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ENHANCING THE USE OF EASTERN AND MIDWESTERN COALS BY GAS REBURNING - SORBENT INJECTION

ENVIRONMENTAL MONITORING PLAN
For CWLP Lakeside Station, Unit 7

Submitted by
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August 23, 1989

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1.0 SUMMARY

Energy and Environmental Research Corporation (EER) is conducting a demonstration project to evaluate an SO_2 and NO_x control technology for coal-fired utility boilers. Funding for the project is being provided by the Department of Energy, the Gas Research Institute, and the Illinois Department of Energy and Natural Resources. The objective of this project is to demonstrate that 50 percent SO_2 control and 60 percent NO_x control can be realized through application of the Gas Reburning-Sorbent Injection (GR-SI) process. Bottom ash generation will be reduced and fly ash will be transported to an off-site landfill. Successful demonstration of the technology is a prerequisite to eventual commercial application of the GR-SI process.

This volume presents the Environmental Monitoring Plan (EMP) for Unit 7 at Lakeside Station of City Water Light and Power (CWLP), one of three technology demonstration sites in the EER project. The EMP, which is required by EER's cooperative agreement with DOE, describes the environmental monitoring that will be conducted at Lakeside Station during the course of the GR-SI demonstration project. Environmental monitoring is a key aspect of this project, since monitoring will supplement the National Environmental Policy Act documentation to ensure that the demonstration project does not result in impacts which 1) violate applicable standards, or 2) are detrimental to human health or the environment. Environmental monitoring will also be used to develop a data base for mitigation of potential environmental problems related to the technology and for replication of the technology independent of site-specific parameters.

Monitoring will be conducted to characterize air emissions, water and solid waste discharges, and other safety and health concerns. Monitoring requirements for compliance with Federal, State, and local regulations are discussed, along with supplemental monitoring requirements which are designed to provide further information about the GR-SI system performance. EER will utilize standard EPA measurement procedures whenever possible. Measurement methods for which no standard procedures are available are described in this volume.

Monitoring is required during all three phases of the demonstration: planning and design, construction, and operation. Table 1-1 summarizes the compliance and supplemental monitoring conducted during Phase I and to be conducted during Phase II of the demonstration project. Compliance measurements are the same as current monitoring requirements. Supplemental measurements will provide baseline data against which GR-SI operation will be evaluated. The parameters listed in Table 1-2 will be monitored during Phase III, operation. Compliance monitoring requirements will remain the same as in Phases I and II. Supplemental monitoring requirements will be focused toward three major objectives:

- evaluate the project's success
- ensure that the project is safe for employees and the environment
- create data base for GR-SI technology

The compliance measurements will be conducted according to CWLP quality assurance procedures, which satisfy the requirements of the Illinois Environmental Protection Agency (IEPA). A Quality Assurance plan for the supplemental measurements has been prepared according to U.S. EPA guidelines. Sample custody procedures will be followed in accordance with EPA's chain of custody procedures as recorded in Section 3 of the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III Stationary Source Specific Methods, EPA-600/4-77-027b, August 1977. Internal quality control checks will be conducted by EER's Quality Assurance Officer with independent checks by the test supervisor. Corrective action will be taken if deficiencies are noted during audits or the quality assurance goals have not been achieved. This may involve recalculation of derived measurements or repetition of selected tests.

Once data quality has been verified, the data will be input to a computer system configured to store, process, and output the data in a variety of operator-selected formats. EER will submit quarterly and annual reports of environmental data to DOE with emphasis on data summaries and potential problem areas. These reports will also contain copies of all compliance reports submitted to IEPA during the reporting period, and a description of the plant's permit status.

Data will be reviewed by EER and CWLP as it becomes available. Data showing significant results will be reviewed, verified, and appropriate action taken if required. This may include modification to monitoring frequency, the addition of a monitoring parameter, or change in monitoring location. EER

TABLE 1-1. PROJECT MONITORING IN PHASES I AND II

MEASUREMENT	SAMPLE TYPE	FREQUENCY	LOCATION
	COMPLIANCE		
WATER			
Flow Rate	single reading estimate	once/wk	ash pond discharge
pH	grab sample	twice/wk	ash pond discharge
Total Suspended Solids	24 hr composite	twice/wk	ash pond discharge
Oil and Grease	grab sample	twice/mo	ash pond discharge
Flow Rate	single reading estimate	once/wk	outfall 008
pH	grab sample	once/wk	outfall 008
Total Suspended Solids	8 hr composite	once/wk	outfall 008
Oil and Grease	grab sample	once/wk	outfall 008
Iron	8 hr composite	once/wk	outfall 008
GASEOUS EMISSIONS			
Opacity	in-situ optical	continuous	stack
	SUPPLEMENTAL		
GASEOUS EMISSIONS			
NO_x	in-situ chemiluminescent	continuous (1)	economizer inlet
CO	in-situ NDIR	continuous (1)	economizer inlet
O_2	in-situ paramagnetic	continuous (1)	economizer inlet
SO_2	in-situ NDUV	continuous (1)	economizer inlet
WATER			
pH, sulfates	grab sample	once	sluice line discharge
pH, sulfates	grab sample	once	sluice water intake (Lake Springfield)
Safety survey	NA	once	all areas of plant

1. Two-week period in Phase I.

TABLE 1-2. PROJECT MONITORING IN PHASE III
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MEASUREMENT	SAMPLE TYPE	FREQUENCY	LOCATION
	COMPLIANCE		
WATER			
Flow Rate	single reading estimate	once/wk	ash pond discharge
pH	grab sample	twice/wk	ash pond discharge
Total Suspended Solids	24 hr composite	twice/wk	ash pond discharge
Oil and Grease	grab sample	twice/mo	ash pond discharge
Flow Rate	single reading estimate	once/wk	outfall 008
pH	grab sample	once/wk	outfall 008
Total Suspended Solids	8 hr composite	once/wk	outfall 008
Oil and Grease	grab sample	once/wk	outfall 008
Iron	8 hr composite	once/wk	outfall 008
GASEOUS EMISSIONS			
Opacity	in-situ optical	continuous	stack
	SUPPLEMENTAL		
WATER			
pH, sulfate	grab sample	see note 4	sluice line discharge
pH, sulfate	grab sample	see note 4	sluice water intake (Lake Springfield)
GASEOUS EMISSIONS			
NOx	in-situ chemiluminescent	continuous	economizer exit/stack breeching
SOx	in-situ NDUV	continuous	
CO	in-situ NDIR	continuous	
CO2	in-situ NDIR	continuous	
O2	in-situ paramagnetic	continuous	
HC	in-situ FID	continuous	
Particulate	Method 17	see note 1	ESP inlet
	Method 5	see note 1	ESP outlet
Particle Size Distribution	cascade impactors	see note 1	ESP inlet and outlet
Resistivity	cyclonic flow probe	see note 1	ESP inlet
Velocity	Method 2	see note 1	ESP inlet
N2O	extractive	see note 2	stack breeching

TABLE 1-2. PROJECT MONITORING IN PHASE III, continued

MEASUREMENT	SAMPLE TYPE	FREQUENCY	LOCATION
SOLID BY-PRODUCTS			
Ash	grab sample	see note 3	ESP hopper
WORKER HEALTH			
Hearing	N/A	once/yr	TBD
Pulmonary Function	N/A	once/yr	TBD
AIR			
Noise	single reading	once (4)	near equipment installation
Coal Dust	single reading	once (4)	near coal pile

1. Measurements taken once during each stage of Phase III--baseline, parametric, and long-term testing.
2. N2O measurements taken once during baseline testing, several times during parametric testing, and monthly for the first three months of long-term testing.
3. Ash sampling will be conducted daily during parametric testing and monthly for the first three months of the long-term testing period.
4. Measurements taken at the beginning of the parametric testing.

will review data continuously throughout all phases of the demonstration project.

A Monitoring Review Committee will be established to act in an advisory capacity for project monitoring. The Committee will comprise representatives from EER, DOE, the funding participants, and the demonstration host utilities. The Committee will meet at least once per year, and its functions will include data review and recommendations for modifications to monitoring tasks or reporting formats. Based on the Committee's ongoing review of monitoring information, members of the Committee can recommend that:

1) Certain monitoring tasks be discontinued, modified or added;
2) New analytical techniques or instrumentation be substituted; or
3) The format of the quarterly and annual reports be changed.

If recommendations are made, project management at DOE and EER will consider modification to the EMP and authorize changes as appropriate.

2.0 INTRODUCTION

Energy and Environmental Research Corporation (EER) is conducting a demonstration project as part of the Department of Energy's Clean Coal Technology program. The project is designed to demonstrate a cost effective SO_2 and NO_x control technology for coal-fired utility boilers. This technology involves the combination of gas reburning with sorbent injection (GR-SI), and will be demonstrated on three full scale utility boilers representing the range of pre-NSPS coal-fired boilers. The project is being co-funded by the Department of Energy, the Gas Research Institute, and the Illinois Department of Energy and Natural Resources.

The remainder of this section presents a description of the GR-SI process, the background and history of the demonstration project, and the purpose and scope of this document.

2.1 Process Technology

Gas reburning involves introduction of natural gas above the main heat release zone to produce a homogeneous, slightly oxygen-deficient zone. Gas reburning is effective in the reduction of NO_x emissions by the reaction of hydrocarbon radical species with NO to form nitrogenous intermediates which react in the oxygen-deficient atmosphere to produce N_2. At the downstream end of this fuel-rich zone, burnout air and calcium-based sorbent are injected into the furnace. The sorbent injection process can be viewed as a sequential coupling of an activation step, in which the calcium-based sorbent calcines or dehydrates to produce CaO, and a heterogeneous sulfation step, where the CaO reacts with gas-phase SO_2/SO_3 and excess oxygen to form solid calcium sulfate. The calcium sulfate is subsequently removed along with the coal fly ash by the plant particulate control equipment.

2.2 Background and History of Project

The technical demonstration project conducted by EER will focus on three Illinois utility boilers representing the range of pre-NSPS boiler technology:

- Central Illinois Light Company, Edwards Station, Unit 1; 117 MW_e (net), front wall fired.

- Illinois Power Company, Hennepin Station, Unit 1; 71 MWe (net), tangentially fired.
- City Water Light and Power, Lakeside Station, Unit 7; 33 MWe (net), cyclone fired.

Lakeside Station has two operational coal-fired steam electric generating units with a total net generating capacity of 66 MWe. Unit 7, which will host the GR-SI demonstration, is a 33 MWe cyclone fired steam electric facility located in Springfield, Illinois. This unit had a capacity factor of 24.0 percent in 1986, and normally operates in cycling service. Lakeside Station is owned and operated by City Water Light and Power (CWLP) of Springfield.

The project is being conducted in three phases. Phase I includes design and the permitting application process. Preliminary tests were conducted during this phase to determine current emission and discharge levels. Phase II includes construction and startup of the GR-SI system. Permits will be obtained at this time. Phase III involves operation of the GR-SI system and demonstration of its NO_x/SO_2 emission control potential.

Phase I testing has been completed. Air emissions were monitored and boiler performance data were recorded. These data are being used in GR-SI system design and providing verification of physical isothermal flow models and thermal performance computer models. Phase II monitoring will provide information about worker safety during the construction process, and about background water pH levels.

During Phase III, testing will occur in three stages: baseline, parametric, and long-term testing. First, tests will be conducted to establish baseline performance of the boiler (without GR-SI) under a range of selected operating conditions. The results of these tests will provide the baseline against which GR-SI performance will be evaluated. The objective of the parametric testing is to evaluate system performance over a wide operating range and to determine the conditions resulting in the best balance of emissions reductions, boiler performance, and cost. Alternate coals and sorbents will be evaluated as well. The long-term evaluation will provide information on the reliability of injection equipment and long-term impacts on boiler performance, including maintenance requirements and overall system performance in terms of emission control.

2.3 EMP Purpose and Scope

This document is the Environmental Monitoring Plan (EMP) for Unit 7 at CWLP's Lakeside Station, submitted in accordance with the cooperative agreement requirement for special reports. The EMP provides a detailed description of the monitoring of environmental and health related factors during construction and operation of the GR-SI system at the demonstration site, both compliance monitoring required by environmental permits and supplemental monitoring for research purposes.

Environmental monitoring will be one of the key methods used by EER and the funding participants to determine the success of this project. The goal is to effect control of SO_2 and NO_x emissions without adversely impacting other boiler performance parameters. Boiler emissions will be monitored to determine if project goals have been met. In addition, measurements will be made to monitor boiler performance and operating characteristics. Water and solid discharge streams will also be monitored on a regular basis. Measurements will be made both prior to and during GR-SI system operation.

The following section provides a more detailed description of the GR-SI process and its impacts on ancillary systems, including sorbent storage, process discharges, and by-product disposal. The project goals for atmospheric emissions and control are given in Section 3.3. Section 4 describes the monitoring which is currently required at Lakeside Station and the anticipated compliance monitoring during all phases of the GR-SI demonstration project. Supplemental monitoring, described in Section 5, is monitoring that is not required by any permit or state regulation. This section also describes the methods EER will use to conduct the supplemental monitoring. Section 6 discusses the monitoring that will be conducted to ensure protection of worker health and safety. Section 7, the Quality Assurance Plan for the project, lists the sampling and analytical procedures which will be used to ensure sample integrity, including audits and QC checks. Section 8 describes the management procedures for monitoring data and the data reporting format.

3.0 PROJECT DESCRIPTION

3.1 Overall Description

Several technologies are available to reduce emissions of SO_2 and NO_x from coal-fired power plants. Gas Reburning-Sorbent Injection (GR-SI) is a retrofittable technology which is generally applicable to a wide range of cyclone-, wall-, and corner-fired boilers that are characteristic of pre-NSPS design practices. GR-SI reduces the emissions of both suspected acid rain precursor species and, therefore, is expected to be an effective acid rain control strategy.

GR-SI combines two technologies: reburning for in-furnace NO_x control and the injection of a calcium-based sorbent in the furnace or convective pass of a coal-fired boiler for in-situ SO_2 removal. Figure 3-1 presents a simplified schematic of the GR-SI combined process when applied to a cyclone-fired boiler. Since NO_x reduction by reburning and SO_2 reduction due to capture by calcium-based sorbents occur in different thermal and spatial zones within the boiler, it is convenient to consider the two processes separately.

3.1.1 Reburning

The concept of reburning for NO_x control has been recognized for over a decade. The overall process can be divided into three zones, namely:

- Main Heat Release Zone - In this zone, approximately 80 percent of the total heat input to the boiler is released (cyclone coal feed region). The coal burners operate under overall fuel-lean conditions and do not require modification.

