

**Engineering Evaluation
Golden State Pet Crematorium
2423 Grove Way, Castro Valley, CA 94546
Plant No. 21539
Application No. 30307**

Project Description: Animal Crematory Equipment

BACKGROUND

Golden State Pet Crematorium is applying for Authority to Construct and Permit to Operate for the following equipment:

**S-4 Animal Cremator: Matthews, Model IEB 32-5S,
with five primary burners, one secondary burner, total 4.25 MMBTU/hr,
250 lbs/hr, natural gas fired**

The animal crematory equipment will be located at 2423 Grove Way, Castro Valley, CA 94546. The primary emissions from each cremator includes nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), sulfur dioxide (SO₂) and precursor organic compounds (POCs) from the combustion of natural gas for fuel and the animal carcass incineration process. Toxic air contaminants (TACs) such as benzene, formaldehyde, and toluene are also emitted during the combustion of natural gas and incineration of the animal carcasses.

EMISSION CALCULATIONS

The applicant has provided the information as shown in Table 1.

S-4 will operate at the maximum rate of 250 lbs/hr, 12 hrs/day, with the annual hours of operation limited to 3120 hours by permit condition. Annual animal carcass throughput is limited to 352,420 lbs/year by permit condition. S-4 is equipped with one Eclipse TJ75 Primary Burner (0.75 MMBtu/hr), four Eclipse TJ50 Primary Burners (0.50 MMBtu/hr), and one TJ150 Secondary Burner (1.5 MMBtu/hr). The total heat input rating for S-4 is 4.25 MMBtu/hr.

Table 1. Incinerator Specifications						
Source	Manufacturer	Model	Heat Input Rating (MMBtu/hr)	Fuel	Animal Carcass Throughput	
					(lbs/hour)	(lbs/year)
S-4	Matthews	IEB 32-5S	4.25	Natural Gas	250	352,420

EMISSION CALCULATIONS

Potential to emit (PTE) values are summarized in the following table.

Table 2. PTE Calculations									
Source	Pollutant	Emissions from Natural Gas Combustion ¹			Emissions from Cremation ² [Including case wrappings]			Total Emissions	
		Emission Factor (lb/MMft ³)	Daily (lb/day)	Annual (lb/yr)	Emission Factor (lb/body)	Daily (lb/day)	Annual (lb/yr)	Daily (lb/day)	Annual (lb/yr)
S-4	PM10	7.60	0.380	99	8.50E-02	1.700	200	2.080	299
	NOx	100.00	5.000	1,300	2.67E-01	5.250	627	10.250	1927
	CO	84.00	4.200	1,092	2.21E-01	4.420	519	8.620	1611
	SO2	0.60	0.030	8	1.63E-01	3.260	383	3.290	391
	POC	5.50	0.275	72	2.24E-02	0.448	53	0.723	125

Additional assumptions are made as follows:

- 1,020 Btu / 1 ft³
- It is assumed that PM₁₀ emission equals PM2.5 emission
- Body = 150 lbs

Sample emission calculations for S-4 are as follows:

Daily PM₁₀ emission becomes,

[Emissions from Natural Gas Combustion for the Incinerator]

+ [Emissions from Cremation including Case Wrappings]

$$= \left[\frac{7.6 \text{ lbs-PM}_{10}}{\text{MMft}^3} \times \frac{\text{MMft}^3}{1,000,000 \text{ ft}^3} \times \frac{\text{ft}^3}{1,020 \text{ Btu}} \times \frac{1,000,000 \text{ Btu}}{\text{MMBtu}} \times \frac{4.25 \text{ MMBtu}}{\text{hr}} \times \frac{12 \text{ hrs}}{\text{day}} \right]$$

$$+ \left[\frac{8.50^{-02} \text{ lbs-PM}_{10}}{\text{body}} \times \frac{\text{body}}{150 \text{ lbs}} \times \frac{250 \text{ lbs}}{\text{hr}} \times \frac{12 \text{ hrs}}{\text{day}} \right]$$

$$= \left[\frac{0.380 \text{ lbs-PM}_{10}}{\text{day}} \right] + \left[\frac{1.700 \text{ lbs-PM}_{10}}{\text{day}} \right]$$

$$= 2.080 \text{ lbs-PM}_{10} \text{ per day}$$

¹ Emission factors are obtained from “Chapter 11.6: Crematories” in BAAQMD Permit Handbook.

