



March 18, 2011

Tammy L. Ribar, Esquire
Houston Harbaugh, P.C.
Three Gateway Center
401 Liberty Avenue, 22nd Floor
Pittsburgh, Pennsylvania 15222-1005

Dear Ms. Ribar:

Subject: Response to Comments
Air Science Consultants, Inc. Letter to Peters Township Planning
Commission dated March 2011
CEC Project 101-462.0001

The purpose of this letter to respond to comments made by Dr. Stanley L. Penkala in his "Evaluation of Funeral Home with Crematory Variance Request" dated March 2011. That document includes a "Critique of Air Quality Evaluation Report [CEC Report]" which offers several comments relative to CEC's September 2, 2010 Air Quality Evaluation and February 24, 2011 addendum. Dr. Penkala's comments and CEC's responses are itemized below.

Comment 1. "It is not stated whether these other crematory units were equipped with the same secondary burner chamber as in the Smoke-Buster™ 140." (Page 4, Item 2)

Response 1. As stated in Section 2.2.1 of the Air Quality Evaluation, CEC contacted Mr. Jarrod Gogel of Matthews International Corporation – Cremation Division (MCD) "to obtain performance data for the Power-Pak II." As Dr. Penkala points out, it is unknown whether or not the tested Power-Pak II crematories were equipped with the additional Smoke-Buster™ 140 system which would be expected to produce emissions even lower than units operated without the Smoke-Buster™ 140. The emission data contained in four of the five referenced stack test reports as summarized in Table 1 are therefore believed to be equal to or worse than what would be emitted from the proposed Power-Pak II plus Smoke-Buster™ 140.

In the interest of providing emissions data from other available sources for comparison, CEC surveyed and summarized other published crematory emissions data in Tables 2 and 3. The worst-case emission estimates from all available data sources were used to evaluate health risks from the proposed unit. It is likely that emissions data associated with the EPA WebFIRE factors summarized in Table 2 may overestimate the emissions from a new state-of-the-art unit because, as Dr. Penkala states: "Expectations would be that the newer units would be equipped with such controls" (i.e., the Power-Pak II plus Smoke-Buster™ 140).

Civil & Environmental Consultants, Inc.

Pittsburgh 333 Baldwin Road
Pittsburgh, Pennsylvania 15205
Phone 412/429-2324
Fax 412/429-2114
Toll Free 800/365-2324
E-mail info@cecinc.com

Chicago 877/963-6026
Cincinnati 800/759-5614
Cleveland 866/507-2324
Columbus 888/598-6808
Detroit 866/380-2324

Export 800/899-3610
Indianapolis 877/746-0749
Nashville 800/763-2326
Phoenix 877/231-2324
St. Louis 866/250-3679



Tammy L. Ribar, Esquire
 CEC Project 101-462.0001
 Page 2
 March 18, 2011

Comment 2. “For two criteria pollutants, particulate matter and sulfur dioxide [SO₂], the General Operating Permit sets specific limits. The CEC report should have compared the typical cremator operations to these criteria.” (Page 4, Item 3).

Response 2. Particulate matter and sulfur dioxide data obtained from the five stack test results discussed in response to Comment 1 are summarized here.

Year	1999	2003	2005	2006	2010
Study	US EPA	Horizon	Air Testing & Consulting	AirNova	Arlington
Make/Model	Not stated	IEE Power-Pak II	Matthews Power-Pak II	Power-Pak II	Matthews Power-Pak II
Pollutant					
Average Particulate (gr/dscf @ 7% O ₂)	0.068	0.011	0.0231	0.023	0.0334
Average Sulfur Dioxide (ppm)	27	9	47.7	No data	No data
Average Temperature °F	NA	1,109	1,220.3	1,063	1,286.7

As shown, reported emissions of particulate matter and sulfur dioxide for these units were below the Pennsylvania Department of Environmental Protection (PADEP) General Permit limits of 0.08 gr/dscf for particulate matter and 500 parts per million for sulfur compounds. Also provided are average stack exhaust temperatures from each test run that have been used in the revised modeling discussed later.

