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October 8, 2010

Air Quality
County:
OCT 12 2010
Facility:

EXPRESS MAIL
*Fed Ex. No. 8720 7753 0292*
Mr. Shailesh Patel
Air Quality Engineer
Air Quality Program
Pennsylvania Department of Environmental Protection
Northeast Regional Office
Two Public Square
Wilkes-Barre, PA 18711

Subject: Requested Information
RE: CONFIDENTIAL VERSION - RFD for Energy Production Process
Delta Thermo Energy, Inc.
112 Union Street
Allentown, Pennsylvania
IES Project No. EHS09894.01

Dear Mr. Patel:

On behalf of Delta Thermo Energy, Inc. (DTE), IES Engineers (IES) is pleased to submit additional requested information in support of a Request for Determination of Requirement for Plan Approval (RFD) for the operation of a Research and Development (R&D) Energy Production facility.

Please note that this letter and its attachments contain proprietary information; release of this information to a third party could jeopardize DTE's competitive position in the industry. The information provided in this application should be treated as "Confidential" under 25 Pa. Code Section 127.12(d), inasmuch as the application contains trade secrets and intellectual property rights, the disclosure of which could potentially adversely impact the competitive position of the applicant. In addition to the protections accorded by 25 Pa. Code Section 127.12(d), the application should be considered exempt from public disclosure under Section 708(b)(11) of the Pennsylvania Right-to-Know Law. Under the Right-to-Know Law, the application marked **"Confidential"** should not be considered a public record because it would reveal trade secrets or other confidential proprietary information.

We are sending this information in response to our recent telephone conversations regarding the proposed energy production process. Data contained in the attachments to this letter should provide answers to your questions regarding the scrubber and combustion systems.

Enclosed, please find the following documents for your review:

- Complete Combustion Chamber (CCC): Attachment 1 presents a schematic process diagram of the CCC system. Technical process information, including moisture content, operating temperatures, and descriptions of the internal parts are included. The heat input for the natural gas-fired support fire burner is approximately 1.1 MMBTU/hr; this burner is expected to operate for approximately 6 to 8 hours upon startup of the unit and will occur approximately 2 to 3 times per year.

- Scrubber System: Attachment 2 provides a narrative description of the scrubber, describes detailed scrubber mechanisms and chemistry of the pollutant removal capabilities of the system. Attachment 3 contains scrubber specifications and a schematic diagram of the scrubber and its operating parameters.

The DTE facility meets the definition of "research and development" under the air regulations, inasmuch as it "is not engaged in the manufacture of products for commercial sale except in de minimis amounts on an infrequent basis" and its purpose is to research new processes for turning biosolids and MSW into energy in a manner not previously used in the Commonwealth or the United States. If the new processes are demonstrated to work successfully at the Allentown R&D facility, then larger scale commercial units may be produced for use elsewhere in the Commonwealth and the United States.

With respect to your question concerning the research and development nature of the installation, please note that during the R&D period while the technology is being tested and proven, if there is any excess power generated, any revenue from the sale of any excess power into the grid from the Allentown project will be used to pay for the costs of the R&D work until those costs are recovered.

The majority of the electricity is not going to be sold commercially. Most of the electric power will actually be donated to the City of Allentown for their Waste Water Treatment Plant and a portion will be used internally for DTE's operation. In total, this represents about two thirds of the production of electricity of the plant. Also DTE will be testing the viability of connection to the grid, the management of power generation, the associated interconnectivity and metering issues, and related monitoring processes and systems to be tested.

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We appreciate the Department's cooperation in approving this RFD so that the project may proceed as soon as possible. Should you have any questions, please let me know.

Very truly yours,

*Robert W. Schlosser* /e/
Robert W. Schlosser, P.E.
Principal Project Manager

Enclosures

cc: M. Bonilla, DTE
R. Van Naarden, DTE
J. Bolstein, FR, LLP
B. Bakrania, IES
M. Tucci, IES
A. Soni, IES

