**TECHNICAL SUPPORT DOCUMENT**

**Air Discharge Permit 25-3700**
**Air Discharge Permit Application CL-3292**

**Issued: April 9, 2025**

**Evergreen Memorial Gardens**

**SWCAA ID – 2295**

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Air Quality Engineer
Southwest Clean Air Agency

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## ABBREVIATIONS

*List of Acronyms*

ADP ..... Air Discharge Permit
BACT..... Best Available Control Technology
BART ..... Best Available Retrofit Technology
CAM ..... Compliance Assurance Monitoring
CAS#..... Chemical Abstracts Service registry number
CFR..... Code of Federal Regulations
EPA..... U.S. Environmental Protection Agency
EU ..... Emission Unit
LAER..... Lowest achievable emission rate
MACT..... Maximum Achievable Control Technologies
NESHAP..... National Emission Standards for Hazardous Air Pollutants
NOV..... Notice of Violation
NSPS..... New Source Performance Standard
PSD ..... Prevention of Significant Deterioration
RACT..... Reasonably Available Control Technology
RCW ..... Revised Code of Washington
SQER ..... Small Quantity Emission Rate listed in WAC 173-460
Standard ..... Standard conditions at a temperature of 68°F (20°C) and a pressure of 29.92 in Hg (760 mm Hg)
SWCAA ..... Southwest Clean Air Agency
T-BACT ..... Best Available Control Technology for toxic air pollutants
WAC ..... Washington Administrative Code

*List of Units and Measures*

acfm ..... Actual cubic feet per minute
lb/ ..... Pounds per
lb/hr..... Pounds per hour
lb/yr..... Pounds per year
MMBtu/hr.....Millions of British thermal units per hour
tpy.....Tons per year

*List of Chemical Symbols, Formulas, and Pollutants*

$CH_4$..... Methane
CO..... Carbon monoxide
$CO_2$..... Carbon dioxide
$CO_2e$..... Carbon dioxide equivalent
HAP ..... Hazardous air pollutant listed pursuant to Section 112 of the Federal Clean Air Act
$N_2O$ ..... Nitrous oxide
$NO_2$ ..... Nitrogen dioxide
$NO_X$..... Nitrogen oxides
$O_2$ ..... Oxygen
$O_3$ ..... Ozone
PM .....Particulate Matter with an aerodynamic diameter 100 µm or less
$PM_{10}$.....PM with an aerodynamic diameter 10 µm or less
$PM_{2.5}$ .....PM with an aerodynamic diameter 2.5 µm or less
$SO_2$.....Sulfur dioxide
$SO_X$ .....Sulfur oxides
TAP.....Toxic air pollutant pursuant to Chapter 173-460 WAC
VOC.....Volatile organic compound

Terms not otherwise defined have the meaning assigned to them in the referenced regulations or the dictionary definition, as appropriate.

## 1. FACILITY IDENTIFICATION

| | |
|---|---|
| Applicant Name: | Evergreen Memorial Gardens, Inc. |
| Applicant Address: | 1101 NE 112th Ave., Vancouver, WA 98684 |
| Facility Name: | Evergreen Memorial Gardens |
| Facility Address: | 1101 NE 112th Ave., Vancouver, WA 98684 |
| SWCAA Identification: | 2295 |
| Contact Person: | Lindsay Fisher, President |
| Primary Process: | Funeral Services and Crematories / Cemeteries and Crematories |
| SIC/NAICS Code: | 7261: Funeral services and crematories<br>812220: Cemeteries and crematories |
| Facility Latitude and Longitude: | 45°37′45.67″N<br>122°33′21.40″W |
| Facility Classification: | Natural Minor |

## 2. FACILITY DESCRIPTION

Evergreen Memorial Gardens is an established cemetery and funeral chapel in Vancouver, Washington that operates a single crematory.

## 3. CURRENT PERMITTING ACTION

This permitting action is in response to Air Discharge Permit (ADP) application number CL-3292 received February 11, 2025. ADP application CL-3292 was submitted for installation of a replacement crematory unit. The existing one was damaged in a fire. The new replacement unit will have an increased hourly capacity.

ADP 25-3700 will supersede ADP 07-2722 in its entirety.

## 4. PROCESS DESCRIPTION

The human crematory (incinerator) will operate on a single charge (body) basis. The unit has two combustion chambers, each equipped with natural gas-fired burners. Remains and the casket / container are loaded into the primary combustion chamber via a large refractory-lined door. In both combustion chambers, the burner and air supply are controlled to control burn rate and temperature.

## 5. EQUIPMENT/ACTIVITY IDENTIFICATION

5.a. Crematory (*new*). The crematory consists of a primary chamber in which the body is placed, and a secondary chamber to ensure complete combustion of gaseous and particulate byproducts from the primary chamber. The crematory is lined with a non-chromite refractory. Electrical interlocks prevent the charging door from being opened for the introduction of remains and casket / container until the secondary chamber exceeds the minimum temperature setpoint.

| | |
|---|---|
| Crematory Make / Model: | Facultatieve Technologies / FT III |
| Design Burn Rate: | 200 pounds per hour |
| Primary Burner Capacity: | 1.1 MMBtu/hr |
| Secondary Burner Capacity: | 0.95 MMBtu/hr |
| Burner Fuel: | Natural Gas |
| Maximum Case Size: | N/A – manufacturer indicates that system capacity only limited by primary chamber volume |
| Secondary Chamber Volume: | 3.2 $m^3$ |
| Secondary Chamber Residence Time: | 2.0 seconds (1,600 °F, 7% $O_2$) |
| Stack Description: | 18″ diameter vertical stack discharging 24.7′ above grade, 0.7′ above roof peak, 750 °F, 3,379 acfm |

