April 30, 2015

Via e-mail to betsy.brown@buncombecounty.org

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Re: Comments on Draft Title V Permit Renewal for Duke Energy Progress' Asheville Steam Electric Plant, Permit No. 11-628-15

Dear Ms. Brown:

On behalf of its more than 60,000 North Carolina members and supporters, the Sierra Club respectfully submits these comments on the Draft Title V Permit Renewal, Permit No. 11-628-15 ("Draft Permit") published by the Western North Carolina Regional Air Quality Agency ("WNCRAQA" or "Agency") for Duke Energy Progress' Asheville Steam Electric Plant ("Asheville Plant" or "Plant") in Buncombe County, North Carolina.

As discussed in greater detail below, the Draft Permit fails to require adequate control of air pollution as required by the federal Clean Air Act and by governing state and local laws and regulations. Specifically, the Draft Permit does not include numerical emission limits for sulfur dioxide ("SO_2") or for nitrogen oxides ("NO_X"), including nitrogen dioxide ("NO_2"), that are stringent enough to ensure that the Plant will not cause or contribute to exceedances of the governing ambient air quality standards, does not include appropriate averaging time periods by which to measure compliance with emission limits, does not require that the operation of various air pollution control technologies be continuous or in accordance with design specifications and best engineering practices, does not provide a schedule for compliance with ongoing violation of the current permit, and does not include clear conditions governing compliance with the new mercury and air toxics standard.

Accordingly, the Sierra Club urges the Agency to correct these defects in a revised draft permit before issuing a final Title V air operation permit for the Plant.

I. Governing Law and Regulations

The Clean Air Act is intended to protect and enhance the public health and public welfare of the nation.[1] To this end, the U.S. Environmental Protection Agency ("EPA") is required to promulgate primary and secondary National Ambient Air Quality Standards ("NAAQS") for six "criteria" pollutants—sulfur dioxides, nitrogen oxides, particulate matter, carbon monoxide, ozone, and lead.[2] Primary NAAQS are health-based standards and must be set at a level adequate to protect the public from the harmful effects of exposure to the criteria pollutants with an adequate margin of safety.[3]

For sulfur dioxide, EPA adopted a one-hour standard of 75 parts per billion (ppb) (equivalent to 196.2 micrograms per cubic meter ($\mu g/m^3$)), in recognition of the fact that the prior 24-hour and annual standards did not adequately protect the public against adverse respiratory effects associated with short term (5-minute to 24-hour) exposure.[4] Due to both the shorter averaging time and the lower concentration value, the one-hour 75-ppb standard for SO_2 is far more protective than prior standards and is projected to have enormous public health benefits—EPA has estimated that 2,300 to 5,900 premature deaths and 54,000 asthma attacks a year will be prevented by the new standard.[5] North Carolina and WNCRAQA regulations were both revised in 2011 to incorporate the one-hour, 75-ppb standard. For nitrogen dioxide, EPA adopted a one-hour standard of 100 ppb, as a supplement to the existing annual standard in light of the causal connection between short-term exposure to NO_2 and adverse respiratory effects.[6]

In addition to the national standards for criteria pollutants, EPA must promulgate standards for various air toxics, and sources of such pollution must comply "as expeditiously as practicable, but in no event later than 3 years after the effective date" of those standards.[7] After decades of delay, EPA finally issued the required Mercury and Air Toxics Standards ("MATS") for coal- and oil-burning power plants in 2012.[8] Timely compliance with the

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[1] *See* 42 U.S.C. § 7401(b)(1).

[2] *Id.* at § 7409.

[3] *Id.*

[4] U.S. EPA, Final Rule, Primary National Ambient Air Quality Standard for Sulfur Dioxide, 75 Fed. Reg. 35,520 (June 22, 2010) (codified at 40 C.F.R. § 50.17(a)).

[5] U.S. EPA, Final Regulatory Impact Analysis (RIA) for the SO2 National Ambient Air Quality Standards (NAAQS) tbl. 5.14 (2010), *available at* www.epa.gov/ttnecas1/regdata/RIAs/fso2ria100602full.pdf.

[6] U.S. EPA, Primary National Ambient Air Quality Standards for Nitrogen Dioxide, 75 Fed. Reg. 6,474 (Feb. 9, 2010) (codified at 40 C.F.R. Parts 50, 58).

[7] 42 U.S.C. § 7412(i)(3).

[8] *See* 77 Fed. Reg. 9,304 (Feb. 16, 2012) (codified at 40 C.F.R. Parts 60, 63).

MATS is necessary to prevent adverse public health impacts.[9] For example, uncontrolled releases of mercury from coal-burning power plants can damage children's developing nervous systems, reducing their ability to think and learn.[10] Releases of other toxic air pollutants from these plants can cause a range of dangerous health problems in adults, from cancer to respiratory illnesses.[11]

State and regional air quality agencies that are delegated implementation authority under the Clean Air Act (such as WNCRAQA) develop and implement plans by which they ensure attainment of the federal NAAQS and other standards. The air quality standards contained in each implementation plan are applied to specific major emissions sources through the "Title V" permitting program.[12] Major stationary sources of air pollution are prohibited from operating except in compliance with an operating permit issued under Title V of the Act.[13] Title V permits must require compliance with all applicable federal, state, and local regulations in one legally enforceable document, thereby ensuring that all Clean Air Act requirements are applied to the facility.[14] These permits must include emission limitations and other conditions necessary to assure a facility's continuous compliance with all applicable requirements.[15] Title V permits must also contain monitoring, recordkeeping, reporting, and other requirements to assure continuous compliance by sources with emission control requirements.[16]

EPA delegated to North Carolina the authority to administer the Title V operating permit program within the State. North Carolina, in turn, delegated to WNCRAQA the authority to administer the program in Buncombe County and the City of Asheville. Title V permits issued by WNCRAQA must include enforceable emission limitations and standards and such other conditions as are necessary to assure compliance with all applicable requirements at the time of permit issuance.[17] "Applicable requirements" include standards or other requirements of the Clean Air Act that are codified in state or federal laws such as regulations that have been promulgated or approved by EPA through rulemaking at the time

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[9] U.S. EPA, Fact Sheet: Mercury and Air Toxics Standards, Benefits and Costs of Cleaning up Toxic Air Pollution from Power Plants (Dec. 21, 2011), *available at* www.epa.gov/mats/pdfs/20111221MATSimpactsfs.pdf.

[10] *Id.*

[11] *Id.*

[12] *See* 42 U.S.C. §§ 7410, 7661.

[13] 42 U.S.C. § 7661a(a); 40 C.F.R. § 70.5(a).

[14] *See* 42 U.S.C. §§ 7661a(a) and 7661c(a); 40 C.F.R. § 70.6(a)(1).

[15] *See id.*

[16] *See* 40 C.F.R. Part 70.

[17] *See* 42 U.S.C. § 7661c(a); 40 C.F.R. § 70.6(a)(1).

of permit issuance but that have future effective compliance dates, as well as standards that are effective at the time of permit issuance.[18]

Among the applicable requirements for Title V permits issued by WNCRAQA is the prohibition of pollution that causes the exceedance of an ambient air quality standard. Specifically, both North Carolina and WNCRAQA regulations provide that "[n]o facility or source of air pollution shall cause any ambient air quality standard in this Section to be exceeded or contribute to a violation of any ambient air quality standard in this Section."[19] In addition, State and WNCRAQA regulations both require that sources of air pollution "be operated with such controls or in such manner that the source shall not cause the ambient air quality standards" and further require that, when the numerical emission limits established by regulation are insufficient to prevent violation of ambient air quality standards, a permit "contain a condition requiring [more stringent limits]."[20]

As the Draft Permit notes, "WNCRAQA may issue a permit only after it receives reasonable assurance that the installation will not cause air pollution in violation of any of the applicable requirements."[21] Thus, the burden is on polluters to demonstrate that their activities will not cause the exceedance of an ambient air quality standard or the violation of the MATS and other applicable requirements.

When providing reasonable assurance that a stationary source of air pollution will not cause pollution in violation of any applicable requirements, permit applicants have relied upon air dispersion modeling to demonstrate that their operations will not cause exceedances of ambient air quality standards.[22] Indeed, modeling is the best way to assess SO_2 concentrations for NAAQS implementation purposes. Recognizing the "strong source-oriented nature of SO_2 ambient impacts,"[23] EPA has concluded that the appropriate methodology for purposes of determining compliance, attainment, and nonattainment with the one-hour SO_2 NAAQS is air dispersion modeling.[24] In promulgating that standard, EPA

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[18] *See* 40 C.F.R. § 70.2.

[19] 15A N.C.A.C. § 2D.0401(c); WNCRAQA Code § 4.0401(c).

[20] 15A N.C.A.C. § 2D.0501(c); WNCRAQA Code § 4.0501(c).

[21] Draft Permit at 30.

[22] *See*, *e.g.*, *Haile Community Ass'n v. Florida Rock Indus., Inc.*, Case No. 95-5531 (DOAH July 23, 1996) ([T]he applicant "provided reasonable assurance through air quality modeling that [it] would meet primary and secondary ambient air quality standards."); *Arnold R. Di Silvestro v. Medico Envtl. Servs., Inc.*, Case No. 92-0851 (DOAH Feb. 19, 1993) ("The air model shows that none of the National Ambient Air Quality Standards for any of the criteria pollutants would be exceeded by adding either the impact of the . . . facility [at issue]" or another nearby polluting facility, or both facilities combined).

[23] 75 Fed. Reg. at 35,370.

[24] *Id.* at 35,551 (describing dispersion modeling as "the most technically appropriate, efficient, and readily available method for assessing short-term ambient SO2 concentrations in areas with large point sources.").

explained that "it is more appropriate and efficient to principally use modeling to assess compliance for medium to larger sources."[25]

As EPA explained in the preamble to its Title V Program rule, "regulations are often written to cover broad source categories," leaving it "unclear which, and how, general regulations apply to a source."[26] Title V permits bridge this gap by "clarify[ing] and mak[ing] more readily enforceable a source's pollution control requirements," including making clear how general regulatory provisions apply to specific sources.[27] In short, Title V permits are supposed to link general regulatory provisions to a specific source to provide a way "to establish whether a source is in compliance."[28]

The provisions of a Title V permit must be sufficiently clear and specific to ensure that all applicable requirements are enforceable as a practical matter. EPA describes the requirement of "practical enforceability" as follows:

> A permit is enforceable as a practical matter (or practically enforceable) if permit conditions establish a clear legal obligation for the source [and] allow compliance to be verified. / Providing the source with clear information goes beyond identifying the applicable requirement. It is also important that permit conditions be unambiguous and do not contain language which may intentionally or unintentionally prevent enforcement.[29]

In short, an interested person should be able to understand from the permit how much pollution the plant is legally authorized to emit and how the source is monitored for compliance. The public should not be forced to conduct air dispersion modeling or other resource-intensive analyses in order to determine whether emissions from a permitted air pollution source are causing unsafe air downwind and, thus, violating narrative permit provisions. Instead, the permitting agency should establish numerical emission limits that are stringent enough to ensure that Plant emissions do not interfere with the attainment or maintenance of downwind air quality standards.

As WNCRAQA staff has correctly noted, EPA will soon revisit its process of determining whether the air quality in particular geographic areas satisfies the one-hour SO_2

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[25] *Id.* at 35,570; *see also Montana Sulphur & Chem. Co. v. EPA*, 666 F.3d 1174 (9th Cir. 2012) (affirming use of modeling to ascertain SO_2 pollution impacts); U.S. EPA, Final Response to Petition From New Jersey Regarding SO_2 Emissions From the Portland Generating Station, 76 Fed. Reg. 69,052 (Nov. 7, 2011) (using modeling to set emission limits sufficient to prevent air pollution).

[26] U.S. EPA, Operating Permit Program, 57 Fed. Reg. 32,250, 32,251 (July 21, 1992).

[27] S. Rep. 101-228, 1990 USCAAN 3385, 3730 (Dec. 20, 1989).

[28] *Id.*

[29] U.S. EPA, Region 9, Title V Permit Review Guidelines (Sept. 9, 1999) III-55, *available at* http://www.epa.gov/region9/air/permit/titlev-guidelines/practical-enforceability.pdf.

NAAQS. However, this process—which itself could take more than five years, not counting the subsequent development and approval of implementation plans—does not prohibit WNCRAQA from establishing string numerical emission limits in permits in order to protect the health and wellbeing of the people who breathe the air downwind of the Asheville Plant—and who will continue to do so for the next five years.

II. Sulfur Dioxide Pollution from Duke Energy's Asheville Plant

As we explained in our February 24, 2015 letter to WNCRAQA Permitting Program Manager Ashley Featherstone, the results of an air quality dispersion modeling analysis conducted on behalf of the Sierra Club demonstrate that SO_2 emissions from the Asheville Plant have caused and likely are continuing to cause unsafe ambient air conditions downwind of the Plant. (A report prepared by Air Resource Specialists, Inc. detailing that analysis is attached as Exhibit A.) Troublingly, the analysis reveals that, on one out of every three to four days between 2010 and 2014, operation of the Plant caused SO_2 ambient air concentrations higher than the 75-ppb (196-$\mu g/m^3$) standard. Indeed, SO_2 concentrations of 696 $\mu g/m^3$—nearly 3.5 times higher than the governing health-based standard—were calculated. Areas with elevated SO_2 concentrations include parts of South Asheville, Fairview, and Leicester, as well as hiking trails in Bent Creek Forest. Given the fact that exposure to SO_2 for even very short periods of time can result in serious adverse health effects, the communities within the area of impact are rightly concerned.

The modeling of emissions from the Asheville Plant was based on actual emissions data collected from the Plant's continuous emission monitoring system and real-time meteorological data collected by the National Weather Service at the Asheville Regional Airport, which, given the airport's close proximity to the Plant, provide a reliable basis for calculating the dispersion of the pollution. The experts who conducted the analysis utilized the air dispersion model developed and approved by EPA (AERMOD) and followed applicable federal and state modeling guidance. EPA's AERMOD has been rigorously field-tested, including in areas with complex, hilly terrain, and such testing shows a high correlation between monitored and modeled ambient pollutant concentrations. All assumptions that were made were conservative, so as to underestimate the impact of pollution from the Asheville Plant. For example, the model assumed that the background concentration of SO_2 was zero; therefore, all impacts calculated are solely attributable to emissions from Duke's Asheville Plant.

The results of the air dispersion modeling analysis demonstrate that the numerical limits for SO_2 emissions included in the Draft Permit (2.3 lbs/MMBtu)[30] are not stringent enough to ensure that the Plant will not cause downwind exceedances of the governing ambient air quality standard. Instead, the air modelers found that the SO_2 emission rate that

[30] Draft Permit at 4–5.

resulted in an AERMOD prediction equal to the 75-ppb standard was 61.7 lb/hr for each unit (123.4 lbs/hr combined for Units 1 and 2). Based on the Btu rating of each boiler as listed in the Draft Permit, this SO_2 emissions rate would equate to an average rate across both units of 0.029 lb/MMBtu—approximately 80 times more stringent than the proposed limit. Thus, in order to ensure that the Plant's emissions do not cause or contribute to the exceedance of the 75-ppb standard, a numerical emission limit at least as stringent as 0.029 lb/MMBtu is necessary.

III. Operations at Duke Energy's Asheville Plant

In addition to the new modeling results, a separate analysis of the operations at the Asheville Plant indicates that, after an initial decline following the installation of the flue gas desulfurization systems ("FGD systems" or "scrubbers"), SO_2 emission rates began to increase in 2008 and remained higher than the rates that were being achieved during the first months of scrubber operation. (A report by Dr. Ranajit Sahu detailing that analysis is attached as Exhibit B.) For both of the coal-burning units at the Asheville Plant, the emission rate increases coincide with self-reported declines in the Plant's annual scrubber efficiencies.

Both scrubbers are designed to achieve 97% SO_2 removal efficiency, and, following their installation, both were tested and found to actually be removing more than 97% of the SO_2 generated in the Plant's two boilers. Nevertheless, in 2009, Duke reported scrubber efficiencies of 93.1% and 93.8% for Asheville Units 1 and 2, respectively. Between 2009 and 2012, Duke's self-reported annual scrubber efficiencies remained low, averaging around 93%. Moreover, Duke's permit application assumes an even lower scrubber efficiency value of 90%.[31] Independent calculations of actual scrubber performance paint an even worse picture: scrubber efficiency as low as 78% for Unit 2 in 2011.

Similarly, based on a preliminary analysis of Duke's operations of the pollution control equipment designed to remove NO_X—a selective catalytic reduction system ("SCR") for each unit—it appears that these systems likely are not achieving the NO_X removal efficiencies that they were designed to achieve. The SCR systems were installed at Asheville Units 1 and 2 in 2007 and 2006, respectively and were designed to remove a minimum of 90% of NO_X from the boiler flue gas.[32] However, the permit application submitted by Duke Energy to WNCRAQA assumes only 70% removal efficiency for the Plant's SCR systems. Indeed, NO_X emission rates in recent years have increased compared to the rates being achieved immediately following SCR installation.

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[31] Permit Application at 105, 120.

[32] Steve Cisek, "Case Histories: Asheville Power Station's Retrofit First to Meet North Carolina's Clean Smokestacks Act," POWER (Sept. 1, 2006), *available at* www.powermag.com/case-histories-asheville-power-stations-retrofit-first-to-meet-north-carolinas-clean-smokestacks-act/.

IV. The Draft Permit Fails to Establish Sufficiently Stringent Numerical Emission Limits for Harmful Pollutants.

Despite new federal rules that require stronger protections against the harms posed by exposure to SO_2 pollution, the Draft Permit includes the same numerical emission limits for SO_2 (2.3 lbs/MMBtu) as the Plant's previous air permit. These limits are not stringent enough to protect public health from the dangers posed by exposure to SO_2 or to ensure compliance with applicable requirements. Indeed, there is no indication in the permit record that either Duke Energy or the Agency assessed the outdated SO_2 emission limits to determine whether they could prevent the Asheville Plant from causing or contributing to exceedances of the 75-ppb ambient air quality standard for SO_2. Thus, the people who breathe the air downwind of the Plant have no reasonable assurance that the Plant's emissions won't lead to unsafe pollution levels and associated health risks.

In fact, and as discussed above, the results of an air dispersion modeling analysis demonstrate that the limits are nowhere near strong enough to prevent emissions that can cause or contribute to the downwind exceedance of the 75-ppb air quality standard. Modeling of the Plant's *actual* emissions from between August 2010 to July 2014 revealed that those emissions caused a peak SO_2 impact of 696 $\mu g/m^3$—a pollution concentration 3.5 times higher than the level above which EPA considers risks to public health unacceptable. Between 2010 and 2014, the Plant's average SO_2 emission rate was approximately 0.18 lbs/MMBtu[33]—far below the numerical limit, but still high enough to cause unsafe pollution downwind. If the Plant were to emit SO_2 at the *allowable* 2.3 lbs/MMBtu rate, downwind impacts would be far greater.

Both North Carolina and WNCRAQA require that sources of air pollution "be operated with such controls or in such manner that the source shall not cause the ambient air quality standards" and that, "[w]hen controls more stringent than named in the applicable emission standards [*i.e.*, 2.3 lbs/MMBtu] are required to prevent violation of the ambient air quality standards or are required to create an offset, the permit shall contain a condition requiring these controls."[34] The North Carolina Department of Environment and Natural Resources Division of Air Quality has relied on this narrative prohibition on pollution that causes the exceedance of air quality standards to impose more stringent numerical limits for SO_2 emissions than are provided for in other regulatory provisions.[35] Thus, WNCRAQA should not feel constrained by section 4.0516(a) of its Code, which provides that the "[e]mission of sulfur dioxide … shall not exceed 2.3 pounds of sulfur

[33] EPA's Clean Air Markets Database, Query, Emissions from Asheville, *available at* http://ampd.epa.gov/ampd/.

[34] 15A N.C.A.C. § 2D.0501(c); *see also* WNCRAQA Code § 4.0501(c).

[35] *See, e.g.*, Air Quality Permit No. 01001T48 for the Roxboro Steam Electric Plant at 8 (citing 15A NCAC 2D.0501(c) as "Applicable Regulation" requiring a numerical emission limit more stringent than 2.3 lbs/MMBtu).

dioxide per million BTU input." This provision establishes a regulatory floor; WNCRAQA has the authority and indeed the duty, per section 4.0501(c), to set permit limits that are more stringent in order to ensure the protection of public health and the attainment of air quality standards.

As with SO_2 the Title V permit must ensure that the Plant's emissions do not cause the exceedance of the 100-ppb ambient air quality standard for NO_2. There is no indicated that either Duke or the Agency assessed the numerical emission limit for NO_2 to ensure that it is strong enough to protect against the exceedance of the new air quality standard. Therefore, we urge the Agency to modify the Draft Permit to include modeling-based numerical emission limits that will guarantee that the new, more protective one-hour air quality standards for SO_2 and NO_2 can be achieved in areas downwind of the Plant and that the public is protected from unsafe levels of air pollution.

V. The Draft Permit Fails to Include Proper Averaging Periods for the Plant's Emission Limits.

In addition to lacking sufficiently stringent numerical SO_2 emission limits, the Draft Permit also fails to set an appropriate averaging period for determining compliance with those limits. Despite the fact that EPA has determined a one-hour air quality standard is necessary to protect public health from the dangers associated with exposure to SO_2, the Draft Permit measures compliance with its limits on SO_2 emissions according to a 24-hour averaging time period.[36]

As discussed above, the new 75-ppb air quality standard is designed to prevent harm to human health—harm which can be caused by as little as five minutes of exposure—and, therefore, is based on a one-hour averaging time.[37] Continued reliance on the 24-hour averaging time to determine compliance with permit limits could result in the release of emissions at rates during a single hour of the day that are far higher than the permit limit and that could lead to dramatic downwind exceedances of the health-based air quality standard. Unfortunately, the fact that the 24-hour average is below a certain level provides no comfort to the people downwind of the Plant who will breathe heavily polluted air at a particular point during the day. Indeed, this aspect of the Draft Permit flies in the face of EPA's rationale for tightening the SO_2 air quality standard—namely, the scientific evidence that short-term exposure to SO_2 for time periods as low as five minutes can cause serious health problems.

EPA guidance has recommended that averaging times for emissions limits "should not exceed the averaging time of the applicable NAAQS that the limit is intended to help

[36] Draft Permit at 6.

