2

DE/MC/25185-3361

SOLID WASTE SAMPLING AND DISTRIBUTION PROJECT

SAMPLING REPORT #4

January 1993

Work Performed Under Contract No. DE-AC21-88MC25185

for

U.S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
Morgantown, West Virginia

by

Energy and Environmental Research Corporation
Irvine, California

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MASTER

qf b

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

INTRODUCTION

The United States Department of Energy (DOE) has established a Waste Management Program within the Office of Fossil Energy. A key goal of this program is to ensure that waste management issues do not become obstacles to the commercialization of advanced coal utilization technologies. In achieving this goal, the Waste Management Program identifies various emerging coal utilization technologies and performs comprehensive characterizations of the waste streams and products. The characterizations include engineering assessments to define waste streams of interest/potential concern, field studies to collect samples of the waste, and complete chemical analysis of the collected samples.

In a previous effort under the above mentioned program, DOE obtained waste stream samples from approximately 20 different facilities utilizing advanced coal technologies. These facilities were mainly small pilot scale facilities. DOE now is extending their characterization program to include a number of new facilities, particularly larger pilot- and commercial-scale units. Energy and Environmental Research Corporation (EER) was selected to perform the site selection and the sampling aspects of five (5) of these facilities.

The current EER contract consists of two interrelated efforts: site selection and waste sampling. Detailed sample analysis is being conducted under another DOE contract. The primary objectives of the site selection and sampling effort are listed below.

- Survey sites at which advanced fossil energy combustion technologies are being operated, and identify five sites for sampling. Priority should be given to DOE Clean Coal Technology (CCT) Program Sites.
- Identify candidate solid waste streams in advanced coal utilization processes likely to present disposal problems and prioritize them for sampling at selected sites.
- Contact site personnel for site access, sample the streams representatively and document them according to established methodology and known process conditions.

- Distribute the samples to DOE's Morgantown Energy Technology Center or their representatives for analysis and report on the site visit.

Several advanced coal utilization technologies have been tentatively selected for comprehensive waste characterization. One of those technologies is the SO_x - NO_x - RO_x Box (SNRB) Flue Gas Cleanup process being demonstrated by Babcock & Wilcox (B&W) at Site E. On December 16, 1992 samples were collected to characterize solid waste streams. This document provides background information on the site and describes sampling activities performed at this facility.

SITE SELECTION

EER established criteria for selecting candidate sites. These include:

- The demonstration has been selected as part of DOE's Clean Coal Technology (CCT) Program,
- There is a lack of data regarding the waste products from this technology,
- Facility operators will cooperate,
- There is a possibility that the waste contains regulated compounds, and
- The demonstration is being conducted in a pilot scale facility or larger with the availability of 85 lbs of waste.

Babcock & Wilcox is demonstrating a 5 MWe pilot scale usage of the SNRB process. This is a new technology which has not been demonstrated commercially and thus limited data is available regarding the characteristics of the waste products. The demonstration was selected as one of the projects funded in Round II of DOE's CCT Program, and the facility operators were willing to have this sampling program conducted at their facility. Having met all of the criteria listed above, the SNRB technology being developed by B&W and Ohio Edison of Akron, OH was selected for inclusion in the current sampling program.

STREAM SELECTION

A schematic of the SNRB demonstration unit and accompanying boiler is shown in Figure 1. This figure indicates the air, fuel, sorbent, flue gas, ammonia and waste stream flow paths through the unit as well as the locations for stream sampling. Figure 2 provides an equipment layout for the SNRB process. Only solid phase by-products were generated by this facility. The major solid by-product stream sampled was the baghouse flyash. Additional solids samples were taken of the hydrated lime sorbent, coal, boiler bottom ash, economizer ash, and electrostatic precipitator (ESP) flyash. A process flow diagram of the SNRB demonstration is provided in Figure 3.

The bottom ash consists of coal ash, unburned coal, small rocks, and metal. This ash is collected in the bottom of the boiler and passed to sluice lines on either side of the boiler. The bottom ash drops into a water channel which transports the ash to the ash pond.

Some ash particles that remain present in the boiler exit gases are collected in the economizer/air preheater hopper. This ash is collected in one of two hoppers located just below the air preheater for the unit. The ash collected in these two hoppers is sluiced along with the boiler bottom ash to the bottom ash disposal pond.