5.b. Crematory (*removed*). *The following general description of the ThermTec SQC-300 primary and secondary crematory chambers were excerpted from the manufacturer's description:*

*The Primary Chamber (Gasification Chamber) is a horizontally arranged steel plate box having a composite lining of high temperature block fiber and a dense, abrasion resistant castable refractory with replaceable hearth tiles. A gas or oil (in this case the unit is natural gas fired) burner is fitted to the Primary Chamber so as to provide a means of combusting and calcifying the pathological material. The Primary Chamber is fed air from a blower which provides combustion air to maintain the combustion process. This air enters the Primary Chamber via a series of air tuyeres, which penetrates the refractory lining from an air plenum in the lower portion of the Primary Chamber. A case is loaded into the Primary Chamber via a large refractory-lined door, which provides access to the full inside diameter of the chamber.*

*The Control Chamber (Thermal Reactor) is a two piece refractory lined assembly consisting of a mixing chamber, having externally arranged air adjustments, which deliver secondary combustion air via a series of radially arranged air ports which protrude through the refractory lining to promote optimum mixing with the gas from the Primary Chamber. This chamber operates in an excess air condition (120%) to achieve a high level of combustion efficiency. The upper part of the two piece Control Chamber is fitted with two Control Burners. Two burners assure adequate combustion even if one burner were to fail.*

*The following equipment details were provided:*

*Design Burn Rate:* *100 pounds per hour*
*Primary Burner Capacity:* *1.5 MMBtu/hr natural gas*
*Secondary Burner Capacity:* *(2) at 1.08 MMBtu/hr each, total of 2.16 MMBtu/hr*
*Secondary Chamber Retention Time:* *1.5 seconds*
*Primary Burner Make/Model:* *Midco International / Unipower GB-Series G57B*
*Secondary Burners (2) Make/Model:* *Midco Internation / Incinomite J121-DS*
*Stack Description:* *28″ ID, ~29′ above grade, ~4′ above roof peak*

5.c. Equipment/Activity Summary.

| ID No. | Equipment/Activity | Control Equipment/Measure |
|---|---|---|
| 1 | Crematory<br>(Facultatieve Technologies / FT III) | Controlled combustion,<br>secondary combustion chamber |

## 6. EMISSIONS DETERMINATION

Unless otherwise specified by SWCAA, actual emissions must be determined using the specified input parameter listed for each emission unit and the following hierarchy of methodologies:
(a) Continuous emissions monitoring system (CEMS) data;
(b) Source emissions test data (EPA reference method). When source emissions test data conflicts with CEMS data for the time period of a source test, source test data must be used;
(c) Source emissions test data (other test method); and
(d) Emission factors or methodology provided in this TSD.

Nothing precludes the use, including the exclusive use of any credible evidence or information relevant to identifying or quantifying emissions if methods identified above, in the ADP, or elsewhere in this TSD have not provided adequate quantification of actual emissions.

6.a. Crematory. Maximum potential emissions were calculated assuming a processing rate of one case every 1.5 hours for a total of 5,840 cases per year. Conservatively the average case size was assumed to be 200 pounds.

**Crematory Emissions - Criteria Air Pollutants**

| | | |
|---|---|---|
| # of Bodies per Year = | 5,840 | (continuous operation, 1 case/1.5 hrs) |
| Average Body Weight = | 200 | lbs (conservative - average case ~182.1 lbs) |
| Weight Burned per Year = | 584 | tons |
| Maximum Burn Rate = | 200 | lb/hr |
| Exhaust Flow Rate = | 777 | dscfm @ 7% $O_2$ |
| Estimated Burn Rate = | 133 | lb/hr (average) |
| Primary Burner Heat Input Capacity = | 0.95 | MMBtu/hr (Natural Gas) |
| Secondary Burner Heat Input Capacity = | 1.10 | MMBtu/hr (Natural Gas) |
| Carbon Content of Human Body = | 18 | % by mass |
| Body Heat Content (MMBtu/ton body) = | 20.5 | MMBtu/ton |

| Pollutant | Emission Factor lb/ton | Max Rate Emissions lb/hr | tpy | EF Source |
|---|---|---|---|---|
| $NO_X$ | 11.69 | 1.17 | 3.41 | BACT - 140 ppmvd @ 7% $O_2$ |
| CO | 2.03 | 0.20 | 0.59 | BACT - 40 ppm @ 7% $O_2$ |
| VOC | 0.299 | 0.03 | 0.09 | AP-42 Table 2.3-2 (7/93) |
| $SO_X$ as SO2 | 8.00 | 0.80 | 2.34 | 0.2% Sulfur in human body |
| $PM/PM_{10}/PM_{2.5}$ | 3.331 | 0.33 | 0.97 | 0.05 gr/dscf @ 7% $O_2$ |
| $CO_2e$ (from body) | 1,320 | | 385 | Assuming body is 18% C by wt. |
| $CO_2e$ (from natural gas) | 2,401 | | 701 | 40 CFR 98 |

