration was zero for their air quality modeling.

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 (Appendix D illustrates the cover page of the referenced report, the full report was provided with the modeling protocol and is provided here with the digital files). A value of "0" in the data reported 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).

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

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[2] Barnes, I (editor), Global Atmospheric Change and its Impact on Regional Air Quality, NATO Science Series, Kluwer Academic Publishers, 2002.

[3] EPA, Integrated Science Assessment for Sulfur Oxides-Health Criteria, EPA/600/R-08/047F, 2008.

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. As described in the addendum to the modeling protocol, GUM hourly and special observations were used to characterize the transport wind direction for emissions from the applicable sources. The Nimitz Hill monitoring site was identified as the location experiencing plume impacts from the Piti generating units and the monitoring data were processed to eliminate periods with potential plume impacts following the Guideline procedure. The resulting Nimitz Hill concentration data set was processed to determine the 99th percentile of the daily maximum one-hour observed concentrations. This resulted in a conservative 99th percentile background concentration of 29 $\mu g/m^3$, which is added to the predicted 99th percentile AERMOD predicted concentration to determine the design value 99th percentile one hour daily maximum concentration for comparison to the NAAQS.

8.0 MODELING RESULTS

GPA Applicable Sources

The applicable GPA sources described in Table 1 were modeled over the period 2011-2013 and the three year average of the 99th percentile (highest fourth high concentration or H4H) of the daily maximum one-hour average SO_2 concentrations was determined to be 2,214 µg/m³ plus 29 µg/m³ background concentration, for a total impact of 2,243 µg/m³. A culpability analysis was performed on this result to determine the contribution of this maximum design value from the modeled applicable sources. Table 7 presents the three-year average H4H and the contribution from the GPA modeled sources.

Table 7: Culpability Analysis of GPA Applicable Sources' Modeled H4H Result (µg/m³); No Background Added

Source	H4H (2011-2013) 2011		2012		2013		3yr Avg	
	µg/m³	ppb	µg/m³	ppb	µg/m³	ppb	µg/m³	ppb
ALL	2280	870	2927	1117	1434	547	**2214**	**845**
CAB B1	729	278	807	308	395	151	644	246
CAB B2	727	277	822	314	354	135	634	242
CAB E3_4	676	258	1010	385	446	170	711	271
MEC E8_9	130	50	234	89	211	81	192	73
TEMES_7	18	7	54	21	28	11	34	13

NAAQS = 196 µg/m³ or 75 ppb

The predicted H4H design value occurs on the Nimitz Hill elevated terrain to the southeast of the GPA modeled sources as can be noted in Figure 7. Concentrations are highest in areas of elevated terrain like Nimitz Hill to the southeast and in the northeast region of the island. In addition, there is an area of high design values over Orote Peninsula to the west. As can be noted, the modeled maximum design values are above the NAAQS in multiple regions across the island.

There are two significant reasons for these high modeled impacts. First, available monitored values, albeit from the 1999-2000 period, observed for the same areas do not match modeled values and therefore, the substantial modeled results are not representative of actual conditions. Actual monitored one-hour average SO_2 concentration at multiple locations across the island for the year October 1999 through September 2000, reference the report provided in the modeling protocol, indicated maximum H4H value measured at Nimitz Hill during that period at 17 ppb (45 µg/m³). The location of the historical Nimitz Hill monitor is noted in Figure 7 and is close proximity to the modeled H4H location. Thus, the measured value is directly comparable to the over 2,000 μg/m^3 modeled in that area under the permitted and potential to emit stack conditions described in Table 1. It is therefore apparent that the modeled results are not representative of actual measured concentrations and should be taken as grossly conservative.

Second, modeled emission rates are significantly higher than reported actual rates, therefore the substantial modeled results are not representative of actual conditions. Table 8 below presents a comparison of modeled rates calculated on an annual basis and reported annual rates from the Guam EPA emissions inventory submitted to EPA January 15, 2016 in support of the data requirements rule. As can be noted, actual annual emissions were between 28% and 64% of modeled rates. As hourly actual data were not available at the time of this analysis, permitted and potential to emit rates were used. As Table 8 shows, this is a large over-estimation of actual emission rates from the applicable sources. It is therefore likely that modeled results are not representative of actual conditions, and should be taken as grossly conservative.

Other Sources

The other (Marine) sources described in Table 1 were modeled over the three year period 2011-2013 and the H4H averaged over three years was determined to be 401 μg/m^3 plus 29 μg/m^3 background concentration for a total impact of 430 μg/m^3. Figure 8 presents the distribution of the modeled maximum H4H results and as is evident, the maximum impacts from the other modeled sources are confined to the region near the marine harbors and hoteling locations. It is also apparent from the design value maxima distribution that the maritime sources do not impact GPA applicable source maximum design values and further, that GPA applicable sources do not impact the maritime modeled source design value maxima. It should finally be noted that the representation of the marine sources is likely quite conservative, given the volume source depiction and methodology employed to characterize these sources.