- Reburning Zone - The reburning zone is the region where the natural gas is injected, and accounts for a maximum of 20 percent of the total heat input. It is injected downstream of the main heat release zone to create a fuel-rich reburning zone. The NO produced in the main heat release zone reacts with hydrocarbon radicals formed by the partial oxidation of the reburning fuel. This produces reduced nitrogen-containing reaction intermediates, such as amines and cyano compounds, which may further react to form N_2 by a reaction path which can be summarized by:

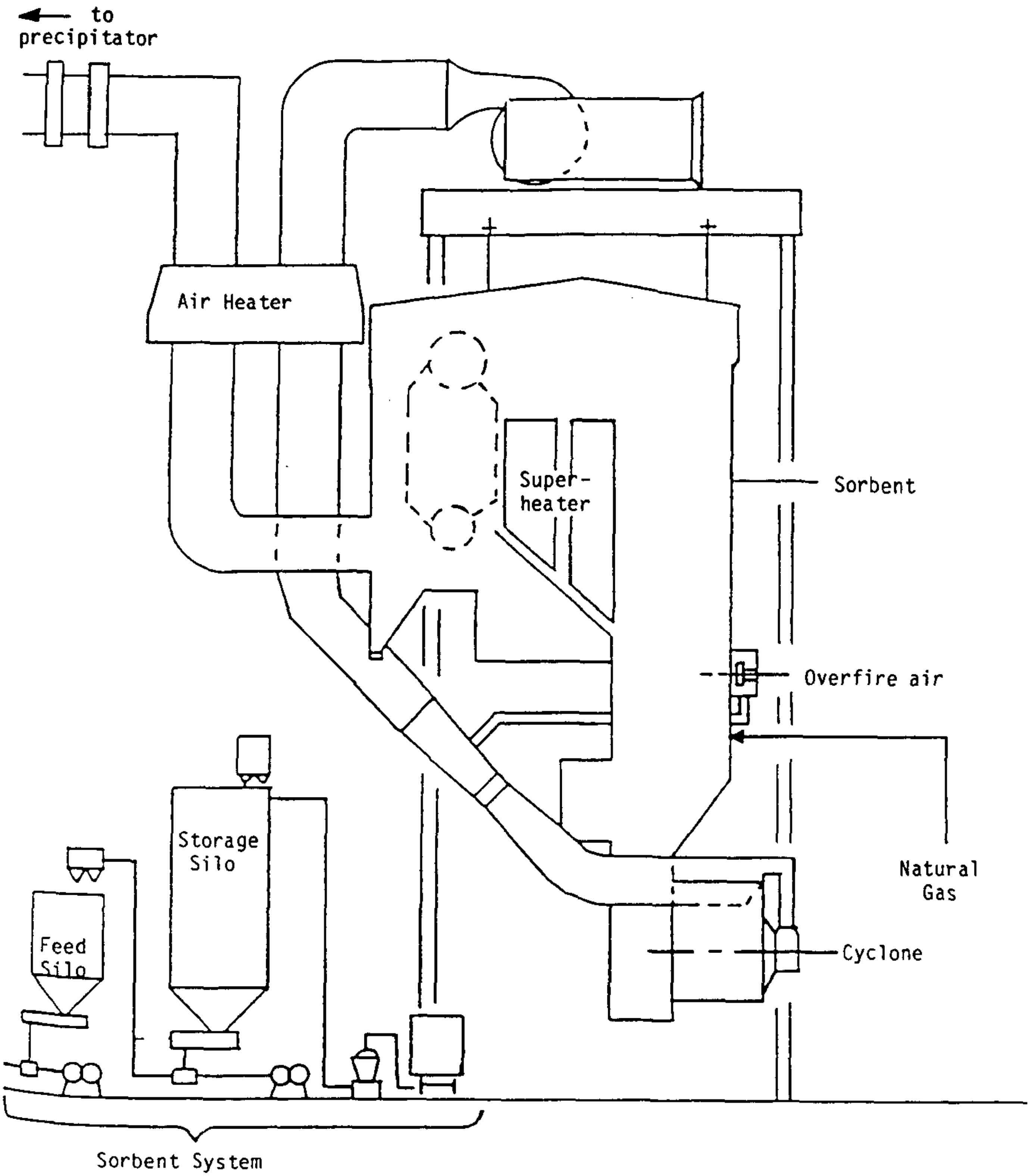

Figure 3-1. Application of Gas Reburning-Sorbent Injection
for NO_x/SO_2 Control

$CH + NO \rightarrow HCN + O$

$HCN + OH \rightarrow NH_i + CO_2$

$NH_i + OH \rightarrow N_2 + NO$

$NH_i + NO \rightarrow N_2 + H_2O$

- Burnout Zone - The burnout zone is the region where air is added to create overall fuel-lean conditions and ensure complete oxidation of the reburning gas. Remaining reduced nitrogen species are converted either to NO or N_2. The fuel and air stoichiometries in the reburning zone and the burnout zone are adjusted so that N_2 formation is maximized.

3.1.2 Sorbent Injection

The use of calcium-based sorbents with furnace injection for SO_2 control has been studied extensively. The process involves calcination or dehydration of a calcium-based sorbent, which may be either a carbonate or a hydrated lime, producing calcium oxide. This calcium oxide reacts with SO_2 in the sulfation zone producing solid calcium sulfate. Two major parameters control the utilization of the calcium in the sorbent:

- The reactivity of the calcium oxide formed by calcination - This is strongly dependent upon the surface area of the calcine which is a function of the sorbent type and the thermal history of the calcine. Reactivity tends to decrease as the sorbent particle temperature is increased due to grain growth.

- The residence time of the calcine under conditions conducive to sulfation - Significant sulfation cannot occur above approximately 2250°F because of rate and equilibrium limitations, and the rate of sulfation becomes negligible below approximately 1600°F. Thus, the residence time of the active particle within this temperature window is important in the sulfur capture process.

The calcium sulfate, unreacted sorbent, and coal fly ash are removed from the gas stream prior to the stack by an electrostatic precipitator (see Figure 3-2).

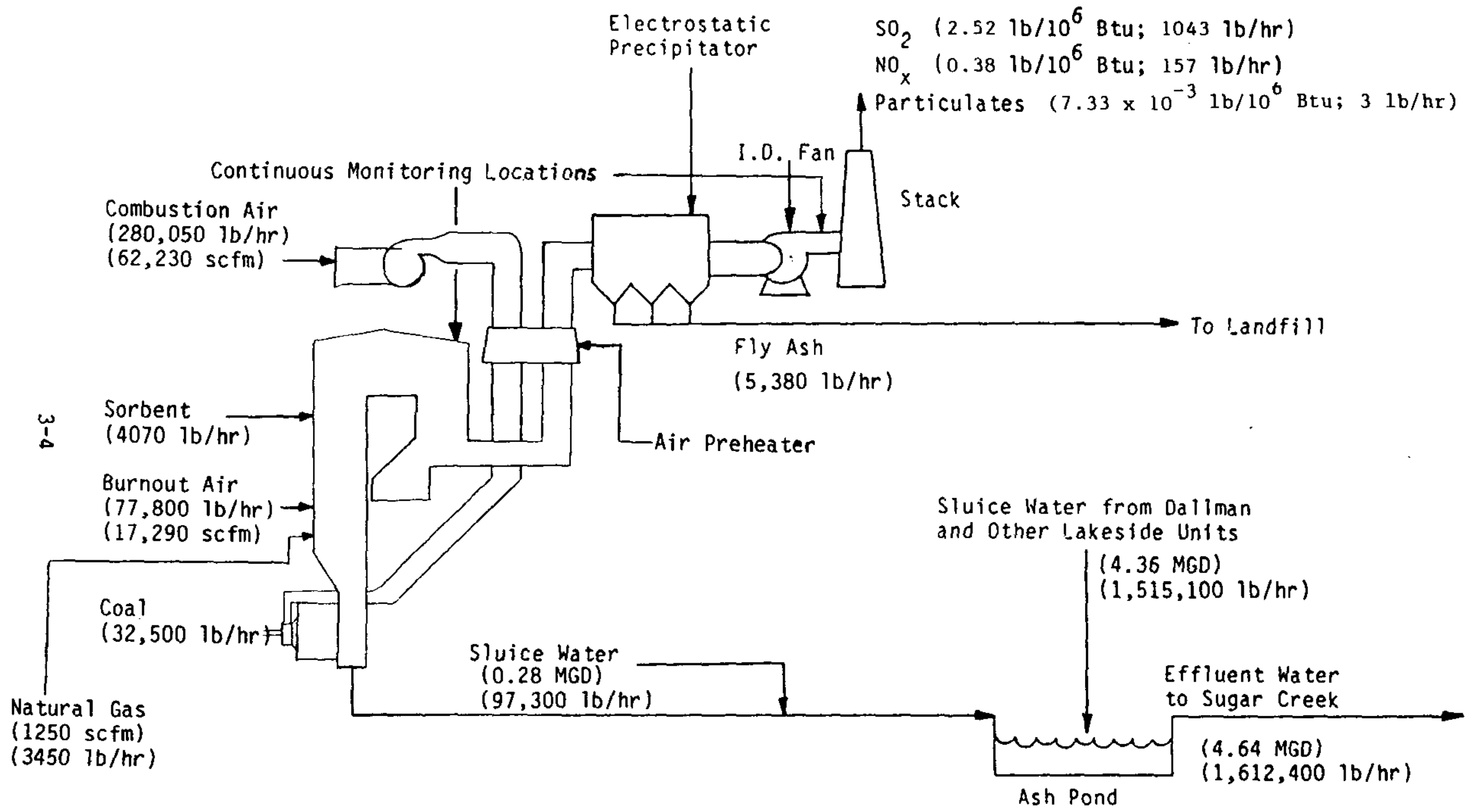

Figure 3-2. Process Flows for GR-SI During Peak Output

3.1.3 Gas Reburning for SO_2 Control

As was described in Section 3.1.2, sorbent injection is the primary means of SO_2 control. However, combining gas reburning with sorbent injection results in a lower SO_2 offgas level than applying sorbent injection alone. The combustion of natural gas in the reburning process replaces 20 percent of the heat input which would otherwise be supplied by the coal. This reduced coal use reduces the amount of sulfur in the fuel available for SO_2 formation. Thus, SO_2 control is enhanced by the reburning process since baseline SO_2 levels are reduced.

Gas reburning and sorbent injection are being combined for NO_x and SO_2 control in Unit 7 of CWLP's Lakeside Station. A flow diagram for the system is shown in Figure 3-2. The remaining discussion in this section describes material storage and discharge streams from the plant during GR-SI operation.

3.2 Material Storage

Materials that will be utilized during the GR-SI demonstration project are sorbent, natural gas, and coal. The sorbent used in the majority of the tests will be hydrated lime, with lime or limestone being tested for comparative purposes. The sorbent will be stored in a silo with appropriate provisions for loading and unloading. Natural gas will be provided directly to the furnace by pipeline. There are no on-site storage requirements for gas. The coal for the plant is currently stored in a coal pile on site.

3.3 Emissions and Discharges

A coal-fired boiler incorporating the GR-SI process contains many input and output streams. The main inputs to the system, as described above, include fuel (coal and natural gas), and sorbent for SO_2 capture. Major output streams include gaseous combustion products, fly ash which includes the spent sorbent, and bottom ash. These streams are shown with corresponding flow rates for Lakeside Unit 7 in Figure 3-2. The current practice of sluicing the bottom ash stream to the existing ash pond will continue to be employed after GR-SI implementation. When the GR-SI system is in operation, the fly ash will be transported pneumatically to a storage silo, unloaded to a truck by a dustless unloader, and then transported off-site to an appropriate landfill. When the GR-SI system is not in operation, the fly ash will be sluiced to the ash pond.

3.3.1 Atmospheric Emissions and Control

At Lakeside, the SO_2 emission control strategy for the GR-SI demonstration project is to reduce the existing SO_2 emission level by 50 percent. The current SO_2 emission rate from Lakeside Unit 7 is approximately 5.05 lb/10^6 Btu (2086 lb/hr at full load), based on recent emissions tests. The GR-SI system will provide 60 percent NO_x control. There is no NO_x emission constraint for this unit, thus NO_x emission reduction could be useful to the utility in response to acid rain regulations if and when they are promulgated. The current NO_x emission rate from Lakeside Unit 7 is approximately 0.95 lb/10^6 Btu (392 lb/hr at full load) and is expected to be reduced to 0.38 lb/10^6 Btu (157 lb/hr at full load) through GR-SI implementation. The baseline particulate emission rate of 7.33×10^{-3} lb/10^6 Btu (3 lb/hr at full load) is expected to increase due to the GR-SI process, but will remain below the allowable limit of 0.1 lb/10^6 Btu.

3.3.2 Aqueous Discharges and Control

The only two aqueous discharge streams which may be affected by the GR-SI system are the ash pond effluent and the Lakeside coal pile runoff. Since the sorbent is injected into the upper furnace, it is expected that no spent or unreacted sorbent will be present in the bottom ash. This will be verified via bottom ash sluice pH measurements during Phase III. When the GR-SI system is in operation, the fly ash will normally be handled and disposed dry. This will reduce the quantity of ash and water being transported to the pond because less coal is consumed, which results in less bottom ash, and because the fly ash will no longer be discharged to the on-site pond. However, the qualitative characteristics of the influent to the pond will not be affected.

The Lakeside coal pile runoff discharge is actually the discharge for a number of yard and building drains. The yard area surrounding the sorbent storage silo has the potential of collecting spilled or blown sorbent. After a rain, the sorbent on the ground will be washed to the Lakeside coal pile runoff point. This discharge is monitored weekly for a number of parameters, one of which is pH level. The pH level will indicate whether a significant amount of sorbent was spilled. This discharge passes through the water treatment plant before being discharged to Lake Springfield, so even if the pH of the normal discharge were increased, it could be corrected before affecting the lake.

3.3.3 By-Product Disposal System

When the GR-SI system is operating, the fly ash will be handled dry. The ash will be transported pneumatically from the ESP hoppers to a fly ash storage silo. The silo will be emptied periodically via a dustless unloader into trucks which will transport the material to a designated landfill. The dustless unloader mixes water with the GR-SI fly ash, preventing the material from becoming dusty. The water also causes the lime in the ash to hydrate, generating heat. The water addition rate is controlled for proper hydration and dust control. When the GR-SI system is not operational, the fly ash will be pulled from the ESP hoppers by a hydroveyor system and sluiced to the existing ash pond. Since this is the current means of ash disposal, there will be no need for additional control measures when the GR-SI system is not operating. If the dry handling equipment fails to operate, the GR-SI system will be shut down until the equipment can be made operational.

4.0 COMPLIANCE MONITORING

4.1 Purpose and Scope

EER has evaluated the potential environmental risks associated with this project to aid DOE in preparing the necessary documentation to satisfy requirements of the National Environmental Policy Act. The results of this analysis, documented in the Environmental Information Volume for CWLP Lakeside Station, indicate that no adverse effects are expected on the environment as a result of this project. Nevertheless, both compliance and supplemental monitoring will be required to verify this conclusion.

Compliance monitoring is that environmental monitoring required by State regulatory obligations. Most of these obligations are specified in permits obtained by CWLP for operation of the facility, though some are requirements imposed by general regulations.