**Crematory Emissions - Toxic Air Pollutants**

Weight Burned per Year = 584 tons

| TAPs/HAPs | CAS # | Emission Factors lb/ton | lb/yr | Original Basis lb/yr | Project Impact lb/yr | TAP lb/yr | HAP lb/yr |
|---|---|---|---|---|---|---|---|
| Acenaphthene | 833-22-9 | 1.30E-06 | 7.6E-04 | 3.6E-04 | 4.0E-04 | | 7.6E-04 |
| Acenaphthylene | 208-96-8 | 8.97E-07 | 5.2E-04 | 2.5E-04 | 2.7E-04 | | 5.2E-04 |
| Acetaldehyde | 75-07-0 | 9.27E-04 | 5.4E-01 | 2.6E-01 | 2.8E-01 | 5.4E-01 | 5.4E-01 |
| Anthracene | 120-12-7 | 2.39E-06 | 1.4E-03 | 6.6E-04 | 7.3E-04 | | 1.4E-03 |
| Arsenic | 7440-38-2 | 3.00E-06 | 1.8E-01 | 1.3E-01 | 4.5E-02 | 1.8E-01 | 1.8E-01 |
| Benzene | 71-43-2 | 7.20E-04 | 4.2E-01 | 2.0E-01 | 2.2E-01 | 4.2E-01 | 4.2E-01 |
| Benzo(a)anthracene | 56-55-3 | 1.17E-07 | 6.8E-05 | 3.2E-05 | 3.6E-05 | 6.8E-05 | 6.8E-05 |
| Benzo(a)pyrene | 50-32-8 | 4.72E-07 | 2.8E-04 | 1.3E-04 | 1.4E-04 | 2.8E-04 | 2.8E-04 |
| Benzo(b)fluoranthene | 205-99-2 | 1.74E-07 | 1.0E-04 | 4.8E-05 | 5.3E-05 | 1.0E-04 | 1.0E-04 |
| Benzo(g,h,i)perylene | 191-24-2 | 5.87E-07 | 3.4E-04 | 1.6E-04 | 1.8E-04 | | 3.4E-04 |
| Benzo(k)fluoranthene | 207-08-9 | 1.49E-07 | 8.7E-05 | 4.1E-05 | 4.5E-05 | 8.7E-05 | 8.7E-05 |
| Beryllium | 7440-41-7 | 1.76E-05 | 1.0E-02 | 4.9E-03 | 5.4E-03 | 1.0E-02 | 1.0E-02 |
| Cadmium | 7440-43-9 | 1.60E-04 | 9.3E-02 | 4.5E-02 | 4.9E-02 | 9.3E-02 | 9.3E-02 |
| Chromium | 7440473 | 2.00E-05 | 1.2E-02 | 5.6E-03 | 6.1E-03 | 1.2E-02 | 1.2E-02 |
| Chromium (VI) | 18540-29-9 | 9.20E-06 | 5.4E-03 | 2.6E-03 | 2.8E-03 | 5.4E-03 | 5.4E-03 |
| Chrysene | 218-01-09 | 2.88E-07 | 1.7E-04 | 8.0E-05 | 8.8E-05 | 1.7E-04 | 1.7E-04 |
| Copper | 7440-50-8 | 4.00E-04 | 2.3E-01 | 1.1E-01 | 1.2E-01 | 2.3E-01 | |
| Cobalt | 7440-48-4 | 8.87E-05 | 5.2E-02 | 2.5E-02 | 2.7E-02 | 5.2E-02 | 5.2E-02 |
| Dibenz(a,h)anthracene | 53-70-3 | 1.35E-07 | 7.9E-05 | 3.8E-05 | 4.1E-05 | 7.9E-05 | 7.9E-05 |
| Fluoranthene | 206-44-0 | 1.34E-06 | 7.8E-04 | 3.7E-04 | 4.1E-04 | | 7.8E-04 |
| Fluorene | 86-73-7 | 3.76E-06 | 2.2E-03 | 1.0E-03 | 1.2E-03 | | 2.2E-03 |
| Formaldehyde | 50-00-0 | 2.47E-04 | 1.4E-01 | 6.9E-02 | 7.6E-02 | 1.4E-01 | 1.4E-01 |
| Hydrogen Chloride | 7647-01-0 | 7.20E-03 | 4.2E+02 | 2.0E+00 | 4.2E+02 | 4.2E+02 | 4.2E+02 |
| Hydrogen Fluoride | 7664-39-3 | 8.65E-03 | 5.1E+00 | 2.4E+00 | 2.6E+00 | 5.1E+00 | 5.1E+00 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.44E-07 | 8.4E-05 | 4.0E-05 | 4.4E-05 | 8.4E-05 | 8.4E-05 |
| Lead | 7439-92-1 | 9.00E-03 | 5.3E+00 | 2.5E+00 | 2.8E+00 | 5.3E+00 | 5.3E+00 |
| Mercury | 7439-97-6 | 2.18E-04 | 1.3E+01 | 1.4E+01 | -1.7E+00 | 1.3E+01 | 1.3E+01 |
| Naphthalene | 91-20-3 | 7.52E-04 | 4.4E-01 | 2.1E-01 | 2.3E-01 | 4.4E-01 | 4.4E-01 |
| Nickel | 7440-02-0 | 4.15E-04 | 2.4E-01 | 1.2E-01 | 1.3E-01 | 2.4E-01 | 2.4E-01 |
| Phenanthrene | 85-01-8 | 1.53E-05 | 8.9E-03 | 4.3E-03 | 4.7E-03 | | 8.9E-03 |
| Pyrene | 129-00-0 | 1.47E-06 | 8.6E-04 | 4.1E-04 | 4.5E-04 | | 8.6E-04 |
| Selenium | 7782-49-2 | 4.97E-04 | 2.9E-01 | 1.4E-01 | 1.5E-01 | 2.9E-01 | 2.9E-01 |
| Toluene | 108-88-3 | 9.90E-03 | 5.8E+00 | 2.8E+00 | 3.0E+00 | 5.8E+00 | 5.8E+00 |
| Xylenes | 1330-20-7 | 2.80E-03 | 1.6E+00 | 7.8E-01 | 8.6E-01 | 1.6E+00 | 1.6E+00 |
| Zinc | 7440-66-6 | 5.20E-04 | 3.0E-01 | 1.4E-01 | 1.6E-01 | 3.0E-01 | |
| | | | | | Total = | 454 | 453 |

