



**Event Analysis
Kingston Fossil Plant Ash Deposition Incident September 18, 2009**

Revision: 1

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Table of Contents

1.0	Introduction and Background	3
1.1	Event Description.....	3
1.2	Timeline of Events	5
2.0	Analysis and Findings	7
2.1	Kingston Fossil Plant Equipment Configuration and Operating Conditions.....	7
2.2	Stack 1 and Stack 2 Observations	7
2.3	Fault Tree	11
2.3.1	Ammonium Bisulfate and Ammonium Sulfate	13
2.3.2	Sulfated Ash	17
2.3.3	Fly Ash.....	19
3.0	Conclusions and Recommendations	20
3.1	Root Cause Analysis Results	22
3.2	Summary of Action Items	23
4.0	References	24
5.0	Appendices	25
5.1	Appendix A - TDEC Sample from Ellis’ Residence	25
5.2	Appendix B - Unit 3 Electrostatic Precipitator Samples.....	27
5.3	Appendix C - Unit 4 Electrostatic Precipitator Samples.....	29
5.4	Appendix D - Stack 1 Liner Samples.....	31
5.5	Appendix E - Stack Bottom - White Flakes	32



1.0 INTRODUCTION AND BACKGROUND

Tennessee Valley Authority's (TVA) Kingston Fossil Plant experienced an event of material exiting the stacks and settling onto TVA and neighboring properties. The Tennessee Department of Environment and Conservation (TDEC) was notified and collected a sample of the material from a neighboring property. TDEC then notified Kingston Fossil Plant and a TVA investigation ensued to determine the cause of the event, the contributing factors, and how to prevent this event in the future.

While TDEC's sample did not contain enough material for chemical analysis, their physical analysis of the material indicates it consists mostly of fly ash (The full sample analysis is included in the Appendix of this report). The TVA investigation team was unable to collect a sample of the actual material.

This report presents details of the investigation including timelines, data and sample analyses, inspections, personnel interviews, etc. Section 2.0 discusses the analysis techniques used, the possible contributors to the event, and the findings from the investigation. Section 3.0 offers conclusions and recommended action items resulting from this investigation. All data and analysis used in this investigation are given in the Appendices.

1.1 Event Description

On September 18, 2009, TDEC received a complaint at approximately 11 a.m. from a resident near TVA's Kingston Fossil Plant. When TDEC arrived at the residence, they found material on the resident's car. A picture of the material on the car is shown in Figure 1.1-1. Personnel at Kingston were notified and investigations began. Plant personnel then performed on-site inspections in and around the plant and noticed the ash-like material. However, any visible fallout of material from the stack had stopped before the inspections were started. At 6:23 p.m. Unit 4 was removed from service and at 02:41 a.m. on September 19, 2009, Unit 3 was removed from service resulting in no units generating on Stack 1. Unit 9 on Stack 2 continued to operate.



PHOTO BY RANDY ELLIS

Randy Ellis, vice chairman of the Roane County Community Advisory Group, took this photo of fly ash on a vehicle at his home after TVA test-burned coal Friday at the Kingston Fossil Plant.

Figure 1.1-1 [1] This is the material recorded by a local resident on September 18, 2009. A sample of this material was not collected by TVA's investigation team. However, TDEC did take a sample of the material around 2:30 pm local time. This analysis is given in the appendix.

During the investigation, a prior event was discovered in which a flake-like material was found on an employee's car on 9/10/09 but was not reported to TVA management. Therefore, a sample was not collected for analysis. This event is pictured in Figure 1.1-2.



Figure 1.1-2 This is the first material observed during the test burn on September 10, 2009. This material was located on an employee's car in the Kingston Fossil Plant parking lot.



Prior to and during the time of the events, Kingston was burning a higher sulfur coal to evaluate plant impacts ahead of scrubber installation. Scrubbers are being installed at Kingston to control emissions of sulfur dioxide with half of the scrubber slated for operation this fall and the remainder coming into service in early summer 2010. The installation of these devices will allow Kingston to burn different coals and it is advantageous to test burn alternate fuels to understand impacts prior to full scale implementation.

1.2 Timeline of Events

Kingston has been operating at lower than historical generation due to the current low demand for generation and impacts from the ash spill. Figure 1.2-1 shows the load generation on each stack for the calendar year. The load on each stack has been limited to one unit except for a few occasions throughout this year.

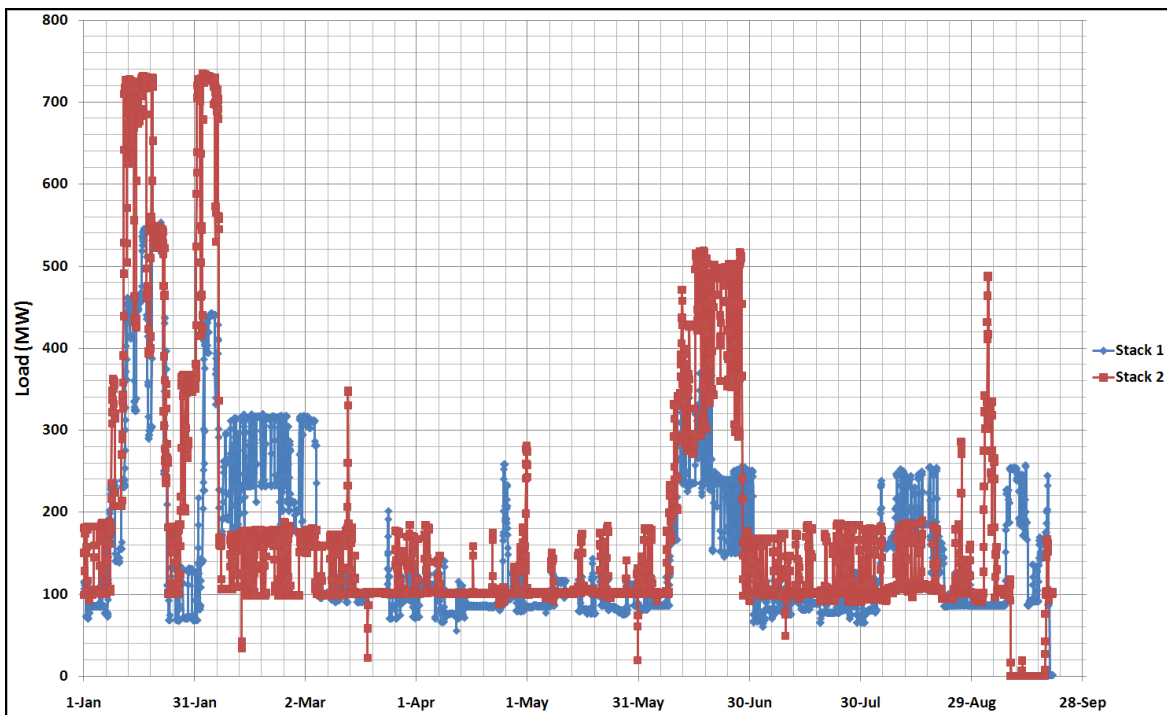


Figure 1.2-1 This graph shows the load for each stack since January 1st, 2009.

As discussed earlier, a test burn was being conducted during the event. A timeline was generated and is shown in Figure 1.2-2. As will be discussed later in this document, we have sufficient evidence that the material originated from Stack 1, therefore only Stack 1 events are shown on the timeline. A sequence of events is detailed as follows:

- September 6, 2009 approximately 8:00 a.m. The higher sulfur coal, Gibson County coal, started burning in Unit 3. This coal contains approximately 2.2 lbs SO₂/MMBtu.
- September 7, 2009 05:22 a.m. Unit 5 online. Unit 5 is burning Kingston's normal coal. This coal contains approximately 1.1 lbs SO₂/MMBtu.



- September 10, 2009 approximately 5:00 p.m. Picture taken of material on employee's car in the employee parking lot. This was not reported and not known by plant management until September 18, 2009.
- September 13, 2009 at 04:17 a.m. Unit 5 is taken offline.
- September 16, 2009 at 04:18 a.m. Unit 4 is brought online. Gibson County coal loaded into Unit 4.
- September 18, 2009 at approximately 11:00 a.m. TDEC receives complaint. Investigation started.
- September 18, 2009 at 6:23 p.m. Unit 4 is taken offline.
- September 19, 2009 at 02:41 a.m. Unit 3 is taken offline.

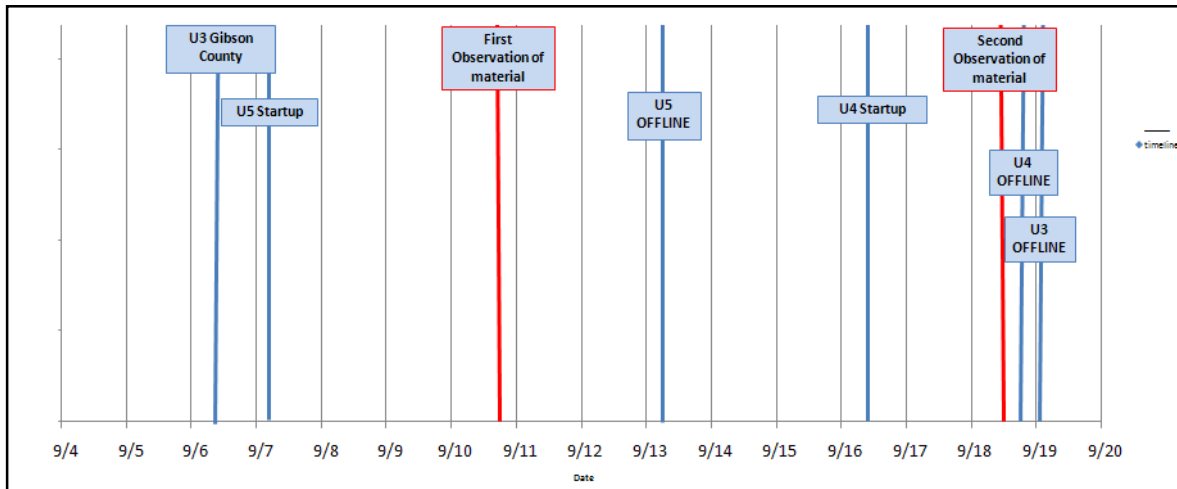


Figure 1.2-2 Timeline of events for Stack 1 during the test burn period.



