NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date:

Region: Washington Regional Office
County: Wayne
NC Facility ID: 9600017
Inspector's Name: Robert Bright
Date of Last Inspection: 02/22/2017
Compliance Code: 3 / Compliance - inspection

Facility Data

Applicant (Facility's Name): Duke Energy Progress, LLC - H.F. Lee Steam Electric Plant

Facility Address:
Duke Energy Progress, LLC - H.F. Lee Steam Electric Plant
1199 Black Jack Church Road
Goldsboro, NC 27530

SIC: 4911 / Electric Services
NAICS: 221112 / Fossil Fuel Electric Power Generation

Facility Classification: Before: Title V **After:** Title V
Fee Classification: Before: Title V **After:** Title V

Permit Applicability (this application only)

SIP: 15A NCAC 02D .0515, .0516, .0521, .0540
NSPS: NA
NESHAP: NA
PSD: NA
PSD Avoidance: 15A NCAC 02Q .0317
NC Toxics: 15A NCAC 02D .1100
112(r): NA
Other: NA

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Mike Graham Sr. EHS Professional (919) 722-6551 1199 Black Jack Church Road Goldsboro, NC 27530	Jeffery Hines General Manager II (919) 722-6450 H.F. Lee Steam Electric Plant Goldsboro, NC 27530	Erin Wallace Sr. Environmental Specialist (919) 546-5797 410 South Wilmington Street Raleigh, NC 27601

Application Data

Application Number: 9600017.17A
Date Received: 11/13/2017
Application Type: Modification
Application Schedule: TV-Sign-501(c)(2) Part I

Existing Permit Data

Existing Permit Number: 01812/T42
Existing Permit Issue Date: 09/08/2016
Existing Permit Expiration Date: 06/30/2020

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP
2016	15.59	1060.46	35.69	223.78	159.34	6.30	4.25 [Formaldehyde]
2015	17.62	1156.11	25.61	271.41	158.83	5.31	3.32 [Formaldehyde]
2014	17.10	1029.78	12.85	529.22	136.88	3.54	2.15 [Formaldehyde]
2013	14.59	1019.21	11.70	144.08	146.77	3.47	2.30 [Formaldehyde]
2012	5931.08	1717.47	49.52	330.21	220.14	350.00	318.79 [Hydrogen chloride (hydrochlori]

Review Engineer: Ed Martin

Review Engineer's Signature: **Date:** 06/08/2018

DRAFT for PUBLIC NOTICE

Comments / Recommendations:
Issue 01812/T43
Permit Issue Date:
Permit Expiration Date:

Chronology

November 13, 2017	Application received.
June 10, 2015	In a letter to Mr. Jim Clayton with The SEFA Group, in response to their request, the Division of Air Quality (DAQ) made a determination of regulatory status, with respect to 40 CFR 241 "Solid Wastes Used as Fuels or Ingredients in Combustion Units," that flyash received directly from a coal-fired power plant's particulate collection device (i.e., electrostatic precipitator or baghouse), and flyash received from landfills and ash ponds to be used in the STAR® reactor is a “non-hazardous secondary material” (NHSM), is an "ingredient," meets the legitimacy criteria, and is not a solid waste. Therefore, the STAR® reactor is not subject to the Commercial and Industrial Solid Waste Incineration (CISWI) requirements in 40 CFR 60 Subpart CCCC "Standards of Performance for Commercial and Industrial Solid Waste Incineration Units" or, Subpart DDDD "Emissions Guidelines and Compliance Times for Commercial and Industrial Solid Waste Incineration Units." (see Section VII.A.2, under Non-applicable Regulations)
December 18, 2017	A letter was sent to Jeffery D. Hines (facility RO) at Duke informing them that the STAR® modification emissions cannot be included under the existing Prevention of Significant Deterioration (PSD) avoidance limits since those limits were for an unrelated project, and therefore those emissions must be analyzed separately with respect to the applicability of PSD. This additional information on PSD applicability is needed in order to determine that the application is complete for further processing. The letter also informs Duke that the draft CAM Plan, as submitted with the application, is not necessary at this time since a construction permit is to be issued initially, with the Part 70 Title V permit application to be filed within 12 months after commencing operation in accordance with 02D .0501(c)(2). (see Section VII.A.3, under Non-applicable Regulations)
January 5, 2018	Meeting with Duke (William Willets, Cyndi Winston, Erin Wallace and Ed Martin) to discuss DAQ’s request in the December 18, 2017 letter (item 1) for more information regarding PSD applicability. Duke presented their reasoning why they believed the project emissions should be included under the existing PSD avoidance limits. Duke was to provide additional information for DAQ’s review.
February 1, 2018	In an email, Duke was asked to complete 1-hour NO_2 and SO_2 NAAQS modeling, as internal DAQ discussions indicated this was needed to be consistent with the Buck STAR® application.
February 5, 2018	Conference call (William Willets, Mark Cuilla, Booker Pullen, Cyndi Winston, Erin Wallace and Ed Martin) with Duke to discuss Duke’s proposed reasoning to include the project emissions under the existing PSD avoidance limits. DAQ asked Duke to provide their

	reasoning in a letter. Also, Duke mentioned there may be differences between the Buck and Lee projects regarding whether it was necessary to conduct 1-hour NO_2 and SO_2 NAAQS modeling for Lee.
February 13, 2018	DAQ internal meeting (William Willets, Tom Anderson, Matt Porter and Ed Martin) to discuss how the Buck 1-hour NO_2 and SO_2 NAAQS modeling was conducted and whether this modeling may be needed for Lee. DAQ's decision depended on receipt of Duke's additional information regarding whether the project emissions can be included under the existing PSD avoidance limits.
February 19, 2018	A letter (dated February 7, 2018) was received from Duke with additional information explaining their rationale that the STAR® project should be considered part of the same project that retired the coal-fired boilers and installed the three new combined cycle turbines and to therefore include the STAR® project emissions under the existing PSD avoidance limits.
February 20, 2018	After reviewing Duke's rationale in their February 7, 2018 letter that the STAR® ash beneficiation project should be considered as part of the same project that retired the three coal-fired boilers and installed the three new combined cycle turbines, Duke was informed that DAQ agreed and that the STAR project emissions can be included under the existing PSD avoidance limits. Also, as a result, the 1-hour SO_2 and NO_2 NAAQS modeling will not be needed (see Section IX, 1-hour NO_2 and SO_2 NAAQS Modeling).
February 23, 2017	In an email, Duke responded to DAQ's request of January 11, 2018 for additional information and answered some of the questions. However, many items remained unanswered and the application processing clock remained on hold.
March 14, 2018	In an email, DAQ responded to Duke's February 23, 2018 response to elaborate information needed for items not fully addressed by Duke. Duke was asked several questions for additional information related to emission calculations, sources of emission factors, design capacity of the STAR® unit, actual emissions versus potential emissions for a proposed PSD avoidance condition, how the emission rates used in their toxics modeling analysis were determined, Duke's proposed monitoring for SO_2 for compliance with 02D .0516, etc. The application processing clock was stopped awaiting the additional information. The application remained on hold.
April 4, 2018	In an email, Duke responded to DAQ's request of March 14, 2018 and provided further information. The only missing requested information was the source of the CO and VOC emission factors referenced in the application for reactor ES-31. The application remained on hold.
April 17, 2018	In an email, DAQ again asked for the source of the CO and VOC emission factors for reactor ES-31.
April 25, 2018	In an email to Duke, DAQ asked if the existing gasoline storage tank (ID No. 4) was modeled.
April 25, 2018	In an email, regarding the above question on whether the gasoline tank was modeled, Duke responded it would appear that the gasoline storage was inadvertently left out of the air dispersion analysis (for Benzene, Hexane, and Toluene). Duke provided potential emissions for the tank for DAQ's use in the Health Risk Assessment.
May 25, 2018	Sent draft permit to Duke for review.
June 4, 2018	Email from Duke with comments on the draft permit (see Section XII).

I. Purpose of Application

Duke has applied to install and operate a flyash processing facility consisting of a Staged Turbulent Air Reactor (STAR®) with supporting ancillary sources at the H.F. Lee Steam Electric Plant as shown in Section X below. This is one of three flyash beneficiation projects in North Carolina (the others are at Duke's Buck and Cape Fear plants) mandated by HB 630 (Session Law 2016), which modified the closure requirements for coal combustion residuals surface impoundments under the Coal Ash Management Act (CAMA) of 2014. The law requires the impoundment owner (Duke) to identify, on or before July 1, 2017, a total of three impoundment sites (located within the State) with ash stored in the impoundments on that date that is suitable for processing for cementitious purposes. The CAMA requires Duke to enter into a binding agreement for the installation and operation of the ash beneficiation projects capable of annually processing 300,000 tons of ash each to specifications appropriate for cementitious products with all ash processed to be removed from the impoundment located at the sites. No later than 24 months after issuance of all necessary permits, operation of each ash beneficiation project is to commence.

The facility will process wet or dry flyash feedstock containing various amounts of unburned carbon into a variety of commercial applications including partial cement replacement and other commercial and industrial applications. The actual design capacity of the H.F. Lee STAR® facility is to produce up to 400,000 tons of flyash product annually.

The STAR® system is a patented technology developed by The SEFA Group Inc. (SEFA) to process feedstock (of any carbon content) like flyash (wet or dry) along with other ingredient materials into a variety of commercial products. These products are used, not only for application as a partial cement replacement, but for many other commercial and industrial applications.

The first STAR® plant began commercial operation in February 2008 at SCE&G's McMeekin Station in Lexington, South Carolina. Lessons learned from the first STAR® Plant were incorporated into the design of the next generation STAR® II Facility, which began commercial operations in September 2012 at NRG located in Newburg, Maryland. The third STAR® facility began operations in 2015, and is located in Georgetown, South Carolina, at the Santee Cooper Winyah Generating Station. It is the only facility capable of processing ash from surface ponds.

This is the first step of a significant permit modification pursuant to rule 15A NCAC 02Q .0501(c)(2). The application was received on November 13, 2017 and deemed complete for processing on that date. Public notice of the draft permit for Title V purposes is not required at this time. The Permittee must file a Title V Air Quality Permit Application pursuant to 15A NCAC 02Q .0504 for these changes on or before 12 months after commencing operation in accordance with General Condition NN.1, at which time the changes will go through the second step of the 15A NCAC 02Q .0501(c)(2) Title V permitting process. The permit shield described in General Condition R does not apply to these changes. The only public notice at this time is a notice of public hearing pursuant to the construction and operating permit under rule 15A NCAC 2Q .0300 and the Coal Ash Management Act.

II. Permit Changes

The following changes were made to the Duke Energy Progress - H. F. Lee Steam Electric Plant Air Permit No. 01812T42:

Old Page	Old Section	New Page	New Section	Description of Change(s)
Cover		Cover		Amended permit numbers and dates.
Insignificant Activities List		Insignificant Activities List		Added I-ES-39A, I-ES-39B, I-ES-40A, I-ES-40B, I-F-1, I-F-2, I-F-3, I-F-5 and I-F-6.
3-4	1, table of permitted emission sources	3-5	1, table of permitted emission sources	Added emission sources: ID Nos. ES-30A, ES-30B, ES-31, ES-32, ES-33, ES-34, ES-35, ES-36A, ES-36B, ES-37A, ES-37B, ES-38, ES-38A, ES-38B and F-4; with footnote **.
23-27	2.1.D.5	48-54	2.2.B	Relocated this PSD avoidance condition for turbines 1A, 1B and 1C

				from Section 2.1.D.5 to Section 2.2.B.1 and revised the limits to also include the new STAR® project sources.
--	--	37-40	2.1.J	Added this section for new STAR® reactor.
--	--	40-42	2.1.K	Added this section for new STAR® supporting sources.
--	--	43-44	2.1.L	Added this section for new STAR® ash basin (ID No. F-4) fugitive source.
40-41	2.2.A.1.a	44-47	2.2.A.1.a	Revised this 02D .1100 condition to include emission limits for new facility-wide toxics modeling.
--	--	47	2.2.A.1.b	Added requirement to submit a modeling protocol to update the toxics modeling demonstration in Application 9600017.17A to revise the toxics emission rates in Section 2.2.A.1.a, and submit a permit application showing compliance with 15A NCAC 2D .1100 prior to startup of the STAR® project sources.
46-54	3	59-67	3	Updated general conditions to version 5.2, 04/03/2018. Condition K changed: Permit expiration terminates the facility's right to operate unless a complete 15A NCAC 02Q .0500 renewal application is submitted at least six months before the date of permit expiration.

III. Facility Description

Duke Energy's H. F. Lee Steam Electric Plant is an electric utility facility that generates electrical power. The facility previously had two main parts – the old coal-fired Lee plant (which was retired in 2012) and the "Wayne County" combustion turbine plant. Currently the main emission sources are five No. 2 fuel oil/natural gas-fired simple-cycle internal combustion turbines (Lee IC Unit Nos. 10, 11, 12, 13 and 14). Also, the following sources were added in Permit No. 01812T35 issued August 11, 2010, and began commercial operation on January 1, 2013: three nominal 170 MW natural gas/No. 2 fuel oil-fired simple/combined-cycle internal combustion turbines (Lee IC Unit Nos. 1A, 1B and 1C). Other sources include: one natural gas-fired auxiliary boiler (AB1), three natural gas-fired dew point heaters (DPH1, DPH2 and DPH3), one diesel-fired firewater pump engine (FWP1), one multi-cell wet surface air cooler with drift eliminators (CT1), one multi-package/multi-cell turbine inlet chiller with drift eliminators (CT2), and one No. 2 fuel oil fixed-roof storage tank with atmospheric vents (ST3).

IV. STAR Project Equipment Description

The associated sources of air emissions proposed to support the STAR® system includes the following:

- Ash Basin excavation.
- Ash Handling/Processing.
- Haul Roads.
- Screener.
- Crusher.
- Two diesel engines associated with a Screener and a Crusher.
- Wet ash receiving area and storage shed.
- Wet ash feed hopper.
- Wet ash unloading pile.
- Two External heat exchangers (EHE) (with baghouses).
- Transfer silo filling and unloading (with bin vent product capture device).
- Feed silo filling and unloading (with bin vent product capture device).
- Storage dome filling and unloading (with bin vent product capture device).
- Loadout silo (with bin vent product capture device).
- Loadout silo chute 1A (with bin vent product capture device).
- Loadout silo chute 1B (with bin vent product capture device).

• FGD Byproduct Silo (with bin vent product capture device).
• FGD Absorbent Silo (with bin vent product capture device).