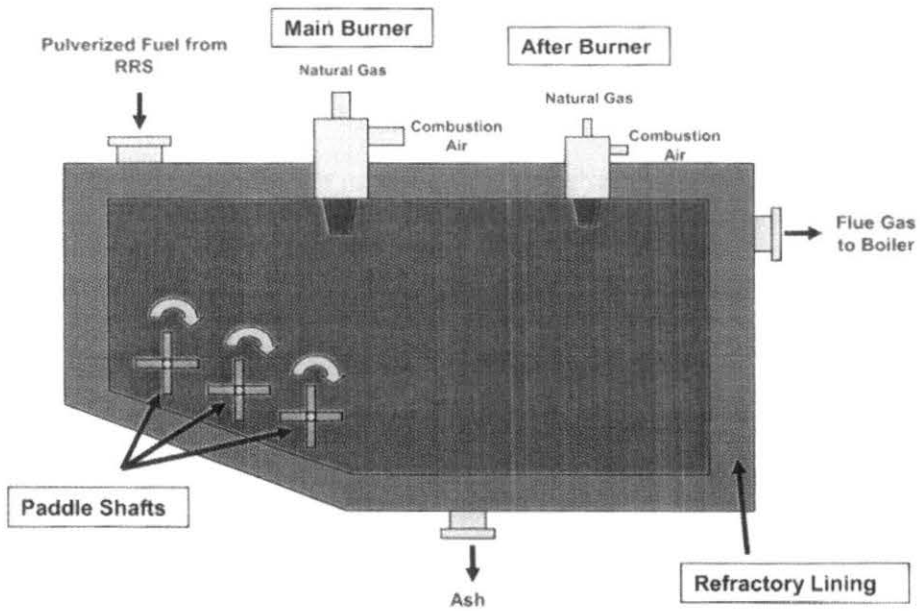
ATTACHMENT 1

COMPLETE COMBUSTION CHAMBER INFORMATION

The CCC:

Here is additional information on the CCC, as requested.

1. Some more information on the uniqueness of the design of the CCC.




- The CCC is designed to allow combustion of feedstock materials with up to 30% water content.
- It allows combustion of pulverized fuel as well as shredded MSW.
- It is made of welded metal sheet construction, with an inside refractory lining.
- The CCC is heated directly by a fuel gas burner system. The start burner system is used only for start up (typically for 6-8 hours).
- Inside the CCC, the feedstock material is burned at a temperature of approximately 900 °C (1,652 °F).
- The paddles inside the CCC assist in moving the material through the drying and burning stages in the combustor.
- Due to its design the CCC will provide low dust emissions in the off gas.
- The residence time of the off gas is equal or greater than two seconds.
- Allows treatment of high calorific wastes and fuels up to 25 MJ/kg LHV
- No additional firing of fossil fuel in operation at > 12 MJ/kg LHV depending from moisture contend
- Low maintenance costs compared to similar combustors
- System removes up to 90% of ash – resulting in a clean boiler!
- Staged combustion provides for low NOx and near zero CO emissions
- Air emissions after waste gas cleaning system (scrubber or bag house) are far below European Emission Act norms
- CCC allows for treatment of high calorific wastes and fuels up to 25.000 kJ/kg
- There is no additional firing of fossil fuel during normal operations
- Low Equipment and Maintenance Costs compared to other combustors systems

2. Additional information about the boiler, as needed:

- The boiler will be manufactured in the USA. It will be designed and equipped in accordance to the US regulations and standards.
- The boiler includes inspection openings, all necessary connection pieces for steam extraction, delivery, discharge, desalination and the necessary measurements.
- The boiler body is insulated with mineral wool matting and covered of galvanized sheet steel.
- Essentially, the water-steam circuit consists basically of the steam system, steam turbo set, the condensation and feed water system and the cooling system.

ATTACHMENT 2

SCRUBBER SYSTEM TECHNICAL INFORMATION

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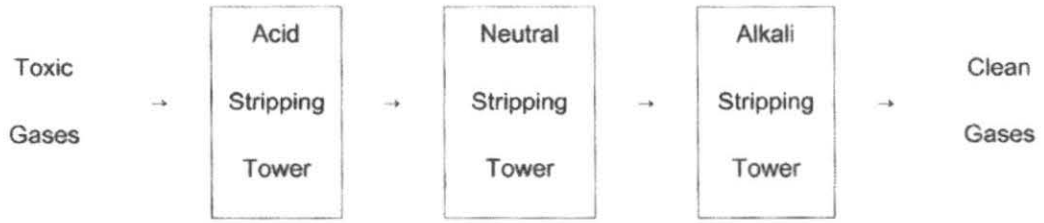
## Superior Eco Scrubber (SES)

