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**RESULTS OF THE JUNE 6, 1988  
SCRUBBER PERFORMANCE TEST AT THE  
ST. CROIX WASTE TO ENERGY INCINERATION  
FACILITY IN NEW RICHMOND, WISCONSIN**

Submitted to:

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Report Number 8-2560I  
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KE/klq

1 INTRODUCTION

On June 6, 1988, Interpoll Laboratories personnel conducted hydrogen chloride and sulfur dioxide removal on the Interel dry scrubber system installed on three incinerators at the St. Croix Waste To Energy Facility in New Richmond, Wisconsin. On-site testing was performed by J. Buresh, T. Hogan, D. Smith and T. Johnson.

The gas samples were collected at the inlet to the dry scrubber and the stack using a standard EPA Method 5 train, except that 1 N NaOH was used in the first two impingers instead of distilled water. Both acidic gases, hydrogen chloride and sulfur dioxide, were collected simultaneously using identical sampling trains. The collected samples were analyzed by ion chromatography.

A three-point traverse was used at each test site to collect representative gas samples. Each traverse point was sampled 10 minutes to give a total sampling time of 30 minutes per run.

The important results of the HCl and SO<sub>2</sub> test are summarized in Section 2. Detailed computer results are presented in Section 3. Field data and all other supporting information are presented in the appendices.

2 SUMMARY AND DISCUSSION

The important results of the removal efficiency determinations are summarized in Table 1.

The average removal efficiency of the Interel dry scrubbing system for hydrogen chloride was 99.87%. The average removal efficiency for sulfur dioxide was 79.2%. As will be noted, the sulfur dioxide removal efficiency decreased during the course of the test.

No difficulties were encountered in the field or in the laboratory evaluation of the samples. On the basis of this fact and a complete review of the entire data and results, it is our opinion that the concentrations and mass rates reported herein are accurate and closely reflect the actual values which existed at the time the test was performed.

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Table 1. Summary of the Results of the June 6, 1988 Removal Efficiency Determinations at the St. Croix Waste To Energy Facility in New Richmond, Wisconsin".

Test/ Run	Concentration (ppm,w)		Mass Rate (LB/HR)		Removal Efficiency (% w/w)
	Inlet	Stack	Inlet	Stack	
<b>(Hydrogen chloride)</b>					
4/1	188	0.099	22	0.013	99.94
4/2	162	0.11	18	0.015	99.92
4/3	182	0.41	21	0.054	99.74
Avg	177	0.21	20	0.027	99.87
<b>(Sulfur Dioxide)</b>					
4/1	98	4	20	0.98	95.1
4/2	40	8	8.0	1.9	76.3
4/3	59	16	12	3.7	66.2
Avg	66	9	13	2.2	79.2

### 3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition (Orsat and moisture) are presented first followed by the computer printout of the sulfur dioxide and hydrogen chloride results.

The results have been calculated on an IBM PC Computer using programs written in Extended BASIC specifically for source testing calculations. EPA-published equations have been used as the basis of the calculation techniques in these programs.

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Test No. 4  
MSW Incinerator Scrubber Inlet

**Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)**

Date of run	Run 1 06-06-88	Run 2 06-06-88	Run 3 06-06-88
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**Dry basis (orsat)**

carbon dioxide.....	5.20	4.49	4.78
oxygen.....	15.00	15.77	15.54
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.80	79.72	79.68

**Wet basis (orsat)**

carbon dioxide.....	4.80	4.19	4.45
oxygen.....	13.85	14.73	14.46
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	73.70	74.35	74.14
water vapor.....	7.64	6.73	6.95
Dry molecular weight.....	29.43	29.35	29.39
Wet molecular weight.....	28.56	28.59	28.60
Specific gravity.....	0.986	0.987	0.988

Test No. 4  
MSW Incinerator Scrubber Stack

**Results of Orsat & Moisture Analyses-----Methods 3 & 4 (%v/v)**

Date of run	Run 1 06-06-88	Run 2 06-06-88	Run 3 06-06-88
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**Dry basis (orsat)**

carbon dioxide.....	3.83	3.59	3.58
oxygen.....	16.54	16.87	16.83
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.63	79.54	79.59

**Wet basis (orsat)**

carbon dioxide.....	3.57	3.36	3.38
oxygen.....	15.44	15.81	15.91
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	74.33	74.53	75.24
water vapor.....	6.66	6.30	5.47
Dry molecular weight.....	29.27	29.25	29.25
Wet molecular weight.....	28.52	28.54	28.63
Specific gravity.....	0.985	0.986	0.989

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Results of Sulfur Dioxide Determinations-----Method 6

