Ed Svec

1210471-001-AC

Module AB 177

ALL4

May 10, 2013

Mr. Syed Arif, PE
Florida Department of Environmental Protection
Division of Air Resource Management
Office of Permitting and Compliance, Minerals and Metals
2600 Blair Stone Road
M.S. 5500
Tallahassee, FL 32399-2400

RE: Integrated Waste Management Systems, Inc. Air Construction Permit Application

Dear Mr. Arif:

All4 Inc. (ALL4) is submitting this Air Construction Permit Application to the Florida Department of Environmental Protection (FDEP), Office of Permitting and Compliance on behalf of Integrated Waste Management Systems, Inc. (IWMS). This submittal is a follow-up to our March 26, 2013 meeting in Tallahassee and a May 8, 2013 conversation with Mr. Ed Svec of FDEP and Mr. Bill Straub of ALL4. This submittal includes the following:

- Two (2) signed original copies of the IWMS Air Construction Permit Application;
- Two (2) signed original copies of the IWMS Responsible Official Notification Form (DEP Form No. 62-213.900(3); and
- A check in the amount of $5,750 payable to the "Florida Department of Environmental Protection".

IWMS appreciates the opportunity to submit this Air Construction Permit Application to FDEP, and we look forward to working together to develop the Air Construction Permit for the proposed facility. If you have any questions regarding this submittal, please contact me at 610.933.5246 x 112 or wstraub@all4inc.com.

Sincerely,

All4 Inc.

William V. Straub, PE
Principal Consultant

cc: Major General (Retired) Marvin Jay Barry – IWMS
Sam E. Mousa, P.E., JBC Planning & Engineering, LLC
Don Corwin, P.E., Therm-a-Cor
Alberta Hipps, Hipps Group Inc.

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INTEGRATED WASTE MANAGEMENT SYSTEMS, INC.

AIR CONSTRUCTION PERMIT APPLICATION

Submitted By:

INTEGRATED WASTE MANAGEMENT SYSTEMS, INC.
932 Lark Street
Lehighton, PA 18235-8903

Submitted To:

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION NORTHEAST DISTRICT OFFICE
7825 Baymeadows Way
Suite B-200
Jacksonville, FL 32256

Prepared By:

ALL4 INC.
2393 Kimberton Road
PO Box 299
Kimberton, PA 19442-0299

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION TALLAHASSEE OFFICE
2600 Blair Stone Road
MS 5500
Tallahassee, Florida 32399-2400

Submitted: May 2013
Version 1.0

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1. INTRODUCTION

1.1 APPLICATION OVERVIEW

Integrated Waste Management Systems of Lehighton, PA (IWMS) is planning to build, own, and operate a hospital, medical, and infectious waste incineration (HMIWI) facility in Suwannee County, Florida ("Suwannee facility" or "facility" or "Project"). IWMS will construct and operate up to four (4) HMIWIs, each burning a maximum of 30-tons per day (tpd) of hospital, medical, and infectious waste (HMIW) at the Suwannee facility. The proposed facility will also construct and operate one (1) emergency generator and one (1) emergency fire pump, at a maximum of 500 hours per year each.

On October 6, 2009, The U.S. Environmental Protection Agency (U.S. EPA) amended 40 CFR Part 60, Subpart Ec (New Source Performance Standards for Hospital/Medical/Infectious Waste Incinerators) and the Florida Department of Environmental Protection (FDEP) adopts these rules under FAC 62-204.800(8)(b)(8). IWMS will be subject to 40 CFR Part 60, Subpart Ec since the HMIWI will be considered "new HMIWI" for which construction will commence after June 20, 1996. After initial discussions with the FDEP Northeast District office and FDEP Tallahassee, IWMS is submitting this Air Construction Permit Application to gain authorization to construct the proposed facility. The information presented in the remainder of this application document is provided pursuant to the requirements of the FDEP air permit application process as detailed in "DEP Form No. 62-210.900(1) – Form, effective March 11, 2010".

1.2 FACILITY BACKGROUND INFORMATION

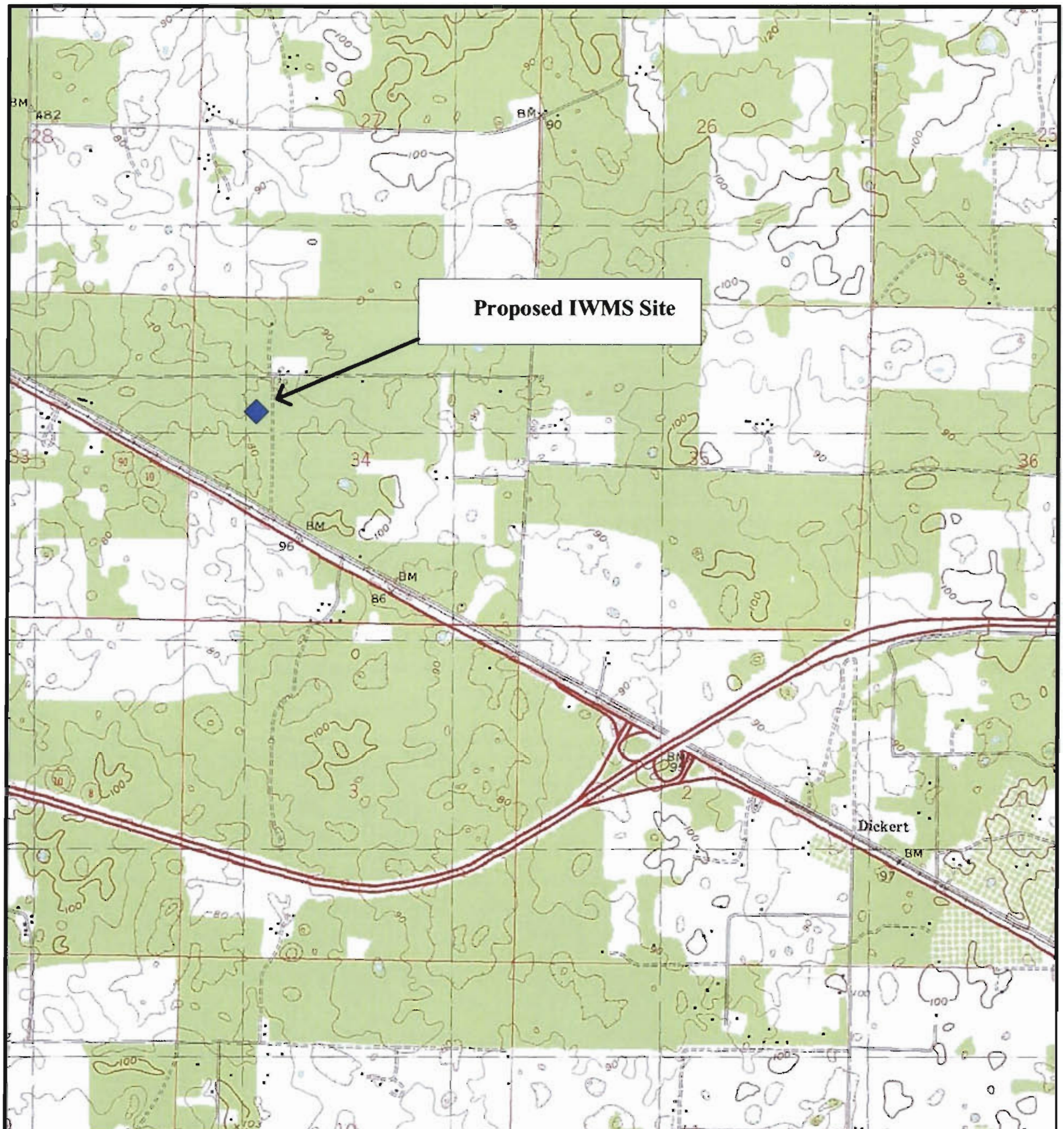
Integrated Waste Management Systems (IWMS) is planning to build, own, and operate the facility in Suwannee County, Florida ("Suwannee facility" or "facility"). IWMS is registered with the State of Florida under document number F12000001519 and authorized to conduct business. The proposed Suwannee County site will be located near the intersection of 175th Road and 50th Street (Latitude: 30.356268, Longitude: -83.111422). Figure 1-1 shows the general location of the facility on a section of United States Geological Survey (USGS) quadrangle. A facility process flow diagram is found in Appendix A, Figure A-1.

The Project is under the jurisdiction of the following State and Federal agencies:

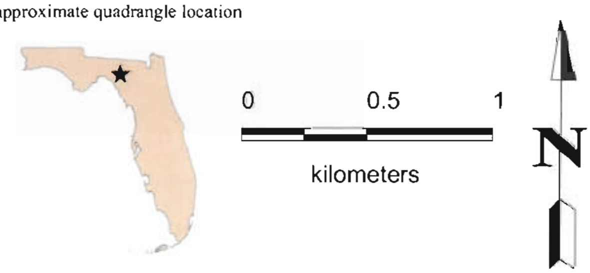
Florida Department of Environmental
Protection (FDEP)
Northeast District Office
7825 Baymeadows Way
Suite B-200
Jacksonville, FL 32256

U.S. EPA Region 4
61 Forsyth Street, SW
Atlanta, GA 30303-8960

Florida Department of Environmental
Protection (FDEP)
2600 Blair Stone Road
MS 5500
Tallahassee, Florida 32399-2400



approximate quadrangle location



Based on USGS 1:24,000 topographical map for Kutztown, Pennslyvania, 1997.

Integrated Waste Management Systems, Inc.
Live Oak, FL

Figure 1-1
Facility Location Map

2. APPLICATION ORGANIZATION

This application includes technical information regarding the new equipment and systems that will comprise the new IWMS Facility or Project. IWMS has prepared this permit application in accordance with the FDEP Air Construction Permit requirements using the following report format:

- **Section 1 – Introduction** – Provides an overview of the Project's background, company information, proposed location, and purpose of the application.
- **Section 2 – Application Organization** – Presents the organization of the permit application document.
- **Section 3 – Project Description** – Provides an overview of the anticipated Project configuration and operations and a project timeline.
- **Section 4 – Emissions Inventory** – Presents an emissions inventory for all of the emissions units that are part of the Project.
- **Section 5 – Reasonable Assurance** – Discusses how the emission rates in Section 4 were developed and provides supporting information pursuant to F.A.C. 62-4.070 that reasonably assures the emissions will not exceed FDEP's standards.
- **Section 6 – Applicable Requirements** – Includes an analysis of the U.S. EPA and Florida air quality rules that are potentially applicable to the Project. It includes a discussion of the applicability or non-applicability of each rule identified as appropriate.
- **Section 7 – Hospital/Medical/Infectious Waste Incinerator and Air Pollution Control Equipment Monitoring** – Identifies operating parameters to be monitored for the proposed HMIWI and the compliance demonstration approach.
- **Section 8 – Siting Analysis** – Analyzes air pollution control alternatives.
- **Section 9 – FDEP Air Construction Permit Approach** – Provides an overview of the approach that IWMS used to complete the FDEP permit application forms.
- **Appendix A** – Contains Facility Process Flow Diagrams.
- **Appendix B** – Contains supporting emission calculations for the emissions units.
- **Appendix C** – Contains the applicable FDEP application forms for the emissions units comprising the Project.
- **Appendix D** – Contains the Particulate Matter Control Plan for the Facility.

- **Appendix E** – Contains the Vendor Specification Sheets and Supporting Documentation for the Proposed Equipment.

3. PROJECT DESCRIPTION

The proposed Project is a hospital, medical, and infectious waste treatment facility that will include up to four (4) HMIWIs that will each burn up to 30 tons per day of waste and will meet the regulatory definition of "Continuous HMIWI". In addition to the four (4) HMIWI, the Project includes a 670 horsepower (HP) emergency generator, a 100 HP emergency water fire pump, and two (2) dry sorbent storage silos associated with the facility's air pollution control systems.

IWMS plans to construct the HMIWI in a phased approach. In the initial phase, IWMS plans to install two (2) HMIWI and one (1) common dry sorbent storage silo that will service the HMIWIs. The emergency generator and the emergency water fire pump will be installed with the first phase of construction. IWMS will construct the remaining two (2) HMIWI and supporting silo as market demand increases.

Each HMIWI is composed of the waste feed mechanism, the primary combustion chamber, the secondary combustion chamber, the boiler, the quench, the fabric filter with catalyst impregnated structured bag system and the induced draft (ID) fan. A detailed summary is provided in the sections below. Process Flow diagrams are provided in Appendix A.

3.1 HMIWI UNITS

3.1.1 Waste Feed

The proposed facility will operate up to four (4) Pennram (or equivalent) pathological incinerators; model PHCA-2500 (or equivalent) with a waste feed rate limited to 2,500 pounds of waste charged per hour for each incinerator. The units are designed such that boxes and other containers of waste will be weighed and fed to the combustion chamber in 100 to 300 pound batches. A hydraulic lifter on each unit will dump each batch into a feed chamber. The chamber is sealed to the environment by the closure of the top hatch door. After the seal is secured, the fire door of the primary combustion chamber will open. A hydraulic ram will push the batch of waste into the primary combustion chamber. The fire inlet door will close after the batch has been pushed into the chamber to fully seal the chamber. The system of door openings is sequenced to minimize the potential that fugitive emissions will exit the primary chamber during the feed cycle and the unit is operated under negative pressure.

The operator will load the batch feed hopper manually to assure that the appropriate material is incorporated into the next batch feed. Batch weights will be recorded and tracked to maintain compliance with permit limits. The system automatically feeds each batch into the primary combustion chamber based on the time cycle of the system. This type of operation meets the regulatory definition of "Continuous HMIWI". The operator will observe operations and control batch size and mixture of materials to control combustion temperature and other parameters. The feed system will be automatically disabled when a permitted operating parameter, including the feed rate, is not within its limits. The heat value of the medical waste can vary from less than 1,000 Btu/lb for pathological waste to over 10,000 Btu/lb for waste with a high plastics content. The heat content generally associated with medical waste for the purpose of determining nameplate capacity has been 8,500 Btu/lb as provided in the preamble to the 40 CFR 60, Subparts Ce and Ec.

3.1.2 Primary Combustion Chamber

The combustion process is initiated in the primary combustion chamber. Initially, heat is applied to the waste with a small propane-fired burner and minimum combustion air. After initial combustion, heat from the previously fed waste will ignite the new waste. The air entering the chamber is tightly controlled. The waste will not fully burn in the primary chamber without sufficient air and therefore the combustion in the primary chamber is controlled by the amount of air fed into that chamber. The chamber is operated with a deficiency of oxygen. Thus a reduction in the air fed into it by the blowers will slow the combustion in this chamber. The organic portion of the waste is combusted under this reducing condition and is converted into gas. The resulting fire in the bed is a basic requirement for the safe and efficient burning of medical waste.

The amount of oxygen is controlled by monitoring the temperature in the primary chamber. As the temperature rises, less oxygen is fed into the unit. This reduces the burning rate in the primary chamber. If the fire is too robust in the primary chamber, water may be sprayed on the burning bed to slow the process down further. However, under normal operation, the method for controlling the temperature is through the reduction of the underfire air. Water in the primary chamber is used as a back-up form of temperature control when reduction of the underfire air is not enough to keep the temperature from getting too hot. The amount of water is also controlled by the temperature of the primary chamber. The temperature is controlled in the primary section within a range of approximately 1400 to 2000 deg F. This temperature range will assure that the organic component of the waste is vaporized, pathological components are destroyed, and melting of the glassware in the waste materials is minimized. Some of the glassware may partially melt depending on the exact conditions as the glassware passes through the primary chamber.

The size of the primary chamber is dictated by industry sizing criteria based on the waste feed rate. 40 CFR Part 60, Subpart Ec defines the maximum design waste burn capacity to be based on the following equation:

$$C = P_v \times (15{,}000/8{,}500)$$

Where:

C = HMIWI capacity (lb/hr)
P_v = Primary chamber volume (ft^3)
15,000 = Primary chamber heat release rate factor ($Btu/ft^3/hr$)
8,500 = Standard waste heating value (Btu/lb)

Based on a design capacity of 2,500 lb/hr, the primary chamber volume will be at least 1,417 ft^3.

The controlled combustion in the primary chamber is critical to the proper operation of the system. Because the total amount of air is tightly controlled to be less than is needed to fully burn the material, the new material does not burn rapidly. This restricted air flow is required to maintain a low temperature to prevent melting of metal and glasses in the chamber. The melting of the inorganic material that can result from excessive temperature in the primary chamber may cause slag to form along the walls and the floor. This slag can plug up the air holes and prevent the material from being transferred to the ash collection pit. It is critical to the operation to control the oxygen in this chamber.

The small, propane-fired burner is located on the side wall of the primary chamber. This burner operates intermittently to assure that the temperature is maintained above the minimum needed to assure proper combustion of the waste materials. The burner is also used during the initial heat up of the unit. Additionally, underfire air is modulated to assist in temperature maintenance. The propane burner and the underfire air injectors are sized to assure that they can meet all of the potential operational conditions as dictated by the range of possible waste feeds at any particular moment. The system must accommodate the variable nature of the waste on an instantaneous basis to assure proper operation.

The medical waste placed into the incinerator will contain non-combustible materials. These materials, generally called ash, will exit the chamber into the ash quench at the opposite end of the primary chamber. Some of the ash will be metallic medical items that cannot be recycled through sterilization methods. This includes aluminum, stainless steel, and other components of bags such as zippers, fasteners and pins. Another major component of the ash will be glassware. The glassware may have contained pathological materials, medicines, wastes, and other items that required incineration to properly handle the dangerous property of that material. Anything that will not burn is classified as ash. The amount of ash is a function of the hospital waste policy and the type of treatment that the hospital is performing. Large instruments and other large metal devices will not be placed into the incinerator. The ash will be tested to verify that it can be placed in a landfill that is certified and approved to receive the ash.

As the material is converted to a gas in the primary chamber, the remaining solid material is slowly moved along the primary chamber by ash transfer rams. These rams are programmed on a timed basis to slowly move the material away from the charge door and direct it toward the ash quench. As the individual rams move the material towards the ash pit, the material falls down a step at each ram. This provides mixing and exposes the underside of the material to the heat. Thus the organic component of the material is exposed to heat and some oxygen to continue the slow combustion process.

Reclaimed wash water from the truck and/or tub washing processes that may contain some organic material can be injected into the primary chamber so that any organic matter in the reclaimed water system is destroyed in the same manner as the solid medical waste materials. In addition, the injection of the reclaimed wash water can also be used to assure that the temperature does not exceed the upper operational limit of the primary chamber.

The primary combustion chamber is located physically below the secondary chamber. This allows the gases generated in the primary chamber to flow upward into the secondary chamber for continued processing and combustion of the organics components.

3.1.3 Ash Collection

There are two types of ash that would be generated at the facility: bottom ash and fly ash. Bottom ash is the ash generated in the primary combustion chamber and fly ash is the ash that is collected from the fabric filter baghouse system that is part of the air pollution control system.

The bottom ash is recovered from the primary water quench and will be wet. The fly ash is dry and will be collected in a covered hopper. The respective ashes are then sampled, analyzed, and then properly transported and disposed of in an appropriately licensed landfill based on the results of the sampling and the regulatory requirements. The solid waste classification will either be non-hazardous waste or hazardous waste based on the results of the ash sampling and analysis. IWMS will only send the ash to permitted landfills that accept our ash criteria. IWMS has no intention of land-applying any of the ash collected at the facility. IWMS will follow a strict sampling/analysis/transportation/disposal plan that will minimize the potential environmental impact of the ash and will only dispose of the ash at appropriately licensed landfill(s).

3.1.4 Secondary Combustion Chamber

All of the hot gases flow out of the primary chamber into the secondary combustion chamber. As they flow into the chamber, they are mixed with secondary combustion air. The air supplies the additional oxygen needed to complete the combustion process. The temperature will rise in the chamber as the products of incomplete combustion from the primary combustion chamber enter the secondary chamber and are mixed with the additional oxygen.

The secondary chamber provides the residence time with sufficient oxygen and the appropriate mixing required to assure that all of the gases exiting the primary chamber are fully combusted. A propane-fired burner is installed in the secondary chamber to assist in maintaining the set point temperature and to assist in the mixing of the air with the gases exiting the primary chamber. An independent secondary air blower is also included to supply the additional oxygen. The temperature of the secondary chamber is controlled by a temperature measurement device (i.e., thermocouple) located at the outlet of the secondary chamber. The temperature controller will either add fuel or air to maintain the set point temperature. The secondary air flow rate is controlled by the oxygen concentration of the gases exiting the stack and the temperature in the secondary chamber. This control system assures that all of the organics in the system are fully combusted.

Reclaimed wash water from the truck and/or tub washing processes that may contain some organic material can also be injected into the inlet section of the secondary chamber. Any organic material in the waste water will then be fully destroyed. A specially designed nozzle will be required to assure proper atomization of the water. The water must be broken into small droplets (atomized) by the nozzle to assure that any organics in the water will be properly treated in the secondary chamber. The purpose of injecting water into the secondary combustion chamber is to support the goal of the project to have zero process water discharge. The secondary chamber is where wash water from the trucks/bins and boiler blowdown could be introduced to achieve the zero process water discharge.

An emergency bypass stack (or dump stack) is located on the outlet of the secondary chamber. The bypass stack is opened when the temperatures in the downstream equipment exceed a safe operating limit or if there is an emergency condition. During operation of the HMIWI, the bypass stack is only opened to prevent "catastrophic events". There is no waste feed to the unit whenever the bypass stack is opened.

The secondary chamber will be designed to handle 200% of the theoretical air capacity of the system. There are no set points for the secondary chamber temperature. A minimum secondary chamber temperature operating parameter will be set based on the results of the initial compliance test. Based on prior IWMS Project Team experience, IWMS expects the secondary temperature to range from 1,600 – 2,000 deg F. Temperature control in the secondary chamber will be through the modulation of excess air and use of a propane burner, as needed. There will not be a secondary chamber auxiliary ID fan as part of the system.

3.1.5 Heat Recovery Boiler and Steam Turbine

The heat recovery boiler is used to extract energy from the hot gases exiting the secondary combustion chamber. These hot gases are cooled as they pass through the boiler. The boiler selected is generically called a fire tube boiler. Hot gases from the incineration process pass through the inside of the boiler tubes. The boiler water is on the outside of the tubes. As the water is heated in the boiler, it turns into steam. The steam is collected in the top of the boiler to be used by the process or used to drive the ~540 kW steam turbine – there are no products of combustion or emissions associated with the turbine. The boiler is designed to protect all metal surfaces from the hot gases from the secondary chamber.

The boiler is designed to generate as much as 20,000 pounds per hour (lb/hr) of ~230 PSIG steam. The steam generation rate is a function of the exhaust gas flow rate and temperature exiting the secondary combustion chamber. This steam generation rate requires boiler water feed rate of 40 gallons per minute (gpm). The boiler feed water is treated water that does not contain oxygen and is chemically treated to protect the boiler tubes. The boiler feed water may be condensed steam or newly treated water if the steam is exported. This boiler feed water requirement is the maximum for each of the HMIWI trains.

There will be a boiler blowdown water purge (rejection) rate of approximately 1% from the boiler. This water will contain high solids concentrations. The rejection rate will be a function of the water quality and feed rate of the boiler feed water. This water is included in the 40 gpm supply. Solids from the boiler will be collected periodically as the performance (i.e., heat transfer) of the boiler degrades. The solids will be combined with the flyash (i.e., dust collected from the baghouse) and stored in a roll-off before being sent to a landfill. The exit temperature and steam production rate of the boiler will be used as an indicator of performance. IWMS has provided values for the exit temperature and steam production in Appendix A, Figure A-2. The system will be cooled and solids will be removed from the boiler. Water from the boiler can either be sent to the sanitary sewer system (upon approval) or re-used within the system. Preliminary plans have IWMS injecting the water in either the primary chamber or secondary chamber to support the zero process water discharge plans of the project.

The boiler steam production will vary with time due to the loading of the primary and secondary chambers and the amount of fouling on the boiler tube walls. The hot gasses passing through the boiler will be rapidly cooled along the metal walls of the tubes. The cooling will be slower in the middle of the tubes. Materials from the combustion process naturally condense on the wall forming a thin film. This film reduces the amount of heat that the boiler can extract from the gas stream. Periodic cleaning will be performed to maintain the design heat transfer.

3.1.6 Quench System/Dry Scrubber System (Sodium Bicarbonate Addition)

The boiler gas outlet temperature will vary as of function of the following: (1) secondary chamber outlet temperature, (2) waste feed rate to the primary chamber, (3) air and gas addition to the secondary combustion chamber, and (4) the steam production of the boiler. The temperature of the exhaust gas at the fabric filter inlet must be maintained below the maximum material temperature. To control the temperature of the exhaust gas and to assure that the filters are not damaged by temperature of the exhaust gas that may exit the boiler, a water spray quench section is installed between the boiler and the fabric filter with catalyst impregnated structured bag system.

The quench section is installed after the boiler to condition the gases prior to their entrance to the fabric filter with catalyst impregnated structured bag system. The gases must be cooled below the maximum allowable filter inlet temperature. Since the boiler is a variable heat transfer device, it will gradually have an increased outlet temperature as fouling occurs. The quench water spray section will protect the fabric filter system from high inlet temperatures that will degrade its performance and provide the potential of degradation of the mechanical equipment.

The quench system consists of a non-contact water spray mixing chamber that will assure a uniform outlet temperature from this section. The quench water flow rate will vary from 1 to 5 gpm depending on the variability of the conditions listed above. While there are three opportunities for water addition to the system (i.e., primary chamber, secondary chamber, and quench system), the first two are for operational controls and the quench system is part of the air pollution control system for treating the exhaust gas stream. The quench system is used to rapidly reduce the temperature of the exhaust gas. The term non-contact refers to the type of water used in the quench system and comes from the non-contact boiler system. No water that has had any contact with HMIW will be injected in the quench system. This water will be directly injected into the exhaust gas stream during the quench to bring the exhaust gas temperature into an appropriate range for treatment in the air pollution control train. IWMS has provided a process flow diagram, heat exchange rates, and other relevant information in Appendix 2, Figure A-2.

Due to the importance of protecting the fabric filter system, an emergency water source is required to assure that the catalyst impregnated structured bag system does not over heat. The emergency dump stack could also provide such protection; however, its opening during emergency events could create an exceedance of the emission limits and it is only used to prevent a catastrophic failure of the unit and associated air pollution control system. Consequently, the addition of water during initial periods of high temperature will minimize the number of emergency openings.

After cooling the gas stream, sodium bicarbonate will be added immediately upstream of the fabric filter system. Sodium bicarbonate ($NaHCO_3$) will provide acid gas neutralization and mercury (Hg) and dioxin/furan control. Sodium bicarbonate is a powder that reacts with acid components in the gas stream to create sodium salts (NaCl and Na_2SO_3) that can be captured in the filtration system. The powder is removed from the bottom of its storage silo, by a small screw conveyor, the speed of which is calibrated to control the rate at which it is removed. The screw discharges into a small hopper in which the mass of sodium bicarbonate is confirmed. A second screw then drops the powder into an eductor, where the flow is pulled into a small compressed air flow. The compressed air carries the powder to the flue gas duct, where it is dispersed into the flue gas through a nozzle, positioned and designed to maximize mixing prior to entering the filtration system.

The injection rates will be measured (minimum frequency is hourly) and recorded (minimum frequency is once per hour), as required by 40 CFR Part 60, Subpart Ec. The injection rate will be monitored as part of the initial performance test program and will be used to develop a continuous monitoring system parameter limit during future operation of the HMIWIs.

3.1.7 Fabric Filter with Catalyst Impregnated Structured Bag System

The fabric filter with catalyst impregnated structured bag system removes solid particles from the exhaust gas stream. Additionally, the filter system removes dioxins/furans, mercury, and other low boiling point metals. The final acid neutralization is also performed on the surface of the catalyst impregnated structured bag system. In addition to sodium bicarbonate controlling Hg and dioxins/furans, additional Hg and dioxins/furans control will be supported by the catalyst impregnated in the filter bags.

The fabric filter with catalyst impregnated structured bag system is composed of many individual filters. Each of these filters is a ceramic fiber filter tube with embedded nano-catalysts that is a rigid ceramic structure that the exhaust gases pass through. The material acts as a screen to remove the particles from the gas stream. The gas flow enters from the bottom and travels upward in the baghouse. The particles are caught on the outside of the bags. While the term "Fabric Filter" is used, the preferred system is called a Ceramic filter as more descriptive of the filter elements themselves. The casing, and function, of the device is otherwise similar to the conventional baghouse. The filter elements are vacuum formed on a mold from refractory materials, and baked to yield a material with more structure and heat resistance than the conventional fiberglass bag. Technical information for the proposed catalytic fabric filter system is included in Appendix E.

The sodium bicarbonate particles are collected on the outside of the structured bag system with all of the other particles. When acids in the gas stream pass over these alkali particles, they are neutralized. This is the process that removes the acid gases from the exhaust gas stream. The injected sodium bicarbonate sorbent responds to the hot gas by releasing a CO_2 molecule, leaving highly reactive NaOH to neutralize the acid gases. A portion of the alkali reacts with acid gases "in flight". The resulting salts, unreacted bicarbonate/ NaOH, and all other particulate matter (including the PM_{10} and $PM_{2.5}$ size fractions) accumulate on the outside of the filter elements. These yield total solids removal typically greater than 99.9%. The alkali continues to react with acid gases in the "cake" layer on the filter surface, ultimately removing 97% of SO_2

and 99%+ of the HCl in the flue gas. The resulting sodium salts make up a portion of the cake. Bicarbonate is added at a rate in excess of the acid gas load to ensure effective removal. The fabric filter with catalyst impregnated structured bag system is designed to assure that the exhaust gas stream exiting the air pollution control system meets the emission limits. The sodium bicarbonate is collected on the outside of the structured bag system and disposed of with the fabric filter dust in the fly ash.

The fabric filter structured bag system cloth is impregnated with a catalyst that captures any dioxins/furans formed by combustion and the slow cooling in the heat recovery boiler. A proprietary catalyst compound, formed in "nano-bits", is mixed with the ceramic filter constituents when they are prepared and formed, so that the filter is thoroughly impregnated with this catalyst. The catalyst facilitates several reactions. At a minimum, it will provide for the oxidation of dioxin and furan compounds that may have formed at low levels in the flue gas, so that stack levels will be up to 99% lower than levels exiting a system equipped with a conventional baghouse. The oxidation of these compounds adds a small quantity of CO_2, H_2O and salts to the flue gas. Similarly, this catalyst can facilitate the reaction of NO (formed in the combustion process) with injected ammonia (NH_3) to form N_2 and H_2O. If NO levels are problematic – though they are not expected to be – NH_3 or urea injection can be added to control that pollutant (see the Selective Non-Catalytic Reduction contingency control system section below). The fabric filter with catalyst impregnated structured bag system operates at a temperature well above 250 deg. F to prevent the condensation of water vapor within the filter system. This high temperature will shorten and/or eliminate the water vapor plume that could be generally observed exiting the exhaust stack. The exhaust stack will be designed and constructed to satisfy the stack sampling requirements that are consistent with HMIWI.

The filter assembly will be equipped with a compressed air manifold on the downstream (clean) side of the filters. This manifold will "pulse" the filters with air to force accumulated solids to drop off the outside of them, into the bottom of the housing. This reverse jet action has been proven in both conventional baghouse and design of the ceramic filter system. The solids will collect in the bottom of the housing, and be conveyed into a closed container for disposal.

3.1.8 Selective Non-Catalytic Reduction (Contingency Control System, as needed)

IWMS's preliminary design does not include the addition of selective catalytic reduction (SNCR) as IWMS believes that the NO_X emission limits can be met through good combustion controls and practices. Technical research indicates that NO_X does not form in significant amounts until flame temperatures reach 2,800 deg F. Through the staged combustion design of the proposed HMIWI, temperatures in both the primary and secondary chambers are carefully controlled. Temperatures in the primary chamber are limited by controlling the amount of air provided in order to maintain combustion under reducing (sub-stoichiometric) conditions. This process generates a fuel-rich off gas for combustion in the secondary chamber, resulting in low levels of thermal NO_X formation and minimization of particulate matter carryover (fly ash). It also ensures that glass, ash, and other materials that can melt and form slag at high temperatures don't have the opportunity to do so, since the result can be operational problems with the equipment. Temperatures in the secondary chamber are also carefully controlled. Typical HMIWI operate with secondary chamber temperatures ranging from a minimum of 1800 deg. F up to approximately 2000 deg. F. This range provides maximum destruction of the organic compounds present in the gas while reducing the demand for auxiliary fuel and minimizing the formation of thermal NO_X.

If during the startup and shakedown of the system, engineering data shows that NO_X emissions are a concern; IWMS identifies the installation of SNCR at the outlet of the waste heat boiler to control NO_X. The contingency NO_X control system would include the injection of ammonia or urea upstream of the catalyst fabric filter elements. The ammonia or urea reacts with NO_X in the presence of the catalyst to form molecular nitrogen and water. The system would include a storage tank for the aqueous ammonia or urea, an injection system for each gas cleaning train, and automated control systems for managing the injection rates to each unit.

3.1.9 Carbon Injection (Contingency Control System, as needed)

IWMS preliminary design also does not include the carbon injection system for mercury (Hg) control as IWMS believes that Hg control can be achieved through the segregation of Hg from the waste stream before it reaches the incinerators. As presented in F.A.C. 62-737, incoming waste streams containing Hg may not "knowingly be incinerated or disposed of in a landfill". In the case where the disposal of Hg is done unlawfully, the responsibility falls on the waste generator, not the site at which the waste is treated (i.e., IWMS).

If the scenario should arise where IWMS believes that compliance with the Hg standard could be an issue, IWMS has proposed a design and inclusion of an activated carbon injection (ACI) system as a contingency control option for Hg vapor-phase emissions. In the system, powdered activated carbon is injected from super sacks into the flue gas ductwork of the air pollution control system upstream of the fabric filter with catalyst impregnated structured bag system using the same type of configuration as the sodium bicarbonate. The carbon adsorbs the vaporized Hg from the flue gas and then is collected as fly ash. IWMS plans to test the HMIWI with, and without, the carbon injection system in operation during shakedown to determine if the carbon injection system is required to be operated for IWMS to demonstrate compliance with the Hg emission standards.

3.2 ANCILLARY OPERATIONS

Several ancillary operations that may contribute to overall facility emissions are described in the following subsections.

3.2.1 Handling and Storage Systems

Dry sorbent (e.g. sodium bicarbonate) will be bulk delivered to the facility via dry tank trucks and purchased in bulk, powdered form. The facility will be equipped with two storage silos each capable of holding approximately 1.5 truckloads of the sodium bicarbonate powder. The sodium bicarbonate will be pneumatically offloaded from the tank trucks to the silos. Each silo will be equipped with a small fabric filter for controlling particulate matter emissions and two separately controlled feed systems that will each supply the sorbent powder to a separate HMIWI gas cleaning system. The rate of flow of sodium bicarbonate to the gas cleaning systems will be controlled and used as a key operating parameter to ensure emissions compliance.

Dry sorbent will be extracted from the silo via a rotary valve and then pneumatically conveyed to, and injected into, the ductwork ahead of the fabric filter system. Minor emissions of PM may result during the transfer of sorbent from the tanker truck to the storage silo via pressure relief through the cartridge dust collector inside of the building.

3.2.2 Emergency Fire Water Pump and Emergency Generator

The project will include the installation of an emergency fire water pump and an emergency generator. Both units will be propane powered with a site rating of 100 hp and 670 hp, respectively. These units are back-up units and are included as part of the project to operate during a scenario where there is a loss of electrical power.

3.2.3 Insignificant Sources

The following list represents typical facility support and maintenance operations that will be present at the facility. These units are traditionally identified as insignificant or trivial sources for air permitting considerations.

- Comfort Heaters;
- Wet ash handling;
- Dry dust handling;
- Air Conditioning Units;
- Air Compressors;
- Pumps;
- Portable and Temporary Equipment; and
- Maintenance Shop Activities.

3.3 PROJECT SCHEDULE

Project timing and construction is critical to IWMS. IWMS's goal is to submit the Construction Permit Application in May 2013 and then to work closely with FDEP to obtain the requisite permit(s) as expeditiously as possible in order to commence construction. Work on the project will then be completed over the subsequent 12 to 18 month period.

4. EMISSIONS INVENTORY

This section includes an overview of the emissions data developed and relied upon for this permit application and a description of the project emissions inventory used to determine the applicability of the Federal and Florida's Prevention of Significant Deterioration (PSD) and Non-attainment New Source Review (NNSR) regulations – collectively referred to as the New Source Review (NSR) regulations. Supporting tables, emission factors, and related emissions inventory documentation are provided in Appendix B. The following subsections present the emissions inventory associated with the project and the associated PSD/NNSR applicability evaluation.

4.1 POTENTIAL TO EMIT

Because the proposed Project is a "greenfield" facility and is comprised of new emission units, NSR applicability is evaluated based on the potential to emit (PTE) of each new unit. The proposed HMIWIs have two modes of operation that impact emissions: startup and normal operation. Startup mode is characterized as the firing of auxiliary propane burners. The startup mode is required when bringing the HMIWIs on-line from a cold mode to bring the temperature of the HMIWI up to operating temperature in a controlled manner and then to begin combustion of the HMIW in the HMIWIs. Normal HMIWI operation is characterized as the firing 100% HMIW with no supplemental propane combustion (e.g., the supplementary propane burners do not operate during normal HMIWI operation). The PTE of each regulated NSR pollutant from the HMIWI includes emissions from both startup and normal operations. The PTE of each regulated NSR pollutant from the ancillary operations: emergency generator, emergency fire pump, and the silo unloading operations are attributable to normal operation and are also included in the analysis.

The PTE of each regulated NSR pollutant from the proposed HMIWIs during normal operations, were calculated based upon engineering judgment, 40 CFR Part 60 Subpart Ec emission concentration limits, and U.S. EPA's "*AP-42, Compilation of Air Pollutant Emission Factors*" (AP-42) emission factors. The normal operations emissions for each HMIWI were calculated based upon consistent engineering design parameters, as well as an operating time of 8,760 hours per year (hr/yr), and a maximum HMIWI feed rate of 2,500 lb/hr. The proposed auxiliary propane fired burners will be designed to be fired during startup conditions only. The proposed four (4) propane burners in each HMIWI have an estimated total burner capacity of approximately 15.5 MMBtu/hr. IWMS used an assumed maximum annual consumption of 150,000 gallons of propane per HMIWI to develop the emissions associated with propane firing during startup. The propane fuel will have an estimated heating value of 90,500 Btu/gal.

Removal efficiencies as a method for demonstrating satisfactory system performance were removed from 40 CFR 60, Subpart Ec as part of the October 2009 Revisions to the HMIWI rules and only the concentration-based emission limits remained. There are several references in the preamble that state the removal efficiencies or percent reduction limits were removed from the rule as they allowed more emissions provided a given level of removal efficiency. The PSD analysis included in this section considers the removal efficiencies of the control systems. The potential to emit (PTE) rates specified in the emissions inventory take into account the control efficiencies for the individual pollutants controlled. PSD applicability for new emissions units require that applicability be based on the PTE.

The PTE of each regulated NSR pollutant from the proposed emergency generator and emergency fire pump assume that the units will be operated during emergency conditions only and were calculated based upon emission factors developed using AP-42 emission factors for natural gas and engineering judgment. The PTE of the proposed emergency generator is based upon a maximum operating time of 500 hr/yr and a rated power output of 670 HP. The PTE of the proposed emergency fire water pump is based upon a maximum operating time of 500 hr/yr and rated power output of 100 HP.

The PTE of each regulated NSR pollutant from the silos is based on the following assumptions: an outlet particulate matter (PM) grain loading of 0.02 grains/dscf, 1,000 dscf/min, and 10 hours of silo loading time per week. Emissions are assumed to be negligible during non-loading times. Please note, preliminary design plans have the silos discharging into the building during periods of silo loading. IWMS has quantified the PM emissions in the event that the silos would discharge directly to atmosphere.

4.2 SELECTION OF EMISSION FACTORS

The proposed HMIWI units and the associated air pollution control systems are being designed as state-of-the art equipment intended to meet the stringent new Federal Subpart Ec requirements for HMIWI. The new Subpart Ec standards require subject units to meet a combination of new limits that no individual existing unit has previously been designed to meet. As a result, there are no readily available representative emission factors for either controlled or uncontrolled emissions from the proposed units for the 9 pollutants regulated under 40 CFR Part 60, Subpart Ec. For these pollutants, IWMS has specified emission concentrations that meet the new Subpart Ec standards that the proposed system vendors will be required to meet and has used these concentration values in the development of the emissions inventory for this permit application.

Rule 62-210.370, F.A.C. includes the hierarchy of methodologies required for emissions computation and reporting. The first method specifies that an owner or operator may use CEMS data and other appropriate information to calculate emissions. This option is not available to IWMS as the units will be a newly designed installation. The second method specifies that an owner or operator may use mass balance calculations to compute emissions. Given the nature of the combustion process and the variable nature of the feed materials, the mass balance approach does not lend itself to computing emission rates from the proposed HMIWI units. The third method specifies that the owner or operator may use emission factors to compute emission rates. As explained above, there are no available emission factors that are specifically applicable for the proposed HMIWI units.

The inherent combustion controls of the HMIWI systems and the design of each step of the air pollution control train are proven technologies that have been successfully employed in various industrial sectors to achieve the type of performance required by 40 CFR 60, Subpart Ec. The detailed information provided in the Reasonable Assurance section herein, in combination with the requirement to conduct an initial compliance test for each pollutant regulated under 40 CFR, Subpart Ec, provides FDEP with the reasonable assurance that the allowable standards will be met, or the HMIWIs will not be permitted to operate.

Detailed emission calculations are provided in Appendix B. Table B-1 presents a summary of HMIWI PTE of NSR regulated pollutants and Table B-2 presents a summary of the HMIWI PTE of GHG's, during normal operation. The PTE identified for each unit includes emissions while in startup mode and during normal operation.

Emissions from the dry sorbent silos are presented in Table B-5. Tables B-6 and B-7 summarize emissions from the emergency generator and emergency fire water pump, respectively. The results of the major source threshold summary for the Project are presented in Table 4-1. Table 4-1 represents the total emissions for the proposed facility and includes the emissions from the ancillary operations. No emissions are identified for the Heat Recovery Boiler and Steam Turbine system as there are no fuels associated with these units.

4.3 PSD/NSR APPLICABILITY ANALYSIS

NSR requirements potentially apply to new major stationary sources and major modifications to existing major stationary sources. Within the NSR program, major stationary sources may need to be evaluated for Nonattainment New source Review (NNSR) in areas designated as nonattainment with the National Ambient Air Quality Standards (NAAQS) or Prevention of Significant Deterioration (PSD) in areas designated as in attainment or unclassifiable with the NAAQS.

As presented in Table 4-1, the proposed Suwannee Facility is not subject to the requirements of NSR. HMIWIs are not listed as one of the source categories within 40 CFR §52.21(b) that would subject them to a major source threshold of 100 tons per year (tpy) of a regulated NSR pollutant. In addition, the proposed facility will not have emissions of greater than 250 tpy of any regulated NSR pollutant that would designate the project as a major modification under the NSR Program.

4.4 HAZARDOUS AIR POLLUTANTS

Using the available factors from AP-42, Chapter 2.3, IWMS estimated potential estimated HAP emissions from the proposed Project. The potential emissions are summarized in their respective tables in Appendix B. Based on the information provided in Appendix B, the Project will not emit more than 25 tpy for all combined HAP nor emit more than 10 tpy of any individual HAP. As such, the facility is not considered a "major source" for HAP emissions.

Table 4-1
Florida Project New Source Review Applicability Summary - All Project Related Emissions
Integrated Waste Management Systems, Inc.

Pollutant	Footnote	Potential to Emit (ton/yr)	Major Source Threshold (ton/yr)	Major Source? Yes/No
PM	(a)	12.00	250	No
PM_{10}	(a)	0.30	250	No
$PM_{2.5}$	(a)	0.30	250	No
NO_X	(a)	176.05	250	No
SO_2	(a)	13.78	250	No
CO	(a)	12.25	250	No
VOC	(a)	0.31	250	No
Pb	(a)	N/A	250	No
Fluorides	(a)	N/A	250	No
H_2SO_4	(a)	N/A	250	No
TRS	(a)	N/A	250	No
CO_2	(b)	83,804	N/A	No
CH_4	(b)	0.26	N/A	No
N_2O	(b)	0.27	N/A	No
Total GHG CO_2e	(b)	83,839	100,000	No

Notes:

(a) A major source of air emissions is defined at 40 CFR §51.166 as any stationary source which emits, or has the potential to emit, 250 tons per year or more of a regulated NSR pollutant (for non-named source categories).

(b) Greenhouse gases are subject to regulation at a new stationary source pursuant to 40 CFR §51.166 if the new stationary source will emit or have the potential to emit 100,000 tons per year of CO_2e.

5. REASONABLE ASSURANCE

The purpose of section is to discuss the development of the emission rates identified in Section 4 and to provide FDEP with supporting information requirements to satisfy the "reasonable assurance" provisions of F.A.C. 62-4.070. The reasonable assurance provisions state that FDEP may only issue a permit after it receives reasonable assurance "based on plans, test results, installation of pollution control equipment, or other information, that the construction, expansion, modification, operation, or activity of the installation will not discharge, emit, or cause pollution in contravention of Department standards or rules."

The key regulations in question are the federal emission standards for HMIWIs that are identified in 40 CFR Part 60, Subpart Ec and adopted by reference in F.A.C. 62-204-.800. FDEP has additional emissions standards identified in 62-296-.401(4)(b); however, they are less stringent than the standards provided in the federal standards and therefore do not apply. The emission limits identified in 40 CFR Part 60, Subpart Ec were developed pursuant to Section 129(a)(2) of the Clean Air Act (CAA) such that the limits "shall reflect the maximum degree of reduction in emissions of [certain listed air pollutants] that the Administrator, taking into consideration the cost of achieving such emission reduction, and any non-air quality health and environmental impacts and energy requirements, determines is achievable for new and existing units in each category." The level of control is referred to as the maximum achievable control technology, or MACT standard. The federal HMIWI standards are developed based on levels of emissions control achieved or required to be achieved by the subject units. The following lists several key underlying facts that IWMS believes satisfy FDEP's requirements of the reasonable assurance provisions.

- The emission limits identified in 40 CFR Part 60, Subpart Ec were developed pursuant to Section 129(a)(2) of the Clean Air Act (CAA) such that the limits "shall reflect the maximum degree of reduction in emissions of [certain listed air pollutants] that the Administrator, taking into consideration the cost of achieving such emission reduction, and any non-air quality health and environmental impacts and energy requirements, determines is achievable for new and existing units in each category." The level of control is referred to as the maximum achievable control technology, or MACT standard. The federal HMIWI standards are developed based on levels of emissions control achieved or required to be achieved by the subject units. IWMS believe that the underlying approach for the development of the 40 CFR Part 60, Subpart Ec emission limitations satisfies the reasonable assurance provisions.

- The 2009 40 CFR Part 60, Subpart Ec rulemaking addressed both the accurate setting of the MACT floor and the U.S. EPA's 5-year review of the HMIWI standards. Both steps require the review and setting of emission limitations based on actual emission test data. The final 2009 emission standards in 40 CFR Part 60 Subpart Ec are based on a statistical review of actual emission test data and HMIWI performance. IWMS believes that the use of actual test data to set the limits satisfies the reasonable assurance provisions.
- As discussed previously, 40 CFR Part 60, Subpart Ec is considered a MACT standard – maximum achievable control technology. The preamble for 40 CFR Part 60, Subpart Ec states: "The combination of waste segregation, good combustion practices, and add-on air pollution control equipment (dry sorbent injection fabric filters, wet scrubbers, or combined fabric filter and wet scrubber systems) effectively reduces emissions of the pollutants for which emissions limits are required under CAA Section 129: Hg, CDD/CDF, Cd, Pb, PM, SO2, HCl, CO, and NO_X." Consequently, the air pollution control technology component of the reasonable assurance provisions has been one of the primary considerations in the development of the emission limitations. IWMS believes that the identification of a maximum achievable control technology in the regulations, combined with IWMS's commitment to employ air pollution control equipment identified as MACT satisfies the reasonable assurance provisions.

IWMS has highlighted the applicable emission standards as the federal emission standards because much of the data that IWMS relies upon in this section to provide "reasonable assurance" that IWMS units will be in compliance is the same data that U.S. EPA relied upon to support the development of the new emission standards that were finalized in 2009. The 2009 rulemaking has not yet been fully implemented by the industry since the compliance date is still in the future; therefore, there is very limited emission test data available from existing HMIWI to demonstrate compliance with the 2009 emission standards. In addition, the 2009 rule included the removal of the "percent reduction" emission standard option from the original rule and focuses solely on outlet concentration emission standards. IWMS has reviewed the HMIWI design criteria, air pollution control systems, operating parameters, and emission test results from the HMIWIs used to develop the 2009 emission standards and designed our proposed facility based on the best performing units that were the basis for the new 2009 standards. IWMS believes that this is a critical component that creates a highly defensible foundation for satisfying the FDEP "reasonable assurance" criteria.

IWMS has assembled a team of experienced HMIWI and air pollution control manufacturers, HMIWI engineers, and environmental consultants to design a system that can achieve the 2009 emission standards. The use of proven process and air pollution control technology; in conjunction with proper waste selection/segregation, training, and operation will be employed to meet the new emission standards. In addition, IWMS recognizes that the Initial Performance Test will be ultimate "reasonable assurance" component as compliance with all nine (9) regulated pollutants is required during the Initial Performance Test and continuous operating parameter limits will be established.

IWMS acknowledges that application for, and receipt of, the Title V Air Operation Permit and continued operation of the IWMS facility is contingent upon demonstrating compliance with ALL of the emission standards during this Initial Performance Test program and developing operating parameter limits that will be used for on-going compliance indicators.

5.1 EMISSION CALCULATIONS

In Appendix B, IWMS identified several emission rates for the Hospital/Medical/Infectious Waste Incinerators (HMIWIs) that were based directly on the emission limits identified in 40 CFR Part 60, Subpart Ec. FDEP had indicated that they would also like to review the anticipated uncontrolled and controlled emissions rates for the regulated air pollutants to provide FDEP with a "reasonable assurance" that the proposed HMIWIs will meet the allowable standards. FDEP also indicated that the control device removal efficiencies and supporting data should also be provided.

IWMS has developed Table B-10 to summarize the requested information and it is included Appendix B. Table B-1 has been developed to address the air pollutants regulated in 40 CFR Part 60, Subpart Ec.

The data in Table B-1 in the columns labeled "Emission Rate Calculations – Emission Factors and Control Efficiencies" are provided for completeness and clarification to support FDEP's review of the application. These data are not intended to be used to develop additional emission limits or permit restrictions. Also note that current emission test data for HMIWI does not require any measurement on the inlet side of the air pollution control equipment (i.e., uncontrolled data) as the emission standards are only based on data that reflects "post-control".

IWMS relied upon U.S. EPA's AP-42, Chapter 2.3 "Medical Waste Incineration" for the uncontrolled emission factors. Please recognize that these emission factors were published in 1993 and represent a limited set of test data and that not all of the factors include U.S. EPA's highest confidence rating. Based on the date of publication, some of the uncontrolled factors are "pre-NSPS" and "pre-Emission Guideline" factors and do not take into account waste segregation and operating procedure improvements that have reduced certain pollutants from the waste stream.

As stated above, IWMS will meet the future regulatory emissions limits. Since the waste cannot be characterized, IWMS must rely on strict compliance by the waste generators to adhere to the specifications developed for waste acceptance. The medical waste generators currently are under local, state, and federal regulatory guidelines that limit the types of wastes sent to HMIWIs that will have the potential to generate emissions from the proposed IWMS facility (e.g., Florida defines and identifies facility policies and procedures for segregation, storage, containment, labeling, transport, and treatment of biomedical waste under the Department of Health, Chapter 64E-16, Florida Administrative Code). Recent data shows that the emissions are below the detection limit of the EPA testing methods. As such, removal efficiencies cannot be applied when the emission rate is so low that it cannot be measured. Previously, the standard method used by U.S. EPA was to use the minimum detection limit as the actual value. This approach can lead to underestimating the removal efficiency as the outlet values represent a conservative maximum value.

5.2 AIR POLLUTION CONTROL DEVICES AND REMOVAL EFFICIENCY

The air pollution control train that IWMS proposes to use for the HMIWIs (a dry gas cleaning system) is common to many existing HMIWI with the exception of the catalyst-impregnated filter bag system. It is becoming common to have an additional level of emissions control provided by filter bags made of proprietary materials and design on HMIWI. Removal efficiency data is not generally available because the units are tested based on the emissions standards and the standards reflect emissions at the outlet of the air pollution equipment and not removal efficiency. Actual test data from existing HMIWI using the dry gas cleaning system that IWMS proposes were used to develop the NSPS-based concentration limits that IWMS relied upon in our draft permit application.

These test data are the outlet conditions (i.e., controlled) which were used to ensure that the future regulatory emission limits would be met. These data are readily available in the HMIWI docket (http://www.regulations.gov/fdmspublic/component/main?main=DocketDetail&d=EPA-HQ-OAR-2006-0534). The December 19, 2006 memo hyperlinked herein provides a summary of the test data that U.S. EPA relied upon to develop the emission limits (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2006-0534-0028).

The proposed IWMS HMIWIs will employ a "dry injection with fabric filter" control system. Similar systems have been labeled with "DIFF" for the air pollution control code (APCD Code) in the linked memo. As such, IWMS has not tracked down additional stack test data for the pollutants that are commonly controlled by a dry injection with fabric filter systems. IWMS focused the supporting data collection on the Tri-Mer Fabric Filter System that includes the catalyst-impregnated filter bag system. Specifically, IWMS used data that will show either enhanced or additional control associated with the catalyst-impregnated filter bag system.

IWMS used consistent control efficiency across a class of pollutants. For example, IWMS applied the 99.99% particulate matter (PM) control efficiency across particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), and all metals; with the exception of mercury (Hg). Due to the well-known properties of Hg that cause it to react differently than other metals, IWMS did not apply the PM control efficiency to Hg and used 90% control efficiency as a more appropriate value. All metals emissions will be directly related to the metals contained in the waste.

The PM control efficiency of 99.99% is consistent with the documented Tri-Mer control efficiency of 99.99% which is directly tied to the rigid bag filter structure and the "air to cloth" ratio. The SO_2 control efficiency of 90% is a conservative value that is below the anticipated Tri-Mer control efficiency of 97%. As an acid gas, SO_2 control will be based on the same premise as HCl control discussed below. IWMS has included a complete Tri-Mer package of supporting materials Appendix E.

The HCl and other acid gas (chlorine, hydrogen bromide (HBr), and hydrogen fluoride (HF)) control efficiency of 99.3% is based on Arm & Hammer test data demonstrating sodium bicarbonate performance. The removal efficiency will be based on a combination of sodium bicarbonate feed rate, adequate system design to facilitate sodium bicarbonate/exhaust gas mixing, and inherent efficiencies associated with the Tri-Mer bag structure that provides for a thicker cake (and consequently additional treatment). The supporting test data has been included in the second attachment of Section E-4 in Appendix E.

5.3 EMISSION LIMIT COMPLIANCE ON A POLLUTANT-BY-POLLUTANT BASIS

When reviewing the calculated emission rates based on the AP-42 uncontrolled emission factors from 1993 and the anticipated control efficiencies that would be associated with anticipated air pollution control equipment, there were several pollutants [CO, HCl, and Metals (Cd, Pb, and

Hg)] where the calculated emission rate could be close to, or potentially exceed the calculated emission limit. There are a number of notable points that relate to the 1993 uncontrolled AP-42 emission factors and the proposed IWMS HMIWI's ability to meet the 2009 emission standards. First, medical waste in 1993 was different than medical waste is in 2013. The waste segregation practices of 2013 were not utilized in 1993. As a result, the 1993 AP-42 uncontrolled emission factors were higher than what would be developed in 2013 as uncontrolled emission factors. Second, the emission standards for HMIWI are concentration-based standards (mass per volume of exhaust gas) and the comparison in Table B-1 is being made on mass emission rate basis (pounds per hour). As such, IWMS has relied on several assumptions to be able to make this comparison. Provided below is an analysis of these pollutants and IWMS's approach to complying with the concentration-based emission limits.