² PM₁₀ emission factor is obtained from EPA’s FIRE Program. In deriving the PM₁₀ emission factor, the average weight per body incinerated was approximately 150 lbs (rounded up). Therefore, average weight per body incinerated is assumed to be 150 lbs for the calculation of the emission values from cremation.

Similarly, annual PM₁₀ emission becomes,

[Emissions from Natural Gas Combustion for the Incinerator]

+ [Emissions from Cremation including Case Wrappings]

$$= \left[\frac{7.6 \text{ lbs-PM}_{10}}{\text{MMft}^3} \times \frac{\text{MMft}^3}{1,000,000 \text{ ft}^3} \times \frac{\text{ft}^3}{1,020 \text{ Btu}} \times \frac{1,000,000 \text{ Btu}}{\text{MMBtu}} \times \frac{4.25 \text{ MMBtu}}{\text{hr}} \times \frac{3,120 \text{ hrs}}{\text{year}} \right]$$

$$+ \left[\frac{8.50^{-02} \text{ lbs-PM}_{10}}{\text{body}} \times \frac{\text{body}}{150 \text{ lbs}} \times \frac{352,420 \text{ pounds}}{\text{year}} \right]$$

$$= \left[\frac{99 \text{ lbs-PM}_{10}}{\text{year}} \right] + \left[\frac{200 \text{ lbs-PM}_{10}}{\text{year}} \right]$$

$$= 299 \text{ lbs-PM}_{10} \text{ per year}$$

The maximum annual operation hours are used to calculate maximum emissions from the natural gas combustion.

The plant cumulative emission calculations are summarized in Table 3.

Table 3. Plant Cumulative Emissions			
Pollutant	Existing	New	Total
	(ton/yr)	(ton/yr)	(ton/yr) ³
PM ₁₀	0.130	0.150	0.280
NO _x	0.640	0.964	1.604
CO	0.540	0.806	1.346
SO ₂	0.210	0.196	0.406
POC	0.300	0.063	0.363

TOXIC HEALTH RISK ASSESSMENT

This project triggers health risk assessment. Please see Appendix A of this report for the summary of the Toxic Air Contaminant (TAC) calculations.

Regulation 2-5 requires that the cumulative impacts from all related projects permitted within the last three years be included in the health risk assessment. The facility is new and has not submitted another application within the last three years.

³ There are 2,000 lbs in a ton.

Emissions factors for benzene and toluene from natural gas combustion are from Table 1.4-3 of AP-42.

Benzene = $(0.0021 \text{ lb/MMscf}) / (1020 \text{ MMBtu}/10^6 \text{ ft}^3) = 2.06 \times 10^{-6} \text{ lb/MMBtu}$, and
Toluene = $(0.0034 \text{ lb/MMscf}) / (1020 \text{ MMBtu}/10^6 \text{ ft}^3) = 3.33 \times 10^{-6} \text{ lb/MMBtu}$.

Per the BAAQMD Permit Handbook Chapter 11.6, formaldehyde and acetaldehyde are calculated from the data in CARB's Test Report No. C-90-004, "Evaluation Test on Two Propane Fired Crematories Camellia Memorial Lawn Cemetery," October 29, 1992. All other Toxic Air Contaminants (TAC) emission factors for cremation are from EPA's Factor Information Retrieval (FIRE) database.