Flyash from the SNRB process is collected in the high temperature baghouse. A 5 MW_e slipstream of flue gas is sent through the SNRB process. Sorbent and ammonia are injected into the flue gas for SO_x and NO_x reduction, respectively. Next, the mixture of ammonia, sorbent, and flue gas passes through a high temperature baghouse. The flue gas passes through the bag filters which collect the flyash. The ammonia in the flue gas reacts in the catalyst bed located in the bag filters to reduce the NO_x emissions of the boiler. Sulfur compounds are captured in the flyash which consists of coal ash and reacted sorbent. The flyash is collected in hoppers located at the bottom of the baghouse. The hoppers are emptied one at a time. A valve at the bottom of the hopper is opened and the ash falls into a lock hopper. Once full, the valve at the top of the hopper is closed and the lock hopper is

Figure 1. Schematic of SNRB process.

C112 675

Figure 2. SNRB Demonstration Equipment Layout

Figure 3. SNRB Process Flow Diagram

emptied pneumatically. The ash is transported to a storage silo then emptied by gravity into a trailer for disposal. The cleaned flue gas stream is returned to the main boiler flue gas stream prior to the ESP inlet.

Flyash present in the flue gas stream which does not travel through the SNRB process is removed in the ESP. The direct current electricity present in each of the fields of the ESP charge the ash particles causing them to be attracted to the neutral plates. Ash is removed from the neutral plates by mechanically striking the support structure for the plates. The ash falls into ash hoppers where it is collected and pneumatically transported to flyash storage silos. The flyash remains in these silos until it is loaded onto trucks for disposal.

Streams identified for sampling include boiler bottom ash, economizer/air preheater ash, ESP flyash, baghouse flyash, sorbent, and unburned coal. The boiler bottom ash was collected from an inspection door at the end of the bottom ash hopper. Economizer ash was collected from a sampling port located at the bottom of the ash hopper. Samples of the ESP ash were obtained by collecting samples throughout the day from each of the ESP hoppers. Baghouse ash samples were obtained from a sampling port on one of the baghouse ash hoppers. A sampling port on the sorbent rotary feeder was used to gather the bulk sorbent sample. Finally, a bulk sample of unburned pulverized coal was obtained from the boiler coal transport piping.

SAMPLING PROCEDURES

The sampling team was on-site for the entire day of December 16, 1992, when B&W was conducting operational tests. A copy of the sampling plan is provided in Appendix A. Addendum 1 of this report outlines any actions or procedures taken during the sampling visit that deviated from the original sampling plan. The following subsections provide a description of the sampling methods, the operational data collected and the packing and shipping procedures for delivering samples to the laboratories.

Streams Sampled

As described above, there are six streams from which samples were taken:

- 1) unburned coal, 2) sorbent, 3) boiler bottom ash, 4) ESP flyash, 5) baghouse flyash, and 6) economizer/air preheater ash.

During the sampling, EER collected samples from each of these streams for analytical purposes with the exception of sorbent and unburned coal. Ash analytical samples were placed in 500 ml Teflon® bottles and sealed. The bottles were then placed in coolers, packed with ice and sent to Iowa State University for analysis. This sample was also placed in a cooler, packed with ice and sent to Iowa State University. Bulk samples were taken of the baghouse flyash, sorbent, and coal. The bulk coal sample was taken in one 8-gallon Rubbermaid® containers. The sorbent sample was collected in one 5-gallon container. Baghouse flyash was collected in one 18-gallon Rubbermaid® container. All bulk samples were sealed and shipped to the University of North Dakota Energy and Environmental Research Center. Figure 1, on page 5, represents the location and type (ie. bulk or analytical) of samples taken at various points for the Site "E" sampling visit.

Unburned coal was collected from sampling ports located on the coal transport piping. A roto-probe isokinetic sampler was used to collect the samples. Each transport pipe was sampled with each sample being placed in the same bulk container. Only 4-gallons of coal could be collected during the eight hour sampling period due to restrictions on the capacity of the sampler.

A bulk sample of sorbent was taken from a sampling port located at the bottom of the sorbent silo rotary feeder. Due to the consistency of the sorbent analysis, one bulk sample was collected near the end of the sampling period. This sample was placed in a 5-gallon Rubbermaid® container.

Boiler bottom ash analytical samples were collected using a Teflon® container clamped at the end of an extension arm. The ash sample was obtained by filling the container with ash accessible through the bottom ash hopper inspection door. A total of three 500-ml samples were taken during the day and placed in Teflon® containers. These samples were composited at the lab to form two separate samples.

Three ESP flyash samples were collected for analytical purposes from the ESP ash hoppers. These samples were obtained by compositing flyash samples obtained at three separate times from each ESP hopper. These samples were placed in 500-ml Teflon® containers and prepared for shipment to the analytical laboratory.

A bulk baghouse flyash sample was obtained from a sampling port located at the bottom of the baghouse ash hopper. Samples were obtained each hour and combined to form the composite bulk sample. The bulk sample was collected in an 18-gallon Rubbermaid® container.

Two analytical samples of baghouse ash were obtained by filling two 500-ml Teflon® jars with the composited bulk baghouse ash sample. These samples were collected and packed for shipment to the analytical laboratory.