In general, new, modified or reconstructed sources of air emissions are required to meet the New Source Performance Standards (NSPS) developed as part of the Clean Air Act. However, EPA regulations specifically exempt addition of air pollution control equipment from the definition of a modification that may trigger NSPS [40 CFR 60.14(e)(5)].

CWLP is currently required to conduct monitoring at Lakeside Unit 7 for air and water discharges by the Illinois Environmental Protection Agency (IEPA). Modifications to the facility to implement GR-SI will require some modifications to the existing permits. The remainder of this section describes the existing monitoring requirements at Lakeside Station and the anticipated compliance monitoring requirements during all phases of the demonstration project.

4.2 Current Monitoring Requirements

IEPA has issued permits to CWLP for operating Lakeside Unit 7 as an air emission source and a water discharge source. Compliance monitoring requirements for both permits are summarized in Table 4-1 for the discharges which will be affected by the GR-SI project.

TABLE 4-1. LAKESIDE STATION PERMIT MONITORING REQUIREMENTS

MEASUREMENT	SAMPLE TYPE	FREQUENCY	LOCATION
AIR EMISSION SOURCE OPERATING PERMIT			
Opacity	In-situ optical	Continuous	Stack
NPDES PERMIT			
Flow Rate	Single reading estimate	Once/wk	Ash pond discharge
pH	Grab sample	Twice/wk	Ash pond discharge
Total Suspended Solids	24 hr composite	Twice/wk	Ash pond discharge
Oil and Grease	Grab sample	Twice/mo	Ash pond discharge
Flow Rate	Single reading estimate	Once/wk	Discharge 008 (Lakeside coal pile runoff)
pH	Grab sample	Once/wk	Discharge 008
Total Suspended Solids	8 hr composite	Once/wk	Discharge 008
Oil and Grease	Grab sample	Once/wk	Discharge 008
Iron	8 hr composite	Once/wk	Discharge 008

The air emission source operating permit establishes emission limits, monitoring requirements, and reporting requirements. An emission limit has been established for particulate, but no limit exists for SO_2. The monitoring requirement to indicate that the emission limit for particulate is being met is continuous monitoring of opacity. A high opacity reading indicates to the operators that there may be a particulate emission problem. Reporting requirements include quarterly submittal of a list of any and all opacity measurements which exceed 30 percent, averaged over a six minute period. A copy of the permit is provided in Appendix A.

The regulations for water discharges are determined by the National Pollutant Discharge Elimination System (NPDES) permit, and implemented through IEPA's Water Pollution Division. The NPDES permit lists the monitoring requirements and allowable discharge levels for all water discharges from the plant. There are eleven discharge locations described in the permit, with twelve contributing discharge streams. These are listed in Table 4-2. There are two discharges which may be affected by the GR-SI project. One is the ash pond discharge, number 004, and the other is the Lakeside coal pile runoff, number 008. The coal pile runoff discharge could be affected by any spills of lime which may occur around the sorbent storage silo. The ground surrounding the silo will drain to the coal pile runoff pond. Monitoring the pH will indicate if any spills affect the normal discharge. Monitoring of discharge 008 required by the NPDES permit includes weekly readings of flow rate, pH, total suspended solids, oil and grease and iron. Monitoring required by the NPDES permit for discharge 004 includes determinations of the discharge flow rate once per week, readings of pH and total suspended solids twice per week, and measurements of oil and grease twice per month. Appendix A contains a copy of the entire NPDES permit.

Illinois regulations concerning fugitive emissions are listed in Part 212, Subpart K of the Air Pollution Rules and Regulations, and are enforced through IEPA's Air Pollution Division. These rules require that no visible emissions be observable at the property boundary. Further, operations within any particulate non-attainment area must ensure that every source of possible fugitive particulate emission shall be operated under an emissions control program approved by IEPA. Sangamon County is an attainment area for particulates and no fugitive emissions plan is required.

TABLE 4-2. DISCHARGE STREAMS DESIGNATED IN LAKESIDE NPDES PERMIT

DISCHARGE NO.	DISCHARGE NAME	RECEIVING WATERS
001	Lakeside 1 and 2 Condenser Cooling Water Outfall	Lake Springfield
001a	Lakeside Turbine Room, Boiler Room and Equipment Drains, Lakeside 2 Boiler Blowdown	Lake Springfield
002	Dallman 1 and 2 Condenser Cooling Water Outfall	Lake Springfield
005	Industrial Wastewater Treatment Plant Outfall	Lake Springfield
006	Ash Pond Discharge to Lake Springfield	Lake Springfield
007	Dallman Coal Pile Runoff	Lake Springfield
008	Lakeside Coal Pile Runoff	Lake Springfield
009	Dallman 3 Condenser Cooling Water Outfall	Lake Springfield
010	Dallman Plant Intake Screen Backwash	Lake Springfield
011	Scrubber Surge Pond Overflow	Lake Springfield
003	Lakeside Storm Sewer	Sugar Creek
004	Ash Pond Discharge	Sugar Creek

4.3 Pre-Construction

Lakeside Station Unit 7 continues to operate under existing permits during Phase I. In Phase I, EER conducted preliminary tests to assess the operating condition of the plant. These measurements were not taken for compliance purposes, although current monitoring required by the air and NPDES permits remained in effect during Phase I and were conducted by CWLP as required. Records of all monitoring will be available for comparison with test results from later phases of the program.

4.4 Construction

The monitoring required by IEPA permits for air emissions and water discharges during Phase II will remain the same as the current monitoring requirements, described in Table 4-1.

4.5 Operation

EER expects that no additional compliance monitoring requirements will be imposed during the test program.

4.6 Post-Operation

When the GR-SI demonstration is complete, CWLP has the choice of keeping the equipment which was installed for the GR-SI system or having it removed. If the system equipment remains intact, CWLP may operate the unit with or without the GR-SI system in operation. In either case, the monitoring requirements are expected to remain the same as those required before the project commenced.

4.7 Permits

The only permits governing plant operation currently are the NPDES and air emission source operating permits, both issued by IEPA. The GR-SI demonstration project will necessitate modification of the air permit as well as the addition of others, including:

- Air Construction Permit
- Special Waste Hauling Permit
- Supplemental Waste Stream Permit

Requirements for new and modified permits are discussed below.

A permit is required by IEPA for construction of any new emission source. The permit application must contain information about the proposed equipment, including type, size, efficiency, and specifications. In addition, information on the nature of the emission source must be provided, including description of raw materials, expected quantities of controlled and uncontrolled emissions, operating procedures, and other data to quantify the entire process. In this case, the sorbent storage silo and the ash silo will have vents which are considered new emission sources requiring permits.

An existing operating permit must be reviewed and revised by IEPA when modifications are made to any emission source. At Lakeside, the boiler modifications for the GR-SI system require modifications to the operating permit. The application for this permit modification must contain details of the startup procedures and expected operating characteristics. In some cases, the construction and operating permits are issued jointly if IEPA perceives no complications or unexpected problems in the construction phase.

The NPDES permit regulates each aqueous discharge from the plant, and details the monitoring required at each location. The current NPDES permit must be modified if there are any expected changes in water quality or characteristics from additions or modification to plant equipment. The only aqueous streams affected by GR-SI implementation are discharges 004 and 008. The fly ash generated during the demonstration will normally be handled dry and trucked to a permitted landfill, resulting in a decrease in the average daily flow to the pond compared to current fly ash levels. The quantity of bottom ash to the pond will be reduced due to decreased coal consumption. Discharge 008 is normally treated before being released in the lake. The addition of runoff water which may have a slightly higher than normal pH level will not impact the discharge. These changes to aqueous streams at the Lakeside plant do not require modification to the current NPDES permit.

A Special Waste Hauling permit is required for the GR-SI fly ash hauler. Land use and solid waste disposal are regulated by the Resource Conservation and Recovery Act (RCRA). Currently, high volume solid wastes generated by fossil fuel burning for power production, such as fly ash and flue gas scrubber sludge, are exempt from RCRA hazardous waste disposal regulations. Any waste from a pollution control process is considered a non-hazardous special waste in the State of Illinois (35 Ill. Adm. Code 809.103). Analysis of GR-SI ash generated from pilot scale tests using CWLP's coal indicates this material is non-hazardous. A permit is required by those who haul special waste and in some cases a manifest must accompany the waste from generator to final disposal, depending on final disposal location.

A Supplemental Waste Stream permit must be obtained for the landfill which will receive the waste. This permit is required for any new waste stream to be accepted by a landfill. The application for this permit must be partially completed in draft form by the waste generator, but the application is actually submitted and the permit is obtained by the waste disposal facility. The permit application requires information about the waste's chemical properties as well as the process used to generate the material. Any landfill in Illinois can accept a special waste if they have a permit to operate and a permit to accept the particular waste stream in question.

4.8 Schedules

The timetable for various phases of the GR-SI demonstration project is provided below. Baseline monitoring took place early during Phase I, and continued for approximately two weeks. The construction period is scheduled to be completed about 16 months after the initiation of Phase II. The entire demonstration program (Phase III) is scheduled to last approximately 18 months. The exact schedule will depend on final design, outage schedule, load schedule, and other details. At the end of the demonstration program, CWLP may choose either to keep the equipment installed on Lakeside Unit 7 or have it removed, at no cost to them.

Phase I - 18 months
- Baseline monitoring
- System design
- Permitting (applications)

Phase II - 16 months

- Permitting (secure permits)
- Construction

Phase III - 18 months

- Baseline testing
- Parametric testing
- Long term operation
- Optional equipment removal

5.0 SUPPLEMENTAL MONITORING

5.1 Purpose and Scope

EER will conduct monitoring during the three phases of the test program which is not required for compliance with any federal or state regulations. This type of monitoring is termed supplemental monitoring, and will be focused upon three major goals:

1. Provide a basis for evaluating the success of the demonstration project.
2. Ensure that the demonstration program will not be detrimental to the environment or to worker health and safety.
3. Create a data base from which others may draw for replication of this technology in the future.

This section describes the supplemental measurements which have been and will be made during each phase of the demonstration project, the corresponding measurement methods, and the monitoring schedule.

5.2 Phase I: Pre-Construction

Monitoring is required to document baseline values for environmental parameters which may be affected by the project. Some of this monitoring took place prior to installation of GR-SI equipment in Phase I.

Supplemental emissions of NO_x, SO_2, O_2, and CO were measured early in Phase I. Table 5-1 shows the supplemental gaseous monitoring plan for Phase I as well as Phases II and III. These data are being utilized as system design inputs and to verify computer and physical modeling studies. Additional baseline gaseous emission measurements will be made at the beginning of Phase III.

Other data were also obtained during Phase I for design and permitting purposes. A major by-product of the GR-SI process is the solid waste stream containing a mixture of unreacted and spent sorbent with fly ash. This waste will be disposed in a permitted, off-site landfill. During Phase I, ash was generated in a pilot-scale test furnace under simulated GR-SI conditions. The ash was tested to obtain information required to complete the supplemental

TABLE 5-1. SUPPLEMENTAL EMISSIONS MONITORING PLAN
page 1 of 2

MEASUREMENT		SAMPLE TYPE AND FREQUENCY*	LOCATION
PHASE I			
Preliminary	NOx	Continuous (7E)	Economizer inlet
	02	Continuous (3A)	Economizer inlet
	CO	Coninuous (10)	Economizer inlet
	SO2	Continuous (6C)	Economizer inlet
PHASE II			
No measurements			
Phase III			
Baseline	NOx	Continuous (7E), Method 7	Economizer outlet and stack breeching
	SO2	Continuous (6C), Method 6	Economizer outlet and stack breeching
	CO	Continuous (10)	Economizer outlet and stack breeching
	CO2	Continuous (3A), Method 3	Economizer outlet and stack breeching
	02	Continuous (3A), Method 3	Economizer outlet and stack breeching
	HC	Continuous	Economizer outlet
	Particulate	Method 17 Method 5	ESP inlet ESP outlet
	Particle Size Distribution	Cascade impactors	ESP inlet and outlet
	Resistivity	Cyclonic flow probe	ESP inlet
	Velocity	Method 2	ESP inlet
	N2O	Extractive	Stack breeching

*All sample types are EPA reference methods from 40 CFR 60 Appendix A (1987).

TABLE 5-1. SUPPLEMENTAL EMISSIONS MONITORING PLAN, continued

MEASUREMENT		SAMPLE TYPE AND FREQUENCY*	LOCATION
Parametric	NOx	Continuous (7E), Method 7	Economizer outlet and stack breeching
	SO2	Continuous (6C), Method 6	Economizer outlet and stack breeching
	CO	Continuous (10)	Economizer outlet and stack breeching
	CO2	Continuous (3A), Method 3	Economizer outlet and stack breeching
	O2	Continuous (3A), Method 3	Economizer outlet and stack breeching
	HC	Continuous	Stack breeching
	Particulate	Method 17	ESP inlet
		Method 5	ESP outlet
	Particle Size Distribution	Cascade impactors	ESP inlet and outlet
	Resistivity	Cyclonic flow probe	ESP inlet
	Velocity	Method 2	ESP inlet
	N2O	Extractive	Stack breeching
Long Term Operation	NOx	Continuous (7E)	Stack breeching
	SO2	Continuous (6C)	Stack breeching
	CO	Continuous (10)	Stack breeching
	CO2	Continuous (3A), Method 3	Stack breeching
	O2	Continuous (3A), Method 3	Stack breeching
	HC	Continuous	Stack breeching
	Particulate	Method 17	ESP inlet
		Method 5	ESP outlet
	Particle Size Distribution	Cascade impactors	ESP inlet and outlet
	Resistivity	Cyclonic flow probe	ESP inlet
	Velocity	Method 2	ESP inlet
	N2O	Extractive	Stack breeching

*All sample types are EPA reference methods from 40 CFR 60 Appendix A (1987).

waste stream permit application, which is required when a new waste is admitted to a landfill. The solid waste characterization conducted on the pilot-scale ash included the parameters listed in Table 5-2. The test results indicate that dry disposal should pose no serious problems. Leachate concentrations of all eight elements specified under RCRA were well below values that would classify the ash as hazardous. The ash passed the paint filter test, indicating that there is no liquid portion to the ash. The temperature increase observed when water was added to the GR-SI ash indicates that caution will be required to ensure that the temperature remains within acceptable limits. Finally, the preliminary tests indicate that the GR-SI ash may not satisfy the standard specification for use as a concrete admixture. However, further evaluation of this and other beneficial uses of GR-SI ash will be undertaken during Phase III of this project.

5.3 Phase II: Construction

The only supplemental monitoring being conducted during Phase II will be pre-operational water monitoring. The streams to be monitored including the sluice water inlet stream (from Lake Springfield) and the Unit 7 bottom ash sluice water discharge. Both streams will be analyzed for pH and sulfates.

The Unit 7 bottom ash is not expected to be affected by the GR-SI system. To verify this, the sluice water will be monitored prior to and during GR-SI operation. However, some characteristics of the sluice water stream will depend upon the water characteristics of the inlet water stream. For example, if the pH level of the sluice water discharge is found to be 8 pH units before GR-SI operation and 8.5 pH units during GR-SI operation, it is unclear if the increase is due to a rise in the pH level of the lake water or a result of sorbent in the bottom ash. Therefore, the sluice water supply will be monitored along with the sluice water discharge.

