NJCAT TECHNOLOGY VERIFICATION

AEGEN THERMO POWER TP-75 CHP MODULE

AEGIS ENERGY SERVICES INC./AEGENCO INC.

FEBRUARY 2014

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1. Introduction

1.1 New Jersey Corporation for Advance Technology (NJCAT) Program

NJCAT is a not-for-profit corporation to promote in New Jersey the retention and growth of technology-based businesses in emerging fields such as environmental and energy technologies. NJCAT provides innovators with the regulatory, commercial, technological and financial assistance required to bring their ideas to market successfully. Specifically, NJCAT functions to:

- Advance policy strategies and regulatory mechanisms to promote technology commercialization;
- Identify, evaluate, and recommend specific technologies for which the regulatory and commercialization process should be facilitated;
- Facilitate funding and commercial relationships/alliances to bring new technologies to market and new business to the state; and
- Assist in the identification of markets and applications for commercialized technologies.

The technology verification program specifically encourages collaboration between vendors and users of technology. Through this program, teams of academic and business professionals are formed to implement a comprehensive evaluation of vendor specific performance claims. Thus, suppliers have the competitive edge of an independent third party confirmation of claims.

Pursuant to N.J.S.A. 13:1D-134 et seq. (Energy and Environmental Technology Verification Program) the New Jersey Department of Environmental Protection (NJDEP) and NJCAT have established a Performance Partnership Agreement (PPA) whereby NJCAT performs the technology verification review and NJDEP certifies that the technology meets the regulatory intent and that there is a net beneficial environmental effect of the technology. In addition, NJDEP/NJCAT work in conjunction to develop expedited or more efficient timeframes for review and decision-making of permits or approvals associated with the verified/certified technology.

The PPA also requires that:

- The NJDEP shall enter into reciprocal environmental technology agreements concerning the evaluation and verification protocols with the United States Environmental Protection Agency, other local required or national environmental agencies, entities or groups in other states and New Jersey for the purpose of encouraging and permitting the reciprocal acceptance of technology data and information concerning the evaluation and verification of energy and environmental technologies; and

- The NJDEP shall work closely with the State Treasurer to include in State bid specifications, as deemed appropriate by the State Treasurer, any technology verified under the Energy and Environment Technology Verification Program.

1.2 Verification

On November 12, 2013, Aegis Energy Services, Inc., 55 Jackson Street, Holyoke, MA 01040 submitted a formal request for participation in the NJCAT Technology Verification Program. The technology proposed – The Aegen Thermo Power TP-75 CHP Module – is a 75kW compact combined heat and power (CHP) system that produces both electricity and hot water.

The request (after pre-screening by NJCAT staff personnel in accordance with the technology assessment guidelines) was accepted into the verification program. This verification report covers the evaluation of the performance claim of the vendor, Aegenco, a separate but related company to Aegis Energy Services, Inc., that the TP-75 CHP Module, according to New Jersey Department of Environmental Protection Administrative Code 7:27-8.2(f), qualifies as an “insignificant source” of air emissions and consequently does not require an air permit.

This verification project involved the evaluation of company literature and an independent third party laboratory emissions test report to verify that the Aegen Thermo Power TP-75 CHP Module satisfies the performance claim made by Aegenco.

1.3 Applicant Profile

Aegis Energy Services, Inc. is a United States EPA Combined Heat and Power (CHP) partner and is a NYSERDA- approved vendor. The company was founded in 1985 and has been in business for 28 years. Aegis Energy Services is a full service CHP provider that utilizes modular systems to reduce both energy costs and emissions for a variety of facilities, from healthcare and assisted living facilities, to recreational and multi-residential complexes, and hotels. There are also institutional, educational, and industrial facility applications.

Aegenco has been manufacturing CHP modules since 2005 and to date has manufactured and/or installed nearly 500 units. Aegenco provides turnkey installation of modular cogeneration modules in convenient sizes for a variety of applications. These units can be installed individually (75 kW) or combined to form larger systems. Each cogeneration module includes a natural gas-fueled reciprocating engine, induction generator, microprocessor control panel, protective switchgear, heat recovery equipment, and solid- state controls for automatic and unattended operation. Each module is enclosed in a sound attenuated cover and can be installed indoors or outdoors. Aegenco units are spread throughout the Northeast and Mid-Atlantic States, with a high concentration of systems located in the New York metropolitan area.