Pre-reactor Material Handling Equipment

Excavation and processing of materials from the ash ponds to meet the STAR® system flyash ingredient (feedstock) specifications will be under the control of Duke Energy. All flyash reclaimed from an ash pond delivered for use as an ingredient in the STAR® system must first undergo processing by the owner to be:

- free of all, but minimal contaminants (e.g., organic debris, slag);
- finely-divided and free-flowing;
- have consistent moisture content below 25%; and
- have a consistent chemical composition, including organic content measured by loss on ignition.

The processing sequence of events will include flyash being excavated and staged to allow for dewatering to ensure a moisture content below 25%. Dewatered flyash will then be screened to remove contaminants (organic debris, slag, etc.), to produce a consistent chemical composition and a finely divided free-flowing material.

Wet flyash with a nominal 15% moisture content is delivered via trucks. The wet flyash can be unloaded from the trucks into the storage shed, to a pile, or directly into the feed hopper at up to 70 tons per hour then conveed to the mechanical conveyance equipment. The material is discharged from the mechanical conveyance equipment into a material delumper unit to reduce large size material. The material is then discharged from the delumper into the external heat exchanger (EHE) by gravity, where it is continually fluidized using preheated air.

The fluidized material is dried in the EHE both by intimate contact with the heated fluidizing air and by direct contact with hot water heat exchangers located in the EHE. The material is discharged from the EHE at less than 2% moisture content and at a temperature range of 150 to 300ºF to downstream material-handling equipment (transfer silos).

The exhaust air is discharged from each EHE through interconnecting ductwork to a high efficiency baghouse for feedstock recovery and exhaust air treatment to achieve a PM exhaust rate of 0.025 gr/dscf.

After leaving the baghouse, the cleaned exhaust air stream passes through interconnecting ductwork to the exhaust air fan before being discharged to atmosphere. The exhaust air volumetric rate is estimated at approximately 41,550 acfm at 10 inches of water column above atmospheric pressure and at approximately 150-300 ºF.

STAR® Reactor

STAR® technology transforms and recycles coal ash from surface impoundments or ponds into a high-quality, sustainable environmentally-responsible class F flyash product for the concrete industry for beneficial reuse. The process treats flyash in such a way as to lower the "loss on ignition" (LOI - residual carbon in flyash) for use as pozzolan in concrete and can also remove all the carbon in flyash so that the purified mineral material can be used as raw feed material in other specialty products and processes that historically have been unable to use flyash as raw feed material because of the deleterious effect of the residual carbon in flyash. Using recycled STAR® ash in place of Portland cement in concrete reduces the virgin material required in concrete manufacturing, and for every ton of flyash used in concrete, there is approximately one less ton of CO_2 released into the atmosphere.

The STAR® process is inherently flexible in that operating parameters can be varied and different ingredients can be added to produce a desired product. The primary component of the STAR® is a cylindrical refractory-lined reactor vessel in which the majority of the process reactions take place including both chemical and physical reactions. Air required for the process reactions enters through the floor of the STAR® system as well as through the walls at multiple locations.

The raw flyash feedstock and any other ingredients are introduced through the walls of the STAR®. All of the solids and gases exit together at the top of the reactor. Due to the high gas velocity, multiple injection points, and recycled solids returned, there is a significant amount of turbulence created that enhances the mixing of the ingredients and optimizes the reactions.

The STAR® reactor will normally fire auxiliary fuels during system startup and will cut back on auxiliary fuel (i.e., natural gas or propane) as the reactor reaches auto-ignition and self-sustaining conditions. At this point, the residual carbon in the flyash reacts and becomes the heat source and the process is normally self-sustaining except under certain conditions.

The STAR® reactor design capacity is based on two factors: heat input and flyash throughput. The reactor's short term maximum heat input capacity is 140 mmBtu/hr. The reactor's flyash throughput, however, varies based on the percent LOI (residual carbon) content of the flyash, to achieve the 140 mmBtu/hr maximum design heat input. Duke expects the LOI to be from 6 to 15 percent. Based on the heat content of the residual carbon (14,500 Btu/lb), the throughput will be limited to achieve the maximum 140 mmBtu/hr heat input. At 6 percent LOI and 140 mmBtu/hr heat input, the resulting throughput is 80.5 tons per hour. As the LOI increases, the throughput decreases in order to keep the heat input below the maximum of 140 mmBtu/hr. The reactor system is actually designed to process 75 tons per hour rather than the 80.5 tons per hour, which corresponds to a nominal heat input of 130 mmBtu/hr.

<u>POST-Reactor Material Handling Equipment</u>
After exiting the reactor, the flue gas with entrained flyash enters a hot cyclone where the majority of solids are separated from the gas and recycled back to the reactor for temperature control. The flue gas with entrained flyash leaving the hot cyclone is conveyed to an air preheater, which is designed to preheat the incoming process air (by heat recovery) or cool the flue gas/solids mixture, then passes through a flue gas cooler. The cooled flue gas and flyash then passes through a baghouse for product capture, and then exhausts to a dry flue gas desulfurization (FGD) system (using hydrated lime as a reagent) to reduce SO_2 emissions. The clean FGD exhaust will then flow to an induced draft fan to be discharged to the atmosphere through a stand-alone stack. The captured flyash is pneumatically transferred from the baghouse to either the storage dome or the loadout silo, each equipped with a bin vent, then to a truck loadout station.

V. Summary of Changes to Emission Sources and Control Devices

The following sources and control device descriptions are being added to the permit for this modification:

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description
ES-30	Feed silo (125 tons per hour maximum fill rate, 75 tons per hour maximum unload rate, 400,000 tons per year fill and unload rate)	CD-30	Bin vent filter (4:1 air-to-cloth ratio)
ES-31	STAR® feedstock processing reactor (140 million Btu per hour maximum heat input rate, 130 million Btu per hour nominal heat input rate, designed to process 75 tons per hour and 400,000 tons per year flyash feedstock process rates), equipped with natural gas/propane burners for startup or to maintain temperature with a combined heating capacity of 60 million Btu per hour heat input rate.	CD-31A CD-31B	Dry scrubber (77,500 ACFM maximum inlet flue gas flow rate) Baghouse (26,790 total filter surface area, 2.18:1 air-to-cloth ratio, 77,500 ACFM maximum inlet flue gas flow rate)
ES-32	FGD byproduct storage silo (3120 cubic feet capacity, 1.75 tons per hour maximum fill rate, 300 tons per hour maximum unload rate)	CD-32	Bin vent filter (4:1 air-to-cloth ratio)

ES-33	FGD absorbent storage silo (10,000 cubic feet capacity, 25 tons per hour maximum fill rate, 1.5 tons per hour unload rate)	CD-33	Bin vent filter (4:1 air-to-cloth ratio)
ES-34	EHE- external heat exchanger 1 (70 tons per hour maximum process rate)	CD-34	Baghouse (3:1 air-to-cloth ratio, 32,000 dSCFM exhaust flow rate)
ES-35	EHE- external heat exchanger 2 (70 tons per hour maximum process rate)	CD-35	Baghouse (3:1 air-to-cloth ratio, 32,000 dSCFM exhaust flow rate)
ES-36	Transfer silo filling (125 tons per hour fill rate, 75 tons per hour maximum unload rate, 400,000 tons per year maximum fill and unload rate)	CD-36	Bin vent filter (4:1 air-to-cloth ratio)
ES-37	Storage dome filling (75 tons per hour fill rate, 275 tons per hour maximum unload rate, 400,000 tons per year maximum fill and unload rate)	CD-37	Bin vent filter (4:1 air-to-cloth ratio)
ES-38	Loadout silo (300 tons per hour maximum unload rate, 400,000 tons per year maximum unload rate)	CD-38	Bin vent filter (4:1 air-to-cloth ratio)
ES-38A	Loadout silo chute 1A (100 tons per hour maximum unload rate, 400,000 tons per year maximum unload rate)	CD-38A	Bin vent filter (4:1 air-to-cloth ratio)
ES-38B	Loadout silo chute 1B (100 tons per hour maximum unload rate, 400,000 tons per year maximum unload rate)	CD-38B	Bin vent filter (4:1 air-to-cloth ratio)
F-4*	Ash basin (321 acres)	N/A	N/A

* Fugitive source

VI. Emissions

The proposed project emission rates for criteria pollutants and toxic air pollutants (TAPs) are based on process information developed and provided by SEFA, Duke, manufacturers' data, and/or the Environmental Protection Agency's (EPA) AP-42 emission factors. Unit design parameters and operational practices have been incorporated into the analysis to make the emission estimates conservative and representative of on-site conditions.

<u>STAR® Reactor Emissions</u>

Emissions from the STAR® reactor include PM/particulate matter with a diameter less than 10 microns (PM_{10}), particulate matter with a diameter less than 2.5 microns ($PM_{2.5}$), SO_2, nitrogen dioxide (NOx), carbon monoxide (CO), volatile organic compounds (VOC), and greenhouse gases (GHG) from the auxiliary fuels and residual carbon in the flyash. Emissions from the auxiliary fuels were estimated using the most recent emissions factors for natural gas and propane-fired boilers contained in AP-42. The auxiliary fuel burners are a low-NOx design**.**

Flyash generated from the combustion of coal contains trace quantities of heavy metals. Duke Energy performed a site-specific ash analysis taking samples from the ash pond to calculate the emission rates for each toxic metal. Emission factors of the heavy metal toxics in the flyash before entering the reactor are based on the site-specific ash analysis data. Emission factors of the heavy metals in the flyash after exiting from the reactor are based on the site-specific ash analysis data with a contribution from the use of process water in the reactor.

Emissions of NOx and CO from the processing of the residual carbon in the flyash were estimated based on emissions estimates from other existing STAR® reactor units. Particulate emissions for the STAR® are based on the baghouse manufacturer's data of 0.025 grains per actual cubic foot (gr/acf). The induced draft fan providing the motive force for the product transfer is rated at 77,500 acfm, at the expected process conditions of 350°F and nominal atmospheric pressure.

SO_2 emissions are a function of the amount of flyash processed through the reactor, the sulfur content of the flyash, the amount of sulfur remaining in the product ash exiting the reactor, and an SO_2 removal efficiency of the dry scrubber. Potential emissions of SO_2 are based on a flyash sulfur content of 0.15 percent, 100 percent oxidation of the sulfur, a LOI of 6%, a carbon heat value of 14,500 Btu/lb, and a dry scrubber control efficiency of 95 percent.

Emissions for the STAR® reactor have been estimated conservatively by combining the total emissions associated with firing the worst-case auxiliary fuel at full capacity with the total emissions from flyash processing.

GHG emissions for the STAR® reactor were based on the annual natural gas and propane usages and emissions factors from Table C-1 of Chapter 40, Part 98, Code of Federal Regulations (CFR), Subpart C, along with the residual carbon content (LOI) of the flyash. As discussed in Section VII below, even though the GHG emissions of 116,604 tons per year as shown in Table 2 are greater than the otherwise PSD significant increase rate of 75,000 tons per year, the proposed project does not result in an increase of a regulated NSR pollutant that is not GHGs, and GHGs are not subject to PSD review.

Material Handling Emissions

The material handling system includes one wet ash raw feed unloading pile, one wet ash storage shed, one wet ash EHE feed hopper, two EHEs, raw feed silo, one loadout silo, two loadout chutes, transfer silo, a product storage dome, FGD byproduct silo, FGD absorbent silo, screener, crusher, ash basin and handling, and haul roads. The silos are each equipped with a bin vent filter to minimize product losses associated with the pneumatic transfer process. The truck loadout station uses telescoping chutes and a negative pressure ventilation system to reduce fugitive emissions. Particulate emissions from the silos, loadout chutes and product dome were estimated using the maximum short- and long-term transfer rates and appropriate emission factors from AP-42, Section 13.2.4 and 99% bin vent filter control.

Trace metal concentration data discussed above for the STAR® system were used in conjunction with the calculated PM emissions rates to estimate emissions of trace metal from the material handling activities.

Fugitive Emissions

Additional particulate emissions were also calculated for the wet ash receiving process, ash handling process (including screening and crushing activities) and haul roads. Windblown fugitive dust emissions were also calculated from the unloading pile. The emissions were calculated using the appropriate emissions factors from AP-42.

Potential Emissions

The potential emissions for the project are calculated based on the emission factors and other design parameters as shown in Table 1 below along with the system design process throughput capabilities for the ancillary sources as a function of the reactor throughput as shown in the table in Section VIII.B.1 below. The reactor ES-31 throughput establishes the needed throughput for all other STAR® project ancillary sources and therefore establishes their potential emissions. Potential emissions for all STAR® sources is shown in Table 2.

The emission calculation methodologies and detailed calculations for the STAR® system sources can be found in Appendix B of the application.

