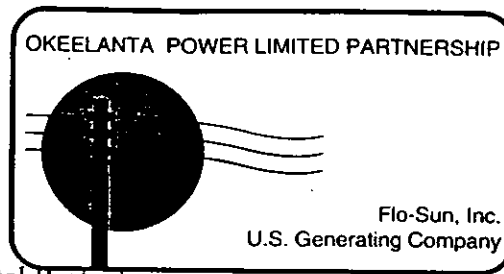


**FILE COPY**

March 25, 1997

State of Florida  
 Department of Environmental Protection  
 2600 Blair Stone Road  
 Tallahassee, Florida 32399-2400

Attn: Mr. A.A. Linero, P.E.  
 Administrator  
 New Source Review Section

Re: Okeelanta Cogeneration Plant  
 DRAFT Permit Amendment No. 0990332-004-AC  
 AC50-219413, PSD-FL-196B

US Postal Service  
**Receipt for Certified Mail**  
 No Insurance Coverage Provided.  
 Do not use for International Mail (See reverse)

Sent to <i>Mr. A.A. Linero, P.E.</i>	
Street & Number <i>2600 Blair Stone Rd.</i>	
Post Office, State, & ZIP Code <i>Tallahassee, FL 32399-2400</i>	
Postage	\$ <i>.78</i>
Certified Fee	<i>1.10</i>
Special Delivery Fee	
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Return Receipt Showing to Whom & Date Delivered	<i>1.10</i>
Return Receipt Showing to Whom, Date, & Addressee's Address	
TOTAL Postage & Fees	\$ <i>2.98</i>
Postmark or Date <i>3/25/97</i>	

PS Form 3800 April 1995

Dear Mr. Linero:

Okeelanta Power has reviewed your letter of December 24, 1996 and encloses the following information regarding sulfuric acid mist emission tests.

1. Okeelanta Power test results for boilers A, B and C using Method 8.
2. Okeelanta Power test results for boilers A, B and C using Modified Method 8 concurrently with Method 8.
3. A Project Overview Discussion by Clean Air Engineering which reviews problems with Method 8 at the facility.
4. A Clean Air Engineering letter dated 12/19/95 which discusses similar problems with Method 8 at the Indiantown Cogeneration Plant.
5. A certificate of analysis for iso-Propyl Alcohol used by Clean Air Engineering during the sulfuric acid mist emission tests.

If you have any questions please contact me at (561) 993-1003.

Sincerely,

James M. Meriwether  
 Environmental Manager

cc: David Knowles - FDEP/South District  
 Ajaya Satyal - PBCHD

**RESULTS**

2-2

Table 2-2:

Stack A - Sulfur Dioxide/Sulfuric Acid Mist (EPA Method 8), Runs 1, 2, 3

Run No.	1	2	3	Average
Date (1996)	May 11	May 12	May 12	
Start Time (approx.)	23:19	01:42	04:26	
Stop Time (approx.)	00:28	02:50	05:39	
<u>Fuel Analysis</u>				
F <sub>d</sub> Fuel factor (dscf/10 <sup>6</sup> Btu)	8,489	8,489	8,489	
<u>Gas Conditions</u>				
T <sub>s</sub> Temperature (°F)	331	328	327	329
B <sub>wo</sub> Moisture (volume %)	17.57	20.00	20.05	19.21
O <sub>2</sub> Oxygen (dry volume %)	6.3	5.8	6.0	6.0
CO <sub>2</sub> Carbon dioxide (dry volume %)	13.7	14.4	14.0	14.0
<u>Volumetric Flow Rate</u>				
Q <sub>a</sub> Actual conditions (acfm)	256,600	251,100	256,800	254,800
Q <sub>std</sub> Standard conditions (dscfm)	140,500	134,000	137,000	137,200
<u>Sulfur Dioxide</u>				
C Concentration (ppm)	25.4	30.0	36.5	30.6
E Emission rate (lb/hr)	35.64	40.07	49.89	41.9
E Emission rate (lb/10 <sup>6</sup> Btu)	0.0514	0.0586	0.0723	0.061
<u>Sulfuric Acid Mist</u>				
C Concentration (ppm)	3.9	3.7	4.0	3.9
E Emission rate (lb/hr)	8.266	7.672	8.305	8.08
E Emission rate (lb/10 <sup>6</sup> Btu)	1.19E-02	1.12E-02	1.20E-02	1.2E-02