Comment 3. “The mass of emissions from the cremator should have been converted to pounds per ton before dividing by the pounds per ton figures from the comparison sources, in generating the “Cremator equivalence” numbers.” (Page 5, Paragraph 4)

Response 3. CEC agrees that a unit-to-unit comparison was not made and that by comparing emissions from the same mass of materials burned, the cremator would produce 93% lower emissions. For this evaluation, it was felt that comparison of typical annual operations (regardless of whether or not the same mass of material was combusted) would be a more representative approach (similarly, no attempt was made to equate the mass of fuel burned by idling vehicles to the mass of bodies cremated). As such, CEC compared emissions from the combustion of one cord of wood in a fireplace or woodstove (approximately 3 tons) over the course of one year to the emissions produced by the maximum expected annual operation of the cremator (i.e., 575 bodies or about 43 tons as estimated by Dr. Penkala). If one desires to compare emissions associated with the combustion of equivalent masses of material, one may



Tammy L. Ribar, Esquire
CEC Project 101-462.0001
Page 3
March 18, 2011

multiply the wood combustion emissions by the factor (43 tons bodies per cremator) / (3 tons wood) = 14.3 (i.e., 14.3 fireplaces burning one cord per year will consume a similar mass of material to the proposed cremator).

Comment 4. “The light duty vehicle engine idling comparison is meaningless, because the data from EPA testing is outdated.” (Page 5, Paragraph 6)

Response 4. In this comparison, it was felt that the available vehicle engine idling data would provide a meaningful comparison. CEC recognizes that the emissions characteristics of the vehicle fleet have changed considerably since 1998; however, we disagree that carbon monoxide and volatile organic compound emissions “...are essentially eliminated from today’s fleet of light duty vehicles.” If traffic counts of all of the vehicle types using Route 19 through Peters Township were available and modeling of annual vehicle emissions was performed, we are confident that a significantly higher contribution to local emissions would be demonstrated than what is shown in the simplistic comparison shown in Table 6 of the Air Quality Evaluation.

Comment 5. “The stack exit gas temperature was given as 1,800 °F...However, the exit gas temperature...might be cooled as the gases travel up the stack...” (Page 6, Paragraph 2).

Response 5. CEC agrees that the exhaust gas temperature will cool below 1,800 °F before being emitted from the stack. Supplemental data compiled in response to Comment 2 above has been used in a revised modeling evaluation. The average measured stack temperature of 1,170 °F (905 K) has been used instead of 1,800 °F (1,255 K) in the revised SCREEN3 modeling presented later.

Comment 6. “The stack height used in the modeling is inadequate.” (Page 6, Paragraph 3)

Response 6. CEC agrees that use of actual building dimensions is appropriate for this screening evaluation and recognizes that Dr. Penkala was unaware that a building had not been selected at the time the Air Quality Evaluation was prepared. CEC has incorporated Dr. Penkala’s recommendations for evaluating building downwash by including the following building and stack dimensions associated with operation of the proposed cremator at the former La-Z-Boy furniture showroom located at 3287 Washington Road, McMurray, PA 15317:

- Building Height: 7.9248 meters (26 feet);
- Minimum Horizontal Building Dimension: 36.576 meters (120 feet);
- Maximum Horizontal Building Dimension: 52.8 meters (173 feet = building diagonal);
- Stack Height Above Ground: 8.83 meters (29 feet assumes 3-foot stack above roof);
- Stack Diameter: 0.51 meters (20-inches per Penkala Comment 7, below); and



Tammy L. Ribar, Esquire
CEC Project 101-462.0001
Page 4
March 18, 2011

- Stack Exit Temperature (K): 905 K (1,170 °F)

Comment 7. “The next problem with the model input is the use of 29 inches [0.74 m] for the stack INSIDE diameter [I.D.]. On the manufacturers documentation, the 29” dimension refers to the stack OUTSIDE diameter, and the INSIDE diameter is 20” [0.51 m].” (Page 6, Paragraph 4)

Response 7. CEC has reduced the inside stack diameter to 0.51 meters as suggested.

Comment 8. “The selection of zero for all building dimensions is curious, because we know there is a building involved, and it is a significant building with respect to the size of the stack being modeled.” (Page 6, Paragraph 5)

Response 8. Please see response to Comment 6. Downwash calculations have been included in the revised modeling.

Comment 9. “In modeling this facility, the concentration estimation should have started at the nearest distance to a property line, in whatever direction that might be, and significant receptors (e.g., nearest commercial building, nearest residence) should have also been input.” (Page 8, Paragraph 3).

Response 9. CEC agrees that actual receptor locations and elevations should be considered in a screening evaluation. CEC agrees with Dr. Penkala that the closest receptor is the residence located on the cul de sac of Sussex Way (see enclosed Google Earth image). CEC has estimated the ground elevation of that property to be approximately 1,050 feet. The estimated base elevation of the crematory property is about 1,015 feet which puts the closest receptor about 11 meters above the stack base. Therefore, assuming a 26-foot building and 3-foot stack (total elevation of 1,044 feet), the closest receptor will be about 6 feet above the stack height.