| **Crematory Emissions - Toxic Air Pollutants** | | |
|---|---|---|
| | | |
| **TAPs/HAPs** | CAS # | Emission Factor Source |
| Acenaphthene | 833-22-9 | 2020 NEI Technical Support Doc Table 29-3 |
| Acenaphthylene | 208-96-8 | 2020 NEI Technical Support Doc Table 29-3 |
| Acetaldehyde | 75-07-0 | 2020 NEI Technical Support Doc Table 29-3 |
| Anthracene | 120-12-7 | 2020 NEI Technical Support Doc Table 29-3 |
| Arsenic | 7440-38-2 | EPA Webfire |
| Benzene | 71-43-2 | SDAPCD |
| Benzo(a)anthracene | 56-55-3 | 2020 NEI Technical Support Doc Table 29-3 |
| Benzo(a)pyrene | 50-32-8 | 2020 NEI Technical Support Doc Table 29-3 |
| Benzo(b)fluoranthene | 205-99-2 | 2020 NEI Technical Support Doc Table 29-3 |
| Benzo(g,h,i)perylene | 191-24-2 | 2020 NEI Technical Support Doc Table 29-3 |
| Benzo(k)fluoranthene | 207-08-9 | 2020 NEI Technical Support Doc Table 29-3 |
| Beryllium | 7440-41-7 | 2020 NEI Technical Support Doc Table 29-3 |
| Cadmium | 7440-43-9 | SDAPCD |
| Chromium | 7440473 | Reevaluation of the Trace Element Content in Reference Man |
| Chromium (VI) | 18540-29-9 | Chromium Ratio Calculation |
| Chrysene | 218-01-09 | 2020 NEI Technical Support Doc Table 29-3 |
| Copper | 7440-50-8 | SDAPCD |
| Cobalt | 7440-48-4 | 2020 NEI Technical Support Doc Table 29-3 |
| Dibenz(a,h)anthracene | 53-70-3 | 2020 NEI Technical Support Doc Table 29-3 |
| Fluoranthene | 206-44-0 | 2020 NEI Technical Support Doc Table 29-3 |
| Fluorene | 86-73-7 | 2020 NEI Technical Support Doc Table 29-3 |
| Formaldehyde | 50-00-0 | 2020 NEI Technical Support Doc Table 29-3 |
| Hydrogen Chloride | 7647-01-0 | EPA Webfire |
| Hydrogen Fluoride | 7664-39-3 | 2020 NEI Technical Support Doc Table 29-3 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 2020 NEI Technical Support Doc Table 29-3 |
| Lead | 7439-92-1 | 2020 NEI Technical Support Doc Table 29-3 |
| Mercury | 7439-97-6 | SDAPCD |
| Naphthalene | 91-20-3 | 2020 NEI Technical Support Doc Table 29-3 |
| Nickel | 7440-02-0 | 2020 NEI Technical Support Doc Table 29-3 |
| Phenanthrene | 85-01-8 | 2020 NEI Technical Support Doc Table 29-3 |
| Pyrene | 129-00-0 | 2020 NEI Technical Support Doc Table 29-3 |
| Selenium | 7782-49-2 | 2020 NEI Technical Support Doc Table 29-3 |
| Toluene | 108-88-3 | SDAPCD |
| Xylenes | 1330-20-7 | SDAPCD |
| Zinc | 7440-66-6 | SDAPCD |

[1] "2020 NEI Technical Support Doc" refers to the "2020 National Emissions Inventory Technical Support Document: Miscellaneous Non-Industrial NEC: Cremation – Human and Animal", EPA-454/R-23-001cc (March 2023).

[2] SDAPCD refers to "C02 - CREMATORY, NATURAL GAS FIRED, ANIMAL REMAINS, CONTROLLED AIR" (last updated 4/20/2022) emission factors from the San Diego Air Pollution Control District.

[3] EPA Webfire values are from SCC 31502101 "Industrial Processes; Photo Equip/Health Care/Labs/Air Condit/SwimPools; Health Care - Crematoriums; Crematory Stack."

[4] For arsenic, the 2020 NEI value is equivalent to ~ 18 mg in a body, which is the ICRP-23 (1973) value for "Reference Man". The current value for "Reference Man" is 2.8 mg, which is much closer to the Webfire value. Presumably arsenic levels have declined as drinking water limits have been implemented, etc.

