Permit Review
Chapter 127

To:	Mark J Wejkszner Program Manager	Through:	Ray Kempa Environmental Group Manager
From:	Shailesh Patel Air Quality Engineer	Date-	
Region 2		Luzerne County	
Permit Number		39-00099A	
Company Name		Delta Thermo Energy A, LLC	
Source Description		Energy Production facility	
Control Equipment		Cyclone, SCR, Bag house, Packed Tower Scrubber Carbon Adsorption System	
Location of Sources		Allentown City, Lehigh County	

THE COMPANY HAS SUBMITTED THE FOLLOWING DOCUMENTATION AS REQUIRED FOR THE PLAN APPROVAL TO BE COMPLETE:

a. A completed Air Pollution Control Act Compliance Review Form dated 3/29/13.
b. Municipal notification received by the host municipality on 3/28/13 as required by Act 14.
c. Municipal notification received by the host county on 3/28/13 as required by Act 14.
d. A check in the amount of $1,700 consistent with Subchapter I of Chapter 127 of the Rules and Regulations of the Department of Environmental Protection.
e. The General Information Form was submitted as part of the application on 1/11/13.

THE DEPARTMENT HAS TAKEN THE FOLLOWING ADMINISTRATIVE ACTIONS:

a. Coordination with other agencies was done and is required.
b. The Application Acceptance/Administrative Completeness Letter was sent on 5/03/13.
c. Notification in the Pennsylvania Bulletin on 5/25/13 to allow an additional 30-day comment period for the public to respond.

GENERAL INFORMATION:

Delta Thermo Energy A, LLC (DTE) has proposed to construct a new Energy Production facility in the City of Allentown, Lehigh County, Pennsylvania. The facility will utilize municipal solid waste (MSW) and sludge from the City of Allentown's Wastewater Treatment Plant as feedstock to produce pulverized fuel to generate 4 gross megawatts (MW) of electricity for internal use and sale. The facility will be designed with equipment capable of processing an average of 120 tons/day of Municipal Solid Waste (MSW) and 47 tons/ day sewage sludge as feedstock. Feedstock for the facility will be prepared onsite from MSW and sludge. The facility will use presorting of the MSW to increase the recovery of recyclables and state-of-the-art technology Resource Recovery System (RRS) to convert feedstock to a renewable clean fuel that will be combusted using an improved Stoker-type combustor to generate steam, which in tum will power a turbine to generate a green, renewable source of electricity.

Process Description
The facility will be consisting of following processes.

1. Receiving & Sorting
2. Shredding
3. Feedstock Pit
4. RRS Units
5. Dryer
6. Combustor (CCC)
7. Boiler
8. Turbine/Generator
9. Wastewater Treatment System (WTS)

1. Receiving & Sorting
Receiving area consists of tipping floor, weigh scale and sorting area.

Trucks delivering MSW and Sludge will be weighed when entering the facility site before unloading their waste into tipping floor. The tipping floor is a concrete area measuring roughly 70 feet by 100 feet, with a 0.50 slope to divert liquids to the drainage system.

Access to the facility will be monitored and truck data and weighing information recorded before unloading .The bulk waste is separated from the rest of the MSW in the tipping floor. Bulk waste is then carried to a separate part of the plant and determined what is needed for their disposal. The rest of the MSW is loaded into the bag opener. After weighing, the sludge is directly deposited in a pit.

After separating the bulk waste out of the waste stream and loading the MSW into the bag opener, the MSW will be moved from the tipping floor to the sorting area, via a conveyor. The sorting line equipment and the sorting line conveyor will be installed with at least three sorting stations on each side. The collection Material Recovery Buckets ("MRBs") for recyclables glass, metals, ceramics, and other non-combustibles/discarded materials, etc, will be on grade and located just below the sorting line. The sorting line will consists of positions for up to six (6) operators and will be moving at a rate of 8 tons/hour.

2. Shredding
There are two components in this area: the shredder equipment and the pit.

Industrial size shredder will be installed after the sorting line. Shredder will be designed to process 4.73 tons/hour of MSW. It will have a slow-motion turner to avoid any spontaneous combustion. The shredder can also be coupled with a baler, which was designed with control technology adapted to the packing of the waste in sealed bales, when required for inside storage. Fugitive emissions from the shredder will be captured in a hood and will be discharged into combustors (CCCs) for combustion.