Aegis Energy Services provides both maintenance contracts and remote monitoring for all of their CHP systems. The Aegis maintenance program and remote monitoring ensure high utilization rates/capacity factor and therefore provide consistent energy savings for site users. High efficiencies and energy savings both imply reduced emissions. The company has a network of maintenance personnel through the Northeast and Mid-Atlantic states.

1.4 Key Contacts

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2. The Aegen Thermo Power TP-75 CHP Module

2.1 Technology Description

2.1.1 Engine-Generator Combined Heat and Power

Combined Heat and Power (CHP), also known as cogeneration, recovers the thermal waste energy of power generation and utilizes it as heat. CHP can describe large megawatt power plants or small-scale power generation technologies down to a few kilowatts. CHP is an on-site technology whereby electricity is produced from a prime mover, and the resultant heat is captured for use in domestic hot water, space heating, absorption cooling, or for industrial processes requiring heat. CHP is most efficient when the heating load is in close proximity to the electricity generation. These systems have efficiencies generally in excess of 85% because of the capture and use of the waste heat, thereby using nearly every BTU of the input fuel to produce useful energy. This is in stark contrast to a central power plant that dumps its heat and suffers distribution losses, as well. It is this high efficiency that results in significant cost savings for customers.

It is this high efficiency that also makes CHP a form of “green energy”, in that it results in lower fuel requirements and therefore fewer emissions than the separate production of electricity from a central power plant and heat from on-site boilers. The best applications for CHP include customers that operate in high electricity rate areas, such as New Jersey, and have a high demand for heat on their premises. These include health clubs, multi-unit residential buildings, universities, and health-care facilities.

Aegis Energy Services' CHP systems have been well-received in the New Jersey market and the company hopes to accelerate installation of its units with the designation by NJDEP as an "insignificant source" of air emissions so that they do not require an air permit.

2.1.2 Aegen Thermo Power TP-75 Model

The Aegen Thermo Power TP-75 (**Figure 1**) is a packaged, compact, low-emission, modular combined heat and power (CHP) system, capable of producing 75 kW of power and 5.23 therms of heat per hour. The CHP module has a natural gas-fired reciprocating engine, induction generator, heat recovery system, a sound attenuating enclosure, electrical switchgear, and solid-state controls for automatic and unattended operation. High efficiency heat recovery components consist of an oil cooler, engine jacket for heat transfer, marine type exhaust gas manifolds and exhaust gas heat exchangers. The Aegen Thermo Power 75 operates in parallel with existing mechanical and electrical systems in the facility. The module includes an advanced utility-grade relay (U.L., C.S.A., and C.E. listed or certified) for electrical protection and redundancy as standard equipment.