**RESULTS**

2-3

Table 2-3:

**Stack A - Sulfur Dioxide/Sulfuric Acid Mist (EPA Method 8), Runs 4, 5, 6**

Run No.	4	5	6	Average
Date (1996)	May 29	May 30	May 30	
Start Time (approx.)	10:10	12:30	14:49	
Stop Time (approx.)	11:20	13:50	15:57	
<u>Fuel Analysis</u>				
F <sub>d</sub> Fuel factor (dscf/10 <sup>6</sup> Btu)	8,489	8,489	8,489	
<u>Gas Conditions</u>				
T <sub>s</sub> Temperature (°F)	332	342	343	339
B <sub>wo</sub> Moisture (volume %)	18.88	21.96	21.60	20.81
O <sub>2</sub> Oxygen (dry volume %)	5.7	6.1	5.6	5.8
CO <sub>2</sub> Carbon dioxide (dry volume %)	14.5	14.0	14.6	14.4
<u>Volumetric Flow Rate</u>				
Q <sub>a</sub> Actual conditions (acfm)	260,500	284,200	289,000	277,900
Q <sub>std</sub> Standard conditions (dscfm)	141,100	146,200	149,100	145,500
<u>Sulfur Dioxide</u>				
C Concentration (ppm)	31.9	35.0	34.0	33.7
E Emission rate (lb/hr)	44.97	51.03	50.60	48.9
E Emission rate (lb/10 <sup>6</sup> Btu)	0.062	0.070	0.066	0.07
<u>Sulfuric Acid Mist</u>				
C Concentration (ppm)	36.1	32.6	35.4	34.7
E Emission rate (lb/hr)	77.71	72.77	80.69	77.1
E Emission rate (lb/10 <sup>6</sup> Btu)	1.07E-01	9.95E-02	1.05E-01	1.0E-01



**RESULTS**

2-4

**Table 2-4:  
 Stack A - Sulfuric Acid Mist (Modified Method 8)**

Run No.	1	2	3	Average
Date (1996)	May 29	May 30	May 30	
Start Time (approx.)	10:10	12:30	14:49	
Stop Time (approx.)	11:20	13:52	15:57	
<u>Fuel Analysis</u>				
F <sub>d</sub> Fuel factor (dscf/10 <sup>6</sup> Btu)	8,489	8,489	8,489	
<u>Gas Conditions</u>				
T <sub>s</sub> Temperature (°F)	334	344	345	341
B <sub>wo</sub> Moisture (volume %)	22.03	22.60	20.73	21.79
O <sub>2</sub> Oxygen (dry volume %)	5.6	6.0	5.8	5.8
CO <sub>2</sub> Carbon dioxide (dry volume %)	14.5	14.2	14.4	14.4
<u>Volumetric Flow Rate</u>				
Q <sub>a</sub> Actual conditions (acfm)	251,900	271,200	275,700	266,300
Q <sub>std</sub> Standard conditions (dscfm)	130,800	138,100	143,500	137,500
<u>Sulfuric Acid Mist</u>				
C Concentration (ppm)	0.4	0.3	0.4	0.4
E Emission rate (lb/hr)	0.8000	0.7000	0.8000	0.767
E Emission rate (lb/10 <sup>6</sup> Btu)	1.14E-03	9.76E-04	1.07E-03	1.1E-03



