DRAFT

Engineering Evaluation Report
All Faith Crematory, Plant #16121
Two Human Crematory Retorts, Application #9748
July 28, 2004

I. Background: All Faith Crematory has applied for an Authority to Construct/Permit to Operate two new Human Crematory Retorts:

S1 Human Crematory Retort: Matthews Cremation Division Ener-Tek, Model MCG IE43-ET-4000, 2.5 MMBtu/hr, 250 lbs/hr capacity

S2 Human Crematory Retort: Matthews Cremation Division Ener-Tek, Model MCG IE43-ET-4000, 2.5 MMBtu/hr, 250 lbs/hr capacity

The crematory retorts are controlled air units with primary and secondary chamber burners. These natural gas-fired units with the secondary chamber operating at or above 1650°F, a residence time greater than one second and an exhaust gas grain loading of less than 0.06 grains per dry standard cubic feet adjusted to 7% O_2 meet the requirement for Best Available Control Technology for toxic air contaminants. These sources will be within 1000 feet of two schools:

San Leandro Unified School
(aka John Muir School)
1444 Williams Street
San Leandro, Ca.

Woodrow Wilson Elementary School
1300 Williams Street
San Leandro, Ca.

II. Emission Calculations: Criteria and toxic air contaminant (TAC) emission estimates are based on the natural gas fuel combusted and the number of bodies that are cremated.

A. Emissions from natural gas fuel combustion.

Basis:

Number of Retorts:	2	
Fuel usage:	18200	MMBtu/year per Retort
Max. Firing Rate:	2.5	MMBtu/hour per Retort
Heating Value:	1020	Btu/scf

Emissions from Natural Gas Fuel Combustion					
Pollutant	Emission Factor, lbs/MMscf (1)	Emission Factor, lbs/MMBtu (2)	Annual Emissions per Retort, lbs/year (3)	Total Annual Emissions, lbs/year (4)	Reg 2, Rule 1 Trigger, lbs/yr
PM_{10}	7.6	7.5 E-3	135.6	271.2	
NO_x	100	9.8 E-2	1784	3569	
SO_x	0.6	5.9 E-4	10.7	21.4	
CO	84	8.2 E-2	1499	2998	
POC	8.7	8.5 E-3	155.2	310.5	
Methane	2.3	2.3 E-3	41.0	82.1	
Benzene	2.1 E-3	2.1 E-6	0.037	0.07	6.7
Formaldehyde	7.5 E-2	7.4 E-5	1.34	2.68	33

1. Emission factors from EPA's AP42 for uncontrolled natural gas combustion in boilers <100 MMBtu/hr (1.4 Natural Gas Combustion, 9/1998: Table 1.4-1 for NOx and CO, Table 1.4-2 for PM10, SOx, Organic compounds and methane, Table 1.4-3 for Benzene and Formaldehyde).
2. Emission Factor, lbs/MMBtu = (emission factors, lbs/MMscf) / (1020 Btu/scf)
3. Annual Emissions per Retort, lbs/yr = (fuel usage, MMBtu/yr) * (emission factors, lbs/MMBtu)
4. Total Annual Emissions, lbs/yr = (number of retorts) * (annual emissions per retort, lbs/r)

II. Emission Calculations:

B. Emissions from cremation of human remains.

Basis:
- Number of retorts: 2
- Number of bodies: 2080 per retort per year
- Average body weight: 150 pounds/body
- Personal effects: 7.5 pounds/body (5% by weight)