2.0 ANALYSIS AND FINDINGS

The TVA investigation team analyzed data from three primary areas:

- 1) Data collected from multiple monitoring locations including temperature, opacity, gas velocity, etc.
- 2) Chemical analysis of samples of deposits taken within the stack and duct work
- 3) Personnel interviews

From that data, the team listed all the failure modes experienced and all possible mechanisms that could cause the failure modes. Using the timeline described in the previous section, the team developed a sequence of events to determine when the mechanisms emerged. A fault tree was employed to capture all possible mechanisms.

Kepner-Tregoe methodology was used to analyze that data to determine the most probable mechanism and root cause. This section of the report first presents the data analyzed and the mechanisms/modes considered and the resultant findings from each analysis.

2.1 Kingston Fossil Plant Equipment Configuration and Operating Conditions

Kingston Fossil Plant has nine coal burning units. Each of these units is equipped with a Selective Catalytic Reduction (SCR) system which utilized anhydrous ammonia and catalyst material to reduce nitrogen oxides (NOx). Following the SCRs, electrostatic precipitators (PPTRs) are used to remove fly ash from the flue gas stream. Flue gas exiting units 1-5 combine in a common trunk duct and exit out of Stack 1 (S1). Similarly, units 6-9 combine and emit flue gas from Stack 2 (S2).

During the event on September 10th, units 3 and 5 were in normal operation at 100-140 MW each and unit 9 was in startup mode and not burning coal (units start on an oil fire). Unit 3 was burning a test coal that contained roughly twice the amount of sulfur than unit 5 at approximately 2.2 lbs SO₂/MMBtu. This fuel is being considered as an option for future fuel flexibility with the startup of the new scrubber this fiscal year. Unit 5 was burning the normal coal blend (approximately 1.0-1.4 lbs SO₂/MMBtu).

During the event on September 18th, units 3 and 4 were each operating at 80-130 MW and both units were burning the test coal. Unit 9 had transitioned from startup to burning a blend of their normal coal with some of the test coal; on September 18th the blend had a range of 1.2-1.5 lbs SO₂/MMBtu. Shortly after the event on September 18th, both unit 3 and 4 were brought offline since they were both burning the test coal.

2.2 Stack 1 and Stack 2 Observations

Using a borescope, (see Figure 2.2-1) S1 was initially investigated at the 330 foot elevation (both stacks are approximately 1000 ft tall). During this inspection, it was observed that the stack liner had a 1/8 inch to 1/4 inch thick coating. This same inspection on S2 revealed no such coating.



Figure 2.2-1. This picture was taken with a borescope of S1 at the 330 foot elevation. A similar inspection of S2 showed no such buildup.

Once S1 was cleared for entry on September 29, 2009, there was evidence of a large amount of material in the bottom of the stack as seen in Figure 2.2-2. During the inspection, flake-like material was found on top of the existing buildup and was falling on inspectors. These flakes appeared similar to the material noticed on September 10th. Another inspection of the top of S1 revealed more deposits as seen in Figure 2.2-3. Prior to the event on September 18th, a similar inspection of S2 was completed as a part of the scrubber project on September 16th, revealing only a minimal amount of material in the bottom of the stack.

FINDING : The investigation focused on S1 due to the overwhelming deposits on the stack liner, bottom, and top of S1.



Figure 2.2-2. This picture was taken at the bottom of S1. The white material is presumed to be the flake material that exited the stack on September 10th and 18th.



Figure 2.2-3. This picture was taken at the top of S1. Again, white material deposited here is presumed to be the flake material that exited the stack on September 10th and 18th.

Two separate types of samples were collected during the September 29, 2009 inspection inside the base of S1. One sample was collected from an area of ash buildup as shown in Figure 2.2-4 where an approximate 4'x 8' section had sloughed off the liner inside the stack. The second sample was a lighter/thinner sample of material which was on top of the previously deposited material and was similar to material that was still falling during the inspection. Figure 2.2-5 shows the differences in appearance between the two materials. The material which had fallen off the side of the stack liner was about 1/8" thick and was hard and dense. The flake-like material was thin, light, and friable. Analysis of the two materials indicated both to be primarily fly ash with higher than normal amounts of sulfates. When compared to ash samples from the precipitators, which are typically about 95 percent ash and about 3 percent sulfates, the stack material was about 75 percent ash and had sulfate levels of about 23-29 percent sulfates. The stack material samples had an



increase in ammonia levels when compared to precipitator ash samples but were still a very small percentage of the total material (~0.25 percent).



Figure 2.2-4. Inside of stack 1 approximately 30 ft from the bottom. The dark brown area exposes the liner where a 4ft x 8ft section of buildup had fallen off.



Figure 2.2-5. This is a picture of the two types of material found on the stack liner and on the stack floor. The material on the left is the light friable material while the picture on the right is the more dense buildup.

FINDING : Based on the overwhelming evidence found in S1 and the absence of significant material and operating conditions in S2, the material was emitted from S1.

FINDING : There are two physically distinct materials found in S1. One material was light and friable and resembled the material reported in the events.

2.3 Fault Tree

After the stack inspection and the finding of different materials in the stack, a fault tree was developed to sort through the possible options that could have created the material in question. The fault tree is presented in Figure 2.3-1. From the fault tree analysis, the material is one or more of the following:

- Ammonium Bisulfate / Ammonium Sulfate
- Sulfated Ash
- Fly ash

Each of these possible scenarios is described in detail below.

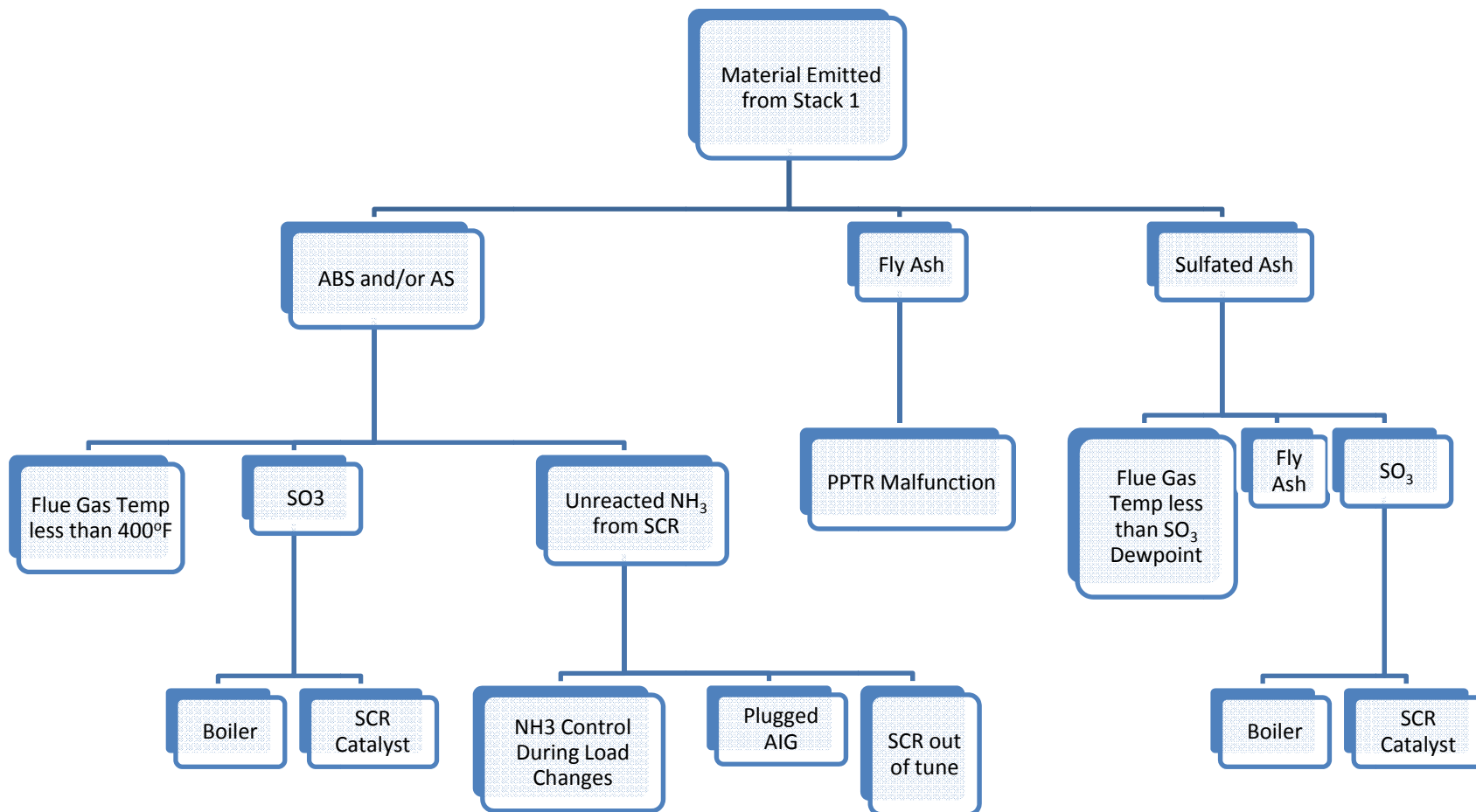
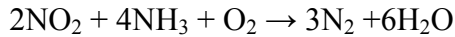
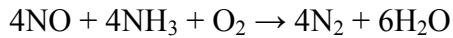


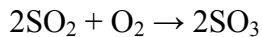
Figure 2.3-1 Fault tree for root cause analysis.

