west virginia department of environmental protection

Division of Air Quality
601 57th 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.:	R13-2371B
Plant ID No.:	039-00481
Applicant:	Cooke & Pauley Funeral Home, Inc.
Facility Name:	Nitro
Location:	Nitro
NAICS Code:	812210
Application Type:	Modification
Received Date:	October 04, 2012
Engineer Assigned:	Edward S. Andrews, P.E.
Fee Amount:	$1000.00
Date Received:	October 4, 2012
Completeness Date:	November 2, 2012
Due Date:	January 31, 2013
Newspaper:	*The Daily Mail*
Applicant Ad Date:	October 4, 2012
UTMs:	Easting: 426.5 km Northing: 4,252.8 km Zone: 17
Description:	This modification permit application is for installation of a third crematory at the facility.

DESCRIPTION OF PROCESS

Facultatieve Technologies FT III Cremator (Human Crematory)

The Facultatieve Technologies FT III Cremator is designed to burn human remains with associated containers. Its automatic controls will function to cremate efficiently with the minimum of operator intervention.

The Facultative Technologies FT III Cremator is a multiple chamber design (primary and secondary) and in the case for this proposed unit will be fired with natural gas as auxiliary fuel.

The cremator has a nominal burn rate of 150 – 200 pounds per hour of human cadavers. The cremator is designed with an automated loading system allowing single batch loading.

The standard process of cremating human cadavers in a Facultatieve Technologies cremator is to preheat the machine with secondary chamber (afterburner) reaching a controlled temperature of not less than 1600^0F and the primary chamber reaching a minimum temperature of 1035^0F. Once these parameters have been reached, the operator is instructed that the cremator is ready to process a cremation. At the time, the operator instructs the machine via the computerized touch screen to charge the cadaver. The primary chamber door automatically opens and the cadaver is delivered via the automated loader into the cremation chamber. The door then closes and the cremation process begins with automatic control process of all function via the onboard computer/Programmable Logical Controller (PLC). Typical process times average 72 minutes and the cremator has a sight glass where the operator can observe that the cremation process has fully completed.

Upon completion of the cremation process, the operator opens the primary chamber door and moves the cremated remains into a cooling area for final disposition. The design of the FT III cremator is to immediately charge the next cadaver into the primary chamber immediately after the cremated remains have been moved to the cooling area. No cool down period is required and thus less requirements for excess fuel usage (cooling and reheating the system) and reduction of emissions from the cremator. In addition, the process design of the FT cremator is to the use human cadaver as the primary fuel source and only uses natural gas to supplement the cremation process. Once the cremator refractory is super-heated, the use of natural gas to perform the cremation process is virtually non-existent.

SITE INSPECTION

On October 16, 2012, the writer conducted a site visit of the facility. Mr. Roger Cooke, the Funeral Director of Cooke & Pauley Funeral Home, Inc., as well as several other staff members were present during this visit. Cooke & Pauley Funeral Home, Inc. plans to purchase the existing two-story building that is right next to the existing cremation building. This proposed building as well as the existing cremator buildings is located in Nitro on 20th Street. This is a commercial area of Nitro.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Facultatieve Technologies has collected emission data on their machines over the years. Facultative Technologies used the emission data to develop an emission inventory for their customers or potential customers. This emissions inventory was included in the application. The data in this inventory were based on cremators operating in the United Kingdom (UK). The provided emission inventory was standardized to 0^0C at 11% oxygen. To make better comparison to other cremators permitted in the United States, the writer corrected these emission

rates to standard temperature and 7% oxygen content. These emission rates were projected on an operating schedule of 1,920 hours per year. The writer annualized them based on no restriction in the annual operating schedule. These estimates are presented in the following table.

Table #1 - Maximum Potential & Projected Emission Rates from a FT III Cremator			
Pollutant	Hourly Emissions lb/hr	Projected Annual Tons per year	Maximum Potential Tons per year
Polycyclic Aromatic Hydrocarbon (PAH)	0.001	0.001	0.005
Mercury	0.020	0.019	0.088
Metals	0.006	0.005	0.025
Hydrogen Chloride (HCL)	0.801	0.769	3.510
HF	0.008	0.008	0.035
Particulate Matter (PM_{10})	0.801	0.769	3.510
Carbon Monoxide (CO)	0.401	0.385	1.755
Oxides of Nitrogen (NO_x)	2.036	1.954	8.916
Sulfur Dioxide (SO_2)	0.801	0.769	3.510
Volatile Organic Compounds (VOCs)	0.080	0.077	0.351

The inventory provided was based on three sets of emissions data, then either the highest concentration was used or some sort of factor to account for variability between cremations was applied multiplied to the highest value. This factor was at least 2 or greater for some of the pollutants, which included particulate matter, sulfur dioxide, and nitrogen oxides. Given the variability of the size and shape of the human remains and types of containers, including some sort of margin or factor of compliance into the emission estimates is justifiable.

Facultative Technologies included in the application the results of two performance tests at two crematoriums in the UK. The presented results are on a dry basis but there is no indication if the flow rates where corrected to a standard temperature and the concentration corrected to specific or regulatory oxygen content. These tests included three test runs with the averages presented in the following table.

Table #2 - Included Test Result of Similar Cremators			
Pollutant	Charnock Richard Cremator lb/hr	East Lancashire Cremator lb/hr	Average of the Two Cremators lb/hr
HCL	0.057	0.119	0.088
Particulate Matter (PM_{10})	0.125	0.172	0.149
CO	0.018	0.0135	0.016
VOCs	0.001	0.001	0.001

Clearly, there is a difference between the provided inventory and the results for all of the pollutants. These differences range from 79% up to 96% for these pollutants.