Figure 7: GPA Applicable Source Modeling Results; Modeled + Background

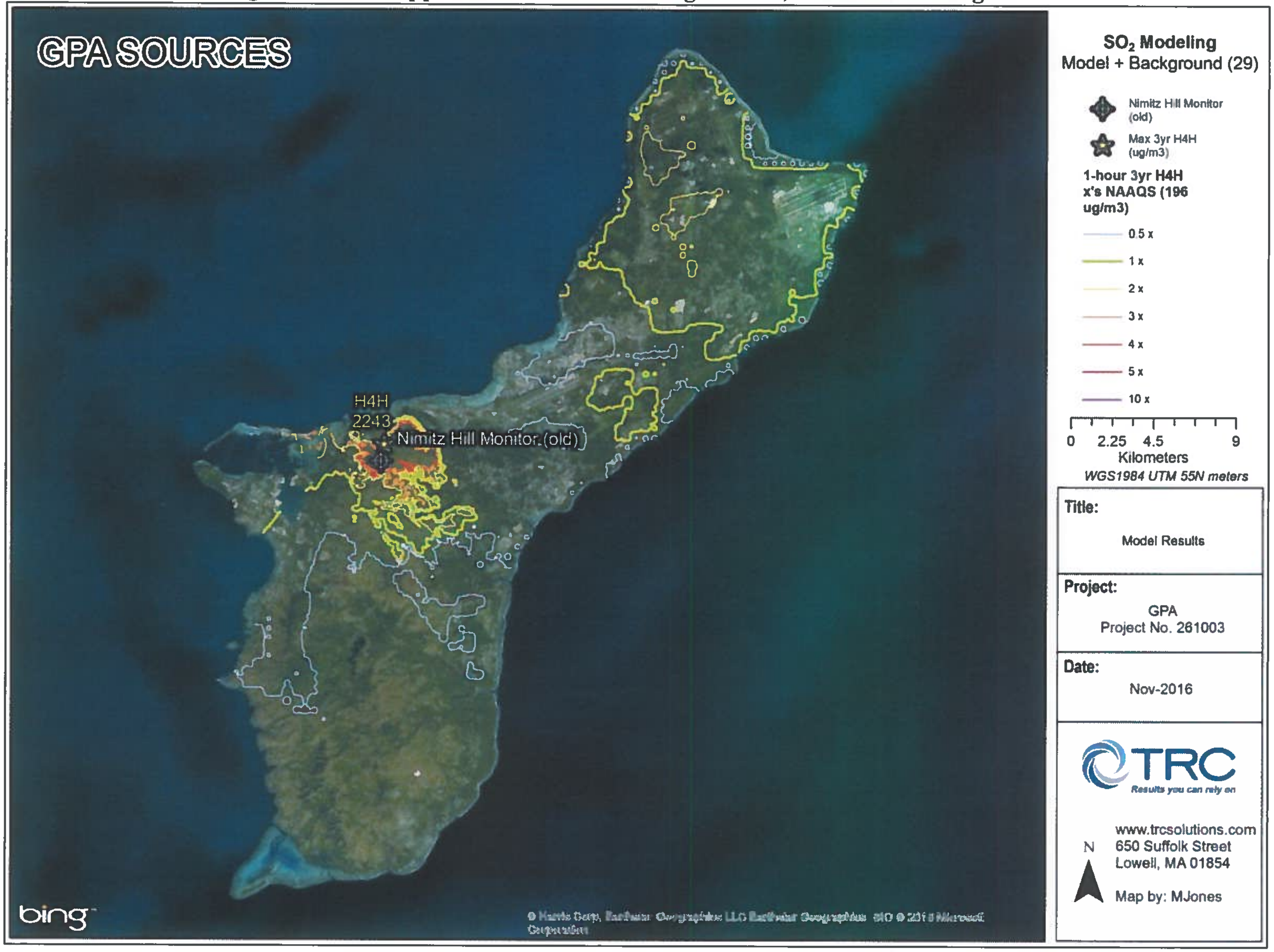
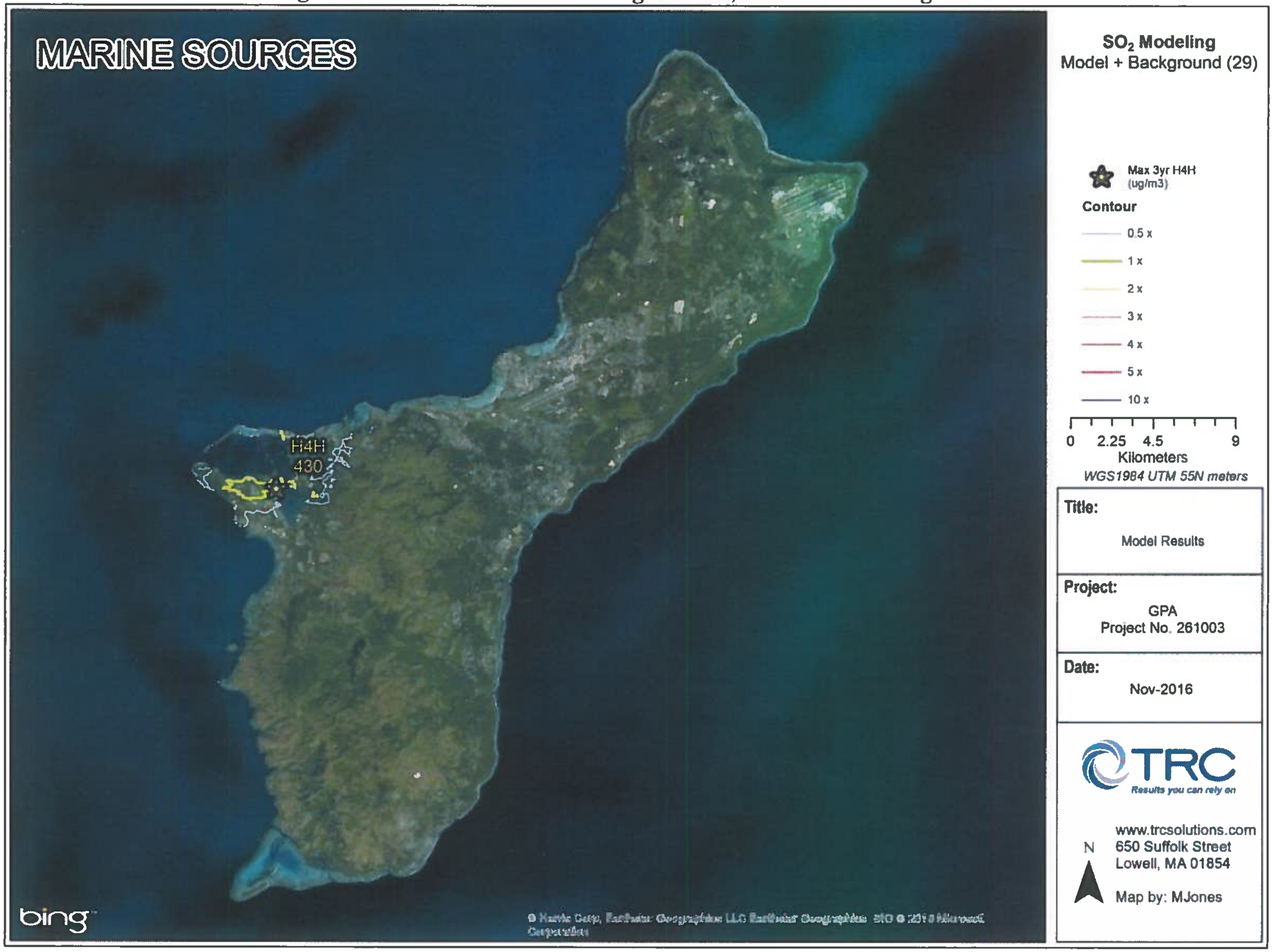


Table 8: Comparison of Modeled Rates Versus Actual Rates

Source ID	Modeled	Calculated	2011 Actual [1]	2011 % of Allowed	2012 Actual [1]	2012 % of Allowed	2013 Actual [1]	2013 % of Allowed
	1-hr	Annual	Annual	Annual	Annual	Annual	Annual	Annual
	SO2	SO2	SO2	SO2	SO2	SO2	SO2	SO2
	g/s	tpy	tpy	tpy	tpy	tpy	tpy	tpy
CAB_B1	159.8371	5560.1	1998.3	36%	2918.7	52%	2614.1	47%
CAB_B2	159.8371	5560.1	2084.9	37%	2842.7	51%	3372.2	61%
CAB_E3_4	185.9719	6469.3	4155.5	64%	2347.6	36%	1842.0	28%
MEC_E8_9	194.9991	6783.3	NA	NA	NA	NA	NA	NA
TEMES_7	28.8535	1003.7	NA	NA	NA	NA	NA	NA

[1] Taken from January 15 2016 letter from Guam EPA to EPA

Figure 8: Other Sources Modeling Results; Modeled + Background



Total Modeled Results

All sources described in Table 1 were modeled together over the three year period 2011-2013 and the H4H averaged over three years was determined to be 2,214 μg/m^3 (with background concentration of 29 μg/m^3, this leads to a total impact of 2,243 μg/m^3). As stated above, the marine sources' impacts and GPA impacts do not generally overlap, leading to the culpability analysis results presented in Table 9. Namely, the total modeled H4H design value is due to GPA applicable sources, with no contribution from other marine sources.

Table 9: Culpability analysis of All Sources' Maximum Modeled H4H Result (μg/m^3); No Background Added

H4H (2011-2013)								
Source	2011		2012		2013		3yr Avg	
	μg/m^3	ppb	μg/m^3	ppb	μg/m^3	ppb	μg/m^3	ppb
ALL	2280	870	2927	1117	1434	547	**2214**	**845**
CAB_B1	729	278	807	308	395	151	644	246
CAB_B2	727	277	822	314	354	135	634	242
CAB_E3_4	676	258	1010	385	446	170	711	271
HOTELING VESSELS	0	0	0	0	0	0	0	0
MEC_E8_9	130	50	234	89	211	81	192	73
TEMES_7	18	7	54	21	28	11	34	13

NAAQS = 196 μg/m^3 or 75 ppb

Similar to the GPA applicable source results, the total modeled source H4H design value occurs over the Nimitz Hill elevated terrain to the southeast of the GPA modeled sources as can be noted in Figure 9. Concentrations are highest in areas of elevated terrain like Nimitz Hill to the southeast and in the northeast region of the island. In addition, there is an area of high design values over Orote Peninsula to the west that marine sources increase slightly. However, it is clear that maximum design values occur on Nimitz Hill and are essentially controlled by GPA applicable sources.

Figure 9: Total Modeling Results; Modeled + Background

9.0 SUMMARY AND IMPLICATIONS

Based on the results of running the applicable sources at highly conservative permitted and potential to emit rates, a broad region in the vicinity of the Cabras/Piti plants, Orote Peninsula, terrain southeast of the plants (Nimitz Hill), and area of elevated terrain to the northeast are above the one-hour NAAQS for SO2. As stated in Section 8, these results are not supported by the available monitored data and are highly over-predictive based on reported actual annual emissions and known conservative model treatment of plume dispersion that will be addressed in the upcoming Appendix W guideline revision. It is expected that application of the revised model options will yield much lower modeled impacts. Nevertheless, the implication from the modeling analyses presented in this report to characterize the potential impact of sources subject to the DRR is that the Orote Peninsula, elevated terrain to the southeast of the Cabras/Piti plants, and elevated terrain to the northeast are in modeled non-attainment of the one-hour average SO_2 NAAQS.

The modeling files and supporting documentation of the modeled results presented in this report are provided in the following attachments and on digital media also included with this report.

APPENDIX A
BPIPPRM OUTPUT

BPIP (Dated: 04274)

DATE : 10/26/2016

TIME : 14:37:41

<<path>>

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BPIP PROCESSING INFORMATION:

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The P flag has been set for preparing downwash related data for a model run utilizing the PRIME algorithm.