Table 1
Emission Factors Used to Determine Emissions

Source		Emissions Factors	
ID No.	**Emission Source Description**	**Pollutant**	**Flyash**
ES-31	STAR® reactor* * includes emissions from worst case startup fuel: propane: AP-42, Table 1.5-1, or natural gas: AP-42, Table 1.4-2	PM, PM_{10}, $PM_{2.5}$	Gas flow of 77,500 acfm and loading rate of 0.025 gr/acf PM10 = 92% of Total PM and PM2.5 = 53% of Total PM (AP-42 Table 1.1-6, Bituminous and Subbituminous Coal Combustion)
		SO_2	Based on 6% LOI, 0.15% flyash sulfur content, 14,500 Btu/lb carbon heat value, 95% scrubber control efficiency,
		NO_x	Based on SEFA operation experience
		CO	Based on SEFA operation experience
		VOC	Based on stack test performed at an existing STAR facility, CO emissions are expected to be 10% (or less) of VOC emissions.
		GHG CO_2e	Based on the annual natural gas and propane usages and emission factors from Table C-1 of Chapter 40, Part 98, CFR, Subpart C, along with the LOI of the flyash.
		H_2SO_4	Based on SEFA stack test performed September 2016. Sulfuric Acid Mist was 0.05 lb/hr for contingency was doubled to 0.1 lb/hr.
		Pb	Duke site-specific average ash analysis
Material Handling Emissions (PM, PM_{10}, $PM_{2.5}$, Pb)			
ES-30	Feed silo	AP-42, Section 13.2.4 and 99% bin vent filter control Duke site-specific average ash analysis	
ES-36	Transfer silo		
ES-32	FGD byproduct storage silo	Gas flow: 1300 acfm and PM loading rate of 0.005 gr/acf PM10 = 92% of Total PM and PM2.5 = 53% of Total PM (AP-42 Table 1.1-6, Bituminous and Subbituminous Coal Combustion) Duke site-specific average ash analysis	
ES-33	FGD absorbent storage silo filling		
ES-34 ES-35	EHE (Units1 and 2)	Exhaust Flow: 32,000 dscfm and PM loading at 0.025 grains/dscf PM10 = 92% of Total PM and PM2.5 = 53% of Total PM (AP-42 Table 1.1-6, Bituminous and Subbituminous Coal Combustion) Duke site-specific average ash analysis	
ES-37	Storage dome	AP-42, Section 13.2.4 and 99% bin vent filter control Duke site-specific average ash analysis	
ES-38	Loadout silo		
ES-38A	Loadout silo chute 1A		
ES-38B	Loadout silo chute 1B		
I-ES-39A	Screener	AP-42, Table 11.19.2-2 Duke site-specific average ash analysis	
I-ES-40A	Crusher		
Engine Emissions			
I-ES-39B	No. 2 fuel oil-fired screener engine (91 HP)	AP-42 Chapter 3.3, Table 3.3-1 (Gasoline & Diesel Industrial Engines)	

I-ES-40B	No. 2 fuel oil-fired crusher engine (300 HP)	
Fugitive Emissions (PM, PM_{10}, $PM_{2.5}$, Pb)		
I-F-1	Wet ash receiving transfer to shed	AP-42 Section 13.2-4 (Aggregate Handling and Storage Piles) Duke Energy Average Ash Analysis
I-F-2	Wet ash receiving transfer to hopper	
I-F-3	Wet ash receiving unloading pile	AP-42 Section 13.2.5 (Industrial Wind Erosion) Duke Energy Average Ash Analysis
F-4	Ash basin	
I-F-5	Ash handling	AP-42 Section 13.2.4 (Aggregate Handling and Storage Piles) Duke Energy Average Ash Analysis
I-F-6	Haul roads	AP-42 Section 13.2.2 (Unpaved Roads) No Pb emissions.

Table 2
Potential Annual Project Emission Increases

Source		Emissions (ton/yr)									
ID No.	**Emission Source Description**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_x**	**CO**	**VOC**	**GHG CO_2e**	**H_2SO_4**	**Pb**
ES-31	STAR® reactor	72.74	66.92	38.55	98.18[1]	193.60	91.10	9.11	116,406[2]	0.44	1.57E-03
ES-30	Feed silo	0.04	0.02	0.02							7.73E-07
ES-36	Transfer silo										
ES-32	FGD byproduct storage silo	0.24	0.22	0.13							
ES-33	FGD absorbent storage silo filling	0.24	0.22	0.13							
ES-34 ES-35	EHE (Units1 and 2)	30.03	27.63	15.92							5.96E-04
ES-37	Storage dome	0.04	0.02	0.02							7.73E-07
ES-38	Loadout silo										
ES-38A	Loadout silo chute 1A										
ES-38B	Loadout silo chute 1B										
I-ES-39A	Screener	0.020	0.007	0.0004							3.90E-07
I-ES-39B	No. 2 fuel oil-fired screener engine (91 HP)	0.26	0.26	0.26	0.243	3.667	0.79	0.292	135.45	NA[3]	7.45E-06
I-ES-40A	Crusher	0.002	0.001	0.0001							2.99E-08
I-ES-40B	No. 2 fuel oil-fired crusher engine (300 HP)	0.120	0.120	0.120	0.112	1.697	0.366	0.135	62.69	NA[3]	3.45E-06
I-F-1	Wet ash receiving transfer to shed	0.0129	0.00608	0.000921							2.55E-07
I-F-2	Wet ash receiving transfer to hopper										
I-F-3	Wet ash receiving unloading pile	0.0137	0.00687	0.00103							2.73E-07
F-4	Ash basin	7.05	3.53	0.53							1.40E-04
I-F-5	Ash handling	0.141	0.0666	0.0101							2.80E-06
I-F-6	Haul roads	1.53	0.395	0.0395							
	Total	**112.49**	**99.43**	**55.73**	**98.53**	**198.96**	**92.26**	**9.54**	**116,604**	**0.44**	**2.32E-03**

1 SO_2 for ES-31 based on 6% LOI, 0.15% flyash sulfur content, 14,500 Btu/lb carbon heat value, 95% scrubber control efficiency, flyash process rate of 75 tons per hour and 8760 hours per year operation.
2 GHG emissions for ES-31 based on an average flyash LOI of 7.80%. Duke expects 6%-15% LOI.
3 H_2SO_4 not listed in AP-42 Section 3.3 or DAQ's spreadsheet.

VII. Regulatory Analysis

A. <u>New Source Review Evaluation</u>

Under Prevention of Significant Deterioration (PSD) requirements, all major new or modified stationary sources of air pollutants as defined in Section 169 of the Federal Clean Air Act (CAA) must be reviewed and permitted prior to construction by EPA or permitting authority, as applicable, in accordance with Section 165 of CAA. A *major stationary source* is defined as any one of 28 named source categories, which emits or has a potential to emit (PTE) 100 tons per year of any regulated pollutant, or any other stationary source, which emits or has the potential to emit 250 tons per year of any PSD regulated pollutant.

The Lee facility is an existing PSD major stationary source of criteria air pollutants as defined at 40 CFR 51.166(b)(1)(i)(a), and is classified as one of the 28 named source categories under the category of "fossil fuel-fired steam electric plants of more than 250 million Btu per hour heat input," which emits or has a potential to emit (PTE) 100 tons per year of any regulated pollutant.

For existing major stationary sources, there are several steps to determine whether the modification is a *major modification* and therefore subject to PSD preconstruction review. The first step is to determine whether there is a physical change or change in the method of operation. Second, there must be an emissions increase. And third, the emissions increase must be equal to or greater than the "significance levels" as listed in 40 CFR 51.166(b)(23)(i) for the regulated pollutants.

Because the STAR modification involves a physical change with an emissions increase, it must be determined whether the modification results in an emission increase for any regulated pollutant in the amounts equal or greater than the significance levels, which would therefore trigger a PSD review for those pollutants.

<u>Existing PSD Avoidance Condition</u>

Duke is proposing to include emissions from the STAR® project under the existing PSD avoidance limits in Section 2.1.D.5.a of the current permit 01812T42. The existing PSD avoidance condition was established in permit 01812T35 when the three natural gas/No. 2 fuel oil-fired simple/combined-cycle internal combustion turbines (Lee IC Unit 1A, Lee IC Unit 1B and Lee IC Unit 1C) were first permitted in 2010. At that time, since the three coal-fired boilers (Unit 1 Boiler, Unit 2 Boiler and Unit 3 Boiler) were soon to be retired, Duke began reducing the hours of operation of the boilers as the new turbines came on line. The avoidance limits were based on actual baseline emissions for the three boilers to establish (with the added PSD significance thresholds for each pollutant) the allowable PSD avoidance limits as a "project net" to ensure there was no increase in emissions (beyond PSD significance) above baseline so that emissions from the three boilers plus the three new combustion turbines remain below the limits.

DAQ had initially told Duke in a letter dated December 18, 2017, that the STAR® modification emissions could not be included under the existing PSD avoidance limits since those limits were for an unrelated project, and therefore those emissions must be analyzed separately with respect to the applicability of PSD. DAQ discussed this in a meeting with Duke on January 5, 2018 and in a conference call on February 5, 2018, and asked Duke to provide their reasoning in a letter. In the letter, received on February 19, 2018 (dated February 7, 2018), Duke explained their rationale why the STAR® project should be considered part of the same project that retired the coal-fired boilers and installed the three new combined cycle turbines, and that therefore the STAR® project emissions should be included under the existing PSD avoidance limits.

Duke's rationale for considering the STAR® project to be part of the same project that retired the coal-fired boilers and installed the three new combined cycle turbines is based on the following events that led to the proposed STAR® ash beneficiation project to facilitate retirement of the coal-fired boilers.

- Duke submitted the application to repower the facility with the three new turbines as part of the preparation for retiring the three coal-fired boilers in December 2009. The three boilers were retired on October 1, 2012, and Duke requested the boilers be removed from the permit on November 27, 2012. The boilers were then removed from the permit in 2015 (permit 01812T40).

- At the time the boilers were being planned for retirement, Duke was tracking potential regulations for long-term management of coal combustion products (CCP) at the state and federal levels.
- The regulations were a result of the December 2008 ash release at the Tennessee Valley Authority's Kingston facility and the beginning of EPA's process of assessing ash impoundments to determine where corrective measures may be needed to prevent failures at other facilities.
- EPA sent an information request out to coal-fired electric utilities in February 2009 inquiring about the safety of surface impoundments and basins used to store coal combustion residue.
- EPA published a proposed rule to regulate coal ash on June 21, 2010, and the Disposal of Coal Combustion Residuals from Electric Utilities final rule was signed on December 19, 2014.
- The North Carolina Coal Ash Management Act (CAMA) became law in 2014 and required Duke to begin closure of ash basins and to evaluate beneficial reuse for ash stored in the basins.

DAQ agrees that, based on Duke's explanation, the STAR® project can be considered to be part of the same project that retired the coal-fired boilers and installed the three new combined cycle turbines and can be included in the existing PSD condition.

At the time the boilers were removed from the permit in 2015, the PSD avoidance condition became applicable only to the three turbines with the limits unchanged. Now, with this permit modification, the PSD avoidance condition (moved to Section 2.2.B of the permit) will include the turbines and the new STAR® project sources as discussed below.

Table 3 shows the potential emissions for the STAR® project (row A) and for the existing turbines (row B). To determine the possibility that the total potential emissions under the avoidance condition could exceed the limits and therefore require monitoring of actual emissions, the amount by which the total potential emissions for the turbines and from STAR® sources ES-31, ES-34 and ES-35 in the avoidance condition (row A+B) exceeds the PSD avoidance limits (row C) is determined (row A+B-C). Even though the addition of the STAR® system has the potential to exceed the existing PSD avoidance limit for some pollutants (PM, PM_{10}, $PM_{2.5}$, CO and VOCs), the actual emissions of these pollutants when added to the common pollutants (for example PM_{10}) from the existing turbines is expected to be below the PSD avoidance condition limits. Monitoring, recordkeeping and reporting of actual emissions will be required for the STAR® reactor (ES-31) for all pollutants (PM, PM_{10}, $PM_{2.5}$, CO and VOCs) for which potential emissions of all PSD avoidance source emissions exceed the PSD avoidance limits, and likewise for EHE ES-34 and EHE-35 for those same pollutants which these sources emit (PM, PM_{10} and $PM_{2.5}$ only). Potential emissions for the other pollutants (SO_2, NOx, H_2SO_4 and Pb) are significantly below the new avoidance limits and therefore monitoring of actual emissions is not required for ES-31 since the limits for those pollutants cannot be exceeded. To simplify the monitoring of emissions, the total potential emissions from the small-emitting STAR® project ancillary sources (all except STAR® reactor ES-31, EHE ES-34 and EHE ES-35), as shown in Table 3 (row D), have been added separately in the condition equations as shown in Section VIII.D.2 below with the note that that number represents the potential emissions from the small-emitting STAR® ancillary sources. Since the maximum potential emissions for all STAR® project small-emitting ancillary sources are assumed, no monitoring or recordkeeping of actual emissions is required for those sources. The only monitoring of the STAR® project sources needed is for the STAR® reactor ES-31, EHE ES-34 and EHE ES-35 in the new condition, in addition to the turbines.

The reactor ES-31 throughput establishes the throughput for all other STAR® project ancillary sources and therefore establishes their potential emissions. The system design process throughput capabilities for the ancillary sources as a function of the reactor throughput are shown in the table in Section VIII.B.1 below. Monitoring of reactor emissions will ensure the potential emissions for the ancillary sources are not exceeded.

GHGs. In accordance with PSD regulation 51.166(b)(48)(iv)(b), GHGs are only subject to regulation in the case of an existing major stationary source for a regulated NSR pollutant that is not GHGs if the source will also have an emissions increase of a regulated NSR pollutant (as defined in 51.166(b)(48)(iii) for GHGs), and an emissions increase of 75,000 tpy CO_2e or more. Also, in accordance with NCAC 02D .0544(a), a major stationary source or major modification shall not be required to obtain a prevention of PSD permit on the sole basis of its greenhouse gases emissions. Therefore, even though the GHG emissions of 116,604 tons per year as shown in Table 2 are greater than the otherwise PSD significant increase rate of 75,000 tons per year, the proposed project does not result in an increase of a regulated NSR pollutant that is not GHGs, and GHGs are not subject to PSD review.

Table 3
Emissions Summary for the Revised PSD Avoidance Condition

Category		Emissions (ton/yr)									
		PM	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	VOC	GHG CO_2e	H_2SO_4	Pb
A	Potential emission increases for the proposed STAR® Project[1]	112.49	99.43	55.73	98.53	198.96	92.26	9.54	116,604	0.44	0.00232
B	Potential emissions for turbines 1A, 1B and 1C[3]	214.26	214.26	214.26	21.93	902.13	841.11	122.19	see note 2	15.39	0.06
A+B	Total potential all sources under the PSD avoidance condition	326.75	313.69	269.99	120.46	1101.09	933.37	131.73		15.83	0.06232
C	Existing PSD avoidance limits	218.2	218.2	218.2	14,663.1	3,414.6	829.3	65.1		64.3	0.77
D	Potential emissions from STAR® ancillary sources[4]	9.71	4.873	1.262	0.35	5.36	1.16	0.43		NA	NA
A+B-C	Total of all PSD avoidance source emissions above the PSD avoidance limits	108.55	95.49	51.79	-14,542.64	-2313.51	104.07	66.63		-48.47	-0.70768
	Monitoring required under the PSD avoidance condition for STAR® reactor?	**Yes**	**Yes**	**Yes**	No	No	**Yes**	**Yes**	No	No	No

1 from Table 2
2 PSD avoidance applicability only applies to "anyway sources"
3 from review for permit T35, Table 2
4 from Table 2 (total potential emissions from all sources except STAR® reactor ES-31, EHE ES-34 and EHE ES-35). These amounts are included in the monitoring equations in in Section VIII.E.2.

VIII. Source-by-Source Requirements

A. One STAR® flyash feedstock processing reactor equipped with natural gas/propane startup burners (ID No. ES-31) and associated dry scrubber (ID No. CD-31A) and baghouse (ID No. CD-31B)

Applicable Regulations

1. 15A NCAC 2D .0515: PARTICULATES FROM MISCELLANEOUS INDUSTRIAL PROCESSES
Emissions of particulate matter from this source (ID No. ES-31) shall not exceed an allowable emission rate as calculated by the following equation:

$$E = 4.10 \times P^{0.67} \qquad \text{for } P \leq 30 \text{ tons per hour}$$

or

$$E = 55.0 \times P^{0.11} - 40 \qquad \text{for } P > 30 \text{ tons per hour}$$

Where: E = allowable emission rate in pounds per hour
P = process weight in tons per hour

Liquid and gaseous fuels and combustion air are not considered as part of the process weight.