With the submitted application, Facultative Technologies included a complete compliance test report of a FT III located in Oakland, California. The pollutants measured during these tests were filterable particulate matter and metals, which included mercury. This particular demonstration was conducted using U.S. EPA Method 29.

The results of this testing were not supersized. The emission rates of these metals were very low with the highest rate being measured was zinc at 3.6 grams per hour. The testing was not able to measure or detect beryllium, cobalt, and thallium. Mercury emissions were 0.7 grams per hour. These measurements were taken while the cremator incinerated four sets of human remains with a mass loading ranging from 120 pounds up to 217 pounds. Average measured particulate matter rate was 0.444 pounds per hour.

Table #3 Facility Potential to Emit (PTE)

Pollutant	Permitted Annual Limits tons per year (TPY)	FT III – Maximum PTE (TPY)	New Total (TPY)
Particulate Matter (PM)	0.84	1.94	2.78
Nitrogen Oxides (NO_x)	1.54	8.92	10.46
Carbon Monoxide (CO)	1.72	1.76	3.48
Sulfur Dioxide (SO_2)	0.56	3.5	4.06
Volatile Organic Compounds (VOC)	0.5	0.35	0.85

The increase in emissions for the facility is mainly contributed to the annual operating limitation (existing units are limited to a combined 6,240 hours per year), mass of the remains (incineration rate), and operating temperatures. The existing units have a combined incineration rating of 175 pounds per hour and the FT III has a maximum incineration rate of 275 pounds per hour. The existing units are only required to maintain the secondary temperature of $1,400^0$F. Facultative Technologies has designed the FT III to be operated with the secondary temperature at $1,600^0$F. Operating the secondary chamber at or above $1,600^0$F will ensure complete combustion with greater margin of compliance with PM, CO and VOC limits. However, the

formation of thermal NO_x is greatly increased by operating the secondary chamber at this temperature. Thus, this is why the NO_x potential is so much higher for the FT III than compared to the existing units.

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 to 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 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 0.75 pounds per hour (based on maximum design-incineration rate of 275 lb/hr). This allowable rate is higher than the estimated hourly potential of 0.44 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 cremator to be 3.3 seconds with a the temperatures of the primary and secondary chambers at the maximum operating range, which is 1920^0F and 2100^0F respectively. At minimum operating temperatures, the retention time would extend to nearly 4.2 seconds. The rule of thumb for nearly complete combustion is 1.0-second retention time in the secondary chamber. Thus, this particular crematory should be capable of meeting the applicable limitations of this rule.

45CSR13 - Permits for Modification, 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. Cooke & Pauley Funeral Home, 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 Daily*

Mail on October 4, 2012, paid the $1,000.00 application fee, and submitted a complete permit application.

As a result of this Modification, the Nitro facility will not be classified as a major source of hazardous air pollutants or major source under Title V. In addition, the emission unit is not subject to a New Source Performance Standard. Thus, the facility is not subject to Title V and will not be required to obtain an operating permit under 45CSR30. Therefore, the Nitro 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 not be 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 milligram/cubic meter (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 tremors, 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*.

AIR QUALITY IMPACTS ANALYSIS

The writer deemed that an air dispersion modeling study or analysis was not necessary, because the proposed Modification does not meet the definition of a major source as defined in 45CSR14.

MONITORING OF OPERATIONS

The manufacturer has equipped this unit with a personal computer based control system which includes a data logging function. The system is capable of monitoring the oxygen content of the flue gas, and the temperatures in the both the primary and secondary chambers. Other monitoring that is needed for this type of unit is the weight of each cremation.

Monitoring the secondary chamber temperature is an indicator that the temperature in the secondary chamber is sufficient to ensure complete combustion of the 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 $1{,}600^0$F, which is suggested by the manufacturer. In support of this suggested temperature, the manufacturer provided addition test data of an identical unit with the average temperature of secondary chamber being $1{,}750^0$F. This report indicted the PM rate was 0.44 lb per hour, which is significant less than the allowable under Rule 7.

An annual operational limit of 1,920 hours per year for the crematory was proposed in the application. This is limit is not required. Without the limit, the maximum predicted emissions rate of NO_x on an annual basis is 8.9 tons per year (See Table #3). This annual rate without any operational restrictions is below the definition of a "stationary source" under Rule 13.

To ensure compliance with the visible emission standard of Rule 6, the writer proposed requiring visible emission checks to be conducted once every quarter.

CHANGES TO R13-2371A

The Specific Conditions of Permit R13-2371A are being re-organized to three specific conditions for each one of the cremators. Conditions 4.1.3. and 4.1.4. were omitted. Condition 4.1.3. is already covered by Condition 3.1.4., which pertains releases that causes objectionable odors. Condition 4.1.4. cites 45CSR§6-4.7, which pertains to the evaluation of incineration of site specific wastes must be conducted. The permit will limit the type(s) of waste that are allowed to be incinerated. Any changes to what has been would require the permit to at the least be administratively updated. Thus, it is not necessary to incorporate this rule citation into the permit.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application and the conditions set forth in the permit indicates this FT III cremator should meet all applicable state rules and federal regulations when operated. Therefore, this writer recommends that a Rule 13 Modification Permit should be granted to Cooke & Pauley Funeral Home, Inc. for their proposed crematory at the Nitro facility.

Edward S. Andrews, P.E.
Engineer

Date: November 16, 2012