Inputs entered in METERS will be converted to meters using a conversion factor of 1.0000. Output will be in meters.

The UTMP variable is set to UTMY. The input is assumed to be in UTM coordinates. BPIP will move the UTM origin to the first pair of UTM coordinates read. The UTM coordinates of the new origin will be subtracted from all the other UTM coordinates entered to form this new local coordinate system.

Plant north is set to 0.00 degrees with respect to True North.

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PRELIMINARY* GEP STACK HEIGHT RESULTS TABLE
(Output Units: meters)

Stack Name	Stack Height	Stack-Building Base Elevation Differences	GEP** EQN1	Preliminary* GEP Stack Height Value
CAB_B1	61.00	0.10	85.25	85.25
CAB_B2	61.00	-0.06	85.41	85.41
CAB_E3_4	61.57	0.47	79.99	79.99
MEC_E8_9	61.90	-0.28	57.53	65.00
TEMES_7	21.21	-0.67	57.92	65.00

* Results are based on Determinants 1 & 2 on pages 1 & 2 of the GEP Technical Support Document. Determinant 3 may be investigated for additional stack height credit. Final values result after Determinant 3 has been taken into consideration.

** Results were derived from Equation 1 on page 6 of GEP Technical Support Document. Values have been adjusted for any stack-building base elevation differences.

Note: Criteria for determining stack heights for modeling emission limitations for a source can be found in Table 3.1 of the GEP Technical Support Document.

BPIP (Dated: 04274)

DATE : 10/26/2016
TIME : 14:37:41

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BPIP output is in meters

SO	BUILDHGT	CAB_B1	34.14	34.14	32.10	32.10	32.10	32.10
SO	BUILDHGT	CAB_B1	32.10	32.10	32.10	34.14	34.14	34.14
SO	BUILDHGT	CAB_B1	34.14	34.14	34.14	34.14	34.14	34.14
SO	BUILDHGT	CAB_B1	34.14	34.14	32.10	32.10	32.10	32.10
SO	BUILDHGT	CAB_B1	32.10	32.10	32.10	34.14	34.14	34.14
SO	BUILDHGT	CAB_B1	34.14	34.14	34.14	34.14	34.14	34.14
SO	BUILDWID	CAB_B1	36.90	34.30	53.59	49.30	43.52	36.42
SO	BUILDWID	CAB_B1	39.89	63.62	75.00	33.22	36.14	37.95
SO	BUILDWID	CAB_B1	38.62	38.11	36.44	37.85	38.71	38.39
SO	BUILDWID	CAB_B1	36.90	34.30	53.59	49.30	43.52	36.42
SO	BUILDWID	CAB_B1	39.89	63.62	75.00	33.22	36.14	37.95
SO	BUILDWID	CAB_B1	38.62	38.11	36.44	37.85	38.71	38.39
SO	BUILDLEN	CAB_B1	33.22	36.14	54.79	52.90	49.41	44.41
SO	BUILDLEN	CAB_B1	49.74	87.21	82.84	36.90	34.30	30.65
SO	BUILDLEN	CAB_B1	26.07	20.69	14.69	18.93	24.49	29.30
SO	BUILDLEN	CAB_B1	33.22	36.14	54.79	52.90	49.41	44.41
SO	BUILDLEN	CAB_B1	49.74	87.21	82.84	36.90	34.30	30.65
SO	BUILDLEN	CAB_B1	26.07	20.69	14.69	18.93	24.49	29.30
SO	XBADJ	CAB_B1	-17.15	-15.98	-90.38	-90.42	-87.71	-82.34
SO	XBADJ	CAB_B1	-80.48	-76.19	-69.59	-3.69	-2.51	-1.26
SO	XBADJ	CAB_B1	0.03	1.31	2.56	-1.45	-6.58	-11.50
SO	XBADJ	CAB_B1	-16.07	-20.16	35.58	37.52	38.31	37.93
SO	XBADJ	CAB_B1	30.74	-11.02	-13.25	-33.22	-31.78	-29.38
SO	XBADJ	CAB_B1	-26.09	-22.01	-17.25	-17.48	-17.91	-17.80
SO	YBADJ	CAB_B1	-14.76	-14.63	11.42	0.31	-10.81	-21.61
SO	YBADJ	CAB_B1	-31.91	-32.19	-36.70	-0.54	2.09	4.66
SO	YBADJ	CAB_B1	7.08	9.29	11.22	12.51	13.69	14.45
SO	YBADJ	CAB_B1	14.76	14.63	-11.42	-0.31	10.81	21.61
SO	YBADJ	CAB_B1	31.91	32.19	36.70	0.54	-2.09	-4.66

```
SO YBADJ    CAB_B1          -7.08   -9.29  -11.22  -12.51  -13.69  -14.45


SO BUILDHGT CAB_B2          34.14   34.14   32.10   32.10   32.10   32.10
SO BUILDHGT CAB_B2          32.10   32.10   32.10   34.14   34.14   34.14
SO BUILDHGT CAB_B2          34.14   34.14   34.14   34.14   34.14   34.14
SO BUILDHGT CAB_B2          34.14   34.14   32.10   32.10   32.10   32.10
SO BUILDHGT CAB_B2          32.10   32.10   32.10   34.14   34.14   34.14
SO BUILDHGT CAB_B2          34.14   34.14   34.14   34.14   34.14   34.14
SO BUILDWID CAB_B2          36.90   34.30   53.59   49.30   43.52   36.42
SO BUILDWID CAB_B2          50.30   63.62   75.00   33.22   36.14   37.95
SO BUILDWID CAB_B2          38.62   38.11   36.44   37.85   38.71   38.39
SO BUILDWID CAB_B2          36.90   34.30   53.59   49.30   43.52   37.26
SO BUILDWID CAB_B2          50.30   63.62   75.00   33.22   36.14   37.95
SO BUILDWID CAB_B2          38.62   38.11   36.44   37.85   38.71   38.39
SO BUILDLEN CAB_B2          33.22   36.14   54.79   52.90   49.41   44.41
SO BUILDLEN CAB_B2          88.93   87.21   82.84   36.90   34.30   30.65
SO BUILDLEN CAB_B2          26.07   20.69   14.69   18.93   24.49   29.30
SO BUILDLEN CAB_B2          33.22   36.14   54.79   95.37   93.40   88.59
SO BUILDLEN CAB_B2          88.93   87.21   82.84   36.90   34.30   30.65
SO BUILDLEN CAB_B2          26.07   20.69   14.69   18.93   24.49   29.30
SO XBADJ    CAB_B2         -36.27  -38.56 -115.74 -117.78 -116.25 -111.19
SO XBADJ    CAB_B2        -108.75 -103.04  -94.19  -25.30  -20.47  -15.03
SO XBADJ    CAB_B2          -9.13   -2.95    3.32    4.30    4.00    3.58
SO XBADJ    CAB_B2           3.05    2.42   60.94   22.41   22.85   22.60
SO XBADJ    CAB_B2          19.82   15.83   11.35  -11.61  -13.82  -15.62
SO XBADJ    CAB_B2         -16.94  -17.75  -18.01  -23.23  -28.49  -32.88
SO YBADJ    CAB_B2           6.84    3.32   25.19    9.46   -6.55  -22.37
SO YBADJ    CAB_B2         -32.46  -42.77  -51.78  -19.66  -20.49  -20.70
SO YBADJ    CAB_B2         -20.28  -19.25  -17.63  -15.76  -13.16  -10.15
SO YBADJ    CAB_B2          -6.84   -3.32  -25.19   -9.46    6.55   21.95
SO YBADJ    CAB_B2          32.46   42.77   51.78   19.66   20.49   20.70
SO YBADJ    CAB_B2          20.28   19.25   17.63   15.76   13.16   10.15


SO BUILDHGT CAB_E3_4        32.10   32.10   32.10   32.10   23.75    0.00
SO BUILDHGT CAB_E3_4        32.10   32.10   32.10   34.14   34.14   32.10
SO BUILDHGT CAB_E3_4        32.10   32.10   32.10   32.10   32.10   32.10
SO BUILDHGT CAB_E3_4        32.10   32.10   32.10   32.10   23.75    0.00
SO BUILDHGT CAB_E3_4        32.10   32.10   32.10   34.14   34.14   32.10
SO BUILDHGT CAB_E3_4        32.10   32.10   32.10   32.10   32.10   32.10
SO BUILDWID CAB_E3_4        57.18   56.24   53.59   49.30   60.48    0.00
SO BUILDWID CAB_E3_4        50.30   45.89   50.50   30.88   30.88   54.79
SO BUILDWID CAB_E3_4        52.90   49.41   44.41   49.74   53.88   56.39
SO BUILDWID CAB_E3_4        57.18   56.24   53.59   49.30   60.48    0.00
SO BUILDWID CAB_E3_4        50.30   45.89   50.50   30.88   30.88   54.79
SO BUILDWID CAB_E3_4        52.90   49.41   44.41   49.74   53.88   56.39
SO BUILDLEN CAB_E3_4        53.57   55.02   54.79   52.90   52.89    0.00
SO BUILDLEN CAB_E3_4        88.93   53.88   56.39   36.90   34.30   53.59
```

```
SO BUILDLEN CAB_E3_4      49.30   43.52   36.42   39.89   45.89   50.50
SO BUILDLEN CAB_E3_4      53.57   55.02   54.79   52.90   52.89    0.00
SO BUILDLEN CAB_E3_4      88.93   53.88   56.39   36.90   34.30   53.59
SO BUILDLEN CAB_E3_4      49.30   43.52   36.42   39.89   45.89   50.50
SO XBADJ    CAB_E3_4     -58.52  -54.56  -48.93  -41.82  -35.24    0.00
SO XBADJ    CAB_E3_4     -19.92  -15.22  -10.06   52.60   48.81    6.59
SO XBADJ    CAB_E3_4      11.97   16.98   21.48   19.65   15.16   10.21
SO XBADJ    CAB_E3_4       4.95   -0.46   -5.86  -11.08  -17.65    0.00
SO XBADJ    CAB_E3_4     -69.00  -38.66  -46.33  -89.50  -83.11  -60.18
SO XBADJ    CAB_E3_4     -61.27  -60.51  -57.90  -59.54  -61.05  -60.71
SO YBADJ    CAB_E3_4     -24.00  -29.14  -33.39  -36.62  -37.92    0.00
SO YBADJ    CAB_E3_4     -34.39  -38.11  -35.46   23.08   35.13  -21.53
SO YBADJ    CAB_E3_4     -15.37   -8.74   -1.84    4.95   11.72   18.14
SO YBADJ    CAB_E3_4      24.00   29.14   33.39   36.62   37.92    0.00
SO YBADJ    CAB_E3_4      34.39   38.11   35.46  -23.09  -35.13   21.53
SO YBADJ    CAB_E3_4      15.37    8.74    1.84   -4.95  -11.72  -18.14


SO BUILDHGT MEC_E8_9      22.90   22.90   22.90   22.90   22.90   22.90
SO BUILDHGT MEC_E8_9      22.90   22.90   22.90   22.90   22.90   22.90
SO BUILDHGT MEC_E8_9      22.90   22.90   22.90   22.90   22.90   22.90
SO BUILDHGT MEC_E8_9      22.90   22.90   22.90   22.90   22.90   22.90
SO BUILDHGT MEC_E8_9      22.90   22.90   22.90   22.90   22.90   22.90
SO BUILDHGT MEC_E8_9      22.90   22.90   22.90   22.90   22.90   22.90
SO BUILDWID MEC_E8_9      38.50   39.68   45.07   49.09   51.62   52.58
SO BUILDWID MEC_E8_9      51.94   49.73   46.00   40.88   41.17   46.08
SO BUILDWID MEC_E8_9      49.58   51.58   52.01   50.85   48.16   44.00
SO BUILDWID MEC_E8_9      38.50   39.68   45.07   49.09   51.62   52.58
SO BUILDWID MEC_E8_9      51.94   49.73   46.00   40.88   41.17   46.08
SO BUILDWID MEC_E8_9      49.58   51.58   52.01   50.85   48.16   44.00
SO BUILDLEN MEC_E8_9      40.88   41.17   46.08   49.58   51.58   52.01
SO BUILDLEN MEC_E8_9      50.85   48.16   44.00   38.50   39.68   45.07
SO BUILDLEN MEC_E8_9      49.09   51.62   52.58   51.94   49.73   46.00
SO BUILDLEN MEC_E8_9      40.88   41.17   46.08   49.58   51.58   52.01
SO BUILDLEN MEC_E8_9      50.85   48.16   44.00   38.50   39.68   45.07
SO BUILDLEN MEC_E8_9      49.09   51.62   52.58   51.94   49.73   46.00
SO XBADJ    MEC_E8_9     -13.46   -8.13   -5.74   -3.18   -0.52    2.15
SO XBADJ    MEC_E8_9       4.76    7.22    9.47   11.43    8.88    3.63
SO XBADJ    MEC_E8_9      -1.72   -7.02  -12.10  -16.82  -21.03  -24.60
SO XBADJ    MEC_E8_9     -27.42  -33.04  -40.33  -46.40  -51.05  -54.16
SO XBADJ    MEC_E8_9     -55.62  -55.38  -53.47  -49.93  -48.55  -48.70
SO XBADJ    MEC_E8_9     -47.37  -44.60  -40.47  -35.12  -28.69  -21.40
SO YBADJ    MEC_E8_9     -30.68  -28.71  -26.17  -22.83  -18.79  -14.18
SO YBADJ    MEC_E8_9      -9.15   -3.83    1.60    6.98   12.45   17.29
SO YBADJ    MEC_E8_9      21.61   25.26   28.15   30.19   31.30   31.47
SO YBADJ    MEC_E8_9      30.68   28.71   26.17   22.83   18.79   14.18
SO YBADJ    MEC_E8_9       9.15    3.83   -1.60   -6.98  -12.45  -17.29
SO YBADJ    MEC_E8_9     -21.61  -25.26  -28.15  -30.19  -31.30  -31.47
```