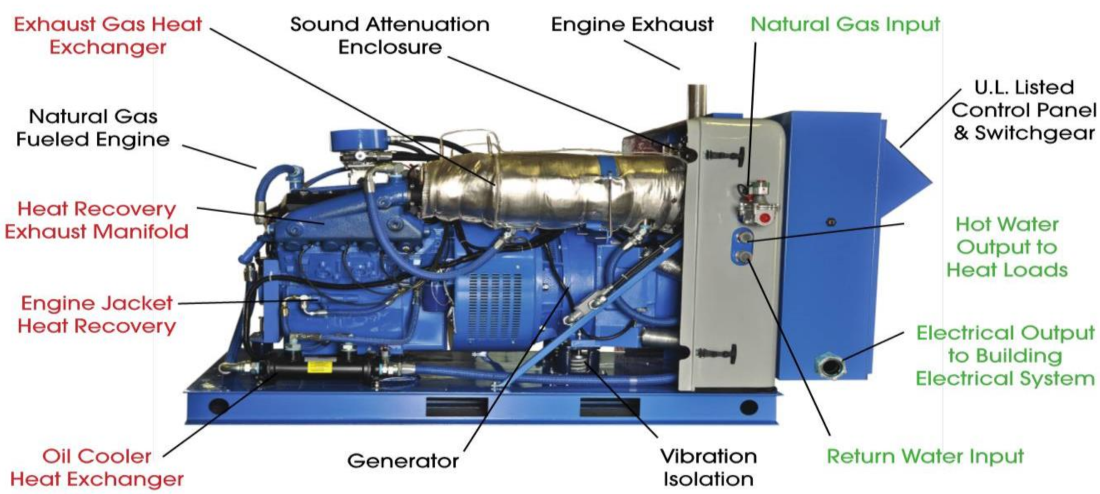

Figure 1 Aegen Thermo Power TP-75 Model

The TP-75's prime mover is a 7.4L, Power Systems, Inc., V8 engine which drives an induction generator. The engine is equipped with an emissions control package which includes a dual-layer, three-way non-selective catalytic converter and a Continental Controls Corporation Electronic Gas Carburetor (EGC), which allows Aegenco's CHP modules to meet the most stringent air emissions requirements. The EGC precisely controls the air/fuel ratio using variable pressure control combined with an advanced and improved mixing venturi. For rich-burn or stoichiometric spark-ignited engines, the catalytic converter promotes the three-way reactions of oxides of nitrogen (NO_x), carbon monoxide (CO), and hydrocarbons (C_xH_y) into nitrogen (N_2), carbon dioxide (CO_2), and water (H_2O). The EGC provides built in control for a wide band oxygen sensor that is located in the exhaust stream. Used in conjunction with the 3-way catalytic converter and run in a rich-burn or stoichiometric mode, the EGC enables the TP-75 to meet New Jersey's stringent emission requirements.

Aegenco produces several models of their cogeneration systems employing the same 7.4L, V8 engine platform and exhaust treatment technology. These systems are designated as:

- PowerSynch 75
- PowerVerter 75

These two systems employ the same engine platform and exhaust treatment technology as the TP-75, except that they incorporate a synchronous generator in the PowerSynch 75 and PowerVerter 75 models. In the PowerVerter 75 model, the generated power is fed through an inverter. PowerVerter 75 is engineered to interface with utility area or spot networks, such as those found in parts of New York City, or other cities in the Northeast. These two systems are designed to operate in black-start (stand-alone) mode, thereby providing heat and power during a central grid failure.

2.2 New Jersey Administrative Code

According to New Jersey Administrative Code (N.J.A.C.) section 7:27-8.2(c), any equipment or source operation that may emit one or more air contaminants, except carbon dioxide (CO_2), directly or indirectly into the outdoor air and belongs to one of the categories listed below (e.g. any stationary reciprocating engine with a maximum rated power output of 37 kW or greater, used for generating electricity, not including emergency generators), is a significant emissions source (and therefore requires a preconstruction permit and an operating certificate), unless it is exempted from being a significant source pursuant to (d), (e) or (f) below:

N.J.A.C. section 7:27-8.2(f)1.ii provides for "any piece of electric generating equipment, other than a fuel cell system or a microturbine, with less than 500 kilowatts generating capacity and that has been verified according to the requirements in (f)2 below to emit less than

(1) 0.40 pounds of NO_x per megawatt hour;
(2) 0.25 pounds of CO per megawatt hour;
(3) 0.10 pounds of PM per megawatt hour; and
(4) 0.01 pounds of SO_2 per megawatt hour",

to not be classified as a significant source.

2.3 Technical Performance Claim

Claim – The Aegen Thermo Power TP-75 CHP Module fired with natural gas when operated at 100% load has demonstrated by source emission testing that it emits less than 1) 0.40 pounds of NO_x per megawatt hour, 2) 0.25 pounds of CO per megawatt hour, 3) 0.10 pounds of PM per megawatt hour; and 4) 0.01 pounds of SO_2 per megawatt hour and, therefore, it is not a significant source of emissions in accordance with N.J.A.C. 7:27-8.2(f)1.ii.

3. Technology Evaluation

3.1 Introduction

Air Tox Environmental Company, Inc. (Air Tox) of Willington, Connecticut, was contracted by Aegenco to conduct stationary source emissions testing on the Aegen Thermo Power TP-75 (TP-75) unit developed by Aegenco. The purpose of the test was to measure emissions from the TP-75 for oxides of nitrogen (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), oxygen (O_2), carbon dioxide (CO_2), and particulate matter (PM). The testing was conducted to demonstrate that the TP-75 is not a significant source of emissions in accordance with N.J.A.C. 7:27-8.2(f) 1.ii.

The test program was performed under the supervision of Mr. Dominik Grzywacz, QSTI and Project Engineer of Air Tox. Mr. Grzywacz supervised all field operations during the performance of this test program. Tyler Lundstrum, Environmental Technician of Air Tox, provided field support. Ms. Diane Molokotos, of Aegis Energy Services, oversaw the performance of the test program. Mr. Brad Walker, of Aegis Energy Services, oversaw process operations during this test program. **Table 1** lists key personnel responsible for the successful completion of this test program.

