PHASE I REPORT

Ash Quantification and Characterization Study

California Integrated Waste Management Board

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R.W. BECK
AND ASSOCIATES

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NOTE: Legislation (SB 63, Strickland, Chapter 21, Statutes of 2009) signed into law by Gov. Arnold Schwarzenegger eliminated the California Integrated Waste Management Board (CIWMB) and its six-member governing board effective Dec. 31, 2009.

CIWMB programs and oversight responsibilities were retained and reorganized effective Jan. 1, 2010, and merged with the beverage container recycling program previously managed by the California Department of Conservation.

The new entity is known as the Department of Resources Recycling and Recovery (CalRecycle).

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PHASE I REPORT
ASH QUANTIFICATION
AND
CHARACTERIZATION STUDY

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Ash Quantification and Characterization Study

1.0 INTRODUCTION

The State of California has a large urban and agricultural sector and, as a result, significant amounts of municipal solid waste (MSW), medical wastes, agricultural wastes, and municipal sewage sludge are generated in California. Some of these waste streams, such as agricultural waste and wood waste, are utilized as a fuel in boilers to generate steam or electricity. Other lower calorific value waste streams, such as sewage sludges, are incinerated for purposes of volume reduction prior to landfilling.

The California Integrated Waste Management Board (CIWMB) is interested in determining:

A. A list of operational waste fuel combustion facilities in the State and;

B. The characteristics of the incinerated residue ash.

Based on the characterization of the ash stream, CIWMB's ultimate goal is to determine methods or uses for the ash product. Recycling of the ash stream may result in significant savings of valuable landfill space.

This Phase I report summarizes data on the amount of ash generated in the state for all known existing operational waste fuel combustion facilities. This report also provides information on the technology, type of fuel, air pollution control equipment, location, and capacity of each combustion facility. Upon conclusion of this Phase I study, R. W. Beck and Associates (R. W. Beck) will proceed with the Phase II work which will include sampling and testing of ash from selected facilities.

2.0 STUDY OVERVIEW

Several State offices maintain records on different types of combustion facilities. For example, the California Energy Commission has a list of all energy generation facilities in California and the California Air Resources Board has a listing of all MSW and sewage sludge incineration facilities. The first task was to obtain a detailed listing of all operating incineration or waste-to-

energy generation facilities. R. W. Beck contacted the following State offices to determine the availability for the required information:

- California Air Resources Board
- California Energy Commission
- Department of Health Services

The California Air Resources Board is primarily concerned with air emissions from point sources and maintains a computerized listing of all operating combustion facilities in the State. The California Energy Commission maintains updated records on all energy generation facilities located within California. The Department of Health Services keeps data on all hospital and medical waste incinerators.

Individual data was requested from each of the above mentioned offices and a listing of each type of incineration facility was obtained. However, the data obtained was not sufficient for purposes of this study. For example, existing records did not indicate the quantity of ash generated and other pertinent details on the air pollution control equipment. Therefore, R. W. Beck followed up with a telephone survey. Each combustion facility was contacted to obtain additional data. Each facility operator was asked to provide data or to confirm the following information:

- Location of facility
- Type of fuel used
- Start date of operation
- Hours of operation
- Method of ash disposal
- Facility ownership
- Air pollution control equipment
- Previous ash testing
- Long term plans
- Seasonal fluctuations in ash generation
- Contact person
- Nameplate capacity
- Amount of fuel combusted
- Quantity of ash generated
- Location of ash disposal
- Facility expansion or closure plans
- Breakdown of total ash into bottom ash and fly ash
- Facility downtime for scheduled maintenance
- Combustion technology

Some biomass facilities use more than one type of fuel. With the help of the survey, this study attempted to determine the seasonal fluctuation and proportional changes in the fuel firing rates, if any, for biomass facilities.

Except for a few facilities that did not respond, the telephone survey was successful in offering reasonably accurate information. Some smaller facilities were not sure about the actual ash generation rates due to lack of record keeping and weighing of the incinerated residue. Contrary to initial CIWMB's expectations, the information reported by each facility is the best available

information and not exact data. This study provides data as reported by each participating facility and various state agencies. The reported data was not verified through site visitation nor evaluation of operating records. All data received by R. W. Beck were entered into a computerized data base in a matrix format. The appendices to this report include the matrix data base. Each appendix provides information for each facility type.

3.0 DATA ANALYSIS

This report provides a complete list of operational biomass, municipal solid waste, tire, sewage sludge, and medical waste incineration facilities in the State of California. It should be noted that only limited information pertaining to *small* medical incineration facilities is contained in this report. *Small* medical incineration facilities are those facilities with feedstock input rates of less than or equal to 1.0 ton per day.

3.1 BIOMASS COMBUSTION FACILITIES

Biomass is defined as a renewable fuel which includes wood and agricultural wastes. A substantial quantity of such waste is generated in California. Biomass has a heating value of between 3000 Btu per pound to 7000 Btu per pound and can be used to fuel steam and power generation facilities. Based on our survey and updated data from the California Energy Commission, 58 biomass fired steam or power generation facilities are operating in California. A listing obtained from the California Energy Commission (CEC) shows 66 facilities. However, the CEC listing included eight facilities that have shut down, therefore, presently there are only 58 operational facilities.

Table 1 provides a listing of the 58 operational facilities as well as four major facility parameters, which are; type of combustor, type of fuel, particulate control method, and nameplate boiler capacity of the facility. Table 1 shows that 15 facilities were equipped with fluidized bed reactors, 38 facilities have fixed or traveling grates, four facilities have pile burners, and one has an other type of furnace. The predominant fuel is wood waste. Table 1 shows that 39 facilities combust green wood wastes, five facilities combust only agricultural waste, one facility combusts animal waste and 13 facilities combust a combination of wood and agricultural waste including urban wood waste. It should be noted that a significant portion of the residue from biomass facilites is utilized as soil amendment.

The survey showed that there are no major changes in types of fuel used due to the seasonality factor. If more than one fuel is combusted in one facility, then the primary fuel is base loaded becuase it has a higher availability. The secondary and tertiary fuels are usually stockpiled and fed into the boiler at some consistent ratio with the primary fuel. Therefore, there are no substantial changes in fuel firing rates from season to season.

TABLE 1
BIOMASS COMBUSTION FACILITIES IN CALIFORNIA

No.	Project Name	Type of Combustor	Type of Fuel	Particulate Control Method	Nameplate Capacity (PPH Steam)
1	Auberry Energy Inc.	Bubbling bed	W 95% - Ag 5%	ESP	100,000
2	Big Valley Lumber Co	Pile burner	W	Multiclone, Afterburner	60,000
3	Blue Diamond Growers Cogeneration Plant	Fixed grate	UW 30% Ag 70%	Baghouse	125,000
4	Burney Forest Products	Fixed grate	W	Multiclone, ESP	159,000
5	Burney Mountain Power	Traveling grate	W	Multiclone, ESP	110,000
6	California Cedar Products	Fixed grate	W	Multiclone	34,000
7	Chowchilla Biomass Power Plant II	Bubbling bed	UW 55% Ag 45%	Multiclone, Baghouse	120,000
8	Collins Pine Co. Project	Fixed grate	W	ESP	140,000
9	Delano Energy Company Inc.	Fluidized bed	UW 50% Ag 50%	Baghouse	255,000
10	Diamond Walnut Power Plant	Fixed grate	Ag	Baghouse	60,000
11	Dinuba Energy, Inc.	Moving grate	W 85% Ag 15%	ESP	128,000
12	El Nido Biomass Power Plant	Bubbling bed	Ag	Baghouse	122,000
13	Fairhaven Power Co.	Fixed grate	W	ESP	180,000
14	Feather River Energy	Circulating bed	UW 20% W 50% Ag 30%	Multiclone, ESP	172,000
15	Fibreboard Corp. Powerhouse	Traveling grate	W	Multiclone	100,000

BIOMASS COMBUSTION FACILITIES CONTINUED					
16	Georgia Pacific Corp	Fixed grate	W	Wet Scrubber	385,000
17	Girvan Lumber Co.	Fixed grate	W	Multiclone	13,000
18	H.L. Power	Moving grate	W	ESP	315,000
19	Hi-Ridge Lumber	Fixed grate	W	Multiclone	40,000
20	Hudson ICS	Dutch Oven	W	Multiclone	16,000
21	Hudson Lumber	Fixed grate	W	Multiclone	90,000
22	Imperial Resource Recovery Projects	Moving grate	UW 99%, Ag 1%	Baghouse	366,000
23	Koppers Industries	Pile burner	W	Multiclone	60,000
24	Lincoln Cogeneration	Fixed grate	W	Multiclone, ESP	170,000
25	Lindsay Olive Growers	Fluidized sand bed	Ag	Baghouse	18,000
26	Louisiana Pacific, Oroville	Fixed grate	W	ESP	130,000
27	Madera Power Plant (Capco)	Bubbling bed	UW 75%, Ag 25%	Baghouse	280,000
28	Martell Cogen	Fixed grate	W	ESP	180,000
29	Masonite Plant	Fixed grate	W	Scrubber	220,000
30	Mendota Biomass Power, Ltd.	Fluidized bed	W 64% Ag 36%	Baghouse	250,000
31	Mesquite Lake Resource Recovery Project	Fluidized bed	Animal Waste	Baghouse	158,000
32	Michigan-California Lumber	Pile burners	W	Multiclone	120,000
33	Mt. Lassen Power	Traveling grate	W	Multiclone, ESP	105,000

BIOMASS COMBUSTION FACILITIES CONTINUED					
34	North Fork Energy	Bubbling bed	W 75% UW 20% Ag 5%	ESP	100,000
35	Operational Energy Company	Moving grate	Ag	Baghouse	192,000
36	Pacific Lumber Co.	Moving grate	W	ESP	450,000
37	Pacific Oroville Power	Fixed grate	W	ESP	180,000
38	Roseburg Lumber	Fixed grate	W	Dry and Wet Scrubbers	90,000
39	Schmidtbauer Lumber Co.	Fixed grate	W	Multiclone	30,000
40	Sierra Pacific Industries - Central Valley	Fixed grate	W	Multiclone, ESP	60,000
41	Sierra Pacific Industries - Hayfork	Fixed grate	W	Multiclone, ESP	130,000
42	Sierra Pacific Industries - Burney	Fixed grate	W	Multiclone, ESP	200,000
43	Sierra Pacific Industries - Quincy	Fixed grate	W	Multiclone, ESP	200,000
44	Sierra Pacific Industries - Loyalton	Fixed grate	W	ESP	200,000
45	Sierra Pacific Industries - Susanville	Fixed grate	W	Multiclone, ESP	160,000
46	Sierra Power	Fixed Grate	W	ESP	100,000
47	Signal Wheelabrator	Traveling grate	W	Multiclone, ESP	510,000
48	Soledad Energy Partnership	Fluidized bed	W	Multiclone, ESP	135,000
49	Stone Forest Industries	Fixed grate	W	No Response	20,000
50	Susanville Forest Products	Fixed grate	W	Multiclone	No Response
51	Tracy Biomass Plant	Vibrating Hydrograte	W	ESP	180,000
52	Tri-Valley Growers Plant	Fixed grate	Ag	Baghouse	60,000

BIOMASS COMBUSTION FACILITIES CONTINUED					
53	Ultrapower - Rocklin	Circulating bed	W	Multiclone, ESP	225,000
54	Ultrapower Chinese Station	Bubbling bed	UW, W, Ag	Multiclone, ESP	208,000
55	Ultrapower - Blue Lake	Moving grate	W	Multiclone, ESP	105,000
56	Ultrapower - Fresno	Circulating bed	W 50% Ag 50%	Multiclone, ESP	220,000
57	Woodland Biomass Power, Ltd.	Fluidized bed	W 60% Ag 40%	Baghouse	250,000
58	Forest Hill (Georgia Pacific Corp.)	Pile burner	W	Multiclone	32,000

Note:

The first column of this table corresponds to the facility number as in Appendix B.

Keys: *ESP - Electrostatic Precipitator*
Multiclone - Multiclone Separator
W - Green Wood Waste
Ag - Agricultural Waste
An - Animal Waste
UW - Urban Wood Waste

The biomass facilities surveyed use a variety of air pollution control equipment. Of the 58 facilities, 29 are equipped with electrostatic precipitators, 13 have baghouses and 12 have multiclone separators for controlling particulate emissions. In addition, three are facilities equipped with scrubbers and one facility did not respond in the survey. It should be noted that 15 of the 29 facilities using electrostatic precipitators are also equiped with multiclone units.

Each of the biomass facilities generates steam and the nameplate steam capacity for each facility is provided in Table 1. Multiple boilers may be included in the nameplate capacity figure. Note that the facilities may not continuously operate at the given nameplate capacity. With the help of the telephone survey, R. W. Beck requested that each facility provide data on annual ash generation rates. Precise information cannot be obtained from daily generation data due to operating capacity factors and facility downtime for scheduled and unscheduled maintenance. Our survey confirmed that in most cases the facilities could not provide us with actual data and only gave us their best estimate of ash generation rates for a given period. Therefore, the annual ash generation rate data in the appendices are the best available information. For details on the biomass facilities scheduled downtime, types of biomass fuel used, annual fuel consumption and ash generation rates see Appendix B.

Ash characteristics are influenced by three variables: the reactor combustion technology; fuel feedstock; and to a certain extent, the air pollution control equipment which captures fly ash. The characteristics of ash produced by these facilities is influenced most by the reactor combustion technology. The variation in ash characteristics due to fuel feedstock should be minimal because wood waste is the predominant fuel feedstock for biomass facilities (as seen in Table 1). Finally, the ash characteristics are impacted less by air pollution control equipment than the other two. Because combustion technology influences ash characteristics more than the other two variables, the facilities have been grouped by reactor combustion technology.

The following tables include the facility number in relation to the database matrix, the facility name, average fuel combustion, average ash generation, air pollution control equipment, fuel type and ash to fuel ratio for each of the boiler technologies. This was done to facilitate the selection of representative facilities for sampling.

Table 2 provides a listing of all 15 operational biomass facilities which utilize fluidized bed technology and also lists the facilities by their primary particulate control equipment. The table shows that about 7,050 tons per day of biomass waste fuel is burned in fluidized bed reactors and the average ash generation rate from all 15 facilities is about 600 tons per day.

Table 3 shows the biomass combustion facilities equipped with fixed grate systems. The table is also broken down by the primary particulate control equipment. There are 27 operational fixed grate biomass combustion facilities.

Finally, Table 4 provides information about the 11 biomass facilities with moving grates, and Table 5 provides a list of other types of combustion reactors used in the State's biomass facilities.

