Blue Ridge Environmental Defense League

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September 23, 2013

Ms. Heather Ceron, Air Permits Section Chief
United States Environmental Protection Agency
Air, Pesticides, and Toxics Management Division
Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303
Ceron.Heather@epa.gov

SUBJECT: Proposed Air Quality Permit No. 08759T14
Duke Energy Progress - Richmond County Turbines
Facility ID: 7700070, Hamlet, NC, Richmond County

Dear Ms. Ceron:

On behalf of the Blue Ridge Environmental Defense League, I write about the Richmond County Turbines draft permit now under review by the North Carolina Division of Air Quality.

Recommendations

The Blue Ridge Environmental Defense League requests that the EPA require the NC Division of Air Quality to:

1. Redraft the permit as a site-wide permit
2. Require Duke Energy Progress to abide by the NC SIP
3. Prevent six combustions sources from being separated from the existing permit

Background

At the Richmond County Energy Complex, a Class I_C facility, Duke Energy Progress operates seven combustion turbines permitted to burn either fuel oil or natural gas, and three auxiliary boilers burning natural gas. Five of the turbines are simple cycle; two are combined cycle. All seven turbines use dry low NOx combustors and water injection for pollution control. The two combined cycle turbines add selective catalytic reduction. Presently, the electric output of the facility is 1600 MWe, and is classed standard industrial code SIC 4911. With the new permit, Duke Energy Progress seeks to increase its power by 36% to approximately 2000 MWe.

The draft permit adds two 190 MWe Siemens SGT6-5000F combustion turbine generators (ES-13 and ES-14), a new natural gas fired auxiliary boiler (ES-15), seeks to modify the existing natural gas fired auxiliary boiler (ES-10) and removes six units from the permit, although they still operate within the facility fence line.

General Problems with the Permit

Combustion turbines are remarkable for their lack of efficiency in converting chemical energy to mechanical energy. Part of the output is lost the in compressor where intake air is compressed up to 30 atmospheres of pressure, before the fuel is burned. Accordingly, ñMore than 50 percent of the shaft horsepower is needed to drive the internal compressor and the balance of recovered shaft horsepower is available to drive an external load.ò[1] The two types of turbines utilized at the Richmond County facility are simple-cycle and combined-cycle. The simple cycle has a thermal efficiency of only 15 to 42 percent. Combined cycle units add a *heat recovery steam generator* to boost efficiency to between 38 and 60 percent. So, from 40 to 85 percent of the fuel burned produces no electric power. But air pollution and global warming gases are created by combustion whether power is produced or not.

Moreover, how the turbine is operated affects air pollution emissions and efficiency. Duke Energy Progress has trimmed its application to escape requirements of BACT and MACT by reducing hours of operation for some units with negative consequences; e.g., Turbine Units ES-13 and ES-14 could operate for 1000 hours per year burning fuel oil and 2000 hours burning natural gas. This could result in underestimated levels of toxic air pollution.

> Available emissions data indicate that the turbineôs operating load has a considerable effect on the resulting emission levels. Gas turbines are typically operated at high loads (greater than or equal to 80 percent of rated capacity) to achieve maximum thermal efficiency and peak combustor zone flame temperatures. With reduced loads (lower than 80 percent), or during periods of frequent load changes, the combustor zone flame temperatures are expected to be lower than the high load temperatures, yielding lower thermal efficiencies and more incomplete combustion.[2]

The products of incomplete productionð carbon monoxide and PM-10ð increase with reduced operating loads. So in addition to escaping Clean Air Act provisions, the operatorôs regulatory stratagem of reducing hours of operation could create higher levels of pollution per kilowatt-hour. The EPA should assess the impact of gaming the system. Best available control technology for criteria pollutants and maximum achievable control technology for hazardous air pollutants are the standards which should be required for the Richmond County Combustion Turbines Title V permit.

If approved as written, the draft permit for the Richmond County Turbines would allow significant modification of the facility. The permit must comply with the air quality permitting program under Title V and 40 CFR Part 70, but the removal of several emissions sources operating within the energy complex, the removal of alternative compliance procedures under several MACT sources and alterations in enforcement of rule requirements make the draft permit unacceptable.

[1] US EPA Air Pollution Emission Factors, AP-42, Stationary Gas Turbines, Section 3.1.2 Process Description
[2] *Id.* Page 3.1-3

Combustion Units Added

The Duke Energy Progress - Richmond County Turbines are listed in the NC SIP, 15A NCAC 2D .1417, as ñCP&L Marks Creek, Richmond Countyò with a power rating of 1628.4 MWe and nitrogen oxide limits totaling 189 tons/season on seven units @ 27 per unit. The rule states:

> (A) Except as allowed under Paragraph (d) of this Rule, sources named in the table in this Subparagraph shall not exceed the nitrogen oxide (NOx) emission allocations in the table beginning May 31 through September 30, 2004 and May 1 through September 30, 2005 and each year thereafter until revised according to Rule .1420 of this Section.

