MERCURY COMPLIANCE USING SORBALIT® IN THE 1200 TPD MONTGOMERY COUNTY RESOURCE RECOVERY FACILITY

Jay Lehr
Montenay Energy Resources of Montgomery County, Inc. (MERMCI)
Conshohocken, PA

Anthony Licata
Licata Energy & Environmental Consultants, Inc.
Yonkers, NY

Louis A. Terracciano
Licata Energy & Environmental Consultants, Inc.
Yonkers, NY

ABSTRACT
When the Montenay Energy Resources of Montgomery County, Inc. (MERMCI) facility initially began operation in 1992, the operating permit emission limit for mercury (Hg) was 627 μg/dscm. However, in 1995, the USEPA promulgated emission guidelines that required the facility to meet a more stringent Hg emission standard of 80 μg/dscm or achieve an 85% reduction.

Historical stack testing indicated the facility would not meet this standard without the installation of new control equipment. MERMCI and the Waste System Authority of Montgomery County (WSA) evaluated several mercury reduction technologies. The decision was made to utilize Sorbalime since the application of this technology did not require new capital investment in equipment. The economic analysis indicated Sorbalime technology was cost neutral, results of testing at other facilities indicated Sorbalime was effective and Sorbalime could be implemented in a short period of time.

MERMCI and Carmeuse undertook an evaluation to determine the applicability of Sorbalime to the facility and what the most economical and technically feasible formulation would be in order to achieve compliance. In April 1999, Montenay and Carmeuse undertook a testing program to evaluate Sorbalime at MERMCI. Based on the test results from the Niagara Falls Resource Recovery Facility, Montenay and Carmeuse decided that only one formulation of Sorbalime (2% carbon and 0.25% sulfur) should be tested and evaluated. If the tests indicated that the tested formulation needed to be modified, the new formulation could readily be calculated from regression models developed by Licata Energy.

The April 1999 stack test showed a Sorbalime formulation with 2% carbon and 0.25% sulfur would meet the new Hg emission standard at MERMCI. This finding was confirmed by the official tests that were conducted in May of 1999 and the facility has been using Sorbalime since.

INTRODUCTION
On February 17, 1992, the Montgomery County Resource Recovery Facility (see Figure 1) completed performance testing and began full commercial operation. Table 1 provides an overall description of the facility. The facility was constructed with the purpose of processing solid waste generated by approximately 425,000 residents of 24 municipalities of eastern Montgomery County, Pennsylvania. The facility is located in Conshohocken, Pennsylvania, approximately 10 miles west of Philadelphia. The plant transforms heat energy produced during the combustion of waste into electrical energy. Since the start of commercial operation, the facility has satisfied all contractual commitments and environmental regulations by significant margins. The facility is owned and operated by Montenay Power Corporation, a subsidiary of Paris based Vivendi. Montenay is the operator of eight Waste-to-Energy plants throughout North America and Vivendi is the world's largest operator of Waste-to-Energy facilities with over 70 plants worldwide.

FACILITY PRODUCTION

Since the start of commercial operation, the facility continues to operate at peak performance with few problems. Plant availability averages above 90%. Contractual production guarantees have been surpassed by significant margins since startup. Production guarantees are based on waste processed and electricity produced. The annual waste throughput guarantee is 350,000 tons. The facility averages 408,000 tons per year waste throughput. The facility average of 207,000 MWH per year electrical power exported is well above the annual guaranteed amount of 169,000 MWH. Table 2 provides a summary of facility operations data from 1992 through 1997.

GENERAL FACILITY DESCRIPTION

The facility consists of two units each designed for normal processing of 608 tons per day (tpd) of municipal solid waste (see Figure 2). Waste is transported to the facility by transfer trailers as well as smaller packer-type trash trucks. The trucks are weighed as they enter the facility and again on exit. Each truck is issued a registration sticker by Montgomery County. The truck's identification number is entered in a computer system as it is weighed and all hauler billing is automated.

The trucks enter a totally enclosed tipping hall and back up to a pit where they discharge the refuse. The tipping hall is continually kept under a negative pressure in order to keep any odors and dust generated in the tipping hall from escaping and entering the surrounding community. Two overhead bridge cranes are used to move the trash from the pit to the furnace feed hoppers. Each crane is equipped with a polyprong type orange peel grapple that has an 11ton, 8 cubic yard capacity. The cranes are also used to mix the refuse contained in the pit in order to obtain a more homogenous fuel for the furnace, thus insuring a more constant energy content of the fuel and eliminating large swings in steam flow in the boilers.