3. Feedstock Pit
The Feedstock Pit is where the shredded MSW is deposited along with the sewage sludge. The pit will be located below grade (18 feet below grade) and will contain both the shredder MSW and the Sludge. This mixed pit will be used to contain the mixed waste before loading it to the RRS using a crane. Maximum capacity of the feedstock pit will be 22,320 ft^3 and will be 69 long'X23'wideX14'deep in size. Fugitive emissions from the feedstock pit area will be captured and treated in the CCC as combustion air.

4.RRS Units
After the feedstock pit, the Hydrothermal Decomposition Process will start with the Resource Recycling System (RRS). Five RRSs will be installed at the facility to convert the feedstock to pulverized fuel (PF) by Hydrothermal Decomposition, on a batch basis The RRSs, will be supplied by Hokuto. Approximately a 2:1 mix, by volume, of shredded MSW and sludge (feedstock) will be supplied to the RRS units, which are operated as batch units under high pressure steam to produce clean renewable pulverized fuel ("PF"). The plant will have five (5) RRSs. The RRSs will function in parallel 24x7. The volume of each of these RRSs is ten cubic meters. They will be located after the receiving and mixed material pits following the flow of the plant process. RRSs will be installed on grade but the feeding hoppers for each RRS will be above grade. Each of the RRSs will be fed separately by using an overhead crane. The crane will carry the

materials from the mixed feedstock pit to the RRS's hoppers. Approximately 3.66 tons of feed stock will be process to produce PF per batch. Each batch will last approximately 150 min and will produce 9.32 tons of wet PF. When Hydrothermal Decomposition is complete for a batch, the high pressure steam is released to a cyclone condenser. PF from the RRS contains 50 % of moisture. Moisture from PF will be removed by dryer using excess heat from the facility. Fugitive emissions from the RRSs will be captured and treated in the CCC as combustion air.

5. Dryer
Each batch of pulverized fuel processed in the RRS is discharged unto a conveyor. This conveyor takes the wet fuel to the dryer, which works using the excess heat from the boiler and turbine. The dryer will be supplied by Jasper GmbH to process 8.5 tons/hr feed. Moisture evaporates and is carried out by air blown through the dryer that works as supporting agent. Afterwards this air is cooled down and the water is brought to the Wastewater Treatment System. The drying process reduces the moisture content of the PF to about 18 percent, which is sufficient for combustion.

6. Combustor (CCC)
The CCC will be designed by Jasper GmbH of Germany. It will be designed to burn the pulverized fuel produced by the RSS process and dried in the steam Dryer. The dried pulverized fuel will be fed into the CCC by a controlled fuel charging system and burned at approximately 1,860 ^{O}F. Ash from the combustion process will be removed by a chain conveyor for disposal. Flue gas from the combustor will be transported to a post-combustion chamber where the temperature will be kept above 1,650 ^{O}F, with a residence time of 2 seconds for complete combustion. The CCC will be complete with a natural gas burner that will only be used during startup. The flue gases from the CCC will be directed to the heat recovery boiler for the production of high-pressure super-heated steam to power the turbine to produce electricity. The CCC will be a stoker-type combustor with special Jasper features incorporated into its design, including a rotary paddle system to gently agitate the fuel to the combustion grid. This agitation system helps to ensure complete combustion without the use of a large amount of under fire air, to improve combustion efficiency, and to lower emissions. The ash will be removed from the CCC by a chain conveyor and cooled using water from the Water Treatment System (WTS). Vapors generated from this cooling process will be collected by an ID fan, hoods, and duct work to exhaust the vapors to the CCC and the WTS.

The CCC will consist of: Material dryer as external and internal component of CCC, CCC's charging and discharging system, and Post-combustion chamber,

7. Boiler
The boiler system includes steam generation with heat recovery & will be supplied by Hwa Seong Boiler Company, Ltd. The designed rated heat input for the boiler is 70.4 MMBtu/hr. The flue gas from the CCC's combustion chambers will be supplied to the fire tube boiler for the purpose of generating high temperature steam. The superheated steam will be used for driving the steam turbine and for providing steam to the thermal process in the RRS system as well as supplying heat to assist in drying the processed fuel from the RRS. About 18 percent of the flue gas stream from the economizer will be recirculated to the CCC for control of NOx emissions. The balance of the flue gas stream will treated in the emission control system to reduce NOx, PM, VOC, Hg, SO2, and other acid gases before discharge to the outdoor air. Ancillary equipment will include condensers, heat exchanger, a boiler feed water treatment and return systems for proper operation of the facility.