Operation Data

Operating data for key parameters were also collected during the test program. Data was collected for both the boiler operation as well as the SNRB process operation. Data was collected approximately every hour throughout the time in which samples were being taken. Table 1 outlines the operating parameters measured for the boiler. Table 2 identifies the parameters measured for the SNRB process. Appendix B provides the original data tables.

Sample Shipment

Analytical samples were shipped via Federal Express to Iowa State's Spangler Laboratory for analysis. The analytical samples comprising 11 500-ml Teflon® bottles and were packed in a single cooler. Each sampling container was placed in a plastic zip-lock bag, surrounded with vermiculite and covered with ice packs. All bulk samples were shipped to the University of North Dakota Energy and Environmental Research Center for analysis. The bulk samples consisted of one 5-gallon, one 8-gallon and one 18-gallon Rubbermaid® containers. The chain of custody forms and shipping reports are provided in Appendix C.

**Table 1. Operating Condition Data
R.E. Burger Boiler #8**

(this table must be completed hourly during sample collection)

Parameter		Time								
		0800	0900	1000	1100	1200	1300	1400	1500	1600
Coal Flow Rate (lb/min)										
Sluicing Period (min)										
Boiler Load (MW)		159	159	159	158	159	157	157		156
Steam Temperature (F)		1029	1040	1039	1036	1053	1054	1053		1050
Steam Pressure (psig)		2010	2011	2020	2020	2011	2009	2009		2011
Temperature of Boiler Exit Gas (F)		645	650	650	648	650	650	650		650
Excess Air (%) in Boiler Exit Gas		3.1	3.5	3.0	2.8	3.1	3.1	3.2		3.6
Inlet Temperature of ESP (F)		305	305	305	305	310	310	312		315
Outlet Temperature of ESP (F)		302	302	302	302	310	310	310		310

Table 2. Operating Condition Data
SNRB Demonstration Project

(this table must be completed hourly during sample collection)

		TIME								
		0800	0900	1000	1100	1200	1300	1400	1500	1600
Parameter										
System Inlet Flow Rate	(lb/hr)		33,000	33,000	32,000	32,000	31,900	32,300	32,100	
Baghouse Inlet Flow	(lb/hr)		39,000	39,200	38,000	38,000	38,400	38,600	38,700	
Sorbent/SO ₂ Ratio	(mol/mol)		2.00	2.00	2.00	2.00	2.00	2.00	2.00	
Ammonia/NO _x Ratio	(mol/mol)		0.80	0.79	0.79	0.79	0.79	0.79	0.77	
System Inlet Temperature	(deg. F)		632	634	630	629	631	632	630	
Burner Temperature	(deg. F)		1115	1114	1116	1122	1116	1113	1107	
Injection Temperature	(deg. F)		841	841	843	840	839	840	840	
Inlet Cooler Flue Gas Temp.	(deg. F)		902	901	902	900	899	899	901	
Baghouse Inlet Temp	(deg. F)		841	841	843	840	839	840	840	
Baghouse Outlet Temp	(deg. F)		781	781	782	783	779	780	780	
Outlet Cooler Flue Gas Temp.	(deg. F)		301	300	298	300	299	300	300	
Outlet Cooler Air Temp	(deg. F)		100	100	100	100	100	100	100	
Sorbent Type			SHL	SHL	SHL	SHL	SHL	SHL	SHL	
Sorbent Injection Flow	(lb/hr)		490	520	495	500	490	480	480	
Injection Location (1,2,3,4,5)			1	1	1	1	1	1	1	
Total Sorbent Res. Time	(sec)		0.68	0.67	0.69	0.69	0.69	0.68	0.69	
Sorbent Injection Temperature	(deg. F)		841	841	843	840	839	840	840	

ADDENDUM

The following describes any procedures or actions taken during the sampling visit on December 16, 1992 that deviated from the original sampling plan submitted for sampling activities at Site E.

All decontamination of sampling containers was performed before shipment of equipment to the sampling location. All analytical sampling containers were cleaned and inclosed in plastic bags. All bulk sampling containers were sealed by placing packing tape around the lid of the container.

The unburned coal bulk sample was obtained by Ohio Edison personnel employed at the R.E. Burger generating station. Approximately four (4) gallons of sample was obtained. The amount actually obtained differed from that required by the sampling plan due to the fact that the iso-kinetic sampler was unable to obtain more sample in the designated eight (8) hour sampling schedule. The EER personnel felt that the 4-gallons of sample obtained was sufficient for accurate bulk analysis since extreme care was taken to insure that the sample was representative of the process. Samples from each coal transport pipe were taken throughout the day and composited to form one bulk sample.