Previously, the proposed project was subject to state-only BACT requirements (15A NCAC 2D .0530(h)) when cost recovery was sought pursuant to the NC Clean Smokestacks Act (G.S. 62-133.6). However, Duke Energy Progress will not seek cost recovery and has requested that BACT emission limits the new combustion turbines (ID Nos. ES-13 and ES-14) be removed from the permit. Is this in accord with the State Implementation Plan?

Moreover, pursuant to 40 CFR 51.166 (b)(1)(i)(*c*), Prevention of significant deterioration of air quality, ñAny physical change that would occur at a stationary source not otherwise qualifying under paragraph (b)(1) of this section, as a major stationary source if the change would constitute a major stationary source by itself.ò

Combustion turbines ES-13 and ES-14 are classified as new stationary sources for the purpose of MACT (maximum achievable control technology). Any new or reconstructed unit which is a *lean premix oil-fired stationary combustion turbine* commencing operation after March 5, 2004 must comply with the emissions and operating limits in 40 CFR § 63.6095(a)(2). In the draft permit, these units are permitted to burn fuel oil up to 1000 hours per year and natural gas up to 8760 hours per year. Notwithstanding the US EPA stay of standards which applies to *lean premix gas-fired stationary combustion turbines*, as referenced in the Divisions Air Permit Review, these two units must meet the standards of 40 CFR § 63 including MACT.[3] In lean-premix combustors the fuel is mixed before entering the power producing combustion chamber. The purpose of Subpart YYYY of this rule is to limit hazardous air pollutants from stationary combustion turbines located at major sources of HAP emissions, and requirements to demonstrate initial and continuous compliance with the emission and operating limitations.

The facility is already a major source of hazardous air pollutants, but the new permit would allow increases in emissions of HAPs. We have run an EPA model to calculate ambient levels of formaldehyde and benzene in the air around the Richmond County Combustion Turbines. The calculations are attached to this letter. The results are as follows.

Including emissions from natural gas-fueled Units 1, 2, 3, 4, 6, 7, 8, 10, 13, 14, 15, 19 and 20, the model indicates the level of formaldehyde is above NC acceptable ambient levels (AALs) as far as 3,500 meters (2.17 miles) from the RCCT sources burning natural gas only. Including the emissions from fuel oil-burning Units 1, 2, 3, 4, 6, 7, 8, 13 and 14, the model indicates the level

[3] 40 CFR 63, Subpart YYYY - National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines

of formaldehyde is above NC AALs 2,100 meters (1.3 miles) from the RCCT sources burning fuel oil #2 only. Finally, the model indicates the level of formaldehyde emitted from Units 13 and 14 alone burning only natural gas would be above NC AALs 1,600 meters (1 mile) from the RCCT facility.

Including emissions from natural gas-fueled Units 1, 2, 3, 4, 6, 7, 8, 10, 13, 14, 15, 19 and 20,the model indicates the level of benzene is above NC AALs 10,000 meters (6.2 miles) from the source when burning natural gas only. In fact, at 10 kilometers, the ambient level is still 460% above NC AALs for benzene if it is considered an area source. If considered a volume source, 400% above. Also, counting emissions from fuel oil-burning Units 1, 2, 3, 4, 6, 7, 8, 13 and 14, the model indicated that the level of benzene is far above NC AALs 10,000 meters (6.2 miles) from the source when burning fuel oil #2 only. At 10 kilometers, if considered an area source, benzene levels are 27 times above NC AAL of 0.00012 mg/m^3.

Combustion Units Removed

The Richmond County plant has three natural gas fired heaters (ES-21, ES-22 and ES-23) with a heat input of 8.75 MMBtu/hr each. In their permit application submitted in 2008, three additional natural gas fired heaters (ES-16, ES-17 and ES-18) with a heat rating of 5.0 MMBtu/hr were to be added to the permit. However, Duke requested that the DAQ remove all six of these natural gas fired units from their permit. These heaters are located within the fence line of the Richmond County facility but owned and operated by Piedmont Natural Gas.

The federal Clean Ait Act Title V operating permit program requires that major industrial sources and certain other sources obtain a permit that consolidates all of the applicable requirements for a facility into one document. The Richmond County Energy Complex is a single site with co-located air pollution emission sources. The purpose of title V permits is to reduce violations of air pollution laws and improve enforcement of those laws. We recommend that EPA not permit the six combustions sources to be separated from the extant permit.

According to 42 USC § 7412 - Hazardous air pollutants, the term ñmajor sourceò means ñany stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit considering controls, in the aggregate, 10 tons per year or more of any hazardous air pollutant or 25 tons per year or more of any combination of hazardous air pollutants.ò The NC DAQ has adopted a truncated view of the meaning for common control by labeling it ñlegal control.ò The state permit review holds that:

> Although these heaters are located within the RCCTF fence line, the equipment is owned, operated and maintained by Piedmont Natural Gas. Even though this equipment was originally included in the applicable permit application, the definition of ñstationary sourceò according to the DAQ indicates that inclusion of equipment owned, operated and maintained by Piedmont Natural Gas is not considered part of the stationary source that is owned, operated and maintained by Duke.
>
> 40 CFR 51.166(b)(5) defines ñstationary sourceò as any building, structure, facility, or installation which emits or may emit a regulated NSR pollutant.
>
> Additionally, 40 CFR 51.166(b)(6) defines ñbuilding, structure, facility, or installationò as all of the pollutant emitting activities which belong to the same

industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control) except the activities of any vessel. Pollutant-emitting activities shall be considered as part of the same industrial grouping if they belong to the same major group (i.e. which have the same two-digit code) as described in the Standard Industrial Classification Manual, 1972....

