DOE/PC/79798--T8

DE91 002601

DOE/PC/7

LIMB DEMONSTRATION PROJECT EXTENSION

QUARTERLY REPORT NO. 13
FOR THE PERIOD - MAY, JUNE, JULY, 1990

SEPTEMBER 21, 1990

DOE Agreement No: DE-FC22-87PC79798

B&W CRD Agreement No: CRD-1171

Prepared by:
Babcock & Wilcox
a McDermott Company

DISCLAIMER

TABLE OF CONTENTS

TABLE OF CONTENTS

DISCLAIMER

This report was prepared by The Babcock & Wilcox Company pursuant to a cooperative agreement partially funded by the U. S. Department of Energy and neither The Babcock & Wilcox Company, nor any of its subcontractors nor the U. S. Department of Energy, nor any person acting on behalf of either:

(a) Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately-owned rights;

or

(b) assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method or process disclosed in this report.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U. S. Department of Energy. The views and opinions of authors expressed herein do not necessarily state or reflect those of the U. S. Department of Energy.

1.0 EXECUTIVE SUMMARY

The LIMB Demonstration Project Extension (DOE Agreement No. DE-FC22-87PC79798) progress for May, June, and July 1990, was made in the completion of Phase II, Coolside and LIMB Construction, Start-Up and Shakedown and continuation of Phase III, Operation, Data Collection, Reporting and Disposition.

Project Management activities have focused on finalizing the procurement of the four (4) sorbents to be used in LIMB testing, completing the upgrade of the lime feed system, and continuing the LIMB Extension test program.

Phase I, Design and Permitting, activities were limited to updating drawings to as-built conditions. This Phase is essentially complete.

Phase II, Coolside and LIMB Construction Start-Up and Shake-down, activities were completed in this quarter.

Task 3 activities included finalizing the procurement of the four (4) different sorbents to be used in LIMB testing and completing the installation and start-up of the lime feed system upgrade.

Phase III, Operation, Data Collection Reporting and Disposition, activities were focused on writing the draft of the Coolside topical report and continuing the LIMB Extension testing program.

Release of the Coolside topical report to B&W is expected in late September, 1990. Release of the Coolside Topical report to DOE is expected to occur in October, 1990.

LIMB Extension testing continued during the quarter with lignosulfonated hydrated lime, pulverized limestone, and hydrated dolomitic lime while firing 1.8% and 3% sulfur coals. Sulfur dioxide removal efficiencies were equivalent to the results found during EPA, base LIMB testing. Sulfur dioxide removal efficiencies were lower than expected while testing with pulverized limestone without humidification. A slight increase in sulfur capture was noted while injecting pulverized limestone at the 187' elevation and with the humidifier outlet temperature at 145°F.

Radian Corporation continued to monitor emissions and to implement the environmental plan.

2.0 INTRODUCTION

As per the Cooperative Agreement No. DE-FC22-87PC79798 dated June 25, 1987, the following quarterly report has been prepared for Phases I, II and III of the LIMB Demonstration Project Extension. This DOE project includes "Coolside" technology and LIMB multiple sorbent injection. The period covered by this quarterly report is May, June, and July, 1990. This report represents the thirteenth three month period of the project.

The subject of this report is progress during the quarter for Phase I - Design and Permitting, Phase II - Coolside/LIMB Construction, Start-Up and Phase III - Operation, Data Collection, Reporting and Disposition.

Under Phase I, Task 2, activities were limited to updating drawings to as-built conditions. This phase is essentially complete.

Under Phase II, Tasks 1 and 2 activities are complete. Task 3, LIMB System Start-up, activities were completed in this quarter with the finalization of the material procurement and completion the lime feed system upgrade and start-up.

Under Phase III, Task 1, maintenance work on the LIMB system was performed during Ohio Edison's summer outage program. Task 2 activities included Consol's work on completing the draft of the Coolside Topical report. Task 3 activities continued with LIMB testing while firing 1.8% and 3% sulfur coals.

3.0 PROJECT DESCRIPTION:

3.1 BACKGROUND

3.1.1 EPA Base LIMB

The DOE LIME Demonstration Project Extension is a continuation of the EPA Limestone Injection Multistage Burner (LIMB) Demonstration.

The EPA LIMB program was initiated in 1981, although work in related areas had been conducted by EPA and others prior to that time. The LIMB program is structured to provide an understanding of the controlling factors in the LIMB process and to establish a basis for private sector commercialization of the technology. EPA ultimately expects to show that LIMB is a low cost control technology capable of producing moderate SO_x and NO_x control (50-60 percent) with applicability for retrofit to the major portion of the existing coal-fired boiler population.

The current EPA Wall-Fired LIMB Demonstration is a four-year project that includes design and installation of a LIMB system at the 105-MW Unit 4 boiler at Ohio Edison's Edgewater Station in Lorain, Ohio. The project plan calls for a full year of operating and testing to demonstrate its capabilities. In addition to the EPA the major project participants are the State of Ohio, Ohio Edison, and Babcock & Wilcox (B&W).

