DE-AC22-92PC91338--18

# High $SO_2$ Removal Efficiency Testing

## Quarterly Report
## October 1 - December 31, 1996

**By**
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**Technical Progress Report - October - December 1996**

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## 1.0 INTRODUCTION

This document provides a discussion of the technical progress on DOE/PETC project number DE-AC22-92PC91338, "High Efficiency $SO_2$ Removal Testing," for the time period 1 October through 31 December 1996. The project involves testing at six full-scale utility flue gas desulfurization (FGD) systems, to evaluate low capital cost upgrades that may allow these systems to achieve up to 98% $SO_2$ removal efficiency. The upgrades being evaluated mostly involve using performance additives in the FGD systems.

The "base" project involved testing at the Tampa Electric Company's Big Bend Station. All five potential options to the base program have been exercised by DOE, involving testing at Hoosier Energy's Merom Station (Option I), Southwestern Electric Power Company's Pirkey Station (Option II), PSI Energy's Gibson Station (Option III), Duquesne Light's Elrama Station (Option IV), and New York State Electric and Gas Corporation's Kintigh Station (Option V). The originally planned testing has been completed for all six sites. However, additional testing has been planned at the Big Bend Station, and that testing commenced during the current quarter.

The remainder of this document is divided into four sections. Section 2, Project Summary, provides a brief overview of the status of technical efforts on this project. Section 3, Results, summarizes the outcome from technical efforts during the quarter, or results from prior quarters that have not been previously reported. In Section 4, Plans for the Next Reporting Period, an overview is provided of the technical efforts that are anticipated for the first quarter of calendar year 1996. Section 5 contains a brief acknowledgment.

## 2.0 PROJECT SUMMARY

On the base program, testing was completed at the Tampa Electric Company's (TECo) Big Bend Station in November 1992. The upgrade option tested was DBA additive. Additional testing is planned at this site, and that testing was begun during the last quarter of calendar year 1996. However, due to operating difficulties with the FGD system and test equipment problems, this testing was stopped after only four days. These problems are being resolved, and the testing is anticipated to resume in March 1997.

For Option I, at the Hoosier Energy Merom Station, results from another program co-funded by the Electric Power Research Institute (EPRI) and the National Rural Electric Cooperative Association have been combined with results from DOE-funded testing. Three upgrade options have been tested: DBA additive, sodium formate additive, and high pH set-point operation. All testing was completed by November 1992. There were no activities for this site during the current quarter.

Option II involved testing at the Southwestern Electric Power Company Pirkey Station. Both sodium formate and DBA additives were tested as potential upgrade options. All of the testing at this site was completed by May 1993. There were no activities for this site during the current quarter.

On Option III, for testing at the PSI Energy Gibson Station, testing with sodium formate additive was completed in early October 1993, and a DBA additive performance and consumption test was completed in March 1994. There were no efforts for this site during the current quarter.

Option IV is for testing at the Duquesne Light Elrama Station. The FGD system employs magnesium-enhanced lime reagent and venturi absorber modules. An EPRI-funded model evaluation of potential upgrade options for this FGD system, along with a preliminary economic evaluation, determined that the most attractive upgrade options for this site were to increase thiosulfate ion concentrations in the FGD system liquor to lower oxidation percentages and increase liquid-phase sulfite alkalinity, and to increase the venturi absorber pressure drop to improve gas/liquid contacting. Parametric testing of these upgrade options was conducted in March 1994. There were only reporting activities for this site during the current quarter.

Option V is for testing at the NYSEG Kintigh Station. Baseline testing was conducted in July 1994. Parametric testing at this site was conducted in late August, and a sodium formate additive consumption test was conducted in September 1994. There were only reporting activities related to this site during the current quarter.

## 3.0 RESULTS

Results from the base program (at the TECo Big Bend Station) and the first optional site (Hoosier Energy Merom Station) were presented in detail in the April 1993 quarterly Technical Progress Report, and updates were included in the July 1993 and October 1993 reports. The additional testing planned for the Big Bend site began in late October, but was stopped after four days because of various problems. This effort is briefly described below.

For the second optional site (the Southwestern Electric Power Company Pirkey Station), results were presented in the July 1993 quarterly Technical Progress Report and updated in the October 1993 report.

For the third optional site (the PSI Energy Gibson Station), baseline testing was conducted in May 1993, and those results were presented in the July 1993 quarterly report. Parametric testing at this site was completed in early October 1993, and these results were discussed in the January 1994 Technical Progress Report. A DBA performance and consumption test was conducted in February and March of 1994. Preliminary results from this test were discussed in the April 1994 Technical Progress Report. An update of the results from this site was presented in the April 1995 quarterly report.