Compliance
The following table shows the allowable PM emission rate according to this rule compared to the potential after control PM emissions rate for this source.

Emissions Source	ID No.	Process Rate (tph)	Allowable PM Emission Rate (lb/hr)	Potential PM Emission Rate (lb/hr)*	Compliance Expected?
STAR® reactor	ES-31	75	48.4	16.61	yes

* after control

Since compliance is expected well within the allowable emission rate, the following monitoring applies in order to ensure the control devices are being properly maintained and that the above after control rates are not exceeded.

Particulate matter emissions from this source (ID No. ES-31) shall be controlled by the baghouse (ID No. CD-31B). To assure compliance, the Permittee shall perform inspections and maintenance as recommended by the manufacturer. In addition to the manufacturer's inspection and maintenance recommendations, or if there is no manufacturer's inspection and maintenance recommendations, as a minimum, the inspection and maintenance requirement shall include the following:

i. a monthly visual inspection of the system ductwork and material collection unit for leaks; and
ii. an annual (for each 12-month period following the initial inspection) internal inspection of the baghouse's structural integrity.

The results of inspection and maintenance shall be maintained in a logbook (written or electronic format) on-site and made available to an authorized representative upon request. The logbook shall record the following:

i. the date and time of each recorded action;
ii. the results of each inspection;
iii. the results of any maintenance performed on the dust extraction system; and
iv. any variance from manufacturer's recommendations, if any, and corrections made.

Reporting

The Permittee shall submit the results of any maintenance performed on any control device within 30 days of a written request by the DAQ.

The Permittee shall submit a summary report of monitoring and recordkeeping activities postmarked on or before January 30 of each calendar year for the preceding six-month period between July and December and July 30 of each calendar year for the preceding six-month period between January and June.

2. 15A NCAC 02D .0516: SULFUR DIOXIDE EMISSIONS FROM COMBUSTION SOURCES

Emissions of sulfur dioxide from this source (ID No. ES-31) shall not exceed 2.3 pounds per million Btu heat input. Sulfur dioxide formed by the combustion of sulfur in fuels, wastes, ores, and other substances shall be included when determining compliance with this standard.

Testing

Under the provisions of NCGS 143-215.108, the Permittee shall demonstrate compliance with the emission limit in Section 2.1.J.2.a above by conducting an initial stack test for sulfur dioxide emissions, with the reactor operating within 10% of its maximum heat input rate, in accordance with a testing protocol approved by the DAQ. Details of the emissions testing and reporting requirements can be found in Section 3 - General Condition JJ. Testing shall be completed within 90 days of initial start-up of the reactor (ID No. ES-31). Test results shall be the average of 3 valid test runs each when the source is processing flyash with: (1) a low sulfur content, (2) a medium sulfur content, and (3) a high sulfur content; to establish a minimum lime-to-sulfur ratio for the dry scrubber (ID No. CD-31A) for each fly ash sulfur content range that demonstrates compliance with the emissions limit in paragraph a above. In addition, the Permittee shall measure the pressure drop across the baghouse (ID No. 31B) during each test.

Test results shall include the following test condition information for each run:

i. Sulfur dioxide emission rate (lb/mmBtu).

ii. Dry scrubber lime-to-sulfur ratio.
iii. Reactor heat input (mmBtu/hr).
iv. Reactor flyash raw feed rate (tons per hour).
v. Flyash loss on ignition (% carbon).
vi. Flyash sulfur content (%).
vii. Baghouse pressure drop (Δp).

Compliance

a. The Permittee shall operate the dry scrubber at any time the reactor is in operation other than during startup, shutdown or malfunction, with a lime-to-sulfur ratio necessary to achieve a 95% sulfur dioxide removal efficiency.
b. Any time the reactor is in operation, the dry scrubber shall be operated at the minimum lime-to-sulfur ratio established during initial stack testing for each flyash sulfur content range.
c. Once per hour, the Permittee shall record in a logbook (written or electronic format) on-site and made available to an authorized representative upon request, the following information:
    i. Flyash sulfur content (%).
    ii. Dry scrubber lime-to-sulfur ratio.
    iii. Baghouse pressure drop (Δp).

Reporting

The Permittee shall submit to the DAQ Permitting Section a summary of the results of the initial stack testing that includes the information in Section 2.1.J.2.b above for each of the three sulfur content ranges of fly ash being processed, no later than 30 days after completing the initial stack test in accordance with General Condition JJ; and submit a complete permit application to revise the permit accordingly.

3. 15A NCAC 02D .0521: CONTROL OF VISIBLE EMISSIONS

Visible emissions from this source (ID No. ES-31) shall not be more than 20 percent opacity (except during startups, shutdowns, and malfunctions) when averaged over a six-minute period. However, six-minute averaging periods may exceed 20 percent not more than once in any hour and not more than four times in any 24-hour period. In no event shall the six-minute average exceed 87 percent opacity.

Compliance

To ensure compliance, once a week the Permittee shall observe the emission points of this source (ID No. ES-31) for any visible emissions above normal. The weekly observation must be made for each week of the calendar year period to ensure compliance with this requirement. The Permittee shall establish "normal" for this source in the first 30 days following the effective date of beginning operation. If visible emissions from this source are observed to be above normal, the Permittee shall either:

i. take appropriate action to correct the above-normal emissions as soon as practicable and within the monitoring period and record the action taken as provided in the recordkeeping requirements below, or
ii. demonstrate that the percent opacity from the emission points of the emission source in accordance with 15A NCAC 02D .2610 (Method 9) for 12 minutes is below the emission limit.

The results of the monitoring shall be maintained in a logbook (written or electronic format) on-site and made available to an authorized representative upon request. The logbook shall record the following:

i. the date and time of each recorded action;
ii. the results of each observation and/or test noting those sources with emissions that were observed to be in noncompliance along with any corrective actions taken to reduce visible emissions; and
iii. the results of any corrective actions performed.

Reporting

The Permittee shall submit a summary report of the monitoring and recordkeeping postmarked on or before January 30 of each calendar year for the preceding six-month period between July and

December and on or before July 30 of each calendar year for the preceding six-month period between January and June.

Non-applicable Regulations
The STAR reactor (ID No. ES-31) is not subject to the following regulations:

1. 15A NCAC 2D .0503 – PARTICULATES FROM FUEL BURNING INDIRECT HEAT EXCHANGERS
This rule applies to installations burning fuel, including natural gas and fuel oils, for the purpose of producing heat or power by indirect heat transfer. The STAR® is not an indirect heat exchanger, therefore this regulation does not apply.

2. 15A NCAC 02D .0524 - NSPS for Commercial and Industrial Solid Waste Incineration Units (40 CFR 60, Subpart CCCC)
Unless exempt, combustion of a "non-hazardous secondary material" (NHSM), as defined in §241.2 would subject the STAR® reactor to requirements in 40 CFR 60 Subpart CCCC "Standards of Performance for Commercial and Industrial Solid Waste Incineration Units" or, Subpart DDDD "Emissions Guidelines and Compliance Times for Commercial and Industrial Solid Waste Incineration Units." These regulations are known as the CISWI ("Commercial and Industrial Solid Waste Incineration") rules. In 2014, The SEFA Group requested DAQ's determination of regulatory status, with respect to 40 CFR 241 "Solid Wastes Used as Fuels or Ingredients in Combustion Units," for using flyash in its STAR® reactor. In a letter dated June 10, 2015 (Appendix F of the application) to Mr. Jim Clayton with The SEFA Group, the DAQ made a determination that flyash received directly from a coal-fired power plant's particulate collection device (i.e., electrostatic precipitator or baghouse) and flyash received from landfills and ash ponds is a NHSM and is an "ingredient", as defined in §241.2. §241.3(b)(4) of the rule states that NHSMs used as fuel or ingredient products in a combustion unit, and that are produced from the processing of discarded NHSMs and that meet the legitimacy criteria specified in §241.3(d)(l), with respect to fuels, and §241.3(d)(2), with respect to ingredients," are not solid waste. §241.3(b)(3) states that NHSMs when used as an ingredient in a combustion unit that meet the legitimacy criteria specified in paragraph §241.3(d)(2) are not solid waste. Therefore, the STAR® reactor is not subject to the CISWI requirements.

3. 15A NCAC 02D .0614 – Compliance Assurance Monitoring (40 CFR 64)
The CAM rule applies to each pollutant-specific emissions unit at a Title V facility if the individual emissions unit uses a control device to achieve compliance with an emission limit or standard, and if the potential pre-control emissions from that specific source are equal to or greater than the major source threshold (100 tons per year each) of any regulated air pollutant. The STAR® reactor will have potential pre-control SO_2 emissions greater than 100 tons per year and will employ a dry scrubber for control of SO_2 to meet the emission limit of 2.3 lb/mmBtu in rule 15A NCAC 02D .0516. However, the draft CAM Plan, as submitted with the application, is not necessary at this time since a construction permit is to be issued initially; with the Part 70 Title V permit application to be filed within 12 months after commencing operation in accordance with 02D .0501(c)(2). The deadline for submittal of a CAM Plan is that it is to be part of an application for a significant permit revision under 40 CFR Part 70 as specified in 40 CFR §64.5. Therefore, the final CAM Plan will be required to be submitted along with the Part 70 application for this modification, for inclusion into the Title V permit at that time.

B. Feed silo (ID No. ES-30) and associated bin vent filter (ID No. CD-30), FGD byproduct storage silo (ID No. ES-32) and associated bin vent filter (ID No. CD-32), FGD absorbent storage silo (ID No. ES-33) and associated bin vent filter (ID No. CD-33), EHE- external heat exchanger 1 (ID No. ES-34) and associated baghouse (ID No. CD-34), EHE- external heat exchanger 2 (ID No. ES-35) and associated baghouse (ID No. CD-35), transfer silo (ID No. ES-36) and associated bin vent filter (ID No. CD-36), storage dome (ID No. ES-37) and associated bin vent filter (ID No. CD-37), loadout silo (ID No. ES-38) and associated bin vent filter (ID No. CD-38), loadout silo chute 1A (ID No. ES-38A) and associated bin vent filter (ID No. CD-38A) and loadout silo chute 1B (ID No. ES-38B) and associated bin vent filter (ID No. CD-38B)

Applicable Regulations

1. 15A NCAC 2D .0515: PARTICULATES FROM MISCELLANEOUS INDUSTRIAL PROCESSES
Emissions of particulate matter from these sources (ID Nos. ES-30, ES-32, ES-33, ES-34, ES-35, ES-36, ES,37, ES-38, ES-38A, ES-38B) shall not exceed an allowable emission rate as calculated by the following equation:

$$E = 4.10 \times P^{0.67} \quad \text{for } P \leq 30 \text{ tons per hour}$$

or

$$E = 55.0 \times P^{0.11} - 40 \quad \text{for } P > 30 \text{ tons per hour}$$

Where: E = allowable emission rate in pounds per hour
P = process weight in tons per hour

Liquid and gaseous fuels and combustion air are not considered as part of the process weight.

Compliance
The following table shows the allowable PM emission rate according to this rule compared to the potential after control PM emissions rate for these sources.

Emissions Source	ID No.	Process Rate (tph)	Allowable PM Emission Rate (lb/hr)	Potential PM Emission Rate (lb/hr)*	Compliance Expected?
Feed silo filling	ES-30	125	53.5	0.00609	yes
Feed silo unloading		75	48.4	0.00365	yes
STAR® reactor	ES-31	75	48.4	16.61	yes
FGD Byproduct Silo filling	ES-32	1.75	5.97	0.06	yes
FGD Byproduct Silo unloading		300	63		
FGD Absorbent Silo filling	ES-33	25	35.4	0.06	yes
FGD Absorbent Silo unloading		1.5	5.4		
EHE (Units1 and 2)	ES-34 ES-35	70	47.8	6.86	yes
Transfer silo filling	ES-36	125	53.5	0.006093	yes
Transfer silo unloading		75	48.4	0.00365	yes
Storage dome filling	ES-37	75	48.4	0.00365	yes
Storage dome unloading		275	62.02	0.0134	yes
Loadout silo	ES-38	300	63	0.0146	yes
Loadout silo chute 1A	ES-38A	100	51.3	0.00487	yes
Loadout silo chute 1B	ES-38B	100	51.3	0.00487	yes

Since compliance is expected well within the allowable emission rates, the following monitoring applies in order to ensure the control devices are being properly maintained and that the above after control rates are not exceeded.

Particulate matter emissions from these emission sources (ID Nos. ES-30, ES-32, ES-33, ES-34, ES-35, ES-36, ES-37, ES-38, ES-38A, ES-38B) shall be controlled by bin vent filters and baghouses (ID Nos. CD-30, CD-32, CD-33, CD-34, CD-35, CD-36, CD,37, CD-38, CD-38A, CD-38B). To assure compliance, the Permittee shall perform inspections and maintenance as recommended by the manufacturer. In addition to the manufacturer's inspection and maintenance recommendations, or if there is no manufacturer's inspection and maintenance recommendations, as a minimum, the inspection and maintenance requirement shall include the following:

i. a monthly visual inspection of the system ductwork and material collection unit for leaks; and
ii. an annual (for each 12-month period following the initial inspection) internal inspection of the baghouse's structural integrity.

The results of inspection and maintenance shall be maintained in a logbook (written or electronic format) on-site and made available to an authorized representative upon request. The logbook shall record the following:

i. the date and time of each recorded action;
ii. the results of each inspection;
iii. the results of any maintenance performed on the dust extraction system; and
iv. any variance from manufacturer's recommendations, if any, and corrections made.

Reporting

The Permittee shall submit the results of any maintenance performed on any control device within 30 days of a written request by the DAQ.

The Permittee shall submit a summary report of monitoring and recordkeeping activities postmarked on or before January 30 of each calendar year for the preceding six-month period between July and December and July 30 of each calendar year for the preceding six-month period between January and June.