Approximately three (3) gallons of hydrated lime were obtained from the sorbent rotary feeder. It was extremely difficult to obtain more sample due to the time and dust problems caused by the sampling of this input stream.

Three (3) 500-ml boiler bottom ash samples were gathered from the bottom ash hopper. These samples were obtained by using a Teflon container clamped to a metal rod as a sampling scoop. The samples were gathered approximately two (2) hours apart. The containers were allowed to cool before sealing the lids. All three samples were sent to the analytical lab where they were composited for analysis.

Three (3) economizer/air preheater ash samples were collected from the two (2) economizer ash hoppers. Approximately 250-ml of sample was collected from each hopper to

form each of the three (3) samples. The samples were obtained by scooping the ash from ash hopper sampling port using the lid of the Teflon sampling container. All three samples were sent to the analytical lab where they were composited by being analyzed.

Three (3) 500-ml flyash samples were collected by sampling the ESP ash hoppers. The samples were obtained by using a 4" OD steel pipe to take a core sample of the hopper ash through the sampling port. The ESP consisted of four rows of four ash hoppers (4X4 arrangement). Approximately 400-ml of sample was collected from each hopper in the first collection field three separate times during the day. The same 400-ml of sample was collected from each hopper in the second field, as well. However, samples could only be obtained from all four hoppers during one of the three sampling times. For the other two sampling times, only two hoppers provided enough ash to sample. Sufficient quantities of ash could not be obtained in the third and fourth ESP fields. All samples were placed in one container and composited. Three (3) 500-ml analytical samples were then obtained from the composite and packaged for shipment to the analytical laboratory.

Ash samples collected from the SNRB baghouse proved to be extremely difficult to handle. The ash was first collected in one-hour intervals in a 5-gallon bucket. After the sample had cooled, it was placed in the bulk sample container. The first sample melted the sampling container, requiring a new container to be purchased. This replacement container was also a Rubbermaid product. The remaining samples, along with the remainder of the first sample, were then placed in the replacement container. It was felt that Rubbermaid containers were better suited for these samples than stainless steel. At the temperatures exhibited by the ash, stainless steel would react with the ash causing higher concentrations of trace metals such as nickel and chromium to be present in the samples. Even if the plastic containers were to be affected by the temperature of the ash, only polymers and rubber compounds would be introduced to the ash. It has been proven in the past that these rubber and polymer compounds can be more easily separated from the actual ash analysis than trace metals from stainless steel sampling containers.

The original sampling container used to gather the baghouse ash could not be used to ship the ash sample. A replacement container had to be purchased at the time of the sampling event. Since all decontamination procedures were completed before arriving on site, the proper decontamination solutions were not available. The container was only rinsed with deionized water before being used.

Appendix A

**EER-Sampling Plan
Solid Waste Sampling Project
Site E
SNRB Project**

November 30, 1992

Background

The U.S. Department of Energy (DOE) has established a Waste Management Program within the Office of Fossil Energy. One of the projects in this program is to characterize the solid waste from advanced coal combustion or conversion technologies. In order to implement the characterization process, it is necessary to identify the potential units with waste streams of interest, obtain samples of the waste, and perform a complete analysis of the samples.

Energy and Environmental Research Corporation (EER) was selected to perform the site selection and the sampling aspects of this project. EER selected Babcock & Wilcox's (B&W) SO_x-NO_x-RO_x Box (SNRB) Flue Gas Cleanup demonstration as one of five sites identified for participation in the sampling program. The technologies being demonstrated at Site E are sorbent injection, selective catalytic reduction (SCR), and high efficiency particulate collection.

This Clean Coal Technology is being demonstrated by B&W at Site E. The EER field team has already conducted a preliminary site visit at Site E and is familiar with operating conditions at the plant. The EER field team will conduct the sampling effort in December. At this time, Site E will be undergoing continuous operation. These operating conditions will be conducive for obtaining representative waste samples. During the long-term testing period, EER will take analytical samples from the bottom ash hopper, economizer, precipitator, sorbent storage silo, and baghouse ash silo and send them to Iowa State University for analysis. EER will also collect bulk samples of the pulverized coal, sorbent, baghouse ash for testing at the University of North Dakota Energy and Environmental Research Center (UNDERC). EER must also record any necessary operating condition data during the sampling event, and report them to DOE. A brief final report of the field work will also be completed and sent to DOE.

Pre-Sampling

Call Rita Bolli with Ohio Edison at (216) 384-4901 and Kevin Redinger with B&W at (216) 829-7719 several days before the sampling is scheduled to begin. Make certain that the process is up and running, and that Rita Bolli and Kevin Redinger are aware that we will be there to sample.