[5] For chromium, a material balance was used based on the total chromium content in "Reference Man." There have been source tests from crematoriums that indicated greater chromium emissions than can be explained by the amount of chromium present in the human body. It is possible that the primary source of chromium in these cases was chromium-containing refractory that is not used in the proposed crematory. 45% of the total chromium was assumed to be hexavalent chromium based on the ratio of hexavalent chromium to total chromium in EPA's Webfire database.

[6] The San Diego Air Pollution Control District (SDAPCD) emission factor for mercury was accepted over the 2020 NEI value because it appears to more closely match the amount expected in dental amalgams when total amalgams by age (CDC data) is weighted by the expected death rate by age. Note that the average amount of mercury emitted per body now is expected to be lower than in 2007 when the previous crematory was reviewed due to the decline in the use of mercury dental amalgams.

6.b. Emissions Summary

| Air Pollutant | Facility-wide Potential to Emit (tpy) | Project Impact (tpy) |
|---|---|---|
| $NO_X$ | 3.41 | 0.16 |
| CO | 0.59 | 0.02 |
| VOC | 0.09 | -0.33 |
| $SO_2$ | 2.34 | 0.95 |
| PM | 0.97 | 0.41 |
| $PM_{10}$ | 0.97 | 0.41 |
| $PM_{2.5}$ | 0.97 | 0.41 |
| TAP | 0.23 | 0.21 |
| HAP | 0.23 | 0.21 |
| $CO_2/CO_2e$ | 1,086 | -289 |

## 7. REGULATIONS AND EMISSION STANDARDS

Regulations have been established for the control of emissions of air pollutants to the ambient air. Regulations applicable to the proposed facility that have been used to evaluate the acceptability of the proposed facility and establish emission limits and control requirements include, but are not limited to, the following regulations, codes, or requirements. These items establish maximum emissions limits that could be allowed and are not to be exceeded for new or existing facilities. More stringent limits are established in this Permit consistent with implementation of Best Available Control Technology (BACT):

7.a. Title 40 Code of Federal Regulations (40 CFR) 60 Subpart Ce "Emission Guidelines and Compliance Times for Hospital/Medical/Infectious Waste Incinerators" contains emission guidelines and compliance times for the control of certain designated pollutants from hospital/medical/infectious waste incinerator(s) (HMIWI) in accordance with sections 111 and 129 of the Federal Clean Air Act and 40 CFR 60 Subpart B. The crematory unit does not meet the definition of a HMIWI or HMIWI unit; therefore, this regulation does not apply to the crematory.

7.b. 40 CFR 60 Subpart E "Standards of Performance for Incinerators" applies to incinerators with a charging rate of more than 45 metric ton/day (50 ton/day) of solid waste. Human remains do not meet the definition of solid waste, so the crematory is not considered an incinerator; therefore, this regulation does not apply to the crematory.

7.c. 40 CFR 60 Subpart Ec "Standards of Performance for Hospital/Medical/Infectious Waste Incinerators for Which Construction Is Commenced After June 20, 1996" applies to each HMIWI unit. The crematory unit does not meet the definition of a HMIWI or HMIWI unit; therefore, this regulation does not apply to the crematory.

7.d. 40 CFR 60 Subpart CCCC "Standards of Performance for Commercial and Industrial Solid Waste Incineration Units for Which Construction Is Commenced After November 30, 1999 or for Which Modification or Reconstruction Is Commenced on or After June 1, 2001" applies to each new commercial and industrial solid waste incineration (CISWI) unit. The crematory does not meet the definition of a CISWI unit under § 60.2265; therefore, this regulation does not apply to the crematory.

7.e. 40 CFR 60 Subpart EEEE "Standards of Performance for Other Solid Waste Incineration Units for Which Construction Is Commenced After December 9, 2004, or for Which Modification or Reconstruction Is Commenced on or After June 16, 2006" applies to other solid waste incineration (OSWI) units. Other solid waste incineration units are very small municipal waste combustion units and institutional waste incineration units. The crematory unit does not meet the definition of an OSWI unit under § 60.2977; therefore, this regulation does not apply to the crematory.

7.f. Revised Code of Washington (RCW) 70A.15.2040 empowers any activated air pollution control authority to prepare and develop a comprehensive plan or plans for the prevention, abatement and control of air pollution within its jurisdiction. An air pollution control authority may issue such orders as may be necessary to effectuate the purposes of the

Washington Clean Air Act (RCW 70A.15) and enforce the same by all appropriate administrative and judicial proceedings subject to the rights of appeal as provided in Chapter 62, Laws of 1970 ex. sess. This law applies to the facility.

7.g. RCW 70A.15.2210 provides for the inclusion of conditions of operation as are reasonably necessary to assure the maintenance of compliance with the applicable ordinances, resolutions, rules and regulations when issuing an ADP for installation and establishment of an air contaminant source. This law applies to the facility.

7.h. WAC 173-460 "Controls for New Sources of Toxic Air Pollutants" requires BACT for toxic air pollutants (T-BACT), identification and quantification of emissions of toxic air pollutants, and demonstration of protection of human health and safety.

The facility emits TAPs; therefore, this regulation applies to the facility.

7.i. WAC 173-476 "Ambient Air Quality Standards" establishes ambient air quality standards for $PM_{10}$, $PM_{2.5}$, lead, $SO_2$, $NO_X$, ozone, and CO in the ambient air, which must not be exceeded. The facility emits $PM_{10}$, $PM_{2.5}$, $SO_X$, $NO_X$, and CO; therefore, certain sections of this regulation apply.

