Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

ARB/ML-88-026

Evaluation Retest on a Hospital Refuse Incinerator At Sutter General Hospital, Sacramento, CA

April, 1988

CALIFORNIA AIR RESOURCES BOARD

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Revised 3/89

II. PROCESS DESCRIPTION

Sutter General Hospital operates a multichambered waste heat recovery incinerator located at 2801 L Street, Sacramento, CA. The incinerator, Model/No. 67-SA and heat recovery system, Model HR-1000-2-SK-9, are manufactured by Thermtec of Tualatin, Oregon. This system consists of a dual chambered hospital refuse burning incinerator which passes its exhaust gases through a waste heat boiler for steam generation. The incinerator is equipped to burn natural gas, which is used during start-up and to maintain the necessary temperature. A schematic of the incinerator/heat recovery system is shown in Figure 1.

The average refuse feed rate to the incinerator during the test period was reported as follows:

DATE	TIME	NUMBER OF a/ INFECTIOUS BOXES (pounds)	NUMBER OF b/ CARTS (pounds)	PROCESS WEIGHT RATE, LB/HR
7-29-87	1300-1800	13 (264)	36 (2700)	593
7-30-87	0900-1400	14 (284)	29 (2175)	492
7-31-87	0900-1900 c/	37 (751)	49 (3675)	443
8-3-87	1300-2300	34 (690)	40 (3000)	369

a/ Infectious boxes weigh 20.3 pounds each
b/ Typical cart trash weight is 75 pounds
c/ On July 31, 1987 the refuse loading ram to the bottom chamber was inoperative from approximately 1000 to 1500 HOURS. During this period the bottom chamber was in a burndown configuration with an increased natural gas comsumption in the upper chamber to satisfy boiler heating requirements.

TABLE 4

DAILY AVERAGE STACK CONDITIONS FOR INCINERATOR
AT SUTTER GENERAL HOSPITAL

Date	Stack Gas Velocity (Ft/Sec)	Stack Gas Flow Rate (DSCFM)	Moisture Content, (% By Volume)	Stack Gas Temperature (°F)
7-29-87	10.9	2687	13.2	328
7-30-87	13.4	3145	13.2	369
7-31-87	13.0	2833	15.5	409
8-3-87	11.9	2894	10.9	357

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TABLE 5

DAILY AVERAGE CONCENTRATIONS OF SELECTED GASEOUS AIR POLLUTANTS FROM THE SUTTER GENERAL INCINERATOR

DATE	PM d/	O2 a/	CO2 a/	CO a/	NOX b/	SO2 b/	HC bc/	HCL c/
	GR/DSCF	PERCENT	PERCENT	PPMV	PPMV	PPMV	PPMV	PPMV
7-29-87	-	15.6	4.0	<50	130	50	<3	-
7-30-87	-	12.1	5.5	<50	90	13	<2	315
7-31-87	0.024 f/	12.5	5.2	<50	80	11 e/	<2	224 g/
8-3-87	0.050 h/	13.9	4.8	<50	100	22	12	-

a/ THE O2, CO2 AND CO VALUES WERE USED TO DETERMINE THE MOLECULAR WEIGHT OF THE STACK GAS.
b/ NOX, SO2 AND HC VALUES ARE CORRECTED TO 3 PERCENT O2.
c/ TOTAL HYDROCARBON DATA REPORTED AS PROPANE.
d/ REPORTED AT ACTUAL FLUE GAS O2 CONCENTRATIONS.
e/ SO2 ANALYZER INOPERATIVE DURING PART OF TEST PERIOD.
f/ AVERAGE OF FOUR TEST RUNS (0.027 , 0.021 , 0.023 AND 0.024 GR/DSCF)
g/ AVERAGE OF TWO TEST RUNS (285 AND 159 PPMV)
h/ AVERAGE OF TWO TEST RUNS (0.043 AND 0.057 GR/DSCF)

SYMBOL (<) INDICATES BELOW DETECTABLE LIMIT. C-87-030

TABLE 6

PARTICULATE MATTER AND HYDROCHLORIC ACID
CONCENTRATIONS AND MASS EMISSION RATES

		PM		HCl	
		GR/DSCF	LB/HR	PPM	LB/HR
DATE RUN	NO.				
7-30-87	HCl-1S	-	-	315	5.79
7-31-87	HCl-2S	-	-	282	4.46
	HCl-3S	-	-	159	2.59
	M5-1S	0.027	0.74	-	-
	M5-2S	0.021	0.50	-	-
	M5-3S	0.023	0.55	-	-
	M5-4S	0.024	0.53	-	-
8-3-87	M5-5S	0.043	1.09	-	-
	M5-6S	0.057	1.38	-	-

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TABLE 9

PCDD/PCDF MASS EMISSION RATES IN STACK GAS
(ng/sec)

RUN # Sampling date	DT-1S 7-29-87	DT-2S 7-30-87	DT-3S 7-30-87
DIOXINS			
2,3,7,8-TCDD	0.24	< 0.11	0.140
Total TCDD	25.4	21.0	33.3
1,2,3,7,8-PeCDD	4.03	2.39	3.8
Total PeCDD	138	103	106
1,2,3,4,7,8-HxCDD	10.9	8.96	10.1
1,2,3,6,7,8-HxCDD	21.5	18.7	21.5
1,2,3,7,8,9-HxCDD	13.4	10.5	12.5
Total HxCDD	291	236	242
1,2,3,4,6,7,8-HpCDD	157	13.8	169
Total HpCDD	349	334	355
Total OCDD	237	265	269
Total PCDD	1041	959 **	1005
FURANS			
2,3,7,8-TCDF	6.51	4.86	6.05
Total TCDF	329	253	256
1,2,3,7,8-PeCDF	30.0	25.2	30.6
2,3,4,7,8-PeCDF	36.4	29.7	37.0
Total PeCDF	407	342	333
1,2,3,4,7,8-HxCDF	50.0	43.6	49.6
1,2,3,6,7,8-HxCDF	53.2	41.1	43.8
1,2,3,7,8,9-HxCDF	14.5	13.9	17.5
2,3,4,6,7,8-HxCDF	115	104	103
Total HxCDF	463	374	431
1,2,3,4,6,7,8-HpCDF	233	244	236
1,2,3,4,7,8,9-HpCDF	45.5	51.1	56.2
Total HpCDF	437	462	477
Total OCDF	381	404	396
Total PCDF	2016	1834	1893

NOTES
< indicates below limit of detection (MDL)
** - Total includes MDLs for homologues below the detection limit

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TABLE 16

MASS EMISSION RATES OF TRACE METALS IN STACK GAS

MASS EMISSION RATES, POUNDS/HOUR[a/]

RUN NO.	As.	Cd	Cr	Fe	Mn	Ni	Pb
M5-1S	0.45E-5	5.90E-4	9.84E-5	2.99E-3	1.14E-4	< 6.71E-5	7.65E-3
M5-2S	ND	1.86E-4	4.22E-5	3.12E-3	2.55E-5	< 6.09E-5	2.01E-3
M5-3S	ND	1.95E-4	5.20E-5	0.37E-3	1.67E-5	< 6.96E-5	2.97E-3
M5-4S	ND	2.07E-4	<4.87E-5	0.70E-3	0.31E-4	< 7.30E-5	2.34E-3
M5-5S	ND	6.68E-4	7.30E-5	1.52E-3	0.80E-4	< 9.13E-5	6.31E-3
M5-6S	0.11E-5	6.85E-4	1.16E-4	1.06E-2	2.55E-4	< 7.94E-5	1.23E-2

a/ Symbol (<) indicates below limit of detection.

ND Not Determined

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