SO	BUILDHGT	TEMES_7	0.00	17.43	17.43	17.43	17.43	17.43
SO	BUILDHGT	TEMES_7	17.43	14.80	14.80	14.80	9.14	7.32
SO	BUILDHGT	TEMES_7	7.32	0.00	0.00	0.00	0.00	0.00
SO	BUILDHGT	TEMES_7	0.00	14.80	0.00	0.00	0.00	9.14
SO	BUILDHGT	TEMES_7	9.14	9.14	14.80	14.80	9.14	0.00
SO	BUILDHGT	TEMES_7	0.00	22.90	22.90	22.90	22.90	22.90
SO	BUILDWID	TEMES_7	0.00	55.67	49.50	44.17	50.19	54.68
SO	BUILDWID	TEMES_7	57.51	102.44	97.30	90.00	8.59	10.08
SO	BUILDWID	TEMES_7	8.68	0.00	0.00	0.00	0.00	0.00
SO	BUILDWID	TEMES_7	0.00	107.58	0.00	0.00	0.00	13.20
SO	BUILDWID	TEMES_7	13.02	12.45	97.30	90.00	8.59	0.00
SO	BUILDWID	TEMES_7	0.00	51.58	52.01	50.85	48.16	44.00
SO	BUILDLEN	TEMES_7	0.00	56.92	53.10	48.48	54.41	59.30
SO	BUILDLEN	TEMES_7	62.37	98.43	104.69	107.77	13.25	18.43
SO	BUILDLEN	TEMES_7	18.04	0.00	0.00	0.00	0.00	0.00
SO	BUILDLEN	TEMES_7	0.00	79.97	0.00	0.00	0.00	10.82
SO	BUILDLEN	TEMES_7	12.09	12.98	104.69	107.77	13.25	0.00
SO	BUILDLEN	TEMES_7	0.00	51.62	52.58	51.94	49.73	46.00
SO	XBADJ	TEMES_7	0.00	-95.34	-98.70	-99.88	-103.04	-103.07
SO	XBADJ	TEMES_7	-99.97	-128.70	-126.72	-120.89	-23.81	-50.77
SO	XBADJ	TEMES_7	-50.86	0.00	0.00	0.00	0.00	0.00
SO	XBADJ	TEMES_7	0.00	15.36	0.00	0.00	0.00	9.00
SO	XBADJ	TEMES_7	9.94	10.59	22.03	13.12	10.56	0.00
SO	XBADJ	TEMES_7	0.00	-109.21	-113.15	-113.66	-110.71	-104.40
SO	YBADJ	TEMES_7	0.00	31.64	19.13	6.81	-5.56	-17.76
SO	YBADJ	TEMES_7	-29.43	-18.28	-31.45	-44.07	-4.27	3.03
SO	YBADJ	TEMES_7	-4.23	0.00	0.00	0.00	0.00	0.00
SO	YBADJ	TEMES_7	0.00	-57.59	0.00	0.00	0.00	-10.17
SO	YBADJ	TEMES_7	-7.56	-4.73	31.45	44.07	4.27	0.00
SO	YBADJ	TEMES_7	0.00	26.86	11.96	-3.30	-18.47	-33.07