The furnace, grate system and heat recovery boiler were supplied by L&C Steinmüller of Germany (See Figure 2). Waste is introduced into the furnace by way of a water-cooled feed chute and hydraulic ram system. In order to minimize feedrate variations, the feeder system consists of two rams arranged one on top of the other that are operated alternately. The feed system terminates at the first grate zone. The stoker system utilizes a reciprocating grate design typical of other Steinmüller units throughout the world.

The grate system consists of two parallel grate sections with five zones per section. Typically, the first grate zone is used to dry the waste, while the second, third, and fourth grate zones are used for combustion. The fifth grate is used for final "burn out" of the fuel. The grate system is equipped with alternate rows of movable and fixed grate bars. Gaps between adjacent grate bars provide space for the introduction of combustion air and a passage for the removal of fines.

The movable bars are arranged on a frame separate from the fixed grates. The grate carriage runs on axleless rollers. The roller assembly is protected from dirt by a casing. Varying the movement of any of the five hydraulically operated grate zones can control the speed of refuse feed. The refuse feed rate can be automated using a steam flow setpoint. As steam flow deviates from the setpoint, the refuse feed rate is adjusted to decrease the deviation from setpoint.

The boiler steam flow is set at 162,000 lbs/hr but may be adjusted to compensate for the quality of waste being processed. Combustion airflow is adjusted accordingly to ensure complete combustion of the refuse by utilizing the amount of oxygen in the flue gas as a setpoint. Typically the units are operated to maintain 8% oxygen (wet). Primary air is provided through spaces between the grate bars to support combustion. Primary air, also known as underfire air, serves a secondary purpose of cooling the grate bars to prevent heat damage. Plant operators have the capability of pre-heating the primary air using a steam pre-heater to enhance the combustion of wet waste. Primary air flow is divided between the five grate zones; air flow to each zone can be controlled individually by the operators in order to assure complete burnout of the waste.

Secondary air is injected above the burning refuse for the purpose of combusting the volatile gases given off during primary combustion. Secondary air also serves as a "blanket" that will decrease carry-over of particulate matter into the convective sections of the boiler. Temperature in the furnace is in excess of 2000° F, which is sufficient to ensure destruction of dioxins and organics. Each unit is equipped with three oil burners capable of burning #2 fuel oil. As required by permit, oil burners are used to bring the furnace temperature up to 1800° F before any municipal solid waste (MSW) is introduced into the combustor and to allow a controlled shutdown of the unit.

The heat from the combustion process is transmitted to the waterwall tubes of the furnace and two empty radiation chambers, providing three gas passes, thus forcing the flue gas to make two 180-degree changes in direction. At each turn, particulate matter drops from the gas stream. The heated gas then passes through the convective sections of the boiler. These consist of a final and initial superheater, evaporator and economizer surfaces. Superheated steam at 650 psig and 750°F from both boilers is used to drive a single turbine that is coupled with a 36 MW generator. The power generated is used to drive electrical equipment in the facility with the excess electrical power sold to the local electric utility.

The condensate system consists of a steam surface condenser, condensate pumps and other equipment as found in a conventional power producing facility. The plant is also equipped with a dump condenser that allows both furnaces to remain in service at full load in the event the turbine must be bypassed. The facility utilizes a forced draft cooling tower for cooling the condensate and auxiliary cooling water.

Noncombustible material and ash residue from the combustion process falls from the end of the fifth grate into a water filled ash extractor where it is quenched. Fly ash from the air pollution control system and boiler is added to the bottom ash at this point. The combined ash from both units is then transferred to a common ash discharge conveyor by hydraulic rams. The ash conveyor passes under two magnetic belt separators that remove the ferrous material from the ash and discharge it to a concrete bunker. The remaining ash is transported to a separate bunker. An overhead bridge crane is used to transfer the ash into trucks for transportation to a landfill. The ash residue is beneficially utilized as daily cover material at the landfill. The recovered ferrous material is sold to a local scrap dealer.

Each combustor is equipped with a Fueltech $DeNO_X$ system that utilizes urea injection to reduce NO_x emissions. The combustors are each also equipped with a spray dryer (dry scrubber) and baghouse for control of air emissions. The boiler exit gas enters the scrubber where lime and activated carbon (Sorbalime) slurry is injected into the gas path via six atomizing nozzles. The lime acts to neutralize the acid gases produced during combustion; activated carbon captures mercury and other heavy metals and the dilution water controls the baghouse inlet temperature. The decrease in flue gas temperature also causes vaporized metals to condense and be deposited in the fly ash and activated carbon, therefore reducing metal emissions, to the atmosphere.