The basic goal of the LIMB demonstration is to extend LIMB technology development to a full-scale application on a representative wall-fired utility boiler. The successful retrofit of LIMB to an existing boiler is expected to demonstrate that (a) reductions of 50 percent or greater in SO_x and NO_x emissions can be achieved at a fraction of the cost of add-on FGD systems, (b) boiler reliability, operability, and steam production can be maintained at levels existing prior to LIMB retrofit, and (c) technical difficulties attributable to LIMB operation, such as additional slagging and fouling, changes in ash disposal requirements, and an increased particulate load, can be resolved in a cost-effective manner. The primary fuel to be used will be an Ohio bituminous coal having a nominal sulfur content of 3 percent or greater.

The demonstration project consists of several distinct phases: a preliminary phase to develop the LIMB process design applicable to the host boiler, a construction and start-up phase, and an operating and evaluation phase. The first major activity, the development of the Edgewater LIMB design, was completed in January 1986 and detailed engineering is now complete. Major boiler-related components were installed during a September 1986 boiler outage. Start-up activities began in March of 1987 with tuning of the low NO_x burners. Sorbent injection activities were under way as of July 1987.

3.1.2 Humidification

As a modification to the Base LIMB work, the applicability of flue gas humidification as a supplement to the LIMB process for the purpose of improving particulate collection and SO_2 capture efficiencies is being evaluated. The reason for this investigation is that the LIMB process may cause some degradation in the performance of electrostatic precipitators. This degradation will be the result of three factors:

1. The dust loading to the ESP will more than double.

2. The particle size distribution of the injected sorbent may be finer and, therefore, more difficult to capture than the normal flyash from coal combustion.

3. The sorbent has a chemical affinity for SO_3. This will result in a lowering of the acid dew point and consequently increasing of the resistivity of the ash.

Humidification may provide a low-cost option that would restore ESP performance on LIMB retrofitted boilers. In addition, humidification of flue gas has been shown to increase SO_2 capture by rendering sorbent particles more reactive. The amount of humidification required to improve SO_2 capture efficiency and to restore ESP performance may present operational problems. The EPA Humidification program will result in a humidification system design aimed at minimizing operational problems and maximizing SO_2 capture and particulate removal enhancement. The effect of humidification will be determined during the EPA LIMB Demonstration testing at Ohio Edison's Edgewater Unit 4.

The incentives to humidify to as close an approach to saturation as possible are:

1. Particulate emissions from the small ESP's designed for burning high-sulfur coal can possibly be kept in compliance without the high cost of additional particulate collection area.

2. Additional SO_2 removal can be achieved by taking advantage of the unused sorbent from the boiler.

However, the extent of SO_2 removal will be strongly dependent upon how much the flue gas temperature is reduced. The risk of scaling, pluggage, and other operating problems also increases sharply as the gas temperature approaches adiabatic saturation.

It is because of the risk of scaling and pluggage that the humidification demonstration is being carried out in a bypass flue. With the humidifier installed in a bypass flue, initial operating problems will not interrupt boiler operation. Various operating conditions at closer approaches to saturation can be tried without fear of shutting down the boiler should a wall deposition problem develop. This bypass will be used for EPA humidification

work and for the DOE LIMB and Coolside process demonstrations, of which humidification is an integral part. Funding for the bypass will be provided as part of the DOE LIMB Demonstration Project Extension.

3.2 DOE LIMB DEMONSTRATION PROJECT EXTENSION OVERVIEW

The purpose of the DOE LIMB Demonstration Project Extension is to extend the data base on LIMB technology and to expand DOE's list of Clean Coal Technologies by demonstrating the Coolside process as part of the project.

The main objectives of this project are:

1. To demonstrate the general applicability of LIMB technology by testing 3 coals and 4 sorbents (total of 12 coal/sorbent combinations) at the Ohio Edison Edgewater plant.

2. To demonstrate that Coolside is a viable technology for improving precipitator performance and reducing sulfur dioxide emissions while acceptable operability is maintained.

To achieve these objectives, B&W will perform a three-phase project consistent with the DOE PON:

PHASE I: DESIGN AND PERMITTING
PHASE II: CONSTRUCTION AND START-UP ("SHAKEDOWN")
Phase II A: Site Preparation and Long-Lead Time Item Procurement
Phase II B: Coolside/LIMB Construction, Start-up and Shakedown
PHASE III: OPERATION, DATA COLLECTION, REPORTING AND DISPOSITION

Since the DOE LIMB Demonstration Project Extension is a continuation of an ongoing EPA Project, it was necessary at the start of the project to divide Phase II into IIA and IIB to avoid project schedule delays on both projects. Phase IIA entailed certain site preparation and long-lead time item procurement activities which had to take place before actual construction and start-up could commence. Most of these activities were completed during the boiler outage originally scheduled by Ohio Edison from September 28, 1987 through December 20, 1987 to perform major turbine maintenance. The outage actually lasted until late January 1988. It provided the opportunity to perform the flue gas duct revisions needed for the tie-in of the bypass duct once its construction was complete.