TABLE 2
BIOMASS FACILITIES WITH FLUIDIZED BED TECHNOLOGY
(SEGREGATED BY PARTICULATE CONTROL EQUIPMENT)

No.	Name	Average Fuel Combustion (TPD)	Average Ash Generation (TPD)	Air Pollution Control Equipment	Fuel	Ash to Fuel Ratio (wt %)
			BAGHOUSE			
7	Chowchilla Biomass Power Plant II	312	96	Baghouse, DeNOx	UW, Ag	30.7
9	Delano Energy Co.	720	36	Baghouse, DeNOx	UW, Ag	5.0
12	El Nido Biomass Power Plant	300	28	Baghouse, DeNOx, SO_2 Control	Ag	9.2
25	Lindsay Olive Growers	30	<1	Baghouse, DeNOx	Ag	0.5
27	Madera Power Plant	624	44	Baghouse, DeNOx	UW, Ag	7.0
30	Mendota Biomass Power	650	25	Baghouse, DeNOx	W, Ag	3.9
57	Woodland Biomass Power	600	50	Baghouse, DeNOx	W, Ag	8.3
31	Mesquite Lake R.R. Project	960	160	Baghouse, Flue Gas Recirculation	Ag	16.7
			ELECTROSTATIC PRECIPITATORS			
1	Auberry Energy	432	9	3-Cell ESP	W, Ag	2.0
34	North Fork Energy	432	7	ESP	W,UW, Ag	1.6
14	Feather River Energy	132	31	Multiclone, ESP	UW,W, Ag	23.5
53	Ultrapower - Rocklin	576	26	Multiclone, ESP	W	4.5
56	Ultrapower - Fresno	500	50	Multiclone, ESP	UW, Ag	10.0
48	Soledad Energy Partnership	288	30	Multiclone, ESP, DeNOx, SO_2 Control	W	10.3
54	Ultrapower - Chinese Station	500	13	Multiclone, ESP, DeNOx	UW,W, Ag	2.5
	TOTALS	7,056 TPD	605 TPD			

Note:

The first column of this table corresponds to the facility number as in Appendix B.

TABLE 3
BIOMASS FACILITIES WITH FIXED GRATE COMBUSTION REACTORS
(SEGREGATED BY PARTICULATE CONTROL EQUIPMENT)

No.	Name	Average Fuel Combustion (TPD)	Average Ash Generation (TPD)	Air Pollution Control Equipment	Fuel	Ash to Fuel Ratio (wt %)
			BAGHOUSE			
3	Blue Diamond Growers	192	7	Baghouse	UW, Ag	3.7
10	Diamond Walnut Power Plant	115	2	Baghouse	Ag	1.6
52	Tri-Valley Growers Plant	34	3	Baghouse	Ag	7.4
			ELECTROSTATIC PRECIPITATOR			
8	Collins Pine Co.	320	4	ESP	W	1.2
13	Fairhaven Power Co.	912	28	ESP	W	3.0
26	Louisiana Pacific	438	8	ESP	W	1.9
28	Martell, Cogeneration	450	40	ESP	W	8.9
37	Pacific Oroville Power	468	11	ESP	W	2.4
24	Lincoln Cogeneration	186	16	Multiclone, ESP	W	8.4
41	Sierra Pacific Industries - Hayfork	528	4	Multiclone, ESP	W	0.7
42	Sierra Pacific Industries - Burney	960	9	Multiclone, ESP	W	1.0
43	Sierra Pacific Industries - Quincy	660	9	Multiclone, ESP	W	1.4
45	Sierra Pacific Industries - Susanville	780	8	Multiclone, ESP	W	1.0
4	Burney Forest Products	520	63	ESP, DeNOx	W	12.1
40	Sierra Pacific Industries - Central Valley	144	1	Multiclone, ESP, DeNOx	W	0.4
44	Sierra Pacific Industries - Loyalton	52	6	ESP, DeNOx	W	12.1
46	Sierra Power	237	4	ESP DeNOx	W	1.5

TABLE 3
BIOMASS FACILITIES WITH FIXED GRATE COMBUSTION REACTORS
(SEGREGATED BY PARTICULATE CONTROL EQUIPMENT)

No.	Name	Average Fuel Combustion (TPD)	Average Ash Generation (TPD)	Air Pollution Control Equipment	Fuel	Ash to Fuel Ratio (wt %)
(TABLE 3 CONTINUED)			MULTICLONE SEPARATOR			
17	Girvan Lumber Co.	18	<1	Multiclone	W	0.5
19	Hi-Ridge Lumber	25	1	Multiclone	W	2.5
6	California Cedar Products	42	1	Multiclone, Wet Scrubber	W	1.6
21	Hudson Lumber	384	27	Multiclone, Scrubber	W	7.0
29	Masonite Plant	205	19	Multiclone, Scrubber	W	9.2
			OTHERS			
50	Susanville Forest Products	120	1	No response	W	1.0
16	Georgia Pacific Corp.	900	30	Wet Scrubbers	W	3.3
38	Roseburg Lumber	110	7	Dry Particulate and Wet Gas Scrubbers	W	6.0
39	SchmidtBauer Lumber Co.	36	4	Flue Gas Recirculation	W	11.8
49	Stone Forest Industries	40	<1	Unknown	W	0.03
	TOTAL	8,876	313			

Note:

The first column of this table corresponds to the facility number as in Appendix B.

TABLE 4
OPERATIONAL BIOMASS FACILITIES WITH MOVING GRATES SEGREGATED BY PARTICULATE CONTROL EQUIPMENT

No.	Name	Average Fuel Combustion (TPD)	Average Ash Generation (TPD)	Air Pollution Control Equipment	Fuel	Ash to Fuel Ratio (wt %)
			BAGHOUSE			
22	Imperial Resource Recovery Project	500	50	Baghouse, DeNOx and Dry Scrubber	UW, Ag	10.0
35	Operational Energy Co.	600	120	Baghouse	Ag	20.0
			ELECTROSTATIC PRECIPITATOR			
11	Dinuba Energy Inc.	552	20	ESP	W, Ag	3.6
18	Honey Lake Power	648	27	ESP	W	4.2
36	Pacific Lumber Company	2,016	40	ESP	W	2.0
51	Tracy Biomass Plant	400	25	ESP	W	6.3
5	Burney Mountain Power	456	6	Multiclone, ESP	W	1.4
33	Mt. Lassen Power	312	13	Multiclone, ESP	W	4.2
55	Ultrapower - Blue Lake	288	22	Multiclone, ESP	UW, Ag	7.7
47	Signal Wheelabrater	2,400	70	Multiclone, ESP, DeNOx	W	2.9
			MULTICLONE SEPARATOR			
15	Fibreboard Corp Powerhouse	270	6	Multiclone, Wet Scrubber	W	2.2
	TOTAL	8,442	399			

Note:

The first column of this table corresponds to the facility number as in Appendix B.

TABLE 5
BIOMASS FACILITIES WITH OTHER TYPES OF COMBUSTION REACTORS SEGREGATED BY PARTICULATE CONTROL EQUIPMENT

No.	Name	Average Fuel Combustion (TPD)	Average Ash Generation (TPD)	Technology	Air Pollution Control Equipment	Fuel	Ash to Fuel Ratio (wt %)
			MULTICLONE SEPARATOR				
20	Hudson ICS	20	<1	Dutch Oven	Cyclone Separator	W	0.5
2	Big Valley Lumber Co.	100	2	Pile Burner	Multiclone, Afterburner	W	2.0
23	Kopper Industries	110	5	Pile Burner	Multiclone	W	4.0
32	Michigan-California Lumber	240	9	Pile Burner	Multiclone	W	3.5
58	Forest Hill (Georgia Pacific Corp.)	34	<1	Pile Burner	Multiclone	W	0.15
	TOTAL	504	16				

Note:

The first column of this table corresponds to the facility number as in Appendix B.

3.2 MUNICIPAL SOLID WASTE COMBUSTION FACILITIES

There are currently only three operating MSW waste-to-energy facilities in California. Table 6 provides the location and names of the three operating MSW waste-to-energy facilities.

TABLE 6
OPERATIONAL MUNICIPAL SOLID WASTE COMBUSTION FACILITIES

Name	Average Fuel Combustion (TPD)	Average Ash Generated (TPD)	Air Pollution Control Equipment	Location (City, County)
Commerce Refuse to Energy Facility	360	115	Dry Scrubber, Baghouse, Thermal DeNOx	Commerce, Los Angeles
Southeast Resource Recovery Facility (SERRF)	1,320	436	Dry Scrubber, Baghouse, DeNOx	Long Beach, Los Angeles
Stanislaus County Resource Recovery Facility	800	232	Dry Scrubber, Baghouse, DeNOx	Crows Landing, Stanislaus
TOTAL	2,480	783		

The data in Table 6 shows that about 2,500 TPD of MSW is combusted as a fuel and about 780 TPD of ash is generated from these three facilities. On the average, the ash stream is about 30 percent of the incoming fuel due to the glass, metals, fines and other non-combustibles present in the MSW waste stream. The Stanislaus facility is recovering ferrous metals from the residual ash. The metals reclaimed constitute about 3 percent of the fuel feedstock. All three facilities are equipped with state-of-the-art air pollution control equipment to capture the fly ash. All three MSW combustion facilities are also equipped with DeNOx equipment to reduce quantities of nitrogen oxides emitted in the atmosphere. All of the MSW combustion facilities dispose of their ash in local landfills.

At this time, facility operators at the Commerce facility are constructing an ash treatment system for their plant while facility operators at SERRF are designing an ash treatment system for their plant. The treatment process is scheduled to be operational in both facilities by June of 1992. The facilities' treated ash is supposed to bind certain toxic metals and make them less leachable in landfills.

3.3 MEDICAL WASTE INCINERATION FACILITIES

There are 73 operational medical waste incineration facilities in California (See Appendices D1 and D2). However, only seven of the surveyed facilities have feedstock input rates of greater or equal to 1.0 TPD. Table 7 below identifies the seven medical incineration facilities which responded and the 1 facility which did not respond.

TABLE 7
OPERATIONAL MEDICAL WASTE INCINERATION FACILITIES WITH INPUT OF GREATER THAN 1.0 TPD

Name	Average Ash Generation (TPD)	Air Pollution Control Equipment	Average Waste Combustion (TPD)
Alexian Brothers Hospital	0.02	Afterburner	1.3
American Environmental Management Corporation*	0.96	Acid gas scrubber Baghouse	7.8
Integrated Environmental Systems	5.77	Afterburner, Acid gas scrubber, Particulate scrubber	15.9
Roseville Community Hospital	0.16	Afterburner	1.2
St. Lukes Hospital	1.25	Afterburner, Particulate scrubber	1.5
St. Rose Hospital	0.34	Afterburner	1.0
Stanford University Environmental Safety	0.78	Afterburner, Particulate scrubber	1.5
**Thermal Combustion Innovators	No response	No response	1.3
TOTAL	9.28		31.5

Note:

**This is the only facility in Table 7 that operates on a 24 hour and 7 day basis.*

*** This facility did not respond to the survey. Information provided for this facility is a result of C.I.W.M.B. data.*

Table 7 shows that only about 9 TPD of ash is generated from the medical facilities that responded to the survey. All of the remaining ash from medical waste incineration facilities is disposed of in landfills. One large scale medical waste combustor, Thermal Combustion Innovators located in San Bernardino County, refused to respond to our survey. CIWMB sources indicate that this facility combusts about 300 pounds per hour and operates for about

2600 hours per year. For details on annual ash generation rates from each facility see Appendix D1.

Note that there are another 64 small scale medical waste incinerators operating in the State. These facilities generate insignificant quantities of ash and therefore are not listed in Table 7, however, for informational purposes, they are listed under Appendix D2.

3.4 SEWAGE SLUDGE INCINERATION FACILITIES

There are only six operational sewage sludge incineration facilities in California. A listing of the six is provided in Table 8. This table shows that about 35 TPD of ash is generated in California from all six operating facilities. Ash from sewage sludge incineration facilities is disposed of in various ways. One facility disposes of ash on site, one facility in a local landfill, one in an out-of-state landfill, and two facilities truck ash to a copper smelter in Arizona. In addition, facility operators at the Contra Costa Sanitation District site only landfill a portion of their material and have developed an alternative use for ash as a light weight aggregate material in order to recycle the remaining portion.

Table 8 also provides data on the air pollution control equipment for each facility. For additional details on the operational sewage sludge incineration facilities see Appendix E.

TABLE 8
OPERATIONAL SEWAGE SLUDGE INCINERATION FACILITIES

Name	Average Fuel Combustion (TPD)**	Average Ash Generated (TPD)	Air Pollution Control Equipment	Location (City, County)
City Of Barstow *	3	<1	Wet Scrubber	Barstow, San Bernardino
City Of San Mateo	10	2	Wet Scrubber	San Mateo, San Mateo
Contra Costa Sanitation District	36	5	Multiclone, Wet Scrubber	Martinez, Contra Costa
Doc May Regional WWTP	15	3	Impingement Tray	Palo Alto, Santa Clara
Hyperion Treatment Plant	40	20	Wet Scrubber, Baghouse	Playa Del Mar, Los Angeles
South Tahoe PUD	11	4	Wet Scrubber	S. Lake Tahoe, El Dorado
TOTAL	115	34		

Note:

**This facility does not operate on a 24 hour and 7 day basis.*
*** Figures were reported as dry tons.*

3.5 TIRE INCINERATION FACILITIES

Our survey located only one tire waste to energy facility which is located near Modesto, California. Table 9 provides the average fuel combustion and the ash generation rate for this facility. The Modesto facility claims that it is selling its fly ash to a to a metal reclaimer and resmelter, is currently stockpiling its bottom ash and is selling the scrubber blow down as a soil amendment. The bottom ash is stockpiled for future sale or disposal.

TABLE 9
OPERATIONAL TIRE INCINERATION FACILITIES

Name	Average Fuel Combustion (TPD)	Average Ash Generated (TPD)	Air Pollution Control Equipment	Location (City, County)
Modesto Tire-to-Energy Facility	144	18	Wet Scrubber, Baghouse, Denox	Westley, Stanislaus

For additional details on facility ownership and other facility data, refer to Appendix F.