**RESULTS**

2-2

**Table 2-2:  
 Stack B - Sulfur Dioxide/Sulfuric Acid Mist (EPA Method 8), Runs 1, 2, 3**

Run No.	1	2	3	Average
Date (1996)	May 15	May 16	May 16	
Start Time (approx.)	23:59	01:45	03:23	
Stop Time (approx.)	01:06	02:51	04:33	
<b>Fuel Analysis</b>				
F <sub>d</sub> Fuel factor (dscf/10 <sup>6</sup> Btu)	8,476	8,476	8,476	
<b>Gas Conditions</b>				
T <sub>s</sub> Temperature (°F)	291	292	294	292
B <sub>wo</sub> Moisture (volume %)	19.30	19.77	19.90	19.66
O <sub>2</sub> Oxygen (dry volume %)	5.8	5.5	5.9	5.7
CO <sub>2</sub> Carbon dioxide (dry volume %)	14.8	15.0	14.9	14.9
<b>Volumetric Flow Rate</b>				
Q <sub>a</sub> Actual conditions (acfm)	249,300	252,300	243,500	248,400
Q <sub>std</sub> Standard conditions (dscfm)	141,500	142,100	136,600	140,100
<b>Sulfur Dioxide</b>				
C Concentration (ppm)	32.6	40.7	40.4	37.9
E Emission rate (lb/hr)	49.97	63.92	59.41	57.8
E Emission rate (lb/10 <sup>6</sup> Btu)	0.0691	0.0862	0.0856	0.080
<b>Sulfuric Acid Mist</b>				
C Concentration (ppm)	8.6	8.6	7.8	8.3
E Emission rate (lb/hr)	20.30	20.71	17.52	19.5
E Emission rate (lb/10 <sup>6</sup> Btu)	0.0280	0.0279	0.0252	0.027



**RESULTS**

2-3

Table 2-3:

**Stack B - Sulfur Dioxide/Sulfuric Acid Mist (EPA Method 8), Runs 5, 6, 7**

Run No.	5	6	7	Average
Date (1996)	May 31	May 31	May 31	
Start Time (approx.)	15:21	17:34	20:14	
Stop Time (approx.)	16:36	19:23	21:27	
<u>Fuel Analysis</u>				
F <sub>d</sub> Fuel factor (dscf/10 <sup>6</sup> Btu)	8,476	8,476	8,476	
<u>Gas Conditions</u>				
T <sub>s</sub> Temperature (°F)	331	325	326	327
B <sub>wo</sub> Moisture (volume %)	24.19	22.66	22.46	23.10
O <sub>2</sub> Oxygen (dry volume %)	5.6	6.2	5.6	5.8
CO <sub>2</sub> Carbon dioxide (dry volume %)	14.6	14.2	14.7	14.5
<u>Volumetric Flow Rate</u>				
Q <sub>a</sub> Actual conditions (acfm)	278,900	266,800	273,500	273,100
Q <sub>std</sub> Standard conditions (dscfm)	141,200	139,000	142,700	141,000
<u>Sulfuric Acid Mist</u>				
C Concentration (ppm)	29.7	53.1	46.4	43.1
E Emission rate (lb/hr)	70.57	119.1	111.3	100
E Emission rate (lb/10 <sup>6</sup> Btu)	9.64E-02	1.72E-01	1.51E-01	1.4E-01



**RESULTS**

2-4

**Table 2-4:  
 Stack B - Sulfuric Acid Mist (Modified Method 8)**

Run No.	1	2	3	Average
Date (1996)	May 31	May 31	May 31	
Start Time (approx.)	15:21	17:34	20:14	
Stop Time (approx.)	16:36	19:23	21:27	
<u>Fuel Analysis</u>				
F <sub>d</sub> Fuel factor (dscf/10 <sup>6</sup> Btu)	8,476	8,476	8,476	
<u>Gas Conditions</u>				
T <sub>s</sub> Temperature (°F)	333	325	326	328
B <sub>wo</sub> Moisture (volume %)	24.64	22.97	23.61	23.74
O <sub>2</sub> Oxygen (dry volume %)	5.5	6.0	6.0	5.8
CO <sub>2</sub> Carbon dioxide (dry volume %)	14.6	14.2	14.2	14.3
<u>Volumetric Flow Rate</u>				
Q <sub>a</sub> Actual conditions (acfm)	274,300	263,800	269,300	269,100
Q <sub>std</sub> Standard conditions (dscfm)	137,800	136,800	138,400	137,700
<u>Sulfuric Acid Mist</u>				
C Concentration (ppm)	0.64	0.37	0.27	0.43
E Emission rate (lb/hr)	1.487	0.8360	0.6099	0.978
E Emission rate (lb/10 <sup>6</sup> Btu)	2.07E-03	1.21E-03	8.73E-04	1.4E-03