- Carbon Monoxide (CO) – CO is a product of the combustion process and, as such, there is no removal efficiency that has/can been identified for this pollutant. Much of the effort through the 1990s centered on developing a better understanding of the combustion process and improving combustion controls to minimize the products of combustion; including CO. IWMS will meet the CO emission limit based on the design of the proposed Pennram HMIWI and proper operation and maintenance of the HMIWI. IWMS recently acquired an emission test program for an existing unit in North Dakota that was able to achieve a 3-run average CO concentration of 9.25 ppmdv @ 7% O2 using good combustion control. A copy of the summary of results is included in Appendix E-6. Please note that the test data is representative of an existing HMIWI that conducted an emission test program to demonstrate compliance with the current emission standards. The CO value has been referenced as it demonstrates compliance with the new HMIWI CO emission standard.
- Cd and Pb - IWMS proposes to control particulate matter through the installation of the Tri-Mer Fabric Filter System. Cd and Pb are particulate metals and will be controlled through the application of the Tri-Mer system. Tri-Mer has numerous studies that show that their filtration systems can capture and control particulate matter to less than 0.001 grains/dscf (included in our August 2012 submittal, Attachment 1:

UltraCat Hot Gas Filtration, Boiler MACT Solution literature). The HMIWI PM standards are 0.008 grains/dscf – eight times higher than the demonstrated Tri-Mer performance. Table 4 of the UltraCat Hot Gas Filtration literature provides PM control efficiency data for various industries. IWMS utilized a PM control efficiency of 99.99% (as demonstrated in the Secondary Aluminum Sector testing) for developing the emissions estimates. When applying this 99.99% control efficiency to PM, Cd, and Pb, the resulting mass emission rate provide reasonable assurance that IWMS will comply with the PM, Cd, and Pb HMIWI emission standards.

- Hg - The primary form of Hg control is the segregation of Hg from the waste stream. F.A.C. 62-737 includes provisions on the management of certain mercury-containing devices which may not "knowingly be incinerated or disposed of in a landfill". The burden of this rule is squarely on the waste generator who unlawfully disposes of these wastes. IWMS highlights this regulation as another example of how the primary control of Hg is through segregation of Hg-containing waste at the generator and not at the treatment location. The Hg emission standards in the HMIWI rule reflect proper segregation of Hg-containing waste from hospital/medical/infectious waste (HMIW). IWMS is committed to the on-going education process to help our future customers effectively segregate Hg-containing waste; Florida and U.S. EPA mandate that we effectively implement Waste Management Plans for our customers. IWMS reviewed available Hg test data and control configurations for Hg in other industries to determine an effective control scenario. Based on these activities, IWMS further proposes to control Hg emissions at the IWMS facility as follows.

    1. Develop of a Waste Management Plan for clients and effective communication and education.
    2. Installation of the Tri-Mer Fabric Filter System to control particulate Hg emissions.
    3. Design and inclusion of a carbon injection system as a contingency control option for Hg vapor-phase emissions.

IWMS proposes to test the HMIWI with, and without, the carbon injection system in operation during shakedown to determine if the carbon injection system is required to be operated for IWMS to demonstrate compliance with the Hg emission standards.

- Hydrogen Chloride (HCl) – IWMS proposes to control HCl and other acid gases through the addition of sodium bicarbonate and the installation of the Tri-Mer Fabric Filter System. Sodium bicarbonate addition in combination with a fabric filter was identified by U.S. EPA as MACT. Acid gas formation will be dependent on the waste composition. Acid gas control will be directly tied to: (1) the amount of sodium bicarbonate addition, and (2) the design of the fabric filter system. IWMS will employ the Tri-Mer Fabric Filter System that is designed with a bag structure to promote a thicker cake build up resulting in improved acid gas treatment. Based on the results of an Arm & Hammer study in the second attachment of Section E-4 in Appendix E and data developed in the rule-making by U.S. EPA, HCl removal efficiencies of 99%+ can be achieved using this technology. IWMS recently acquired an emission test program for an existing unit in North Dakota that was able to achieve a 3-run average HCl concentration of 3.51 ppmdv @ 7% O2 using sodium bicarbonate injection. A copy of the summary of results is included in Appendix E-6. Please note that the test data is representative of an existing HMIWI that conducted an emission test program to demonstrate compliance with the current emission standards. The HCl value from the North Dakota test data in conjunction with the Arm & Hammer study are referenced in combination as they demonstrates performance of the sodium bicarbonate injection for compliance with the new HMIWI HCl emission standard. IWMS will meet the HCl emission limit based on the design of the proposed sodium bicarbonate injection system in conjunction with the Tri-Mer Fabric Filter System.

IWMS has included Table B-10 to summarize the 40 CFR Part 60, Subpart Ec regulated air pollutants and the estimated emissions anticipated from the IWMS facility. Using the information and justification provided above, IWMS is able to show emission calculations for HCl, Cd, and Pb that demonstrate compliance with the emission standards. IWMS has identified

CO, HCl, and Hg emission rates equal to the emission standards also based on the justification provided above.

5.4 METHODS USED TO PREVENT INTRODUCTION OF HAZARDOUS WASTE INTO INCINERATION STREAM

The revisions to the federal HMIWI rules in October 2009 included a revision to the waste management plan requirements to promote the segregation of wastes. §60.55c has been modified to require commercial HMIWI to conduct training and education programs for each of the company's waste generator clients and ensure that each client prepares its own waste management plan to specifically address plastics, Hg-containing waste, paper products, etc. Please note, however, that given the OSHA requirements to which commercial HMIWI operators are subject, those operators cannot be expected to remove certain materials from wastes that they receive.

Florida DEP introduced a document "Best Management Practices for Reducing and Managing Mercury in Florida Medical Facilities: Field Testing, January – July, 1999". This document highlights activities that waste generators should undertake to eliminate the inclusion of Hg in wastes that are sent off-site for treatment. In addition, FAC 62-737 specifically states that mercury-containing devices may not knowingly be incinerated or disposed of in a landfill. Furthermore, any person who unlawfully disposes of these items will be held liable to the state for any damage caused and for civil penalties. This regulation clearly provides the following:

1. Mercury-containing waste qualifies as hazardous waste and should not be treated as biomedical waste.
2. The burden for proper disposal of "mercury containing devices" and the resulting penalties for non-compliance is placed on the generator.

The combination of the regulatory requirement and IWMS commitment to develop a Waste Management Plan and to conduct the outreach training for the waste generators in conjunction with the regulatory burden of the waste generators to properly handle and dispose of the mercury-containing waste, provides reasonable assurance that mercury-containing waste should not be in the waste feed stream to the HMIWI.

6. APPLICABLE REQUIREMENTS

IWMS has reviewed the Federal and State of Florida air quality regulations to determine which regulations could potentially apply to the proposed project. The following sections summarize only those air regulations that could potentially be triggered by the proposed project.

6.1 FEDERAL AIR QUALITY REGULATIONS

For the purpose of this application, potentially applicable Federal regulations are defined as:

- New Source Review (NSR)
- New Source Performance Standards (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAP)
- Title V Operating Permit (Title V)
- Compliance Assurance Monitoring (CAM)

A discussion of each specific Federal requirement is provided in the following subsections.

6.1.1 New Source Review (NSR)

The Federal New Source Review (NSR) program is codified in 40 CFR §§51.165, 51.166, 52.21, 52.24, and 40 CFR Part 51, Appendix S. NSR requirements potentially apply to new major stationary sources and major modifications to major stationary sources. The NSR program is further broken down as Nonattainment New Source Review (NNSR) in areas designated as nonattainment with the National Ambient Air Quality Standards (NAAQS) or Prevention of Significant Deterioration (PSD) in areas designated as in attainment or unclassifiable with the NAAQS.

The proposed IWMS facility will be located in Suwannee County Florida. Since Suwannee County is currently classified as either unclassifiable or attainment for all NSR regulated pollutants NNSR does not apply.

Under the PSD rules a major source is defined as a stationary source of air pollutants that emits or has the potential to emit 250 tons per year or more of any regulated NSR pollutant unless, the source is one of 27 listed source categories. The proposed IWMS facility is not one of the listed source categories and potential emissions from the facility of any regulated NSR pollutant are less than 250 tons per year. Therefore, the PSD requirements are not triggered by the proposed project and are not addressed in this Air Construction Permit Application.

6.1.2 New Source Performance Standards (NSPS)

U.S. EPA promulgates standards of performance for new, modified, or reconstructed sources of air pollution (New Source Performance Standards, NSPS) and Emission Guidelines (EG) for existing sources of air pollution at 40 CFR Part 60. The proposed facility will be subject to 40 CFR Part 60, Subpart Ec (Standards of Performance for Hospital/Medical/Infectious Waste Incinerators for Which Construction is Commenced After June 20, 1996). Subpart Ec was originally promulgated in 1997 and was most recently amended on October 6, 2009 with an effective date of May 4, 2011. Since the proposed HMIWIs will be new units and will commence construction in 2013, each HMIWI will be required to meet the emissions limitations found in Table 1B of Subpart Ec and must comply with the applicable parts of Subpart Ec. In addition, Subpart Ec (§60.50c(l)) requires that affected HMIWI facilities subject to the rule must operate pursuant to a Title V operating permit.

As an owner and operator, IWMS's proposed emergency fire water pump and emergency generator will commence construction after June 12, 2006 making the engines subject to 40 CFR Part 60, Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines). The emergency fire water pump and emergency generator engines firing propane would meet the applicability criteria of 40 CFR §60.4230(a)(4) – stationary spark ignition engines manufactured on or after July 1, 2007 (manufacture date varies by engine power) and are subject to the emission standards codified at 40 CFR §60.4233(c), which references engine manufacturer emission limits. Both engines will be subject to the NSPS upon start-up.

6.1.3 National Emission Standards for Hazardous Air Pollutants (NESHAP)

National Emission Standards for Hazardous Air Pollutants (NESHAP) promulgated prior to the Clean Air Act Amendments (CAAA) of 1990, found at 40 CFR Part 61, apply to specific compounds emitted from specific processes. The proposed facility will not subject to any Part 61 requirements.

NESHAP promulgated under 40 CFR Part 63, also referred to as Maximum Achievable Control Technology (MACT) standards, apply to specific source categories that are considered area sources or major sources of hazardous air pollutants (HAP) emissions. A major source of HAP emissions is defined as a source with the facility-wide potential to emit any single HAP of 10 tons per year or more, or with a facility-wide potential to emit total HAP of 25 tons per year or more. As proposed, the IWMS facility will be an area source of HAP emissions (i.e., emits less than 10 tons per year of any single HAP and less than 25 tons per year of total HAP).

The proposed facility's Emergency Fire Water Pump and Emergency Generator engines will be subject to 40 CFR Part 63, Subpart ZZZZ (National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (RICE)), which became effective on May 3, 2010. The rule applies to both area sources and major sources of HAP emissions.

Both the Emergency Fire Water Pump and the Emergency Generator at the proposed facility will be propane powered with a site rating of 100 hp and 670 hp, respectively. Pursuant to 40 CFR

§63.6590(a)(2)iii, the proposed Emergency Fire Water Pump and the Emergency Generator will be an affected source classified as a new stationary RICE because they will be located at an area source and construction will have commenced on or after June 12, 2006. However, because both engines will be subject to 40 CFR Part 60 Subpart JJJJ and meet such requirements, IWMS will comply with the requirements of 40 CFR Part 63, Subpart ZZZZ pursuant to the "new area source stationary RICE" exemption criteria identified in 40 CFR §63.6590(C)(1). No further requirements apply for such engines under 40 CFR Part 63, Subpart ZZZZ. There are no additional proposed or promulgated Part 63 requirements that apply to the facility.

6.1.4 Title V Operating Permit (Title V)

The Federal regulations that define the Title V operating permit program requirements for approved States are codified at 40 CFR Part 70. Florida has an approved Title V operating permit program discussed under the State of Florida Regulations section presented below. The proposed IWMS facility will be required to obtain a future Title V operating permit since it qualifies as a Title V source as a result of the applicability of the NSPS Subpart Ec rule discussed above.

6.1.5 Compliance Assurance Monitoring (CAM)

Compliance Assurance Monitoring Requirements are promulgated under 40 CFR Part 64 and apply to certain pollutant-specific emissions units at Title V sources that employ control devices to comply with applicable emission limits. 40 CFR §64.2(b) identifies exemptions from the requirements for any emission limitations or standards proposed by the Administrator after November 15, 1990 pursuant to Section 111 or 112 of the Act (the NSPS and NESHAP requirements). CAM could potentially apply for any pollutant that has pre-control emissions for greater than 100 tons per year. Particulate Matter (PM) emissions from the IWMS HMIWIs have pre-control could potentially exceed 100 tons per year from the HMIWI at the proposed Facility. However, PM emissions from the HMIWIs are regulated pursuant to 40 CFR Part 60, Subpart Ec (a post November 15, 1990 NSPS standard). Therefore, the HMIWI are exempt from developing a CAM Plan for PM and no CAM Plans will be included with the Title V operating permit application. No other pollutants have pre-control potential emissions greater than the 100 tons per year major source threshold so, CAM does not apply to the proposed project.

6.2 STATE OF FLORIDA REGULATIONS

6.2.1 Federal Regulations Adopted by Reference

The Florida Department of Environmental Protection (FDEP) adopts Federal Air Quality Regulations by reference into the Florida Administrative Code (FAC) at FAC 62-204.800. The table below summarizes the Federal Regulations discussed above and their adoption by reference in the FAC. Other FAC requirements applicable to the proposed IWMS facility are discussed below.

Table 6-1
Applicable Federal Requirements Incorporated by Reference into FAC

Applicable Regulation	Applicable Regulation	FAC Citation
Standards of Performance for Hospital/Medical/Infectious Waste Incinerators for Which Constructions is Commenced After June 20, 1996	40 CFR Part 60, Subpart Ec	FAC 62-204.800(8)(b)8
New Source Performance Standards for Stationary Spark Ignition Internal Combustion Engines	40 CFR Part 60, Subpart JJJJ	FAC 62-204.800(8)(b)(80)
National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (RICE)	40 CFR Part 63, Subpart ZZZZ	FAC 204.800(11)(b)82
Compliance Assurance Monitoring (CAM)	40 CFR Part 64	FAC 204.800(12)

A discussion of each specific FAC requirement is addressed in the subsections below. For the purpose of this application, there are currently no other proposed or promulgated FAC requirements to date that potentially apply to the proposed project.

6.2.2 State-Specific Regulations

6.2.2.1 FAC 62-4 Permits

This chapter of the Florida regulations identifies the general requirements for sources requiring permits. The proposed IWMS facility is required to comply with the applicable permitting requirements identified in this chapter.

6.2.2.2 FAC 62-210 Stationary Sources – General Requirements.

This chapter of the Florida regulations identifies the general requirements for all stationary sources requiring permits. The proposed IWMS facility is required to comply with the applicable stationary source general requirements identified in this chapter.

6.2.2.3 FAC 62-212 Stationary Sources – Preconstruction Review

This chapter of the Florida regulations includes the requirements for new or modified facilities to undergo preconstruction review and approval. The proposed IWMS facility is required to apply for and obtain an air construction permit prior to commencing construction. Chapter 212 includes the requirements for determining major NSR applicability, as well as the specific provisions for applying for and obtaining the requisite air construction permit for the facility.

6.2.2.4 FAC 62-213 Operating Permits for Major Sources of Air Pollution

This chapter of the Florida regulations includes the various requirements associated with obtaining and operating under the operating permit program mandated by Title V of the 1990 Clean Air Act Amendments. The proposed IWMS facility meets the definition of Title V Source (§62-210.200(188)) since it is subject to the Federal NSPS Subpart Ec discussed above. Therefore, it will be necessary to obtain a Title V operating permit for the facility in the future. The Title V operating permit application must identify all of the facility emissions units and applicable requirements and must include the proposed methods for demonstrating compliance with such requirements. The Florida rules (§62-213.405) allow a facility to request that the FDEP process the facility's Title V operating permit application concurrently with the construction permit application required pursuant to FAC 62-Chapter 212 discussed above. However, in making such a request the facility waives the agency's application processing time requirements specified in Chapter 212.

6.2.2.5 FAC 62-296 Stationary Sources – Emission Standards

The following general pollutant emission standards specific to air emitting sources operating in the State of Florida would potentially apply to the proposed project.

- FAC 62-296.100 Purpose and Scope
- FAC 62-296.320(2) Objectionable Odor Prohibited – This rule prohibits the discharge of air pollutants which cause or contribute to an objectionable odor.
- FAC 62-296.401 Incinerators – FAC 62-296.401 specifies requirements for various types of incinerators. Specifically, FAC 62-296.401 (4) applies to any biological waste incinerator unit also regulated pursuant 40 CFR Part 60, Subpart Ec. The requirements of FAC 62-296.401 (4) shall only apply such that they are stricter than, or supplemental to, the requirements of 40 CFR Part 60, Subpart Ec. As a result, the proposed HMIWI would be subject to additional or more stringent requirements as

provided in FAC 62-296.401(4) (e.g., operating and design requirements, testing, monitoring, training, etc.).

6.2.2.6 FAC 62-297 Stationary Sources – Emissions Monitoring

The following general emissions monitoring requirements specific to air emitting sources operating in the State of Florida would potentially apply to the proposed project.

- FAC 62-297.100 Purpose and Scope
- FAC 62-297.310 General Compliance Test Requirements

There are no additional proposed or promulgated State requirements triggered by this application.

7. HOSPITAL/MEDICAL/INFECTIOUS WASTE INCINERATOR AND AIR POLLUTION CONTROL EQUIPMENT MONITORING

40 CFR Part 60, Subpart Ec requires operating parameters to be monitored for the HMIWI and the air pollution control device (APCD) equipment. Based on §60.57c, IWMS has identified the required operating parameters for the IWMS HMIWIs in Table 6-1 and has provided a detailed diagram in Appendix A, Figure A-1. The operating parameter limits will be established during the initial performance test and will be used to demonstrate on-going compliance with the emission limits.

Table 7-1
HMIWI and APCD Monitoring

Operating Parameters to be Monitored	**Minimum Frequency**	
	Data measurement	Data recording
Maximum waste charge rate	Continuous	Once per hour
Maximum fabric filter inlet temperature	Continuous	Once per minute
Minimum secondary chamber temperature	Continuous	Once per minute
Maximum flue gas temperature	Continuous	Once per minute
Minimum HCl sorbent flow rate (sodium bicarbonate)	Hourly	Once per hour
Minimum dioxin/furan sorbent flow rate (sodium bicarbonate)	Hourly	Once per hour
Minimum mercury (Hg) sorbent flow rate (sodium bicarbonate)	Hourly	Once per hour
Bag leak detection system	Continuous	Upon alarm
Minimum mercury (Hg) sorbent flow rate (carbon, if contingency control option is required)	*Hourly*	*Once per hour*
Minimum reagent flow rate (ammonia or urea, if contingency control option is required)	*Hourly*	*Once per hour*

IWMS's APCD system qualifies as a "*dry scrubber followed by a fabric filter*" identified in §60.56c(g). Operation of the incinerator above any of the applicable maximum operating parameters or below any of the applicable minimum operating parameters identified will result in the following emission limit violations:

- Operation of the affected facility above the maximum waste charge rate and below the minimum secondary chamber temperature (each measured on a 3-hour rolling average) simultaneously shall constitute a violation of the CO emission limit.
- Operation of the affected facility above the maximum fabric filter inlet temperature, above the maximum charge rate, and below the minimum dioxin/furan sorbent flow rate (each measured on a 3-hour rolling average) simultaneously shall constitute a violation of the dioxin/furan emission limit.
- Operation of the affected facility above the maximum waste charge rate and below the minimum HCl sorbent flow rate (each measured on a 3-hour rolling average) simultaneously shall constitute a violation of the HCl emission limit.
- Operation of the affected facility above the maximum waste charge rate and below the minimum Hg sorbent flow rate (each measured on a 3-hour rolling average) simultaneously shall constitute a violation of the Hg emission limit.
- Use of the bypass stack shall constitute a violation of the PM, dioxin/furan, HCl, Pb, Cd and Hg emission limits.

In the event that the contingency control options are employed, the following conditions would also apply.

- *Operation of the affected facility above the maximum waste charge rate and below the minimum Hg sorbent flow rate [carbon] (each measured on a 3-hour rolling average) simultaneously shall constitute a violation of the Hg emission limit.*
- *Operation of the affected facility above the maximum charge rate, below the minimum secondary chamber temperature, and below the minimum reagent flow rate (each measured*

on a 3-hour rolling average) simultaneously shall constitute a violation of the NO_X emission limit.

Since IWMS will also rely upon the catalyst impregnated structured bag system, IWMS is also required to develop site-specific operating parameters for this air pollution control option. Pursuant to §60.50c(i)(1), U.S. EPA maintains Administrator authority for the establishment of site-specific operating parameters. IWMS will submit site-specific operating parameters for the catalyst impregnated structured bag system to U.S. EPA for approval. Based on discussions with the proposed bag system vendor, the bags are designed to last 7 years. Standard Operating Procedures require a sample bag to be sent back to the manufacturer at 5 years to be tested to ensure that the catalyst is working properly and then to be tested annually thereafter until the bags are replaced.

Please note that IWMS believes that the requirement in Table 3 of §60.57c to monitor the maximum flue gas temperature is an error in the regulation. U.S. EPA ties the maximum flue gas temperature definition to the outlet of a wet scrubber system. IWMS's configuration does not include a wet scrubber system and the maximum flue gas temperature is not tied to any emission limit violations. Furthermore, 60 CFR Part 62, Subpart HHH (which implement 40 CFR Part 60, Subpart Ce) corrects this error by removing the requirement to monitor maximum flue gas temperature for any "dry scrubber followed by fabric filter" systems. IWMS recognizes the role of the U.S. EPA as the administrator for this monitoring parameter exclusion. IWMS would ask FDEP to include a footnote that would identify the parameter to be monitored unless approved by the U.S. EPA.

8. SITING ANALYSIS

8.1 BACKGROUND

40 CFR Part 60 Subpart Ec, specifically §60.54c, addresses siting requirements for new HMIWI. An analysis of the impacts of the affected facility must be prepared in accordance with §60.54c (a) – (c). Specifically, the analysis shall consider air pollution control alternatives that minimize, on a site-specific basis, to the maximum extent practicable, potential risks to public health or the environment. The underlying driver for this requirement is Section 129(a)(3) – Control Methods and Technologies, of the Clean Air Act (CAA). In considering such control alternatives, the analysis may consider costs, energy impacts, non-air environmental impacts, or any other factors related to the practicability of the alternatives. The siting analysis must be prepared and submitted prior to commencement of construction as required in §60.58c(a)(1)(iii). This section serves as IWMS's Siting Analysis.

8.2 AIR POLLUTION CONTROL ALTERNATIVES

As described above, the purpose of the siting analysis is to consider air pollution control alternatives on a site-specific basis to minimize potential risks to the environment or public health. On October 6, 2009, 40 CFR Part 60 Subparts Ce and Ec were revised by U.S. EPA. The revisions focused primarily on emission limits and, as a result, the underlying air pollution control systems were analyzed in detail. The revised emission limits were developed on a pollutant-by-pollutant basis and are based on top performing unit for new HMIWI (for each category).

For example, the emission standard for new HMIWI for PM was based on the top performing unit for PM and the emission standard for new HMIWI for HCl was also based on the top performing unit for HCl. As such, the new HMIWI emission standards are developed based on the lowest pollutant-by-pollutant values developed from emission testing and have been developed from a series of HMIWI that are equipped with different air pollution control alternatives.

This is important from several perspectives: (1) it confirms that U.S. EPA did not intend for the application of a single air pollution control alternative to achieve compliance with the promulgated emission limits; and (2) by installing an air pollution control system that achieves compliance with the emission limits for new HMIWI, the proposed IWMS HMIWIs would be the top performing HMIWIs in the United States as there is not an existing HMIWI in operation that is currently required to comply with all of the recently promulgated new HMIWI emission limits.

As described in Section 3, IWMS has identified a preliminary air pollution control system consisting of a dry scrubber followed by a fabric filter which will utilize cloth bags impregnated with a catalyst that provides additional control for Hg and dioxins/furans. This air pollution control configuration (dry scrubber followed by a fabric filter) is consistent with the three potential air pollution control scenarios identified by U.S. EPA with the additional control of the catalyst impregnated bags. The preliminary air pollution control system for the proposed IWMS HMIWI will meet or exceed the performance of the systems identified by U.S. EPA in the development of the 40 CFR Part 60 Subpart Ec emission standards. The preliminary air pollution control system considers the various control scenarios identified by U.S. EPA, input from HMIWI and air pollution control device vendors, and expertise from independent consultants. The proposed scenario will minimize the potential risks to public health and the environment based on the required performance to meet the emission standards.

8.3 SELECTION OF AIR POLLUTION CONTROL SYSTEM

The design of the HMIWI systems proposed for installation at the Suwannee facility was chosen with the understanding that the facility would need to be a "state-of-the art" system capable of achieving the stringent new Federal emission standards for these types of units and minimizing risk to public health and the environment. The air contaminants potentially emitted from HMIWI and other combustion sources can be grouped according to their physical properties at the point of generation or control, generally as follows:

- Particulate matter (PM) and PM HAPS
- NO_X
- Volatile organic compounds (VOC) and organic HAPs (VOHAP)
- CO
- Semi-volatile HAPs
- SO_2 and acid gases

IWMS evaluated the potential formation of, and the uncontrolled emission rates, for each of these groups of contaminants and selected the most efficient and reliable control options available in order to ensure that the systems would meet the stringent new Federal standards. The two-stage design of the HMIWI units is intended to minimize the formation of air contaminants through automated burner and combustion air system control. Combustion control in the primary combustion chamber serves as the first component of the system designed to minimize air contaminant emissions. The reducing atmosphere and controlled temperature in the primary chamber serve to minimize NO_X formation and particulate (and potential PM HAP) carryover. Operating temperature and gas residence time in the secondary combustion chamber serve as the second air contaminant control system component. The fuel rich gas generated by the reducing conditions in the primary chamber are combusted in the secondary chamber under carefully controlled conditions that maximize combustion efficiency resulting in the destruction of the majority of the uncontrolled VOC and VOHAP, and minimize the emissions of CO.

The combustion gases leaving the secondary chamber will be routed directly to the heat recovery boiler. The thermal energy in the hot gas leaving the HMIWI unit is transferred indirectly through the boiler and steam is generated by the boiler. The decision to include a heat recovery boiler was made based on long term considerations for the facility. On a short-term basis, the investment in the boiler has a low payback. However, the steam produced by the boiler is expected to increase in value over time in a number of ways. The initial installation will be designed to produce electricity with the steam, in a turbine generator that will in part supply the electrical demand of the facility. The reduced purchase of electricity provides an immediate financial benefit. As electricity prices rise, this benefit will increase accordingly. In the future, neighboring facilities will be solicited as possible purchasers of the boiler steam output since steam used for process purposes is more valuable than steam used in a condensing turbine generator to produce electricity only. If a purchaser for some or all of the steam emerges in the medium or long-term, the value of the steam from the waste heat boiler will increase dramatically.

The boiler choice required careful review and consideration of the potential formation of dioxin and furan (D/F) emissions. These potential D/F emissions consist of a number of semi-volatile compounds that are very similar in nature. As scientific understanding of both the formation and health effects of D/F has grown, the chemistry behind formation has become much more clearly understood. The use of a boiler downstream of an incinerator to recover energy from the hot flue gases slowly cools these gases. As the gases pass through a temperature "window", variously described but in the range of 400 to 800 degrees F, D/F can be formed at greater levels than would otherwise occur with a rapid quench, such as would result from cooling the gases quickly without the use of a boiler. However, the availability of the catalytic dioxin destruction technology, designed into the proposed IWMS air pollution control systems, support the decision to incorporate the heat recovery boiler into the design of each unit. Any dioxins formed in the exhaust gas as it exits the boiler will be destroyed at a high removal efficiency by the proposed catalytic technology and the resulting D/F emissions are expected to be lower than those achieved by rapid gas quenching.

In considering a rapid quench system, the most straight forward design would be a fully wet gas cleaning train (series of add-on control equipment). The wet system would lend itself to incorporating wet scrubbing technologies for controlling SO2 and acid gases. While there are a number of permutations for wet gas cleaning train designs, they center on one key fact – to operate a rapid quench and fully wet scrubbing system the plant must be equipped to discharge wastewater from the air pollution control system to a sewer system. That discharge flow will represent additional water consumption beyond the committed design and perhaps more importantly, represents an additional sewage treatment plant load.

A hybrid system, using a wet scrubber downstream of a filter system, was also considered as a way to eliminate the sewer discharge. This design would instead evaporate the wastewater and capture the residual salts in the filter. This design results in a trade-off in that the hot gas exiting the incinerator only has enough energy content to either make steam or to evaporate the wastewater, not both.

In terms of pollutant removal efficiencies, the proposed dry system using the fabric filter equipped with ceramic, catalytic bags, and the upstream injection of dry sodium bicarbonate is expected to outperform either a wet system or a hybrid system. The use of ceramic filters provides better resilience in the event of a high temperature excursion, which could destroy a set of conventional fiberglass bags almost immediately. Incorporation of the dry gas cleaning system following the two-stage HMIWI and heat recovery boiler provides an overall design that accomplishes the following:

1. Minimizes the generation of uncontrolled PM and PM HAPs in the HMIWI and provides the maximum PM control efficiencies achievable through fabric filtration,
2. Minimizes NOX formation through the design and combustion control afforded by the two-stage HMIWI,
3. Provides a high level of combustion efficiency for minimizing CO formation and a high level of destruction of VOC and VOHAP in the design and combustion control inherent in the secondary chamber of the HMIWI units,
4. Provides a high level of removal efficiency for semi-volatile HAPs including D/F emissions through catalytic oxidation, and

5. Provides a high level of removal efficiency for acid gases and the small amounts of SO2 generated in the process through the injection of sodium bicarbonate upstream of the fabric filter.

Given the stringency of the new Federal HMIWI emission standards, none of the alternative control technologies would be expected to provide any additional control beyond the levels achieved by the proposed system. The various factors cited here led to the selection of the dry system described in the permit application as the best air pollution design approach. Based on the proposed design, the Suwannee facility will meet the stringent new Federal standards for HMIWI while minimizing risk to public health and the environment.

9. FDEP AIR CONSTRUCTION PERMIT APPROACH

9.1 APPROACH

IWMS's approach is to include FDEP forms specific to an Air Construction Permit Application. Included in this application are completed FDEP Forms No. 62-210.900(1), effective March 11, 2010, in Appendix C. The forms are divided into the following sections.

- Section I: Application Information – includes facility identification and general information on the scope and purpose of the Air Construction Permit Application.
- Section II: Facility Information – provides general facility information, facility regulations, facility pollutants and facility supplemental information.
- Section III: Emissions Unit Information – provides general emissions unit information, emissions unit capacity, emissions unit regulations, emission point data, process/fuel data, emissions unit pollutants, emissions unit pollutant detail information, visible emission information, continuous monitor information, and emissions unit supplemental information for each of the significant emissions units, as listed below.
    - HMIWI (4 units, Unit ID Numbers 001-004)
    - Dry Sorbent Storage Silo (2 silos, Unit ID Numbers 005and 006)
    - Emergency Generator (Unit ID Number 007)
    - Emergency Diesel Powered Fire Water Pump (Unit ID Number 008)

9.2 IWMS'S APPROACH TO COMPLETING THE FDEP PERMIT APPLICATION FORMS

IWMS developed the FDEP Form No. 62-210.900(1) – Form with the following approach:

- IWMS completed one set of forms for each emission unit type for the HMIWI (Unit ID Nos. 001-004) and Dry Sorbent Storage Silo (Unit ID Nos.005and 006) as the subsequent units are anticipated to be identical for each category.
- IWMS included forms for the Dry Sorbent Storage Silo even though preliminary design plans indicate that the silos will discharge into the building. IWMS will

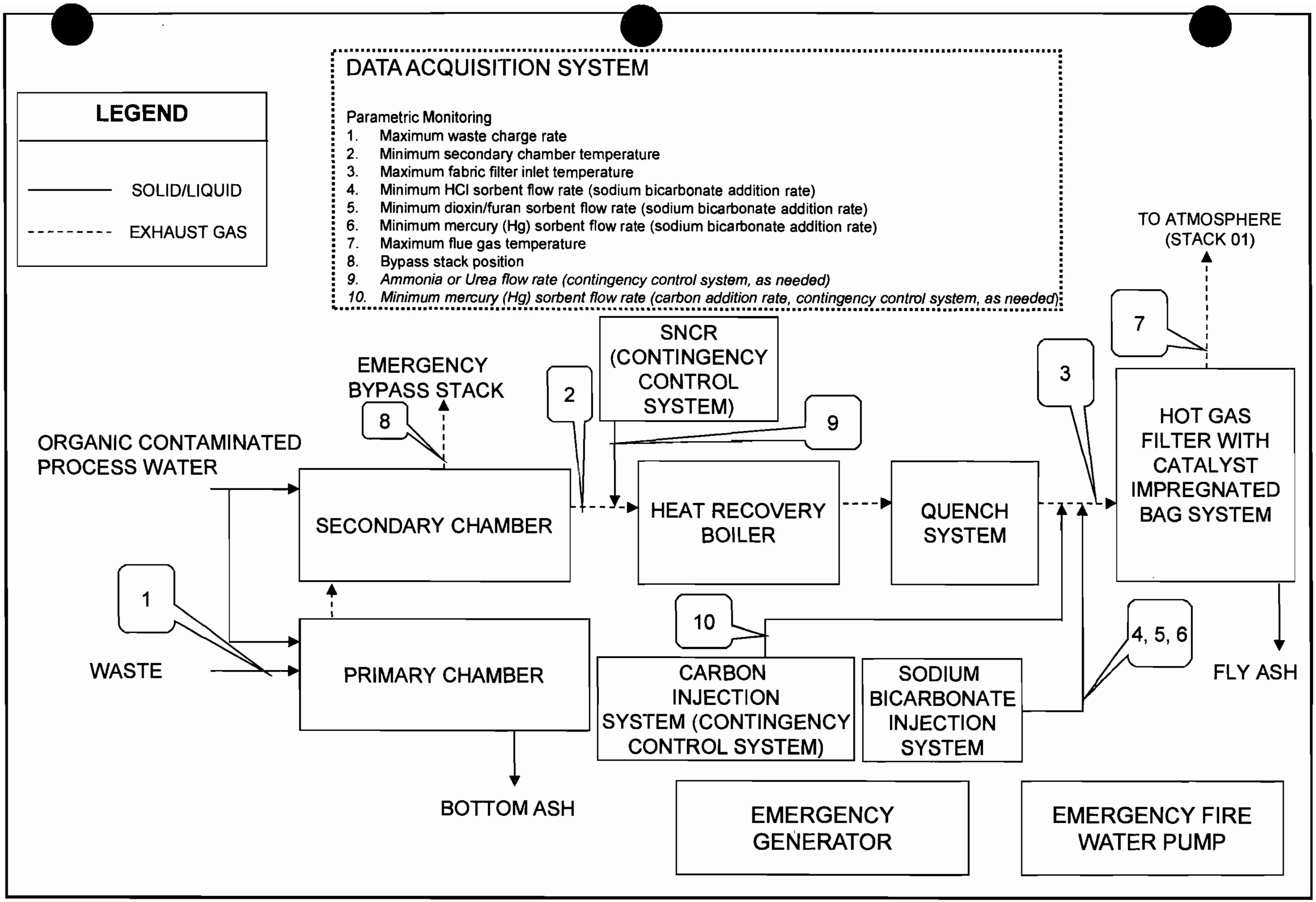
coordinate with FDEP during the permit development process to provide input on the final configuration and coordinate any impacts on the permit conditions.

- IWMS has not included The Fuel Analysis or Specification in Section I – Emissions Unit Additional Information. IWMS anticipates using commercial great liquid propane gas; however, a preferred vendor has not been identified at this time.

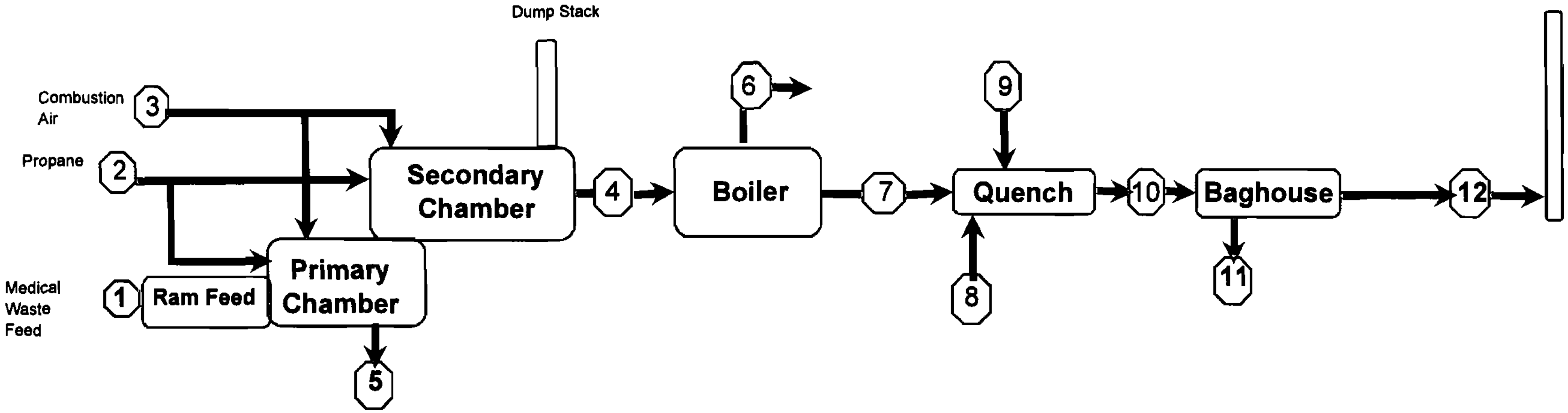
9.2.1 List of Equipment/Activities Regulated Under Title VI:

IWMS is still finalizing the design of the support facility and operations at the proposed site and anticipates there will be comfort heating/cooling and possibly other support operations that would be regulated under Title VI. IWMS will provide a list of equipment/activities at the facility after final design considerations that will be regulated under Title VI, as applicable.

APPENDIX A -
FACILITY PROCESS FLOW DIAGRAMS



Appendix A: Figure A-1
Detailed Process Flow Diagram with Parametric Monitoring
IWMS



		1	2	3	4	5	6	7	8	9	10	11	12
		Feed	Propane	Comb Air	Flue Gas	Ash	Steam	Boiler Exit	NaHCO3	Water	Cooled Gas	Ash	Stack Gas
Weight	lb/hr	2500	1	36166	38667	250	11500	38666	250	as Needed	38617	280	38617
Gas Flow	ACFM			7931	34326	0	0	15327			15310		15310
Gas Flow	SCFM					0	0	0			0	0	0
Temperature	Deg F	60	60	60	1624	60	0	470	60	60	470		470
											0	0	0
											0	0	0
Carbon Dioxide	% wet	0	0	0	6.15%		0	6.15%			6.15%	0	6.15%
Water	% wet	0	0	0	9.28%		100.00%	9.28%			9.28%	0	9.28%
Oxygen	% wet	0	0	20.70%	11.00%		0	11.00%			11.01%	0	11.01%
Nitrogen	% wet	0	0	79.90%	73.48%		0	73.48%			73.55%	0	73.55%
HCl	% wet	0	0	0	0.10%		0	0.10%			0.00%	0	0.00%

APPENDIX B - SUPPORTING EMISSION CALCULATIONS

Table B-1
Florida Project Emission Rates
Integrated Waste Management Systems, Inc.

Pollutant	AP-42 Uncontrolled Emission Factor [a] [d]	Units	Control Efficiency (%)	Comment	Controlled Emissions (lb/hr)	Controlled Emissions (ton/yr)	Emission Limit	Units	Footnote	Potential to Emit[e] (lb/hr)	Potential to Emit[e] (ton/yr)
	Potential to Emit Emission Rate Calculations - Emission Factors and Control Efficiencies						*Allowable Emission Rates*				
PM	4.67	lb/ton	99.99%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	2.33E-03	1.02E-02	0.008	gr/dscf @ 7% O_2	(c)	2.67	11.70
PM_{10}	4.67	lb/ton	99.99%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	2.33E-03	1.02E-02					
$PM_{2.5}$	4.67	lb/ton	99.99%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	2.33E-03	1.02E-02					
NO_X	3.56	lb/ton	N/A	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. SNCR is identified as an optional add-on control technology and will be employed if IWMS determines during installation and shakedown that additional NO_X control is required	17.80	77.96	140	ppmv @ 7% O_2	(c)	39.06	171.06
SO_2	2.17	lb/ton	90.00%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. IWMS has conservatively relied upon a 90% SO_2 control efficiency based on TriMer test data.	1.09	4.75	8.1	ppmv @ 7% O_2	(c)	3.14	13.77
CO	11.00	ppmv @ 7% O_2	N/A	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. IWMS will control CO through good combustion practices. The potential emissions were calculated based on designing the system to meet the HMIWI emission standards	1.87	8.18	11	ppmv @ 7% O_2	(c)	1.87	8.18
VOC	2.99E-01	lb/ton	90.00%	There are no add-on controls proposed for VOC. IWMS will control volatiles through good combustion practices and high combustion temperatures. IWMS has assumed 90% control of volatile organics	1.50E-01	6.55E-01					
HCl	5.10	ppmv @ 7% O_2	N/A	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. IWMS will control HCl through the installation of the sodium bicarbonate system and use of the TriMer Fabric Filter System. The potential emissions were calculated based on designing the system to meet HMIWI emission standards	1.11	4.88	5.1	ppmv @ 7% O_2	(c)	1.11	4.88
Cd	5.48E-03	lb/ton	99.99%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99.99% Cd control efficiency based on TriMer test data	2.74E-06	1.20E-05	1.30E-01	µg/dscm @ 7% O_2	(c)	1.90E-05	8.31E-05
Hg	1.30	µg/dscm @ 7% O_2	N/A	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. Hg emissions will be controlled by: (1) waste segregation, (2) TriMer fabric filter system, and (3) carbon addition as a contingency control option. The potential emissions were calculated based on designing the system to meet HMIWI emission standards.	1.90E-04	8.31E-04	1.30	µg/dscm @ 7% O_2	(c)	1.90E-04	8.31E-04
Pb	7.28E-02	lb/ton	99.99%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99.99% Pb control efficiency based on TriMer test data	3.64E-05	1.59E-04	6.90E-01	µg/dscm @ 7% O_2	(c)	1.01E-04	4.41E-04
Dioxins	2.13E-05	lb/ton	99.00%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99% D/F control efficiency based on TriMer test data	1.07E-06	4.66E-06	9.3	ng/dscm @ 7% O_2	(c) (e)	1.36E-06	5.94E-06
Furans	7.15E-05	lb/ton	99.00%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99% D/F control efficiency based on TriMer test data	3.58E-06	1.57E-05					
Aluminum	1.05E-02	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data.	5.25E-06	2.30E-05					
Antimony	1.28E-02	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data.	6.40E-06	2.80E-05					
Arsenic	2.42E-04	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	1.21E-07	5.30E-07					
Barium	3.24E-03	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	1.62E-06	7.10E-06					
Beryllium	6.25E-06	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	3.12E-09	1.37E-08					
Chlorine	1.05E-01	lb/ton	99.30%	The emission rate calculations rely upon a 99.3% HCl control efficiency based on the Arm & Hammer CISI Incinerator test data	3.68E-03	1.61E-02					
Chromium	7.75E-04	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	3.87E-07	1.70E-06					
Copper	1.25E-02	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	6.25E-06	2.74E-05					
Hydrogen Bromide	4.33E-02	lb/ton	99.30%	The emission rate calculations rely upon a 99.3% HCl control efficiency based on the Arm & Hammer CISI Incinerator test data	1.52E-03	6.64E-03					
Hydrogen Fluoride	1.49E-01	lb/ton	99.30%	The emission rate calculations rely upon a 99.3% HCl control efficiency based on the Arm & Hammer CISI Incinerator test data.	5.22E-03	2.28E-02					
Iron	1.44E-02	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data.	7.20E-06	3.15E-05					
Manganese	5.67E-04	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data.	2.83E-07	1.24E-06					
Nickel	5.90E-04	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data.	2.95E-07	1.29E-06					
Silver	2.26E-04	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data.	1.13E-07	4.95E-07					
SO_3	9.07E-03	lb/ton	90.00%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. IWMS has conservatively relied upon a 90% SO_2 control efficiency based on TriMer test data.	4.54E-03	1.99E-02					
Thallium	1.10E-03	lb/ton	99.99%	The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data.	5.50E-07	2.41E-06					
Total PCBs	4.65E-05	lb/ton	90.00%	There are no add-on controls proposed for total PCBs. IWMS will control volatiles through good combustion practices and high combustion temperatures. IWMS has assumed 90% control of volatile organics.	2.33E-05	1.02E-04					
Total HAPs	N/A	N/A	N/A	N/A	8.92E-03	3.91E-02					

Notes:

[a] Emission calculations are based on the:

Parameter	Value	Units
Stack Gas Volumetric Flow Rate	17,520	ACFM @ 7% O_2
Stack Gas Temperature	395	°F
Standard Stack Gas Volumetric Flow Rate	9,737	DSCFM @ 68 °F
Stack Gas Moisture	10.0%	% by v
HMIW Feed Rate (per HMIWI)	2,500	lb/hr
Operating Time	8,760	hr/yr
Number of Incinerators	4	Units
Conversion Factor 1	60	min/hr
Conversion Factor 2	7,000	gr/lb
Conversion Factor 3	2.2046E-09	lb/µg
Conversion Factor 4	35.31	ft^3/m^3
Molar Volume of Air @ STP	385.35	scf/lb mol
Molecular Weight of NO_x (as NO_2)	46	lb/lb mol
Molecular Weight of SO_2	64	lb/lb mol
Molecular Weight of CO	28	lb/lb mol
Molecular Weight of HCl	36	lb/lb mol

[b] Emission factor represents emission guarantee provided by TriMer Corporation for an UltraCat Filtration (UCF) Air Pollution Control System for total filterable particulate matter.
[c] Emission limit represents emission limit for new units subject to 40 CFR Part 60, Subpart Ec "Standards of Performance for New Stationary Sources: Hospital/Medical/Infectious Waste Incinerators."
[d] Emission factors from AP-42 Chapter 2.3.
[e] Allowable emissions represent the emission concentration limit for dioxins/furans.

Table B-2
Florida Project PTE - HMIWIs Firing Propane Under Supplemental Fuel Firing Operation
Integrated Waste Management Systems, Inc.

Pollutant	Emission Factor [b]	Units	Footnote	Potential to Emit[a]	
				(lb/hr)	(ton/yr)
PM	0.7	$lb/10^3$ gal	(b)	0.48	0.21
PM_{10}	0.7	$lb/10^3$ gal	(b)	0.48	0.21
$PM_{2.5}$	0.7	$lb/10^3$ gal	(b)	0.48	0.21
NO_X	13	$lb/10^3$ gal	(b)	8.91	3.90
SO_2[c]	0.02	$lb/10^3$ gal	(b)	0.01	0.01
CO	7.5	$lb/10^3$ gal	(b)	5.14	2.25
VOC	1.0	$lb/10^3$ gal	(b)	0.69	0.30

Notes:

[a] Emission calculations are based on the following information.

Parameter	Value	Units
Number of Incinerators	4	Units
Conversion Factor 1	2,000	lb/ton
Propane Burner Capacity	15.5	MMBtu/hr
Propane Higher Heating Value	90,500	Btu/gal
Propane Consumed Annually	150,000	gal/incinerator

[b] Emission factors from AP-42 Chapter 1.5, Table 1.5-1.

[c] Sulfur content of propane assumed to be equivalent to butane.

Table B-3
Florida Project Greenhouse Gas PTE - HMIWIs Under Normal Operation
Integrated Waste Management Systems, Inc.

Greenhouse Gas Pollutant	Emission Factor [a]	GHG Emissions Mass Basis [b]	Global Warming Potential	GHG Emissions CO_2 Equivalent [c]
	(lb/MMBtu)	(short ton/yr)	N/A	(short ton/yr)
CO_2	192.26	80,000	1	80,000
CH_4	4.81E-04	2.00E-01	21	4.20
N_2O	0.00E+00	0.00E+00	310	0.00
Total GHG Emissions	N/A	80,000	N/A	80,004

Notes:

[a] These emission factors are based on engineering judgement after reviewing the combustion balance.

[b] Emission calculations are based on the following information.

Parameter	Value	Units
HMIW Feed Rate	2,500	lb/hr
HMIW Heat Content	9,500	btu/lb
Operating Time	8,760	hours/yr
Number of Incinerators	4	Units
Conversion Factor	1.00E+06	btu/mmBtu

[c] CO_2e is carbon dioxide equivalent, calculated according to 40 CFR 98 Equation A-1:

$$CO_2e = \sum_{i=1}^{n} GHG_i \times GWP_i$$

where GHG_i = annual mass emissions of greenhouse gas i (metric tons/year)

GWP_i = global warming potential of greenhouse gas i

Table B-4

Florida Project Greenhouse Gas PTE - HMIWIs Firing Propane Under Supplemental Fuel Firing Operation

Integrated Waste Management Systems, Inc.

Greenhouse Gas Pollutant	Emission Factor (a)	GHG Emissions Mass Basis (b)	Global Warming Potential	GHG Emissions CO_2 Equivalent (c)
	($lb/10^3$ gal)	(short ton/yr)	N/A	(short ton/yr)
CO_2	12,500	3,750	1	3,750
CH_4	0.20	0.06	21	1
N_2O	0.90	0.27	310	84
Total GHG Emissions	N/A	3,750	N/A	3,835

Notes:

(a) Emission factor from AP-42 Chapter 1.5-1.

(b) Emission calculations are based on the following information.

Parameter	Value	Units
Number of Incinerators	4	Units
Conversion Factor 1	2,000	lb/ton
Propane Burner Capacity	15.5	MMBtu/hr
Propane Higher Heating Value	90,500	Btu/gal
Propane Consumed Annually	150,000	gal/incinerator/yr

(c) CO_2e is carbon dioxide equivalent, calculated according to 40 CFR 98 Equation A-1:

$$CO_2e = \sum_{i=1}^{n} GHG_i \times GWP_i$$

where GHG_i = annual mass emissions of greenhouse gas i (metric tons/year)

GWP_i = global warming potential of greenhouse gas i

Table B-5
Florida Project Dry Sorbent Silo PTE
Integrated Waste Management Systems, Inc.

Pollutant	Emission[a] Factor (gr/dscf)	Potential to Emit[b] (lb/hr)	Potential to Emit[b] (ton/yr)
PM	0.02	0.34	0.09
PM_{10}	0.02	0.34	0.09
$PM_{2.5}$	0.02	0.34	0.09

[a] Emission factors developed using engineering judgment. Preliminary design includes dicharge of silos inside of the building.

[b] Potential to emit assumes the following:

Parameter	Value	Units
Volumetric Flow rate	1000	scfm
Conversion factor	7000	gr/lb
Operating Time[c]	10	hrs/week
Number of Emission Units	2	Silos

[c] Silo loading time is estimated to be approximately 10 hrs/wk, which equates to 520 hr/yr.

Table B-6
Florida Project Emergency Generator PTE
Integrated Waste Management Systems, Inc.

Pollutant	Emission Factor		Potential to Emit[c], [d]	
	lb/MMBtu [a]	g/kW-hr	(lb/hr)	(ton/yr)
NO_x [b]	2.21E+00	3.42E+00	3.76E+00	9.41E-01
CO [b]	3.72E+00	5.75E+00	6.34E+00	1.58E+00
CO_2	1.10E+02	1.70E+02	1.87E+02	4.68E+01
SO_2	5.88E-04	9.09E-04	1.00E-03	2.50E-04
TOC	3.58E-01	5.53E-01	6.10E-01	1.52E-01
VOC	2.96E-02	4.58E-02	5.04E-02	1.26E-02
PM Condensable	9.91E-03	1.53E-02	1.69E-02	4.22E-03
PM_{10} Filterable	9.50E-03	1.47E-02	1.62E-02	4.05E-03
$PM_{2.5}$ Filterable	9.50E-03	1.47E-02	1.62E-02	4.05E-03

[a] Emission factors from AP-42 Table 3.2-3 for natural gas fired engines.

[b] 90-105% load assumed

[c] No speciated HAPs have been included, as the potential to emit any of these pollutants is negligible.

[d] Potential to emit assumes the following:

Parameter	Value	Units
Generator	670	hp
Operating Time	500	hours/yr
Conversion Factor 1	2,543	Btu/hp-hr
Conversion Factor 2	454	g/lb
Conversion Factor 3	0.746	kW/hp
Conversion Factor 4	1,000,000	Btu/MMBtu
Conversion Factor 5	2,000	lb/ton

Table B-7
Florida Project Emergency Fire Water Pump PTE
Integrated Waste Management Systems, Inc.

Pollutant	Emission Factor		Potential to Emit[c], [d]	
	lb/MMBtu [a]	g/hp-hr	(lb/hr)	(ton/yr)
NO_x [b]	2.21E+00	2.55E+00	5.62E-01	1.40E-01
CO [b]	3.72E+00	4.29E+00	9.46E-01	2.36E-01
CO_2	1.10E+02	1.27E+02	2.80E+01	6.99E+00
SO_2	5.88E-04	6.78E-04	1.49E-04	3.74E-05
TOC	3.58E-01	4.13E-01	9.10E-02	2.28E-02
VOC	2.96E-02	3.41E-02	7.53E-03	1.88E-03
PM Condensable	9.91E-03	1.14E-02	2.52E-03	6.30E-04
PM_{10} Filterable	9.50E-03	1.10E-02	2.42E-03	6.04E-04
$PM_{2.5}$ Filterable	9.50E-03	1.10E-02	2.42E-03	6.04E-04

[a] Emission factors from AP-42 Table 3.2-3 for natural gas fired engines.

[b] 90-105% load assumed

[c] No speciated HAPs have been included, as the potential to emit any of these pollutants is negligible.

[d] Potential to emit assumes the following:

Parameter	Value	Units
Generator	100	hp
Operating Time	500	hours/yr
Conversion Factor 1	2,543	Btu/hp-hr
Conversion Factor 2	454	g/lb
Conversion Factor 4	1,000,000	Btu/MMBtu
Conversion Factor 5	2,000	lb/ton

Table B-8
Florida Project Emergency Generator Regulated Emissions
Integrated Waste Management Systems, Inc.

Pollutant	Emission[a] Factor (g/Kw-hr)	Potential to Emit[b] (lb/hr)	(ton/yr)
NMHC + NO_x	6.400	7.05	1.76
CO	3.500	3.85	0.96
PM	0.200	0.22	0.06

[a] Emission factors developed using EPA Tier 2 standards.
[b] Potential to emit assumes the following:

Parameter	Value	Units
Generator	670	hp
Operating Time	500	hours/yr
Conversion Factor 1	0.746	KW/hp
Conversion Factor 2	454	g/lb
Conversion Factor 3	2,000	lb/ton

Table B-9
Florida Project Emergency Fire Water Pump Regulated Emissions
Integrated Waste Management Systems, Inc.