8. Turbine/generator
The water-steam circuit and associated systems will be used to generate power for the plant's own internal power use as well as for feeding the excess electricity into the public electric power producing grid. The steam power is built up in the steam turbine through the conversion of the thermal energy into mechanical and electrical energy. The turbine generator set will be a condensing steam turbine with output and operating characteristics to best utilize the output energy captured in the boiler steam. The proposed steam turbine will be supplied by Dresser Rand (Model U) and have a nominal rating of 4 MW at 5,350 RPM with steam inlet conditions of 580 psig and 752 °f. The unit will be a condensing-type

steam turbine. The plant will produce an average of 3.7 MW and consume approximately 1.4 MW. It will provide 2.3 MW to the grid for sale.

9. Wastewater Treatment System (WTS)
Water utilized in the boiler(s) will be provided from the water main located on the site prior some appropriate pretreatment. Additionally, all waste water, including leachate water, generated by the facility's process will be treated by the WTS before being discharged to the water sewage system (namely Allentown's Waste Water Treatment Plant). The wastewater treatment system will be supplied by ETC, Inc. Boiler blow down and other process waste water, including water from the scrubber, will be treated in the WTS as well.

Air Pollution Control System

The facility will emit Clean Air Act-regulated pollutants, including PM_{10}, NOx, CO, SO2, VOC, acid gases and metals. The emission control system consists of the following devices in series: Twin cyclone for primary PM removal, Selective catalytic reduction (SCR) system with urea injection for NOx control, Economizer Flue gas recirculation for NOx control, Fabric filter for control of PM and metals, Wet packed tower with caustic solution recirculation for control of SO_2, HCl, and HF 2-stage carbon adsorption system for VOC and mercury control, 600-hp ID fan and discharged through a stack 57.5 feet above grade (5 feet above roof)

Cyclone
Combustion gases exhausted from the boiler will enter the cyclone at a temperature of 550-650 ^{O}F, where dry centrifugal separation removes more than 80 percent of the particulate. The cyclone will be manufactured by Ducon or equivalent and will a twin cyclone having model no. 810, Size 2-635. The unit is a twin cyclone having 91.5" cylinder length, 72" cylinder diameter. The cyclone is designed to handle airflow of up to 56,760 ACFM at 600 ^{O}F temperature. The unit has an overall collection efficiency of 80% for particulate. The pressure drop across the cyclone is 5 inches w.g. The collected dust will be containerized for offsite disposal at a licensed facility. The cyclone is followed by the SCR system.

SCR System
Exhaust gases from the cyclone will be at a sufficient temperature (>560 ^{O}F) to initiate the reaction for conversion of NOx to N_2 in the SCR unit. The unit will be a Ducon or equivalent manufactured having model no. NR-90, Size 36. Urea (30 to 40 percent solution) will be injected into the duct upstream of the SCR unit. The SCR will be designed to handle airflow of up to 56,760 ACFM at 600 ^{O}F temperatures. The minimum NOx removal efficiency will be 85 percent. Pressure drop across the catalyst bed will be 2-3 inches w.g. Ammonia slip in the stack gases will not exceed 5 ppmv. The SCR system will be followed by the economizer, which will extract useful heat for pre-heating the boiler feed water and lower the gas temperature to protect the bags in the fabric filter. Approximately 18 percent of the flue gas stream will be recirculated to the CCC for NOx control. Urea will be delivered as needed in integrated bulk containers (totes).

Fabric Filter
Exhaust gases from the boiler economizer (320 ^{O}F) will be treated in the fabric filter collector designed by Ducon or equivalent having model no. UNF-1 Size 64. The unit will be a suction designed capable of handling 41,767 acfm at 320 ^{O}F with a single compartment containing 640 bags with a total filtration area of 14,080 ft^2 and a minimum of 3:1 air to cloth ratio. The bags are P84 (polyimide fiber) bags, 6 inches in diameter and 14 feet long. Compressed air will be used to clean the bags when the pressure drop reaches 4-6 inches w.g. The minimum fabric filter efficiency for PM and metals will be greater than 99.4 percent. Dust collected in the hopper will be containerized and sent off site for disposal at an approved facility.

Packed Tower Scrubber
Exhaust gases from the fabric filter will be discharged into a vertical packed column scrubber manufactured by Ducon or equivalent having model no. CAT, size 96. The unit is designed to handle

34,226 acfm at 135 ^{O}F. The exhaust gases will be cooled in the quench chamber from 320 ^{O}F to 135 ^{O}F by water injection, prior to entering the packed tower. The packed column is 10 feet in diameter with 8 feet of polypropylene packing to promote intimate contact between the gaseous and liquid phases. Liquor containing caustic soda (PH 6.0 to 7.5) will be recirculated at a rate of 480 gpm in the packed column to remove acid gases. 20% sodium hydroxide solution will be used to maintain the appropriate pH in the scrubber system. Expected pressure drop across scrubber will be 4" w.c. The scrubber will be equipped with a 2-stage demister --an FRP chevron demister and a polypropylene mesh pad to remove liquid droplets. The removal efficiency for SO_2 and HCL will be greater than 99 percent; the HF removal efficiency will be greater than 87 percent. Approximately 2.2 gpm of blow down from the scrubber will be discharged to the on-site wastewater treatment plant.