Emission Factors for Cremation of Human Remains				
Pollutant	TAC Emission Factors for Bodies, lbs/body (1)	Criteria Emission Factors for Bodies, lbs/ton (2)	Emission Factors for personal effects, lbs/ton (3)	Combined Emission Factor, lbs/body (4)
PM_{10}		3	2.50E+01	2.88E-01
NO_x		3	3.56E+00	2.34E-01
SO_x		1	3.23E+00	8.31E-02
CO		2.5	2.95E+00	1.95E-01
POC		0.1	2.99E-01	8.25E-03
Acetaldehyde	1.3E-04			1.30E-04
Arsenic	3.0E-05		4.37E-03	4.64E-05
Beryllium	1.4E-06		6.25E-06	1.42E-06
Cadmium	1.1E-05		1.09E-02	5.19E-05
Chromium, hexavalent	1.4E-05		4.49E-04	1.57E-05
Copper	2.7E-05		1.25E-02	7.39E-05
Formaldehyde	3.4E-05			3.40E-05
Hydrogen Chloride	7.2E-02		3.35E+01	1.98E-01
Hydrogen Fluoride	6.6E-04		1.49E-01	1.22E-03
Lead	6.6E-05		2.13E-01	8.65E-04
Mercury	1.1E-03		1.07E-01	1.50E-03
Nickel	3.8E-05		7.85E-03	6.74E-05
Selenium	4.4E-05			4.40E-05
Zinc	3.5E-04			3.50E-04
Chlorinated dibenzo -dioxins and -furans of concern (expressed as 2,3,7,8 TCDD equiv.)	1.3E-09		9.0E-09	1.33E-09
PAH's (benzo(a)pyrene equivalents)	9.7E-08			9.70E-08

1. Except for mercury, formaldehyde and acetaldehyde, emission factors for TACs are from EPA's FIRE (Factor Information Retrieval) Data System version 6.22. Formaldehyde and acetaldehyde emission factors are calculated from the data (hourly emissions x duration of burn / number of bodies) in the CARB test results published in the October 29, 1992 report - "Evaluation Test on Two Propane-Fired Crematories at Camelia Memorial Lawn Cemetery. The mercury emission factor is derived from the data (annual emissions / annual number of cremations) in the BAAQMD report Estimate of Mercury Emissions from Crematoria.

2. Emission factors for PM10, POC, NOx, SO2, CO from 8/3/1994 interoffice memo and are based on source test.

3. Except for dioxins, emission factors are highest of factors in EPA's AP42 for uncontrolled mass burn municipal solid waste (MSW) incinerators (2.1 Refuse Combustion, Oct. 1996) or controlled-air medical waste incinerators (2.3 Medical Waste Incineration, July 1993). The AP42 total Cr factor was adjusted to Cr+6 using a 5% factor. Dioxin emission factor is EPA/ORD estimated average for uncontrolled medical waste incinerators taken from Sept. 2000 draft Dioxin Reassessment.

4. Combined Emission factors = (emission factors, lbs/body) + [(emission factors, lbs/ton) * (ton/2000lbs) * (150lbs/body)]

II. Emission Calculations:

B. Emissions from cremation of human remains (continued).

Emissions from Cremation of Human Remains				
Pollutant	Combined Emission Factor, lbs/body	Annual Emissions per Retort, lbs/yr (1)	Total Annual Emissions, lbs/yr (2)	Risk Screening Trigger Level, lbs/yr
PM_{10}	2.88E-01	5.98E+02	1.20E+03	
NO_x	2.34E-01	4.87E+02	9.73E+02	
SO_x	8.31E-02	1.73E+02	3.46E+02	
CO	1.95E-01	4.05E+02	8.11E+02	
POC	8.25E-03	1.72E+01	3.43E+01	
Acetaldehyde	1.30E-04	2.70E-01	5.41E-01	7.2E+01
Arsenic	4.64E-05	8.51E-02	**1.70E-01**	2.5E-02
Beryllium	1.42E-06	2.94E-03	5.89E-03	1.4E-02
Cadmium	5.19E-05	7.96E-02	**1.59E-01**	4.6E-02
Chromium, hexavalent	1.57E-05	3.15E-02	**6.29E-02**	1.3E-03
Copper	7.39E-05	1.21E-01	2.42E-01	4.6E+02
Formaldehyde	3.40E-05	7.07E-02	1.41E-01	3.3E+01
Hydrogen Chloride	1.98E-01	3.24E+02	6.48E+02	1.4E+03
Hydrogen Fluoride	1.22E-03	2.15E+00	4.30E+00	1.1E+03
Lead	8.65E-04	1.24E+00	2.49E+00	1.6E+01
Mercury	1.50E-03	2.84E+00	5.69E+00	5.8E+01
Nickel	6.74E-05	1.20E-01	2.40E-01	7.3E-01
Selenium	4.40E-05	9.15E-02	1.83E-01	9.7E+01
Zinc	3.50E-04	7.28E-01	1.46E+00	6.8E+03
Chlorinated dibenzo -dioxins and -furans of concern (expressed as 2,3,7,8 TCDD equivalents)	1.33E-09	2.75E-06	**5.50E-06**	1.2E-06
PAH's (as benzo(a)pyrene equivalents)	9.70E-08	2.02E-04	4.04E-04	4.4E-02

