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west virginia department of environmental protection

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Division of Air Quality  
601 57<sup>th</sup> Street SE  
Charleston, WV 25304  
Phone 304/926-0475 • FAX: 304/926-0479

Earl Ray Tomblin, Governor  
Randy C. Huffman, Cabinet Secretary  
www.wvdep.org

## ENGINEERING EVALUATION / FACT SHEET

### BACKGROUND INFORMATION

Application No.: R13-2708A  
Plant ID No.: 045-00130  
Applicant: Gevans Inc. DBA Evans Funeral Home  
Facility Name: Chapmanville  
Location: Chapmanville  
NAICS Code: 812210  
Application Type: Modification  
Received Date: September 6, 2012  
Engineer Assigned: Edward S. Andrews, P.E.  
Fee Amount: \$1000.00  
Date Received: September 6, 2012  
Completeness Date: October 4, 2012  
Due Date: January 2, 2012  
Newspaper: *The Logan Banner*  
Applicant Ad Date: September 7, 2012  
UTMs: Easting: 417.3 km      Northing: 4,255.8 km      Zone: 17  
Description: This construction permit application is for the construction and operation of Matthews Power Pak II Plus crematory.

### DESCRIPTION OF PROCESS

#### **Power-Pak II Plus (Human Crematory)**

The IE43-PPII Power-Pak II Plus crematory is designed to complete one human cremation in one hundred (100) minutes or less. This time does not include preheating the secondary chamber or the cool-down period before the removal of the remains (½ hour). The crematory has a maximum burn rate of 175 pounds per hour of remains and the associated container, based on the entire cremation period. The crematory is a dual chamber design and is fired with natural gas as an auxiliary fuel. It is designed to be manually loaded in batches with

Promoting a healthy environment.

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maximum load capacity of 400 pounds. The Power-Pak II Plus can handle loads up to 750 pounds. Matthews International Cremation Division, Industrial Equipment & Engineering, Co., the crematory manufacturer, has prescribed specific operating procedures for cremating remains over 400 pounds up to 750 pounds in the Power-Pak II Plus.

The remains are typically loaded into the primary chamber and then the secondary chamber is preheated to 1400-1800<sup>0</sup>F in 30 minutes using the secondary chamber burner (afterburner). Then, the primary or cremation burner is ignited to begin the cremation cycle. Actual cycle time varies from 90 minutes to 6 hours. A cool-down period of 30 minutes or more is recommended at the end of the cremation cycle before removing the cremated remains and loading the next set of remains.

The secondary chamber has one Eclipse TJ150 burner rated at a maximum of 1.5 MM Btu/hr, and is normally set to 1.2 MM Btu/hr. The secondary chamber temperature is monitored by a digital controller which adjusts the after burner gas input to maintain the desired temperature set point. The crematory operates best with a minimum secondary chamber temperature of 1400-1600<sup>0</sup>F.

The primary chamber has one Eclipse TJ150 burner rated at a maximum of 1.5 MM Btu/hr and is normally set to 0.7 MM Btu/hr. The primary chamber temperature ranges from 500<sup>0</sup>F at the beginning of the first cremation of the day to 1800<sup>0</sup>F or more during successive cremations.

The Power Pak II Plus is nearly identical to the Power Pak II with a few differences. Matthews increased the primary chamber by one cubic foot and the secondary by 25 cubic feet, which equates to a 35% increase in the secondary chamber volume of a Power Pak II. The increase of the volume of the secondary chamber significantly increase the residence time of the exhaust gases in the secondary chamber. According to Matthew's calculations, the retention time is increase up to 3.11 seconds at 1400<sup>0</sup>F. The calculated retention time for a Power Pak II (basic model) is 1.88 seconds.

## SITE INSPECTION

On June 14, 2012, Mr. Joshua Woody, an engineer assigned to the Compliance & Enforcement Section, conducted a compliance inspection of the facility. Based on this inspection, Mr. Woody determined that the facility has been operating the existing crematory in compliance with Permit R13-2708. No site inspection is necessary for this permitting action.

## ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

The applicant presented potential emission estimates based on emission factors published in AP-42, Chapter 2.1 "Refuse Combustion". These factors were developed from sources combusting garbage and other non-hazardous solids, commonly called municipal solid waste. This writer does not believe the emission factors for these municipal solid waste incinerators are representative of human cremations. Therefore, this writer developed factors based from actual emission estimates from Power-Pak II crematories incinerating human remains and their associated containers.