### 1. Superior Eco Scrubber

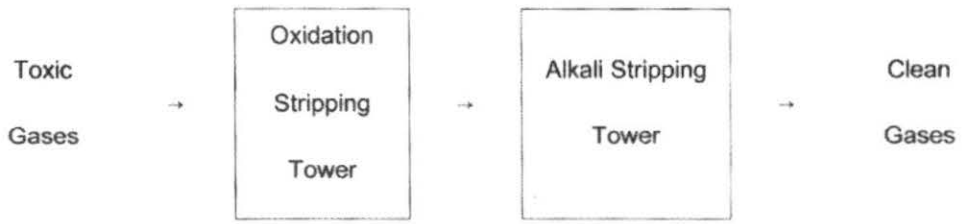
The system is good to remove bad odors and toxic gases by using chemicals and O3 (Ozone) whicr changes the content of toxic air physically by absorbents and chemical reactions among the gases. This SES system can be applied to different combustors and different industries. This process turns gases to odorless and non-toxic thru oxidation on room temperature and low pressure.

### 2. SES Process Flow Chart

1) 3 Stage Chemical Scrubbing System




2) Oxidation and Chemical Mixed System



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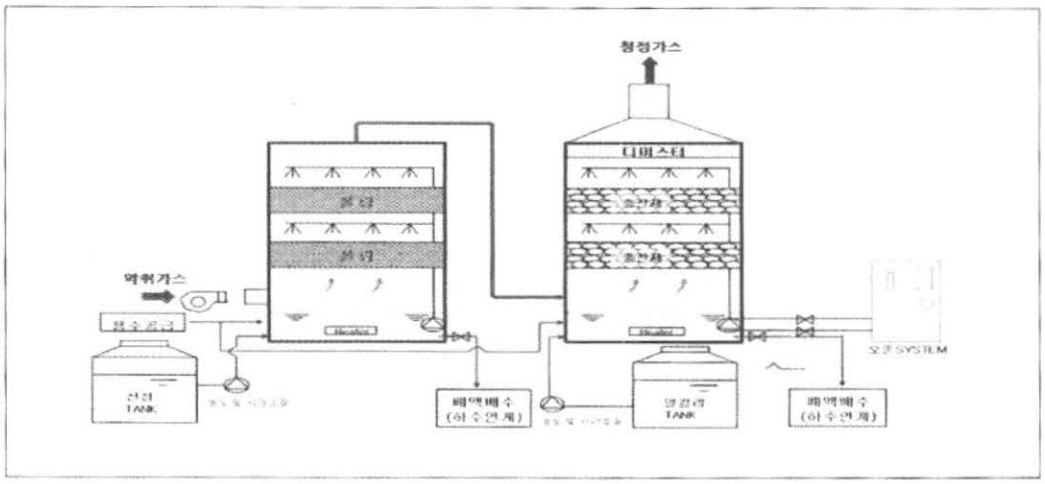


SES System

3. SES Key Attributes

- SES is very effective in removing sulfur, ammonia and other organic elements which produce ba odors
- This system can be used in a wide range of low to high density gases
- SES operates effectively within a wide range residence time, temperature and flow amount within the scrubber
- It will not be produce additional contamination or secondary (mutated) toxic gases from the chemical reaction
- Ease of operation because of pressure loss is negligible
- Completely elimates bacteria and virus
- Reduces flying ash

4. SES Mechanisms and Chemistry

| Family | Toxic Gases | $H_2SO_4$ | HCl | NaOH | $O_3$ |
|---|---|---|---|---|---|
| Alkali | $NH_3$<br>$(CH_3)_3N$ | $2NH_3+H_2SO_4$<br>$\rightarrow(NH_4)_2SO_4$<br>$(CH_3)_3N+ H_2SO_4$<br>$\rightarrow(CH_3)_3N . H_2SO_4$ | $NH_3+HCl$<br>$\rightarrow NH_4Cl$<br>$(CH_3)_3N + HCl$<br>$\rightarrow(CH_3)_3N \cdot NCl$ | No Reaction | $2NH_3 + 3O_3$<br>$\rightarrow N_2 + 3H_2O + 3O_2$<br>$(CH_3)_3N + 3O_3$<br>$\rightarrow CH_2NO_2 + 2CO_2 + 3H_2O$ |
| Acid | $H_2S$ | Toxic Acid Gases | No Reaction | $H_2S + 2NaOH$<br>$\rightarrow Na2S + 2H_2O$ | $H_2S + O_3$<br>$\rightarrow SO_2 + H_2O$<br>$3H_2S + 4O_3$<br>$\rightarrow 3H_2SO_4$ |
| Neutro | $(CH3)_2S$<br>$(CH3)_2S_2$ | No Reaction | No Reaction | No Reaction | $(3(CH3)_2S + O_3$<br>$\rightarrow (CH3)_2SO$<br>$(CH3)_2S +O_3$<br>$\rightarrow (CH3)_2SO_3$<br>$2(CH_3)_2S_2 + H_2O + O_3$<br>$\rightarrow 2CH_3SO3H$<br>$3(CH_3)_2S_2 + 5O_3$<br>$\rightarrow 3(CH_3)_2S_2O_5$ |