Phase IIB consisted of Coolside/LIMB Construction, Start-up and Shakedown activities. This Phase started on August 26, 1987, one month prior to the outage "window". Time was needed to perform pre-outage activities and to assure that outage construction work was organized and ready to begin on schedule. Phase IIB construction consisted primarily of the bypass flue, where the humidifier is installed, and the Coolside feed system.

Originally the bypass was to be completed in time to allow EPA humidification testing to be performed during the last four months of Base LIMB operation. However, preliminary LIMB test results indicated that electrostatic precipitator (ESP) performance suffered as a result of sorbent injection.

Humidification is now considered necessary to improve ESP performance and to allow long term LIMB testing to occur. LIMB and Humidification testing will continue simultaneously after humidifier construction is complete. Thus, a delay in EPA LIMB testing is necessary until the bypass is ready.

EPA LIMB testing with humidification was scheduled to begin in July 1988. Once EPA testing is complete, Phase III of the DOE LIMB Demonstration Project Extension is scheduled to begin operations on July 17, 1989 by testing the Coolside process for a four (4) month period. Afterwards, the LIMB Extension testing, which is scheduled to run for twelve (12) months, will begin.

For the purposes of this quarterly report which includes updated schedule information, Phases IIA and IIB activities have been combined into Phase II as was done in Quarterly Report Number 4. Phase IIA is considered to be complete.

Figures 1, 2, and 3 represent the revised schedules for Phase I, Phase II (combined original Phases IIA and IIB) and Phase III respectively. The DOE LIMB Demonstration Project Extension schedule has been lengthened by three (3) months, from a total of forty-three (43) months to forty-six (46) months, because the start of Coolside testing has been delayed to complete EPA LIMB testing.

A complete Statement of Work is included in Section III, Project Description of the first quarterly report for the project, dated September 15, 1987. It provides the reader, who is not familiar with the project, a complete description of the tasks and subtasks to be undertaken.

4.0 PROJECT STATUS

The period covered by this project Quarterly Report Number 13 is May, June and July, 1990. Progress will be discussed on a task basis for each of Phases I, II and III.

4.1 PHASE I - DESIGN AND PERMITTING (WBS 1.1)

Phase I entails project management, Coolside system design, LIMB system preparation and permitting activities.

4.1.1 Task 1 - Project Management (WBS 1.1.1)

The twelfth quarterly report covering the period of February, March, and April, 1990 for this project was completed and issued to DOE PETC in June, 1990.

4.1.1.1 SUBTASK 1.1 - COOLSIDE MANAGEMENT AND REPORTING (WBS 1.1.1.1).

The activities under this subtask are complete.

4.1.1.2 SUBTASK 1.2 - LIMB EXTENSION MANAGEMENT AND REPORTING (WBS 1.1.1.2).

The activities under this subtask are complete.

4.1.2 Task 2 - Coolside System Design (WBS 1.1.2)

Coolside system design includes sorbent selection, pilot performance tests and detailed engineering.

4.1.2.1 SUBTASK 2.1 - TEST PROGRAM DEVELOPMENT (WBS 1.1.2.1).

The activities under this subtask are complete.

4.1.2.2 SUBTASK 2.2 - CONSOL TECHNOLOGY TRANSFER (WBS 1.1.2.2).

The activities under this subtask are complete.

4.1.2.3 SUBTASK 2.3 - DETAILED ENGINEERING (WBS 1.1.2.3). This subtask is 99% complete. Only updating drawings to as-built conditions remain to be completed.

4.1.3 Task 3 - LIMB System Preparation (WBS 1.13)

The LIMB system preparation activities are designed to update the current LIMB system documentation in use for the EPA testing.

4.1.3.1 SUBTASK 3.1 - TEST PROGRAM DEVELOPMENT (WBS 1.1.2.1) The activities under this subtask are complete.

4.1.3.2 SUBTASK 3.2 - COALS/SORBENTS SELECTION (WBS 1.1.3.2) The activities under this subtask are complete.

4.1.4 Task 4 - Permitting and Licensing (WBS 1.1.4)

Permitting activities are focused on waste characterization to develop the information necessary to fulfill permit requirements. In addition, efforts to fulfill project environmental monitoring requirements are addressed in this task.

4.1.4.1 SUBTASK 4.1 - COOLSIDE PERMITTING (WBS 1.1.4.1).

The activities under this subtask are complete.

4.2 PHASE II COOLSIDE & LIMB CONSTRUCTION, START-UP AND SHAKEDOWN (WBS 1.2)

Phase II consists of actual construction of the Coolside system, including the humidifier, followed by start-up and shakedown activities which make the system ready for the testing program.

4.2.1 Task 1 - Project Management (WBS 1.2.1)

Project management activities pertain to both the Coolside and LIMB construction, start-up and shakedown efforts.

4.2.1.1 SUBTASK 1.1 - COOLSIDE MANAGEMENT AND REPORTING (WBS 1.2.1.1).

The activities under this subtask are complete.