[37] *See* 40 C.F.R. § 50.17(a).

attain."[38] Thus, "emission limits for attaining the 1-hour SO2 standard should limit emissions for each hour, without any provision for limiting emissions as averaged across multiple hours."[39] Moreover, EPA has advised that "any emissions limits based on averaging periods longer than 1 hour should be designed to have comparable stringency to a 1-hour average limit at the critical emission value."[40] Accordingly, if the Agency chooses to employ an averaging period longer than one hour, the numerical limit for the Asheville Plant's SO_2 emissions must be ratcheted down further to provide adequate assurance that those emissions will not cause or contribute to the exceedance of the one-hour, 75-ppb air quality standard.[41]

As with SO_2, WNCRAQA must ensure that the proposed averaging period for the NO_X emission limits is appropriately tailored so that it allows for an accurate determination as to whether the Plant is complying with the one-hour NO_2 NAAQS. The Draft Permit includes a 24-hour averaging period for compliance with NOX emission limits. Accordingly, the Agency should ensure that appropriately stringent SO_2 and NO_X emission limits requested herein apply at all times of the day by establishing an hourly averaging period for permit compliance or, if it intends to retain the 24-hour averaging period, it should adopt even more stringent numerical emission limits. Given the continuous emission monitoring system in place at the Plant, Duke should have no trouble measuring compliance with emission limits every hour.

VI. The Draft Permit Fails to Require Continuous Operation of Existing Equipment in Accordance with Best Engineering Practices.

In addition to the one-hour averaging time and the more stringent numerical emission limit identified above as necessary for a legally-defensible permit, the Draft Permit should be revised to require the operation of its pollution controls at all times and in accordance with best engineering practices. The Draft Permit includes a footnote that specifies that the FGD system is "[t]o be operated on an as-needed basis."[42] This provision should be removed.

As discussed above, recent analysis of operations at the Asheville Plant demonstrates that the Plant's two scrubbers have not been achieving the SO_2 removal efficiencies that they

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[38] U.S. EPA Memorandum of Apr. 23, 2014, to Regional Air Division Directors, Regions 1–10, Guidance for 1-Hour SO2 NAAQS Nonattainment Area SIP Submissions, at 22.

[39] *Id.*

[40] *Id.*

[41] *See id.* Appx. B (detailing EPA's guidance for setting longer term average emission limits).

[42] Draft Permit at 3, n.3.

were designed to achieve and that such sub-par operation has led to emissions that have caused the exceedance of the health-based air quality standard. In addition, given the serious adverse health effects that can be caused by even very short-term exposure to SO_2, it is vitally important that existing pollution control technology is operated continuously and that applicable emission limits apply always.

In addition to their scrubbers, Units 1 and 2 at the Plant are each equipped with a selective catalytic reduction system designed to control the emission of nitrogen oxides ("NOx"). Following the installation of the SCR controls in 2006 and 2007, the Plant's rate of NOx emissions was reduced. Prior to installation, Duke reported a 0.49 lbs/MMBtu NOx emission rate at Unit 1; after installation, the unit was able to achieve a 0.07 lbs/MMBtu rate.[43] Unit 2 was emitting NOx at a 0.23 lbs/MMBtu rate before SCR installation and at a 0.06 lbs/MMBtu rate after.[44]

However, despite being equipped with the technology necessary to control the emission of this pollutant, the Asheville units have, in recent years, been emitting NO_X at greater rates than achievable given the SCR system, suggesting that the SCR system is not being run continuously or in accordance with best engineering practices. Table 1 illustrates the higher NO_X emission rates documented in recent years—about double the rates achieved following SCR installation.[45]

Table 1 – Annual NO_X Emission Rates

	2006	2008	2013	2014
Unit 1	0.49	0.07	0.12	0.12
Unit 2	0.23	0.06	0.11	0.12

As currently written the Draft Permit only requires the Plant's SCR systems, like its FGD systems, to be operated "on an as needed basis."[46] In addition to allowing for unsafe pollution levels, provisions allowing pollution controls to operate on "as needed" bases, conflicts with the assumed control efficiencies identified in the permit application. Accordingly, the Agency should eliminate both of these loopholes and should modify the Draft Permit to require the operation of all of the Plant's pollution control technologies in accordance with best engineering practices and to require that those systems be run continuously.

[43] EPA's Clean Air Markets Database, Query, Emissions from Asheville, *available at* http://ampd.epa.gov/ampd/.

[44] *Id.*

[45] *Id.*

[46] Draft Permit at 3, n.2.

VII. The Draft Permit Fails to Address Current Violations of the Prohibition on Pollution that Causes the Exceedance of an Ambient Air Quality Standard.

As shown by the air dispersion modeling discussed above, SO_2 emissions from the Asheville Plant have, in recent years, caused the frequent exceedance of the 75-ppb air quality standard in communities downwind of the Plant in violation of the current permit's narrative emission limit. Nevertheless—and despite Sierra Club's bringing this fact to WNCRAQA's attention in advance of the publication of the Draft Permit—the provisions in the Draft Permit that pertain to SO_2 pollution are nearly identical to those included in the current permit.

A Title V permit must address and include provisions for achieving compliance with current violations of applicable requirements.[47] Accordingly, permits must contain "a description of the compliance status of the source," "a narrative description of how the source will achieve compliance" with requirements for which it is in noncompliance, and "a schedule of compliance for sources that are not in compliance with all applicable requirements at the time of permit issuance."[48] The compliance schedule must identify "remedial measures, including an enforceable sequence of actions with milestones, leading to compliance with any applicable requirements for which the source will be in noncompliance at the time of permit issuance."[49]

Therefore, WNCRAQA must revise the Draft Permit to include more stringent numerical emission limits for SO_2 as well as proper averaging times and a requirement that the Plant's pollution control technology be operated according to best engineering practices at all time.

VIII. The Draft Permit Fails to Include Clear Conditions Governing Compliance with the New Mercury and Air Toxics Standard.

The Draft Permit very closely resembles the current Title V permit for the Plant (Permit No. 11-628-10B), which was issued by WNCRAQA on January 18, 2011. As discussed above, EPA finalized a new rule governing the emission of mercury and other air toxics from power plants in 2012. The MATS rule includes a compliance deadline of April 16, 2015. Despite this new requirement, the Draft Permit does not appear to incorporate any additional restrictions on the operation of the Asheville Plant that are designed to achieve compliance with the new standard nor does it identify any retrofits that are needed to meet the new standard. Section 2.1(G) of the Draft Permit does refer to the relevant regulatory provisions—*i.e.*, 40 C.F.R. § 63 Subpart UUUUU—but it does not identify any

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[47] 40 C.F.R. § 70.5(c)(8)(iii)(C); *id.* at § 70.6(c)(3).

[48] *Id.*

[49] *Id.*

specific compliance options that Duke intends to utilize in order to meet the new standard.

Some details about Duke's plan for MATS compliance were provided in a request for a minor air permit modification that was submitted to WNCRAQA on March 26, 2015[50]—curiously, the same day that WNCRAQA give the public notice of the opportunity to comment on the Draft Permit. Given that the compliance deadline for EPA's new rule of April 16, 2015 has undoubtedly been known by Duke since the rule was finalized in February 2012, it is a wonder that the company waited until just three weeks before that deadline to start the process of demonstrating to WNCRAQA how the Asheville Plant will comply with MATS.

In any event, the public must be able to understand how Duke will comply with the new standard and to rely on enforceable permit conditions that specify emission limits and monitoring options. Neither the Draft Permit nor the modification request make clear what MATS limits apply at the Asheville Plant and how compliance with them will be monitored. The Draft Permit should be revised to include the specific, enforceable limits necessary to ensure compliance with the MATS rule, and, to the extent the Plant was out of compliance with the standard as of April 16, 2015, the Draft Permit should address those violations and ensure that future violations will not occur.

IX. Miscellaneous

We bring the following remaining miscellaneous concerns with the Draft Permit to the Agency's attention. The Draft Permit allows for the use of "unbiased" values in connection with monitoring and recordkeeping requirements.[51] The permit record does not include any rationale for the use of unbiased values and such use is inconsistent with federal regulations, which provide for the use of "bias-adjusted" values when substituting for missing data.[52] The Agency should revise the Draft Permit to comport with federal regulations.

The Draft Permit requires a malfunction abatement plan,[53] but such plan is not available for review by the public. In addition, Duke Energy's permit application includes numerous unsupported assumptions and relies on documents that have not been made available to the public (it is unclear whether they were provided to Agency staff). Because the permit application and all supporting information and materials are part of the final Title V permit, it is important that such information and materials are available for review by the public and the Agency. We, therefore, request that the missing materials identified herein, to

[50] It is not clear whether this request is properly styled as a minor modification.

[51] Draft Permit at 6, 7, 20.

[52] 40 C.F.R. Part 75, Appx. A, Sec. 7.6.5(f).

[53] Draft Permit at 14.

the extent they are within the Agency's control, be provided to the public. In addition, we request that additional time for public comment on the Draft Permit Renewal be afforded once those materials are produced and in light of the voluminous permit renewal record, some documents of which we were able to obtain for the first time this week.

Materials relied upon in the permit application, but not made available include:[54] EPRI Report, Electric Utility Trace Substances Synthesis Report;[55] basis for assumption that control efficiency from hydrated lime addition is 40%;[56] basis for assumption that ammonia slip from the SCR catalyst is limited to 2 ppm;[57] basis for assumption that volumetric flow rate is 500,000 cubic feet per minute (for ammonia mass calculation);[58] source of various wind speed and moisture inputs;[59] EPRI PISCES Database (version 2005a);[60] metals speciation for limestone;[61] metals speciation for gypsum;[62] metals speciation for hydrated lime;[63] and basis for assumption about 27% control level for mercury.[64]

Finally, we highlight the following additional issues with the permit application. The permit application presents various emissions calculations that relate to EDTA reference data from the Roxboro and Robinson plants; it is not clear to us why this data would be relevant to the permitting of the Asheville Plant.[65] The permit application refers to the EPA TANKS 4.0 program,[66] but we note that EPA has discontinued its support of this program and has upgraded to TANKS 4.09D.[67] The permit application includes a calculation of the Plant's potential to emit that improperly uses average emission factors for various metals,[68] when, instead, the calculation should use maximum emission factors. In addition, because the Draft Permit does not specify a particular coals type, the applicability of the metal tests provided in the permit application is not sufficient.

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[54] This list of materials refers to those parts of the permit application that concern Unit 1; similar materials are missing from the parts of the application concerning Unit 2 and also are hereby requested.

[55] Permit Application at 107.

[56] *Id.* at 108.

[57] *Id.*

[58] *Id.* at 109.

[59] *Id.* at 129, 134, 148.

[60] *Id.* at 129, 130.

[61] *Id.* at 134, 142.

[62] *Id.* at 149.

[63] *Id.* at 155.

[64] *Id.* at 157.

[65] *Id.* at 111–18, 157.

[66] *Id.* 176–80.

[67] U.S. EPA, TANKS Emissions Estimation Software, Version 4.09D, www.epa.gov/ttnchie1/software/tanks/.

[68] Permit Application at 110–18.

X. Conclusion

For all the reasons discussed above, Sierra Club urges the Agency to modify the Draft Permit as follows to:

(1) establish modeling-based, numerical emission limits for SO_2 stringent enough to guarantee that pollution from the Asheville Plant will not cause or contribute to exceedances of the 75-ppb air quality standard for SO_2 downwind of the Plant;

(2) establish modeling-based, numerical emission limits for NO_X stringent enough to guarantee that pollution from the Asheville Plant will not cause or contribute to exceedances of the 100-ppb air quality standard for NO_X downwind of the Plant;

(3) require one-hour averaging times for SO_2 and NO_X emission limits;

(4) require that all air control pollution technology be operated continuously and in accordance with best engineering practices;

(5) address current violations of the prohibition on pollution that causes the exceedance of ambient air quality standards by implementing the modifications identified above;

(6) include clear conditions governing compliance with the new Mercury and Air Toxics Standard;

(7) correct inconsistencies in the Draft Permit;

(8) make available all information and materials relied upon for permit issuance; and

(9) provide additional time for public comment.

We thank the Agency for its attention to and consideration of these comments, and please do not hesitate to contact me if you would like to discuss them further.

Sincerely,

Bridget M. Lee
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AIR QUALITY DISPERSION MODELING
1-HOUR AVERAGE STANDARD FOR SULFUR DIOXIDE
DUKE ENERGY – ASHEVILLE PLANT

Expert Report

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Revised:
February 13, 2015

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1.0 INTRODUCTION & EXECUTIVE SUMMARY

This report describes an air quality dispersion modeling analysis for sulfur dioxide (SO_2) emissions from the Duke Energy Asheville Plant located near Asheville, North Carolina. The modeling analysis has been conducted to assess whether or not SO_2 emissions from the Asheville Plant cause or contribute to exceedances of the National Ambient Air Quality Standards (NAAQS) for SO_2, specifically the 1-hour average NAAQS of 75 parts per billion (ppb).

The air quality modeling analysis has been prepared by Air Resource Specialists, Inc. (ARS) on behalf of Sierra Club. Qualifications of the author are provided in Appendix A.

The modeling applied the US Environmental Protection Agency (USEPA) AERMOD dispersion model, which is the approved regulatory model in 40 CFR 51 Appendix W for applications in the "near-field", defined as ambient air quality impacts within 50 kilometers (km) of the emissions unit. The modeling approach followed the applicable guidance for dispersion modeling found in 40 CFR 51 Appendix W and accompanying State of North Carolina modeling guidelines. The modeling study was also consistent with USEPA's draft 2013 technical guidance on making SO_2 attainment designations using air quality modeling.

The modeling was based on actual SO_2 emissions from the two (2) Asheville Plant coal-fired generating units, as compiled in the USEPA Clean Air Markets database. ARS considered actual SO_2 emissions over the time period starting August 23, 2010 and ending June 30, 2014. This time period was selected because August 23, 2010 represents the date which the 1-hour average SO_2 NAAQS became effective on a federal level and June 30, 2014 is the most recent date through which information on SO_2 emissions from the Clean Air Markets database was available at the time this modeling evaluation was completed.

In addition, different subsets of this time interval were also considered, specifically:

1) the most recent three complete calendar years, i.e., 2011-2013,
2) the three year period ending June 30, 2014, i.e., July 1, 2011 through June 30, 2014,
3) the time period following adoption of the 1-hour NAAQS SO_2 standard by the Western North Carolina Regional Air Quality Agency (WNCRAQA); i.e., November 14, 2011 through June 30, 2014.

Meteorological inputs for the modeling were taken from concurrent National Weather Service surface observations collected at the Asheville Regional Airport coupled with upper air observations collected at Greensboro, NC. The Asheville Regional Airport is located in close proximity to the Duke Energy Asheville Plant and is only about 4 kilometers (km) or 2.5 miles south of the power plant site. The proximity of the Asheville Airport to the plant makes these meteorological data representative of the general turbulence and dispersion conditions around the Asheville Plant site.

Other required data for the AERMOD modeling (stack height, etc.) were taken from publically available data and/or information supplied by the WNCRAQA.

The 1-hour average NAAQS for sulfur dioxide (SO_2) is set at 75 ppb, based on the 99th percentile of the daily maximum concentration averaged over three (3) years (75 FR 35520, June 22, 2010). For the purpose of this modeling study, ARS used 196 micrograms per cubic meter as the equivalent concentration for the NAAQS. The AERMOD model computes the 1-hour average concentration for all hours of the time interval modeled, and then sorts the data to determine maximum daily 1-hour average concentration. Then, the 99th percentile concentration (based on the 4th highest concentration in each year) is calculated by the model and AERMOD averages the 99th percentile concentration for each year across all years of data modeled. If the time interval in AERMOD is different than three years, AERMOD still uses the time interval modeled to compute the average, as per USEPA guidance. The average of the 4th highest daily maximum concentrations over the time interval modeled is reported by AERMOD and is the concentration compared to the NAAQS.

The modeling results are summarized in Table 1-1.

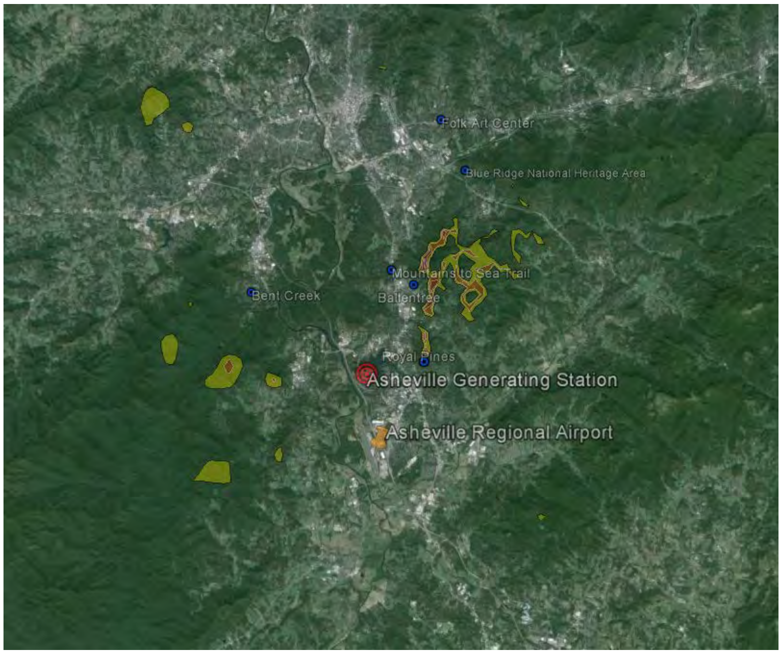
Table 1-1
Days Exceeding NAAQS at any Receptor
Asheville Station; Asheville, NC – Actual SO_2 Emissions
Concentrations in Micrograms per Cubic Meter

Model Scenario	**Start Date**	**End Date**	**Total Days**	**Modeled Days Above NAAQS**	**Percent**	**Modeled SO_2 Concentration**
1	8/23/2010	6/30/2014	1408	448	31.82%	696.29
2	1/1/2011	12/31/2013	1096	334	30.47%	554.25
3	7/1/2011	6/30/2014	1096	295	26.92%	571.51
4	11/14/2011	6/30/2014	960	250	26.04%	526.23

The AERMOD dispersion modeling demonstrates that the Duke Energy Asheville Plant does not meet the 1-hour average NAAQS for SO_2. Depending on the time period selected, the modeled SO_2 concentrations were roughly a factor of three above the NAAQS, with some time periods modeled showing that the SO_2 concentrations exceeded the applicable NAAQS by a factor of approximately 3.5.

In addition, from the modeling results, ARS computed the number of time periods over which a modeled concentration above the 1-hour SO_2 NAAQS occurred at any modeled receptor. That analysis concluded that the modeled exceedances of the SO_2 NAAQS were frequent, occurring about once every three days over the period August 23, 2010 through June 30, 2014.

Lastly, ARS evaluated the AERMOD output data to assess locations where the modeled NAAQS exceedances occurred. This analysis is shown in Figure 1-1. The modeled NAAQS exceedances occurred in all directions from the Duke Energy Asheville Plant, with most of the problem receptors at higher elevations where the Asheville Plant plume impinged on nearby elevated terrain. There was a cluster of receptors with elevated SO_2 concentrations east of the Skyland area, located in and near a populated residential area. In this area, the receptors that were calculated to exceed the SO_2 NAAQS also appeared to be correlated with elevation, and generally occurred when the ground-level elevation was in the range of 2,700 to 2,800 ft MSL. To the south, some receptors with SO_2 concentrations above the NAAQS occurred in adjacent Henderson County.



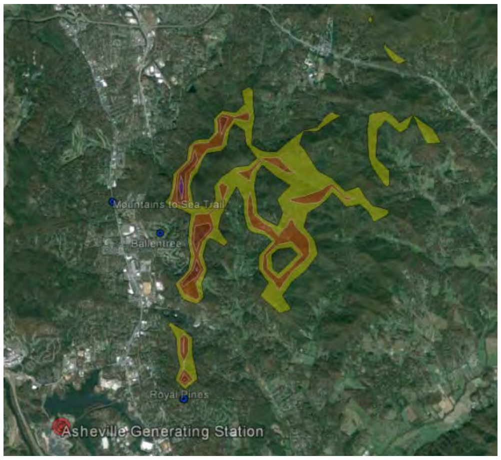


Figure 1-1.
Asheville Plant Modeling – SO_2 NAAQS Exceedance Locations
Contours show with darker colors indicating higher modeled SO_2 concentrations
Based on modeling for the August 23, 2010 through August 22, 2013 time interval.

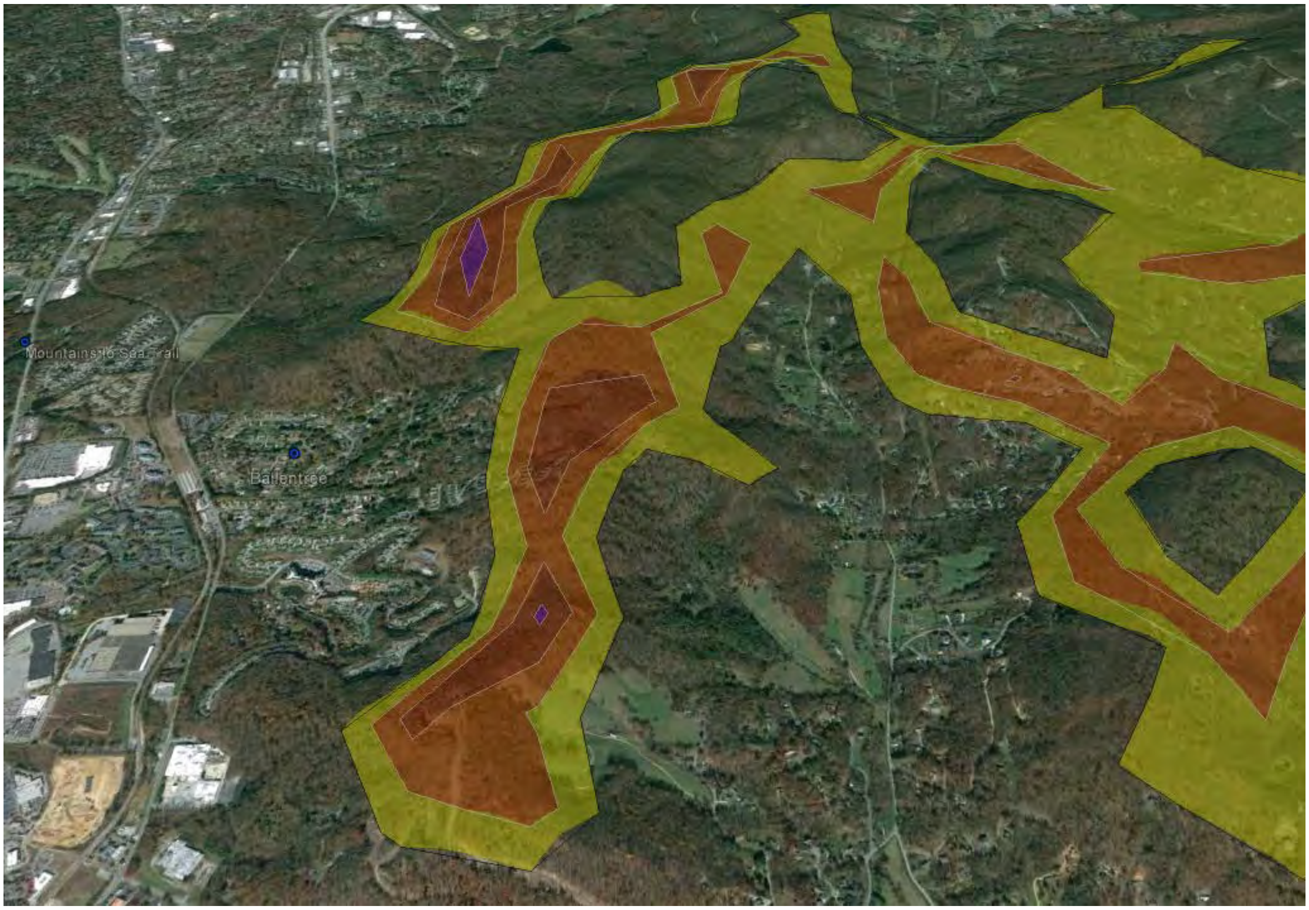


Figure 1-2.
Asheville Plant Modeling – Close Up of SO_2 NAAQS Exceedance Locations
Contours show with darker colors indicating higher modeled SO_2 concentrations
Based on modeling for the August 23, 2010 through August 22, 2013 time interval.

