ALLEGHENY COUNTY HEALTH DEPARTMENT
AIR QUALITY PROGRAM

February 15, 2011

SUBJECT: Review of Application
Title V Operating Permit Renewal
Orion Power MidWest, L.P.
Brunot Island Power Plant
2849 West Carson Street
Pittsburgh, PA 15204

RE: Operating Permit File No. 0056
Commercial electrical power generation plant

TO: Sandra L. Etzel
Air Pollution Control Manager

FROM: David D. Good
Air Quality Engineer

FACILITY DESCRIPTION:

The Orion Power Midwest, Brunot Island Power Plant is a commercial electrical power generation facility. The source is composed of three 22 MW no.2 fuel oil-fired simple cycle combustion turbines and three 50.5 MW natural gas fired combined cycle combustion turbines. Each combined cycle turbine is equipped with a heat recovery steam generator (HRSG) supplied with duct burners rated at 240 mmbtu. The simple cycle combustion turbines have no emission controls and the combined cycle units are equipped with selective catalytic reduction (SCR) and water injection for NO_X control. Additional emission units consist of one 84,000 gallon per minute cooling tower, two 765,810 gallon aboveground storage tanks (ASTs) for no. 2 fuel oil, five 1,637,908 gallon AST for no.2 fuel oil, one 20,500 gallon aqueous ammonia AST and one 3.4 mmBtu/hr diesel starter engine.

The facility is a major source of particulate matter (PM), particulate matter < 10 microns in diameter (PM_{10}), particulate matter < 2.5 microns in diameter ($PM_{2.5}$), nitrogen oxides (NO_X), carbon monoxide (CO), sulfur dioxide (SO_2), and volatile organic compounds (VOCs) and a minor source of hazardous air pollutants (HAPs), as defined in section 2101.20 of Article XXI.

Unit Descriptions:

Each turbine

Unit:	Simple cycle combustion turbines
I.D.:	1A, 1B & 1C
Make:	General Electric
Model	5000N
Fuel:	No.2 fuel oil
Sulfur content:	0.2% maximum by weight
Rating:	22 MW - 300 x 10^6 btu/hr at HHV
Capacity factor:	36%
Controls:	None

Each turbine

Unit:	Combined cycle combustion turbines
I.D.:	2A, 2B & 3
Make:	General Electric
Model	Frame 7000-B
Fuel:	Natural gas only
Rating:	50.5 MW - 918 x 10^6 btu/hr at HHV (Combustion Turbine and HSRG)
Exhaust:	HRS with 240 mmbtu/hr duct burners
Controls:	Water injection with SCR
Instrumentation:	CEMs for NOX, CO & O2, continuous exhaust gas flow & fuel flow monitors

Cooling tower

Process Description:	One multi-cell evaporative cooling tower
No. of cells:	Four
Facility ID:	CT-1
Coolant:	Water
Control Device(s):	Mist eliminators (limit drift to 0.0005% of circulating water flow)
Capacity:	84,000 gallon per minute
Max. TDS:	3327 ppm

No.2 fuel oil tanks

Process Description:	Two 765,810 gallon ASTs & five 1,637,908 gallon ASTs
Facility ID:	T001 through T007
Contents:	No.2 fuel oil
Control Device(s):	Conservation vents

Ammonia tank

Process Description:	One 20,500 gallon storage tank
Facility ID:	T001A
Contents:	Aqueous Ammonia.
Control Device(s):	Vapor balancing and bottom loading

Diesel Starter Engine

Process Description:	One Diesel Starter Engine for simple cycle combustion turbines
Facility ID:	1A-DS
Fuel:	No. 2 fuel oil
Rating:	3.4 mmbtu/hr
Control Device(s):	None

ALLOWABLE EMISSION SUMMARY:

1A, 1B & 1C-each:

Pollutant	lbs/mmbtu or ppm	lbs/hr	tons/yr[a]	Basis
PM	0.005	1.50	2.37	OP#1065009-000-23600
PM10	0.005	1.50	2.37	OP#1065009-000-23600
PM2.5	0.005	1.50	2.37	OP#1065009-000-23600
NOx	0.698	209.4	330.2	RACT Order 260
CO	0.50 ppm	35.5	56.0	OP#1065009-000-23600
SO2	0.21	63.0	99.3	OP#1065009-000-23600
VOC	See note #f	9.22	14.54	OP#1065009-000-23600