1. Annual Emissions per Retort = (# of bodies cremated per retort) * (Combined Emission Factor, lbs/body)

2. Annual Emissions, total = (# of retorts) * (Annual Emissions per retort, lbs/yr)

II. Emission Calculations:

C. Total Criteria Emissions from Fuel Usage and Cremation of Human Remains.

Pollutant	Emissions from Fuel Use per Retort, lbs/yr	Emissions from Cremation of Human Remains per Retort, lbs/yr	Emissions per Retort, lbs/yr (1)	Emissions per Retort, lbs/day (2)
PM_{10}	135.6	598.0	733.6	2.0
NO_x	1784	486.5	2270.5	6.2
SO_2	10.7	172.8	183.5	0.5
CO	1499	405.3	1904.3	5.2
POC	155.2	17.2	172.4	0.5

1. Emissions per Retort, lbs/yr = (Emissions from Fuel Use per Retort, lbs/yr) + (Combined Emission Factor, lbs/yr)
2. Emissions per Retort, lbs/day = (Emissions per Retort, lbs/yr) * (year / 365 days)

	Total Annual Criteria Emissions	
Pollutant	Pounds per Year	Tons per Year
PM_{10}	1467	0.73
NO_x	4542	2.27
SO_2	367	0.18
CO	3809	1.90
POC	345	0.17

III. Plant Cumulative Increase (as of April 5, 1991):

Pollutant	Current, tpy	Proposed, tpy	New Total, tpy
PM_{10}	0.0	0.73	0.73
POC	0.0	0.17	0.17
NO_x	0.0	2.27	2.27
SO_2	0.0	0.18	0.18
CO	0.0	1.90	1.90

IV. Health Risk Screening Analysis:

A health risk screening analysis is required because the crematory retorts may emit some TACs in amounts that exceed the risk screen trigger levels (see table in section II.B. emissions from cremation of human remains). The results of the health risk screening analysis, based on the crematory retort operating schedule of 20 hours per day, 7 days per week, 50 weeks per year and a maximum of 2080 bodies cremated per retort per year, are presented in the table below.

Receptor	Cancer Risk in a Million	Chronic Hazard Index
Off-site Worker	7	0.4
Residential	1	0.04
School	0.1	0.01

IV. Health Risk Screening Analysis:

Under the District's Risk Management Policy, the proposed project, with an incremental cancer risk less than ten in a million and a chronic hazard index less than one, is acceptable for operations that meet best available control technology for toxic emissions (TBACT).

A. TAC Emissions: TAC emissions used in the risk analysis are those presented in section II.B. The emission input into the atmospheric dispersion model for cancer risk assessment includes emission rates for each TAC, the corresponding cancer unit risk values and a 1000000 multiplier so that the model result would be in terms of cancer risk in a million. Likewise, the emission input into the model for chronic hazard index assessment includes emission rates for each TAC and the corresponding chronic reference exposure level so that the model result would be in terms of chronic hazard index.