Air Testing & Consulting, Inc. conducted the emission tests of Baldwin Fairchild's IE43-PPII (Power-Pak II) on May 5, 2005 and December 9, 2004. Air Testing & Consulting measured particulate matter, carbon monoxide, hydrogen chloride, oxides of nitrogen sulfur dioxide and volatile organic compounds on December 9, 2004. The Orange County Florida, Environment Protection Division requested PM, CO and visible emissions be measured from their Power-Pak II unit on May 5, 2005. Results of a third test were obtained from the agency's files. The third set of results was used in Permit Applications R13-2583 and R13-2653. Presented in the following tables are the results of these tests and the incineration rate that the crematory unit was operating at during the test.

| Table #1 - Tests Results for Power-Pak II                    |                                   |                       |                        |
|--|-----------------------------------|-----------------------|------------------------|
| Pollutant  | Test Data <sup>1</sup><br>(lb/hr) | TestData <sup>2</sup> | Test Data <sup>3</sup> |
|  |                                   | Lb/hr                 | lb/hr                  |
| Average Incineration Rate of the test(lb/hr)                 | 82                                | 150                   | 111                    |
| Particulate Matter (PM/PM <sub>10</sub> /PM <sub>2.5</sub> ) | 0.095                             | 0.23                  | 0.156                  |
| Sulfur Dioxide (SO <sub>2</sub> )                            | 0.154                             | NM                    | NM                     |
| Oxides of Nitrogen (NO <sub>x</sub> )                        | 1.000                             | NM                    | NM                     |
| Carbon Monoxide (CO)   | 0.005                             | 0.007                 | 0.027                  |
| Volatile Organic Compounds (VOCs)                            | 0.005                             | MN                    | NM                     |
| Hydrogen chloride (HCL)                                      | 0.080                             | NM                    | NM                     |

1 - Results of testing conducted on 12/9/2004

2 - Results of testing conducted on 5/5/2005

3 - Results of testing conducted on 3/11/1999

These results were an average of three one-hour runs for each test. All of these results were corrected to a standard Oxygen content of 7%. VOC emissions were assumed propane. To review these results concerning the maximum incineration rate, the measured results were

corrected to the maximum incineration rate of 175 lb/hr, which is present in the following Table #2.

| Table #2 - Tests Results for Power-Pak II Corrected to a Incineration Rate 175 lb/hr |                                   |                       |                        |
|--|-----------------------------------|-----------------------|------------------------|
| Pollutant  | Test Data <sup>1</sup><br>(lb/hr) | TestData <sup>2</sup> | Test Data <sup>3</sup> |
|  |                                   | Lb/hr                 | lb/hr                  |
| Incineration Correction Ratio  | 2.13                              | 1.17                  | 1.58                   |
| Particulate Matter (PM/PM <sub>10</sub> /PM <sub>2.5</sub> )                         | 0.20                              | 0.27                  | 0.25                   |
| Sulfur Dioxide (SO <sub>2</sub> )  | 0.33                              | NM                    | NM                     |
| Oxides of Nitrogen (NO <sub>x</sub> )  | 2.13                              | NM                    | NM                     |
| Carbon Monoxide (CO)   | 0.01                              | 0.008                 | 0.04                   |
| Volatile Organic Compounds (VOCs)  | 0.010                             | MN                    | NM                     |
| Hydrogen chloride (HCL)  | 0.17                              | NM                    | NM                     |

NM - Not Measured

1 - Results of testing conducted on 12/9/2004

2 - Results of testing conducted on 5/5/2005

3 - Results of testing conducted on 3/11/1999

Reviewing the above-corrected results, the arithmetic mean corrected PM rate was determined to be 0.24 lb/hr with a standard deviation of 0.029 lb/hr. Again using the corrected results, arithmetic mean for CO was 0.019 lb/hr with a standard deviation of 0.015 lb/hr. Using the annual schedule operation of 3,744 hours per year and the corrected data, this writer estimated that this proposed crematory potential to emit, which is presented in the following table.

| Table #3 -Potential to Emit for Power-Pak II Plus            |             |                  |                   |
|--|-------------|------------------|-------------------|
| Pollutant  | Hourly Rate | Annual Emissions | Maximum Potential |
|  | lb/hr       | TPY              | TPY               |
| Particulate Matter (PM/PM <sub>10</sub> /PM <sub>2.5</sub> ) | 0.24        | 0.45             | 1.05              |
| Sulfur Dioxide (SO <sub>2</sub> )                            | 0.33        | 0.62             | 1.45              |
| Oxides of Nitrogen (NO <sub>x</sub> )                        | 2.13        | 3.99             | 9.33              |
| Carbon Monoxide (CO)   | 0.02        | 0.04             | 0.09              |
| Volatile Organic Compounds (VOCs)                            | 0.01        | 0.02             | 0.04              |
| Hydrogen chloride (HCL)                                      | 0.17        | 0.32             | 0.74              |

## REGULATORY APPLICABILITY

The following state regulations apply.