TABLE 1
LIST OF KEY PERSONNEL

NAME/TITLE	COMPANY	RESPONSIBILITY	PHONE NO.	EMAIL ADDRESS
Diane Molokotos Project Engineer	AEGIS	Project Oversight	(413) 536-1156	dianem@aegisenergyservices.com
Brad Walker	AEGIS	Operations Oversight	(413) 536-1156	BWalker@aegisenergyservices.com
Dominik Grzywacz Project Engineer	Air Tox	Project Manager	(860) 487-5606	Dominik@airtoxenviro.com
Tyler Lundstrum Technician	Air Tox	Project Support	(860) 487-5606	Tyler@airtoxenviro.com

3.2 Sampling and Analytical Methodology

The following sections detail the methodologies that were utilized to complete the test program. All sampling and analyses performed during this test program were carried out in accordance with the requirements set by the United States Environmental Protection Agency (EPA) and the New Jersey Department of Environmental Protection. Testing was based on the specific requirements outlined in New Jersey Administrative Code Title 7, Chapter 27, Subchapter 8, Permits and Certificates for Minor Facilities (and Major Facilities without an Operating Permit) for the Aegen Thermo Power TP-75. Sampling was performed at the main exhaust stack to determine the gaseous emission concentrations and particulate matter emissions.

3.2.1 Testing Parameters and Methodologies

Emission measurements were performed at sample ports on the TP-75 exhaust stack for the parameters listed in **Table 2** below, in accordance with the respective test methodologies.

TABLE 2
EMISSION PARAMETERS

Emission Parameter	Reference Method
Oxygen (O_2/CO_2)	EPA Method 3A
Oxides of Nitrogen (NO_x)	EPA Method 7E
Carbon Monoxide (CO)	EPA Method 10
Pollutant Mass Emission Rate (NO_x, SO_2)	EPA Method 19
Particulate Matter (PM)	EPA Method 5
Sulfur Dioxide (SO_2)	ASTM D-5504-08

A detailed summary of the methodologies used to perform the test program are presented below.

3.2.2 Gaseous Reference Method Sampling

Continuous monitoring was performed at a sample port on the exhaust stack to determine the concentration of O_2, CO, and NO_x, according to EPA Reference Methods 3A, 10, and 7E. Calibrations of instrumental analyzers were performed at the beginning and end of each test using EPA Protocol 1 calibration gases. Calibration gases were introduced directly to the analyzers (by-passing the sampling system) at the beginning of each test run to verify that the calibration error was < 2.0% and to establish instrument linearity. Additionally, Air Tox determined system bias, using a zero and upscale gas for each instrument. Calibration gas was introduced to the sample probe at the beginning and end of each test run. The average test concentration was corrected for the line bias, if any, according to procedures contained in Method 7E.

Stack gas was drawn through a sintered stainless steel probe, heated Teflon sample line (300°F nominal), and a stainless steel sample conditioner by a leak-less Teflon diaphragm pump. The sample was then pumped through a manifold under slightly positive pressure with a bypass to atmosphere. Samples were continuously drawn from this manifold to a Thermo Model 42C NO_X analyzer, as well as a Thermo Model 60i to measure oxygen and carbon monoxide concentrations. The analyzer outputs were continuously recorded using an ESC 8816 data logger supported by ESC's software on a laptop PC. The signals from the analyzers are "viewed" by the data logger at 10-second intervals, from which one-minute averages are formed. The ESC software was used to generate reports for discrete test periods. The corrected test averages were used to calculate emission rates, in accordance with Reference Method 19, which were used to determine the mass emissions rates in terms of units of the NJDEP emission limits. A schematic of the gaseous reference method sampling system is presented in **Figure 2**.

