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Project Summary

Technical and Economic Evaluation of Organic Acid Addition to a Commercial FGD System

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This report summarizes the results of organic acid addition tests at a commercial FGD system. The tests were conducted at San Miguel Electric Cooperative's 410 MW lignite-fired Unit 1, outside Jourdanton, TX. During the program, several organic acid mixtures were tested over a range of operating conditions to determine if the use of organic acids would allow San Miguel to reduce FGD system operating costs. Based on the test results, a cost analysis indicated that the use of organic acid addition at San Miguel will result in a first-year cost savings of over $600,000. In terms of cumulative net present worth, the estimated savings over a 15-year period will be $7.2 million in 1984 dollars.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

A test program was conducted to evaluate the technical and economic aspects of organic acid addition to San Miguel Electric Cooperative's Unit 1 wet limestone FGD system. This program, sponsored by EPA's Air and Energy Engineering Research Laboratory, marked the first time organic acids have been used in an FGD system in an attempt to reduce operating costs. As part of the program, three different organic acids were tested over a range of operating conditions, and measurements were made to permit changes in operating costs to be quantified. The results of this program have shown that a substantial reduction in costs can be realized by San Miguel through the continued use of organic acids in the FGD system. The estimated first year cost savings for San Miguel are $600,000. Over a 15-year period, this translates into a net present worth of $7.2 million in 1984 dollars. Most of these savings are either directly or indirectly attributable to a reduction in limestone consumption by the San Miguel FGD system. As a result of the test program at San Miguel, the utility has installed a permanent organic acid addition system and has plans for continued use of organic acids.

Background

As part of an earlier economic study sponsored by EPA, the San Miguel FGD system was identified as a good candidate for a program designed to reduce operating costs through the use of organic acids. The primary reason San Miguel was so identified was that the system was operating at a very high limestone stoichiometry. Based on the limestone stoichiometries reported by San Miguel and previous data on the effects of organic acids in FGD systems, an initial analysis showed that the cost savings which could result from reduced limestone consumption would more than offset costs associated with the use of organic acids. The

initial study also showed the potential for San Miguel to improve FGD system operation and reduce maintenance expenditures by operating at low stoichiometries (which should have been possible once organic acids were added to the system). Because of the potential benefits associated with organic acid addition, San Miguel agreed to participate in a test program to evaluate the use of organic acids in the Unit 1 FGD system.

Test Program

The test program conducted at San Miguel included eight tests with organic acids and baseline measurements to quantify the performance of the FGD system without organic acids present. The three organic acids tested were:

- A mixture of dibasic acids supplied by DuPont Petrochemicals of Victoria, Texas. The major components of this mixture were adipic (15 wt%), succinic (25 wt%), and glutaric (60 wt%) acids.
- A mixture of dibasic and monobasic acids supplied by Badische Corporation of Freeport, Texas. The major components of this mixture were adipic (45 wt%) and hydroxycaproic (35 wt%) acids.
- An organic acid stream composed primarily (80 wt%) of dibasic maleic acid supplied by Badische Corporation.

The results of the tests with these three acid mixtures over a range of test conditions permitted an economic analysis to identify the most cost effective additive and mode of operation for the San Miguel FGD system.

Test Results

The major results of the San Miguel test program can best be summarized by a cost comparison of the three additives tested. These results are shown in Table 1. This table presents estimated 15-year net present worth of the cost savings for each additive tested. The costs and savings are calculated for actual test conditions and they represent annualization of measurements made during individual tests. For the two Badische additives, the costs represent the only conditions examined during the test program.

As shown in Table 1, the estimated cost savings for each additive include costs for the organic acid and capital charges for the organic acid addition system. As mentioned earlier, the savings shown result primarily from reduced limestone consumption. These savings include:

- Reduced limestone reagent costs.
- Reduced costs for operation of the limestone grinding circuit.
- Reduced costs for sludge disposal since less limestone is present in the FGD waste.
- Reduced costs for operation of the dewatering area of the FGD system for the same reason.

These represent the major savings. Savings also resulted from San Miguel's ability to bypass flue gas around the FGD system, thereby reducing the energy required for reheating the scrubbed flue gas. This bypass was made possible by the improved SO_2 removal in the FGD system which resulted from organic acid addition.

An additional saving shown for the DuPont acid is a reduction in scrubber maintenance costs. This reduction is a result of reduced absorber and mist eliminator plugging which was attributed to the low pH (low stoichiometry) operating conditions made possible by using the DuPont acid. An equivalent saving is not shown for the Badische acids since it was not possible to operate at the same low pH's at the concentrations at which these additives were tested.

The net result of the organic acid addition test program at San Miguel is the potential for a substantial reduction in FGD system operating costs with any of the organic acids tested. The maximum saving is projected to result from use of the DuPont DBA. As a result of the test program at San Miguel and the economic analysis summarized in this document, San Miguel has made the use of the DuPont DBA material a part of the normal operation of the Unit 1 FGD system.

Table 1. Fifteen-Year Cumulative Net Present Worth for the Three Additives Tested at San Miguel

	Estimated Savings (costs) in $1000s		
	Acid/Buffer Capacity		
Cost Component[a]	DuPont DBA/ 600 ppm	EP-306/ 460 ppm	EP-501/ 125 ppm
Capital Investment	(215)	(215)	(215)
Organic Acid	(6093)	(3395)	(5054)
Limestone Reagent	6939	5949	4562
Limestone Grinding	1306	1120	859
Sludge Disposal	2523	2163	1659
Maintenance	752	--	--
Dewatering	353	303	232
Bypass Credit	1650	914	914
Total	7215	6839	2957

[a]All costs in mid-1984 dollars.

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The complete report, entitled "Technical and Economic Evaluation of Organic Acid Addition to a Commercial FGD System," (Order No. PB 85-191 724/AS; Cost: $13.00, subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
The EPA Project Officer can be contacted at:
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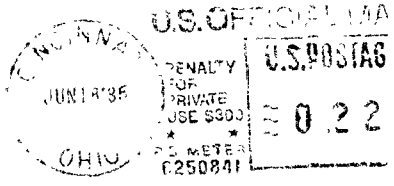

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