Worst-case modeling of the proposed crematory emissions has been re-run to include the terrain of this receptor. As shown in the accompanying Table 7 (updated from the original Air Quality Evaluation), the results indicate that under the conservative assumptions built into this evaluation, the human health risks associated with exposure to the specified pollutant emission rates are below the EPA’s criteria for screening health risk evaluations. Margins of safety range from a factor of 5 for chromium VI to over 367,000 for selenium.

SCREEN3 model runs are included for reference. In addition to the terrain evaluation, a building downwash model run is attached. Because the SCREEN3 model overrides downwash when performing a complex terrain evaluation, the downwash evaluation was performed



Tammy L. Ribar, Esquire
CEC Project 101-462.0001
Page 5
March 18, 2011

separately. As shown on Page 2 of the output, the maximum 1-hour concentration associated with downwash was $1,277 \mu\text{g}/\text{m}^3$ at 24 meters downwind (the approximate distance to the nearest commercial building). The associated annual average concentration at that location would be $127.7 \mu\text{g}/\text{m}^3$. That annual concentration would be about 81% of the worst-case complex terrain impact ($156.76 \mu\text{g}/\text{m}^3$) so the results of the complex terrain model run demonstrate the worst-case impacts.

Comment 10. "The addendum report presented some references pertaining to mercury emissions as a function of crematory operations... As the modeling of the first report was flawed, the results of this addendum would be similarly tainted." (Page 8, Paragraph 7).

Response 10. Based on the revised modeling evaluation discussed above, the extremely conservative assumption regarding mercury content (i.e., assumed to be 10 times greater than the 1.5 grams per body indicated by U.S. EPA), still results in risk exposures below the EPA screening threshold. This is evidenced by the safety factor of 73 shown on the revised Table 7. As such, a 10-fold increase in the mercury emission rate would still provide a safety factor of 7 for the worst-case receptor (i.e., the Sussex Way residence).

In conclusion, CEC has addressed the comments raised in the Air Science Consultants, Inc. critique of the air quality evaluation and addendum prepared for the proposed crematory. We believe that the conclusions of our initial evaluations remain unchanged even when assumptions intended to produce very high estimates of human health risk exposure are included.

Very truly yours,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

A handwritten signature in blue ink that reads "Kristian A. Macoskey".

Kristian A. Macoskey, QEP
Principal

A handwritten signature in blue ink that reads "Emory T. McLean".

Emory T. McLean, P.E.
Vice President

Enclosures
101-462.0001-RC-HH-3-18-11/P

Table 2
EPA WebFIRE HAP Emission Factors

CAS	POLLUTANT	LB/BODY	LB/HOUR (Calculated)
83-32-9	Acenaphthene	1.11E-07	5.55E-08
208-96-8	Acenaphthylene	1.22E-07	6.10E-08
120-12-7	Anthracene	3.24E-07	1.62E-07
7440-36-0	Antimony	< 3.02E-05	1.51E-05
7440-38-2	Arsenic	< 3.00E-05	1.50E-05
7440-39-3	Barium	2.40E-05	1.20E-05
7440-41-7	Beryllium	1.37E-06	6.85E-07
7440-43-9	Cadmium	1.11E-05	5.55E-06
7440-47-3	Chromium	2.99E-05	1.50E-05
18540-29-9	Chromium (VI)	1.35E-05	6.75E-06
7440-48-4	Cobalt	< 1.75E-06	8.75E-07
7440-50-8	Copper	2.74E-05	1.37E-05
206-44-0	Fluoranthene	2.05E-07	1.03E-07
86-73-7	Fluorene	4.17E-07	2.09E-07
7647-01-0	Hydrogen chloride	7.20E-02	3.60E-02
7664-39-3	Hydrogen fluoride	6.55E-04	3.28E-04
7439-92-1	Lead	6.62E-05	3.31E-05
7439-97-6	Mercury	3.29E-03	1.65E-03
7439-98-7	Molybdenum	< 1.67E-05	8.35E-06
7440-02-0	Nickel	3.82E-05	1.91E-05
85-01-8	Phenanthrene	2.29E-06	1.15E-06
	PAH (benzo(a)pyrene eq.)	4.90E-08	2.45E-08
129-00-0	Pyrene	1.62E-07	8.10E-08
7782-49-2	Selenium	< 4.36E-05	2.18E-05
7440-22-4	Silver	7.30E-06	3.65E-06
7440-28-0	Thallium	< 8.52E-05	4.26E-05
7440-62-2	Vanadium	5.79E-05	2.90E-05
7440-66-6	Zinc	3.53E-04	1.77E-04
	Total Dioxin/Furan (2,3,7,8-TCDD eq.)	1.40E-09	7.00E-10

Emissions Testing of a Propane Fired Incinerator at a Crematorium. October 29, 1992.