Carbon Adsorption System
The saturated gas stream from the scrubber system will be treated in the pre-filter to remove residual water droplets, acting as a water trap to minimize carryover into the carbon adsorption system. The carbon system consists of two components --the first component is a sacrificial bed containing non-activated carbon; the second component includes four beds containing activated carbon. The sacrificial bed surface area is 170 square feet; the total surface are of the four activated carbon beds is 452 square feet. The carbon system removal efficiency will be greater than 90 percent for mercury and 75 percent for VOC. Exhaust gases from the carbon system will be transported by an ID fan complete with a 600 hp motor and discharged to the outdoor air through a stack 57.5 feet above grade.

POTENTIAL EMISSIONS:

Following are the potential emissions estimated by the company using emissions factors supplied by Jasper GmbH of Quickborn, Germany and are based on 8760 hours of operation & without control.

Pollutant	Emission Factor Mg/m^3 (dry)	Lb/hr	Ton/yr
NOx	100	8.74	33.0
SO_2	477	41.74	160.2
SO_3	9.7	0.85	3.3
HCL	162	14.16	54.4
HF	9.2	0.80	3.1
CO	40	3.5	13.4
VOC	20	1.75	6.7
PM	2000	174.88	671.5
Hg	0.175	0.015	0.058
CO_2	0.166 kg/m^3	16,382	62,907

CONTROLLED EMISSIONS

Using the removal efficiencies of the control devices provided by Ducon, the controlled emissions in the stack gases are presented in the following table.

Pollutant	Control Efficiency %	Controlled Emissions	
		Lb/hr	Tons/yr
NOx	85.1	1.3	5.0
SO_2	97.5	1.04	4.0
SO_3	---	0.85	3.3
HCL	99.1	0.13	0.5

HF	85	0.12	0.46
CO	---	3.5	13.4
VOC	40.6	1.04	4.0
PM	99.8	0.39	1.5
Hg	90	0.0015	0.006
CO_2	---	16382	62,907

Fugitive Emissions:
The fugitive emissions from the shredder operations will be captured in a hood and treated in the Complete Combustion Chamber (CCC). The feedstock pit is enclosed within four walls in the plant to limit fugitives and odorous contaminants. The pit is separated from the Resource Recovery System (RRS), the other components, and the tipping areas. Fugitive emissions will be captured and treated in the CCC as combustion air. The company do not expect any fugitive emissions from the sorting of the recyclable materials such as glass, metals, and non-combustible materials. Any large particulate matter generated by these operations will settle onto the building floor and other horizontal surfaces, which will periodically be cleaned. All of these operations are enclosed in the building, which will be maintained under negative pressure to prevent the escape of potential fugitive emissions to outdoor air. Air curtains at the doors will assist in maintaining the negative pressure within the building.

REGULATORY ANALYSIS:

New Source Performance Standards
The Clean Air Act of 1970 directed the USEPA to develop New Source Performance Standards (NSPS) for specific industrial categories. However, the proposed project is not covered by NSPS regulations.

Hazardous Air Pollutant Regulations
There are no standards in 40 CFR Part 63 that are applicable to this project

Greenhouse Gas Tailoring & reporting Rule
The Greenhouse Gas Tailoring Rule does not apply to this plan approval application since it is neither a PSD nor a Title V permit application.

The rated heat input of the CCC unit is76.28 MMBtu/hr, which exceeds 30 MMBtu/hr, hence the company will calculate the annual GHG emissions for each calendar year. If they exceed the threshold of 25,000 metric tons per year, the company will submit the required GHG report to EPA by March 31 of the following year.

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION REGULATIONS

Section 123.1 -Prohibition of Certain Fugitive Emissions
This regulation imposes a general ban on fugitive emissions, except for the following activities: clearing of land; construction and demolition; grading, paving and maintenance of roads and streets; use of roads and streets; and stockpiling of materials. Where these exempt activities are conducted, the facility must implement one or more of the following measures to minimize fugitive emissions: The company will implements these measures, as necessary, to minimize fugitive emissions. In addition, the feedstock shredder will be located indoors, which will minimize fugitive emissions from that source.

