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# **Advanced Sulfur Control Concepts for Hot Gas Desulfurization Technology**

## **Quarterly Technical Progress Report**

**Submitted to**

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### 1. CONTRACT OBJECTIVE:

The objective of this project is to develop a hot-gas desulfurization process scheme for control of H<sub>2</sub>S in HTHP coal gas that can be more simply and economically integrated with known regenerable sorbents in DOE/METC-sponsored work than current leading hot-gas desulfurization technologies. In addition to being more economical, the process scheme to be developed must yield an elemental sulfur byproduct.

### 2. TECHNICAL APPROACH:

The Direct Sulfur Recovery Process (DSRP), a leading process for producing an elemental sulfur byproduct in hot-gas desulfurization systems, incurs a coal gas use penalty, because coal gas is required to reduce the SO<sub>2</sub> in regeneration off-gas to elemental sulfur. Alternative regeneration schemes, which avoid coal gas use and produce elemental sulfur, will be evaluated. These include (i) regeneration of sulfided sorbent using SO<sub>2</sub>; (ii) partial oxidation of sulfided sorbent in an O<sub>2</sub> starved environment; and (iii) regeneration of sulfided sorbent using steam to produce H<sub>2</sub>S followed by direct oxidation of H<sub>2</sub>S to elemental sulfur. Known regenerable sorbents will be modified to improve the feasibility of the above alternative regeneration approaches. Performance characteristics of the modified sorbents and processes will be obtained through lab- and bench-scale testing. Technical and economic evaluation of the most promising processes concept(s) will be carried out.

### 3. CONTRACT TASKS:

#### Phase I - Concept Assessment:

Completed.

#### Phase II:

##### Bench-Scale Sorbent Testing

The laboratory bench-scale test unit is undergoing maintenance activity to prepare it for testing of two candidate sorbents. A faulty gas chromatograph was repaired. The piping and instrumentation diagrams (P&ID's) for the unit are being reviewed and brought up-to-date. The data logging/ process control software was upgraded to a Y2K compliant version. The screen designs and log file formats were reprogrammed to be compatible with the upgraded software. The thermocouples and instrument signals were rewired to a new computer interface device that was required for compatibility with the Y2K compliant software.

Scaled-up batches of two (2) candidate sorbents, designated AHI-1 and AHI-2 were prepared and are ready for testing.

#### PSDF Field Test

Work continued on the renovation of the Mobile Laboratory for the Advanced Hot Gas Process (AHGP) field test. Automatic valves used for the control of coal gas into the trailer were temporarily re-installed in order to test the interface with the control panel.

The coal gas mass flow control scheme was programmed into the process control/data logging computer and the scheme was tested. It was discovered that the differential pressure transmitter was faulty. The manufacturer's tech service department determined that the electronic components were at fault, and may be covered by a warranty. However, a working transmitter was still not available after several weeks of discussion. The other automatic control loops (e.g., back pressure control valve) checked out fine.

#### General

A paper was prepared and submitted for presentation at the 4<sup>th</sup> International Symposium and Exhibition "Gas Cleaning at High Temperatures," to be held in Karlsruhe, Germany, in September, 1999. It covers the laboratory-scale and bench-scale work that RTI has done to develop the SO<sub>2</sub> regeneration-based AHGP. Recent results from the lab-scale testing of new sorbent formulations at Hampton University were also included.

#### **4. OPEN ITEMS**

The issue of a subcontract between RTI and Southern Company Services (SCS) was an open item throughout the quarter, and as of the end of June was not fully resolved. That subcontract, part of the DSRP development contract (DE-AC21-93MC-30010) was required in order for SCS to install the coal gas slip stream line that will also be used for the field test portion of the AHGP project. Because of the potential impact on the field test schedule of any further delay in establishing the subcontract, other approaches were investigated in order to establish a working relationship between RTI and SCS.

The current plan is that SCS will not be a subcontractor to RTI. Rather, the work that SCS was to perform would be de-scoped from the RTI contract, and added to an existing contract that SCS is operating. A "site access agreement" would be executed between SCS and RTI, but no funds would be exchanged between these parties, both of whom are separate, independent contractors to DOE. Draft site access agreements were passed between RTI and SCS, but as of the end of June, no agreement had been executed by both parties. The DSRP field test must proceed in order for the field test portion of this project to take place, as well.

**5. PLANS FOR NEXT QUARTER:**

- ! Continue the construction activities in the Mobile Laboratory including repaired or replaced differential pressure transmitter.
- ! Complete the planning for bench-scale testing (25 cycles each) of two candidate sorbents, AHI-1 and AHI-2, followed by a long duration test of one selected sorbent.
- ! Conduct the bench-scale testing of the two candidate sorbents.