5.4 Phase III: Operation

The supplemental monitoring of environmental parameters during Phase III will include gaseous emissions, solid by-products, worker health, and water discharges. These measurements are described in more detail below. The worker health monitoring is described in Section 6.

TABLE 5-2. SOLID BY-PRODUCT CHARACTERIZATION

<u>CHEMICAL CHARACTERISTICS</u>

- Mineral Analysis
- EP Toxicity
- Free CaO
- Total Organic Carbon
- Sulfate
- Chemical Oxygen Demand
- Phenol
- Cyanide
- Chloride
- Sulfide
- Paint Filter Test

<u>PHYSICAL CHARACTERISTICS</u>

- Specific Gravity
- Fineness
- Pozzolanic Activity
- Soundness

5.4.1 Air Emissions

The objective of this project is to verify that GR-SI can effectively control SO_2 and NO_x emissions. In addition, boiler performance will be evaluated during system operation. The focus of all environmental measurements is the output streams, particularly air emissions of SO_2, NO_x, and particulates. Other parameters will be monitored to aid in the understanding of the processes occurring within the furnace during GR-SI operation. Table 5-1 summarizes the gaseous emissions monitoring plan for all three phases of the demonstration project.

Gaseous emissions to be monitored during the test program include SO_2, NO_x, CO, CO_2, O_2, and hydrocarbons. EER will use a special continuous monitoring system designed to overcome problems such as gaseous stratification and in-probe SO_2 capture. Figure 5-1 shows a schematic diagram of the continuous monitoring system developed by EER for the evaluation of sorbent injection on utility boilers. Key features of the system include:

- Multiple probes
- Rotameters to allow accurate flow rate balancing
- Phase discrimination probes
- All components heated upstream of moisture removal
- Zero and span gases for instrument calibration

For gaseous measurements, six to 16 probes are plumbed to a mixing manifold to provide an average sample. Glass rotameters are used to provide an on-line indication of each probe flow rate. Phase discrimination probes are used to provide inertial separation of particulate while minimizing the contacting of the gas with the particulate. Figure 5-2 shows the design of a phase discrimination probe. This probe has been developed by EER to separate particulate from sample gas via inertial effects prior to SO_2 measurement. Under typical probe operating conditions, in excess of 90 percent of the particulate matter is separated from the gas stream which is to be monitored. This greatly reduces the potential for interaction between the gas sample and the particulate in the sampling system. All components are heated to 250°F or above and insulated to eliminate the possibility of condensation in the sample system. Calibration of each of the gas monitors is accomplished with zero and span gases on a regular basis. Hydrocarbons (HC) will be measured at the economizer inlet using a Beckman 402 heated flame ionization detector. A

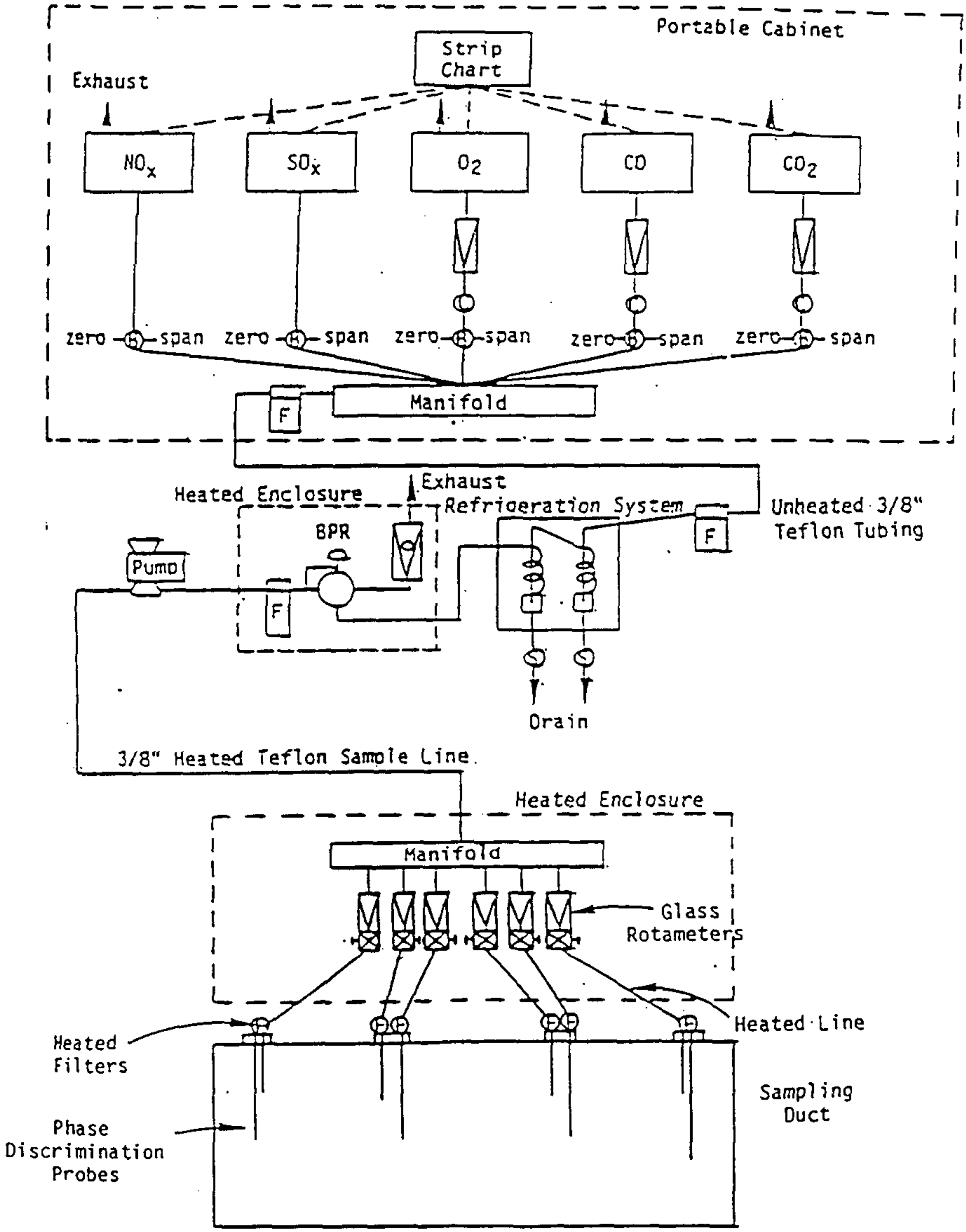

Figure 5-1. Continuous Monitor Sampling Train

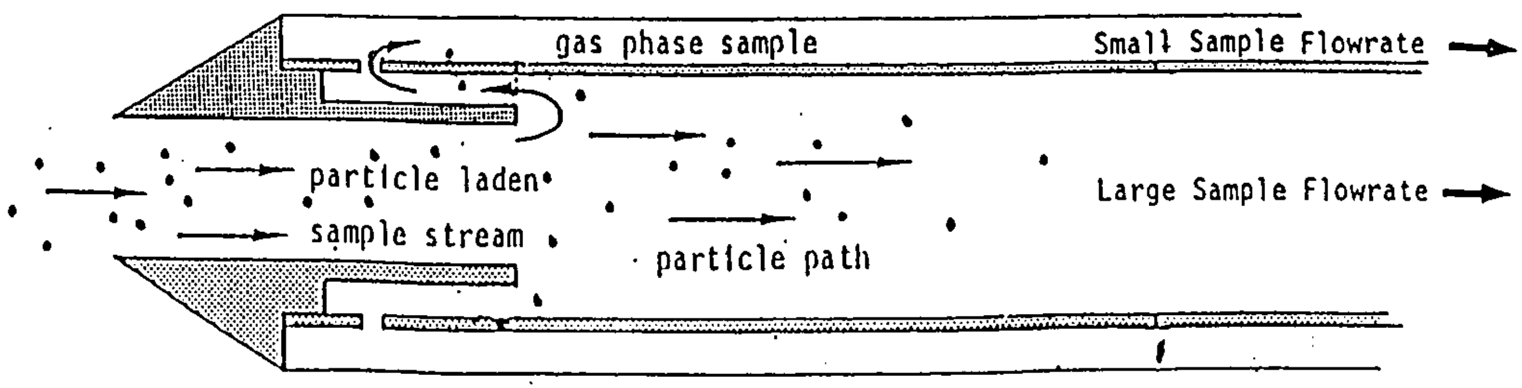

FIGURE 5-2. PHASE DISCRIMINATION PROBE

separate single point sampling system heated to 350°F will be used to minimize the potential loss or hang-up of hydrocarbons in the sampling system. Table 5-3 lists the instrumentation to be used for each of the gases monitored.

Measurement of SO_2 in the presence of active particulate is difficult due to the reaction of the SO_2 with unreacted calcium in the presence of moisture. This can cause higher SO_2 capture levels to be reported than actually exist at the probe inlet. Due to the importance of the SO_2 measurement system, and the possibility of interactions between SO_2 and sorbent in the sampling system, EER will perform the primary SO_2 measurements at the precipitator outlet. Because the precipitator removes nearly all of the particulate, SO_2 measurements at the outlet will not be subject to interference from the reactive particulate. Measurements at the economizer outlet will also be taken and will be used primarily for diagnostic purposes.

Concentrations of O_2, CO, HC, and CO_2 will be measured to confirm boiler operating conditions. The O_2 concentration in the flue gas provides an indication of the boiler excess air and is used to convert the other emissions concentrations to a standard condition. The CO_2 provides a means of checking the O_2 measurements based on the fuel composition and a carbon mass balance. CO and hydrocarbon (HC) concentration provides a relative indication of combustion efficiency. The concentration of CO is typically less than 200 ppm in coal-fired boilers. CO and HC will be monitored to determine if the process causes a change in emissions or combustion completeness. Also, CO and O_2 stratification across the economizer outlet can be used as an indication of burner fuel-air balance.

EER will utilize EPA Reference Methods to verify the emissions measurements obtained with the continuous monitors. EPA Method 3 will be used to verify CO_2 and O_2 measurements in Phase III once during baseline testing and once during long-term operation. Method 7 will be used for verification of the NO_x measurement. SO_2 measurements will be verified using EPA Method 6. Both methods 6 and 7 will be used once during baseline testing and once during long-term operation. EER utilizes a modified Method 6 to measure SO_2 to minimize the interaction of active particulate and sample gas. A Method 5 sample train with a 4-inch heated out-of-stack filter is used rather than the standard Method 6 sample train. The large heated filter reduces the build-up of a filter cake, minimizing the potential loss of SO_2 in the sample system. The Method 6 sampling will be conducted at the precipitator outlet to further

TABLE 5-3. CONTINUOUS GAS ANALYZERS

GAS MEASURED	DETECTION PRINCIPAL	MANUFACTURER	MODEL NO.	RANGE
SO_2	NDUV	Western Research	721AT	0-5000 ppm
NO_x	Chemiluminescent	TECO	10AR	0-2.5 ppm to 0-10,000 ppm
O_2	Paramagnetic	Taylor	0A570	0-10%, 0-25%
CO	Nondispersive Infrared	ANARAD	AR500R	0-500 ppm to 0-2,000 ppm
CO_2	Nondispersive	ANARAD	AR500R	0-25%
HC	Flame Ionization	Beckman	402	0-50 ppm to 0-25%

minimize the potential for SO_2/particulate interactions. Additional details regarding data quality assurance can be found in Section 7.

Nitrous oxide (N_2O) will be measured during baseline, parametric and long term testing of Phase III. Samples will be extracted, dried, scrubbed for SO_2, then kept in sampling flasks until analyzed. Removal of all moisture and SO_2 is particularly crucial, since N_2O tends to be formed from NO in the presence of these constituents. N_2O analysis will be conducted by gas chromatography. Sampling will occur once during baseline tests, several times during parametric testing, and monthly for the first three months during the long term tests. At the end of this time, results will be analyzed to determine the need for additional monitoring.

Total particulate emissions will be measured at the precipitator inlet using EPA Reference Method 17 and at the outlet using Reference Method 5. Particle size distribution will also be measured at the ESP inlet and outlet using in-stack cascade impactors. A Brinks impactor will be used at the inlet because the low sample flow rate of this impactor will allow a longer sample time with a high inlet grain loading. An Andersen impactor will be used at the outlet because the relatively high sample flow rate of this sampler is more appropriate for the low grain loading. The resistivity of the gases entering the ESP will be measured with a Wahlco cyclonic flow probe. Velocity will be measured using EPA Reference Method 2. Measurements of particulate, particle size distribution, resistivity, and velocity will be taken once during baseline operation, once during the parametric testing, and once during the long term operation.

5.4.2 Solid By-Products Discharge

A major by-product of the GR-SI process is the solid waste stream containing a mixture of unreacted and spent sorbent with fly ash. When the GR-SI system is operating, the mixture will be stored dry in a silo for subsequent disposal to a permitted landfill. In order to characterize the ash, samples must be obtained and analyzed for chemical constituents and physical properties.

During the second stage of Phase III, parametric testing, the GR-SI ash will be sampled on a daily basis by EER personnel. Samples will be obtained with a scoop from the openings in the ESP hoppers and placed in four-ounce sample containers with screw lids. Sample containers will be labeled and stored in a clean, dry environment. Ash samples will be analyzed at the beginning of parametric testing when the waste is first generated. Analysis will then be conducted for screening purposes on a monthly basis for the first three-month period in the third stage of Phase III, long-term testing. At the end of the three-month period, results will be evaluated to define trends and to determine appropriate follow-up analyses.

The preliminary analyses will be conducted for comparison with pilot scale data generated in Phase I. As described in Section 5.2, the data will be used to verify the supplemental waste stream permit, since IEPA is expected to require a verification with data from the full scale facility during GR-SI operation. Tests will be performed for physical and chemical characteristics which were listed previously in Table 5-2. These tests include analyses for major constituents and anions, pH, and total solids. Leaching characteristics for metals will also be determined using the EPA EP toxicity procedure. Also noted will be physical traits such as color, density, and specific gravity. In addition, screening tests for polynuclear aromatic hydrocarbons which may be adsorbed on fly ash or unburned carbon particles will be conducted.

In addition to verification of pilot-scale data, the data analyses will be used to fully characterize the by-product from the GR-SI process, and to add to the limited existing data base of ash composition and characterization from processes similar to GR-SI. Results from the analyses will be compared with literature data for consistency. If any unexpected constituents are present in the ash, or if constituents are present at unexpected levels, the constituent will be identified as a future monitoring need. After the first three-month period in the long-term testing, analyses for certain constituents will be conducted on an as-needed basis, to be determined when results from the screening tests have been evaluated. Screening test results will also aid EER in determining if handling or disposal procedures require modification.