Pollutant	Annual Average Emission Rate per Retort, g/s (1)	Chronic Inhalation Reference Exposure Level (ug/m^3) (2)	Chronic Hazard Index (multipath) per unit concentation ($ug/m^3)^{-1}$ (3)	Model Emissions Input for Chronic Hazard Index per Retort (4)	Unit Risk Value ($ug/m^3)^{-1}$ (2,5)	Model Emissions Input for Cancer Risk per Retort (6)
Acetaldehyde	3.9E-06	9.0E+00		4.3E-07	2.7E-06	1.1E-05
Arsenic	1.2E-06		6.2E+01	7.6E-05	1.6E-02	1.9E-02
Benzene	5.4E-07	6.0E+01		9.0E-09	2.9E-05	1.6E-05
Beryllium	4.2E-08		1.4E+02	6.1E-06	2.4E-03	1.0E-04
Cadmium	1.1E-06		5.6E+01	6.4E-05	4.2E-03	4.8E-03
Chromium, hexavalent	4.5E-07		5.0E+00	2.3E-06	1.5E-01	6.8E-02
Copper	1.7E-06	2.4E+00		7.3E-07		
Formaldehyde	2.0E-05	3.0E+00		6.8E-06	6.0E-06	1.2E-04
Hydrogen Chloride	4.7E-03	9.0E+00		5.2E-04		
Hydrogen Fluoride	3.1E-05		7.1E-02	2.2E-06		
Lead	1.8E-05				3.6E-05	6.4E-04
Mercury	4.1E-05		6.9E+01	2.8E-03		
Nickel	1.7E-06		2.0E+01	3.4E-05	2.6E-04	4.5E-04
Selenium	1.3E-06	2.0E+01		6.6E-08		
Zinc	1.0E-05	3.5E+01		3.0E-07		
Chlorinated dibenzo-dioxins and -furans of concern (expressed as 2,3,7,8 TCDD equivalents)	4.0E-11		2.7E+05	1.0E-05	3.4E+02	1.3E-02
PAH's (as benzo(a)pyrene equivalents)	2.9E-09				1.7E-02	4.8E-05
			totals	3.5E-03		1.1E-01

IV. Health Risk Screening Analysis:

Table Notes:

1. Annual Avg. Emission Rate per Retort, g/s = (Emission Rate per Retort, lbs/yr) * (453.6 g/lb) * (yr/8760hr) * (hr/3600s) Includes benzene and formaldehyde emissions from natural gas combustion.

2. The health risk values are those adopted by OEHHA for use in the Air Toxics "Hot Spots" Program.

3. The Chronic HI per unit concentration for Arsenic, Beryllium, Cadmium, Hexavalent Chromium, Hydrogen Fluoride, Mercury, Nickel and chlorinated dibenzo-dioxins and -furans address the inhalation, soil ingestion, dermal absorption and mother's milk ingestion pathways and are derived from CARB's HARP version 1.0 program.

4. For pollutants that only have the inhalation pathway,
Model Emissions Input for Chronic Hazard Index per body = (annual emission rate, g/s) / REL

For pollutants that have multipathway impacts,
Model Emissions Input for Chronic Hazard Index per body = (annual emission rate, g/s)
* (chronic hazard index per unit concentration)

5. The cancer unit risk value for arsenic, lead, PAHs and chlorinated dibenzo-dioxins and -furans address the inhalation, soil ingestion, dermal absorption and mother's milk ingestion pathways and are derived from CARB's HARP version 1.0 program.

6. Model Emissions Input for Cancer Risk = (annual average emission rate g/s) * (unit risk (ug/m3)-1) * 1E6

B. Modeling: The ISCST3 and ISCPrime models were run with Oakland Airport meteorological data, the annual averaging period, the rural land use option and again using the urban land use option. The ISCST3 results, run with the urban land use option, yielded the most conservative values; these results are presented in this analysis.

C. Cancer Risk: Estimates of residential risk are based on continuous 70-year exposure to annual average pollutant concentrations. For students, the risk is based on higher breathing rates for children (581 L/kg versus 286 L/kg) and an exposure for 10 hours per 20 hour operating day, 5 days per week, 36 weeks per 50 week operating year for 9 years out of a 70-year lifetime. For off-site workers, the risk is based on an exposure for 8 hours per 20-hour operating day, 5 days per week, 48 weeks per 50-week operating year for 46 years out of a 70-year lifetime.

Receptor	Cancer Risk in a Million Based on Continuous Exposure	Exposure Adjustment Factor	Exposure Adjusted Cancer Risk in a Million
Off-site Worker	40	0.18	7
Residential	1.2	1	1
School	1.4	0.07	0.1

IV. Health Risk Screening Analysis:

D. Chronic Hazard Index: Estimates of residential chronic hazard index are based on continuous exposure to annual average pollutant concentrations. For students, the hazard index is based on an exposure for 10 hours per 20-hour operating day, 5 days per week, and 36 weeks per 50-week operating year. For off-site workers, the risk is based on an exposure for 8 hours per 20-hour operating day, 5 days per week, 48 weeks per 50-week operating year.