**RESULTS**

2-2

**Table 2-2:  
 Stack C - Sulfur Dioxide/Sulfuric Acid Mist (EPA Method 8)**

Run No. <sup>1</sup>	2	3	4	Average
Date (1996)	June 3	June 3	June 3	
Start Time (approx.)	19:02	21:03	22:59	
Stop Time (approx.)	20:16	22:13	00:10	
<b>Fuel Analysis</b>				
F <sub>d</sub> Fuel factor (dscf/10 <sup>6</sup> Btu)	9,567	9,567	9,567	
<b>Gas Conditions</b>				
T <sub>s</sub> Temperature (°F)	316	319	316	317
B <sub>wo</sub> Moisture (volume %)	20.00	20.85	20.93	20.59
O <sub>2</sub> Oxygen (dry volume %)	6.8	6.6	6.8	6.7
CO <sub>2</sub> Carbon dioxide (dry volume %)	13.4	13.8	13.4	13.5
<b>Volumetric Flow Rate</b>				
Q <sub>a</sub> Actual conditions (acfm)	286,500	284,600	282,300	284,500
Q <sub>std</sub> Standard conditions (dscfm)	156,500	153,100	152,200	153,900
<b>Sulfur Dioxide</b>				
C Concentration (ppm)	20	10	19	16
E Emission rate (lb/hr)	31.13	15.78	28.81	25.2
E Emission rate (lb/10 <sup>6</sup> Btu)	0.0470	0.0240	0.0447	0.039
<b>Sulfuric Acid Mist</b>				
C Concentration (ppm)	37.3	15.5	18.2	23.7
E Emission rate (lb/hr)	90.49	37.26	42.89	56.9
E Emission rate (lb/10 <sup>6</sup> Btu)	1.40E-01	5.80E-02	6.81E-02	8.9E-02

<sup>1</sup> Run 1 conducted for diagnostic purpose.





**RESULTS**

2-3

**Table 2-3:  
 Stack C - Sulfuric Acid Mist (Modified Method 8)**

Run No. <sup>1</sup>	2	3	4	Average
Date (1996)	June 3	June 3	June 3	
Start Time (approx.)	19:07	21:03	22:59	
Stop Time (approx.)	20:16	22:14	00:10	
<b>Fuel Analysis</b>				
F <sub>d</sub> Fuel factor (dscf/10 <sup>6</sup> Btu)	9,567	9,567	9,567	
<b>Gas Conditions</b>				
T <sub>s</sub> Temperature (°F)	315	317	316	316
B <sub>wo</sub> Moisture (volume %)	20.83	19.81	18.14	19.59
O <sub>2</sub> Oxygen (dry volume %)	6.7	6.6	6.4	6.6
CO <sub>2</sub> Carbon dioxide (dry volume %)	13.4	13.6	13.7	13.6
<b>Volumetric Flow Rate</b>				
Q <sub>a</sub> Actual conditions (acfm)	282,800	284,900	280,500	282,700
Q <sub>std</sub> Standard conditions (dscfm)	152,900	155,500	156,600	155,000
<b>Sulfuric Acid Mist</b>				
C Concentration (ppm)	0.5	0.3	0.3	0.4
E Emission rate (lb/hr)	1.2249	0.6736	0.8062	0.902
E Emission rate (lb/10 <sup>6</sup> Btu)	1.92E-03	1.03E-03	1.21E-03	1.4E-03

<sup>1</sup> Run 1 conducted for diagnostic purpose.



## PROJECT OVERVIEW

1-4

### DISCUSSION

#### Methodology

During this test program, Clean Air Engineering incorporated guidelines as stated in Title 40 of the Code of Federal Regulations, Parts 60 (40 CFR 60), 61 (40 CFR 61) and 51 (40 CFR 51). Additional guidelines were followed in accordance with applicable requirements and provisions of 40 CFR 60, Subpart Da. The specific testing followed procedures in EPA Methods 1, 2, 3, 3A, 4, 5, 7E, 8, 9, 10, 12, 13B, 18, 19, 25, 25A, 101A, 104, 108, 201A and the EPA Emissions Measurement Technical Information Center (EMTIC) conditional test method CTM-012.

#### Fuel-Based Emission Rate Calculation

The emission rate of lb/10<sup>6</sup>Btu was calculated using a fuel factor (F<sub>d</sub>) of 9,567 dscf/10<sup>6</sup>Btu. This is an average of the 11 separate fuel samples collected by BPC during the test program. The results of the individual samples are contained in Appendix I.

#### Sulfuric Acid Mist

Based on experience gained during the Indiantown Cogeneration Project compliance test program in which a similar sampling situation was present, the following modifications to the sampling program were instituted.

Three EPA Method 8 runs were conducted simultaneously with three runs using Modified Method 8 procedures. This was due to a suspected positive bias caused by interferences in the flue gas resulting in the standard EPA Method 8 samples to be non-representative of the actual stack gas concentration of sulfuric acid mist.