5. SES Target Application

- Industries which produce toxic gases such as chemical, and steel.
- Plants which produce volatile organic compounds (VOCs)

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- Plating companies which produce toxic fumes
- Waste water treatment plants and MSW or biomass or animal manure treatment plants, etc.
- Plants which produce flying ash
- Plants which produce various toxic gases or micro particulate dust

## 6. SES Key Design Factors

1) Flow rate per minute
2) Content of toxic gases
3) Density of toxic gas: $m^3$/min
4) Temperature of gases: ℃
5) Operations: hr/day

| Chemical Stripping | Speed of Flow (m/sec) | Residence Time (sec) | Quantity (ℓ/N $m^3$) | Chemical Gas Ratio (ℓ/G) | pH | Density of ion (ppm) |
|---|---|---|---|---|---|---|
| Water | 1.0 | 1.5 | 1.5 ~ 2.0 | 2.5 ~ 5.0 | - | - |
| Acids | 1.3 | 1.5 | 0.005 ~ 0.01 | 3 | 3.5 ~ 4.5 | - |
| Alkali | 1.3 | 1.5 | 0.005 ~ 0.01 | 3 | 9.5 ~ 10.5 | 8 ~ 10 |
| NACIO | 1.3 | 1.5 | 0.005 ~ 0.01 | 3 | - | 100 ~ 200 |
| Ozone | 1.3 | 1.5 | 0.005 ~ 0.01 | 3 | - | - |

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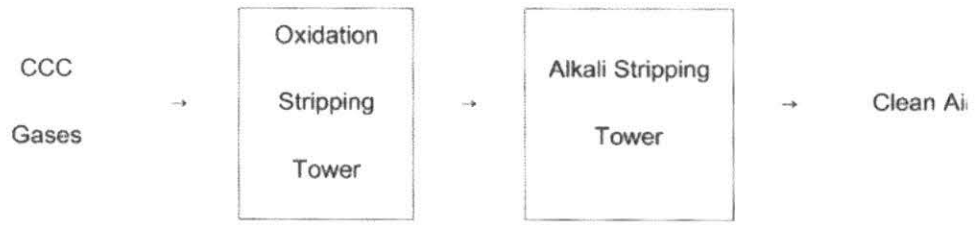
## Wet Scrubber Installed After CCC in Allentown Plant




**Two Stage Process Stripping: Oxidation + Alkali**

**1. HCl**

Effectiveness of removal: 95~98% - by means of Alkali stripping

$2NaOH + CO_2 \rightarrow Na2CO_3 + H_2O$

$Na2CO_3 + CO_2 \rightarrow NaCO_3 + CO_2$

$Na2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

**2. SOx**

Effectiveness of removal: 95~98% - by means of Alkali stripping

$2NaOH + CO_2 \rightarrow Na_2CO_3 + H2O$

$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

$Na_2CO_3 + CO_2 \rightarrow NaCO_3 + CO_2$

$Na_2SO_3 + SO_2 + H_2O \rightarrow 2NaHSO_3$

$Na_2SO_3 + 1/2^o{}_2 \rightarrow Na_2SO_4$

3. NOx (NO, $NO_2$)

Effectiveness of removal: 90~95% - by means of Oxidation and Alkali stripping

NO + oxidants $\rightarrow$ $NO_2$ + oxidants (reduced)

$2NO_2 + H_2O \rightarrow HNO_3 + HNO_2$

4. Pb

There will be no lead detected at the stack because it will remain in the fly ash or bottom ash within the CCC combustor chamber. Over ninety five percent (95%) of the fly ash will then be removed by the wet scrubber (SES). As such, any Pb in the fly ash removed by wet scrubber will be cleaned by the waste water treatment system. Then, this minute quantity of lead will be sent back to the Allentown Waste Water Treatment Plant (WWTP) for additional processing, which means that all the Pb in the fly ash will be in the waste water sent to the WWTP.