Based on 3,120 operating hours per year and the reduced throughput of 352,450 pounds per year for S-4, the project passed the HRA conducted on September 28, 2021, by the District's Toxics Section. The throughput was initially proposed to be 780,000 lbs/year. With initial throughput of 780,000 lbs/year, the results from this HRA indicate that the project cancer risk is estimated at 22 in a million, the project chronic hazard index is estimated at 0.26, and the acute hazard index is estimated at 0.012. In accordance with the District's Regulation 2, Rule 5, the initial throughput for S-4 did not comply with the TBACT and project risk requirements. To comply with Regulation 2, Rule 5 project risk requirements, the throughput had to be reduced to 352,420 lbs/year.

With 352,420- lbs/year of throughput, that the project cancer risk is estimated at 9.9 in a million, the project chronic hazard index is estimated at 0.12, and the acute hazard index is estimated at 0.012.

Since the facility is within 1,000 feet of school, the health risk was estimated for the students attending the school. At the reduced throughput of 352,420 lbs/year, the facility passed the HRA for students at an estimated cancer risk of 0.24 in a million.

With the reduced throughput of 352,420 lbs/year, S-4 meets Best Available Control Technology for Toxics (TBACT).

STATEMENT OF COMPLIANCE

Regulation 1: General Provisions & Definitions

Regulation 1, Section 301 prohibits all sources from causing public nuisance. This source is not expected to be a source of public nuisance for either odor or emissions if it is maintained and operated in accordance with the manufacturer's recommendations.

Regulation 6, Rule 1: Particulate Matter – General Requirements

The owner/operator is expected to comply with Regulation 6-1 (Particulate Matter and Visible Emissions Standards), since the unit is fueled with LPG. Thus, for any period aggregating more than three minutes in any hour, there should be no visible emission as dark or darker than No. 1 on the Ringlemann Chart (Regulation 6-1-301) and no visible emission to exceed 20% opacity (Regulation 6-1-302).

Regulation 6-1-305 prohibits emissions of visible particles from causing a nuisance on property other than that of the operator. With proper equipment operation, this project is expected to comply with this standard.

Regulation 6-1-310 limits particulate emissions to 0.15 grains/dscf of exhaust gas volume.

The estimated grain loading for the cremation is calculated as follows:

S-4:

$$\begin{aligned} & [\text{(hourly PM-10 emissions from natural gas combustion)} \\ & + \text{(hourly PM-10 emissions from cremation)}] / \text{(12 hours per day of operation)} \\ & \times \text{(7,000 grains / lb)} \times \text{(hour/60 min)} \times \text{(min/2,100 dscf)} \\ & = \text{(combined daily PM-10 emissions)} / \text{(12 hours per day of operation)} \\ & \times \text{(7,000 grains / lb)} \times \text{(hour/60 min)} \times \text{(min/2,100 dscf)} \\ & = \text{(2.080 lbs PM-10)} / \text{day} / \text{(12 hours per day of operation)} \\ & \times \text{(7,000 grains / lb)} \times \text{(hour/60 min)} \times \text{(min/2,100 dscf)} \\ & = 0.0096 \text{ grains / dscf.} \end{aligned}$$

Since 0.0096 grains/dscf is less than 0.15 grains/dscf, compliance with this rule is expected.

Regulation 6-1-401 requires the operator to have the means to visually monitor emissions from the operation at all times. The emissions from the incinerator will occur during active, manned operation of the source. Therefore, the emissions will be always visible to the operator.

Regulation 7: Odorous Substances

In Regulation 7, Sections 301 and 302 limit discharges of odorous emissions from sources. This source is not expected to be a source of public nuisance for either odor or emissions if it is maintained and operated in accordance with the manufacturer's recommendations.

Regulation 8, Rule 2: Miscellaneous Operations

Regulation 8-2-301 prohibits any miscellaneous operation from discharging an emission containing more than 15 pounds per day and containing a concentration of 300 ppm total carbon on a dry basis. The daily POC emissions were estimated at 0.172 lbs/day. Since the emissions from the proposed equipment is less than 15 lbs/day limit, this project will comply with Regulation 8-2-301.

Regulation 9, Rule 1: Inorganic Gaseous Pollutants – Sulfur Dioxide

This rule establishes emission limits for sulfur dioxide from all sources, and limits ground level concentrations of sulfur dioxide. S-4 will comply with this rule by using only natural gas for its fuel.