2.3.1 Ammonium Sulfate (AS) and Ammonium Bisulfate (ABS)

Ammonium Sulfate (AS) and ammonium bisulfate (ABS) are common compounds found in fly ash for coal burning fossil power plants with Selective Catalytic Reduction (SCR) technology. SCR's use catalyst along with ammonia (NH₃) injection at flue gas temperature above 600°F to reduce nitrogen oxides (NO or NO₂) emissions via the reactions described below.



Although NO_x emissions can be reduced by more than 90%, the catalyst causes some of the sulfur dioxide (SO₂) in the flue gas to convert to sulfur trioxide (SO₃) by reacting with oxygen.

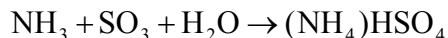


Each layer of catalyst at Kingston converts approximately 0.75% of the SO₂ in the flue gas to SO₃. Some units have two layers of catalyst and some have three layers of catalyst. Some of this injected ammonia does not react. The available SO₃ can react with this unreacted ammonia via the reactions described below. Ammonium sulfate is usually formed when the amount of ammonia is roughly twice the molar ratio of SO₃. Ammonium bisulfate is usually formed when the molar ratio of ammonia to SO₃ is one or less. Between molar ratios of one and two, a combination of ABS and AS can be formed. The SCR is designed to operate at a nominal 2 ppm ammonia "slip" (slip refers to the amount of unreacted ammonia that "slips" by the SCR catalyst). The reaction equations for the formation of ABS and AS are given below.

Ammonium Sulfate:



Ammonium Bisulfate:



Any AS or ABS that forms should be collected by the precipitator. However, the precipitator is only efficient in removing particulates from the flue gas (i.e., fly ash, ABS, AS, etc.) but does not collect any gases. This is significant since Kingston combines the flue gas from units 1-5 on Stack 1. If one unit has excess ammonia and another has excess SO₃, these constituents could combine and form a solid particulate after the precipitator.

As seen in Figures 2.3.1-1 and 2.3.1-2, ammonia injection spikes during load changes. During load changes the ammonia flow control logic is not adequate to maintain reasonable ammonia levels. This likely causes the ammonia slip to temporarily be in excess of 2 ppm. The samples collected on S1's liner and bottom contained ammonia, most likely in the form of ammonium sulfate and/or ammonium bisulfate. Samples



collected from the plates and electrodes in units 3's and 4's PPTR's had 1/10th to 1/100th the ammonia concentration of the stack samples which suggests formation of AS and ABS downstream of the precipitators.

Figure 2.3.1-3 shows the inside of the PPTR which was relatively clean upon inspection. Upon further inspection of data collected by the PPTR's with regard to performance, there did not appear to be any malfunction that would cause excessive emission of particulates during the events on the 10th and 18th.

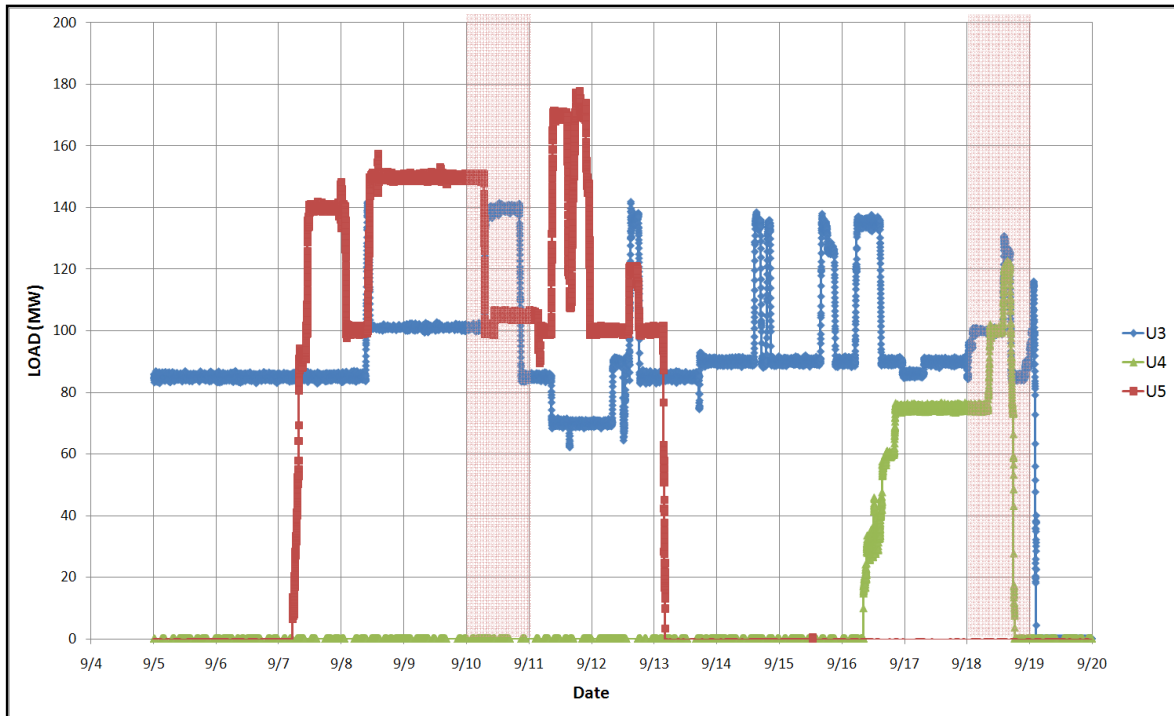


Figure 2.3.1-1 Load changes on Stack 1 during the week of the test burn.

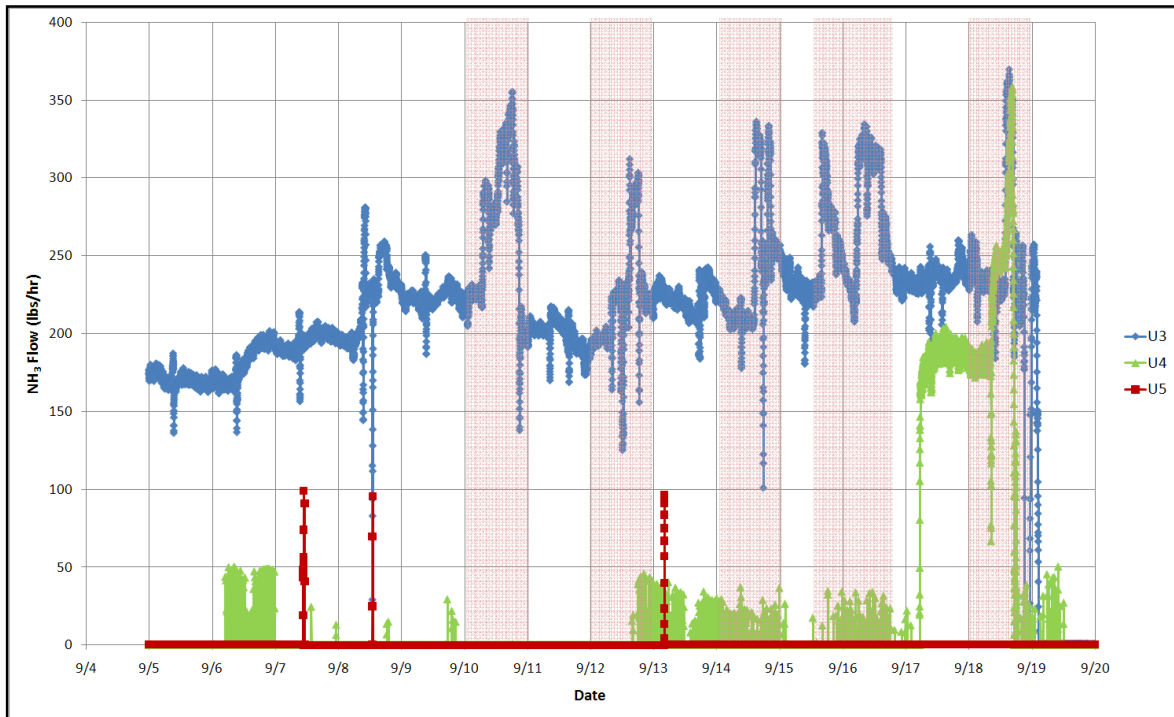


Figure 2.3.1-2 Ammonia injection on units 3-5 during the week of the test burn. Suspected events are shown in the shaded areas.



Figure 2.3.1-3 Unit 3's and 4's PPTR plates and electrodes

As seen in Figure 2.3.1-2, there were five events that are highlighted on the 10th, 12th, 14th, 16th-17th, and 18th, that resulted in ABS and AS formation. The ABS and AS formed on these days may have adhered to the stack liner or exited the stack if they weren't collected by the PPTRs or were formed downstream of the precipitators.