4.2.1.2 SUBTASK 1.2 - LIMB EXTENSION MANAGEMENT AND REPORTING (WBS 1.2.2.1). The activities under this subtask are complete

4.2.2 Task 2 - Coolside Construction & Start-Up (WBS 1.2.2)

Coolside start-up and construction activities include materials procurement during construction plus installation of the Coolside sorbent feed system and humidifier bypass system.

4.2.2.1 SUBTASK 2.1 - MATERIALS PROCUREMENT (WBS 1.2.2.1).

The activities under this subtask are complete.

4.2.2.2 SUBTASK 2.2 - SORBENT FEED SYSTEM INSTALLATION (WBS 1.2.2.2). It is noted that a significant portion of the existing LIMB sorbent feed system will be used for Coolside. The equipment includes the LIMB sorbent storage silo and the pneumatic conveying system that brings sorbent to the feed silo. The present feed silo and the dilute phase metering and pneumatic conveying systems up to the present distributor bottles will also be utilized for the Coolside demonstration.

The Coolside sorbent feed system installation includes the installation of new piping from the end of the present dilute phase pneumatic conveying system to a point in the bypass duct upstream of the humidifier. This piping includes another distributor bottle to assure good sorbent distribution in the humidifier. The distributor bottle will allow multiple injection points into the duct as opposed to a single injection point.

A second system that is considered part of Coolside equipment requirements is the ash recycle system. This system will recycle a portion of the ash collected in the electrostatic precipitator back to the inlet of the humidifier bypass duct. It is made up of an ash pneumatic conveying system, delivery piping to the inlet of the bypass duct, and another distributor bottle.

The activities under this subtask are complete.

4.2.2.3 SUBTASK 2.3 - BYPASS INSTALLATION (WBS 1.2.2.3). The bypass duct construction was completed and the duct was placed into service during EPA LIMB testing with humidification.

The activities under this subtask are complete.

4.2.2.4 SUBTASK 2.4 - START-UP AND SHAKEDOWN (WBS 1.2.2.4). The activities under this subtask are complete.

4.2.3 Task 3 - LIMB System Start-Up (WBS 1.2.3)

Effort under this task is anticipated to be minimal, since the LIMB system will have been operational for the EPA base LIMB program prior to this testing. Nevertheless, some preparation and change over will be necessary in shifting from the DOE Coolside testing to the LIMB Demonstration Extension Testing.

4.2.3.1 SUBTASK 3.1 - MATERIALS PROCUREMENT (WBS 1.2B.3.1). The coals and sorbents will be procured under this subtask. Activities will include arranging transportation, scheduling and expediting deliveries, storage at the site, verifying that materials meet specifications, etc.

The objective of this subtask is to finalize the procurement of three (3) different coals and four (4) different sorbents.

B&W Project Management placed a requisition for calcitic limestone originating in St. Genevieve, Mo., after failing to find an adequate stone for testing in Ohio. Maximum available fineness was 58 to 73 percent passing through 325 mesh. Also, a requisition was placed for Type-N dolomitic hydrated lime produced in Genoa, Ohio.

A purchase order was placed with Marblehead Lime Company for calcitic hydrated lime to be used in future LIMB Extension testing.

4.2.3.2 SUBTASK 3.2 - PREOPERATION PREPARATIONS (WBS 1.2B.3.2). Activities under this subtask will include inspection of equipment and instrumentation, and repair or replacement of system components where necessary prior to beginning LIMB Extension testing.

The sorbent feed system delivery points will need to be changed from the Coolside injection area upstream of the humidifier back to the upper regions of the boiler for LIMB operation.

The objective of this subtask is to prepare the LIMB equipment for continuous operation after Coolside testing is complete.

The work scope of this task was revised to include an upgrade to the lime feed system involving material and labor costs. The upgrade is expected to significantly increase the feed system reliability and capacity for the LIMB Extension program.

The scope of work involved rebuilding a used Fuller-Kinyon lime pump from another B&W project to replace one of the two rotary air-locks on the discharge side of the Acrison feeders. The weight of the pump and the additional density of limestone required reinforcement and load distribution additions to the building structure.

The majority of the work on the upgrade of the lime feed system was completed during the last quarter. This included all engineering, fabrication, structural work and most of the installation. In this quarter the installation of the 200mm Fuller-Kinyon feed pump was completed with the finalization of the electrical power wiring. The Network 90 controls were modified to run either or both Acrison feeders through the Fuller-Kinyon pump.

4.2.3.3 SUBTASK 3.3 - START-UP AND SHAKEDOWN (WBS 1.2B.3.3). Start-Up and check-out of any equipment or instrumentation that was repaired or replaced during the previous subtasks will be done. Since the first series of coal and sorbent combinations that will be tested will use the EPA Base LIMB coal, little or no shakedown of the coal feed system and burner system will be necessary. Some adjustment to new sorbent may be required. Later in the project when the coal is changed, shakedown will be necessary as is typical with any coal change at the plant.