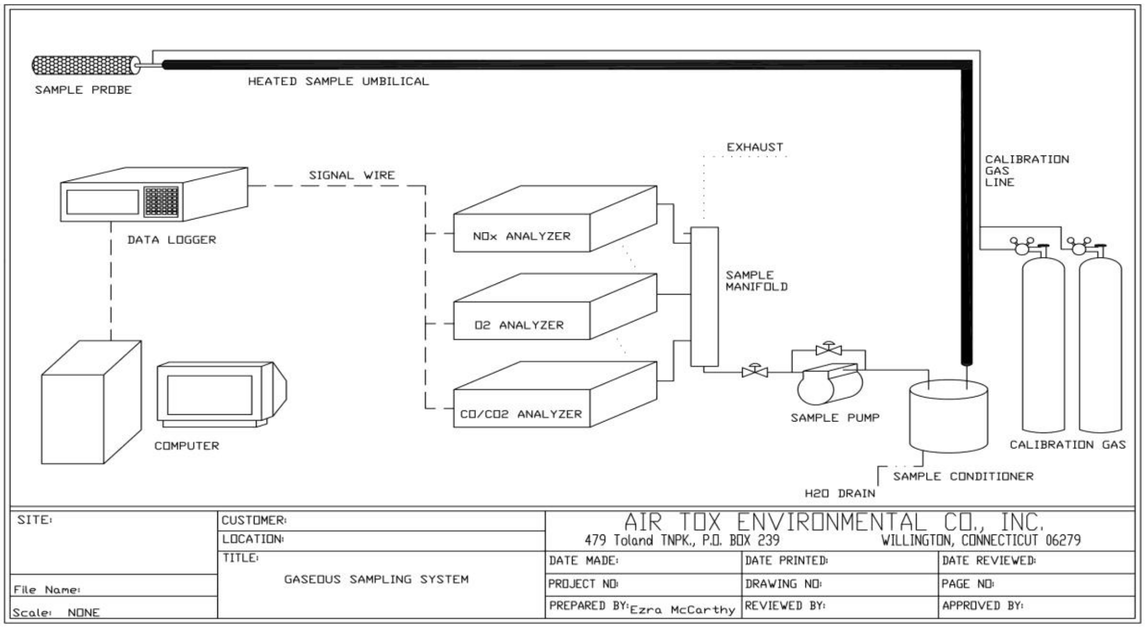

Figure 2 Gaseous Reference Method Sampling Schematic

The specific analyzers, along with their ranges, are listed in **Table 3**.

TABLE 3
GAS ANALYZERS

Parameter	Analyzer	Range
O_2	Thermo 60i	0-25 %
CO	Thermo 60i	0-200 ppm
NO_x	Thermo 42 CHL	0-100 ppm

The Thermo 42 CHL NO_x analyzer is equipped with a NO_x converter. The converter efficiency was checked prior to the testing program according to the procedure listed in 40CFR60, Appendix A, Section 8.2.4, EPA Reference Method 7E.

A three point (zero, mid, and span) calibration was performed directly on each analyzer (bypassing the sample transport and conditioning system) at the beginning of the test program to demonstrate analyzer linearity and calculate a predicted response for the mid-level and high-level gases. Calibration error was then determined by introducing the mid-level and high-level gases to the sampling system and comparing the actual response values with the predicted response calculations.

A zero and mid-level bias check and calibration drift check were also performed prior to and after each test run (approximately every hour, as applicable). An injection point at the sample extraction probe was used for the introduction of gases to the entire sample transport and conditioning system for pre and post run calibration checks. EPA Protocol 1 gases, at concentrations within the ranges specified in each test method, were used for all calibrations. Calibration drift, if any, was used to correct the average test run concentrations. Procedures and calculations contained in EPA Reference Method 7E, Sections 6, 7, and 8 were used to determine the average corrected stack concentration of the measured constituents for each test run.

3.2.3 Manual Emission Measurements

Concurrent with the instrumental measurements detailed above, measurements were performed utilizing manual test methods to determine stack gas molecular weight, moisture content, and volumetric flow rate.

Stack Gas Molecular Weight Determination

Molecular weight was determined using calculations listed in EPA Reference Method 3. As detailed above, the composition of the gas stream was analyzed for carbon dioxide concentration, in accordance with EPA Reference Method 3A. This data, together with the measured carbon monoxide and oxygen concentrations, allowed the stack gas molecular weight to be calculated.

Stack Gas Moisture Content Measurements

Stack gas moisture content was determined according to EPA Reference Method 4. The necessary three (3) 1-hour moisture runs were performed in conjunction with the Method 5 testing.

Volumetric Flow Measurements

Exhaust stack volumetric flow rate were determined in accordance with EPA Reference Methods 1A and 2.

EPA Method 5 for PM Emissions Measurement

Particulate sampling was performed using an EPA Reference Method 5 sampling train. A total of three (3) 1-hour test runs were performed for this test program. Prior to testing, all sample train components were cleaned and assembled in accordance with Method 5. Prior to and following sampling, the sample train was sealed with Parafilm to prevent contamination. The sampling train consists of a borosilicate or quartz nozzle, a heated quartz fiber filter (83mm) encased in a glass filter holder with a Teflon coated frit, and four impingers. The first two impingers (Greenberg-Smith) were each charged with 100 ml of de-ionized water. The third impinger was left empty, and the fourth impinger contained 200 grams of indicating silica gel to remove any remaining moisture. A diagram of the sample train is presented in **Figure 3**.

