DOE/MC/27363 -- 5519

Tampa Electric Company - DOE IGCC Project

Quarterly Report
July 1 - September 30, 1996

Work Performed Under Contract No.: DE-FC21-91MC27363

For
U.S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
P.O. Box 880
Morgantown, West Virginia 26507-0880

By
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TECO
POWER SERVICES
A TECO ENERGY COMPANY

December 9, 1996

Mr. Nelson Rekos
Project Manager
Coal Projects Management Division
Morgantown Energy Technology Center
US Department of Energy
P.O. Box 880
Collins Ferry Road
Morgantown, W VA 26505

RE: Tampa Electric Company - DOE IGCC Project
July - August - September 1996 Quarterly Report

Dear Nelson,

The third quarter of 1996 has resulted in the completion of over five (5) years of extensive project development, design, construction and start-up of the 250MW Polk Power Station Unit #1 IGCC Project. Tampa Electric would like to take this opportunity to express our profound thanks for the DOE perseverance and assistance provided over these years. Special thanks go to Nelson Rekos, METC's Project Manager for his pragmatic approach and assistance in solving numerous, never before confronted issues, all leading to the successful start-up of this first-of-a-kind facility, with truly world wide repercussions. DOE is to be commended for it's Clean Coal Program initiative which is providing the results anticipated so many years ago.

On the first of July 1996, there were 530 construction personnel on site and only about 21% of the plants systems had been completed, start-up and accepted by the plant operations staff. Although the power block, the combustion turbine (CT) and steam turbine (ST) combined cycle, had been previously run and were being fueled with distillate oil to meet Tampa Electric's (TEC) summer peaks, there was still a tremendous amount of effort yet to be expended before the IGCC could be completed.

As has been previously reported, the combined cycle performance test was completed on June 18, 1996. This test demonstrated that on distillate fuel, the combined cycle achieved a net output of 222,299 KW with a net heat rate of 6,868 BTU/KW. This is about 3.86% and 2.76% better than the guaranteed values of 214,040 KW and 7,063 BTU/KW respectively.

During the initial planning and scheduling, it was projected that the first fire of the gasifier would occur on July 17, 1996. Though a sizeable effort put forth by TEC and its contractors, and with significant support from DOE, on July 19, 1996 at 4:18PM the gasifier was first started. This monumental first gasifier run lasted about 21 ½ hours which was a record for first coal fires in Texaco coal fueled gasifiers. Attachment #1 is a curve which shows the gasifier temperature and pressures associated with the first start.

As significant as this first gasifier run was, it was not without problems. The gasifier had to be tripped after 21 ½ hours due to major pluggage in the black and grey water systems. Slag and fines permeated these systems to such a large extent that further operation could not be sustained and it required almost two (2) weeks to purge and clean these systems. The problem was caused by excessive fines from the gasifier slag being circulated throughout the grey water system which supplies system purges and flushes. The amount of fines was so great that the grey water settler, fines filter and storage tanks all filled with fines preventing further operation. During this first gasifier run all the raw syngas generated was sent to the flare.

Throughout the months of July and August, seven (7) additional gasifier runs were accomplished with durations ranging from three (3) hours to almost three (3) days. Problems and successes were many during these next runs. Each successive run enabled us to push further along in the gasifier train. Operation and fine tuning of the acid gas removal (AGR) system, ammonia and amine strippers, clean syngas flare system and sulfuric acid plant (SAD) was also achieved.

During these early stages, the syngas quality steadily improved until on September 12, 1996 syngas was sent to the CT for the first time. Attachment #2 is an analysis of the first syngas sent to the CT. This analysis is generally as expected except for higher than anticipated levels of sulfur in the form of carbonyl sulfide (COS) and hydrogen sulfide (H_2S). Because of these higher overall sulfur levels it was necessary to temporarily operate the HRSG at a slightly higher temperature than expected to prevent corrosion in the HRSG exit.

Longer and longer runs on the gasifier resulted in fine turning the gasifier controls. Operation of the gasifier, although still very complex, has been less difficult than originally expected. We feel that this is due to the intense training, planning and start-up/check out effort put forth prior to actual operation.

The main problem encountered after solving the early ash and grey/black water system pluggage, was the pluggage in the parallel gas/gas heat exchangers immediately downstream of the convective syngas coolers (CSC).

After several forced outages to clean out the gas to gas exchangers, we believe we have found a way to operate which does not cause additional pluggage. This is directly related to the operating temperature of the gasifier. Above certain temperatures (over a very narrow range) pluggage ceases to occur and even reverses itself, evening cleaning (on line) prior pluggage.

This pluggage is very different from the pluggage originally anticipated during the early design. We had feared major pluggage in the transfer lines between the radiant syngas cooler (RSC) and the CSC's. This may indeed be a problem, but for now is not, due to the fact that the RSC outlet temperatures is about 300°F less than intended. It appears that the RSC is probably oversized thus removing too much heat from the syngas. This then has shifted to focal point of pluggage from the transfer lines to the gas to gas exchangers.