(Confidential Report No. ERC-39)

Wrapping material = 4 lbs of cardboard and 2 lbs of wood.

Assume average weight of body = 150 pounds, assume 2 hours per burn cycle.

SCC: 31502101 - Uncontrolled emissions

Table 3
Cremator Emission Estimate Summary

Basis:	
Maximum Natural Gas Firing Rate (MMBTU/hr)	3
Maximum Annual Bodies Cremated (body/yr)	575
Maximum Daily Bodies Cremated (body/day)	2.5
Maximum Hourly Burn Rate (lb/hr)	75
Typical Annual Operating Days (day/yr)	260

Constants:	
Natural Gas Heating Value (BTU/ft ³)	1020
Average Body Weight (lbs)	150

Calculated Values:	
Annual Cremating Hours (hr/yr)	1150
Maximum Annual Daily Natural Gas Usage (MMft ³ /day)	1.47E-02
Maximum Annual Natural Gas Usage (MM ft ³ /yr)	3.38

Natural Gas Combustion Emissions

Emissions from Natural Gas Combustion			
Pollutant	Emission Factor (lb/MMft ³)	Max. Daily (lb/day)	Annual (lb/yr)
PM10	7.6	0.11	25.71
NOx	100	1.47	338.24
CO	84	1.24	284.12
SO2	0.6	0.01	2.03
VOC	5.5	0.08	18.60

Notes:

1. Emission factors from AP-42 for uncontrolled natural gas combustion in boilers < 100 MMBTU/hr. AP-42 Chapter 1.4 (Tables 1.4-1 and 1.4-2)

Cremation Emissions

Emissions from Cremation of Body (including case wrappings)			
Pollutant	Emission Factor (lb/body)	Max. Daily (lb/day)	Annual (lb/yr)
PM10	8.50E-02	0.21	48.88
NOx	2.57E-01	0.64	147.78
CO	2.21E-01	0.55	127.08
SO2	1.63E-01	0.41	93.73
VOC	2.24E-01	0.56	128.80

Notes:

1. PM10 emission factor from EPA's FIRE program.
2. Emission factors from other pollutants are from AP-42 for uncontrolled medical waste incineration. AP-42 Chapter 2.3 (Tables 2.3-1 and 2.3-2)

Total Criteria Pollutant Emissions

Pollutant	Source (a)	Emission Rate (lb/hr)		
		(Values are the greater of either EPA data provided here or stack test averages from Table 1, as noted)		
		(lb/yr)	(TPY)	
PM10	Table 1	0.15	172.5	0.09
NOx	Table 1	0.533	613.0	0.31
CO	Table 3	0.36	414.0	0.21
SO2	Table 1	0.119	136.9	0.07
VOC	Table 3	0.13	149.5	0.07

Toxic Emissions from Cremator

Pollutant	Emission Factor		Stack Test Emission Rates From Table 1	Annual (lb/yr)	Using Table 1
	(lb/body)	(lb/hr)			
Acenaphthene	1.11E-07	5.55E-08	ND	6.38E-05	
Acenaphthylene	1.22E-07	6.10E-08	ND	7.02E-05	
Anthracene	3.24E-07	1.62E-07	ND	1.86E-04	
Antimony	3.02E-05	1.51E-05	ND	1.74E-02	
Arsenic	3.00E-05	1.50E-05	ND	1.73E-02	
Barium	2.40E-05	1.20E-05	ND	1.38E-02	
Beryllium	1.37E-06	6.85E-07	ND	7.88E-04	
Cadmium	1.11E-05	5.55E-06	1.32E-04	1.52E-01	X
Chromium, VI	1.35E-05	6.75E-06	ND	7.76E-03	
Cobalt	1.75E-06	8.75E-07	ND	1.01E-03	
Copper	2.74E-05	1.37E-05	ND	1.58E-02	
Fluoranthene	2.05E-07	1.03E-07	ND	1.18E-04	
Fluorene	4.17E-07	2.09E-07	ND	2.40E-04	
Hydrogen chloride	7.20E-02	3.60E-02	1.70E-01	1.96E+02	X
Hydrogen fluoride	6.55E-04	3.28E-04	ND	3.77E-01	
Lead	6.62E-05	3.31E-05	6.82E-04	7.85E-01	X
Mercury	3.29E-03	1.65E-03	1.90E-04	1.89E+00	
Nickel	3.82E-05	1.91E-05	9.60E-06	2.20E-02	
Phenanthrene	2.29E-06	1.15E-06	ND	1.32E-03	
Pyrene	1.62E-07	8.10E-08	ND	9.32E-05	
Selenium	4.36E-05	2.18E-05	ND	2.51E-02	
Silver	7.30E-06	3.65E-06	ND	4.20E-03	
Vanadium	5.79E-05	2.90E-05	ND	3.33E-02	
Zinc	3.53E-04	1.77E-04	ND	2.03E-01	
Chlorinated dibenzodioxins and furans	1.40E-09	7.00E-10	2.54E-08	2.92E-05	X
PAH (benzo(a)pyrene equivalents)	4.90E-08	2.45E-08	ND	2.82E-05	