SO₂ concentration becomes,

$$\frac{0.60 \text{ lbs-SO}_2}{\text{MMft}^3} \times \frac{\text{MMft}^3}{10^6 \text{ ft}^3} \times \frac{\text{ft}^3}{1,020 \text{ Btu}} \times \frac{10^6 \text{ Btu}}{\text{MMBtu}} \times \frac{385.5 \text{ ft}^3\text{-SO}_2}{\text{lb-mol SO}_2} \times \frac{10^6 \text{ standard ft}^3 \text{ flue}}{1 \text{ ft}^3\text{-SO}_2}$$
$$\times \frac{(20.9 - 3)}{20.9} \times \frac{1 \text{ lb-mol SO}_2}{64.06 \text{ lb-SO}_2} \times \frac{\text{MMBtu}}{8,710 \text{ ft}^3 \text{ flue}}$$

= 0.348 ppmv at 3% O₂

Based on the calculation above, combustion of natural gas is expected to produce a SO₂ concentration of less than 1 ppmv, thereby meeting the requirement of a maximum outlet concentration of 300 ppmv of SO₂ prescribed in Regulation 9, Rule 1-302.

California Environmental Quality Act: CEQA

The issuance of this Authority to Construct is exempt from CEQA because the Air District's approval was "ministerial" and, therefore, exempt from CEQA under CEQA § 21080(b)(1); CEQA Guidelines Section 15268(a). The issuance of this Authority to Construct is exempt from CEQA per Regulation 2-1-312.11.

The Air District's action is ministerial because regulatory requirements that govern the approval of this project involved objective numerical standards outlined in the Permit Handbook Chapter 11.6, which did not allow for or require any subjective judgment or discretion to interpret or apply. The Air District is required to approve the project where it complied with such standards. The crematory met the requirements for Best Available Control Technology for Toxics (TBACT). All the criteria for approval of ministerial permit applications were met pursuant to Regulation 2-1-428, including the criteria for the TBACT determination. Because the approval is ministerial, the project is exempt from CEQA. A CEQA Notice of Exemption will be filed with Alameda County.

California Health & Safety Code §42301.6 and Regulation 2-1-412

Pursuant to California Health & Safety Code §42301.6(a), prior to approving an application for a permit to construct or modification of a source, which is located within 1,000 feet from the outer boundary of a school site, the District shall prepare a public notice as detailed in §42301.6. §42301.9(a) defines a "school" as any public or private school used for the purposes of the education of more than 12 children in kindergarten or any grades 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in private homes.

The proposed cremator will be located within 1,000 feet of the outer boundary of K-12 schools. Therefore, the requirements of the California Health & Safety Code §42301.6 are applicable.

Public School Notification

This application proposes a new source of TACs and is located within 1,000 feet of the outer boundary of a school. Therefore, public notification pursuant to Reg. 2-1-412 is required. The school public notice will be distributed to the parents and guardians of the students at the following school as well as to addresses located within 1,000 feet of the site:

- Hayward Twin Oaks Montessori School, 2652 Vergil Ct, Castro Valley, CA 94546

The public notice period ended. The public was informed that the proposed cremator complies with all the rules and regulations of Bay Area Air Quality Management District and therefore we will be issuing an authority to construct for the proposed cremator.

BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

In accordance with Regulation 2-2-301 (Best Available Control Technology Requirement), BACT is triggered for any new or modified source with the potential to emit 10 pounds or more per highest day of POC, NPOC, NO_x, CO, SO₂, PM₁₀, or PM_{2.5}.

For S-4, daily NO_x emissions exceed 10 pounds. Therefore, BACT is triggered for NO_x. BACT for the crematorium is presented in the *“BAAQMD BACT Guideline – Crematory”* (Workbook). The following table provides an analysis of the BACT requirements.