### **45CSR6 - To Prevent and Control Air Pollution From Combustion of Refuse**

The purpose of this rule is to prevent and control air pollution from combustion of refuse. The permittee has proposed install and operate one human crematory. This rule defines incineration as the destruction of combustible refuse by burning in a furnace designed for that purpose. The proposed crematory is specifically designed to destroy human remains and associated containers through incineration. Thus, it meets this definition.

Per section 4.1, these crematories must meet the particulate matter limit by weight. The human crematory will have an allowable particulate matter emission rate of 0.48 pounds per hour (based on maximum design-incineration rate of 175 lb/hr). This allowable rate is higher than the estimated hourly potential of 0.23 lb/hr. Thus, the unit should be more than capable of meeting this PM standard.

The crematory is subject to the 20% opacity (visible emission) limitation in section 4.3 of this rule. The opacity and the allowable limits should be met since the crematory is equipped with a secondary chamber with the afterburner, which is designed to reduce the particulate matter and other pollutants entrained in the exhaust stream into products of complete combustion. The writer calculated the retention time of this crematory to be 3.5 seconds with a secondary chamber temperature of 1,800<sup>0</sup>F. At 1,400<sup>0</sup>F, the retention time would extend to nearly 4 seconds. The rule of thumb for nearly complete combustion is 1.0-second retention time in the secondary chamber. At Thus, this particular crematory should be capable of meeting the applicable limitations of this rule.

### **45CSR13 - Permits for Construction, Modification, Relocation and Operation of Stationary sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation**

The potential-to-emit from the proposed crematories are below 6 pounds per hour and 10 tons per year for all of the criteria pollutants, which is less than the permit trigger level as defined in 45CSR§13-2.24.b. However, Rule 6 requires all incinerators be required to obtain a construction or modification permit regardless of size. Gevans, Inc. has proposed to install a crematory, which is subject to Rule 6. Therefore, the facility is required to obtain a permit as required in 45CSR§6-6.1. and 45CSR§13-2.24.a. The facility has met the applicable requirements of this rule by publishing a Class I Legal Advertisement in *The Logan Banner* on September 7, 2012, paid the \$1,000.00 application fee, and submitted a complete permit application.

This modification will not make the Chapmanville facility be classified as a major source of hazardous air pollutants. In addition, the emission unit is not subject to New Source Performance Standard. The only standard that might be applicable is Subpart EEEE, Part 60. 40

CFR§60.2887(l) of Subpart EEEE specificity exclude incinerators that consume at least 90% pathological waste. Pathological waste includes human remain. The applicant has not indicate that the crematory will be used for destroy any other types. Therefore, this exclusion remains in effect for this emission unit. Thus, the facility is not subject to Title V and will not be required to obtain an operating permit under 45CSR30. Therefore, Chapmanville facility will remain classified as a "9B - Crematory Incinerator" source as defined in 45CSR22.

## TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

Only trace amounts of non-criteria regulated pollutants will be emitted from this facility. These are acetaldehyde, arsenic, antimony, beryllium, cadmium, chromium, copper, formaldehyde, hydrogen chloride, lead, and mercury. Only the metals, (i.e. cadmium, chromium, mercury, etc.) and hydrogen chloride would be not controlled by the afterburner (secondary chamber).

Under EPA's IRIS program, hydrogen chloride (hydrochloric acid) has undergone a complete evaluation and determination for evidence of human carcinogenic potential. Reference concentration for chronic inhalation exposure to HCl was determined to be 0.02 mg/cu.m. In general, the reference concentration is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily inhalation exposure of the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

### **Mercury**

Mercury emissions are a potential concern from crematories. Mercury vapor is released from the human remains during the crematory process. The majority of this mercury is from silver amalgam fillings used in the dental practice. Currently, U.S. EPA is using the Toxic Substances Control Act to reduce or eliminate the use of elemental mercury in certain products such as silver amalgam fillings. Thus, actual mercury emissions from crematories will be reduced by removing this mercury-containing product from the dental industry. Assuming a cremation every two hours and the average release of mercury being 1 grams/cremation, this unit could emit 4.1 pounds per year

The inhalation Reference Concentration (RfC) is analogous to the oral RfD and is likewise based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis. The inhalation RfC considers toxic effects for both the respiratory system (portal-of-entry) and for effects peripheral to the respiratory system (extrarespiratory effects). It is expressed in units of mg/cu.m. In general, the RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily inhalation exposure of the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. The Rfc for mercury is 0.0003 mg/cu. m. The critical effect of mercury exposure can be hand tremor, increases in memory disturbance; slight subjective and objective evidence of autonomic dysfunction.

All HAPs have other non-carcinogenic chronic and acute effects. These adverse health effects may be associated with a wide range of ambient concentrations and exposure times and are influenced by source-specific characteristics such as emission rates and local meteorological conditions. Health impacts are also dependent on multiple factors that affect variability in humans such as genetics, age, health status (e.g., the presence of pre-existing disease) and lifestyle. As stated previously, *there are no federal or state ambient air quality standards for these specific chemicals*. The file contains summaries of the IRIS database information on hydrogen chloride and mercury. For a complete discussion of the known health effects, refer to the IRIS database located at [www.epa.gov/iris](http://www.epa.gov/iris).