(a): Criteria pollutant emission rates reflect the higher of either the EPA factors reported here or the Power-Pak II stack testing results presented in Table 1.

Table 4
Comparison of Fireplace and Woodstove Emissions to a Cremator

Pollutant	Residential Fireplace		Catalytic Wood Stove		Cremator operating for one year (lbs)	Cremator Equivalence to Fireplace	Cremator Equivalence to Woodstove
	Emission Factor (lb/ton)	Emissions from Burning One Cord (lbs) ^(a)	Emission Factor (lb/ton)	Emissions from Burning One Cord (lbs) ^(a)			
PM ₁₀	34.6	103.8	20.4	61.2	172	1.7	2.8
NO _x	2.6	7.8	2	6	613	79	102
CO	252.6	757.8	104.4	313.2	414	0.5	1.3
SO ₂	0.4	1.2	0.4	1.2	137	114	114
VOC	229	687	15	45	150	0.2	3
POM/PAH ^(b)	0.016	0.048	0.41	1.24	2.82E-05	5.9E-04	2.3E-05
Cadmium	ND	ND	4.60E-05	1.38E-04	1.52E-01	NA	1,101
Nickel	ND	ND	2.20E-06	6.60E-06	2.19E-02	NA	3,318

(a) For comparison, it is assumed that a residence could consume one cord (3 tons) of wood per season.

(b) POM = polycyclic organic matter which includes polycyclic aromatic hydrocarbons (PAH) as reported for the crematory. Fireplace emissions are given in terms of POM while woodstove emissions are given in terms of PAH.

Table 6
Comparison of Light Duty Vehicle Engine Idling Emissions to a Cremator

Pollutant	Engine Idling		Cremator operating for one year (lbs)	Cremator Equivalence to One Year of Engine Idling
	Light Duty Gasoline Vehicle (grams/hr)	Emissions from One Year of Idling (per car) (lbs) ^(a)		
VOC	18.6	359	150	0.42
CO	300.0	5,794	414	0.07
NO _x	5.4	105	613	5.83

(a) Emission estimates are based on EPA (1998a) factors for light duty gasoline vehicles when idling (average of winter and summer factors).

Table 7
Risk Screening Summary

Pollutant	Emission Factor (lb/body)	Emission Rate		Max Conc. ^(a) ($\mu\text{g}/\text{m}^3$)	EPA Risk Screen ^(b) ($\mu\text{g}/\text{m}^3$)	Exceeds Screen? (yes/no)	Safety Factor ^(c)
		(lb/hr)	(g/s)				
Arsenic	3.00E-05	1.97E-06	2.48E-07	3.89E-05	5.66E-04	no	15
Barium	2.40E-05	1.58E-06	1.98E-07	3.13E-05	5.21E-01	no	16,638
Beryllium	1.40E-06	9.19E-08	1.16E-08	1.83E-06	1.01E-03	no	553
Chromium, (VI)	1.35E-05	8.86E-07	1.12E-07	1.76E-05	8.35E-05	no	5
Cobalt	1.75E-06	1.15E-07	1.45E-08	2.28E-06	2.70E-04	no	118
Hydrogen chloride	7.20E-02	4.73E-03	5.95E-04	9.39E-02	2.09E+01	no	222
Hydrogen fluoride	6.55E-04	4.30E-05	5.42E-06	8.55E-04	1.46E+01	no	17,084
Mercury	3.29E-03	2.16E-04	2.72E-05	4.29E-03	3.13E-01	no	73
Nickel	3.82E-05	2.51E-06	3.16E-07	4.98E-05	1.04E-01	no	2,087
Selenium	4.36E-05	2.86E-06	3.61E-07	5.69E-05	2.09E+01	no	367,391
Vanadium	5.79E-05	3.80E-06	4.79E-07	7.55E-05	1.04E-01	no	1,377
Total Dioxin/Furan	1.40E-09	9.19E-11	1.16E-11	1.83E-09	1.87E-06	no	1,024
PAH (benzo(a)pyrene equivalents)	4.90E-08	3.22E-09	4.05E-10	6.39E-08	8.73E-04	no	13,655

(a) Derived from maximum 24-hr ground-level concentration of 391.9 $\mu\text{g}/\text{m}^3$ at 38 meters adjusted for an annual average (multiplied times 0.4 = 156.76 $\mu\text{g}/\text{m}^3$) downwind of source using SCREEN3 modeling of typical stack configuration consisting of (represents worst-case complex terrain at 11 meters).