In conclusion, the modeling analysis found that for all time periods examined, emissions from the Ashville Plant were solely responsible for causing 99^{th} percentile 1-hour average SO_2 concentrations that were multiple times higher than the NAAQS and that such NAAQS exceedances occurred on roughly 1 out of every 3 days over the time period modeled.

2.0 MATERIALS CONSULTED

The following resources were consulting in preparing this expert report:

Anderson, Tom. Personal Communication. E-Mail communication with Tom Anderson, Meteorologist II for NC DENR Division of Air Quality, December 13, 2012.

Federal Register, June 22, 2010. 75 FR 35520.

Fahrer, Victor. Personal Communication. E-Mail communication with Victor S. Fahrer, Western North Carolina Regional Air Quality Agency. June 6, 2012.

North Carolina Department of Environment and Natural Resources. Guidelines for Evaluation the Air Quality Impacts of Toxic Air Pollutants in North Carolina (December 2009).

Progress Energy Carolinas, Inc. Clearing the Air – Facts about emission reductions at the Asheville Plant (see: www.duke-energy.com/power-plants/coal-fired/asheville.asp).

SourceWatch. Information about Asheville Plant (see: www.sourcewatch.org).

US Environmental Protection Agency. Guideline on Air Quality Models, 40 CFR 51 Appendix W.

US Environmental Protection Agency. Air Markets Program Data (AMPD) Website (see: http://ampd.epa.gov/ampd).

US Environmental Protection Agency. SO_2 NAAQS Designations Modeling Technical Assistance Document. USEPA, Office of Air Quality Planning and Standards, Air Quality Assessment Division, December 2013.

US Environmental Protection Agency (March 19, 2009). AERMOD Implementation Guide. USEPA, Office of Air Quality Planning and Standards, Air Quality Assessment Division, March 19, 2009.

US Environmental Protection Agency (September 2004). User's Guide for the AMS/EPA Regulatory Model—AERMOD.

Western North Carolina Regional Air Quality Agency. Permit # 11-628-10B issued to Progress Energy Carolinas, Inc. – Asheville Steam Electric Plant, Permit date January 18, 2011.

3.0 INFORMATION ON DUKE ENERGY – ASHEVILLE PLANT

Duke Energy (formerly Progress Energy Carolinas, Inc.) operates the Asheville Steam Electric Plant, which consists of two (2) coal-fired electric generation units with a combined capacity of 376 megawatts (MW). In addition, there are two (2) natural gas-fired combustion turbines producing a combined total of 324 MW. However, the combustion turbine emissions were not evaluated for this SO_2 modeling study.

The Asheville Plant was originally constructed in 1964 and is located near Skyland, North Carolina, about 5 miles south of the City of Asheville and near the Asheville Regional Airport. Figure 3-1 shows the general location of the Asheville Station, taken from Google Earth on September 30, 2013.

For SO_2 emissions controls, the Asheville Plant employs “scrubbers”, where a water and limestone mixture is introduced into the flue gas to react with the SO_2 emissions and produce a gypsum by-product, which can be recovered and used as an additive for concrete or the production of wallboard.

Construction on the scrubber project began in 2003, with one unit coming on-line in 2005 and the second scrubber unit coming on-line in 2006. Duke Energy reports that SO_2 emission reductions associated with the Asheville Plant scrubber would be about 93 percent compared to a baseline of 2001 emissions (www.duke-energy.com/power-plants/coal-fired/asheville.asp).

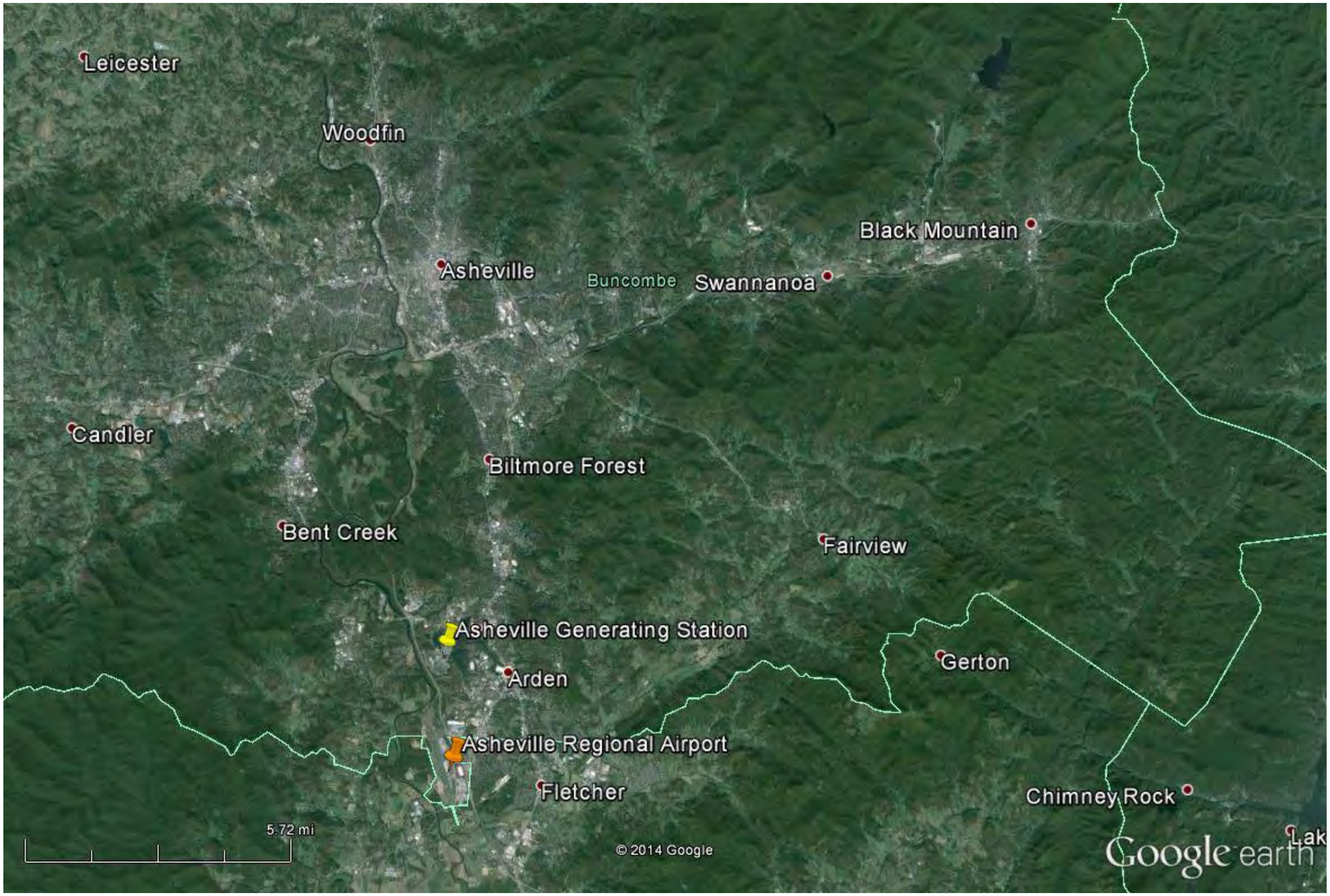


Figure 3-1. Google Earth Image of Asheville Plant Site

4.0 NATIONAL AMBIENT AIR QUALITY STANDARDS

On June 22, 2010, the USEPA revised the NAAQS for sulfur dioxide (SO_2), incorporating a 1-hour average standard set at 75 ppb, based on the 99th percentile of the daily maximum concentration averaged over three (3) years (75 FR 35520, June 22, 2010). The State of North Carolina adopted the same standards into its rules (see 15A NCAC 02D.0402) on September 1, 2011. The 1-hour SO_2 NAAQS standard was also adopted by WNCRAQA Board at its meeting on November 14, 2011.

USEPA's preferred approach for assessing SO_2 concentrations in the vicinity of large emission sources is through dispersion modeling. When the 1-hour SO_2 NAAQS was adopted, USEPA commented that modeling was "*the most technically appropriate, efficient, and readily available method for assessing short-term ambient SO_2 concentrations in areas with large point sources*" (75 FR Page 35551, June 22, 2010). Also, no ambient air quality monitoring for SO_2 is conducted in Buncombe County, which contains the Asheville Plant and the community of Asheville.

For the modeling, the 99th percentile daily maximum concentration would represent the 4th highest daily maximum for a one year (365 day) period. As such, in order to compute the average concentration for assessing whether or not the NAAQS has been exceeded, one would determine the 4th highest daily maximum concentration in each modeling year and then determine the average concentration from that set of data. The NAAQS is based on a three-year average, but if modeling contains more than three years of data (e.g., five years of data as per 40 CFR 51 Appendix W), EPA's modeling guidelines state that the modeled concentration for comparison to the NAAQS would be the average of the 99th percentile daily maximum concentration based on all data years modeled.

5.0 MODELING PROTOCOL

5.1 Model Selection and Technical Inputs

Dispersion modeling was conducted using AMS/EPA Regulatory Model (AERMOD). All AERMOD technical options selected followed the regulatory default option. Model inputs also specified rural conditions for dispersion coefficients and other variables. AERMOD Version 14134 was utilized for this analysis. The AERMET data processing was also completed using the current regulatory model (Version 14134).

The application of AERMOD follows guidance from the *EPA Guideline for Air Quality Models* (40 CFR 51, Appendix W), as well as procedures outlined in the USEPA *AERMOD Implementation Guide* (March 19, 2009).

All modeling used the Universal Transverse Mercator (UTM) grid coordinates. UTM coordinates for the emission points were obtained using an overlay map of the power plant facility. A precise definition of the facility boundary was not necessary as the maximum SO_2 impacts from the two (2) coal–fired units occurred several kilometers downwind of the plant.

Modeling input/output files are included on the enclosed CD-ROM (See Appendix B). Only sulfur dioxide (SO_2) emissions from the two (2) coal-fired units at the Asheville Plant were considered in the modeling.

5.2 Emissions and Stack Exhaust Information

5.2.1 Emissions Information

Hourly SO_2 emissions information for the Asheville Plant were obtained from the USEPA Air Markets Program Data (AMPD) website (http://ampd.epa.gov/ampd).

There are two (2) coal-fired emission units at the Asheville Plant. Unit #1 is noted as ID #1816 and Unit #2 is noted as ID #1817 in the AMPD data. The 2010, 2011, 2012, and 2013 hourly SO_2 emissions data were retrieved from the AMPD database by ARS on May 6, 2014. The 2014 hourly SO_2 emissions data was provided to ARS by Sierra Club, but also traces back to the AMPD database.

The hourly SO_2 emissions downloaded from the AMPD database were input to AERMOD using the HOUREMIS keyword. Under this option, a separate data file provides the hourly emissions input to AERMOD, along with the stack gas exit temperature (degrees K) and the stack gas exit velocity (meters/sec). The hour-by-hour stack gas temperature and exit velocity data input to the model were assumed to be static. The stack velocity and temperature data are described in the next section.

Figure 5-1 and 5-2 show time series plots for the hourly SO_2 emissions data at the Asheville Plant. Figure 5-1 shows the Unit #1 data and Figure 5-2 shows the Unit #2 data. Note that one hourly emissions point for Unit #2 (857.17 lb/hr on April 9, 2013, Hour 11) is not shown as this point lies outside the boundaries of the graph.

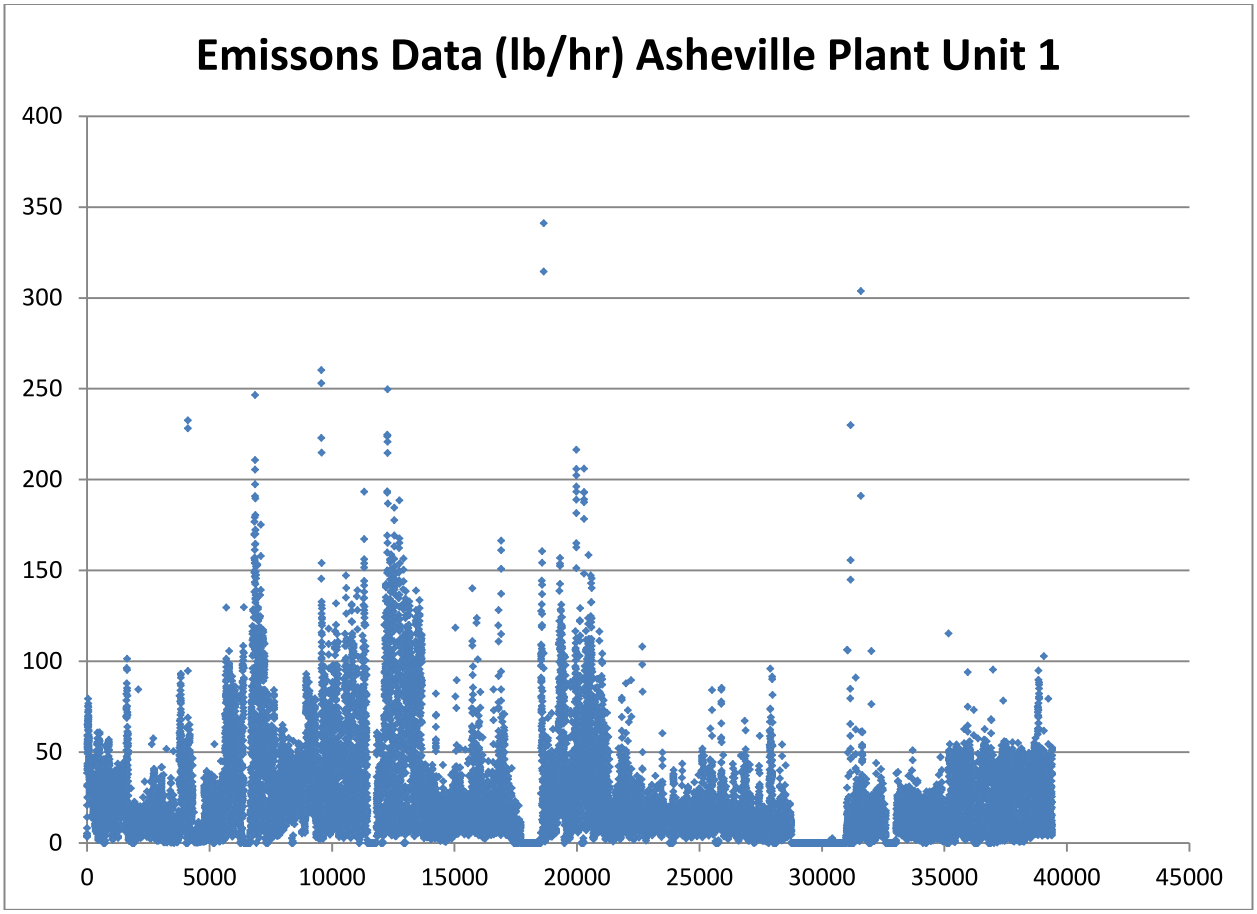


Figure 5-1. Time Series Plot for Hourly SO_2 Emissions Data
Duke Energy Asheville Plant – Unit #1
Hour 1 starts January 1, 2010

2010: 1-8760, 2011: 8761-17520, 2012: 17521-26280, 2013: 26281-35040, 2014: 35041+

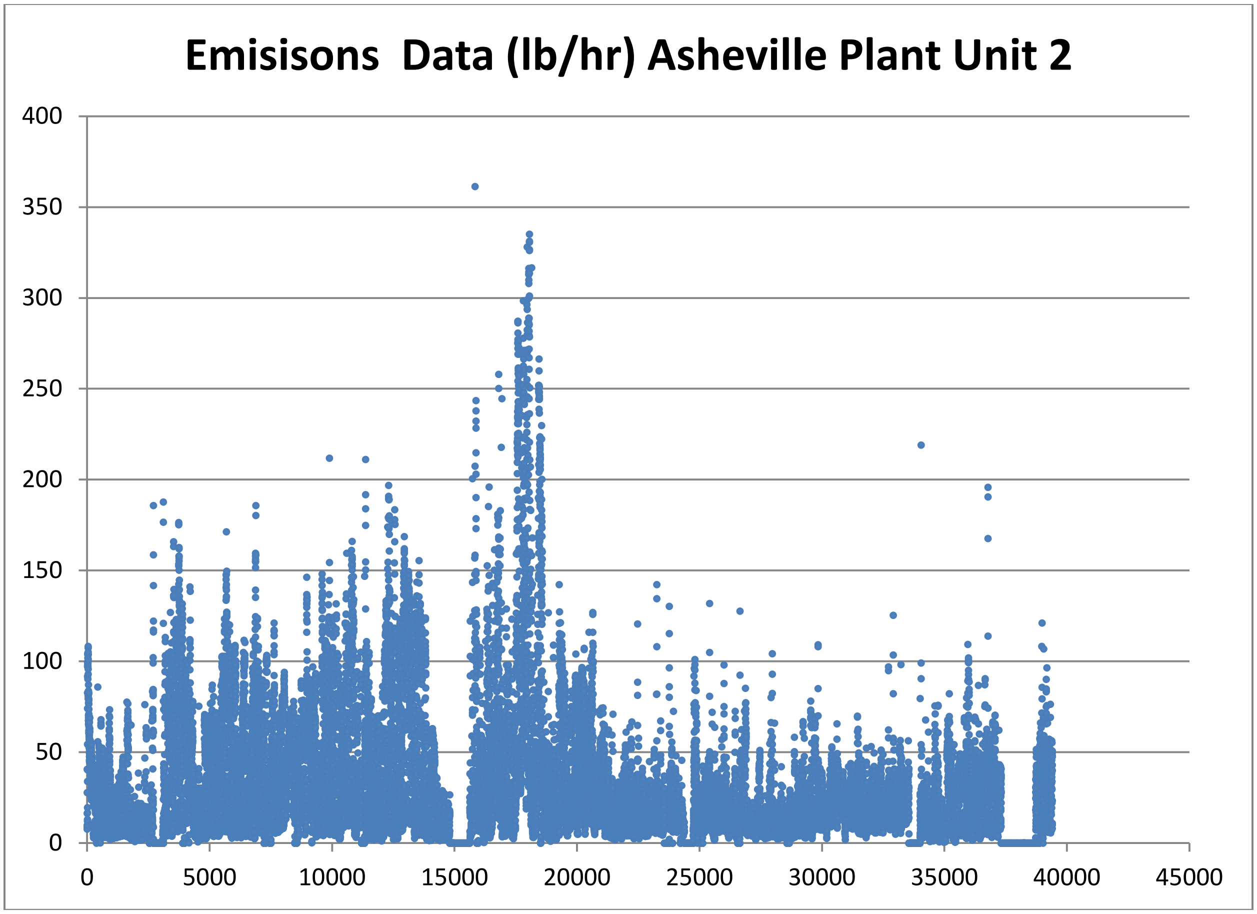


Figure 5-2. Time Series Plot for Hourly SO_2 Emissions Data
Duke Energy Asheville Plant – Unit #2
Hour 1 starts January 1, 2010

2010: 1-8760, 2011: 8761-17520, 2012: 17521-26280, 2013: 26281-35040, 2014: 35041+

5.2.2 Stack Exhaust Information

The stack exhaust information for both Asheville Plant coal-fired units (stack height, stack diameter, stack flow rate/velocity, and stack exhaust temperature) were provided by WNCRAQA (Mr. Victor Fahrer). These data are shown in Table 5-1.

Table 5-1
Asheville Station Source Input Parameters
(Data provided by Mr. Victor Fahrer, WNCRAQA)

Unit ID	UTM E (m)	UTM N (m)	Stack Height (ft.)	Stack Diameter (ft.)	Stack Exit Velocity (ft./sec)	Stack Exit Temperature (degree F)
STACK1	359964.72	3926330.67	327	16.5	56.74	121
STACK2	359971.88	3926329.20	327	16.5	56.14	119

The stack exit velocity and stack exit temperature were assumed to be static in the hourly emissions file described previously; i.e., these parameters were not varied with time. As explained below, this assumption favors Duke Energy as this assumption likely underestimates the true impact of the SO_2 emission under partial load conditions. The velocity and temperature data listed in Table 5-1 were input to each hour of the hourly emissions file as described in the previous section.

ARS' understanding is that the stack parameter data in Table 5-1 represent each unit when operating at or near full load. At partial load conditions, the stack exhaust flow and resulting exit velocity would likely be less than the data input to AERMOD. So at partial load conditions, the resulting plume rise from each stack would be less than the plume rise calculated by the model using the data from Table 5-1. If the plume is actually closer to the ground that is computed by AERMOD, the resulting SO_2 concentrations in real life would likely be higher than the SO_2 concentrations summarized later in Section 6.