The ammonia slip events on the 10th and 18th correlate to the reported observations of material leaving the Kingston stack. No incidents were reported on the days of the other three ammonia slip events, and it is believed that the weather (wind and rain) masked these events. As seen in Figures 2.3.1-4 and 2.3.1-5, there were prevailing winds and rain on those three events.

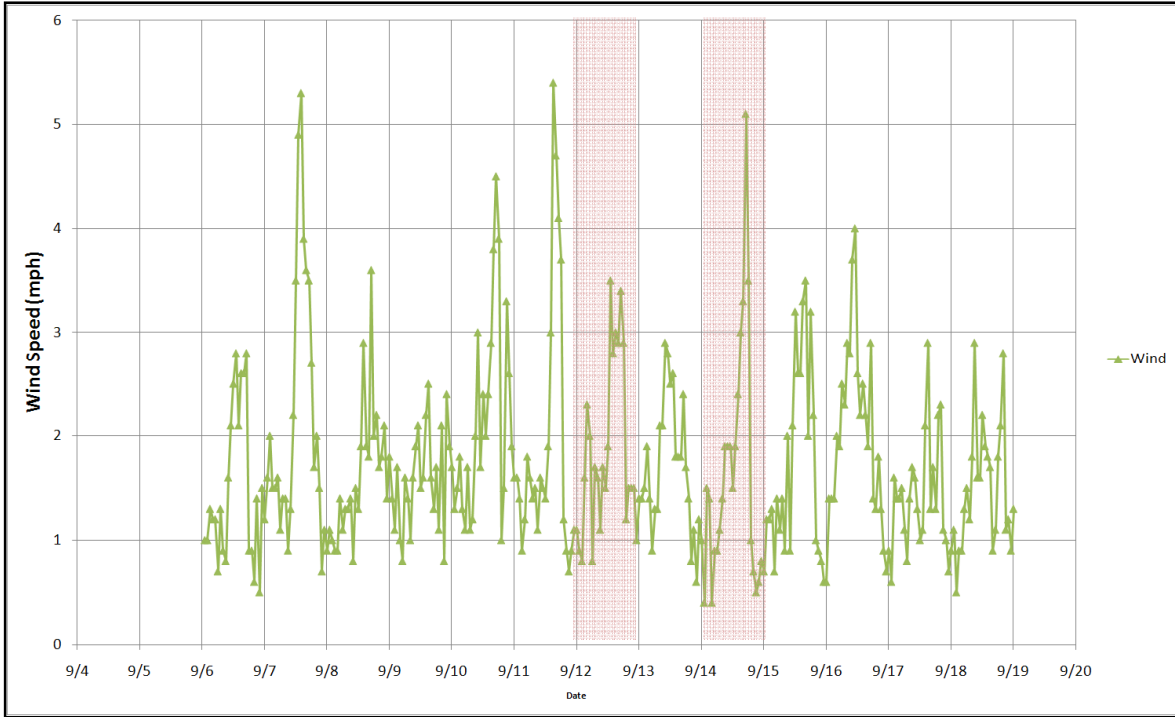


Figure 2.3.1-4 Winds on the 12th and 14th likely masked the suspected emissions.

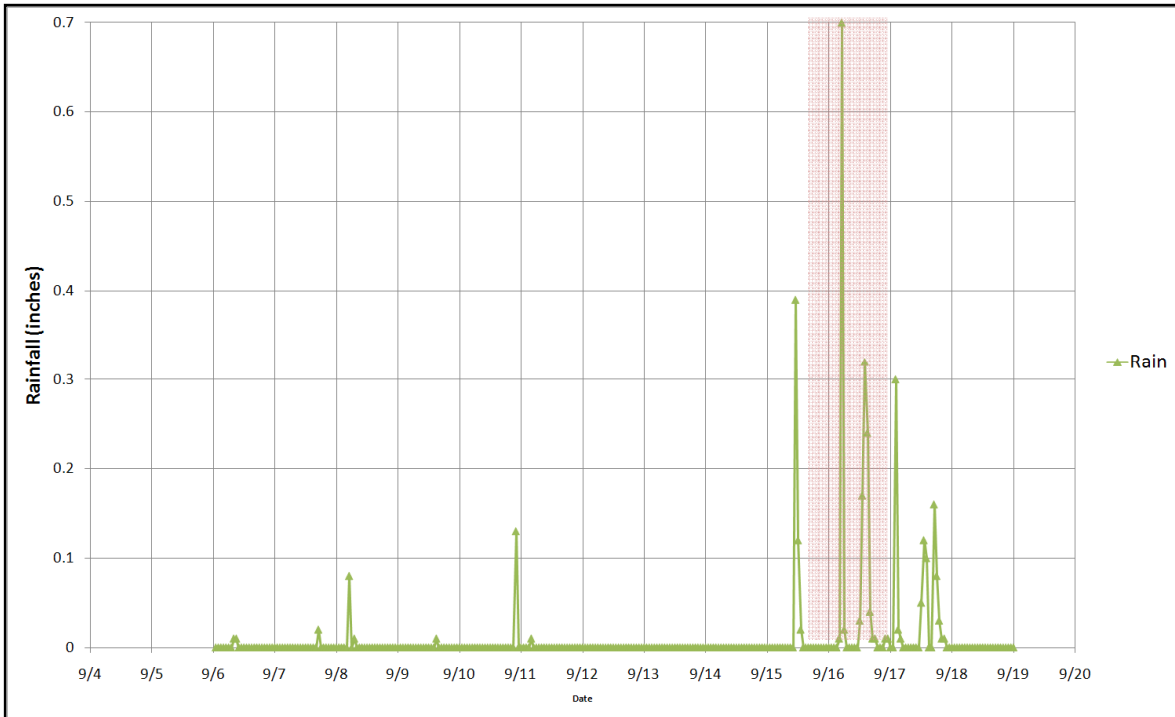


Figure 2.3.1-5 Rain on the 16th - 17th likely masked the other suspected emissions.

FINDING : ABS and AS were contributors to the reported observations of material leaving S1.

2.3.2 Sulfated Ash

As stated in the previous section, the SCR catalyst will oxidize a percentage of the SO_2 to SO_3 . There is a relationship between SO_3 concentrations and temperature commonly referred to as the dew point temperature (see Figure 2.3.2-1). As the gas temperature drops the SO_3 in the gas will condense. When it condenses it will either condense on fly ash particles or it will self nucleate as an aerosol. The aerosol particles and the fly ash particles with the condensed sulfates would tend to stick to internal surfaces (duct and stack liner). The condensed SO_3 would be a source of sulfated ash.

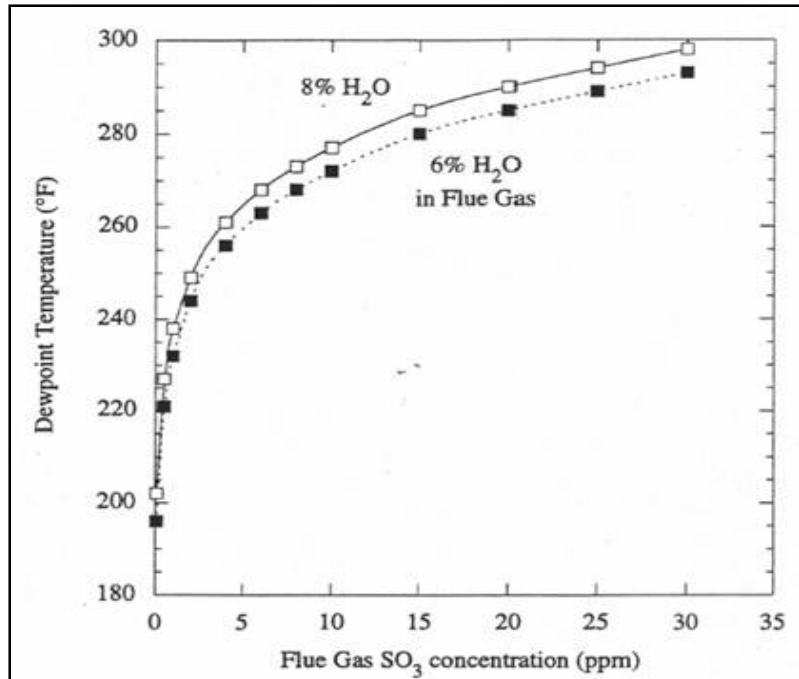


Figure 2.3.2-1 [2]. The dewpoint temperature of SO_3 increases as the concentration of SO_3 in the flue gas increases.

The analysis of the material indicated higher levels of sulfates (22% - 29%) than typical fly ash (2% - 3%). This increase in sulfates is most probably formed by a combination of the higher than normal sulfur trioxide concentration by burning the higher sulfur fuel and the lower than normal duct and stack temperatures. Sulfur trioxide levels were measured at the PPTR outlet of unit 3 during the higher sulfur test burn at concentrations of 13 ppm, as shown in Figure 2.3.2-2.