Units 2A, 2B & 3-each:

Pollutant	lbs/mmbtu	ppm_{vd}	Each Unit lbs/hr	Combined tons/yr[a]	Basis
PM	0.015		6.7	30.0	IP-0560-I001a
PM10	0.015		6.7	30.0	IP-0560-I001a
PM2.5	0.015		6.7	30.0	IP-0560-I001a
NOx		3.5[b]	11.8[c]	51.7	IP-0560-I001a
CO			40[d]/80[e]	175	IP-0560-I001a
SO2	0.00286		2.6	11.5	IP-0560-I001a
VOC			3.0[d]/6.0[e]	12.0	IP-0560-I001a
Formaldahyde			0.64[d]/1.32[e]	2.8	IP-0560-I001a
Ammonia			14.0	61.3	IP-0560-I001a

Cooling Tower:

Pollutant	lbs/day	tons/yr[a]	Basis
PM	53.52	9.76	IP-0560-I001a
PM10	53.52	9.76	IP-0560-I001a
PM2.5	53.52	9.76	IP-0560-I001a

Diesel Starter Engine:

POLLUTANT	Hourly Emissions (lb/hr)	Yearly Emissions (tons/yr)[1]
PM	1.1	0.3
PM10	1.1	0.3
PM2.5	1.1	0.3
NOx	15.2	4.4
SO2	1.0	0.3
CO	3.3	0.9
VOC	1.2	0.4

[1] A year is defined as any 12 consecutive months. Based on 500 hours per year.

Fire Pump Engine:

POLLUTANT	Hourly Emissions (lb/hr)	Yearly Emissions (tons/yr)[1]
PM	0.64	0.16
PM10	0.64	016
PM2.5	0.64	0.16
NOx	8.84	2.21
SO2	0.16	0.04
CO	1.92	0.48
VOC	0.72	0.18

[1] A year is defined as any 12 consecutive months. Based on 500 hours per year.

Combined Facility Allowable Emissions:

Pollutant	lbs/hr	tons/yr[a]
PM	26.34	107.33
PM10	26.34	107.33
PM2.5	26.34	107.33
NOx	687.8	1152.3
CO	231.7[g]	694.4
SO2	198.0	332.74
VOC	38.58[g]	80.20
Formaldehyde	1.92[g]	8.4
Ammonia	42.0	183.9

[a] A year is defined as any consecutive 12-month period. Annual emissions include emissions during startup and shutdown. Operation of units 1A, 1B & 1C are limited to 36% of full annual capacity.
[b] @15% O_2 during any three hour time period at or above 60% of full load for NO_X
[c] Based on a rolling 3-hour average
[d] 90% to 100% of full load
[e] < 90% of full load
[f] 0.002% of stack gas volume as carbon
[g] at 90% to 100% of full load

EMISSIONS CALCULATIONS:

1A, 1B and 1C emissions:

1. Sulfur Dioxide Emissions

Orion Power Midwest has agreed to a maximum sulfur content of the No. 2 fuel oil of 0.2%. In accordance with the Article XXI definition of "allowable emissions", the related emission limits in units of lb/MMBtu, lb/hr and tons/year are presented below:

No. 2 fuel oil – representative values
Density @ 15^oC = 868 Kg / m^3 = 7.21 lb / gal

Gross calorific value = 140,556 Btu / gal = 19,446 Btu / lb

Emission limit =
(0.002 lb S / 1 lb oil) * (64 lb SO2 / 32 lb S) * (1 lb oil / 19,446 Btu) * (1E+06 Btu / 1 MMBtu) = 0.21 lb/MMBtu

Emission limit =
(0.21 lb / MMBtu) * (300 MMBtu / hr) = 63.0 lb/hr

Emission limit =
(63.0 lb / hr) * (8760 hr / yr) * (36% capacity factor) * (1 ton / 2000 lb) = 99.3 ton/year