Because the only emissions considered in the modeling were from the elevated stacks at Units #1 and #2, no building downwash parameters were included in the modeling. The tall stacks at Units #1 and #2 are sufficiently high (327 ft.) to avoid any significant building downwash influences and omitting the building downwash parameterization from the AERMOD inputs does not alter the modeling results.

5.3 Receptor Inputs

The receptor data used for the AERMOD modeling were based on Section 5.3 of the *Guidelines for Evaluating the Air Quality Impacts of Toxic Air Pollutants in North Carolina (December 2009)*, henceforth referred to as the Guideline.

Based on the Guideline, it is recommended that modeling receptor grids extend a distance of 5-10 km, noting that for stacks greater than 50 m (164 ft.), larger receptor grids are needed to determine the "general area of maximum impact of each pollutant." For the Asheville Plant modeling project, 15 km was the distance necessary to determine all maximum impacts (modeling results show that concentrations diminish beyond 15 km). The Guideline goes on to say that all receptor grids should have a spacing of no greater than 1000 m and that denser receptor grids should be used closer in to identify the maximum pollutant concentrations (down to 100 m spacing). However, in this particular case, the recommended close-in receptors are not needed due to the tall stack heights of the emission sources (327 ft.).

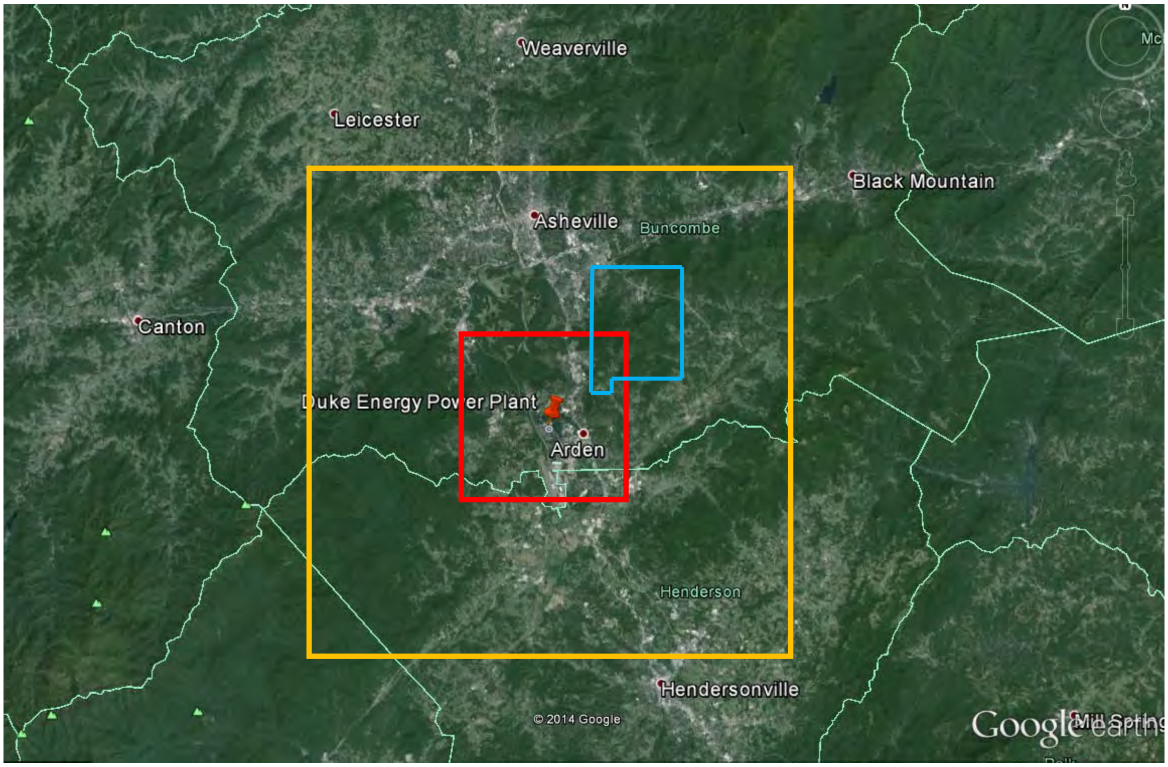
For the Asheville Plant modeling study, the receptor grid density was every 500 m out to 5 km and every 1000 m out to approximately 15 km. This receptor grid is consistent with the North Carolina Guideline. Then, once the locations of maximum impact were identified, additional receptors at a spacing of 100 meters were input to the model at such locations. The 100 meter grid generally encompassed any locations where the 500-1,000m grid modeling identified concentrations above the 1-hour SO_2 NAAQS, which generally occurred along elevated terrain to the northeast of the Ashville Plant.

Also, please note that all receptors were placed at ground-level. No "flagpole" receptors were used in this analysis.

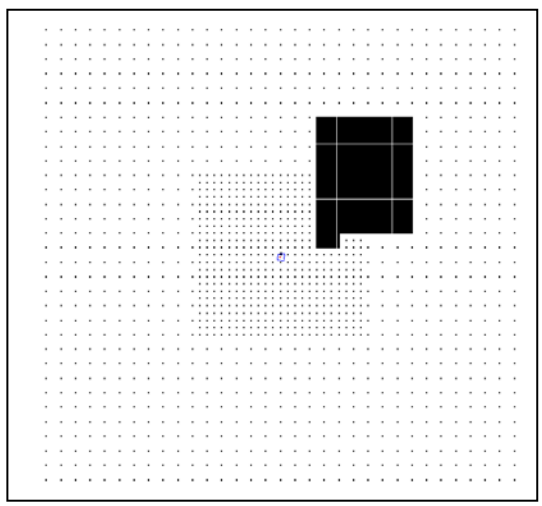
Terrain elevations for receptors were determined using the USEPA AERMAP preprocessor program and the United States Geological Survey (USGS) National Elevation Dataset (NED) input data for the surrounding area. GEOTIFF files were downloaded from the USGS National Map Viewer on January 31, 2013. The downloaded files provided digital terrain elevation data with a resolution of 1/9 arc second.

Figure 5-3 shows a plot of the receptor network used in the modeling.

Figure 5-3
Receptor Map and Placement



1000 m grid	yellow line
500 m grid	red line
100 m grid	blue line



5.4 Meteorological Data Inputs

The dispersion modeling study uses meteorological data for the time period of interest using the surface observations from the Asheville, NC Regional Airport and the Greensboro, NC upper air observations. The Asheville Regional Airport is located within about 4 km (2.5 miles) of the Asheville Generating Station.

The meteorological data was prepared by Oris Solutions/Bee-Line Software (Oris) following instructions provided to Oris by the author. The preparation of the meteorological data is described below. The meteorological data were processed using the current regulatory version of the USEPA AERMET meteorological processor (Version 14134).

5.4.1 Data Sources

Raw National Weather Service (NWS) surface data from the Asheville, NC Regional Airport (WBAN ID #03812 - call sign AVL) and upper air data from Greensboro, NC's Piedmont Triad International Airport (WBAN #13723 - call sign GSO) were processed through the USEPA AERMET/AERMINUTE preprocessing software.

The hourly raw surface meteorological data from Asheville were obtained from the National Climatic Data Center (NCDC) ftp site (ftp://ftp.ncdc.noaa.gov/pub/data/noaa/) in Integrated Surface Hourly Data (ISHD) format (TD-3505), while the Greensboro raw upper air data were downloaded from the National Oceanic and Atmospheric Administration's (NOAA) Earth Systems Research Laboratory Radiosonde Database website in FSL format. (http://esrl.noaa.gov/raobs/). Both ISHD data and FSL data are time-stamped in Greenwich Mean Time (GMT). The Asheville hourly surface data was supplemented with 1-minute Automated Surface Observation System (ASOS) wind data collected at AVL. The ASOS 1-minute data were downloaded from another NCDC ftp site (ftp://ftp.ncdc.noaa.gov/pub/data/asos-onemin/).

Because ISHD surface data and FSL upper air data are based on Greenwich Mean Time (GMT), the 1st day of the following year must be also be processed. Otherwise, AERMET writes missing (99999) data for the last 5 hours of the year (for Eastern time). The extra day of data (January 1 for the following year) was then deleted from the meteorological file prior to running AERMOD.

For the ISHD surface data, the raw data for the year of interest is appended with the data for January 1 of the following year as explained above. The following month (January) of the 1-minute ASOS data must also be used (the ASOS 1-minute data is available in 1-month blocks). The FSL data download site allows the user to specify January 1, hour 0 YYYY to January 1, hour 23, YYYY+1, where YYYY is the year being processed.

5.4.2 Meteorological Data Processing Methodology

Standard USEPA meteorological data processing guidance as found in the *AERMOD Implementation Guide*, the *AERMET Users Guide*, the *AERMINUTE Users Guide*, and the *AERSURFACE Users Guide* was followed in developing the meteorological data files.

Prior to incorporating the ASOS data into AERMET, it must be processed in another program called AERMINUTE (Version 11325). AERMINUTE converts the raw ASOS 1-minute wind speed and wind direction data into 1-hour average scalar wind speeds and unit vector-averaged wind directions for each hour. The primarily utility of AERMINUTE is that it eliminates instances previously recorded as either calm or missing in the ISHD surface data, resulting in more valid hours for input to AERMOD.

The surface characteristics of albedo, Bowen ratio, and surface roughness length are also required by AERMET. Albedo represents the fraction of incoming solar radiation that is reflected back to space and has a value between 0 and 1. Light-colored surfaces have a higher albedo than darker surfaces, indicating that more of the incoming solar radiation is reflected. Bowen ratio represents the ratio of sensible heat flux to latent or evaporative heat flux and is an indicator of soil moisture. Surface roughness length (z_o) represents the height above ground at which the mean wind drops to zero, based on the frictional effects of the earth's surface. Over smooth surfaces, such as calm waters, z_o is on the order of 1 millimeter. Where the surface has large obstructions such as trees and/or buildings, z_o can be 1 meter or greater.

In order to generate the three (3) surface characteristics for input to AERMET, the USEPA pre-processor AERSURFACE (Version 13016) was used. AERSURFACE takes as input the location of interest, as well as information related to wintertime snow cover, whether the site is an airport, whether the location is classified as "arid" (defined as receiving less than 9 inches of rainfall per year), and information on soil moisture (derived from the annual precipitation). AERSURFACE then "reads" the National Land Cover Data Base (1992) and based on the type of land use, generates values for surface roughness length, albedo, and Bowen ratio. For this study, single spatial and seasonal/temporal modes were used. In other words, AERSURFACE generated average values over the entire domain of interest for each of the four climatological seasons (spring, summer, fall, and winter).

A refinement was also used to determine soil moisture based upon a climatological assessment of annual precipitation at AVL. For this adjustment, the annual precipitation total at AVL was determined for each year in a 30-year period (1983-2012). According to the *AERSURFACE Users Guide*, the definition of "dry conditions" is the lowest or driest 30% of the 30 years (lowest 9 years), average moisture is the middle 40% (middle 12 years) and wet conditions are the highest 30% (9 years). The sorted years and annual precipitation are shown in Table 5-2, sorted from wettest to driest.

Table 5-2
Asheville, North Carolina Year Annual Precipitation (inches per year)

High Precipitation Years		**Middle Precipitation Years**		**Low Precipitation Years**	
Year	**Precip.**	**Year**	**Precip.**	**Year**	**Precip.**
2013	75.22	2011	41.78	2010	31.64
2009	52.87	1992	41.61	2000	31.28
1989	51.68	2005	40.64	1985	30.7
2003	48.2	1996	40.45	2001	30.21
2004	46.42	2006	39.38	1999	29.85
1994	45.42	2002	38.1	2008	28.64
1990	44.86	1997	38.02	1986	25.67
2012	44.68	1984	36.24	2007	23.55
1995	43.81	1998	35.48	1988	23.05
		1991	33.05		
		1987	32.67		
		1993	32.65		

Based on the precipitation totals, 2010, was a “low” precipitation year, 2011 was an “average” precipitation year, while 2012 and 2013 were “wet” precipitation years. For 2014, since the data were not complete at the time this modeling was completed, the precipitation was assumed to be “average.” Also, AERSURFACE used the following input information: 1) the area is not covered in continuous snow for one or more months of the year, 2) the site is at an airport, and 3) the location is not defined as “arid.”

Once the AERMINUTE and AERSURFACE processing was completed, the AERMET processing proceeded using the most recent regulatory model (Version 14134). Once the data was entered into AERMET, the model was executed using the standard three-step processing procedure. Step 1 reads the surface and upper air data files and performs quality assurance (QA) on both data sets. Step 2 merges the surface and upper air data into 24-hour blocks (including the results from AERMINUTE). Step 3 then calculates the hourly PBL parameters to go with the rest of the meteorological data. Finally, after Stage 3 is completed, the hours and data associated with January 1 of the following year were manually removed from the SFC and PFL output files. As a result, two files were generated as final output from AERMET for each year of meteorological data in a format ready for input to AERMOD (SFC and PFL).

As the last step, the individual meteorological years set were merged into a single file for AERMOD so that the model could properly calculate the average of the 99^{th} percentile daily maximum 1-hour SO_2 concentration. The specific meteorological data years merged were dependent on the time period selected for each individual AERMOD run.

6.0 MODELING RESULTS

This section summarizes the modeling results for the SO_2 modeling for emissions at Duke Energy – Asheville Plant. These results are presented for the different time periods considered in the modeling:

- All data following the adoption of the 1-hour SO_2 NAAQS by USEPA, i.e., August 23, 2010 through June 30, 2014,
- The most recent three complete calendar years, i.e., January 1, 2011 through December 31, 2013,
- The most recent three-year period ending June 30, 2014, i.e., July 1, 2011 through June 30, 2014, and
- All data following adoption of the 1-hour SO_2 standard by the Western North Carolina Regional Air Quality Agency (WNCRAQA); i.e., November 14, 2011 through June 30, 2014.

The NAAQS for SO_2 is expressed as 75 ppb, based on the 99th percentile of the daily maximum concentration, averaged over three (3) years. However, the AERMOD modeling results are expressed in units of micrograms per cubic meter (ug/m^3). ARS has used a modeled concentration of 196 ug/m^3 as the equivalent of 75 ppb.

An exceedance was calculated by the model if at least one receptor showed the time period average for the maximum daily 1-hour average SO_2 concentration was in excess of the NAAQS (75 ppb or 196 ug/m^3). Again, all modeling was based on the actual SO_2 emissions reported for the Asheville Plant in EPA's Air Markets Program Data and the actual meteorological conditions occurring for the specific hour of those emissions. In this manner, the ARS modeling study followed the recommendations in EPA's *SO_2 NAAQS Designations Modeling Technical Assistance Document (DRAFT - December 2013).*

In AERMOD, the model determines the 99th percentile (4th highest) daily maximum 1-hour SO_2 concentration for the year and then computes the average of those values. As necessary, the AERMOD input file used a "zero" emissions rate for any individual hours outside the time interval of interest so that the model results during any such period would also be zero. In this way, non-zero SO_2 concentrations are returned by AERMOD only for the time period of interest. When a partial year was modeled, ARS understands that AERMOD computation of the multi-year average truncates any incomplete year and does not use data from the incomplete 365-day period when computing the average of the 4th highest daily maximum values. In other words, only years with a complete 365-day record in the meteorological data file were used to compute the multi-year average. However, the 365-day period need not start on January 1.

The analysis also underestimates the total SO_2 concentrations given that a "background" concentration for SO_2 has not been considered. Thus, all calculated instances of the SO_2 concentrations exceeding the NAAQS are solely attributable to emissions from the Duke Energy Asheville Plant. A complete list of modeling results at all receptors for each time period modeled is shown in the electronic modeling files (Appendix B).

6.1 Time Period #1 – All Data Following USEPA's Adoption of the 1-Hour SO_2 NAAQS

For this modeling analysis, the time period considered was all time periods following adoption of the 1-hour average SO_2 NAAQS by USEPA, or August 23, 2010 through June 30, 2014.

The AERMOD model output represents the average of the 4^{th} highest daily maximum concentrations over the time period modeled. The computation was done for each receptor and the calculated value at each receptor was then compared to the NAAQS.

In this modeling scenario, the time period at the end of the data record (August 23, 2013 to June 30, 2014) is an incomplete year. As described above, AERMOD does not compute the 4^{th} highest concentration for any incomplete period when calculating the multi-year average. The average concentration for the purpose of comparison to the NAAQS is based on the three complete years of data, i.e., 1) August 23, 2010 through August 22, 2011, 2) August 23, 2011 through August 22, 2012, and 3) August 23, 2012 through August 22, 2013. However, the 1-hour concentrations in the incomplete year are computed by the model and can be processed separately by the user if desired.

Table 6-1 summarizes the AERMOD modeling results for this time period. Only the top ten receptors showing a calculated NAAQS exceedance are shown in Table 6-1. For this time period, the worst-case impact location was shown to have the 99^{th} percentile daily maximum 1-hour average SO_2 concentration in excess of the NAAQS by about a factor of 3.5.

Table 6-1

1-Hour SO_2 Modeling Results – Top 10 Results
Average of the 4^{th} Highest Daily Maximum 1-Hr Concentration
Time Period Modeled: August 23, 2010 through August 22, 2013
Asheville Station; Asheville, NC – Actual SO_2 Emissions
Concentrations in Micrograms per Cubic Meter

X Coordinate	Y Coordinate	Concentration
362900	3927200	696.29
362900	3931700	686.19
363000	3932000	659.57
363000	3932000	659.57
363300	3929700	633.31
363000	3931900	631.00
362900	3927400	623.28
362800	3931600	619.94
362900	3931600	618.05
363300	3929800	614.86

6.2 Time Period #2 – The Most Recent Three Calendar Years (2011-2013)

For this modeling analysis, the time period considered was the most recent complete three calendar years, or January 1, 2011 through December 31, 2013.

The AERMOD model output represents the average of the 4^{th} highest daily maximum concentrations over the time period modeled, in this case Calendar Years 2011, 2012, and 2013. In other words, AERMOD computed the 4^{th} highest (99^{th} percentile) concentration for each calendar year period, and then computed the average of these values. The computation is done for each receptor and the calculated value at each receptor was then compared to the NAAQS.

Table 6-2 summarizes the AERMOD modeling results for this time period. Only the top ten receptors showing a calculated NAAQS exceedance are shown in Table 6-2. For this time period, the worst-case impact location was shown to have the 99^{th} percentile daily maximum 1-hour average SO_2 concentration in excess of the NAAQS by about a factor of 2.8.

Table 6-2

1-Hour SO_2 Modeling Results – Top 10 Results
Average of the 4^{th} Highest Daily Maximum 1-Hr Concentration
Time Period Modeled: January 1, 2011 through December 31, 2013
Asheville Station; Asheville, NC – Actual SO_2 Emissions
Concentrations in Micrograms per Cubic Meter

X Coordinate	Y Coordinate	Concentration
362900	3927400	554.25
363100	3927400	540.38
362900	3927300	531.52
363300	3927500	508.30
362900	3928600	500.76
362900	3927200	497.26
362900	3928500	495.72
363000	3932200	494.68
363000	3932000	494.64
363000	3932000	494.64

6.3 Time Period #3 – The Three-Year Period Ending June 30, 2014

In this analysis, the time period considered was the most recent three years of data, or July 1, 2011 through June 30, 2014.

As explained above, the AERMOD model output represents the average concentration over the time period modeled. However, because AERMOD works best when modeling data on a calendar years basis, the meteorological data were reordered. Given that AERMOD computes the concentrations for each hour independently of the other hours, the order in which the meteorological data are processed are of no consequence.

The data reordering creates a “pseudo” calendar year which better matches the AERMOD model expectations for data processing and assures that the three year average 4th highest concentration was calculated correctly. The “pseudo” calendar years were as follows:

- 2012: January 1 through June 30, 2012 and July 1 through December 31, 2011, thus simulating the time period July 1, 2011 through June 30, 2012.
- 2013: January 1 through June 30, 2013 and July 1 through December 31, 2012, thus simulating the time period July 1, 2012 through June 30, 2013.
- 2014: January 1 through June 30, 2014 and July 1 through December 31, 2013, thus simulating the time period July 1, 2013 through June 30, 2014.

In this case, there were three different “pseudo” calendar years modeled (2012, 2013, and 2014). AERMOD computed the 4th highest (99th percentile) concentration for each of the three “pseudo” calendar year periods, and then computed the average of these values. The computation was done for each receptor and the calculated value at each receptor was then compared to the NAAQS.

Table 6-3 summarizes the AERMOD modeling results for this time period. Only the top ten receptors showing a calculated NAAQS exceedance are shown in Table 6-3. For this time period, the worst-case impact location was shown to have the 99th percentile daily maximum 1-hour average SO_2 concentration in excess of the NAAQS by about a factor of 2.9.

Table 6-3

1-Hour SO_2 Modeling Results – Top 10 Results
Average of the 4th Highest Daily Maximum 1-Hr Concentration
Time Period Modeled: July 1, 2011 through June 30, 2014
Asheville Station; Asheville, NC – Actual SO_2 Emissions
Concentrations in Micrograms per Cubic Meter

X Coordinate	Y Coordinate	Concentration
363300	3929700	571.51
363100	3929800	555.62
362900	3927200	550.43
363300	3929800	535.61
363400	3929900	529.63
363200	3929900	526.73
363300	3929900	525.44
363400	3930100	508.48
363500	3930000	507.14
363500	3930000	507.14

6.4 Time Period #4 – The Period following Adoption of the 1-Hour SO2 NAAQS by WNCRAQA

In this analysis, the time period considered was the period following adoption of the 1-hour NAAQS standard by the WNCRAQA Board, or the time period starting November 14, 2011 and ending June 30, 2014. For this analysis, the "pseudo" calendar years described in Section 6.3 were modeled, except that for the period July 1, 2011 through November 13, 2011, the Asheville Power Plant emissions were set to zero.

There are three (3) different "pseudo" calendar years modeled for this time period (2012, 2013, and 2014). These "pseudo" years actually represent:

1) 2012: July 1, 2011 through June 30, 2012,
2) 2013: July 1, 2012 through June 30, 2013, and
3) 2014: July 1, 2013 through June 30, 2014.

Only a partial year was actually modeled in the first year, as an emission rate of zero was used for time period July 1 through November 13, 2011. This approach allowed AERMOD to return an average concentration over the entire three year period, instead of truncating the incomplete year.