2. 15A NCAC 02D .0521: CONTROL OF VISIBLE EMISSIONS

Visible emissions from these sources (ID Nos. ES-30, ES-32, ES-33, ES-34, ES-35, ES-36, ES-37, ES-38, ES-38A, ES-38B, ES-39A and ES-40A) shall not be more than 20 percent opacity (except during startups, shutdowns, and malfunctions) when averaged over a six-minute period. However, six-minute averaging periods may exceed 20 percent not more than once in any hour and not more than four times in any 24-hour period. In no event shall the six-minute average exceed 87 percent opacity.

Compliance

To ensure compliance, once a month the Permittee shall observe the emission points of this source (ID No. ES-31) for any visible emissions above normal. The monthly observation must be made for each month of the calendar year period to ensure compliance with this requirement. The Permittee shall establish "normal" for this source in the first 30 days following the effective date of beginning operation. If visible emissions from this source are observed to be above normal, the Permittee shall either:

i. take appropriate action to correct the above-normal emissions as soon as practicable and within the monitoring period and record the action taken as provided in the recordkeeping requirements below, or
ii. demonstrate that the percent opacity from the emission points of the emission source in accordance with 15A NCAC 02D .2610 (Method 9) for 12 minutes is below the emission limit.

The results of the monitoring shall be maintained in a logbook (written or electronic format) on-site and made available to an authorized representative upon request. The logbook shall record the following:

i. the date and time of each recorded action;
ii. the results of each observation and/or test noting those sources with emissions that were observed to be in noncompliance along with any corrective actions taken to reduce visible emissions; and
iii. the results of any corrective actions performed.

Reporting

The Permittee shall submit a summary report of the monitoring and recordkeeping activities postmarked on or before January 30 of each calendar year for the preceding six-month period between

July and December and on or before July 30 of each calendar year for the preceding six-month period between January and June.

C. Ash basin (ID No. F-4)

Applicable Regulations

1. 15A NCAC 02D .0540: PARTICULATES FROM FUGITIVE NON-PROCESS DUST EMISSION SOURCES
   a. For the purpose of this Rule the following definitions shall apply:
      i. "Fugitive non-process dust emission" means particulate matter that is not collected by a capture system and is generated from areas such as pit areas, process areas, haul roads, stockpiles, and plant roads.
      ii. "Substantive complaints" means complaints that are verified with physical evidence acceptable to the DAQ.
   b. The Permittee shall not cause or allow fugitive non-process dust emissions to cause or contribute to substantive complaints.
   c. If fugitive non-process dust emissions from a facility required complying with this Rule cause or contributing to substantive complaints, the Permittee shall:
      i. Within 30 days upon receipt of written notification from the Director of a second substantive complaint in a 12-month period, submit to the Director a written description of what has been done and what will be done to reduce fugitive non-process dust emissions from that part of the facility that caused the second substantive complaint;
      ii. Within 90 days of receipt of written notification from the Director of a second substantive complaint in a 12-month period, submit to the Director a control plan as described in Paragraph (e) of this Rule; and
      iii. Within 30 days after the Director approves the plan, be in compliance with the plan.
   d. The Director may require that the Permittee develop and submit a fugitive non-process dust control plan as described in Paragraph (e) of this Rule if:
      i. Ambient air quality measurements or dispersion modeling acceptable to the DAQ show violation or a potential for a violation of an ambient air quality standard for particulates in 15A NCAC 02D .0400 "Ambient Air Quality Standards;" or
      ii. If the DAQ observes excessive fugitive non-process dust emissions from the facility beyond the property boundaries.

      The control plan shall be submitted to the Director no later than 90 days after notification. The facility shall be in compliance with the plan within 30 days after the Director approves the plan.
   e. The fugitive dust control plan shall:
      i. Identify the sources of fugitive non-process dust emissions within the facility;
      ii. Describe how fugitive non-process dust will be controlled from each identified source;
      iii. Contain a schedule by which the plan will be implemented;
      iv. Describe how the plan will be implemented, including training of facility personnel; and
      v. Describe methods to verify compliance with the plan.
   f. The Director shall approve the plan if:
      i. The plan contains all required elements in Paragraph (e) of this Rule;
      ii. The proposed schedule contained in the plan will reduce fugitive non-process dust emissions in a timely manner;
      iii. The methods used to control fugitive non-process dust emissions are sufficient to prevent fugitive non-process dust emissions from causing or contributing to a violation of the ambient air quality standards for particulates; and
      iv. The described compliance verification methods are sufficient to verify compliance with the plan.

      If the Director finds that the proposed plan does not meet the requirements of this Paragraph he shall notify the Permittee of any deficiencies in the proposed plan. The Permittee shall have 30 days after receiving written notification from the Director to correct the deficiencies.

g. If, after a plan has been implemented, the Director finds that the plan inadequately controls fugitive non-process dust emissions, the Permittee shall be required to correct the deficiencies in the plan. Within 90 days after receiving written notification from the Director identifying the deficiency, the Permittee shall submit a revision to his plan to correct the deficiencies.

D. Multiple Emission Sources

Applicable Regulations

1. Facility-wide Toxics Demonstration

State-Only Requirement

15A NCAC 02D .1100 CONTROL OF TOXIC AIR POLLUTANTS

As a result of this modification to add the STAR® reactor and supporting ancillary sources emitting toxic air pollutants, a facility-wide toxics modeling demonstration is triggered.

In accordance with 15A NCAC 02Q .0709(a), the owner or operator of a source who is applying for a permit or permit modification to emit toxic air pollutants shall:

i. demonstrate to the satisfaction of the Director through dispersion modeling that the emissions of toxic air pollutants from the facility will not cause any acceptable ambient level listed in 15A NCAC 02D .1104 to be exceeded beyond the premises (adjacent property boundary); or
ii. demonstrate to the satisfaction of the Commission or its delegate that the ambient concentration beyond the premises (adjacent property boundary) for the subject toxic air pollutant shall not adversely affect human health (e.g., a risk assessment specific to the facility) though the concentration is higher than the acceptable ambient level in 15A NCAC 02D .1104.

As required by NCAC 02Q .0706(b), the owner or operator of the facility shall submit a permit application to comply with 15A NCAC 02D .1100 if the modification results in:

i. a net increase in emissions or ambient concentration of any toxic air pollutant that the facility was emitting before the modification; or
ii. emissions of any toxic air pollutant that the facility was not emitting before the modification if such emissions exceed the levels contained in 15A NCAC 02Q .0711.

As required by NCAC 02Q .0706(c), the permit application shall include an evaluation for all toxic air pollutants covered under 15A NCAC 02D .1104 for which there is:

i. a net increase in emissions of any toxic air pollutant that the facility was emitting before the modification; and
ii. emission of any toxic air pollutant that the facility was not emitting before the modification if such emissions exceed the levels contained in 15A NCAC 02Q .0711.

All sources at the facility, excluding sources exempt from evaluation in 15A NCAC 02Q .0702, emitting these toxic air pollutants shall be included in the evaluation.

Duke performed a facility-wide air toxics analysis, for all new and existing sources being permitted, including the existing MACT sources, except the new MACT diesel engines (ID Nos. ES-39B and ES-40B) and the 1000-gallon gasoline storage tank (ID No. 4) were not included. Air toxics emissions for the sources in this permit subject to a Part 63 MACT are exempt from air permitting, pursuant to 02Q .0702(a)(27)(B) and a Permittee is not required to model exempt MACT sources. Nevertheless, except for the above two MACT engines, the Permittee has volunteered to include emissions for all such exempt sources in the modeling analysis. The gasoline tank is not a MACT source, and should have been included in Duke's modeling. Duke will be required to submit an application including a modeling demonstration for the purpose of updating the air toxics emission rates in Section 2.2.A.1.a of the permit as necessary for final as-built equipment locations showing compliance with 15A NCAC 2D .1100 prior to startup of the STAR® equipment to include all sources and any updated as-built equipment locations (see Section 2.2.A.1.b of the draft permit). Potential toxic emissions from these sources were determined to be insignificant as shown in the Health Risk Assessment below, which addresses the omission of the two engines and gasoline storage tank from the toxics demonstration.

The first step in the toxics analysis, as stated above, is to determine if the modification results in a net increase in emissions or ambient concentration of any toxic air pollutant that the facility was emitting before the modification, or if the modification results in emissions of any toxic air pollutant that the facility was not emitting before the modification if such emissions exceed the levels contained in 15A NCAC 02Q .0711. Table 4 presents the potential emissions for the short-term and annual pollutants for the TAPs for which the modification results in a net increase in emissions that the facility was emitting before the modification. There are no new TAPs being emitted for which the facility was not emitting before the modification.

Table 4
Toxic Emissions Increase for the Proposed STAR® Project

Compound	Total Emission Increases		
	lb/hr	lb/day	lb/yr
Sulfuric acid	1.00E-01	2.40	
Benzene			3.34
Formaldehyde	7.64E-03		
Hexane		2.54	
Toluene	1.32E-03	3.17E-02	
Arsenic			8.60
Beryllium			0.94
Cadmium			0.61
Chromium VI		4.05E-04	
Manganese		3.34E-02	
Mercury		4.64E-04	
Nickel		1.71E-02	

Once it had been determined which TAP emissions were being increased due to the modification, the next step of the modeling analysis is to perform a toxic pollutant emission rate (TPER) analysis using total facility-wide potential emissions from the proposed modification (Table 4) and the existing sources, to determine if the TPERs in rule 02Q .0711 were exceeded for each TAP emission being increased.

The TPER analysis showed that all facility-wide (except for the two engines ES-39B and ES-40B) toxic potential emissions exceeded their respective TPERs, except for the hourly toluene emission rate, as shown in Table 5 below.

Table 5
Toxic Pollutant Emission Rate (TPER) Analysis*

Compound	Facility-wide Potential Emission Rates			Toxic Pollutant Emission Rates (TPER)			TPER Exceeded?		
	lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr
Sulfuric acid	270.61	6494.64		0.025	0.25		yes	yes	
Benzene			1787.54			8.1			yes
Formaldehyde	11.61			0.04			yes		
Hexane		64.18			23.0			yes	
Toluene	4.42	106.11		14.4	98.0		no	yes	
Arsenic			289.30			0.053			yes
Beryllium			8.86			0.28			yes
Cadmium			124.13			0.37			yes
Chromium VI		2.12			0.013			yes	
Manganese		302.91			0.630			yes	
Mercury		0.46			0.013			yes	
Nickel		1.79			0.013			yes	

* Potential emission rates taken from Duke's application Appendix B, Table 1A.

After the toxics exceeding their TPERs were identified, an air dispersion modeling analysis was completed using potential emissions for comparison to the allowable Acceptable Ambient Levels (AALs).

The toxic modeling analysis was conducted with emissions rates and exhaust characteristics (flow rate and temperature) that are expected to represent the worst-case parameters for the proposed and existing sources.

The analysis included all existing sources (except for the gasoline storage tank as discussed above) including the five existing simple-cycle combustion turbines (Lee IC Unit Nos. 10-14) and the three existing combined-cycle/simple-cycle combustion turbines (Lee IC Unit No. 1A, 1B and 1C). The existing combined-cycle turbines were modeled in combined-cycle mode at 100 percent load with duct burners and in simple-cycle mode at 100 percent load with evaporative coolers to account for the worst-case stack parameters. The annual emissions were modeled with four scenarios that are based on the following combinations:

Scenario #1 Each combined-cycle combustion turbine operating in:

- Combined-cycle mode for 6,760 hours per year (hr/yr) operating on natural gas.
- Simple-cycle mode for 1,000 hr/yr operating on natural gas and 1,000 hr/yr operating on fuel oil.

Scenario #2 Each combustion turbine operating in:

- Combined-cycle mode for 5,760 hr/yr operating on natural gas and 1,000 hr/yr operating on fuel oil.
- Simple-cycle mode for 2,000 hr/yr operating on natural gas.

Scenario #3 Each combustion turbine operating in combined-cycle mode for 8,760 hr/yr operating on natural gas.

Scenario #4 Each combustion turbine operating in combined-cycle mode for 7,760 hr/yr operating on natural gas and 1,000 hr/yr operating on fuel oil.

For each of the four combined-cycle annual scenarios above, there were 3 corresponding scenarios for the 5 simple cycle turbines, for a total of 12 scenarios for the turbines:

- All 5 simple cycle turbines on oil for 2000 hours.
- All 5 simple cycle turbines on gas for 2000 hours.
- All 5 simple cycle turbines 1000 hours gas/1000 hours oil.

To maximize operational flexibility and to possibly reduce the need for future TAP modeling analyses for these sources at the facility, Duke requested permit limits based on “optimized” emission rates. That is, based on the resulting concentrations from the potential model run, the potential emission rates for each source were increased to optimized rates which result in ambient concentrations that are a greater percent of the AALs than for the potential model run while still staying below 100% the AALs. A comparison of the potential (baseline) and optimized rates is shown in Table 6 with the ratio of increase from potential emissions to optimized emissions indicated. Results for the optimized modeling analysis are shown in Table 7 below with the resulting percent of the AAL for each toxic.

Table 6
Comparison of Potential Emissions to Optimized Emissions

Compound	Facility-wide Potential Emission Rates			Facility-wide Optimized Emission Rates			Ratio of Potential to Optimized Emissions		
	lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr
Sulfuric acid	270.61	6494.64		947.13	10,781.10		2.9E-01	6.0E-01	
Benzene			1787.54			510,598.49			3.5E-03
Formaldehyde	11.61			1776.30			6.5E-03		
Hexane		64.18			138,647.28			4.6E-04	
Toluene	4.42	106.11		961,534.32	11,593,642.41		4.6E-06	9.2E-06	
Arsenic			289.30			387.55			7.5E-01
Beryllium			8.86			212.67			4.2E-02
Cadmium			124.13			14,274.49			8.7E-03
Chromium VI		2.12			616.41			3.4E-03	
Manganese		302.91			62,703.25			4.8E-03	
Mercury		0.46			1204.33			3.8E-04	
Nickel		1.79			232.17			7.7E-03	

Table 7
Results of Optimized Modeling Analysis

Compound	Averaging Period	Maximum Impact ($\mu g/m^3$)*	Maximum Allowable Concentration ($\mu g/m^3$)	Percent of AAL (%)	Complies?
Sulfuric acid	1-hr	91.61	100	91.6	yes
	24-hr	10.51	12.00	87.6	yes
Benzene	annual	1.15E-01	1.20E-01	95.9	yes
Formaldehyde	1-hr	140.91	150	93.9	yes
Hexane	24-hr	1,063.46	1,100	96.7	yes
Toluene	1-hr	53,600.71	56,000	95.7	yes
	24-hr	4,502.69	4,700	95.8	yes
Arsenic	annual	2.02E-03	2.10E-03	96.2	yes
Beryllium	annual	3.94E-03	4.10E-03	96.1	yes
Cadmium	annual	5.37E-03	5.50E-03	97.6	yes
Chromium VI	24-hr	0.58	0.62	93.5	yes
Manganese	24-hr	29.13	31	94.0	yes
Mercury	24-hr	0.57	0.60	95.4	yes
Nickel	24-hr	0.59	0.60	98.4	yes

* Maximum impact over 5-years (2012-2016) of meteorological data

Duke's toxics dispersion modeling analysis was received on November 14, 2017, and was reviewed by Alex Zarnowski, AQAB, (see memo to Ed Martin dated January 8, 2018) and, as stated in the memo, the modeling results demonstrate compliance.

