STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

NEW SOURCE REVIEW PERMIT
TO CONSTRUCT AND OPERATE
A STATIONARY SOURCE

Issued pursuant to Title 22a of the Connecticut General Statutes (CGS) and Section 22a-174-3a of the Regulations of Connecticut State Agencies (RCSA).

Owner/Operator:	Yale University - School of Medicine
Address:	2 Whitney Avenue, 5th Floor, New Haven, CT 06520
Equipment Location:	Sterling Power Plant, 309 Congress Avenue, New Haven, CT 06519
Equipment Description:	7.5 MW Solar Taurus 70 Turbine/Rentech Duct Burner with SCR and CO Catalyst Oxidizer

Town-Permit Numbers:	117-0369
Town-Premises Numbers:	117-0049
Permit Issue Date:	March 12, 2009
Expiration Date:	None

/s/ Gina McCarthy
Gina McCarthy
Commissioner

3/12/09
Date

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

This permit specifies necessary terms and conditions for the operation of this equipment to comply with state and federal air quality standards. The Permittee shall at all times comply with the terms and conditions stated herein.

PART I. DESIGN SPECIFICATIONS

A. General Description

Combined heat and power facility consisting of two 7.5 MW Solar Taurus 70 turbines, each paired with a 67 MMBTU/hr Rentech duct burner.

B. Equipment Design Specifications

Turbine

1. Maximum Fuel Firing Rate(s): 0.089 MMscf/hr(natural gas)
   637.5 gal/hr (No. 2 fuel oil)
2. Maximum Gross Heat Input (MMBTU/hr): 91.01 (natural gas)
   83.06 (No. 2 fuel oil)

Duct Burner

3. Maximum Fuel Firing Rate(s): 0.066 MMscf/hr
4. Maximum Gross Heat Input (MMBTU/hr): 67 (natural gas)

C. Control Equipment Design Specifications

1. Selective Catalytic Reduction (SCR)
   a. Make and Model: Rentech or equivalent
   b. Catalyst Type: Homogeneous Honeycomb or equivalent

2. Oxidation Catalyst
   a. Make and Model: Rentech or equivalent
   b. Catalyst Type: Platinum or alumina or equivalent

3. Low NOx Burners
   a. Make and Model: Turbine: SoLoNOx dry low NOx combustor; Duct Burner: Rentech or equivalent low-NOx burner

D. Stack Parameters

1. Minimum Stack Height (ft): 170
2. Stack Exit Diameter (ft): 5
3. Minimum Exhaust Gas Flow Rate (acfm): 72,903[a]
4. Minimum Stack Exit Temperature (°F): 306[a]
5. Minimum Distance from Stack to Property Line (ft): 219

(a). Exhaust parameters reflect operation at 100% load and the following ambient conditions: 20 °F, 14.7 psia and 60% relative humidity.

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART II. OPERATIONAL CONDITIONS

A. Operating Limits

Turbine

1. Fuel Type(s): Natural Gas, No. 2 Oil
2. Maximum Fuel Consumption over any Consecutive 12 Month Period[(b)]:
   1,563.2 MMscf/yr (natural gas)
   1,300,094 gal/yr (No. 2 oil)
3. Maximum Oil Sulfur Content (% by weight, dry basis): 0.0015

Duct Burner

4. Fuel Type(s): Natural gas
5. Maximum Fuel Consumption over any Consecutive 12 Month Period[(b)]:
   1,150.8 MMscf/yr(natural gas)

(b). Maximum fuel consumption values are the combined limits for Permit Nos. 117-0369 and 117-0370.