The baghouse consists of eight compartments per unit. Filters are cleaned by reverse air introduced to an isolated compartment whenever the pressure drop across the particular compartment reaches a pre-determined value. The fly ash generated in the baghouse and the scrubber residue is transported to the ash extractor via a pneumatic dense phase conveying system. The ash from the convective section of the boiler is collected in hoppers below the heat recovery boiler and transported by screw conveyors to the ash extractor. Ash and slag buildup on the boiler tubes is removed on a regular basis by pneumatic and mechanical rappers.

The facility is operated through a Bailey distributed control system (DCS). The control room operator can operate or monitor over 90% of the equipment in the plant. The DCS consists of three computer monitors where the operator can call up over 100 displays depicting operating data of the facility systems and equipment. Although much of the equipment is automated, operator interface is very important to the safe and efficient operation of the plant.

FACILITY ENVIRONMENTAL HIGHLIGHTS

The environmental impact of the facility on the surrounding community was given a great amount of attention prior to construction. The facility was built using the best proven and economically feasible pollution reduction technology available at the time of design. The facility meets the strict permit requirements specified by the Pennsylvania Department of Environmental Protection (PADEP). The Facility was the first Waste-to-Energy plant in North America to become ISO 14001 registered. The International Standards Organization (ISO) sets the specifications for Environmental Management Systems (EMS). An independent accredited auditor certifies that the facility demonstrates conformance with the ISO standard. A surveillance audit performed by an independent accredited auditor every six months is required to maintain ISO 14001 registration.

The plant is a zero process water discharge facility. No wastewater is allowed to leave the site except for sanitary sewer discharge. All wastewater generated in the process is recycled at various points in the facility. Storm water runoff is diverted by swales surrounding the plant and is collected in a retention pond. Monitoring for concentrations of organic material and metals in the effluent is performed twice a year according to the facility NPDES Stormwater permit.

Air pollution is controlled by the grate and furnace design insuring proper combustion, urea injection, the scrubber with Sorbalime injection and the baghouse. Air emissions are monitored using a state of the art continuous emission monitoring system (CEMS). The concentrations of various pollutants are measured at the inlet of the air pollution control (APC) equipment as well as at the stack. This allows the facility to calculate the reduction of emissions across the APC as required by the facility air permit.

The CEMS consists of six extractive type multi-component analyzers capable of measuring SO_2, CO, CO_2, HCl, NO_x, O_2 and moisture content of the gas. Each boiler has one dedicated inlet and one dedicated outlet monitor. The system also includes two stand-by monitors, one inlet and one outlet, which can monitor either unit 1 or unit 2 emissions. The redundant monitors are a necessity due to strict data availability requirements imposed by PADEP on the facility. The redundant monitors will continue to provide data when a primary analyzer requires maintenance or enters required daily calibration. Each boiler is equipped with two opacity monitors, one primary and one redundant, both located in the stack. The CEMS also records the furnace temperature.

The data provided by all monitors is transmitted to a dedicated data acquisition system (DAS) that records and reports the data in a variety of formats. The DAS also performs calculations on the data to provide the required averaging times and correction to 7% O_2 (dry). The data is transmitted to a dedicated workstation located in the main control room where an operator can monitor emissions and take precautions to prevent excess emissions. The DAS is accessible via computer modem to the PADEP and EPA, as well as Montgomery County and the local township. In addition to required quarterly reporting, emissions are checked on a regular basis by these agencies through the telemetry system.

Through the conscientious actions of the operations and maintenance staff of the facility, air contaminant emissions from the facility are among the lowest in the country for similarly constructed facilities. The facility air quality permit dictates strict emission limitations for the facility.

Operating Permit Limitations

The limits as stated in the Facility operating permit are as follows (all concentrations corrected to 7% O_2 on a dry basis, unless noted):

- Opacity no greater than 10% for any 3 minutes in an hour no greater than 30% at any time
- SO_2 <30 ppm or 70% reduction
- CO<100 ppm (daily average)
- NO_x<205 ppm (daily average)
- HCl<30 ppm or 90% reduction
- Combustion Efficiency>99.9% (calculated by $CO_2/(CO_2 + CO) \times 100$)
- O_2 Wet>3%
- Furnace Temperature>1800°F for 1 second retention time

Operating Permit Testing Requirements

Stationary source testing is performed at the facility every six months for arsenic, beryllium, cadmium, nickel, hexavalent chromium, lead, benzo(a)pyrene, VOC, mercury and particulate matter. Testing for total dioxin and furan emissions is conducted once a year. Dispersion modeling is performed on data collected from each stack test in order to find the maximum ambient impact on air quality in the surrounding area. After a significant time of weekly and monthly testing, ash residue generated at the facility is currently running TCLP analysis on a quarterly composite sample basis. Ash is tested for moisture content on a daily basis.