4.0 CONCLUSIONS

Based on the existing data base maintained by the California Air Resources Board, information from the California Energy Commission and the Department of Health Services, and a comprehensive follow-up survey by R. W. Beck, it is determined that about 27,649 TPD of solid waste fuel is combusted in the State of California. This solid waste fuel includes biomass, tires, sewage sludge, agricultural waste, medical waste, and municipal solid waste. There is only one permitted tire waste-to-energy facility in California and there are six operational sludge sludge incineration facilities. The combustion of these materials results in an ash residue and the survey data indicates that approximately 2,173 TPD of ash is generated from all facilities. A breakdown of the ash streams from the different sectors is provided in Table 10.

TABLE 10
ASH GENERATION BY TYPE OF FACILITY

Type of Facility	Number of Facilities	Average Fuel Combustion (TPD)	Average Ash Generation (TPD)	Percentage Ash Contribution
Biomass	58	24,878	1,328	61.1%
Municipal Solid Waste	3	2,480	783	36.1%
Medical Waste	8	32	10	0.5%
Sewage Sludge Incineration-	6	115	34	1.6%
Tire Incineration	1	144	18	0.8%
TOTALS	76	27,649	2,173	100%

* Estimates recorded as dry weight equivalents.

Table 10 shows that ash is predominately generated by biomass-to-energy facilities and that the three MSW facilities generate about a third of the total ash while combusting less than one tenth of the total fuel.

All three municipal solid waste-to-energy facilities are operating at design capacity and generate about 780 TPD of ash which is landfilled. Two waste-to-energy facilities located in Los Angeles County have initiated implementation of an ash treatment process at their facilities. The survey data show that minimal quantities of medical waste are being combusted.

Table 11 summarizes the biomass combustion technology data and the different combustion technologies and particulate control methods for the biomass facilities. In addition, the biomass facilities survey data shows the three major combustion technologies - fluidized bed, fixed grate, and moving grate - are used by 53 of the 58 operating facilities. The sampling program should include a variety of facilities to determine if there is a wide variation in the ash characteristics generated from different types of fuels, combustion reactors, and particulate control technologies.

TABLE 11
SUMMARY OF BIOMASS FACILITIES

Combustion Technology	No. of Facilities with Baghouse	No. of Facilities with ESP	No. of Facilities with Multiclone	No. of Facilities with Other Types of Particulate Control Equipment
Fluidized Bed	8	7	0	0
Fixed Grate	3	14	5	5
Moving Grate	2	8	1	0
Other Type	0	0	5	0
TOTALS	13	29	12	4

APPENDIX A1

Matrix Abbreviations and Conversion Factors

ABBREVIATIONS:

Fuels:

W = Wood Waste
V = Virgin Wood
Ag = Agricultural Waste
An = Animal Waste
LPG = Liquid Propane Gas
UW = Urban Wood Waste
F = Fuel Oil
G = Natural Gas
P = Propane
D = Diesel Fuel
T = Tires

CONVERSION FACTORS:

Volume:

7.48 Gallons/Cubic Foot
0.1337 Cubic Feet/Gallon
0.00465 Cubic Yards/Gallon

Average Ash Density:

**1255 Pounds/Cubic Yard
46 Pounds/Cubic Foot
6.150 Pounds/Gallon

Other:

2000 Pounds/Ton
27 Cubic Feet/Cubic Yard
365 Days Per Year
52 Weeks Per Year

Facilities:

BIO = Biomass Incineration Facilities
MED = Medical Waste Incineration Facilities
MSW = Municipal Solid Waste Facilities
TIR = Tire Incineration Facilities
(UC) = Incineration Facilities that were identified as under construction during the study period.

NOTES:

Only for select Medical Facilities with <1 TPD average waste combustion : If "Ash Quant Gend" (Survey Response) does not reasonably correlate with the "Estimated Quant of Fuel Burned" for any incineration facility, then the "Estimated Quant of Ash Gend (TPY)" will equal 10 percent of the "Estimated Quant of Fuel Burned."

** Source: Ash Density (1255 Pounds per Cubic Yard)
NSWMA - Technical Bulletin #85-6, Basic Data: Solid Waste Amounts, Composition and Management Systems. October 1, 1985. Cited from: Engineering Principles and Management Issues, 2nd Edition. Draft. George Tchobanoglous, Hulary Theisen, and Sam Vigil. UCD, Department of Civil Engineering. Fall, 1990. Under permision from the author.

Ash density used when a facility was unable to provide volume and\or weight estimates of ash generation that were reasonablly accurate.

unknown Biomass Facilities Only: If "Ash Quant Gend" (Survey Response) is "unknown," then "Ash Quant Gend (TPY)" equals 6 percent of the "Estimated Quant Fuel Burned."

APPENDIX A2

Methodology and Column Descriptions for the Presentation of Survey Data

INTRODUCTION

This section presents the methodology for the compilation of the Phase I Report of the Ash Quantification and Characterization Study performed for the California Integrated Waste Management Board (CIWMB) by R. W. Beck and Associates (the Consultant). Phase I of the Ash Quantification and Characterization Study has been devised to gather data from biomass incineration facilities, municipal solid waste incineration facilities, medical waste incineration facilities, sewage sludge facilities, and tire incineration facilities throughout California.

DATABASE DEVELOPMENT

It was necessary to determine exactly what data was needed by CIWMB in order to establish a comprehensive database of incineration facilities in California. Information pertaining to key elements from each facility were determined by CIWMB and listed in the database. Data gathering techniques were then implemented to acquire the information. First, data gathered from existing sources (secondary data) was obtained for each facility, then data obtained directly from incineration facilities (primary data), followed. Both secondary data and primary data were used to furnish or confirm the following information:

- Location of Facility
- Type(s) of Fuels Used
- Start Date of Operation
- Hours of Operation
- Method(s) of Ash Disposal
- Facility Ownership
- Air Pollution Control Equipment
- Previous Ash Testing
- Seasonal Fluctuations in Ash Generation
- Long Term Plans
- Contact Person
- Nameplate Capacity
- Amount of Fuel Combusted
- Quantity of Ash Generated
- Location of Ash Disposal
- Facility Expansion or Closure Plans
- Generation of Bottom Ash and Fly Ash
- Scheduled Facility Downtime
- Combustion Technology

Table A-2 provides the detailed matrix information and definitions used to provide the facility information above.

SECONDARY DATA

The first task was to obtain a detailed listing of all operating incineration or waste-to-energy facilities. In order to obtain this information, the Consultant contacted the California Air Resources Board, the California Energy Commission, and the California Department of Health Services.

The California Air Resources Board is primarily concerned with air emissions from point sources and maintains a computerized listing of all operating combustion facilities in the State. The California Energy Commission maintains updated records on all energy generation facilities located within California. The Department of Health Services keeps data on all hospital and medical waste incinerators.

Individual data was requested from each of the above mentioned government offices and a listing of each type of incineration facility was obtained. Table A-1 shows the type of facility and the corresponding secondary data that was used in the preliminary portion of the study.

TABLE A-1
SECONDARY DATA SOURCES

Incineration Facility Type	Secondary Data Source
Biomass Facilities	State of California Air Resources Board Air Pollution Control at Resource Recovery Facilities 1991 Update, May 1991. State of California Energy Commission California Biomass Facility Directory Survey Report, by NEOS Corporation for the California Energy Commission, January 22, 1991
Municipal Solid Waste Facilities	State of California Air Resources Board Air Pollution Control at Resource Recovery Facilities 1991 Update, May 1991.
Medical Waste Facilities	State of California Department of Health Services Inventory. (Agency Database)
Sewage Sludge Facilities	State of California Air Resources Board Air Pollution Control at Resource Recovery Facilities 1991 Update, May 1991.
Tire Facilities	State of California Air Resources Board Air Pollution Control at Resource Recovery Facilities 1991 Update, May 1991.

The data obtained from these sources was not, by itself, sufficient for the purposes of this study. For example, existing records did not indicate the quantity of ash generated and other pertinent details on the air pollution control equipment. Thus, the data presented in Table A-1 was sufficient only to supply a preliminary database.

PRIMARY DATA

For the purposes of this study, a more comprehensive computerized database was required. In order to develop the database, the collection of additional data for each facility was necessary. A telephone survey was developed to collect the additional primary data from each facility and necessary calculations were performed to consolidate available survey information into a comprehensive format. To conduct the survey, each facility was contacted and the person responsible for supervising incineration activities (the contact) was asked to provide updated information pertaining to the facility.

Except for a few facilities that did not respond to the Consultant's telephone calls, the telephone survey was successful in offering reasonably accurate information. Some low ash generating medical incineration facilities kept few or no records pertaining to fuel burned and ash generated, therefore the accuracy of these facilities may be crude.

COMPLETE DATABASE
(Column Names and Descriptions)

The complete set of information was developed and organized into a Microsoft® EXCEL® database matrix and presented in the Phase I Appendices. The matrix data and definitions included are explained in the following table:

TABLE A-2
DATABASE MATRIX OF INTERPRETATION FOR THE PHASE I REPORT OF THE ASH QUANTIFICATION AND CHARACTERIZATION STUDY

Matrix Information (Origin of Information)	Definitions for Matrix Information
Facility Type (secondary data and survey response)	The general classification of fuel that the facility incinerates. (i.e. MSW, Biomass, Sewage...)
Facility Name (secondary data and survey response)	The facility's permitted name.
Street (secondary data and/or survey response)	The permitted facility street address.

TABLE A-2
DATABASE MATRIX OF INTERPRETATION FOR THE PHASE I REPORT OF THE ASH QUANTIFICATION AND CHARACTERIZATION STUDY

Matrix Information (Origin of Information)	Definitions for Matrix Information
City (secondary data and/or survey response)	The city or area in which the facility is located.
Zip Code (secondary and/or survey response)	The mailing address zip code of the facility.
County (secondary data and/or survey response)	The county in which the facility is located.
Contact Person (secondary data and/or survey response)	The person contacted in the telephone survey. All persons contacted in the telephone survey were individuals supervising incineration activities with the exception of maintenance employees responsible for incineration at a small number of medical facilities.
Phone Number (secondary data)	The area code and telephone number of the facility.
Type of Fuel (survey response)	The distinctive types of fuel burned by the facility.
Nameplate Capacity (survey response)	Rated steam output of the boiler in pounds per hour. The Consultant had to calculate and make estimates with some varying assumptions.
Boiler Burn Technology (survey response)	Information of the facility's combustion grate technology or the combustion reactor.
Start Date (survey response)	The date that the facility was fully commissioned to begin operations.
Amount of Fuel Combusted (survey response)	The contact's response concerning the amount of fuel combusted by the facility. The respondent was asked to provide the average amount of fuel incinerated by the facility for a measurable time frame. The average amount of fuel incineration is defined as the total fuel burned for a period of time with all unscheduled downtime as well as unused facility capacity being accounted for. The facilities were not uniform in their practices for measurements, therefore measurement units and time frames vary.
Hours of Operations (survey response)	The hours of facility operation per 24 hour period.

TABLE A-2
DATABASE MATRIX OF INTERPRETATION FOR THE PHASE I REPORT OF THE ASH QUANTIFICATION AND CHARACTERIZATION STUDY

Matrix Information (Origin of Information)	Definitions for Matrix Information
Quantity of Ash Generated (survey response)	The contact's response concerning the amount of ash generated by the facility. The respondent was asked to provide the average amount of ash generated by the facility for a measurable time frame. The average amount of ash generation is defined as the total ash generation for a period of time with all unscheduled downtime as well as unused facility capacity being accounted for. The facilities were not uniform in their practices for measurements, therefore measurement units and time frames vary.
Method of Ash Disposal (survey response)	The contact's response concerning the method of ash disposal/removal utilized by the facility. The respondent was asked to provide all methods of ash disposal and/or other types ash removal.
Location of Ash Disposal (survey response)	The contact's response concerning the location of ash disposal/recycling by the facility. The respondent was asked to provide the location (relative to the incineration facility) where the facility's ash is transported after extraction from the facility incinerator.
Facility Ownership (survey response)	The name of the entity who/which is the permitted owner of the facility.
Expansion or Closure Plans (survey response)	The contact's response concerning foreseen expansion and/or closure plans anticipated by the facility.
Air Pollution Control Equipment (survey response)	This refers the contact's response concerning the air pollution control equipment that is in place and operational at the facility. The respondent was asked to provide information about all operational air pollution control equipment utilized.
Bottom versus Fly Ash (generation) (survey response)	The contact's response concerning the proportion of bottom ash total generation to fly ash total generation. The respondent was asked to provide a proportion of bottom ash generation to fly ash generation or the total generation of bottom ash and fly ash.
Previous Ash Testing (survey response)	The contact's response concerning any previous ash testing occurring at the facility. The respondent was asked to provide the time frame in which testing takes place and any brief details pertaining to the testing.

TABLE A-2
DATABASE MATRIX OF INTERPRETATION FOR THE PHASE I REPORT OF THE ASH QUANTIFICATION AND CHARACTERIZATION STUDY

Matrix Information (Origin of Information)	Definitions for Matrix Information
Seasonal Fluctuations in (ash) Generation (survey response)	The contact's response concerning any seasonal fluctuation of ash generation by the facility. The respondent was asked to provide any available information or assessment of seasonal fluctuation in fuel burned or ash generation.
Scheduled Facility Downtime (survey response)	The contact's response concerning the facility's scheduled downtime or non-operational periods. The respondent was asked to provide the total amount of time that the facility is scheduled to be non-operational. If downtime was not scheduled, the amount of maintenance downtime for the prior year was used.
Long Term Plans (survey response)	The contact's response concerning foreseen long term plans. This question was designed to re-examine expansion and/or closure plans anticipated by the facility. The respondent was asked to provide any information pertaining to the facility's long term plans.
Notes (survey response)	This is any unique information pertaining to the facility.
Estimated Quantity of Ash Generated TPD (calculated)	Estimated quantity of ash generated (TPD) based on contact's response to "Quantity of Ash Generated" question, taking into account quantity of ash, hours per day of operation, and facility downtime.
Estimated Quantity of Fuel Burned TPD (calculation)	Estimated quantity of fuel burned (TPD) based on contact's response to "Amount of Fuel Combusted" question, taking into account quantity of ash, hours per day of operation, and facility downtime.
Estimated Quantity of Ash Generated TPY (1) (calculation)	Ash generated (TPY) based on contact's response to "Quantity of Ash Generated" question, taking into account quantity of ash, hours per day of operation, and facility downtime.
Percent Ash to Fuel (calculation)	The ratio of "Estimated Quantity of Ash Generated (TPD)" to "Estimated Quantity of Fuel Burned (TPD)."
Days down per year (calculation)	Days per year that the facility was non-operational, based on the contacts response to the "Facility Downtime" question.