APPENDIX B-1

AERMINUTE INPUT FILE

```
STARTEND 1 2011 12 2011
IFWGROUP Y 8 9 2004

DATAFILE STARTING
64050PGUM201101.dat
64050PGUM201102.dat
64050PGUM201103.dat
64050PGUM201104.dat
64050PGUM201105.dat
64050PGUM201106.dat
64050PGUM201107.dat
64050PGUM201108.dat
64050PGUM201109.dat
```

<note that remaining months are not available for 1-minute ASOS from NCDC. See ftp://ftp.ncdc.noaa.gov/pub/data/asos-onemin/6405-2011/.>

```
DATAFILE FINISHED

SURFDATA STARTING
912120-41415-2011

SURFDATA FINISHED

OUTFILES STARTING
HOURFILE GUM_2011.AERMINUTE
SUMMFILE GUM_2011.summ
COMPFILE GUM_2011.comp
OUTFILES FINISHED
```

APPENDIX B-2

AERMET INPUT FILE

AERMET INPUT

STAGE 1

```
JOB

  MESSAGES    "aermet_2011.MS1"
  REPORT      "aermet_2011.RP1"

UPPERAIR

    AUDIT     UATT
    RANGE     UATT -350 < 400  99999
    DATA      "U:\Met_Data\Upper Air\PGAC_2011-2015.fsl"   FSL
    EXTRACT   "UAEXOUT.DSK"
    QAOUT     "UAQAOUT.DSK"

    XDATES    10/12/31 TO 12/1/1

    LOCATION  91212  13.55N  144.83E   -10

SURFACE

    DATA      "U:\Met_Data\Surface\912120-41415-2010-2015"  ISHD
    EXTRACT   "SFEXOUT.DSK"
    QAOUT     "SFQAOUT.DSK"
    AUDIT     TSKC
    RANGE     TMPD -330 < 420  999

    XDATES    10/12/31  TO  12/1/1

    LOCATION  41415  13.478N  144.793E  -10  77.4

ONSITE
  DATA      "U:\Met_Data\Onsite\onsite_2011-2015.txt"
  XDATES    10/12/31  TO  12/1/1
  LOCATION  0000001  144.687E  13.461N  0  2.0
  QAOUT     "OSQAOUT.DSK"


  READ 1 OSYR OSMO OSDY OSHR HT01 WS01 WD01

  FORMAT 1 FREE

RANGE WS 0 <= 50 99
RANGE WD 0 <= 360 999

  THRESHOLD  0.3
```

STAGE 2

```
JOB

  MESSAGES "aermet_2011.MS2"
  REPORT   "aermet_2011.RP2"

ONSITE
  QAOUT    "OSQAOUT.DSK"

SURFACE

  QAOUT    "SFQAOUT.DSK"
  ASOS1MIN "U:\02_aerminute\GUM_2011-2015.AERMINUTE"

UPPERAIR

  QAOUT    "UAQAOUT.DSK"

MERGE

  OUTPUT   "aermet_2011.MRG"
  XDATES   10/12/31 TO 11/12/31
```

STAGE 3

```
JOB

  MESSAGES    "aermet_2011.MS3"
  REPORT      "aermet_2011.RP3"

METPREP

  DATA        "aermet_2011.MRG"
  METHOD      REFLEVEL SUBNWS
  METHOD      WIND_DIR RANDOM
  NWS_HGT     WIND 10
  THRESH_1MIN 0.5
  UAWINDOW    -7 +3
  OUTPUT      "GPA_2011.SFC"
  PROFILE     "GPA_2011.PFL"
  MODEL       AERMOD
  XDATES      10/12/31 TO 11/12/31

** Primary site Onsite - WET
  FREQ_SECT ANNUAL 8
  SECTOR  1  0  45
  SITE_CHAR  1  1  0.127  0.179  0.004
  SECTOR  2  45  90
```

```
  SITE_CHAR  1  2  0.127  0.179  0.054
  SECTOR  3  90  135
  SITE_CHAR  1  3  0.127  0.179  0.184
  SECTOR  4  135  180
  SITE_CHAR  1  4  0.127  0.179  0.343
  SECTOR  5  180  225
  SITE_CHAR  1  5  0.127  0.179  0.373
  SECTOR  6  225  270
  SITE_CHAR  1  6  0.127  0.179  0.019
  SECTOR  7  270  315
  SITE_CHAR  1  7  0.127  0.179  0.013
  SECTOR  8  315  360
  SITE_CHAR  1  8  0.127  0.179  0.018

** Secondary site GUM - WET
  FREQ_SECT2 ANNUAL 8
  SECTOR2  1  0  45
  SITE_CHAR2  1  1  0.137  0.269  0.064
  SECTOR2  2  45  90
  SITE_CHAR2  1  2  0.137  0.269  0.076
  SECTOR2  3  90  135
  SITE_CHAR2  1  3  0.137  0.269  0.142
  SECTOR2  4  135  180
  SITE_CHAR2  1  4  0.137  0.269  0.178
  SECTOR2  5  180  225
  SITE_CHAR2  1  5  0.137  0.269  0.156
  SECTOR2  6  225  270
  SITE_CHAR2  1  6  0.137  0.269  0.116
  SECTOR2  7  270  315
  SITE_CHAR2  1  7  0.137  0.269  0.068
  SECTOR2  8  315  360
  SITE_CHAR2  1  8  0.137  0.269  0.061
```

APPENDIX B-3

AERMAP INPUT FILE

```
CO STARTING
CO TITLEONE GPA DRR MODELING
CO TITLETWO WGS 84 ZONE 55
CO TERRHGTS EXTRACT
CO DATATYPE NED
CO DATAFILE "C:\USERS\MJONES\DESKTOP\GPA_LOCAL\04_AERMAP\00354969.TIF"
CO DATAFILE "C:\USERS\MJONES\DESKTOP\GPA_LOCAL\04_AERMAP\47642395.TIF"
CO DATAFILE "C:\USERS\MJONES\DESKTOP\GPA_LOCAL\04_AERMAP\74318991.TIF"
CO ANCHORXY 245353.1 1464472 245353.1 1464472 55 3
CO RUNORNOT RUN
CO NADGRIDS "C:\PROGRAM FILES (X86)\PROVIDENCE\BEEST\"
CO FINISHED

SO STARTING
SO LOCATION CAB_B1 POINT 249454.6 1489682.1
SO LOCATION CAB_B2 POINT 249479.2 1489697.18
SO LOCATION CAB_E3_4 POINT 249395.07 1489668.61
SO LOCATION MEC_E8_9 POINT 249840.4 1489439.
SO LOCATION TEMES_7 POINT 249838.8 1489522.
SO LOCATION HOTELC1 VOLUME 246877. 1489122.
SO LOCATION HOTELN2 VOLUME 246777.8 1486660.
SO LOCATION HOTELN3 VOLUME 247504.1 1486606.
SO LOCATION MNGN_T01 POINT 256718.21 1484075
SO LOCATION TALO_T01 POINT 256557.77 1477300.6
SO LOCATION TALO_T02 POINT 256557.77 1477300.6
SO LOCATION MCHS01 POINT 264772.44 1494642.4
SO LOCATION MCHS02 POINT 264803.93 1494663.5
SO LOCATION CAB34S01 POINT 249406.05 1489600.7
SO LOCATION CAB34S02 POINT 249424.48 1489658.4
SO LOCATION CAB12S01 POINT 249514.91 1489659.5
SO LOCATION CAB1S01 POINT 249491.27 1489680.6
SO LOCATION CAB1S02 POINT 249488.24 1489681.6
SO LOCATION CAB2S01 POINT 249471.54 1489669.9
SO LOCATION CAB2S02 POINT 249467.85 1489670.4
SO LOCATION DDT1S01 POINT 267502.06 1495200
SO LOCATION DDT1S02 POINT 267477.33 1495240.9
SO LOCATION DDT2S01 POINT 267500.48 1495162.9
SO LOCATION DDT2S02 POINT 267475.19 1495197.1
SO LOCATION DDDS01 POINT 267533.83 1495150.9
SO LOCATION DDDS02 POINT 267565.45 1495171.6
SO LOCATION DDDS03 POINT 267534.52 1495169.2
SO LOCATION DDTS01 POINT 267476.57 1495273.1
SO LOCATION DDTS02 POINT 267491.94 1495272.7
SO LOCATION DDTS03 POINT 267495.52 1495252
SO LOCATION TNGS01 POINT 262764.27 1498088.2
SO LOCATION PIT25S01 POINT 249746.63 1489539.2
SO LOCATION PIT25S02 POINT 249753.96 1489462.8
SO LOCATION MEC89S01 POINT 249884.28 1489417.6
SO LOCATION TMS7S01 POINT 249824.74 1489518
```