MERCURY TESTING

Stack test programs for mercury emissions were performed on Unit 1 and Unit 2 in January of 1992, March of 1993, March of 1994, April of 1999 and May of 1999. Three test runs were performed to make a test series for each test program.

Results and Discussion

Table 3 provides a summary of five mercury stack emissions test programs performed on Unit 1 and Unit 2 beginning in 1992. The initial three test programs were conducted at the baghouse outlet with no Sorbalime use. The flue gas mercury content for these three initial test programs ranged from 88 to 222 µg/dscm @ 7% O_2 with an average value of 157 µg/dscm @ 7% O_2 for Unit 1 testing. The corresponding flue gas mercury content for Unit 2 ranged from 101 to 307 µg/dscm @ 7% O_2 with an average value of 191 µg/dscm @ 7% O_2. Average mercury stack emissions from both units were above the required 80 µg/dscm level.

As a result of these test results and after careful review and evaluation of alternatives, the facility decided to use Sorbalime in place of lime to reduce the mercury emissions. Sorbalime is a quicklime-based product composed of lime, activated carbon and other proprietary sulfur components that can be applied at any facility that currently slakes lime for a spray dryer. The Sorbalime replaces lime with virtually no additional equipment required.

In April of 1999 a mercury stack emissions test was performed at the dry scrubber inlet and at the baghouse outlet on Unit 1 and Unit 2 using Sorbalime containing 2% activated carbon. The testing was performed as a trial test to verify the plant would meet the mercury emission limit of 80 µg/dscm @ 7% O_2 in advance of the official compliance test scheduled for May. The average flue gas mercury content measured at the dry scrubber inlet for Unit 1 and Unit 2 was 158 and 145 µg/dscm @ 7% O_2 respectively. The corresponding average flue gas mercury content measured at the baghouse outlet for Unit 1 and Unit 2 was 23 and 27 µg/dscm @ 7% O_2 respectively. Both of these values were in compliance with the state limit of 80 µg/dscm @ 7% O_2. These results indicated a mercury removal efficiency of 84% for Unit 1 and 81% for Unit 2.

The official compliance test was then performed in May of 1999. As was done in April, the mercury stack emissions test was performed at the dry scrubber inlet and at the baghouse outlet on Unit 1 and Unit 2 using Sorbalime containing 2% activated carbon. The average flue gas mercury content measured at the dry scrubber inlet for Unit 1 and Unit 2 was 125 and 93 µg/dscm @ 7% O_2 respectively. The corresponding average flue gas mercury content measured at the baghouse outlet for Unit 1 and Unit 2 was 12 and 28 µg/dscm @ 7% O_2 respectively. Once again, both units were in compliance with the state limit of 80 µg/dscm @ 7% O_2. These results indicated a mercury removal efficiency of 90% for Unit 1 and 69% for Unit 2.

TABLE 1
MONTGOMERY COUNTY
RESOURCE RECOVERY FACILITY

A. FACT SHEET

• Plant Capacity	1,216 tons per day
• Annual Waste Processing Capability	377,000 tons
• Electrical Output per ton	490 kWh
• Annual Electrical Power Sales	169 million kWh
• Steam Output per ton	5,200 pounds
• Electrical Capacity:	36 MW

B. PHYSICAL CHARACTERISTICS OF PLANT

• Building Height:	
•Tipping Hall	35 feet
•Boiler House	142 feet
•Stack	305 feet
•Furnace	100 feet x 25 feet (width) x 100 feet (length)

- 2,000 tons of reinforcing steel
- 20,000 cubic yards of concrete

C. MAJOR SUPPLIERS

• Boilers and Grates	Steinmüller
• Turbine and Generator	General Electric
• Air Pollution Control System	Research Cottrell
• Cranes	Whiting
• Cooling Towers	Hamon
• Stack	Custodis
• Emissions Monitoring	Environmental Elements Corp
• Truck Scales	Toledo
• System Controls	Bailey