Table 4 Analysis of BACT Requirements				
Pollutant	BACT Requirement	Source	Source Data	In Compliance with Requirement?
NO _x	Natural Gas Firing	S-4	Natural Gas Fuel	Yes

Applying the aforementioned methodology, S-4 is expected to satisfy the BACT requirements for NO_x and CO.

OFFSETS

Offsets must be provided for any new or modified source at a facility that emits more than 10 tons per year of POC or NO_x. Furthermore, pursuant to Regulation 2-2-303, offsets must be provided for any new or modified source with a cumulative increase that exceeds 100 tons per year of PM₁₀ or SO₂. As shown in Tables 3, the facility emissions do not exceed the offset threshold for any pollutant. Therefore, offsets are not triggered for this project.

NEW SOURCE PERFORMANCE STANDARDS (NSPS)

NSPS requirements do not apply to incinerators at animal crematories.

**NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS
(NESHAP)**

NESHAP requirements do not apply to incinerators at animal crematories.

PERMIT CONDITIONS

COND# 27506-----

**S-4 Animal Cremator: Matthews, Model IEB 32-5S,
with five primary burners, one secondary burner, total 4.25 MMBTU/hr,
250 lbs/hr, natural gas fired**

1. The owner/operator shall operate S-4 Cremator in such a way that the cremator's processing rate shall not exceed 250 pounds per hour, and the maximum firing rate shall not exceed 4.25 MM BTU per hour.
(basis: Cumulative Increase; Regulation 2, Rule 5)
2. The owner/operator shall ensure that the minimum stack height will be 40 feet for S-4 Matthews IEB32-4S cremator.
(basis: Regulation 2, Rule 5)
3. The owner/operator shall ensure that the total natural gas usage at S-4 shall not exceed 13,260 MMBtu in any consecutive twelve-month period.
(basis: Cumulative Increase; Regulation 2, Rule 5)
4. The owner/operator shall not cremate more than 352,420 pounds of animal remains using S-4 Matthews IEB32-4S cremator in any consecutive twelve-month period.
(basis: Cumulative Increase; Regulation 2, Rule 5)
5. The owner/operator shall maintain the operating temperature in the secondary chamber of the S-4 Cremators at or above 1650 degrees Fahrenheit during the cremation mode. Any temperature excursion below 1600 degrees Fahrenheit during the cremation mode will be considered a violation of this permit condition. The owner/operator shall equip the cremator with a District approved continuous temperature monitoring and recording device to ensure compliance with this condition. The location of the thermocouple shall be approved by the Source Test Section of the District. Natural gas input to the secondary chamber burner shall be increased, if necessary, to increase temperature sufficiently to control odor and visible plume. (Basis: Regulation 6-1-301, 6-1-310; TBACT)
6. After the shutdown, the owner/operator shall not cremate until the S-4 Cremator has been preheated so that the temperature in the secondary chamber is at least 1650 degrees Fahrenheit.
(Basis: Regulation 6-1-301, 6-1-310; TBACT)
7. The owner/operator shall fire the S-4 Cremator with natural gas only. (basis: Cumulative Increase; TBACT)
8. The owner/operator shall use the S-4 Cremators to cremate animal remains with or without enclosure in associated containers. No other material contaminated with toxic air contaminants as

listed by Air Resources Board, including radioactive and biohazardous waste shall be incinerated in this cremator without prior approval of the District. (basis: Cumulative Increase; Regulation 2, Rule 5)

9. The District may require the owner/operator of the cremator to conduct a District approved source test to determine particulate matter, hydrocarbon, NOX, CO, O2, HCl, and toxic emissions under unusual conditions, such as: disaster bags. The Source Test Section of the District shall be contacted to obtain approval for the source test method. The Source Test Section shall be notified at least 7 days in advance of any expected source test. A copy of source test report for each test shall be provided to the District within 30 days of source test date. (basis: Cumulative Increase; Regulation 2, Rule 5)

10. The owner/operator shall have the S-4 Cremator equipped with sampling ports and platforms, the location of which shall have the approval of the Source Test Section of the District. (Basis: Regulation 6-1-310)