In this analysis, AERMOD computed the 4th highest (99th percentile) daily maximum 1-hour average SO_2 concentration for each of the three "pseudo" calendar year periods, and then computed the average of these values. The computation was done for each receptor and the calculated value at each receptor was then compared to the NAAQS.

Table 6-4 summarizes the AERMOD modeling results for the selected time period. Only the top ten receptors showing a calculated NAAQS exceedance are shown in Table 6-4. For this time period, the worst-case impact location was shown to have the 99th percentile daily maximum 1-hour average SO_2 concentration in excess of the NAAQS by about a factor of 2.7.

Table 6-4

1-Hour SO_2 Modeling Results – Top 10 Results
Average of the 4th Highest Daily Maximum 1-Hr Concentration
Time Period Modeled: November 14, 2011 through June 30, 2014
Asheville Station; Asheville, NC – Actual SO_2 Emissions
Concentrations in Micrograms per Cubic Meter

X Coordinate	Y Coordinate	Concentration
363100	3929800	526.23
363200	3929900	526.15
363300	3930000	502.57
363300	3929900	501.15
362900	3928500	494.46
363400	3930100	492.55
363000	3928500	489.18
363000	3928500	489.18
363000	3929700	488.51
362900	3928300	487.85

6.5 Discussion

6.5.1 NAAQS Concentration

The AERMOD emissions modeling for the Duke Energy Asheville Plant, using actual SO_2 emissions data over the period of interest (August 2010 through June 2014) demonstrated that various receptor locations surrounding the Asheville Plant exceeded the 1-hour average NAAQS for SO_2, based on the average of the 99th percentile daily maximum concentrations determined over the period of interest. This conclusion is valid regardless of the time interval considered in the modeling analysis.

Table 6-5 lists the number of days for each time interval modeled where the calculated daily maximum 1-hour average SO_2 concentration exceeded the NAAQS at any receptor. The maximum modeled SO_2 concentration, based on the average of the 99th percentile concentration over the period modeled, is also shown in Table 6-5.

Table 6-5

Days Exceeding NAAQS at any Receptor
Asheville Station; Asheville, NC – Actual SO_2 Emissions
Concentrations in Micrograms per Cubic Meter

Model Scenario	**Start Date**	**End Date**	**Total Days**	**Modeled Days Above NAAQS**	**Percent**	**Modeled SO_2 Concentration**
1	8/23/2010	6/30/2014	1408	448	31.82%	696.29
2	1/1/2011	12/31/2013	1096	334	30.47%	554.25
3	7/1/2011	6/30/2014	1096	295	26.92%	571.51
4	11/14/2011	6/30/2014	960	250	26.04%	526.23

Depending on the time interval selected, the number of days calculated to exceed the NAAQS ranges from about 26% up to about 32%. This means that approximately one out of every 3-4 days had a calculated SO_2 concentration that was above the NAAQS, based on modeling of the actual SO_2 emissions from the Duke Energy Asheville Station.

Figure 6-1 shows the receptor locations where a modeled concentration above the 1-hour average SO_2 NAAQS occurred. These receptors have been overlayed onto a Google Earth image in order to provide some perspective as to where the SO_2 NAAQS exceedances occurred. Figure 6-1 also shows the concentration contours with the darker colors indicating higher modeled SO_2 concentrations. The concentration contours in Figure 6-1 are based on the modeling for the October 23, 2010 through October 22, 2013 time period. However, the locations of receptors where modeled concentrations exceed the NAAQS were approximately the same for all of the time intervals modeled. Similar graphics for the other time periods modeled are shown in Appendix C.

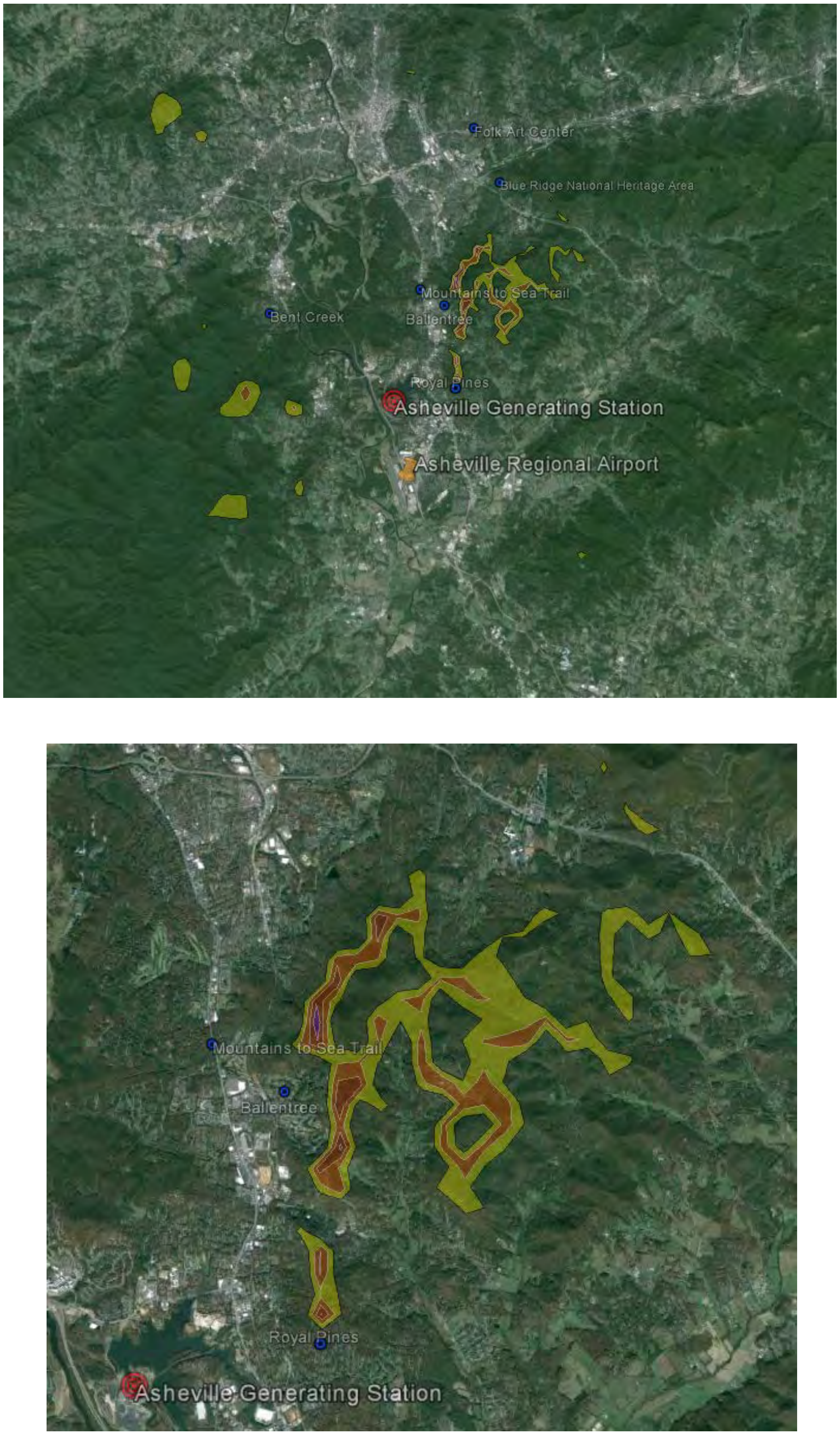


Figure 6-1.
Asheville Plant Modeling – SO_2 NAAQS Exceedance Locations
Contours show with darker colors indicating higher modeled SO_2 concentrations
Based on modeling for the August 23, 2010 through August 22, 2013 time interval.

As shown by the figure, there is a cluster of exceeding receptors east of Skyland, located in and near a populated residential area. In this area, the receptors with a calculated SO_2 NAAQS exceedance also appear to be correlated with elevation, and generally occurred when the ground-level elevation was in the range of 2,700 to 2,800 ft MSL.

The modeled NAAQS exceedances occurred in all directions from the Duke Energy Asheville Plant. Most of the receptors with concentrations above the NAAQS occurred at higher elevations where the Asheville Plant plume impinged on elevated terrain. To the south, additional receptors exceeding the NAAQS also occurred in adjacent Henderson County.

6.5.2 Calculation of the Maximum Allowable SO_2 Emission Rate

As documented above, emissions from the Duke Energy Asheville Plant cause local SO_2 concentrations to exceed the 1-hour average NAAQS, based on air dispersion modeling of actual emissions and concurrent meteorological dispersion conditions. In this section, modeling was conducted to determine a maximum allowable hourly SO_2 emission rate that would assure that ambient SO_2 concentrations are below the NAAQS.

For this modeling evaluation, a constant emission SO_2 emission rate was determined that would result in the three-year average of the 99th percentile daily maximum concentration equaling the NAAQS (196 micrograms per cubic meter). The emissions at Unit #1 and Unit #2 were assumed to be equal for this analysis. This particular modeling evaluation was based on the calendar year 2011-2013 meteorological data described previously, which is the most recent period where a complete calendar year of data were available for each year.

The modeled SO_2 emission rate that resulted in an AERMOD prediction equal to the 1-hour average NAAQS was 7.78 grams per second, or 61.7 lb/hr for each unit (123.4 lb/hr combined for Units #1 and #2). Based on the BTU rating of each boiler as listed in the Asheville Plant Title V operating permit (2,155 MMBtu/hr at Unit #1 and 2,102 MMBtu/hr at Unit #2), this SO_2 emissions rate would equate to an average rate across both units of 0.029 lb/MMBtu.

The electronic file for this AERMOD modeling run is also provided in Appendix B.

7.0 SUMMARY & CONCLUSIONS

This report describes an air quality dispersion modeling analysis for sulfur dioxide (SO_2) emissions from the Duke Energy Asheville Plant located near Asheville, North Carolina. The air quality modeling analysis has been conducted to assess whether or not SO_2 emissions from the Asheville Plant cause or contribute to an exceedance of the National Ambient Air Quality Standards (NAAQS) for SO_2, specifically the 75 parts per billion 1-hour average NAAQS. The ARS modeling analysis used 196 micrograms per cubic meter (ug/m^3) to represent the 75 ppb NAAQS level.

The air quality modeling analysis has been prepared by Air Resource Specialists, Inc. (ARS) on behalf of Sierra Club. The Asheville Plant modeling applied the US Environmental Protection Agency (USEPA) AERMOD dispersion model, which is the approved regulatory model in 40 CFR 51 Appendix W for applications in the "near-field", defined as ambient air quality impacts within 50 kilometers (km) of the emissions unit. The modeling approach follows the applicable dispersion modeling guidance found in 40 CFR 51 Appendix W and accompanying State of North Carolina guidelines.

All modeling was based on the actual SO_2 emissions reported for the Asheville Plant in EPA's Air Markets Program Data and the actual meteorological conditions occurring for the specific hour of those emissions. In this manner, the ARS modeling study followed the recommendations in EPA's *SO_2 NAAQS Designations Modeling Technical Assistance Document (DRAFT - December 2013).*

ARS modeling analysis considered SO_2 emissions over the time period starting August 23, 2010 through June 30, 2014. August 23, 2010 is the first day that the 1-hour SO_2 NAAQS was effective under USEPA regulations and information on SO_2 emissions from the USEPA Air Markets Program Data was only available through June 30, 2014 at the time this modeling evaluation was initiated.

Meteorological inputs for the modeling were taken from concurrent National Weather Service surface observations collected at the Asheville Regional Airport coupled with upper air observations collected at Greensboro, NC. The Asheville Regional Airport is located in close proximity to the Asheville Station., e.g., within about 4 km (2.5 miles). The proximity of the Asheville Regional Airport to the Duke Energy Asheville Station makes the Asheville meteorological data representative of the general turbulence and dispersion conditions across the modeling domain.

Other required data for the AERMOD modeling (stack height, etc.) were taken from publically available data and/or information supplied by the Western North Carolina Regional Air Quality Agency. The modeling study used the current regulatory versions of AERMET and AERMOD (Version 14143).

A NAAQS exceedance was determined if at least one receptor showed the multi-year average for the maximum daily 1-hour average SO_2 concentration was in excess of the NAAQS (75 ppb or 196 ug/m^3). This calculation was performed internally within AERMOD for the time period of interest. Again, all modeling was based on the actual SO_2 emissions reported for the Asheville Plant in EPA's Air Markets Program Data and the actual meteorological conditions occurring for the specific hour of those emissions.

Only complete data years were considered by AERMOD in the multi-year average. If the individual modeling year covered less than 365 days, that data was truncated and not considered when computing the multi-year average of the 4th highest daily maximum concentration. However, the individual 1-hour concentrations for the truncated year were calculated by the model and were available to the user in any external data processing outside of AERMOD.

The modeling analysis also underestimated the total SO_2 concentrations given that a "background" concentration for SO_2 was not considered. Any exceedances of the SO_2 NAAQS were thus attributable solely to the emissions from the Duke Energy Asheville Plant.

The Asheville Steam Electric Plant modeling calculated a peak 1-hour SO_2 concentration of about 696 ug/m^3 based on the three year average for the 99th percentile daily maximum for the period August 23, 2010 through August 22, 2013. This concentration was almost a factor of 3.5 above the USEPA NAAQS concentration. For other time period intervals considered, the peak multi-year average 1-hour SO_2 concentration was less, but still above the NAAQS by about a factor of three. Receptors predicted to exceed the NAAQS were concentrated in the Skyland area to the located northeast of the Ashville Plant at elevations were the power plant plume impinged on local terrain. However, receptors with SO_2 concentrations above the NAAQS were identified in nearly every direction from the Asheville Plant.

In addition, ARS computed the number of time periods over which a modeled concentration attributable to emissions from the Ashville Plant was calculated to be above the 1-hour SO_2 NAAQS at any modeled receptor. That analysis concluded that the modeled exceedances of the SO_2 NAAQS were frequent, occurring about once every 3 days over the period August 23, 2010 through June 30, 2014.

In conclusion, the AERMOD dispersion modeling completed by ARS demonstrates that the Duke Energy Asheville Steam Electric Plant causes ambient SO_2 concentrations exceeding the applicable 1-hour NAAQS. The AERMOD modeling also determined that the maximum allowable SO_2 emissions rate that would assure that ambient SO_2 concentrations are below the NAAQS was 61.7 lb/hr for each unit (123.4 lb/hr combined for Units #1 and #2), which equates to a plantwide average SO_2 emission rate of 0.029 lb/MMBtu.

Appendix A

Professional Resume of D. Howard Gebhart

D. HOWARD GEBHART

Environmental Compliance Section Manager

EDUCATION

M.S. Meteorology, University of Utah 1979

B.S. Professional Meteorology, Saint Louis University 1976

MEMBERSHIPS

Air & Waste Management Association

National Weather Association

Colorado Mining Association

Nevada Mining Association

Nebraska Industrial Council on Environment

EXPERIENCE SUMMARY

Mr. Gebhart has nearly 30 years' experience in air quality permitting and compliance specializing in issues affecting regulated industries. His expertise lies with permitting and support of the ethanol industry. He manages the environmental compliance section at Air Resource Specialists, Inc., and provides technical studies and evaluations; and prepares models, client permit applications, and air emission calculations. He is well experienced in working with the federal Clean Water Act, Clean Air Act, Resource Conservation and Recovery Act (RCRA), and many similar programs enacted in many states throughout the United States.

PROJECT EXPERIENCE

- Produces and manages quality assurance documents including quality management plans and quality assurance project plans.
- Provides technical studies and evaluations, prepares models, and prepares permit applications for a wide variety of clients.
- Provides emissions inventories, dispersion modeling, regulatory analysis and interpretation, and air compliance auditing.
- Prepares applications for new source permits under federal Prevention of Significant Deterioration (PSD) and state construction and operating permit programs.
- Provides technical studies supporting Environmental Impact Statements (EISs) and Environmental Assessments (EAs) under the National Environmental Policy Act (NEPA).
- Manages the Environmental Compliance Section team.
- Performs permitting and air quality studies for bio-fuel (ethanol), oil & gas petroleum, mining and minerals, semiconductor, and National Park Service projects, with experience representing both government and private clients.
- Performs air pathway evaluations for releases of hazardous air pollutants from Superfund sites, hazardous waste sites, and incinerators.
- Models the potential consequences of accidental releases of hazardous materials.

Appendix B

AERMOD Input-Output Files
(See Enclosed CD-ROM)

Appendix C

Asheville Plant Modeling – SO_2 Exceedance Locations

Figure C-1.
Asheville Plant Modeling – SO_2 NAAQS Exceedance Locations
Contours show with darker colors indicating higher modeled SO_2 concentrations
Based on modeling for the January 1, 2011 through December 31, 2013 time interval.

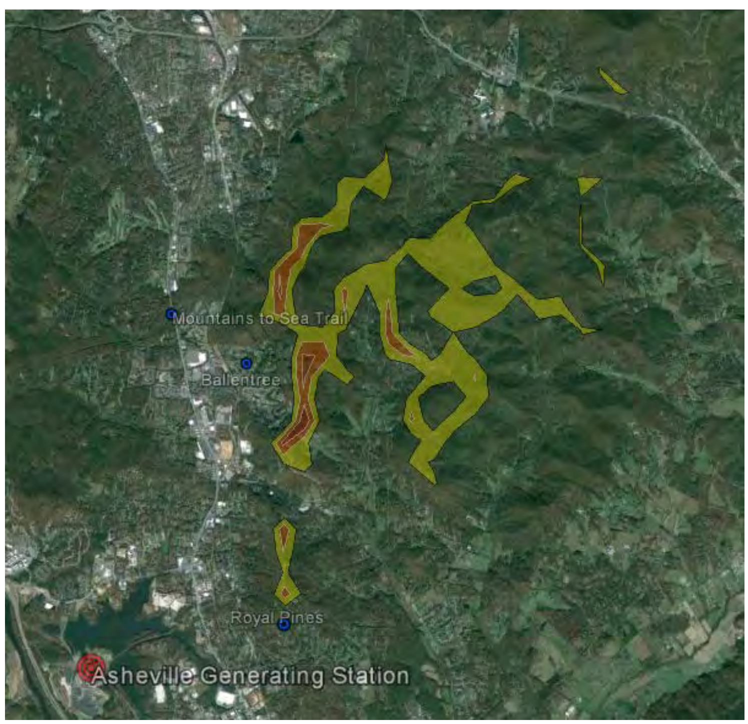


Figure C-2.
Asheville Plant Modeling – SO_2 NAAQS Exceedance Locations
Contours show with darker colors indicating higher modeled SO_2 concentrations
Based on modeling for the July 1, 2011 through June 30, 2014 time interval.

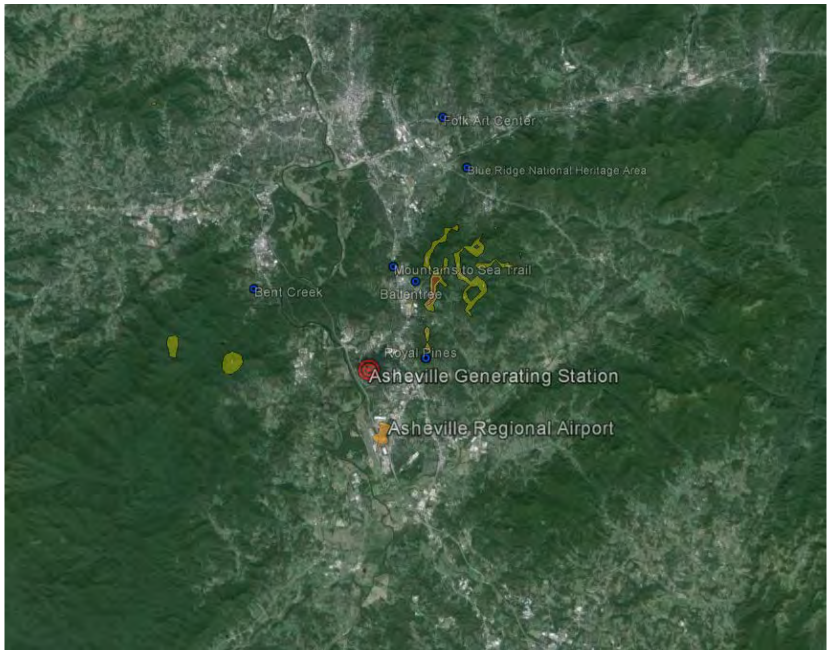


Figure C-3.
Asheville Plant Modeling – SO_2 NAAQS Exceedance Locations
Contours show with darker colors indicating higher modeled SO_2 concentrations
Based on modeling for the November 14, 2011 through June 30, 2014 time interval.

ANALYSIS OF SCRUBBER OPERATION
DUKE ENERGY – ASHEVILLE POWER PLANT

Expert Report

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February 16, 2015

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I. ABSTRACT

The two coal-fired units at the Duke-Progress Asheville power plant in North Carolina are equipped with relatively new (though not the most efficient, for their age) wet scrubbers for the removal of sulfur dioxide (SO2) from the exhaust gases from the units. However, it is clear, from the examination of data reported by the utility to the US Environmental Protection Agency (EPA) and the US Department of Energy (DoE), that: (a) just a few years after installation, the utility stopped operating its scrubbers at their design SO2 removal efficiencies; and (b) more recently, the utility has been using coal with higher sulfur content than previously. Both actions, individually and in combination, have caused each of the units to emit far greater amounts of SO2 than they were emitting (on a lb/million Btu basis) in the months after each scrubber was installed. Both actions (i.e., not running its scrubbers at or near their design efficiencies and using coal with higher sulfur content) reduce the operating costs for generating electricity sold by the utility thereby increasing its profits. Finally, I was asked to evaluate the plant's historic and current operations and whether its SO2 emissions have met or could meet a level of 123.4 pounds per hour from both units. I have determined that, as the units have operated and continue to operate, they currently emit SO2 in quantities greater than 123.4 pounds per hour for most time periods. However, if the utility uses low-sulfur coals used in the past and operates their scrubbers consistent with their design, the units could meet the 123.4 pounds per hour emission rate in the future.

II. INTRODUCTION

Asheville Units 1 and 2 in Arden, North Carolina, are drum-type units rated at net generating capacities of 200 MW and 194 MW respectively. They each include a single wall-fired boiler and reheat steam turbine with auxiliary facilities common to both units. Unit 1 went into commercial operation in 1964; Unit 2 joined it in 1971. Asheville Unit 1 was the first coal-fired unit to be retrofitted with a flue gas desulphurization (FGD) system (or scrubber) in North Carolina. That scrubber went into operation in late 2005. The scrubber for Unit 2 went into operation in mid-2006.