7.j. SWCAA 400-040 "General Standards for Maximum Emissions" requires all new and existing sources and emission units to meet certain performance standards with respect to Reasonably Available Control Technology (RACT), visible emissions, fallout, fugitive emissions, odors, emissions detrimental to persons or property, $SO_2$, concealment and masking, and fugitive dust. This regulation applies to the facility.

7.k. SWCAA 400-040(1) "Visible Emissions" requires that emissions of an air contaminant from any emissions unit must not exceed twenty percent opacity for more than three minutes in any one hour at the emission point, or within a reasonable distance of the emission point. This regulation applies to the facility.

7.l. SWCAA 400-040(2) "Fallout" requires that emissions of PM from any source must not be deposited beyond the property under direct control of the owner(s) or operator(s) of the source in sufficient quantity to interfere unreasonably with the use and enjoyment of the property upon which the material is deposited. This regulation applies to the facility.

7.m. SWCAA 400-040(4) "Odors" requires any source which generates odors that may unreasonably interfere with any other property owner's use and enjoyment of their property to use recognized good practice and procedures to reduce these odors to a reasonable minimum. This source must be managed properly to maintain compliance with this regulation. This regulation applies to the facility.

7.n. SWCAA 400-040(8) "Fugitive Dust Sources" requires that reasonable precautions be taken to prevent fugitive dust from becoming airborne and to minimize emissions. This regulation applies to the facility.

7.o. SWCAA 400-109 "Air Discharge Permit Applications" requires that an ADP application be submitted for all new installations, modifications, changes, or alterations to process and emission control equipment consistent with the definition of "new source". Sources wishing to modify existing permit terms may submit an ADP application to request such changes. An ADP must be issued, or written confirmation of exempt status must be received, before beginning any actual construction, or implementing any other modification, change, or alteration of existing equipment, processes, or permits. This regulation applies to the facility.

7.p. SWCAA 400-110 "New Source Review" requires that SWCAA issue an ADP in response to an ADP application prior to establishment of the new source, emission unit, or modification.

7.q. SWCAA 400-111 "Requirements for Sources in a Maintenance Plan Area" requires that no approval to construct or alter an air contaminant source will be granted unless it is evidenced that:

(1) The equipment or technology is designed and will be installed to operate without causing a violation of the applicable emission standards;
(2) Emissions will be minimized to the extent that the new source will not exceed emission levels or other requirements provided in the maintenance plan;
(3) BACT will be employed for all air contaminants to be emitted by the proposed equipment;
(4) The proposed equipment will not cause any ambient air quality standard to be exceeded; and
(5) If the proposed equipment or facility will emit any toxic air pollutant regulated under WAC 173-460, the proposed equipment and control measures will meet all the requirements of that Chapter.

The facility is located in a maintenance plan area; therefore, this regulation applies to the facility.

## 8. RACT/BACT/BART/LAER/PSD/CAM DETERMINATIONS

The proposed equipment and control systems incorporate BACT for the types and amounts of air contaminants emitted by the processes as described below:

*New BACT Determination(s)*

8.a. Criteria Pollutants and VOC from Crematory. The crematory is a source of combustion products. CO, VOC, and PM emissions will be controlled with the use of a secondary combustion chamber with a residence time of 2.0 seconds at a minimum operating temperature of 1,600 °F. CO emissions were limited to 40 ppmvd @ 7% $O_2$. $PM_{10}$ emissions were limited to 0.05 gr/dscf @ 7% $O_2$. Based on a review of test results from other types of crematories in SWCAA's jurisdiction and two test reports from this same model crematory in other jurisdictions, these emission levels are readily achievable, especially considering the secondary chamber residence time of the proposed unit. These emission limits meet the requirements of BACT for this crematory. Additional control

equipment consisting of scrubbers, baghouses and/or catalytic oxidizers would not be cost-effective.

$NO_X$ emissions were limited to 140 ppmvd @ 7% $O_2$. $NO_X$ will be formed both from the combustion of nitrogen-containing materials, and the oxidation of gaseous nitrogen (thermal $NO_X$). To reduce thermal $NO_X$ would require operating at lower temperatures, which could reduce CO, VOC, and PM control efficiency. Reduction of $NO_X$ formed from the combustion of nitrogen-containing materials would require post-combustion controls that would not be cost-effective for this source. Based on these analyses, and a review of source tests from this model and other crematories, limitation of $NO_X$ emissions to 140 ppmvd @ 7% $O_2$ meets the requirements of BACT for this crematory.

8.b. Toxic Air Pollutants from Crematory. The crematory is a source of toxic air pollutants, primary metal compounds and acid gases (HCl and HF). These metals, chlorine, and fluorine originate from the body itself. Mercury is one of the most concerning toxic air pollutants, and the relative cost of controlling mercury is not expected to have changed significantly since the 2007 analysis (below). Based on a review of the potential emissions and the cost of controlling these emissions, no additional controls are necessary to meet the requirements of BACT for toxic air pollutants.

*Previous BACT Determination(s)*

8.c. BACT – Criteria Pollutants (ADP 07-2722). The crematory is a source of combustion products. CO, VOC and PM emissions will be controlled with the use of a secondary combustion chamber with a residence time of 1.5 seconds at an operating temperature of 1,500°F. CO emissions were limited to 50 ppmvd @ 7% $O_2$. Filterable PM emissions were limited to 0.025 gr/dscf @ 7% $O_2$. These emission limits meet the requirements of BACT for this crematory. Additional control equipment consisting of scrubbers, baghouses and/or catalytic oxidizers would not be cost-effective.