5.4.3 Aqueous Discharge

During normal operation of the GR-SI system, the modified fly ash from Unit 7 will be handled and disposed of dry. The bottom ash will be sluiced to the current ash disposal pond, and co-disposed with the fly ash and bottom ash from Lakeside Unit 8 and Dallman Station Units 31, 32, and 33. The ash disposal pond has current monitoring requirements imposed by the IEPA through the National Pollutant Discharge Elimination System (NPDES) permit. These requirements will remain in effect during the demonstration project.

The bottom ash from Unit 7 is not expected to contain any unreacted sorbent or products from the sorbent injection system. To verify this, the pH level and the sulfate level of the sluice discharge into the pond will be measured when Unit 7 bottom ash is discharging--both before GR-SI operation in Phase II and during GR-SI operation in Phase III. The pH and sulfate levels of Lake Springfield will also be measured near the sluice water intake. This is necessary to indicate if observed changes in pH or sulfate levels of the sluice discharge are due to changes in background levels or effects of the GR-SI system. The pH level of the discharge will indicate if any sorbent or calcium sulfate is mixed with the bottom ash. If the relative pH does not change (based on background pH levels), no further action or monitoring will be required. If the relative pH increases substantially (by more than 1 pH unit), EER will maintain a close watch on the pond effluent pH level and will re-evaluate the GR-SI bottom ash management procedures.

A summary of monitoring for both the solid by-products and the aqueous discharges is listed in Table 5-4. No measurements were conducted in Phase I.

5.5 Post-Operation

The supplemental monitoring conducted during the construction and operation stages is designed to identify instantaneous effects on the environment produced by the GR-SI system. If CWLP elects to operate Unit 7 with the GR-SI system, the environmental effects will already be known. If CWLP does not operate the GR-SI equipment when this project is complete, there will be no environmental effects of concern. All by-products generated during Phase III of this program will be disposed off site in a permitted facility. Therefore, no supplemental monitoring is anticipated when the demonstration program is complete.

5.6 Schedules

Supplemental monitoring will be required only during the pre-construction and operating phases of the demonstration program. Preliminary baseline tests for gaseous emissions occurred during the middle of Phase I and lasted for approximately two weeks. Supplemental monitoring for determining

TABLE 5-4. *SUPPLEMENTAL MONITORING PLAN FOR SOLID BY-PRODUCTS AND AQUEOUS DISCHARGES*

	MEASUREMENT	SAMPLE TYPE	FREQUENCY	LOCATION
<u>PHASE I</u>				
No measurements				
<u>PHASE II</u>				
	pH, sulfates	grab sample	once	sluice line discharge
	pH, sulfates	grab sample	once	sluice water intake (Lake Springfield)
<u>PHASE III</u>				
Parametric	Ash	grab sample	sample daily analysis once	ESP hoppers
	pH, sulfates	grab sample	once	sluice line discharge
	pH, sulfates	grab sample	once	sluice water intake (Lake Springfield)
Long Term	Ash	grab sample	monthly for first 3 months	ESP hoppers

pre-operational water quality levels will occur during Phase II. Phase III is defined as the operating phase and will have a duration of approximately 18 months, including baseline testing, parametric testing, and long-term testing. Table 5-1, presented earlier, describes the schedule which will be used for the supplemental monitoring of gaseous emissions, and Table 5-4 provides a schedule for supplemental monitoring of aqueous and solid waste discharges.

6.0 HEALTH AND SAFETY MONITORING

6.1 Purpose and Scope

To protect the safety and health of plant employees, some general safety practices must be followed. This section describes the current safety program at Lakeside Station, as well as the additional safety and health monitoring which will be conducted during the GR-SI project.

6.2 Current Safety Program at CWLP Lakeside Station

The Department of Labor's Occupational Safety and Health Administration (OSHA) has produced a set of standards which can be applied nationwide to a variety of industries. These are specified in Title 29, Part 1910 of the Code of Federal Regulations. These guidelines are not specific to each particular industry, but cover most industries in general, including public utilities. Sub-parts include topics such as General Safety and Health, Walking-Working Surfaces, Means of Egress, Occupational Health and Environmental Control, and Hazardous Materials.

All utilities are required to follow OSHA's standards listed in 29 CFR 1910, but CWLP maintains an additional safety program through the Human Resources Department which ensures safe working conditions at all CWLP facilities, including Lakeside Station. CWLP's safety program includes safety training for new equipment, availability of Material Safety Data Sheets (MSDS), and development and distribution of a safety manual and an emergency procedures handbook. Mandatory training sessions are conducted to familiarize personnel with new equipment and procedures. Employees are provided with Material Safety Data Sheets (MSDS) which indicate the hazards and properties of all the substances to which workers may be exposed. In addition, there is a Safety Manual which is available to all employees describing the safety regulations of the utility. This manual reiterates and explains the OSHA standards, and provides additional guidelines developed by CWLP safety personnel. The emergency procedures handbook provides instructions for CWLP employees at the Lakeside and Dallman generating facilities in the event of an emergency such as flood, fire, severe weather, hazardous material incident, and other emergencies.

CWLP has a program to provide physical examinations for all employees. Physicals are required for all new employees and those returning to work after an extended absence.

6.3 GR-SI Health and Safety Monitoring

Maintaining the health and safety of all employees during the course of the GR-SI project is a top priority to the EER project management team as well as to CWLP management. In general, the safety practices which are currently in effect, as described in the Safety Manual, will remain in effect during the GR-SI project and will be the primary source of guidelines for safety practices at Lakeside Station.

Any construction which may occur at the plant due to the addition of the GR-SI process will be governed by OSHA standards for construction, listed in 19 CFR 1926. All personnel required for the construction phase will be informed of these standards and required to abide by them. No additional health and safety monitoring is anticipated to be required during this phase, except that associated with asbestos abatement activities and a safety survey.

Boiler tubes and other plant piping are insulated with asbestos to minimize heat loss, and some asbestos handling will be required to perform necessary modifications during construction activities. All asbestos removal will be conducted by a contractor qualified to work with asbestos-containing material. The contractor's specifications will include a requirement that all applicable OSHA and EPA regulations be satisfied, including asbestos removal guidelines, air monitoring requirements, and proper disposal considerations. When the contractor is on site, EER and CWLP will verify that proper measures are being implemented.

Prior to the initiation of Phase III, a safety survey will be conducted by EER and CWLP personnel. The purpose of this survey is to ensure that:

1) All OSHA regulations have been and will be met, specifically related to noise, dust, and asbestos; and
2) All testing facilities and safety equipment are available before test personnel arrive.

In addition, monitoring of worker health will be conducted, both prior to GR-SI operation and annually thereafter until project completion. Monitoring will be conducted for hearing and pulmonary function. Records of all employees' test results will be maintained confidentially throughout the demonstration project. Monitoring will be required for all EER employees and available for CWLP employees who are expected to be associated with plant operations on a regular basis.

Noise monitoring is required by OSHA regulations (29 CFR 1910.95) to determine which areas of the plant require hearing protection. Once these areas are established, area monitoring is not required unless a change in process or equipment increases or decreases noise level. EER anticipates that three blowers required for the GR-SI system may produce noise levels above 85 dB. These blowers will be installed in areas which do not currently exceed the OSHA noise 'action level' of 85 dB. Therefore noise monitoring will be required to determine installed equipment noise level and worker exposure. Monitoring of the areas where these fans are installed will be required only once at the beginning of Phase III.

A hearing conservation program must be instituted if employee exposure will exceed an eight hour time weighted average of 85 decibels or an equivalent exposure level (higher noise level over a shorter time period). The hearing conservation program requires monitoring of employee hearing within the first six months of exposure, to establish a baseline level, and annually thereafter, to check for a change in hearing level. All employees who have a possibility of excessive noise exposure will be included in the hearing conservation program.

OSHA regulations governing dust exposure (29 CFR 1910.1000) require that employees not be exposed to a total dust level of greater than 15 mg/m^3 or a coal dust level of 2.4 mg/m^3 on an eight-hour time weighted average. It is anticipated that dust could be generated during GR-SI system operation from the sorbent, the coal, or the fly ash. During system startup, areas with visible dust will be monitored, and workers task areas will be evaluated to determine employee exposure. If levels are observed to exceed allowable exposure limits, administrative and engineering controls will be identified and implemented. When such controls are not feasible to achieve full compliance, protective measures shall be used. No additional monitoring for dust is anticipated.

The only particular safety issues which are unique to the GR-SI project include handling of natural gas, sorbent, and the solid by-product. Safety procedures for transporting and utilizing natural gas in boiler furnaces are well established. All hardware and controls installed will be consistent with good industry practice. Gas firing poses no unusual problems for this application.

The baseline sorbent used in the GR-SI demonstration at Lakeside Station will be hydrated lime [$Ca(OH)_2$] in a fine (micron-sized) powder form that is a caustic irritant and is sufficiently fine to be suspendable and inhalable. According to the National Lime Association, studies performed on workers in lime plants show that dust from hydrated lime can be irritating if inhaled, but is not injurious to the respiratory system.[1] Material Safety Data Sheets will be available for all those working with hydrated lime and will be posted. Handling procedures and dust suppression systems are available which will minimize the human contact with the powder. In addition, all workers who will be directly exposed to the lime powder will be provided with a lightweight filter mask and tight fitting safety glasses with side shields. Minimal safety problems are expected from dry sorbent utilization, and no additional health monitoring is considered necessary.

The only waste product generated in the process is the fly ash/sorbent mixture caught in the particulate collection equipment. This mixture contains sorbent particles which have been sulfated as well as some unreacted calcium oxide. The calcium oxide material will hydrate when exposed to moisture with significant heat release. However, controlled hydration of the product will be performed to hydrate the material completely and neutralize the material before it is disposed. There are no specific monitoring requirements for the spent sorbent other than those described in Section 5.4.2, monitoring of solid by-product discharge.

Table 6-1 shows the worker health and safety monitoring which will be conducted during Phases II and III of the demonstration project. No health or safety monitoring was conducted during Phase I.

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[1] National Lime Association, "Lime Handling, Application, and Storage." Bulletin 213, National Lime Association, Arlington, VA, 1982.

TABLE 6-1. WORKER HEALTH AND SAFETY MONITORING PLAN

MONITORING PARAMETER	FREQUENCY	LOCATION
PHASE I		
No monitoring		
PHASE II		
Safety Survey	once	All applicable areas of plant
PHASE III		
Dust	as required	Areas with visible dust
Worker Health	annually (1)	N/A
Hearing		
Pulmonary Function		
Noise Level	once	Near fans

1. *Initial screening must be conducted prior to operation of the* GR-SI system. Annual exams will continue until the demonstration is complete.

7.0 QUALITY ASSURANCE AND QUALITY CONTROL

7.1 Purpose and Scope

This section contains the Quality Assurance (QA) plan for the GR-SI project concerning the supplemental measurements described in this document; the QA procedures for compliance monitoring will continue as they are currently practiced at the plant. This QA plan has been prepared according to the EPA guidelines for quality assurance plans.

7.2 Sampling Procedures

Sampling procedures for each measurement to be employed during the GR-SI demonstration are described in Sections 4 and 5. The description includes sampling location, sampling procedures, and sampling frequency for each measurement. EPA procedures are used where appropriate, and procedures which are not standard protocol have been described in more detail in Section 5.

Reagents to be used in the measurements conform to the specifications of the reference methods. Reagent grade chemicals are used exclusively. Clean sample containers are used to collect samples, with each container prepared by rinsing in appropriate solutions. For example, particulate probe wash samples are acetone-rinsed, and all containers are air-dried after rinsing. Samples are analyzed as rapidly as is practical; however, no special preservation or holding times are required for these measurements.

7.3 Sample Custody

Many of the measurements to be employed during the GR-SI demonstration involve the use of continuous monitors or other measurement methods which do not require custody procedures. All compliance monitoring requires stringent sample custody procedures. EER will work closely with CWLP's quality assurance groups on any compliance related sampling. The supplemental measurements generating samples that will require physical custody are the particle loading and particle size measurements, the EPA reference method test to verify the accuracy of the continuous SO_2 and NO_x measurements, and ash analysis. Samples collected for particulate characterization include particulate matter on glass fiber filters, in probe washes and on cascade impactor substrates. Samples for SO_2 and NO_x verification are liquid samples containing SO_2 and NO_x collected in aqueous solutions, and the ash is a solid sample. EER will utilize the "chain of custody" procedures for all samples as defined by EPA for legal sample custody. These procedures are listed in Section 3 of Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III -Stationary Source Specific Methods, EPA-600/4-77-027b, August 1977.

7.4 Calibration Procedures and Frequency

Calibration procedures and frequency for each measurement system are listed in Table 7-1. Standard calibration procedures will be used for each system. Each system will be calibrated at a frequency to ensure that the accuracy of the measurement is traceable to the calibration standards.

7.5 Analytical Procedures

Continuous monitoring instrumentation to be used to analyze CO, HC, CO_2, O_2, NO_x, and SO_2 concentrations is described in Table 7-2. These instruments were specifically selected to provide the highest sensitivity and minimum interferences possible. Test data from the instruments will be continuously recorded with a strip chart recorder to provide permanent documentation of test results.

The EPA standard procedures given in Table 7-1 are used with the monitoring instruments listed in Table 7-2. Where possible, the remaining measurements use other standard procedures. Some measurements such as analysis of parameters in aqueous and solid samples will be conducted by outside laboratories who have their own instrumentation and calibration procedures.