<u>Health Risk Assessment</u>
As stated above, Duke performed a facility-wide air toxics analysis for all new and existing sources being permitted, except the new MACT diesel engines ES-39B and ES-40B and the (non-MACT) 1000-gallon gasoline storage tank ID No. 4 were not included. Therefore, to demonstrate that the modification would not present an unacceptable risk to human health, the following evaluation is made to determine the effect by not including these sources in the facility-wide modeling. Even though MACT sources are exempt from toxics permitting, they must be evaluated in the health risk assessment.

Engines ES-39B and ES-40B

Engine ES-39B is a 91 hp No. 2 fuel oil-fired screener engine that operates 2600 hours per year and engine ES-40B is a 300 hp No. 2 fuel oil-fired crusher engine that operates one hour per day. The potential toxics emitted by these engines are determined using DAQ's spreadsheet for Gas and Diesel Internal Combustion Engines with power rating less than or equal to 600 hp for diesel fueled engines, as shown in Table 8.

Table 8
Toxic Emission Increases from Engines ES-39B and ES-40B*

Compound	Engine ES-39B			Engine ES-40B			Total Engines ES-39B and ES-40B		
	lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr
Sulfuric acid **									
Benzene			1.55E+00			7.15E-01			2.26E+00
Formaldehyde	7.52E-04			2.48E-03			3.23E-03		
Hexane***									
Toluene	2.61E-04	6.25E-03		8.59E-04	2.06E-02		1.12E-03	2.68E-02	
Arsenic			6.62E-03			3.07E-03			9.69E-03
Beryllium			4.97E-03			2.30E-03			7.27E-03
Cadmium			4.97E-03			2.30E-03			7.27E-03
Chromium VI		4.59E-05			1.51E-04			1.97E-04	
Manganese		9.17E-05			3.02E-04			3.94E-04	
Mercury		4.59E-05			1.51E-04			1.97E-04	
Nickel		4.59E-05			1.51E-04			1.97E-04	

* From DAQ spreadsheet for Gas and Diesel Internal Combustion Engines with power rating less than or equal to 600 hp for diesel fueled engines.
** Sulfuric acid not listed in AP-42 Section 3.3 or DAQ's spreadsheet.
*** Not emitted from diesel fuel.

Gasoline Tank No. 4

The 1000-gallon gasoline tank was inadvertently omitted from Duke's toxics modeling. The potential toxics emitted by this tank (from previous modeling) are shown in Table 9.

Table 9
Toxic Emission Increases from Gasoline Tank No. 4

Compound	Gasoline Tank No. 4		
	lb/hr	lb/day	lb/yr
Benzene			1.11E+01
Hexane		2.40E-02	
Toluene	4.77E-03	1.14E-01	

The total TAP emissions for the engines from Table 8, and from the gasoline tank from Table 9 are taken to Table 10 for comparison to the total facility-wide optimized emissions as modeled without the emissions from the two engines and gasoline tank as taken from Table 6 above.

Table 10
Toxic Emission Increases from Engines ES-39B and ES-40B and Gasoline Tank No. 4

Compound	Emission Rates from Engines ES-39B and ES-40B and Gasoline Tank No. 4*			Facility-wide Optimized Emission Rates** without Engines ES-39B and ES-40B and Gasoline Tank No. 4			Percent Increase due to Engines ES-39B and ES-40B and Gasoline Tank No. 4 (%)		
	lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr
Benzene			1.34E+01			510,598.49			2.61E-03
Formaldehyde	3.23E-03			1776.30			1.8E-04		
Hexane		2.40E-02			138,647.28			1.73E-05	
Toluene	5.89E-03	1.41E-01		961,534.32	11,593,642.41		6.13E-07	1.21E-06	
Arsenic			9.69E-03			387.55			2.5E-03
Beryllium			7.27E-03			212.67			3.41E-03
Cadmium			7.27E-03			14,274.49			5.09E-05
Chromium VI		1.97E-04			616.41			3.19E-05	
Manganese		3.94E-04			62,703.25			6.28E-07	
Mercury		1.97E-04			1204.33			1.63E-05	
Nickel		1.97E-04			232.17			8.49E-05	

* Total from Tables 8 and 9
** From Table 6

It can be seen that the percent increase contribution from the two engines and gasoline tank is insignificant; therefore, there is not an unacceptable risk to human health from the modification.

No toxics monitoring is required since the potential emissions are significantly below the optimized emissions (Ratio of Potential to Optimized Emissions in Table 6) which results in compliance with the AALs as shown in Table 7.

Detailed toxic emission calculations are presented in Duke's application Appendix B.

The permit toxic limits for all sources modeled, except for the MACT sources which are exempt from toxics permitting, are shown below in Table 10. No toxics monitoring is required since the baseline modeling analysis shows the percent of AAL to be very small (see Table 6). In addition, as discussed above, emissions from the gasoline tank were not modeled. The limits for this tank shown below are potential emissions and are to be revised in an updated modeling analysis (as discussed above and noted in the table) showing compliance with 15A NCAC 2D .1100 prior to startup of the STAR® equipment.

Table 10
Permit Toxic Emission Limits

Emission Source	Toxic Air Pollutant	Emission Limit		
		(lb/yr)	(lb/day)	(lb/hr)
Lee IC Units No. 10 and 11 (per turbine)	Sulfuric acid		3.23E+02	2.84E+01
	Benzene	1.33E+04		
	Formaldehyde			2.10E+02
	Toluene		1.87E+06	1.55E+05
	Arsenic	1.31E+01		
	Beryllium	6.53E+00		
	Cadmium	4.85E+02		
	Chromium VI		2.40E+01	
	Manganese		7.55E+03	
	Mercury		1.45E+02	
	Nickel		2.76E+01	
Lee IC Units No. 12 and 13 (per turbine)	Sulfuric acid		3.22E+02	2.83E+01
	Benzene	1.25E+04		
	Formaldehyde			1.97E+02
	Toluene		1.77E+06	1.47E+05
	Arsenic	1.23E+01		
	Beryllium	6.19E+00		
	Cadmium	4.58E+02		
	Chromium VI		2.27E+01	
	Manganese		7.15E+03	
	Mercury		1.37E+02	
	Nickel		2.61E+01	
ID No.4 Gasoline storage tank - 1,000 gallons * potentials shown until remodeled – see permit Section 2.2.A.1.b	Benzene*	1.11E+01		
	Hexane*		2.40E-02	
	Toluene*		1.14E-01	4.77E-03
ES-30 Feed silo	Arsenic	2.03E-03		
	Beryllium	3.97E-03		
	Cadmium	8.07E-04		
	Chromium VI		4.56E-05	
	Manganese		2.63E-03	
	Mercury		9.78E-05	
	Nickel		7.08E-04	
ES-31 STAR® feedstock processing reactor	Sulfuric acid		3.98E+00	3.50E-01
	Benzene	3.25E+02		
	Formaldehyde			6.75E-01
	Hexane		5.75E+03	
	Toluene		5.24E+02	4.35E+01

	Arsenic	7.72E+00		
	Beryllium	1.50E+01		
	Cadmium	6.83E+01		
	Chromium VI		7.75E-02	
	Manganese		4.59E+00	
	Mercury		1.13E+00	
	Nickel		1.59E+00	
ES-34 EHE- external heat exchanger 1	Arsenic	3.13E+00		
	Beryllium	6.14E+00		
	Cadmium	1.24E+00		
	Chromium VI		3.21E-02	
	Manganese		1.85E+00	
	Mercury		6.90E-02	
	Nickel		4.99E-01	
ES-35 EHE- external heat exchanger 2	Arsenic	3.13E+00		
	Beryllium	6.14E+00		
	Cadmium	1.24E+00		
	Chromium VI		3.21E-02	
	Manganese		1.85E+00	
	Mercury		6.90E-02	
	Nickel		4.99E-01	
ES-36 Transfer silo	Arsenic	2.03E-03		
	Beryllium	3.97E-03		
	Cadmium	8.07E-04		
	Chromium VI		4.56E-05	
	Manganese		2.63E-03	
	Mercury		9.78E-05	
	Nickel		7.08E-04	
ES-37 Storage dome	Arsenic	2.03E-03		
	Beryllium	3.97E-03		
	Cadmium	8.07E-04		
	Chromium VI		7.96E-05	
	Manganese		4.60E-03	
	Mercury		1.71E-04	
	Nickel		1.24E-03	
ES-38 Loadout silo	Arsenic	1.02E-03		
	Beryllium	1.99E-03		
	Cadmium	4.05E-04		
	Chromium VI		6.84E-05	
	Manganese		3.94E-03	
	Mercury		1.47E-04	
	Nickel		1.06E-03	
ES-38A Loadout silo chute 1A	Arsenic	5.08E-04		
	Beryllium	9.94E-04		
	Cadmium	2.02E-04		

	Chromium VI		2.28E-05	
	Manganese		1.31E-03	
	Mercury		4.89E-05	
	Nickel		3.56E-04	
ES-38B Loadout silo chute 1B	Arsenic	5.08E-04		
	Beryllium	9.94E-04		
	Cadmium	2.02E-04		
	Chromium VI		2.28E-05	
	Manganese		1.31E-03	
	Mercury		4.89E-05	
	Nickel		3.56E-04	
I-F-1 Wet ash receiving transfer to shed	Arsenic	4.45E-04		
	Beryllium	8.74E-04		
	Cadmium	1.77E-04		
	Chromium VI		6.98E-06	
	Manganese		4.04E-04	
	Mercury		1.51E-05	
	Nickel		1.09E-04	
I-F-2 Wet ash receiving transfer to hopper	Arsenic	8.91E-04		
	Beryllium	1.75E-03		
	Cadmium	3.54E-04		
	Chromium VI		1.40E-05	
	Manganese		8.10E-04	
	Mercury		3.01E-05	
	Nickel		2.18E-04	
I-F-3 Wet ash receiving unloading pile	Arsenic	1.43E-03		
	Beryllium	2.80E-03		
	Cadmium	5.68E-04		
	Chromium VI		1.47E-05	
	Manganese		8.45E-04	
	Mercury		3.15E-05	
	Nickel		2.28E-04	
F-4 Ash basin I-F-5 Ash handling I-ES-39A Screener I-ES-40A Crusher	Arsenic	7.51E-01		
	Beryllium	1.47E+00		
	Cadmium	2.99E-01		
	Chromium VI		7.82E-03	
	Manganese		4.49E-01	
	Mercury		1.67E-02	
	Nickel		1.21E-01	

2. Three natural gas/No. 2 fuel oil-fired simple/combined cycle internal combustion turbines (ID Nos. Lee IC Unit No. 1A, Lee IC Unit No. 1B and Lee IC Unit No. 1C), each equipped with dry low-NO_x combustors and water injection control, a heat recovery steam generator with natural gas-fired duct burner, and a common steam turbine; and associated selective catalytic reduction (ID Nos. Unit 1A SCR, Unit 1B SCR and Unit 1C SCR) and oxidation catalyst (ID Nos. Unit 1A OxdnCat, Unit 1B OxdnCat and Unit 1C OxdnCat)

One STAR® flyash feedstock processing reactor equipped with natural gas/propane startup burners (ID No. ES-31) and associated dry scrubber (ID No. CD-31A) and baghouse (ID No. CD-31B)

EHE- external heat exchanger 1 (ID No. ES-34) and associated baghouse (ID No. CD-34), and EHE- external heat exchanger 2 (ID No. ES-35) and associated baghouse (ID No. CD-35)

Applicable Regulations
15A NCAC 02Q .0317: AVOIDANCE CONDITION for
15A NCAC 02D .0530: PREVENTION OF SIGNIFICANT DETERIORATION

a. In order to avoid applicability of 15A NCAC 02D .0530(g), the combined emissions of nitrogen oxides, sulfur dioxide, particulate matter, PM-10, PM-2.5, carbon monoxide, VOCs, sulfuric acid and lead from these sources (ID Nos. Lee IC Unit 1A, Lee IC Unit 1B, Lee IC Unit 1C, ES-31, EHE-34 and EHE-35) shall not exceed the following limits.

Regulated Pollutant	Limits/Standards (tons per year)	Applicable Regulation
nitrogen oxides	3414.6	15A NCAC 02Q.0317(a)(1) (PSD avoidance)
sulfur dioxide	14,663.1	
particulate matter	218.2	
PM-10	218.2	
PM-2.5	218.2	
carbon monoxide	829.3	
VOCs	65.1	
sulfuric acid	64.3	
lead	0.77	

Compliance
b. The Permittee shall keep records of the monthly emissions from each source (ID Nos. Lee IC Unit 1A, Lee IC Unit 1B, Lee IC Unit 1C, ES-31, EHE-34 and EHE-35) in a logbook (written or in electronic format). The Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530(g) if these records are not kept or if any of the above limits are exceeded. Emissions shall be determined as follows:

Total emissions of nitrogen oxides =

$$\textit{Lee IC Unit 1A CEMS} + \textit{Lee IC Unit 1B CEMS} + \textit{Lee IC Unit 1C CEMS} + 5.36^{*} \frac{tons}{rolling\ 12\ months} \leq 3414.6 \frac{tons}{rolling\ 12\ months}$$

* This number represents the potential emissions from the STAR® ancillary sources (all sources except ES-31, ES-34 and ES-35) in this and the following equations (see Table 3 above).