Pollutant	Emission[a] Factor (g/Kw-hr)	Potential to Emit[b] (lb/hr)	Potential to Emit[b] (ton/yr)
NMHC + NO_x	6.400	1.05	0.26
CO	3.500	0.58	0.14
PM	0.200	0.03	0.01

[a] Emission factors developed using EPA Tier 2 standards.
[b] Potential to emit assumes the following:

Parameter	Value	Units
Generator	100	hp
Operating Time	500	hours/yr
Conversion Factor 1	0.746	KW/hp
Conversion Factor 2	454	g/lb
Conversion Factor 3	2,000	lb/ton

Table B-10
Florida Project Emission Rates
Integrated Waste Management Systems, Inc.

Pollutant	Potential to Emit Emission Rate Calculations - Emission Factors and Control Efficiencies						Allowable Emission Rates				
	AP-42 Uncontrolled Emission Factor [a] [d]	Units	Control Efficiency (%)	Comment	Controlled Emissions (lb/hr)	Controlled Emissions (ton/yr)	Emission Limit	Units	Footnote	Potential to Emit[a] (lb/hr)	Potential to Emit[a] (ton/yr)
PM	4.67	lb/ton	99.99%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	2.33E-03	1.02E-02	0.008	gr/dscf @ 7% O_2	(c)	2.67	11.70
NO_X	3.56	lb/ton	N/A	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. SNCR is identified as an optional add-on control technology and will be employed if IWMS determines during installation and shakedown that additional NO_X control is required	17.80	77.96	140	ppmv @ 7% O_2	(c)	39.06	171.06
SO_2	2.17	lb/ton	90.00%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. IWMS has conservatively relied upon a 90% SO_2 control efficiency based on TriMer test data.	1.09	4.75	8.1	ppmv @ 7% O_2	(c)	3.14	13.77
CO	11.00	ppmv @ 7% O_2	N/A	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. IWMS will control CO through good combustion practices. The potential emissions were calculated based on designing the system to meet the HMIWI emission standards.	1.87	8.18	11	ppmv @ 7% O_2	(c)	1.87	8.18
HCl	5.10	ppmv @ 7% O_2	N/A	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. IWMS will control HCl through the installation of the sodium bicarbonate system and use of the TriMer Fabric Filter System. The potential emissions were calculated based on designing the system to meet HMIWI emission standards.	1.11	4.88	5.1	ppmv @ 7% O_2	(c)	1.11	4.88
Cd	5.48E-03	lb/ton	99.99%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	2.74E-06	1.20E-05	1.30E-01	μg/dscm @ 7% O_2	(c)	1.90E-05	8.31E-05
Hg	1.30	μg/dscm @ 7% O_2	N/A	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. Hg emissions will be controlled by: (1) waste segregation, (2) TriMer fabric filter system, and (3) carbon addition as a contingency control option. The potential emissions were calculated based on designing the system to meet HMIWI emission standards.	1.90E-04	8.31E-04	1.30	μg/dscm @ 7% O_2	(c)	1.90E-04	8.31E-04
Pb	7.28E-02	lb/ton	99.99%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99.99% PM control efficiency based on TriMer test data	3.64E-05	1.59E-04	6.90E-01	μg/dscm @ 7% O_2	(c)	1.01E-04	4.41E-04
Dioxins	2.13E-05	lb/ton	99.00%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99% D/F control efficiency based on TriMer test data	1.07E-06	4.66E-06	9.3	ng/dscm @ 7% O_2	(c) (e)	1.36E-06	5.94E-06
Furans	7.15E-05	lb/ton	99.00%	IWMS is committed to designing/constructing/operating the HMIWI system to meet the HMIWI emission standards. The emission rate calculations rely upon a 99% D/F control efficiency based on TriMer test data	3.58E-06	1.57E-05					

Notes:
[a] Emission calculations are based on the following information.

Parameter	Value	Units
Stack Gas Volumetric Flow Rate	17,520	ACFM @ 7% O_2
Stack Gas Temperature	395	°F
Standard Stack Gas Volumetric Flow Rate	9,737	DSCFM @ 68 °F
Stack Gas Moisture	10.0%	%, by v
HMIW Feed Rate (per HMIWI)	2,500	lb/hr
Operating Time	8,760	hr/yr
Number of Incinerators	4	Units
Conversion Factor 1	60	min/hr
Conversion Factor 2	7,000	gr/lb
Conversion Factor 3	2.2046E-09	lb/μg
Conversion Factor 4	35.31	ft^3/m^3
Molar Volume of Air @ STP	385.35	scf/lb mol
Molecular Weight of NO_X (as NO_2)	46	lb/lb mol
Molecular Weight of SO_2	64	lb/lb mol
Molecular Weight of CO	28	lb/lb mol
Molecular Weight of HCl	36	lb/lb mol

[b] Emission factor represents emission guarantee provided by Tri-Mer Corporation for an UltraCat Filtration (UCF) Air Pollution Control System for total filterable particulate matter.
[c] Emission factor represents emission limit for new units subject to 40 CFR Part 60, Subpart Ec "Standards of Performance for New Stationary Sources: Hospital/Medical/Infectious Waste Incinerators."
[d] Emission factor from AP-42 Chapter 2.3.
[e] Allowable emissions represent the emission concentratin limit for dioxins/furans.

APPENDIX C -
FDEP FORMS NO. 62-210.900(1), EFFECTIVE MARCH 11, 2010

Department of Environmental Protection

Division of Air Resource Management

RECEIVED
MAY 13 2013
DIVISION OF AIR RESOURCE MANAGEMENT

APPLICATION FOR AIR PERMIT - LONG FORM

I. APPLICATION INFORMATION

Air Construction Permit – Use this form to apply for an air construction permit:

- For any required purpose at a facility operating under a federally enforceable state air operation permit (FESOP) or Title V air operation permit;
- For a proposed project subject to prevention of significant deterioration (PSD) review, nonattainment new source review, or maximum achievable control technology (MACT);
- To assume a restriction on the potential emissions of one or more pollutants to escape a requirement such as PSD review, nonattainment new source review, MACT, or Title V; or
- To establish, revise, or renew a plantwide applicability limit (PAL).

Air Operation Permit – Use this form to apply for:

- An initial federally enforceable state air operation permit (FESOP); or
- An initial, revised, or renewal Title V air operation permit.

To ensure accuracy, please see form instructions.

Identification of Facility

1. Facility Owner/Company Name: ***Integrated Waste Management Systems***	
2. Site Name: ***IWMS Suwannee***	
3. Facility Identification Number: ***N/A*** 1210471	
4. Facility Location... Street Address or Other Locator: ***175th Road and 50th Street*** City: ***Live Oak*** County: ***Suwannee*** Zip Code: ***32060***	
5. Relocatable Facility? ☐ Yes ☒ No	6. Existing Title V Permitted Facility? ☐ Yes ☒ No

Application Contact

1. Application Contact Name: ***William V. Straub***
2. Application Contact Mailing Address... Organization/Firm: ***All4 Inc.*** Street Address: ***PO Box 299*** City: ***Kimberton*** State: ***PA*** Zip Code: ***19442***
3. Application Contact Telephone Numbers... Telephone: ***(610) 933-5246*** ext. ***112*** Fax: ***(610) 933-5127***
4. Application Contact E-mail Address: ***wstraub@all4inc.com***

Application Processing Information (DEP Use)

1. Date of Receipt of Application: 5-13-13	3. PSD Number (if applicable):
2. Project Number(s): 1210471-001-AC	4. Siting Number (if applicable):

APPLICATION INFORMATION

Purpose of Application

This application for air permit is being submitted to obtain: (Check one)

Air Construction Permit

[x] Air construction permit.

[ ] Air construction permit to establish, revise, or renew a plantwide applicability limit (PAL).

[ ] Air construction permit to establish, revise, or renew a plantwide applicability limit (PAL), and separate air construction permit to authorize construction or modification of one or more emissions units covered by the PAL.

Air Operation Permit

[ ] Initial Title V air operation permit.

[ ] Title V air operation permit revision.

[ ] Title V air operation permit renewal.

[ ] Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is required.

[ ] Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is not required.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit (Concurrent Processing)

[ ] Air construction permit and Title V permit revision, incorporating the proposed project.

[ ] Air construction permit and Title V permit renewal, incorporating the proposed project.

Note: By checking one of the above two boxes, you, the applicant, are requesting concurrent processing pursuant to Rule 62-213.405, F.A.C. In such case, you must also check the following box:

[ ] I hereby request that the department waive the processing time requirements of the air construction permit to accommodate the processing time frames of the Title V air operation permit.

Application Comment

This application is for an air construction permit for a proposed new facility.

APPLICATION INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Processing Fee
001	*HMIWI #1*	*AC1B*	*$5,000*
002	*HMIWI #2*	*N/A*	*Similar emissions unit fee*
003	*HMIWI #3*	*N/A*	*Similar emissions unit fee*
004	*HMIWI #4*	*N/A*	*Similar emissions unit fee*
005	*Dry sorbent storage silo #1 (sodium bicarbonate)*	*AC1F*	*$250*
006	*Dry sorbent storage silo #2 (sodium bicarbonate)*	*N/A*	*Similar emissions unit fee*
007	*Emergency generator*	*AC1F*	*$250*
008	*Emergency fire pump*	*AC1F*	*$250*

Application Processing Fee

Check one: [X] Attached - Amount: $ 5,750 [ ] Not Applicable

APPLICATION INFORMATION

Owner/Authorized Representative Statement

Complete if applying for an air construction permit or an initial FESOP.

1.	Owner/Authorized Representative Name : ***Major General (Ret) Marvin Jay Barry***
2.	Owner/Authorized Representative Mailing Address... Organization/Firm: ***Integrated Waste Management Systems*** Street Address: ***932 Lark Street*** City: ***Lehighton*** State: ***PA*** Zip Code: ***18235-8903***
3.	Owner/Authorized Representative Telephone Numbers... Telephone: ***(610) 377-6989*** ext. ***N/A*** Fax: ***(610) 377-1339***
4.	Owner/Authorized Representative E-mail Address: ***jaybarry@ptd.net***
5.	Owner/Authorized Representative Statement: *I, the undersigned, am the owner or authorized representative of the corporation, partnership, or other legal entity submitting this air permit application. To the best of my knowledge, the statements made in this application are true, accurate and complete, and any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department.* Signature [signature] Date 5/10/2013

Application Responsible Official Certification

Complete if applying for an initial, revised, or renewal Title V air operation permit or concurrent processing of an air construction permit and revised or renewal Title V air operation permit. If there are multiple responsible officials, the "application responsible official" need not be the "primary responsible official."

1.	Application Responsible Official Name: ***Major General (Retired) Marvin Jay Barry***
2.	Application Responsible Official Qualification (Check one or more of the following options, as applicable): [X] For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C. [ ] For a partnership or sole proprietorship, a general partner or the proprietor, respectively. [ ] For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official. [ ] The designated representative at an Acid Rain source or CAIR source.
3.	Application Responsible Official Mailing Address... Organization/Firm: ***Integrated Waste Management Systems*** Street Address: ***932 Lark Street*** City: ***Lehighton*** State: ***PA*** Zip Code: ***18235-8903***
4.	Application Responsible Official Telephone Numbers... Telephone: ***(610) 377-6989*** ext. ***N/A*** Fax: ***(610) 377-1339***
5.	Application Responsible Official E-mail Address: ***jaybarry@ptd.net***

6. Application Responsible Official Certification:

I, the undersigned, am a responsible official of the Title V source addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other applicable requirements identified in this application to which the Title V source is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application.

Signature   Date 5/10/2013

Professional Engineer Certification

1. Professional Engineer Name: ***William Straub***
   Registration Number: ***59838***
2. Professional Engineer Mailing Address...
   Organization/Firm: *N/A*
   Street Address: ***2393 Kimberton Road, PO Box 299***
   City: ***Kimberton*** State: ***PA*** Zip Code: ***19442***
3. Professional Engineer Telephone Numbers...
   Telephone: ***(610) 933 - 5246 ext. 12*** Fax: ***(610) 933 - 5127***
4. Professional Engineer E-mail Address: ***wstraub@all4inc.com***
5. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

(3) If the purpose of this application is to obtain a Title V air operation permit (check here [ ], if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.

(4) If the purpose of this application is to obtain an air construction permit (check here [X], if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here [ ], if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application. ***See next page for exception to certification.***

(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here , if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

Signature (seal) — STATE OF FLORIDA

Date: 5/7/13

* Attach any exception to certification statement.

APPLICATION INFORMATION

Exception to Certification Statement

As an independent professional engineer and air quality consultant, my responsibilities with this project included the following:

- *review and recommendation of air pollution control strategy;*
- *qualification and quantification of emissions of regulated air pollutants;*
- *identification of permitting approach; and*
- *development and review of the air permit application.*

Integrated Waste Management Systems (IWMS) personnel and emission unit/air pollution control device vendors have lead the design and engineering modifications to the emissions units and associated air pollution control equipment. IWMS staff are not under my direct supervision. I reviewed the data to the extent that it relates to applicable air quality regulatory and permitting requirements and found it to be in conformity with sound engineering principles applicable to the control of emissions of air pollutants.

______________________ 5/7/13

Signature ***Date***

APPLICATION INFORMATION

Professional Engineer Certification

1.	Professional Engineer Name: ***Donald L. Corwin*** Registration Number: ***74522***
2.	Professional Engineer Mailing Address... Organization/Firm: ***N/A*** Street Address: ***418 Pawlings Road*** City: ***Phoenixville*** State: ***PA*** Zip Code: ***19460***
3.	Professional Engineer Telephone Numbers... Telephone: ***(610)935-8493*** Fax:
4.	Professional Engineer E-mail Address: ***donaldcorwin@therm-a-cor.com***
5.	Professional Engineer Statement: *I, the undersigned, hereby certify, except as particularly noted herein*, that:* *(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and* *(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.* *(3) If the purpose of this application is to obtain a Title V air operation permit (check here ☐, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.* *(4) If the purpose of this application is to obtain an air construction permit (check here* **X** *, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here ☐, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.* ***See next page for exception to certification.*** *(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here , if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.* Donald L. Corwin 07 May 13 Signature Date (seal) No. 74522

* Attach any exception to certification statement.

Exception to Certification Statement

As an independent professional engineer and incinerator consultant, my responsibilities with this project included the following:

- *independent review of vendor HMIWI design;*
- *review and recommendation of combustion strategy;*
- *review and recommendation of air pollution control strategy;*
- *qualification and quantification of emissions of regulated air pollutants; and*
- *review of the air permit application.*

Integrated Waste Management Systems (IWMS) personnel and emission unit/air pollution control device vendors have lead the design of the process and associated air pollution control equipment. IWMS staff are not under my direct supervision. I reviewed the data to the extent that it relates to the proper and safe design, configuration, and installation of the HMIWI and associated air pollution control equipment and found it to be in conformity with sound engineering principles applicable to the control of emissions of air pollutants.

Signature 07 May 13 **Date**

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates... Zone *17* East *297067* (km) North *3360154* (km)		2. Facility Latitude/Longitude... Latitude ***30°21'22.565" N*** (DD/MM/SS) Longitude ***-83°06'41.119"W*** (DD/MM/SS)	
3. Governmental Facility Code: ***0***	4. Facility Status Code: ***C***	5. Facility Major Group SIC Code: ***49***	6. Facility SIC(s): ***4953***
7. Facility Comment : ***Facility proposes to install and operate four (4) Hospital, Medical, Infectious Waste Incinerators (HMIWIs), and associated air pollution control devices. Two (2) storage silos, an emergency generator, and an emergency fire pump will also be located at the facility site. The Facility UTM Coordinates and Latitude/Longitude represent the approximate location of the center of the facility.***			

Facility Contact

1. Facility Contact Name: ***Major General (Retired) Marvin Jay Barry***
2. Facility Contact Mailing Address... Organization/Firm: ***Integrated Waste Management Systems*** Street Address: ***932 Lark Street*** City: ***Lehighton*** State: ***PA*** Zip Code: ***18235-8903***
3. Facility Contact Telephone Numbers: Telephone: ***(610) 377-6989*** ext. ***N/A*** Fax: ***(610) 377-1339***
4. Facility Contact E-mail Address: ***jaybarry@ptd.net***

Facility Primary Responsible Official

Complete if an "application responsible official" is identified in Section I that is not the facility "primary responsible official."

1. Facility Primary Responsible Official Name: ***Major General (Retired) Marvin Jay Barry***
2. Facility Primary Responsible Official Mailing Address... Organization/Firm: ***Integrated Waste Management Systems*** Street Address: ***932 Lark Street*** City: ***Lehighton*** State: ***PA*** Zip Code: ***18235-8903***
3. Facility Primary Responsible Official Telephone Numbers... Telephone: ***(610) 377-6989*** ext. ***N/A*** Fax: ***(610) 377-1339***
4. Facility Primary Responsible Official E-mail Address: ***jaybarry@ptd.net***

Facility Regulatory Classifications

Check all that would apply *following* completion of all projects and implementation of all other changes proposed in this application for air permit. Refer to instructions to distinguish between a "major source" and a "synthetic minor source."

1. ☐ Small Business Stationary Source	☐ Unknown
2. ☐ Synthetic Non-Title V Source	
3. ☒ Title V Source	
4. ☐ Major Source of Air Pollutants, Other than Hazardous Air Pollutants (HAPs)	
5. ☐ Synthetic Minor Source of Air Pollutants, Other than HAPs	
6. ☐ Major Source of Hazardous Air Pollutants (HAPs)	
7. ☐ Synthetic Minor Source of HAPs	
8. ☒ One or More Emissions Units Subject to NSPS (40 CFR Part 60)	
9. ☐ One or More Emissions Units Subject to Emission Guidelines (40 CFR Part 60)	
10. ☒ One or More Emissions Units Subject to NESHAP (40 CFR Part 61 or Part 63)	
11. ☐ Title V Source Solely by EPA Designation (40 CFR 70.3(a)(5))	
12. Facility Regulatory Classifications Comment:	

FACILITY INFORMATION

List of Pollutants Emitted by Facility

1. Pollutant Emitted	2. Pollutant Classification	3. Emissions Cap [Y or N]?
$PM/PM_{10}/PM_{2.5}$	***B***	***N***
CO	***B***	***N***
NO_x	***A***	***N***
SO_2	***B***	***N***
Pb	***B***	***N***
H027 (Cd)	***B***	***N***
H114 (Hg)	***B***	***N***
H106 (HCl)	***B***	***N***
VOC	***B***	***N***
NMHC	***B***	***N***
H156/H058 (dioxins/furans)	***B***	***N***

B. EMISSIONS CAPS

Facility-Wide or Multi-Unit Emissions Caps *N/A*

1. Pollutant Subject to Emissions Cap	2. Facility-Wide Cap [Y or N]? (all units)	3. Emissions Unit ID's Under Cap (if not all units)	4. Hourly Cap (lb/hr)	5. Annual Cap (ton/yr)	6. Basis for Emissions Cap

7. Facility-Wide or Multi-Unit Emissions Cap Comment:

N/A- Emissions caps are not being considered.

C. FACILITY ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1.	Facility Plot Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date:__________
2.	Process Flow Diagram(s): (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date:__________
3.	Precautions to Prevent Emissions of Unconfined Particulate Matter: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date: __________

Additional Requirements for Air Construction Permit Applications

1. Area Map Showing Facility Location: [x] Attached, Document ID: ***See attached application narrative*** [ ] Not Applicable (existing permitted facility)
2. Description of Proposed Construction, Modification, or Plantwide Applicability Limit (PAL): [x] Attached, Document ID: ***See attached application narrative***
3. Rule Applicability Analysis: [x] Attached, Document ID: ***See attached application narrative***
4. List of Exempt Emissions Units: [x] Attached, Document ID: ***See attached application narrative***
5. Fugitive Emissions Identification: [x] Attached, Document ID: ***See attached application narrative***
6. Air Quality Analysis (Rule 62-212.400(7), F.A.C.): [ ] Attached, Document ID:__________ [x] Not Applicable
7. Source Impact Analysis (Rule 62-212.400(5), F.A.C.): [ ] Attached, Document ID:__________ [x] Not Applicable
8. Air Quality Impact since 1977 (Rule 62-212.400(4)(e), F.A.C.): [ ] Attached, Document ID:__________ [x] Not Applicable
9. Additional Impact Analyses (Rules 62-212.400(8) and 62-212.500(4)(e), F.A.C.): [ ] Attached, Document ID:__________ [x] Not Applicable
10. Alternative Analysis Requirement (Rule 62-212.500(4)(g), F.A.C.): [ ] Attached, Document ID:__________ [x] Not Applicable

C. FACILITY ADDITIONAL INFORMATION (CONTINUED)

Additional Requirements for FESOP Applications *(N/A)*

1. List of Exempt Emissions Units: ☐ Attached, Document ID:__________ ☐ Not Applicable (no exempt units at facility)

Additional Requirements for Title V Air Operation Permit Applications *(N/A)*

1. List of Insignificant Activities: (Required for initial/renewal applications only) ☐ Attached, Document ID:________________Not Applicable (revision application)
2. Identification of Applicable Requirements: (Required for initial/renewal applications, and for revision applications if this information would be changed as a result of the revision being sought) ☐ Attached, Document ID: ________________ ☐ Not Applicable (revision application with no change in applicable requirements)
3. Compliance Report and Plan: (Required for all initial/revision/renewal applications) ☐ Attached, Document ID:__________ Note: A compliance plan must be submitted for each emissions unit that is not in compliance with all applicable requirements at the time of application and/or at any time during application processing. The department must be notified of any changes in compliance status during application processing.
4. List of Equipment/Activities Regulated under Title VI: (If applicable, required for initial/renewal applications only) ☐ Attached, Document ID:______________________ ☐ Equipment/Activities Onsite but Not Required to be Individually Listed ☐ Not Applicable
5. Verification of Risk Management Plan Submission to EPA: (If applicable, required for initial/renewal applications only) ☐ Attached, Document ID:__________ ☒ Not Applicable
6. Requested Changes to Current Title V Air Operation Permit: ☐ Attached, Document ID:__________ ☒ Not Applicable

C. FACILITY ADDITIONAL INFORMATION (CONTINUED)

Additional Requirements for Facilities Subject to Acid Rain, CAIR, or Hg Budget Program

1. Acid Rain Program Forms:

   Acid Rain Part Application (DEP Form No. 62-210.900(1)(a)):

   ☐ Attached, Document ID:__________ ☐ Previously Submitted, Date:__________

   ☒ Not Applicable (not an Acid Rain source)

   Phase II NO_X Averaging Plan (DEP Form No. 62-210.900(1)(a)1.):

   ☐ Attached, Document ID:__________ ☐ Previously Submitted, Date:__________

   ☒ Not Applicable

   New Unit Exemption (DEP Form No. 62-210.900(1)(a)2.):

   ☐ Attached, Document ID:__________ ☐ Previously Submitted, Date:__________

   ☒ Not Applicable

2. CAIR Part (DEP Form No. 62-210.900(1)(b)):

   ☐ Attached, Document ID:__________ ☐ Previously Submitted, Date:__________

   ☒ Not Applicable (not a CAIR source)

Additional Requirements Comment

N/A- No emission units are proposed that would be subject to the acid rain program or the Clean Air Interstate Rule (CAIR).

III. EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Application - For Title V air operation permitting only, emissions units are classified as regulated, unregulated, or insignificant. If this is an application for an initial, revised or renewal Title V air operation permit, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each regulated and unregulated emissions unit addressed in this application. Some of the subsections comprising the Emissions Unit Information Section of the form are optional for unregulated emissions units. Each such subsection is appropriately marked. Insignificant emissions units are required to be listed at Section II, Subsection C.

Air Construction Permit or FESOP Application - For air construction permitting or federally enforceable state air operation permitting, emissions units are classified as either subject to air permitting or exempt from air permitting. The concept of an "unregulated emissions unit" does not apply. If this is an application for an air construction permit or FESOP, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air permitting are required to be listed at Section II, Subsection C.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit Application – Where this application is used to apply for both an air construction permit and a revised or renewal Title V air operation permit, each emissions unit is classified as either subject to air permitting or exempt from air permitting for air construction permitting purposes, and as regulated, unregulated, or insignificant for Title V air operation permitting purposes. A separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit addressed in this application that is subject to air construction permitting and for each such emissions unit that is a regulated or unregulated unit for purposes of Title V permitting. (An emissions unit may be exempt from air construction permitting but still be classified as an unregulated unit for Title V purposes.) Emissions units classified as insignificant for Title V purposes are required to be listed at Section II, Subsection C.

If submitting the application form in hard copy, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application must be indicated in the space provided at the top of each page.

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

   ☐ The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

   ☐ The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)

   [x] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

   ☐ This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

   ☐ This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in this Section:

HMIWIs – No.1, No. 2, No. 3 and No. 4

3. Emissions Unit Identification Number:

4. Emissions Unit Status Code:	5. Commence Construction Date:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:
C	***TBD***	***TBD***	***49***

8. Federal Program Applicability: (Check all that apply) ***N/A***

   ☐ Acid Rain Unit

   ☐ CAIR Unit

9. Package Unit: ***HMIWI***
   Manufacturer: ***Pennram (or similar)*** Model Number: ***PHCA-2500 (or similar)***

10. Generator Nameplate Rating: ***N/A*** MW

11. Emissions Unit Comment:
The HMIWIs are each equipped with four (4) propane gas fired burners (15.5 MMBtu/hr total capacity). Two (2) propane burners are located in the primary chamber and the other two (2) propane burners are located in the secondary chamber.

Emissions Unit Control Equipment/Method: Control *1* of *4*

1. Control Equipment/Method Description: ***An SNCR system will be used to inject an ammonia reagent to control NO_x. [please note this air pollution control equipment will only be installed if IWMS seeks additional safety margin for NO_X compliance]***
2. Control Device or Method Code: ***-107 (Selective Non-catalytic Reduction for NO_x)***

Emissions Unit Control Equipment/Method: Control *2* of *4*

1. Control Equipment/Method Description: ***Sodium bicarbonate will be added prior to the fabric filter to control mercury, dioxins/furans, and acid gases.***
2. Control Device or Method Code: ***-206 (Dry Sorbent Injection)***

Emissions Unit Control Equipment/Method: Control *3* of *4*

1. Control Equipment/Method Description: ***IWMS will use a fabric filter with a catalyst impregnated structured bag system to remove PM, dioxins/furans, and mercury.***
2. Control Device or Method Code: ***-016 (Fabric Filter- High Temperature [T>250 °F]***

Emissions Unit Control Equipment/Method: Control *4* of *4*

1. Control Equipment/Method Description: ***Carbon will be added prior to the fabric filter to control mercury. [please note this air pollution control equipment will only be installed if IWMS seeks additional safety margin for Hg compliance]***
2. Control Device or Method Code: ***-206 (Dry Sorbent Injection)***

B. EMISSIONS UNIT CAPACITY INFORMATION
(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate: ***N/A***	
2. Maximum Production Rate: ***N/A***	
3. Maximum Heat Input Rate: ***23.75 million Btu/hr***	
4. Maximum Incineration Rate: ***2500*** pounds/hr ***30*** tons/day	
5. Requested Maximum Operating Schedule: ***24*** hours/day ***52*** weeks/year	***7*** days/week ***8760*** hours/year
6. Operating Capacity/Schedule Comment: ***All entries reflect the values for a single HMIWI.***	

C. EMISSION POINT (STACK/VENT) INFORMATION

(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: ***Stack***	2. Emission Point Type Code: ***1***	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking: ***N/A- Emission units do not share a common emission point.***		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:		
5. Discharge Type Code: ***V***	6. Stack Height: ~***70*** feet	7. Exit Diameter: ~***4*** feet
8. Exit Temperature: ~***395*** °F	9. Actual Volumetric Flow Rate: ~***17,520*** acfm	10. Water Vapor: ~***10%***
11. Maximum Dry Standard Flow Rate: ~***10,850*** dscfm	12. Nonstack Emission Point Height: ***N/A*** feet	
13. Facility UTM Coordinates... Zone ***17*** East ***297067*** (km) North ***3360154*** (km)	14. Facility Latitude/Longitude... Latitude (DD/MM/SS): ***30°21'22.565"*** Longitude (DD/MM/SS) :***-83°06'41.119"***	
15. Emission Point Comment: ***Each HMIWI will have a dedicated stack. All four (4) HMIWI stacks will be identical. Each HMIWI is also equipped with an emergency bypass stack that is only opened during operation to prevent "catastrophic events". The Facility UTM Coordinates and Latitude/Longitude represent the approximate location of the center of the facility.***		

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment *1* of 2

1. Segment Description (Process/Fuel Type): ***Hospital Medical Infectious Waste***		
2. Source Classification Code (SCC): ***5-02-005-05***	3. SCC Units: ***Tons***	
4. Maximum Hourly Rate: ***1.25 ton/hr***	5. Maximum Annual Rate: ***10,950 ton/yr***	6. Estimated Annual Activity Factor: ***N/A***
7. Maximum % Sulfur: ***N/A***	8. Maximum % Ash: ***N/A***	9. Million Btu per SCC Unit:
10. Segment Comment: ***The above values reflect the rates for each of the four (4) HMIWIs, not the combined rates of all of the HMIWIs.***		

Segment Description and Rate: Segment *2* of *2*

1. Segment Description (Process/Fuel Type): ***Propane***		
2. Source Classification Code (SCC): ***1-01-006-02***	3. SCC Units: ***gallons***	
4. Maximum Hourly Rate: ***171.27 gal/hr***	5. Maximum Annual Rate: ***N/A***	6. Estimated Annual Activity Factor: ***N/A***
7. Maximum % Sulfur: ***N/A***	8. Maximum % Ash: ***N/A***	9. Million Btu per SCC Unit: ***0.0905 MMBtu/gal***
10. Segment Comment: ***Propane will be used as a startup and stabilization fuel. Emissions from Propane were calculated and presented separately. For establishing permit limits, it is assumed that waste incineration occurs 100% of the time. IWMS requests no additional restrictions beyond the physical capability of the unit for the fuel.***		

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
PM	***-016***	***N/A***	***EL***
PM_{10}	***-016***	***N/A***	***EL***
NO_x	***-107 [optional, if required]***	***N/A***	***EL***
SO_2	***-016***	***N/A***	***EL***
CO	*N/A*	***N/A***	***EL***
H106	***-206***	***N/A***	***EL***
H027	***-016***	***N/A***	***EL***
H114	***-206***	***-016/-206 [optional, if required]***	***EL***
Pb	***-016***	***N/A***	***EL***
D/F	***-206***	***-016***	***EL***

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***PM***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***0.67*** lb/hour ***2.92*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***0.008 gr/dscf @ 7% O_2*** Reference: ***40 CFR 60 Subpart Ec, Table 1B incorporated by reference at F.A.C. 62.204.800(8)(b)8***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: From: ***N/A*** To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years

10. Calculation of Emissions:

See Table B-1 of Appendix B for emission calculations. Note that the emission rates and information on this form are for 1 of 4 HMIWIs.

11. Potential, Fugitive, and Actual Emissions Comment:

N/A

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***PM_{10}/$PM_{2.5}$***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***0.67*** lb/hour ***2.92*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***0.008 gr/dscf @ 7% O_2*** ***Reference: PM_{10} and $PM_{2.5}$ assumed to be equal to PM.***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: From: ***N/A*** To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years
10. Calculation of Emissions: ***See Table B-1 of Appendix B for emission calculations. Note that the emission rates and information on this form are for 1 of 4 HMIWIs.***	
11. Potential, Fugitive, and Actual Emissions Comment: ***N/A***	

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***NO_X***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***10.76*** lb/hour ***42.77*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***140 ppmv @ 7% O_2*** ***Reference: 40 CFR 60 Subpart Ec, Table 1B incorporated by reference at F.A.C. 62.204.800(8)(b)8***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: From: ***N/A*** To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years

10. Calculation of Emissions:

See Table B-1 of Appendix B for emission calculations. Note that the emission rates and information on this form are for 1 of 4 HMIWIs.

11. Potential, Fugitive, and Actual Emissions Comment:

N/A

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***SO_2***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***0.79*** lb/hour ***3.44*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: 8.1 ppmv @ 7% O_2 ***Reference: 40 CFR 60 Subpart Ec, Table 1B incorporated by reference at F.A.C. 62.204.800(8)(b)8***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: From: ***N/A*** To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years

10. Calculation of Emissions:

See Table B-1 of Appendix B for emission calculations. Note that the emission rates and information on this form are for 1 of 4 HMIWIs.

11. Potential, Fugitive, and Actual Emissions Comment:

N/A

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***CO***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***0.47*** lb/hour ***2.05*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***11 ppmv @ 7% O_2*** Reference: ***40 CFR 60 Subpart Ec, Table 1B incorporated by reference at F.A.C. 62.204.800(8)(b)8***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: From: ***N/A*** To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years

10. Calculation of Emissions:

See Table B-1 of Appendix B for emission calculations. Note that the emission rates and information on this form are for 1 of 4 HMIWIs.

11. Potential, Fugitive, and Actual Emissions Comment:

N/A

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***HCl***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***0.28*** lb/hour ***1.22*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***5.1 ppmv @ 7% O_2*** Reference: ***40 CFR 60 Subpart Ec, Table 1B incorporated by reference at F.A.C. 62.204.800(8)(b)8***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: From: ***N/A*** To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years

10. Calculation of Emissions:

See Table B-1 of Appendix B for emission calculations. Note that the emission rates and information on this form are for 1 of 4 HMIWIs.

11. Potential, Fugitive, and Actual Emissions Comment:

N/A

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***Cd***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***4.74E-06*** lb/hour ***2.08E-05*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***0.13 µg/dscm @ 7% O_2*** Reference: ***40 CFR 60 Subpart Ec, Table 1B incorporated by reference at F.A.C. 62.204.800(8)(b)8***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: From: ***N/A*** To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years

10. Calculation of Emissions:

See Table B-1 of Appendix B for emission calculations. Note that the emission rates and information on this form are for 1 of 4 HMIWIs.

11. Potential, Fugitive, and Actual Emissions Comment:

N/A

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***Hg***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***4.76E-05*** lb/hour ***2.08E-04*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***1.30 μg/dscm @ 7% O_2*** ***Reference: 40 CFR 60 Subpart Ec, Table 1B incorporated by reference at F.A.C. 62.204.800(8)(b)8***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: From: ***N/A*** To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years

10. Calculation of Emissions:

See Table B-1 of Appendix B for emission calculations. Note that the emission rates and information on this form are for 1 of 4 HMIWIs.

11. Potential, Fugitive, and Actual Emissions Comment:

N/A

EMISSIONS UNIT INFORMATION **POLLUTANT DETAIL INFORMATION**

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***Pb***	2. Total Percent Efficiency of Control: ***N/A***	
3. Potential Emissions: ***2.52E-05*** lb/hour ***1.10E-04*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No	
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year		
6. Emission Factor: ***0.69 µg/dscm @ 7% O_2*** Reference: ***40 CFR 60 Subpart Ec, Table 1B incorporated by reference at F.A.C. 62.204.800(8)(b)8***	7. Emissions Method Code: ***0***	
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: From: ***N/A*** To:	
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years	
10. Calculation of Emissions: ***See Table B-1 of Appendix B for emission calculations. Note that the emission rates and information on this form are for 1 of 4 HMIWIs.***		
11. Potential, Fugitive, and Actual Emissions Comment: ***N/A***		

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***Dioxins and Furans***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***3.39E-07*** lb/hour ***1.49E-06*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***9.3 ng/dscm @ 7% O_2*** ***Reference: 40 CFR 60 Subpart Ec, Table 1B incorporated by reference at F.A.C. 62.204.800(8)(b)8***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: From: ***N/A*** To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years

10. Calculation of Emissions:

See Table B-1 of Appendix B for emission calculations. Note that the emission rates and information on this form are for 1 of 4 HMIWIs.

11. Potential, Fugitive, and Actual Emissions Comment:

N/A

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions *1* of *9*

1. Basis for Allowable Emissions Code: ***RULE***	2. Future Effective Date of Allowable Emissions: ***Upon Startup***
3. Allowable Emissions and Units: ***0.008 gr/dscf @ 7% O_2***	4. Equivalent Allowable Emissions: ***0.74*** lb/hour ***3.25*** tons/year
5. Method of Compliance: ***Method 5 or 26A testing pursuant to 40 CFR 60.56c.***	
6. Allowable Emissions Comment (Description of Operating Method): ***PM*** ***40 CFR 60 Subpart Ec Table 1B, incorporated by reference at F.A.C. 62.204.800(8)(b)8***	

Allowable Emissions Allowable Emissions *2* of *9*

1. Basis for Allowable Emissions Code: ***RULE***	2. Future Effective Date of Allowable Emissions: ***Upon Startup***
3. Allowable Emissions and Units: ***140 ppmv @ 7% O_2***	4. Equivalent Allowable Emissions: ***10.85*** lb/hour ***47.52*** tons/year
5. Method of Compliance: ***Method 7 testing pursuant to 40 CFR 60.56c.***	
6. Allowable Emissions Comment (Description of Operating Method): ***NO_x*** ***40 CFR Part 60 Subpart Ec Table 1B, incorporated by reference at F.A.C. 62.204.800(8)(b)8***	

Allowable Emissions Allowable Emissions *3* of *9*

1. Basis for Allowable Emissions Code: ***RULE***	2. Future Effective Date of Allowable Emissions: ***Upon Startup***
3. Allowable Emissions and Units: ***8.1 ppmv @ 7% O_2***	4. Equivalent Allowable Emissions: ***0.87*** lb/hour ***3.83*** tons/year
5. Method of Compliance: ***Method 6 testing pursuant to 40 CFR 60.56c.***	
6. Allowable Emissions Comment (Description of Operating Method): ***SO_2*** ***40 CFR Part 60 Subpart Ec Table 1B, incorporated by reference at F.A.C. 62.204.800(8)(b)8***	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 4 of 9

1. Basis for Allowable Emissions Code: ***RULE***	2. Future Effective Date of Allowable Emissions: ***Upon Startup***
3. Allowable Emissions and Units: ***11 ppmv @ 7% O_2***	4. Equivalent Allowable Emissions: ***0.52*** lb/hour ***2.27*** tons/year
5. Method of Compliance: ***Method 10 testing pursuant to 40 CFR 60.56c.***	
6. Allowable Emissions Comment (Description of Operating Method): ***CO*** ***40 CFR Part 60 Subpart Ec Table 1B, incorporated by reference at F.A.C. 62.204.800(8)(b)8***	

Allowable Emissions Allowable Emissions 5 of 9

1. Basis for Allowable Emissions Code: ***RULE***	2. Future Effective Date of Allowable Emissions: ***Upon Startup***
3. Allowable Emissions and Units: ***5.1 ppmv @ 7% O_2***	4. Equivalent Allowable Emissions: ***0.31*** lb/hour ***1.35*** tons/year
5. Method of Compliance: ***Method 26 or 26A testing pursuant to 40 CFR 60.56c.***	
6. Allowable Emissions Comment (Description of Operating Method): ***HCl*** ***40 CFR Part 60 Subpart Ec Table 1B, incorporated by reference at F.A.C. 62.204.800(8)(b)8***	

Allowable Emissions Allowable Emissions 6 of 9

1. Basis for Allowable Emissions Code: ***RULE***	2. Future Effective Date of Allowable Emissions: ***Upon Startup***
3. Allowable Emissions and Units: ***0.13 μg/dscm @ 7% O_2***	4. Equivalent Allowable Emissions: ***5.27E-06*** lb/hour ***2.31E-05*** tons/year
5. Method of Compliance: ***Method 29 testing pursuant to 40CFR 60.56c.***	
6. Allowable Emissions Comment (Description of Operating Method): ***Cd*** ***40 CFR Part 60 Subpart Ec Table 1B, incorporated by reference at F.A.C. 62.204.800(8)(b)8***	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions *7* of *9*

1. Basis for Allowable Emissions Code: ***RULE***	2. Future Effective Date of Allowable Emissions: ***Upon Startup***
3. Allowable Emissions and Units: ***1.30 μg/dscm @ 7% O_2***	4. Equivalent Allowable Emissions: ***5.27E-05*** lb/hour ***2.31E-04*** tons/year
5. Method of Compliance: ***Method 29 testing pursuant to 40 CFR 60.56c.***	
6. Allowable Emissions Comment (Description of Operating Method): ***Hg*** ***40 CFR Part 60 Subpart Ec Table 1B, incorporated by reference at F.A.C. 62.204.800(8)(b)8***	

Allowable Emissions Allowable Emissions *8* of *9*

1. Basis for Allowable Emissions Code: ***RULE***	2. Future Effective Date of Allowable Emissions: ***Upon Startup***
3. Allowable Emissions and Units: ***0.69 μg/dscm @ 7% O_2***	4. Equivalent Allowable Emissions: ***2.80E-05*** lb/hour ***1.22E-04*** tons/year
5. Method of Compliance: ***Method 29 testing pursuant to 40 CFR 60.56c.***	
6. Allowable Emissions Comment (Description of Operating Method): ***Pb*** ***40 CFR Part 60 Subpart Ec Table 1B, incorporated by reference at F.A.C. 62.204.800(8)(b)8***	

Allowable Emissions Allowable Emissions *9* of *9*

1. Basis for Allowable Emissions Code: ***RULE***	2. Future Effective Date of Allowable Emissions: ***Upon Startup***
3. Allowable Emissions and Units: ***9.3 ng/dscm @ 7% O_2***	4. Equivalent Allowable Emissions: ***3.77E-07*** lb/hour ***1.65E-06*** tons/year
5. Method of Compliance: ***Method 23 testing pursuant to 40 CFR 60.56c.***	
6. Allowable Emissions Comment (Description of Operating Method): ***Dioxins and Furans*** ***40 CFR Part 60 Subpart Ec Table 1B, incorporated by reference at F.A.C. 62.204.800(8)(b)8***	

G. VISIBLE EMISSIONS INFORMATION

Complete Subsection G if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation *1* of *2*

1. Visible Emissions Subtype: ***VEO5***	2. Basis for Allowable Opacity: [x] Rule [ ] Other
3. Allowable Opacity: Normal Conditions: ***5*** % Exceptional Conditions: ***15*** % Maximum Period of Excess Opacity Allowed: ***6*** min/hour	
4. Method of Compliance: ***Annual Method 9 testing will be performed on the air pollution exhaust system.***	
5. Visible Emissions Comment: ***FAC 62-296.401(4)(b)1***	

Visible Emissions Limitation: Visible Emissions Limitation *1* of *2*

1. Visible Emissions Subtype: ***VE10***	2. Basis for Allowable Opacity: [x] Rule [ ] Other
3. Allowable Opacity: Normal Conditions: ***10% (6 minute block average)*** Exceptional Conditions: ***N/A*** Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: ***Annual Method 9 testing will be performed on the air pollution exhaust system.***	
5. Visible Emissions Comment: ***40 CFR Part 60.56c***	

H. CONTINUOUS MONITOR INFORMATION

Complete Subsection H if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor 1 of 7

1. Parameter Code: ***Waste Charge Rate***	2. Pollutant(s): ***N/A***
3. CMS Requirement:	[x] Rule [ ] Other
4. Monitor Information... Manufacturer: ***TBD*** Model Number: ***TBD***	Serial Number: ***TBD***
5. Installation Date: ***Upon start-up***	6. Performance Specification Test Date: ***According to rule***
7. Continuous Monitor Comment: ***40 CFR Part 60.57c***	

Continuous Monitoring System: Continuous Monitor 2 of 7

1. Parameter Code: ***Secondary Chamber Temperature***	2. Pollutant(s): ***N/A***
3. CMS Requirement:	[x] Rule [ ] Other
4. Monitor Information... Manufacturer: ***TBD*** Model Number: ***TBD***	Serial Number: ***TBD***
5. Installation Date: ***Upon start-up***	6. Performance Specification Test Date: ***According to rule***
7. Continuous Monitor Comment: ***40 CFR Part 60.57c***	

H. CONTINUOUS MONITOR INFORMATION (CONTINUED)

Continuous Monitoring System: Continuous Monitor 3 of 7

1. Parameter Code: ***Fabric Filter Inlet Temperature***	2. Pollutant(s): ***N/A***
3. CMS Requirement:	[x] Rule [ ] Other
4. Monitor Information... Manufacturer: ***TBD*** Model Number: ***TBD***	Serial Number: ***TBD***
5. Installation Date: ***Upon start-up***	6. Performance Specification Test Date: ***According to rule***
7. Continuous Monitor Comment: ***40 CFR Part 60.57c***	

Continuous Monitoring System: Continuous Monitor 4 of 7

1. Parameter Code: ***Sodium Bicarbonate Feed Rate***	2. Pollutant(s): ***N/A***
3. CMS Requirement:	[x] Rule [ ] Other
4. Monitor Information... Manufacturer: ***TBD*** Model Number: ***TBD***	Serial Number: ***TBD***
5. Installation Date: ***Upon start-up***	6. Performance Specification Test Date: ***According to rule***
7. Continuous Monitor Comment: ***40 CFR Part 60.57c***	

H. CONTINUOUS MONITOR INFORMATION (CONTINUED)

Continuous Monitoring System: Continuous Monitor 5 of 7

1. Parameter Code: ***Bag leak detection system***	2. Pollutant(s): ***N/A***
3. CMS Requirement: [x] Rule [ ] Other	
4. Monitor Information... Manufacturer: ***TBD*** Model Number: ***TBD*** Serial Number: ***TBD***	
5. Installation Date: ***Upon start-up***	6. Performance Specification Test Date: ***According to rule***
7. Continuous Monitor Comment: ***40 CFR Part 60.57c***	

Continuous Monitoring System: Continuous Monitor 6 of 7

1. Parameter Code: ***Carbon Feed Rate***	2. Pollutant(s): ***N/A***
3. CMS Requirement: [x] Rule [ ] Other	
4. Monitor Information... Manufacturer: ***TBD*** Model Number: ***TBD*** Serial Number: ***TBD***	
5. Installation Date: ***Upon start-up***	6. Performance Specification Test Date: ***According to rule***
7. Continuous Monitor Comment: ***40 CFR Part 60.57c – This continuous monitoring system would only be required if the contingency control option was installed.***	

H. CONTINUOUS MONITOR INFORMATION (CONTINUED)

Continuous Monitoring System: Continuous Monitor 7 of 7

1. Parameter Code: ***Flue Gas Temperature***	2. Pollutant(s): ***N/A***
3. CMS Requirement: [x] Rule [ ] Other	
4. Monitor Information... Manufacturer: ***TBD*** Model Number: ***TBD***	Serial Number: ***TBD***
5. Installation Date: ***Upon start-up***	6. Performance Specification Test Date: ***According to rule***
7. Continuous Monitor Comment: ***40 CFR Part 60.57c – IWMS plans to request the removal of this parameter as discussed in Section 7 of the application narrative.***	

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date __________
2. Fuel Analysis or Specification: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date __________
3. Detailed Description of Control Equipment: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date __________
4. Procedures for Startup and Shutdown: (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) [ ] Attached, Document ID: ______ [ ] Previously Submitted, Date ______ [x] Not Applicable (construction application)
5. Operation and Maintenance Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ***N/A- Greenfield site; O and M plan to be developed*** [ ] Attached, Document ID: ______ [ ] Previously Submitted, Date ______ [ ] Not Applicable

6. Compliance Demonstration Reports/Records:

☐ Attached, Document ID: ________

Test Date(s)/Pollutant(s) Tested: ________

☐ Previously Submitted, Date: ______

Test Date(s)/Pollutant(s) Tested: ________

☒ To be Submitted, Date (if known): ________

Test Date(s)/Pollutant(s) Tested: ***Initial performance test results submitted per requirements found in 40 CFR Part 60 Subpart Ec.***

☐ Not Applicable

Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.

7. Other Information Required by Rule or Statute:

☒ Attached, Document ID: ***See attached application narrative*** ☐ Not Applicable

I. EMISSIONS UNIT ADDITIONAL INFORMATION (CONTINUED)

Additional Requirements for Air Construction Permit Applications

1. Control Technology Review and Analysis (Rules 62-212.400(10) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e)): ☐ Attached, Document ID: ________ ☒ Not Applicable	
2. Good Engineering Practice Stack Height Analysis (Rules 62-212.400(4)(d) and 62-212.500(4)(f), F.A.C.): ☐ Attached, Document ID: ________ ☒ Not Applicable	
3. Description of Stack Sampling Facilities: (Required for proposed new stack sampling facilities only) ☒ Attached, Document ID: ***See attached application narrative*** ☐ Not Applicable	

Additional Requirements for Title V Air Operation Permit Applications *(N/A)*

1. Identification of Applicable Requirements: ☐ Attached, Document ID: ________	
2. Compliance Assurance Monitoring: ☐ Attached, Document ID: ________ ☐ Not Applicable	
3. Alternative Methods of Operation: ☐ Attached, Document ID: ________ ☐ Not Applicable	
4. Alternative Modes of Operation (Emissions Trading): ☐ Attached, Document ID: ________ ☐ Not Applicable	

Additional Requirements Comment

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

☐ The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

☐ The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)

[x] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

☐ This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

☐ This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in this Section:
Emergency Propane Powered Fire Water Pump

3. Emissions Unit Identification Number: ***N/A***

4. Emissions Unit Status Code: ***A***	5. Commence Construction Date: ***TBD***	6. Initial Startup Date: ***TBD***	7. Emissions Unit Major Group SIC Code: ***49***

8. Federal Program Applicability: (Check all that apply) ***N/A***

☐ Acid Rain Unit

☐ CAIR Unit

9. Package Unit: ***N/A***
Manufacturer: Model Number:

10. Generator Nameplate Rating: ***N/A*** MW

11. Emissions Unit Comment:

Emissions Unit Control Equipment/Method: Control __ of __ *N/A*

1. Control Equipment/Method Description:
2. Control Device or Method Code:

Emissions Unit Control Equipment/Method: Control __ of __

1. Control Equipment/Method Description:
2. Control Device or Method Code:

Emissions Unit Control Equipment/Method: Control __ of __

1. Control Equipment/Method Description:
2. Control Device or Method Code:

Emissions Unit Control Equipment/Method: Control __ of __

1. Control Equipment/Method Description:
2. Control Device or Method Code:

B. EMISSIONS UNIT CAPACITY INFORMATION
(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate: *N/A*	
2. Maximum Production Rate: *N/A*	
3. Maximum Heat Input Rate: ***100 hp***	
4. Maximum Incineration Rate: *N/A* pounds/hr *N/A* tons/day	
5. Requested Maximum Operating Schedule: *N/A* hours/day *N/A* weeks/year	*N/A* days/week *N/A* hours/year
6. Operating Capacity/Schedule Comment:	

C. EMISSION POINT (STACK/VENT) INFORMATION
(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: *N/A*	2. Emission Point Type Code: *1*	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking: *N/A*		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common: *N/A*		
5. Discharge Type Code: ***TBD***	6. Stack Height: ***TBD*** feet	7. Exit Diameter: ***TBD*** feet
8. Exit Temperature: ***TBD*** °F	9. Actual Volumetric Flow Rate: ***TBD*** acfm	10. Water Vapor: ***TBD*** %
11. Maximum Dry Standard Flow Rate: ***TBD*** dscfm	12. Nonstack Emission Point Height: ***TBD*** feet	
13. Emission Point UTM Coordinates... Zone *17* East ***297067*** (km) North ***3360154*** (km)	14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS): ***30°21'22.565"*** Longitude (DD/MM/SS): ***-83°06'41.119"***	
15. Emission Point Comment: ***The Emission Point UTM Coordinates and Latitude/Longitude represent the approximate location of the center of the facility.***		

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment *1* of *1*

1. Segment Description (Process/Fuel Type): ***Propane***		
2. Source Classification Code (SCC): ***TBD***	3. SCC Units: ***TBD***	
4. Maximum Hourly Rate: ***TBD***	5. Maximum Annual Rate: ***TBD***	6. Estimated Annual Activity Factor: ***N/A***
7. Maximum % Sulfur: ***TBD***	8. Maximum % Ash: ***TBD***	9. Million Btu per SCC Unit: ***TBD***
10. Segment Comment:		

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit ***N/A- Emissions unit is not subject to any emission limitations***

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions *N/A-*
Emissions unit is not subject to any emission limitations

1. Pollutant Emitted:	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? ☐ Yes ☐ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8.a. Baseline Actual Emissions (if required): tons/year	8.b. Baseline 24-month Period: From: To:
9.a. Projected Actual Emissions (if required): tons/year	9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years
10. Calculation of Emissions:	
11. Potential, Fugitive, and Actual Emissions Comment:	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions __ of __ ***N/A- Emissions unit is not subject to any emission limitations.***

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions __ of __

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions __ of __

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

G. VISIBLE EMISSIONS INFORMATION

Complete Subsection G if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation *1* of *1*

1. Visible Emissions Subtype: *VE20*	2. Basis for Allowable Opacity: [x] Rule [ ] Other
3. Allowable Opacity: *20%* Normal Conditions: *20* % Exceptional Conditions: *20* % Maximum Period of Excess Opacity Allowed: *N/A* min/hour	
4. Method of Compliance:	
5. Visible Emissions Comment: *Rule 62-296.320*	

H. CONTINUOUS MONITOR INFORMATION

Complete Subsection H if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor ___ of ___ *N/A*

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	☐ Rule ☐ Other
4. Monitor Information... Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

Continuous Monitoring System: Continuous Monitor ___ of ___

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	☐ Rule ☐ Other
4. Monitor Information... Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date ____________
2. Fuel Analysis or Specification: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date ____________
3. Detailed Description of Control Equipment: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) *N/A* [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date ____________
4. Procedures for Startup and Shutdown: (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) [ ] Attached, Document ID: ________ [ ] Previously Submitted, Date ________ [x] Not Applicable (construction application)
5. Operation and Maintenance Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ***N/A- Greenfield site; O and M plan to be developed*** [ ] Attached, Document ID: ________ [ ] Previously Submitted, Date ________ [ ] Not Applicable

6. Compliance Demonstration Reports/Records: *N/A*

☐ Attached, Document ID: __________

Test Date(s)/Pollutant(s) Tested: ____________________

☐ Previously Submitted, Date: _______

Test Date(s)/Pollutant(s) Tested: ____________________

☐ To be Submitted, Date (if known): __________

Test Date(s)/Pollutant(s) Tested: ____________________

☒ Not Applicable

Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.