Section 123.2 -Fugitive Particulate Matter
This section prohibits fugitive particulate emissions in such a manner that they are visible beyond the facility property line. The company will pave the haul roads on the site. The MSW and sewage sludge will be staged indoors and the building will be maintained under negative pressure. Therefore, visible fugitive emissions beyond the facility's property line are not expected.

Section 123.11 Particulate Emissions -Combustion Units

For combustion units with rated heat input between 2.5 and 50 MMBtu/hr, allowable particulate emissions are 0.4 lb/MMBtu. Particulate emissions will be 0.0051 lb/MMBtu, complying with this limit.

Section 123.22(c)(l) -Sulfur Compound Emissions --Combustion Units
Emissions of sulfur oxides, expressed as SO_2, may not exceed 3 lb/MMBtu in any 1-hour period. SO_2 emissions will be less than 0.025 lb/MMBtu complying with this limit.

Section 123.31 -Odor Emissions
Emissions of malodorous air contaminants into the outdoor atmosphere such that the malodors are detectable outside the property line are prohibited. The facility will receive feedstock and store it indoors and the building will be maintained under negative pressure. The company will install air curtains, the overhead doors serving the incoming delivery trucks. In view of the high combustion temperature and the operation of multiple emission control devices, odors detectable beyond the property line are not expected.

Section 123.41 -Visible Emissions
Emissions may not equal or exceed 20 percent opacity for more than three minutes in any hour, and may not equal or exceed 60 percent opacity at any time. Because of the high combustion efficiency and the emission control systems, visible emissions are expected to remain within these limits.

Section 123.51 -Nitrogen Compound Emissions
This regulation applies to combustion units with rated heat input greater than 250 MMBTU/hr. The CCC has a rated heat input of 76.28 MMBTU/hr. Therefore, this rule does not apply.

Chapter 124 -Hazardous Air Pollutants
Chapter 124 adopts the National Emission Standards for Hazardous Air Pollutants codified at 40 CFR Part 61. The facility is not subject to these standards.

25 PA Code Section 127.12(a)(5)- Best Available Technology:

PM and Metals
The company has proposed to utilize a cyclone in conjunction with fabric filtration to control particulate & metal emissions from the facility, which is a best available technology for these pollutant and satisfy this requirements.

NOx
The company has proposed to utilize FGR in conjunction with SCR to control NO_X emissions from the facility. SCR achieves NOx removal efficiencies above 85 percent. Therefore, the proposed combination of FGR and SCR represents BAT for this type of project.

Acid Gases
Acid gases including SO_2, HCL, and HF will be emitted by the facility. The proposed packed column scrubber technology for controlling acid gases represents BAT for the project.

VOCs
Proposed Carbon adsorption, for removing low-concentration VOCs including mercury, represent BAT for the project.

BAT
The proposed BAT controls are:

Pollutant	BAT Control
NO_x	Combustion controls, flue gas recirculation, and SCR with ammonia injection
Acid gases (SO_2, HCL, & HF)	Wet scrubber -Packed tower

VOC	Combustion controls and activated carbon system
PM, PM_{10} & Metals	Cyclone and fabric filter
CO	Combustion controls
Mercury	Activated carbon bed system

New Source Review & PSD
Although the facility is located in the OTR region, which is classified as a nonattainment area for ozone, NSR requirements listed in Subchapter E of Chapter 127 do not apply to this facility as the NO_X and VOC emissions from the facility are well below the applicable threshold limits of 100 TPY and 50 TPY respectively.

NSR, PSD, and offsets do not apply at these emission rates.

MONITORING, TESTING, COMPLINCEAND RECORDKEEPING REQUIREMENTS:

The company will demonstrate compliance with the emissions limitations as follows:

The Applicant will monitor and record fuel usage for the combustors on an annual basis. Testing will be conducted after start-up to show compliance with emissions limitations. Test results will be reported to the Department; thereafter the company will monitor pressure drops across scrubber & baghouse, solution flow rate across the scrubber and operate the sources with good engineering practices to show compliance with the emission rate and Department's regulations. In addition stack test results will be used to calculate emissions from the facility to show compliance with emissions limitations. These records will be maintained on site and be made available to the Department upon request.

Company shall maintain a file containing all records and other data that are required to be collected pursuant to the various provisions of the plan approval. The file shall include, but not be limited to: all air pollution control systems performance evaluations and records of calibration checks, adjustments and maintenance performed on all equipment which are subject to the plan approval.

RECOMMENDATION:

It is recommended that the plan approval be issued.