$NO_X$ emissions were limited to 175 ppmvd @ 7% $O_2$. $NO_X$ will be formed both from the combustion of nitrogen-containing materials, and the oxidation of gaseous nitrogen (thermal $NO_X$). To reduce thermal $NO_X$ would require operating at lower temperatures, which could reduce CO, VOC, and PM control efficiency. Reduction of $NO_X$ formed from the combustion of nitrogen-containing materials would require post-combustion controls that would not be cost-effective for this source. Based on these analyses, limitation of $NO_X$ emissions to 175 ppmvd @ 7% $O_2$ and 3.25 tons per year meets the requirements of BACT for this source.

8.d. BACT – Mercury (ADP 07-2722). The primary source of mercury in crematory emissions is the mercury amalgam dental fillings of cremated bodies. Removing the filling prior to cremation has been determined to be an unacceptable option. Based on a conversation with the manufacturer on March 21, 2007, post-combustion controls (consisting of thermal quenching, activated carbon injection, and a baghouse) are estimated to cost roughly $300,000 and cost approximately $30,000 per year to operate and maintain. With an 80% control efficiency, up to 11.5 pounds per year of mercury emissions could be eliminated in this fashion. Conservatively assuming an 8% cost of capital and a 20-year equipment life,

the cost-effectiveness of this option is $5,253 per pound of mercury removed. More realistically, no more than 1,560 bodies would be processed in any one year, increasing the cost of this control option to $14,748 per pound of mercury removed.

As the popularity of mercury amalgam fillings has been dropping significantly (~38% in a recent 10-year period) in recent years, it is expected that mercury emissions from the crematory will fall significantly in future years. In addition, SWCAA is not aware of any other crematoria in the region that have installed mercury emission controls. Mercury emissions from crematoria have been reviewed by the Environmental Protection Agency in the past, and SWCAA expects that if mercury emissions from crematoria are appropriate, rules will be implemented on a nationwide basis. Based on the relatively high cost-effectiveness of controls, the expectation that mercury emissions will decline over time, and the fact that the installation of crematoria mercury controls is not common, SWCAA has determined that no mercury emission controls are required to meet the requirements of BACT.

*Other Determinations*

8.e. Prevention of Significant Deterioration (PSD) Applicability Determination. This permitting action will not result in a potential increase in emissions equal to or greater than the PSD thresholds. Therefore, PSD review is not applicable to this action.

8.f. Compliance Assurance Monitoring (CAM) Applicability Determination. CAM is not applicable to any emission unit at this facility because it is not a major source and is not required to obtain a Part 70 (Title V) permit.

## 9. AMBIENT IMPACT ANALYSIS

9.a. Criteria Air Pollutant Review. Emissions of $NO_X$, CO, $PM_{10}$, $PM_{2.5}$, VOC (as a precursor to $O_3$), and $SO_2$ are emitted at levels where no adverse ambient air quality impact is anticipated.

9.b. Toxic Air Pollutant Review. The proposed replacement crematory has a greater operating capacity than the unit it replaces; therefore, emissions of most toxic air pollutants are expected to increase. Mercury emissions might be an exception since the amount of mercury used in dental filling has decreased significantly in recent years. With few exceptions, the emission factors for toxic air pollutants are of poor quality; however, where data was available the incremental emissions change was estimated and the impact on ambient air quality was reviewed. With the exception of cadmium, the incremental increase in all pollutants is below the applicable Small Quantity Emission Rates (SQERs) listed in WAC 173-460; therefore, toxic impacts are presumed to be below regulatory significance. The applicant modeled the maximum potential incremental ambient impact of cadmium emissions using EPAs AERMOD (version 23132) dispersion model. The results of the model indicated that the maximum potential incremental ambient impact is below the Acceptable Source Impact Level (ASIL) in WAC 173-460.

**Conclusions**

9.c. Operation of the new crematory unit, as proposed in ADP application CL-3292 and in accordance with ADP 25-3700, will not cause the ambient air quality requirements of 40 CFR 50 "National Primary and Secondary Ambient Air Quality Standards" to be violated.

9.d. Operation of the new crematory unit, as proposed in ADP application CL-3292 and in accordance with ADP 25-3700, will not cause the requirements of WAC 173-460 "Controls for New Sources of Toxic Air Pollutants" or WAC 173-476 "Ambient Air Quality Standards" to be violated.

9.e. Operation of the new crematory unit, as proposed in ADP application CL-3292 and in accordance with ADP 25-3700, will not violate emission standards for sources as established under SWCAA General Regulations Sections 400-040 "General Standards for Maximum Emissions."

## 10. DISCUSSION OF APPROVAL CONDITIONS

SWCAA has made a determination to issue ADP 25-3700 in response to ADP application CL-3292. ADP 25-3700 contains approval requirements deemed necessary to assure compliance with applicable regulations and emission standards as discussed below.

10.a. Supersession of Previous Permits. ADP 25-3700 supersedes ADP 07-2722 in its entirety.

10.b. Emission Limits. Annual and short-term emission limits were provided for the primary criteria pollutants ($NO_X$, CO, and $PM_{10}$) in accordance with the BACT limitations discussed in Section 10. In addition, visible emission limits were provided because visible emission limits provide an easy way to identify a malfunction. $SO_2$ emissions are purely a function of the sulfur content of the fuels combusted and therefore will not vary significantly so a permit limit for $SO_2$ would not be constructive. VOC emissions are expected to be relatively small, and an exceedance of the estimated emissions is highly unlikely if the CO, $PM_{10}$, and visible emissions are within limits, so a separate VOC limit was not included.