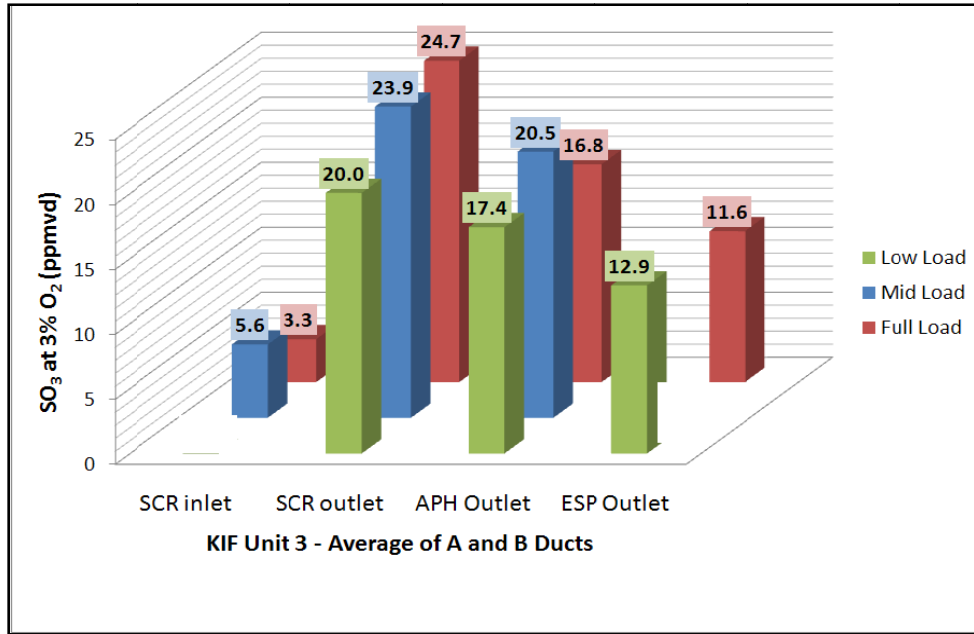


Figure 2.3.2-2. Unit 3 SO₃ Data Collected During Coal Test Burn

The dew point (the temperature which the material will condense) at this SO₃ concentration is about 285 F. The actual stack temperature was about 250 F during the test burn as shown in Figure 2.3.2-3. Air infiltration from offline units mixing with flue gas from the operating unit(s) cooled the flue gas in the stack liner below the SO₃ dew point. This lower temperature would cause a significant amount of sulfur trioxide to condense into a liquid aerosol or condense on fly ash particles as detailed in Figure 2.3.2-4.

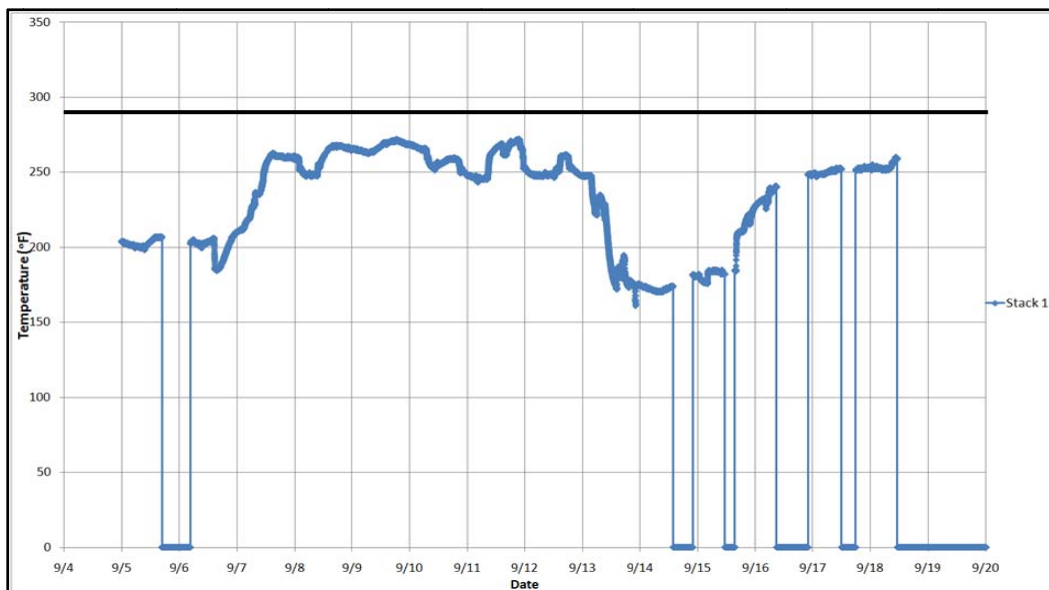


Figure 2.3.2-3 The black line represents the approximate dewpoint temperature during the test burn. The blue line represents the actual stack temperature. As seen in the graph, the stack temperature was below the dewpoint of SO₃ for the duration of the test burn.

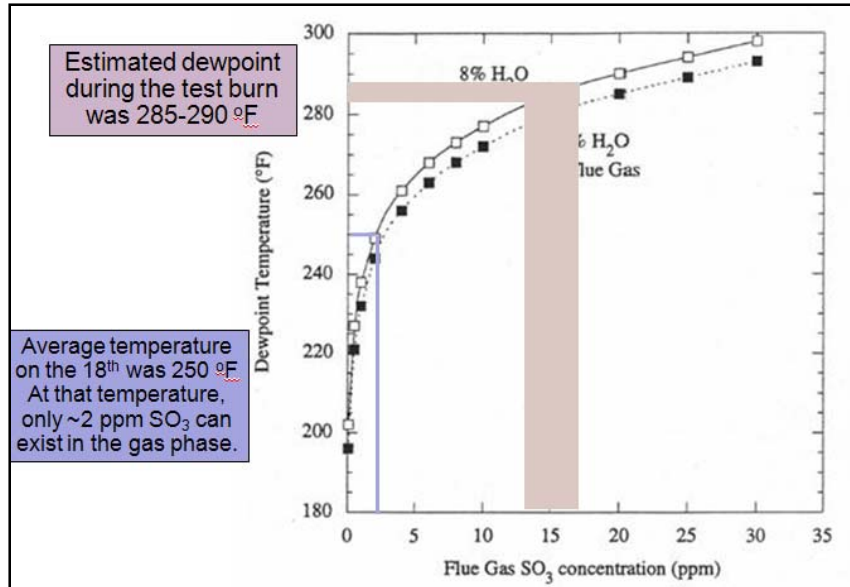


Figure 2.3.2-4 Estimated Dewpoint During Test Burn

The higher levels of sulfur trioxide during the test burn would cause the process of condensation and build up to accelerate. The lower operating stack temperatures since February of this year have resulted in a slow build up of ash material causing the thicker heavier material (which fell off on the stack floor). The lighter, thinner material was most probably built up during the recent test burn when the sulfur trioxide levels were elevated from the higher sulfur test burn.

FINDING : Low stack temperatures coupled with the presence of SO₃ in the flue gas is causing sulfated ash buildup in S1.

FINDING : Sulfated Ash is a contributor to the reported observations of material leaving S1.

2.3.3 Fly Ash

Fly ash is collected by the precipitator and could have been emitted due to equipment malfunctions.

Precipitator performance data was reviewed for the time period of the events and all equipment was operating normally. No data that would indicate any excess fly ash carry over was found.

FINDING : Excess fly ash from an electrostatic precipitator malfunction is not a contributor to the reported observations of material leaving S1

3.0 CONCLUSIONS AND RECOMMENDATIONS

Section 1.0 summarized the event and the sequence of events. Section 2.0 discussed the analysis techniques, failure modes, failure mechanisms, and the findings. This section will offer conclusions and recommended actions to prevent a similar event. Conclusions are summarized below:

- A sample of the material was collected by TDEC but there was insufficient quantity to perform any chemical analysis. A microscopic analysis was performed on the sample but did not provide any significant data to be useful in this analysis. TVA was unable to collect a sample of the deposited material.
- The material was emitted from Stack 1. Inspections inside Stack 1 revealed material physically similar to the material reported. Stack 1 was operating below the SO₃ dew point. Stack 1 had units burning the higher sulfur test coal. Stack 1 had similar deposits on the rain cap outside the stack at the top.
- The test burn of higher sulfur coal allowed a physically different material to condense and buildup on the previous/older buildup material. Although this lighter material is chemically similar to the previous buildup; they are both high in sulfates, it is light, fragile, and white in color. The rate of buildup was accelerated from the amount of additional SO₃ available with the higher sulfur coal. This light material fell down on inspectors inside the stack during post event inspections. This light material is likely to have contributed to the event.
- The two events on September 10 and September 18, where material deposited outside the stack, occurred when ammonia slip was present allowing ABS/AS to form. ABS / AS was present in the stack samples and is a contributor to the reported events.
- Condensed SO₃ caused a buildup of material within Stack 1. Operation below the SO₃ dew point had been occurring since February 2009. If operations would have continued in this manner the quantity of buildup would have triggered an event similar to this one in the future.
- Sulfated fly ash is a contributor to the reported events.
- Excess fly ash from an electrostatic precipitator malfunction is not a contributor to the reported observations of material leaving S1.

The three failure modes and their contribution to these events are summarized in Table 3-1.



TABLE 3-1. SUMMARY OF FAILURE MODES AND CONTRIBUTION

	Ash Material from Stack 1		
Failure Mode	ABS/AS	Sulfated Ash	Fly Ash
Contribution	Major	Major	None
Comments	Data and timelines indicate that the events occurred during time period where conditions were suitable for ABS/AS formation	Chemical analysis of the light friable material collected in the stack indicates high concentration of sulfates. This material looks physically similar to the material reported in the events.	No Precipitator Malfunctions were identified during the events



3.1 Root Cause Analysis Results

A summary of the Root Cause Analysis including failure modes, contributing factors, failure mechanisms, root causes, and corrective actions are shown in Table 3-2.