I have reviewed the current Title V operating permit[1] for the Asheville plant, which covers SO2 emissions from its two units. While Asheville operates under the permit with both numerical and narrative permit limits, the numerical limits in the permit are very weak and lenient such that they do not require operation of the scrubbers as designed (or at their full potential). The narrative limit provides a backstop that ensures that the plant does not cause unhealthy air; however, air dispersion modeling would need to be done to determine the numerical limit that is needed to comply with the narrative limit to ensure healthy air.

The Title V operating permit recognizes that each unit is equipped with a "flue gas desulfurization system," (or scrubber) but does not hold the scrubbers to any numerical operational standard noting, simply, that they can be "operated on an as-needed basis."[2]

Separately, the Title V operating permit states that each boiler's SO2 emissions limit is "2.3 pounds per million BTU heat input" (lb/MMBtu).[3] But, at 2.3 lb/MMBtu, this limit is typical of uncontrolled (i.e., pre-scrubber) SO2 emissions rather than emissions from a unit with an operating scrubber, as I discuss later. In fact, actual reported data (to the EPA[4] by the utility) shows that SO2 emissions ranged from 1.17 to 1.35 lb/MMBtu in 2003–2005[5], the years preceding installation of the scrubbers.

In addition, the Title V operating permit contains separate Clean Air Act Title IV SO2 annual limits (in tons per year) for each unit as follows: 6,633 tons per year for Unit 1 for 2010 and later years; and 5,271 tons per year for Unit 2 for 2010 and later years.[6]

The Title V operating permit contains separate SO2 annual limits (in tons per year) under the Clean Air Interstate Rule (CAIR) for each unit. Using the heat input rates for each unit as specified in the permit (i.e., 2,155 MMBtu/hr for Unit 1 and 2,102 MMBtu/hr for Unit 2),[7] and conservatively

[1] Permit No. 11-628-10B, issued by the Western North Carolina Regional Air Quality Agency (WNCRAQA) to the Progress Energy Carolina, Inc., Asheville Steam Electric Plant, on January 18, 2011 (hereafter the "Title V operating permit").

[2] Title V operating permit, page 3 of 43, FN 3.

[3] Title V operating permit, page 4 of 43, Section 2.1.

[4] www.epa.gov/ampd.

[5] Unit 1 reported 1.17 lb/MMBtu in 2005; Unit 2 reported 1.35 lb/MMBtu in 2005. The reported values for either unit for the years 2003 and 2004 were within this range.

[6] Title V operating permit, pages 28 and 29 of 43.

[7] Title V operating permit, Section I, page 3 of 43.

assuming year-round (i.e., 24 hours per day and 365 days per year or 8760 hours per year) operation at full load,[8] these CAIR limits translate to SO2 emission rates of approximately 0.7 lb/MMBtu for Unit 1 and 0.57 lb/MMBtu for Unit 2. These rates are still much too high (to require operating the scrubbers at anywhere close to their design SO2 removal efficiencies) and easily achievable by operating the scrubbers at very low efficiencies. For example, using the actual 2004 (i.e., pre-scrubber) SO2 emission rate of 1.26 lb/MMBtu (i.e., the highest emission rate between years 2003–2005, pre-scrubber), Unit 1 would only need to operate its scrubber at an annual efficiency of 44.4% to achieve the 0.7 lb/MMBtu rate implied in the CAIR limit. Similarly, using the actual pre-scrubber 2005 SO2 emission rate (1.35 lb/MMBtu, i.e., the highest rate between 2003–2005, pre-scrubber), Unit 2 would only need to operate its scrubber at an efficiency of 57.8% to achieve its 0.57 lb/MMBtu rate implied in its CAIR limit. Of course, if one assumed less than 100% load for a full year, scrubber efficiencies would be lower still to meet the CAIR limits. For example, in 2013 Unit 1 had a total heat input of 6,249,326 MMBtus and Unit 1 had a total heat input of 8,277,515 MMBtus. Using these heat inputs, the CAIR limits translate to 2.12 lb/MMBtu for Unit 1 and 1.27 lb/MMBtu for Unit 2.[9] Thus, the CAIR limits in the Title V operating permit do not require that the scrubbers be operated efficiently or anywhere close to their design SO2 removal efficiencies as I discuss in the next section.

I note that the Title V operating permit states that "[I]n addition to any control or manner of operation necessary to meet emission standards specified in this permit, any source of air pollution shall be operated with such control or in such manner that the source shall not cause the ambient air quality standards in WNCRAQA Code 4.0400 to be exceeded at any point beyond the premises on which the source is located."[10] This narrative requirement may be the most restrictive limit on the plant's operations. However, as stated above, air dispersion modeling would need to be conducted in order to calculate a numerical limit that would be adequately protective of human health.

Finally, the Asheville plant and its two units are subject to North Carolina's Clean Smokestacks Act, which currently limits the annual SO2 emissions from all of Progress's coal-fired units to 50,000 tons per year.[11] But this cap limit also includes several plants and units that have been shut down such as Cape Fear Units 5 and 6; Lee Units 1, 2, and 3; and Weatherspoon Units 1, 2, and 3.[12] The cap is not adjusted down as units are retired or shut down.

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[8] These (i.e., 8760 hours of operation at full load) are conservative assumptions—in favor of the plant—in that the calculated scrubber efficiency would be the highest (and the calculated SO2 rate the lowest) using these assumptions. I demonstrate that this is in fact the case using actual 2013 heat inputs for the units in later discussion.

[9] In comparison, had the scrubbers been operating at the design efficiency of 97% as I discuss in the next section, the SO2 emission rate should have been around 0.04 lb/MMBtu.

[10] See p. 39 of 43, Section (II) of the Title V operating permit.

[11] This cap did not change and was not affected by Duke's recent purchase of Progress's coal plants.

[12] See Appendix B, Table 1 of "Implementation of the Clean Smokestacks Act," NCDENR and NCUC, May 30, 2014.

III. DESIGN EFFICIENCIES OF THE ASHEVILLE SCRUBBERS

Based on statements made by the engineering contractor who designed the scrubber and by the utility itself, and on initial testing data reported by the utility to Federal agencies, the scrubbers at Units 1 and 2 were designed to achieve 97% removal efficiency of the SO2 exiting the boilers from typical coals that were being burned around 2003 (the approximate time frame when the scrubbers were designed). Proof of this is provided in the statements below.

The scrubbers were designed by Babcock and Wilcox (B&W). In a 2003 press release, B&W stated that "B&W's work will include the supply of flue gas desulfurization (FGD) units, more commonly called scrubbers, for Units 1 and 2 at Progress Energy's Asheville Steam Plant in Skyland, N.C. . . . The scrubber units at Asheville and Roxboro will be designed to achieve approximately 97 percent sulfur dioxide removal from the plants' emissions."[13]

"[A]s of November 16, 2005, at least 97% of the sulfur dioxide that had been emitted from the plant's boiler is now being removed. The FGD system for Unit 2, the second FGD to be placed in service in the state, went into operation May 17, 2006."[14]

Finally, as the utility had reported to the US DoE,[15] the tested efficiencies of the scrubbers in October 2006 were 97.7% for Unit 1 and 97.8% for Unit 2. These are reported at 100% load. Given the manner in which such wet scrubbers operate, their efficiencies should not be lower (or need not be lower) at lower loads, at which time inlet SO2 mass levels to the scrubbers are lower.

I note that most wet scrubbers installed at coal-fired power plants since even the mid-1990s were designed with SO2 removal efficiencies of at least 98% for the types of coal in use at Asheville both at the time the scrubbers came on line and at present. Lest it seem like quibbling there is a significant difference in SO2 emissions from a scrubber that is 98% efficient versus that which is 97% efficient, assuming the same SO2 at inlet of each. Simple mathematics dictates that the former (98% efficient scrubber), which emits 2% of the uncontrolled emissions will emit 67% of the SO2 emissions as compared to that emitted by the 97% efficient scrubber, which will emit 3% of the uncontrolled emissions.

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[13] http://www.businesswire.com/news/home/20030617005470/en/Babcock-Wilcox-Signs-Scrubber-Alliance#.VCd8kvldVIE. Press Release June 17, 2003.

[14] http://www.powermag.com/case-histories-asheville-power-stations-retrofit-first-to-meet-north-carolinas-clean-smokestacks-act/.

[15] Form EIA-923.

IV. ACTUAL EFFICIENCIES OF THE ASHEVILLE SCRUBBERS

Actual annual scrubber efficiencies at Asheville at 100% load are reported by the utility to the US DoE.[16] The latest year for which such data are available is 2012. Considering the data for the last several years, Table 1 below shows the reported scrubber efficiencies.

Table 1 – Reported Scrubber Efficiencies at 100% Load

Year	Reported Scrubber Efficiency – Unit 1	Reported Scrubber Efficiency – Unit 2
2009	93.1	93.8
2010	94.2	91.7
2011	93.2	90.7
2012	96.1	94.8

While we have no verification of how these numbers, at 100% load, were derived by the utility, they are reported to the US DoE and we accept them as such. As is obvious, scrubber efficiencies at each unit are significantly below the design 97% or the tested 97.7% (for Unit 1) and 97.8% (for Unit 2), as noted earlier.

In reality, annual scrubber efficiencies calculated under actual operating conditions were as low as 78% (for Unit 2 in 2011). Supporting calculations are provided in Table 2 in Attachment B to this report.

Lastly, although monthly scrubber efficiencies are not directly reported by the utility, they can be reasonably calculated by using data that the utility itself reports concerning the monthly coal consumption, heating value and sulfur content data (which are reported to the DoE/EIA) along with the SO2 emissions that are reported to the EPA. Using these data, it is also clear that scrubber efficiencies started decreasing just a few years after installation – typically after 2009. See supporting calculations in Table 3 in Attachment B.

Thus, it is clear that the plant is not operating the scrubbers at their design SO2 removal efficiencies. Instead the scrubbers are being operated at lower removal efficiencies, thereby allowing greater SO2 emissions to the atmosphere.

[16] Form EIA-923.

V. SCRUBBER OPERATION AND COSTS

As discussed, the units have wet scrubbers. In such systems, the exhaust of flue gases from the boiler are brought into contact with a sorbent (typically a liquid alkali like lime or limestone). This contact allows the SO2 in the exhaust gases to react with the sorbent, forming salts and thereby removing the SO2 from the exhaust.

Obviously constructing scrubbers requires money or capital costs. The utility has stated publicly that capital costs for the two scrubbers were around 190 million dollars. That cost was presumably passed on to ratepayers. Once constructed, it costs money to operate the scrubbers. These so-called "operating and maintenance" costs are typically divided into two sub-types: fixed operating and maintenance costs (FOM) and variable operating and maintenance costs (VOM). As the EPA notes FOM "represent expenses incurred regardless of the extent to which the emission control system is run."[17] They include costs for labor/staff, certain onging maintenance activities, as well as costs for administrative functions. While the FOM will depend on the size of the unit, for a given unit such as Asheville Unit 1 or 2, the FOM is generally fixed and does not depend on how the scrubber is operated. That is not the case with VOM. VOM represents costs that are explicitly tied to how much and how hard the emission control device is operated. As EPA notes, VOM includes "(a) costs for reagent (or sorbent) usage, (b) costs for waste generation, (c) make up water costs, and (d) cost of additional power required to run the control (often called the "parasitic load")."[18]

Thus, by not operating the scrubbers as designed (i.e., by operating them at lower efficiencies) the utility reduces its VOM costs.

[17] http://www.epa.gov/airmarkt/progsregs/epa-ipm/docs/v410/Chapter5.pdf.

[18] http://www.epa.gov/airmarkt/progsregs/epa-ipm/docs/v410/Chapter5.pdf.

VI. CHANGING COAL TYPE

As noted earlier, it appears that the utility is now using coal with a higher sulfur content than it had used previously in these units. Indeed, the utility's own reports to the US DoE show the sulfur contents in the coal burned at the two units (coal sulfur content data are shown in Table 2 in Attachment B).

It is worth noting that from early 2009 through roughly the first three quarters of 2011, the sulfur content of the coal burned at the units was: (a) consistent between the two units and (b) less than 1.6%. More specifically, the sulfur content was almost always 1% or lower in 2010, creeping up to between 1 and 1.6% in the first three quarters of 2011. Since that time however, as seen in Table 4, there is a lot more divergence in the sulfur contents of the coal burned at each unit and the levels of sulfur in the coal are often significantly greater than 1.6%. For example, the highest monthly sulfur content for Unit 1 coal was 3.27% and that for Unit 2 was 3.38% – or roughly double the sulfur content of the coals previously burned.

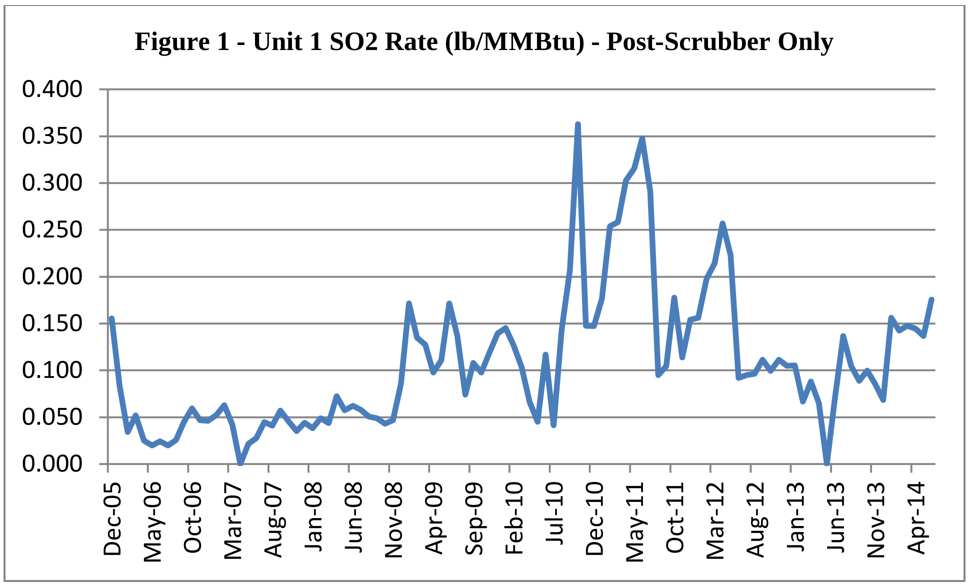
It is well known that, in general, the cost of higher-sulfur (i.e., dirtier) coal is lower than that of lower-sulfur coal. Thus, utilities that have installed scrubbers have incentives to burn higher-sulfur coals. For example, in an article titled "High Sulfur Coal Has Investors Glowing" in 2006, Duke Energy vice president Vince Stroud was reported as stating "[W]e're spending almost $4 billion as a company on various environmental plans, mostly for scrubbers, in the last few years, so we might as well go for the cheaper, high-sulfur coal."[19] Thus, it appears that, as part of this type of strategy, since around Q3 2011, the utility has been reducing its costs and saving money by burning dirtier, cheaper, higher-sulfur coal.

[19] See "High-Sulfur Coal Has Investors Glowing," April 24, 2006. Available at http://online.wsj.com/articles/SB114583391429033632.

VII. ACTUAL SO2 EMISSION RATES FOR THE ASHEVILLE PLANT

The first scrubber at Unit 1 began operating on November 6, 2005. Pre-scrubber SO2 emissions were typically in the range of 1.2 to 1.8 lb/MMBtu. And, as expected, SO2 emissions were lower after the scrubber was installed. Actual monthly emission rates as reported by the Utility to the US EPA are provided in Table 4 in Attachment B.

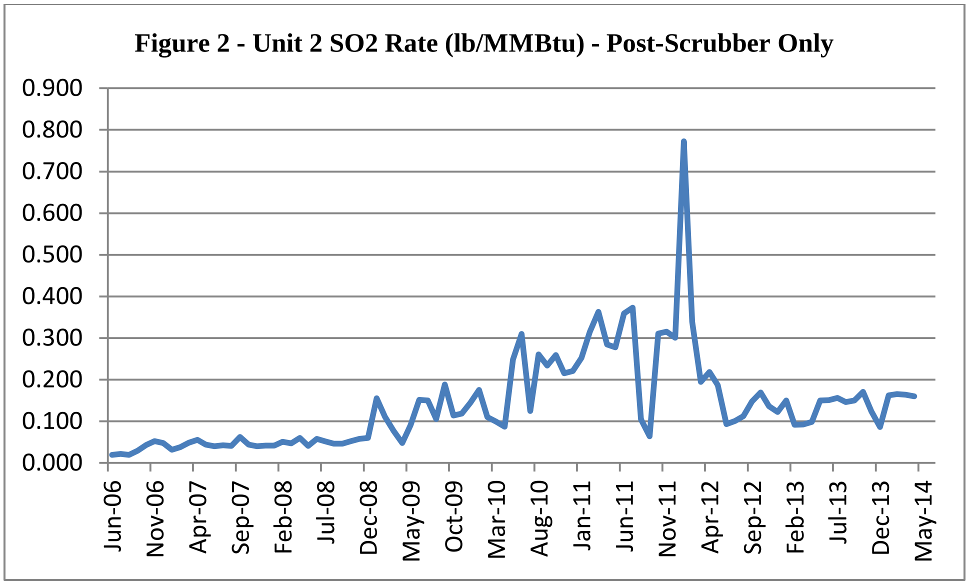
Table 4 shows that emission rates of 0.020–0.026 lb/MMBtu were being achieved in the months after the scrubber went into operation at Unit 1. However, the table also shows how the actual SO2 emission rates increased to over 0.3 lb/MMBtu in subsequent months/years. This increase is also shown in Figure 1 below.



While the increase in the SO2 emission rate (as compared to the low rates of 0.020–0.026 lb/MMBtu) through 2010-mid 2011 appears to be mainly due to a reduction in the efficiency of the scrubber (since the coal sulfur content is generally consistent), the higher SO2 emission rates since late 2011 are a combination of higher-sulfur coal usage along with lower scrubber efficiency.

Similar data are shown in the figure below for Unit 2. The scrubber began operating at this unit on May 26, 2006. Again, the initial reduction in the SO2 emission rate (from the pre-scrubber rate range of 1.2–1.8 lb/MMBtu) is readily seen in the monthly reported emissions data shown in Table 5 in Attachment B.

Like Unit 1, low rates of 0.019–0.022 lb/MMBtu were achieved by this unit's scrubber in the months after initial operation. Thereafter the SO2 emission rates increase as seen in Figure 2 below to over 0.7 lb/MMBtu, dropping to between 0.1–0.2 lb/MMBtu in recent months.



It is clear that, especially after 2009, the low rates obtained initially after the scrubber went into operation, were not repeated. While the rates have come down in late 2012 (as compared to the rates in 2010 and 2011), they are still nowhere as low as the rates in mid-2006. In fact, current rates are around 5–8 times greater than they were when the scrubber first went into operation.

As in the case of Unit 1, the increase in the SO2 rate at Unit 2 (as compared to the low rates of 0.019–0.022 lb/MMBtu) through 2010-mid 2011 appears to be mainly due to a reduction in the efficiency of the scrubber (since the coal sulfur content is generally consistent) while the higher SO2 emission rates in the latter part of 2011 into early 2012 appear to be a combination of higher-sulfur coal usage along with lower scrubber efficiency.

VIII. ACHIEVABLE SO2 EMISSION RATES FOR THE ASHEVILLE PLANT

Based on modeling conducted by others using the EPA-standard AERMOD model, the modeled SO2 emission rate that resulted in an AERMOD prediction equal to the 1-hour National Ambient Air Quality Standard (NAAQS) for SO2 was 7.78 grams per second (61.7 lb/hr for each unit or 123.4 lb/hr combined for Units 1 and 2). Based on the BTU rating of each boiler as listed in the Asheville Plant Title V operating permit (i.e., 2,155 MMBtu/hr at Unit 1 and 2,102 MMBtu/hr at Unit 2), the compliant SO2 emissions rate would equate to an average rate across both units of 0.029 lb/MMBtu. As discussed earlier, rates comparable this were being achieved in the months after the scrubbers went into operation.

Since midnight of January 1, 2011 (close to the issuance of the Title V operating permit on January 18, 2011) through midnight of December 31, 2013 there have been 26,304 calendar hours. During these hours, the combined actual SO2 emission rates of the two units exceeded the NAAQS-compliance requirement of 123.4 lb/hr on 19,518 hours or 74.2% of the time. It should be kept in mind that the calendar hours include many hours in which either one or both units did not operate. When considering just those hours when both units operated, the NAAQS-compliance requirement was exceeded in 82.6% of the hours. Thus, one can conclude that with the type of coal being burned at the units along with the manner in which the scrubbers are being operated, it is almost certain that the 1-hour SO2 NAAQS in the surrounding community is being exceeded.

However, if the utility operates the units with coal containing lower sulfur (as was the case when the scrubbers were designed) and also operates the scrubbers consistent with their design efficiency and consistent with their actual performance in the months after the scrubbers were full operational, it is likely that the combined SO2 emission rates from the two units would be below the value of 123.4 lb/hr for most hours.

APPENDIX A

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CONSULTANT, ENVIRONMENTAL AND ENERGY ISSUES

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EXPERIENCE SUMMARY

Dr. Sahu has over twenty three years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment for a wide range of emissions sources; soils and groundwater remediation including landfills as remedy; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

Specifically, over the last 20+ years, Dr. Sahu has consulted on several municipal landfill related projects addressing landfill gas generation, landfill gas collection, and the treatment/disposal/control of such gases in combustion equipment such as engines, turbines, and flares. In particular, Dr. Sahu has executed numerous projects relating to flare emissions from sources such as landfills as well as refineries and chemical plants. He has served as a peer-reviewer for EPA in relation to flare combustion efficiency, flare destruction efficiency, and flaring emissions.

He has over twenty one years of project management experience and has successfully managed and executed numerous projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public. Notably, he has successfully managed a complex soils and groundwater remediation project with a value of over $140 million involving soils characterization, development and implementation of the remediation strategy including construction of a CAMU/landfill and associated groundwater monitoring, regulatory and public interactions and other challenges.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past twenty three years include various steel mills, petroleum refineries, cement companies, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, and various entities in the public sector including EPA, the US Dept. of Justice, California DTSC, various municipalities, etc.). Dr. Sahu has performed projects in over 44 states, numerous local jurisdictions and internationally.

In addition to consulting, Dr. Sahu has taught numerous courses in several Southern California universities including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management) for the past seventeen years. In this time period he has also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental areas discussed above in both state and Federal courts as well as before administrative bodies.