SO LOCATION TMS7S02 POINT 249808.62 1489537.1
SO LOCATION TMS7S03 POINT 249778.85 1489554.1
SO LOCATION TNJS01 POINT 249540.44 1484392.4
SO LOCATION TNJS02 POINT 249546.49 1484397.8
SO LOCATION YIGS01 POINT 271958.49 1498343.9
SO FINISHED

RE STARTING
<<CUT FOR SPACE, SEE DIGITAL FILES>>
RE FINISHED

OU STARTING
OU RECEPTOR "C:\USERS\MJONES\DESKTOP\GPA_LOCAL\04_AERMAP\GPADRR.RCF"
OU SOURCLOC "C:\USERS\MJONES\DESKTOP\GPA_LOCAL\04_AERMAP\GPADRR.SRF"
OU FINISHED

APPENDIX B-4

AERMOD INPUT FILE

```
CO STARTING
CO TITLEONE GPA DRR Modeling
CO TITLETWO WGS 84 ZONE 55
CO MODELOPT DFAULT CONC
CO AVERTIME 1
CO POLLUTID SO2
CO RUNORNOT RUN
CO FINISHED

SO STARTING
SO ELEVUNIT METERS
** CABRAS - 66 MW Heavy Oil Fired Boiler and Steam Engine
SO LOCATION CAB_B1 POINT 249454.6 1489682.1 0.72
SO SRCPARAM CAB_B1 159.83707 61. 422. 15.700248 2.59
SO BUILDHGT CAB_B1         34.14     34.14     32.10     32.10     32.10     32.10
SO BUILDHGT CAB_B1         32.10     32.10     32.10     34.14     34.14     34.14
SO BUILDHGT CAB_B1         34.14     34.14     34.14     34.14     34.14     34.14
SO BUILDHGT CAB_B1         34.14     34.14     32.10     32.10     32.10     32.10
SO BUILDHGT CAB_B1         32.10     32.10     32.10     34.14     34.14     34.14
SO BUILDHGT CAB_B1         34.14     34.14     34.14     34.14     34.14     34.14
SO BUILDWID CAB_B1         36.90     34.30     53.59     49.30     43.52     36.42
SO BUILDWID CAB_B1         39.89     63.62     75.00     33.22     36.14     37.95
SO BUILDWID CAB_B1         38.62     38.11     36.44     37.85     38.71     38.39
SO BUILDWID CAB_B1         36.90     34.30     53.59     49.30     43.52     36.42
SO BUILDWID CAB_B1         39.89     63.62     75.00     33.22     36.14     37.95
SO BUILDWID CAB_B1         38.62     38.11     36.44     37.85     38.71     38.39
SO BUILDLEN CAB_B1         33.22     36.14     54.79     52.90     49.41     44.41
SO BUILDLEN CAB_B1         49.74     87.21     82.84     36.90     34.30     30.65
SO BUILDLEN CAB_B1         26.07     20.69     14.69     18.93     24.49     29.30
SO BUILDLEN CAB_B1         33.22     36.14     54.79     52.90     49.41     44.41
SO BUILDLEN CAB_B1         49.74     87.21     82.84     36.90     34.30     30.65
SO BUILDLEN CAB_B1         26.07     20.69     14.69     18.93     24.49     29.30
SO XBADJ    CAB_B1        -17.15    -15.98    -90.38    -90.42    -87.71    -82.34
SO XBADJ    CAB_B1        -80.48    -76.19    -69.59     -3.69     -2.51     -1.26
SO XBADJ    CAB_B1          0.03      1.31      2.56     -1.45     -6.58    -11.50
SO XBADJ    CAB_B1        -16.07    -20.16     35.58     37.52     38.31     37.93
SO XBADJ    CAB_B1         30.74    -11.02    -13.25    -33.22    -31.78    -29.38
SO XBADJ    CAB_B1        -26.09    -22.01    -17.25    -17.48    -17.91    -17.80
SO YBADJ    CAB_B1        -14.76    -14.63     11.42      0.31    -10.81    -21.61
SO YBADJ    CAB_B1        -31.91    -32.19    -36.70     -0.54      2.09      4.66
SO YBADJ    CAB_B1          7.08      9.29     11.22     12.51     13.69     14.45
SO YBADJ    CAB_B1         14.76     14.63    -11.42     -0.31     10.81     21.61
SO YBADJ    CAB_B1         31.91     32.19     36.70      0.54     -2.09     -4.66
SO YBADJ    CAB_B1         -7.08     -9.29    -11.22    -12.51    -13.69    -14.45
** CABRAS - 66 MW Heavy Oil Fired Boiler and Steam Engine
SO LOCATION CAB_B2 POINT 249479.2 1489697.18 0.56
SO SRCPARAM CAB_B2 159.83707 61. 422. 15.700248 2.59
SO BUILDHGT CAB_B2         34.14     34.14     32.10     32.10     32.10     32.10
SO BUILDHGT CAB_B2         32.10     32.10     32.10     34.14     34.14     34.14
```

```
SO BUILDHGT CAB_B2          34.14     34.14     34.14     34.14     34.14     34.14
SO BUILDHGT CAB_B2          34.14     34.14     32.10     32.10     32.10     32.10
SO BUILDHGT CAB_B2          32.10     32.10     32.10     34.14     34.14     34.14
SO BUILDHGT CAB_B2          34.14     34.14     34.14     34.14     34.14     34.14
SO BUILDWID CAB_B2          36.90     34.30     53.59     49.30     43.52     36.42
SO BUILDWID CAB_B2          50.30     63.62     75.00     33.22     36.14     37.95
SO BUILDWID CAB_B2          38.62     38.11     36.44     37.85     38.71     38.39
SO BUILDWID CAB_B2          36.90     34.30     53.59     49.30     43.52     37.26
SO BUILDWID CAB_B2          50.30     63.62     75.00     33.22     36.14     37.95
SO BUILDWID CAB_B2          38.62     38.11     36.44     37.85     38.71     38.39
SO BUILDLEN CAB_B2          33.22     36.14     54.79     52.90     49.41     44.41
SO BUILDLEN CAB_B2          88.93     87.21     82.84     36.90     34.30     30.65
SO BUILDLEN CAB_B2          26.07     20.69     14.69     18.93     24.49     29.30
SO BUILDLEN CAB_B2          33.22     36.14     54.79     95.37     93.40     88.59
SO BUILDLEN CAB_B2          88.93     87.21     82.84     36.90     34.30     30.65
SO BUILDLEN CAB_B2          26.07     20.69     14.69     18.93     24.49     29.30
SO XBADJ    CAB_B2         -36.27    -38.56   -115.74   -117.78   -116.25   -111.19
SO XBADJ    CAB_B2        -108.75   -103.04    -94.19    -25.30    -20.47    -15.03
SO XBADJ    CAB_B2          -9.13     -2.95      3.32      4.30      4.00      3.58
SO XBADJ    CAB_B2           3.05      2.42     60.94     22.41     22.85     22.60
SO XBADJ    CAB_B2          19.82     15.83     11.35    -11.61    -13.82    -15.62
SO XBADJ    CAB_B2         -16.94    -17.75    -18.01    -23.23    -28.49    -32.88
SO YBADJ    CAB_B2           6.84      3.32     25.19      9.46     -6.55    -22.37
SO YBADJ    CAB_B2         -32.46    -42.77    -51.78    -19.66    -20.49    -20.70
SO YBADJ    CAB_B2         -20.28    -19.25    -17.63    -15.76    -13.16    -10.15
SO YBADJ    CAB_B2          -6.84     -3.32    -25.19     -9.46      6.55     21.95
SO YBADJ    CAB_B2          32.46     42.77     51.78     19.66     20.49     20.70
SO YBADJ    CAB_B2          20.28     19.25     17.63     15.76     13.16     10.15
** CABRAS - 40 MW Low Speed Diesel Engine
SO LOCATION CAB_E3_4 POINT 249395.07 1489668.61 1.09
SO SRCPARAM CAB_E3_4 185.9719 61.5696 445.65 21.336 2.4384
SO BUILDHGT CAB_E3_4        32.10     32.10     32.10     32.10     23.75      0.00
SO BUILDHGT CAB_E3_4        32.10     32.10     32.10     34.14     34.14     32.10
SO BUILDHGT CAB_E3_4        32.10     32.10     32.10     32.10     32.10     32.10
SO BUILDHGT CAB_E3_4        32.10     32.10     32.10     32.10     23.75      0.00
SO BUILDHGT CAB_E3_4        32.10     32.10     32.10     34.14     34.14     32.10
SO BUILDHGT CAB_E3_4        32.10     32.10     32.10     32.10     32.10     32.10
SO BUILDWID CAB_E3_4        57.18     56.24     53.59     49.30     60.48      0.00
SO BUILDWID CAB_E3_4        50.30     45.89     50.50     30.88     30.88     54.79
SO BUILDWID CAB_E3_4        52.90     49.41     44.41     49.74     53.88     56.39
SO BUILDWID CAB_E3_4        57.18     56.24     53.59     49.30     60.48      0.00
SO BUILDWID CAB_E3_4        50.30     45.89     50.50     30.88     30.88     54.79
SO BUILDWID CAB_E3_4        52.90     49.41     44.41     49.74     53.88     56.39
SO BUILDLEN CAB_E3_4        53.57     55.02     54.79     52.90     52.89      0.00
SO BUILDLEN CAB_E3_4        88.93     53.88     56.39     36.90     34.30     53.59
SO BUILDLEN CAB_E3_4        49.30     43.52     36.42     39.89     45.89     50.50
SO BUILDLEN CAB_E3_4        53.57     55.02     54.79     52.90     52.89      0.00
SO BUILDLEN CAB_E3_4        88.93     53.88     56.39     36.90     34.30     53.59
SO BUILDLEN CAB_E3_4        49.30     43.52     36.42     39.89     45.89     50.50
SO XBADJ    CAB_E3_4       -58.52    -54.56    -48.93    -41.82    -35.24      0.00
```