TABLE 3-2. SUMMARY OF ROOT CAUSE ANALYSIS

Failure Mode	Failure/Error Mechanism	Root Cause	Corrective Action
Material discharging out of Stack 1	Operating below the acid dew point.	Dispatch and operational processes and procedures were not identified and implemented for maintaining adequate stack temperatures.	Implement criteria to maintain stack temperatures above acid dew point.
Contributing Factors	Failure/Error Mechanism	Root Cause	Corrective Action
Physically Different Buildup	More SO ₃ available from higher sulfur coal created a dissimilar buildup at a faster rate.	Test Burn procedure did not identify possible failure mechanism of lower temperature with higher SO ₃	Revise Test Burn procedure to identify possible factors that would cause operation below dew point
Unreacted Ammonia (Slip)	Excess ammonia promotes ABS/AS formation	Controls do not minimize slip during load changes	Update controls to minimize slip during load changes/upsets.
Air In-Leakage	Operation with idle units not isolated and material condition of expansion joints/ductwork.	No experience operating with most units out of service and not understanding the current operational conditions and their impacts	Establish operating and maintenance practices to minimize air in-leakage



3.2 Summary of Action Items

A summary of the action items and the impacts that they will improve are listed in Table 3-3.

TABLE 3-3. SUMMARY OF ACTION ITEMS

Action Item	Improvements
Implement criteria to maintain a minimum stack temperature during operation for all fuel types. This guidance will be developed by corporate engineering and submitted to all of the plants	Maintaining an minimum temperature will prevent SO ₃ condensation and potential buildups on ducts and stacks through TVA Fossil Plants
Revise the ammonia control logic for the SCR to minimize ammonia slip during all operation situations at KIF	Minimizing slip will minimize ABS/AS formation
Revise the Test Burn procedure to identify possible factors that would cause operation below the dewpoint and any other external impacts	Prevent future test burns from impacting any environmental or external issues.
Complete a TVA wide study to revise operational and maintenance routines and practices for long term low load operation.	Identify potential pitfalls and issues throughout the fleet with long term low load operation

The most immediate action for Kingston is to clean the stack and trunk duct to remove all of the buildup. This work is complete. When the units return to service, the stack will be maintained above the SO₃ dewpoint to prevent future condensation within the stack.

TVA will inspect its other non-scrubbed units for similar buildup, install temperature indication for operations and engineering, and implement criteria to maintain stack temperatures above the SO₃ dewpoint. These units include Colbert 1-4, Johnsonville, Widow’s Creek 1-6, John Sevier and Gallatin. TVA will revise the corporate test burn procedure to identify possible factors that would cause operation below the SO₃ dewpoint.



4.0 REFERENCES

1. Fowler, Bob. “Ash fallout from test burn in Roane still a mystery to TVA” Knoxville News Sentinel Co. Online.
<http://www.knoxnews.com/news/2009/sep/23/ash-fallout-from-test-burn-still-a-mystery-to/>
2. SO₃ Mitigation Guide. EPRI. (TR-104424, Research Project 2250-03) Final Report October 1994.



5.0 APPENDIX

5.1 Appendix - A - TDEC Sample from Ellis' Residence

STATE OF TENNESSEE ENVIRONMENTAL LABORATORIES
REQUEST FOR MICROSCOPIC ANALYSIS

Please complete shaded areas

PROJECT/SITE NO. <i>Ellis</i>	PROJECT NAME <i>Ellis</i>
FIELD NUMBER <i>1</i>	COUNTY <i>Roane</i>
DESCRIPTION <i>Particulate</i>	
SAMPLE TYPE: <input type="checkbox"/> BULK INSULATION	<input checked="" type="checkbox"/> OTHER <i>Particulate</i>
DATE COLLECTED <i>9-18-09</i>	TIME <i>~2:30 PM</i>
SAMPLER'S NAME <i>Jarrett Rudd</i>	PHONE NUMBER: <i>865-594-5568</i>
AGENCY <i>TDEC-APC</i>	BILLING CODE: <i>32731</i>
SEND REPORT TO <i>Jarrett Rudd</i>	TEST REQUESTED:
<i>TDEC-APC</i>	<input type="checkbox"/> ASBESTOS
<i>3711 Middlebrook Pike</i>	<input checked="" type="checkbox"/> OTHER MICROSCOPIC
<i>Knoxville, TN 37924</i>	

FOR LABORATORY USE ONLY

LABORATORY NUMBER	<i>K8000-2884-001</i>
DATE RECEIVED	<i>9/21/09</i>
DATE REPORTED	<i>9/25/09</i>
ANALYZED BY	<i>E. McCravy</i>

LABORATORY RESULTS:

Percent	Material	Percent	Material
<i>75</i>	<i>unburned coal, flyash</i>		
<i>6</i>	<i>plant tissue</i>		
<i>6</i>	<i>flyash (tarry)</i>		
<i>4</i>	<i>soil particles</i>		
<i>3</i>	<i>quartz, other minerals</i>		
<i>2</i>	<i>black, opaque cenospheres</i>		
<i>1</i>	<i>glassy spheres</i>		
<i>1</i>	<i>miss duct</i>		
<i>1</i>	<i>pollen grains</i>		
<i>1</i>	<i>cellulose fiber</i>		

UNSATISFACTORY FOR ANALYSIS

COMMENTS *Small sample amount for analysis*

Notes: All asbestos analyses are performed in accordance with EPA Method 600/R-93/116. A visual estimation is used to determine the percent of asbestos present. The use of trade names is for identification purposes only. Results only apply to the individual sample submitted for analysis. This report may not be reproduced except in full without the written approval of the laboratory.



STATE OF TENNESSEE
DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORIES

TDH: Lab Services JRL
Lab Services - Jackson Regional Lab
Jackson, TN 38301
731-426-0686

TDH: Lab Services KRL
Lab Services - Knoxville Regional Lab
Knoxville, TN 37920
865-549-6201

TDH: Lab Services NCL
Lab Services - Nashville Central Lab
Nashville, TN 37243
615-262-6300

Sent To: Jackie Waynick
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3711 Middlebrook Pike
Knoxville, TN 37921

Lab ID: K00002884
Knoxville Regional Laboratory

Sampling Agency: TDEC: Division of Air Pollution Control

Billing Code: 327.31-10

This is to certify that the following results were determined using good laboratory practices and in accordance with federal or state approved methodologies.

Edward M. Gray
Analytical Supervisor



5.2 Appendix - B - Unit 3 Electrostatic Precipitator Samples

3B AAF Middle Door N Col Scrapings

Analyte	CAS Number ¹	Result	Units	MDL ²	Analysis		Analyst	Method Reference
					Date	Time		
Loss on Ignition of Ash, as determi		8.86	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Silicon Dioxide	14808-60-7	48.90	%		09/23/2009	12:39	RLB	ASTM D 6349
Aluminum Oxide	1344-28-1	27.29	%		09/23/2009	12:39	RLB	ASTM D 6349
Iron Oxide	1317-61-9	10.11	%		09/23/2009	12:39	RLB	ASTM D 6349
Calcium Oxide	1305-78-8	4.32	%		09/23/2009	12:39	RLB	ASTM D 6349
Magnesium Oxide	1309-48-4	1.55	%		09/23/2009	12:39	RLB	ASTM D 6349
Potassium Oxide	12136-45-7	2.47	%		09/23/2009	12:39	RLB	ASTM D 6349
Sodium Oxide	1313-59-3	0.88	%		09/23/2009	12:39	RLB	ASTM D 6349
Titanium Oxide	13463-67-7	1.39	%		09/23/2009	12:39	RLB	ASTM D 6349
Phosphorus Oxide	1314-56-3	0.46	%		09/23/2009	12:39	RLB	ASTM D 6349
Sulfur Oxide	7446-09-5	2.11	%		09/23/2009	12:39	RLB	ASTM D 6349
Undetermine		0.50	%		09/23/2009	12:39	RLB	ASTM D 6349
Base/Acid Ratio		0.25	%		09/23/2009	12:39	RLB	ASTM D 6349
T250		2675	%		09/23/2009	12:39	RLB	ASTM D 6349
Ammonia as N	7664-41-7	240	mg/Kg	0.5	09/22/2009	15:33	ADP	EPA 350.1
Residual Moisture		1.37	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, as determined		91.14	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, dry		92.41	%		09/23/2009	7:49	RLB	ASTM D 3176
Loss on Ignition of Ash, dry		7.59	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Sulfate, High Level	14808-79-8	29780	ppm	0.4	09/23/2009	13:28	CLS	CLS-105.01-003
Miscellaneous Test (Narrative)		L5394787.NT			09/23/2009	13:00	CLS	
		1:1 Mass/Volume Dilution						
		Initial pH - 3.69						
		Equilibrium pH - 3.92						
Chloride, Leach	16887-00-6	36	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003
Fluoride, Leach	16984-48-8	89	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003