The objective of this subtask is to begin operation of the LIMB system to verify system capability for continuous operation.

The 200mm Fuller-Kinyon lime feed pump was tested for capacity and it was found necessary to resheave the v-belt drive to increase its speed to handle the low density, very fine material. A capacity of 18,000 lbs/hr of lignosulfonated hydrated lime was obtained using both feeders. Staggering the fill cycle of the two feeder-hoppers was found to prevent flooding. The F-K lime feed pump was operated for two (2) days on lignosulfonated hydrated lime before testing was switched to limestone. The pump easily handled the higher density limestone. LIMB Extension start-up began on April 18, 1990 using the standby feed system utilizing the old rotary airlock valve. Equipment operation and capacity were checked. High sulfur coal was loaded into the bunkers on April 26, 1990.

4.3 PHASE III - OPERATION, DATA COLLECTION, REPORTING AND DISPOSITION (WBS 1.3)

Phase III entails the actual testing of the Coolside process for an approximate four (4) month period followed by an additional twelve (12) month period of LIMB Demonstration Project Extension testing. Phase I - Design and Permitting and Phase II - Construction and Start-up will have been substantially completed by the provided scheduled start date of Phase III providing the ground work to begin testing.

4.3.1 Task 1 - Project Management (WBS 1.3.1)

Project management activities pertain to both the Coolside and LIMB Extension operation, data collection, reporting and disposition.

4.3.1.1 SUBTASK 1.1 - COOLSIDE MANAGEMENT AND REPORTING (WBS 1.3.1.1)

There was no activity under this subtask during this quarter.

4.3.1.2 SUBTASK 1.2 - LIMB EXTENSION MANAGEMENT AND REPORTING (WBS 1.3.1.2)

On July 20th work began on the three week unit outage program. The humidification lance outer "skin" casings were found to be severely corroded and needed to be replaced before full testing, with humidification, continued. A requisition for new casings, including stainless alloys, was issued and quotes were reviewed. A complete rebuilt set of lances, with ceramic internals, is scheduled by the end of September, 1990. The following work on the LIMB system was also accomplished during the outage.

- Perform maintenance on the XCL burners.
- Move LIMB injection nozzles to a higher elevation.
- Install by-pass around the ash booster pumps.

4.3.2 Task 2 - Coolside Operation and Evaluation (WBS 1.3.2)

Activities under this task will be directed at setting the Coolside operating parameters and demonstrating and evaluating Coolside technology.

4.3.2.1 SUBTASK 2.1 - OPTIMIZATION (WBS 1.3.2.1). Following the Start-up, which was covered as part of Phase II, B&W will demonstrate that the equipment is capable of operating within the design range and will make modifications that it deems necessary. This activity pertains to the Coolside sorbent feed system, the ash recycle equipment and the caustic injection system. Operating characteristics of greatest importance are the sorbent and ash recycle distribution achieved at the inlet to the humidifier and ease of handling of the ash at low approaches to saturation temperature. It is as a result of these concerns that modifications may become necessary.

The activities under this subtask are complete.

4.3.2.2 SUBTASK 2.2 - TESTING PROGRAM (WBS 1.3.2.2).

Demonstration of the Coolside process was completed on February 16, 1990.

4.3.2.3 SUBTASK 2.3 - EVALUATION AND REPORTING (WBS 1.3.2.3). Evaluation of the test data generated from the four (4) month test program will include: 1) data reduction and 2) a determination of the overall effectiveness of the tested Coolside process.

Upon completion of the data evaluation, a Final Report will be written that addresses the technical performance of the Coolside System, an evaluation of the System in terms of its design, capital and operating costs, operational and maintenance features.

At the completion of Coolside testing, Consol began evaluating the data taken during the Coolside testing program. Due to problems with data analysis, release of the draft of the Coolside topical report from Consol to B&W is not expected until late September, 1990. Release to DOE is expected in October, 1990.

4.3.2.4 SUBTASK 2.4 - DISPOSITION (WBS 1.3.2.4). After completion of all Coolside testing, the disposition of the sorbent injection system will be determined.

This subtask is complete.

4.3.3. Task 3 - LIMB Extension Operation and Evaluation (WBS 1.3.3.).

4.3.3.1 SUBTASK 3.1 - TESTING PROGRAM (WBS 1.3.3.1). Three (3) coals and four (4) sorbents will be tested during an approximate twelve (12) month period. One promoted sorbent will be tested with the EPA Base LIMB 3.0%-sulfur coal.

Each remaining coal/sorbent combination will be tested for approximately one (1) month. The one month of testing will be divided into three (3) distinct test periods - Change-over, Optimization and Continuous Operation.

LIMB Extension testing continued during the quarter. Four-hundred and twenty-eight (428) hours of LIMB operation occurred during May, four hundred and seventy-eight (478) hours in June, and forty-three (43) hours in July.

In May, LIMB was available for service whenever the boiler was in operation. LIMB Extension testing with lignosulfonated hydrated lime and 3% sulfur coal was completed on May 25, 1990. Pulverized limestone was delivered to the Edgewater plant and entered into the feed system for testing on May 29, 1990.