Flexible tubing, a vacuum gauge, needle valves, a leak-less vacuum pump, a bypass valve, dry gas meter, critical orifice and inclined manometer complete the sampling train. The stack velocity pressure was measured using a pitot tube and inclined manometer according to EPA

Method 2. The stack temperature was monitored by a thermocouple connected to a potentiometer. A nomograph and/or calculator were used to quickly determine the orifice pressure drop required for pitot velocity pressure and stack temperature measurements in order to maintain isokinetic sampling conditions. Sampling flow was adjusted by means of the bypass valve. Before and after each particulate test run, the sampling train was leak-checked (acceptable at less than 0.02 cubic feet per minute). The moisture content of the exhaust gases was also determined during each particulate test run as part of this sampling train according to EPA Reference Method 4. Upon completion of each 1-hour sample run, the train components were moved into a relatively clean area to minimize the chances of contamination during sample recovery.

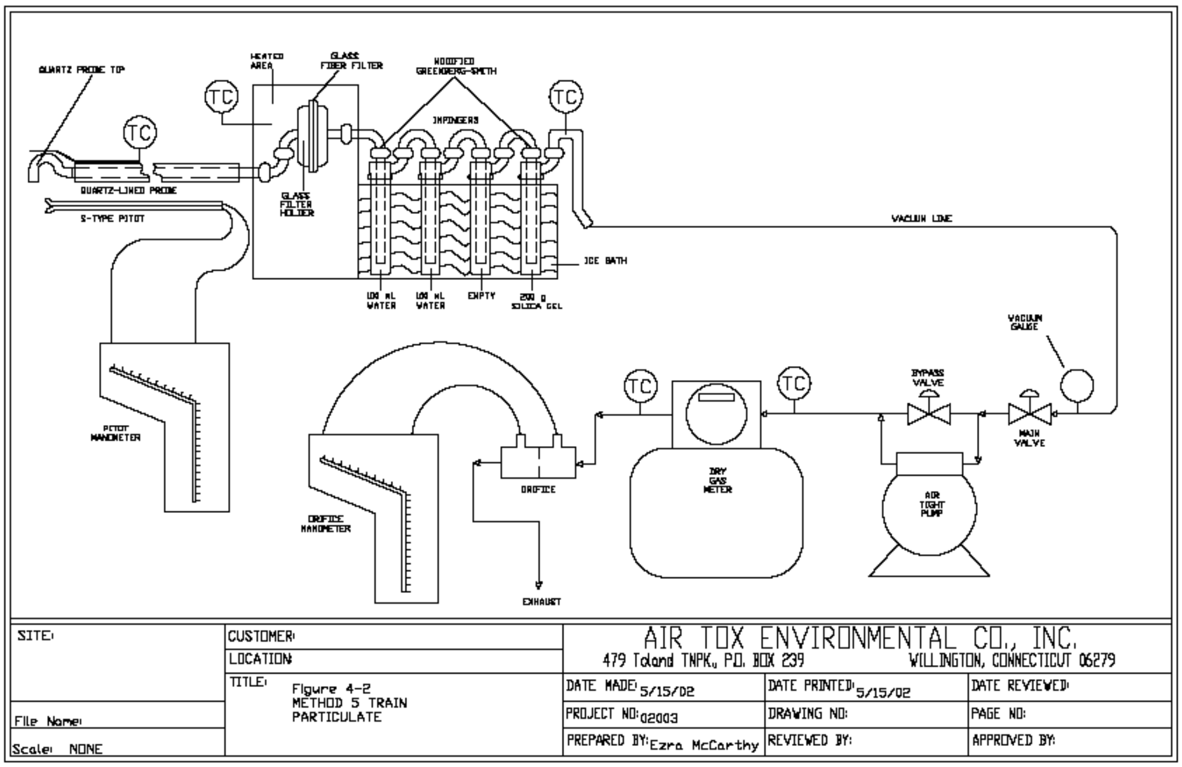

Figure 3 EPA Method 5 – Particulate Matter Sampling Schematic

Test data were recorded on field data sheets and included in the Air Tox Test Report. The sample train was inspected for abnormal conditions and completely disassembled. Samples were recovered and placed in sample containers as follows:

Container No. 1 - The filter was placed in a Petri dish and sealed for gravimetric analysis.