CAE and Bechtel proposed a modification to the sampling procedure during the Indiantown Cogeneration compliance project to minimize the positive bias. Verbal agreement was received from the FDEP during that project to conduct the Modified Method 8 procedures concurrently with EPA Method 8 and submit both for review. The recommendation of the FDEP to perform additional Method 8 runs during the Indiantown Project was also followed during the Okeelanta test program.

The results of the modified runs are included in Table 2-3.

The modified sampling approach included the elimination of the analysis of the IPA impinger. In its place, the amount of filterable sulfate is considered to represent the sulfuric acid mist.

The following specific method alterations were followed in the modified runs.



## PROJECT OVERVIEW

1-5

1. A heated glass fiber filter was inserted between the probe and first impinger. This variance as allowed in paragraph 3 of section 1.2 of Method 8.
2. The train was operated according to standard Method 8 procedures.
3. At the completion of sampling, the probe and front-half glassware were rinsed with IPA. The filter was added to this rinse. These rinses were not mixed with the IPA from the first impinger.
4. The filter/probe rinse solution was analyzed for sulfate using standard Method 8 titration procedures.
5. The  $H_2SO_4$  emissions were considered to be completely represented by the sulfate determined from the filter and probe wash.

The stated detection limit for EPA Method 8 is 0.015 ppm. However, the method was specifically developed for use at sulfuric acid plants at which the flue gas is dry and free from known interferents such as ammonia and chlorides. At a facility such as Okeelanta, the method detection limit would be expected to be much higher, primarily due to interference from the combination of high flue gas moisture ( $\approx 20\%$ ) and sulfur dioxide ( $SO_2$ ).

Over the course of sampling,  $SO_2$  is partially absorbed in the isopropanol (IPA) impinger. This absorption is enhanced as the aqueous component of the first impinger increases from the condensed flue gas moisture. The method calls for a post-sampling air purge of the sampling train to remove the absorbed  $SO_2$  from the IPA. However, a small amount of  $SO_2$  will always remain in this impinger after purging due to vapor-liquid equilibrium phenomena.

### Total Non-Methane Hydrocarbons

At the request of the U.S. Generating Company, concurrent EPA Method 25 and Method 25A samples were collected during the compliance test program. In addition, EPA Method 18 was used to determine methane concentrations. Although both EPA Methods (25 and 25A) yielded mass emission rates that are below permitted limits, the results of the EPA Method 18/25A sampling procedure are believed to be more representative of actual stack conditions.

The results of the EPA Method 25A sampling indicated that minimal hydrocarbons ( $\approx 4.6$  ppm as carbon) were present in the stack gas. This was corroborated by the Method 18 results ( $\approx 2.5$  ppm) which indicated methane (also measurable by Method 25A) was also present in the stack gas in minimal quantities.



Clean Air Engineering

Phone: 412/787-9130 • Fax: 412/787-9136

MEMORANDUM

TO: Michelle Griffin  
U.S. Generating  
FAX: (301) 718-6917

FROM: Jim Wright  
Technical Director  
Clean Air Engineering  
Phone: (412) 787-9130

DATE: 12/19/95

RE: Method 8 Testing Limitations

CC: Bill Harper  
Bechtel  
FAX: (301) 330-2581

I researched the problem we are currently encountering in measuring sulfuric acid mist, ( $H_2SO_4$ ) at the Indiantown facility. Based on the test results thus far, I do not believe that EPA Method 8 can be used to demonstrate compliance with the  $H_2SO_4$  limit of 1 lb/hr (=0.1 ppm) without some alterations to the method.

The stated detection limit for Method 8 is 0.015 ppm. By itself, this should be low enough to demonstrate compliance with the facility's  $H_2SO_4$  emissions limit. However, the method was specifically developed for use at sulfuric acid plants at which the flue gas is dry and free from known interferences such as ammonia and chlorides. At a facility such as Indiantown, the method detection limit would be expected to be much higher, primarily due to interference from the combination of flue gas moisture and sulfur dioxide ( $SO_2$ ).

Over the course of sampling,  $SO_2$  is partially absorbed in the isopropanol (IPA) impinger. This absorption is enhanced as the aqueous component of the first impinger increases from the condensed flue gas moisture. The method calls for a post-sampling air purge of the sampling train to remove the absorbed  $SO_2$  from the IPA. However, a small amount of  $SO_2$  will always remain in this impinger after purging due to vapor-liquid equilibrium phenomena.