Stack Height: 29 feet (8.83 m) compared to 26 feet

Stack Inside Diameter: 20 inches (0.51 m) compared to 29 inches

Stack Exhaust Temperature: 1,170 F (905 K) compared to 1800 F

Exhaust Flow Rate: 2,000 acfm (per vendor) compared to 1,857 acfm

Emission Rate: 1.0 g/s (unit basis)

Building Dimensions: 26 feet tall 7.925 m

120 feet wide minimum horizontal dimension = 36.6 m

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

125 feet long max horizontal dimension is the diagonal = 173 ft (52.8 m)

(b) Obtained from U.S. EPA Regional Screening Tables: http://epa-prgs.org/cgi-bin/chemicals/csl_search

(c) Number the maximum concentration must be multiplied by to equal the EPA risk screen concentration.

Receptor Location (Sussex Way Residence): Distance (38 m), elevation (11 m)

Emission rates are based on a production rate of 575 bodies cremated per year.

SCREEN.OUT

03/17/11
14:29:37

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 96043 ***

Crematorium with downwash

COMPLEX TERRAIN INPUTS:

SOURCE TYPE = POINT
EMISSION RATE (G/S) = 1.00000
STACK HT (M) = 8.8300
STACK DIAMETER (M) = .5100
STACK VELOCITY (M/S) = 4.6205
STACK GAS TEMP (K) = 905.0000
AMBIENT AIR TEMP (K) = 293.0000
RECEPTOR HEIGHT (M) = .0000
URBAN/RURAL OPTION = URBAN

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 1.992 M**4/S**3; MOM. FLUX = .449 M**4/S**2.

FINAL STABLE PLUME HEIGHT (M) = 36.4
DISTANCE TO FINAL RISE (M) = 200.2

TERR HT (M)	DIST (M)	MAX 24-HR CONC (UG/M**3)	*VALLEY 24-HR CALCS*		**SIMPLE TERRAIN 24-HR CALCS**				
			CONC (UG/M**3)	PLUME HT ABOVE STK BASE (M)	CONC (UG/M**3)	PLUME HT ABOVE STK HGT (M)	SC	U10M	USTK (M/S)
11.	38.	391.9	54.02	17.9	391.9	3.6	4	8.0	8.0

*** SUMMARY OF SCREEN MODEL RESULTS ***

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
COMPLEX TERRAIN	391.9	38.	11. (24-HR CONC)

** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 96043 ***

Crematorium with downwash

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = POINT
EMISSION RATE (G/S) = 1.00000
STACK HEIGHT (M) = 8.8300
STK INSIDE DIAM (M) = .5100
STK EXIT VELOCITY (M/S) = 4.6205
STK GAS EXIT TEMP (K) = 905.0000
AMBIENT AIR TEMP (K) = 293.0000
RECEPTOR HEIGHT (M) = .0000
URBAN/RURAL OPTION = URBAN
BUILDING HEIGHT (M) = 7.9248
MIN HORIZ BLDG DIM (M) = 36.5760
MAX HORIZ BLDG DIM (M) = 52.8000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

STACK EXIT VELOCITY WAS CALCULATED FROM
VOLUME FLOW RATE = 2000.0000 (ACFM)

BUOY. FLUX = 1.992 M**4/S**3; MOM. FLUX = .449 M**4/S**2.