Call Ed Olson at (701) 777-5155 at the University of North Dakota Environmental Research Center (UNDERC). He is our lab contact for the bulk samples and needs to be notified when the sampling will take place, so that he can be prepared to receive the samples.

Call Dr. Carol Kilgore at (515) 294-8203 or Dr. Colin Criswell at (515) 294-6776 at Iowa State University. Dr. Kilgore is our lab contact for analytical samples and needs to be notified when the sampling is taking place, so that she can be prepared to receive the samples. In the event that Dr. Kilgore is unable to be reached, contact Dr. Criswell and notify him of the impending sample shipment.

Sampling

There are seven locations at the plant, from which samples will be taken. The coal sample will be taken from the transport piping leading from the pulverizers to the burner panels. Sorbent samples will be taken from the sorbent storage silo. A dry boiler bottom ash sample will be taken from the bottom ash hopper prior to being sluiced. Dry flyash samples will be taken from the economizer, precipitator, and baghouse hoppers.

Each of the seven locations will be sampled during the normal 8-hour operating period for analytical samples. Bulk samples will only be taken of the pulverized coal, baghouse ash and sorbent. One 5-gallon sample of unburned coal will be collected for the coal transport piping using an isokinetic sampler. One 5-gallon bulk sample of sorbent will be collected from a rotary feeder located at the bottom of the sorbent storage silo. Two 500-ml analytical samples of boiler bottom ash will be obtained from the bottom ash hopper by restricting the flow of sluice water while sampling. Two 500-ml analytical samples of economizer ash and precipitator flyash will be collected from sampling points located at the bottom of the respective ash hoppers (total of 4 samples). An 85 lb. bulk sample of baghouse ash will be collected while the ash is being loaded into trucks for disposal. Two 500-ml analytical samples will also be taken from this location.

A detailed description of the specific sampling procedures for each sample location is listed in the "Sampling Instructions" section of this report.

Equipment

The following equipment will be used for the sampling program.

- 1- (1) Coolers/Ice Packs
- 2- 10 - 500 ml Teflon Sample Jars
- 3- (2) 8-gallon Rubbermaid trash cans with lids
- 4- Stainless steal ladle
- 5- Paper Towels
- 6- Bottle labels and pens
- 7- Hardhats
- 8- Ear plugs
- 9- First Aid Kit
- 10- Tools-Knife
- 11- Traffic Reports and Chain of Custodies
- 12- Flash Light
- 13- Vermiculite and other packing supplies
- 14- Cooler custody seals
- 15- Cloth Gloves
- 16- Safety Glasses
- 17- Field Book
- 18- Sampling and Health and Safety Plans
- 19- Bottle Overpacks
- 20- Fed Ex Forms
- 21- Zip-lock bags

Bottle List

- 10- 500 ml Teflon jars will be used for the dry analytical samples.
- 2- 8-gallon Rubbermaid containers with lids for the bulk bottom ash and flyash samples.
- 1- Large Coleman coolers will be used for the analytical samples.

Pre-Sampling Decontamination Procedures

The following procedures should be followed before the sampling event takes place, ideally the afternoon before initiation of the sampling event. In addition, these procedures for decontamination should be followed in between any sets of samples in which the same sampling equipment may be utilized more than once. However, these procedures will take place before arrival at Site E due to the lack of adequate space.

- 1- Identify the sampling items to be decontaminated.
  - All Teflon sampling containers necessary for the sampling event.
  - All buckets to be used for collecting the sluice or dry samples.
  - All spatulas or stainless steel scoops to be used for the sampling event.

*The Boston Round Amber bottles with Teflon caps are pre-cleaned to EPA specifications and do not need to be decontaminated prior to sampling.
- 2- Obtain all necessary decontamination solutions and equipment:
  - Plastic sheeting
  - 1-five gallon bucket
  - 1-scrub brush
  - 1-concentrated liquid soap
  - Tap water
  - Deionized water
  - 10% Nitric Acid
  - Methanol
  - Acetone
  - Polyethylene squirt bottles
- 3- Establish an area where the decontamination procedure can take place. Make the following preparations for the area:
  - Lay clear plastic sheeting over a specific area for drying the cleaned items;
  - Have all cleaning solutions and equipment set up near plastic sheeting so that a wash and dry area is established.
- 4- The decontamination procedure for each piece of equipment should be as follows:
  - Wash the piece of equipment with the concentrated liquid soap
  - Rinse with tap water
  - Rinse with 10% nitric acid
  - Rinse with deionized water
  - Rinse with methanol
  - Rinse with deionized water
  - Rinse with acetone
  - Rinse with deionized water
  - Let air dry on plastic sheeting
  - Rinse once more with deionized water before beginning sampling