Sulfur Dioxide
Emissions of sulfur dioxide shall be determined in accordance with the following equation.

$$Total\ emissions\ of\ sulfur\ dioxide =$$

$$\left(\frac{0.00152\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC{-}oil, Lee\ IC\ Unit\ 1A}{rolling\ 12\ months} + \frac{mmBtu\ SC{-}oil, Lee\ IC\ Unit\ 1B}{rolling\ 12\ months} + \frac{mmBtu\ SC{-}oil, Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right) +$$

$$\left(\frac{0.0006\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC{-}gas, Lee\ IC\ Unit\ 1A}{rolling\ 12\ months} + \frac{mmBtu\ SC{-}gas, Lee\ IC\ Unit\ 1B}{rolling\ 12\ months} + \frac{mmBtu\ SC{-}gas, Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right) +$$

$$\left(\frac{0.00152\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC{-}oil, Lee\ IC\ Unit\ 1A}{rolling\ 12\ months} + \frac{mmBtu\ CC{-}oil, Lee\ IC\ Unit\ 1B}{rolling\ 12\ months} + \frac{mmBtu\ CC{-}oil, Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right) +$$

$$\left(\frac{0.0006\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC{-}gas, Lee\ IC\ Unit\ 1A}{rolling\ 12\ months} + \frac{mmBtu\ CC{-}gas, Lee\ IC\ Unit\ 1B}{rolling\ 12\ months} + \frac{mmBtu\ CC{-}gas, Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right) +$$

$$0.35^{*}\ \frac{tons}{rolling\ 12\ months} \le 14{,}663.1\ \frac{tons}{rolling\ 12\ months}$$

Particulate Matter
Emissions of particulate matter shall be determined in accordance with the following equation.

$$Total\ emissions\ of\ particulate\ matter =$$

$$\left(\frac{0.0232\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC{-}oil, Lee\ IC\ Unit\ 1A}{rolling\ 12\ months} + \frac{mmBtu\ SC{-}oil, Lee\ IC\ Unit\ 1B}{rolling\ 12\ months} + \frac{mmBtu\ SC{-}oil, Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right) +$$

$$\left(\frac{0.0074\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC{-}gas, Lee\ IC\ Unit\ 1A}{rolling\ 12\ months} + \frac{mmBtu\ SC{-}gas, Lee\ IC\ Unit\ 1B}{rolling\ 12\ months} + \frac{mmBtu\ SC{-}gas, Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right) +$$

$$\left(\frac{0.0244\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC{-}oil, Lee\ IC\ Unit\ 1A}{rolling\ 12\ months} + \frac{mmBtu\ CC{-}oil, Lee\ IC\ Unit\ 1B}{rolling\ 12\ months} + \frac{mmBtu\ CC{-}oil, Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right) +$$

$$\left(\frac{0.0062\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC{-}gas, Lee\ IC\ Unit\ 1A}{rolling\ 12\ months} + \frac{mmBtu\ CC{-}gas, Lee\ IC\ Unit\ 1B}{rolling\ 12\ months} + \frac{mmBtu\ CC{-}gas, Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right) +$$

$$\left(\frac{number\ hours\ operated, ES{-}31}{rolling\ 12\ months}\right)(77{,}500\ acfm\ baghouse\ flow\ rate)\left(\frac{0.025\ grains}{acf}\right)\left(\frac{60\ min}{hour}\right)\left(\frac{lb}{7000\ grains}\right) +$$

$$\left(\frac{number\ hours\ operated, ES{-}34}{rolling\ 12\ months}\right)(32{,}000\ acfm\ baghouse\ flow\ rate)\left(\frac{0.025\ grains}{acf}\right)\left(\frac{60\ min}{hour}\right)\left(\frac{lb}{7000\ grains}\right) +$$

$$\left(\frac{number\ hours\ operated, ES{-}35}{rolling\ 12\ months}\right)(32{,}000\ acfm\ baghouse\ flow\ rate)\left(\frac{0.025\ grains}{acf}\right)\left(\frac{60\ min}{hour}\right)\left(\frac{lb}{7000\ grains}\right) +$$

$$9.71^{*}\ \frac{tons}{rolling\ 12\ months} \le 218.2\ \frac{tons}{rolling\ 12\ months}$$

where:

mmBtuSC-oil	=	heat input for last 12 month period when burning fuel oil in simple-cycle mode
mmBtuSC-gas	=	heat input for last 12 month period when burning natural gas in simple-cycle mode
mmBtuCC-oil	=	heat input for last 12 month period when burning fuel oil in combined-cycle mode
mmBtuCC-gas	=	heat input for last 12 month period when burning natural gas in combined-cycle mode

PM-10

Emissions of PM-10 shall be determined in accordance with the following equation.

$$Total\ emissions\ of\ PM-10 =$$

$$\left(\frac{0.0232\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC-oil,Lee\ IC\ Unit\ 1A}{rolling\ 12\ months}+\frac{mmBtu\ SC-oil,Lee\ IC\ Unit\ 1B}{rolling\ 12\ months}+\frac{mmBtu\ SC-oil,Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.0074\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC-gas,Lee\ IC\ Unit\ 1A}{rolling\ 12\ months}+\frac{mmBtu\ SC-gas,Lee\ IC\ Unit\ 1B}{rolling\ 12\ months}+\frac{mmBtu\ SC-gas,Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.0244\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC-oil,Lee\ IC\ Unit\ 1A}{rolling\ 12\ months}+\frac{mmBtu\ CC-oil,Lee\ IC\ Unit\ 1B}{rolling\ 12\ months}+\frac{mmBtu\ CC-oil,Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.0062\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC-gas,Lee\ IC\ Unit\ 1A}{rolling\ 12\ months}+\frac{mmBtu\ CC-gas,Lee\ IC\ Unit\ 1B}{rolling\ 12\ months}+\frac{mmBtu\ CC-gas,Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{number\ hours\ operated,ES-31}{rolling\ 12\ months}\right)(0.92)(77{,}500\ acfm\ baghouse\ flow\ rate)\left(\frac{0.025\ grains}{acf}\right)\left(\frac{60\ min}{hour}\right)\left(\frac{lb}{7000\ grains}\right)+$$

$$\left(\frac{number\ hours\ operated,ES-34}{rolling\ 12\ months}\right)(0.92)(32{,}000\ acfm\ baghouse\ flow\ rate)\left(\frac{0.025\ grains}{acf}\right)\left(\frac{60\ min}{hour}\right)\left(\frac{lb}{7000\ grains}\right)+$$

$$\left(\frac{number\ hours\ operated,ES-35}{rolling\ 12\ months}\right)(0.92)(32{,}000\ acfm\ baghouse\ flow\ rate)\left(\frac{0.025\ grains}{acf}\right)\left(\frac{60\ min}{hour}\right)\left(\frac{lb}{7000\ grains}\right)+$$

$$4.873^{*}\ \frac{tons}{rolling\ 12\ months} \le 218.2\frac{tons}{rolling\ 12\ months}$$

PM-2.5

Emissions of PM-2.5 shall be determined in accordance with the following equation.

$$Total\ emissions\ of\ PM-2.5 =$$

$$\left(\frac{0.0232\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC-oil,Lee\ IC\ Unit\ 1A}{rolling\ 12\ months}+\frac{mmBtu\ SC-oil,Lee\ IC\ Unit\ 1B}{rolling\ 12\ months}+\frac{mmBtu\ SC-oil,Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.0074\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC-gas,Lee\ IC\ Unit\ 1A}{rolling\ 12\ months}+\frac{mmBtu\ SC-gas,Lee\ IC\ Unit\ 1B}{rolling\ 12\ months}+\frac{mmBtu\ SC-gas,Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.0244\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC-oil,Lee\ IC\ Unit\ 1A}{rolling\ 12\ months}+\frac{mmBtu\ CC-oil,Lee\ IC\ Unit\ 1B}{rolling\ 12\ months}+\frac{mmBtu\ CC-oil,Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.0062\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC-gas,Lee\ IC\ Unit\ 1A}{rolling\ 12\ months}+\frac{mmBtu\ CC-gas,Lee\ IC\ Unit\ 1B}{rolling\ 12\ months}+\frac{mmBtu\ CC-gas,Lee\ IC\ Unit\ 1C}{rolling\ 12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{number\ hours\ operated,ES-31}{rolling\ 12\ months}\right)(0.53)(77{,}500\ acfm\ baghouse\ flow\ rate)\left(\frac{0.025\ grains}{acf}\right)\left(\frac{60\ min}{hour}\right)\left(\frac{lb}{7000\ grains}\right)+$$

$$\left(\frac{number\ hours\ operated,ES-34}{rolling\ 12\ months}\right)(0.53)(32{,}000\ acfm\ baghouse\ flow\ rate)\left(\frac{0.025\ grains}{acf}\right)\left(\frac{60\ min}{hour}\right)\left(\frac{lb}{7000\ grains}\right)+$$

$$\left(\frac{number\ hours\ operated,ES-35}{rolling\ 12\ months}\right)(0.53)(32{,}000\ acfm\ baghouse\ flow\ rate)\left(\frac{0.025\ grains}{acf}\right)\left(\frac{60\ min}{hour}\right)\left(\frac{lb}{7000\ grains}\right)+$$

$$1.262^{*}\ \frac{tons}{rolling\ 12\ months} \le 218.2\frac{tons}{rolling\ 12\ months}$$

Carbon Monoxide

Emissions of carbon monoxide shall be determined in accordance with the following equation.

$$Total\ emissions\ of\ CO = Lee\ IC\ Unit\ 1A\ CEMS + Lee\ IC\ Unit\ 1B\ CEMS + Lee\ Unit\ 1C\ CEMS\ +$$

$$\left(\frac{lb\ CO,ES-31}{mmBtu}\right)\left(\frac{mmBtu,ES-31}{rolling\ 12\ months}\right)\left(\frac{tons}{2000\ lb}\right) + 1.16^{*}\left(\frac{tons}{rolling\ 12\ months}\right) \leq 829.3\ \frac{tons}{rolling\ 12\ months}$$

where: $\left(\frac{lb\ CO,ES-31}{mmBtu}\right) = CO\ Emission\ factor\ for\ reactor\ ES-31\ to\ be\ determined\ by\ the\ following\ stack\ test$:

Testing [15A NCAC 02Q .0508(f)]

Under the provisions of NCGS 143-215.108, the Permittee shall demonstrate compliance with the CO emission limit above by conducting an initial stack test for CO emissions, with the reactor operating within 10% of its maximum heat input rate, in accordance with a testing protocol approved by the DAQ. Details of the emissions testing and reporting requirements can be found in Section 3 - General Condition JJ. Testing shall be completed within 90 days of initial start-up of the reactor (ID No. ES-31) and the results submitted according to Section 3 - General Condition JJ. Test results shall be the average of 3 valid test runs.

Test results shall be submitted as required in Section VIII.E.2.c below and the following information for each test run shall be included:

i. CO emissions (lb/mmBtu).
ii. Reactor heat input (mmBtu/hr).
iii. Reactor flyash raw feed rate (tons per hour).
iv. Flyash loss on ignition (% carbon).

The CO test results (lb/mmBtu) shall be used for ES-31 to calculate the total CO emissions each month in the above equation as soon as the test results have been completed regardless of whether the results have been approved by NCDAQ.

Carbon Monoxide Continuous Emissions Monitoring

The CO CEMS for Lee IC Unit 1A, Lee IC Unit 1B, Lee IC Unit 1C shall meet the requirements of 15A NCAC 02D .0613 except that:

i. A Cylinder Gas Audit (CGA) shall be conducted at least once each QA operating quarter on each simple-cycle stack CO CEMS and each combined-cycle stack CO CEMS in accordance with 40 CFR Part 75, Appendix B, §2.2.1 instead of once every calendar quarter. A QA operating quarter for each CO CEMS is defined as a calendar quarter in which the unit operates at least 168 unit operating hours (in simple-cycle or combined-cycle mode), and a unit operating hour is a clock hour during which a unit combusts any fuel, either for part of the hour or for the entire hour. Regardless of the number of hours of operation, at a minimum, a CGA shall be conducted at least once every four calendar quarters on each CO CEMS consistent with the requirements in 40 CFR Part 75, Appendix B, §2.2.3(f).
ii. A Relative Accuracy Test Audit (RATA) shall be conducted once every four successive QA operating quarters (as defined above) in accordance with 40 CFR Part 75, Appendix B, §2.3.1.2 instead of once every four calendar quarters. Regardless of the number of hours of operation, at a minimum, a RATA shall be conducted at least once every eight calendar quarters on each CO CEMS consistent with the requirements in 40 CFR Part 75, Appendix B, §2.3.1.1(a). The frequency timeline for the RATAs shall begin with the last RATA conducted prior to July 16, 2014.
iii. All grace period provisions from Part 75, Appendix B, §2.2.4 and, §2.3.3 apply.

VOCs

Emissions of VOCs shall be determined in accordance with the following equation.

Total emissions of VOCs =

$$\left(\frac{0.00085\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC-oil,Lee\ IC\ Unit\ 1A}{12\ months}+\frac{mmBtu\ SC-oil,Lee\ IC\ Unit\ 1B}{12\ months}+\frac{mmBtu\ SC-oil,Lee\ IC\ Unit\ 1C}{12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.00077\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC-gas,Lee\ IC\ Unit\ 1A}{12\ months}+\frac{mmBtu\ SC-gas,Lee\ IC\ Unit\ 1B}{12\ months}+\frac{mmBtu\ SC-gas,Lee\ IC\ Unit\ 1C}{12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.0004\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC-oil,Lee\ IC\ Unit\ 1A}{12\ months}+\frac{mmBtu\ CC-oil,Lee\ IC\ Unit\ 1B}{12\ months}+\frac{mmBtu\ CC-oil,Lee\ IC\ Unit\ 1C}{12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.0004\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC-gas,Lee\ IC\ Unit\ 1A}{12\ months}+\frac{mmBtu\ CC-gas,Lee\ IC\ Unit\ 1B}{12\ months}+\frac{mmBtu\ CC-gas,Lee\ IC\ Unit\ 1C}{12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{lb\ VOCs,ES-31}{mmBtu}\right)\left(\frac{mmBtu,ES-31}{rolling\ 12\ months}\right)\left(\frac{tons}{2000\ lb}\right)+0.43^{*}\left(\frac{tons}{rolling\ 12\ months}\right)\leq 65.1\ \frac{tons}{rolling\ 12\ months}$$

where: $\left(\frac{lb\ VOCs,ES-31}{mmBtu}\right) = VOC\ Emission\ factor\ for\ reactor\ ES-31\ to\ be\ determined\ by\ the\ following\ stack\ test$:

Testing [15A NCAC 02Q .0508(f)]

Under the provisions of NCGS 143-215.108, the Permittee shall demonstrate compliance with the VOC emission limit above by conducting an initial stack test for VOC emissions, with the reactor operating within 10% of its maximum heat input rate, in accordance with a testing protocol approved by the DAQ. Details of the emissions testing and reporting requirements can be found in Section 3 - General Condition JJ. Testing shall be completed within 90 days of initial start-up of the reactor (ID No. ES-31) and the results submitted according to Section 3 - General Condition JJ. Test results shall be the average of 3 valid test runs.