*** FULL METEOROLOGY ***

*** SCREEN AUTOMATED DISTANCES ***

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	.0000	0	.0	.0	.0	.00	.00	.00	NA
100.	380.4	6	4.0	4.0	10000.0	11.45	10.79	9.79	SS
200.	174.6	4	1.5	1.5	480.0	23.47	30.79	27.20	SS
300.	161.9	6	1.0	1.0	10000.0	30.61	31.18	20.35	SS
400.	149.1	6	1.0	1.0	10000.0	30.61	40.85	25.68	SS
500.	125.6	6	1.0	1.0	10000.0	30.61	50.21	30.59	SS
600.	104.6	6	1.0	1.0	10000.0	30.61	59.27	35.15	SS
700.	87.77	6	1.0	1.0	10000.0	30.61	68.06	39.42	SS
800.	74.64	6	1.0	1.0	10000.0	30.61	76.59	43.44	SS
900.	64.34	6	1.0	1.0	10000.0	30.61	84.89	47.25	SS
1000.	56.17	6	1.0	1.0	10000.0	30.61	92.97	50.86	SS
1100.	49.59	6	1.0	1.0	10000.0	30.61	100.83	54.31	SS
1200.	44.22	6	1.0	1.0	10000.0	30.61	108.50	57.61	SS
1300.	39.77	6	1.0	1.0	10000.0	30.61	115.99	60.78	SS
1400.	36.05	6	1.0	1.0	10000.0	30.61	123.30	63.84	SS
1500.	32.90	6	1.0	1.0	10000.0	30.61	130.44	66.78	SS
1600.	30.20	6	1.0	1.0	10000.0	30.61	137.43	69.63	SS
1700.	27.87	6	1.0	1.0	10000.0	30.61	144.27	72.38	SS
1800.	25.85	6	1.0	1.0	10000.0	30.61	150.97	75.06	SS
1900.	24.07	6	1.0	1.0	10000.0	30.61	157.54	77.66	SS
2000.	22.51	6	1.0	1.0	10000.0	30.61	163.98	80.19	SS
2100.	21.12	6	1.0	1.0	10000.0	30.61	170.30	82.65	SS
2200.	19.88	6	1.0	1.0	10000.0	30.61	176.50	85.05	SS

SCREEN.OUT									
2300.	18.76	6	1.0	1.0	10000.0	30.61	182.59	87.40	SS
2400.	17.76	6	1.0	1.0	10000.0	30.61	188.57	89.69	SS
2500.	16.85	6	1.0	1.0	10000.0	30.61	194.45	91.93	SS
2600.	16.02	6	1.0	1.0	10000.0	30.61	200.24	94.13	SS
2700.	15.26	6	1.0	1.0	10000.0	30.61	205.93	96.28	SS
2800.	14.57	6	1.0	1.0	10000.0	30.61	211.54	98.39	SS
2900.	13.94	6	1.0	1.0	10000.0	30.61	217.05	100.46	SS
3000.	13.35	6	1.0	1.0	10000.0	30.61	222.49	102.49	SS
3500.	11.00	6	1.0	1.0	10000.0	30.61	248.52	112.14	SS
4000.	9.331	6	1.0	1.0	10000.0	30.61	272.88	121.08	SS
4500.	8.084	6	1.0	1.0	10000.0	30.61	295.82	129.44	SS
5000.	7.121	6	1.0	1.0	10000.0	30.61	317.54	137.31	SS
5500.	6.357	6	1.0	1.0	10000.0	30.61	338.21	144.78	SS
6000.	5.737	6	1.0	1.0	10000.0	30.61	357.94	151.89	SS
6500.	5.225	6	1.0	1.0	10000.0	30.61	376.84	158.70	SS
7000.	4.794	6	1.0	1.0	10000.0	30.61	395.00	165.23	SS
7500.	4.428	6	1.0	1.0	10000.0	30.61	412.50	171.52	SS
8000.	4.113	6	1.0	1.0	10000.0	30.61	429.40	177.59	SS
8500.	3.838	6	1.0	1.0	10000.0	30.61	445.74	183.47	SS
9000.	3.598	6	1.0	1.0	10000.0	30.61	461.59	189.17	SS
9500.	3.386	6	1.0	1.0	10000.0	30.61	476.98	194.70	SS
10000.	3.196	6	1.0	1.0	10000.0	30.61	491.93	200.08	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:
 24. 1277. 6 3.0 3.0 10000.0 9.32 2.74 4.83 SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

 *** REGULATORY (Default) ***
 PERFORMING CAVITY CALCULATIONS
 WITH ORIGINAL SCREEN CAVITY MODEL
 (BRODE, 1988)

*** CAVITY CALCULATION - 1 ***	*** CAVITY CALCULATION - 2 ***
CONC (UG/M**3) = 268.4	CONC (UG/M**3) = 369.0
CRIT WS @10M (M/S) = 11.87	CRIT WS @10M (M/S) = 12.47
CRIT WS @ HS (M/S) = 11.87	CRIT WS @ HS (M/S) = 12.47
DILUTION WS (M/S) = 5.94	DILUTION WS (M/S) = 6.23
CAVITY HT (M) = 7.96	CAVITY HT (M) = 7.92
CAVITY LENGTH (M) = 34.66	CAVITY LENGTH (M) = 29.72
ALONGWIND DIM (M) = 36.58	ALONGWIND DIM (M) = 52.80