Sampling Instructions

All samples will be obtained during a normal 8-hour operating period in which the SNRB Project is being demonstrated at full load. The operating condition data must be completed each hour during which samples are collected. This information should be documented in Table 1. Rita Bolli and Kevin Redinger will aid in obtaining this information. The sampling parameters, locations, and sampling approach are described below:

Bulk Unburned Coal-A five-gallon Rubbermaid® container will be filled with coal obtained from the coal transport piping using an isokinetic sampler coal sampler and sealed for a bulk sample. Label the bucket for shipment to the UNDERC.
Designated sampler:

Bulk Sorbent Samples-A 5-gallon Rubbermaid® container sorbent will be obtained from a rotary feeder located at the bottom of the Sorbent Storage Silo for bulk purposes. The sample will be sealed, labeled and packed for shipment to UNDERC.
Designated sampler:

Bottom Ash Samples-Two 500 ml Teflon® containers of dry bottom ash will be obtained from the Bottom Ash Hopper for analytical purposes. These samples will be obtained in dry form using a long-handled stainless steel scoop prior to being sluiced to the ash pond. These analytical samples will be labeled and packed for shipment to Iowa State University.
Designated sampler:

Fly Ash Samples-Two 500 ml Teflon® containers of dry fly ash will be obtained from each of the following locations: economizer ash hopper and precipitator ash hopper. The ash samples will be collected from sampling locations located at the bottom of the respective ash hoppers. Three (3) samples will be taken from each hopper at approximately one hour intervals. These three samples will be combined to produce two (2) analytical samples from each location. These analytical samples will be labeled and packed for shipment to Iowa State University.
Designated sampler:

Bulk Baghouse Ash Samples-An 85 lb. bulk sample of baghouse ash will be collected for bulk analysis. This sample will be collected while loading the baghouse ash into the storage trailer using a stainless steel scoop. The bulk sample will be labeled and packed for shipment to the UNDERC.
Designated sampler:

Baghouse Ash Samples-Two 500-ml analytical samples of baghouse ash will be collected from the baghouse storage trailer. These samples will be collected after loading the baghouse ash into the storage trailer using a stainless steel scoop. A core sample of the ash in the storage trailer will be taken and mixed to form these two analytical samples. The analytical samples will be labeled and packed for shipment to the Iowa State University.

Designated sampler:

Labeling and Packing Instructions

- 1- All dry analytical samples will be collected into 500 ml Teflon® jars with the exception of the bulk samples.
- 2- Each jar should be labeled with "Site E" and a designated sample number, the sample location, the date and time of the sample, initials of the samplers, and be sure to note whether the sample is analytical or bulk. The analytical sample jars will also be marked to indicate the liquid levels before shipping. The only bulk samples will be the fly ash bulk samples and the bulk sample of raw coal.
- 3- Chain of Custody forms and EER Field Sample Tracking Reports should be completed to document the type, quantity, location, and sampler involved with collecting each sample. A copy of these forms and an EER sampling label are attached in App. A.
- 4- Place each analytical sample inside a ziplock bag, and then place the bagged jar inside the protective four inch PVC sleeve. Place the entire unit into the cooler, and keep it cool with ice packs until all the samples are collected, and the whole cooler is ready to be packed for shipment to Iowa State University. The bulk samples should be packed in triple-layer trash bags inside one of the coolers. The bulk samples do not need to be kept on ice.
- 5- When packing the cooler with the analytical samples, remove the ice packs, and place enough vermiculite around the bottles to make certain that they are unable to shift or move during transport. Pack vermiculite across the top of the containers, leaving enough room to replace one layer of ice packs. After including the ice packs, pack any remaining space with vermiculite, and make sure that nothing can shift during shipment. As stated previously, the bulk samples should be packed in triple-layer trash bags inside one of the coolers. The bulk samples do not need to be kept or mailed on ice.
- 6- All bulk samples will be sent in one cooler to the University of North Dakota, UNDERC, laboratory. All analytical samples will be sent in one cooler to the Iowa State University laboratory. Make sure that each of the mailing addresses is written correctly on each of the appropriate coolers.
- 7- Seal the appropriate Chain of Custody forms inside the cooler, with the corresponding samples. Sign at least two EER Custody Seals. These seals along with clear packing tape will be used to seal the cooler.
- 8- Attach the Federal Express forms and a mailing label to the top of the cooler, along with 'Fragile', 'Handle With Care', and 'Caustic' stickers. The cooler should then be ready to take to the Federal Express office.

QA/QC

Chain of Custody forms and Field Sample Tracking Reports must be maintained and filled out for the samples. List the bulk samples on separate Chain of Custody forms, but you may put all the analytical samples on the same Chain Custody form.

There are no travel blanks, nor any other QA samples to be submitted with these samples. There is also no data package to request.