During the month, LIMB Extension testing was run under the following conditions:

1. Lignosulfonated hydrated lime, May 1st to May 25th

    a. Calcium hydroxide to sulfur dioxide molar ratios from 1.0 to 2.0

    b. Humidifier outlet temperatures from 145°F to 275°F

    c. Unit loads from 50 MW to 100 MW

Sulfur dioxide removal was noted to be equivalent to the results found during EPA, base LIMB testing.

2. Pulverized limestone, May 29th to May 31st

    a. Calcium hydroxide to sulfur dioxide molar ratios from 1.0 to 2.0

    b. Humidifier outlet temperature, 275°F

    c. Unit loads from 42 MW to 100 MW

Sulfur dioxide removal efficiencies were lower than expected.

In June, LIMB was available for service whenever the boiler was in operation. Testing continued with pulverized limestone at all three injection levels., 181 ft., 187 ft., and 191 ft., with 3% and 1.8% sulfur coals.

During the month, LIMB Extension testing was run under the following conditions:

1. Pulverized limestone, June 1st to June 30th

    a. Calcium hydroxide to sulfur dioxide molar ratios from 1.0 to 2.0

    b. Humidifier outlet temperature, 145°F to 275°F

    c. Unit loads from 41 MW to 102 MW

Sulfur dioxide removal efficiencies remained lower than expected while testing with pulverized limestone and without humidification. A slight increase in performance was noted while injecting at the 187' elevation level. An improved amount of sulfur dioxide capture was noted during the tests conducted with the humidifier outlet temperature of 145°F.

In July, testing with pulverized limestone was completed using 3% sulfur coal and then switched to 1.8% sulfur coal to maintain the Edgewater plant's thirty (30) day rolling average for SO_2 emissions compliance. Shakedown and testing of hydrated dolomitic lime began in mid July and continued until the start of the scheduled unit outage on July 20, 1990.

During the month, LIMB Extension testing was run under the following conditions:

1. Pulverized limestone, July 1st to July 16th

    a. Calcium dioxide to sulfur dioxide molar ratio at 1.0

    b. Humidifier off

    c. Unit load, 98 MW

2. Hydrated dolomitic lime July 17th to July 20th

    a. Calcium hydroxide to sulfur dioxide molar ratio at 2.0

    b. Humidifier outlet temperature, 235°F to 250°F

    c. Unit load, 98 MW

Radian Corporation continued to monitor emissions and to implement the environmental monitoring plan.

4.3.3.2 SUBTASK 3.2 - EVALUATION AND REPORTING (WBS 1.3.3.2). Evaluation of the test data generated from the twelve (12) month program will include: 1) data reduction, 2) a technoeconomic study of test results, and 3) a determination of the overall effectiveness of the tested LIMB process in achieving the project performance goals. Upon completion of the evaluation, a detailed report will be prepared.

This activity is not scheduled to occur as yet.

4.3.3.3 SUBTASK 3.3 - DISPOSITION (WBS 1.3.3.3). After completion of the LIMB Extension testing, disposal of all equipment installed as part of this contract will be determined during this subtask.

This activity is not scheduled to occur as yet.

5.0 PLANNED ACTIVITIES

Planned activities for the next quarter, August, September, October, 1990, will include the completion and release of Phase III Coolside topical report and the continuation of Phase III LIMB Extension testing program.

In August, LIMB Extension testing will resume after completion of Ohio Edison's scheduled unit outage. During the outage, the discovery of corroded atomizer lance airfoil casings set back the schedule for returning them to service until late September, 1990. Stainless steel casings will now be supplied in addition to the original rebuild with wear-resistant ceramic internals in the atomizers.

In August and September, LIMB Extension operations will include testing without humidification using dolomitic hydrated lime while firing 1.6 percent sulfur coal. If precipitator performance and stack opacity remains satisfactory long enough to collect usable data, testing will continue. If stack opacity excursions limit testing, testing will be stopped until humidification is available. Testing with humidification using dolomitic lime and firing 3 percent sulfur coal will occur in October.

Consol will continue to work on the Coolside topical report. The first draft is expected to be released to B&W in late September. Release of the Coolside topical report to DOE is expected to occur in October. Radian will continue emissions and environmental monitoring during all testing.

In September, B&W will submit to the DOE revised Phase I and Phase II cost plans, a Phase III cost plan, and cost performance report.

6.0 SUMMARY

Phase I - Design and Permitting - is essentially complete. Activities were limited to updating drawings.

Phase II - Construction, Shakedown and Start-Up activities were completed with the finalization of material procurement and the installation of the lime feed system upgrade and start-up.

Phase III - Operation, Data Collection, Reporting and Disposition - activities continued with Consol writing the Coolside Topical report and LIMB Extention testing using three (3) different sorbent and 1.8% and 3% sulfur coal.