10.c. Operating Limits and Requirements. To prevent the possibility of smoke and excess emissions during the beginning of a crematory cycle, the secondary chamber must be pre-heated to the target operating temperature prior to loading the crematory. This is a standard precaution for crematories and the manufacturer's literature indicates that the primary chamber door is interlocked to prevent loading until the secondary chamber is pre-heated to the desired setpoint.

The permit requires that accessible test ports be included in case source emissions testing (beyond the required performance monitoring) is required.

There have been source tests from crematoriums that indicated greater chromium emissions than can be explained by the amount of chromium present in the human body. It is possible that the primary source of chromium in these cases was chromium-containing refractory.

The proposed crematory does not use chromium-containing refractory. A permit requirement was included to also require that all replacement refractory material not include chromium except as a trace impurity or contaminant to prevent the possibility of excess chromium (especially hexavalent chromium) emissions from the refractory.

10.d. Monitoring and Recordkeeping. Sufficient monitoring and recordkeeping was established to document compliance with the annual emission limits and provide for general requirements (e.g. excess emission reporting, annual emission inventory submission). In addition, recording of maintenance activities that may impact emissions must be logged for each occurrence. This record allows the facility and SWCAA inspectors to ensure the equipment is being properly maintained and investigate any complaints or excess emissions incidents.

The permit requires continuous monitoring and logging of the primary and secondary chamber temperatures. This data can be used to help determine if the unit is operating properly.

10.e. Reporting. The permit requires reporting of the annual air emissions inventory, and reporting of the data necessary to develop the inventory. Excess emissions must be reported immediately in order to qualify for relief from monetary penalty in accordance with SWCAA 400-107. In addition, prompt reporting was required because it allows for accurate investigation into the cause of the event and prevention of similar future incidents.

## 11. START-UP AND SHUTDOWN/ALTERNATIVE OPERATING SCENARIOS/POLLUTION PREVENTION

11.a. Start-up and Shutdown Provisions. Pursuant to SWCAA 400-081 "Start-up and Shutdown", technology-based emission standards and control technology determinations must take into consideration the physical and operational ability of a source to comply with the applicable standards during start-up or shutdown. Where it is determined that a source is not capable of achieving continuous compliance with an emission standard during start-up or shutdown, SWCAA will include appropriate emission limitations, operating parameters, or other criteria to regulate performance of the source during start-up or shutdown.

The permit requires pre-warming of the secondary combustion chamber prior to loading the crematory. This is necessary to prevent excess emissions upon startup.

11.b. Alternate Operating Scenarios. SWCAA conducted a review of alternate operating scenarios applicable to equipment affected by this permitting action. The permittee did not propose or identify any applicable alternate operating scenarios. Therefore, none were included in the approval conditions.

11.c. Pollution Prevention Measures. SWCAA conducted a review of possible pollution prevention measures for the facility. No pollution prevention measures were identified by

either the permittee or SWCAA separate or in addition to those measures required under BACT considerations. Therefore, none were included in the approval conditions.

## 12. EMISSION MONITORING AND TESTING

Performance monitoring of the crematory with a combustion analyzer or equivalent is required initially and at least once every five years. In SWCAA's experience this monitoring is relatively inexpensive compared to the quantity of emissions that can be prevented by this procedure. It is unlikely that crematory emissions will degrade rapidly enough that more frequent monitoring is necessary to prevent an exceedance of the permitted emission limits. SWCAA has reviewed source test reports for this model of crematory that confirm the ability of the unit to meet the emission limits in this permit, therefore more extensive source testing was not required as part of the permit. In accordance with SWCAA 400-105, SWCAA may require or conduct source emissions testing at the facility but since such testing was not anticipated at the time of permitting, such testing was not included in the permit.

## 13. FACILITY HISTORY

This facility first operated a crematory at the site on August 21, 2008. That original unit was destroyed by fire on January 25, 2024.

13.a. Previous Permitting Actions. The following past permitting actions have been taken by SWCAA for this facility:

| Permit | Application | Date Issued | Description |
|---|---|---|---|
| **07-2722** | CL-1776 | April 4, 2007 | Approval for a Therm Tec model SQC-300 crematory. |

Approvals in bold have been superseded or are no longer active with issuance of ADP 25-3700.

13.c. Compliance History. A search of source records on file at SWCAA did not identify any outstanding compliance issues at this facility.

## 14. PUBLIC INVOLVEMENT OPPORTUNITY

14.a. Public Notice for ADP Application CL-3292. Public notice for ADP application CL-3292 was published on the SWCAA website for a minimum of fifteen (15) days beginning on February 26, 2025.

14.b. Public/Applicant Comment for ADP Application CL-3292. SWCAA did not receive specific comments, a comment period request, or any other inquiry from the public or the applicant regarding ADP application CL-3292. Therefore, no public comment period was provided for this permitting action.

14.c. State Environmental Policy Act. After reviewing the SEPA Checklist for this project, SWCAA has determined that the project does not have a probable significant impact on the environment and has issued Determination of Non-Significance 25-016. An Environmental Impact Statement is not required under RCW 43.21C.030(2)(c).