Shipping

•All bulk samples will be shipped, appropriately packed (see packing instructions) in Coleman coolers, via Federal Express to the following shipping address:

University of North Dakota
Energy and Environmental Research Center
15 North 23rd St.
Grand Forks, ND 58201
Attn: Ed Olson (701) 777-5155

•All analytical samples will be shipped, appropriately packed (see packing instructions) in Coleman coolers, via Federal Express to the following shipping address:

Iowa State University
Spangler Laboratory
Ames, Iowa, 50011
Attn: Dr. Carol Kilgour (515) 294-8203

The nearest Federal Express office is located at: Wheeling, WV
The Federal Express will pick up the samples at Site E when notified as long as the samples are ready by 4:00 pm. If the samples are not ready at this time, they can be taken to the Federal Express cargo office at Pittsburgh International Airport.

Special Considerations

There is quite a bit of noise inside the boiler building, so it is recommended that hearing protection be worn. Safety glasses and hard hats are required to be worn whenever you are inside the boiler building. Use clear glasses; it is fairly dark inside the building.

Contact Personnel

Todd Beaver-	EER	(919)-489-1726
Jerry Harness-	METC/DOE	(304)-291-4835
Rita Bolli-	Ohio Edison	(216)-384-4901
Kevin Redinger-	Babcock & Wilcox	(216)-829-7719 or (614)-676-8112
Jerry Amritein/-	Babcock & Wilcox	(614)-676-8112
John McCoury		
Ed Olson-	Lab contact-Bulk	(701)-777-5155
Carol Kilgour-	Lab contact-Analytical	(515)-294-8203
Colin Criswell-	Lab contact-Analytical	(515)-294-6776

No. 142723
 Date _____
 Time _____
 Test No. _____
 Site _____
 Location _____
 Sample Description _____
 _____

18 Mason

Irvine, CA 92714

(714) 859-8851

Energy and
 Environmental
 Research Corporation

Official Custody Seal

Name _____

Date _____

FIELD SAMPLE TRACKING REPORT

[illegible]

ergy and
nvironmental
esearch Corporation

CHAIN OF CUSTODY

Plant _____ Project No. _____ Date _____

Sample No.   Test No.   Description

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Sampling System Prepared By _____

Test Operator _____

Others Involved in Test _____

Sample Recovery By _____

Relinquished by   Received by   Time   Date   Reason

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Laboratory Analysis By _____ Date _____

(this table must be completed hourly during sample collection)

32

**Table 1. Operating Condition Data
R.E. Burger Boiler #8**

(this table must be completed hourly during sample collection)

Parameter		Time							
Coal Flow Rate (lb/min)									
Sluicing Period (min)									
Boiler Load (MW)									
Steam Temperature (F)									
Steam Pressure (psig)									
Temperature of Boiler Exit Gas (F)									
Excess Air (%) in Boiler Exit Gas									
Inlet Temperature of ESP (F)									
Outlet Temperature of ESP (F)									

33

Appendix B

(this table must be completed hourly during sample collection).

[illegible]

TABLE 2. Operating Condition Data
(this table must be completed hourly during sample collection)

12/16/92

PARAMETER	UNITS	TIME						
		0900	1000	1100	1200	1300	1400	1500
System Inlet Flow Rate	(lb/hr)	33,000	33,000	32,000	32,000	31,900	32,300	32,100
Baghouse Inlet Flow Rate	(lb/hr)	39,000	39,200	38,000	38,000	38,400	38,600	38,700
Sorbent/SO ₂ Ratio	(mol/mol)	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Ammonia/NO _x Ratio	(mol/mol)	0.80	0.79	0.79	0.79	0.79	0.79	0.77
System Inlet Temperature	(°F)	632	634	630	629	631	632	630
Burner Temperature	(°F)	1115	1114	1116	1122	1116	1113	1107
Injection Temperature	(°F)	841	841	843	840	839	840	840
Inlet Cooler Flue Gas Temp	(°F)	902	901	902	900	899	899	901
Baghouse Inlet Temp	(°F)	841	841	843	840	839	840	840
Baghouse Outlet Temp	(°F)	781	781	782	783	779	780	780
Outlet Cooler Flue Gas Temp	(°F)	301	300	298	300	299	300	300
Outlet Cooler Air Temp	(°F)	100	100	100	100	100	100	100
Sorbent Type *		SHL	SHL	SHL	SHL	SHL	SHL	SHL
Sorbent Injection Flow	(lb/hr)	490	520	495	500	490	480	480
Injection Location (1,2,3,4,5)		1	1	1	1	1	1	1
Total Sorbent Res. Time	(sec)	0.68	0.67	0.69	0.69	0.69	0.68	0.69
Sorbent Injection Temperature	(°F)	841	841	843	840	839	840	840