FIGURE 1

Phase I - Design & Permitting

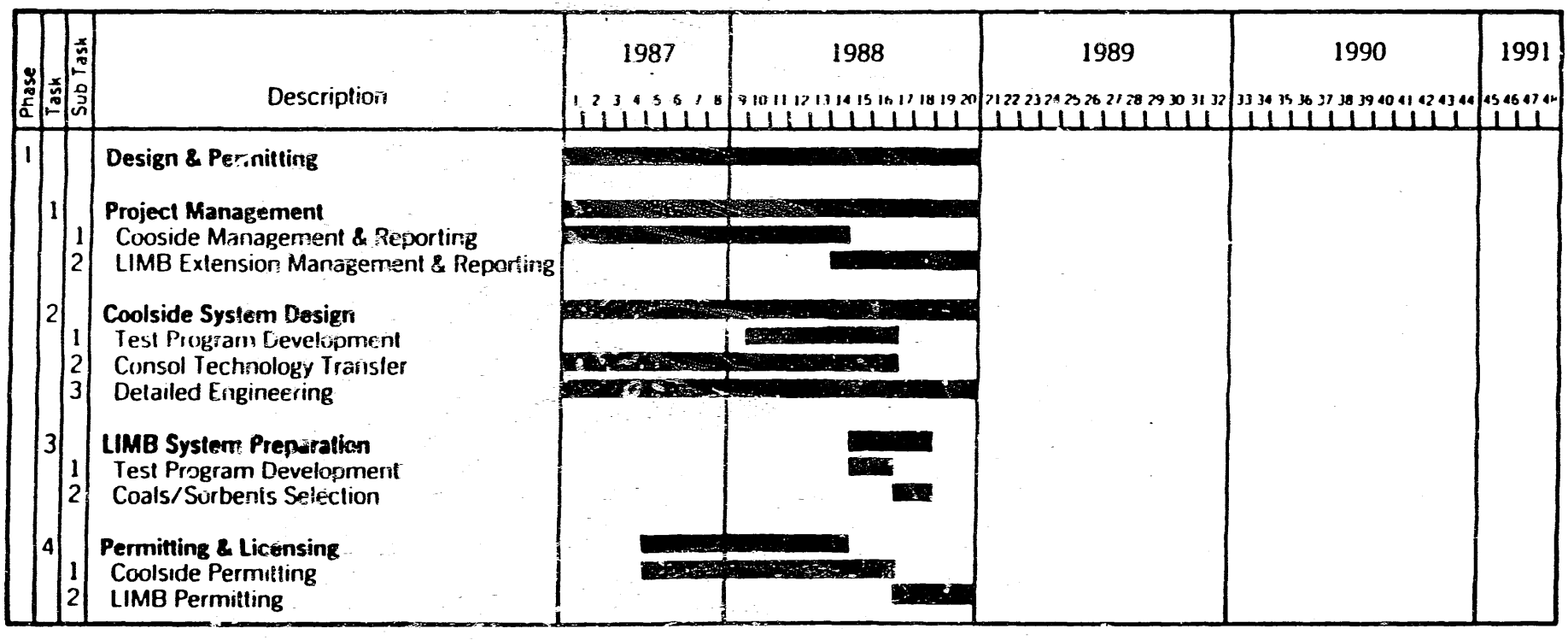


FIGURE 2

Phase II - Coolside/LIMB Construction, Start-Up & Shakedown