CONCLUSION

The database provides a list of operational waste fuel combustion facilities in California and summarizes data on several aspects of each facility. The database was developed using secondary information from a number of California State agencies and further added to, refined and updated by the Consultant through the use of a specialized telephone survey. The updated information contained in this database will help the CIWMB analyze the State's "ash stream" and provide a comprehensive list of state waste fuel incineration facilities.

Ash Sampling Methodology

INTRODUCTION

This document provides general guidelines on approaches for the sampling of ash from biomass waste, medical waste, municipal solid waste, and tire incineration facilities. Readers of this document are reminded that this is a general methodology and must be adapted to the particular facility under consideration. For example, bottom ash may not be mixed with fly ash at each facility. Therefore, the actual sampling points, or type of samples obtained, may vary from facility to facility.

SAMPLING PROCEDURE

The objective of sampling and analysis is to assess the properties of the waste being generated. Each residual waste stream that is stored, transported, or disposed of as a separate unit is considered to be a discrete waste and must be evaluated accordingly. Different facility designs may produce different waste streams, which may be mixed on a conveyer system or a storage area and may not be managed separately. Therefore, depending on the design of each facility, it will be determined if a separate fly ash and bottom ash sample or mixed sample is to be obtained. However, the focus of this study is to sample the mixed waste stream and not individual waste streams.

There are two methods for sampling of the ash; (1) sampling from the particular facility's ash discharge conveyor and (2) sampling from a truck or ash storage area. The methodology presented here is based on sampling from the ash discharge conveyor.

A. SAMPLING FROM MUNICIPAL SOLID WASTE FACILITIES

1. An overview of the MSW sampling program is shown in Figure 1.

2. Keeping in perspective that the goal is to obtain representative samples, determine the most convenient location for sampling. Accessibility and adequate space for sample preparation is required. The best location is at the ash drag chain or conveyor belt head pully area.

3. To facilitate sampling, a minimum of a fork lift and a 3-cubic yard bin will be required. Coordinate with plant manager to ensure availability of these two equipment items.

4. At the discharge point of the conveyor, collect about a one-cubic yard sample in the 3-cubic yard bin every two hours for a period of six hours over the operation of one normal day. Empty bin between collections and keep samples separate. Obtain samples from as close to the head pulley as possible.

5. The bulk density of the ash sample is assumed to be 50 lbs. per cubic foot. Therefore, each one cubic yard sample will weigh about 1,350 lbs.

6. Each 1,350 lbs. ash sample will be screened to determine the quantity of material that is greater than two inches and the quantity of material that is less than two inches in size. All material greater than two inches will be identified and separated into the following categories:

   - Organics
   - Slag
   - Concrete
   - Others
   - Rock/stone
   - Asphalt
   - Brick
   - Ferrous

   With the help of a magnet, remove and weigh ferrous material from the under two inch material.

7. Thoroughly mix the material under two inches and proportionally combine it with that days other two samples of material under two inches. Initiate the cone and quarter process in accordance with ASTM test methods C702-87, Standard Practice for Reducing Field Samples of Aggregate to Testing Size, Method B-Quartering. After forming a cone of the composite ash sample, proceed to flatten the cone with a shovel, and then divide the flattened cone into four quarters. Combine two opposite quarters to obtain one sample. Repeat the coning and quartering process with the material until four 200 lb. samples are obtained.

8. With the four 200 lb. samples proceed as follows:

   (a) Double bag, identify, date, and ship one 200 lb. sample to the material testing laboratory (Geofon Inc.). Note that for handling purposes the sample can be divided and packed in several bags and cartons and all 200 lbs. need not be packed in one carton.

(b) From Step 7, take one 200 lb. sample and following the quartering and coning procedure, reduce it to about 50 lbs. Double bag, identify, date, and ship the 50 lb. sample to the analytical laboratory (CKY Inc.).

(c) From Step 7, double bag, identify, date and store one 200 lb sample until the end of the three day sampling event. At the end of the third day one composite sample of 200 lbs. is to be selected on a random basis. Divide by the coning procedure. One approximately 150 lbs random composite sample will be shipped to the materials laboratory, and one approximately 50 lb. sample will be shipped to the analytical laboratory.

(d) Discard the fourth sample.

9. The two laboratories are to be notified on the date the sample is mailed. Both laboratories will proceed to prepare for incoming samples and follow all established procedures for materials and analytical testing.

10. Both laboratories will hold the sample marked "random" for exactly 30 days from sampling date prior to initiating testing.

11. As shown in Figure 1, the total number of samples obtained will be four from each event, and 16 samples from the whole program. Both laboratories will receive four samples each at the end of each event and sixteen samples each at the end of the program.

12. Each laboratory will provide a minimum of four reports, one report for each event.

Insert Figure 1

B. SAMPLING FROM MEDICAL WASTE FACILITIES

1. An overview of the medical waste sampling program is shown in Figure 2.

2. Determine the most convenient location for sampling. Accessibility and adequate space for sample preparation is required. The best location for sampling is at the ash drag chain or conveyor head pully area.

3. To facilitate sampling, a 90 gallon plastic container will be required.

4. At the discharge point of the ash discharge conveyor, collect about 100 lbs. of material, a minimum of six times at hourly intervals over the operation of one normal day.

5. Screen each 100 lb. sample to determine the quantity of material greater than two inches, and the quantity of material less than two inches in size. All material greater than two inches will be identified and separated into the following categories:

   - Organics
   - Inerts
   - Slag
   - Ferrous

   With the help of a magnet, remove and weigh ferrous material from the under two inch material.

6. Thoroughly mix each 100 lb. sample (less than two inch material). Using the coning and quartering procedure described above, remove about 25 lbs. of sample from each 100 lb. sample. As shown in Figure 2, six 25 lb. samples will be shipped to the analytical laboratory at the end of each sampling day.

7. As shown in Figure 2, for each day of sampling make two composites (one from Sample #1, 2, 3, and one from Sample #4, 5, 6). Proportional composites will be made of the less than two inch material, minus the 25 lbs. of material already removed for the analytical laboratory.

8. At the end of each sampling day, the eight samples obtained will be individually shipped to the respective laboratories (the six individual samples to the analytical laboratory and the two composite samples to the material laboratory).

9. Each sample will be doubled bagged, identified, and dated prior to shipment to the laboratories.

10. The laboratories are to be notified on the date the sample is shipped and both will proceed to prepare for incoming samples and follow all pre-established procedures for materials and analytical testing.

11. Both laboratories will provide an individual report for each of the two event samplings.

Insert Figure 2

C. SAMPLING FROM BIOMASS FACILITIES

1. An overview of the biomass sampling program is shown in Figure 3.

2. Determine that most convenient location for sampling. Accessibility and adequate space for sample preparation is required. The best location for sampling is at the ash drag chain or conveyor belt head pully area.

3. To facilitate sampling a 90 gallon plastic container will be required.

4. At the discharge point of the ash discharge conveyor, collect about 100 lbs. of material a minimum of six times at hourly intervals over the operation of one normal day.

5. As shown in Figure 3, for each day of sampling make two composite samples (one from Sample #1, 2, 3 and one from Sample #4, 5, 6). Note samples 1, 2, 3, 4, 5, and 6 should be equal in size.

6. Use the coning and quartering procedure described above for reduction of sample size to the appropriate weight required for the laboratory.

7. At the end of each sampling day, ship two composite samples (one 250 lb sample each) to the materials laboratory and two composite samples (one 60 lb. sample each) to the analytical laboratory.

8. Each sample will be doubled bagged, identified, and dated prior to shipment to the laboratories.

9. The laboratories are to be notified on the date the sample is shipped and both will proceed to prepare for incoming samples and follow all pre-established procedures for material and analytical testing.

10. Both laboratories will provide an individual report for each of the 10 events sampled.

Insert Figure 3

FIELD QUALITY ASSURANCE AND CONTROL

The project manager will ensure that appropriately trained and qualified staff are involved in the sampling program. Contacts will be made with each facility manager and appropriate information on equipment, conveyor size, hours of operation, etc. will be obtained prior to the visitation of the facilities.

The field staff will be instructed on how to reduce the sample size using the coning and quartering method and of the acquisition of representative samples. The field staff will maintain a log which will detail any unforseen events such as shutdown of the facility.

LABORATORY QUALITY ASSURANCE AND CONTROL

The goal of a Quality Assurance and Quality Control (QA/QC) program is to assure that all information, data, and analyses are technically sound, statistically valid and properly documented. For this program, CKY, Inc. and Geofon Laboratories, have developed QA/QC manuals in accordance with California State Department of Health Services (Department of Toxics Control) in U.S. Environmental Protection Agency, guidelines. These manuals define the authority and responsibility of involved individuals and provides the requirements by which the quality of equipment and services shall be achieved and verified. The goal of any QA/QC program is to ensure that all data collected and processed is scientifically valid, defensible, and of known precision and accuracy. R. W. Beck's Project Manager will discuss with both laboratories the importance of following ASTM procedures in sample preparation and reduction.

SAMPLING EQUIPMENT REQUIREMENTS

- Plastic bags (2' x 3' size)
- Shovel
- Labels, tape, other stationary
- Hard hat and safety glasses
- Two inch screen (2' x 2')
- Two hand held magnets
- 90 Gallon plastic bucket
- Shipping cartons (1' x 1' x 2' size)
- Gloves
- Address of nearest UPS office
- Availability of front end loader and one 3-cubic yard bin for MSW ash testing.
- One mechanical scale

REFERENCES

1. Sampling and Analysis of Municipal Refuse Incineration Ash. Office of Solid Waste, USEPA, Washington D.C., Draft on July 26, 1988.

2. ASTM Procedure C702-87 Standard Practice of Reducing Field samples of Aggregate to Testing Size, Methods B-Quartering.

3. ASTM Procedure D75-82 Standard Practice for Sampling Aggregates.

4. ASTM Draft, Committee D-34, Subcommittee D34.01, Standard Practice for Sampling Non-Liquid Waste From Trucks.

5. Laboratory Quality Control Manual, CKY Inc., May 1991.

6. Quality Assurance Manual for Laboratory Operations, Geofon Inc.

Appendix B1

Survey Data on Biomass Incineration Facilities

R.W. BECK
AND ASSOCIATES

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Serv. Response
1	BIO	x	Auberry Energy	32180 Auberry Rd.	Auberry	93602	Fresno	Doug Thompson	(209) 855-4001	W - 95% Ag - 5%	100,000 PPH steam	Bubbling bed; 4 drum B&W	1985	18 TPH	24 hours	7-11 TPD
2	BIO	x	Big Valley Lumber Co.	Hwy 299 East	Bieber	96009	Lassen	Bruce Main	(916) 294-5221	W	60,000 PPH steam	Pile burner	1983	100 TPD	24 hours	2 TPD
3	BIO	x	Blue Diamond Growers Cogen Plant	2020 North B St.	Sacramento	95812	Sacramento	Earl Ruby	(916) 442-0771	UW - 30% Ag - 70%	125,000 PPH steam	Fixed grate: inclined grate	1981, expanded in 1988	192 TPD	24 hours	7 TPD
4	BIO	x	Burney Forest Products	35586 Highway 299 E. P.O. Box 1476	Burney	96013	Shasta	Kenny Laybanger	(916) 335-5023	W	159,000 PPH	Fixed grate	1989	26 Dry TPH	20 Hours per day ----7 day/wk	100 cubic yard/day
5	BIO	x	Burney Mountain Power	Hwy 299 East + Energy Drive	Burney	96013	Shasta	Jeff White	(916) 335-5434	W	110,000 PPH steam, 11.5 MW	Moving grate: traveling grate	1984	18-20 TPH	24 hours	10 YPD
6	BIO	x	California Cedar Products	1340 W. Washington Street	Stockton	95201	San Joaquin	Lou Wathin or Rod Gonzales	(209) 944-5800	W	34,000 PPH steam	Fixed Grate	1962	3,000-4,000 PPH (3,300 avg)	24 hours	80 TPY
7	BIO	x	Chowchilla Biomass Power Plant II	16457 Avenue 24 1/2	Chowchilla	93610	Madera	Pat Henderson	(209) 665-5771	UW - 55% Ag 45%	120,000 PPH, 12.5 M.W	Forced circulation - bubbling bed	1989	13 TPH	24 Hours	630 TPW
8	BIO	x	Collins Pine Co. Project	500 Main St.	Chester	96020	Plumas	Jim Stuart	(916) 258-2112	W	140,000 PPH steam - 12 MW	Fixed grate	1985	320 TPD	24 hours	6 YPD
9	BIO	x	Delano Energy Company, Inc.	11300 Pond Road	Delano	93215	Kern	Paul Dolano	(617) 622-1000 or (617) 622-1146 direct	UW - 50% Ag - 50%	255,000 PPH 31.8 MW	Fluidized bed	Septem. 1990	30 TPH	24 hours	5% by weight
10	BIO	x	Diamond Walnut Power Plant	1050 S. Diamond Street	Stockton	95205	San Joaquin	James Wagner	(209) 467-6000	Ag	60,000 PPH	Fixed grate	1980	115 TPD	24 hours	3 YPD
11	BIO	x	Dinuba Energy, Inc.	6801 Ave 430	Dinuba	93618	Tulare	Bill Hammond	(209) 591-8060	W - 85% Ag - 15%	128,000 PPH steam	Moving grate	1952 (upgrade in	23 TPH	24 hours	20 TPD
12	BIO	x	El Nido Biomass Power Plant	30 W. Sand Marsh Rd.	El Nido	95340	Merced	Roger Radcliff or Roger Rechless	(209)665-4875	Ag	122,000 PPH steam	Bubbling bed/ forced circulation	1988	300 TPD	24 hours	25-30 TPD
13	BIO	x	Fairhaven Power Company	97 Bay Street --P.O. Box 280 (95501)	Samoa	95564	Humbolt	Dennis Johnston, Plant Mgr.	(707) 445-5434	W	180,000 PPH steam	Fixed grate: natural circulation	1986	38 TPH 912 TPD	24 hours	25-30 TPD
14	BIO	x	Feather River Energy	3712 Feather River Blvd.	Marysville	95901	Yuba	Mike Lawanda	(916)741-9663	UW - 20% W - 50% Ag - 30%	172,000 PPH	Circulating bed	1987	43,500 TPY (Bone Dry)	24 Hours	20-27% o f Fuel Weight
15	BIO	x	Fibreboard Corp. Powerhouse	19440 Standard Rd. --P.O. Box 218	Standard	95373	Tuolumne	Jim Brisco	(209)532-7141	W	100,000 PPH steam 3 MW	Moving grate: traveling grate	1980	270 TPD	24 hours	6 TPD
16	BIO	x	Georgia Pacific Corp.	90 West Redwood Ave.	Fort Bragg	95437	Mendocino	Chuck Roth, Plant Engineer	(707)964-5651 X335	W	3 boilers - 1 @ 105,000 PPH steam, 2@ 140,000 PPH steam	Fixed grate, spreader stoker	2 (105K & 140K) 20 yrs old 1(140 K) 8-9 yrs old	800-1000 TPD	24 hrs Boiler #1 (105 K PPH) and #2 (140 K) alternate in operation	47 CY/Day 2 boilers active (105K PPH and 140K PPH) Total Output 245K #/hour