TABLE 1 (CONTINUED)
MONTGOMERY COUNTY
RESOURCE RECOVERY FACILITY

D. MAIN PROCESS EQUIPMENT SPECIFICATIONS

Quantity	Description	Size/Capacity
2	Refuse Cranes with Orange Peel Grapples	11-ton capacity 10.46 cubic yard capacity
2	Incinerator/Boilers	L. & C. Steinmüller GmbH 608 TPD rated MSW Capacity @ HHV 5,000 Btu/pound. Maximum continuous rating 162,000 pounds/hour @ 650 psig, 750°F with 260°F feedwater, 85% excess air, rapper cleaning
2	Dry Scrubbers Air atomized slaked lime	Research Cottrell
2	Baghouses	Research Cottrell reverse air type
1	Stack (2 Flues)	Height: 305 feet above grade
1	Condenser Turbine Generator	General Electric @ 36,000 kW, 3,600 rpm, 13,800 V
1	Process Wastewater System	Zero discharge
1	Continuous Emission Monitoring System for each unit plus one backup system	HCl, SQ_x, NO_x, CO, O_2, CO_2, opacity, temperature. Remote accessing of data by DEP through telemetry system

E. AIR PERMIT INFORMATION

Particulates	0.015 gr/dscf
Combustion	1,800°F for one second
HCl	30 ppmv or 90% removal
SO_2	30 ppmv or 70% removal
CO	100 ppmv
NO_x	205 ppmv (24 hr. average)

TABLE 1 (CONTINUED)
MONTGOMERY COUNTY
RESOURCE RECOVERY FACILITY

F. GENERAL PROJECT INFORMATION

- Municipal solid waste disposal and electrical generating facility, operated by Montenay and owned by Montenay and ESI.
- Construction of the Facility began on May 23, 1989 and went into full operation on February 17, 1992 on an interim basis upon completion of the performance tests.
- The Facility achieved full acceptance on May 23, 1994 and began a 20 year service agreement with the Eastern District of Montgomery County.
- Serves 24 municipalities in the Eastern District of Montgomery County with population of about 425,000.
- The Eastern District has obligation to deliver at least 280,000 tons per year and can deliver up to the guaranteed plant capacity of 377,000 tons per year.
- Balance of plant capacity is from 3rd party waste. Typically, waste is 80% from the County and 20% from 3rd parties.
- Electrical Capacity: 36 MW
- The electricity produced is sold to PECO.
- Ash residue is beneficially utilized as daily cover at a landfill.

TABLE 1 (CONTINUED)
MONTGOMERY COUNTY
RESOURCE RECOVERY FACILITY

G. Contract Guarantees

- The 20 year Operating Service Agreement between WSA and Montenay began on May 23, 1994 upon issuance of the Operating Permit from PADEP.

• Throughput Guarantee:	350,000 tons per year @ 5000 BTU per pound
• Electrical Guarantee:	464 net kWh/ton @ 4500 BTU per pound 169,000 MWh per year
• Steam production Guarantee:	5,200 pounds per ton @ 5000 BTU per pound
• Ash Residue Guarantee:	≤ 4% combustible material ≤ 0.2% putrescibles ≤ 22% moisture ≤ 25% by weight (dry basis) ≤ 10% by volume

TABLE 2 – MERMCI FACILITY DATA

MSW ASH/METALS		1992	1993	1994	1995	1996	1997	1998	1999
MSW Received	Ton	343,734	408,641	399,300	409,738	421,292	411,375	404,657	402,177
MSW Processed	Ton	343,413	409,780	398,600	412,692	412,642	419,145	408,659	404,258
Bypassed MSW	Ton	0	0	3,000	1,935	0	0	0	7,388
Non-processible MSW	Ton	3	53	73	76	82	82	50	50
Ferrous recovery	Ton	3,532	2,822	4,500	5,415	6,506	6,280	4,912	3,683
Ash	Ton	94,417	121,585	119,600	120,874	118,462	115,173	111,915	116,410

ENERGY		1992	1993	1994	1995	1996	1997	1998	1999
Gross Generation	MWH	208,340	251,250	228,680	244,280	238,690	244,450	250,860	245,430
Plant Use	MWH	31,800	36,640	35,600	37,340	36,630	36,830	36,870	36,080
Net Generation (Utility Meter)	MWH	176,540	214,910	194,780	207,650	202,390	208,610	214,450	209,970
Purchased Power from Utility	MWH	480	300	1,700	710	330	990	460	620
kWh/ton	kWh/ton	514	524	497	503	490	498	525	519