7.6 Data Reduction and Validation

Figure 7-1 shows the general reporting scheme for each measurement from collection of raw data to validation and reporting of results. Following the sampling and analysis portion of each measurement, results are calculated for each measurement. The preliminary results are then subjected to an independent check by the test supervisor to verify the following:

TABLE 7-1. CALIBRATION PROCEDURES

MEASUREMENT PARAMETER	CALIBRATION PROCEDURE	CALIBRATION FREQUENCY	CALIBRATION STANDARD	REFERENCE
EXHAUST GAS COMPOSITION				
NO, NO2	Compare to Calibration Gases	Daily	Certified gases	40 CFR 60 App. A, Method 7E
O2	Compare to Calibration Gases	Daily	Certified gases	40 CFR 60 App. A, Method 3A
CO	Compare to Calibration Gases	Daily	Certified gases	40 CFR 60 App. A, Method 10
CO2	Compare to Calibration Gases	Daily	Certified gases	40 CFR 60 App. A, Method 3A
HC	Compare to Calibration Gases	Daily	Certified gases	40 CFR 60 App. A, Method 25A
SO2	Compare to Calibration Gases	Daily	Certified gases	40 CFR 60 App. A, Method 6C
SO3	Compare to Std Acid	Monthly or with new titrant	Gravimetrically prepared std. solution	40 CFR 60 App. A, Method 6
PARTICULATE				
Gas Meter	Compare to std	Before use	Std test meter	40 CFR 60 App. A, Method 5
Orifice Meter	Compare to gas meter	Before, after use	Field test meter	40 CFR 60 App. A, Method 5
Pitot Probe	Compare to std	Before use	Standard pitot	40 CFR 60 App. A, Method 2
Nozzle	Direct measure	Before use	Micrometer	40 CFR 60 App. A, Method 5
Thermocouple	Compare to std	Before, after use	ASTM Thermometer	40 CFR 60 App. A, Method 2
Balance	Compare to std weights	As needed	Class S weights	--

TABLE 7-2. CONTINUOUS GAS ANALYSIS INSTRUMENTS

GAS MEASURED	DETECTION PRINCIPAL	MANUFACTURER	MODEL NO.	RANGE
CO	Nondispersive Infrared	ANARAD	AR500R	0-500 ppm to 0-2,000 ppm
CO2	Nondispersive	ANARAD	AR500R	0-25%
O2	Paramagnetic	Taylor Servomex	OA570	0-10% 0-25%
SO2	NDUV	Western Research	721AT	0-5000 ppm
NOx	Chemiluminescent	TECO	10AR	0-2.5 ppm to 0-10,000 ppm
HC	Flame Ionization	Beckman	402	0-50 ppm to 0-25%

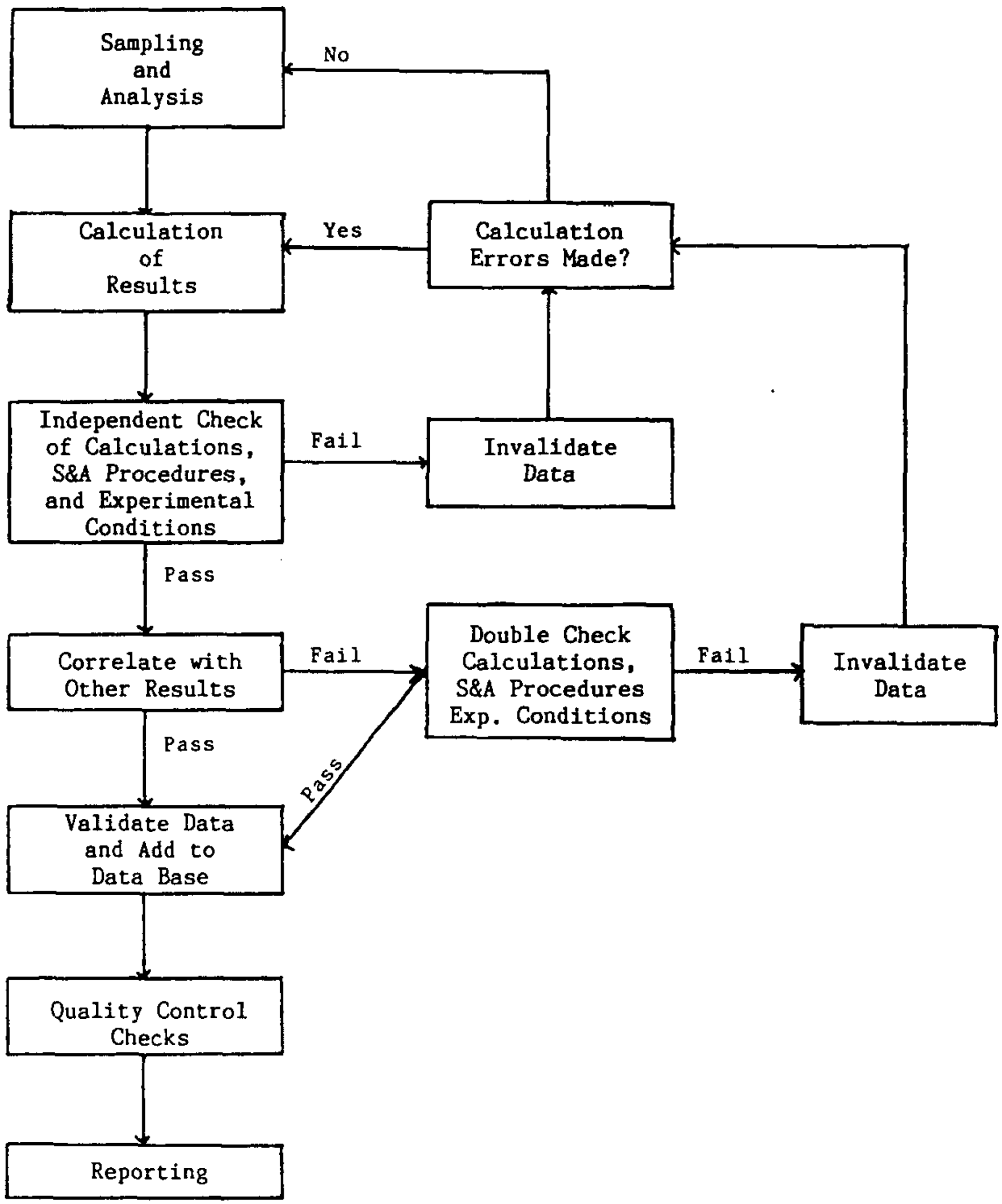

FIGURE 7-1. DATA REDUCTION AND VALIDATION

- Accuracy of calculations
- Proper sampling and analytical procedures
- Representative experimental conditions

Data obtained with improper sampling or analytical procedures, or under non-representative conditions, are then invalidated. Results passing the checks are then correlated with other results to identify potential outliers. Results not correlating with existing data are subjected to a double check of calculations and measurement procedures.

Measurements passing the above checks are then validated and added to the data base. Specific criteria used to validate data are the following:

1. Measurement performed under representative experimental conditions.
2. Proper sampling and analytical procedures utilized.
3. Calculations independently checked.

The on-site Test Engineer will be responsible for the collection, reduction, and validation of data. The on-site Test Supervisor will be responsible for ensuring that the measurements fulfill the program objectives. The Quality Assurance Officer will be responsible for verifying that the specified data handling procedures are followed and that the results meet the validation criteria.

7.7 Internal Quality Control Checks

EER will conduct an internal quality control program which will include the following items:

- Routine calibrations and maintenance
- Internal audits
- Periodic quality control checks

The engineers/technicians responsible for data collection will also be responsible for routine calibration and maintenance of all instruments and measurement systems. Specific calibration procedures and frequency are discussed in Section 7.4.

The EER Quality Assurance Officer (QAO) will conduct internal audits of measurement systems and procedures to ensure that all quality assurance requirements are met. These audits are discussed in Section 7.8.

The EER QAO will also administer a program of quality control checks. The quality control checks to be used are listed below.

1. Calibration Standards and Devices
   - equipment checks
   - reagents
   - zero and span gases
2. Quality Control Samples
   - blanks
   - spiked samples
   - surrogate samples
3. Replicates
4. Control charts

7.8 Performance and System Audits

EER will participate in and conduct system and performance audits. A system audit is an on-site inspection and review of the quality assurance system used for the total measurement system (sample collection, sample analysis, data processing, etc.) for each monitoring sensor or sample collected. System audits are normally a qualitative appraisal and include assessment of the following:

1. Organization and Responsibility - Is the quality assurance organization operational?
2. Sample Collection - Are written sample-collection procedures available and are these followed as written?
3. Sample Analysis - Are written analysis procedures available and are these followed as written?
4. Data Validation - Is a list of criteria for data validation available and is it used?
5. Calibration - Are written calibration procedures available and are these followed as written? In addition, a review should be made of procedures used to establish traceability of calibration schedule and data by measurement sensor.

6. Audits - Are control charts for performance audits reviewed?
7. Interlaboratory Tests - Are results from interlaboratory testing reviewed?
8. Preventive Maintenance - Is the preventive maintenance schedule being followed as recommended in the QA plan?

Performance audits refer to independent checks made by the supervisor or auditor to evaluate the quality of data produced by the total sampling and analysis system. Performance audits generally are categorized as follows:

1. Sampling audits
2. Analysis audits
3. Data processing audits

These audits are performed independently of and in addition to normal quality control checks by the operator/analyst. Independence can be achieved by having the audit made by a different operator/analyst from the one conducting the routine measurements or, in the case of sampling or analysis, by the introduction of external reference standards into the sampling or analysis system or interlaboratory comparison, and the subsequent plotting of results on control charts by the supervisor. The use of external reference standards should be applied without the knowledge of the operator/analyst, if possible, to ensure that recorded results reflect normal operating conditions.

Performance audits made by a different operator/analyst from the one conducting the routine measurement may be conducted in several ways. The following are examples of the most common type of audits.

1. Sampling Audit - The auditor uses a separate set of calibrated flow meters and reference standards to check the sample collection system:
    a. flow rate devices
    b. instrument calibration
    c. instrument calibration gases, when applicable

2. Analysis Audits - The auditor is commonly provided a portion or aliquot of several routine samples for analysis.

3. Data Processing Audits - Data processing commonly involves a spot-check on calculations, and data validation may be checked by inserting in the data processing system a dummy set of raw data followed by review of these validated data.

As part of EER's internal quality control program discussed in Section 7.7, the EER QAO will conduct independent system and performance audits. These audits will provide a comprehensive evaluation of conformance with the requirements specified in the QA plan. Where applicable, the audits will be conducted according to the procedures specified in Quality Assurance Handbook for Air Pollution Measurement Systems, Volumes I and II, EPA-600/9-76-005, March 1976 and EPA-600/4-77-027b, August 1977. For measurements where no EPA audit procedures have been developed, the audits will be conducted by following the EPA guidelines and substituting the types of audit samples, etc., appropriate for the specific measurement systems.

Following each audit, the EER QAO will evaluate the results and report them to the Test Supervisor. If the audits identify QA problems, corrective action will be initiated as discussed in Section 7.11. The results of all audits and any corrective action will be discussed in the quarterly monitoring reports.

7.9 Preventive Maintenance

Proper equipment operation is essential to obtaining quality measurements. During this project, EER will utilize standard procedures for routine preventive maintenance and maintain an inventory of critical spare parts to ensure that quality data are collected and to minimize data loss due to equipment malfunctions. Tables 7-3 and 7-4 list standard maintenance procedures and critical spare parts for the measurement systems. In addition to these routine procedures, EER personnel continually monitor equipment performance to detect and allow correction of equipment problems.

7.10 Calculation of Data Quality Indicators

The precision, accuracy, and completeness of each of the data quality indicator measurements will be monitored over the duration of this project to ensure that the quality assurance goals are achieved. Project goals for precision, accuracy, and completeness of critical measurement data are listed

TABLE 7-3. PREVENTIVE MAINTENANCE PROCEDURES

EQUIPMENT	PROCEDURE	FREQUENCY
CONTINUOUS MONITORING INSTRUMENTATION		
Calibration Gases	Verify pressure > 100 psig	Daily
Instrument Operating Conditions	Verify to manufacturer's specifications	Daily
Leak Check Sample System	Vacuum and pressure component check	Daily
Clean Probe Filter Tips	Reverse gas purge with compressed air	Daily
Sample Probes	Balance sample flow in each probe	Daily
Filters	Change	Weekly, or as required
Sample Flow Rate	Verify constant	Daily
System Vacuum/ Pressure	Verify constant	Daily
Heater and Chiller Temperatures	Verify within specifications	Daily
NOx Vacuum Pump Oil	Change	Monthly
LABORATORY EQUIPMENT		
Balances	Calibration check Service and calibration by manufacturer	Daily Semiannually
Instrumentation	Routine service	As specified by manufacturer

TABLE 7-4. CRITICAL SPARE PARTS

CONTINUOUS MONITORING INSTRUMENTATION	MANUAL SAMPLING EQUIPMENT	LABORATORY EQUIPMENT
Filters	Sample Pump	Reagents
Probe Filter Frits	Nozzles	GC Columns
Sample Pump	Pump Oil	Glassware
Pump Valves, Diaphragm	Manometer Oil	Instrument Spare Parts:
Back Pressure Regulator	Fuses	Combustion Tubes
NOx Sample Capillary	Glass Probe Liners	Filters
Infrared Sample Cells	Nozzle "O" Rings	Scrubbers
Valves, Flowmeters	Sample Filters	
Misc. Tubing and Fittings	Thermocouples and Lead Wire	
	Glassware	
	Reagents	
	Ash Sampling Containers	

in Table 7-5. The confidence interval will also be determined for each measurement to allow the significance of the results to be evaluated.

Quality control charts will be maintained on a daily basis for precision and accuracy to identify immediately a loss of control in any measurement and to show any trends in improvement or deterioration in quality control. Quality control charts will be constructed and maintained as described in EPA-600/9-76-005. Control charts will be utilized to monitor data quality and to indicate a loss of control for any measurements. The precision and accuracy of each measurement will be plotted as the relative standard deviation, s, of each measurement and the mean of the accuracy determinations. Control lines will be established at $\pm 2s$ for the warning limit and $\pm 3s$ for the quality control limit. Initially, these limits will be established based on results of previous measurement programs and will be modified as necessary after a data base of 15 to 20 determinations is obtained for this project. Measurements exceeding the warning limit will be subjected to review to determine the cause of the loss of control before being validated.

7.11 Corrective Action

The following occurrences will require corrective action:

1. QA Goals Not Achieved - This includes the failure to achieve the precision, accuracy and completeness criteria specified in Section 7.1.
2. Audit Deficiencies - Deficiencies may be identified during systems and/or performance audits.
3. Interlaboratory Comparison Problems - This includes discrepancies between similar samples analyzed by separate laboratories.
4. Significant Concentrations of Unregulated Substance - This involves a determination by the advisory group that significant environmental and health concerns exist.