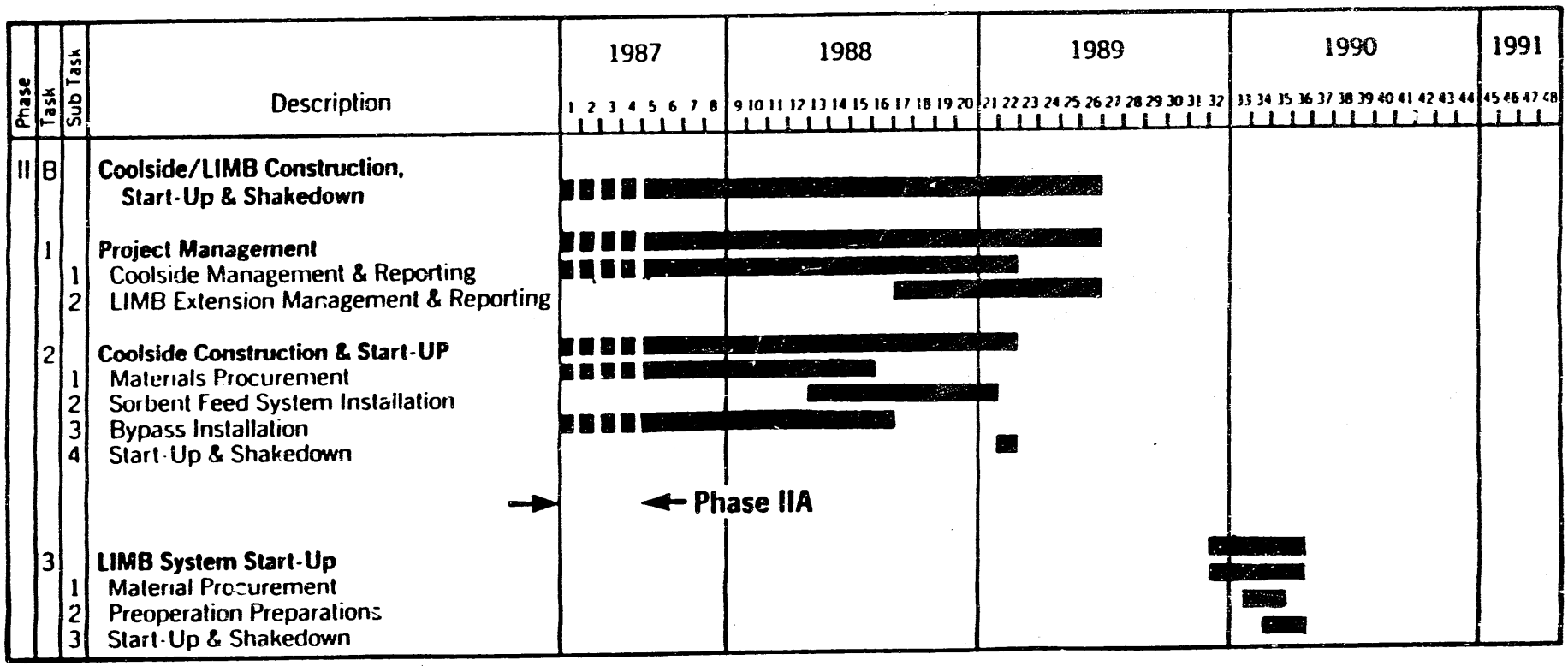
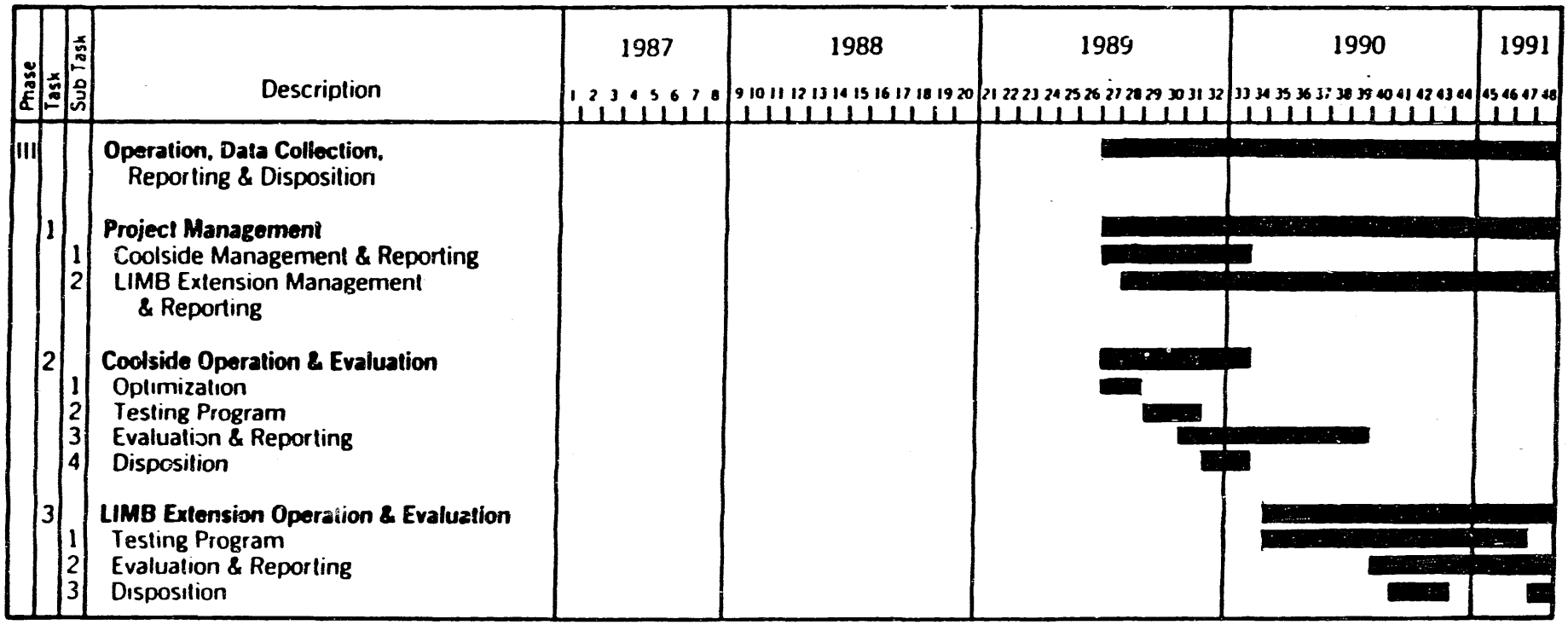


FIGURE 3

Phase III - Operation, Data Collection Reporting & Disposition



END

DATE FILMED

12/10/90