MASTER

OPERATION, MODIFICATION, AND MAINTENANCE
OF
DOE/PETC 700 H.P. COMBUSTION TEST FACILITY
CONTRACT NO. EW-78-C-02-4740

QUARTERLY ACTIVITY REPORT
For the Period
April 2, 1979 to July 1, 1979
SECOND QUARTER

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BACKGROUND

The General Electric Company (MATSCO) was awarded the contract to operate, modify, and maintain the DOE/PETC 700 H.P. Combustion Test Facility. The 700 H.P. Combustion Test Facility was designed and built by the Department of Energy at Pittsburgh Energy Research Center and its ultimate success is the responsibility of DOE/PETC. G. E. Co/MATSCO will provide support to assist in the goal of successful operation of this pilot plant facility. The primary objective of the DOE/PETC 700 H.P. CTF is to establish the practicality of coal oil slurry combustion as a technically, economically, and environmentally feasible retrofit technology.

WORKSCOPE SUMMARY

The Contractor shall provide all things necessary for the operation, modification, and maintenance of the plant as provided in the Operating/Maintenance Manual, and carry out the experimental and developmental operations in said plant as directed by the DOE Technical Project Officer.

The operation, modification, and maintenance of the 700 H.P. CTF shall be in accordance with all applicable safety, health codes, standards, and regulations of DOE. The operation, modification, and maintenance shall include the following phases:

- a) Phase I - Preparatory Work - includes personnel staffing and training, preparation of detailed operating, maintenance, and safety manuals, purchase of tools, spare parts and initial operating supplies.
- b) Phase II - Start-Up and Adjustment Period - Check out and activation of all plant systems and subsystems including run-in adjustment and lubrication of all components, chemical cleaning and flushing of systems and lines, and any other activities necessary to achieve steady-state operating conditions.
- c) Phase III - Process Investigation Operations - Experimental establishment of the effect of applicable process variables and changes in configuration on plant parameters to determine optimum conditions and configuration for technical, economical and environmental analysis. This includes varying feed rates of consumables, varying temperatures and pressures, and accomplishing plant configuration changes necessary to investigate and all of the operating alternatives outlined in the Operating Manual as directed by DOE.

PROGRESS DURING THIS REPORTING PERIOD
700 H.P. COMBUSTION TEST FACILITY

The coal-oil mixture (COM) combustion test program of the 700 H.P. Combustion Test Facility has been performed successfully according to schedule. The parametric coal-oil mixture combustion tests with 30 and 40 percent coal concentrations were completed. Test data are being analyzed; some meaningful results were obtained. The combustor tests with 50% coal concentration have been initiated. The installation of the new 100 H.P. oil fired fire tube boiler for COM combustion studies is on schedule and facility shake down tests are scheduled for the next reporting period.

OPERATIONS

The coal-oil mixture parametric combustion tests with different coal concentrations, initiated in the last quarter, have been completed with 30 and 40 percent coal concentrations. The tests with 50 percent coal-oil mixtures have been initiated. The objective of the coal concentration test is to analyze the effects of three different coal concentrations (30, 40, and 50 percent) in the oil-fired 700 H.P. boiler.

A total of 19 tests were conducted for the 30 percent COM and 25 tests for the 40 percent COM. The following parameters were varied: boiler firing rates, combustion air levels, atomizing steam pressures, fuel temperatures and swirler settings. Two tests in which the furnace pressure was varied were also conducted during the 40 percent COM tests. No apparent ash deposits were found during the 30 percent COM tests, but during the 40 percent tests, some ash deposits were found in the furnace.

A number of measurements were made inside the 700 H.P. boiler and at the stack to assess the performance of the combustor. The boiler was instrumented to permit detailed heat balances, emission measurements and flame characterization. The particulate level in the stack was monitored using isokinetic stack samples and was compared to opacity data obtained from the transmissometer. The size distribution of the particulate matter in the stack was monitored by a cascade impactor. The average emissivity of the flame was determined using various targets and optical pyrometers.