These two definitions outline three distinct and independent criteria that must all be satisfied in order to be considered part of a single stationary source:

(1) Common legal control
(2) Contiguous or adjacent properties
(3) Part of the same 2-digit SIC code

At RCCTF, the M&R Station will be located on contiguous property and share the same 2-digit SIC code, however, is not under common legal control. Therefore, the natural gas fired heaters are not required to be included in the RCCTF Title V permit and the heaters have been removed from the permit.

The difference between ñlegal controlò and ñcommon controlò here seems to be the nexus of the stateôs allowing Duke Energy Progress to pare off six combustion units from their permit. They are plainly within the same fence line. Are they under totally independent operation? Can Piedmont Natural Gas units numbered consecutively with Duke Energy Progress units actually shut down without alerting Duke Energy Progress, or vice versa?

Conclusion

In summary, the permit would allow excessive emissions of toxic air pollutants which would have a negative impact on public health. We recommend that the EPA reject this permit.

Thank you for your attention to this matter.

Respectfully,

Louis A. Zeller
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CC: Donald R. van der Vaart

EMISSION SOURCES LISTED IN PERMIT No. 08759T15

EMISSION SOURCES OMITTED IN PERMIT No. 08759T15

Emission Source Number	Type	Fuel Type	Heat Rate million Btu/hour	Hours
Unit 1*	simple-cycle internal combustion turbine	natural gas	1,628	1000
Unit 1*	simple-cycle internal combustion turbine	No. 2 fuel oil	1,819	1000
Unit 2*	simple-cycle internal combustion turbine	natural gas	1,628	1000
Unit 2*	simple-cycle internal combustion turbine	No. 2 fuel oil	1,819	1000
Unit 3*	simple-cycle internal combustion turbine	natural gas	1,628	1000
Unit 3*	simple-cycle internal combustion turbine	No. 2 fuel oil	1,819	1000
Unit 4*	simple-cycle internal combustion turbine	natural gas	1,628	1000
Unit 4*	simple-cycle internal combustion turbine	No. 2 fuel oil	1,819	1000
Unit 6*	simple-cycle internal combustion turbine	natural gas	1,628	1000
Unit 6*	simple-cycle internal combustion turbine	No. 2 fuel oil	1,819	1000
Unit 7*	combined-cycle internal combustion turbines	natural gas	1,628	7760
Unit 7*	combined-cycle internal combustion turbines	No. 2 fuel oil	1,819	1000
Unit 8*	combined-cycle internal combustion turbines	natural gas	1,628	7760
Unit 8*	combined-cycle internal combustion turbines	No. 2 fuel oil	1,819	1000
Unit 10	auxiliary boiler	natural gas	16.74	8760
Unit 13	simple/combined cycle internal combustion turbines	natural gas	2,084/2,225	7760
Unit 13	simple/combined cycle internal combustion turbines	No. 2 fuel oil	1,983	1000
Unit 14	simple/combined cycle internal combustion turbines	natural gas	2,084/2,225	7760
Unit 14	simple/combined cycle internal combustion turbines	No. 2 fuel oil	1,983	1000
Unit 15	auxiliary boiler	natural gas	16.74	8760
Unit 16		natural gas	5.0	
Unit 17		natural gas	5.0	
Unit 18		natural gas	5.0	
Unit 19		natural gas	2.6	8760
Unit 20		natural gas	2.6	8760
Unit 21		natural gas	8.75	
Unit 22		natural gas	8.75	
Unit 23		natural gas	8.75	

NB: Hours in above table have cumulative totals for each combustion unit. For example, if Unit 13 is permitted to use fuel oil for 1000 hours per year, we list the difference in numbers of annual hours as 7760. In this way we calculate the annual potential pollution impacts without overestimation.

Ambient Pollutant Calculations

CH_2O, Formaldehyde

MW=30.03 grams $mole^{-1}$
NC AAL for CH_2O = 0.15 mg/m^3
Concern level (ppm) = 24.45 x 0.15 mg/m^3 (NC AAL) ÷ 30.03 = 0.112 ppm

The model indicates the level of formaldehyde is above NC AALs 3,500 meters (2.17 miles) from the RCCT sources burning natural gas only.

The model indicates the level of formaldehyde is above NC AALs 2,100 meters (1.3 miles) from the RCCT sources burning fuel oil #2 only.

The model indicates the level of formaldehyde emitted from Units 13 and 14 alone burning natural gas would be above NC AALs 1,600 meters (1 mile) from the RCCT facility.