Container No. 2 - Contained the acetone wash of probe and front half of the filter holder. The nozzle and front half of the filter holder were washed and brushed three times. Container was labeled and sealed for transport.

Container Nos. 3-5 - Moisture content of Impingers 1, 2 and 3 was determined, and the contents discarded.

Container No. 6 Silica gel was massed to determine moisture gain in Impinger 4.

3.3 Sampling Locations

Samples were collected at the outlet of the exhaust gas treatment system of the Thermo Power TP-75. A pipe extension was attached to the exhaust pipe of the unit so that the sampling locations would meet the minimum testing requirements of EPA Method 1A. The following are the emission sampling and gas velocity measurement location dimensions:

Sampling Location Configuration – Emission Sampling Probe (PM):	
Upstream	10 in. (2.5 duct diameters)
Downstream	38 in. (9.5 duct diameters)
Port Diameter	3 in.
Number of Sampling Ports	1
Stack Diameter	4 in. (internal diameter)

Sampling Location Configuration – Gas Velocity	
Upstream	37.5 in. (9.375 duct diameters)
Downstream	10.5 in. (2.625 duct diameters)
Port Diameter	0.75 in.
Number of Sampling Ports	1
Stack Diameter	4 in. (internal diameter)
Sampling Location Configuration – Emission Sampling Probe (CEMS)	
Upstream	40 in. (10 duct diameters)
Downstream	8 in. (2 duct diameters)
Port Inside Diameter	1 in.
Number of Sampling Ports	1
Stack Diameter	4 in. (internal diameter)

4. Verification Procedures: Technology System Performance

4.1 Quality Assurance

Dominik Grzywacz, project manager, was responsible for implementation of the quality assurance program as applied to this project. Implementation of quality assurance procedures for source measurement programs are designed by Air Tox so that the work is done:

- By competent, trained individuals experienced in the methodologies being used.
- Using properly calibrated equipment.
- Using approved procedures for sample handling and documentation.

Measurement devices, pitot tubes, dry gas meters, thermocouples and portable gas analyzers are uniquely identified and calibrated with documented procedures and acceptance criteria before and after the field effort. Records of all calibration data are maintained in the files and presented in the Air Tox final report. Data are recorded on standard forms. Field notebooks were used to record observations and miscellaneous elements affecting data, calculations, or evaluation.

Specific details of Air Tox's QA program for stationary air pollution sources may be found in "Quality Assurance Handbook for Air Pollution Measurement Systems", Volume III (EPA-600/4-7-027b).

EPA Reference Methods

Calibration gases utilized for instrumental analysis methods are prepared in accordance with EPA Protocol 1 or certified to be within ±2% of the cylinder “tag” value concentration. All calibration gases used during the performance of this testing were provided by an EPA PGVP certified participant. Analyzer linearity, bias, calibration drift, and calibration drift corrections were determined in accordance with Reference Method 7E, as outlined in Section 3.2.2 of this verification report.

4.2 Test Results

The emissions test program performed on the Aegen Thermo Power 75 generator was performed on November 25, 2013. Three (3) one-hour test runs were performed at the TP-75’s exhaust stack sampling locations when firing natural gas (Holyoke Gas & Electric, Holyoke, MA), while operating the TP-75 unit at 100% load. Load was determined by having a constant kW output of 75. Key field data are summarized in **Appendix A**.

Gaseous emissions were calculated using EPA Method 19. Each one (1) hour average test run emissions were first calculated in pounds per million British Thermal Units (lb/MMBtu) using the equations and constants provided in EPA Method 19 and a fuel factor of 8710 (from Table 19-2 for natural gas), and then converted to lb/MW-hr using the measured flow rate in standard cubic feet (scf), a fuel heating value of 1020.7 Btu/scf (independent laboratory analysis), and a constant kW output of 75. The fuel usage for test runs no. 1, 2, and 3 were determined to be 880, 920, and 935 scf respectively.

SO_2 emissions were calculated by mass balance. The total sulfur content of the natural gas fueling the TP-75 was determined by fuel analysis. Sulfur content in grains/100 scf was determined by ASTM D-5504-08 which was used to calculate emissions in lb/MW-hr. Fuel analysis determined the sulfur content to be 0.1531 grains/100 scf. This along with the measured fuel usage for each run enabled the determination of SO_2 emissions in lb/MW-hr.