PART III. CONTINUOUS EMISSION MONITORING REQUIREMENTS AND ASSOCIATED EMISSION LIMITS

The Permittee shall comply with the CEM requirements as set forth in RCSA §§ 22a-174-4. CEM shall be required for the following pollutant/operational parameters and enforced on the following basis:

Pollutant/Operational Parameter	Averaging Times	Units
☒ NOx	24 hour rolling	2.0 ppmvd@15%O_2 (Natural Gas) 9.6 ppmvd@15%O_2 (No.2 fuel Oil)
☒ O_2	1 hour block	none

PART IV. MONITORING, RECORD KEEPING AND REPORTING REQUIREMENTS

A. Monitoring

1. The Permittee shall use individual non-resettable totalizing fuel metering devices to continuously monitor the natural gas and No. 2 fuel oil feed to each turbine and the natural gas feed to each duct burner.

2. The Permittee shall continuously monitor and continuously record the SCR aqueous ammonia injection rate (lb/hr), operating temperature (°F) and pressure drop (inches of water) across the catalyst bed. The Permittee shall maintain these parameters

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART IV. MONITORING, RECORD KEEPING AND REPORTING REQUIREMENTS, continued

within the ranges recommended by the manufacturer to achieve compliance with the emission limits in this permit.

3. The Permittee shall continuously monitor and continuously record the oxidation catalyst inlet temperature (°F). The Permittee shall maintain this parameter within the range recommended by the manufacturer to achieve compliance with the emission limits in this permit.

4. The Permittee shall inspect the SCR and oxidation catalysts once per year, at a minimum, or more frequently if recommended by manufacturer.

B. Record Keeping

1. The Permittee shall keep records of each delivery of aqueous ammonia. The records shall include the date of delivery, the name of the supplier, the quantity of aqueous ammonia delivered, and the percentage of ammonia in solution, by weight.

2. The Permittee shall keep records of monthly and consecutive 12 month fuel consumption. The consecutive 12 month fuel consumption shall be determined by adding (for each fuel) the current month's fuel consumption to that of the previous 11 months. The Permittee shall make these calculations within 30 days of the end of the previous month. Fuel consumption records shall be kept independently for each turbine and duct burner.

3. The Permittee shall keep records of the fuel certification for each delivery of fuel oil from a bulk petroleum provider or a copy of the current contract with the fuel supplier supplying the fuel used by the equipment that includes the applicable sulfur content of the fuel as a condition of each shipment. The shipping receipt or contract shall include the date of delivery, the name of the fuel supplier, type of fuel delivered, the percentage of sulfur in such fuel, by weight, dry basis, and the method used to determine the sulfur content of such fuel.

4. The Permittee shall calculate and record the monthly and consecutive 12 month PM-10, SO_2, NOx, CO, and VOC emissions in units of tons. The consecutive 12 month emissions shall be determined by adding (for each pollutant) the current month's emissions to that of the previous 11 months. Such records shall

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART IV. MONITORING, RECORD KEEPING AND REPORTING REQUIREMENTS, continued

include a sample calculation for each pollutant. The Permittee shall make these calculations within 30 days of the end of the previous month.

5. The Permittee shall keep records of the inspection and maintenance of the SCR and oxidation catalysts. The records shall include the name of the inspector, the date, the results or actions and the date the catalyst is replaced.

6. The Permittee shall keep records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of the stationary gas turbine, duct burner and any malfunction of the air pollution control equipment or any periods during which a continuous monitoring system or monitoring device is inoperative.

7. The Permittee shall keep records of all exceedances of the NOx emission limit. Such records shall include:
   a. the date and time of the exceedance,
   b. a detailed description of the exceedance, and
   c. the duration of the exceedance.

8. The Permittee shall keep all records required by this permit for a period of no less than five years and shall submit such records to the commissioner upon request.

C. Reporting

1. The Permittee shall submit a report of exceedances to the commissioner within 30 days of the end of the previous month. Such report shall include the following:
   a. copies of the exceedance records for the month, as recorded in Part IV.B.7 of this permit,
   b. an explanation of the likely causes of the exceedances, and
   c. an explanation of remedial actions taken to correct the exceedance.