	Method of Ash Disposal	Location of Ash Disposal	Facility Ownership	Expansion or Closure Plans	Air Pollution Control Equipment	Bottom versus Fly Ash	Previous Ash Testing	Seasonal Fluctuations in Generation	Scheduled Downtime	Long term Plans	Notes	Estimated Quantity of Ash Generated TPD	Estimated Quant fuel Burned TPD	Estimated Quant of Ash Generated TPY	Percent Ash to Fuel	Days down per year
1	Asphalt - soil enhancer	local	Boise Idaho Yankee Energy	Lifespan - No Closure Plans	3 cell electrostatic precipitator	unknown	Results in Home Office	none	15 days/ year	unknown	No seasonal fluctuation in fuel source	9.0	432.0	3150	2.08%	15
2	Landfill	On-site landfill	Big Valley Lumber Co.	None	After burner; multiclone separator	unknown	within last year	higher 5/1-10/31 by 33%	14 days total in April & November	none		2.0	100.0	702	2.00%	14
3	10% landfilled; 60% used as fertilizer	various	BDG sants	None	Baghouse	2.5:1	No significant contamination	PG&E elective curtailment	10 days each April & November	unknown	Fuel proportions fluctuate depending on availability	7.0	192.0	2415	3.65%	20
4	Soil Amendment	Farm --45 miles away	Burney Forest Products	None	Multi-clone, Electrostatic precipitator, Thermal Denox (ammonia injection)	10 % bottom Ash	Monthly	None	14 days/yr	unknown	Interested in survey results	62.8	520.0	22025	12.07%	14
5	Sold as soil enhancer	Local farmers	Pacific Energy, Irvine	None	Electrostatic Precipitator, multiclone	unknown	Monthly	none	5 days each April & November	unknown		6.3	456.0	2228	1.38%	10
6	Landfilled (guess)	Local "15-20 Miles away"	California Cedar Products	None	Multi clone: wet scrubber	unknown	Testing frequency unknown, although there is testing - clean elements	Winter - slight increase	July and August 1990 43 weeks 1991 35 weeks	unknown		0.7	42.0	80	1.59%	245
7	Hauled by Lariats to Landfill	Local	Chowchilla Biomass Power Plant Assn II (CAPCO)	None	Ammonia Injection, Flue Gas Recirculating, Baghouse, Multi-clone	unknown	Weekly tests--nothing unusual	None	1 Day/Mo.	unknown	Hauled by Lariats; fuel burned varies depending on availability	95.8	312.0	33800	30.69%	12
8	County approved ash pit	Plumas county	Collins Pine Co.	unknown	Electrostatic precipitator	unknown	Monthly	Winter lower (contract with	3 days in April & November	none		3.8	320.0	1352	1.18%	6
9	soil amendment - sold to distributor	local distributor	Thermoelectron	Add a 202,000 PPH - 24.5 MW begin const. end of '93	Amonia injection, Limestone injection, baghouse	unknown	Weekly -- nothing unusual	None	50 days/yr	Expansion of 24.5 Mega watts '93	5% Ash to fuel burned; minimal seasonal variation in fuel burned	36.0	720.0	11340	5.00%	50
10	Sold to distributor for use in fertilizer	various	Diamond Walnut Growers, Inc.	None	Baghouse	unknown	Some - trace heavy metals	Burn more in summer (PG&E contract)	April and Nov. maint. 14-16 days each	none		1.9	115.0	631	1.64%	30
11	Mixed with asphalt or composted	Asphalt on site, compost in	Dinuba Energy, Inc.	None	Electrostatic Precipitator	unknown	Quarterly	none	7-14 days each, May and November	unknown	No seasonal variation in fuel	20.0	552.0	6480	3.62%	21
12	Soil Amendment	To Hauler	Capco Management	None	Baghouse; Ammonia injection; Sorbet injection; SO2 control	unknown	Monthly no significant elements	None	3-5 days each quarter 12-20 days/year Winter	None		27.5	300.0	9598	9.17%	16
13	Landfilled at Municipal Landfill	Local	EEL River Sawmills, Inc.	None	Electrostatic Precipitator	Unknown	June '91 nothing unusual	Constant generation	Constant Generation	unknown		27.5	912.0	10038	3.02%	0
14	Disposal - Landfill capping material Soil Amendment -- UCD Testing	Anderson Landfill, UCD Davis	Fibre Energy USA, Inc.	None	Multi-clone and Electrostatic Precipitator	unknown	Weekly	None	Nov. & March 2-3 wk maintenance each	unknown	Ash = 20-27% of fuel weight; 5% variation in fuel burned	31.0	131.8	10223	23.50%	35
15	Soil Amendment	local farmers	Fibreboard Corp.	None	wet scrubber, Multi-clone	No bottom ash	May '91 Nothing above limits	Higher electrical generation in winter	10 days last year No facility downtime actually scheduled	unknown		6.0	270.0	2130	2.22%	10
16	Fly ash is re-injected. Bottom ash is plowed into the ground at site.	Company Property	Georgia Pacific Corp.	None	Wet scrubbers	Unknown	9/91 tests for bm No test for hazardous	Power Gen decrease in winter due to wet fuel 5-6%	None rotate three boilers' downtime	unknown		29.5	900.0	10765	3.28%	0

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Response
17	BIO	x	Girvan Lumber Co.	78 9th Street -- P.O. Box 2311	Redding	96099	Shasta	George	(916)244-9710	W	13,000 PPH	Fixed grate, single cell	1978	.75 TPH	24 hours	5,000 lbs/Mo.
18	BIO	x	H.L. Power	732-025 Wendell Rd	Wendel	96136	Lassen	Ralph Sanders	(916) 254-6161	W	315,000 PPH	Moving grate: traveling grate stoker	7/89	27 dry TPH	24 hours	27 tpd
19	BIO	x	Hi-Ridge Lumber Co.	Phillips Lane -- P.O. Box 458	Yreka	96097	Siskiyou	Curt Judkins	(916) 842-4451 Fax (916) 842-6375	W	40,000 PPH steam	Fixed grate	1977	25 TPD 30% Avg Moisture Content	24 hours	1 CY/day
20	BIO	x	Hudson ICS	400 Hudson Lane -- P.O. Box 338	San Leandro	94577	Alameda	Robert Hassomeb	(415) 351-5872	W	16,000 PPH steam	1 dutch oven	1956	6,770 TPY	24 Hours	200 Pounds Per Day
21	BIO	x	Hudson Lumber	5189 Hwy 99 North	Anderson	96007	Shasta	Ed Dondon	(916) 365-3791	W	90,000 PPH steam	Fixed grate: spreader stoker	1982	16 TPH	24 hours	27 TPD (average)
22	BIO	x	Imperial Resource Recovery Project	3505 Hwy 111	El Centro	92251	Imperial	Larry McCrachan, Plant Mgr	(619) 344-7200	UW - 99% Ag - 1%	2 boilers @ 183,000 PPH steam -- 25 MW	Moving grate: traveling grate	Commissioned '89 Recommission	500 TPD	24 Hours	10% of fuel (50 TPD inferred)
23	BIO	x	Koppers Industries	Marysville - Beggett Rd.	Oroville	95965	Butte	Cecil Volkman	(916) 533-8335	W	60,000 PPH steam	Pile burner	1982	110 TPD	24 hours	7 YPD (average)
24	BIO	x	Lincoln Cogeneration	1445 Hwy 65	Lincoln	95648	Placer	Paul Kissel	(916) 645-1631	W	2 boilers @ 85,000 PPH steam	Fixed grate	Facility A-1984 Facility B-1987	5,500 TPM dry combined	24 Hours 355 days/yr	20-30 yds/day
25	BIO	x	Lindsay Olive Growers	650 Tulare Rd.	Lindsay	93247	Tulare	Jerry Sullivan	(209) 562-5121	Ag	18,000 PPH steam	Fluidized sand bed	1986	30 TPD	16-18 hrs/day	250-300 Pounds Per Day
26	BIO	x	Louisiana Pacific, Oroville	Myrtle Lane -- P.O. Box 1879	Oroville	95965	Butte	Bill Webb	(916) 534-6604	W	1 boiler = 90,000 PPH, 1 boiler = 40,000 PPH	Fixed grate	Dec-87	Boiler 1 = 30K-35K PPH ---- Boiler 2= 4KPPH	24 Hours	Boiler 1 = 2% of fuel weight. Boiler 2 = 1% of fuel weight.
27	BIO	x	Madera Power Plant (Cogen)	Ave 7 & Road 145	Firebaugh	93638	Madera	Dave Martin	(209) 659-1624	UW=75% Ag=25% (ag 70% sept.-mar.)	280,000 PPH	Bubbling bed / Natural circulation	Aug-89	26 TPH Dry	24 hours	7% ash from fuel mass
28	BIO	x	Martell Cogen.	Hwy 49 & Ridge Rd.	Martell	95654	Amador	Bob Cologna, Plant Mgr	(209)223-4581	W	180,000 PPH steam	Fixed grate: 2 drum boat tube	1985	450 TPD Dry	24 hours 345 day/yr	40 TPD
29	BIO	x	Masonite Plant	300 Ford Rd.	Ukiah	95482	Mendocino	Robert Scaglione	(707) 462-2961	W	220,000 PPH steam	Fixed grate: inclined grate	1979	200-210 TPD	24 hours	30 YPD

	Method of Ash Disposal	Location of Ash Disposal	Facility Ownership	Expansion or Closure Plans	Air Pollution Control Equipment	Bottom versus Fly Ash	Previous Ash Testing	Seasonal Fluctuations in Generation	Scheduled Downtime	Long term Plans	Notes	Estimated Quantity of Ash Generated TPD	Estimated Quant fuel Burned TPD	Estimated Quant of Ash Generated TPY	Percent Ash to Fuel	Days down per year
17	Local Hauler to Landfill	Local	Wisconsin-California Forest Products	None	Multi-clone	unknown	CH2M Hill - nothing unusual	10 % loss capacity in Summer, depends on fuel availability	36-48 hrs/yr	unknown		0.1	18.0	30	0.46%	4
18	Landfill	Landfill and soil amendment	H. L. Power Partnership	None	electrostatic precipitator, STI monitoring equip	5% bottom	Quarterly - normal	None	8 days -- spring 2 days -- fall	unknown		27.0	648.0	9585	4.17%	10
19	Compost	County Dump	Hi-Ridge Lumber Co.	None	Zurn Multi Clone	unknown	None	Summer 6mo. 8,000 PPH Winter 6 mo. 15,000 PPH	5 days per year	May install turbin generator in 6 mo.	Will not increase fuel consumption.	0.6	25.0	226	2.51%	5
20	Landfill	Colusa Co. Dump	Catalyst Energy, Hudson ICS	None	Cyclone Seperators	See data in letter	1990	None	3 weeks in August	unknown		0.1	19.7	34	0.51%	21
21	Landfill	Local	Catalyst Energy	None	Multiclone; scrubber; afterburner	10%	1990	Increase in winter due to dirty bark	2wks in April	unknown		27.0	384.0	9477	7.03%	14
22	currently permitting for ash disposal. Ash currently stored	Currently stored on site.	Hydroco Enterprises. Syracuse, New York	None	Ammonia injection; dry scrubber; baghouse, dust separation	unknown	Testing done in the last two months.	No Fluctuation.	800 hr/yr	None	No seasonal variation in fuel	50.0	500.0	16600	10.00%	33
23	Plowed into site	On-site	Koppers Industries, Inc.	None	Multiclone	unknown	1990: no metals/ dioxin	Higher in summer (20-100%) -- Depends on fuel	7-10 days, twice per year	none		4.4	110.0	1529	3.99%	17
24	Blend with soil amendment and barter with distributor to reclaim log yard waste	Plant is invest. rebumers ultimately it goes to distributor	Bohemia, Inc.	None	Each boiler has multiclone electrostatic precipitators	unknown	Several years ago - was clean only PH was slitte hi.	More gen. in winter upto 20% increase	Maintenance 5 days in April and November downtime = 10 days/yr	unknown		15.7	185.9	5569	8.44%	10
25	Landfill (Class I)	Kings County	Lindsay Olive Growers	None	Ammonia injection; baghouse	#N/A	Annually: No metals	Shutdown July & August	July & August	unknown		0.1	30.0	42	0.46%	62
26	Landfill	local	Louisiana Pacific Corp.	None	Electrostatic precipitator	unknown	unknown	20-25% more in winter	Boiler 1 = 4-5 days for July inspections Boiler 2 = 3 days every 3 weeks	unknown		8.3	438.0	2981	1.89%	5
27	Contracted Soil Amendment	local	CAPCO	None	Baghouse, Multi-clone, Ammonia injection, flue gas recirculation	unknown	Monthly	May-Oct -- increase 5% power generation	Down 15% of the year (55 days)	unknown	Ash = 7% of fuel combustion	43.7	624.0	13541	7.00%	55
28	Fly Soil - Amendment Bottom - Landfill	Local Municipal	Martell Cogeneration Ltc. Partnership	None	Electrostatic Precipitator., Monitors for CO1, NOx, O2, opacity.	3% bottom : fly	Monthly - last mo. no metals or dioxin Fly test quality - last month -- no elements unusual Bottom -- 3 mo. ago	Generate the same capacity through-out Nov- May gen more steam to mill May-Nov gen electric (steam)	20 days out total 10 days each December 10 days out March or April	none		40.0	450.0	13800	8.89%	20
29	Landfill	Local municipal	Masonite	None	Multiclone; scrubber	<=5%	Semi-annual - no metals/dioxins	None	5-7 days October/November	none		18.8	205.0	6758	9.18%	6