2. Nitrogen Oxides Emissions

A 36% capacity factor was used to calculate the annual NOx emissions limit in the TVOP

Emission limit = (209.4 lb / hr) * (8760 hr / yr) * (36% capacity factor) * (1 ton / 2000 lb) = 330.2 ton/year

3. Particulate Matter and PM10 Emissions

Emission limit = (1.50 lb / hr) * (8760 hr / yr) * (36% capacity factor) * (1 ton / 2000 lb) = 2.37 ton/year

4. Carbon Monoxide Emissions

Although there are no promulgated carbon monoxide emission limits for simple cycle combustion turbines listed in Article XXI, Orion Power Midwest has agreed to accept a maximum carbon monoxide emissions limit of 50 ppm at 15% O2. This emission limit is similar to limits for newer simple cycle combustion turbines of similar capacity. The related emission limits in units of lb/hr and tons/year are presented below:

Please reference the U.S. EPA-approved oxygen-based dry F-factor for fuel oil = 9190 dscf / MMBtu (per U.S. EPA reference Method 19)

Emission limit = (50 ppmv) * (7.266E-08 lb/dscf / 1 ppmv) * (9190 dscf/MMBtu) * (20.9% / (20.9% - 15%)) * (300 MMBtu/hr) = 35.5 lb/hr

Emission limit = (35.5 lb / hr) * (8760 hr / yr) * (36% capacity factor) * (1 ton / 2000 lb) = 56.0 ton/year

5. Formaldehyde Emissions

No formaldehyde emission limits were included in the original operating permit issued in the early 1970s. The formaldehyde limits (0.080 lb/hr and 0.13 tons/year), based on AP-42 emission factors, were small since fuel oil combustion generates less formaldehyde than natural gas combustion. Because of this the ACHD has agreed to delete the formaldehyde limits for combustion turbines 1A, 1B, and 1C.

2A, 2B & 3 emissions:

Based on information from the stack test performed in the fall of 2002 and the retest on Unit 2B in 2003, the Department has revised the mid-load emission limits for VOC and CO consistent with data from those tests and included an additional 10% to account for process variation. Emission limits for formaldehyde were not revised. The construction permit (0056-I001a) was revised to incorporate these changes as well.

Orion Power MidWest requested that the permit conditions pertaining to warm startup be deleted and the times/durations for the cold and hot starts and shutdown be revised. The Department reviewed the May 9, 2003 letter and revised the conditions pertaining to startup from those in the originally issued permit (0056-I001a).

EMISSION CONTROL:

The three simple cycle combustion turbines have no emission controls. The three combined cycle combustion turbines are equipped with water injection and selective catalytic reduction for control of nitrogen oxides. The cooling tower is equipped with mist eliminators for control of particulates.

TESTING REQUIREMENTS:

Units no.2A, 2B & 3

Emissions testing shall be performed once every three years for volatile organic compounds and formaldehyde and annually to demonstrate compliance with the ammonia emissions limitation of 10 ppm and the corresponding ammonia lbs/hr and tons/yr emission limits.

Units no.1A, 1B & 1C

Emissions testing shall be performed within 6 months of all three units achieving an average capacity factor of 3.5%.

MONITORING REQUIREMENTS:

Article XXI, Section 2108.03 requires the installation, operation and maintenance of continuous nitrogen oxides monitoring systems and fuel flow monitoring systems for units 2A, 2B & 3 in compliance with 25 PA Code 139.101 to 139.111. Units 1A, 1B & 1C will have analyses of fuel sulfur and nitrogen as well as records of fuel use in order to monitor emissions.

APPLICABLE AND NON-APPLICABLE REQUIREMENTS:

Article XXI, Requirements for Issuance:

The requirements of Article XXI, Parts B and C for the issuance of major source operating permits have been met for this facility. Article XXI, Part D, Part E & Part H will have the necessary sections addressed individually.

40 CFR PART 64, "Compliance Assurance Monitoring":

The requirements of 40 CFR Part 64, "Compliance Assurance Monitoring," were found to be applicable to this facility. CAM applies to NO_X on units 2A, 2B and 3 due to the presence of controls and the magnitude of emissions. The applicability of acid rain regulations to these units makes them exempt from CAM under section 64.2(b)(iii) of the rule.