	Run 1	Run 2	Run 3
Date of run	06-06-88	06-06-88	06-06-88
Time run start/end.....(HRS)	1035/1105	1120/1150	1203/1233
Barometric pressure...(IN.HG)	29.05	29.05	29.05
Meter temperature....(DEG-F)	93.00	100.10	102.80
Meter correction coefficient	1.0069	1.0069	1.0069
Volume through gas meter.... at meter conditions...(CF) standard conditions...(SCF)	23.010 21.565	23.300 21.560	23.290 21.447
Total sampling time....(MIN)	30.0	30.0	30.0
Moisture content.....(%V/V)	7.67	6.73	6.95
Milliequivalents of SO <sub>4</sub> in.. gas sample.....	5.3800	2.1700	3.1900
<u>Sulfur dioxide concentration</u>			
(GR/DSCF).....	0.1233	0.0497	0.0735
(MG/DSCM).....	282	114	168
(PPM-DRY).....	106	43	63
(PPM-WET).....	98	40	59
SO <sub>2</sub> Emission rate....(LB/HR)	19.77	7.97	11.78

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Results of Sulfur Dioxide Determinations-----Method 6

	Run 1	Run 2	Run 3
Date of run	06-06-88	06-06-88	06-06-88
Time run start/end.....(HRS)	1035/1105	1120/1150	1203/1233
Barometric pressure...(IN.HG)	29.05	29.05	29.05
Meter temperature....(DEG-F)	90.75	96.67	99.25
Meter correction coefficient	0.9953	0.9953	0.9953
Volume through gas meter.... at meter conditions...(CF) standard conditions..(SCF)	22.740 21.157	22.840 21.025	23.140 21.202
Total sampling time....(MIN)	30.0	30.0	30.0
Moisture content.....(%V/V)	6.66	6.30	5.47
Milliequivalents of SO <sub>4</sub> in.. gas sample.....	0.2250	0.4340	0.8470
<u>Sulfur dioxide concentration</u>			
(GR/DSCF).....	0.0053	0.0102	0.0197
(MG/DSCM).....	12	23	45
(PPM-DRY).....	5	9	17
(PPM-WET).....	4	8	16
SO <sub>2</sub> Emission rate....(LB/HR)	0.98	1.91	3.69

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Results of HCl Determinations

	Run 1	Run 2	Run 3
Date of run	06/06/88	06/06/88	06/06/88
Time run start/end.....(HRS)	1035/1105	1120/1150	1203/1233
Barometric pressure...(IN.HG)	29.05	29.05	29.05
Meter temperature....(DEG-F)	93.00	100.10	102.80
Meter correction coefficient	1.0069	1.0069	1.0069
Volume through gas meter.... at meter conditions...(CF)	23.010	23.300	23.290
Total sampling time....(MIN)	30.0	30.0	30.0
Moisture content.....(%V/V)	7.64	6.73	6.95
Volumetric flow rate (DSCFM)	18716	18716	18716
HCl in sample.....(mG)	188.20	160.44	179.98
HCl concentration..... (GR/DSCF).....	0.1346	0.1148	0.1294
(MG/DSCM).....	308.30	262.88	296.44
(PPM-DRY).....	203.36	173.40	195.54
(PPM-WET).....	187.82	161.73	181.95
HCl emission rate....(LB/HR)	21.593	18.412	20.763

HCl = Hydrogen chloride

A trailing '<=' symbol indicates that the true value  
 is less than or equal to the reported value

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Results of HCl Determinations -----

	Run 1	Run 2	Run 3
Date of run	06/06/88	06/06/88	06/06/88
Time run start/end.....(HRS)	1035/1105	1120/1150	1203/1233
Barometric pressure...(IN.HG)	29.05	29.05	29.05
Meter temperature....(DEG-F)	90.75	96.67	99.25
Meter correction coefficient	0.9953	0.9953	0.9953
Volume through gas meter.... at meter conditions...(CF)	22.740	22.840	23.140
Total sampling time....(MIN)	30.0	30.0	30.0
Moisture content.....(%V/V)	6.66	6.30	5.47
Volumetric flow rate (DSCFM)	21809	21809	21809
HCl in sample.....(uG)	96.67	110.04	394.92
HCl concentration..... (GR/10 <sup>3</sup> DSCF).....	0.0705	0.0807	0.2873
(uG/DSCM).....	161.41	184.90	657.98
(PPB-DRY).....	106.47	121.96	434.01
(PPB-WET).....	99.38	114.28	410.27
HCl emis. rate...(10 <sup>-3</sup> LB/HR)	13.17	15.09	53.70

HCl = Hydrogen chloride

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