Receptor	Chronic Hazard Index Based on Continuous Exposure	Exposure Adjustment Factor	Exposure Adjusted Chronic Hazard Index
Off-site Worker	1.3	0.27	0.4
Residential	0.04	1.00	0.04
School	0.05	0.26	0.01

V. Best Available Control Technology:

BACT is not triggered for PM_{10}, POC, NOx, CO and SO_2 emissions, each of which does not exceed 10 pounds per highest day. However, TBACT is required for projects that result in an incremental cancer risk of more than one, but less than ten in a million. Operation of the natural gas-fired crematory retorts with the secondary combustion chamber operating at or above 1650^{o}F with a residence time greater than one second and exhaust gas grain loading less than 0.06 grains per dry scf adjusted to 7% O_2 meets TBACT.

VI. Statement of Compliance:

A. Regulation 2, Permits:

1. CEQA: This evaluation is conducted using the fixed standards and objective measurements outlined in Permit Handbook Chapter 11. Thus, this project is considered to be ministerial under Regulation 2-1-311 and therefore is not subject to CEQA review.

2. Public Notice, Schools: This project is within 1,000 ft of San Leandro Unified School (aka John Muir School) and Woodrow Wilson Elementary School. The public notification requirements of Regulation 2-1-412 are triggered for this application. A public notice, dated July {??}, 2004 was sent out to the parents of the students and to the residences within 1000 feet of the source. During the 30-day comment period, {##} residents in the area responded to the public notice. The main concerns expressed were {?concern?}. {?response?}.

3. Offsets and PSD are not triggered because total facility emissions are less than 15 tons per year.

VI. Statement of Compliance:

B. Regulation 6, Particulate Matter and Visible Emissions: The operation of the crematory retorts is subject to and expected to be in compliance with the following sections of Regulation 6.

1. Section 301 limits emissions, for a period or periods aggregating more than three minutes in any hour, to a visible emission of less than No. 1 on the Ringelmann Chart.

2. Section 310 limits emissions of particulate matter to no more than 0.15 grains/dscf in exhaust gas volume, corrected to 12% CO_2 by volume.

C. Regulation 10, Standards of Performance for New Stationary Sources (NSPS): NSPS is not triggered.

D. Regulation 11, National Emission Standards for Hazardous Air Pollutants (NESHAP): NESHAP is not triggered.

VII. Conditions: For each crematory retort,

1. The owner/operator shall operate the crematory retort in such a way that:
   a. the processing rate shall not exceed 250 pounds per hour,
   b. the total number of cremations shall not exceed 2080 per consecutive 365-day period

   (Basis: cumulative increase; toxic risk screen)

2. The owner/operator shall fire the crematory retort with natural gas only.

   (Basis: cumulative increase; TBACT)

3. The owner/operator shall use the crematory retort to process only:
   a. human remains
   b. body bags required by OSHA or other regulations. Only chlorine-free body bags shall be provided by the owner/operator for cremations. Body bags provided by others are not subject to this restriction.
   c. cremation containers and cremation caskets
   d. personal effects and mementos containing no more than five pounds of combustible material.

   (Basis: cumulative increase; toxic risk screen)

VII. Conditions (continued)**:**

4. The owner/operator shall maintain the operating temperature in the secondary chamber of the crematory retort at or above 1650 degrees Fahrenheit during the cremation mode. The retention time in the secondary chamber shall be at least one second.

   (Basis: Regulation 6-301, 6-310; TBACT)

5. To determine compliance with the temperature requirement in Condition 4, the crematory retort shall be equipped with a temperature measuring device capable of continuously measuring and recording the temperature in the secondary chamber. The owner/operator shall install, and maintain in accordance with manufacturer's recommendations, a temperature measuring device that meets the following criteria: the minimum and maximum measurable temperatures with the device are 0 degrees Fahrenheit and 2500 degrees Fahrenheit, respectively, and the minimum accuracy of the device over this temperature range shall be 1.0 percent of full-scale.