CAE's experience has shown that, for a wet flue gas of ~100 ppm  $SO_2$ , the amount of residual  $SO_2$  left after purging equates to an in-stack bias of approximately 1 ppm. Thus, the potential positive bias in the method is significantly higher than the emissions limit itself. Furthermore, methodology modifications such as increased sample gas volume or increased analytical sensitivity will not improve this situation.

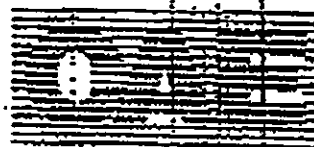
In order to circumvent this problem, I propose that the testing approach be modified to eliminate analysis of the IPA impinger. In its place, I recommend determining the amount of filterable sulfate and expressing this quantity as sulfuric acid mist. Since the flue gas temperature is relatively low (less than  $\approx 180^{\circ}\text{F}$ ), any gaseous sulfur trioxide ( $\text{SO}_2$ ) should already exist as condensed sulfuric acid, which is filterable. Thus, the amount of potential negative bias due to the modification should be negligible. This argument should help in obtaining agency approval for the modification.

The following specific method alterations are recommended:

1. Insert a heated glass fiber filter between the probe and first impinger. This variance as allowed in paragraph 3 of section 1.2 of Method 8.
2. Operate the train according to standard Method 8 procedures.
3. At the completion of sampling, rinse the probe and front-half glassware with IPA and add the filter to this rinse. Do not mix these rinses with the IPA from the first impinger.
4. Analyze the filter/probe rinse solution for sulfate using standard Method 8 titration procedures.
5. Consider the  $\text{H}_2\text{SO}_4$  emissions to be completely represented by the sulfate determined from the filter and probe wash.

One potential problem with this approach may be in the generation of a positive bias due to the presence of non-sulfuric acid sulfates such as ammonium sulfate (note that this is a problem with the current approach as well.) If this problem is suspected, then it may be desirable to use a more sophisticated analytical approach (e.g., ion chromatography) to quantify the amount of ammonium ion present, and subtract this from the total sulfate.

I hope that this information helps to clarify the current situation and potential testing options. Please feel free to call me or Bob Preksta at (412) 787-9130 if you have any additional questions.





# EM SCIENCE CERTIFICATE OF ANALYSIS

EM SCIENCE  
480 S. Democrat Road  
Gibbstown, NJ 08027  
Phone: 1-800-222-0342

NAME: iso-Propyl Alcohol (2-Propanol)  
OmniSolv(R)  
ITEM NUMBER: PX1834-1  
LOT NUMBER: 36038  
FORMULA: CH<sub>3</sub>CHOHCH<sub>3</sub>  
FORMULA WT: 60.10

Data Order No: 00008007

PROPERTY	LIMITS		RESULTS	UNITS
	Min.	Max.		
Assay (GC):	99.9		99.95	%
Capillary ECD responsive substances (as C6Cl6):			3.40	ppt
Capillary FID responsive substances (as decane):				ppb
Color (APHA):		10	<10	APHA
ECD responsive substances (as heptachlor epoxide):		2.0	0.50	ppt
Filtered for particulate matter:			Passes test	
Fluorescence (as quinine base):		250	26.3	ppt
Form:			Clear liquid	
Infrared spectrum:			Conforms to standard	
Refractive Index (n <sub>D</sub> <sup>25</sup> ):			1.3782	
Residue after evaporation:		1	<0.1	ppm
Titratable acid:		0.2	0.08	µeq/g
UV Abs. at 204 nm:		1.00	0.492	AU
UV Abs. at 205 nm:		0.80	0.380	AU
UV Abs. at 210 nm:		0.35	0.122	AU
UV Abs. at 220 nm:		0.10	0.037	AU
UV Abs. at 230 nm:		0.05	0.016	AU
UV Abs. at 240 nm:		0.02	0.005	AU
UV Abs. at 260 nm:		0.005	<0.001	AU
UV Abs. at 300 nm:		0.005	<0.001	AU
UV Cut-off:		204	201.4	nm
Water (H <sub>2</sub> O):		0.05	0.014	%

Charles M. Wilson,  
Quality Assurance Manager  
Analysis Date: 02/08/96