The corrective action procedure is shown schematically in Figure 7-2. It is the responsibility of the EER QAO to bring to the attention of the EER Test Supervisor (TS) any of the problems listed above. The TS and QAO will then review, determine what data are suspect, and compare the QA and project goals to determine if the specific QA problem will actually cause a problem in achieving project goals. If it is determined that the QA goals are too

ΓA

CCURACY	COMPLETENESS
20%	90%

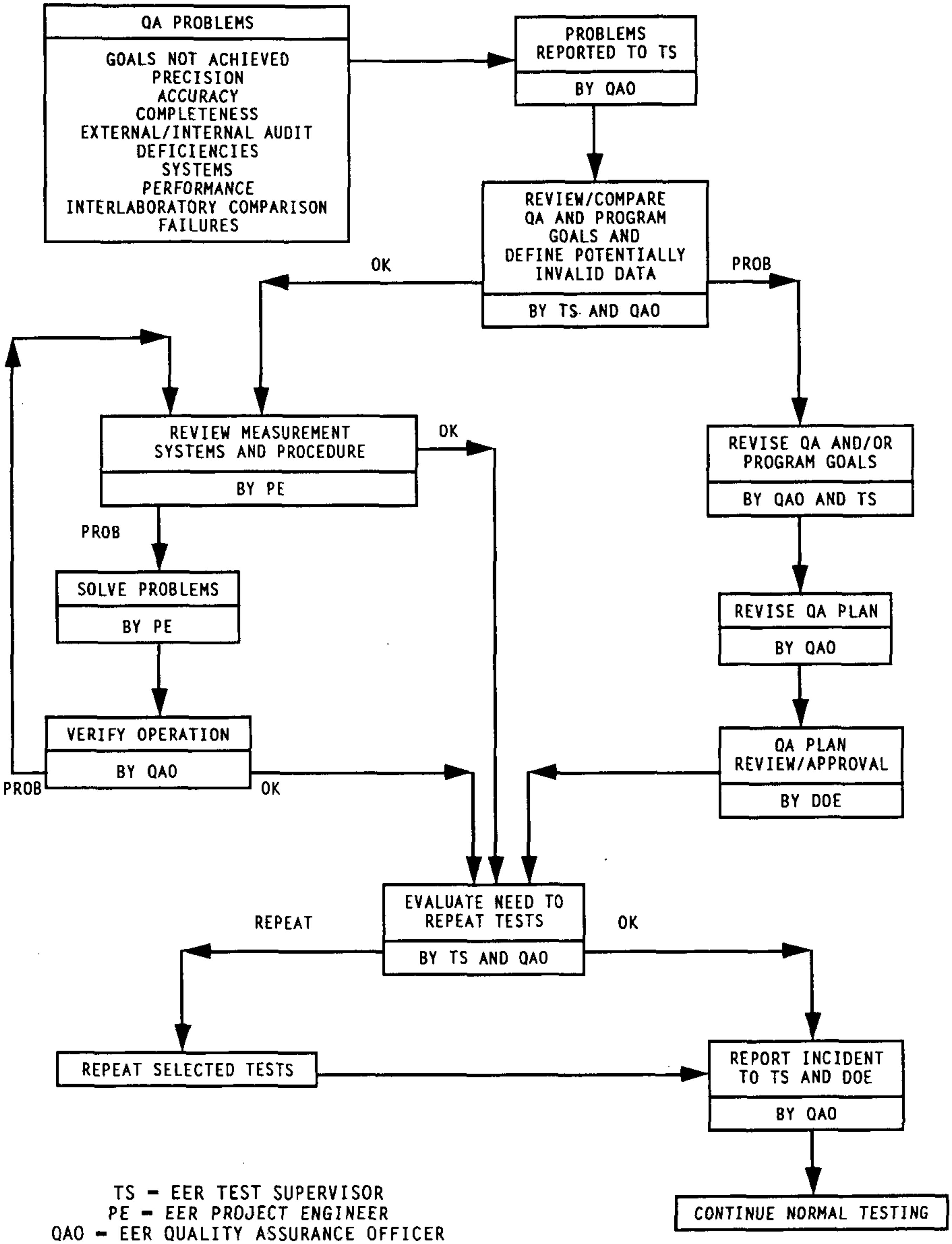

Figure 7-2. Corrective action procedure.

stringent, they will be modified to reflect the current project objectives. The QA plan will then be revised by the QAO accordingly.

If the QA and project goals are determined to be satisfactory, the TS will delegate review of the subject measurement systems and procedures to an EER project engineer (PE). The PE will proceed to solve the measurement system problems, etc., as required. When the PE has determined that the problems have been solved, the EER QAO will verify the results. This may include specific calibration, systems and/or performance audits, etc. Any remaining problems will be handled by the PE.

Following revision of the QA plan, solution of measurement problems and other related actions, the TS will review the questionable data in accordance with the data reduction and validation process (Figure 7-1) and determine if specific tests must be repeated.

Although unlikely, it is possible that suspect data are found to be valid and values are actually much higher (or lower) than anticipated. Significant concentrations of some substances could indicate unforeseen situations during GR-SI operations. In these situations, EER will make every effort to determine the nature of the problem and correct it as soon as possible. In some cases, the high concentrations may simply represent the characteristics of GR-SI application to this boiler. If it is found that any concentrations of substances exist at levels which generate environmental or health concerns, action will be taken to correct the problem, either with process modification or treatment technologies. The details of each incident requiring corrective action will be reported in the quarterly monitoring reports.

7.12 Quality Assurance of Outside Organizations

In some instances, samples will be obtained and analyses performed for this program by non-EER personnel, including both utility laboratories and contract laboratories. In order to verify data quality from these measurements/analysis, the quality assurance plans of these organizations will be incorporated into the EER quality assurance plan with regard to data supplied by those laboratories.

8.0 DATA MANAGEMENT AND REPORTING

8.1 Purpose and Scope

The management of data which have been generated is an integral part of any test program. They must be recorded faithfully with backups and checks to ensure data quality. They must be stored in a system which has sufficient information storage capacity for a period of months or years. The system must be flexible enough for the user to have access to any data which may be required, and capable of performing data processing functions as well. Finally, the system must have the capability of reproducing the data in a format which the user requires.

The specific data management procedures applied to environmental data will depend upon the manner in which the data are acquired and upon the type of data. Environmental data acquisition may be accomplished via any of the following means:

1. Direct in-situ acquisition of data (e.g. pH meter reading recorded in field logbook).
2. Laboratory analysis of discrete samples with manual recording of results on laboratory data sheets.
3. Continuous data recording on strip chart recorders.
4. Continuous data acquisition by on-line computer, with data recording on disk.

Figure 8-1 illustrates the logic behind the data management system. Once data are generated they will be recorded either manually for subsequent entry to a computer system or directly to the computer, as noted above. After the data have been entered, a hard copy will be produced and the validity of the data checked. Printouts will be compared with manual documentation for validation of data recording procedures and hardware.

Once the data quality is verified and corrected as necessary, the data will be stored within the computer system. Any additional information which may be pertinent to the testing will also be stored for data identification purposes. As data reporting is required, reports can be generated by the system in a user-specified format. Some of the information may require processing to produce the data in an applicable and relevant manner. The

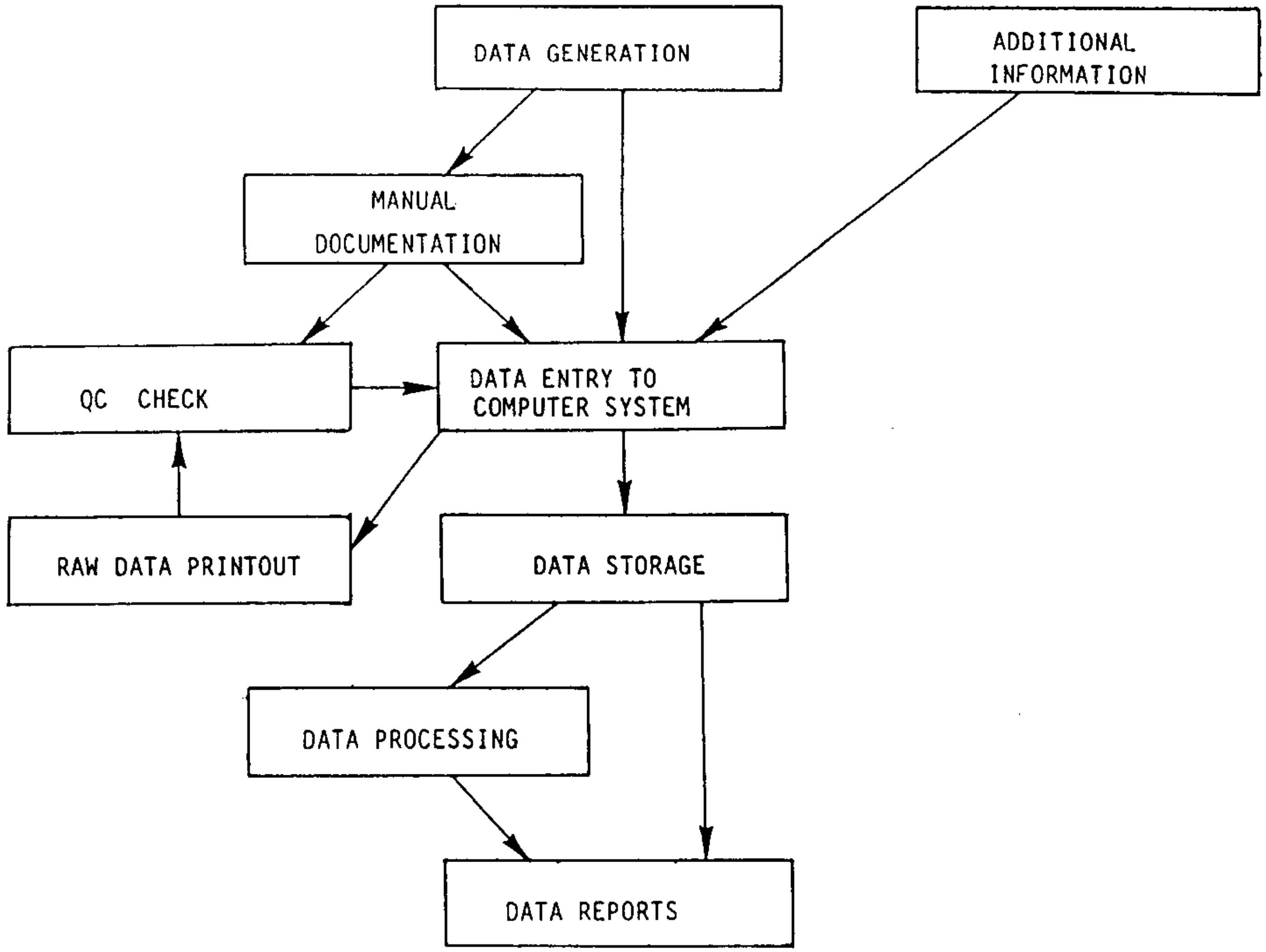

FIGURE 8-1. DATA MANAGEMENT SYSTEM FLOW DIAGRAM

computer system has the capability for any data processing necessary for the test program.

8.2 Reporting Requirements

The communication of process and measurement information must be performed on a regular basis with complete reporting of all relevant data. EER will submit quarterly and annual reports of the environmental data to DOE, with emphasis on data summaries and potential problem areas. Quarterly reports will include:

1. Summaries of environmental monitoring data collected during the prior quarter.

2. Copies of all compliance reports and analyses submitted to regulatory authorities during previous quarter. This includes monthly NPDES monitoring reports and reports of excess opacity measurements.

3. Identification and characterization of unregulated substances present at concentrations of significant environmental and health concern, as determined by an advisory group comprising representatives from EER and the utilities.

4. Description of the plant's permit status, including a description of any significant changes to the terms of permits or notices of violations issued by the regulatory authorities.

5. Identification of problem areas encountered during the prior quarter and indication of actual, anticipated, or possible solutions.

6. Recommendation of modifications to or deletion of specific tasks defined in the Monitoring Plan which are not yielding useful information, including a basis for the recommendation.

Annual reports will include:

1. The fourth quarterly report.

2. Summary of monitoring information from all prior annual reports and the four previous quarterly reports, including trends and patterns in the data and summary of data.

3. Indication of any trends of environmental or health concern, based on previous reports which have been submitted.

4. Indication whether any of the problem areas identified in previous quarterly or annual reports have been resolved and, if not, what mitigation measures should be taken.

8.3 Monitoring Data Review

Data will be reviewed by EER and CWLP as it becomes available. Data showing significant results will be reviewed, verified, and appropriate action taken if required. This may include modification to monitoring frequency, the addition of a monitoring parameter, or change in monitoring location. EER will review data continuously thorughout all phases of the demonstration project.

Data will be reviewed on an annual basis by a Monitoring Review Committee. The first meeting will be held in the early part of Phase III, so that comments from the Committee can be incorporated into future monitoring efforts. The Committee will be composed of representatives from all project participants, including EER, DOE, the funding participants, and the utilities providing host sites for the demonstration projects. The main purpose of this review is to determine if there are any significant findings among the data provided in the quarterly and annual reports. Based on the Committee's ongoing review of monitoring information, members of the Committee can recommend that:

1) Certain monitoring tasks be discontinued, modified or added;
2) New analytical techniques or instrumentation be substituted; or
3) The format of the quarterly and annual reports be changed.

If recommendations are made, project management at DOE and EER will consider modification to the EMP and authorize changes as appropriate.

APPENDIX A

Illinois Environmental Protection Agency 2200 Churchill Road, Springfield, IL 62706

217/782-2113

OPERATING PERMIT

RECEIVED
SEP - 1 1988
ENVIRONMENTAL AFFAIRS

PERMITTEE

City Water Light & Power
Attn: Louis Skibicki
Seventh & Monroe
Springfield, IL 62757

Application No.: 84030062 I.D. No.: 167120AA0
Applicant's Designation: LAKESIDEII Date Received: June 2, 1988
Subject: Lakeside Plant II Units 7&8 and ESP
Date Issued: August 30, 1988 Expiration Date: August 29, 1990
Location: 3100 Stevenson Drive

Permit is hereby granted to the above-designated Permittee to OPERATE emission source(s) and/or air pollution control equipment consisting of boilers 7 & 8 with associated electrostatic precipitator as described in the above-referenced application. This Permit is subject to standard conditions attached hereto and the following special condition(s):

1. Particulate matter emissions shall not exceed 0.10 lbs per million btu.

2. Operation in excess of applicable emission standards is allowed during startup, malfunction and breakdown.

3. The Permittee shall notify the Agency's regional office by telephone as soon as possible during normal working hours upon the occurrence of excess emissions due to malfunctions, or breakdowns. The Permittee shall comply with all reasonable and safe directives of the regional office regarding such malfunctions and breakdowns. Within five (5) working days of such occurrence the Permittee shall give a written follow-up notice to the Agency's regional office providing an explanation of the occurrence, the length of time during which operation continued under such conditions, measures taken by the Permittee to minimize excess emissions and correct deficiencies, and when normal operation resumed.

4. The permittee shall maintain and operate a continuous opacity monitoring system on the above-referenced equipment. On or before the 30th day of each calendar quarter, the permittee shall submit to the Agency a report for the last preceding calendar quarter of any and all opacity measurements which exceed 30 percent, averaged over a six minute period.

These "excess opacity" reports shall provide, for each such incident, the percent opacity measured as well as the date and span of such incident. These reports shall also specify for each incident whether it occurred during startup, shut-down, or malfunction. If a malfunction is indicated in the report, all corrective actions taken, if any, shall be reported. The reports shall also specify, for each calendar quarter, the date of those periods during which the continuous monitoring system was not in operation and list the number of hours when at least one boiler was in operation.

Terry A. Sweitzer, P.E.
Manager, Permit Section
Division of Air Pollution Control

TAS:PDD:jmm/5057H/71-72

cc: Region 2

NPDES Permit No. IL0024767

Illinois Environmental Protection Agency

Division of Water Pollution Control

2200 Churchill Road

Springfield, Illinois 62706

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Reissued (NPDES) Permit

Expiration Date: August 1, 1991

Issue Date: September 30, 1986
Effective Date: October 30, 1986

Name and Address of Permittee:

City of Springfield
Department of Public Property
City Water, Light and Power
Environmental Affairs
7th and Monroe Streets
Springfield, Illinois 62757

Facility Name and Address:

City Water, Light and Power
3100 Stevenson Drive
Springfield, Illinois 62707
Sangamon County

Discharge Number and Name:	Receiving Waters
001 Lakeside 1 and 2 Condenser Cooling Water Outfall 001(a) Lakeside Turbine Room, Boiler Room and Equipment Drains, Lakeside 2 Boiler Blowdown 002 Dallman 1 and 2 Condenser Cooling Water Outfall 005 Industrial Wastewater Treatment Plant Outfall 006 Ash Pond Discharge to Lake Springfield 007 Dallman Coal Pile Runoff 008 Lakeside Coal Pile Runoff 009 Dallman 3 Condenser Cooling Water Outfall 010 Dallman Plant Intake Screen Backwash 011 Scrubber Surge Pond Overflow	Lake Springfield
003 Lakeside Storm Sewer 004 Ash Pond Discharge	Sugar Creek

In compliance with the provisions of the Illinois Environmental Protection Act, Subtitle C Rules and Regulations of the Illinois Pollution Control Board, and the FWPCA, the above-named permittee is hereby authorized to discharge at the above location to the above-named receiving stream in accordance with the standard conditions and attachments herein.