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Responses
30	BIO	x	Mendota Biomass Power, Ltd.	400 Childen Pkwy.	Mendota	93640	Fresno	Glenn Simmons	(209) 655-4921	UW=64% Ag=36%	250,000 PPH steam	Fluidized bed	6/6/89	650 TPD	24 hours	25 TPD
31	BIO	x	Mesquite Lake R.R. Project	Hwy 111 (1/2 mile south of Keystone Rd.)	Imperial	92251	Imperial	Con Murphy	(619) 344-2028	Ag	158,000 PPH steam	Fluidized Bed	1987	40 TPH	24 hours	160 TPD
32	BIO	x	Michigan-California Lumber	3950 Carson Rd.	Camino	95709	El Dorado	Dennis Gomez	(916) 644-2311	W	120,000 PPH steam	Pile burners	1974	10 TPH	24 hours	3000 TPY
33	BIO	x	Mt. Lassen Power	County Road A21 -- (1/4 mile W. of Town)	Westwood	96137	Lassen	Gary Pritchard, Supervisor	(916) 256-3155	W	105,000 PPH	Vertical water tube traveling grate	1983	13 dry tons/hr 110,000 tons/yr	24 hours	7,000 - 8,000 Yds/yr
34	BIO	x	North Fork Energy, Inc.	578 - 39 Road 225	North Fork	93643	Madera	Tim Davis, Plant Mgr.	(209) 877-7708	W - 75% UW - 20% Ag - 5%	100,000 PPH	Bubbling bed	12/1988 commissioned	18 TPH wet tons	24 hours	7 tons/day Ash Dry
35	BIO	x	Operational Energy Company	6247 Myers Rd.	Williams	95987	Colusa	Bob Ellery	(707) 578-6144	Ag	192,000 PPH -- 25.5 MW	Moving Grate	Mar-89	600 TPD	24 Hours	120 TPD
36	BIO	x	Pacific Lumber Co.	P.O. Box 37	Scotia	95565	Humbolt	Richard H. Sweet	(707) 764-2222	W	150,000 x3 PPH steam	Moving grate: air traveling grate	1988	2016 TPD	24 hours	40 TPD
37	BIO	x	Pacific Oroville Power	3050 S. 5th Avenue	Oroville	95965	Butte	Joe Brown	(916) 532-0597	W	2 boilers @ 90,000 PPH	Fixed grate - 10 hole	1985	19.5 Dry TPH	24 Hours	2400TPY
38	BIO	x	Rosenberg Lumber	Barney Road	Anderson	96007	Shasta	Bill Hoogstadt	(916) 365-7661	W	Boiler #1 = 45,000 PPH Boiler #2 = 45,000 PPH Boiler #3 = 33,000 PPH Boiler #4 = 33,000PPH Boiler #5 = 35,000 PPH 3 online at 75 - 90% capacity = 90,000 PPH at a time	All Dutch Ovens with fixed grates and ID fans.	1949 1950 1945 1945 1951	3 boilers online @ 75-90% capacity = 200 Cubic ft/hr w/ 55% moisture content	24 hours	unknown
39	BIO	x	Schmidbauer Lumber Co.	P.O. Box 152	Eureka	95501	Humbolt	Larry McKracken	(707) 443-7024	W	30,000 PPH	Fixed grate	1979	36 TPD	24 hours	8500 PPD
40	BIO	x	Sierra Pacific (Central Valley)	5735 El Cajon Ave	Central Valley	96019	Shasta	Scott Leiby	(916) 365-3721 (916) 275-8812	W	2 Incinerators (Wellons) 30,000 PPH per	Fixed grate	1978 & 1990	144 TPD dry	24 Hours	1 Cubic Yard /Day Ill-fluctuations

	Method of Ash Disposal	Location of Ash Disposal	Facility Ownership	Expansion or Closure Plans	Air Pollution Control Equipment	Bottom versus Fly Ash	Previous Ash Testing	Seasonal Fluctuations in Generation	Scheduled Downtime	Long term Plans	Notes	Estimated Quantity of Ash Generated TPD	Estimated Quant fuel Burned TPD	Estimated Quant of Ash Generated TPY	Percent Ash to Fuel	Days down per year
30	Landspread	Distributor	Thermoelectron	None	Ammonia injection; baghouse; monitoring system (carbon denox wheel abraider baghouse NOx opacity +CO2 monitoring)	unknown	Monthly - no metals or dioxin	None	2 weeks April, 2 weeks November	none	Only contractual arrangement with PG&E curtails generation.	25.0	650.0	8425	3.85%	28
31	Stored on site	On site	NEA Project Services Inc.	None	Baghouse; flue gas recirc.	80% fly	1990	none	35 days/year maint., 30 days other	none	R.W. Beck & Assoc. did their feasibility study	160.0	960.0	48000	16.67%	65
32	Sold to nursery as soil amendment	Local nursery	Michigan-California Lumber	Restart soon (shut down for 6 months after fire)	Multicyclone separator	unknown	1990, 1988	3-5% increase in winter	1 week over 4th of July	unknown		8.4	240.0	3000	3.49%	7
33	Soil amendment on local (private) timberlands.	Local Timberlands	Pacific Energy	No Expansion	Electrostatic Precipitator, torus chamber, fuel dryer multi-clone	Bottom 1%	May 1991above water quality limits, but ok for background levels	None	4-5 day maintanence Twice per Year 8-10 day down time/yr	unknown	A "few"days per year output is reduced to comply with PG&E contracts	13.2	312.0	4706	4.24%	9
34	Soil Amendment - sold to distributor	Distributor	North Fork Energy, Inc. Parent Company Yanks Engergy	None	Electrostatic Precipitator	Unknown	1990 - no exceptionals	None	5-6 Down times/Yr 2 times for 1 week (5 days)	Unknown	Ag. waste fuel increases by 5% in fall	7.0	432.0	2443	1.62%	16
35	Currently Stockpiled	On site stockpile	Oxford Energy Company	None	Baghouse	unknown	Weekly 97% silica	None	14 days per yr	None		120.0	600.0	42120	20.00%	14
36	Char sold as activated carbon; rest landfilled	local landfill	Pacific Lumber Co.	None	Electrostatic precipitator	N/A	1991: no hazardous elements found	none	10 days each in November & May	none	Ash = 2% of fuel combustion	40.0	2016.0	13800	1.98%	20
37	Soil Amendment	Local Ranch Land	Pacific Energy	Pending expansion under PG&E contract dispute	Electrostatic precipitator	Bottom less than 10%	Jun-91	In operation 7 months of the year, curtailed for 5 months	No additional downtime to 5 months of curtailed operation	PG&E pending contract dispute	Many aspects of this operation will be dependant upon the outcome of the PG&E	11.3	468.0	2400	2.41%	152
38	Mix w/ Logyard waste -mulch- &Soil Amendment	Company Property	Roseburg Lumber Products	None	Dry + Wet Scrubbers	unknown	Years Ago - Nothing Significant	None	Usually no down time	unknown	This facility runs 3 of 5 Incinerators at any one time. Maintenance is done when one furnace takes over for another. Because ash generation is unknown, an estimated 6% of fuel weight was used to calculate	6.6	110.4	2418	6.00%	0
39	Hauler	Landfill	Schmidthauser Lumber Co.	Re-open 12/20/91	Flue gas recirculation	unknown	none	none	30 days/year	none	Shutdown since 8/22/91. Re-open 12/20/91	4.3	36.0	1424	11.81%	30
40	landfilled	Local	Sierra Pacific Industries	None	Vaporized ammonia injection, multicione and electrostatic precipitator	unknown	None	None	10 days/year	unknown		0.6	144.0	223	0.44%	10

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Response
41	BIO	x	Sierra Pacific Industries	Highway 3 & Mill Avenue	Hayfork	96041	Trinity	Larry Lawson	(916) 628-5291	W	130,000 PPH	Fixed grate	1985	22 TPH	24 Hours	150 Tons every 6 wks
42	BIO	x	Sierra Pacific Industries	Hwy 299 East	Burney	96013	Shasta	Tom Broadway	(916) 335-3681	W	200,000 PPH	Fixed grate	1986	80,000 lbs/hr	24 hours	15 cubic yards/day
43	BIO	x	Sierra Pacific Industries	1538 Lee Road	Quincy	95971	Plumas	Don Camp	(916) 283-2820	W	200,000 PPH	Fixed grate	Dec-87	55,000 lbs/hr	24 Hours	15 yards/day
44	BIO	x	Sierra Pacific Industries	Rail Road Avenue	Loyalton	96118	Sierra	George McCartney	(916) 993-4867	W	200,000 PPH 20MW gen	Fixed grate	1989	8 cubic yards/hr	24 Hours	10 cubic yard/day
45	BIO	x	Sierra Pacific Industries	End of Sunkist Rd	Susanville	96130	Lassen	Dave Raw	(916) 257-7908	W	160,000 PPH	Fixed grate	Dec-85	65,000 lbs/hr 55% Moisture Content	24 hrs	Avg 10-15 cubic yard daily
46	BIO	x	Sierra Power	9000 Rd. 234	Terra Bella	93270	Tulare	Bob Spyke - Plant Engineer	(209) 535-4893	W	100,000 PPH steam	Fixed grate	1986	80,000 TPY Dry	24 hrs	1200 TPY
47	BIO	x	Signal Wheelabrator	20811 Industry Road	Anderson	96007	Shasta	Bill Carson	(916) 365-9172	W	170,000 PPH Steam each (3 boilers)	Moving grate: traveling grate	1987	100 green TPH (wood)	24 hrs	70 TPD
48	BIO	x	Soledad Energy Partnership	959 Los Cochas Drive	Soledad	93960	Monterey	Harry Hunzie	(408) 678-2400	W	135,000 PPH	Fluidized bed	Dec-89	12 TPH dry	24 Hours	900 TPM
49	BIO	x	Steen Forest Industries	63616 Hwy 96 -- P.O. Box 527	Happy Camp	96039	Siskiyou	Rich Davis, G.M.	(916) 493-2231	W	20,000 PPH steam	Fixed grate	1971 (20 years old)	40 TPD	24 hours	20 lbs/day "A wheel-barrow load/day"
50	BIO		Susanville Forest Products	P.O. Box 789	Susanville	96130	Lassen	Kurt Schwartz	(916) 257-5571	W	No Response	Fixed grate: "A" type design	No Response	120 TPD	No Response	1 TPD Fly Ash .1 TPD Bottom Ash
51	BIO	x	Tracy Biomass Plant	P.O. Box 1211 -- 14800 W. Schulte Road	Tracy	95376	San Joaquin	Larry K. Linn	(209) 835-6914	W	180,000 PPH steam	Vibrating hydrogate: shaking grate	1990	400 TPD	24 Hours	25 TPD
52	BIO	x	Tri-Valley Growers Plant 9	736 Mariposa	Modesto	95354	Stanislaus	Alvin Lee	(209) 572-5531	Ag	60,000 PPH steam	Fixed grate	1981	32-36 TPD	24 hours	3-5 yds/day
53	BIO	x	Ultrapower - Rocklin	3100 Sparta Court	Rocklin	95648	Placer	Brian Evans	(916) 645-3383	W	225,000 PPH	Circulating bed	1989	18-30 dry tons/hr	24 Hours	600-1100 tons/mo. 750 avg

	Method of Ash Disposal	Location of Ash Disposal	Facility Ownership	Expansion or Closure Plans	Air Pollution Control Equipment	Bottom versus Fly Ash	Previous Ash Testing	Seasonal Fluctuations in Generation	Scheduled Downtime	Long term Plans	Notes	Estimated Quantity of Ash Generated TPD	Estimated Quant fuel Burned TPD	Estimated Quant of Ash Generated TPY	Percent Ash to Fuel	Days down per year
41	Landfill	Private landfill 70 miles away	Sierra Pacific Industries	None	Multi-clone, electrostatic precipitator	unknown	2-3 times a year - (test ing) nothing unusual	None	7-10 days in spring and 2 days in Fall	unknown	3 days of down time total this year	3.7	528.0	1300	0.70%	11
42	landfill	Private local landfill	Sierra Pacific Industries	None	Electrostatic precipitator, Sand sep. Reburner, Multi-Clone	unknown	w/ in last 6 mo.	Peak noon-6pm daily . Drop of 25-30% in winter ---- June - Nov = Normal output	14 days/yr	unknown		9.4	960.0	3304	0.98%	14
43	Soil Amendment	Private Property -- local	Sierra Pacific Industries	None	Multi-clone, 3 cell electrostatic precipitator	unknown	None	None	Spring and Fall approx. 1 week each	unknown		9.4	660.0	3304	1.43%	14
44	On site -- Used as road bed	On site	Sierra Pacific Industries	None	Electrostatic Precipitator, and Ammonia Injection	unknown	Monthly	None	1 week maint. in Spring and Fall	None	Sysco Custom Instrumentation installed emissions monitoring equip	6.3	51.8	2203	12.10%	14
45	Soil Amendment	Local Ranch	Sierra Pacific Industries	None	Electrostatic precipitator, Multi-Clone	unknown	Monthly Nothing unusual	None	7 days/yr	unknown	Local water quality district. has test results.	7.8	780.0	2808	1.01%	7
46	Landfill - Private	local	Sierra Forest Products	None	electrostatic precipitator, amonia injection	unknown	quarterly testing within limits for metals, dioxins	none	2 weeks each May and 2 weeks each Nov or Dec	unknown		3.6	237.4	1200	1.50%	28
47	Fly ash: 75% soil amend 25% landfill (class III)	local	Wheelabrator Shasta Energy Co.	None	Ammonia Injection, Multi-clone, Electrostatic precipitator	1:3 Bottom to fly	Monthly w/in limits	None	20 days per year	None	Fly ash reduction by 50% in weight within 6 months w/ afterburner	70.0	2400.0	24150	2.92%	20
48	Landfill	Rock and Bottom Landfill	Soledad Energy Partnership	None	Amonia Injection, Dolimit SO2 Control, Electrostatic Precipitator, Multi-Clone	>30 TPD Fly - 5 TPD Bottom	Quarterly Some Lead in Precipitator	None	April 2 wks maintenance Nov. 1 wk maintenance	Unknown		29.6	288.0	10184	10.28%	21
49	Reburned in boiler	local	Stone Forest Industries	None	unknown	unknown	Regular testing Air quality ok last test	None	2 weeks per year, 1 week in April- May, 1 week in December	None	Consumption in units 1 unit = 1 ton	0.01	40.0	4	0.03%	14
50	Fly Ash is Landfilled Bottom Ash disposed on site	Fly Ash is Landfilled locally Bottom Ash disposed on site	Jen Wen, Inc.	No Response	Multi-Cyclone	90 % fly ash 10 % bottom ash	No Response	No Response	No Response	No Response	Sent letter & Called at least 10 times - NO RESPONSE Data Provided by CEC	1.2	120.0	438	1.00%	0
51	Soil Amendment	Distributor of Soil Amendment	Thermal Energy Development	None	Electrostatic Precipitator	60:40 by weight	Yes, 1990, 1991 w/in limits	Very little	90% availability 10% downtime	None		25.0	400.0	8200	6.25%	37
52	Used as soil amendedment on plant property in Los Banos	Los Banos local	Tri-Valley Growers	None	Baghouse	unknown	1990 Normal elements	None	2 weeks in December	unknown	Now only steam plant, no electricity production	2.5	34.0	881	7.38%	14
53	Soil amendment	Private vendor	Constellation Energy, Chrysler Corp.	None	Electrostatic precipitator, Multi-clone	Bottom to fly: 1:10	Monthly + quarterly	FGD&E reduced load 10-15% during nights & weekends - Oct-June	2 times/yr April - Nov 8-10 days each	None		25.9	576.0	9000	4.50%	18