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SO XBADJ    CAB_E3_4      -19.92   -15.22   -10.06    52.60    48.81     6.59
SO XBADJ    CAB_E3_4       11.97    16.98    21.48    19.65    15.16    10.21
SO XBADJ    CAB_E3_4        4.95    -0.46    -5.86   -11.08   -17.65     0.00
SO XBADJ    CAB_E3_4      -69.00   -38.66   -46.33   -89.50   -83.11   -60.18
SO XBADJ    CAB_E3_4      -61.27   -60.51   -57.90   -59.54   -61.05   -60.71
SO YBADJ    CAB_E3_4      -24.00   -29.14   -33.39   -36.62   -37.92     0.00
SO YBADJ    CAB_E3_4      -34.39   -38.11   -35.46    23.08    35.13   -21.53
SO YBADJ    CAB_E3_4      -15.37    -8.74    -1.84     4.95    11.72    18.14
SO YBADJ    CAB_E3_4       24.00    29.14    33.39    36.62    37.92     0.00
SO YBADJ    CAB_E3_4       34.39    38.11    35.46   -23.09   -35.13    21.53
SO YBADJ    CAB_E3_4       15.37     8.74     1.84    -4.95   -11.72   -18.14
** MEC PITI - Turbine
SO LOCATION MEC_E8_9 POINT 249840.4 1489439. 2.76
SO SRCPARAM MEC_E8_9 194.99910199999 61.8995 812.59 7.253535 5.3216
SO BUILDHGT MEC_E8_9       22.90    22.90    22.90    22.90    22.90    22.90
SO BUILDHGT MEC_E8_9       22.90    22.90    22.90    22.90    22.90    22.90
SO BUILDHGT MEC_E8_9       22.90    22.90    22.90    22.90    22.90    22.90
SO BUILDHGT MEC_E8_9       22.90    22.90    22.90    22.90    22.90    22.90
SO BUILDHGT MEC_E8_9       22.90    22.90    22.90    22.90    22.90    22.90
SO BUILDHGT MEC_E8_9       22.90    22.90    22.90    22.90    22.90    22.90
SO BUILDWID MEC_E8_9       38.50    39.68    45.07    49.09    51.62    52.58
SO BUILDWID MEC_E8_9       51.94    49.73    46.00    40.88    41.17    46.08
SO BUILDWID MEC_E8_9       49.58    51.58    52.01    50.85    48.16    44.00
SO BUILDWID MEC_E8_9       38.50    39.68    45.07    49.09    51.62    52.58
SO BUILDWID MEC_E8_9       51.94    49.73    46.00    40.88    41.17    46.08
SO BUILDWID MEC_E8_9       49.58    51.58    52.01    50.85    48.16    44.00
SO BUILDLEN MEC_E8_9       40.88    41.17    46.08    49.58    51.58    52.01
SO BUILDLEN MEC_E8_9       50.85    48.16    44.00    38.50    39.68    45.07
SO BUILDLEN MEC_E8_9       49.09    51.62    52.58    51.94    49.73    46.00
SO BUILDLEN MEC_E8_9       40.88    41.17    46.08    49.58    51.58    52.01
SO BUILDLEN MEC_E8_9       50.85    48.16    44.00    38.50    39.68    45.07
SO BUILDLEN MEC_E8_9       49.09    51.62    52.58    51.94    49.73    46.00
SO XBADJ    MEC_E8_9      -13.46    -8.13    -5.74    -3.18    -0.52     2.15
SO XBADJ    MEC_E8_9        4.76     7.22     9.47    11.43     8.88     3.63
SO XBADJ    MEC_E8_9       -1.72    -7.02   -12.10   -16.82   -21.03   -24.60
SO XBADJ    MEC_E8_9      -27.42   -33.04   -40.33   -46.40   -51.05   -54.16
SO XBADJ    MEC_E8_9      -55.62   -55.38   -53.47   -49.93   -48.55   -48.70
SO XBADJ    MEC_E8_9      -47.37   -44.60   -40.47   -35.12   -28.69   -21.40
SO YBADJ    MEC_E8_9      -30.68   -28.71   -26.17   -22.83   -18.79   -14.18
SO YBADJ    MEC_E8_9       -9.15    -3.83     1.60     6.98    12.45    17.29
SO YBADJ    MEC_E8_9       21.61    25.26    28.15    30.19    31.30    31.47
SO YBADJ    MEC_E8_9       30.68    28.71    26.17    22.83    18.79    14.18
SO YBADJ    MEC_E8_9        9.15     3.83    -1.60    -6.98   -12.45   -17.29
SO YBADJ    MEC_E8_9      -21.61   -25.26   -28.15   -30.19   -31.30   -31.47
** TEMES PITI - 40 MW simple cycle combustion turbine
SO LOCATION TEMES_7 POINT 249838.8 1489522. 2.37
SO SRCPARAM TEMES_7 28.85351465 21.209 831.83 26.33 4.0864
SO BUILDHGT TEMES_7         0.00    17.43    17.43    17.43    17.43    17.43
SO BUILDHGT TEMES_7        17.43    14.80    14.80    14.80     9.14     7.32
SO BUILDHGT TEMES_7         7.32     0.00     0.00     0.00     0.00     0.00
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SO BUILDHGT TEMES_7           0.00     14.80     0.00     0.00     0.00     9.14
SO BUILDHGT TEMES_7           9.14      9.14    14.80    14.80     9.14     0.00
SO BUILDHGT TEMES_7           0.00     22.90    22.90    22.90    22.90    22.90
SO BUILDWID TEMES_7           0.00     55.67    49.50    44.17    50.19    54.68
SO BUILDWID TEMES_7          57.51    102.44    97.30    90.00     8.59    10.08
SO BUILDWID TEMES_7           8.68      0.00     0.00     0.00     0.00     0.00
SO BUILDWID TEMES_7           0.00    107.58     0.00     0.00     0.00    13.20
SO BUILDWID TEMES_7          13.02     12.45    97.30    90.00     8.59     0.00
SO BUILDWID TEMES_7           0.00     51.58    52.01    50.85    48.16    44.00
SO BUILDLEN TEMES_7           0.00     56.92    53.10    48.48    54.41    59.30
SO BUILDLEN TEMES_7          62.37     98.43   104.69   107.77    13.25    18.43
SO BUILDLEN TEMES_7          18.04      0.00     0.00     0.00     0.00     0.00
SO BUILDLEN TEMES_7           0.00     79.97     0.00     0.00     0.00    10.82
SO BUILDLEN TEMES_7          12.09     12.98   104.69   107.77    13.25     0.00
SO BUILDLEN TEMES_7           0.00     51.62    52.58    51.94    49.73    46.00
SO XBADJ    TEMES_7           0.00    -95.34   -98.70   -99.88  -103.04  -103.07
SO XBADJ    TEMES_7         -99.97   -128.70  -126.72  -120.89   -23.81   -50.77
SO XBADJ    TEMES_7         -50.86      0.00     0.00     0.00     0.00     0.00
SO XBADJ    TEMES_7           0.00     15.36     0.00     0.00     0.00     9.00
SO XBADJ    TEMES_7           9.94     10.59    22.03    13.12    10.56     0.00
SO XBADJ    TEMES_7           0.00   -109.21  -113.15  -113.66  -110.71  -104.40
SO YBADJ    TEMES_7           0.00     31.64    19.13     6.81    -5.56   -17.76
SO YBADJ    TEMES_7         -29.43    -18.28   -31.45   -44.07    -4.27     3.03
SO YBADJ    TEMES_7          -4.23      0.00     0.00     0.00     0.00     0.00
SO YBADJ    TEMES_7           0.00    -57.59     0.00     0.00     0.00   -10.17
SO YBADJ    TEMES_7          -7.56     -4.73    31.45    44.07     4.27     0.00
SO YBADJ    TEMES_7           0.00     26.86    11.96    -3.30   -18.47   -33.07
SO LOCATION HOTELC1 VOLUME 246877. 1489122. 0.00
SO SRCPARAM HOTELC1 2.1646 25. 13.9534884 11.627907
SO LOCATION HOTELN2 VOLUME 246777.8 1486660. 0.00
SO SRCPARAM HOTELN2 2.1646 25. 13.9534884 11.627907
SO LOCATION HOTELN3 VOLUME 247504.1 1486606. 0.00
SO SRCPARAM HOTELN3 2.1646 25. 13.9534884 11.627907
SO SRCGROUP ALL
SO SRCGROUP GPA  CAB_B1 CAB_B2 CAB_E3_4 MEC_E8_9 TEMES_7
SO SRCGROUP HOTEL  HOTELC1 HOTELN2 HOTELN3
SO SRCGROUP CAB_B1  CAB_B1
SO SRCGROUP CAB_B2  CAB_B2
SO SRCGROUP CAB_E3_4  CAB_E3_4
SO SRCGROUP MEC_E8_9  MEC_E8_9
SO SRCGROUP TEMES_7  TEMES_7
SO FINISHED