7. Other Information Required by Rule or Statute:

☒ Attached, Document ID: ***See attached application narrative*** ☐ Not Applicable

I. EMISSIONS UNIT ADDITIONAL INFORMATION (CONTINUED)

Additional Requirements for Air Construction Permit Applications *N/A*

1. Control Technology Review and Analysis (Rules 62-212.400(10) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e)): ☐ Attached, Document ID: ___________ ☒ Not Applicable	
2. Good Engineering Practice Stack Height Analysis (Rules 62-212.400(4)(d) and 62-212.500(4)(f), F.A.C.): ☐ Attached, Document ID: ___________ ☒ Not Applicable	
3. Description of Stack Sampling Facilities: (Required for proposed new stack sampling facilities only) ☒ Attached, Document ID: ***See attached application narrative*** ☐ Not Applicable	

Additional Requirements for Title V Air Operation Permit Applications ***(N/A)***

1. Identification of Applicable Requirements: ☐ Attached, Document ID: ___________	
2. Compliance Assurance Monitoring: ☐ Attached, Document ID: ___________ ☐ Not Applicable	
3. Alternative Methods of Operation: ☐ Attached, Document ID: ___________ ☐ Not Applicable	
4. Alternative Modes of Operation (Emissions Trading): ☐ Attached, Document ID: ___________ ☐ Not Applicable	

Additional Requirements Comment

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification *(N/A)*

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

☐ The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

☐ The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)

[x] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

☐ This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

☐ This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in this Section:

Emergency Generator

3. Emissions Unit Identification Number: *N/A*

4. Emissions Unit Status Code: *A*	5. Commence Construction Date: ***TBD***	6. Initial Startup Date: ***TBD***	7. Emissions Unit Major Group SIC Code: ***49***

8. Federal Program Applicability: (Check all that apply) *N/A*

☐ Acid Rain Unit

☐ CAIR Unit

9. Package Unit: ***TBD***
Manufacturer: ***TBD*** Model Number: ***TBD***

10. Generator Nameplate Rating: *N/A* MW

11. Emissions Unit Comment:

Emissions Unit Control Equipment/Method: Control __ of __ *N/A*

1. Control Equipment/Method Description:	
2. Control Device or Method Code:	

Emissions Unit Control Equipment/Method: Control __ of __

1. Control Equipment/Method Description:	
2. Control Device or Method Code:	

Emissions Unit Control Equipment/Method: Control __ of __

1. Control Equipment/Method Description:	
2. Control Device or Method Code:	

Emissions Unit Control Equipment/Method: Control __ of __

1. Control Equipment/Method Description:	
2. Control Device or Method Code:	

B. EMISSIONS UNIT CAPACITY INFORMATION
(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate: *N/A*	
2. Maximum Production Rate: *N/A*	
3. Maximum Heat Input Rate: ***670 hp***	
4. Maximum Incineration Rate: *N/A* pounds/hr *N/A* tons/day	
5. Requested Maximum Operating Schedule: *N/A* hours/day *N/A* weeks/year	 *N/A* days/week ***500*** hours/year
6. Operating Capacity/Schedule Comment:	

C. EMISSION POINT (STACK/VENT) INFORMATION

(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: ***TBD***		2. Emission Point Type Code: ***1***
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking: *N/A*		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common: *N/A*		
5. Discharge Type Code: ***TBD***	6. Stack Height: ***TBD*** feet	7. Exit Diameter: ***TBD*** feet
8. Exit Temperature: ***TBD*** °F	9. Actual Volumetric Flow Rate: ***TBD*** acfm	10. Water Vapor: ***TBD*** %
11. Maximum Dry Standard Flow Rate: ***TBD*** dscfm		12. Nonstack Emission Point Height: ***TBD*** feet
13. Emission Point UTM Coordinates... Zone ***17*** East ***297067*** (km) North ***3360154*** (km)		14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS): ***30°21'22.565"*** Longitude (DD/MM/SS): ***-83°06'41.119"***
15. Emission Point Comment: ***The Emission Point UTM Coordinates and Latitude/Longitude represent the approximate location of the center of the facility.***		

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment *1* of *1*

1. Segment Description (Process/Fuel Type): ***Propane***		
2. Source Classification Code (SCC): ***TBD***	3. SCC Units: ***TBD***	
4. Maximum Hourly Rate: ***TBD***	5. Maximum Annual Rate: ***TBD***	6. Estimated Annual Activity Factor: ***TBD***
7. Maximum % Sulfur: ***TBD***	8. Maximum % Ash: ***TBD***	9. Million Btu per SCC Unit: ***TBD***
10. Segment Comment:		

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
$NMHC + NO_x$	*N/A*	*N/A*	***Emissions Limit***
CO	*N/A*	*N/A*	***Emissions Limit***
PM	*N/A*	*N/A*	***Emissions Limit***

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: *NMHC + NO_x*	2. Total Percent Efficiency of Control: *N/A*
3. Potential Emissions: ***7.05*** lb/hour ***1.76*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): *N/A* to tons/year	
6. Emission Factor: ***6.4 g/kW-hr*** Reference: ***40 CFR 60.4205(b), 40 CFR 60.4202(a)(2), 40 CFR 89.112(a)***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): *N/A* tons/year	8.b. Baseline 24-month Period: *N/A* From: To:
9.a. Projected Actual Emissions (if required): *N/A* tons/year	9.b. Projected Monitoring Period: *N/A* ☐ 5 years ☐ 10 years
10. Calculation of Emissions: ***See attached Appendix B***	
11. Potential, Fugitive, and Actual Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***CO***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***3.85*** lb/hour ***0.96*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***3.5 g/kW-hr*** Reference: ***40 CFR 60.4205(b), 40 CFR 60.4202(a)(2), 40 CFR 89.112(a)***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: ***N/A*** From: To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years
10. Calculation of Emissions: ***See attached Appendix B***	
11. Potential, Fugitive, and Actual Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***PM***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***0.22*** lb/hour ***0.06*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***0.2 g/kW-hr*** Reference: ***40 CFR 60.4205(b), 40 CFR 60.4202(a)(2), 40 CFR 89.112(a)***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: ***N/A*** From: To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years
10. Calculation of Emissions: ***See attached Appendix B***	
11. Potential, Fugitive, and Actual Emissions Comment:	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable *NMHC + NO_x* Emissions *1* of *3*

1. Basis for Allowable Emissions Code: ***40 CFR 60.4205(b), 40 CFR 60.4202(a)(2), 40 CFR 89.112(a)***	2. Future Effective Date of Allowable Emissions: ***N/A***
3. Allowable Emissions and Units: ***6.4 g/kW-hr***	4. Equivalent Allowable Emissions: ***7.05*** lb/hour ***1.76*** tons/year
5. Method of Compliance: ***Manufacturer limit.***	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable *CO* Emissions *2* of *3*

1. Basis for Allowable Emissions Code: ***40 CFR 60.4205(b), 40 CFR 60.4202(a)(2), 40 CFR 89.112(a)***	2. Future Effective Date of Allowable Emissions: ***N/A***
3. Allowable Emissions and Units: ***3.5 g/kW-hr***	4. Equivalent Allowable Emissions: ***4.*** lb/hour tons/year
5. Method of Compliance: ***Manufacturer limit.***	
6. Allowable Emissions Comment (Description of Operating Method):	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable *PM* Emissions *3* of *3*

1. Basis for Allowable Emissions Code: ***40 CFR 60.4205(b), 40 CFR 60.4202(a)(2), 40 CFR 89.112(a)***	2. Future Effective Date of Allowable Emissions: ***N/A***
3. Allowable Emissions and Units: ***0.2 g/kW-hr***	4. Equivalent Allowable Emissions: ***0.22*** lb/hour ***0.06*** tons/year
5. Method of Compliance: ***Manufacturer limit.***	
6. Allowable Emissions Comment (Description of Operating Method):	

G. VISIBLE EMISSIONS INFORMATION

Complete Subsection G if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation *1* of *1*

1. Visible Emissions Subtype: *VE20/VE15/VE50*	2. Basis for Allowable Opacity: [x] Rule [ ] Other
3. Allowable Opacity: ***See below*** Normal Conditions: % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: *N/A*	
5. Visible Emissions Comment: ***Based upon the following references:*** • ***40 CFR 60.4205(b)*** • ***40 CFR 60.4202(a)(2)*** • ***40 CFR 89.112(a)*** ***Exhaust opacity for the compression-ignition emergency generator must not exceed:*** ***(1) 20 percent during the acceleration mode;*** ***(2) 15 percent during the lugging mode; and*** ***(3) 50 percent during the peaks in either the acceleration or lugging modes.***	

H. CONTINUOUS MONITOR INFORMATION

Complete Subsection H if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor ___ of ___ *N/A*

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	☐ Rule ☐ Other
4. Monitor Information... Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

Continuous Monitoring System: Continuous Monitor ___ of ___

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	☐ Rule ☐ Other
4. Monitor Information... Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
[x] Attached, Document ID: ________ [ ] Previously Submitted, Date __________

2. Fuel Analysis or Specification: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
[x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date ____________________

3. Detailed Description of Control Equipment: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
[x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date ____________________

4. Procedures for Startup and Shutdown: (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
[ ] Attached, Document ID: _________ [ ] Previously Submitted, Date __________
[x] Not Applicable (construction application)

5. Operation and Maintenance Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
N/A- Greenfield site; O and M plan to be developed
[ ] Attached, Document ID: _________ [ ] Previously Submitted, Date __________
[ ] Not Applicable

6. Compliance Demonstration Reports/Records: ***N/A***
[ ] Attached, Document ID: _________
Test Date(s)/Pollutant(s) Tested: ______________________________
[ ] Previously Submitted, Date: _______
Test Date(s)/Pollutant(s) Tested: ______________________________
[ ] To be Submitted, Date (if known):__________
Test Date(s)/Pollutant(s) Tested:______________________________
[x] Not Applicable
Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.

7. Other Information Required by Rule or Statute:
[x] Attached, Document ID: ***See attached application narrative*** [ ] Not Applicable

I. EMISSIONS UNIT ADDITIONAL INFORMATION (CONTINUED)

Additional Requirements for Air Construction Permit Applications

1. Control Technology Review and Analysis (Rules 62-212.400(10) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e)): ☐ Attached, Document ID: ______ ☒ Not Applicable	
2. Good Engineering Practice Stack Height Analysis (Rules 62-212.400(4)(d) and 62-212.500(4)(f), F.A.C.): ☐ Attached, Document ID: ______ ☒ Not Applicable	
3. Description of Stack Sampling Facilities: (Required for proposed new stack sampling facilities only) ☒ Attached, Document ID: ***See attached application narrative*** ☐ Not Applicable	

Additional Requirements for Title V Air Operation Permit Applications *(N/A)*

1. Identification of Applicable Requirements: ☐ Attached, Document ID: ______	
2. Compliance Assurance Monitoring: ☐ Attached, Document ID: ______ ☐ Not Applicable	
3. Alternative Methods of Operation: ☐ Attached, Document ID: ______ ☐ Not Applicable	
4. Alternative Modes of Operation (Emissions Trading): ☐ Attached, Document ID: ______ ☐ Not Applicable	

Additional Requirements Comment

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification *(N/A)*

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

   ☐ The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

   ☐ The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)

   [x] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

   ☐ This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

   ☐ This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in this Section:

Dry Sorbent Storage Silos No. 1 and No. 2

3. Emissions Unit Identification Number: *N/A*

4. Emissions Unit Status Code: *A*	5. Commence Construction Date: ***TBD***	6. Initial Startup Date: ***TBD***	7. Emissions Unit Major Group SIC Code: ***49***

8. Federal Program Applicability: (Check all that apply) *N/A*

   ☐ Acid Rain Unit

   ☐ CAIR Unit

9. Package Unit: ***TBD***
   Manufacturer: ***TBD*** Model Number: ***TBD***

10. Generator Nameplate Rating: *N/A* MW

11. Emissions Unit Comment:
All storage silos are assumed to be identical.

Emissions Unit Control Equipment/Method: Control _1_ of _1_

1. Control Equipment/Method Description: ***Bag filter used for controlling emissions during product loading. [preliminary design has the silo discharge inside of the building.]***
2. Control Device or Method Code: ***-018 (Fabric Filter- Low Temperature [T<180 °F]***

Emissions Unit Control Equipment/Method: Control __ of __

1. Control Equipment/Method Description:
2. Control Device or Method Code:

Emissions Unit Control Equipment/Method: Control __ of __

1. Control Equipment/Method Description:
2. Control Device or Method Code:

Emissions Unit Control Equipment/Method: Control __ of __

1. Control Equipment/Method Description:
2. Control Device or Method Code:

B. EMISSIONS UNIT CAPACITY INFORMATION
(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate: *N/A*	
2. Maximum Production Rate: *N/A*	
3. Maximum Heat Input Rate: *N/A*	
4. Maximum Incineration Rate: *N/A* pounds/hr *N/A* tons/day	
5. Requested Maximum Operating Schedule: *N/A* hours/day *N/A* weeks/year	 *N/A* days/week ***55*** hours/year
6. Operating Capacity/Schedule Comment: ***All entries reflect the values for a single silo.***	

C. EMISSION POINT (STACK/VENT) INFORMATION
(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: ***TBD***	2. Emission Point Type Code: ***1***
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking: ***N/A***	
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common: ***N/A***	

5. Discharge Type Code: ***TBD***	6. Stack Height: ***TBD*** feet	7. Exit Diameter: ***TBD*** feet
8. Exit Temperature: ***TBD*** °F	9. Actual Volumetric Flow Rate: ***TBD*** acfm	10. Water Vapor: ***TBD*** %

11. Maximum Dry Standard Flow Rate: 500 dscfm	12. Nonstack Emission Point Height: ***TBD*** feet
13. Emission Point UTM Coordinates... Zone ***17*** East ***297067*** (km) North ***3360154*** (km)	14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS): ***30°21'22.565"*** Longitude (DD/MM/SS): ***-83°06'41.119"***
15. Emission Point Comment: ***All entries reflect values for a single silo. The Emission Point UTM Coordinates and Latitude/Longitude represent the approximate location of the center of the facility. Preliminary design is for the silo to discharge into the building.***	

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment __ of __ *N/A*

1. Segment Description (Process/Fuel Type):		
2. Source Classification Code (SCC):	3. SCC Units:	
4. Maximum Hourly Rate:	5. Maximum Annual Rate:	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment:		

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
PM	*N/A*	*N/A*	***Emissions Limit***
PM_{10}	*N/A*	*N/A*	***Emissions Limit***

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

<u>Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions</u>

1. Pollutant Emitted: ***PM***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***0.86*** lb/hour ***0.22*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***0.1 gr/dscf*** Reference: ***Engineering Judgment***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: ***N/A*** From: To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years

10. Calculation of Emissions:

See attached Appendix B. Emissions during silo loading only. Preliminary design is for the silo to discharge into the building.

11. Potential, Fugitive, and Actual Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: ***PM_{10}***	2. Total Percent Efficiency of Control: ***N/A***
3. Potential Emissions: ***0.86*** lb/hour ***0.22*** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): ***N/A*** to tons/year	
6. Emission Factor: ***0.1 gr/dscf*** Reference: ***Engineering Judgment***	7. Emissions Method Code: ***0***
8.a. Baseline Actual Emissions (if required): ***N/A*** tons/year	8.b. Baseline 24-month Period: ***N/A*** From: To:
9.a. Projected Actual Emissions (if required): ***N/A*** tons/year	9.b. Projected Monitoring Period: ***N/A*** ☐ 5 years ☐ 10 years
10. Calculation of Emissions: ***See attached Appendix B. Emissions during silo loading only. Preliminary design is for the silo to discharge into the building.***	
11. Potential, Fugitive, and Actual Emissions Comment:	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable ***PM*** Emissions ***1*** of ***2***

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions: ***N/A***
3. Allowable Emissions and Units: ***0.1 gr/dscf***	4. Equivalent Allowable Emissions: ***0.86*** lb/hour ***0.22*** tons/year
5. Method of Compliance: ***Manufacturer limit.***	
6. Allowable Emissions Comment (Description of Operating Method): ***Emissions during silo loading only. Preliminary design is for the silo to discharge into the building.***	

Allowable Emissions Allowable ***PM*** Emissions ***2*** of ***2***

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions: ***N/A***
3. Allowable Emissions and Units: ***0.1 gr/dscf***	4. Equivalent Allowable Emissions: ***0.86*** lb/hour ***0.22*** tons/year
5. Method of Compliance: ***Manufacturer limit.***	
6. Allowable Emissions Comment (Description of Operating Method): ***Emissions during silo loading only. Preliminary design is for the silo to discharge into the building.***	

G. VISIBLE EMISSIONS INFORMATION

Complete Subsection G if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation *1* of *1*

1. Visible Emissions Subtype: *VE20/VE15/VE50*	2. Basis for Allowable Opacity: [x] Rule [ ] Other
3. Allowable Opacity: ***See below*** Normal Conditions: % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: *N/A*	
5. Visible Emissions Comment: ***Emissions during silo loading only. Preliminary design is for the silo to discharge into the building.***	

H. CONTINUOUS MONITOR INFORMATION

Complete Subsection H if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor ___ of ___ *N/A*

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement: ☐ Rule ☐ Other	
4. Monitor Information... Manufacturer: Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

Continuous Monitoring System: Continuous Monitor ___ of ___

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement: ☐ Rule ☐ Other	
4. Monitor Information... Manufacturer: Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   [x] Attached, Document ID: ________ [ ] Previously Submitted, Date __________

2. Fuel Analysis or Specification: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date ____________________

3. Detailed Description of Control Equipment: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   [x] Attached, Document ID: ***See attached application narrative*** [ ] Previously Submitted, Date ____________________

4. Procedures for Startup and Shutdown: (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   [ ] Attached, Document ID: _________ [ ] Previously Submitted, Date __________
   [x] Not Applicable (construction application)

5. Operation and Maintenance Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   N/A- Greenfield site; O and M plan to be developed
   [ ] Attached, Document ID: _________ [ ] Previously Submitted, Date __________
   [ ] Not Applicable

6. Compliance Demonstration Reports/Records: ***N/A*** ☐ Attached, Document ID: ______ Test Date(s)/Pollutant(s) Tested: ______ ☐ Previously Submitted, Date: ______ Test Date(s)/Pollutant(s) Tested: ______ ☐ To be Submitted, Date (if known): ______ Test Date(s)/Pollutant(s) Tested: ______ ☒ Not Applicable Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.
7. Other Information Required by Rule or Statute: ☒ Attached, Document ID: ***See attached application narrative*** ☐ Not Applicable

I. EMISSIONS UNIT ADDITIONAL INFORMATION (CONTINUED)

Additional Requirements for Air Construction Permit Applications

1.	Control Technology Review and Analysis (Rules 62-212.400(10) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e)): ☐ Attached, Document ID: ________ ☒ Not Applicable
2.	Good Engineering Practice Stack Height Analysis (Rules 62-212.400(4)(d) and 62-212.500(4)(f), F.A.C.): ☐ Attached, Document ID: ________ ☒ Not Applicable
3.	Description of Stack Sampling Facilities: (Required for proposed new stack sampling facilities only) ☒ Attached, Document ID: ***See attached application narrative*** ☐ Not Applicable

Additional Requirements for Title V Air Operation Permit Applications *(N/A)*

1.	Identification of Applicable Requirements: ☐ Attached, Document ID: ________
2.	Compliance Assurance Monitoring: ☐ Attached, Document ID: ________ ☐ Not Applicable
3.	Alternative Methods of Operation: ☐ Attached, Document ID: ________ ☐ Not Applicable
4.	Alternative Modes of Operation (Emissions Trading): ☐ Attached, Document ID: ________ ☐ Not Applicable

Additional Requirements Comment

APPENDIX D -
PARTICULATE MATTER CONTROL PLAN

INTEGRATED WASTE MANAGEMENT SYSTEMS, INC.

PARTICULATE MATTER CONTROL PLAN VERSION 1.0

Submitted By:

INTEGRATED WASTE MANAGEMENT SYSTEMS, INC.
932 Lark Street
Lehighton, PA 18235-8903

Submitted To:

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION NORTHEAST DISTRICT OFFICE
7825 Baymeadows Way
Suite B-200
Jacksonville, FL 32256

Prepared By:

ALL4 INC.
2393 Kimberton Road
PO Box 299
Kimberton, PA 19442-0299

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION TALLAHASSEE OFFICE
2600 Blair Stone Road
MS 5500
Tallahassee, Florida 32399-2400

Submitted: May 2013
Version 1.0

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Section..Page Number

1. INTRODUCTION

Integrated Waste Management Systems, Inc. (IWMS) has prepared this document including the procedures and systems detailed herein for the Suwannee facility in order to satisfy specific requirements contained in Florida Administrative Code in Rule 62-296.320(4), "Particulate Matter Control Plan". Under 62-296.320(4), any person owning or operating sources of particulate matter, including storage, hauling, or handling operations shall submit and maintain a plan to control particulate matter to the Florida Department of Environmental Protection (FDEP). The intent is to address particulate matter control strategies for sources of particulate matter. This document is the Suwannee facility's Particulate Matter Control Plan. The facility will adhere to the procedures and systems detailed in this Plan, and the Plan will be routinely updated consistent with substantive changes in facility equipment and practices.

2. FACILITY OPERATIONS

The facility will be under the jurisdiction of the following State and Federal agencies:

Florida Department of Environmental
Protection (FDEP)
Northeast District Office
7825 Baymeadows Way
Suite B-200
Jacksonville, FL 32256

Florida Department of Environmental
Protection (FDEP)
2600 Blair Stone Road
MS 5500
Tallahassee, Florida 32399-2400

U.S. EPA Region 4
61 Forsyth Street, SW
Atlanta, GA 30303-8960

The IWMS Suwannee facility will accept biohazardous waste for incineration in four (4) dual-chamber incinerators. The incinerators will be permitted to charge 2,500 pounds per hour and fire propane gas as a supplemental fuel.

The facility will consist of four (4) continuous biological waste incinerators Model PHCA-2500, manufactured by Pennram (or equivalent). The incinerators will be equipped with temperature controls located at the exit of the primary and secondary chamber and have an afterburner in the secondary chamber and a separate dry scrubbing system which includes a quench chamber, sodium bicarbonate injection, and a baghouse to control emissions. The baghouse collection system uses a Tri-Mer Corporation system design. IWMS has also identified two contingency control systems: selective non-catalytic reduction (SNCR) for NO_X control and carbon injection for mercury (Hg) control. These contingency control systems will be utilized, if necessary, to comply with the HMIWI emission limits.

The facility also will also include up to four (4) dry sorbent reagent storage silos equipped with bag filters used during pneumatic loading, emergency generator, and an emergency fire water pump.

In addition to the air pollution control system, a data monitoring and acquisition system has been installed to monitor key process parameters. These process parameters required to be monitored are listed in 40 CFR Part 60, Subpart Ec.

3. PARTICULATE MATTER SOURCES AND CONTROL STRATEGIES

IWMS's Suwannee facility has been designed to minimize the sources of particulate matter. In addition, IWMS will take all reasonable measures to minimize the potential of particulate. The potential particulate matter sources at the facility include:

- Parking lot and access roadway
- Bottom Ash System
- Fly Ash System
- Dry Sorbent Silo Systems

Provided below is a summary of the particulate matter sources and their respective control strategies.

3.1 PARKING LOT AND ACCESS ROADWAY

The parking lot and the access roadway will be the primary potential source of particulate matter at the facility. Particulate matter may be generated on-site or carried on-site with the delivery trucks. IWMS employees will utilize the following preventive and mitigative procedures to minimize the potential for particulate matter generation from the parking lot and access roadway:

- Daily rountine rounds that include a survey of the parking lot and access roadway looking for a buildup of dust, debris, and/or trash that could become airborne.
- Periodic sweeping and/or vacuuming, as needed, to minimize the buildup of dust, debris, sand, crushed slag, and/or trash.
- Loading and off-loading of vehicles in an enclosed processing area.

3.2 BOTTOM ASH SYSTEM

The bottom ash system will be a potential source of particulate matter at the facility. Ash from the primary chamber will drop into a pit where it will be quenched and loaded into a roll-off. The ash will be periodically tested and sent to a landfill. The ash will be completely wetted, so there is no chance for particulate matter generation; however, IWMS employees will utilize the following preventive and mitigative procedures to minimize the potential for particulate matter generation from the bottom ash system:

- Daily routine rounds that include a survey of the ash pit, quench system, and roll-off storage for proper operation and to ensure that there are no particulate matter emissions that could escape the fully enclosed processing area.
- Periodic sweeping of the processing area, as needed, to minimize the buildup of ash, dust, debris, and/or trash.

- Standard operating procedures that ensure that the processing area remains fully enclosed during normal operation.

3.3 FLY ASH SYSTEM

The fly ash system will be a potential source of particulate matter at the facility. Ash from the baghouse will drop into a fully enclosed solidification system, where it is stored. The ash will be sent to an approved landfill. The chance for particulate matter generation is minimal; however, IWMS employees utilize the following preventive and mitigative procedures to minimize the potential for particulate matter generation from the fly ash system:

- Daily routine rounds that include a survey of ash collection system for proper connection and to ensure that there are no particulate matter emissions that could escape the fully enclosed processing area.
- Periodic sweeping of the processing area, as needed, to minimize the buildup of ash, dust, debris, and/or trash.
- Standard operating procedures that ensure that the processing area remains fully enclosed during normal operation.

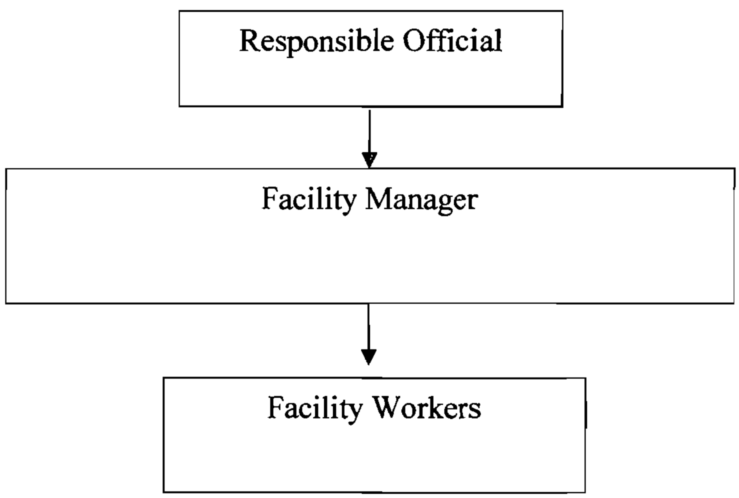
3.4 DRY SORBENT SILO SYSTEMS

The dry sorbent silo systems will be a potential source of particulate matter at the facility. They will be pneumatic processes, so the chance for particulate matter generation is minimal; however, IWMS employees will utilize the following preventive and mitigative procedures to minimize the potential for particulate matter generation from the hydrated lime silo system:

- Pre-inspection of the pneumatic loading system(s) prior to unloading to ensure that all connections and valves are secure.
- Routine inspection during pneumatic loading of the silo(s) that includes a survey of the connections of the pneumatic system(s) and the bag filter(s).

4. RESPONSIBLE PARTIES

Overall responsibility for the Particulate Matter Control Plan lies with the Suwannee Facility Responsible Official (designated signee). The Suwannee Facility has identified one coordinator who has been charged by the owner with overseeing all aspects of the facility's Particulate Matter Control Plan requirements: the Facility Manager. The underlying responsibilities for implementing the Plan, however, lie within the facility workers. Identified personnel are charged with implementing the Plan, documenting the required information, updating the Plan as required, and developing the appropriate reports. The following organization chart specifies the responsible parties at the Suwannee Facility who are charged with the designated related activities:



Roles and Responsibilities

Responsible Party	Responsibility
Responsible Official	Ultimate Particulate Matter Control Plan Authority.
Facility Manager	Coordination of all particulate matter control activities, responsible for recordkeeping and reporting, and modifying the Plan as necessary. Overview and oversight of Plan.
Facility Workers	Implement the Plan, complete all documentation, maintain records/update data as necessary, communicate/notify Facility Manager of all particulate matter events, changes to equipment, and events not addressed in the Plan.

APPENDIX E-1
ULTRACAT CATALYST FILTER (TRI-MER)

ULTRACAT

HOT GAS FILTRATION | BOILER **MACT** SOLUTION

UltraCat Catalyst Filters Control PM, SO_2, HCl, NO_X & Dioxins

High NO_X Control Starting at 350°F

UltraCat Meets Boiler MACT, Glass Furnace Requirements

UltraCat catalyst filters are composed of fibrous ceramic materials mixed with nanobits of proprietary catalyst. This new generation of light weight, ductile ceramic filter is very efficient in removing NO_X and capturing particulate, including submicron PM, to extremely low levels.

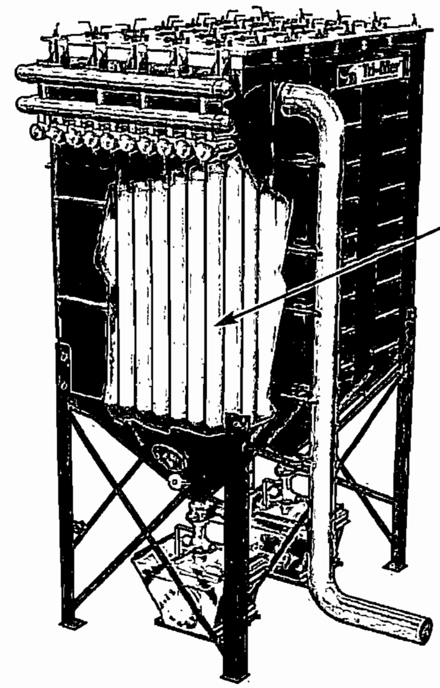
Particulate Control

UltraCat filters typically capture particulate to levels less than 0.001 grains/dscf (2.0 mg/Nm^3). ***For Boiler MACT compliance, levels of less than 0.0011 lbs/MMBtu are guaranteed.*** The unique structure of the filters keeps the collected particles on the surface. On-line cleaning with reverse pulses of air is effective, pressure drop build up is minimal, and the embedded NO_X catalyst is protected.

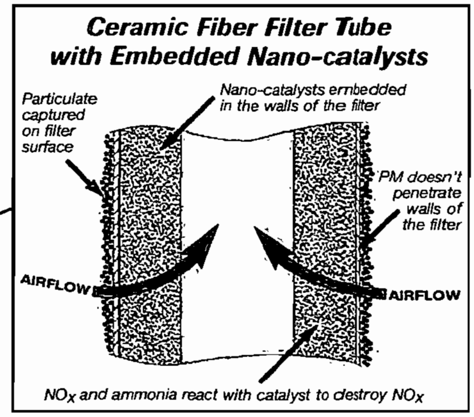
NO_X and Dioxin Control

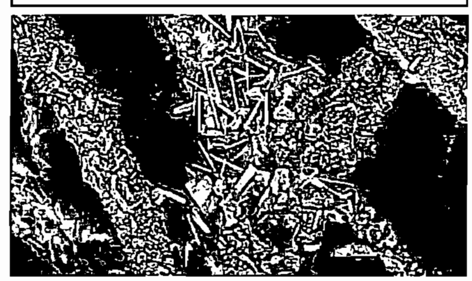
The UltraCat filter tubes have nanobits of proprietary catalyst embedded throughout the filter walls, which are about 3/4" thick *(see illustration opposite)*. The UltraCat can achieve excellent NO_X removal at temperatures of 350°F and higher. **Operating range is approximately 350°F to 700°F.** Urea/ammonia is injected upstream of the filters, reacting with NO_X at the catalyst to form harmless nitrogen gas and water vapor, which then exits the system as gases. The proprietary catalyst is highly resistant to sulfur poisoning and is protected from particulate contamination because it is embedded inside the filter walls. Typical **NO_X results – up to 95% removal.**

UltraCat is also very efficient at destroying dioxins, typically at 97 - 99%.

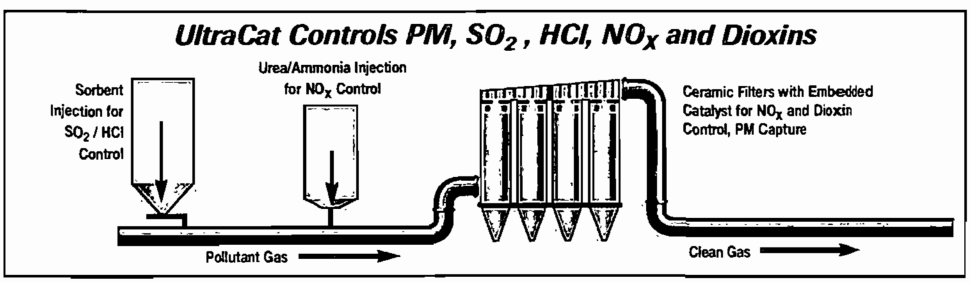


Ceramic filter configuration typical of the 400+ filter applications worldwide.





Micrograph of nano-catalysts embedded in ceramic-coated fibers.



CO in the Boiler MACT

The proposed Boiler MACT regulates production of CO. If CO is managed by combustion conditions, then NO_X production increases. The best strategy for Boiler MACT compliance is to control the CO in the boiler and allow the UltraCat to remove the NO_X in the flue gas.

SO_2, HCl, Acid Gas Control

The UltraCat system can incorporate dry sorbent injection of sodium bicarbonate, trona, or lime for efficient dry scrubbing of SO_2, HCl, and other acid gases. **Typical SO_2 and HCl results show 90 - 98% removal.**

Mercury Control

The strategy for mercury control depends on the constituents in the flue gas and is analyzed on an individual project basis. Levels of mercury control can be achieved through trona injection, activated carbon of various formulations, and other approaches compatible with the UltraCat filter system.

UltraCat is the Low Cost Solution.

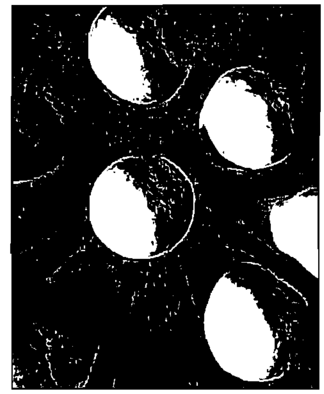
®Tri-Mer® CORPORATION

www.tri-mer.com

ULTRACAT

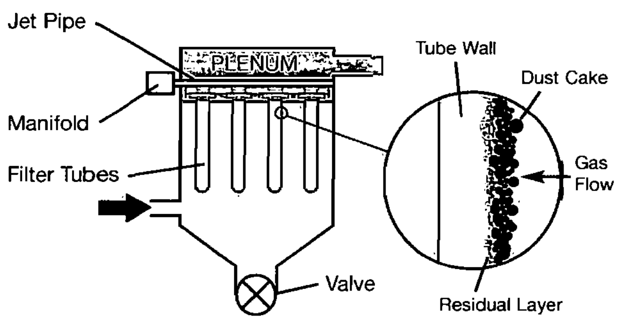
HOT GAS FILTRATION BOILER **MACT** SOLUTION

Operation and Maintenance

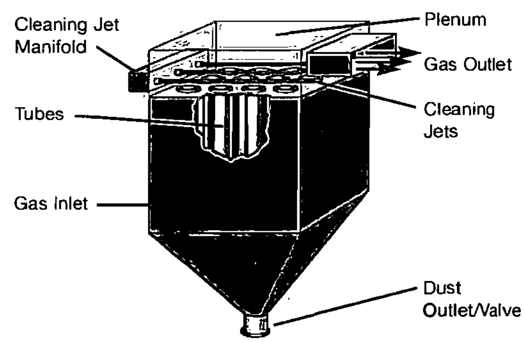


Tri-Mer's UltraCat Hot Gas Filtration System uses a baghouse configuration with a reverse pulse-jet cleaning action. The filters are back-flushed with air, inert gas, syngas, or other appropriate gases. The design has been engineered for easy filter installation and maintenance. Filter tubes are manufactured in various sizes, the largest of which is ten feet long and six inches in diameter, including an integral mounting flange. Filter life averages 5 to 10 years on most applications.

Initial cost is lower than competing systems, with much better performance and flexibility. Pressure drop is 6 to 8 inches w.g. – lower than the total energy usage of multi-step systems, ESP with multiple fields, or single stage ESP with hopper heaters.



Reverse pulse-jet cleaning mechanism for the filter tubes. Filter tube wall approximately 3/4" thick. NO_X control option includes catalyst embedded in tube wall.



Filter element housing module of the Tri-Mer UltraCat Filter System.

UltraCat is the Low Cost Solution for Many Applications

Primary Applications

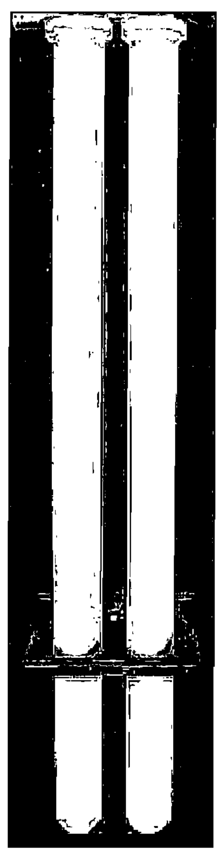
- ***Boiler MACT** compliance for coal, biomass, wood*
- *Glass furnaces*
- *Waste incineration*
- *Waste pyrolysis*
- *Metal smelting, mineral processing*
- *Chemical production*
- *Many specialized high temperature applications*

AIR POLLUTION CONTROL

- *Cement production*
- *Medical waste*
- *Soil cleaning*
- *Foundry processes*
- *Fluidized beds*
- *Energy production*
- *Fire testing*

PRODUCT COLLECTION/ RECOVERY

- *Titanium dioxide production*
- *Fumed silica production*
- *Carbon black production*
- *Catalyst manufacturing*
- *Platinum smelting*
- *Metal powder production*
- *Activated carbon production*



Tri-Mer Corporation, a technology leader in air pollution control, provides turnkey engineering, manufacturing, installation, and service of the UltraCat system through its Michigan factory headquarters.

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Particulate, SO_2, HCl, & NO_x Advanced Control in One System

Advanced, low-density ceramic filter systems are now capable of removing particulate matter (PM), NO_x, SO_2, HCl, dioxins, and even mercury in a single system. Particulate matter is removed to ultralow levels (<2 mg/Nm^3, 0.001 grains/dscf). Control of 90% or greater is common on SO_x, HCl, and other acid gases. System provides effective NO_x destruction as low as 350°F, up to 90% at 450°F for many applications. The Tri-Mer UltraCat Catalyst filter system is a cost-effective solution to many difficult pollution control issues.

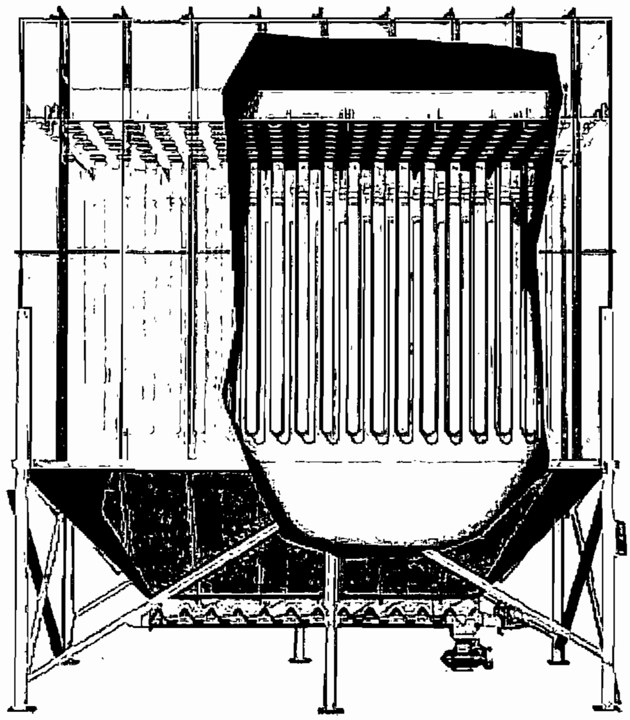

Figure 1. Many filters placed in a single module. Multiple modules are operated in parallel to handle large volumetric flow rates. (Multiple modules shown in Figure 8)

Ceramic filters

Ceramic filters, often called candles because of their solid tube shape, have been used in pollution control for decades.

The original high-density candle filters were manufactured from refractory grains such as alumina or silicon carbide and pressed into the basic candle shape—a tube with a closed, rounded bottom and a flange at the top. The newer, low-density filters start as a slurry of refractory fibers and are vacuum formed into shape. The contrast between types of ceramic filter elements is shown in Table 1.

Table 1

Contrast between types of ceramic filter elements

Characteristics of high- and low-density ceramic-filter elements

	High density	Low density
Structure	Granular	Fibrous
Density	High	Low
Filter Drag	High	Low
Porosity, % (Inverse of resistance to flow)	0.3 - 0.4	0.8 - 0.9
Tensile strength	High	Low
Fracture mechanism	Brittle	Ductile
Thermal shock resistance	Low	High
Cost	High	Low

There are hundreds of applications of these types of filters in Europe, Japan, and Australia. The filter elements are made in various lengths, but it is the latest generation of 3-meter (10-ft) long filters, on the market since 1997, that make industrial applications practical. The filters are placed in a housing module similar to a baghouse (see Figure 1).

These lightweight ceramic filters solve many of the problems associated with "candle filters." While effective, the latter were brittle and prone to cracking and breakage from thermal shock and vibration. As shown in Figure 2, the fibers maintain a very high, open area for low resistance to airflow, minimizing pressure drop and the number of elements required for a given flow rate. This high, open area also makes elements easy to clean using the standard reverse pulse-jet techniques associated with fabric filter baghouses (see Table 2).

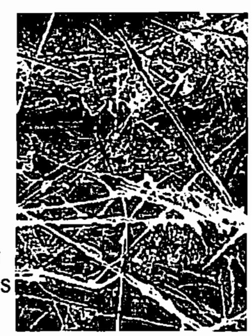

Figure 2. Micrograph of filter elements composition.

Operating characteristics

Ceramic filters must operate above the condensation temperature of the pollutants, or the particulate will not release from the filter surface unless the temperature is raised and the material volatilizes, thus cleaning the filter. Table 3 shows typical operating temperatures for the ceramic filters. The filters are chemically inert and highly corrosion resistant, as would be expected from ceramic materials. Filters are manufactured in two varieties: standard UltraTemp filters and UltraCat catalyst filters.

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Technology Leader
air pollution control

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Table 2

Characteristics of low-density fibrous ceramic filter elements

Form	Monolithic rigid tube
Composition	Refractory fibers plus organic and inorganic binding agents
Porosity	About 80 - 90%
Density	About 0.3 - 0.4 g/cc
Support	Self-supporting from integral flange
Geometry	Outer diameter up to 150mm (6 in.) Length up to 3m (10 ft.)

Table 3

Typical operating temperatures for the ceramic filters

Temperature range of operations

Filter name	Pollutants removed	Temperature Range
UltraTemp Standard	Particulate matter (PM)	300°F to 1650°F
UltraTemp Standard	PM + SO_2, HCl, or other gases	300°F to 1200°F
UltraCat Catalyst	PM + NO_x.	350°F to 700°F
UltraCat Catalyst	PM + NO_x + SO_2, HCl & other acid gases	450°F to 700°F

The catalyst filter is identical to the standard filter, except that it has nanobits of SCR catalyst embedded in the filter walls for NO_x removal and dioxin destruction.

Particulate control

The typical level of PM at the outlet of the ceramic filters is less than 0.001 grains/dscf (2.0 mg/Nm^3). This is true even with very heavy inlet loadings of several thousand milligrams per cubic meter. PM is captured on the face of the filter and does not penetrate deeply into the filter body, thus allowing for repetitive and complete cleaning. This is an engineered feature of the filter surface. The filter does not blind, and only over five to ten years does the pressure drop very gradually increase to the point that filters should be changed. Pressure drop for the new clean filter is approximately 6 inches w.g. Pressure drop can be lowered by adding more filter elements or footprint, and capital cost can be reduced by decreasing the filter count at the expense of fan horsepower.

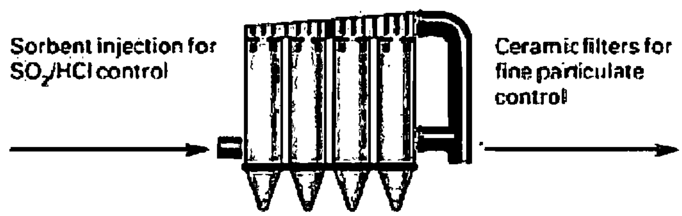
The filter construction also means that standard reverse pulse jet methods, which send a pulse of compressed air down the center of the tube, can thoroughly clean the accumulated PM from the outer surface of the tube. Filters are cleaned on-line, with no need to isolate each housing module.

Typical filter life is 5 to 10 years. The filters are effective across the range of particle sizes, but are most often used when there is a large fraction of PM2.5 and submicron particulate and / or at high temperatures (see Table 4).

SO_2 and acid gas control

Both standard UltraTemp and catalyst UltraCat filter systems feature an option for dry injection of calcium or sodium-based sorbents.

Figure 3. Standard filter system for control of particulate, SO_2, HCl, and other gases



Injected in the duct, upstream of the filter modules, the additional sorbent particulate is easily captured along with its pollutant gas. The sorbent must be milled to small particle size to maximize surface area for maximum reactivity. The reaction occurs within the duct prior to the filter and at the filter cake that builds up on the surface of the filters. The chemical reaction of the sorbent with the acid gas creates a solid particle that is also captured on the filters alongside the unreacted sorbent and the process particulate.

With sorbent injection, SO_2 removal is typically 90 percent or higher, with removal efficiencies as high as 97 percent. HCl removal is typically 95 percent, and often as high as 99 percent. The temperature range for effective removal is 300°F to 1200°F (See Figure 3).

Table 4

Ceramic filters are most effective where there is a large fraction of PM2.5 and submicron particulate

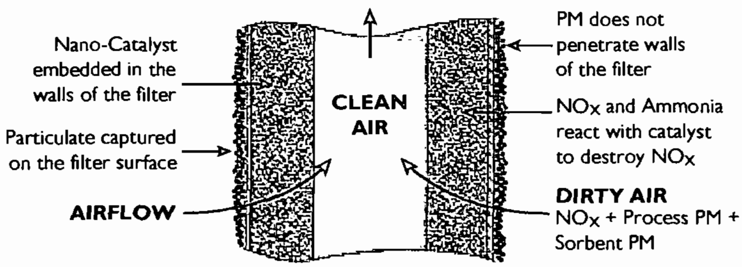
Efficiency of fibrous ceramics filter elements in various applications

Process	Particle size	Inlet PM loading		Outlet PM loading		Inferred efficiency
	d_{50}[1], µm	mg/Nm^3	gr/dscf	mg/Nm^3	gr/dscf	%
Aluminum powder production	<50	550	0.24	<1	<0.0004	99.9
Nickel refining	<10	11,800	5.16	<1	<0.0004	>99.8
Smokeless fuel production	4.8	1,000	0.44	1.5	0.0007	99.9
Zirconia production	1.2	8,000	3.5	0.8	0.0003	99.85
Secondary aluminum	<1.0	870	0.38	0.5	0.0002	>99.99

[1]Diameter of median size particle

Sodium bicarbonate (baking soda) and trona are typical sodium-based sorbents. Trona is the naturally occurring ore from which soda ash and sodium bicarbonate are produced and is mined exclusively in Wyoming. When properly milled, trona can be used as a dry sorbent, no other …essing required, and it is available throughout North America.

Figure 4. Ceramic fiber filter tube with embedded nano-catalysts



NO_x and dioxin control

For NO_x or dioxin removal, UltraCat catalyst filter elements are available with nanobits of SCR catalyst embedded in the walls. The filter walls that contain the catalyst are about 3⁄4 inch (20 mm), as represented in Figure 4. Urea or ammonia is injected upstream of the filters. The catalyst embedded in the filters destroys NO_x with up to 90 percent removal efficiency.

Note the lower operating temperature required for high NO_x destruction: **…°F to 400°F**, compared to 600°F to 650°F for conventional SCR. …des the need for high temperature, a common problem with traditional SCR is the catalyst becomes poisoned and ineffective, necessitating early replacement. Typical poisons are ordinary PM, metals, and HCl. The catalyst used in the filters also has a proprietary formulation with a fraction of the conversion rate of SO_2 to SO_3 of traditional SCR catalysts.

The increased reactivity shown by the catalyst filters at lower temperatures results, in part, from their micronized form. The diffusion restriction is eliminated, and, most significantly, the catalyst is almost completely protected from blinding by particulate matter, since it is protected inside the filter itself (see Figure 5). PM removal, sorbent injection for SO_2 (and other acid gases) and catalytic reduction can be incorporated in a single system.

It is important to note that operating temperature for effective NO_x destruction must be kept at 350°F to 700°F.

Figure 5. Micrograph of nano-catalysts embedded in ceramic-coated fibers

Dioxins are also broken down by the catalyst. Optimum performance for dioxins is limited to an upper temperature of 480°F. Within a wide range, destruction efficiency is typically 97 to 99 percent.

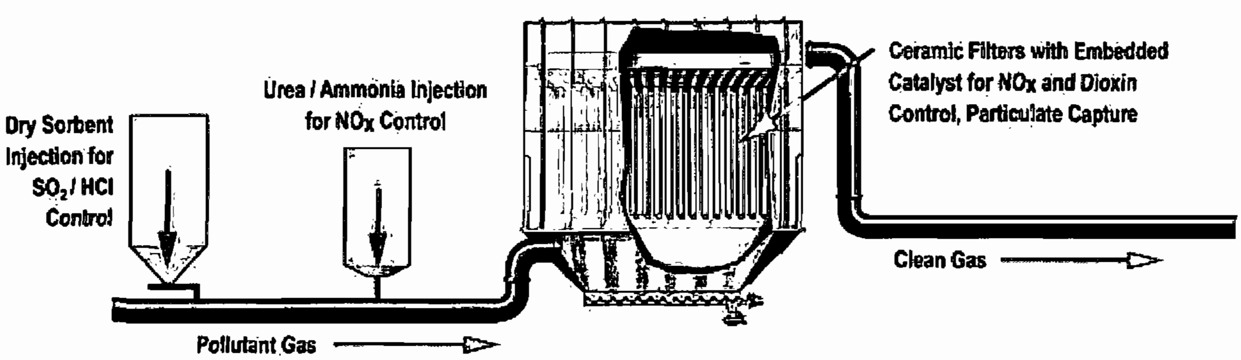
Multi-pollutant capability creates a powerful, all-in-one-solution that is superior, in both performance and economics to having a separate pollution control device for each pollutant. Especially with NO_x, in many circumstances there is insufficient temperature to operate traditional SCR. Low-temperature NO_x removal capability opens a new direction in NO_x control for operators of a wide range of boilers, and other industrial processes requiring NO_x control (see Figure 6).

Mercury control

The ceramic filter systems are compatible with standard mercury removal techniques. Control of mercury is notoriously difficult: each instance is analyzed individually and customized solutions are engineered. A few general observations can be offered,however.

The filters can handle very high particulate loads while maintaining exceptionally low outlet levels. Just as the addition of dry sorbents for the removal of acid gases is effective, so is the addition of powdered activated carbon (PAC) for mercury. In general, regular PAC becomes less effective with temperature, topping out around 400°F. Under the right conditions, 70 to 80 percent control can be achieved. The chemical composition of the pollutant gas plays a major role; hence, the difficulty of blanket statements. At higher temperatures, brominated PAC is required. According to the manufacturers of brominated products, temperatures of 500°F to 800°F are acceptable. Significant levels of mercury capture have also been achieved in applications with injected powdered trona.

Figure 6. Control of PM, SO_2, HCl, NO_x, and dioxins

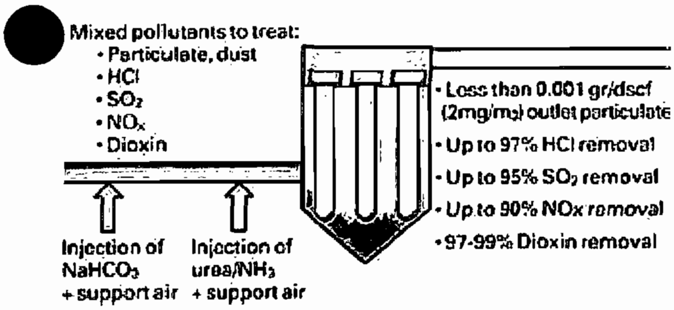


When would ceramic filters be the control technology of choice?

For particulate removal only, the standard UltraTemp ceramic filter can operate at temperatures up to 1650°F. This is far above the temperature range of fabric bags. For applications with temperatures below 400°F and do not have temperature excursions or hot materials that pose a fire hazard to the bags (as can happen with biomasss boilers), or other special circumstances, the fabric bags are less costly than ceramic filters and would be equipment of choice. In borderline cases, the ceramic filters have a much longer element life and often prove to be the most cost-effective solution.

In applications that require NO_x control, the UltraCat catalyst filters are preferable since fabric bags and ESP cannot control NO_x. Ceramic filters also replace electrostatic precipitators (ESPs) when there is a need for very low PM levels, especially on applications with significant portions of PM2.5 and submicron particulate. The filters can handle much higher inlet loadings, are not subject to the selective removal constraints of ESPs, have lower maintenance requirements and fewer corrosion issues, and are roughly equivalent (or lower) in energy usage. Because of the formation of filter cake on the filter surface (which provides more exposure to the acid gases), filter systems consume significantly less sorbent and higher removal efficiency can be achieved on acid gas removal. As stated, fabric bags and ESP do not remove NO_x or dioxins, of course, so a second device (perhaps with temperature addition which can be very expensive to operate) would be needed following them. This adds a layer of cost and complexity. In contrast, the UltraCat catalyst filter can handle all the pollutants in a single device at lower temperatures (see Figure 7).

Figure 7. Catalytic element performance



The catalyst handles all the pollutants in a single device at lower temperatures.

Modular design of the housing units allows filters to be configured to handle even large gas-flow volumes. When large flow volumes are treated, modules are put in parallel. The systems are designed so that a single module can be taken off line if required, and the remaining two or more modules continue to operate at a slightly higher pressure (designed into the fan) without interruption of process itself and with no appreciable change in emission control performance (see Figure 8).

Lightweight ceramic filters have been used for the last 11 years by the U.S. military at munitions-destruction facilities in Indiana, Utah, and Oklahoma. There are hundreds of operating ceramic filter applications throughout the world. With a rapidly growing commercial base in the U.S., the UltraTemp and UltraCat filter systems provide a way to counter many of the difficult situations faced by owners, operators, and consultants in meeting the increasingly strict regulations regarding air pollution control.

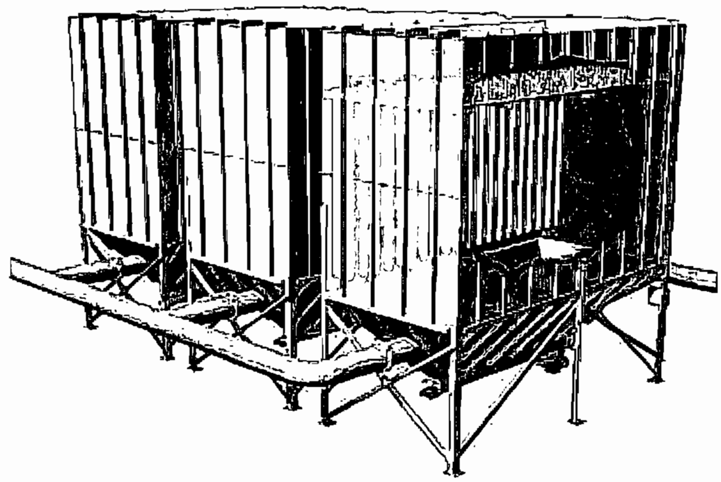


Figure 8. Multiple modules are operated in parallel to handle large volumetric flow rates. With 3 or more modules, if a module needs to be serviced, the other modules are designed to temporarily operate at higher pressure with no measurable change in performance.