   (Basis: Regulation 2-1-403)

6. The temperature limit in Condition 4 shall not apply during an "Allowable Temperature Excursion", provided that the temperature controller setpoint complies with the temperature limit. An Allowable Temperature Excursion is one of the following:
   a. A temperature excursion not exceeding 25 degrees Fahrenheit; or
   b. A temperature excursion for a period or periods which when combined are less than or equal to 15 minutes in any hour; or
   c. A temperature excursion for a period or periods which when combined are more than 15 minutes in any hour, provided that all three of the following criteria are met.
      i. the excursion does not exceed 50 degrees Fahrenheit;
      ii. the duration of the excursion does not exceed 24 hours; and
      iii. the total number of such excursions does not exceed 12 per calendar year (or any consecutive 12 month period).

   Two or more excursions greater than 15 minutes in duration occurring during the same 24-hour period shall be counted as one excursion toward the 12 excursion limit.

   (Basis: Regulation 2-1-403)

7. For each Allowable Temperature Excursion that exceeds 25 degrees Fahrenheit and 15 minutes in duration, the Permit Holder shall keep sufficient records to demonstrate that they meet the qualifying criteria described above. Records shall include at least the following information:
   a. Temperature controller setpoint;
   b. Starting date and time, and duration of each Allowable Temperature Excursion;
   c. Measured temperature during each Allowable Temperature Excursion;
   d. Number of Allowable Temperature Excursions per month, and total number for the current calendar year; and
   e. All strip charts or other continuous temperature records.

   (Basis: Regulation 2-1-403)

8. The owner/operator shall operate the crematory retort in such a way that the emissions of particulate matter in the exhaust gas is no more than 0.06 grains per dry standard cubic feet adjusted to 7% O_2 by volume.

   (Basis: Regulation 6-301, 6-310; TBACT)

9. Within 60 days of start-up, the owner/operator of the crematory retort shall conduct a District approved source test to determine particulate matter, nitrogen oxides, carbon monoxide and hydrogen chloride emissions in pounds per hour. Testing shall be conducted under normal operating conditions. The total body and container weight shall be recorded. Sampling shall be collected during the entire cremation process. The start of the cremation process will be considered to commence when the body is placed in to the crematory retort. The owner/operator shall notify the Manager of the District's Source Test Section at least seven (7) days prior to the test, to provide the District staff the option of observing the testing. Within 45 days of test completion, a comprehensive report of the test results shall be submitted to the Manager of the District's Source Test Section for review and disposition.

   (Basis: Regulation 2-1-403)

10. The crematory retort exhaust stack exit height shall be at a minimum of 22 feet above grade. (Basis: Toxic risk screen)

11. Prior to the commencement of construction, the owner/operator shall submit plans to the District's Source Test Division to obtain approval of the design and location of the secondary chamber thermocouple, source test ports and platforms.

    (Basis: Regulation 1-501)

12. The owner/operator shall have an operator present at all times during cremations.

    (Basis: Regulation 6-301, 6-310, cumulative increase, toxic risk screen)

13. The owner/operator shall keep the cremator in good working condition and record the date and detailed description of the type of maintenance done on crematory retort.

    (Basis: Regulation 6-301, 6-310, cumulative increase, toxic risk screen)

14. 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 the following information:
    a. Daily records of
       i. operating hours
       ii. number of cremations
       iii. processing rate
    b. The secondary chamber temperature records required in Condition 7.
    c. All source test and maintenance records required in Conditions 9 and 13

    All records shall be recorded in a District approved log. All records shall be retained on-site for two years from the date of entry and made available for inspection by District staff upon request. These recordkeeping requirements shall not replace the recordkeeping requirements contained in any applicable District Regulations.

    (Basis: Regulation 1-441, cumulative increase, TBACT, toxic risk screen)

VIII. Recommendation: Issue an Authority to Construct to All Faith Crematory, Plant #16121, for the following equipment:

S1 Human Crematory Retort: Matthews Cremation Division Ener-Tek, Model MCG IE43-ET-4000, 2.5 MMBtu/hr, 250 lbs/hr capacity

S2 Human Crematory Retort: Matthews Cremation Division Ener-Tek, Model MCG IE43-ET-4000, 2.5 MMBtu/hr, 250 lbs/hr capacity

Jane H. Lundquist
Air Quality Engineer II
Permit Services Division