11. The owner/operator shall have an operator present at all times during cremations. (Basis: Regulation 6-1-301)

12. The owner/operator shall keep the S-4 Cremator in good working condition. The date and detailed description of the type of maintenance done on cremator shall be recorded in a District approved logbook. (basis: Regulation 6-1-301, 6-1-310)

13. To determine compliance with the above conditions, the owner/operator shall maintain the following records and provide all of the data necessary to evaluate compliance with the above conditions, including but not limited to daily records of the following information:

- a. Natural Gas Usage
- b. Weight of animal remains
- c. Processing rate

(basis: Regulation 1-441, Regulation 6-1-301, 6-1-310.1, Cumulative Increase, TBACT, Regulation 2, Rule 5)

14. The owner/operator shall keep all monitoring, source test, and maintenance records as required per parts 3, 4, 5, 9, 12, and 13 on this site for at least two years from the date of data entry, and the records shall be made available to the District staff for inspection. These recordkeeping requirements shall not replace the recordkeeping requirements contained in any applicable District regulations. (basis: Cumulative Increase, TBACT; Regulation 6-1-301, 6-1-310)

RECOMMENDATION

Issue an Authority to Construct for the following sources:

- S-4 Animal Cremator: Matthews, Model IEB 32-5S,
with five primary burners, one secondary burner, total 4.25 MMBTU/hr,
250 lbs/hr, natural gas fired**



Youjin Kim
Air Quality Engineer

Date: 04/25/2022

DRAFT

Appendix A

Toxic Air Contaminants (TAC) calculation results are summarized in the following table.
 150 lbs per body has been assumed, based on Permitting Handbook chapter on crematoriums (Chapter 11.6).
 S-4 will operate at the rate of 250 lbs/hr, and 3120 hours/year, with the capped throughput of 352,420 lbs/year per applicant proposal.

Table 1. Project Total TAC Emissions from Natural Gas Combustion and Incineration

Sources	TAC	Combined Emissions from S-4 (lb/hr)	Acute Trigger Level (lb/hr)	Surpassed Acute Trigger Level?	Combined Emissions from S-4 (lb/yr)	Chronic Trigger Level (lb/yr)	Surpassed Chronic Trigger Level?	
S-4	Acetaldehyde	2.17E-04	1.00E+00	No	3.05E-01	2.90E+01	No	
	Arsenic	2.50E-05	4.40E-04	No	3.52E-02	1.60E-03	Yes	
	Beryllium	2.33E-06	N/A	N/A	3.29E-03	3.40E-02	No	
	Cadmium	1.83E-05	N/A	N/A	2.58E-02	1.90E-02	Yes	
	Chromium, hexavalent	2.33E-05	N/A	N/A	3.29E-02	5.10E-04	Yes	
	Copper	4.50E-05	2.20E-01	No	6.34E-02	N/A	No	
	Formaldehyde	3.69E-04	1.20E-01	No	1.05E+00	1.40E+01	No	
	Hydrogen Chloride	1.20E-01	4.60E+00	No	1.69E+02	3.50E+02	No	
	Hydrogen Fluoride	1.10E-03	5.30E-01	No	1.55E+00	5.80E+01	No	
	Lead	1.10E-04	N/A	No	1.55E-01	2.90E-01	No	
	Mercury	Not Relevant*						
	Nickel	6.33E-05	3.10E-05	Yes	8.93E-02	3.10E-01	No	
	Selenium	3.63E-05	N/A	N/A	5.12E-02	8.00E+00	No	
	Chlorinated Dibenzodioxins and Furans	1.77E-09	N/A	N/A	2.50E-06	4.40E-08	Yes	
	Polycyclic Aromatic Hydrocarbons (PAHs)	4.04E-08	N/A	N/A	5.70E-05	3.30E-03	No	
	Benzene	8.76E-06	6.00E-02	No	2.73E-02	2.90E+00	No	
Toluene	1.42E-05	8.20E+01	No	4.42E-02	1.20E+04	No		

*Mercury emissions are only from human cremations.