Primary Applications

Boiler MACT compliance for coal, biomass, wood
Glass furnaces
Waste incineration
Waste pyrolysis
Metal smelting, mineral processing
Chemical production
Many specialized high temperature applications

More Applications

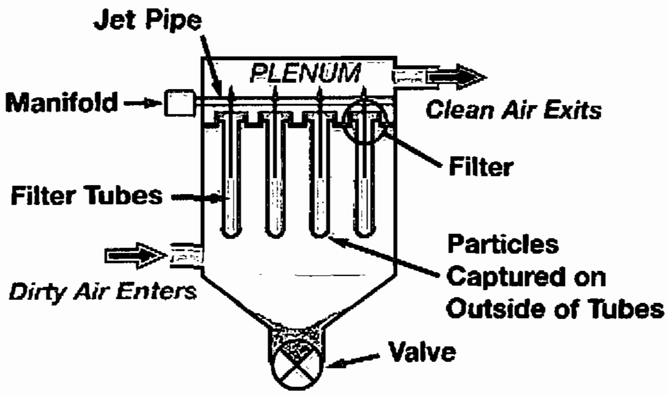
Air Pollution Control
Cement production
Medical waste
Soil cleaning
Foundry processes
Fluidized beds
Energy production
Fire testing
Product Collection/Recovery
Titanium dioxide production
Fumed silica production
Carbon black production
Catalyst manufacturing
Platinum smelting
Metal powder production
Activated carbon production

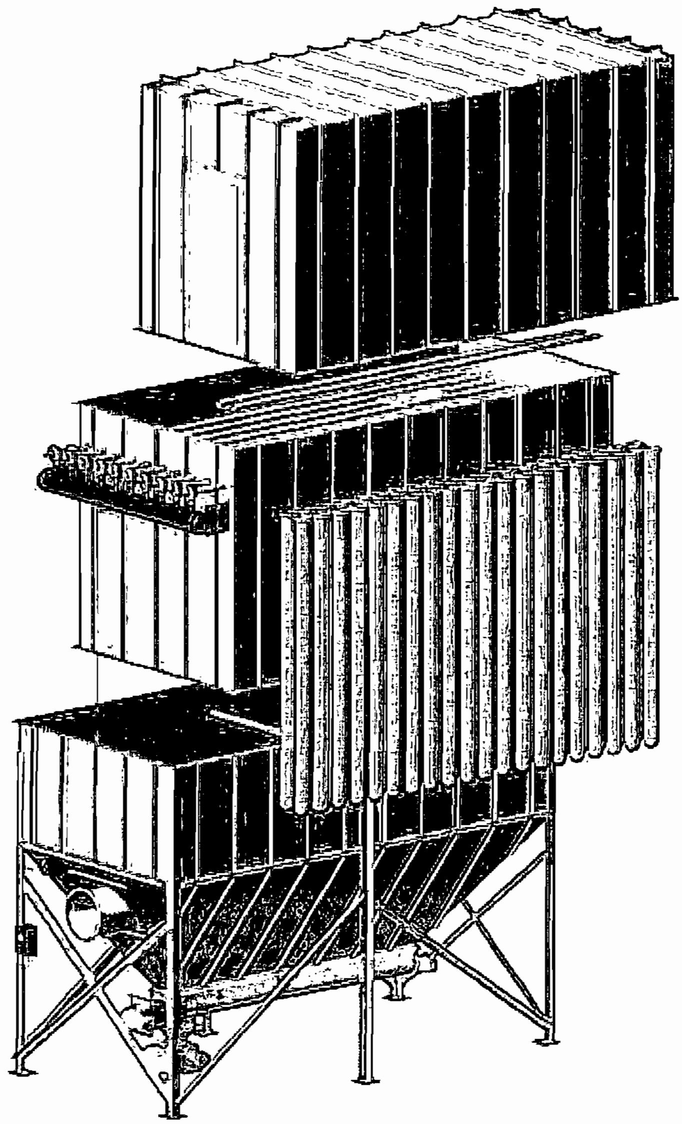
Operation of the UltraTemp filtration system

Tri-Mer's UltraTemp and UltraCat Hot Gas Filter systems use baghouse configurations with a reverse pulse-jet cleaning action. The filters are back-flushed with air, inert gas, or other appropriate gases. A reliable cleaning mechanism is easy to access, and the design has been engineered for easy installation and maintenance. Filter elements are manufactured in various sizes, the largest of which is ten feet long and six inches in diameter, including an integral mounting flange.

- **Pressure drop across the system is approximately 6-8 inches w.g. - lower than the total energy usage of multi-step systems.**

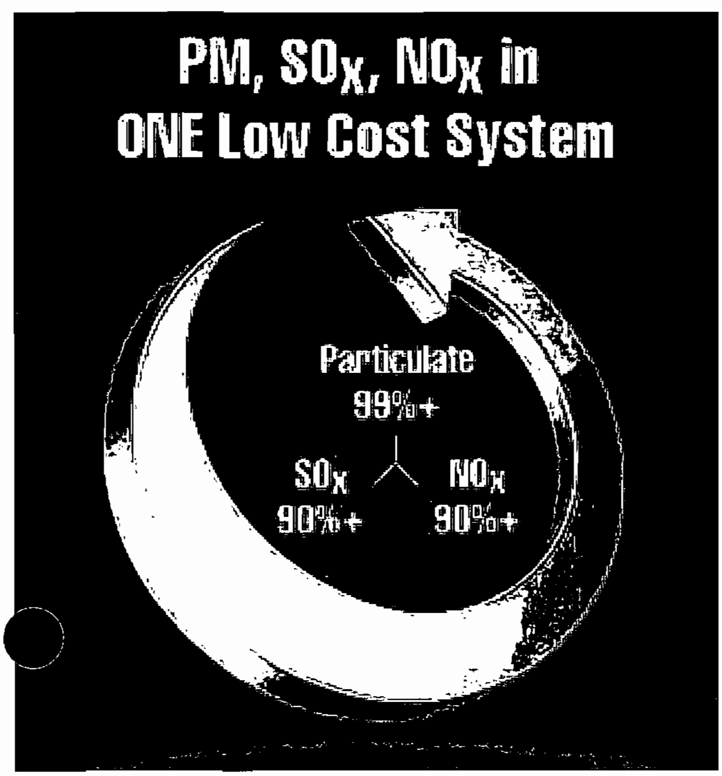
Operation of Filters





Housing modules are manufactured at the Tri-Mer factory in Michigan and sized for convenient shipping. In the field the sections are lifted by crane and bolted together. Filters are then installed by Tri-Mer personnel. The top section is a walk-in plenum for easy, clean maintenance access in all weather; middle section is filters; bottom section is the collection hopper with internal screw conveyor to rotary or slide gate valve discharge.

The UltraTemp and UltraCat Filter systems are efficient, cost-effective approaches for hot gas filtration. With over 400 applications worldwide that use the fibrous ceramic filter elements, this proven technology is now commercially available throughout the US, with full technical and start-up support.



Tri-Mer Corporation, a technology leader in air pollution control, provides turnkey engineering, manufacturing, installation, and service for the UltraTemp and UltraCat filter systems through its Michigan factory headquarters.

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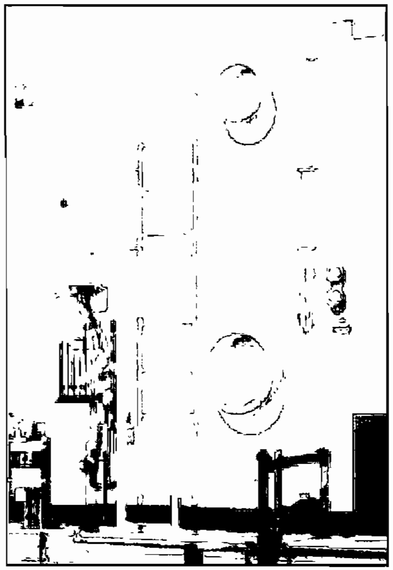
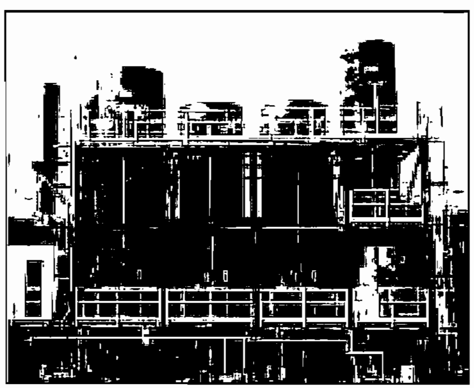
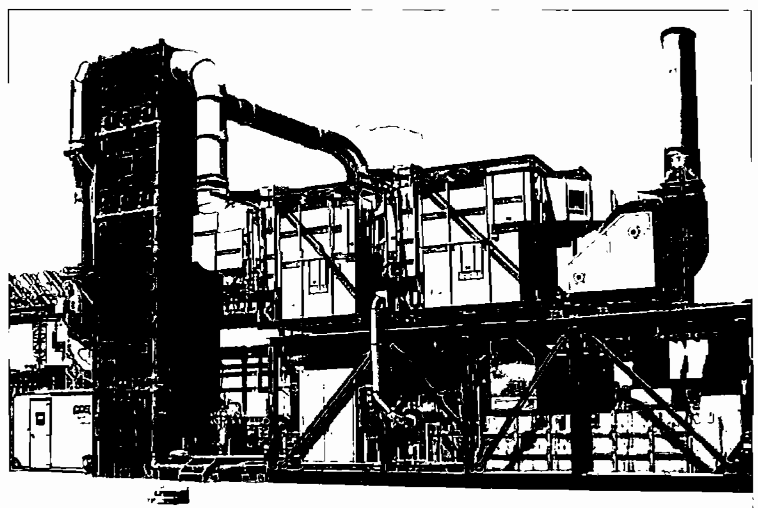
Direct line: (801) 294-5422, or kevin.moss@tri-mer.com

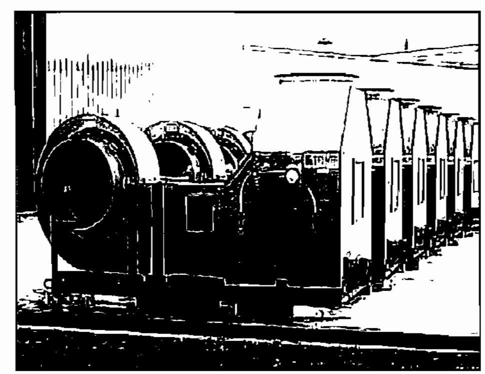
Tri-Mer Corporation: Technology + Project Delivery



- Technology leaders in pollution control
- In-house manufacturing facility and fabrication line in central Michigan
- 15 lines of equipment to fit applications
- Turn-key project services
- Over 6,000 installed scrubber systems
- Projects from 10 cfm to 300,000 cfm
- Worldwide installations, many industries



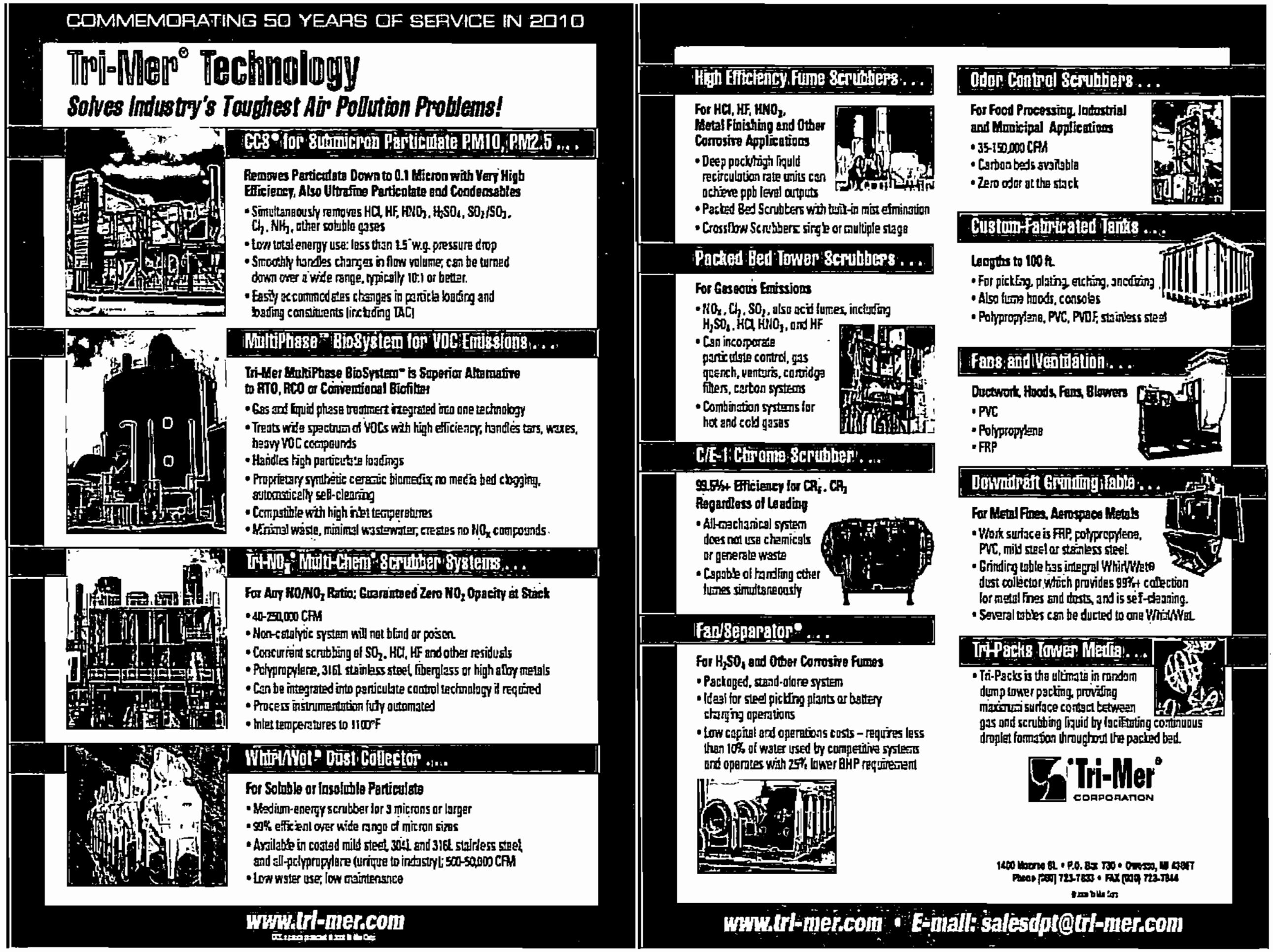


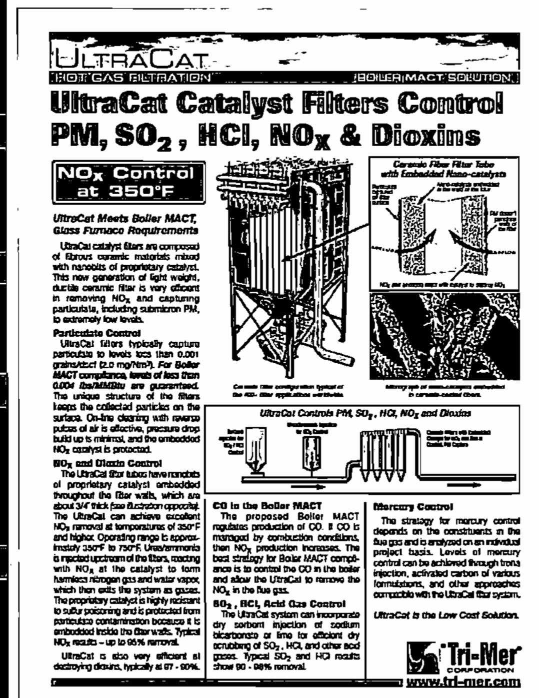


Tri-Mer® CORPORATION

50 YEARS 2010

Tri-Mer Product Line, Wet Scrubbing, Dry Filtration, SCR





Tri-Mer® CORPORATION

50 2010 YEARS

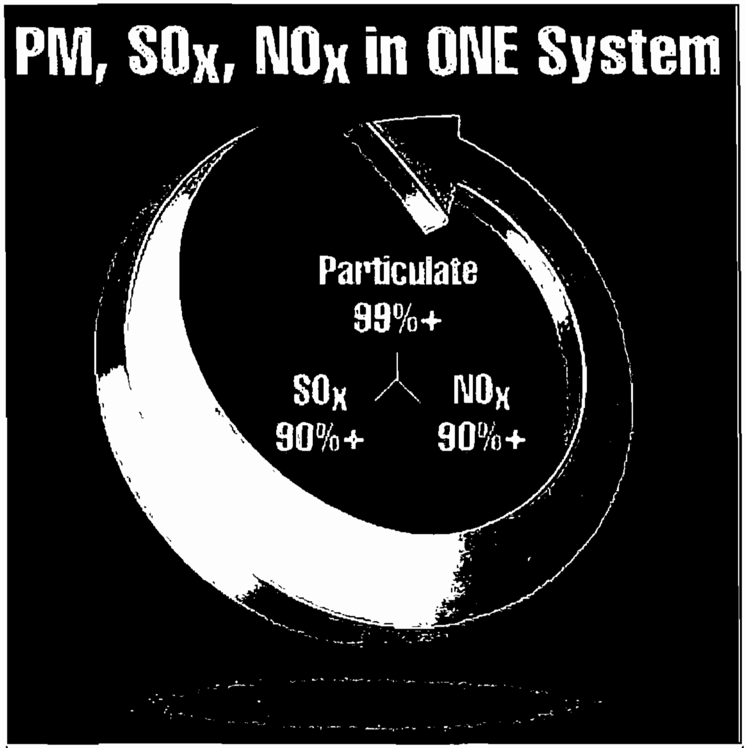
Filter reference list

Over 400 installations primarily in Europe , Japan, and Australia across many industries.

U.S. military applications plus a rapidly growing number of U.S. industrial installations since introduction to the industrial sector. Market driven by strict new regulatory laws.

Ref. No.	Application	Number of Elements	Filter Area m^2	Gas Flow Am^3/h	Average Temp. Deg. C	Face Velocity m/s	Average dP mm wg	Installed	Country	Region
								60mm O/D elements		
A	Gesification & Pyrolysis									
A10	Wood Gasification	1920	364.8	22326	450	0.017	n/a	May-09	UK	Europe
A20	Wood Gasification	640	121.6	7442	450	0.017	n/a	Dec-07	UK	Europe
A30	Wood Gasification	320	60.8	3721	450	0.017	n/a	n/a	UK	Europe
A40	Wood Gasification	320	60.8	3721	450	0.017	n/a	n/a	Germany	Europe
A50	Wood Gasification	160	30.4	1860	450	0.017	n/a	n/a	UK	Europe
A60	Wood Gasification	160	30.4	1860	450	0.017	200	Dec-07	Germany	Europe
A70	Wood Gasification	160	30.4	1860	450	0.017	n/a	n/a	Germany	Europe
B	Waste Incineration									
B30	Waste Incineration	2247	516.8	29500	230	0.016	375	Nov-98	Poland	Europe
B50	Petrochemical Waste Incineration	1764	405.7	35059	290	0.024	n/a	May-02	Spain	Europe
B90	Liquid Waste Incineration	1152	265.0	n/a	n/a	n/a	n/a	2000	Spain	Europe
B100	Waste Plastic Degrader	1296	246.2	22163	250	0.025	n/a	1998	Belgium	Europe
B110	Sludge Incineration	972	184.7	26594	450	0.040	n/a	1994	Thailand	A/P
B118	Clinical Waste Incineration	864	164.2	14774	200	0.025		1999	Poland	Europe
B120	Munitions Waste Incineration	832	158.1	13584	200-250	0.024	n/a	1995	UK	UK
B130	Munitions Waste Incineration	832	158.1	n/a	n/a	n/a	n/a	1997	UK	UK
B135	Clinical Waste Incineration	756	211.7	12000	180	0.016	200	2009	China	China
B140	Clinical Waste Incineration	731	139.1	n/a	220	n/a	n/a	Feb-97	Malaysia	A/P
B150	Sludge Degrader	648	123.1	11081	300	0.025	n/a	1998	Belgium	Europe
B160	Waste Degrader	648	123.1	13300	220	0.030	n/a	1999	Poland	Europe
B170	Clinical Waste Degrader	540	102.6	14774	300	0.040	n/a	1997	Belgium	Europe
B180	Hazardous Waste Incineration	480	91.2	6860	250	0.021	n/a	1997	Argentina	Americas
B190	Clinical Waste Incineration	433	82.1	8865	200	0.030	n/a	1997	South Korea	A/P
B200	Clinical Waste Incineration	420	79.8	11491	170	0.040	300	1997	Spain	Europe
B210	Clinical Waste Incineration	400	76.0	n/a	n/a	n/a	n/a	1998	Portugal	Europe
B230	Clinical Waste Incineration	324	61.6	n/a	n/a	n/a	n/a	Oct-98	UK	Europe
B240	Clinical Waste Degrader	324	61.6	6650	220	0.030	n/a	1999	Poland	Europe
B260	Radioactive Waste Incineration	256	48.6	n/a	n/a	n/a	n/a	n/a	France	Europe
B270	Clinical Waste Incineration	216	41.0	4432	250	0.030	n/a	1997	France	Europe
B278	Mobile waste incineration	210	39.9	4176	400	0.030	n/a	2003	Germany	Europe
B280	Clinical Waste Degrader	144	27.4	2955	220	0.030	n/a	1998	Poland	Europe
B300	Waste Incineration	90	17.1	1847	400	0.030	n/a	1997	Germany	Europe
B310	Industrial Waste Incineration	63	12.0	n/a	200	n/a	n/a	Jul-95	Hungary	Europe
B320	Clinical Waste Incineration	63	12.0	n/a	200	n/a	n/a	Jun-95	Poland	Europe
B330	Clinical Waste Incineration	50	9.5	n/a	200	n/a	n/a	Feb-95	Poland	Europe
B340	L/L Radioactive Waste Incineration	42	8.0	n/a	450	n/a	n/a	Oct-94	France	Europe
B360	Clinical Waste Incineration	30	5.7	n/a	200	n/a	n/a	Feb-94	Hungary	Europe
B400	Radioactive Waste Incineration	7	1.3	n/a	n/a	n/a	n/a	n/a	France	Europe
C	Non Ferrous Industry									
C10	Platinum Recovery	10368	2384.6	n/a	n/a	n/a	n/a	Oct-98	South Africa	Africa
C60	Secondary Aluminium Recovery	1288	244.3	30000	225	0.032	200	Feb-92	UK	UK
C70	Aluminium Melting	1248	237.1	27316	225	0.032	200	Jul-94	UK	UK
C90	Titanium degassing	576	132.5	9000	350	n/a	n/a	Jan-98	UK	UK
C100	Secondary Aluminium -Reverb	576	109.4	18240	140	0.046	260	Apr-94	UK	UK
C140	Metal Recovery from Circuit Boards	364	69.2	n/a	n/a	n/a	n/a	1999	UK	UK
C160	Metal Processing	324	61.6	5540	350	0.025	n/a	1997	Germany	Europe
C170	Secondary Aluminium Smelting	256	48.6	5100	100	0.029	330	Jun-94	UK	UK

UltraCat filter system capability



+ dioxins & heavy metals -- mercury options available.

CERAMIC FILTER ELEMENTS FOR EMISSION CONTROL AND NOX REDUCTION AT HIGH TEMPERATURES

Andrew Startin

Clear Edge UK Ltd., Cerafil Division

1. INTRODUCTION

Gas filtration employing rigid low density ceramic filter elements (aka candles) is now a well established technique. The product was initially developed in the mid 1980's in response to the need to clean hot dirty gas down to levels of particulate matter sufficiently low to meet new environmental legislation. The earliest applications were rather specialised but application soon broadened out to a wide variety of duties where the benefits of the product could be exploited. This process was accelerated by the introduction of monolithic elements in the early 1990's.

Given the benefits of ceramic filters duties are focussed on the need to filter gas, either process or off gas, at a high or variable temperature while delivering high particulate removal efficiency. Key applications therefore include waste incineration and gasification, metals processing, mineral processing and glass melting. The majority of duties are air pollution control (APC) however there is an increasing uptake of ceramic filters for process filtration or product recovery duties.

In recent years the demands on gas filtration media have strengthened while legislative emission limits have tightened. These trends have precipitated an ongoing development program aimed at providing a range of ceramic elements tailored to meet the demands of industrial end users.

Cerafil TopKat (patent granted 2007) represents a revolutionary development in the technology. The element, jointly developed with Haldor Topsøe A/S, incorporates an integral catalyst capable of significantly reducing dioxin, NOx and volatile organic compound (VOC) emissions.

2. CHARACTERISTICS, BENEFITS AND APPLICATION

Low density ceramic elements (ceramic elements) are produced in a variety of sizes from 60mm outside diameter and 1 metre long up to 150mm outside diameter and 3 metres long. The larger sizes can be employed like fabric bags in new equipment and retrofitted into existing plant. Ceramic elements are manufactured from ceramic or mineral fibres, which are bonded together with a combination of organic and inorganic binders. Elements are formed into a shape which incorporates an integral mounting flange resulting in a rigid, self supporting structure.

Ceramic elements take the benefits of fabric bag filtration a stage further by offering excellent filtration efficiency coupled with the ability to operate at elevated temperatures. This latter benefit is utilised across a broad spectrum of industrial applications where there is a requirement to filter gases which are at a high or variable temperature or where temperature surges can occur. An otherwise stable operation can suffer from temperature surges, which can be very damaging to conventional fabric media. When such events occur it is not just the cost of the media which has to be taken into account; the costs associated with an unscheduled filter plant shutdown can also be high.

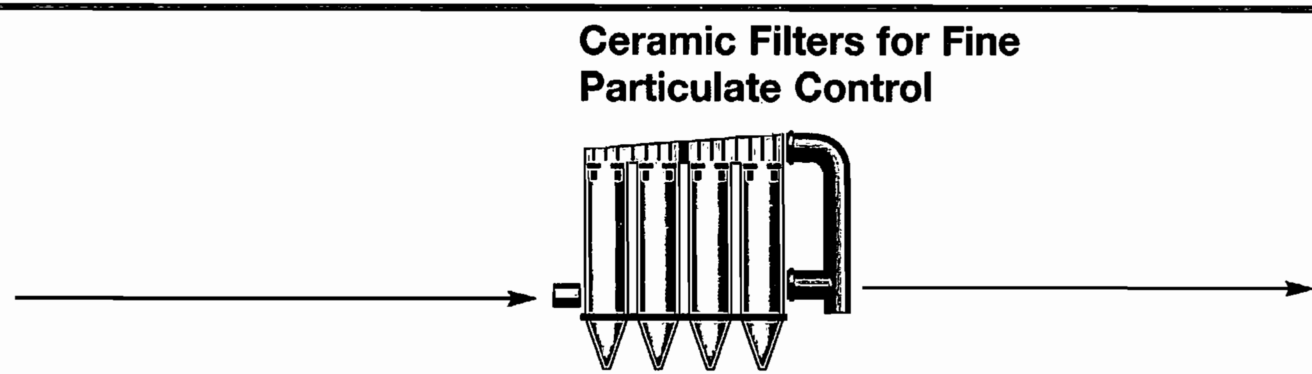
The benefits to the end user of high or elevated temperature filtration include-

- Move away from the temperature limitations imposed by fabric bags
- Reduced requirement for gas dilution results in smaller plant
- Acid and water dew points can be avoided thus minimising plant corrosion
- The gas temperature can be maintained for optimal deNOx
- Elevated temperature gas cleaning gives the potential for heat recovery from clean gas
- Higher stack exit temperatures increase gas buoyancy and therefore reduce the risk pf plume grounding

High filtration efficiency is a key benefit associated with ceramic filter elements. This results from the development, during the early stages of operation, of a protective dust layer on the element surface which promotes cake filtration (figure 1). Cake filtration is essential to long term performance of a

UltraTemp filter for particulate control

- Operating temperature to 1650 F (900 C)
- Typical removal to below 2 mg/Nm^3 (0.001 grains/dscf)
- State-of-the-art for fine particulate control in industry
- High inlet loading capacity up to 10,000+ mg/Nm3 (5 grains/dscf)



UltraTemp Filtration system for control of particulate PM.

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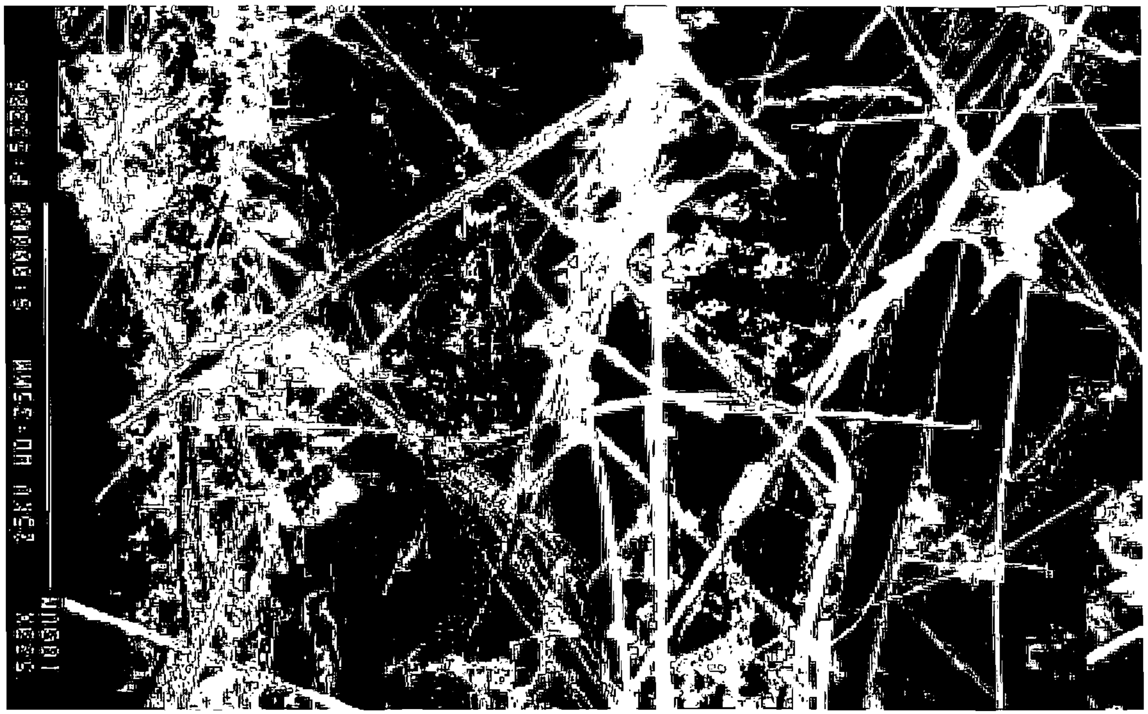
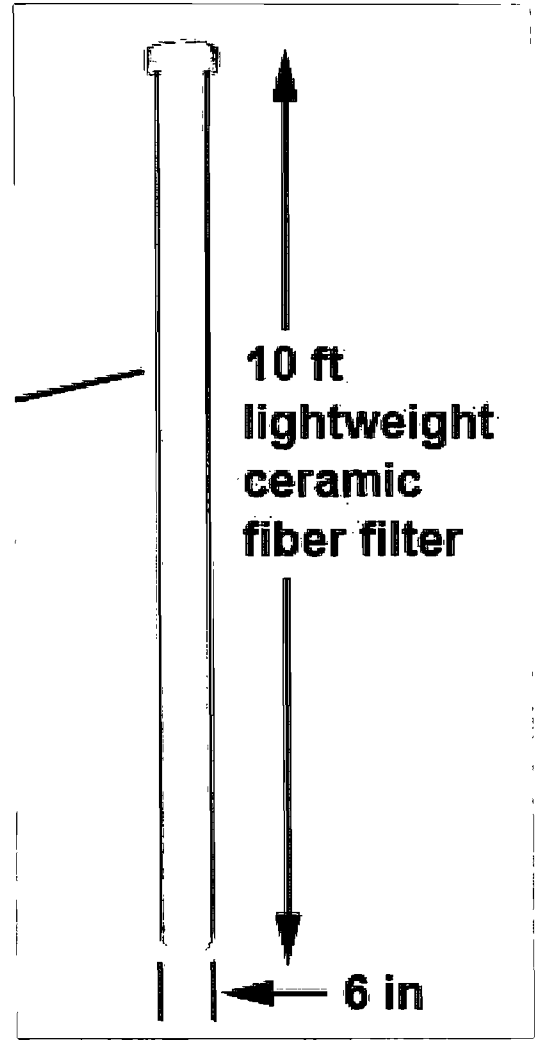
UltraTemp & UltraCat: new low-density ceramic fiber



Available and utilized in Europe since 1989.



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Types of ceramic filter technology

The current generation of ceramic filter is not the old style "candle" filter

CHARACTERISTICS OF HIGH- AND LOW-DENSITY CERAMIC-FILTER ELEMENTS		
	High Density	**Low Density**
Structure	**Granular**	**Fibrous**
Density	**High**	**Low**
Filter Drag	**High**	**Low**
Porosity, % (Inverse of resistance to flow)	**0.3 - 0.4**	**0.8 - 0.9**
Tensile strength	**High**	**Low**
Fracture mechanism	**Brittle**	**Ductile**
Thermal shock resistance	**Low**	**High**
Cost	**High**	**Low**

Source: Reported in Chemical Engineering magazine Jan 2009

Tri-Mer Corporation

UltraTemp High Temp Filter

for PM, PM+SO2/HCI

&

UltraCat Catalyst Filter

for NOx removal, PM+SO2/HCI

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Business Development Director
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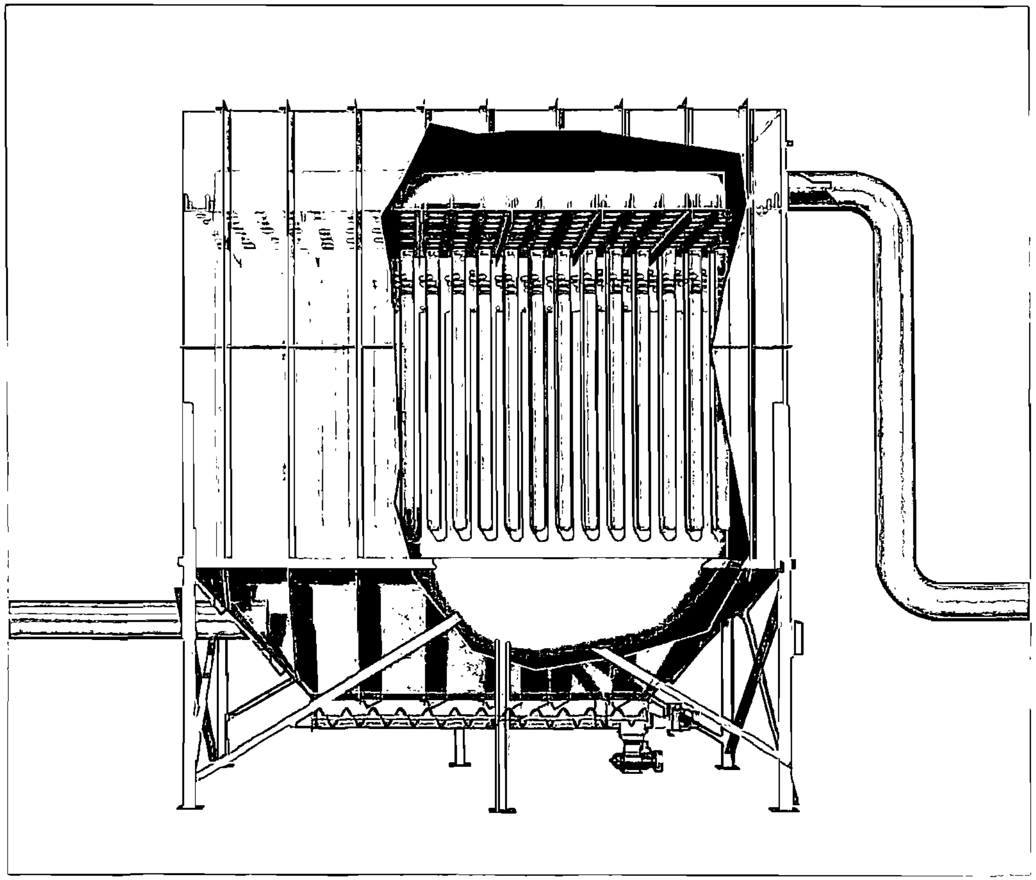
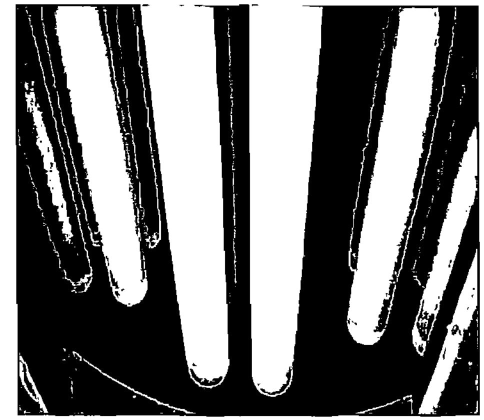
UltraTemp Filter system module, ceramic tube filters

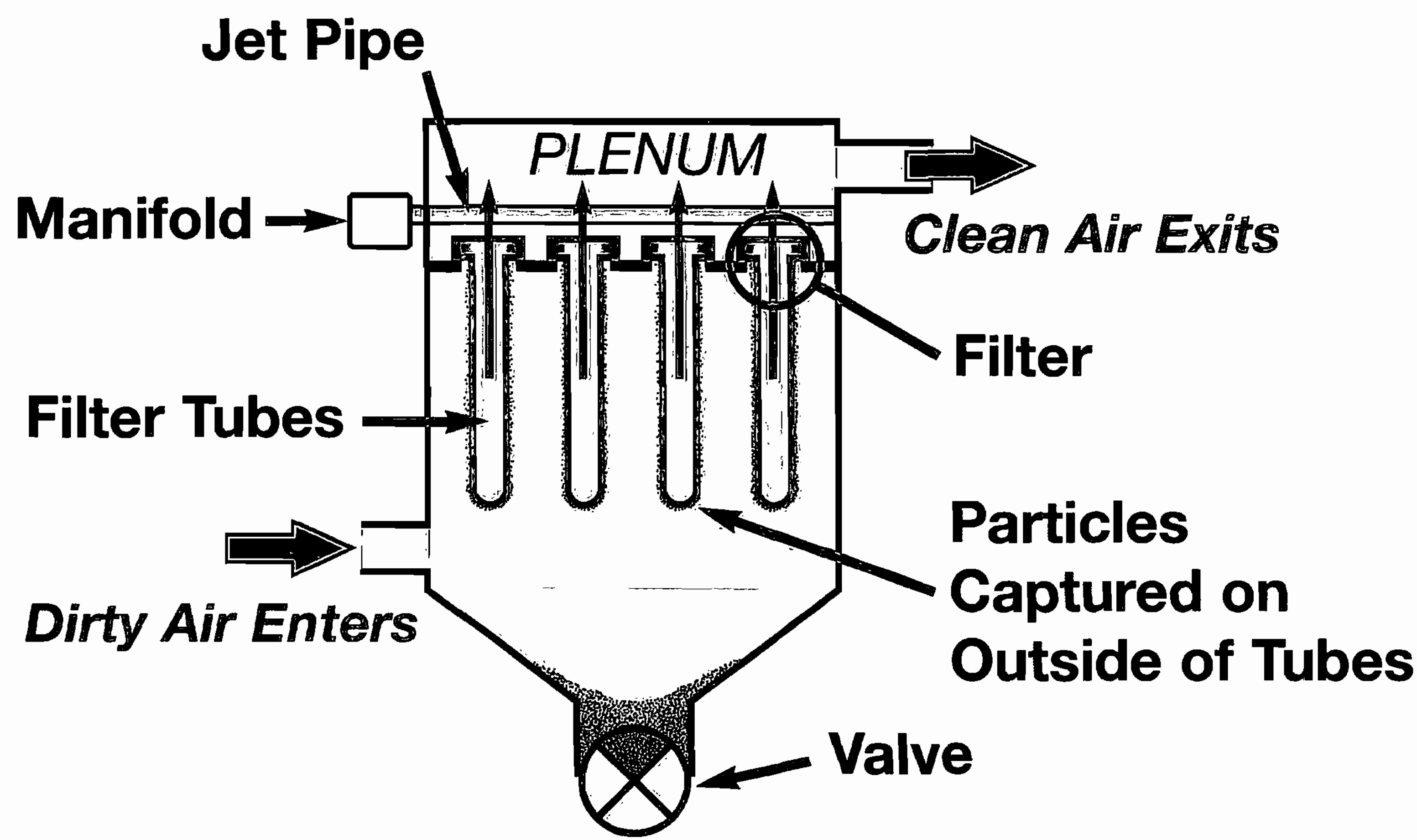




Tubes are 3 meters (10 ft) long, 150 mm (6 in) diameter.

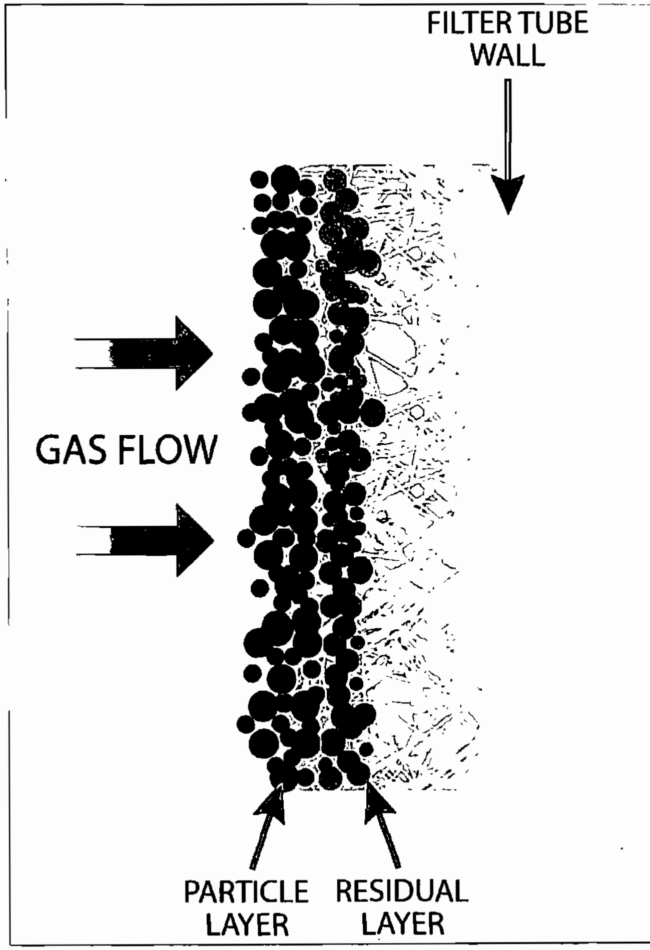
This length utilized since 1997.

Operation of filters in housing



Filtration mechanism

1. Molded as-formed surface (not machined)
2. Dust cake builds upon the residual layer, does not penetrate into filter body
3. Cake is periodically removed with a reverse pulse of air, a brief low volume shockwave
4. Tube does not flex like a Fabric Filter bag



As a consequence:

- Negligible depth penetration
- High filtration efficiency
- Can handle variable loading conditions
- Potential for long filter life

Examples of ceramic filter tube longevity

- Aluminium powder: 5 years
- Waste pyrolysis: 5 years
- Wood waste incineration: 6 years+
- Meat waste incineration: 4 years+
- Lab waste incineration: 15 years
- Asphalt reclamation: 4 years+
- Fluid bed metal cleaning: 5 years+
- Catalyst elements on waste application: 5 years+
- Zirconia production: 6 years+
- Munitions incineration by U.S. Army: 10 years
- Bauxite liquor burner: 10 years

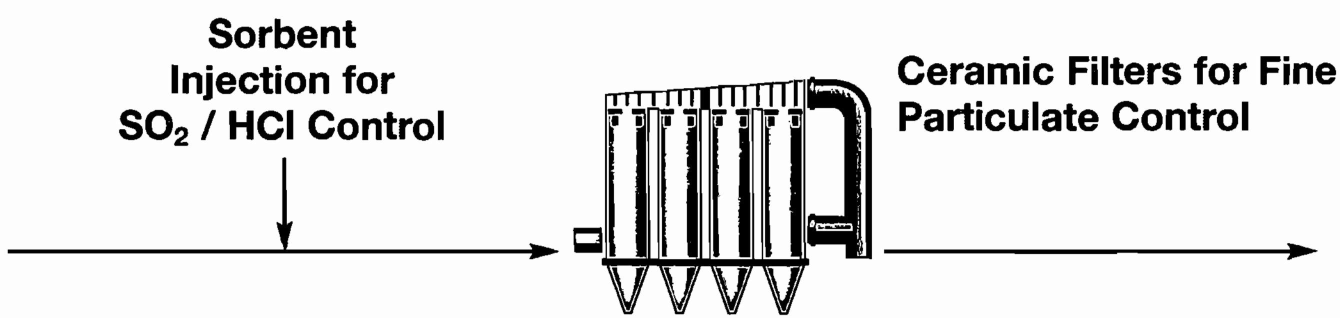
Typical filter results for particulate

EFFICIENCY OF FIBROUS CERAMIC FILTER ELEMENTS IN VARIOUS APPLICATIONS						
PROCESS	PARTICLE SIZE	INLET PM LOADING		OUTLET PM LOADING		INFERRED EFFICIENCY
	d_{50}[1], µm	mg/Nm³	gr/dscf	mg/Nm³	gr/dscf	%
Aluminum powder production	<50	550	0.24	<1	<0.0004	99.99
Nickel refining	<10	11,800	5.16	<1	<0.0004	>99.8
Smokeless fuel production	4.8	1000	0.44	1.5	0.0007	99.9
Zirconia production	1.2	8000	3.5	0.8	0.0003	99.85
Secondary aluminum	<1.0	870	0.38	0.5	0.0002	>99.99

Source: Reported in Chemical Engineering magazine Jan 2009

SO_2, HCl, acid gases – dry powdered sorbent injection

- Operating temperatures 350 F – 1200 F
- Typically 90% or better. Some applications reach 97%
- Both calcium (lime) and sodium-based sorbents used
- Sodium based is preferred due to advantageous chemistry
  - Sodium bicarbonate (baking soda powder) to 800F
  - Trona (a naturally occurring soda compound) to 1200F



UltraTemp Filtration system for control of particulate and SO_2.

Pilot test results in various industries

TRIAL RESULTS FROM DIFFERENT INDUSTRIAL APPLICATIONS						
POLLUTANT	TEMP	INLET mg/Nm³	OUTLET 11%O_2 Dry	REAGENT	PERFORMANCE	APPLICATION
Particulate Matter	290°C	130	<1	–	>99%	Glass Industry
	325°C	330	<1	–	>99%	Glass Industry
	185°C	725	<1.5	–	>99%	Waste from Slaughterhouse
SO_2	290°C	630	30	Sodium Bicarbonate	95%	Glass Industry
	300°C	590	18	Lime with Large Specific Area	97%	Glass Industry
	330°C	1165	480	Standard Lime	59%	Glass Industry
	320°C	1070	250	Sodium Carbonate	77%	Glass Industry
	330°C	355	8	Sodium Bicarbonate	98%	Chemical Industry
	180°C	870	<5	Sodium Bicarbonate	>99%	Waste from Slaughterhouse
HCl	330°C	650	40	Sodium Carbonate	94%	Chemical Industry
		30	<1	Sodium Bicarbonate	96%	Waste from Slaughterhouse
NO_x	280°C	1200	250	Ammonia	79%	Glass Industry
	290°C	2570	113	Ammonia	96%	Engine Fumes
	320°C	350	50	Ammonia	86%	Glass Industry
	280°C	800	<9	Ammonia	97%	Engine Fumes
	180°C	450	48	Ammonia	89%	Waste from Slaughterhouse

Source: Reported in Glass International Feb 2008

Solvay summary

Properties of Trona and Sodium Bicarbonate

	Trona (SOLVAir® Select 200)	Sodium Bicarbonate (SOLVAir® Select 300*)
Formula	$Na_2CO_3.NaHCO_3.2H_2O$	$NaHCO_3$
Particle Size: d_{50} (µm)	~ 30 µm	~ 100 µm
Free-flowing bulk density (lb/ft³)	49	63
Flue Gas Temperature Range for injection	275 – 1500 °F	275 – 1500 °F
SO_2 Removal (%)	Up to 90%	Over 95%
HCl Removal (%)	Up to 98%	Over 99%
Sorbent Cost	Low	Medium

* **Needs to be milled before injection**

What about NOx removal?

Wouldn't it be great to be able to control

NOx in the same system?

First, a quick review of

Selective Catalytic Reduction (SCR)

$2NO_x$ (nitrogen oxides *gas*) + $2NH_3$ (ammonia *liquid*) + $1/2O_2$ (oxygen *gas*)

REACTING on the surface of the proper CATALYST

→ $2N_2$ (nitrogen *gas*)+ $3H_2O$ (water vapor *gas*)

Harmless basic constituents of our atmosphere

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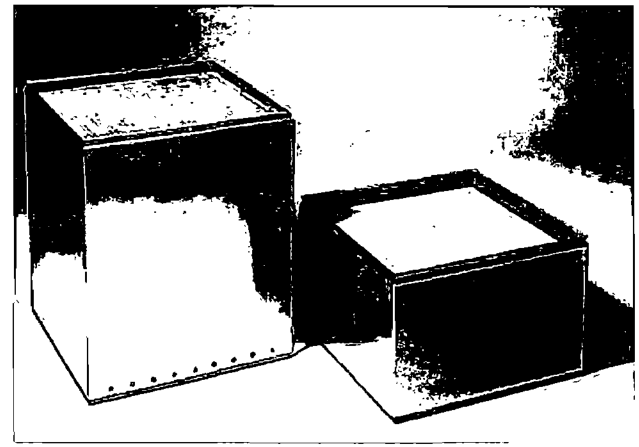
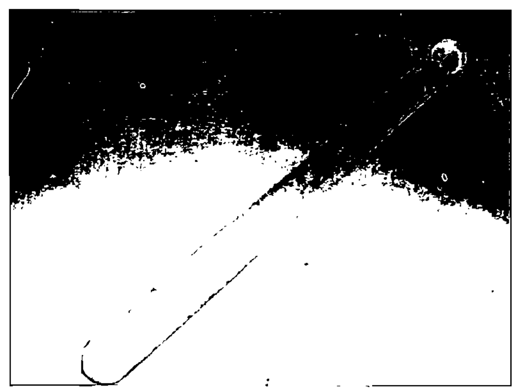
Catalytic filter technology for NO_x

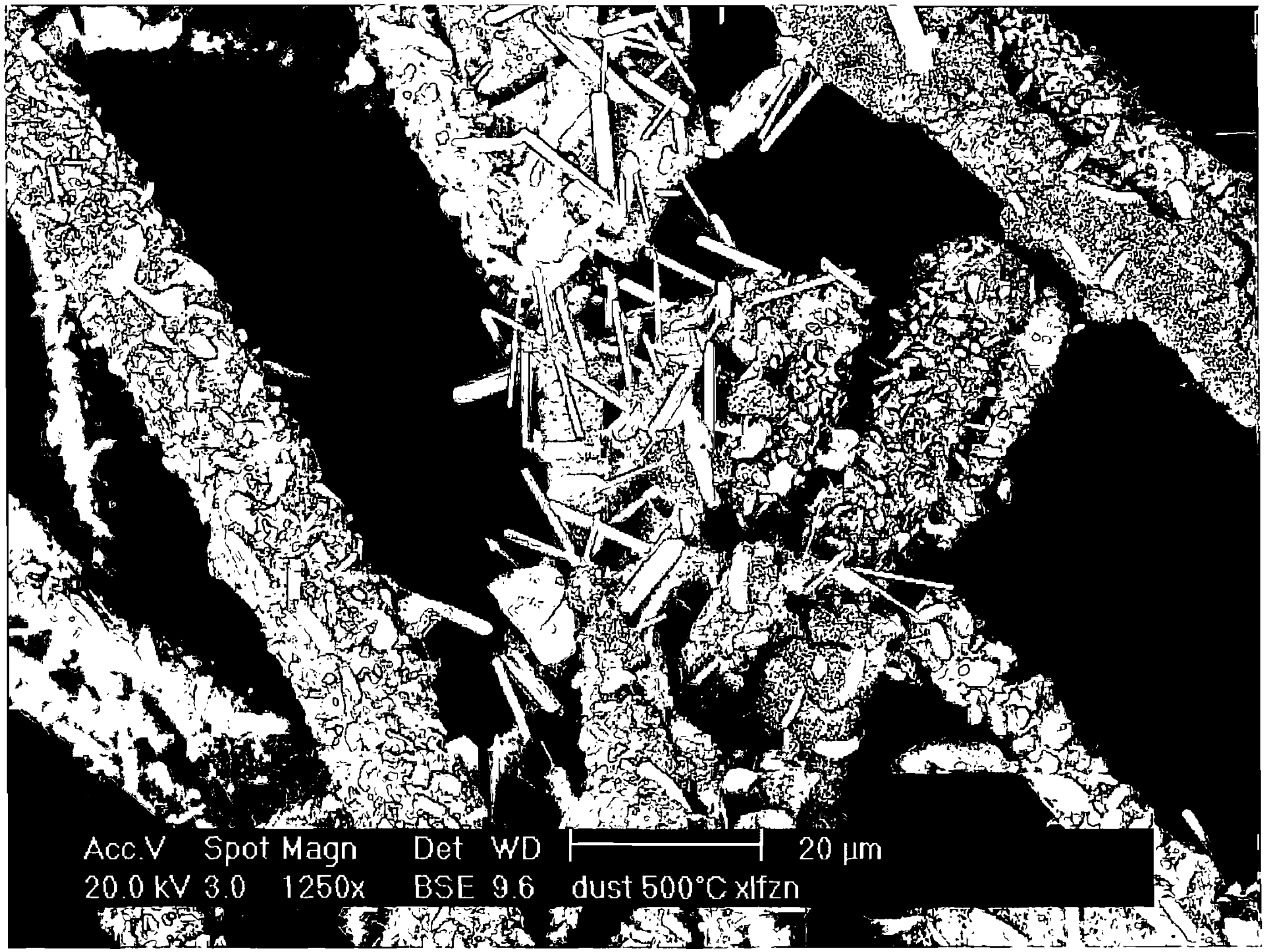
The combination of two well established and effective technologies

Standard filter tube
+ SCR catalyst





Micrograph of Embedded Nano-catalysts



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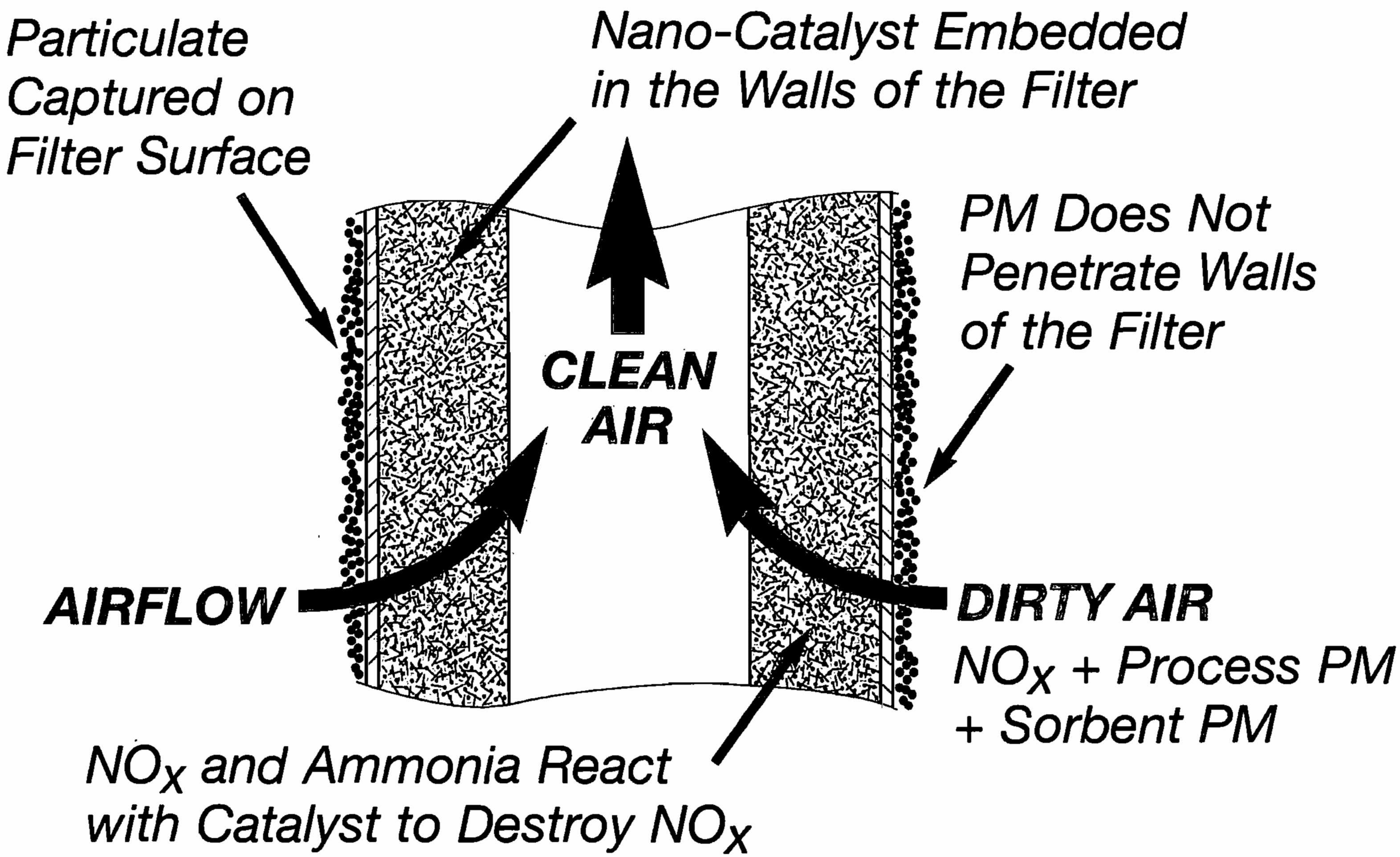
Nano-catalysts in UltraCat filter walls for NOx control



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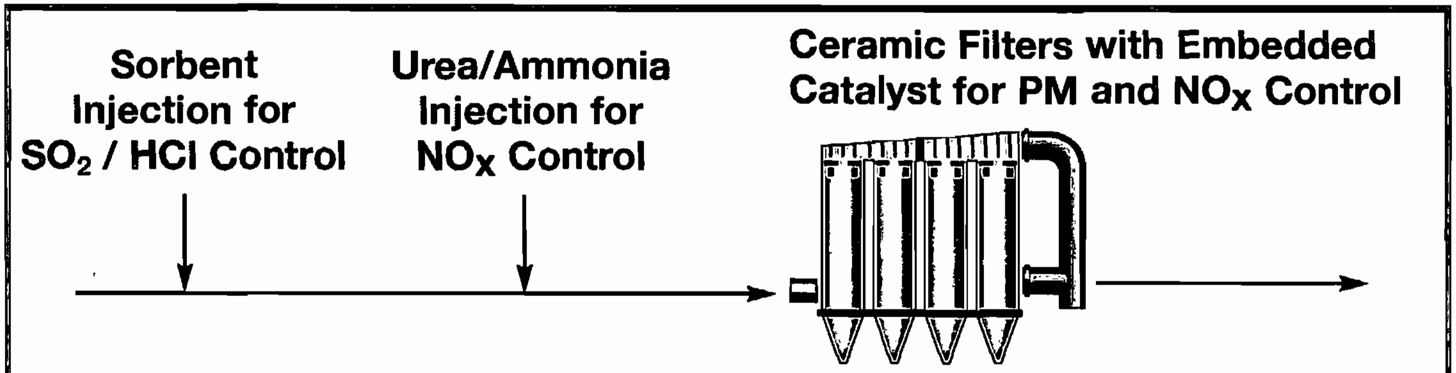
NO_x removal – low temp nanocatalyst & ammonia injection

- UltraCat Catalyst Filters preceded by upstream ammonia injection
  - Selective Catalytic Reduction (SCR) with proprietary catalyst
  - Catalyst formulation much less sensitive to SO2→SO3, HCl

- UltraCat Catalyst Filter performance: up to 95% removal of NO_x
  - Lower operating temperature limit of 350 F
  - Upper operating temperature limit of 700 F



UltraTemp Filtration system for control of particulate, SO_2 and NO_X.