2. The Permittee shall notify the commissioner in writing of any malfunction of the stationary gas turbine/duct burner, the air pollution control equipment or the continuous monitoring system. The Permittee shall submit such notification within ten days of the malfunction. The notification shall include the following: within ten days of the malfunction. The notification shall

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART IV. MONITORING, RECORD KEEPING AND REPORTING REQUIREMENTS, continued

include the following:

a. a description of the malfunction and a description of the circumstances surrounding the cause or likely cause of such malfunction and,
b. a description of all corrective actions and preventive measures taken and/or planned with respect to such malfunction and the dates of such actions and measures.

3. The Permittee shall notify the commissioner, in writing, of the date of commencement of construction and the date of initial startup of this source. Such written notifications shall be submitted no later than 30 days after the subject event.

PART V. OPERATION AND MAINTENANCE REQUIREMENTS

A. The Permittee shall operate and maintain this equipment in accordance with the manufacturer's specifications and written recommendations. The Permittee shall operate and maintain this stationary combustion turbine, air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup, shutdown, and malfunction. [40 CFR §60.4333(a)]

B. The Permittee shall properly operate the control equipment at all times that this turbine is in operation and emitting air pollutants.

PART VI. ALLOWABLE EMISSION LIMITS

The Permittee shall not cause or allow this equipment to exceed the emission limits stated herein:

A. Short Term Emission Limits

These short term emission limits do not apply during periods of start-up and shutdown, unless otherwise noted.

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART VI. ALLOWABLE EMISSION LIMITS, continued

TURBINE FIRING NATURAL GAS

Criteria Pollutants	lb/hr	lb/MMBTU
PM-10/PM-2.5	1.91	0.02
SO_2	0.31	
NOx	0.67	
VOC/HC	0.58	
CO	1.02	

Non-Criteria Pollutants	MASC[(c)] (ug/m^3)
Formaldehyde	8,780
Ammonia	263,000

TURBINE FIRING NO.2 FUEL OIL

Criteria Pollutants	lb/hr	lb/MMBTU
PM-10/PM-2.5	3.24	0.04
SO_2	0.13	
NOx	3.23	
VOC/HC	2.82	
CO	0.98	

Non-Criteria Pollutants	MASC[(c)] (ug/m^3)
Formaldehyde	8,890
Ammonia	267,000

TURBINE & DUCT BURNER FIRING NATURAL GAS

Criteria Pollutants	lb/hr	lb/MMBTU
PM-10/PM-2.5	2.41	0.02
SO_2	0.35	
NOx	1.16	
VOC/HC	0.94	
CO	1.77	

Non-Criteria Pollutants	MASC[(c)] (ug/m^3)
Formaldehyde	8,780
Ammonia	263,000

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART VI. ALLOWABLE EMISSION LIMITS, continued

TURBINE FIRING NO. 2 FUEL OIL & DUCT BURNER FIRING NATURAL GAS

Criteria Pollutants	lb/hr	lb/MMBTU
PM-10/PM-2.5	3.74	0.03
SO_2	0.17	
NOx	5.70	
VOC/HC	3.18	
CO	1.73	

Non-Criteria Pollutants	MASC[(c)] (ug/m^3)
Formaldehyde	8,780
Ammonia	263,000

(c) Maximum Allowable Stack Concentration, 8 hr Hazard Limiting Value.

FOR ALL OPERATING SCENARIOS

Pollutants	ppmvd@15% O_2
NOx (natural gas)	2.0
NOx (No. 2 fuel oil)	9.6
CO	5.0
Ammonia	5.0

B. Start-up and Shutdown Emission Limits

The Permittee shall minimize emissions during periods of start-up and shutdown by following work practices and time constraints. Start the ammonia injection as soon as minimum catalyst temperature is reached. The oxidation catalyst will not be bypassed during start-up or shutdown. The duration of start-up shall not exceed 60 minutes for a hot start or a warm start, nor 240 minutes for a cold start. A hot start shall be defined as start-up when the turbine has been down for less than 8 hours. A warm start shall be defined as start-up when the turbine has been down for more than 8 hours. A cold start shall be defined as start-up when the turbine has been down for more than 24 hours. The duration of shutdown shall not exceed 30 minutes.