Flue gas desulfurization tests are being conducted concurrently with the COM combustion tests to study the effectiveness of injection of dry sodium bicarbonate in the removal of SO_2 from the flue gas.

Below are listed the completed tests:

APRIL

Test No. 700-C3FASTS, (FNNNN-3, FNHNN-1, FNLNN-1)
Test No. 700-C4FASTS, (FNLNN-1, FNNNS-1, THNNN-1)
Test No. 700-C4FASTS, (TLNNN-1, HNNNN-1, HNNNN-1)
Test No. 700-C4FASTS, (HHNNN-1, HLNNN-1, TLNNN-2)
Test No. 700-C4FASTS, (4FNNNN2, COQNNN2)
Test No. 700-C4FASTS, (FHNNN-1, FLNNN-1, FLHNN-1)
Test No. 700-C4FASTS, (FNHNN-1, TNNNN-1, TNNNN-1)

MAY

Test No. 700-C4FASTS, (HNNMN-1, HNNLN-1)
Test No. 700-C4FASTS, (FNNLN-1, FNNNN-2)
Test No. 700-C4FASTS, (FNNNN-3, GUNPOS, FNNXN-1)
Test No. 700-C4FASTS, (QLNNN-1, QNNNN-1, QNNNN-1)
Test No. 700-C4FASTS, (FNNMN-1, FNNHN-1, TNNHN-1)
Test No. 700-C4FASTS, (FNLNN-1, FNNNS-1, THNNN-1)
Test No. 700-C4FASTS, (TLNNN-1, HNNNN-1, HNNNN-1)
Test No. 700-C4FASTS, (HHNNN-1, HLNNN-1, TLNNN-2)

MAINTENANCE AND MODIFICATION

Maintenance and modifications were performed throughout the facility during the last three months. Listed below are some of the major items performed on various equipment.

PULVERIZER AREA

Wet coal received from Consolidated Coal Company caused inaccurate gravimetric feeder operations. Although the feeder was calibrated to operate with coal at a 6% moisture content, the coal received was usually dripping wet. It, therefore, required dumping pulverized coal into the drums, weighing and vacuuming the contents into the mixing tank. To reduce condensation, the baghouse and cyclone separator were insulated and the temperature in the pulverizer was adjusted to find the proper range to obtain drier coal. Temperatures in the roller mill were increased to 237°F which resulted in wet and dry bulb temperatures of 153°F and 182°F respectively. Thermocouples, an additional nitrogen line and an oxygen sample line were installed in the bottom of the baghouse to maintain a constant surveillance of the oxygen and temperature levels. Coal pulverized during the first week of June produced dry coal without incident.

COM MIXING TANK

While preparing a batch of 1900 gallons of 40% COM, 3 to 7 inches of pulverized coal were laying on top of the #6 fuel oil after several hours of agitation. A 1500 gallon COM limit had been placed on the mix tank to prevent a reoccurrence of this problem.

FUEL PLUGGING

During the 40% COM tests, fuel plugging was practically eliminated by replacing the 3/4 inch piping and fittings with tubing.

During the preparation of the 50% COM tests, a new 1 1/2 inch fuel discharge line was used in place of the 3/4 inch line; and the existing fuel oil heater lines were piped in parallel. The overall effect of these changes resulted in a discharge pressure of 140 psig at full load rates utilizing the small Moyno pump. Prior to this modification, 50% COM fuel pressures were greater than 300 psig.

HOLDING TANK LEVEL INDICATION

A pressure gauge was installed below the tank on the outlet line to monitor the height of the fuel. A chart to convert the pressure readings to gallons is posted to determine the remaining fuel in the tank. A high level float switch is being purchased to actuate an alarm in the event too much fuel is being added to the tank.

COM INCONSISTENCIES

Inconsistent batches of COM were due to a leaking shut off valve located between the oil storage tank and the COM mix tank. Better consistency occurred once this situation was corrected.

TEST TUBE SECTION

A major modification made during the month of May was the installation of three test tube coupons inside the boiler. Tubes #5, 19 and 34 had two foot test sections installed in them. The boiler was hydrostatically tested to 375 psi before it was closed up for operation. The trim piping, water control column, and magnetrol were reinstalled at the boiler front, and all boiler equipment passed an additional 175 psi hydrostatic test. This modification was from April 9 to April 12, 1979. Micrometer readings were taken on the test sections, and comparisons will be made in the future when the test sections are removed from the boiler.

BAGHOUSE

The flue gas baghouse pulse pressure has been lowered from 110 psig to 80 psig to conserve bag life time. Eleven bags were replaced in the baghouse after a Visolite leak detection test was conducted.

The baghouse is presently being pulsed every twenty-seven minutes. The baghouse is pulsed for two minutes at the end of twenty-five minutes. This 120 seconds allows all 10 rows of bags to be completely pulsed. By experience, the 27 minute baghouse pulsing curtails furnace pressure buildup.

COM TEST LOOP

Work is nearing completion for the COM test loop. 110 VAC power was tied into the transmitters. A terminal board for the junction box was obtained and mounted. Signal wire from the transmitters was connected to the terminals. The D.O.E. computer group has completed data acquisition tie-ins. To complete this test loop, the transmitters and "Ronningen-Petter" full-stream pressure sensors must be charged with silicone fluid.

RE-CALIBRATION OF INSTRUMENTATION

Re-calibration of the 700 H.P. instrumentation was started during this test period by the D.O.E. instrument group. Relevant information and data concerning these checks and calibrations will be assembled upon completion of the work.

ELECTRO MAGNETIC WATER CONDITIONER

An inspection of the boiler to evaluate the effectiveness of the electromagnetic water conditioner revealed light deposits of decomposed calcium and silica. Only minor oxygen pitting on the upper part of the steam drum was observed. The conductivity level has been relatively low and tubes are usually blown down when the level reaches 2000 micromohs.

ISOKINETIC BUILDING

The prefabricated building was constructed on the roof level of the combustion test facility to house the isokinetic and high volume sampling equipment. This alleviated the congested condition at its previous location at the top landing of the stairwell.

100 H.P. AND 20 H.P. UNITS

The construction phase of the 100 H.P. and the 20 H.P. units is nearing completion. All large equipment for the upper level control room was received during fiscal April, and installation of the control panels and gas sampling panel has been accomplished. The ceiling and sides of the control room were completed. Also included during this test period were wire ways, electric equipment mounting panels, finishing molding and other incidentals.

Sewer drain covers have been fabricated for the 100 H.P.-20 H.P. boiler areas. In the case of an oil spill, these drain covers would prevent oil from going down the sewer.

Installation of the mezzanine by the iron workers was completed during this report period. MATSCO personnel continued installation of equipment during the evening shift to avoid interfering with building of the mezzanine which was completed in approximately three weeks.

Items completed in the boiler room consisted of insulating and covering of the mixing and holding tank with metal wrapping. Other items of installation included flow meters, slurry return lines, fuel lines, instrument and equipment supports, lights, numerous piping installations, relocation of mercury vapor lamps, instrument brackets, valves, and the fuel oil feed pump for the 100 H.P. boiler.

700 H.P. COMBUSTION TEST UNIT QUARTERLY FORECAST

1. Completion of the COM test loop and exploratory evaluations of various flow, viscosity, density and other measuring instruments to be inserted in this test loop.
2. Evaluation of 50% COM in the 700 H.P. test facility and problems associated with mixing, storing and transporting the fuel.
3. The addition of a 3 element boiler control to provide quicker stability action of steam flow, boiler feed water and boiler water level.

4. Installation of additional support equipment to improve performance and reliability of the test data received from the 700 H.P. unit.
5. Endurance tests to evaluate performance of COM in the 700 H.P. unit.

100 H.P. AND 20 H.P. COMBUSTION TEST UNITS QUARTERLY FORECAST

Completion of the piping, wiring, installation of duct work, and commissioning of the 100 H.P. and 20 H.P. units. Modifications of the units will be made in preparation of testing.

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DL/jl