*SHL - SUGAR HYDRATED LIME

36

Appendix C

Project No. 8638

Plant SITE E

FIELD SAMPLE TRACKING REPORT

Analytical

SAMPLE NO.	PROCESS STREAM /LOCATION	DESCRIPTION	DATE	TIME	SAMPLER	LAB SENT TO	DATE
142724	Economizer Hopper	500-ml analytical ash sample	12/16	9:20 am	Todd Beaver	Texas State	12/16
142725	Boiler Bottom Ash Hopper	500-ml analytical ash sample	12/16	9:05 am	Todd Beaver	Texas State	12/16
142726	Boiler Bottom Ash Hopper	500-ml analytical ash sample	12/16	10:40 am	Todd Beaver	Texas State	12/16
142727	Economizer Ash Hopper	500-ml analytical ash sample	12/16	10:55 am	Todd Beaver	Texas State	12/16
142728	ESP Hopper	500-ml analytical ash sample	12/16	2:00 pm	Todd Beaver	Texas State	12/16
142731	ESP Ash Hopper	500-ml analytical ash sample	12/16	2:00 pm	Todd Beaver	Texas State	12/16
142736	Boiler Bottom Ash Hopper	500-ml analytical ash sample	12/16	2:35 pm	Todd Beaver	Texas State	12/16
142732	ESP Ash Hopper	500-ml analytical ash sample	12/16	2:00 pm	Todd Beaver	Texas State	12/16
142728	Boiler Bottom Ash Hopper	500-ml analytical ash sample	12/16	1:00 pm	Todd Beaver	Texas State	12/16
142729	Economizer Ash Hopper	500-ml analytical ash sample	12/16	1:10 pm	Todd Beaver	Texas State	12/16
142735	Boiler Bottom Ash Hopper	500-ml analytical ash sample	12/16	2:30 pm	Todd Beaver	Texas State	12/16

CHAIN OF CUSTODY

Plant SITE E Project No. 8638 Date 12/16/92

<u>Sample No.</u>	<u>Test No.</u>	<u>Description</u>
<u>142724</u>	<u> </u>	<u>Economizer Hopper Ash (500-ml analytical)</u>
<u>142725</u>	<u> </u>	<u>Boiler Bottom Ash (500-ml analytical)</u>
<u>142726</u>	<u> </u>	<u>Boiler Bottom Ash (500-ml analytical)</u>
<u>142727</u>	<u> </u>	<u>Economizer Hopper Ash (500-ml analytical)</u>
<u>142730</u>	<u> </u>	<u>ESP Hopper Ash (500-ml analytical)</u>
<u>142731</u>	<u> </u>	<u>ESP Hopper Ash (500-ml analytical)</u>
<u>142736</u>	<u> </u>	<u>Baghouse Hopper Ash (500-ml analytical)</u>
<u>142732</u>	<u> </u>	<u>ESP Hopper Ash (500-ml analytical)</u>

Sampling System Prepared By Todd Beaver / EER-NC

Test Operator Todd Beaver / EER-NC

Others Involved in Test Rita Balli / OHIO Edison

Gary Sansone / OHIO Edison

Sample Recovery By Gary Sansone and Todd Beaver

<u>Relinquished by</u>	<u>Received by</u>	<u>Time</u>	<u>Date</u>	<u>Reason</u>
<u>P. Todd Beaver</u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Laboratory Analysis By   Date

Analytical

Plant SITE E Project No. 8638 Date 12/16/92

Sampling System Prepared By Todd Beaver / EER-NC
 Test Operator Todd Beaver / EER-NC
 Others Involved in Test Rita Bolli / Ohio Edison
Gary Sansone / Ohio Edison
 Sample Recovery By Gary Sansone and Todd Beaver

Attorney: Amir A. B. ... Date ...

Bulk

CHAIN OF CUSTODY

Plant SITE E

Project No. 8638

Date 12/16/92

Sample No.	Test No.	Description
<u>142734</u>	<u></u>	<u>Bulk Sorbent Sample (~3 gallons)</u>
<u>142737</u>	<u></u>	<u>Bulk Baghouse Ash Sample (~14 gallons)</u>
<u>142738</u>	<u></u>	<u>Bulk Unburned Coal Sample (~5 gallons)</u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>

Sampling System Prepared By MR. MECK AND MR. COOKS / OHIO EDISON AND TODD BEAVER

Test Operator MR. MECKS AND TODD BEAVER

Others Involved in Test JERRY ARMENHEIM / B&W

Sample Recovery By TODD BEAVER / MR. MECKS / MR. ARMENHEIM

Relinquished by	Received by	Time	Date	Reason
<u>R. Todd Beaver</u>	<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>	<u></u>

Laboratory Analysis By Date