Additional Key Points for UltraCat Catalyst Filters

- Surface filtration of ceramic filter prevents poisoning of catalyst by PM. Sorbent injection lowers SO2 load.
- Catalyst does <u>not</u> affect filtration performance.
- Catalyst does <u>not</u> increase pressure drop.
- No reaction between ceramic and catalyst.
- Catalyst does not require regeneration and lifetime is expected to be 5+ years.
- Recent scientific evaluation concluded there was no sign of catalyst deterioration after five years of service.

Results for PM, SO_2, NO_x reported at GPC Oct. 2009

Two large glass plants operating for approx. 3 years, both companies have ordered another system, two additional systems being installed, many under review.

TYPICAL GLASS FURNACE RESULTS FOR PM, SO_2, NO_X CONTROL				
POLLUTANTS	UNITS	FILTER INLET	FILTER OUTLET	EFFICIENCY %
PM	mg/Nm^3	1500	0.5	99.97
NOx	mg/Nm^3	1000	150	85.00
SO2	mg/Nm^3	850	25	97.10
HCl	mg/Nm^3	600	5	99.20

Source: Glass Problems Conference, Columbus OH, October 2009

Pilot test results on flat glass that incorporates SO_2 and NO_x control. NOx removal could have been increased with more ammonia injection. Note that particulate loading includes the dry sorbent to control SO_2. Commercial systems initially based on these results.

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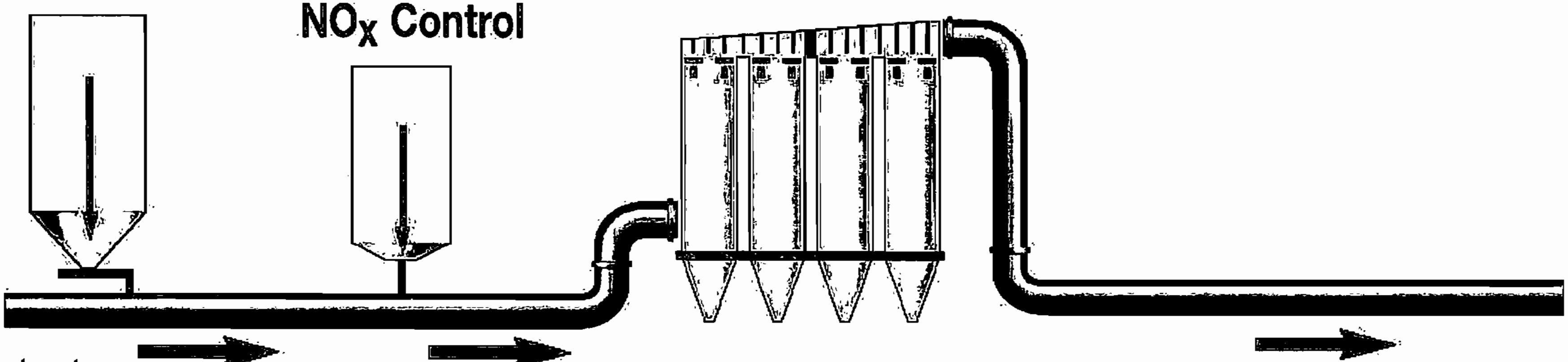
ULTRACAT
HOT GAS FILTRATION

Control of PM, SO_2, NO_x in One System



Tri-Mer offers complete equipment set, engineering, and installation.

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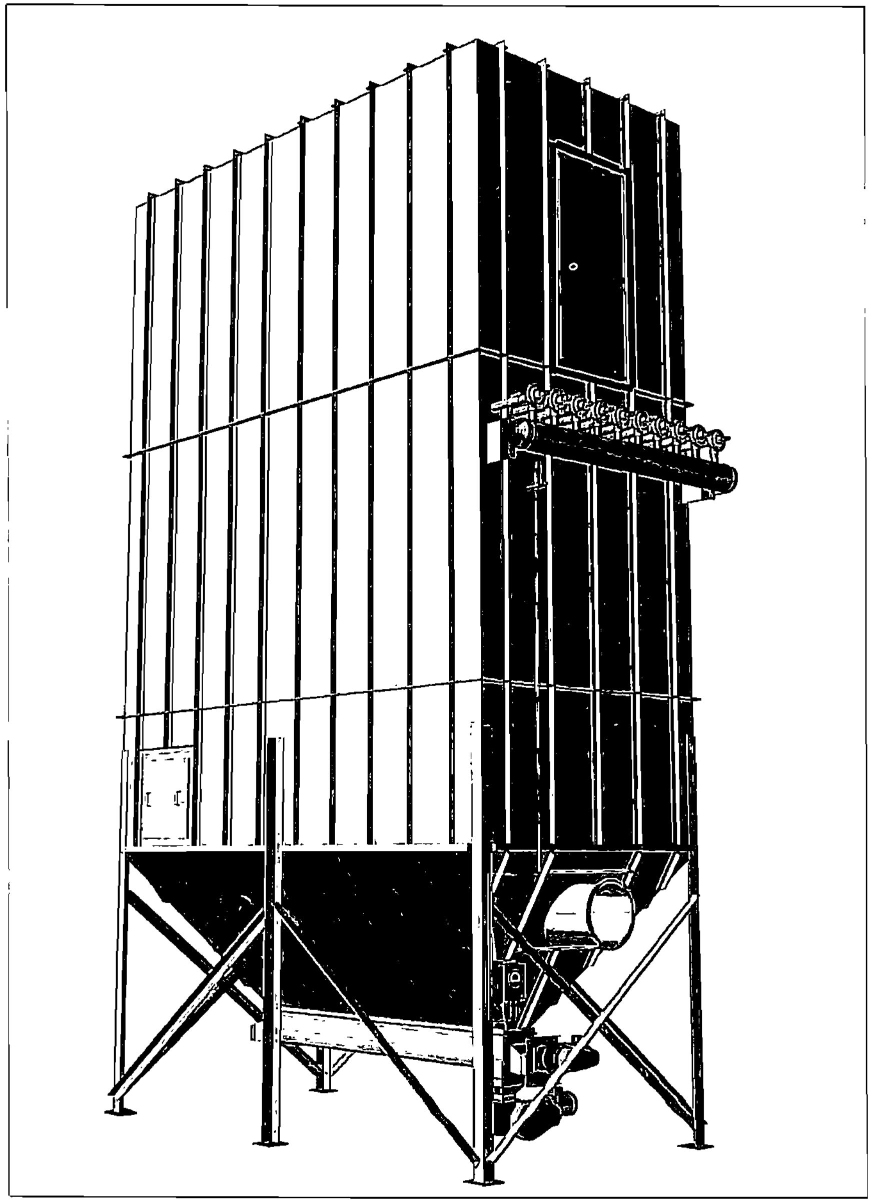
Module, external

Technology transfer of module designs from European collaborator with dozens of installed filter systems over the last decade.

Tri-Mer is expert in steel fabrication, with steel APC equipment in place for over 40 years.



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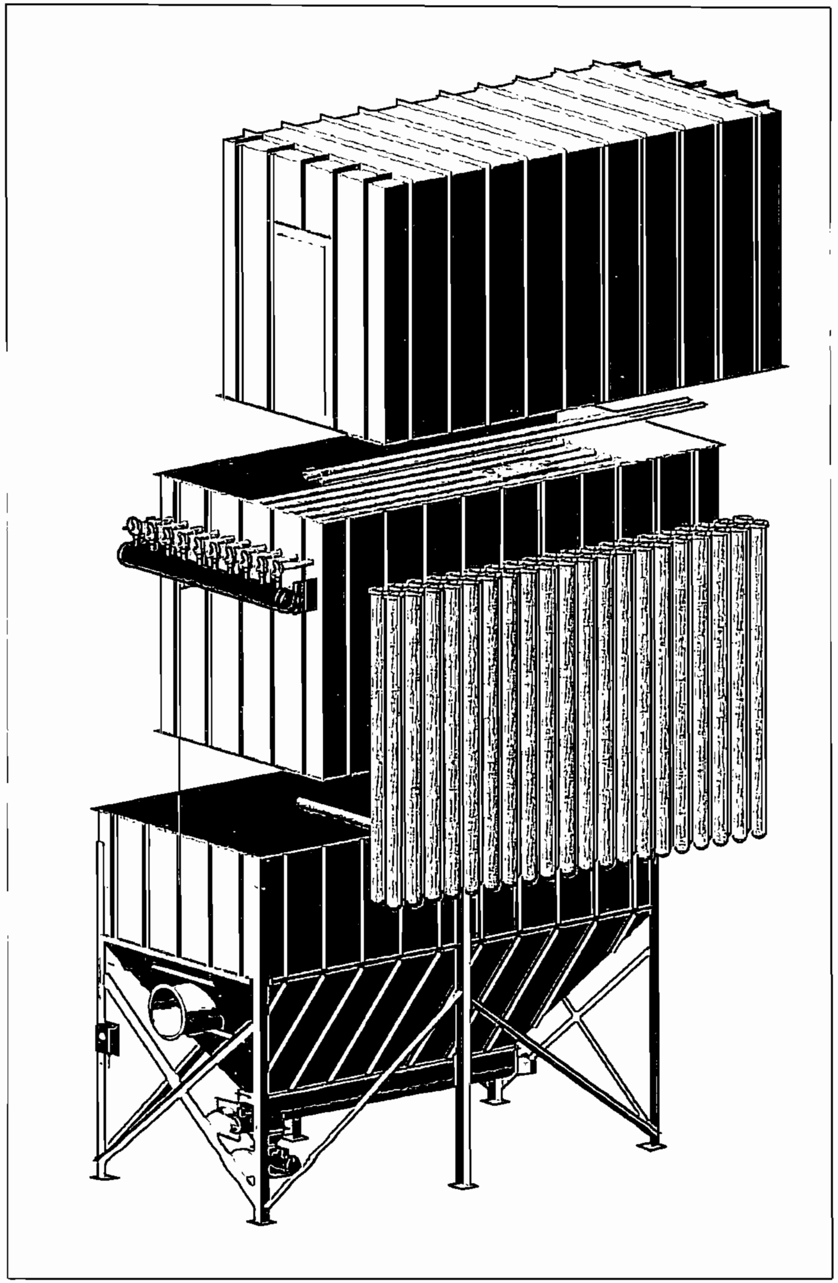
Module, shipping & install

a. Walk-in plenum module shipped in three pieces.

b. Simple installation with a crane.

c. Filter tubes installed in the field by Tri-Mer personnel.



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Assembly of modules

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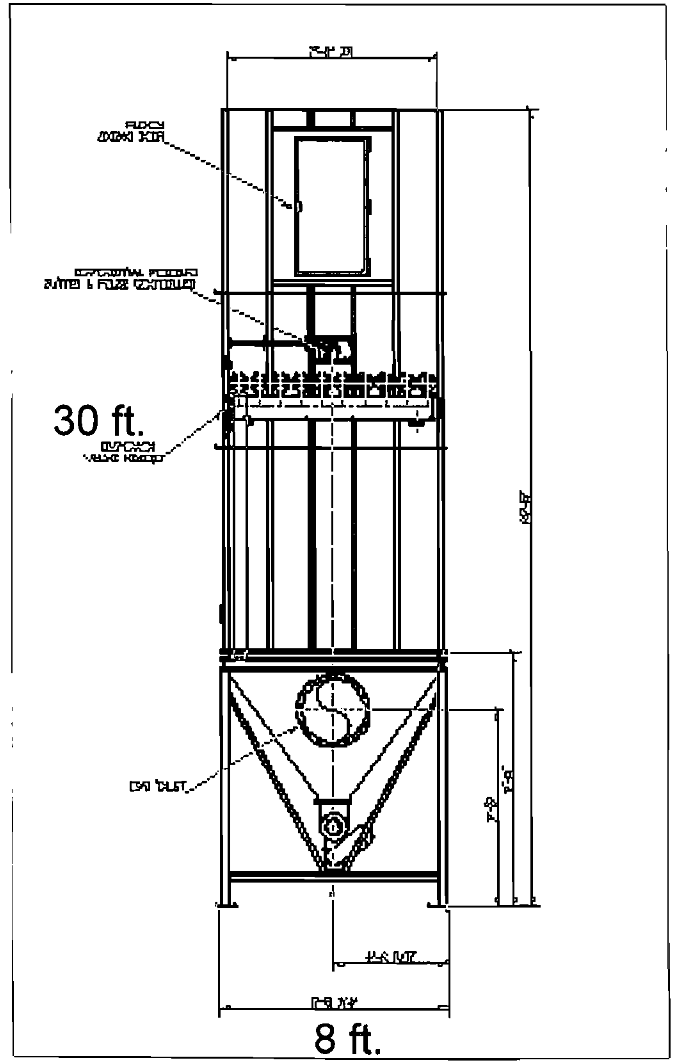
UltraTemp or UltraCat module with walk-in plenum

a) 30 ft. Walk-in Plenum provides easy filter placement, more weather-friendly enclosure.

b) All plenums insulated.

c) Outdoor/indoor placement.



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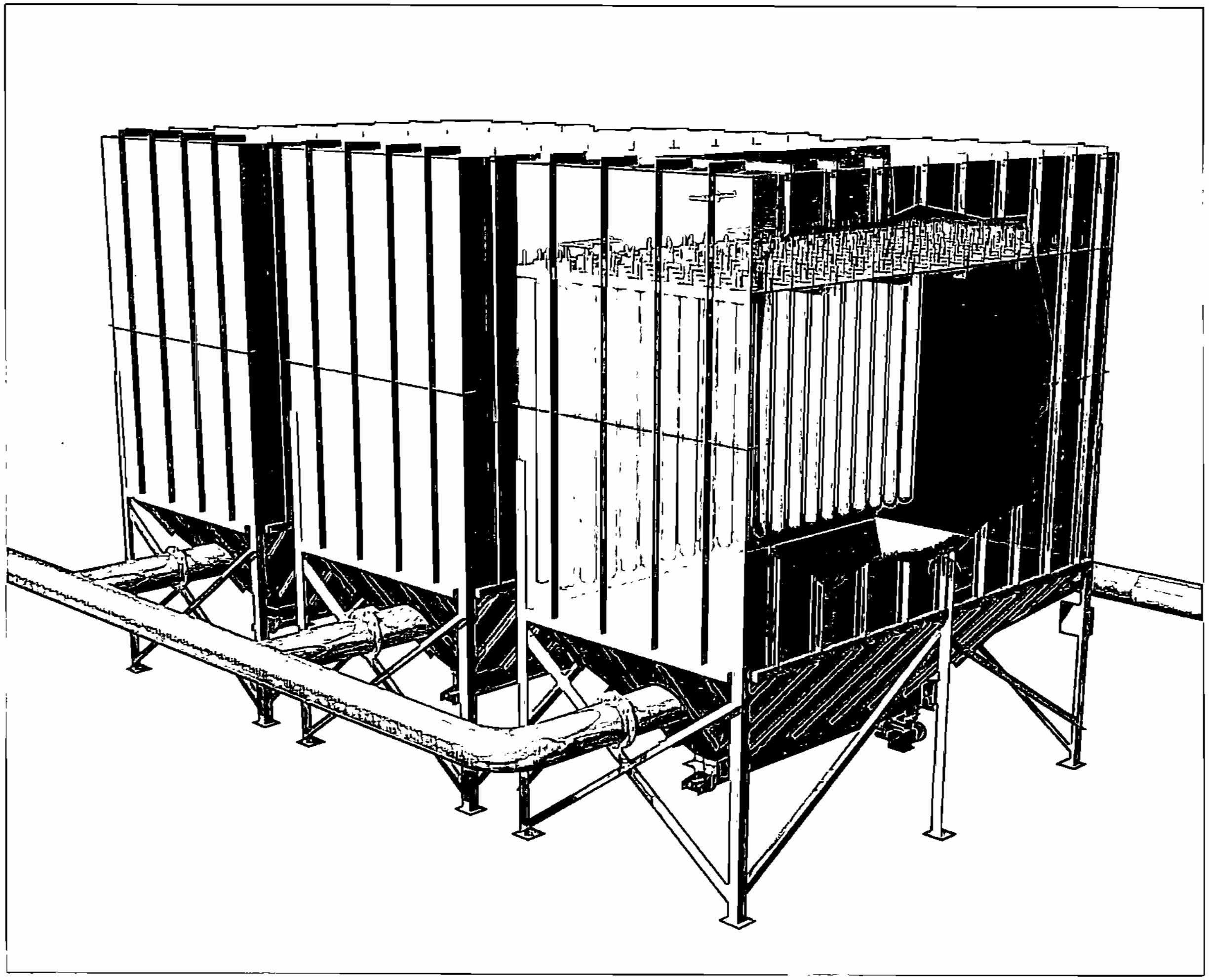
Multiple modules to match the flow



With 3 or more modules, if a module needs to be serviced, the other modules are designed to temporarily operate at higher pressure with minimal change in performance.

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Tri-Mer Glass Project

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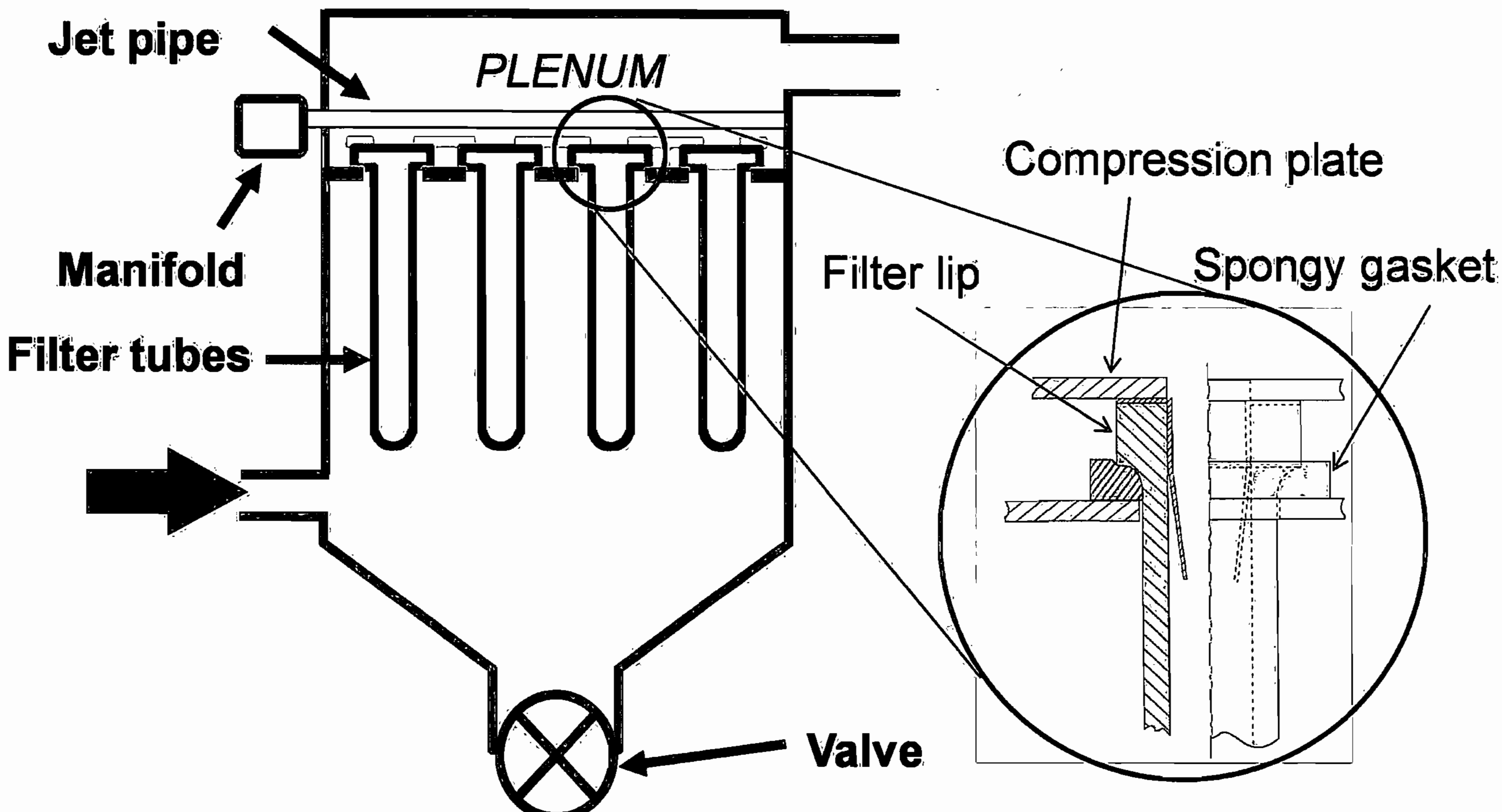
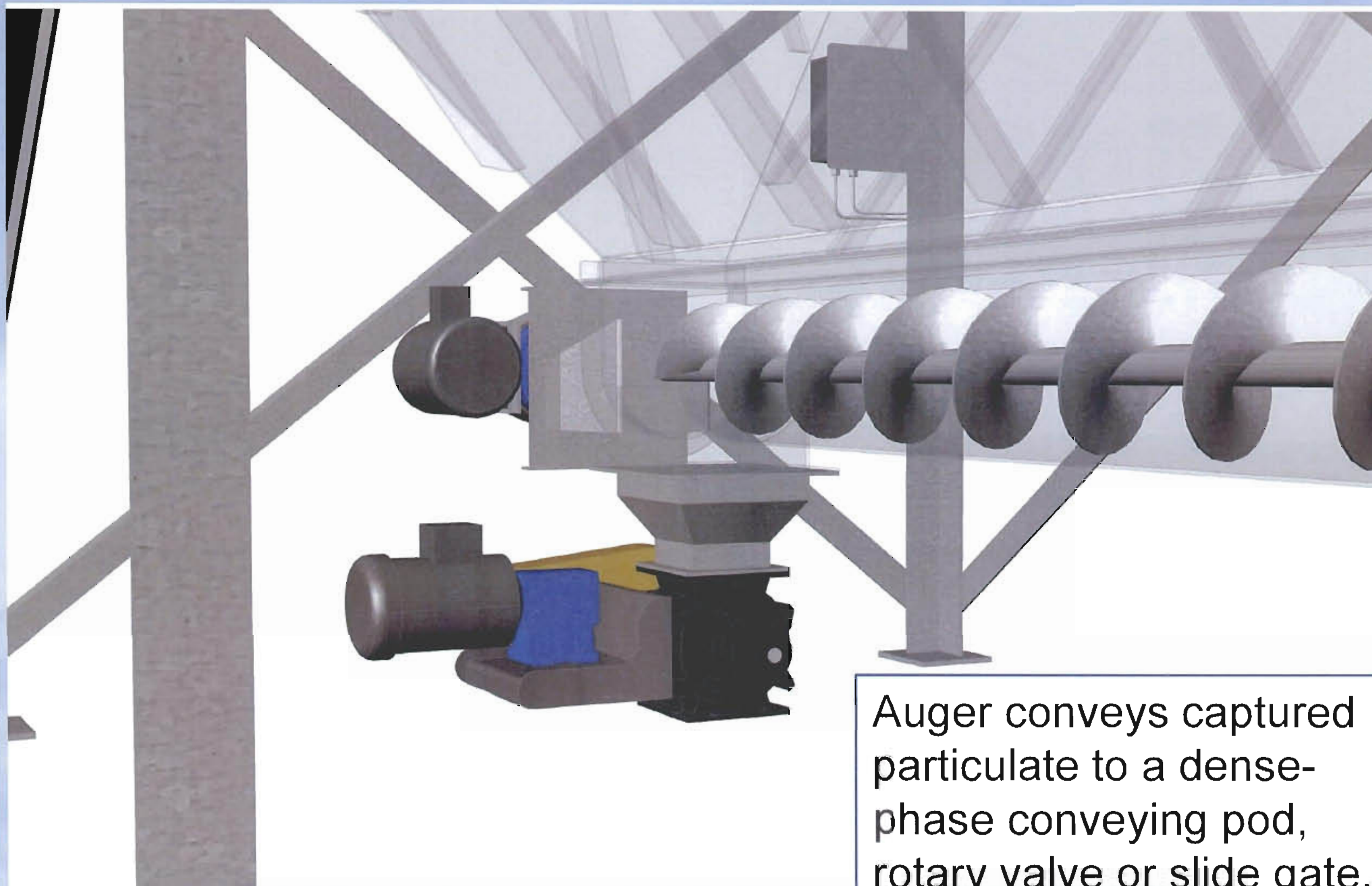
Filter tube sealing mechanism, standard pulse-jet cleaning



Pressure drop: 6-10 inches w.g.
Filters cleaned either on a timer or when dP is 1.0 in w.g.

Module, underside detail



Auger conveys captured particulate to a dense-phase conveying pod, rotary valve or slide gate.

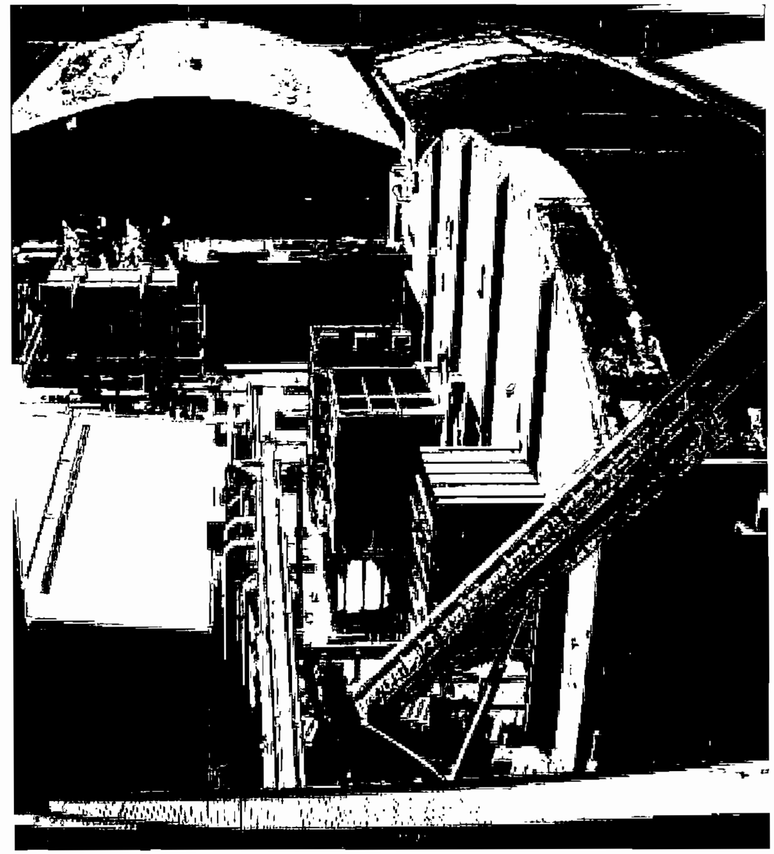
Summary: UTF, UCF advantages

- Lower initial cost because of all-in-one capability
- Lower total operating cost than a train of equipment
- Lower cost of long-term ownership
- Flexibility, simplicity of design, operation, maintenance
- Unsurpassed PM removal
- Low temp NOx removal, dioxin destruction
- SO2 & HCl removal, mercury options
- Performance guarantees, aimed at new Boiler MACT
- Backed by Tri-Mer's 50 years of service and reliability

Tri-Mer Corporation Turn-key Project Delivery

Air Pollution Control (APC) Equipment

1. System design and integration
2. Engineering & shop drawings
3. Equipment manufacture & fabrication
4. Site preparation (customer option)
5. Installation or installation supervision
6. Start-up & training
7. Performance verification
8. Maintenance & service



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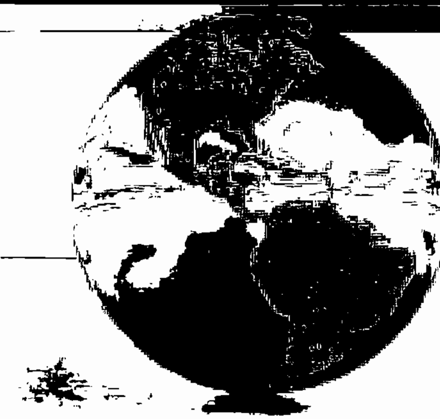
Technology Leader
air pollution control



www.tri-mer.com

THANK YOU !

APPENDIX E-2
CERAFIL CERAMIC FILTER (CLEAR EDGE FILTRATION)

Deutsche Glastechnische Gesellschaft E.V.

Meeting of Technical Committees II and VI
Jena, September 24 2008

CERAMIC FILTER ELEMENTS FOR EMISSION CONTROL AND NOX REDUCTION AT HIGH TEMPERATURES

Andrew Startin

Clear Edge UK Ltd., Cerafil Division, The Stable, Rock Farm, Seckington, Tamworth, B79 0LA, UK

Summary

Glass furnace off gases are characterised by being at elevated temperature, depending on the level of heat recovery, and carrying a mixture of pollutants. Chief among the pollutants in glass furnace off gas are particulate, oxides of sulphur and oxides of nitrogen. A number of well established techniques exist for treating these pollutants, either individually or in combination.

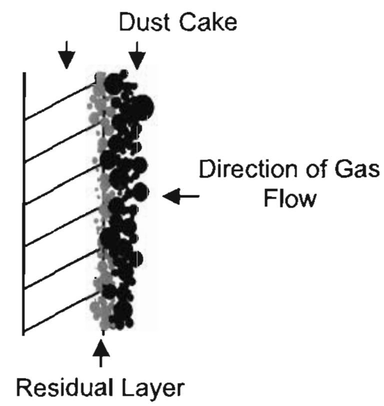
An emerging technology for glass furnace off gas clean up is the employment of low density ceramic filter elements. Ceramic filter elements are extremely efficient and work well in combination with a dry scrubbing agent for acid gas removal. Further, given the refractory nature of the medium, the filtration temperature can be maintained at a suitable level for catalytic treatment of NOx.

The Clear Edge catalytic ceramic filter element, Cerafil TopKat, offers deNOx functionality as well as efficient particulate and acid gas removal. Thus the major pollutants emitted by a glass furnace can be treated in a single piece of equipment. The technology, apart from major environmental performance benefits, offers the possibility of substantial savings both in monetary terms and space utilisation, the latter being of paramount importance for many existing glass manufacturing sites.

Ceramic filters offer the potential for phased implementation of pollution abatement equipment. In the first instance a filter based around standard filter elements can be installed. This phase provides particulate abatement, acid gas removal (with a sorbent) and sufficient temperature for future NOx control. At the point when NOx control is required the end user has the choice to opt for selective catalytic reduction (SCR) technology or retrofit the ceramic filter with Cerafil TopKat filter elements. The most appropriate choice can be made on the basis of economic and technical considerations. The attractions of phased introduction are the ability to meet abatement requirements without unnecessary or premature expense.

Keywords:
Ceramic filter, gas filtration, hot gas filter, high efficiency, catalyst, DeNOx

barrier filter medium. The rigidity of ceramic elements further promotes cake filtration since the protective dust layer is not compromised during cleaning.



Ceramic elements are employed on duties where the benefits, described earlier, of the medium can be effectively utilised. This is typically duties where high capture efficiency is required in combination with temperature resistance. However it is worthwhile stressing that ceramic elements are not simply a "hot gas filter". Although ceramic elements can be and are applied in high temperature filtration duties they are equally applicable where the filtration temperature regime is variable or subject to surges which could damage conventional fabric media.

3. CATALYTIC CERAMIC FILTER ELEMENT

3.1 DEVELOPMENT

Clear Edge, in collaboration with Haldor Topsøe A/S, have developed a catalytically active ceramic filter element. The filter element, named Cerafil TopKat, incorporates an integral catalyst formulated to oxidise dioxins and reduce NOx, the latter in combination with ammonia or urea injection. The catalyst is also effective at oxidising VOC's where the operating temperature regime is sufficiently high (220°C +).

The catalyst material is a proprietary mixture of oxides which is incorporated into the body of a filter element in such a way as to ensure even distribution. Figure 2 below shows an EDAX plot (energy dispersive analysis by x-ray) of the catalyst distribution across the wall of a TopKat element.

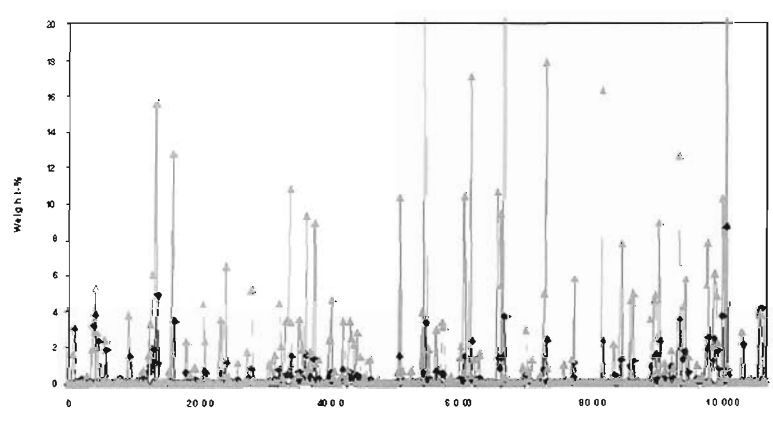


Figure 2 Catalyst distribution plot through 10mm thick element wall

As can be seen, the mixed oxide catalyst materials, represented by the two plots, are both distributed throughout the depth of the filter body thus ensuring maximum possible residence time. Catalyst efficiency is further enhanced by virtue of the fine nature of the material employed. This application of nano technology ensures that the diffusion restrictions associated with conventional catalyst technology are eliminated thus ensuring optimal removal efficiencies. Figure 3 shows an SEM image of a portion of filter body. The catalyst particles can be clearly seen coating the fibres within the fibre matrix.

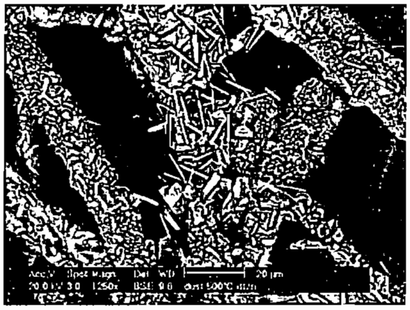


Figure 3 SEM image of filter body

3.2 PERFORMANCE

TopKat builds on the efficiency and temperature capability of ceramic elements by adding the ability to dramatically reduce dioxin, NOx and VOC emissions. As these species increasingly become the focus of environmental legislation technically and economically effective means of controlling them need to be developed.

Selective catalytic reduction (SCR) can be employed for glass furnace off gas NOx reduction, particularly where primary controls are unable to meet local legislative requirements. The technology is effective but there are drawbacks. SCR catalysts can be poisoned by particulate matter carried over from upstream abatement plant. This is especially critical where electrostatic precipitators (ESP's) are employed since emissions of the order of 20 – 30 mg/Nm^3 are typical, even higher during upset conditions. Cerafil TopKat is a potential solution providing the necessary removal efficiency through a filter plant with the minimum of ancillary components.

3.3 IMPLEMENTATION

Ceramic filters offer the potential for phased implementation of pollution abatement equipment. In the first instance a filter based around standard filter elements can be installed. This phase provides particulate abatement, acid gas removal (with a sorbent) and sufficient temperature for future NOx control. At the point when NOx control is required the end user has the choice to opt for selective catalytic reduction (SCR) technology or retrofit the ceramic filter with Cerafil TopKat catalytic filter elements. The most appropriate choice can be made on the basis of economic and technical considerations. The attractions of phased introduction are the ability to meet abatement requirements without unnecessary or premature expense.

3.4 CASE STUDY

A Cerafil TopKat trial has been carried out at a European float glass line in order to demonstrate the technology. A schematic of the pilot installation is shown below (figure 4)-

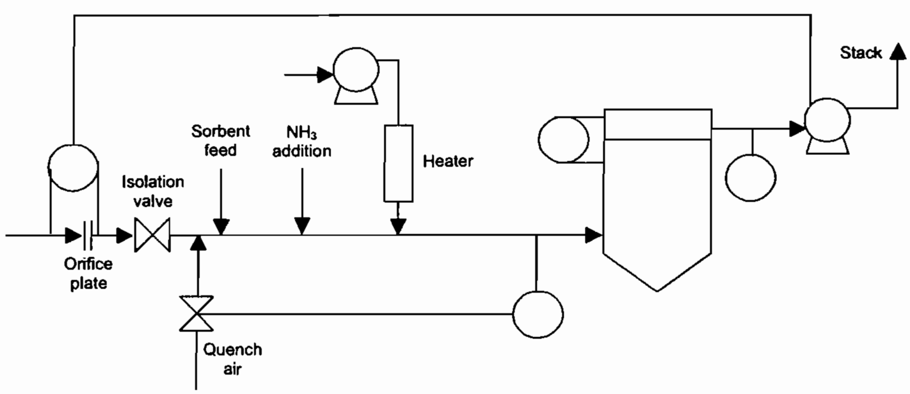


Figure 4 Schematic diagram of pilot filter installation

Advanced AIR POLLUTION CONTROL in One System

Unlike other filter systems, advanced, low-density ceramic filter systems are now capable of removing particulate matter (PM), NO_X, SO_2, HCl, dioxins and mercury, all within a single system.

BY KEVIN MOSS

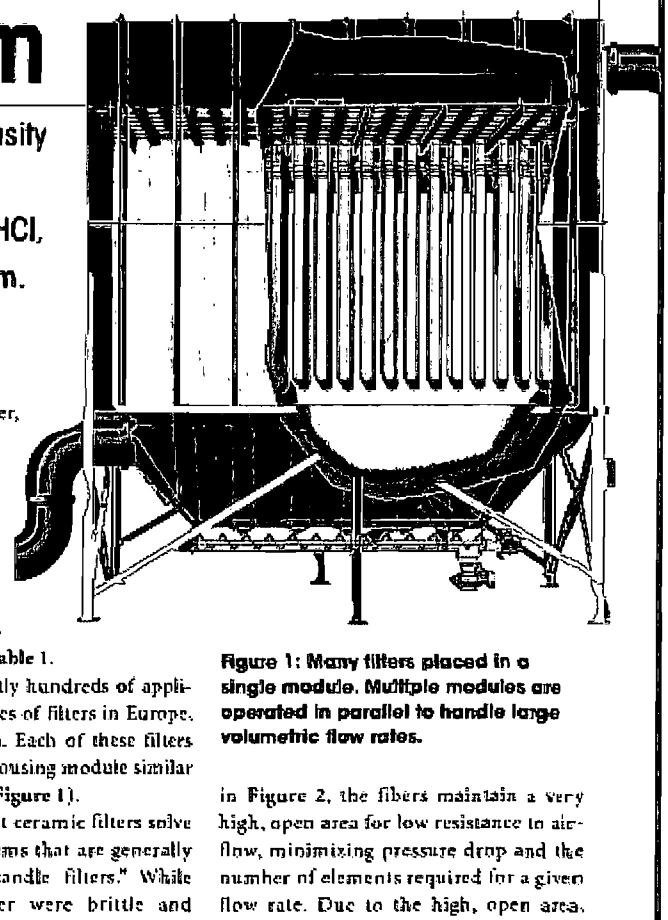


Figure 1: Many filters placed in a single module. Multiple modules are operated in parallel to handle large volumetric flow rates.

Advanced, low-density ceramic filter systems are capable of removing particulate matter (PM), NO_X, SO_2, HCl, dioxins and mercury in a single system. Particulate matter is removed to ultralow levels (less than 2 mg per Nm^3, 0.001 grains per dscf), while other pollutants can be eradicated at percentages greater than 90 percent.

Ceramic filters

Ceramic filters, often called candles because of their solid tube shape, have been used in pollution control systems for decades.

The original high-density candle filters were manufactured from refractory grains, including alumina or silicon carbide, and pressed into a basic candle shape – a tube with a closed, rounded bottom and a flange at the top. Newer, low-density filters start as a slurry of refractory fibers and are vacuum formed. The contrast between each of these types of ceramic filter elements is shown in **Table 1**.

There are currently hundreds of applications of these types of filters in Europe, Japan and Australia. Each of these filters can be placed in a housing module similar to a baghouse (see **Figure 1**).

These lightweight ceramic filters solve many of the problems that are generally associated with "candle filters." While effective, the latter were brittle and prone to cracking and breakage from thermal shock and vibration. As shown in **Figure 2**, the fibers maintain a very high, open area for low resistance to airflow, minimizing pressure drop and the number of elements required for a given flow rate. Due to the high, open area, elements can also be cleaned using the standard reverse pulse-jet techniques

Contrast between types of ceramic filter elements

Characteristics of high- and low-density ceramic-filter elements

	High density	Low density
Structure	Granular	Fibrous
Density	High	Low
Filter Drag	High	Low
Porosity, % (Inverse of resistance to flow)	0.3 - 0.4	0.8 - 0.9
Tensile strength	High	Low
Fracture mechanism	Brittle	Ductile
Thermal shock resistance	Low	High
Cost	High	Low

Characteristics of low-density fibrous ceramic filter elements

Form	Monolithic rigid tube
Composition	Refractory fibers plus organic and inorganic binding agents
Porosity	About 80 - 90%
Density	About 0.3 - 0.4 g/cc
Support	Self-supporting from integral flange
Geometry	Outer diameter up to 150mm (6 in.) Length up to 3m (10 ft.)

Left: Table 1, Above: Table 2

Table 4 Filter parameters

Element type		TopKat-3000
Quantity		40
Surface area	m^2	56
Filtration temp.	°C	.350
Gas flow	Nm^3/h	1800
NOx inlet concentration	mg/Nm^3	~1200
NOx outlet concentarion	mg/Nm^3	<200
Face velocity	m/s	0.02
Pressure drop	KPa	~1.75

Exhaust gases exiting the furnace first pass through a boiler plant which drops the gas temperature to between 400 and 470°C. The filtration temperature was controlled by the addition of heated or quench air. Volume flow through the plant was adjusted by means of a frequency inverter on the fan which in turn was controlled by the orifice plate flow measurement.

The purpose of the trial was to determine the flow/pressure drop/temperature characteristics of the filter media along with NOx reduction efficiency. The trial output has allowed for the future scaling of full scale plants while a NOx reduction in excess of 80%, down to target levels, was achieved.

4. CONCLUSION

The employment of low density ceramic filter elements for pollution control and product recovery applications is now well established. The principal benefits of ceramic elements are high filtration efficiency and high temperature capability. These benefits can most effectively be utilised to treat the gases associated with high temperature processes where high filtration efficiency is required. The latter requirement is usually as a result of stringent emissions legislation.

Demands on filtration technology and therefore filter media have increased in recent years particularly as a result of tightening emissions legislation. In response to these demands low density ceramic filter technology is advancing with the introduction of new formulations and geometries.

Cerafil TopKat represents a revolutionary advance in ceramic filter technology. The new element extends ceramic filter capability by incorporating an integral catalyst for dioxin, NOx and VOC removal. The product has already exhibited excellent NOx removal ability both in pilot and full scale plants. Empirical data collected to date has demonstrated that it is possible to effectively combine filtration capability with catalytic activity.

The development of a catalytic low density ceramic filter element has demonstrated that low density ceramic filter technology can progress to meet the new challenges posed by strengthening environmental legislation. Where a duty demands the ability to operate at a high or variable temperature and control a range of prescribed pollutants ceramic filter technology provides a viable solution.

A. Startin
September 2008

Controlling Emissions With Ceramic Filters

Ceramic filters are well suited for high-temperature processes that are subject to strict emissions limits, including those for dioxins

Andrew Startin and Gary Elliott
Clear Edge Filtration

TABLE 1. CHARACTERISTICS OF HIGH- AND LOW-DENSITY CERAMIC-FILTER ELEMENTS		
	High density	Low density
Structure	Granular	Fibrous
Density	High	Low
Filter drag	High	Low
Porosity, % (inverse of resistance to flow)	0.3 – 0.4	0.8 - 0.9
Tensile strength	High	Low
Fracture mechanism	Brittle	Ductile
Thermal shock resistance	Low	High
Cost	High	Low

Ceramic filters offer practical operating benefits and commercial competitiveness in pollution abatement applications where processes combine elevated-temperature off gases with the need for high levels of corrosion resistance and the ability to eliminate dust emissions. This article discusses the applicability of ceramic filtration technology, with focus on, and examples of its use in incineration processes.

The ability to deliver low emissions, even with fine particles that are 2.5 micrometers (μm) or smaller ($PM_{2.5}$), while operating at an elevated temperature is the primary driver for the application of ceramic elements to high temperature processes that are subject to strict emissions limits. Such processes include metal smelting, chemicals production and waste incineration. In the latter case, ceramic elements have been applied to a number of small- to medium-scale incineration duties including medical waste, soil cleaning, asphalt recycling, industrial waste, chemical waste and building waste.

Several new, high-temperature incineration installations have been set up to deal with waste that is of mixed composition from various sources. Ceramic elements have been selected as the filter medium for a number of these installations. Of particular interest are the emissions of dioxin chemicals and particulate matter that have been under close scrutiny since the 1990s. Official emissions reports commissioned for these plants indicate emissions well within regulated limits.

Ceramic filtration technology

The concept of using a refractory ceramic material to form a filter medium, predominantly for use at elevated temperature (generally in the region of 200–400°C, but can be up to 900°C) has been around for many years [1]. One of the earlier forms of ceramic filter was devised for advanced power-generation applications with the requirement for operation at high temperature and high pressure. In the form of flanged tubes, closed at one end, these "high density" media are still in widespread use across a broad range of applications.

Low-density ceramic filter elements (hereafter referred to as ceramic elements) were initially developed in the middle 1980s. One of the first applications for ceramic elements was in thermal soil remediation. This process involves driving off the volatiles from contaminated soil in a rotary furnace to decontaminate it and make it reusable. The first stage in the complex off-gas treatment train is high tem-

ABOUT INCINERATION

Incineration processes are being widely used more and more to deal with the disposal of waste materials. In many countries, land filling of waste materials is not practical or desirable due to a lack of appropriate sites. Incineration has the benefit of reducing both the volume and mass of waste, thus reducing the amount of material to be disposed of.

Incineration is now applied to a wide range of waste streams from high-tonnage municipal solid waste (MSW) through to the lower-tonnage specialty wastes produced by industrial processes. However, whatever the application, the imperative for the incineration process is broadly the same — a reduction in mass and volume while rendering the remaining waste material as inert as possible and, of course, producing the absolute minimum of emissions.

Waste incineration, as with other industrial processes, has been the subject of ever tightening emissions legislation in recent years. Public disquiet over incineration processes and the generation of potentially dangerous emissions has subsequently, detrimentally affected the approval of many new installations. Consequently, the industry has sought effective post-incinerator processes for dealing with off gases in terms of reducing and eliminating emissions and where practical, recovering useful energy. Many techniques and combinations of techniques have been developed and are under development — a broad overview of which is beyond the scope of this paper. ❑

TABLE 2. CHARACTERISTICS OF (LOW-DENSITY) CERAMIC ELEMENTS	
Form	Monolithic rigid tube
Composition	Refractory fibers plus organic and inorganic binding agents
Porosity	about 80-90%
Density	about 0.3-0.4 g/cc
Support	Self supporting from integral flange
Geometry	Outer dia. up to 150 mm; Length up to 3 m

TABLE 3. MAXIMUM OPERATING TEMPERATURE OF FILTRATION MEDIA		
	Operating Temperature (°C)	
	Continuous	Surge
Sulfar ("Ryton")	180	200
Aramid ("Nomex")	200	240
Polyimide ("P84")	240	260
PTFE ("Teflon")	260	280
Glass	260	300
Ceramic elements	900	900

perature filtration, which removes particulates from the gas prior to further processing.

The ceramic elements manufactured in the middle 1980s were sectional, meaning they were built up from a series of inner- and outer-tube sections. The first monolithic elements were produced around the late 1980s and early 1990s. One of the early applications envisaged was advanced power generation, so the form of the first monolithic ceramic element was typical of the high-density elements being applied in the development of advanced power-generation technology — it was a 1-m-long tube, with a 60-mm outside dia., closed at one end and with an integral mounting flange at the other end.

Table 1 summarizes the main characteristics of the two types of elements referred to as low and high density. In addition to the characteristics outlined in the table, one major difference between high- and low-density ceramic filter elements is the forming method. Typically, high density elements are manufactured from refractory grains (such as alumina or silicon carbide) by pressing or tamping to form the basic shape. Low-density ceramic filter elements are vacuum formed from a slurry of refractory fibers to produce a blank, which is machined to shape, or in some cases to produce the final shape. It is also worth mentioning that ceramic filter elements are also produced in the form of plain tubes and can be applied to "inside out" filtration as well as "outside in". Normally, however, "outside in" filtration is employed.

Characteristics and benefits. The key characteristics of ceramic elements are summarized in Table 2. Ceramic elements are formed from refractory ceramic fibers with a fiber diameter of around 3 µm. Fiber diameter is crucial to promoting surface filtration and thereby good filtration characteristics.

TABLE 4. EFFICIENCY OF CERAMIC ELEMENTS IN VARIOUS APPLICATIONS				
Process	Dust loading	Particle size	Emission level	Inferred efficiency
	mg/Nm³	d_{50}[1], µm	mg/Nm³	%
Zirconia production	Up to 8,000	1.2	0.8	99.99
Aluminum powder production	550	<50	<1	>99.8
Secondary aluminum	about 870	<1	0.5	99.9
Smokeless fuel production	1,000	4.8	1.5	99.85
Nickel refining	about 11,800	<10	<1	>99.99

1. Diameter of median size particle

TABLE 5. EUROPEAN WASTE INCINERATION DIRECTIVE ANNEX V: AIR EMISSION LIMIT VALUES (ELV)			
	Directive Requirement		
	ELV mg/m³	Averaging/Monitoring Period	Monitoring Frequency
Total Dust	10	Daily average	Continuous
VOCs (as TOC)	10	Daily average	Continuous
HCl	10	Daily average	Continuous
HF	1	Daily average	Continuous
SO_2	50	Daily average	Continuous
NOx (as NO_2)	200	Daily average	Continuous
CO	50	Daily average	Continuous
Cd and Tl	total 0.05	All average values over the sample period (30 min to 8 h) to be less than these limits	Periodic: 2 per year but every 3 months during first year of operation
Hg	0.05		
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V	total 0.5		
Dioxins and furans	0.1 ng/m³ TEQ	CEN[2] method, sample period 6 to 8 h	As above

2. Conseil European pour la Normalisation

The structure and composition of ceramic elements confer three principal benefits for the technology:

- High-temperature filtration capability
- High collection efficiency
- Corrosion resistance

Although the maximum use temperature claimed by the various manufacturers for their ceramic elements varies, it is typically stated as 900°C (1,650°F). This temperature is well above that required by the majority of "end-of-pipe" air pollution control (APC) duties that utilize traditional fabric bags for particulate capture. The ceiling temperature for commonly used fabric-bag materials is shown in Table 3.

The elevated ceiling temperature of ceramic elements coupled with high filtration efficiency constitutes the basis for selection of the technology. Where the off gas to be filtered is consistently at a temperature below 250°C, then a needlefelt or coated needlefelt manufactured from a traditional polymeric material will often be adequate. However, stringent emissions regulations coupled with an elevated or variable off-gas temperature can be too tough for polymeric fabrics and favor the application of ceramic elements. Examples of the emissions

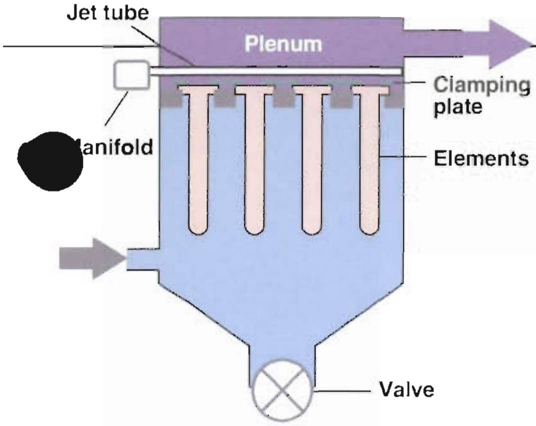


FIGURE 1. A ceramic filter plant is shown in this schematic diagram

TABLE 6. SOME APPLICATIONS OF CERAMIC ELEMENTS

Air pollution control applications	Product collection/recovery applications
Waste incineration	Titanium dioxide production
Soil cleaning	Fumed silica production
Metals smelting	Carbon black production
Minerals processing	Catalyst manufacture
Foundry processes	Platinum smelting
Glass furnaces	Metal powder production
Cement production	Activated carbon production
Fluidized beds	
Boiler plant	

achieved by ceramic elements are presented in Table 4.