C_6H_6, Benzene

MW = 78.11 grams $mole^{-1}$
NC AAL = 1.2 x 10^{-4} mg/m^3
Concern level (ppm) = 24.45 x 0.00012 mg/m^3 (NC AAL) ÷ 78.11 = 3.76 x 10^{-5} ppm

The model indicates the level of benzene is above NC AALs 10,000 meters (6.2 miles) from the source when burning natural gas only. In fact, at 10 kilometers, the ambient level is still 460% above NC AALs for benzene if it is considered an area source. If considered a volume source, 400% above.

The model indicated that the level of benzene is far above NC AALs 10,000 meters (6.2 miles) from the source when burning fuel oil #2 only. At 10 kilometers, if considered an area source, benzene levels are 27 times above NC AAL of 0.00012 mg/m^3.

EPA Worst Source Model

This spreadsheet is based on the ISCST3 computer model and developed by the US Environmental Protection Agency. It calculates the worst case calculations from point, area and volume sources. Entering the emission rate (peak) in grams/second and the molecular weight of the compound (MW) will make the downwind calculations for each of the source types. Entering the concern level in parts per million will make a comparison of the values.

CH_2O

FORMALDEHYDE WITH NAT.GAS

Peak (30 min) Emission Rate =	**1.42**	**g/s**	**49.32**	**tons/yr**
MW=	**30.03**			
Concern level	**0.112**	**ppm**	**137.6**	**ug/m3**

Distance (M)	Point	Area	Volume	Worst	Recommendation
10	1.82E+04	2.44E+05	2.43E+04	**2.44E+05**	reduce emissions
100	1.05E+03	3.35E+04	1.09E+04	**3.35E+04**	reduce emissions
200	5.71E+02	1.33E+04	6.07E+03	**1.33E+04**	reduce emissions
300	3.93E+02	7.20E+03	3.91E+03	**7.20E+03**	reduce emissions
400	3.02E+02	4.56E+03	2.75E+03	**4.56E+03**	reduce emissions
500	2.45E+02	3.18E+03	2.05E+03	**3.18E+03**	reduce emissions
600	2.08E+02	2.36E+03	1.65E+03	**2.36E+03**	reduce emissions
700	1.76E+02	1.83E+03	1.34E+03	**1.83E+03**	reduce emissions
800	1.53E+02	1.48E+03	1.11E+03	**1.48E+03**	reduce emissions
900	1.54E+02	1.23E+03	9.54E+02	**1.23E+03**	reduce emissions
1000	1.54E+02	1.04E+03	8.23E+02	**1.04E+03**	reduce emissions
1100	1.52E+02	9.02E+02	7.20E+02	**9.02E+02**	reduce emissions
1200	1.52E+02	7.90E+02	6.37E+02	**7.90E+02**	reduce emissions
1300	1.52E+02	6.99E+02	5.68E+02	**6.99E+02**	reduce emissions
1400	1.50E+02	6.24E+02	5.11E+02	**6.24E+02**	reduce emissions
1500	1.48E+02	5.61E+02	4.63E+02	**5.61E+02**	reduce emissions
1600	1.46E+02	5.09E+02	4.22E+02	**5.09E+02**	reduce emissions
1700	1.43E+02	4.63E+02	3.86E+02	**4.63E+02**	reduce emissions
1800	1.40E+02	4.25E+02	3.55E+02	**4.25E+02**	reduce emissions
1900	1.36E+02	3.91E+02	3.28E+02	**3.91E+02**	reduce emissions
2000	1.33E+02	3.61E+02	3.09E+02	**3.61E+02**	reduce emissions
2100	1.29E+02	3.37E+02	2.88E+02	**3.37E+02**	reduce emissions
2200	1.25E+02	3.15E+02	2.70E+02	**3.15E+02**	reduce emissions
2300	1.22E+02	2.95E+02	2.54E+02	**2.95E+02**	reduce emissions
2400	1.18E+02	2.78E+02	2.39E+02	**2.78E+02**	reduce emissions
2500	1.15E+02	2.62E+02	2.26E+02	**2.62E+02**	reduce emissions
2600	1.11E+02	2.47E+02	2.14E+02	**2.47E+02**	reduce emissions
2700	1.08E+02	2.34E+02	2.03E+02	**2.34E+02**	reduce emissions
2800	1.05E+02	2.22E+02	1.93E+02	**2.22E+02**	reduce emissions

2900	1.02E+02	2.11E+02	1.83E+02	**2.11E+02**	reduce emissions
3000	9.93E+01	2.01E+02	1.76E+02	**2.01E+02**	reduce emissions
3500	8.67E+01	1.63E+02	1.43E+02	**1.63E+02**	reduce emissions
4000	7.66E+01	1.36E+02	1.20E+02	**1.36E+02**	its OK
4500	6.83E+01	1.16E+02	1.02E+02	**1.16E+02**	its OK
5000	6.15E+01	1.00E+02	8.88E+01	**1.00E+02**	its OK
5500	5.57E+01	8.81E+01	7.81E+01	**8.81E+01**	its OK
6000	5.08E+01	7.82E+01	6.95E+01	**7.82E+01**	its OK
6500	4.66E+01	7.02E+01	6.24E+01	**7.02E+01**	its OK
7000	4.30E+01	6.35E+01	5.65E+01	**6.35E+01**	its OK
7500	3.99E+01	5.80E+01	5.17E+01	**5.80E+01**	its OK
8000	3.72E+01	5.33E+01	4.75E+01	**5.33E+01**	its OK
8500	3.47E+01	4.92E+01	4.39E+01	**4.92E+01**	its OK
9000	3.26E+01	4.57E+01	4.08E+01	**4.57E+01**	its OK
9500	3.07E+01	4.26E+01	3.81E+01	**4.26E+01**	its OK
10000	2.90E+01	3.98E+01	3.56E+01	**3.98E+01**	its OK

FORMALDEHYDE WITH FUEL OIL No. 2

Peak (30 min) Emission Rate =	**0.587**	**g/s**	**20.4**	**tons/yr**
MW=	**30.03**			
Concern level	**0.112**	**ppm**	**137.6**	**ug/m3**

Distance (M)	Point	Area	Volume	Worst	Recommendation
10	7.54E+03	1.01E+05	1.00E+04	**1.01E+05**	reduce emissions
100	4.33E+02	1.39E+04	4.52E+03	**1.39E+04**	reduce emissions
200	2.36E+02	5.49E+03	2.51E+03	**5.49E+03**	reduce emissions
300	1.63E+02	2.98E+03	1.62E+03	**2.98E+03**	reduce emissions
400	1.25E+02	1.89E+03	1.14E+03	**1.89E+03**	reduce emissions
500	1.02E+02	1.32E+03	8.50E+02	**1.32E+03**	reduce emissions
600	8.59E+01	9.75E+02	6.82E+02	**9.75E+02**	reduce emissions
700	7.27E+01	7.55E+02	5.54E+02	**7.55E+02**	reduce emissions
800	6.33E+01	6.13E+02	4.60E+02	**6.13E+02**	reduce emissions
900	6.36E+01	5.09E+02	3.94E+02	**5.09E+02**	reduce emissions
1000	6.37E+01	4.31E+02	3.41E+02	**4.31E+02**	reduce emissions
1100	6.28E+01	3.73E+02	2.98E+02	**3.73E+02**	reduce emissions
1200	6.29E+01	3.27E+02	2.64E+02	**3.27E+02**	reduce emissions
1300	6.27E+01	2.89E+02	2.35E+02	**2.89E+02**	reduce emissions
1400	6.22E+01	2.58E+02	2.11E+02	**2.58E+02**	reduce emissions
1500	6.14E+01	2.32E+02	1.91E+02	**2.32E+02**	reduce emissions
1600	6.03E+01	2.10E+02	1.74E+02	**2.10E+02**	reduce emissions
1700	5.91E+01	1.92E+02	1.60E+02	**1.92E+02**	reduce emissions
1800	5.78E+01	1.76E+02	1.47E+02	**1.76E+02**	reduce emissions
1900	5.64E+01	1.62E+02	1.36E+02	**1.62E+02**	reduce emissions
2000	5.49E+01	1.49E+02	1.28E+02	**1.49E+02**	reduce emissions
2100	5.33E+01	1.39E+02	1.19E+02	**1.39E+02**	reduce emissions

2200	5.18E+01	1.30E+02	1.12E+02	**1.30E+02**	its OK
2300	5.03E+01	1.22E+02	1.05E+02	**1.22E+02**	its OK
2400	4.88E+01	1.15E+02	9.90E+01	**1.15E+02**	its OK
2500	4.74E+01	1.08E+02	9.35E+01	**1.08E+02**	its OK
2600	4.60E+01	1.02E+02	8.85E+01	**1.02E+02**	its OK
2700	4.47E+01	9.69E+01	8.39E+01	**9.69E+01**	its OK
2800	4.35E+01	9.19E+01	7.98E+01	**9.19E+01**	its OK
2900	4.22E+01	8.74E+01	7.59E+01	**8.74E+01**	its OK
3000	4.11E+01	8.32E+01	7.28E+01	**8.32E+01**	its OK
3500	3.59E+01	6.74E+01	5.92E+01	**6.74E+01**	its OK
4000	3.17E+01	5.62E+01	4.95E+01	**5.62E+01**	its OK
4500	2.83E+01	4.79E+01	4.23E+01	**4.79E+01**	its OK
5000	2.54E+01	4.15E+01	3.67E+01	**4.15E+01**	its OK
5500	2.30E+01	3.64E+01	3.23E+01	**3.64E+01**	its OK
6000	2.10E+01	3.24E+01	2.87E+01	**3.24E+01**	its OK
6500	1.93E+01	2.90E+01	2.58E+01	**2.90E+01**	its OK
7000	1.78E+01	2.63E+01	2.34E+01	**2.63E+01**	its OK
7500	1.65E+01	2.40E+01	2.14E+01	**2.40E+01**	its OK
8000	1.54E+01	2.20E+01	1.97E+01	**2.20E+01**	its OK
8500	1.44E+01	2.04E+01	1.82E+01	**2.04E+01**	its OK
9000	1.35E+01	1.89E+01	1.69E+01	**1.89E+01**	its OK
9500	1.27E+01	1.76E+01	1.57E+01	**1.76E+01**	its OK
10000	1.20E+01	1.65E+01	1.47E+01	**1.65E+01**	its OK

FORMALDEHYDE WITH NAT.GAS Units 13 and 14 ALONE

Enter the peak emission rate of the contaminent of concern

Peak (30 min) Emission Rate =	**0.398**	**g/s**	**13.82**	**tons/yr**
MW=	**30.03**			
Concern level	**0.112**	**ppm**	**137.6**	**ug/m3**

Distance (M)	Point	Area	Volume	Worst	Recommendation
10	5.11E+03	6.84E+04	6.81E+03	**6.84E+04**	reduce emissions
100	2.93E+02	9.40E+03	3.06E+03	**9.40E+03**	reduce emissions
200	1.60E+02	3.72E+03	1.70E+03	**3.72E+03**	reduce emissions
300	1.10E+02	2.02E+03	1.10E+03	**2.02E+03**	reduce emissions
400	8.46E+01	1.28E+03	7.71E+02	**1.28E+03**	reduce emissions
500	6.88E+01	8.91E+02	5.76E+02	**8.91E+02**	reduce emissions
600	5.82E+01	6.61E+02	4.62E+02	**6.61E+02**	reduce emissions
700	4.92E+01	5.12E+02	3.75E+02	**5.12E+02**	reduce emissions
800	4.29E+01	4.15E+02	3.12E+02	**4.15E+02**	reduce emissions
900	4.31E+01	3.45E+02	2.67E+02	**3.45E+02**	reduce emissions
1000	4.32E+01	2.92E+02	2.31E+02	**2.92E+02**	reduce emissions
1100	4.25E+01	2.53E+02	2.02E+02	**2.53E+02**	reduce emissions
1200	4.26E+01	2.21E+02	1.79E+02	**2.21E+02**	reduce emissions
1300	4.25E+01	1.96E+02	1.59E+02	**1.96E+02**	reduce emissions

1400	4.21E+01	1.75E+02	1.43E+02	**1.75E+02**	reduce emissions
1500	4.16E+01	1.57E+02	1.30E+02	**1.57E+02**	reduce emissions
1600	4.09E+01	1.43E+02	1.18E+02	**1.43E+02**	reduce emissions
1700	4.00E+01	1.30E+02	1.08E+02	**1.30E+02**	its OK
1800	3.91E+01	1.19E+02	9.96E+01	**1.19E+02**	its OK
1900	3.82E+01	1.10E+02	9.21E+01	**1.10E+02**	its OK
2000	3.72E+01	1.01E+02	8.65E+01	**1.01E+02**	its OK
2100	3.61E+01	9.44E+01	8.08E+01	**9.44E+01**	its OK
2200	3.51E+01	8.83E+01	7.57E+01	**8.83E+01**	its OK
2300	3.41E+01	8.28E+01	7.12E+01	**8.28E+01**	its OK
2400	3.31E+01	7.78E+01	6.71E+01	**7.78E+01**	its OK
2500	3.21E+01	7.34E+01	6.34E+01	**7.34E+01**	its OK
2600	3.12E+01	6.93E+01	5.99E+01	**6.93E+01**	its OK
2700	3.03E+01	6.57E+01	5.69E+01	**6.57E+01**	its OK
2800	2.94E+01	6.23E+01	5.40E+01	**6.23E+01**	its OK
2900	2.86E+01	5.92E+01	5.14E+01	**5.92E+01**	its OK
3000	2.78E+01	5.64E+01	4.93E+01	**5.64E+01**	its OK
3500	2.43E+01	4.57E+01	4.01E+01	**4.57E+01**	its OK
4000	2.15E+01	3.81E+01	3.36E+01	**3.81E+01**	its OK
4500	1.91E+01	3.24E+01	2.87E+01	**3.24E+01**	its OK
5000	1.72E+01	2.81E+01	2.49E+01	**2.81E+01**	its OK
5500	1.56E+01	2.47E+01	2.19E+01	**2.47E+01**	its OK
6000	1.42E+01	2.19E+01	1.95E+01	**2.19E+01**	its OK
6500	1.31E+01	1.97E+01	1.75E+01	**1.97E+01**	its OK
7000	1.20E+01	1.78E+01	1.58E+01	**1.78E+01**	its OK
7500	1.12E+01	1.63E+01	1.45E+01	**1.63E+01**	its OK
8000	1.04E+01	1.49E+01	1.33E+01	**1.49E+01**	its OK
8500	9.74E+00	1.38E+01	1.23E+01	**1.38E+01**	its OK
9000	9.14E+00	1.28E+01	1.14E+01	**1.28E+01**	its OK
9500	8.60E+00	1.19E+01	1.07E+01	**1.19E+01**	its OK
10000	8.12E+00	1.12E+01	9.98E+00	**1.12E+01**	its OK