New Source Performance Standards (NSPS): 40 CFR 60, Subpart GG, Standards of Performance for Stationary Gas Turbines:

This subpart is not applicable to any of the six combustion turbines because each unit was constructed prior to October 3, 1977, which is the applicability date of the subpart.

New Source Performance Standards: 40 CFR 60, Subparts D and Da, Standards of Performance for Steam Generators:

Because the Heat Recovery Steam Generators (HRSGs) which are part of the combined cycle units (2A, 2B, and 3) are rated at less than 250 MMBtu/hr, this NSPS does not apply.

National Emission Standards for Hazardous Air Pollutants: 40 CFR 63, Subpart ZZZZ, National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines:

The facility operates a 3.4 mmBtu/hr 'black start' diesel starter engine and a 0.725 mmBtu/hr 'fire pump' diesel engine that are subject to 40 CFR 63, Subpart ZZZZ.

40 CFR 72 through 78, Acid Rain Requirements:

Units 1A, 1B & 1C are not affected units under 40 CFR 72, subpart A, §72.6(b)(1). Acid rain regulations do not apply due to the turbines being simple cycle turbines that commenced operation prior to November 15, 1990. In addition, each unit is rated at 22 MW which is less than the 25MW applicability threshold.

Units 2A, 2B & 3 are affected units under 40 CFR 72, subpart A, §72.6(a)(2).

Prevention of Significant Deterioration (PSD):

The Department issued a PSD permit to Orion Power MidWest for installation/reactivation of heat recovery steam generators (HRSGs) on Units 2A, 2B and 3. With installation of the HRSGs and associated duct burners, the units became combined cycle units. The conditions of the PSD permit (0056-I001a) have been incorporated into the TVOP. Conditions relating to the operation of the units on natural gas only and in simple cycle mode have not been incorporated because they are no longer applicable after startup of the units in combined cycle mode.

Revisions to the PSD Permit to accommodate changes in requirements for startup conditions and revised emission limits for operation during 60% to 90% of full load are being published for public comment concurrently with this TVOP. The language in this TVOP reflects these changes.

CAIR NOx and SO2 Trading Programs (40 CFR Part 97 and 25 Pa Code § 145):

The permittee shall comply with all requirements of 40 CFR PART 97 (relating to Federal NOx Budget Trading Program and CAIR NOx and SO2 Trading Programs) and 25 Pa Code § 145 (relating to Interstate Pollution Transport Reduction). The permittee is subject to the standard requirements of 40 CFR § 97.106, 40 CFR § 97.206 and 40 CFR § 97.306. The requirements are hereby incorporated by reference in the permit. This program has replaced Pa Code §123.102-123.120(§2105.100).

Requested Permit Changes for Units 1A, 1B and 1C:

In the original October 31, 1995 Operating Permit Application the facility requested higher emission limits for PM, NOX & VOCs for units 1A, 1B & 1C. The present limits from operating permit #1065009-000-23600 are considered BACT for the units and cannot be arbitrarily changed.

An annual emission rate of less than 100 tons per year was requested for sulfur oxides. This was requested because these units operate infrequently making testing arrangements difficult. Compliance with the 99 tpy emission limitation will be based on analysis (by the fuel supplier or Orion) of the sulfur content of the fuel and records of the amount of fuel combusted.

Greenhouse Gases

Presently, there are no Title V applicable requirements pertaining to greenhouse gases.

METHOD OF COMPLIANCE DETERMINATION:

Continuing compliance with the emission limitations of this permit will be reasonably assured by continuous fuel flow monitors and CEMs for NO_X and CO on units 2A, 2B & 3, determination of fuel nitrogen and sulfur contents in 1A, 1B & 1C and SCR and water injection system monitoring in units 2A, 2B & 3, along with associated recordkeeping and reporting requirements.

RECOMMENDATIONS:

The facility is in compliance with all applicable regulations of Article XXI and it is recommended that the Operating Permit No. 0056 be issued.