Application and duties. Many industrial processes, and in particular, high-temperature processes, emit off-gas streams of mixed gas laden with particulate matter that has a variable composition. Managing these off-gas streams is a necessary part of the industrial activity. Air emissions from an incineration plant can involve a broad range of species, including particulate matter, oxides of nitrogen (NOx), oxides of sulfur (SOx), hydrogen chloride, volatile organic compounds (VOCs), polychlorinated biphenyls/dibenzo furans (dioxins) and heavy metals. The abatement regime is required to reduce these pollutants to below the regulated limits. The European Waste Incineration Directive, currently being enacted in the U.K. and elsewhere, requires specified incineration processes to meet a series of defined emission limit values (ELVs). These are outlined in Table 5.

A number of established and emerging technologies have been developed to meet regulated emission limits. These include barrier filters, dry, semidry and wet scrubbing, cyclones, electrostatic precipitators and catalysis-conversion processes. These cleanup processes are used, often in combination, to achieve at least the regulated emission limits. Process choice is affected by many factors, apart from the regulations in force, not least of which are economics and reliability.

Ceramic elements can be employed in a filtration plant to meet the particulate (dust) emission target across a broad range of processes. In this article, the terms filter plant and filtration plant refer to a full filter assembly consisting of the housing and filter elements (Figure 1). The filtration plant can be a new build, or ceramic elements can be retrofitted into an existing bag-house filter. The filter plant, housing the array(s) of ceramic elements, is often used in combination with dry scrubbing and is placed downstream of cooling or heat recovery apparatus.

In principal, the operation of ceramic filter plants is similar to fabric bag houses. The gas to be cleaned is typically drawn into the plant by an induced-draft fan such that the particulate matter being collected builds up on the outside of the elements in the form of a cake. The cleaned gas passes through the wall of the elements and into the plenum, the cake being periodically removed from the elements by a reverse-pulse mechanism. The rigid nature of the elements promotes surface filtration, which in turn results in low emissions and extended media life.

Ceramic elements have been applied to a wide range of services where the benefits of the technology can be utilized, for example the need for efficient filtration at an elevated temperature. Some of these applications are listed in Table 6.

The waste incineration applications can be further sub-divided into a number of small- to medium-scale duties. These include clinical, chemical, petrochemical sludge, animal waste, laboratory waste, tires and building waste.

Japan's incineration example

With an area of 147,000 square miles, a population of 127,000,000, and around two thirds of the land area being mountainous and forested, Japan's relative lack of space has precluded dependence on landfilling for waste management. Japan has achieved creditable recycling rates for waste paper, tires, and aluminum and steel cans; and Japan has utilized incineration for many years.

Of the 51.6-million metric tons (m.t.) of municipal waste created in 1998, some 78% was incinerated in 1,800 incinerators. A further 400-million m.t. of industrial waste are handled by 3,300 privately owned industrial incinerators.

In the 1980s, the Japanese system for dealing with municipal waste, with its integrated recycling and incineration program, was looked upon as somewhat of a model for municipal waste management. However, in the 1990s the growth of incineration led to greater public and media awareness of the potential for pollution created by the many incineration facilities. Particular emphasis was placed on dioxin emissions with the dioxin family of chemicals being suspected of causing a range of health problems.

Tougher emissions regulations for municipal waste incinerators were introduced in 1997, which included a tighter standard for dioxins. The dioxin standard for waste incinerators in Japan is now in line with that specified in European regulations at 0.1 ng/Nm^3 TEQ (toxic equivalent). The standards for other pollutants, such as acid gases and particulates, are generally higher than those adopted in Europe. For instance, the particulate standard for municipal waste incinerators is 50 mg/Nm^3 while a higher figure is regulated for smaller incineration facilities, typically 100–150 mg/Nm^3.

Case study background. As with municipal waste, the incineration of building waste has been the subject of more stringent emissions legislation in recent years. Such waste is derived from the construction and upgrade of buildings. Due to the source of the waste, the composition is highly variable, and contains wood, paper, cardboard, plastics and metal. There are a number of building-waste incineration plants in Japan, most of which are new installations. The first of these plants, a new installation utilizing ceramic elements, was commissioned in May 2002.

During that project design stage the end user considered both PTFE on PTFE needlefelt as well as ceramic elements for the off-gas filtration medium. Given the similar price of the two types of media, ceramic elements were eventually selected due to their additional benefits over the PTFE medium, which include the following:

- Temperature capability giving process latitude and "insurance" against temperature surges
- Low emissions
- Effective acid-gas scrubbing in combination with a dry sorbent

To date, three plants have been commissioned that utilize ceramic elements in the gas cleaning train — two on Honshu and one on Shikoku island. The first plant to be commissioned (referred to hereafter as Honshu I) is in the Chugoku region, the second plant is on Shikoku (Shikoku I) and the third plant also on Honshu (Honshu II). This case study focuses on Honshu I, but emissions test data, also included, have been made available for Honshu II.

Installation details. A simplified schematic diagram of the Honshu I plant is shown as Figure 2. Bulk waste is delivered to the plant and pre-sorted prior to being fed by mechanical loader into a shredder. Metal objects are removed by hand from the shredded material on the conveyor line, which feeds a hydraulically operated charging ram that feeds the primary combustion chamber.

Primary and secondary combustion is carried out at in excess of 1,270 K with further ash treatment in a rotary kiln to reduce final discharge volume. Combustion off gases are cooled by indirect, followed by direct cooling to accurately control temperature prior to sorbent injection.

Principal filter parameters are the following:

- Element type: 3 m length × 0.15 m outer dia.
- Number of elements: 324
- Configuration: Vertically mounted 36 × 9 array
- Filtration area: 453.6 m^2
- Design gas volume: 20,000 Nm^3/h

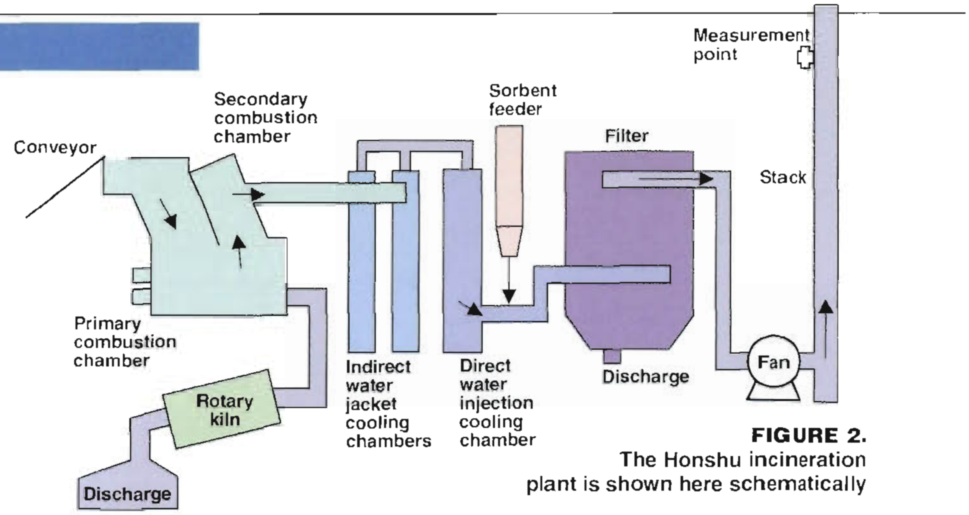


FIGURE 2. The Honshu incineration plant is shown here schematically

FIGURE 3. This is a general view of the filter plant and direct cooling chamber at Honshu I. The ceramic filter plant can be seen center left in the plant. To the right of the filter plant is the direct cooling chamber and to the left the exhaust stack

- Designed filtration velocity: 1.41 m/min at 523 K
- Sorbent: Slaked lime and activated carbon

Figure 3 shows a general view of the incineration facility and filter plant. The Shikoku I and Honshu II plants are similar in concept and operation to the Honshu I plant described above. Principal filter parameters for the Honshu II plant are as follows:

- Element type: 3 m length × 0.15 m outside dia.
- Number of elements: 216
- Configuration: Vertically mounted 24 × 9 array
- Filtration area: 302.4 m^2
- Design gas volume: 10,000 Nm^3/h
- Designed filtration velocity: 1.06 m/min at 523 K
- Sorbent: Slaked lime and activated carbon

The plant is designed somewhat more conservatively than the Honshu I plant to give a lower operational face velocity.

Operational results. In order to be granted an operating permit, all three of the incineration installations had to undergo an official emissions test, based on isokinetic sampling, soon after commissioning. Results from these tests are presented to the plant operators with actual readings being compared to the regulations in force. The official test results from the Honshu I and II plants are presented in Tables 7 and 8. The acid-gas emission figures are a function of the sorbent being employed and its application. Residence time of the sorbent in the gas stream is crucial to allow acid species to react.

TABLE 7. HONSHU I EMISSIONS MEASURED AT THE FILTER STACK ON MAY 31, 2002

Item		Unit	Value
1) Dioxin		ng-TEQ/Nm^3	0.00032
2) Dibenzofuran		ng-TEQ/Nm^3	0.02296
3) PCB		ng-TEQ/Nm^3	0.0000326
4) 1) + 2) + 3)		ng-TEQ/Nm^3	0.023
5) Total particulate		mg/Nm^3	0.3
6) HCl		mg/Nm^3	2
7) SOx		ppm	<1
8) NOx		ppm	120
9) CO		ppm	0
10) O_2		%	10.6
11) Moisture		%	22.0
12) Actual gas volume	Wet	Nm^3/h	19,110
	Dry	Nm^3/h	14,910
13) Gas temperature		°C (K)	188 (461)

TABLE 8. HONSHU II EMISSIONS MEASURED AT THE FILTER STACK ON OCTOBER 25, 2002

Item		Unit	Value[3]	Regulation[3]
1) Dioxin		ng-TEQ/Nm^3		
2) Dibenzofuran		ng-TEQ/Nm^3	0.010	
3) PCB		ng-TEQ/Nm^3	0.000010	
4) 1) + 2) + 3)		ng-TEQ/Nm^3	0.01	0.1
5) Total particulate		mg/Nm^3	0.1	250
6) HCl		mg/Nm^3	45	700
7) SOx	Concentration	ppm	28	
	Emission	Nm^3/h	0.34	10.44
8) NOx		ppm	100	
9) CO		ppm	0	
10) O_2		%	11.1	
11) Moisture		%	7.4	
12) Actual gas volume	Wet	Nm^3/h	13,000	
	Dry	Nm^3/h	12,000	
13) Gas temperature		°C (K)	134 (407)	

3. Empty cells mean either not measured or not regulated

Future developments

Ceramic elements are employed in filter plants, either new or retrofitted, in much the same way as traditional polymeric filter bags. It has been demonstrated that ceramic filters offer practical operating benefits and commercial competitiveness in high-temperature processes where corrosion resistance and the ability to eliminate dust emissions are needed.

A further important development of this technology has seen the introduction of ceramic filter elements that not only deliver the dual benefits of high particulate-removal efficiency and temperature resistance, but also treat gaseous pollutants. Fairly recently, these benefits have been enhanced by the addition of a catalyst to the filter systems [2]. The catalyst can reduce NOx with efficiency up to 95%, with the addition of ammonia or urea, and destroy VOCs as well as dioxins. This new technology has potential for application where particulate and NOx control are needed in tandem, and is competitive with electrostatic precipitators and standard selective catalytic reactors, particularly in the power generation, glass and cement industries. ■

Edited by Dorothy Lozowski

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Authors

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Andrew Startin is the product manager at Clear Edge Filtration's Cerafil Division, where he is responsible for technical and business development aspects of Cerafil. He graduated in 1981 from Brunel University (London, England) with a degree in materials science and technology. From there, he joined Doulton Industrial Products in Stone, Staffordshire where he worked on projects developing industrial ceramics primarily for the aerospace industry. He then joined Ashland Chemicals and followed by Universal Abrasives where he was involved in further development work on technical and industrial ceramics. In 1990 Startin joined Foseco, Birmingham, and first became involved with Cerafil ceramic filter elements in 1992. He became a full time member of the Cerafil team in 1994.

APPENDIX E-3
SORBENT INJECTION (NOL-TEC)

How dry bulk sorbent injection effectively removes stack gas pollutants

Jerry VanDerWerff Nol-Tec Systems

Several technologies are used to reduce pollutant emissions of SO_2, SO_3, Hg, HCl, and HF, common in flue gas streams from coal and other fossil fuel–fired boiler plants. But when it comes to dry bulk sorbent injection, the reagent best suited for mitigating one pollutant may or may not be the one best suited for a different pollutant.

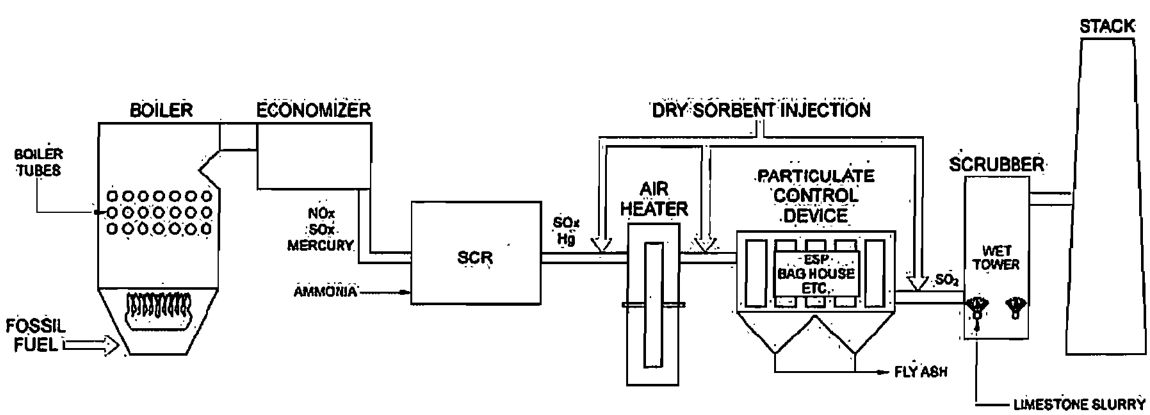
For the better part of the last two decades, increased legislation and mounting regulations have driven research and design efforts in the industrial boiler market to improve their emission mitigation technologies and to reduce stack gas pollutants to ever-decreasing levels of concentration. The early target for this increase of mitigation efficacy has been the coal-fired power generating facility.

Coal–From one fuel, many problems

When coal is oxidized (burned) as fuel, the elemental sulfur it contains is converted to sodium dioxide (SO_2). Some of the SO_2 is converted to sodium trioxide (SO_3) when oxygen left over from the combustion process causes further oxidization in the boiler. These SO_3 concentrations increase when a selective catalytic reducer (SCR) system is used to reduce nitric oxide (NO_x) emissions. The SCR converts additional SO_2 to SO_3. When sulfur oxide (SO_x) combines with flue gas moisture, vapor-phase sulfuric acid is formed.

The presence of sulfuric acid in flue gas escaping into the atmosphere causes a visible plume to form and also increases particulate emissions from the stack. Sulfuric acid also corrodes ducts and damages equipment downstream. In addition, SO_x emissions are known for their detrimental effects on human health and the environment, such as causing smog, acid rain, and ozone depletion. The use of high-sulfur coal, while more economical, exacerbates these issues, driving more legislation with increasingly tighter standards for more stringent emissions controls.

What follows is a description of mitigating SO_2 and SO_3 emissions by injecting powdered sorbent materials directly into a utility's ductwork. The injection point for the reagent is typically located between the air heater and the particulate control device. However, with mitigating efficiencies often affected by the temperatures of the stack gas flow itself, the injection point of the sorbent may differ. There is also detail on the typical design criteria for this technology and an itemization of the major components for the mitigation system.



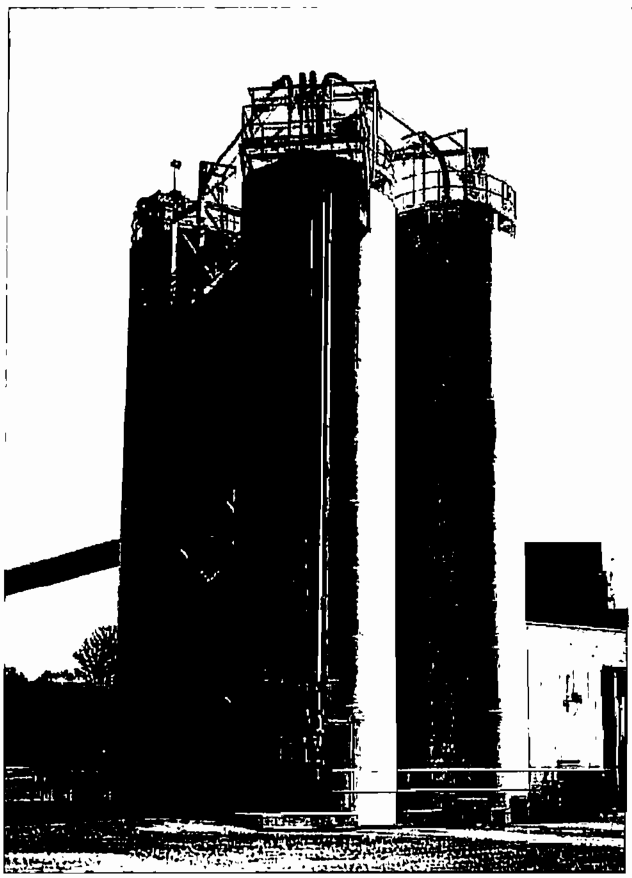
Standard schematic showing possible sorbent injection points

Types of sorbent

The method of dry sorbent injection described in this article would use a fairly well defined list of typical sorbent materials: hydrated lime, Trona (sodium sesquicarbonate), and sodium bicarbonate. The various sorbents are compared in this article.

Typical system concept for coal-fired plants

Dry bulk sorbent injection systems continuously transfer reagent from storage silos to injection ports on boiler flue gas ducts. Although system configurations vary with each application, a typical process includes multiple storage silos designed to hold 5 to 10 days' worth of sorbent material.


Imperials Industries Inc, Wausau, WI

A three-silo configuration for a flue gas desulfurization sorbent injection system

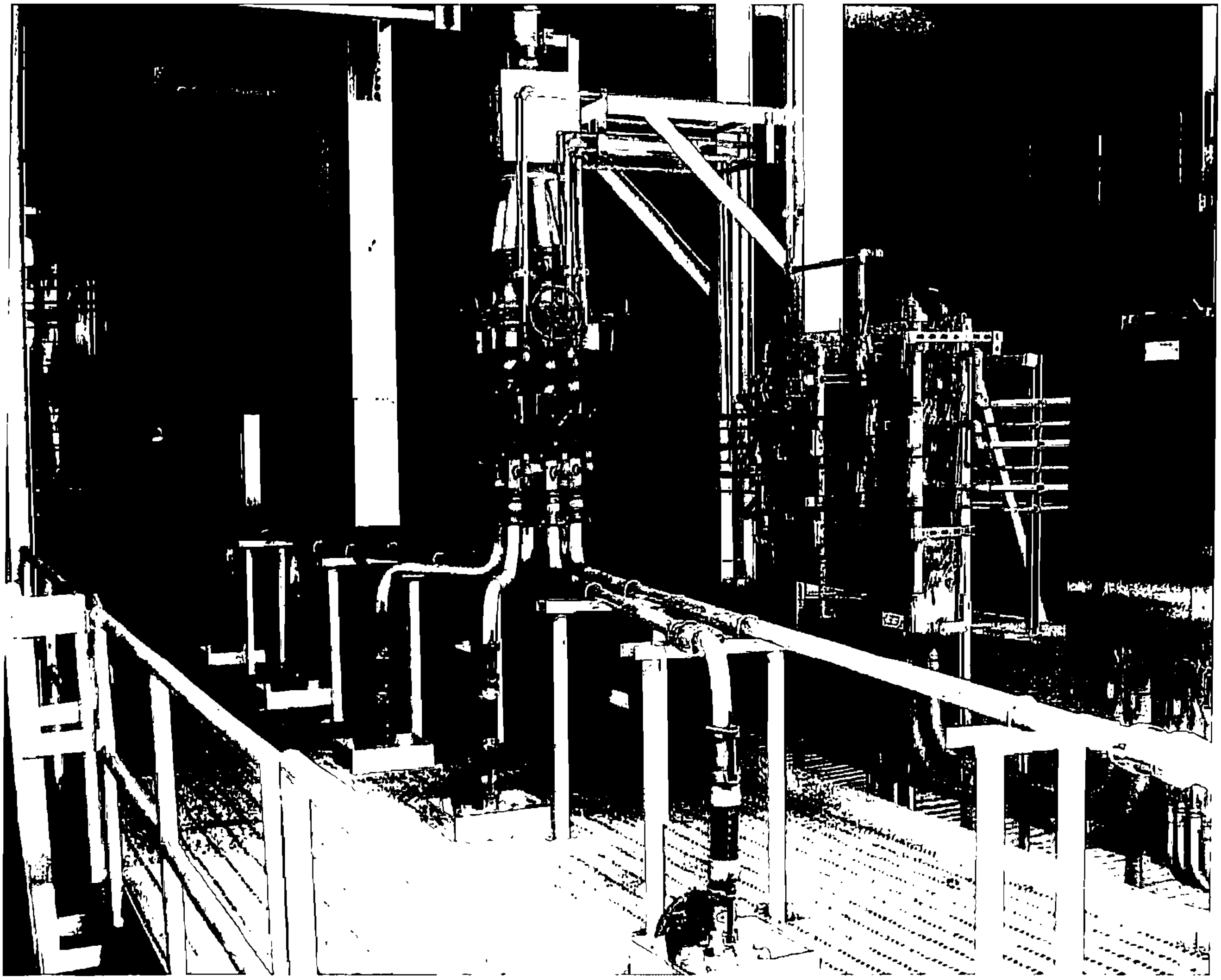
A fluidizing bin bottom is installed on each silo to ensure reliable material flow out of the silo. An automatic butterfly valve is mounted below each fluidizing silo cone bottom, with an air-activated silo discharge system located below to serve as the refill device for the continuous loss-in-weight (LIW) feeder situated under each silo. Except for the butterfly valves used in refilling the LIW feeders, the sorbent is not exposed to any moving parts throughout the entire silo and its discharge system.

The LIW feeders are designed to discharge a continuous flow of sorbent. This example uses a nominal material feed rate of 4,000 lb/hr per duct. Each feeder is capable of holding a minimum of 45 ft^3 of material, which minimizes the number of refills per hour. Minimizing the number of refills in turn maximizes the amount of time the feeders spend in gravimetric (LIW control) mode.

Each feeder hopper is mounted on three load cells linked to the control system. A rotary valve operated by a variable-frequency drive linked to the control system is mounted at the hopper discharge and serves as the material metering device. This valve discharges material through a small, vented chute directly into a blow-through rotary airlock running at a constant speed. The blow-through rotary airlock is the primary seal between the metering systems and the pneumatic conveying line; the metering rotary valve is the secondary seal. Each feeder hopper is equipped with its own reverse-jet pulse filter system that traps nuisance dust generated during feeder refill and returns it to the process. The dust filter also facilitates air displacement in the hopper as material is metered out, as well as air leakage from the blow-through rotary airlock.

Dilute-phase, positive-pressure pneumatic conveying technology is used to transfer and inject metered sorbent into the flue gas duct, and every precaution is taken to ensure that the conveying lines do not become plugged. Each line is equipped with a dedicated positive-displacement blower. These blower packages are coupled with air-to-air heat exchangers to ensure that the conveying air remains cool. As any variation in a blower's steady-state operation could signal the need for conveying line maintenance, flowmeters, pressure transducers, temperature transmitters and variable-frequency drive controls are usually included with the blower packages. The conveying lines may be supplied with blowout ports used to help locate and manage any issue that may arise.

The conveying lines lead to convey line splitters that distribute sorbent to the duct injection lances. The line splitters are vertically oriented to achieve the best distribution possible. Special design considerations ensure an equal distribution of sorbent through each outlet of the splitter. An industrial automation and bulk material handling company has developed a method to analyze the status of each injection lance. Should a blockage occur, the injection lance is automatically purged.



An injection lance array shown supplied by a splitter assembly injects silos

Typical design criteria

The following criteria apply to an effective dry sorbent injection system:

Sorbent:	Hydrated lime, Trona, sodium bicarbonate, or any dry bulk sorbent material
Bulk Density:	25–50 lb / ft^3
Particle Size:	325 mesh
Moisture:	<1%
Temperature:	Ambient
Abrasiveness:	Mild
System Capacity:	Based on plant's flue gas flow rate and chemical composition
Convey Lines:	As required based on number of flue gas ducts

Sorbent considerations

Pros and cons of hydrated lime

Hydrated lime is plentiful and relatively inexpensive. For the money, hydrated lime is effective in mitigating SO_3 to the 5 ppm level. It is "ash-friendly" (that is, environmentally safe). Pilot scale testing has shown that when hydrated lime reacts with SO_x in flue gas, synthetic gypsum is formed. If collected separately from the fly ash, the recovered by-product may be sold to gypsum wallboard plants worldwide.

Although hydrated lime effectively mitigates SO_3, it is less effective in mitigating other acid gases. For example, to mitigate SO_2 with hydrated lime, water must be added to the process to reach acceptable performance levels. The water is needed to facilitate the reaction of hydrated lime and SO_2. This presents an added level of difficulty in designing a cost-effective solution. Last, under certain operating conditions, hydrated lime has a tendency to develop conveying line plugs as compared to sodium-based sorbents.

Pros and cons of sodium-based sorbents

The two most popular sodium-based sorbents are Trona (sodium sequicarbonate) and sodium bicarbonate. Trona is a mined product from Green River, WY. It is abrasive because of its silica content, a factor that must be considered during the design process of the pneumatic injection system. To reduce wear on direction-change elbows, for example, T-bends can be used.

Sodium bicarbonate (SBC) is a nonabrasive, processed chemical typically manufactured to a 400-micron particle size. In most cases, SBC is milled to increase its effectiveness. As a processed chemical, SBC carries a higher purchase cost than Trona, a factor often alleviated by SBC's superior reactive characteristics.

An upside of both Trona and sodium bicarbonate is the improved emissions reduction efficiencies through the "popcorn" effect. For both materials, at temperatures of 300°F–700°F, moisture calcines from the particle and creates more surface area to react with acid gases in the stack gas flow.

This means it is very advantageous to inject sodium at the higher temperature of the gas flow (closer to the boiler) to trigger the popcorn effect. This increases the particle's surface area and also the residence time the particle is in the gas flow, improving the reduction of SO_2, HCl, and other pollutants.

Negatives of sodium in ash

Because removing SO_2 requires so much sodium sorbent to be used (10:1 compared to SO_3 mitigation), the recovered ash may contain too much sodium to be acceptable as a resellable by-product.

Sodium-based sorbent efficacy in SO_2 mitigation

Flue gases carry a much higher concentration of SO_2 than SO_3. As a result, higher volumes of sorbent (often 10 times higher) are necessary to satisfactorily remove SO_2 from the flue gas stream.

In dry sorbent injection, Trona and sodium bicarbonate offer higher SO_2 removal efficiencies than does hydrated lime. This is because of the chemical reaction of sodium and SO_2. Milling the sodium increases the efficiency of the removal. Sodium's ability to be milled allows for particle size reduction to increase the effective SO_2-grabbing surface.

Milling to optimize particle size

Milling sodium sorbents offers substantial benefits. A smaller particle size greatly increases the removal efficiency of pollutants. It would be reasonable to expect a reduction of the sorbent injection rate by 15% to 30% when a coarser product is milled to a finer particle size. The molecular structure of sodium lends itself well to the milling process.

This would mean that if 10,000 lb/hr of a coarse sorbent is normally injected, only 7,000 lb/hr of a milled sorbent might be necessary. Over time, this reduced sorbent quantity requirement would add up to a lot of money in a big hurry.

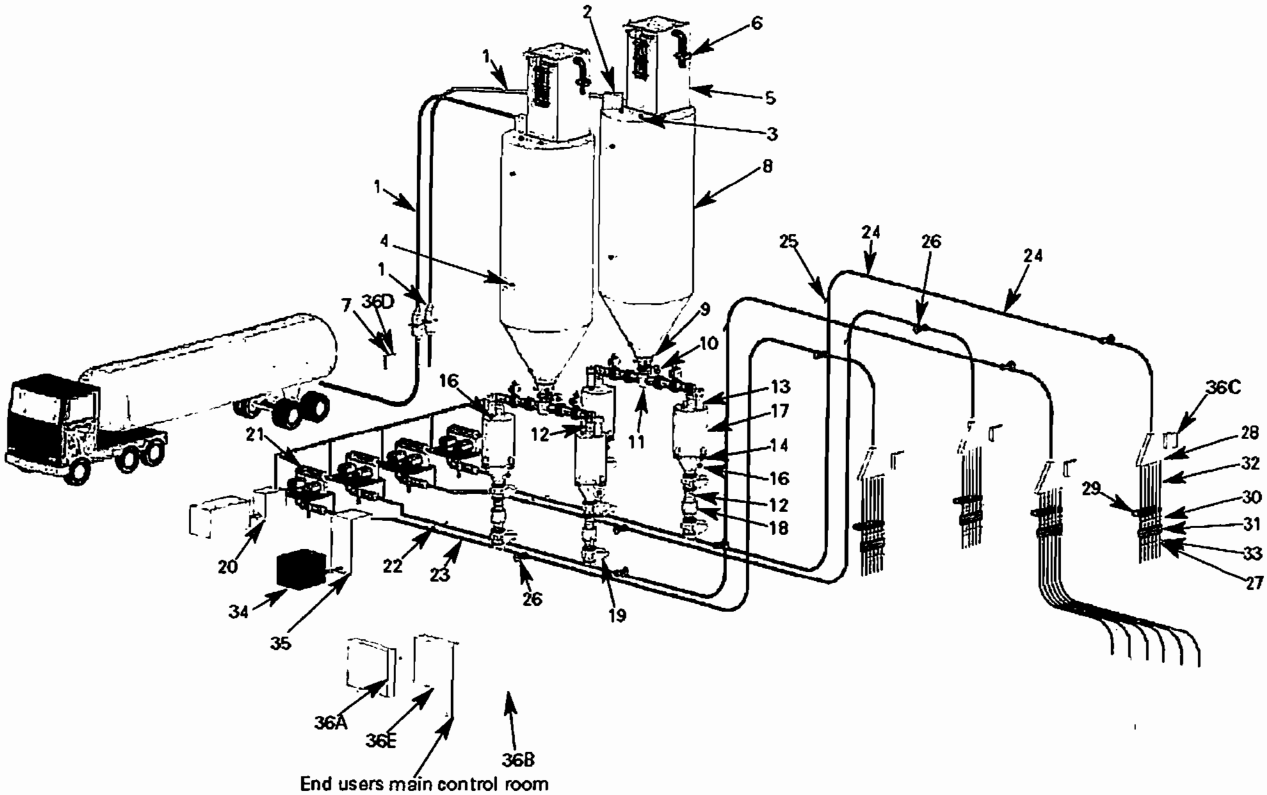
Types of mills

One company in St. Paul, MN, has been successfully using a "blow-through" vertical shaft pin mill through which sorbent is pneumatically conveyed from the silo into the injection lances. The sorbent goes through the mill, is reduced in particle size, and is carried along in the conveyor system airstream to the ductwork. The advantage of this approach is in keeping the product suspended in the airstream to avoid reagglomeration. The blow-through approach is clean, simple, and cost effective.

The only negative to the in-line, blow-through mill is the achievable milled particle size. This design has a practical size reduction limitation compared to other, more complicated mill designs.

There is another type of particle size-reduction mill called an air classifier mill (ACM). ACMs generate a much finer particle size than that of the pin mill—a definite advantage. The design of the ACM is such that material cannot be directly conveyed through it to the injection lances, as is the case with the blow-through pin mill.

Typically, the ACM is used for sodium bicarbonate. Sodium bicarbonate is nonabrasive and more expen-



Dry bulk sorbent injection system diagram

Typical system components

1. Bulk truck unload line components
2. Silo end receivers
3. Guided radar continuous-level indicators
4. Point-level indicators
5. Dust collectors
6. Exhausters
7. Sign for delivery instructions
8. Storage silos
9. Fluidizing bin bottoms
10. Maintenance gates
11. Air-activated silo discharge systems
12. Gravity flexible connectors
13. Single-cartridge dust filters
14. Load cell systems
15. Emergency high-level indicators
16. Emergency low-level indicators
17. Loss-in-weight feeders
18. Vent adapters
19. Air lock packages
20. Air-drying systems
21. Blower packages
22. In-line thermal mass flow meters
23. Air line components from dryers and blowers to rotary airlocks
24. Conveying line components
25. Blow-out ports
26. Knife gates with hand wheel
27. Ball valves
28. Convey line distribution splitter assemblies
29. Pressure transducers
30. Air-operated pinch valves
31. Conveying line components from distribution splitters to injection lances
32. Solenoid valves for injection lance cleaning
33. Injection lances
34. Rotary screw compressors
35. Compressed air dryer packages
36. Electrical controls:
    - a. Main PLC control panel
    - b. HMI workstation for system control room
    - c. Remote I/O panels for injection area
    - d. Truck unloading operator panel
    - e. Motor control center

sive than Trona, thus making this an attractive milling option. As noted previously, making sodium bicarbonate particles finer improves reaction with pollutants in the gas stream. This, in turn, helps make the expense of this sorbent more acceptable. It is generally recognized that SBC must be milled to make a financially feasible installation.

In a typical ACM design, the sorbent is metered into the inlet of the unit, along with a large quantity of air. The negative airflow is created by a material-handling fan placed after the mill outlet. The milled product and air are drawn into the fan's inlet and then pressure-conveyed out of the fan to the duct.

The problem with this approach is that the material-handling fan has a limited capacity for vacuum and pressure. The fan moves a lot of air, but with very limited pressure and vacuum differential. The mill must be placed very close to the duct injection location. In most power plant applications, the flue gas ducts are quite large. To get sufficient dispersion of sorbent, multiple injection lances are required. The limited pressure capability of the ACM material-handling fan precludes the use of multiple injection lances. ACMs are best suited for use in the relatively small ducts of industrial boilers.

Another option is to take an ACM and put a vacuum (negative pressure) dilute-phase system to vacuum the material from the mill and send it up and into a filter receiver. From that filter receiver, a rotary valve feeds the material into a dilute-phase positive-pressure system to convey it to the injection points. This option is viable, but it significantly increases total system cost.

Emissions mitigation with improved cost efficiencies

Traditionally, wet scrubbers have been used at fossil fuel–fired electrical generating plants to effectively remove SO_2 from stack gas flows. Unfortunately, with a typical price tag of 400 to 600 million dollars, wet scrubbers can be costly.

Sodium-based dry sorbent injection systems are available at a significantly lower capital cost. At 1.5 to 10 million dollars, sodium injection systems provide acceptable levels of emission control. Mitigation levels with Trona approach 70% to 80% SO_2 removal. With its smaller particle size, sodium bicarbonate achieves up to 80% to 90% SO_2 removal.

This compares to EPA and state requirements for SO_2 commonly in the 70% to 80% removal range, although this rate may differ by state.

Another option for SO_2 mitigation is the gas suspension absorber (GSA) offered by another large company specializing in air pollution control. This technology utilizes a reactor vessel that recirculates a bed of reagent, promoting contact between the lime and the SO_2 and increasing removal efficiency up to 98%. This proprietary technology is reagent-flexible and can be used with dry lime injection, with lime plus a separate water injection loop for humidification and temperature control, or with lime slurry. While there is a higher capital cost for the GSA (compared to dry sorbent injection alone), it is considerably lower in cost than wet scrubbers.

Environmental considerations

From an environmental perspective, hydrated lime is a more attractive sorbent material than either Trona or sodium bicarbonate. Lime is not considered a problem for landfills and water supplies.

Sodium is water-soluble, so it can leach into soil and water tables. A greater risk of contamination by sodium products requires careful consideration for ash disposal.

Nevertheless, because of sodium's superior mitigating effectiveness for SO_2 and HCl emissions, the extra considerations to protect soil and water resources may prove to be worth the investment.

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APPENDIX E-4
SODIUM BICARBONATE (SOLVAY CHEMICALS)

DRY INJECTION OF SODIUM SORBENTS FOR AIR POLLUTION CONTROL

By Yougen Kong, Ph.D, and Michael Wood, SOLVAir Solutions/Solvay Chemicals, Inc.

Introduction

Coal-fired boilers in the utility power plants or process industry emit air pollutants, such as SO_2, SO_3, hydrochloric acid (HCl), hydrofluoric acid (HF) and Mercury. Ever stricter environmental regulations around the world demand efficient removal of these air pollutants.

One popular SO_2 control, or flue gas desulfurization (FGD), technology is wet scrubbing. In a wet scrubber, a liquid sorbent is sprayed into the flue gas in an absorber vessel. Most wet FGD systems use alkaline slurries of limestone or slaked lime as sorbents. Sulfur oxides react with the sorbent to form calcium sulfite and calcium sulfate.

While wet scrubbers are often used at large boilers due to their high SO_2 removal efficiency (> 95%), their high capital and O&M costs make them uneconomical for small utility boilers (i.e. < 250 MW), industrial coal-fired boilers, and waste-to-energy boilers. The majority of these boilers have neither enough physical space nor the capital funding necessary for wet scrubbers. Another drawback of a wet scrubber is that it makes SO_3 more visible as blue plume.

A good alternative air pollution control technology is dry injection of sodium sorbents (trona or sodium bicarbonate). In a dry sorbent injection system, sodium sorbent is injected into the hot flue gas duct and reacts with SO_2, SO_3, HCl, HF and some NO_x. Due to its low capital cost and ease of operation, dry injection of sodium sorbents is being used at more and more boilers,

Figure 1

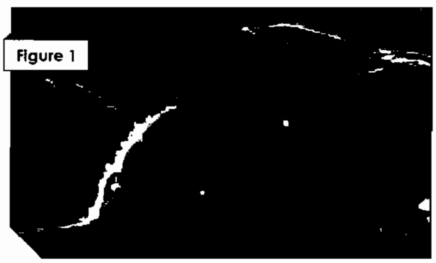
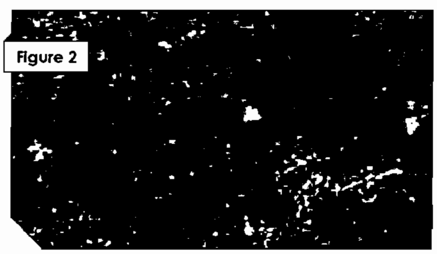


Figure 2



and is able to remove up to 95% of SO_2 and nearly all SO_3, HCl and HF.

With increasing implementation of Selective Catalytic Reduction (SCR) for NO_x control, there are higher concentrations of SO_3 in the flue gas. In addition to forming blue plume after exiting the stack because of condensation of the resultant H_2SO_4, SO_3 can react with NH_3 slip to form sticky NH_4HSO_4 (ammonium bisulfate or ABS) that can plug up the air preheater. Furthermore, SO_3 can pose serious corrosion problems to air preheater, electrostatic precipitator (ESP) and any downstream equipment. Among various SO_3 mitigation technologies, dry injection of sodium sorbents, such as trona, has been proven to be very effective and cost-competitive.

Principles of Dry Injection of Sodium Sorbents

In a dry sorbent injection (DSI) system, a fine powder, such as trona ($Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$) or sodium bicarbonate ($NaHCO_3$), is injected into the flue gas duct. After injection, either sodium sorbent is calcined into porous sodium carbonate (Na_2CO_3), which reacts with acid gases, such as SO_2, SO_3, HCl and HF. The resulting products (Na_2SO_4, NaCl and NaF) are collected by the particulate control device, such as an Electrostatic Precipitator (ESP) or bag filters. Figure 1 shows raw sodium bicarbonate under a microscope.

Figure 3

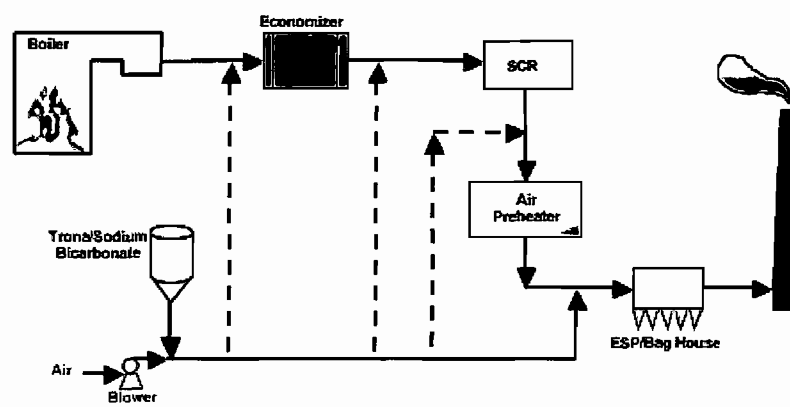


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Figure 4

One example of
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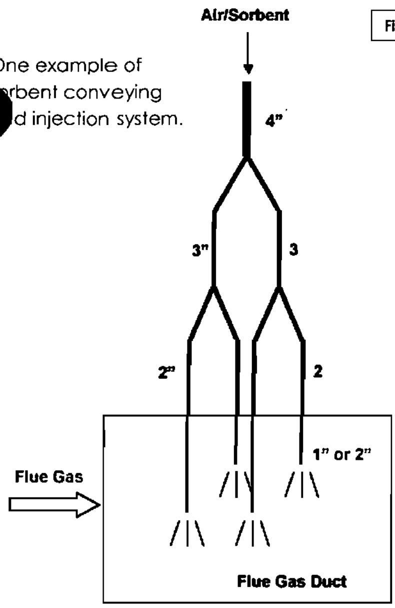
d injection system.



After being injected into hot flue gas (> 275°F), sodium bicarbonate or trona is calcined into sodium carbonate (Na_2CO_3), as shown in the following equations:

- $2NaHCO_3$ Æ $Na_2CO_3 + H_2O$ (gas) + CO_2(gas)
- $2Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$ Æ $3Na_2CO_3 + 5H_2O$ (gas) + CO_2(gas)

The release of water vapor and CO_2 in the above calcination process creates numerous micropores inside the sorbent, a phenomenon called the "pop-corn" effect. The BET specific area of calcined sorbent is approximately 10 m^2/g. This relatively high surface area enables fast reactions between sodium carbonate and acid gases, such as SO_2, SO_3, HCl and HF. The photo of calcined sodium bicarbonate under a microscope is shown in Figure 2.

The overall reactions between calcined sodium sorbents and acid gases are as follows:

- $Na_2CO_3 + SO_2 + 1/2\ O_2$ Æ $Na_2SO_4 + CO_2$
- $Na_2CO_3 + SO_3$ Æ $Na_2SO_4 + CO_2$
- $Na_2CO_3 + 2HCl$ Æ $2NaCl + H_2O + CO_2$
- $Na_2CO_3 + 2HF$ Æ $2NaF + H_2O + CO_2$

The sorbent can be injected at almost any location of the flue gas duct, as shown in Figure 3, as long as the flue gas temperature is above 275 °F.

No supplemental water injection is needed when using sodium sorbents, unlike when using lime or hydrated lime. A simple blower delivers the sorbent into the duct through injection lances.

The efficiency of Dry Sorbent Injection (DSI) system depends on many factors, such as:

- Sorbent particle size: Finer particles result in better performance.
- Sorbent residence time in flue gas stream: Longer residence time gives more time for mixing and chemical reactions, thus better performance.
- Sorbent penetration and mixing with flue gas: Better sorbent penetration into flue gas and mixing gives higher removal efficiencies.
- Particulate control device used (ESP or Baghouse): Since sorbents can build up on the fabric filters of the bag house and provide a layer of sorbent for further reactions with acid gases, baghouse filters have higher efficiencies.
- Temperature at injection site: The minimum flue gas temperature at the sorbent injection should be at least 275 °F. Higher temperatures normally result in better performance. The recommended maximum temperature is 1500 °F.

The key of good DSI system design is to distribute the sorbent evenly in the flue gas so that the sorbent and acid gases will be well mixed. The desired design guidelines are as follows:

- Residence time: > 1 second
- Flue gas temperature: 275 ~ 1500 °F
- Conveying air: < 140 °F

Sodium Sorbents: Trona and Sodium Bicarbonate

The trona is produced in Green River, Wyoming. It is a naturally occurring mineral with a chemical formula of $Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$ and its typical physical properties are:

- d_{50}: ~ 30 µm
- d_{90}: ~ 160 µm
- Bulk density: 49 lb/ft^3

Since it is produced as a fine powder, it is not necessary to mill trona. Although milling can increase the removal efficiency, the additional cost of equipment and maintenance have discouraged most users from using mills.

Sodium bicarbonate is produced in several locations in the US and its typical physical properties are:

- d_{50}: ~ 110 µm
- d_{90}: ~ 250 µm
- Bulk density: 68 lb/ft^3

Raw sodium bicarbonate is too coarse to be injected directly. Therefore, an air-classifying hammer mill or pin mill needs to be used. At one power plant, the particle sizes of milled sodium bicarbonate were d_{50}=12 µm and d_{90}= 30 µm.

Performance of Dry Injection of Sodium Sorbents

Both trona and sodium bicarbonate are effective in removing SO_2, SO_3, HCl and HF. In order to compare the performance of different dry sorbent systems, Normalized Stoichiometric Ratio (NSR) is used to represent sorbent feedrate. The NSR is expressed as:

A GOOD ALTERNATIVE AIR POLLUTION CONTROL TECHNOLOGY IS DRY INJECTION OF SODIUM SORBENTS (TRONA OR SODIUM BICARBONATE)."

- mass of sodium injected
- mass of acid gas entering system
- NSR = mass of sodium theoretically needed to react with a unit mass of acid gas

(a) SO_2

Figure 5 and Figure 6 show the SO_2 removal rates vs. Normalized Stoichiometric Ratio (NSR) using trona or sodium bicarbonate, respectively.

The curves in Figures 5 and 6 were created with the application data of numerous systems over the last 20 years. Sodium bicarbonate is more efficient than trona in removing SO_2. However, the increased efficiency comes at a higher sorbent price. Several factors need to be evaluated to determine which sorbent is best for a specific application. Some of those factors include the level of SO_2 removal required, particulate control device used, injection location and flue gas temperature, plus many more. Generally speaking, trona should be used if the SO_2 removal rate is lower than 50%, and sodium bicarbonate should be the choice if over 70% of SO_2 must be removed. Anything in between requires a careful study of all factors in order to select an economical sorbent.

Figure 5

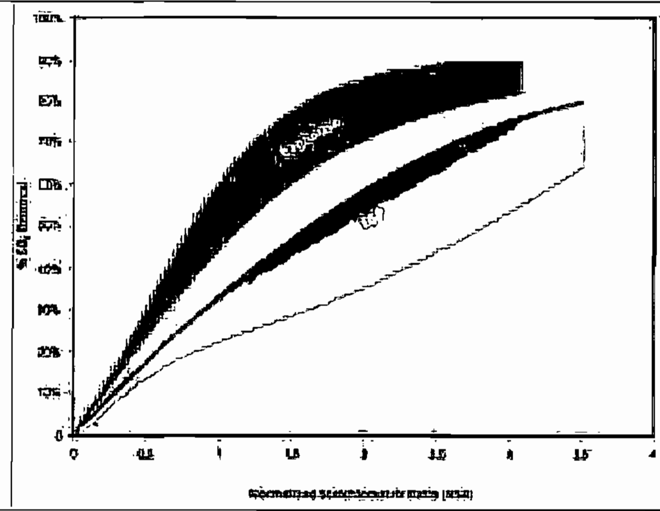
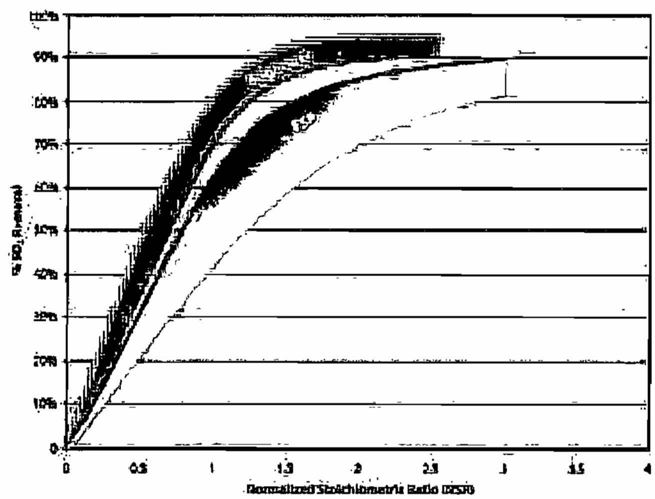


Figure 6



(b) SO_3

The vast majority of sulfur in coal is oxidized into SO_2 during combustion but a small portion – typically 1% to 2% – is further oxidized to sulfur trioxide (SO_3) in the boiler. If there is a SCR system for NO_x control, a small fraction of SO_2 is oxidized to SO_3 by the SCR catalyst. The amount of SO_2 oxidized in the SCR catalyst can vary from 0.3% to around 2%, with the current market driving toward 0.1% oxidation.

Although a wet scrubber is effective in removing SO_2, it can remove only some of the SO_3. Typically, the amount of SO_3 removed is marginal to perhaps as high as 30%. As the flue gas is rapidly cooled by the sprays of liquid in the wet scrubber, the vaporous sulfuric acid undergoes a shock condensation process that produces very fine sulfuric acid aerosol particles. These aerosol particles are, for the most part, too small to be effectively captured in the scrubber and are emitted into the air as a sulfuric acid mist, which forms a blue plume and causes opacity issues.

In addition to the blue plume, SO_3 can cause the following problems:

- Formation of ammonium bisulfate (ABS) in the SCR system. Depending on its concentration, SO_3 can also react with NH_3 under the catalytic conditions that exist in the SCR system at temperatures in the range of 530 °F to 630 °F. ABS is a sticky solid that can foul the SCR catalyst and air heater.
- Formation of ammonium bisulfate (ABS) in the air heater. SO_3 and ammonia (NH_3) will react to form ABS in the air heater if SO_3 is present in molar concentration in excess of the molar concentration of NH_3 and when the flue gas in the air heater cools to between 350 °F and 420 °F.
- Increased air heater fouling. Fouling of a regenerative air heater becomes serious when the flue gas temperature is below the SO_3 dew point and acid condensation occurs. The SO_3 dew point increases with SO_3 concentration.
- Increased corrosion to the downstream equipment.

Trona is very reactive with SO_3. At one power plant, trona was injected between the air preheater and ESP. The SO_3 was measured upstream of the trona injection ports and downstream of the ESP. Figure 7 shows one example of SO_3 removal performance with trona. Since the SO_3 concentration is

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Table 1

REMOVAL OF HCL AND HF BY TRONA AND SODIUM BICARBONATE				
	HCl at Stack (lb/MBtu)	HCl Removal Rate %	HF at Stack (lb/MBtu)	HF Removal Rate (%)
Trona	0.0011	98.8	0.0008	78.4
Sodium Bicarbonate	0.0013	97.8	0.0002	88.0
Permit Limit	0.0072		0.0026	

Figure 7

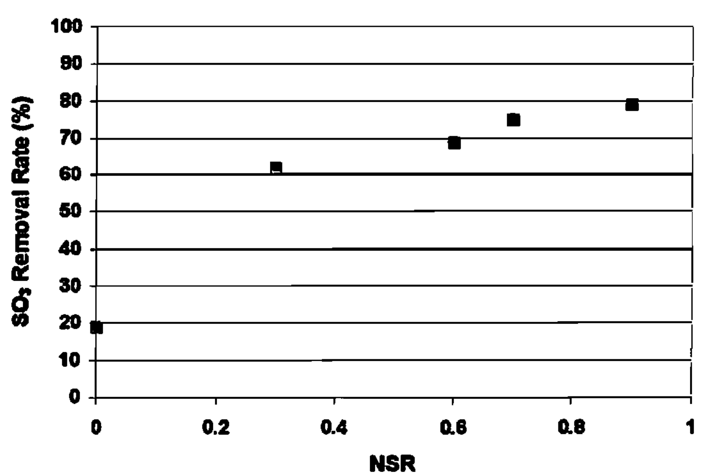
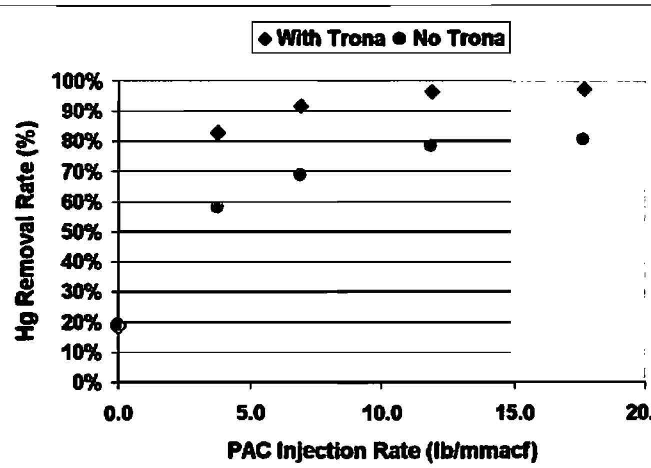


Figure 8



much lower than SO_2, high efficiency removal (i.e. > 95%) requires good mixing between trona and flue gas. In other words, the SO_3 removal efficiency is limited by the mass transfer, not the reactivity between SO_3 and trona.

Sodium bicarbonate is as reactive with SO_3 as trona. However, since sodium bicarbonate is also very reactive with SO_2, some injected sodium bicarbonate can be consumed in reacting with SO_2, which could result in higher operation cost if SO_2 is to be mitigated with other lower-cost methods.

(c) Mercury

As noted earlier, SO3 in flue gas can adsorb onto the fly ash and injected activated carbon, thus in competition with mercury for the active adsorption sites. Therefore, injecting trona to remove SO3 will greatly enhance mercury removal by fly ash and activated carbon. Figure 8 shows the effect of trona injection on the mercury removal by Powdered Activated Carbon (PAC). It was a 340 MW boiler with SCR and cold-side ESP. Trona was injected before the air preheater and powdered activated carbon was injected between the air preheater and ESP. Without trona, no more than 80% of the mercury was removed even at very high PAC feedrates. With trona injection at a NSR of 0.1 (based on SO2), high mercury removal rates (> 90%) were achieved even at low PAC feedrates. The SO3 at the SCR outlet was around 3 ppm. After trona injection, there was no measurable SO3, which was the key to the high mercury removal.

(d) HCl and HF

Trona and sodium bicarbonate are also very reactive with HCl and HF. Table 1 shows the HCl and HF removal performance of trona and sodium bicarbonate where the sorbent was injected upstream of the air preheater of a 100 MW coal-fired boiler. Around 98% of HCl and HF can be removed by injection of trona or sodium bicarbonate.

In addition to mitigating air pollutants, sodium sorbents are able to improve the performance of electrostatic precipitators. Some fly ash has high resistivity, which makes the capture of fine particulate material difficult with electrostatic precipitators. Injection of low-cost sodium sorbent, such as trona, is able to lower the resistivity of fly ash, and consequently improve the performance of ESP.

Conclusion

The high removal efficiencies of SO_2, SO_3, HCl and HF with trona and sodium bicarbonate have been demonstrated at many power plants over the last 20 years. Its low capital cost makes dry sorbent injection even more attractive in today's difficult economic environment. EE

BICARB BULLETIN

Deacidification of Medical Waste Incinerator Gases with Sodium Bicarbonate

HCl Removal with Sodium Bicarbonate Injection at Colorado Incineration Services, Inc., Denver, CO

The efficacy of sodium bicarbonate in reducing SO_2 and other acid pollutants from stack gases is well-known.

This report highlights a process that optimally reduces hydrogen chloride (HCl) emissions and other pollutants below that characteristically observed from medical waste incinerators (MWIs) with dry sorbent injection/fabric filter air pollution control device (APCD) technology. Using ARM & HAMMER® Sorbent Grade Sodium Bicarbonate, HCl removal at the Colorado Incineration Services, Inc. (CISI) facility, near Denver, Colorado, was **99.3** percent.