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Response
54	BIO	x	Ultrapower Chinese Station	8755 Enterprise Dr	Jamestown	95327	Tuolumne	Rick Carter	(209) 984-4660	UW-W-Ag	208,000 PPH steam	Bubbling bed	1986	500 dry TPD	24 hours	12.5 TPD
55	BIO	x	Ultrapower- Blue Lake	200 Taylor Way	Blue Lake	95525	Humbolt	Patricia Murphy	(707) 668-5631	W	105,000 PPH	Moving grate	1985	12 TPH	24 Hours	650 TPM
56	BIO	x	Ultrapower-Fresno	3350 So. Willow Ave	Fresno	93725	Fresno	Paul Jewel, Plant Mgr	(209) 264-4575	UW - 50% Ag - 50%	220,000 PPH	Circulating fluidized bed	Jul-88	500 TPD dry	24 hours	50 TPD dry
57	BIO	x	Woodland Biomass Power, Ltd.	1786 E. Kentucky Ave. -- P.O. Box 1560	Woodland	95695	Yolo	Randy Betts	(916) 661-6095	W - 60% Ag - 40%	250,000 PPH	Fluidized bed	Sep-89	600 TPD	24 hours	50 TPD
*58	BIO	x	Forresthill Facility (Georgia Pacific)	23801 Forresthill Road	Forresthill	95631	Placer	Joe Hughes, Boiler Supervisor	(916) 367-2241	W	Boiler #1 - 16,000 PPH Boiler #2 - 16,000 PPH	Pile Burner	Boiler #1 - 1971 Boiler #2 - 1973	33.6 TPD	24 hours	100 Pounds Per Day 0.05 TPD
			Note: * Not alphabetized because of late data retrieval and entry.													

	Method of Ash Disposal	Location of Ash Disposal	Facility Ownership	Expansion or Closure Plans	Air Pollution Control Equipment	Bottom versus Fly Ash	Previous Ash Testing	Seasonal Fluctuations in Generation	Scheduled Downtime	Long term Plans	Notes	Estimated Quantity of Ash Generated TPD	Estimated Quant fuel Burned TPD	Estimated Quant of Ash Generated TPY	Percent Ash to Fuel	Days down per year
54	Investigating fertilizer usage -- currently landfilled	County owned landfill	Pacific Energy and Ultrasystems	None	multi-clone dust collector electrostatic precipitator; ammonia injection	Unknown	8/1/1991 Not hazardous	None	Maintanance Winter: 7 - 45 days/yr	unknown	UCD is also doing study; did not know fuel proportions	12.5	500.0	4238	2.50%	26
55	City Landfill	City Landfill	Ultrapower, Rincon	None	Electrostatic Precipitator, Ash reinjection, Multi-clone	unknown	Last year BTU Carbon w/in limits	None	April - 6-7 Days May - 6-7 Days	unknown		22.2	288.0	7800	7.69%	13
56	Soil Amendment	local	Constellation/Hadson Enterprises, Irvine (Joint Venture)	None	Electrostatic Precipitator, Multi-Clone	unknown	Monthly - by Lariate - Checks O.K.	None	Out 7-10 days for each Mo. of April and June	unknown	Ag. waste fuel increases to 70% in fall	50.0	500.0	17500	10.00%	15
57	Soil Amendment/	local farmers	Thermoelectron	None	Baghouse NOX Hydrated Lime	70% Fly Ash	Quarterly	3-5% less in winter	30 days/year	unknown	minimal seasonal variation in fuel	50.0	600.0	16750	8.33%	30
*58	Used in Roadbase	On site	Georgia Pacific Corporation	None	Cyclone (to recover particulates)	unknown	None	None	12 days per year	unknown	Late retrieval and entry of data for this facility. Due to low ash generation	0.1	33.6	18	0.15%	12
												1327.8	24877.6	449747	5.34%	1407

Appendix B2

Biomas Incineration Facilities Under Construction

R.W. BECK
AND ASSOCIATES

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Response
1	BIO *(UC)	x	Colmac Mecca Project	62-300 Gene Wellmass Dr.	Mecca	92254	Riverside	Larry Osborne	(619) 396-2534	UW-Ag	464,000 PPH steam Total for 2 Boilers	1992	#N/A	Construction	N/A	N/A
2	BIO *(UC)	x	Delano II - Energy Company, Inc., Thermo Electric	11300 Pond Road	Delano	93215	Kern	Paul Delano	(617) 622-1000 or (617) 622-1146 direct	Under Construction	Under Construction	Under Construction	1993	Under Construction	N/A	N/A

	Method of Ash Disposal	Location of Ash Disposal	Facility Ownership	Expansion or Closure Plans	Air Pollution Control Equipment	Bottom versus Fly Ash	Previous Ash Testing	Seasonal Fluctuations in Generation	Scheduled Downtime	Long term Plans	Notes	Estimated Quantity of Ash Generated TPD	Estimated Quant fuel Burned TPD	Estimated Quant of Ash Generated TPY	Percent Ash to Fuel	Days down per year
1	#N/A	#N/A	Colmac Energy Inc.	Under Construction	unknown	#N/A	#N/A	#N/A	#N/A	#N/A	Currently under construction	#N/A	#N/A	#N/A	#N/A	#N/A
2	#N/A	#N/A	Dalano II - Energy Company, Inc., Thermo Electric	Under Construction	unknown	#N/A	#N/A	#N/A	#N/A	#N/A	Currently under construction	#N/A	#N/A	#N/A	#N/A	#N/A

Appendix C

Survey Data on Municipal Solid Waste Incineration Facilities

R.W. BECK
AND ASSOCIATES

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Response
1	MSW	x	Commerce Refuse-to-Energy	1526 Shiels Street	Commerce	90040	Los Angeles	John Epple, Project Engineer	(213) 699-7411	MSW	360 TPD (response)		1987	360 TPD	24 Hours	115 TPD
2	MSW	x	South East Resource Recovery Facility	120 Henry Ford Ave	Long Beach	90802	Los Angeles	Ed Hazenbuler	(213) 495-2666	MSW	1320 TPD (response = "same as max")		1988	1320 TPD	24 Hours	33 percent Ash by weight = 435 TPD
3	MSW	x	Stanislaus County R.R. Facility	4040 Fink Road -- P.O. Box 278	Crows Landing	95313	Stanislaus	Fred Englehardt	(209) 837-4423	MSW	800 TPD (response)		1988	800 TPD	24 Hours	26%-30% fuel weight after ferrous reclamation (ferrous reclamation = addition 3%)

Appendix **D1**

Survey Data on Medical Waste Incineration Facilities that Have Feedstock Greater than or equal to 1.0 Ton Per Day

R.W. BECK
AND ASSOCIATES

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Response
1	MED	x	American Environmental Mgmt. Corp.	11855 White Rock Rd.	Sacramento	95670	Sacramento	Phil Stasts	(916) 364-8872	P	800 PPH		1984	2762 TPY	24 hrs/day 7 day/wk	520 Cubic Yards/yr
2	MED	x	Alumian Brothers Hospital	225 N. Jackson Ave.	San Jose	95116	Santa Clara	Greg Mills	(408) 259-5000	G	500 PPH		1987	464 TPY	10 hrs/day	312 Cubic Yards/Year
3	MED	x	Integrated Environm'l Systems	499 High St.	Oakland	94601	Alameda	John Barnard	(510) 261-1512	G	1,000 PPH		1985	4,160 TPY	24 Hrs 5days/week	2,400 CY/Yr
4	MED	x	Roseville Community Hospital	333 Sunrise Ave.	Roseville	95661	Placer	Marvin Richardson	(916) 781-1000	G	unknown		1986	432 TPY	14 hrs/day 7 day/wk	19,800 gals/yr
5	MED	x	St. Luke Hospital	3555 Army St.	San Francisco	94110	San Francisco	Joe Agius	(415) 647-8600	G	1000 PPH		1981	234 TPY	8hrs/day - 5days/wk	312 Cubic yards/yr
6	MED	x	St. Rose Hospital	27200 Calaroga Ave.	Hayward	94545	Alameda	Owen Wilkerson	(510) 782-6200	G	750 PPH		1986	250 TPY	7 hrs/day - 5 days/wk	140 Cubic Yards/yr
7	MED	x	Stanford Univ. Environm'l Safety	900 Pasteur Dr.	Palo Alto	94305	San Mateo	Jose Mendez	(415) 723-2300	G	1000 PPH		1986	500 TPY	14 hrs/day 5 days/wk	416 cubic yds/yr
8	MED		Thermal Combustion Innovators	241 West Laurel St.	Colton	92324	San Bernardino	Tom Hayward	(714) 370-0790	Refusal	Refusal		Refusal	Refusal	Refusal	Refusal

Appendix D2

Survey Data on Medical Waste Incineration Facilities that Have Feedstock Less than 1.0 Ton Per Day

R.W. BECK
AND ASSOCIATES

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Responses
1	MED	x	63 CES/DEMMH	Norton AFB	San Bernardino	92409	San Bernardino	Frank Sage	(714)-382-6910	G	N/A (<1 TPY Ash Gen)		1968	N/A (<1 TPY Ash Gen)	N/A (<1 TPY Ash Gen)	<1 TPY
2	MED	x	Alta Bates Hospital	3001 Colby St.	Berkeley	94705	Alameda	H. R.Stafford	(415) 782-6300	G	N/A only 1 TPY Ash		1982	12 TPY	N/A only 1 TPY Ash	unknown
3	MED	x	Auburn Faith Community Hospital	11815 Education St.	Auburn	95604	Placer	Kay Tarimoto	(916) 885-7201	G	unknown		1985	245 TPY	7 hrs/day, 7 days /week	50 PPD
4	MED	x	Barton Memorial Hospital	P.O. Box 9578	South Lake	95731	El Dorado	Robert Dahrum	(916) 541-3420	G	unknown		1974	25 TPY	15 hrs/day	0.4 TPY
5	MED	x	Beverly Enterprises	4768 Palm Ave.	Riverside	92501-4070	Riverside	Gregory Bordenkircher	(714) 686-9000	G	N/A (<1 TPY Ash Gen)		N/A (<1 TPY Ash	4 TPY	N/A (<1 TPY Ash Gen)	N/A (<1 TPY Ash Gen)
6	MED	x	BFI Medical Waste Systems	7737 Formula Place	San Diego	92121	San Diego	James Prunteau	(213) 263-6400	G	unknown		1985	1,000 cubic feet/hr	10 hrs/day	100 PPD
7	MED	x	Broadview Sanatorium	4570 Griffin Ave.	Los Angeles	90031	Los Angeles	Robert Owen	(213) 221-9174	G	50 PPH		1957	4.5 TPY	N/A (<1 TPY	30 Gallns/yr
8	MED	x	Calexico Hospital	450 Birch St.	Calexico	92231	Imperial	Eddie	(619) 357-1191	G	N/A (<1 TPY Ash Gen)		N/A (<1	.4 TPY	1/Week	N/A (<1 TPY
9	MED	x	Casa de Modesto	1745 Eldeen Way	Modesto	95350	Stanislaus	M. Sanchez	(209) 529-4950	G	N/A (<1 TPY Ash Gen)		1965	5 lbs/week	2 hrs/week	N/A (<1 TPY
10	MED	x	Continuis Mammoth Hospital	P.O. Box 660	Mammoth	93546	Mono	Mike Miller	(619) 934-3311	P	N/A (<1 TPY Ash Gen)		N/A (<1	4.5 TPY	N/A (<1 TPY	N/A (<1 TPY
11	MED	x	CIGNA Health Plans of California	1711 W. Temple St.	Los Angeles	90026	Los Angeles	Don Owens	(213) 484-3081	G	N/A (<1 TPY Ash Gen)		1974	< 100 PPY	1 day/ month	N/A (<1 TPY Ash Gen)
12	MED	x	Crestview Convalescent Hospital	1471 South Riverside Ave.	Rialto	92376-7798	San Bernardino	Mrs. Thomas	(714) 877-1361	G	unknown		1964	50 lbs/ week	N/A (<1 TPY Ash Gen)	N/A (<1 TPY Ash Gen)
13	MED	x	Del Puerto Hospital	P.O. Box 187	Patterson	95363	Stanislaus	Engineering	(209) 892-8781	G	N/A (<1 TPY Ash Gen)		1972	11 TPY	N/A (<1 TPY	N/A (<1 TPY
14	MED	x	Delano Veterinary Clinic	Rt. 1 P.O. Box 1490	Delano	93215	Kern		(805) 725-8614	G	70 PPH		1960	1 TPY	1 per week	N/A (<1 TPY
15	MED	x	Delta Memorial Hospital	3901 Lone Tree Way	Antioch	94509	Contra Costa	Chris Mills	(415) 779-7250	G	N/A (<1 TPY Ash Gen)		N/A (<1 TPY Ash	480 PPY	1 per Mo.	N/A (<1 TPY Ash Gen)
16	MED	x	Dept. of Army, Dir. of Eng. & Housing	Presidio of San Fran., Bldg. 283	San Francisco	94129	San Francisco	Alex Maciocich	(415) 561-2211	G	200 PPH		1988	7.3 TPY	1 per Mo.	180 Cubic ft/yr
17	MED	x	Doctors Hosp. of Lakewood	3700 E. South St.	Lakewood	90712	Los Angeles	Tim King	(213) 531-2550	G	N/A (<1 TPY Ash Gen)		1973	400 PPY	1 per Mo.	N/A (<1 TPY
18	MED	x	Dominican Santa Cruz Hospital	1555 Soquel Dr.	Santa Cruz	95065	Santa Cruz	Carolyn Silvers	(408) 462-7700	G	80 PPH		1985	57 TPY	7 hrs/day	4,881 gal/yr
19	MED	x	El Centro Regional Med Cntr	1415 Ross Avenue	El Centro	92243	Imperial	Bob Sims	(619) 339-7100	G	unknown			5 TPY	5 hrs/day	1941 gal/yr
20	MED	x	Enloe Memorial Hospital	W. 5th and The Spinnaeds	Chico	95926	Butte	Les Doll	(916) 891-7300	G	N/A (<1 TPY Ash Gen)		N/A (<1	0.6 TPY	2 weeks/yr	N/A (<1 TPY
21	MED	x	Feather River Hospital	5974 Pentz Rd.	Paradise	95969	Butte	Allen Ossander	(916) 877-9361	G	100 PPH			110 TPY	18 hrs/Day, 7 days/ week	55 gallon wk
22	MED	x	Fort Ord, Silas B. Hayes Hospital		Fort Ord	93941	Monterey	Fred Steven	(408)243-4297	G	N/A (<1 TPY Ash Gen)		N/A (<1	1 TPY	1 per week	5 lbs/wk
23	MED	x	Frank R. Howard Memorial Hosp	Madrone & Mendocino St.	Willits	95490	Mendocino	Jack Lawrence	(707) 459-6801	G	50 PPH			3 TPY	2 per week	910 gal/yr
24	MED	x	Genentech, Inc.	460 Pt. San Bruno Blvd.	S. San Francisco	94080	San Mateo	Dave Odegaard	(415) 266-3321	G	unknown		1983	13 TPY	12 hrs/day – 5 days/wk	2.5 TPY
25	MED		General Hospital	2200 Harrison Ave.	Eureka	95501	Humbolt	N/A No available info on facility	N/A No available info on facility	G	N/A No available info on facility		N/A No available info on facility	N/A No available info on facility	N/A No available info on facility	N/A No available info on facility
26	MED	x	General Services, US Gov't	880 Front St., Rm 5-S-37	San Diego	92188-0050	San Diego	Frank Gene	(619)461-6040	P	unknown		1985	4 TPY	2 per week	3,640 gal/yr
27	MED	x	George AFB	George AFB	Victorville	92394	San Bernardino	Jim Hassell	(619) 269-1110 X 3080	G	N/A (<1 TPY Ash Gen)		N/A (<1 TPY Ash	4 TPY	5day/week 4 hrs/day	1664 gal/year
28	MED	x	George L. Mee Hospital	300 Canal St.	King City	93930	Monterey	Bonnie Costellos	(408) 385-6000	G	N/A only 1 TPY Ash		N/A only 1	8.5 TPY	24 hrs	1 TPY
29	MED	x	Glenn General Hospital	1133 West Sycamore St.	Willows	95988	Glenn	John Steward	(916) 934-6461	G	N/A (<1 TPY Ash Gen)		N/A (<1	9 TPY	N/A (<1 TPY	N/A (<1 TPY
30	MED	x	Hi-Desert Medical Center	6601 Whitefeather Rd.	Joshua Tree	92252	San Bernardino	Ron Massey	(619) 366-3711		75 PPH		1976	16 TPY	8 hr/ day	2,080 gal/year
31	MED	x	International Immunology Corp.	25549 Adams Ave.	Murrieta	92362	Riverside	Randy Jackson	(714) 677-5629	G	N/A (<1 TPY Ash Gen)		1969	3.5 TPY	2 days/Mo.	660 gal/yr
32	MED		Jerry L. Pettis, Mem. Vet's Hosp	11201 Benton Ave.	Loma Linda	92357	San Bernardino	Charles Clark	(714) 825-7084	G	Refusal		1977	Refusal	Refusal	Refusal
33	MED	x	Lakeside Community Hospital	P.O. Box 719	Lakeport	95453	Lake	Wayne Yost	(707) 263-5651	D	unknown		1978	32.5 TPY	6 hours/day, 5 days/ week	7,800 gal/year