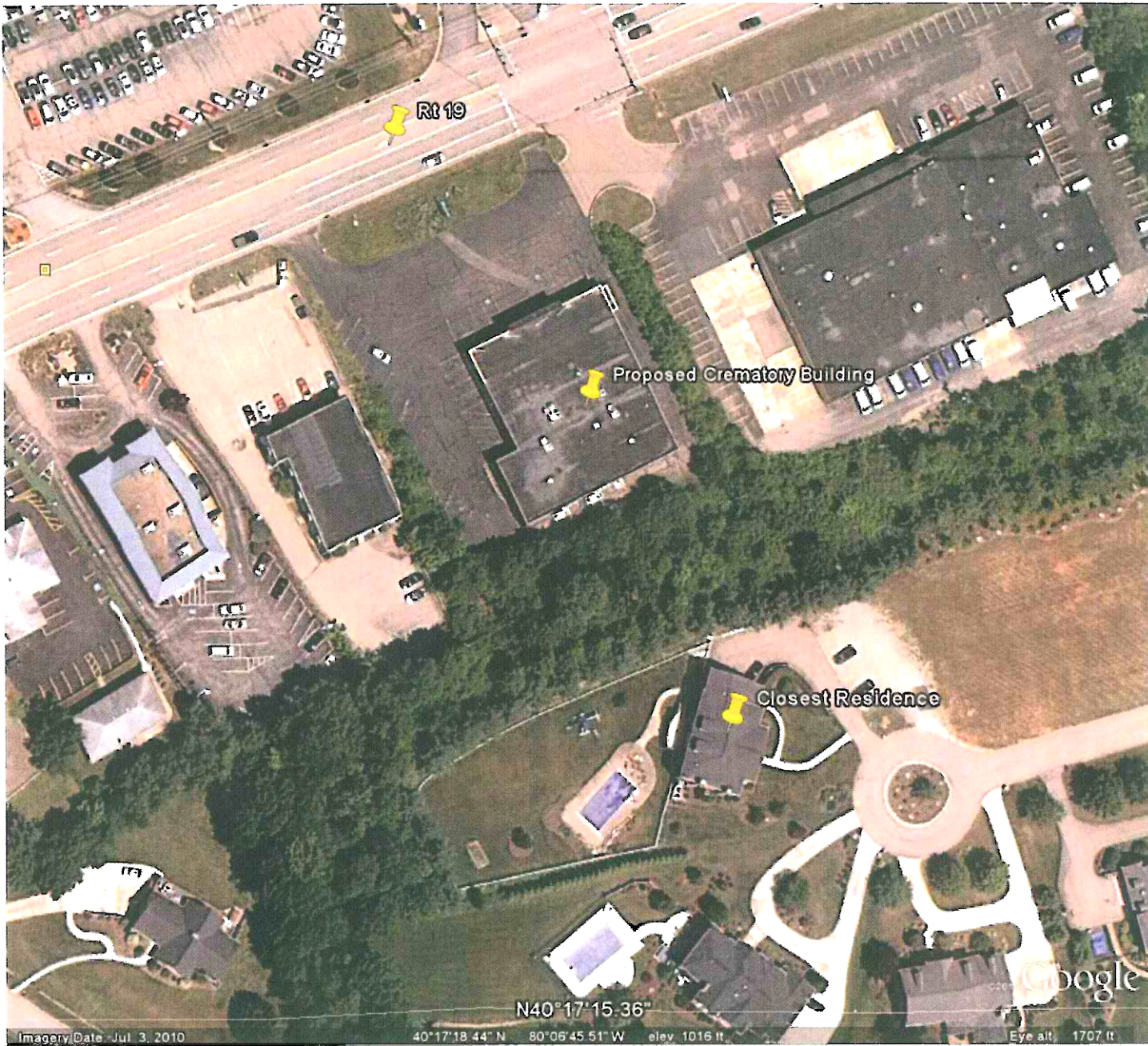
 END OF CAVITY CALCULATIONS

 *** SUMMARY OF SCREEN MODEL RESULTS ***

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
----- SIMPLE TERRAIN	----- 1277.	----- 24.	----- 0.

BLDG. CAVITY-1	268.4	SCREEN.OUT 35.	-- (DIST = CAVITY LENGTH)
BLDG. CAVITY-2	369.0	30.	-- (DIST = CAVITY LENGTH)

** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **



Imagery Date - Jul 3, 2010

N40°17'15.36"

40°17'18.44" N 80°06'45.51" W elev. 1016 ft.

Eye alt. 1707 ft.

Google