3B AAF Middle Door Loose Ash

Analyte	CAS Number ¹	Result	Units	MDL ²	Analysis		Analyst	Method Reference
					Date	Time		
Loss on Ignition of Ash, as determi		4.84	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Silicon Dioxide	14808-60-7	44.96	%		09/23/2009	12:39	RLB	ASTM D 6349
Aluminum Oxide	1344-28-1	25.95	%		09/23/2009	12:39	RLB	ASTM D 6349
Iron Oxide	1317-61-9	11.31	%		09/23/2009	12:39	RLB	ASTM D 6349
Calcium Oxide	1305-78-8	7.23	%		09/23/2009	12:39	RLB	ASTM D 6349
Magnesium Oxide	1309-48-4	2.14	%		09/23/2009	12:39	RLB	ASTM D 6349
Potassium Oxide	12136-45-7	2.15	%		09/23/2009	12:39	RLB	ASTM D 6349
Sodium Oxide	1313-59-3	0.77	%		09/23/2009	12:39	RLB	ASTM D 6349
Titanium Oxide	13463-67-7	1.30	%		09/23/2009	12:39	RLB	ASTM D 6349
Phosphorus Oxide	1314-56-3	0.43	%		09/23/2009	12:39	RLB	ASTM D 6349
Sulfur Oxide	7446-09-5	3.26	%		09/23/2009	12:39	RLB	ASTM D 6349
Undetermine		0.50	%		09/23/2009	12:39	RLB	ASTM D 6349
Base/Acid Ratio		0.33	%		09/23/2009	12:39	RLB	ASTM D 6349
T250		2500	%		09/23/2009	12:39	RLB	ASTM D 6349
Ammonia as N	7664-41-7	300	mg/Kg	0.5	09/22/2009	15:33	ADP	EPA 350.1
Residual Moisture		0.85	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, as determined		95.16	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, dry		95.98	%		09/23/2009	7:49	RLB	ASTM D 3176
Loss on Ignition of Ash, dry		4.02	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Sulfate, High Level	14808-79-8	20780	ppm	0.4	09/23/2009	13:28	CLS	CLS-105.01-003
Miscellaneous Test (Narrative)		L5394802.NT			09/23/2009	13:00	CLS	
		1:1 Mass/Volume Dilution						
		Initial pH - 3.75						
		Equilibrium pH - 3.98						
Chloride, Leach	16887-00-6	198	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003
Fluoride, Leach	16984-48-8	329	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003



3A AAF 1st Door Electrode Scrapings

Analyte	CAS Number ¹	Result	Units	MDL ²	Analysis Date	Analysis Time	Analyst	Method Reference
Loss on Ignition of Ash, as determi		5.62	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Silicon Dioxide	14808-60-7	51.10	%		09/23/2009	12:39	RLB	ASTM D 6349
Aluminum Oxide	1344-28-1	25.65	%		09/23/2009	12:39	RLB	ASTM D 6349
Iron Oxide	1317-61-9	10.60	%		09/23/2009	12:39	RLB	ASTM D 6349
Calcium Oxide	1305-78-8	3.01	%		09/23/2009	12:39	RLB	ASTM D 6349
Magnesium Oxide	1309-48-4	1.26	%		09/23/2009	12:39	RLB	ASTM D 6349
Potassium Oxide	12136-45-7	2.65	%		09/23/2009	12:39	RLB	ASTM D 6349
Sodium Oxide	1313-59-3	1.22	%		09/23/2009	12:39	RLB	ASTM D 6349
Titanium Oxide	13463-67-7	1.42	%		09/23/2009	12:39	RLB	ASTM D 6349
Phosphorus Oxide	1314-56-3	0.53	%		09/23/2009	12:39	RLB	ASTM D 6349
Sulfur Oxide	7446-09-5	2.05	%		09/23/2009	12:39	RLB	ASTM D 6349
Undetermine		0.50	%		09/23/2009	12:39	RLB	ASTM D 6349
Base/Acid Ratio		0.24	%		09/23/2009	12:39	RLB	ASTM D 6349
T250		2700	%		09/23/2009	12:39	RLB	ASTM D 6349
Ammonia as N	7664-41-7	26	mg/Kg	0.5	09/22/2009	15:33	ADP	EPA 350.1
Residual Moisture		0.91	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, as determined		94.38	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, dry		95.25	%		09/23/2009	7:49	RLB	ASTM D 3176
Loss on Ignition of Ash, dry		4.75	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Sulfate, High Level	14808-79-8	33868	ppm	0.4	09/23/2009	13:28	CLS	CLS-105.01-003
Miscellaneous Test (Narrative)		L5394814.NT			09/23/2009	13:00	CLS	
		1:1 Mass/Volume Dilution						
		Initial pH - 4.29						
		Equilibrium pH - 4.83						
Chloride, Leach	16887-00-6	11	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003
Fluoride, Leach	16984-48-8	68	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003



5.3 Appendix - C - Unit 4 Electrostatic Precipitator Samples

4A AAF Middle Door Loose Ash

Analyte	CAS Number ¹	Result	Units	MDL ²	Analysis	Analysis	Analyst	Method
					Date	Time		Reference
Loss on Ignition of Ash, as determi		5.44	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Silicon Dioxide	14808-60-7	48.46	%		09/23/2009	12:39	RLB	ASTM D 6349
Aluminum Oxide	1344-28-1	25.59	%		09/23/2009	12:39	RLB	ASTM D 6349
Iron Oxide	1317-61-9	12.47	%		09/23/2009	12:39	RLB	ASTM D 6349
Calcium Oxide	1305-78-8	3.45	%		09/23/2009	12:39	RLB	ASTM D 6349
Magnesium Oxide	1309-48-4	1.33	%		09/23/2009	12:39	RLB	ASTM D 6349
Potassium Oxide	12136-45-7	2.56	%		09/23/2009	12:39	RLB	ASTM D 6349
Sodium Oxide	1313-59-3	1.17	%		09/23/2009	12:39	RLB	ASTM D 6349
Titanium Oxide	13463-67-7	1.39	%		09/23/2009	12:39	RLB	ASTM D 6349
Phosphorus Oxide	1314-56-3	0.56	%		09/23/2009	12:39	RLB	ASTM D 6349
Sulfur Oxide	7446-09-5	2.52	%		09/23/2009	12:39	RLB	ASTM D 6349
Undetermine		0.50	%		09/23/2009	12:39	RLB	ASTM D 6349
Base/Acid Ratio		0.28	%		09/23/2009	12:39	RLB	ASTM D 6349
T250		2600	%		09/23/2009	12:39	RLB	ASTM D 6349
Ammonia as N	7664-41-7	11	mg/Kg	0.5	09/22/2009	15:33	ADP	EPA 350.1
Residual Moisture		1.14	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, as determined		94.56	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, dry		95.65	%		09/23/2009	7:49	RLB	ASTM D 3176
Loss on Ignition of Ash, dry		4.35	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Sulfate, High Level	14808-79-8	28046	ppm	0.4	09/23/2009	13:28	CLS	CLS-105.01-003
Miscellaneous Test (Narrative)		L5394845.NT			09/23/2009	13:00	CLS	
		1:1 Mass/Volume Dilution						
		Initial pH - 3.77						
		Equilibrium pH - 3.98						
Chloride, Leach	16887-00-6	166	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003
Fluoride, Leach	16984-48-8	267	ppm	0.1	09/23/2009	13:01	CLS	CLS-105.01-003

4A AAF Middle Door Plate Ash

Analyte	CAS Number ¹	Result	Units	MDL ²	Analysis	Analysis	Analyst	Method
					Date	Time		Reference
Loss on Ignition of Ash, as determi		5.13	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Silicon Dioxide	14808-60-7	48.23	%		09/23/2009	12:39	RLB	ASTM D 6349
Aluminum Oxide	1344-28-1	25.50	%		09/23/2009	12:39	RLB	ASTM D 6349
Iron Oxide	1317-61-9	12.08	%		09/23/2009	12:39	RLB	ASTM D 6349
Calcium Oxide	1305-78-8	4.13	%		09/23/2009	12:39	RLB	ASTM D 6349
Magnesium Oxide	1309-48-4	1.47	%		09/23/2009	12:39	RLB	ASTM D 6349
Potassium Oxide	12136-45-7	2.48	%		09/23/2009	12:39	RLB	ASTM D 6349
Sodium Oxide	1313-59-3	1.10	%		09/23/2009	12:39	RLB	ASTM D 6349
Titanium Oxide	13463-67-7	1.38	%		09/23/2009	12:39	RLB	ASTM D 6349
Phosphorus Oxide	1314-56-3	0.52	%		09/23/2009	12:39	RLB	ASTM D 6349
Sulfur Oxide	7446-09-5	2.60	%		09/23/2009	12:39	RLB	ASTM D 6349
Undetermine		0.50	%		09/23/2009	12:39	RLB	ASTM D 6349
Base/Acid Ratio		0.28	%		09/23/2009	12:39	RLB	ASTM D 6349
T250		2600	%		09/23/2009	12:39	RLB	ASTM D 6349
Ammonia as N	7664-41-7	11	mg/Kg	0.5	09/22/2009	15:33	ADP	EPA 350.1
Residual Moisture		1.26	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, as determined		94.87	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, dry		96.08	%		09/23/2009	7:49	RLB	ASTM D 3176
Loss on Ignition of Ash, dry		3.92	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Sulfate, High Level	14808-79-8	31069	ppm	0.4	09/23/2009	13:28	CLS	CLS-105.01-003
Miscellaneous Test (Narrative)		L5394857.NT			09/23/2009	13:00	CLS	
		1:1 Mass/Volume Dilution						
		Initial pH - 3.75						
		Equilibrium pH - 3.94						
Chloride, Leach	16887-00-6	64	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003
Fluoride, Leach	16984-48-8	102	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003