TURBINE GENERATOR #1		1992	1993	1994	1995	1996	1997	1998	1999
On line hours	hours	7,447	8,665	8,230	8,409	8,580	8,324	8,552	8,453
Forced outage hours	hours	36	95	330	104	0	6	58	16
Planned outage hours	hours	149	0	200	247	204	430	150	291
Availability	%	97.6	98.91	93.95	95.99	97.68	95.02	97.62	96.50

BOILER #1		1992	1993	1994	1995	1996	1997	1998	1999
Steam production	Klb	1,053,888	1,258,053	1,175,900	1,237,491	1,164,659	1,235,351	1,231,199	1,235,191
On line hours	hours	6,906	8,047	7,884	8,010	7,721	7,924	7,901	7,974
Forced outage hours	hours	274	365	380	260	591	336	366	304
Planned outage hours	hours	476	348	496	460	473	500	494	483
Availability	%	90.2	91.86	90	91.43	89.96	90.46	90.19	91.02

BOILER #2		1992	1993	1994	1995	1996	1997	1998	1999
Steam production	Klb	1,077,859	1,252,182	1,175,900	1,240,345	1,201,292	1,225,776	1,246,534	1,217,634
On line hours	hours	7,009	7,920	7,884	7,898	7,903	7,909	7,859	7,923
Forced outage hours	hours	169	451	520	290	408	168	475	369
Planned outage hours	hours	478	389	356	572	473	684	426	468
Availability	%	91.5	90.41	90	90.16	89.96	90.28	89.72	90.45

OTHER		1992	1993	1994	1995	1996	1997	1998	1999
Auxiliary fuel/Gas used	MCF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Auxiliary fuel/Oil used	Gallons	175,000	213,088	268,500	368,985	327,744	238,764	221,266	403,579
Lime used	Tons	4,875	6242	5,366	5,882	5,000	4,651	4,764	4,841
Hours in year/month	hours	7,656	8,760	8,760	8,760	8,784	8,760	8,760	8,760

TABLE 3 – SUMMARY OF MERCURY TESTING (2% CARBON)

Unit 1	Jan-92	Mar-93	Mar-94	Average (1/92, 3/93 & 3/94 Tests)	Apr-99	May-99	Average (4/99 & 5/99 Tests)
Inlet							
Flue Gas Temperature - °F	-	-	-	-	457	511	484
µg/DSCM	-	-	-	-	138.3	112.4	125.3
µg/DSCM @7% 0_2	-	-	-	-	157.5	125.4	141.5
lb/hr	-	-	-	-	0.0347	0.0285	0.0316
Outlet							
Flue Gas Temperature - °F	320	306	307	311	316	321	319
µg/DSCM	66.7	134.0	174.2	125.0	18.6	10.6	14.6
µg/DSCM @7% 0_2	88.0	161.0	222.0	157.0	22.7	11.7	17.2
lb/hr	0.0198	0.0346	0.0505	0.0350	0.0055	0.0029	0.0042
Removal Efficiency							
Tested Removal Efficiency Concentration Basis	-	-	-	-	85.52%	90.19%	87.86%
Tested Removal Efficiency Mass Basis	-	-	-	-	84.25%	89.85%	87.05%
Predicted Removal Efficiency Concentration Basis	-	-	-	-	86.33%	86.85%	86.59%
Unit 2	**Jan-92**	**Mar-93**	**Mar-94**	**Average (1/92, 3/93 & 3/94 Tests)**	**Apr-99**	**May-99**	**Average (4/99 & 5/99 Tests)**
Inlet							
Flue Gas Temperature - °F	-	-	-	-	471	505	488
µg/DSCM	-	-	-	-	122.1	87.0	104.6
µg/DSCM @7% 0_2	-	-	-	-	145.1	92.5	118.8
lb/hr	-	-	-	-	0.0333	0.0219	0.0276
Outlet							
Flue Gas Temperature - °F	323	300	310	311	314	321	318
µg/DSCM	128.6	84.8	244.0	152.5	21.7	24.2	22.9
µg/DSCM @7% 0_2	165.0	101.0	307.0	191.0	27.4	27.5	27.5
Lb/hr	0.0385	0.0235	0.0704	0.0441	0.0063	0.0068	0.0065
Removal Efficiency							
Tested Removal Efficiency Concentration Basis	-	-	-	-	81.02%	63.57%	72.29%
Tested Removal Efficiency Mass Basis	-	-	-	-	81.06%	69.08%	75.07%
Predicted Removal Efficiency Concentration Basis	-	-	-	-	88.17%	87.26%	87.71%