ATTACHMENT 3

SCRUBBER SYSTEM SPECIFICATIONS

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(Note: specification may vary depending on airflow and contents of the air)

## Scrubber Equipment Specifications (to be manufactured in USA)

WET SCRUBBER

(1) format style : Wet Scrubber

(2) wind flow rate : 300m³/min

(3) cleaning water rate : 0.5m³/min

(4) Dimensions : 2,200mm Diameter x 5,600mm Height (Stack not included) (Vertical Type)

(5) quantity : 1

(6) Materials :

- Shell (Body & Cone) : F.R.P (Fiberglass Reinforced Plastic)
- Stack : F.R.P
- Distributor & Redistributor : F.R.P
- Spray Pipe : FRP
- Structure : SS400 (stainless steel)
- Hand rail : SS400

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(7) Accessory part

① Manhole : 2 sets

② Sight Glass : 2 sets

③ Light Glass : 2 sets

④ others : 1 lot of various accessories (bolts, nuts, piping, etc.)

(8) cleaning tank –

Materials : F.R.P

- size : 1,800mm W x 1,500mm L x 1,300mm H

- capacity (effective) : 3.5 (2.7)$m^3$

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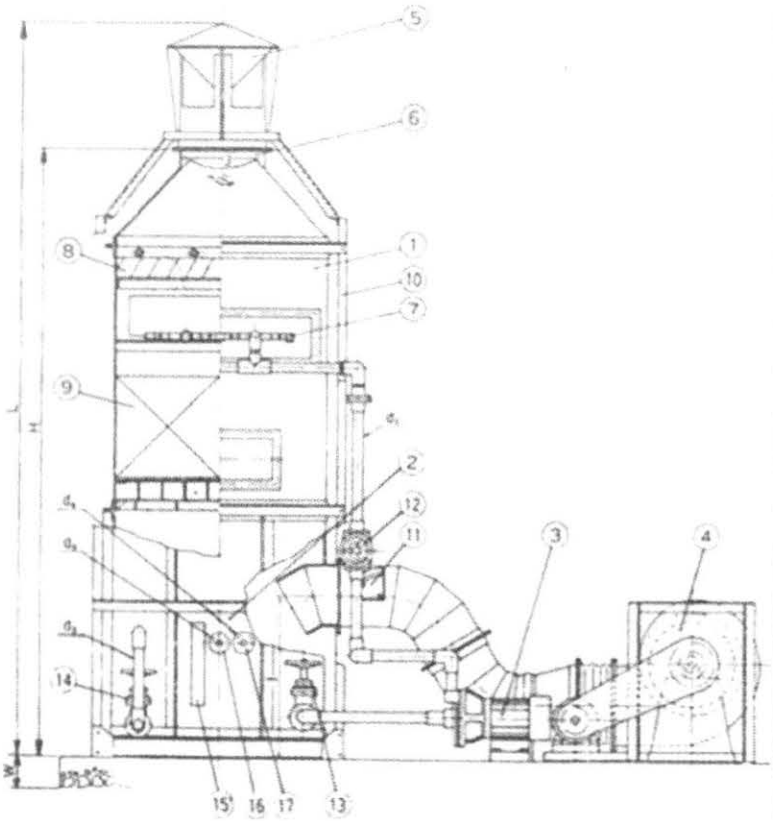


| NO | NAME |
|---|---|
| 1 | BODY |
| 2 | SPRAY TANK |
| 3 | SPRAY PUMP |
| 4 | FAN |
| 5 | STACK |
| 6 | OUT LET |
| 7 | SPRAY NOZZLE |
| 8 | PALLING |
| 9 | PALLING |
| 10 | BODY STRUCTURE |
| 11 | AIR DUMPER |
| 12 | VALVE |
| 13 | VALVE |
| 14 | VALVE |
| 15 | EYE GLASS |
| 16 | FRESH W. IN |
| 17 | FRESH W. IN |

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Facility:
Permit:
File #: