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AQUATECH

Allied Signal

Allied-Signal Inc.
AQUATECH Systems
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July 26, 1993

Quarterly Report Period January - March, 1993

CONTRACT TITLE AND NUMBER:

SOXAL Combined SOx/NOx Flue Gas Control Demonstration

DE AC 22-91 PC 91347

Contractor Name: AQUATECH Systems
7 Powder Horn Drive
Warren, NJ 07059-5191

Contract Period: 9-10-91 - 7-1-93

1. Contract Objective: No Change

Summary of Work -

AQUATECH Systems a business unit of Allied-Signal Inc., proposes to demonstrate the technical viability and cost effectiveness of the SOXAL process a combined SO_x/NO_x control process on a 3 MW equivalent flue gas slip stream from Niagara Mohawk Power Corporation, Dunkirk Steam Station Boiler #4, a coal fired boiler. The SOXAL process combines 90+% sulfur dioxide removal from the flue gas using a sodium based scrubbing solution and regeneration of the spent scrubbing liquor using AQUATECH Systems' proprietary bipolar membrane technology. This regeneration step recovers a stream of sulfur dioxide suitable for subsequent processing to salable sulfur or sulfuric acid.

Additionally 90+% control of NO_x gases can be achieved in combination with conventional urea/methanol injection of NO_2 gas into the duct. The SOXAL process is applicable to both utility and industrial scale boilers using either high or low sulfur coal.

The SOXAL demonstration Program began September 10, 1991 and is approximately 22 months in duration.

During the 6 months of scheduled operations period, expected to begin January 1992, data will be collected from the SOXAL system to define:

MASTER

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1) SO_2 and NO_x control efficiencies

2) Current efficiency for the regeneration unit.

3) Sulfate oxidation in the absorber.

4) Make-up reagent rates.

5) Product quality including concentrations and compositions.

6) System integration and control philosophy

7) Membrane stability and performance with respect to foulants.

A conceptual design for a commercial unit as well as estimated costs will be prepared as part of the final report. The program is expected to be concluded by September 1993.

Technical Approach Changes: No Change

Contract (by reporting element):

Task 1: Program Definition - Complete

Task 2: Engineering, Design and Construction

Subtask 2.1: Engineering, Design and contracting

- Complete

Subtask 2.2: Procurement, Fabrication & Detail Design

- Complete

Subtask 2.3: Site Work

-- Complete.

Subtask 2.4: Installation

-- Complete

Installation of NO_2 Injection System was completed by March 26, 1993.

Task 3: Shakedown, Parametric Testing, and Disassembly

Subtask 3.1: Shakedown

Process shakedown was completed in December 1992. However, several key items have not yet been satisfactorily commissioned. The Lear-Siegler gas analyzer has not yet operated. The NO_2 injection system will be checked out and commissioned in June.

Subtask 3.2: Parametric Tests

Parametric testing commenced on January 6, 1992. Between January 8 and March 5, the pilot plant was operated continuously (7 days per week, 24 hours per day). The plant was easy to operate and control. However, several problems made data collection difficult. These included the lack of any gas analyses, unreliable flow sensors, and inappropriate materials of construction.

Despite many service calls, Lear-Siegler was not able to provide us with a functioning instrument. Reportedly, their PLC programming was causing most of the problems. However, during the short intervals when the analyzer provided measurements, they

did not agree with those of Niagara Mohawk's CEM.

We have had two types of problems with Hoffer flow meters. Initially, we used PVC turbine sensors to measure feed and product rates from the Process skid. During January, several of these sensors broke. Subsequently, we replaced the sensors with 316 stainless steel sensors. Mechanical reliability has been improved. However, we frequently find that electronics on the various circuit boards are failing.

Materials of construction problems have shown up as two types. During January, we found that a number of parts in the piping (fittings, regulators, etc.) were carbon steel, not stainless as specified. All of these parts have corroded and have been replaced. Additionally, we found that 316SS is not appropriate in few spots in our system. Specifically, exposure to hot (>100° F) sulfurous acid in turbulent flow causes gradual corrosion.

Niagara Mohawk shut down Unit No. 4 boiler on March 5 and is scheduled to resume operations on April 7. During the shutdown, we addressed a number of major and minor problems affecting plant operation. Most notably, we arranged for an outside CEM service (Acres International) to provide analyses of our inlet and outlet gas streams. Additionally, we had engineering companies (United Engineers and Constructors, Radian Corporation) review plant equipment and operations. They have recommended a number of minor instrumentation changes to improve control and reliability of the plant.

milestones removed.

Clifford M. Denker
Program Manager

CMD:cml

Attachments:
Milestone Schedule - March 1993