EXPERIENCE RECORD

2000-present **Independent Consultant.** Providing a variety of private sector (industrial companies, land development companies, law firms, etc.) public sector (such as the US Department of Justice) and public interest group clients with project management, air quality consulting, waste remediation and management consulting, as well as regulatory and engineering support consulting services.

1995-2000 Parsons ES, **Associate, Senior Project Manager and Department Manager for** Air Quality/Geosciences/Hazardous Waste Groups, Pasadena. Responsible for the management of a group of approximately 24 air quality and environmental professionals, 15 geoscience, and 10 hazardous waste professionals providing full-service consulting, project management, regulatory compliance and A/E design assistance in all areas.

Parsons ES, **Manager for Air Source Testing Services**. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.

1992-1995 Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department. Responsibilities included multimedia regulatory compliance and permitting (including hazardous and nuclear materials), air pollution engineering (emissions from stationary and mobile sources, control of criteria and air toxics, dispersion modeling, risk assessment, visibility analysis, odor analysis), supervisory functions and project management.

1990-1992 Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department. Responsibilities included permitting, tracking regulatory issues, technical analysis, and supervisory functions on numerous air, water, and hazardous waste projects. Responsibilities also include client and agency interfacing, project cost and schedule control, and reporting to internal and external upper management regarding project status.

1989-1990 Kinetics Technology International, Corp. **Development Engineer.** Involved in thermal engineering R&D and project work related to low-NOx ceramic radiant burners, fired heater NOx reduction, SCR design, and fired heater retrofitting.

1988-1989 Heat Transfer Research, Inc. **Research Engineer**. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

1984-1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1984 M. S., Mechanical Engineering, Caltech, Pasadena, CA.

1978-1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

TEACHING EXPERIENCE

Caltech

"Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.

"Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.

"Caltech Secondary and High School Saturday Program," – taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.

"Heat Transfer," – taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.

"Thermodynamics and Heat Transfer," Fall and Winter Terms of 1996-1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.

"Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

"Advanced Hazardous Waste Management," University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

"Environmental Risk Assessment," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1998.

"Hazardous Waste Remediation," Loyola Marymount University, Dept. of Civil Engineering. Various years since 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

"Environmental Planning and Management," 5 week program for visiting Chinese delegation, 1994.

"Environmental Planning and Management," 1 day program for visiting Russian delegation, 1995.

"Air Pollution Planning and Management," IEP, UCR, Spring 1996.

"Environmental Issues and Air Pollution," IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992-present.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-present.

Air and Waste Management Association, West Coast Section, 1989-present.

PROFESSIONAL CERTIFICATIONS

EIT, California (# XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, since 2000.

CEM, State of Nevada (#EM-1699). Expiration 10/07/2011.

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"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

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APPENDIX B

ADDITIONAL TABLES

Table 2 - Annual Scrubber Performance Analysis [Asheville Power Plant]

State	Facility Name	ORISPL	Unit	2003					2004				
				SO2 (tons)	Heat Input (MMBtu)	SO2 Rate (lb/MMBtu)	Operating Time	SO2 Control(s)	SO2 (tons)	Heat Input (MMBtu)	SO2 Rate (lb/MMBtu)	Operating Time	SO2 Control(s)
NC	**Asheville**	2706	1	8295	13320475	1.245	8587		6741	10702556	1.260	7017	
NC	**Asheville**	2706	2	7794	12289675	1.268	8543		7549	11721463	1.288	8327	
NC	Cape Fear	2708	5	5267	7487542	1.407	7636		6078	8391127	1.449	7392	
NC	Cape Fear	2708	6	6354	9079236	1.400	7242		6992	9515514	1.470	6986	
NC	H F Lee	2709	1	2776	4126574	1.345	6260		2031	3128967	1.298	5364	
NC	H F Lee	2709	2	2602	3889648	1.338	6177		2100	3287998	1.277	5346	
NC	H F Lee	2709	3	8371	12437962	1.346	6975		8713	13735915	1.269	7420	
NC	L V Sutton	2713	1	2565	4127943	1.243	6201		2431	4040144	1.203	6434	
NC	L V Sutton	2713	2	2941	4717205	1.247	6557		2986	4978523	1.200	6610	
NC	L V Sutton	2713	3	14775	23474850	1.259	8331		13533	21738415	1.245	7154	
NC	Mayo	6250	1A	12319	23408089	1.053	7763		14208	26619431	1.068	8695	
NC	Mayo	6250	1B	11622	22106057	1.051	7718		13351	25020309	1.067	8686	
NC	Roxboro	2712	1	18848	26064042	1.446	8760		17977	24314823	1.479	8326	
NC	Roxboro	2712	2	29904	40744834	1.468	7996		29000	38959753	1.489	8026	
NC	Roxboro	2712	3A	16692	22847103	1.461	8343		17250	22722492	1.518	8359	
NC	Roxboro	2712	3B	16353	22395317	1.460	8308		17166	22608314	1.519	8287	
NC	Roxboro	2712	4A	11370	21469218	1.059	8541		11158	21361340	1.045	8453	
NC	Roxboro	2712	4B	10771	20343164	1.059	8535		10710	20536698	1.043	8350	
NC	W H Weatherspoon	2716	1	1667	2052631	1.624	5409		1668	1975952	1.689	5683	
NC	W H Weatherspoon	2716	2	1896	2318642	1.635	5753		1606	1899517	1.691	5448	
NC	W H Weatherspoon	2716	3	3004	3675889	1.635	6273		2405	2910839	1.653	5407	
NC	All Units			196184					195656				
NC	Progress Clean Smokestacks Act			-					-				

Table 2 - Annual Scrubber Performance Anal

State	Facility Name	ORISPL	Unit	2005					2006					
				SO2 (tons)	Heat Input (MMBtu)	SO2 Rate (lb/MMBtu)	Operating Time	SO2 Control(s)	SO2 (tons)	Heat Input (MMBtu)	SO2 Rate (lb/MMBtu)	CE	Operating Time	SO2 Control(s)
NC	**Asheville**	2706	1	6884	11808150	1.166	8223	Wet Lime FGI	268	13318066	0.040	0.968	8085	Wet Lime FGI
NC	**Asheville**	2706	2	8655	12851955	1.347	8420		2220	11143410	0.398		7231	Wet Lime FGI
NC	Cape Fear	2708	5	5951	8264417	1.440	7636		5667	8135544	1.393		7755	
NC	Cape Fear	2708	6	7678	10881312	1.411	7653		7640	11041675	1.384		7911	
NC	H F Lee	2709	1	2816	4279197	1.316	6928		2537	4016709	1.263		6555	
NC	H F Lee	2709	2	2815	4408397	1.277	6828		2391	3913221	1.222		5974	
NC	H F Lee	2709	3	9372	14382666	1.303	7765		8833	13970082	1.265		7618	
NC	L V Sutton	2713	1	3210	5264842	1.220	7316		2848	4629725	1.230		6792	
NC	L V Sutton	2713	2	3679	6069989	1.212	7399		3211	5203884	1.234		6619	
NC	L V Sutton	2713	3	14257	23010941	1.239	7239		13100	20975938	1.249		7983	
NC	Mayo	6250	1A	14116	26733025	1.056	8524		12931	24549326	1.053		8222	
NC	Mayo	6250	1B	12960	24535628	1.056	8593		11568	21927028	1.055		8014	
NC	Roxboro	2712	1	18807	25377431	1.482	8603		17259	25494527	1.354		8391	
NC	Roxboro	2712	2	28211	37090983	1.521	7292		31760	47033163	1.351		8604	
NC	Roxboro	2712	3A	17121	21334748	1.605	8265		12078	17291517	1.397		7097	
NC	Roxboro	2712	3B	16788	20878869	1.608	8297		12749	18202492	1.401		7314	
NC	Roxboro	2712	4A	10696	21183147	1.010	8428		10894	21029565	1.036		8525	
NC	Roxboro	2712	4B	9821	19447408	1.010	8284		9887	19126308	1.034		8389	
NC	W H Weatherspoon	2716	1	2088	2494808	1.674	6679		1709	2047727	1.669		5520	
NC	W H Weatherspoon	2716	2	2014	2418856	1.665	6303		1763	2120634	1.663		5825	
NC	W H Weatherspoon	2716	3	4102	4931189	1.664	7209		3913	4620806	1.693		6260	
NC	All Units			202041					175226					
NC	Progress Clean Smokestacks Act			-					-					

Table 2 - Annual Scrubber Performance Anal

State	Facility Name	ORISPL	Unit	2007 SO2 (tons)	2007 Heat Input (MMBtu)	2007 SO2 Rate (lb/MMBtu)	2007 CE	2007 Operating Time	2007 SO2 Control(s)	2008 SO2 (tons)	2008 Heat Input (MMBtu)	2008 SO2 Rate (lb/MMBtu)	2008 CE	2008 Operating Time	2008 SO2 Control(s)
NC	**Asheville**	2706	1	241	10910350	0.044	0.965	7170	Wet Lime FG	316	11492388	0.055	0.956	7804	Wet Lime FG
NC	**Asheville**	2706	2	278	12585831	0.044	0.965	7961	Wet Lime FG	286	11098434	0.052	0.960	7892	Wet Lime FG
NC	Cape Fear	2708	5	5463	7973126	1.370		8314		4759	7034551	1.353		8049	
NC	Cape Fear	2708	6	7719	11299176	1.366		8292		6578	9750194	1.349		7827	
NC	H F Lee	2709	1	2921	4312727	1.355		7550		2765	4005289	1.380		6986	
NC	H F Lee	2709	2	3243	4800504	1.351		7805		2769	4027277	1.375		6813	
NC	H F Lee	2709	3	9321	13712263	1.360		7659		5660	8123317	1.393		5047	
NC	L V Sutton	2713	1	3461	5561073	1.245		7945		2792	4191414	1.332		6880	
NC	L V Sutton	2713	2	4251	6805586	1.249		8021		3592	5404098	1.330		7145	
NC	L V Sutton	2713	3	12680	19494051	1.301		6956		13076	19173018	1.364		7939	
NC	Mayo	6250	1A	12168	23322034	1.043		8025		11000	21612577	1.018		8360	
NC	Mayo	6250	1B	10642	20418908	1.042		7976		9072	17804376	1.019		7865	
NC	Roxboro	2712	1	15664	24121657	1.299		8053		13792	20921682	1.318		7649	Wet Lime FG
NC	Roxboro	2712	2	7764	43213181	0.359		7753	Wet Lime FG	863	43344702	0.040		8152	Wet Lime FG
NC	Roxboro	2712	3A	13704	20760506	1.320		8255		4515	20878092	0.432		8117	Wet Limeston
NC	Roxboro	2712	3B	13152	19932931	1.320		8191		4251	20123961	0.423		7750	Wet Limeston
NC	Roxboro	2712	4A	7905	17102147	0.924		7512		531	22914647	0.046		8337	Wet Limeston
NC	Roxboro	2712	4B	7058	15250498	0.926		7503		484	20647333	0.047		8227	Wet Limeston
NC	W H Weatherspoon	2716	1	2297	2844280	1.616		7460		1785	2277953	1.567		6295	
NC	W H Weatherspoon	2716	2	2389	2958126	1.615		7649		1762	2241542	1.572		6126	
NC	W H Weatherspoon	2716	3	4919	5901011	1.667		7741		3573	4499288	1.588		6995	
NC	All Units			147241						94220					
NC	Progress Clean Smokestacks Act			-						-					

Table 2 - Annual Scrubber Performance Anal

State	Facility Name	ORISPL	Unit	2009						2010					
				SO2 (tons)	Heat Input (MMBtu)	SO2 Rate (lb/MMBtu)	CE	Operating Time	SO2 Control(s)	SO2 (tons)	Heat Input (MMBtu)	SO2 Rate (lb/MMBtu)	CE	Operating Time	SO2 Control(s)
NC	**Asheville**	2706	1	760	12102509	0.126	0.900	8536	WFGD	850	12873882	0.132	0.895	8247	WFGD
NC	**Asheville**	2706	2	630	10350507	0.122	0.905	8531	WFGD	1145	11714113	0.195	0.847	8169	WFGD
NC	Cape Fear	2708	5	4534	6660491	1.361		7102		5512	7595445	1.451		7900	
NC	Cape Fear	2708	6	6774	9864372	1.373		7464		7826	11213550	1.396		8049	
NC	H F Lee	2709	1	2231	3179784	1.403		5910		2884	4323412	1.334		7362	
NC	H F Lee	2709	2	2353	3447109	1.365		6051		2902	4455150	1.303		6995	
NC	H F Lee	2709	3	8363	11907758	1.405		7712		9744	14825114	1.315		8395	
NC	L V Sutton	2713	1	2613	3550794	1.472		5879		3388	4902752	1.382		7289	
NC	L V Sutton	2713	2	3307	4491372	1.473		6854		3579	5154616	1.389		6769	
NC	L V Sutton	2713	3	12027	16283839	1.477		7557		11861	16806163	1.412		6845	
NC	Mayo	6250	1A	3106	22034667	0.282		7521	WFGD (Bega	2772	26442797	0.210	0.802	8177	WFGD
NC	Mayo	6250	1B	2825	19864642	0.284		7583	WFGD (Bega	2597	24569147	0.211	0.800	8252	WFGD
NC	Roxboro	2712	1	1530	25316586	0.121		8449	WFGD	2140	26707158	0.160	0.890	8290	WFGD
NC	Roxboro	2712	2	3161	43432597	0.146	0.902	7788	WFGD	3071	38583729	0.159	0.892	6776	WFGD
NC	Roxboro	2712	3A	1235	20178902	0.122		8171	Wlime	2106	24937285	0.169	0.887	8539	Wlime
NC	Roxboro	2712	3B	1217	19741105	0.123		8013	Wlime	2095	24858622	0.169	0.887	8336	Wlime
NC	Roxboro	2712	4A	1259	20223248	0.125		8163	Wlime	1369	20419133	0.134	0.873	8085	Wlime
NC	Roxboro	2712	4B	1228	19702117	0.125		8274	Wlime	1333	20185047	0.132	0.874	8328	Wlime
NC	W H Weatherspoon	2716	1	659	768167	1.717		2389		1687	2048268	1.647		5641	
NC	W H Weatherspoon	2716	2	741	872048	1.699		2814		1553	1883791	1.649		5206	
NC	W H Weatherspoon	2716	3	1703	1973343	1.726		3972		3334	4057598	1.643		6575	
NC	All Units			62256						73748					
NC	Progress Clean Smokestacks Act			100000						100000					

Table 2 - Annual Scrubber Performance Anal

State	Facility Name	ORISPL	Unit	2011						2012					
				SO2 (tons)	Heat Input (MMBtu)	SO2 Rate (lb/MMBtu)	CE	Operating Time	SO2 Control(s)	SO2 (tons)	Heat Input (MMBtu)	SO2 Rate (lb/MMBtu)	CE	Operating Time	SO2 Control(s)
NC	**Asheville**	2706	1	1039	9794819	0.212	0.831	8263	WFGD	680	9132710	0.149	0.881	7591	WFGD
NC	**Asheville**	2706	2	1203	8443064	0.285	0.777	7825	WFGD	1132	10267129	0.221	0.827	8180	WFGD
NC	Cape Fear	2708	5	3415	4571872	1.494		5220		1169					
NC	Cape Fear	2708	6	4688	6486071	1.446		5090		2129					
NC	H F Lee	2709	1	1545	2160045	1.430		3746		744					
NC	H F Lee	2709	2	1015	1437249	1.413		2505		59					
NC	H F Lee	2709	3	7047	9891672	1.425		6004		5124					
NC	L V Sutton	2713	1	2048	2929725	1.398		4470		1332					
NC	L V Sutton	2713	2	2083	2894416	1.439		3984		1244					
NC	L V Sutton	2713	3	8850	12231066	1.447		6241		7755					
NC	Mayo	6250	1A	4053	21005427	0.386	0.636	7396	WFGD	6061					
NC	Mayo	6250	1B	3182	17264087	0.369	0.652	6851	WFGD						
NC	Roxboro	2712	1	1650	17404385	0.190	0.870	6630	WFGD	1980					
NC	Roxboro	2712	2	1864	24020328	0.155	0.895	5622	WFGD	4026					
NC	Roxboro	2712	3A	1383	19361707	0.143	0.904	7659	Wlime	3347					
NC	Roxboro	2712	3B	1336	18107500	0.148	0.901	7300	Wlime						
NC	Roxboro	2712	4A	1610	21159626	0.152	0.855	8431	Wlime	4019					
NC	Roxboro	2712	4B	1491	19364788	0.154	0.853	8292	Wlime						
NC	W H Weatherspoon	2716	1	226	279770	1.615		738							
NC	W H Weatherspoon	2716	2	545	700042	1.558		2211							
NC	W H Weatherspoon	2716	3	1143	1450189	1.576		2737							
NC	All Units			51416						40801					
NC	Progress Clean Smokestacks Act			100000						100000					

Table 2 - Annual Scrubber Performance Anal

State	Facility Name	ORISPL	Unit	2013						2014 (Through June)					
				SO2 (tons)	Heat Input (MMBtu)	SO2 Rate (lb/MMBtu)	CE	Operating Time	SO2 Control(s)	SO2 (tons)	Heat Input (MMBtu)	SO2 Rate (lb/MMBtu)	CE	Operating Time	SO2 Control(s)
NC	**Asheville**	2706	1	276	6249326	0.088	0.929	5953	WFGD	388	5142369	0.151	0.880	4087	WFGD
NC	**Asheville**	2706	2	542	8277515	0.131	0.898	8196	WFGD	304	3611032	0.168	0.868	2875	WFGD
NC	Cape Fear	2708	5												
NC	Cape Fear	2708	6												
NC	H F Lee	2709	1												
NC	H F Lee	2709	2												
NC	H F Lee	2709	3												
NC	L V Sutton	2713	1	1308											
NC	L V Sutton	2713	2	986											
NC	L V Sutton	2713	3	8187											
NC	Mayo	6250	1A	4570											
NC	Mayo	6250	1B												
NC	Roxboro	2712	1	2013											
NC	Roxboro	2712	2	4457											
NC	Roxboro	2712	3A	2968											
NC	Roxboro	2712	3B												
NC	Roxboro	2712	4A	3204											
NC	Roxboro	2712	4B												
NC	W H Weatherspoon	2716	1												
NC	W H Weatherspoon	2716	2												
NC	W H Weatherspoon	2716	3												
NC	All Units			28511											
NC	Progress Clean Smokestacks Act			50000											

Table 2 - Annual Scrubber Performance Anal

State	Facility Name	ORISPL	Unit	2014 Projection [from 2012 Plan]						
				Projected SO2 (tons/yr)	SO2 Rate w/2003 HI	CE 2013/2003	SO2 Rate w/2004 HI	CE 2013/2004	SO2 Rate w/2005 HI	CE 2013/2005
NC	**Asheville**	2706	1	578	0.087	0.930	0.108	0.914	0.098	0.916
NC	**Asheville**	2706	2	868	0.141	0.889	0.148	0.885	0.135	0.900
NC	Cape Fear	2708	5							
NC	Cape Fear	2708	6							
NC	H F Lee	2709	1							
NC	H F Lee	2709	2	18						
NC	H F Lee	2709	3	168						
NC	L V Sutton	2713	1							
NC	L V Sutton	2713	2							
NC	L V Sutton	2713	3							
NC	Mayo	6250	1A	3949	0.337	0.679	0.297	0.722	0.295	0.720
NC	Mayo	6250	1B							
NC	Roxboro	2712	1	542	0.042	0.971	0.045	0.970	0.043	0.971
NC	Roxboro	2712	2	3209	0.158	0.893	0.165	0.889	0.173	0.886
NC	Roxboro	2712	3A	1651	0.145	0.901	0.145	0.904	0.155	0.904
NC	Roxboro	2712	3B							
NC	Roxboro	2712	4A	2031	0.189	0.821	0.190	0.818	0.192	0.810
NC	Roxboro	2712	4B							
NC	W H Weatherspoon	2716	1							
NC	W H Weatherspoon	2716	2							
NC	W H Weatherspoon	2716	3							
NC	All Units			13014						
NC	Progress Clean Smokestacks Act			50000						