C_6H_6

BENZENE WITH NAT.GAS

Enter the peak emission rate of the contaminent of concern

Peak (30 min) Emission Rate =	**0.024**	**g/s**	**0.834**	**tons/yr**
MW=	**78.11**			
Concern level	**0.0000376**	**ppm**	**0.12**	**ug/m3**

Distance (M)	Point	Area	Volume	Worst	Recommendation
10	3.08E+02	4.12E+03	4.10E+02	**4.12E+03**	reduce emissions
100	1.77E+01	5.67E+02	1.85E+02	**5.67E+02**	reduce emissions
200	9.65E+00	2.24E+02	1.03E+02	**2.24E+02**	reduce emissions

300	6.64E+00	1.22E+02	6.60E+01	**1.22E+02**	reduce emissions
400	5.10E+00	7.71E+01	4.65E+01	**7.71E+01**	reduce emissions
500	4.15E+00	5.37E+01	3.47E+01	**5.37E+01**	reduce emissions
600	3.51E+00	3.98E+01	2.79E+01	**3.98E+01**	reduce emissions
700	2.97E+00	3.09E+01	2.26E+01	**3.09E+01**	reduce emissions
800	2.59E+00	2.50E+01	1.88E+01	**2.50E+01**	reduce emissions
900	2.60E+00	2.08E+01	1.61E+01	**2.08E+01**	reduce emissions
1000	2.60E+00	1.76E+01	1.39E+01	**1.76E+01**	reduce emissions
1100	2.57E+00	1.52E+01	1.22E+01	**1.52E+01**	reduce emissions
1200	2.57E+00	1.33E+01	1.08E+01	**1.33E+01**	reduce emissions
1300	2.56E+00	1.18E+01	9.61E+00	**1.18E+01**	reduce emissions
1400	2.54E+00	1.05E+01	8.64E+00	**1.05E+01**	reduce emissions
1500	2.51E+00	9.49E+00	7.82E+00	**9.49E+00**	reduce emissions
1600	2.46E+00	8.59E+00	7.13E+00	**8.59E+00**	reduce emissions
1700	2.41E+00	7.83E+00	6.53E+00	**7.83E+00**	reduce emissions
1800	2.36E+00	7.18E+00	6.01E+00	**7.18E+00**	reduce emissions
1900	2.30E+00	6.61E+00	5.55E+00	**6.61E+00**	reduce emissions
2000	2.24E+00	6.11E+00	5.22E+00	**6.11E+00**	reduce emissions
2100	2.18E+00	5.69E+00	4.87E+00	**5.69E+00**	reduce emissions
2200	2.12E+00	5.32E+00	4.57E+00	**5.32E+00**	reduce emissions
2300	2.05E+00	4.99E+00	4.29E+00	**4.99E+00**	reduce emissions
2400	1.99E+00	4.69E+00	4.04E+00	**4.69E+00**	reduce emissions
2500	1.94E+00	4.43E+00	3.82E+00	**4.43E+00**	reduce emissions
2600	1.88E+00	4.18E+00	3.61E+00	**4.18E+00**	reduce emissions
2700	1.83E+00	3.96E+00	3.43E+00	**3.96E+00**	reduce emissions
2800	1.78E+00	3.76E+00	3.26E+00	**3.76E+00**	reduce emissions
2900	1.73E+00	3.57E+00	3.10E+00	**3.57E+00**	reduce emissions
3000	1.68E+00	3.40E+00	2.97E+00	**3.40E+00**	reduce emissions
3500	1.47E+00	2.76E+00	2.42E+00	**2.76E+00**	reduce emissions
4000	1.29E+00	2.30E+00	2.02E+00	**2.30E+00**	reduce emissions
4500	1.15E+00	1.96E+00	1.73E+00	**1.96E+00**	reduce emissions
5000	1.04E+00	1.69E+00	1.50E+00	**1.69E+00**	reduce emissions
5500	9.41E-01	1.49E+00	1.32E+00	**1.49E+00**	reduce emissions
6000	8.58E-01	1.32E+00	1.17E+00	**1.32E+00**	reduce emissions
6500	7.88E-01	1.19E+00	1.05E+00	**1.19E+00**	reduce emissions
7000	7.26E-01	1.07E+00	9.55E-01	**1.07E+00**	reduce emissions
7500	6.74E-01	9.80E-01	8.74E-01	**9.80E-01**	reduce emissions
8000	6.28E-01	9.01E-01	8.04E-01	**9.01E-01**	reduce emissions
8500	5.87E-01	8.32E-01	7.43E-01	**8.32E-01**	reduce emissions
9000	5.51E-01	7.72E-01	6.90E-01	**7.72E-01**	reduce emissions
9500	5.19E-01	7.20E-01	6.43E-01	**7.20E-01**	reduce emissions
10000	4.90E-01	6.73E-01	6.02E-01	**6.73E-01**	reduce emissions

Area: **0.673 ÷ 0.12 = 5.6**
Volume: **0.602 ÷ 0.12 = 5.0**
Point: **0.490 ÷ 0.12 = 4.1**

At 10 kilometers, the ambient level is still 460% above NC AALs for benzene if it is considered an area source. If considered a volume source, 400% above. The best case, if considered as point source (plainly not), 310% above.