CEM shall be operating at all times during periods of start-up and shutdown and shall be used to determine NOx emissions. All pollutant emissions during these periods shall be counted towards the annual emission limits stated herein.

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART VI. ALLOWABLE EMISSION LIMITS, continued

C. Annual Emission Limits

Criteria Pollutants	tons per 12 consecutive months[(d)]
PM-10/PM-2.5	22.6
SO_2	3.1
NOx	15.1
VOC/HC	10.7
CO	15.5

(d) Annual emission limits listed above are the combined limits for Permit Nos. 117-0369 and 117-0370.

D. Hazardous Air Pollutants: This unit shall not cause an exceedance of the Maximum Allowable Stack Concentration (MASC) for any hazardous air pollutant (HAP) listed in RCSA Section 22a-174-29. [**STATE ONLY REQUIREMENT**]

E. OPACITY: This unit shall not exceed 10% opacity during any six minute block average as measured by 40 CFR 60, Appendix A, Reference Method 9.

Demonstration of compliance with the above emission limits shall be met by calculating the emission rates using emission factors from the following sources:

1. NOx: CEM data
2. PM-10/PM-2.5, CO, VOC, Ammonia: Stack test results.
3. SOx, Pb, HAPs: Compilation of Air Pollutant Emission Factors, AP-42, fifth edition, Section 3.1, April 2000 (turbine) and Section 1.4, July 1998 (duct burners).
4. CO for Natural gas: startup: 11.3 lb/event
   shutdown: 11.8 lb/event
5. CO for No. 2 fuel oi: startup: 8.6 lb/event
   Shutdown: 7.9 lb/event

The Permittee is not required to demonstrate compliance with the short-term emission limits stated herein during the initial shakedown period. Emissions during the initial shakedown period shall be counted towards the annual emission limits stated herein. The shakedown period shall not extend beyond the required date for the initial performance tests.

The commissioner may require other means (e.g. stack testing) to demonstrate compliance with the above emission limits, as allowed by state or federal statute, law or regulation.

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART VII. STACK EMISSION TEST REQUIREMENTS

Stack testing shall be performed in accordance with the latest Emission Test Guidelines available on the DEP website:

http://www.ct.gov/dep/cwp/view.asp?a=2684&q=322076&depNav_GID=1619

Initial stack testing shall be required for the following pollutant(s):

☒ $PM_{10}/PM_{2.5}$ ☐ SOx ☒ NOx ☒ CO ☒ VOC/HC ☐ Opacity

☒ Other (HAPs): Ammonia

The Permittee shall conduct initial stack testing within 60 days of achieving the maximum production rate, but not later than 180 days after initial start up. Test results must be submitted within 45 days after testing.

The initial stack testing for NOx shall be performed using CEM in accordance with 40 CFR §60.4405.

Testing being conducted pursuant to 40 CFR Part 60, the test report is to be submitted within 180 days after the initial startup date or within 60 days after reaching maximum production rate. [40 CFR §60.8(a)]

Initial stack testing shall be conducted for PM-10/PM-2.5, NOx, VOC, CO and ammonia for the following operating modes: turbine only on oil, turbine only on natural gas, turbine on oil and duct burner on natural gas, turbine and duct burner on natural gas.

Recurrent stack testing for CO and ammonia shall be conducted within five years from the date of each previous stack test to demonstrate compliance with their respective limits.

Stack test results shall be reported as follows: all pollutants in units of lb/hr, PM-10/PM-2.5 in units of lb/MMBTU, NOx and CO in units of ppmvd at 15% O_2, ammonia in units of $\mu g/m^3$ and ppmvd at 15% O_2.

PART VIII. SPECIAL REQUIREMENTS

A. The Permittee shall comply with all applicable sections of the following New Source Performance Standard at all times: Title 40 CFR Part 60, Subparts KKKK and A.

Copies of the Code of Federal Regulations (CFR) are available online at the U.S. Government Printing Office website.