A summary of results for the compliance demonstration test program performed on the TP-75 exhaust emissions is presented in **Table 4** below. The NOx emissions for Run 1 and the PM emissions for Run 2 are significantly below the results from the other two test runs; however they do not change the finding of an insignificant source of emissions (See note below Table 4).

TABLE 4
TP-75 COMPLIANCE TEST RESULTS*

Pollutant	Test Run No. 1 (09:15-10:14)	Test Run No. 2 (10:45-11:44)	Test Run No.3 (12:08-13:07)	Average**	Limit
NO_x	0.07	0.19	0.20	0.15	0.40
CO	0.14	0.13	0.12	0.13	0.25
SO_2	0.00257	0.00268	0.00273	0.00266	0.01
Particulate	0.095	0.003	0.083	0.06	0.10

* Units are measured in lbs/MW-hr.
** Run 1 NO_x and Run 2 PM report significantly lower emissions than the other two runs. If one were to disregard these unexplainable testing anomalies, the NO_x average emissions for Runs 2 & 3 of 0.195 is below the NO_x limit by 50% and the PM average emissions for Runs 1 & 3 of 0.089 is below the PM limit by 11% demonstrating that the TP-75 is not a significant source of these emissions in accordance with N.J.A.C. 7:27-8.2(f)1.ii.
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The Air Tox reported average NO_x emission was calculated to be 0.15 lbs/MW-hr demonstrating compliance with the 0.40 lbs/MW-hr limit. The average CO emission was calculated to be 0.13 lbs/MW-hr demonstrating compliance with the 0.25 lbs/MW-hr limit. The average particulate emission was calculated to be 0.06 lbs/MW-hr demonstrating compliance with the 0.10 lbs/MW-hr limit. The average SO_2 emission was calculated to be 0.00266 lbs/MW-hr demonstrating compliance with the 0.01 lbs/MW-hr limit. (As noted above, even when the reported low emissions of NO_x and PM are disregarded, compliance with the NOx and PM limits is still attained.)

5. Performance Claim Verification

The Air Tox testing has demonstrated that the Aegen Thermo Power TP-75 natural gas-fired cogeneration module has carbon monoxide emissions well below the emission limit of 0.25 Lb/MW-Hr, has NOx emissions well below the emission limit of 0.40 Lb/MW-Hr, has PM emissions well below the emission limit of 0.10 Lb/MW-Hr and has sulfur dioxide emissions significantly below the emission limit of 0.01 LB/MW-Hr when operated at 100% load. Hence Aegenco's technical performance claim that **"The Aegen Thermo Power TP-75 CHP Module fired with natural gas when operated at 100% load has demonstrated by source emission testing that it emits less than 1) 0.40 pounds of NO_x per megawatt hour, 2) 0.25 pounds of CO per megawatt hour, 3) 0.10 pounds of PM per megawatt hour; and 4) 0.01 pounds of SO_2 per megawatt hour and, therefore, it is not a significant source of emissions in accordance with N.J.A.C. 7:27-8.2(f)1.ii"** has been verified.

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6. Net Environmental Benefit

Engine-driven power cogeneration equipment can provide a source of clean and reliable electricity and heat. Since buildings in the United States contribute 40% of the annual greenhouse gas (GHG) emissions, they are the single largest target for GHG reduction. By generating both electricity and heat at the point of use in a building, an increase in end use fuel efficiency (generally 30-40%) is achieved. The Aegen Thermo Power TP-75 CHP Module fired with natural gas can provide electricity and heat efficiently with insignificant emissions.

7. References

Test Report, Thermo Power TP-75 Manufacturer Compliance Certification Test Program, prepared by Air Tox Environmental Company, Willington, Connecticut (January 2014).

APPENDIX A

Table A-1 Summary of Key Field Data

Emission Parameter	Test Run	Measured Concentration PPM (dry)	Corrected Concentration* PPM (dry)	Lb/MMBtu	Lb/MW-hr
NOx					
	1	**5.0**	**5.2**	**0.0054**	**0.07**
	2	**14.1**	**14.3**	**0.0148**	**0.19**
	3	**15.3**	**15.4**	**0.0161**	**0.20**
Average				**0.0121**	**0.15**
CO					
	1	**18.3**	**17.9**	**0.0113**	**0.14**
	2	**17.1**	**16.7**	**0.0106**	**0.13**
	3	**15.9**	**15.4**	**0.0097**	**0.12**
Average				**0.0105**	**0.13**

***Correction for Calibration Drift**

Test Run	1	2	3
Fuel Use (scf)	**880**	**920**	**935**