BENZENE WITH FUEL OIL No. 2

Peak (30 min) Emission Rate =	**0.116**	**g/s**	**4.029**	**tons/yr**
MW=	**78.11**			
Concern level	**0.0000376**	**ppm**	**0.12**	**ug/m3**

Distance (M)	Point	Area	Volume	Worst	Recommendation
10	1.49E+03	1.99E+04	1.98E+03	**1.99E+04**	reduce emissions
100	8.55E+01	2.74E+03	8.93E+02	**2.74E+03**	reduce emissions
200	4.66E+01	1.08E+03	4.96E+02	**1.08E+03**	reduce emissions
300	3.21E+01	5.88E+02	3.19E+02	**5.88E+02**	reduce emissions
400	2.47E+01	3.73E+02	2.25E+02	**3.73E+02**	reduce emissions
500	2.00E+01	2.60E+02	1.68E+02	**2.60E+02**	reduce emissions
600	1.70E+01	1.93E+02	1.35E+02	**1.93E+02**	reduce emissions
700	1.43E+01	1.49E+02	1.09E+02	**1.49E+02**	reduce emissions
800	1.25E+01	1.21E+02	9.09E+01	**1.21E+02**	reduce emissions
900	1.26E+01	1.01E+02	7.79E+01	**1.01E+02**	reduce emissions
1000	1.26E+01	8.52E+01	6.73E+01	**8.52E+01**	reduce emissions
1100	1.24E+01	7.37E+01	5.88E+01	**7.37E+01**	reduce emissions
1200	1.24E+01	6.45E+01	5.20E+01	**6.45E+01**	reduce emissions
1300	1.24E+01	5.71E+01	4.64E+01	**5.71E+01**	reduce emissions
1400	1.23E+01	5.10E+01	4.18E+01	**5.10E+01**	reduce emissions
1500	1.21E+01	4.59E+01	3.78E+01	**4.59E+01**	reduce emissions
1600	1.19E+01	4.15E+01	3.45E+01	**4.15E+01**	reduce emissions
1700	1.17E+01	3.79E+01	3.16E+01	**3.79E+01**	reduce emissions
1800	1.14E+01	3.47E+01	2.90E+01	**3.47E+01**	reduce emissions
1900	1.11E+01	3.19E+01	2.68E+01	**3.19E+01**	reduce emissions
2000	1.08E+01	2.95E+01	2.52E+01	**2.95E+01**	reduce emissions
2100	1.05E+01	2.75E+01	2.36E+01	**2.75E+01**	reduce emissions
2200	1.02E+01	2.57E+01	2.21E+01	**2.57E+01**	reduce emissions
2300	9.93E+00	2.41E+01	2.08E+01	**2.41E+01**	reduce emissions
2400	9.64E+00	2.27E+01	1.95E+01	**2.27E+01**	reduce emissions
2500	9.36E+00	2.14E+01	1.85E+01	**2.14E+01**	reduce emissions
2600	9.09E+00	2.02E+01	1.75E+01	**2.02E+01**	reduce emissions
2700	8.83E+00	1.91E+01	1.66E+01	**1.91E+01**	reduce emissions
2800	8.58E+00	1.82E+01	1.58E+01	**1.82E+01**	reduce emissions
2900	8.34E+00	1.73E+01	1.50E+01	**1.73E+01**	reduce emissions
3000	8.11E+00	1.64E+01	1.44E+01	**1.64E+01**	reduce emissions
3500	7.08E+00	1.33E+01	1.17E+01	**1.33E+01**	reduce emissions
4000	6.26E+00	1.11E+01	9.78E+00	**1.11E+01**	reduce emissions
4500	5.58E+00	9.46E+00	8.35E+00	**9.46E+00**	reduce emissions
5000	5.02E+00	8.19E+00	7.25E+00	**8.19E+00**	reduce emissions
5500	4.55E+00	7.20E+00	6.38E+00	**7.20E+00**	reduce emissions
6000	4.15E+00	6.39E+00	5.68E+00	**6.39E+00**	reduce emissions
6500	3.81E+00	5.73E+00	5.10E+00	**5.73E+00**	reduce emissions
7000	3.51E+00	5.19E+00	4.62E+00	**5.19E+00**	reduce emissions

7500	3.26E+00	4.74E+00	4.22E+00	**4.74E+00**	reduce emissions
8000	3.04E+00	4.35E+00	3.88E+00	**4.35E+00**	reduce emissions
8500	2.84E+00	4.02E+00	3.59E+00	**4.02E+00**	reduce emissions
9000	2.66E+00	3.73E+00	3.33E+00	**3.73E+00**	reduce emissions
9500	2.51E+00	3.48E+00	3.11E+00	**3.48E+00**	reduce emissions
10000	2.37E+00	3.25E+00	2.91E+00	**3.25E+00**	reduce emissions

3.25 ÷ 0.12 = 27.1
At 10 kilometers, if considered an area source, benzene levels are 27 times above NC AAL.