4B AAF Middle Door Loose Ash

Analyte	CAS Number ¹	Result	Units	MDL ²	Analysis	Analysis	Analyst	Method Reference
					Date	Time		
Loss on Ignition of Ash, as determi		7.79	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Silicon Dioxide	14808-60-7	55.20	%		09/23/2009	12:39	RLB	ASTM D 6349
Aluminum Oxide	1344-28-1	29.69	%		09/23/2009	12:39	RLB	ASTM D 6349
Iron Oxide	1317-61-9	5.30	%		09/23/2009	12:39	RLB	ASTM D 6349
Calcium Oxide	1305-78-8	2.00	%		09/23/2009	12:39	RLB	ASTM D 6349
Magnesium Oxide	1309-48-4	1.29	%		09/23/2009	12:39	RLB	ASTM D 6349
Potassium Oxide	12136-45-7	2.85	%		09/23/2009	12:39	RLB	ASTM D 6349
Sodium Oxide	1313-59-3	0.42	%		09/23/2009	12:39	RLB	ASTM D 6349
Titanium Oxide	13463-67-7	1.46	%		09/23/2009	12:39	RLB	ASTM D 6349
Phosphorus Oxide	1314-56-3	0.16	%		09/23/2009	12:39	RLB	ASTM D 6349
Sulfur Oxide	7446-09-5	1.15	%		09/23/2009	12:39	RLB	ASTM D 6349
Undetermine		0.50	%		09/23/2009	12:39	RLB	ASTM D 6349
Base/Acid Ratio		0.14	%		09/23/2009	12:39	RLB	ASTM D 6349
T250		2900	%		09/23/2009	12:39	RLB	ASTM D 6349
Ammonia as N	7664-41-7	10	mg/Kg	0.5	09/22/2009	15:33	ADP	EPA 350.1
Residual Moisture		1.41	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, as determined		92.21	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, dry		93.53	%		09/23/2009	7:49	RLB	ASTM D 3176
Loss on Ignition of Ash, dry		6.47	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Sulfate, High Level	14808-79-8	27352	ppm	0.4	09/23/2009	13:28	CLS	CLS-105.01-003
Miscellaneous Test (Narrative)		L5394868.NT			09/23/2009	13:00	CLS	
		1:1 Mass/Volume Dilution						
		Initial pH - 3.71						
		Equilibrium pH - 3.79						
Chloride, Leach	16887-00-6	27	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003
Fluoride, Leach	16984-48-8	295	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003



5.4 Appendix - D - Stack 1 Liner Samples from the 300 ft Elevation

Stack 1 On Port CCW of East Port

Analyte	CAS Number ¹	Result	Units	MDL ²	Analysis	Analysis	Analyst	Method
					Date	Time		Reference
Loss on Ignition of Ash, as determi		36.09	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Silicon Dioxide	14808-60-7	41.10	%		09/23/2009	12:39	RLB	ASTM D 6349
Aluminum Oxide	1344-28-1	23.77	%		09/23/2009	12:39	RLB	ASTM D 6349
Iron Oxide	1317-61-9	18.16	%		09/23/2009	12:39	RLB	ASTM D 6349
Calcium Oxide	1305-78-8	3.27	%		09/23/2009	12:39	RLB	ASTM D 6349
Magnesium Oxide	1309-48-4	1.49	%		09/23/2009	12:39	RLB	ASTM D 6349
Potassium Oxide	12136-45-7	2.39	%		09/23/2009	12:39	RLB	ASTM D 6349
Sodium Oxide	1313-59-3	0.58	%		09/23/2009	12:39	RLB	ASTM D 6349
Titanium Oxide	13463-67-7	1.19	%		09/23/2009	12:39	RLB	ASTM D 6349
Phosphorus Oxide	1314-56-3	0.56	%		09/23/2009	12:39	RLB	ASTM D 6349
Sulfur Oxide	7446-09-5	6.99	%		09/23/2009	12:39	RLB	ASTM D 6349
Undetermine		0.50	%		09/23/2009	12:39	RLB	ASTM D 6349
Base/Acid Ratio		0.39	%		09/23/2009	12:39	RLB	ASTM D 6349
T250		2425	%		09/23/2009	12:39	RLB	ASTM D 6349
Ammonia as N	7664-41-7	1400	mg/Kg	0.5	09/22/2009	15:33	ADP	EPA 350.1
Residual Moisture		5.53	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, as determined		63.91	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, dry		67.65	%		09/23/2009	7:49	RLB	ASTM D 3176
Loss on Ignition of Ash, dry		32.35	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Sulfate, High Level	14808-79-8	294338	ppm	0.4	09/23/2009	13:28	CLS	CLS-105.01-003
Miscellaneous Test (Narrative)		L5394824.NT			09/23/2009	13:00	CLS	
		1:1 Mass/Volume Dilution						
		Initial pH - 1.71						
		Equilibrium pH - 1.75						
Chloride, Leach	16887-00-6	83	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003
Fluoride, Leach	16984-48-8	5	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003

Stack 1 East Port

Analyte	CAS Number ¹	Result	Units	MDL ²	Analysis	Analysis	Analyst	Method
					Date	Time		Reference
Loss on Ignition of Ash, as determi		43.15	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Silicon Dioxide	14808-60-7	43.89	%		09/23/2009	12:39	RLB	ASTM D 6349
Aluminum Oxide	1344-28-1	25.72	%		09/23/2009	12:39	RLB	ASTM D 6349
Iron Oxide	1317-61-9	6.75	%		09/23/2009	12:39	RLB	ASTM D 6349
Calcium Oxide	1305-78-8	5.13	%		09/23/2009	12:39	RLB	ASTM D 6349
Magnesium Oxide	1309-48-4	2.05	%		09/23/2009	12:39	RLB	ASTM D 6349
Potassium Oxide	12136-45-7	2.36	%		09/23/2009	12:39	RLB	ASTM D 6349
Sodium Oxide	1313-59-3	0.67	%		09/23/2009	12:39	RLB	ASTM D 6349
Titanium Oxide	13463-67-7	1.32	%		09/23/2009	12:39	RLB	ASTM D 6349
Phosphorus Oxide	1314-56-3	0.57	%		09/23/2009	12:39	RLB	ASTM D 6349
Sulfur Oxide	7446-09-5	11.04	%		09/23/2009	12:39	RLB	ASTM D 6349
Undetermine		0.50	%		09/23/2009	12:39	RLB	ASTM D 6349
Base/Acid Ratio		0.24	%		09/23/2009	12:39	RLB	ASTM D 6349
T250		2700	%		09/23/2009	12:39	RLB	ASTM D 6349
Ammonia as N	7664-41-7	1800	mg/Kg	0.5	09/22/2009	15:33	ADP	EPA 350.1
Residual Moisture		8.25	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, as determined		56.85	%		09/23/2009	7:49	RLB	ASTM D 5142
Ash, dry		61.96	%		09/23/2009	7:49	RLB	ASTM D 3176
Loss on Ignition of Ash, dry		38.04	%	0.00	09/23/2009	7:49	RLB	ASTM D5142
Sulfate, High Level	14808-79-8	316597	ppm	0.4	09/23/2009	13:28	CLS	CLS-105.01-003
Miscellaneous Test (Narrative)		L5394834.NT			09/23/2009	13:00	CLS	
		1:1 Mass/Volume Dilution						
		Initial pH - 1.51						
		Equilibrium pH - 1.58						
Chloride, Leach	16887-00-6	5	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003
Fluoride, Leach	16984-48-8	265	ppm	0.1	09/23/2009	13:28	CLS	CLS-105.01-003



5.5 Appendix - E - Stack Bottom - White Buildup

Analyte	CAS Number ¹	Result	Units	MDL ²	Analysis Date	Analysis Time	Analyst	Method Reference
Silicon Dioxide	14808-60-7	43.71	%		09/30/2009	13:59	RLB	ASTM D 6349
Aluminum Oxide	1344-28-1	24.95	%		09/30/2009	13:59	RLB	ASTM D 6349
Iron Oxide	1317-61-9	14.37	%		09/30/2009	13:59	RLB	ASTM D 6349
Calcium Oxide	1305-78-8	3.22	%		09/30/2009	13:59	RLB	ASTM D 6349
Magnesium Oxide	1309-48-4	1.47	%		09/30/2009	13:59	RLB	ASTM D 6349
Potassium Oxide	12136-45-7	2.60	%		09/30/2009	13:59	RLB	ASTM D 6349
Sodium Oxide	1313-59-3	0.46	%		09/30/2009	13:59	RLB	ASTM D 6349
Titanium Oxide	13463-67-7	1.32	%		09/30/2009	13:59	RLB	ASTM D 6349
Phosphorus Oxide	1314-56-3	0.63	%		09/30/2009	13:59	RLB	ASTM D 6349
Sulfur Oxide	7446-09-5	6.76	%		09/30/2009	13:59	RLB	ASTM D 6349
Undetermine		0.50	%		09/30/2009	13:59	RLB	ASTM D 6349
Base/Acid Ratio		0.32	%		09/30/2009	13:59	RLB	ASTM D 6349
T250		2525	%		09/30/2009	13:59	RLB	ASTM D 6349
Residual Moisture		3.90	%		09/30/2009	7:29	RLB	ASTM D 5142
Ash, as determined		71.89	%		09/30/2009	7:29	RLB	ASTM D 5142
Ash, dry		74.81	%		09/30/2009	7:29	RLB	ASTM D 3176
Loss on Ignition of Ash, dry		25.19	%	0.00	09/30/2009	7:29	RLB	ASTM D5142
Loss on Ignition of Ash, as determi		28.11	%	0.00	09/30/2009	7:29	RLB	ASTM D5142
Sulfate, High Level	14808-79-8	227230	ppm	0.4	09/30/2009	11:23	CLS	CLS-105.01-003
Chloride, Leach	16887-00-6	40	ppm	0.1	09/30/2009	11:09	CLS	CLS-105.01-003
Fluoride, Leach	16984-48-8	335	ppm	0.1	09/30/2009	10:06	CLS	CLS-105.01-003
Ammonia as N	7664-41-7	2500	mg/Kg	0.5	09/30/2009	13:33	ADP	EPA 350.1