Permittee is not authorized to discharge after the above expiration date. In order to receive authorization to discharge beyond the expiration date, the permittee shall submit the proper application as required by the Illinois Environmental Protection Agency (IEPA) not later than 180 days prior to the expiration date.

Thomas G. McSwiggin

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:GC:st/0298E

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

RAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

From the effective date of this permit until August 1, 1991, the effluent of the following scharge(s) shall be monitored and limited at all times as follows:

Outfall(s): 001 Lakeside 1 and 2 Condenser Cooling Water Outfall

is discharge consists of: Approximate Flow

Lakeside 1 and 2 Condenser Cooling Water	21.3 MGD
Lakeside 2 Turbine Rooms 4, 5 and 6 Floor Drains	Intermittent
Lakeside 2 Turbine Rooms 4, 5, 6, and 7 Roof Drains	Intermittent
Lakeside 2 Boiler Rooms 5, 6 and 7 Floor Drains	Intermittent
Lakeside 2 Boiler Rooms 5 and 6 Roof Drains	Intermittent
Lakeside 1 and 2 Equipment Drains	Intermittent
Lakeside 2 Boilers 5, 6, 7 and 8 Boiler Blowdown	Intermittent

ow					Daily	Continuo
mperature	See Special Condition No. 3				Daily	Continuo
tal Residual Chlorine				0.2	2/Month*	Grab**

Outfall(s): 001(a) Lakeside Turbine Room, Boiler Room and Equipment Drains, Lakeside 2 Boiler Blowdown

is discharge consist of: Approximate Flow

Lakeside 2 Turbine Rooms 4, 5 and 6 Floor Drains	Intermittent
Lakeside 2 Turbine Rooms 4, 5, 6, and 7 Roof Drains	Intermittent
Lakeside 2 Boiler Rooms 5, 6 and 7 Floor Drains	Intermittent
Lakeside 2 Boiler Rooms 5 and 6 Roof Drains	Intermittent
Lakeside 1 and 2 Equipment Drains	Intermittent
Lakeside 2 Boilers 5, 6, 7 and 8 Boiler Blowdown	Intermittent
Yard Drains	Intermittent
Miscellaneous Equipment Drains	Intermittent

ow					1/Week	Single Reading Estimate
l	See Special Condition No. 5				2/Month	Grab
tal Suspended Solids			15.0	30.0	2/Month	24 Hour Composit
l and Grease			15.0	20.0	2/Month	Grab

See Special Conditions No. 4 and No. 9
See Special Condition No. 4

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
RAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

From the effective date of this permit until August 1, 1991, the effluent of the following scharge(s) shall be monitored and limited at all times as follows:

Outfall(s): 002 Dallman 1 and 2 Condenser and Miscellaneous Equipment Cooling Water Outfall

Approximate Flow 118.3 MGD

ow					Daily	Continuo
mperature	See Special Condition No. 3				Daily	Continuo
tal Residual Chlorine				0.2	2/Month*	Grab**

See Special Condition No. 4 and 9
See Special Condition No. 4

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

ARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

. From the effective date of this permit until August 1, 1991, the effluent of the following ischarge(s) shall be monitored and limited at all times as follows:

Outfall(s): 003 Lakeside Storm Sewer

his discharge consists of:	Approximate Flow
. Lakeside 1 Turbine Rooms 1, 2 and 3 Floor Drains & Equipment Drains	Intermittent
. Lakeside 1 Turbine Rooms 1, 2 and 3 Roof Drains	Intermittent
. Lakeside 1 Boilers 2, 3 and 4 Boiler Blowdown	Intermittent
. Lakeside 1 Boiler Rooms 2, 3 and 4 Floor Drains & Equipment Drains	Intermittent
. Lakeside 1 Boiler Rooms 2, 3 and 4 Roof Drains	Intermittent
. Lakeside 2 Turbine Rooms 6 and 7 Roof Drains	Intermittent
. Lakeside 2 Boiler Rooms 7 and 8 Roof Drains	Intermittent
. Lakeside 1 and 2 Intake Screen Backwash ***	0.3 MGD
. Screen Washings from Public Water Supply Intake	0.1 MGD
0. Spillway Gate Hydraulic Water ***	Intermittent
1. Miscellaneous Equipment Drains	Intermittent
2. Public Water Supply Drain***	Intermittent

low					1/Week	Single Reading Estimat
H	See Special Condition No. 5				1/Week	Grab
otal Suspended Solids			15.0	30.0	1/Week	24 Hour Composi
il and Grease			15.0	20.0	2/Month	Grab

** Compliance Monitoring samples are collected ahead of this wastestream input to Outfall 003.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
RAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

From the effective date of this permit until August 1, 1991, the effluent of the following scharge(s) shall be monitored and limited at all times as follows:

Outfall(s): 004 Ash Pond Discharge

is discharge consists of:	Approximate Flow
Lakeside Plant Fly Ash and Bottom Ash	2.66 MGD
Dallman Plant Fly Ash and Bottom Ash	4.32 MGD
Non-Chemical Metal Cleaning Wastes ****	Intermittent
Lime Sludge From the City Water Purification Plant	0.33 MGD
Flue Gas Desulfurization System Wastes****	Intermittent
Industrial Wastewater Treatment Plant Sludge	0.19 MGD
Water Treatment Plant Yard Drains	Intermittent

ow					1/Week	Single Reading Estimate
H	See Special Condition No. 1				2/Week	Grab
otal Suspended Solids			15.0	30.0	2/Week	24 Hour Composit
il and Grease			15.0	20.0	2/Month	Grab

*** This wastestream may be directed to the Industrial Wastewater Treatment System

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

1. From the effective date of this permit until August 1, 1991, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall(s): 005 Industrial Wastewater Treatment Plant Outfall

This discharge consists of:	Approximate Flow
1. Demineralizer Regenerant Wastes	0.6 MGD
2. Lakeside 2 Boilers 7 and 8 Slag Tank Overflow	1.0 MGD
3. Lakeside 2 Boiler Rooms 7 and 8 Floor Drains	Intermittent
4. Lakeside 2 Turbine Rooms 6 and 7 Floor Drains	Intermittent
5. Lakeside 2 Boilers 5 and 6 Slag Tank Overflow	0.001 MGD
6. Dallman 1, 2 and 3 Boiler Blowdown, Evaporator and Deaerator Blowdown	0.44 MGD
7. Dallman 1, 2 and 3 Roof and Floor Drains	Intermittent
8. Dallman 1, 2 and 3 Condensate Storage Tank Wastes	Intermittent
9. Dallman 1, 2 and 3 Slag Tank Overflow	1.8 MGD
10. Dallman 1, 2 and 3 Sump Pumps	0.3 MGD
11. Dallman Plant Pyrite Romoval Wastes	0.85 MGD
12. Crusher House and Control House Floor Drains	Intermittent
13. Flue Gas Desulfurization System Wastes*****	Intermittent
14. Dallman Coal Pile Runoff (See Outfall No. 007) *****	Intermittent
15. Dallman 1 and 2 Precipitator Area Drain	Intermittent
16. Non-chemical Metal Cleaning Wastes ****	Intermittent
17. Dallman 1, 2 and 3 Equipment Drains	Intermittent
18. Lakeside Coal Pile Runoff (see Outfall No. 008)*****	Intermittent

PARAMETER	LOAD 30 DAY AVG.	LOAD DAILY MAX.	CONC. 30 DAY AVG.	CONC. DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow					Daily	Contin
pH	See Special Condition No. 1				Daily	Contin
Total Suspended Solids			15.0	30.0	1/Week	24 Hou Composi
Oil and Grease			15.0	20.0	2/Month	Grab
Iron (total)			2.0	4.0	1/Week	24 Hou Composi
Copper (total)			0.5	1.0	1/Week	24 Hou Composi

***** Discharge to the Industrial Wastewater Treatment Plant is an alternate routing.

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Effluent Limitations and Monitoring

RAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

From the effective date of this permit until August 1, 1991, the effluent of the following scharge(s) shall be monitored and limited at all times as follows:

Outfall(s): 006 Ash Pond Discharge to Lake Springfield

					Approximate Flow Intermittent	
ow					1/Week	24 Hour Total
	See Special Condition No. 1				2/Week******	Grab
tal Suspended Solids			15.0	30.0	2/Week******	24 Hour Composi
l and Grease			15.0	20.0	2/Month******	Grab

Outfall(s) 007 Dallman Coal Pile Runoff

is discharge consists of:					Approximate Flow	
Dallman Coal Pile Runoff					Intermittent	
Dallman 1 and 2 Precipitator Area Drain					Intermittent	
low					1/Week	Single Reading Estimate
H	See Special Condition No. 1				1/Week	Grab
otal Suspended Solids			15.0	30.0	1/Week	8 Hour Composit
il and Grease			15.0	20.0	1/Week	Grab
ron (Total)			2.0	4.0	1/Week	8 Hour Composit

****** Monitor if Discharge Occurs During the Month excluding exercising diversion pump.

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Effluent Limitations and Monitoring

RAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

From the effective date of this permit until August 1, 1991, the effluent of the following scharge(s) shall be monitored and limited at all times as follows:

Outfall(s): 008 Lakeside Coal Pile Runoff

is discharge consists of: Approximate Flow

Coal Pile Runoff	Intermittent
Lakeside Plant Precipitator Area Runoff	Intermittent
Parking Lot Runoff	Intermittent

ow					1/Week	Single Reading Estimate
l	See Special Condition 1				1/Week	Grab
otal Suspended Solids			15.0	30.0	1/Week	8 Hour Composit
il and Grease			15.0	20.0	1/Week	Grab
on (Total)			2.0	4.0	1/Week	8 Hour Composit

Outfall(s): 009 Dallman 3 Condenser and Miscellaneous Equipment Cooling Water Outfall

Approximate Flow
151.4 MGD

low					Daily	Continuo
emperature	See Special Condition No. 3				Daily	Continuo
otal Residual Chlorine				0.2	2/Month*	Grab**

See Special Conditions No. 4 and 9
* See Special Condition No. 4

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Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

1. From the effective date of this permit until August 1, 1991, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall(s): 010 Dallman Plant Intake Screen Backwash

Approximate Flow
0.15 MGD

Flow					1/Week	Estimat

Outfall(s): 011 Scrubber Surge Pond Overflow

This discharge consist of:	Approximate Flow
1. Scrubber sludge storage pad runoff	Intermittent
2. Groundwater pumpage from the oil spill recovery well	Intermittent
3. Flue gas desulfurization wastes	Intermittent

PARAMETER	LOAD LIMITS 30 DAY AVG.	LOAD LIMITS DAILY MAX.	CONCENTRATION 30 DAY AVG.	CONCENTRATION DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow					Daily	Single Reading Estimat
pH	See Special Condition No. 1				Daily	Grab
Total Suspended Solids			15.0	30.0	Daily	Grab

Special Conditions

1. The pH shall be in the range 6.0 to 9.0.

2. Samples taken in compliance with the effluent monitoring requirements shall be taken at a point representative of the discharge, but prior to entry into the receiving stream.

3. The thermal discharge to Lake Springfield from the Lakeside plant shall not exceed 99° F more than 5 percent of the hours in the 12-month period ending with any month and the discharge from the Dallman plant shall not exceed 99° F more than 8 percent of the hours in the 12-month period ending with any month and at no time shall any discharge exceed 109° F.

4. Chlorine may not be discharged from each units main cooling condensers for more than two hours in any one day. The reported mean concentration and maximum concentration of Total Residual Chlorine shall be based on a chlorine concentration curve. The concentration curve shall be generated using grab samples with an analytical frequency of 5 minutes or less during the respective chlorination period of each unit allowing for lag time between the initiation of chlorination and the point of sampling before the first sample is taken. Concentration curves shall be submitted with monthly Discharge Monitoring Reports. The frequency and duration of the chlorine dosing period plus the amount of chlorine applied shall be reported on the Discharge Monitoring Reports.

5. The pH shall be in the range 6.0 to 9.0. The pH 9.0 maximum limitation may be exceeded in the following discharges No. 001(a) and No. 003 if the elevated pH level is caused by greater than 9.0 pH levels in the public water supply to the system in which case the upper limit shall be pH 10.0.

6. There shall be no discharge of chemical metal cleaning wastes or associated rinses.

7. There shall be no discharge of polychlorinated biphenyl compounds.

8. To calculate the average daily flow for outfalls 001, 002 and 009 during the reporting period, the total number of pump hours observed is divided by the number of days in the month and then multiplied by the pump rate (gallons/hour). The minimum daily flow rate is determined by multiplying the lowest daily pump hour total by the pump rate. The maximum daily pump rate is calculated by multiplying the highest daily pump hour total by the pump rate.

9. During maintenance outages calcium hypochlorite may be used to passivate the condensers. During discharge of chlorinated wastewater from passivation of the main-cooling condensers a minimum of three grab samples shall be taken at five minute intervals or less at the

Special Conditions

condenser cooling water outfall for each batch discharge allowing for lag time between chlorine discharge and the point of sampling before the first grab sample is taken. The individual values and average value for each set of samples shall be reported with monthly DMR forms including the time samples were collected, the time and duration of chlorine release plus the amount of chlorine applied.

10. The permittee shall record monitoring results on Discharge Monitoring Report Forms using one such form for each discharge each month.

The completed Discharge Monitoring Report forms shall be submitted to IEPA no later than the 15th day of the following month, unless otherwise specified by the permitting authority.

Discharge Monitoring Reports shall be mailed to the IEPA at the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
2200 Churchill Road
Springfield, Illinois 62706

Attention: Compliance Assurance Section

Additionally, Discharge Monitoring Report forms shall be mailed to United States Environmental Protection Agency in Chicago on a quarterly basis. The permittee shall submit the reports as follows, unless otherwise specified by the permitting authority.

Period	Report Due At U.S. Environmental Protection Agency
Jan, Feb, Mar	April 28th
April, May, June	July 28th
July, Aug, Sept	October 28th
Oct, Nov, Dec	January 28th

Reports shall be addressed to United States Environmental Protection Agency as follows:

NPDES Compliance Unit
United States Environmental Protection Agency
Region V
230 South Dearborn Street
Chicago, Illinois 60604