Test results shall be submitted as required in Section VIII.E.2.c below and the following information for each test run shall be included:

i. VOC emissions (lb/mmBtu).
ii. Reactor heat input (mmBtu/hr).
iii. Reactor flyash raw feed rate (tons per hour).
iv. Flyash loss on ignition (% carbon).

The VOC test results (lb/mmBtu) shall be used for ES-31 to calculate the total VOC emissions each month in the above equation as soon as the test results have been completed regardless of whether the results have been approved by NCDAQ.

Sulfuric Acid

Emissions of sulfuric acid shall be determined in accordance with the following equation.

$$Total\ Emissions\ (Sulfuric\ Acid) =$$

$$\left(\frac{0.000232\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC-oil,\ Lee\ IC\ Unit\ 1A}{12\ months}+\frac{mmBtu\ SC-oil,\ Lee\ IC\ Unit\ 1B}{12\ months}+\frac{mmBtu\ SC-oil,\ Lee\ IC\ Unit\ 1C}{12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.0000857\ lb}{mmBtu}\right)\left(\frac{mmBtu\ SC-gas,\ Lee\ IC\ Unit\ 1A}{12\ months}+\frac{mmBtu\ SC-gas,\ Lee\ IC\ Unit\ 1B}{12\ months}+\frac{mmBtu\ SC-gas,\ Lee\ IC\ Unit\ 1C}{12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.00107\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC-oil,\ Lee\ IC\ Unit\ 1A}{12\ months}+\frac{mmBtu\ CC-oil,\ Lee\ IC\ Unit\ 1B}{12\ months}+\frac{mmBtu\ CC-oil,\ Lee\ IC\ Unit\ 1C}{12\ months}\right)\left(\frac{ton}{2000\ lb}\right)+$$

$$\left(\frac{0.000402\ lb}{mmBtu}\right)\left(\frac{mmBtu\ CC-gas,\ Lee\ IC\ Unit\ 1A}{12\ months}+\frac{mmBtu\ CC-gas,\ Lee\ IC\ Unit\ 1B}{12\ months}+\frac{mmBtu\ CC-gas,\ Lee\ IC\ Unit\ 1C}{12\ months}\right)\left(\frac{ton}{2000\ lb}\right)\leq 64.3\frac{tons}{12\ months}$$

Lead
No monitoring is required for lead.

Reporting [15A NCAC 02Q .0508(f)]

c. The Permittee shall submit to the DAQ Permitting Section a summary of the results of the initial stack testing for the reactor ES-31 for CO and VOCs, that includes the information in Section 2.2.B.1.b above, and submit a complete permit application to revise the permit accordingly, no later than 30 days after completing the initial stack tests in accordance with General Condition JJ.
d. The Permittee shall submit a semi-annual summary report, acceptable to the Regional Air Quality Supervisor, of emissions of the above pollutants as applicable from each source (Lee IC Unit 1A, Lee IC Unit 1B, Lee IC Unit 1C, ES-31, ES-34 and ES-35) and the total for all sources based on the calculations above (tons per rolling consecutive 12-month period) postmarked on or before January 30 of each calendar year for the preceding six-month period between July and December, and July 30 of each calendar year for the preceding six-month period between January and June. The emissions must be calculated for each of the 12-month periods over the previous 17 months. The report shall note any monthly emissions that do not include CO or VOC emissions from the reactor ES-31 or do not include DAQ-approved CO or VOC emissions from the reactor ES-31.

IX. 1-hour NO_2 and SO_2 NAAQS Modeling

In an email dated February 1, 2018, Duke was asked to complete 1-hour NO_2 and SO_2 NAAQS modeling, as internal DAQ discussions indicated this modeling was needed to be consistent with the Buck STAR® application.

The necessity of the 1-hour modeling is related to how the emissions from the project are handled with respect to PSD. Previously, before asking Duke to model, a letter had been sent to Duke on December 18, 2017, informing them that the STAR® modification emissions cannot be included under the existing Prevention of Significant Deterioration (PSD) avoidance limits since those limits were for an unrelated project, and therefore those emissions must be analyzed separately with respect to the applicability of PSD.

In a meeting with Duke on January 5, 2018 (William Willets, Cyndi Winston, Erin Wallace and Ed Martin), to discuss DAQ's request in the above December 18, 2017 letter (item 1) for more information regarding PSD applicability, Duke presented their reasoning why they believed the project emissions should be included under the existing PSD avoidance limits as originally requested in the application and was asked to provide additional information for DAQ's review.

In a conference call on February 5, 2018 with Duke (William Willets, Mark Cuilla, Booker Pullen, Cyndi Winston, Erin Wallace and Ed Martin), to discuss Duke's proposed reasoning to include the project emissions under the existing PSD avoidance limits, Duke mentioned there may be differences between the Buck and Lee projects regarding whether it was necessary to conduct 1-hour NO_2 and SO_2 NAAQS modeling for Lee. DAQ asked Duke to provide their reasoning in a letter.

In an internal DAQ meeting (William Willets, Tom Anderson, Matt Porter and Ed Martin) on February 13, 2018, the Buck 1-hour NO_2 and SO_2 NAAQS modeling, recently reviewed and approved by DAQ, was discussed with respect to whether this modeling was needed for Lee. The decision depended on receipt of Duke's letter (for which DAQ was awaiting) with their reasons and justification regarding whether the project emissions can be included under the existing PSD avoidance limits.

In a letter received February 19, 2018 (dated February 7, 2018), Duke submitted their rationale that the STAR® project should be considered part of the same project that retired the coal-fired boilers and installed the three new combined cycle turbines and to therefore include the STAR® project emissions under the existing PSD avoidance limits.

On February 20, 2018, after reviewing Duke's rationale in their February 7, 2018 letter that the STAR® ash beneficiation project should be considered as part of the same project that retired the three coal-fired boilers and installed the three new combined cycle turbines, Duke was informed that DAQ agreed and that the STAR® project emissions can be included under the existing PSD avoidance limits (see Existing PSD Avoidance Condition in Section VII.A).

For the Lee STAR® project, there are no modeling requirements because emissions will be included under the existing PSD avoidance limits and therefore the allowable emission limits are not being increased.

Note, for comparison, in the proposed Buck STAR® project, Duke was requested to model 1-hour NO_2 and SO_2 NAAQS emissions to demonstrate that the contemporaneous emissions decreases used in the PSD netting exercise are creditable. This modeling was required to demonstrate compliance with the requirement under the PSD regulations in 51.166(b)(3)(vi)(*c*), that for a contemporaneous decrease (used for netting): "A decrease in actual emissions is creditable only to the extent that: ... (c) It has approximately the same qualitative significance for public health and welfare as that attributed to the increase from the particular change."

The Lee STAR® project is not using contemporaneous emission decreases; therefore, the 1-hour SO_2 and NO_2 NAAQS modeling is not needed.

X. Public Hearing on the Draft Permit

In accordance with SESSION LAW 2016-95, HOUSE BILL 630 **(**Coal Ash Management Act of 2014) §130A-309.203, the Department shall hold a public hearing and accept written comment on the draft permit decision for a period of not less than 30 or more than 60 days after the Department issues a draft permit decision.

A notice for the public hearing for the draft permit along with the draft permit and review will be placed on the DAQ website on June 8, 2018, to provide for a 30-day comment period in accordance with the public participation procedures in 15A NCAC 2Q .0307. This public notice requirement is for a construction and operating permit under the 15A NCAC 2Q .0300 procedures. EPA does not review the draft permit for the first step of a two-step 15A NCAC 2Q .0501(c)(2) Title V process. The second step of the 15A NCAC 2Q .0501(c)(2) Title V process will occur on or before 12 months after commencing operation.

XI. Other Requirements

PE Seal
The control device form (Form D) for this modification was dated October 30, 2017 and stamped by Mr. Thomas Pritcher (Environmental Consulting & Technology of North Carolina), providing the PE review and seal. The PE number for Mr. Pritcher is 025453. The NCBELS website shows Mr. Pritcher's license status as "current" through 12/31/2018.

Zoning
In accordance with SESSION LAW 2016-95, HOUSE BILL 630 (Coal Ash Management Act of 2014) §130A-309.205, Local ordinances regulating management of coal combustion residuals and coal combustion products invalid; petition to preempt local ordinance, notwithstanding any authority granted to counties, municipalities, or other local authorities to adopt local ordinances, all provisions of local ordinances that regulate or have the effect of regulating the management of coal combustion residuals and coal combustion products, including regulation of carbon burn-out plants, within the jurisdiction of a local government are invalidated and unenforceable, to the extent necessary to effectuate the purposes of the law.

Nevertheless, a Zoning Consistency Determination was received on November 13, 2017, for this modification from Wayne County Planning signed by Chip Crumpler, Planning Director, dated October 20, 2017, stating the agency received a copy of the application and that the proposed project is consistent with local zoning ordinances.

Fee Classification
The facility fee classification after this modification will remain as "Title V" as before.

PSD Increment Tracking
The PSD Minor Baseline Dates for Wayne County are: October 2, 1979 for PM-10 and February 9, 1995 for SO_2 and NOx. Therefore, the addition of the above sources emitting PM-10, SO_2 and/or NOx will consume increment in Wayne County.

Hourly emission rates for PM-10, NOx and SO2 are taken from the application Table 2A for all new STAR® project sources. The following statement is placed in the permit cover letter:

> *Wayne County has triggered increment tracking under PSD for PM-10, SO_2 and NOx. This modification will result in an increase in 23.50 pounds per hour of PM-10, 24.94 pounds per hour of SO_2, and 59.72 pounds per hour of NOx.*

XII. Comments on Pre-Draft Permit

Comments from Duke
The pre-draft permit and review were sent was sent to Erin Wallace at Duke on May 5, 2018 for review. Duke responded on June 4, 2018 with the following comments:

1. Duke is requesting an amendment to the application to put the following sources on the insignificant activities list rather than in the permit itself:

Emission Source I.D.	Emission Source Description
I-ES-39A	Screener
I-ES-39B **NSPS Subpart IIII** **MACT Subpart ZZZZ**	No. 2 fuel oil-fired screener engine (91 HP) (2007 model year or later)
I-ES-40A	Crusher and No. 2 fuel oil-fired engine (300 hp)
I-ES-40B **NSPS Subpart IIII** **MACT Subpart ZZZZ**	No. 2 fuel oil-fired crusher engine (300 HP) (2007 model year or later)
I-F-1	Wet Ash Receiving Transfer to Shed
I-F-2	Wet Ash Receiving Transfer to Hopper
I-F-3	Wet Ash Receiving Unloading Pile
I-F-5	Ash Handling
I-F-6	Haul Roads

These sources qualify as insignificant activities under 15A NCAC 02Q .0503(8) because of size or production rate since emissions would not violate any applicable emissions standard and whose potential emission of particulate, sulfur dioxide, nitrogen oxides, volatile organic compounds, and carbon monoxide before air pollution control devices, are each no more than five tons per year and whose potential emissions of hazardous air pollutants before air pollution control devices, are each below 1000 pounds per year.

DAQ Response
This change was made.

2. For the monitoring, recordkeeping and reporting for 02D .0515 for the reactor ES-31 in Section 2.1.J.1.c, d, e and f of the permit, Duke commented that Buck's permit (similar ash beneficiation permit) did not require monitoring, recordkeeping or reporting for this condition.

DAQ Response

Monitoring, recordkeeping and reporting for 02D .0515 is always required if there is a particulate control device (e.g., baghouse CD-31 in this case) on the source. Therefore, there is no change.

3. For the initial stack test for sulfur dioxide in Section 2.1.J.2.b of the permit, testing was to be completed and the results submitted within 90 days of initial start-up of the reactor. Duke requested that testing be completed within 90 days of initial start-up of the reactor and the results of the testing be submitted no later than 30 days after completing the initial stack test in accordance with General Condition JJ.

   DAQ Response
   This change was made.

4. For the monitoring of emissions in Section 2.2.B.1.b of the permit, Duke requested that the PSD avoidance limit equations be revised to simply subtract off the ancillary sources' emissions.

   DAQ Response
   To simplify the monitoring of emissions, the total potential emissions from the small-emitting STAR® project ancillary sources (all except STAR® reactor ES-31, EHE ES-34 and EHE ES-35), as shown in Section VIII.D.2 above has been added separately in the condition equations with the note that that number represents the potential emissions from the small-emitting STAR® ancillary sources. Rather than subtract the ancillary sources' emissions from the old PSD avoidance limits to arrive at new limits as Duke requested, DAQ wants to keep the old limits in place and show the potential ancillary sources' emissions as a separate contribution in the equations so that it is more straightforward to show that the limits remain unchanged from the old limits. Therefore, no change was made.

5. For the initial stack testing for CO and VOCs in Section 2.2.B.1.b, Duke proposes to use the emission factors used for permitting in lieu of testing. The factors were based on testing at a similar facility and Duke feels they are appropriate for this facility. This would also be consistent with the Buck Facility monitoring.

   DAQ Response
   The application references SEFA operation experience for the CO factor and a stack test for the VOCs factor, but does not provide any other details. DAQ requested additional information on these factors in the March 14, 2018 and April 17, 2018 emails to substantiate the accuracy of the factors to determine if they were appropriate to use in lieu of stacks tests. However, since no further information was provided, stack testing is necessary to determine the factors. Duke was informed that if DAQ can get substantiated emission factors that are based on stack tests or something equivalent, stack testing may not be required to verify the factors. Therefore, no change was made.

6. For the initial stack testing and reporting for CO and VOCs in Sections 2.2.B.1.b and c of the permit, testing was to be completed and the results submitted within 90 days of initial start-up of the reactor. Duke requested this be changed to allow testing to be completed within 90 days of initial start-up of the reactor and the results of the testing be submitted no later than 30 days after completing the initial stack tests in accordance with General Condition JJ.

   DAQ Response
   This change was made.

Comments from WaRO and SSCB
The draft permit and review were sent to Samir Parekh with SSCB and Robert Bright at the Washington Regional Office on May 25, 2018 for review.

On May 29, 2018, in an email Robert Bright responded with the following comment:

1. For the initial stack test for sulfur dioxide in Section 2.1.J.2 of the permit, testing was to be completed and the results submitted within 90 days of initial start-up of the reactor. Robert suggested giving Duke 90 days to complete the testing, and to submit the results, in accordance with General Condition JJ, no later than 30 days after the test.

Permitting Response
This change was made.

No comments were received from SSCB.

XIII. Recommendations

Issuance is recommended pending public notice.