Table 3 - Monthly Scrubber Operation Analysis

Mon-Year	Asheville Unit 1													
	EIA-923	EIA-923	EIA-923	EIA-923	Calculation	Calculation	AMPD	AMPD	Calculation	AMPD	AMPD	Calculation	Calculation	Calculation
	Coal (tons)	HV (MMBtu/ton)	%S	%Ash	HI (MMBtu/mo)	SO2 In (lb/MMBtu)	SO2 (tons)	Heat Input (MMBtu)	HI Comp	Operating Time	Gross Load (MW-h)	Av. MW	SO2 Out (lb/MMbtu)	Scrubber Eff.
Jan-09	57,009	24.400	1.00	13.3	1,391,020	1.64	106.2	1,237,717	12%	744	132830	178.5	0.172	0.895
Feb-09	44,850	25.100	0.90	10.6	1,125,735	1.43	67.5	1,000,051	13%	672	108574	161.6	0.135	0.906
Mar-09	47,021	24.800	1.00	11.3	1,166,121	1.61	69.4	1,089,118	7%	744	117160	157.5	0.127	0.921
Apr-09	44,488	25.000	0.90	11.7	1,112,200	1.44	52.3	1,070,429	4%	720	116623	162.0	0.098	0.932
May-09	37,885	24.700	0.90	11.9	935,760	1.46	49.3	889,671	5%	657.75	96377.25	146.5	0.111	0.924
Jun-09	42,632	24.700	1.00	11.9	1,053,010	1.62	85.4	995,001	6%	719.75	107564.25	149.4	0.172	0.894
Jul-09	44,726	24.700	1.00	11.8	1,104,732	1.62	71.5	1,044,102	6%	744	111754	150.2	0.137	0.915
Aug-09	42,933	24.800	0.70	11.2	1,064,738	1.13	37.9	1,024,588	4%	739.75	108160	146.2	0.074	0.934
Sep-09	37,944	25.000	1.00	10.3	948,600	1.60	48.7	902,061	5%	720	96424	133.9	0.108	0.933
Oct-09	33,921	24.800	1.00	11.5	841,241	1.61	39.3	804,001	5%	658	84867	129.0	0.098	0.939
Nov-09	40,364	25.000	0.90	11.4	1,009,100	1.44	57.7	974,862	4%	720	102953	143.0	0.118	0.918
Dec-09	46,658	24.500	1.00	12.0	1,143,121	1.63	74.7	1,070,910	7%	696.75	117916	169.2	0.140	0.915
Jan-10	47,643	24.000	1.05	11.9	1,143,432	1.75	78.7	1,083,510	6%	700	118252	168.9	0.145	0.917
Feb-10	44,570	24.700	1.13	10.3	1,100,879	1.83	66.8	1,052,688	5%	672	114107	169.8	0.127	0.931
Mar-10	45,282	24.500	1.17	12.7	1,109,409	1.91	53.0	1,022,160	9%	675.75	109749.5	162.4	0.104	0.946
Apr-10	52,688	24.400	1.10	11.6	1,285,587	1.80	39.9	1,203,130	7%	720	130823	181.7	0.066	0.963
May-10	51,744	24.100	1.00	13.0	1,247,030	1.66	26.4	1,169,411	7%	743.5	125358	168.6	0.045	0.973
Jun-10	48,863	24.000	1.37	14.2	1,172,712	2.28	66.7	1,141,098	3%	662.75	121635	183.5	0.117	0.949
Jul-10	48,026	24.500	1.11	13.2	1,176,637	1.81	23.2	1,124,359	5%	744	117205	157.5	0.041	0.977
Aug-10	46,230	23.600	1.58	15.8	1,091,028	2.68	74.2	1,039,849	5%	706	110339	156.3	0.143	0.947
Sep-10	38,873	23.700	1.57	14.3	921,290	2.65	91.9	886,586	4%	562.25	94830	168.7	0.207	0.922
Oct-10	39,488	23.900	1.44	14.7	943,763	2.41	163.0	898,342	5%	688	94887.5	137.9	0.363	0.849
Nov-10	43,265	23.900	1.42	14.7	1,034,034	2.38	73.7	999,335	3%	662.5	105885	159.8	0.148	0.938
Dec-10	54,504	23.700	1.30	14.9	1,291,745	2.19	92.4	1,253,413	3%	710	133412.25	187.9	0.147	0.933
Jan-11	53,492	24.300	1.18	12.1	1,299,856	1.94	108.5	1,229,132	6%	744	132656	178.3	0.177	0.909
Feb-11	38,344	25.100	1.32	10.8	962,434	2.10	113.1	891,069	8%	672	94684	140.9	0.254	0.879
Mar-11	38,575	24.000	1.32	12.6	925,800	2.20	112.1	868,598	7%	744	90678	121.9	0.258	0.883
Apr-11	25,595	24.000	1.49	13.7	614,280	2.48	86.1	568,890	8%	520.5	58946.5	113.2	0.303	0.878
May-11	28,256	24.300	1.20	13.7	686,621	1.98	96.3	609,943	13%	532.25	65131	122.4	0.316	0.840
Jun-11	36,240	23.900	1.46	14.2	866,136	2.44	141.0	810,657	7%	672.75	86455.25	128.5	0.348	0.858
Jul-11	43,885	24.600	1.31	12.7	1,079,571	2.13	140.0	961,895	12%	744	103750	139.4	0.291	0.863
Aug-11	41,324	24.400	1.16	12.2	1,008,306	1.90	44.3	930,928	8%	744	98730	132.7	0.095	0.950
Sep-11	36,464	25.000	1.32	12.0	911,600	2.11	42.7	817,632	11%	720	87308	121.3	0.105	0.950
Oct-11	30,923	24.700	2.47	10.1	763,798	4.00	60.1	676,543	13%	744	72025	96.8	0.178	0.956
Nov-11	34,432	24.500	2.63	9.7	843,584	4.29	43.0	755,674	12%	720	82578	114.7	0.114	0.973
Dec-11	30,257	24.800	2.70	8.8	750,374	4.35	51.9	673,858	11%	705.75	71816	101.8	0.154	0.965
Jan-12	747	24.800	1.56	10.4	18,526	2.52	3	33678	-45%	95	3007	31.7	0.156	0.938
Feb-12	24,168	25.100	1.57	10.5	606,617	2.50	53	533884	14%	462	58913	127.5	0.198	0.921
Mar-12	47,617	25.800	2.83	8.5	1,228,519	4.39	116	1080738	14%	736	119932	162.9	0.214	0.951
Apr-12	37,194	24.900	1.70	10.4	926,131	2.73	111	863673	7%	647	95751	148.1	0.257	0.906
May-12	44,561	25.300	2.69	8.8	1,127,393	4.25	119	1061594	6%	744	114305	153.6	0.223	0.948

Jun-12	37,011	25.500	2.36	9.3	943,781	3.70	41	897558	5%	720	94578	131.4	0.092	0.975
Jul-12	45,154	25.800	2.76	8.6	1,164,973	4.28	51	1064749	9%	744	115450	155.2	0.095	0.978
Aug-12	34,582	25.200	2.18	9.5	871,466	3.46	39	802944	9%	744	86024	115.6	0.096	0.972
Sep-12	23,563	24.700	1.53	10.9	582,006	2.48	31	555470	5%	597	59720	100.1	0.111	0.955
Oct-12	29,500	25.500	3.21	8.0	752,250	5.04	33	671649	12%	744	72284	97.2	0.100	0.980
Nov-12	36,795	25.500	3.27	8.2	938,273	5.13	49	875327	7%	720	93902	130.4	0.111	0.978
Dec-12	29,759	25.200	2.85	9.3	749,927	4.52	36	691447	8%	638	72337	113.4	0.105	0.977
Jan-13	31,971	25.700	3.09	7.9	821,655	4.81	40	757632	8%	744	78467	105.5	0.105	0.978
Feb-13	29,589	25.400	2.24	9.0	751,561	3.53	23	680224	10%	672	71231	106.0	0.067	0.981
Mar-13	31,993	25.300	1.03	10.6	809,423	1.63	34	776023	4%	687	82175	119.6	0.088	0.946
Apr-13	14,481	26.000	1.64	8.0	376,506	2.52	11	341080	10%	290	35856	123.5	0.065	0.974
May-13	0	0.000	0.00	0.0	-					0				
Jun-13	0	0.000	0.00	0.0	-		0	1888		53	0	0.0	0.070	
Jul-13	9,269	25.300	2.92	9.1	234,506	4.62	16	237347	-1%	315	24289	77.1	0.137	0.970
Aug-13	30,351	24.900	1.71	10.4	755,740	2.75	37	706957	7%	676	74883	110.8	0.104	0.962
Sep-13	20,538	25.000	1.82	9.9	513,450	2.91	22	484530	6%	478	50914	106.5	0.089	0.969
Oct-13	24,133	24.900	2.55	10.0	600,912	4.10	29	573934	5%	588	60511	102.9	0.100	0.976
Nov-13	34,815	25.300	1.95	10.5	880,820	3.08	36	844743	4%	705	90446	128.3	0.086	0.972
Dec-13	35,131	25.300	1.78	10.0	888,814	2.81	29	844967	5%	744	89437	120.2	0.068	0.976
Jan-14	39,669	24.600	2.28	9.3	975,857	3.71	74	948464	3%	689	102277	148.4	0.156	0.958
Feb-14	29,755	25.000	2.01	9.0	743,875	3.22	51	720730	3%	552	76977	139.4	0.142	0.956
Mar-14	37,341	24.900	1.95	9.5	929,791	3.13	69	936841	-1%	662	99518	150.3	0.148	0.953
Apr-14	36,505	25.100	2.48	9.9	916,276	3.95	65	905237	1%	720	95988	133.3	0.145	0.963
May-14	33,171	25.300	2.72	9.0	839,226	4.30	54	794895	6%	744	85326	114.7	0.137	0.968
Jun-14	34,511	25.500	3.20	8.2	880,031	5.02	73	836201	5%	720	89215	123.9	0.176	0.965

Table 3 - Monthly Scrubber Operation Analysis

Mon-Year	Asheville Unit 2													
	EIA-923	EIA-923	EIA-923	EIA-923	Calculation	Calculation	AMPD	AMPD	Calculation	AMPD	AMPD	Calculation	Calculation	Calculation
	Coal (tons)	HV (MMBtu/ton)	%S	%Ash	HI (MMBtu/mo)	SO2 In (lb/MMBtu)	SO2 (tons)	Heat Input (MMBtu)	HI Comp	Operating Time	Gross Load (MW-h)	Av. MW	SO2 Out (lb/MMbtu)	Scrubber Eff.
Jan-09	50,048	24.400	1.00	13.3	1,221,171	1.64	87.935	1,129,841	8%	741	117901.25	159.1	0.156	0.905
Feb-09	34,307	25.100	0.90	10.6	861,106	1.43	44.535	802,959	7%	604.5	83964.25	138.9	0.111	0.923
Mar-09	41,503	24.800	1.00	5.9	1,029,274	1.61	38.249	992,270	4%	744	104185	140.0	0.077	0.952
Apr-09	32,396	25.000	0.90	11.7	809,900	1.44	20.072	835,667	-3%	720	86457	120.1	0.048	0.967
May-09	32,787	24.700	0.90	11.9	809,839	1.46	36.915	810,705	0%	674.5	82798	122.8	0.091	0.938
Jun-09	35,477	24.700	1.10	11.9	876,282	1.78	66.407	876,199	0%	720	89522	124.3	0.152	0.915
Jul-09	34,728	24.700	1.00	11.8	857,782	1.62	63.115	842,857	2%	743.75	86832	116.7	0.150	0.908
Aug-09	36,147	24.800	0.70	11.2	896,446	1.13	46.162	879,178	2%	744	90720	121.9	0.105	0.907
Sep-09	30,141	25.000	1.00	10.3	753,525	1.60	69.189	733,422	3%	711.75	76414.25	107.4	0.189	0.882
Oct-09	26,025	24.800	1.00	11.5	645,420	1.61	36.203	634,888	2%	663	65212	98.4	0.114	0.929
Nov-09	30,343	25.000	0.90	11.4	758,575	1.44	44.346	749,642	1%	720	76810	106.7	0.118	0.918
Dec-09	44,876	24.500	1.00	12.0	1,099,462	1.63	76.963	1,062,881	3%	744	112533	151.3	0.145	0.911
Jan-10	45,468	24.000	1.05	11.9	1,091,232	1.75	94.247	1,073,783	2%	743	112623.25	151.6	0.176	0.900
Feb-10	40,599	24.700	1.13	10.3	1,002,795	1.83	54.024	983,822	2%	672	103090	153.4	0.110	0.940
Mar-10	44,672	24.500	1.17	12.7	1,094,464	1.91	50.877	1,023,002	7%	744	108269	145.5	0.099	0.948
Apr-10	36,767	24.400	1.10	11.6	897,115	1.80	37.319	860,801	4%	544.25	90884.5	167.0	0.087	0.952
May-10	33,187	24.100	1.00	13.0	799,807	1.66	97.678	786,023	2%	552.75	79639	144.1	0.249	0.850
Jun-10	48,970	24.000	1.37	14.2	1,175,280	2.28	167.07	1,078,546	9%	657.25	116348.5	177.0	0.310	0.864
Jul-10	46,167	24.500	1.11	13.2	1,131,092	1.81	65.773	1,053,917	7%	744	112707	151.5	0.125	0.931
Aug-10	46,428	23.600	1.58	15.8	1,095,701	2.68	139.024	1,067,149	3%	744	111177	149.4	0.261	0.903
Sep-10	44,577	23.700	1.57	14.3	1,056,475	2.65	120.602	1,030,457	3%	720	108491	150.7	0.234	0.912
Oct-10	36,462	23.900	1.44	14.7	871,442	2.41	108.086	833,205	5%	695.5	86816.5	124.8	0.259	0.892
Nov-10	39,807	23.900	1.42	14.7	951,387	2.38	92.92	864,560	10%	681	96352.5	141.5	0.215	0.910
Dec-10	50,771	23.700	1.30	14.9	1,203,273	2.19	116.932	1,058,847	14%	671.5	122412.75	182.3	0.221	0.899
Jan-11	49,536	24.300	1.18	12.1	1,203,725	1.94	131.329	1,040,428	16%	743.5	120802.25	162.5	0.252	0.870
Feb-11	32,777	25.100	1.32	10.8	822,703	2.10	116.61	742,357	11%	672	79837	118.8	0.314	0.851
Mar-11	32,964	24.000	1.32	12.6	791,136	2.20	129.063	711,786	11%	744	76577	102.9	0.363	0.835
Apr-11	24,094	24.100	1.32	13.4	580,665	2.19	75.885	534,119	9%	607.5	55488.25	91.3	0.284	0.870
May-11	35,782	24.200	1.11	13.5	865,924	1.83	112.37	808,936	7%	744	86962	116.9	0.278	0.849
Jun-11	37,517	23.900	1.45	14.2	896,656	2.43	145.496	810,663	11%	720	87808	122.0	0.359	0.852
Jul-11	41,098	24.600	1.31	12.6	1,011,011	2.13	163.934	879,476	15%	744	95010	127.7	0.373	0.825
Aug-11	38,757	24.400	1.17	12.2	945,671	1.92	46.803	895,543	6%	744	91110	122.5	0.105	0.946
Sep-11	10,507	25.300	1.10	11.5	265,827	1.74	7.978	250,532	6%	217.25	25794	118.7	0.064	0.963
Oct-11	15,957	24.600	3.01	8.4	392,542	4.89	57.394	369,385	6%	426	37618.5	88.3	0.311	0.937
Nov-11	30,042	24.500	2.61	9.8	736,029	4.26	112.1	710,578	4%	719	71766	99.8	0.316	0.926
Dec-11	29,213	24.800	2.72	8.8	724,482	4.39	103.56	689,258	5%	744	69169	93.0	0.300	0.932
Jan-12	38,128	25.100	2.50	8.9	957,013	3.98	343	887405	8%	744	91493	123.0	0.773	0.806
Feb-12	35,899	25.200	1.57	10.6	904,655	2.49	145	853824	6%	692	88045	127.3	0.339	0.864
Mar-12	47,627	25.800	2.85	8.5	1,228,777	4.42	112	1148960	7%	744	117498	157.9	0.195	0.956
Apr-12	46,124	24.900	1.84	10.2	1,148,488	2.96	122	1118997	3%	720	114337	158.9	0.219	0.926
May-12	48,037	25.300	2.67	8.8	1,215,336	4.22	107	1148173	6%	744	119485	160.6	0.187	0.956

Jun-12	38,526	25.500	2.37	9.2	982,413	3.72	43	923068	6%	720	95107	132.1	0.093	0.975
Jul-12	45,122	25.800	2.76	8.6	1,164,148	4.28	54	1079917	8%	744	113154	152.1	0.101	0.977
Aug-12	31,386	25.300	2.14	9.5	794,066	3.38	43	773195	3%	744	77121	103.7	0.112	0.967
Sep-12	19,670	24.900	2.31	9.6	489,783	3.71	35	479033	2%	536	46321	86.3	0.147	0.960
Oct-12	13,276	25.400	3.38	8.0	337,210	5.32	28	329006	2%	389	32028	82.3	0.169	0.968
Nov-12	31,236	25.500	3.27	8.2	796,518	5.13	54	788164	1%	658	79169	120.2	0.136	0.973
Dec-12	30,023	25.200	2.96	9.2	756,580	4.70	45	737387	3%	744	73291	98.5	0.122	0.974
Jan-13	25,032	25.800	3.13	7.9	645,826	4.85	46	615323	5%	677	61400	90.7	0.150	0.969
Feb-13	24,046	25.400	2.18	9.1	610,768	3.43	27	580186	5%	672	57847	86.1	0.092	0.973
Mar-13	31,007	25.300	1.02	10.7	784,477	1.61	36	770917	2%	744	76582	102.9	0.092	0.943
Apr-13	28,148	25.900	1.83	8.2	729,033	2.83	34	699795	4%	643	70313	109.3	0.098	0.965
May-13	30,130	25.500	2.25	8.8	768,315	3.53	54	715082	7%	744	71595	96.2	0.150	0.958
Jun-13	32,247	25.200	2.22	10.8	812,624	3.52	59	779169	4%	720	78588	109.2	0.151	0.957
Jul-13	36,739	25.300	2.92	9.1	929,497	4.62	68	872598	7%	744	86252	115.9	0.156	0.966
Aug-13	31,619	24.900	1.84	10.3	787,313	2.96	56	768966	2%	744	75465	101.4	0.146	0.951
Sep-13	27,800	25.000	1.77	10.3	695,000	2.83	49	660712	5%	720	63876	88.7	0.150	0.947
Oct-13	26,202	24.900	2.64	10.1	652,430	4.24	58	676481	-4%	696	66550	95.7	0.171	0.960
Nov-13	14,280	25.400	1.89	10.1	362,712	2.98	23	367506	-1%	348	36560	105.0	0.124	0.958
Dec-13	31,302	25.300	1.77	10.0	791,941	2.80	33	770779	3%	744	77600	104.3	0.086	0.969
Jan-14	40,891	24.600	2.25	9.4	1,005,919	3.66	78	963580	4%	744	102087	137.2	0.162	0.956
Feb-14	33,711	25.000	2.07	9.0	842,775	3.31	67	811680	4%	672	84076	125.1	0.165	0.950
Mar-14	41,091	24.900	1.94	9.5	1,023,166	3.12	84	1022341	0%	744	104550	140.5	0.164	0.947
Apr-14	5,083	25.100	3.13	8.8	127,583	4.99	12	145200	-12%	95	14662	154.0	0.160	0.968
May-14	0	0.000	0.00	0.0	-		0	1387	-100%	16	0	0.0	0.000	
Jun-14	26,305	25.400	3.20	8.2	668,147	5.04	63	666844	0%	604	67848	112.3	0.190	0.962

Table 4 - Asheville Unit 1 Monthly Reported SO2 Emission Rates [1]	
Mon-Yr	Unit 1 SO2 Rate (lb/MMBtu)
December-05	0.156
January-06	0.083
February-06	0.034
March-06	0.052
April-06	0.025
May-06	0.02
June-06	0.024
July-06	0.02
August-06	0.026
September-06	0.045
October-06	0.059
November-06	0.047
December-06	0.046
January-07	0.052
February-07	0.063
March-07	0.042
April-07	
May-07	0.022
June-07	0.028
July-07	0.045
August-07	0.041
September-07	0.057
October-07	0.046
November-07	0.035
December-07	0.044
January-08	0.038
February-08	0.049
March-08	0.044
April-08	0.072
May-08	0.057
June-08	0.062
July-08	0.058
August-08	0.05
September-08	0.049
October-08	0.043
November-08	0.047
December-08	0.086
January-09	0.172
February-09	0.135
March-09	0.127
April-09	0.098
May-09	0.111
June-09	0.172
July-09	0.137

Table 4 - Asheville Unit 1 Monthly Reported SO2 Emission Rates [1]	
Mon-Yr	Unit 1 SO2 Rate (lb/MMBtu)
August-09	0.074
September-09	0.108
October-09	0.098
November-09	0.118
December-09	0.14
January-10	0.145
February-10	0.127
March-10	0.104
April-10	0.066
May-10	0.045
June-10	0.117
July-10	0.041
August-10	0.143
September-10	0.207
October-10	0.363
November-10	0.148
December-10	0.147
January-11	0.177
February-11	0.254
March-11	0.258
April-11	0.303
May-11	0.316
June-11	0.348
July-11	0.291
August-11	0.095
September-11	0.105
October-11	0.178
November-11	0.114
December-11	0.154
January-12	0.156
February-12	0.198
March-12	0.214
April-12	0.257
May-12	0.223
June-12	0.092
July-12	0.095
August-12	0.096
September-12	0.111
October-12	0.1
November-12	0.111
December-12	0.105
January-13	0.105
February-13	0.067
March-13	0.088

Table 4 - Asheville Unit 1 Monthly Reported SO2 Emission Rates [1]	
Mon-Yr	Unit 1 SO2 Rate (lb/MMBtu)
April-13	0.065
May-13	
June-13	0.07
July-13	0.137
August-13	0.104
September-13	0.089
October-13	0.1
November-13	0.086
December-13	0.068
January-14	0.156
February-14	0.142
March-14	0.148
April-14	0.145
May-14	0.137
June-14	0.176

[1] Blank indicates that the Unit was not operating that month.

Table 5 - Asheville Unit 2 Monthly Reported SO2 Emission Rates [1]	
Yr-Mon	Unit 2 SO2 Rate (lb/MMBtu)
June-06	0.02
July-06	0.022
August-06	0.019
September-06	0.029
October-06	0.043
November-06	0.052
December-06	0.048
January-07	0.032
February-07	0.038
March-07	0.049
April-07	0.055
May-07	0.044
June-07	0.04
July-07	0.043
August-07	0.041
September-07	0.063
October-07	0.043
November-07	0.04
December-07	0.041
January-08	0.042
February-08	0.051
March-08	0.047
April-08	0.06
May-08	0.041
June-08	0.058
July-08	0.052
August-08	0.046
September-08	0.046
October-08	0.053
November-08	0.058
December-08	0.06
January-09	0.156
February-09	0.111
March-09	0.077
April-09	0.048
May-09	0.091
June-09	0.152
July-09	0.15
August-09	0.105
September-09	0.189
October-09	0.114
November-09	0.118
December-09	0.145
January-10	0.176

Table 5 - Asheville Unit 2 Monthly Reported SO2 Emission Rates [1]	
Yr-Mon	Unit 2 SO2 Rate (lb/MMBtu)
February-10	0.11
March-10	0.099
April-10	0.087
May-10	0.249
June-10	0.31
July-10	0.125
August-10	0.261
September-10	0.234
October-10	0.259
November-10	0.215
December-10	0.221
January-11	0.252
February-11	0.314
March-11	0.363
April-11	0.284
May-11	0.278
June-11	0.359
July-11	0.373
August-11	0.105
September-11	0.064
October-11	0.311
November-11	0.316
December-11	0.3
January-12	0.773
February-12	0.339
March-12	0.195
April-12	0.219
May-12	0.187
June-12	0.093
July-12	0.101
August-12	0.112
September-12	0.147
October-12	0.169
November-12	0.136
December-12	0.122
January-13	0.15
February-13	0.092
March-13	0.092
April-13	0.098
May-13	0.15
June-13	0.151
July-13	0.156
August-13	0.146
September-13	0.15

Table 5 - Asheville Unit 2 Monthly Reported SO2 Emission Rates [1]	
Yr-Mon	Unit 2 SO2 Rate (lb/MMBtu)
October-13	0.171
November-13	0.124
December-13	0.086
January-14	0.162
February-14	0.165
March-14	0.164
April-14	0.16
May-14	
June-14	0.19

[1] Blank indicates that the Unit was not operating that month.