Case Background
CISI was incorporated in 1989 to handle and dispose of infectious waste according to the guidelines set by Colorado's New Source Performance Standard (NSPS) for MWI emissions. In June 1994, CISI ceased incineration operations. However, the data remains both valid and valuable from which similar operations can benefit.

CISI provided medical waste incineration services to hospitals, doctors' offices and clinics throughout Colorado, Wyoming, Nebraska and New Mexico. Additional materials were handled from pharmaceutical manufacturers and laboratories, industrial clinics and dental offices.

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Deacidification of Medical Waste Incinerator Gases with Sodium Bicarbonate

System Description

For its size (750-pounds-per-hour) CISI used a slightly different process than most conventional MWIs by operating in a continuous cycle rather than in batches. The facility operated continuously, going to stand-by mode when the APCD was pulsed down and the fabric filter was pre-coated. After baghouse pulsing and precoating, gas flow was re-established to the APCD.

The facility used a dual chamber, starved-air incinerator (Reference CISI plant flow diagram). The solid waste feeder supplied waste to a stationary hearth gasifier (primary chamber) which operated at 1600°F and used a 29-foot rotary ash kiln to gasify 95 percent of the solid waste.

Volatile organic compounds (VOCs) produced during this process were dissipated in a thermal oxidation chamber. This secondary chamber operated between 2150°F-2300°F with 100 percent excess air. Flue gases from this chamber entered five cross flow, air-air tubed heat exchangers (two ceramic and three stainless steel) and cooled to 375°F. Pollutant-laden gases then entered the APCD for pollution reduction.

There were five categories of pollutants generated by the medical waste. First was metals, which included arsenic, beryllium, cadmium, chromium, lead, mercury and nickel. The second type was chlorine isomers. The last three categories were HCl, carbon monoxide and particulate matter.

APCD Operating Mode

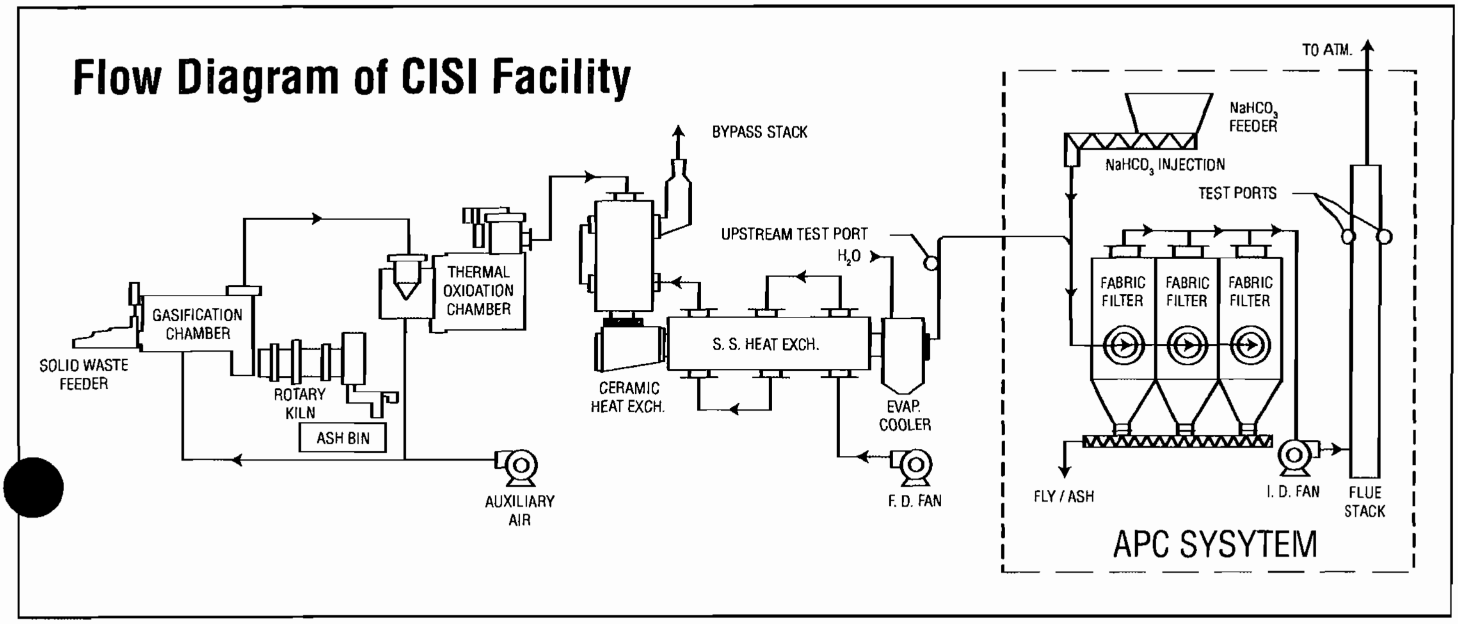
Pollutant-laden gases entered the APCD, which consisted of a sodium bicarbonate-injected fabric filter system that used 168 bags divided among three chambers, for a total filtration surface area of 1385 square feet.

To reduce pollutant emissions below that considered acceptable by most regulators and APCD manufacturers, CISI applied and maintained a sodium bicarbonate ($NaHCO_3$) precoat injection onto the fabric filter bags during the entire burn cycle.

ARM & HAMMER® Sorbent Grade Sodium Bicarbonate was metered and pneumatically injected into the waste gas stream at 350°F to 375°F, and thermally decomposed for maximum scrubbing. The injection of dry sorbent at a rate of 38.5 pounds per hour fully neutralized the HCl, based on a maximum waste output of 10 pounds per hour.

The baghouse operated on an automatic differential pressure (ΔP) cleaning cycle which activated when pressure drop across each filtration chamber rose above eight inches of H_2O. Operators could control the cleaning cycle by manually overriding the automatic system. This cleaning cycle began with a one-hour burn down, during which the waste feed was terminated, which lowered pollutant emissions across the APCD.

Flow Diagram of CISI Facility



Deacidification of Medical Waste Incinerator Gases with Sodium Bicarbonate

All chambers were fully pulsed to remove fly ash and residue. A precoat layer of sodium bicarbonate was then injected into the baghouse to re-establish a filter cake of approximately 1/64 of an inch on the fabric filter surface (CISI's system requires a total of 200 pounds $NaHCO_3$ to achieve this precoat). Such precoating resulted in a pressure drop of less than 0.4 inches of H_2O across the APCD. The baghouse was then put on-line and sodium bicarbonate injection resumed to a 38.5 pounds per hour level as waste feed was re-established. The system typically operated for 12 hours of continuous service before a differential pressure-based cleaning cycle (described above) was required.

Sorbent Stoichiometry / Reaction Mechanism

Upon injection into the hot flue gas stream, sodium bicarbonate undergoes rapid thermal decomposition. This results in a highly porous, high surface area particle which has significant affinity to neutralize acidic emissions such as HCl. Acid/base neutralization of HCl is represented in the following stoichiometric reaction:

$$NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$$

Water vapor and carbon dioxide produced by this reaction vent to the atmosphere through the flue. The neutral salt reaction product (sodium chloride), along with the fly ash and unreacted sorbent, collect as filter cake on the fabric filters in the baghouse.

Results

Through injection of sodium bicarbonate, HCl emissions were reduced by an average of 99.3 percent based on Colorado State certified stack test results (Reference Table 1).

In addition, other pollutants such as particulate, metals and dioxins were well within state regulatory requirements (Reference Table 2).

Compared to other sorbents, sodium bicarbonate results in high utilization efficiencies, improved baghouse performance due to reduced pressure drop, and improved operational and mechanical reliability due to its non-corrosive, non-erosive nature. At the same time, the reduced spent sorbent volume decreased disposal costs and minimized the negative environmental impact.

Other notable advantages observed by CISI included the assurance of worker safety, easy-to-handle neutral salt by-products and improved particulate control device performance.

By using ARM & HAMMER® Sorbent Grade Sodium Bicarbonate, data collected demonstrate that a dry scrubber APCD can operate extremely efficiently with minimal system modifications.

Table 1: CISI stack test results (EPA method 26)

Stack Data	Run Number				
	1	2	3	4	Avg.
Volumetric Flow (ACFM)	7569	8062	6716	7936	7571
Volumetric Flow (DSCFM)	3988	4107	3458	4141	3924
Temperature (°F)	345	354	354	356	352
Moisture (Vol.%)	4.3	6.4	5.5	4.0	5.1
Hydrogen Chloride (@ 7% O_2)					
Scrubber Inlet (ppm)	807	1022	1152	905	1009
*Stack (ppm)	6.6	7.7	8.3	5.4	7.1
HCl Removal Efficiency	99.2	99.2	99.3	99.4	99.3

*Department of Environmental Conservation

Table 2: CISI stack test results

	Test Number		
	1	2	3
Facility Data			
Primary Temp (°F)	1700	1700	1700
Secondary Temp	2250	2250	2250
APCD Type	FF	SI	FF/SI
Waste Type	General/Red	General/Red	General/Red
Sorbent	$NaHCO_3$	$NaHCO_3$	$NaHCO_3$
Stack Conditions			
Flow Rate (ACFM)	7,729	8,018	7,977
Temperature (°F)	358	376	350
Moisture (Vol.%)	5.8	4.9	6.5
Metals µg/dscm @ 7% O_2			
Arsenic	1.17E – 0 1	6.68E – 0 2	-1.78E – 0 2
Cadmium	1.26E + 0 0	1.57E + 0 0	7.99E – 0 1
Chromium	2.23E + 0 0	8.18E – 0 1	1.38E + 0 0
Lead	2.35E + 0 1	1.50E + 0 1	1.24E + 0 1
Mercury	2.26E + 0 3	2.14E + 0 3	1.28E + 0 3
Dioxin ng/dscm @ 7% O_2			
2,3,7,8 TCDD	8.70E – 0 1	4.70E – 0 1	2.30E + 0 0
2,3,7,8 TCDF	4.45E + 0 0	5.20E – 0 1	3.40E – 0 1
Total PCDD/PCDF	5.32E + 0 0	9.90E – 0 1	2.64E + 0 0
Particulate gr/dsccf @ 7% O_2			
PM	6.08E – 0 3	4.51E – 0 3	5.21E – 0 3

FF = Fabric Filter, SI = Sorbent Injection, $NaHCO_3$ = Sodium Bicarbonate

In One System

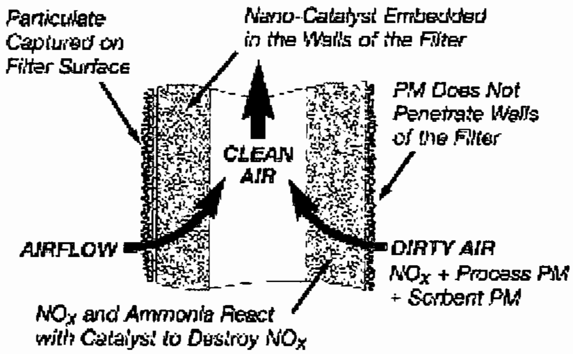


Figure 4: Ceramic fiber filter tube with embedded nano-catalysts

Mercury control

The ceramic filter systems are compatible with standard mercury removal techniques. Mercury control is notoriously difficult: each instance is individually analyzed and customized solutions are engineered. A few general observations can be made.

Figure 5: Micrograph of nano-catalysts embedded in ceramic-coated fibers

The filters can handle high particulate loads while maintaining low outlet levels. Just as the addition of dry sorbents for the removal of acid gases is effective, so is the addition of powdered activated carbon (PAC) for adsorbing mercury. In general, regular PAC becomes less effective with increased temperature, topping out around 400°F. Under the right conditions, 70 to 80 percent control can be achieved. The chemical composition of the pollutant gas plays a major role. At higher temperatures, brominated PAC is required. According to the manufacturers of brominated products, temperatures of 500°F to 800°F are acceptable. Significant levels of mercury have also been captured in applications with injected powdered trona.

What conditions favor ceramic filters?

For particulate removal only, the standard ceramic filter can operate at temperatures as high as 1,650°F, exceeding the tempera

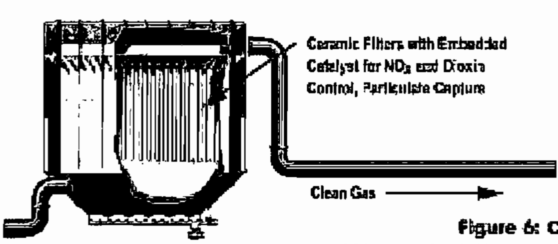


Figure 6: Control of PM, SO_2, HCl, NO_x, and dioxins

APPENDIX E-5
CATALYST FILTER SYSTEM OVERVIEW

Ref. No.	Application	Number of Elements	Filter Area m^2	Gas Flow Am^3/h	Average Temp. Deg. C	Face Velocity m/s	Average dP mm wg	Installed	Country	Region

60mm O/D elements

A Gasification & Pyrolysis

A10	Wood Gasification	1920	364.8	22326	450	0.017	n/a	May-09	UK	Europe
A20	Wood Gasification	640	121.6	7442	450	0.017	n/a	Dec-07	UK	Europe
A30	Wood Gasification	320	60.8	3721	450	0.017	n/a	n/a	UK	Europe
A40	Wood Gasification	320	60.8	3721	450	0.017	n/a	n/a	Germany	Europe
A50	Wood Gasification	160	30.4	1860	450	0.017	n/a	n/a	UK	Europe
A60	Wood Gasification	160	30.4	1860	450	0.017	200	Dec-07	Germany	Europe
A70	Wood Gasification	160	30.4	1860	450	0.017	n/a	n/a	Germany	Europe

B Waste Incineration

B30	Waste Incineration	2247	516.8	29500	230	0.016	275	Nov-98	Poland	Europe
B50	Petrochemical Waste Incineration	1764	405.7	35059	290	0.024	n/a	May-02	Spain	Europe
B90	Liquid Waste Incineration	1152	265.0	n/a	n/a	n/a	n/a	2000	Spain	Europe
B100	Waste Plastic Degrader	1296	246.2	22162	250	0.025	n/a	1998	Belgium	Europe
B110	Sludge Incineration	972	184.7	26594	450	0.040	n/a	1994	Thailand	A/P
B115	Clinical Waste Incineration	864	164.2	14774	200	0.025		1999	Poland	Europe
B120	Munitions Waste Incineration	832	158.1	13584	200-250	0.024	n/a	1995	UK	UK
B130	Munitions Waste Incineration	832	158.1	n/a	n/a	n/a	n/a	1997	UK	UK
B135	Clinical Waste Incineration	756	211.7	12000	180	0.016	200	2009	China	China
B140	Clinical Waste Incineration	732	139.1	n/a	220	n/a	n/a	Feb-97	Malaysia	A/P
B150	Sludge Degrader	648	123.1	11081	300	0.025	n/a	1998	Belgium	Europe
B1[illegible]	Waste Degrader	648	123.1	13300	220	0.030	n/a	1999	Poland	Europe
B1[illegible]	Clinical Waste Degrader	540	102.6	14774	300	0.040	n/a	1997	Belgium	Europe
B180	Hazardous Waste Incineration	480	91.2	6860	250	0.021	n/a	1997	Argentina	Americas
B190	Clinical Waste Incineration	432	82.1	8865	200	0.030	n/a	1997	South Korea	A/P
B200	Clinical Waste Incineration	420	79.8	11491	170	0.040	300	1997	Spain	Europe
B210	Clinical Waste Incineration	400	76.0	n/a	n/a	n/a	n/a	1998	Portugal	Europe
B230	Clinical Waste Incineration	324	61.6	n/a	n/a	n/a	n/a	Oct-98	UK	Europe
B240	Clinical Waste Degrader	324	61.6	6650	220	0.030	n/a	1999	Poland	Europe
B260	Radioactive Waste Incineration	256	48.6	n/a	n/a	n/a	n/a	n/a	France	Europe
B270	Clinical Waste Incineration	216	41.0	4432	250	0.030	n/a	1997	France	Europe
B275	Mobile waste incineration	210	39.9	4176	400	0.030	n/a	2002	Germany	Europe
B280	Clinical Waste Degrader	144	27.4	2955	220	0.030	n/a	1998	Poland	Europe
B300	Waste Incineration	90	17.1	1847	400	0.030	n/a	1997	Germany	Europe
B310	Industrial Waste Incineration	63	12.0	n/a	200	n/a	n/a	Jul-95	Hungary	Europe
B320	Clinical Waste Incineration	63	12.0	n/a	200	n/a	n/a	Jun-95	Poland	Europe
B330	Clinical Waste Incineration	50	9.5	n/a	200	n/a	n/a	Feb-95	Poland	Europe
B340	L/L Radioactive Waste Incineration	42	8.0	n/a	450	n/a	n/a	Oct-94	France	Europe
B360	Clinical Waste Incineration	30	5.7	n/a	200	n/a	n/a	Feb-94	Hungary	Europe
B400	Radioactive Waste Incineration	7	1.3	n/a	n/a	n/a	n/a	n/a	France	Europe

C Non Ferrous Industry

C10	Platinum Recovery	10368	2384.6	n/a	n/a	n/a	n/a	Oct-98	South Africa	Africa
C60	Secondary Aluminium Recovery	1296	246.2	30000	225	0.032	200	Feb-92	UK	UK
C70	Aluminium Melting	1248	237.1	27316	225	0.032	200	Jul-94	UK	UK
C90	Titanium degreasing	576	132.5	9600	350	n/a	n/a	Jan-98	UK	UK
C100	Secondary Aluminium -Reverb	576	109.4	18240	140	0.046	260	Apr-94	UK	UK
C140	Metal Recovery from Circuit Boards	364	69.2	n/a	n/a	n/a	n/a	1999	UK	UK
C150	Metal Processing	324	61.6	5540	350	0.025	n/a	1997	Germany	Europe
C1[illegible]	Secondary Aluminium Smelting	256	48.6	5100	100	0.029	330	Jun-94	UK	UK

Ref. No.	Application	Number of Cerafil Elements	Filter Area m^2	Gas Flow Am^3/h	Average Temp. Deg. C	Face Velocity m/s	Average dP mm wg	Installed	Country	Region
C180	Secondary Aluminium Smelting	256	48.6	n/a	n/a	n/a	n/a	n/a	UK	UK
C190	Secondary Aluminium Smelting	256	48.6	n/a	n/a	n/a	n/a	n/a	UK	UK
C240	Bronze Foundry	160	30.4	n/a	n/a	n/a	n/a	n/a	UK	UK
C250	Secondary Aluminium Smelting	132	25.1	2550	175	0.028	n/a	Feb-93	UK	UK
C260	Secondary Aluminium Smelting	128	24.3	n/a	n/a	n/a	n/a	n/a	UK	UK
C270	Lead Melting	120	22.8	n/a	n/a	n/a	n/a	n/a	UK	UK
C280	Magnesium Production	81	15.4	997	150-300	0.018	100	1998	UK	UK
C290	Magnesium Production	81	15.4	997	380	0.018	100	1998	UK	UK
C310	Lead Melting	80	15.2	n/a	n/a	n/a	n/a	n/a	UK	UK
C320	Magnesium Alloy Production	80	15.2	1700	n/a	0.031	n/a	Mar-93	UK	UK
C330	Fume from Lead Kettles	72	13.7	3400	n/a	0.069	n/a	Nov-92	UK	UK
C340	Nickel Refining	42	8.0	300	160	0.010	153	1997	UK	UK
C350	Lead Recovery	36	6.8	850	20	0.035	n/a	Jan-95	UK	UK
C360	Lead Solder Smelting	36	6.8	1615	25	0.066	241	Aug-92	UK	UK
C370	Aluminium Foundry	20	3.8	n/a	n/a	n/a	n/a	n/a	UK	UK

D Chemicals Manufacture

D10	Catalyst manufacture	864	198.7	10731	265	0.015	88.9	n/a	UK	UK
D20	Silica Gel Manufacture	648	123.1	14000	200	0.032	290	n/a	France	Europe
D30	Chemicals Manufacture	512	97.3	n/a	n/a	n/a	n/a	n/a	France	Europe
D35	Zirconia Production	432	82.1	n/a	375	0.022	n/a	Sep-02	UK	UK
D70	Chemicals Manufacture	80	15.2	n/a	n/a	n/a	n/a	n/a	France	Europe
D90	Lead Oxide Recovery	80	15.2	n/a	n/a	n/a	n/a	n/a	UK	UK
D160	Molybdenum Oxide Production	24	4.6	410	280	0.025	200	Mar-95	Belgium	Europe
D170P	*Lime Calcination*	*16*	*3.0*	*255*	*35*	*0.023*	*204*	*Oct-96*	*Australia*	*A/P*

E Ferrous Industry

E5	Iron Foundry	256	48.6	n/a	n/a	n/a	n/a	n/a	UK	UK

F Fluidised bed applications

F10	Metal Cleaning in Fluidised Bed	3456	656.6	100410	350	0.042	250	1995	South Korea	A/P
F13	Metal Cleaning in Fluidised Bed	2000	380.0	19152	350	0.014	200	2002	Greece	Europe
F15	Metal Cleaning in Fluidised Bed	864	164.2	23640	400	0.040	n/a	1999	UK	UK
F16	Metal Cleaning in Fluidised Bed	864/TK1000	164.2	29550	350	0.040	350	1999	France	Europe
F20	Metal Cleaning in Fluidised Bed	576	109.4	19699	450	0.050	n/a	1992	Belgium	Europe
F22	Metal Cleaning in Fluidised Bed	480	110.4	n/a	n/a	n/a	n/a	2004	UK	Europe
F25	Sand Reclamation	432	82.1	14200	350	0.048	220	1995	Germany	Europe
F28	Metal Cleaning in Fluidised Bed	324	61.6	11081	450	0.050	n/a	1993	Italy	Europe
F29	Metal Cleaning in Fluidised Bed	324	61.6	6648	200	0.030	n/a	1993	Slovenia	Europe
F30	Metal Cleaning in Fluidised Bed	288	54.7	9850	400	0.050	n/a	1991	Belgium	Europe
F40	Metal Cleaning in Fluidised Bed	216	41.0	7387	450	0.050	n/a	1993	Slovenia	Europe
F45	Metal Cleaning in Fluidised Bed	216	41.0	7387	300	0.050	n/a	1993	Italy	Europe
F50	Metal Cleaning in Fluidised Bed	216	41.0	7387	450	0.050	n/a	1992	Italy	Europe
F60	Metal Cleaning in Fluidised Bed	216	41.0	7387	450	0.050	n/a	1992	Italy	Europe
F70	Metal Cleaning in Fluidised Bed	180	34.2	6156	250	0.050	n/a	1993	Belgium	Europe
F80	Metal Cleaning in Fluidised Bed	180	34.2	6156	300	0.050	n/a	1993	Germany	Europe
F82	Metal Cleaning in Fluidised Bed	120	22.8	n/a	n/a	n/a	n/a	2005	Belgium	Europe
F84	Metal Cleaning in Fluidised Bed	108	20.5	3694	250	0.050	n/a	1996	Italy	Europe
F85	Metal Cleaning in Fluidised Bed	108	20.5	3694	250	0.050	n/a	1997	USA	Americas
F88	Test Filter	90	17.1	n/a	500	n/a	n/a	1994	Belgium	Europe
F90	Metal Cleaning in Fluidised Bed	72	13.7	2462	450	0.050	n/a	1992	UK	UK
F91	Metal Cleaning in Fluidised Bed	72	13.7	2462	300	0.050	n/a	1995	USA	Americas
F9[illegible]	Metal Cleaning in Fluidised Bed	72	13.7	2462	250	0.050	n/a	1994	Hungary	Europe

Ref. No.	Application	Number of Cerafil Elements	Filter Area m^2	Gas Flow Am^3/h	Average Temp. Deg. C	Face Velocity m/s	Average dP mm wg	Installed	Country	Region
F94	Metal Cleaning in Fluidised Bed	63	12.0	2155	250	0.050	n/a	1997	USA	Americas
F100	Metal Cleaning in Fluidised Bed	32	6.1	1094	250	0.050	n/a	1995	USA	Americas
F105	Metal Cleaning in Fluidised Bed	28	5.3	958	450	0.050	n/a	1998	Taiwan	A/P
F110	Metal Cleaning in Fluidised Bed	24	4.6	821	450	0.050	n/a	1992	Belgium	Europe
F120	Metal Cleaning in Fluidised Bed	24	4.6	821	450	0.050	n/a	1992	Germany	Europe
F125	Metal Cleaning in Fluidised Bed	24	4.6	821	450	0.050	n/a	1993	Germany	Europe
F126	Metal Cleaning in Fluidised Bed	24	4.6	985	250	0.060	n/a	1995	Switzerland	Europe
F127	Metal Cleaning in Fluidised Bed	21	4.0	862	250	0.060	n/a	1995	USA	Americas
F130	Metal Cleaning in Fluidised Bed	18	3.4	616	250	0.050	n/a	1996	Australia	A/P
F140	Metal Cleaning in Fluidised Bed	15	2.9	513	250	0.050	n/a	1997	USA	Americas
F150	Metal Cleaning in Fluidised Bed	15	2.9	718	250	0.070	n/a	1997	USA	Americas
F160	Metal Cleaning in Fluidised Bed	15	2.9	513	250	0.050	n/a	1998	Italy	Europe
F170	Metal Cleaning in Fluidised Bed	15	2.9	513	450	0.050	n/a	1999	Australia	A/P

H Investment Casting

H10	Investment Casting	36	6.8	n/a	n/a	n/a	n/a	n/a	USA	Americas
H20	Investment Casting	36	6.8	n/a	n/a	n/a	n/a	n/a	UK	UK
H30	Investment Casting	36	6.8	n/a	n/a	n/a	n/a	n/a	UK	UK
H40	Investment Casting	36	6.8	n/a	n/a	n/a	n/a	n/a	UK	UK
H50	Investment Casting	36	6.8	n/a	n/a	n/a	n/a	n/a	UK	UK
H60	Investment Casting	36	6.8	n/a	n/a	n/a	n/a	n/a	UK	UK
H70	Investment Casting	36	6.8	n/a	n/a	n/a	n/a	n/a	Switzerland	Europe
H80	Investment Casting	36	6.8	n/a	n/a	n/a	n/a	n/a	UK	UK

I Cement Manufacture

I1[illegible]	[illegible]linker Cooling	128	24.3	n/a	n/a	n/a	n/a	n/a	UK	UK
I20P	*Clinker Cooling*	*16*	*3.0*	*339*	*80*	*0.031*	*140*	*Aug-96*	*Australia*	*A/P*

L General

L20	*Coated Sand Calcining*	*832*	*158.1*	*17800*	*253*	*0.031*	*260*	*Aug-92*	*UK*	*UK*
L30	Fire Testing Unit	288	54.7	5910	n/a	0.030	n/a	1994	Denmark	Europe
L40	Sand Drying	208	39.5	n/a	100	n/a	n/a	Aug-92	UK	UK
L50		180	34.2	n/a	n/a	n/a	n/a	1999	Noway	Europe
L60	Silo Venting, 2 units	96	18.2	1275	20	0.019	n/a	Nov-92	UK	UK

M Waste Pyrolysis

M10	MSW Incinerator Ash Treatment	35	11.8	n/a	400	n/a	n/a	Dec-98	Japan	A/P
M20	MSW Incinerator Ash Treatment	35	11.8	n/a	400	n/a	n/a	Nov-99	Japan	A/P
M30	MSW Incinerator Ash Treatment	35	11.8	n/a	400	n/a	n/a	Nov-99	Japan	A/P
M40	MSW Incinerator Ash Treatment	30	10.1	n/a	400	n/a	n/a	Jan-99	Japan	A/P
M50	MSW Incinerator Ash Treatment	30	5.7	n/a	400	n/a	n/a	Feb-00	Japan	A/P
M60	MSW Incinerator Ash Treatment	30	5.7	n/a	400	n/a	n/a	Feb-00	Japan	A/P
M70	MSW Incinerator Ash Treatment	30	10.1	n/a	400	n/a	n/a	Apr-00	Japan	A/P
M80	MSW Incinerator Ash Treatment	24	4.6	n/a	400	n/a	n/a	Oct-99	Japan	A/P
M90	MSW Incinerator Ash Treatment	24	4.6	n/a	400	n/a	n/a	Oct-99	Japan	A/P
M100	MSW Incinerator Ash Treatment	20	6.8	n/a	400		n/a	Mar-00	Japan	A/P
M110	MSW Incinerator Ash Treatment	15	2.7	n/a	400	n/a	n/a	Mar-00	Japan	A/P
M120	MSW Incinerator Ash Treatment	15	2.7	n/a	400	n/a	n/a	Mar-00	Japan	A/P
M130	MSW Incinerator Ash Treatment	15	2.7	n/a	400	n/a	n/a	Mar-00	Japan	A/P
M140	MSW Incinerator Ash Treatment	15	2.7	n/a	400	n/a	n/a	Mar-00	Japan	A/P
M15[illegible]	MSW Incinerator Ash Treatment	15	2.7	n/a	400	n/a	n/a	Mar-00	Japan	A/P
M1[illegible]	[illegible]DF Incinerator Ash Treatment	12	2.3	n/a	400	n/a	n/a	Aug-99	Japan	A/P

Ref. No.	Application	Number of Cerafil Elements	Filter Area m²	Gas Flow Am³/h	Average Temp. Deg. C	Face Velocity m/s	Average dP mm wg	Installed	Country	Region
M170	Kiln Ash Treatment	12	2.3	n/a	400	n/a	n/a	Feb-00	Japan	A/P
M180	MSW Incinerator Ash Treatment	8	1.5	n/a	400	n/a	n/a	Dec-98	Japan	A/P
M190	MSW Incinerator Ash Treatment	8	1.5	n/a	400	n/a	n/a	Dec-98	Japan	A/P
M200	MSW Incinerator Ash Treatment	8	1.5	n/a	Amb-400	n/a	n/a	Mar-99	Japan	A/P
M210	MSW Incinerator Ash Treatment	8	1.5	n/a	400	n/a	n/a	Nov-99	Japan	A/P
M220	MSW Incinerator Ash Treatment	8	1.5	n/a	400	n/a	n/a	Dec-99	Japan	A/P
M230	MSW Incinerator Ash Treatment	8	1.5	n/a	400	n/a	n/a	Mar-00	Japan	A/P
M240	MSW Incinerator Ash Treatment	8	1.5	n/a	400	n/a	n/a	Mar-00	Japan	A/P
M250	MSW Incinerator Ash Treatment	8	1.5	n/a	400	n/a	n/a	Mar-00	Japan	A/P
M260	MSW Incinerator Ash Treatment	6	1	n/a	400	n/a	n/a	Jan-00	Japan	A/P
M270	MSW Incinerator Ash Treatment	6	1	n/a	400	n/a	n/a	Jan-00	Japan	A/P
M280	MSW Incinerator Ash Treatment	6	1	n/a	400	n/a	n/a	Jan-00	Japan	A/P
M290	MSW Incinerator Ash Treatment	6	1	n/a	400	n/a	n/a	Jan-00	Japan	A/P
M300	*MSW Incinerator Ash Treatment*	*4*	*0.76*	*n/a*	*400*	*n/a*	*n/a*	*Mar-98*	Japan	A/P

Large Elements

O Power Generation

O10	Diesel Exhaust	16/3m	22.2	2060	265	0.026	200	1997	Spain	Europe
O20	Diesel Exhaust	49/3m	64.5	5000	400	0.022	150	1997	Spain	Europe

P Non Ferrous Industry

P20	Tin Smelting	770/2m	631.4	48400	300	0.021	150	Apr-02	Thailand	A/P
P30	Tin Smelting	770/2m	631.4	48400	300	0.021	150	Apr-02	Thailand	A/P
P4[illegible]	Secondary Aluminium Smelting	380/3m	530.5	77000	250 max.	0.040	250-300	Jul-97	Saudi Arabia	A/P
P[illegible]	Tin Smelting	528/2m	433.0	40200	400-450	0.026	150	2000	Thailand	A/P

R Gasification and Pyrolysis

R10	Waste Pyrolysis	600/3m	868.0	n/a	n/a	n/a	n/a	Sep-02	Japan	A/P
R17	Waste Gasification	120/3m	168.0	n/a	n/a	n/a	n/a	Jun-09	Sweden	Europe
R20	*MSW Pyrolysis Pilot Plant*	*52 x 3m*	*66.7*	*n/a*	*n/a*	*n/a*	*n/a*	*Sep-99*	*Japan*	*A/P*
R30	Waste Gasification	48/3m	67.2	2051	175	0.008	40	2002	Japan	A/P

S Soil Remediation

S10	Thermal Soil Remediation	58/2.25m	55.9	n/a	550	n/a	30-130	1989	Germany	Europe
S20	Thermal Soil Remediation	48/1.8m	39.8	n/a	n/a	n/a	n/a	Jul-00	Australia	Australia
S40	*Thermal Soil Remediation*	*30/1.53m*	*19.8*	*n/a*	*n/a*	*n/a*	*n/a*	*May-98*	*Malaysia*	*A/P*

T Alumina Refining

T10	Liquor burning	2520/3m	3528.0	135000	200	0.011	150	Jun-00	Australia	Australia
T20	Liquor burning	2400/3m	3360.0	n/a	n/a	n/a	n/a	2005	Australia	Australia

U Asphalt Reclamation

U10	Asphalt Reclamation	2640/3m	3696.0	296000	300	0.022	n/a	Jan-06	Netherlands	Europe

V Chemicals Manufacture

V10	Carbon Black Production	144/3m	168.5	3500	150	0.006	130	May-01	Sweden	Europe
V20	Activated Carbon	120/3m	168.0	n/a	n/a	n/a	n/a	Aug-01	Japan	Japan
V[illegible]	Blue Pigment Production	648/2.25m	344.1	23658	265	0.019	n/a	Feb-08	France	Europe

Ref. No.	Application	Number of Cerafil Elements	Filter Area m^2	Gas Flow Am^3/h	Average Temp. Deg. C	Face Velocity m/s	Average dP mm wg	Installed	Country	Region
V30	*Alumina Calcination*	*1/3m*	*1.4*	*101*	*230*	*0.020*	*150*	*May-99*	*Australia*	*Australia*

W Waste Incineration

Ref. No.	Application	Number of Cerafil Elements	Filter Area m^2	Gas Flow Am^3/h	Average Temp. Deg. C	Face Velocity m/s	Average dP mm wg	Installed	Country	Region
W5	Meat Waste Incineration	1344/3m	1881.6	91154	280	0.013	n/a	Mar-07	France	Europe
W10	Industrial Waste Incineration	600/3m	840.0	n/a	n/a	n/a	n/a	May-05	Japan	Japan
W20	Sewage Sludge Incineration	550/3m	770.0	n/a	n/a	n/a	n/a	Mar-04	Japan	Japan
W30	Building Waste Incineration	540/3m	756.0	n/a	n/a	n/a	n/a	Sep-02	Japan	Japan
W40	Industrial Waste Incineration	490/3m	686.0	n/a	n/a	n/a	n/a	Dec-04	Japan	Japan
W50	Sewage Sludge Incineration	484/3m	677.6	n/a	n/a	n/a	n/a	Mar-06	Japan	Japan
W55	Sewage Sludge Incineration	442/3m	618.8	35800	370	0.016	210	Nov-06		
W60	Industrial Waste Incineration	330/3m	462.0	n/a	n/a	n/a	n/a	Mar-03	Japan	Japan
W70	Building Waste Incineration	324/3m	453.6	32410	190	0.020	225	May-02	Japan	A/P
W80	Clinical Waste Incineration	280/3m	392.0	n/a	n/a	n/a	n/a	2000	UK	UK
W90	Industrial Waste Incineration	220/3m	308.0	n/a	n/a	n/a	n/a	Jun-04	Japan	Japan
W100	Building Waste Incineration	216/3m	302.4	19158	250	0.018		Oct-02	Japan	A/P
W110	Industrial Waste Incineration	216/3m	302.4	n/a	n/a	n/a	n/a	Oct-02	Japan	Japan
W120	Industrial Waste Incineration	216/3m	302.4	n/a	n/a	n/a	n/a	Dec-02	Japan	Japan
W130	Industrial Waste Incineration	216/3m	302.4	n/a	n/a	n/a	n/a	Sep-03	Japan	Japan
W140	Industrial Waste Incineration	216/3m	302.4	n/a	n/a	n/a	n/a	Dec-03	Japan	Japan
W150	Industrial Waste Incineration	200/3m	280.0	n/a	n/a	n/a	n/a	Oct-04	Japan	Japan
W160	Munitions Waste Incineration	156/3m	218.4	15725	370	0.020	100-175	Dec-99	USA	Americas
W170	Munitions Waste Incineration	156/3m	218.4	n/a	370	n/a	100-175	n/a	USA	Americas
W180	Munitions Waste Incineration	156/3m	218.4	n/a	370	n/a	100-175	n/a	USA	Americas
W190	Munitions Waste Incineration	156/3m	218.4	n/a	370	n/a	100-175	n/a	USA	Americas
W200	Munitions Waste Incineration	156/3m	218.4	n/a	370	n/a	100-175	n/a	USA	Americas
W210	Industrial Waste Incineration	144/3m	201.6	n/a	n/a	n/a	n/a	Sep-02	Japan	Japan
W[illegible]	Clinical Waste Incineration	132/3m	183.5	n/a	n/a	n/a	n/a	Oct-95	UK	UK
W2[illegible]	Industrial Waste Incineration	130/3m	182.0	n/a	n/a	n/a	n/a	Sep-04	Japan	Japan
W240	Sludge Incineration	124/3m	173.6	n/a	n/a	n/a	n/a	Jan-06	Japan	Japan
W250	Clinical Waste Incineration	100/3m	140.0	n/a	n/a	n/a	n/a	Jun-05	UK	UK
W255	Laboratory Waste Incineration	96/TK3000	134.4	n/a	n/a	n/a	n/a	Aug-09	UK	UK
W260	Industrial Waste Incineration	81/3m	113.4	n/a	n/a	n/a	n/a	Oct-02	Japan	Japan
W270	Industrial Waste Incineration	81/3m	113.4	n/a	n/a	n/a	n/a	Oct-02	Japan	Japan
W275	Meat Waste Incineration	80/TK3000	112.0	4700	220	0.012	180	Jan-05	France	Europe
W280	Industrial Waste Incineration	72/3m	100.8	n/a	n/a	n/a	n/a	Apr-04	Japan	Japan
W285	Animal Carcasse Incineration	64/TK3000	89.6	n/a	n/a	n/a	n/a	Jul-05	UK	UK
W290	Waste Plastic Incineration	56/3m	78.4	n/a	n/a	n/a	n/a	Oct-99	Taiwan	A/P
W300	Industrial Waste Incineration	50/3m	70.0	n/a	n/a	n/a	n/a	Aug-04	Japan	Japan
W310	Industrial Waste Incineration	40/3m	56.0	n/a	n/a	n/a	n/a	Aug-04	Japan	Japan
W330	Municipal Waste Incineration	34/3m	47.6	n/a	n/a	n/a	n/a	Aug-00	Japan	Japan
W340	Clinical Waste Incineration	24/3m	33.4	n/a	260	n/a	n/a	Mar-96	UK	UK

X Glass Industry

Ref. No.	Application	Number of Cerafil Elements	Filter Area m^2	Gas Flow Am^3/h	Average Temp. Deg. C	Face Velocity m/s	Average dP mm wg	Installed	Country	Region
X5	Float glass line	1820/3m	2548.0	131000	350	0.014	n/a	Sep-09	Spain	Europe
X10	*Borosilicate Glass furnace*	*253/3m*	*354.2*	*15300*	*250*	*0.012*	*250*	*Dec-99*	*UK*	*Europe*
X20	Glass furnace	112/2.3m	112.7	11000	390	0.027	338	Dec-97	Germany	Europe
X30P	Float glass line	40/TK3000	56	3225	370	0.016	170	Oct-06	Belgium	Europe

Issue date: 10/02/10

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Tri-Mer UltraTemp & UltraCat Ceramic Filter Systems

	Project	Type	ACFM	Product and Emissions	Operational
1	Porocel, AR	Catalyst Manufacturing	1,200	UltraTemp - PM	May 2011
2	Plasma Power, FL	Syngas R&D	1,930	UltraTemp - PM	July 2011
3	University of Iowa, IA	Biomass Boiler	15,600	UltraCat + CO unit - PM, NOx, CO	December 2011
4	Illumina, CA	RTO Exhaust, biotechnology process	13,500	UltraCat - PM, HCl, NOx, Dioxins	February 2012
5	Intel, NM	RTO Exhaust, semiconductor	Undisclosed	UltraCat - PM, HCl, NOx, Dioxins	Q1 2012
6	Durand Glass, NJ	Glass Furnaces, tableware	Approx. 100,000	UltraCat - PM, SO2, HCl, NOx, metals	Q1, Q2 2012
7	Anchor Glass, PA	Glass Furnace, tableware	29,300	UltraCat - PM, SO2, HCl, NOx, metals	2012
8	Undisclosed	Kilns, ceramics	Approx. 200,000	UltraCat - PM, SO2, HCl, HF, NOx	Q3 2012
9	AGC Glass, TN	Glass Furnace, float	165,000	UltraCat - PM, SOX, HCl, NOx, metals	Q4 2012
10	Porocel, AR	Catalyst Manufacturing	5,797	UltraCat - PM, NOx	June 2012
11	Calgon Carbon, AZ	Reactivation Furnace	25,378	UltraTemp - PM, SO2, HCl	Q4 2012
12	Gallo	Glass Furnace, container	Undisclosed	UltraTemp – PM, SO2, HCl	Q4 2012
13	MaxWest	RTO Exhaust , biowaste	20,368	UltraCat – PM, SO2, HCl, NOx	Q! 2013

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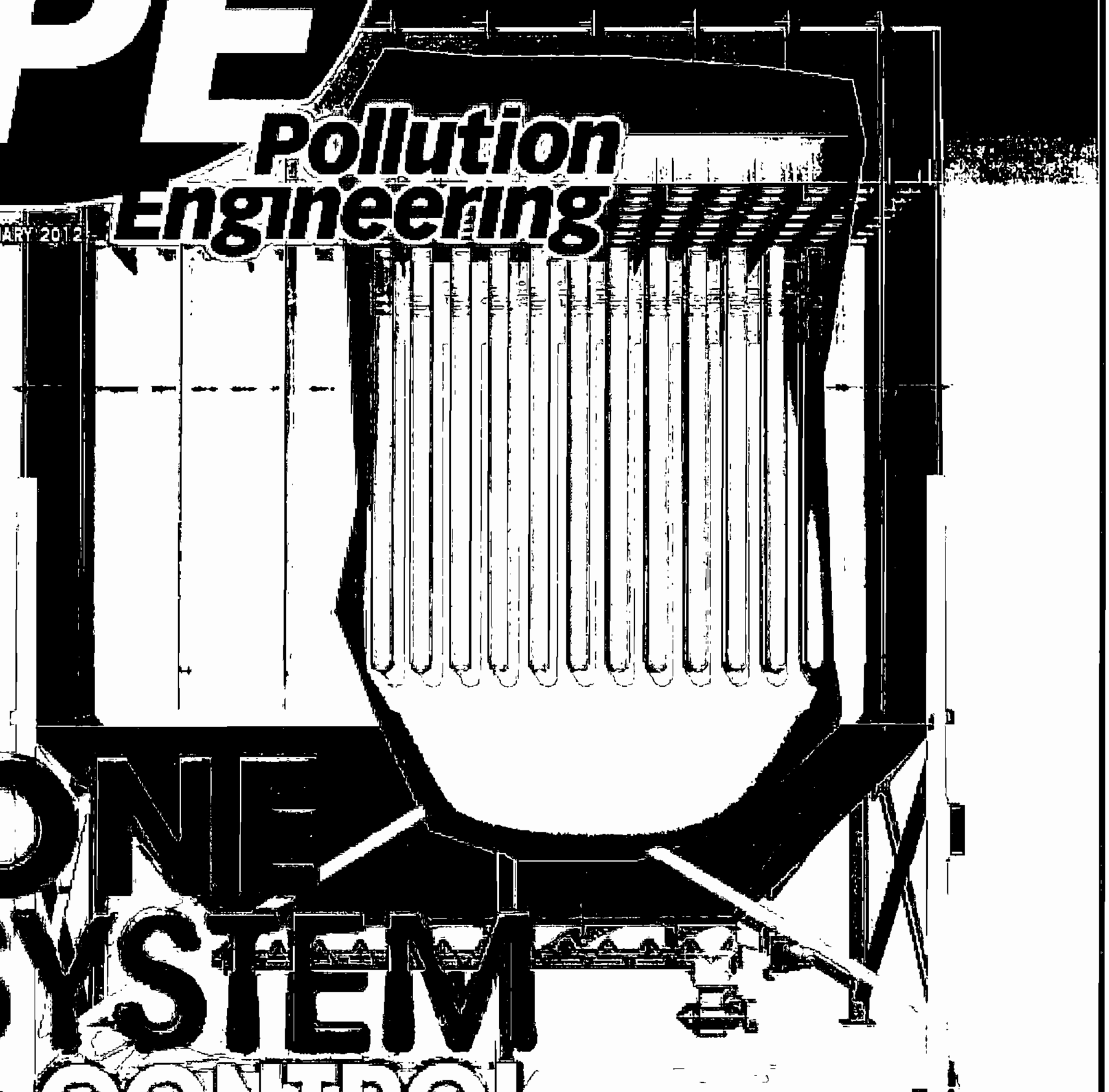

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that are associated with fabric filter baghouses (see **Table 2**).

Operating characteristics

Ceramic filters must operate above the condensation temperature of the pollutants, or else the particulate will not be released from the filter surface, unless the temperature is raised and the material volatilizes, thus cleaning the filter. **Table 3** shows typical operating temperatures for the ceramic filters. The filters are chemically inert and highly corrosion resistant. Tri-Mer manufactures two varieties of filters: standard UltraTemp filters and UltraCat catalyst.

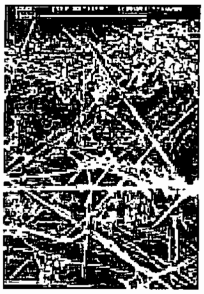


Figure 2: Micrograph of filter elements composition.

The catalyst filter is identical to the standard filter, except that it has nano-bits of selective catalytic reduction (SCR) catalyst embedded in the filter walls for NO_X removal and dioxin destruction.

Particulate control

The typical level of PM at the outlet of the ceramic filters is less than 0.001 grains per dscf. This is accurate even with heavy inlet loadings of several thousand milligrams per cubic meter. PM is captured on the face of the filter and does not deeply penetrate into the filter body, thus allowing for repetitive and complete cleaning. The filter does not blind, and the pressure tends to drop very gradually, typically lasting five to 10 years, to the point at which filters should be changed. Pressure drop for the new clean filter is approximately six inches w.g. The pressure drop can be lowered by adding more filter elements, and capital cost can be reduced by decreasing the filter count at the expense of fan horsepower.

As a result of the filter construction, standard reverse pulse jet methods can thoroughly clean accumulated PM from the outer surface of the tube. Filters are cleaned on-line, with no need to isolate each housing module.

The filters are effective across many particle sizes, but are most often used when there is a large fraction of PM2.5 and submicron particulate at high temperatures (see **Table 4**).

SO_2 and acid gas control

Both filter systems feature an option for dry injection of calcium or sodium-based sorbents. Injected in the duct upstream of the filter modules, additional sorbent particulate is captured along with its pollutant gas. The sorbent must be milled to a small particle size to maximize surface area for maximum reactivity. The reaction occurs within the duct, prior to the filter, and at the filter cake that builds up on the surface of the filters. The chemical reaction of the sorbent, along with the acid gas, creates a solid particle that captured on the filters alongside the unreacted sorbent and the process particulate.

With sorbent injection, SO_2 removal is typically 90 percent or higher, with removal efficiencies as high as 97 percent. On the other hand, HCl removal is normally 95 percent, and often as high as 99 percent. The temperature range for effective removal is 300°F to 1,200°F (See **Figure 3** on next page).

Sodium bicarbonate and trona are typical sodium-based sorbents. Trona is the ore from which soda ash and sodium bicarbonate are produced. When properly milled, trona can be used as a dry sorbent, requiring no other processing, and is available throughout North America.

Typical operating temperatures for the ceramic filters

Temperature range of operations

Filter name	Pollutants removed	Temperature Range
UltraTemp Standard	Particulate matter (PM)	300°F to 1650°F
UltraTemp Standard	PM + SO_2, HCl, or other gases	300°F to 1200°F
UltraCat Catalyst	PM + NOx, Dioxins also destroyed	350°F to 700°F
UltraCat Catalyst	PM + NOx (+Dioxins) + SO_2, HCl & other acid gases	350°F to 700°F

Table 3

Ceramic filters are most effective where there is a large fraction of PM 2.5 and submicron particulate

Efficiency of fibrous ceramics filter elements in various applications

Process	Particle size	Inlet PM loading		Outlet PM loading		Inferred efficiency
	d_{50}[1], µm	mg/Nm³	gr/dscf	mg/Nm³	gr/dscf	%
Aluminum powder production	<50	550	0.24	<1	<0.0004	99.9
Nickel refining	<10	11,800	5.16	<1	<0.0004	>99.8
Smokeless fuel production	4.8	1,000	0.44	1.5	0.0007	99.9
Zirconia production	1.2	8,000	3.5	0.6	0.0003	99.85
Secondary aluminum	<1.0	870	0.38	0.5	0.0002	>99.99

[1]Diameter of median size particle

Table 4

NO_X and dioxin control

For NO_X or dioxin removal, catalyst filter elements are available with nano-bits of SCR catalyst embedded in the walls. The filter walls containing the catalyst are about 3/4 inch (20 mm), as represented in Figure 4. Urea, or ammonia, is injected upstream of the filters. The embedded catalyst then destroys NO_X, with up to 95 percent removal efficiency.

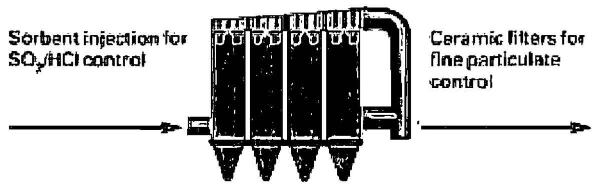


Figure 3: Standard filter system for control of particulate, SO_2, HCl, and other gases

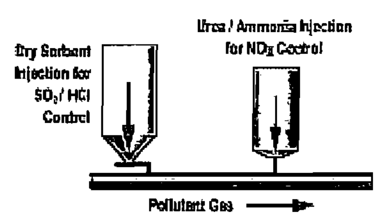
Of note, the operating temperature required for high NO_X destruction is 350°F to 400°F, compared to 600°F to 650°F for conventional SCR. Besides the need for high temperature, a common complication regarding traditional SCR is that the catalyst becomes poisoned and ineffective, necessitating early replacement. Typical poisons are ordinary PM, metals and HCl. The catalyst used in the filters is a proprietary formulation to improve performance.

The increased reactivity at lower temperature is partly due to their micronized form. The diffusion restriction is eliminated, and the catalyst is almost completely protected from blinding by particulate matter, since it is sheltered inside the filter itself (see Figure 5). PM removal, sorbent injection for SO_2 (and other acid gases) and catalytic reduction can be incorporated within a single system.

It is important to note that operating temperature for high NO_X removal must be kept between 350°F and 700°F to achieve NO_X removal rates up to 95 percent.

Dioxins are also broken down by the catalyst. Optimum performance for dioxins is limited to an upper temperature of 480°F. Destruction efficiency is typically 97 to 99 percent.

Multi-pollutant capability creates a powerful, all-in-one-solution that is superior, in performance and economics, to having a separate pollution control device for each pollutant. There is often insufficient temperature to operate a traditional SCR for NO_X removal. Low-temperature NO_X removal provides flexibility for industrial processes requiring control (see Figure 6).



ture range of fabric bags. If temperatures remain below 400°F and there are no special circumstances, the fabric bags are less costly than ceramic filters. In borderline cases, the ceramic filters have a much longer element life and often prove to be the most cost-effective solution.

In applications that require NO_X removal, since fabric bags and electrostatic precipitators (ESPs) cannot control NO_X, catalyst filters are preferable. Ceramic filters also replace (ESPs) when there is a need for very low PM levels, especially for applications with significant concentrations of PM2.5 and submicron particulate. The filters can handle much higher inlet loadings, are not subject to the selective removal constraints of ESPs, have lower maintenance requirements and fewer corrosion issues and are roughly equivalent (or lower) in energy usage. Because of the formation of filter cake on the filter surface, which provides more exposure to the acid gases, filter systems consume significantly less sorbent; consequently, higher removal efficiency can be achieved for acid gas removal. As stated, fabric bags and ESP do not remove NO_X or dioxins. Therefore, a second technology (perhaps with additional temperature control) would also be required. In contrast, the catalyst filter can handle all of the pollutants in a single device and at lower temperatures (see Figure 7).

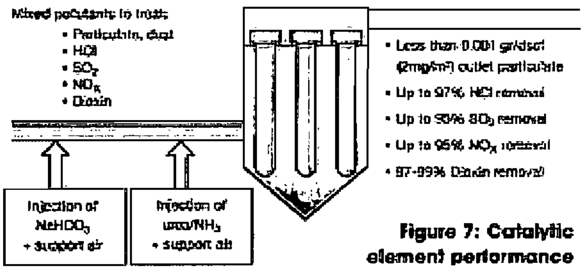


Figure 7: Catalytic element performance

The modular design of the housing units allows filters to be configured to handle large gas-flow volumes. When large flow volumes are treated, modules are placed in parallel. The systems are designed so that a single module can be taken off line if required, and the remaining two or more modules can continue to operate at a slightly higher pressure (designed into the fan) without interruption of the process itself, and with no appreciable change in emission control performance.

Lightweight ceramic filters have been used for the last 10 years by the U.S. military at munitions-destruction facilities in Indiana, Utah and Oklahoma. Hundreds of ceramic filter applications are currently located throughout the world. ***PE***

For more information, please contact Kevin Moss, Tri-Mer business development director, advanced technologies. He may be reached at (801) 294-5422, or kevin.moss@tri-mer.com. Visit www.tri-mer.com

APPENDIX E-6
CO AND HCL EMISSION STANDARD COMPLIANCE

2 SUMMARY AND DISCUSSION

The results of the air emission compliance tests are presented in the tables on the following pages. An overview of the results is presented in the table below:

Parameter	Limit	Average
PARTICULATE		
Dry Catch Only		
........................(GR/DSCF @ 7% O_2)	0.015	0.0037
........................(LB/HR)	N/A	0.0873
Opacity........................(%)	10	0 %
HYDROGEN CHLORIDE		
........................(ppm,d @ 7% O_2)	100	3.51
TRACE METALS		
Cadmium		
........................(grains/Mdscf @ 7% O_2)	0.07	< 0.003
........................(LB/HR)	N/A	< 0.00009
Lead		
........................(grains/Mdscf @ 7% O_2)	0.52	≤ 0.037
........................(LB/HR)	N/A	≤ 0.0011
Mercury		
........................(grains/Mdscf @ 7% O_2)	0.24	≤ 0.00068
........................(LB/HR)	N/A	≤ 0.00002
DIOXINS		
Total Dioxins		
........................(grains/Gdscf @ 7% O_2)	55	2.33
Toxicity Equivilency		
........................(grains/Gdscf @ 7% O_2)	1	0.042
SULFUR DIOXIDE (SO_2)		
........................(ppm,d @ 7% O_2)	55	1.64
........................(lb/hr)	N/A	0.04
OXIDES OF NITROGEN (NO_x)		
........................(ppm,d @ 7% O_2)	250	106.58
........................(lb/hr)	N/A	2.09
CARBON MONOXIDE (CO)		
........................(ppm,d @ 7% O_2)	40	9.25
........................(lb/hr)	N/A	0.11