## AIR QUALITY IMPACTS ANALYSIS

This writer deemed that an air dispersion modeling study or analysis was not necessary, because the proposed modification will not make the facility a major source as defined in 45CSR14.

## MONITORING OF OPERATIONS

For the purposes of ensuring compliance with the proposed emissions limits and applicable rules, the facility should be required to monitor and keep records of the following:

Weight of each charge/batch per crematory.

Temperature of the secondary chamber on a continuous basis for each crematory.

Hours of operation of the crematory to include the date and time of each start-up and shut-down for each cremation.

Proper operation of a crematory or any other incinerator begins with not over loading the unit. Overloading an incinerator beyond the manufacturer's rated capacity usually results in incomplete incineration and/or excess emissions.

Monitoring the secondary chamber temperature is an indicator that the temperature in the secondary chamber is sufficient to ensure complete combustion of products of incomplete combustion such as particulate matter, carbon monoxide, and volatile organic compounds. The applicant proposed operating the secondary chamber at a minimum temperature of 1,400<sup>0</sup>F, which is suggested by the manufacturer. In support of this suggested temperature, the manufacturer provided addition test data of Power Pak II with the temperature of secondary chamber set at 1,400<sup>0</sup>F. This report indicted the PM rate was 0.04 lb per hour, which is significant less than the allowable under Rule 7. In addition, the writer noticed that the NO<sub>x</sub> emissions at this lower temperature were significantly less than was predict using emission data from units with the secondary chamber being operate at minimum of 1,600<sup>0</sup>F.

Gevans has proposed an annual operational limit of 3,744 hours per year for the crematory. This annual operation schedule coincides with the annual emission limits respectively. Stipulating such, a limit will need to be monitored by recording the start and end times for each cremation charge. These limitation and recordkeeping requirements have been established as permit conditions in the draft for consideration.

This unit is equipped with an opacity controller at the base of the exhaust stack. The purpose of this controller (sensor) is to provide an input to the controller regulating the unit when visible emissions are detected. Once a signal is sent to the controller, the primary burner is turned off and the hearth air damper is closed. Then, the damper for the combustion air is opened. These actions reduce the exhaust flow from the primary chamber and increasing the amount of excess air for complete combustion of the unburned particulate in the secondary chamber. These actions slow down the combustion of the remains in the primary chamber and optimize the conditions in the secondary chamber to ensure complete combustion of the exhaust gasses. The interruption in normal operation occurs for three minutes. After that, the unit should resume back normal operations. The agency should consider as alternative to requiring quarterly visible emission checks. Recording the date, length of the event, and operator action if required is deemed reasonable requirements to be incorporated into the permit. This form of monitoring is more stringent than conducting quarterly visible emission checks.

#### CHANGES TO PERMIT R13-2708

Permit R13-2708 covers a Power Pak II crematory. This permitted crematory is equipped with the same opacity controller. The writer recommends adopting the requirements for these opacity controllers as stated in the Florida State Code. The Florida Rule requires these controllers to be set to restrict combustion once the sensor reads the opacity has reached 15%. Normal satisfactory operation of crematory is zero visible emission. Setting the controller at 15% opacity, which is only 75% of the allowable under Rule 6, would ensure the unit should be operator in compliance at all times.

Second, the existing unit is limit to an annual limit of total remains cremated on a mass bases. There is really no reason to hold such a minor source to such limits for the purposes of limiting the annual emissions from the unit. Without the limit, the most the unit could emit would be 8 tons of oxides of nitrogen. The rest of pollutants would be at or below one ton per year except for sulfur dioxide, which would be 1.23 tons per year. Both units without any restrictions on annual use, the facility total potential to emit of oxides of nitrogen would be 17.3 tons per year.

After speaking to the crematory operator at the facility and reviewing Permit R13-2708, the writer believes the requirements and recordkeeping for this source needs to be simplified to the level proposed for this new unit, which would make the permit consist for both unit verses having different monitoring and recordkeeping for the units, which are nearly identical. Thus, the writer recommends establishing nearly the same requirements for both unit, which includes monitoring and recordkeeping.

## RECOMMENDATION TO DIRECTOR

The information provided in the permit application and the conditions set forth in the permit indicates this Power Pak II Plus crematory should meet all applicable state rules and federal regulations when operated in accordance with the manufacturer's recommendations. Therefore, this writer recommends that a Rule 13 Modification Permit should be granted to Gevans, Inc. for their proposed additional crematory at the Chapmanville facility.

Edward S. Andrews, P.E.  
Engineer

Date: October 15, 2012