RE STARTING
RE ELEVUNIT METERS
RE DISCCART 253653.1 1482317 35.29 216.42
<<< see digital file for all receptors >>>
RE DISCCART 252600 1489100 171.08 177.86
RE FINISHED
```

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ME STARTING
ME SURFFILE "GPA_2011-2013.SFC" FREE
ME PROFFILE "GPA_2011-2013.PFL"
ME SURFDATA  41415 2011
ME UAIRDATA  91212 2011
ME PROFBASE 77.4 METERS
ME FINISHED

OU STARTING
OU RECTABLE 1 FIRST SECOND THIRD FOURTH
OU PLOTFILE 1 ALL FOURTH "GPADRR.GRF" 31
OU PLOTFILE 1 GPA FOURTH "GPADRR.GRF" 31
OU PLOTFILE 1 HOTEL FOURTH "GPADRR.GRF" 31
OU SUMMFILE "GPADRR.SUM"
OU FILEFORM EXP
OU FINISHED
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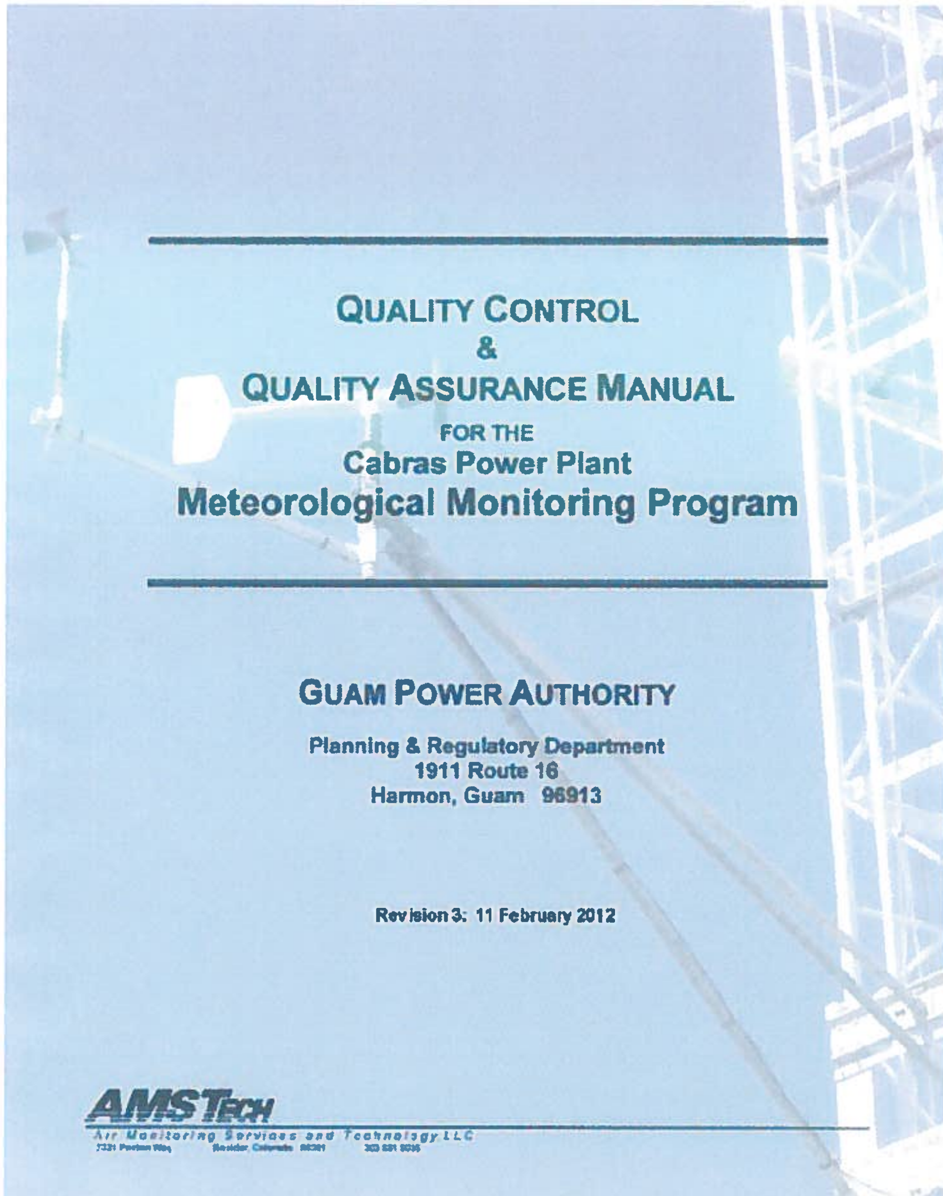
APPENDIX C
QUALITY CONTROL AND QUALITY ASSURANCE MANUAL FOR THE CABRAS POWER PLANT METEOROLOGICAL MONITORING PROGRAM (PROVIDED IN DIGITAL FORM WITH THE MODELING FILES)



QUALITY CONTROL
&
QUALITY ASSURANCE MANUAL

FOR THE

Cabras Power Plant
Meteorological Monitoring Program

GUAM POWER AUTHORITY

Planning & Regulatory Department
1911 Route 16
Harmon, Guam 96913

Revision 3: 11 February 2012

AMSTECH
Air Monitoring Services and Technology LLC

APPENDIX D
AMBIENT AIR QUALITY MONITORING NETWORK ANNUAL DATA REPORT FOR OCTOBER 1999-SEPTEMBER 2000

(PROVIDED IN DIGITAL FORM WITH THE MODELING FILES)

FINAL DATA REPORT
OCTOBER 2000

GUAM POWER AUTHORITY

AMBIENT AIR QUALITY MONITORING NETWORK

ANNUAL DATA REPORT FOR OCTOBER 1999 – SEPTEMBER 2000

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