Baseline testing at the fourth optional site (Duquesne Light's Elrama Station) was completed in July 1993. Those results were discussed in the October 1993 quarterly report. The results of EPRI-funded FGDPRISM modeling and preliminary economic evaluations of potential upgrades for this FGD system were discussed in the January 1994 Technical Progress Report. In March of 1994, parametric testing of the most promising upgrade options was conducted. The preliminary results of these tests were discussed in the April 1994 Technical Progress Report. A draft Technical Note for this site was submitted to DOE in January 1995. An overview of new results presented in this draft Technical Note was included in the Technical Progress Report for the time period October through December 1994, dated 3 February 1995.

For the fifth optional site at the New York State Electric and Gas Corporation's (NYSEG's) Kintigh Station, baseline, parametric, and additive consumption tests were completed during the third quarter of 1994. Results from the baseline testing at this site were discussed in the Technical Progress Report for the third quarter of calendar year 1994, dated December 1994. The parametric and additive consumption tests at this site were also completed late in the third quarter. These results were discussed in the April 1995 quarterly Technical Progress Report. Late in the fourth quarter of calendar year 1994, FGDPRISM modeling of the Kintigh FGD system was completed, as were the economic evaluations of potential upgrade options for this site. A draft report discussing these results was submitted to DOE and to NYSEG in the first quarter of calendar year 1995. These results were discussed in the quarterly Technical Progress Report dated July 1995.

There are no significant new project results to present this quarter. The following is a brief discussion of the problems encountered in the four days of testing at TECo's Big Bend Station that were conducted in late October. An overview of the plan for this testing was included in the Technical Progress Report dated July 1996.

## 3.1 Testing at TECo's Big Bend Station

For the base project at Tampa Electric's Big Bend Station, the major ongoing activity has been the planned longer-term demonstration of high-efficiency $SO_2$ removal operation at this site. The high-efficiency operation being demonstrated is the use of performance additives and other low capital cost modifications to allow the existing FGD system to operate at higher flue gas velocities. This in turn would allow the existing FGD system to scrub flue gas from another, unscrubbed unit at this station.

This demonstration finally began late in October but was stopped after only four days of testing due to problems with the test absorber and with some of the sampling equipment. The test absorber was experiencing lower than expected $SO_2$ removal operation, apparently due to a condition called "sulfite blinding" of the limestone reagent. This in turn was apparently caused by an inadequate ratio of oxygen in the forced oxidizing air to $SO_2$ removed in the absorber. TECo will modify the oxidizing air scheme during an outage planned for February in an attempt to increase this ratio.

The second problem was a failure of Koch Engineering's Phase Doppler Particle Analyzer, which is to be used to quantify droplet carryover rates from the test absorber mist eliminator as a function of flue gas velocity. This analyzer will be repaired prior to a restart of the ultra-high velocity testing, which will most likely be in March 1997.

## 4.0 PLANS FOR THE NEXT REPORTING PERIOD

Scheduled efforts during the first quarter of calender year 1997 will consist of project management and reporting, and a second attempt to conduct the additional testing at the TECo Big Bend (base program) site. As described in previous Technical Progress Reports, there is a plan to demonstrate high-efficiency $SO_2$ removal operation for a longer period of time (up to six months) at that site. A three-week intensive test period will likely be completed in March, and longer-term monitoring of the system performance should continue into the second and third quarters of calendar year 1997.

Options I and II (Hoosier Energy's Merom Station, SWEPCo's Pirkey Station, respectively) are in final reporting phases. No efforts are expected for these options during the next quarter.

For the PSI Energy Gibson Station (Option III), a Technical Note summarizing results from both the sodium formate and DBA performance and additive consumption tests was revised and resubmitted as a final report to DOE during the second quarter of calendar year 1996. A draft Topical Report for this site was also submitted. This draft Topical Report will be revised as necessary and reissued in final form during the next quarter.

A revised Technical Note for the Duquesne Light Elrama site (Option IV) was submitted to DOE and to Duquesne Light, and review comments were received during the previous quarter. A draft Topical Report for this site will be prepared during the next quarter.

For Option V, testing at the NYSEG Kintigh Station, a revised Technical Note was prepared and submitted as a final report during the second quarter of calendar year 1996. A draft Topical Report for this site has been prepared and will be submitted during the next quarter.

## 5.0 ACKNOWLEDGMENTS

Funding for the FGDPRISM modeling portion of this study is being provided by the Electric Power Research Institute.