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Incinerator Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Response
34	MED	x	Mad River Hospital	3800 Janes Rd.	Arcata	95521	Humbolt	Ken Mommon	(707) 822-3621	G	N/A (<1 TPY Ash Gen)		N/A (<1 TPY Ash	22 TPY	N/A (<1 TPY Ash Gen)	250 gall/yr
35	MED	x	Mendocino District Coast Hospt	700 River Dr.	Ft. Bragg	95437	Mendocino	Rober Neal	(707) 961-1234	G	N/A (<1 TPY Ash Gen)		1985	4.5 TPY	5 hr/5 days/week	N/A (<1 TPY Ash Gen)
36	MED	x	Merced County Animal Shelter	2080 Grogan Avenue	Merced	95340	Merced	Officer Akers	(209) 385-7455	G	N/A (<1 TPY Ash Gen)		N/A (<1	<1 Ton/yr	N/A	<1 Ton/yr
37	MED	x	Modoc Medical Center	228 McDowell	Alturas	96101	Modoc	Louis Schaeffer or Murty	(916) 233-5131	N/A (<1 TPY Ash	N/A (<1 TPY Ash Gen)		N/A (<1 TPY Ash	0.5 TPY	1 day per week	N/A (<1 TPY Ash Gen)
38	MED	x	Nazareth House	245 Nova Albion Way	San Rafael	94903	Marin	Lucille Yates	(415) 479-8282	G	N/A (<1 TPY Ash Gen)		1984	32 TPY	N/A (<1 TPY	0.5 TPY
39	MED	x	Needles Desert Community	1401 Bailey Ave.	Needles	92363	San Bernardino		(619) 326-4531	N/A (<2 TPY Ash	N/A (<2 TPY Ash Gen)		N/A (<2 TPY Ash	18 TPY	N/A (<2 TPY Ash Gen)	1.5 TPY
40	MED	x	No. Inyo Hospital	150 Pioneer Lane	Bishop	93514	Inyo	Bob Webster	(619) 873-5811	LPG	N/A (<1 TPY Ash Gen)		1981	0.5 TPY	1.5hrs/day 5days/week	1,300 gal/yr
41	MED	x	Oroville Hospital	2767 Olive Hwy.	Oroville	95965	Butte	Larry Brilliante	(916) 533-8500	G	unknown		unknown	108 TPY	7hrs/day 7 days/week	6,692 gall/year
42	MED	x	Pacific Presbyterian Med Cntr	2333 Buchanan St.	San Francisco	94115	San Francisco	Dennis Layden	(415) 923-3355	G	N/A (<1 TPY Ash Gen)		1973	780 PPY	3 days/week	<1 TPY
43	MED	x	Pioneer Memorial Hospital	207 W. Legion Rd.	Brawley	92227	Imperial	Delvin Yamell	(619) 351-3333	G	N/A (<1 TPY Ash Gen)		N/A (<1 TPY Ash Gen)	5 TPY	1hr/5 day week	2,860 gals/yr
44	MED	x	Redbud Community Hospital	18th Ave. and Hwy 53	Clearlake	95422	Lake	Frank Ignacio	(707) 994-6486	P	100 PPH		1985	15.6 TPY	7hrs/day 6 day/wk	6,240 gall/yr*
45	MED	x	Redwood Memorial	3300 Renner Drive	Fortuna	95540	Humbolt	Fred Hesch	(707) 725-3361	G	unknown		unknown	15.6 TPY	6hrs/day 6 day/wk	6,860 gall/yr*
46	MED	x	Royal Convalescent	P.O. Box 1380	Brawley	92227	San Diego	Fred Friedman	(619) 344-5431	G	N/A (<1 TPY Ash Gen)		1967	0.6 Tons/Yr	5 days/wk	N/A (<1 TPY Ash Gen)
47	MED	x	Seneca Hospital	130 B. Drive	Chester	96020	Plumas	Linda McCurdy	(916) 258-2151	P	unknown		1989	66 TPY	7 Hrs per day-4 days/wk	3,432 gals/yr
48	MED	x	Sepulveda V.A. Medical Center	16111 Plummer St.	Sepulveda	91343	Los Angeles	Robert Borjon	(818) 891-7711 x2717	G	N/A (<1 TPY Ash Gen)		1972	unknown	4 times per year	N/A (<1 TPY Ash Gen)
49	MED	x	Sierra Nevada Memorial Hospital	155 Hanson Way	Grass Valley	95945	Nevada	Ron Kimbrough	(916) 274-6000 x5295	G	N/A (<3 TPY Ash Gen)		N/A (<3 TPY Ash	15 TPY	6 hrs/day 7 days/wk	< 3 TPY
50	MED	x	Siskiyou General Hospital	818 South Main St.	Yreka	96097	Siskiyou	Bob Bailey	(916) 842-4121	G	100 PPH		1985	9 TPY	2 hrs per day -7days/wk	4,014 gals/yr
51	MED	x	So. Inyo Hospital	150 Pioneer Lane	Bishop	93514	Inyo	Bob Webster	(619) 873-5811	LPG	N/A (<2 TPY Ash Gen)		1985	5.9 TPY	1.5 hrs/day 5 days/wk	2,860 gal/yr
52	MED		SRI International	333 Ravenswood Ave., Bldg	Menlo Park	94025	San Mateo	Charles Anderson	(415) 859-2211	G	No Response		1950	No Response	No Response	No Response
53	MED	x	St. Bernardine Medical Center	2101 N.Waterman, P.O. Box 647	San Bernardino	92404	San Bernardino	Michael Rousseau	(714) 883-8711 x3339	G	unknown		1985	10.8 TPY	12 hr per day-7 days/wk	10,800 gall/yr
54	MED	x	St. Helena Hospital	Sanitrm & Sunnyside Rds.	Deer Park	94576	Napa		(707) 963-3611	G	N/A (<1 TPY Ash Gen)		N/A (<1	9 TPY	N/A (<1 TPY	N/A (<1 TPY
55	MED	x	St. Joseph Hospital	2700 Dolbeer St.	Eureka	95501	Humbolt	Fred Hesch	(707)445-8121	G	N/A (<1 TPY Ash Gen)		N/A (<1 TPY Ash	10 TPY	14 hrs/day-6days	104 Cubic Yards per year
56	MED	x	Sutter Davis	Rd. 99 at Cowell Blvd	Davis	95616	Yolo	John Pate	(916) 756-6440	G	N/A (<3 TPY Ash Gen)		1975	30 TPY	4 hrs/day - 7 days/wk	477 gallons/yr
57	MED	x	Tracy Defense Depot		Tracy	unknown	San Joaquin	Wes Harris	(209) 832-4536		500 PPH			39 TPY	8hrs/day - 3 days/wk	7800 gallons/yr
58	MED		Trinity General Hospital	410 North Taylor	Weaverville	96093	Trinity	Richard Reagan	(916) 623-9536	G	Refusal		1989	Refusal	Refusal	Refusal
59	MED	x	U.S. Air Force	60 ABG/DB	Travis AFB	94535-5496	Solano	Tom Hayes	(707) 423-3700	G	200 PPH		1990	20.8 TPY	1 Day/wk	60 PPD

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Response
60	MED		UC Medical Center	Box 0894	San Francisco	94143	San Francisco	Al Imnlotheri	(415)476-2125	G	300 PPH		1971	900PPD	8.5 hours, 5 days /week	35 PPD
61	MED	n	Ukiah Valley Medical Center	275 Hospital Dr.	Ukiah	95482	Mendocino	Paul Kassler	(707)462-3111	G	unknown		1982	140 TPY	24 Hrs - 7days/wk	9.3 TPY
62	MED	n	USDA - Animal Plant Hlth Insp Serv	P.O. Box 431., 720 East San Ysidro Blvd.	San Ysidro	92073	San Diego	W.D. Garner	(619) 428-7333	G	N/A (<1 TPY Ash Gen)		1978	13.5 TPY	2hrs/day - 7days/wk	N/A (<1 TPY Ash Gen)
63	MED	n	Vet's Administration Med Cntr	4150 Clement St.	San Francisco	94121	San Francisco	Lou Bright	(415) 750-3412	G	150 PPH		1984	10.4 TPY	6hr/day - 3 days/week	960 gills/yr
64	MED	n	Vienna Convalescent Hospital	800 South Hunt	Lodi	95242	San Joaquin	Glenn	(209) 368-7141	N/A (<1 TPY Ash	N/A (<1 TPY Ash Gen)		1966	0.5 TPY	1 hr/day - 5 day/wk	N/A (<1 TPY Ash Gen)

Appendix E

Survey Data on Sewage Sludge Incineration Facilities

R.W. BECK
AND ASSOCIATES

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Responses
1	SEW	x	City of Barstow	2200 E. Riverside Dr.	Barstow	92311	San Bernardino	John Brand	(619) 256-3531	SEW	500 PPH	Multiple Hearth	1968	800 Dry TPY	8 hrs/day 5 days/wk	40 TPY
2	SEW	x	City of San Mateo	2050 Detroit Drive	San Mateo	94404	San Mateo	Ty Plischke	(415) 377-4690	G	2800 PPH	Multiple Hearth	1980	10 Dry TPD	24 hours	2 TPD
3	SEW	x	Contra Costa Sanitary District	5019 Imhoff Pl.	Martinez	94553	Contra Costa	Bill Brennan	(415) 689-3890	G	7500 PPH	Multiple Hearth	1984	36 Dry TPD	24 hours	5 TPD
4	SEW	x	Doc May Regional WWTP	2501 Embarcadero Way	Palo Alto	94303	Santa Clara	Bill Mike	(415) 329-2243	G	2520 PPH	Multiple Hearth	1972	15 Dry TPD	24 hours	3 TPD
5	SEW	x	Hyperion Treatment Plant	1200 Vista Del Mar	Playa Del Mar	90291	Los Angeles	Rich Vardal	(213) 648-5113	G	27000 PPH 13500 PPH	Fluidized Bed	1987	40 Dry TPD	24 Hours	20 TPD
6	SEW	x	South Tahoe PUD	P.O. Box 19548	S. Lake Tahoe	96151	El Dorado	Jerry Sills	(916) 544-6474	G-P	73000 PPH	Multiple Hearth	1961	11 Dry TPD	24 hours	4 TPD

Appendix F

Survey Data on Tire Incineration Facilities

R.W. BECK
AND ASSOCIATES

	Facility Type	X	Facility Name	Street	City	Zip	County	Contact Person	Phone Number	Type of Fuel	Nameplate Capacity	Boiler/ Burn Technology	Start Date	Amount of fuel Combusted	Hours of Operation	Quantity of Ash Generated Surv. Response
1	TIR	n	Modesto Tire-to-Energy	4549 Ingram Road	Westley	95387	Stanislaus	Bob Ellery	(707) 578-6144	T	6.5 TPH	Moving Grate	1987	47,376 TPY	24 hours	6000 TPY