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART VIII. SPECIAL REQUIREMENTS, continued

B. STATE ONLY REQUIREMENT: The Permittee shall operate this facility at all times in a manner so as not to violate or contribute significantly to the violation of any applicable state noise control regulations, as set forth in RCSA §§22a-69-1 through 22a-69-7.4.

C. In the event that a malfunction causing either an emission exceedence or a parameter monitored out of recommended range is not corrected within three hours, the Permittee shall immediately institute shutdown of the turbine/duct burner.

D. The Permittee shall not allow total actual annual NOx emissions from this premises to exceed 116.6 tons. This limit includes emissions from all permitted and registered fuel burning equipment at the premises, any sources at the Premises operating under Section 22a-174-3b of RCSA, and any other source of NOX emissions at the premises. Compliance with this NOx emissions cap shall be determined on a rolling 12 month basis. The Permittee shall make records sufficient to document compliance with this requirement within ten days of the end of each month. All such records shall be retained for a period of not less than five years from the making of such record. Any exceedance of the cap shall be reported to the commissioner within ten days of the Permittee becoming aware of such exceedance.

PART IX. ADDITIONAL TERMS AND CONDITIONS

A. This permit does not relieve the Permittee of the responsibility to conduct, maintain and operate the regulated activity in compliance with all applicable requirements of any federal, municipal or other state agency. Nothing in this permit shall relieve the Permittee of other obligations under applicable federal, state and local law.

B. Any representative of the DEP may enter the Permittee's site in accordance with constitutional limitations at all reasonable times without prior notice, for the purposes of inspecting, monitoring and enforcing the terms and conditions of this permit and applicable state law.

C. This permit may be revoked, suspended, modified or transferred in accordance with applicable law.

D. This permit is subject to and in no way derogates from any present or future property rights or other rights or powers of the State of Connecticut and conveys no property rights in real estate or material, nor any exclusive privileges, and is further subject to any and all public and private rights and to any federal, state or local

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART IX. ADDITIONAL TERMS AND CONDITIONS, continued

laws or regulations pertinent to the facility or regulated activity affected thereby. This permit shall neither create nor affect any rights of persons or municipalities who are not parties to this permit.

E. Any document, including any notice, which is required to be submitted to the commissioner under this permit shall be signed by a duly authorized representative of the Permittee and by the person who is responsible for actually preparing such document, each of whom shall certify in writing as follows: "I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that any false statement made in the submitted information may be punishable as a criminal offense under section 22a-175 of the Connecticut General Statutes, under section 53a-157b of the Connecticut General Statutes, and in accordance with any applicable statute."

F. Nothing in this permit shall affect the commissioner's authority to institute any proceeding or take any other action to prevent or abate violations of law, prevent or abate pollution, recover costs and natural resource damages, and to impose penalties for violations of law, including but not limited to violations of this or any other permit issued to the Permittee by the commissioner.

G. Within 15 days of the date the Permittee becomes aware of a change in any information submitted to the commissioner under this permit, or that any such information was inaccurate or misleading or that any relevant information was omitted, the Permittee shall submit the correct or omitted information to the commissioner.

H. The date of submission to the commissioner of any document required by this permit shall be the date such document is received by the commissioner. The date of any notice by the commissioner under this permit, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is personally delivered or the date three days after it is mailed by the commissioner, whichever is earlier. Except as otherwise specified in this permit, the word "day" means calendar day. Any document or action which is required by this permit to be submitted or performed by a date which falls on a Saturday, Sunday or legal

PERMIT FOR FUEL BURNING EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART IX. ADDITIONAL TERMS AND CONDITIONS, continued

holiday shall be submitted or performed by the next business day thereafter.

I. Any document required to be submitted to the commissioner under this permit shall, unless otherwise specified in writing by the commissioner, be directed to: Office of Director; Engineering & Enforcement Division; Bureau of Air Management; Department of Environmental Protection; 79 Elm Street, 5th Floor; Hartford, Connecticut 06106-5127.