The solution to the RSC outlet temperature problem as being proposed by MAN GHH is installing refractory type material on the lower portion of the RSC wingwalls to block heat transfer and increase gas outlet temperatures. From an overall system performance stand point, the excess heat removed from the syngas is routed to the HRSG in the form of increased steam flow generated in the RSC, which is recovered ultimately by the ST. This is slightly less efficient than intended but not an operational problem for the power block.

Another problem encounted with the gas to gas exchangers has been downtime corrosion. The fire tube heat exchanger tube materials were optimized for on line corrosion, erosion and heat transfer efficiency. We have determined that anytime the unit is removed from service and opened for inspection or cleaning, the moist Florida atmosphere coupled with the byproducts of previous combustion creates a hostile environment, very detrimental to the gas to gas exchanger tubing. Subsequent restarts with the propane start-up burner generates significant quantities of moisture as a product of combustion. This moisture accumulates in the gas to gas exchangers, interacts with remaining ash, and accelerates the corrosion problem. Attached are pictures showing the pluggage and corrosion discussed above. It should be noted that the downtime corrosion damage to date has caused pitting approximately ⅔ the way through the wall thickness in some areas. TEC is currently evaluating plans for a temporary bypass around the gas to gas exchangers to allow operation of the IGCC plant till a permanent solution to the downtime corrosion can be determined and implemented.

The other direct impact to the pluggage problem has been gas velocity through the tubing. TEC had a choice during the early design of optimizing the velocity design for pluggage or erosion. TEC had really anticipated a more severe erosion problem because they had intensively studied all possible causes of pluggage and believed they had solved those problems. However, the pluggage problem expected was different from what has been experienced. The greatest fears were of sticky ash pluggage. Probably because of the low RSC outlet temperature, we have not experienced that problem, yet. The pluggage that has been experienced is from a softer, non sticky ash which has agglomerated due to low velocity in the pressence of binders related to chlorine volitization. Our solution has been to increase tube velocities about 25% over design by plugging an appropriate number of gas to gas exchanger tubes.

Another problem related to the generation of fines is in our ability to sell our byproduct slag. Our contract with the byproduct user was based on an expected ratio of coarse to fine ash particles. To date, this ratio has been much more biased to the fine particle size. Our slag purchaser had indicated he will not take the slag in its present configuration. We will either have to screen the fines out and make other arrangements for the ultimate disposal of the fines or find another method altogether for handling/storing the slag. Obviously, this is a very serious and potentially costly issue which TEC is pursuing with great vigor.

Early in the start-up of the HGCU system, we discovered that the head flange of the absorber vessel would not sustain the field pressure test. Subsequent testing revealed that the two (2) flange surfaces were not parallel and required extensive field machining to make pressure light. Another problem in the HGCU system was with the inlet gas expansion joints. Early gasifier runs pointed towards water intrusion into the syngas from somewhere around the HGCU system inlet. What was eventually discovered was that the water cooled expansion joint between the convective cooler outlet and the HGCU inlet had a problem with the post-weld heat treatment and stress corrosion cracking. This intricate expansion joint was subsequently removed, and returned to the vendor for correction of the fabrication and material selection problems. The inlet to the HGCU system has been blanked off until the expansion joint can be repaired and returned to the site.

It is expected that the during the next reporting period that the cold flow attrition testing using Z-Sorb III will be completed.

During the third quarter of 1996, the combustion turbine was run on syngas two (2) different times for a combined total of about seven hours. Attachment #4 shows graphically the transfer from oil to syngas. Emission levels were generally acceptable even though no specific emissions tuning was completed by GE and the emissions monitoring equipment was not yet completely operational.

GE did experience some significant operational problems related to their combustion system. During one of the early runs on syngas, while shutting the CT down after operation on syngas, hardware on the combustion can end cap was found to be seriously overheated and required subsequent redesign and repair.

During the fourth quarter of 1996 the following major activities will be pursued and reported on:

- fine tuning of the combustion turbine on syngas

- operation of the brine concentration system
- fine tuning of the air separation plant
- start-up and tuning of the sulfuric acid plant
- completion of HGCU check out and start-up
- definition of overall plant performance
- optimization of coal grinding and slag handling

To date, TEC is quite satisfied with the initial performance of the Polk IGCC plant. Additional tuning will be required to optimize unit heat rate, availability and capacity. Based on preliminary reports, it appears that the Polk Project costs will be slightly better than projected plant estimates. From a schedule standpoint, even though there remains some amount of tuning, TEC, for accounting (book) purposes, declared the unit to be in commercial operation as of September 30, 1996. This accomplishment bettered the formally reported project schedule of October 15, 1996.

In summary, the third quarter of 1996 resulted in the satisfactory completion of the construction and start-up of the Polk IGCC project. This successful part of DOE's Clean Coal Program is a tribute to the efforts of Tom Bechtel and his METC staff and it is expected to be continued under the leadership of Rita Bajura and the FETC staff, as we go forward in Budget Period - 3 the Demonstration Phase of the project.

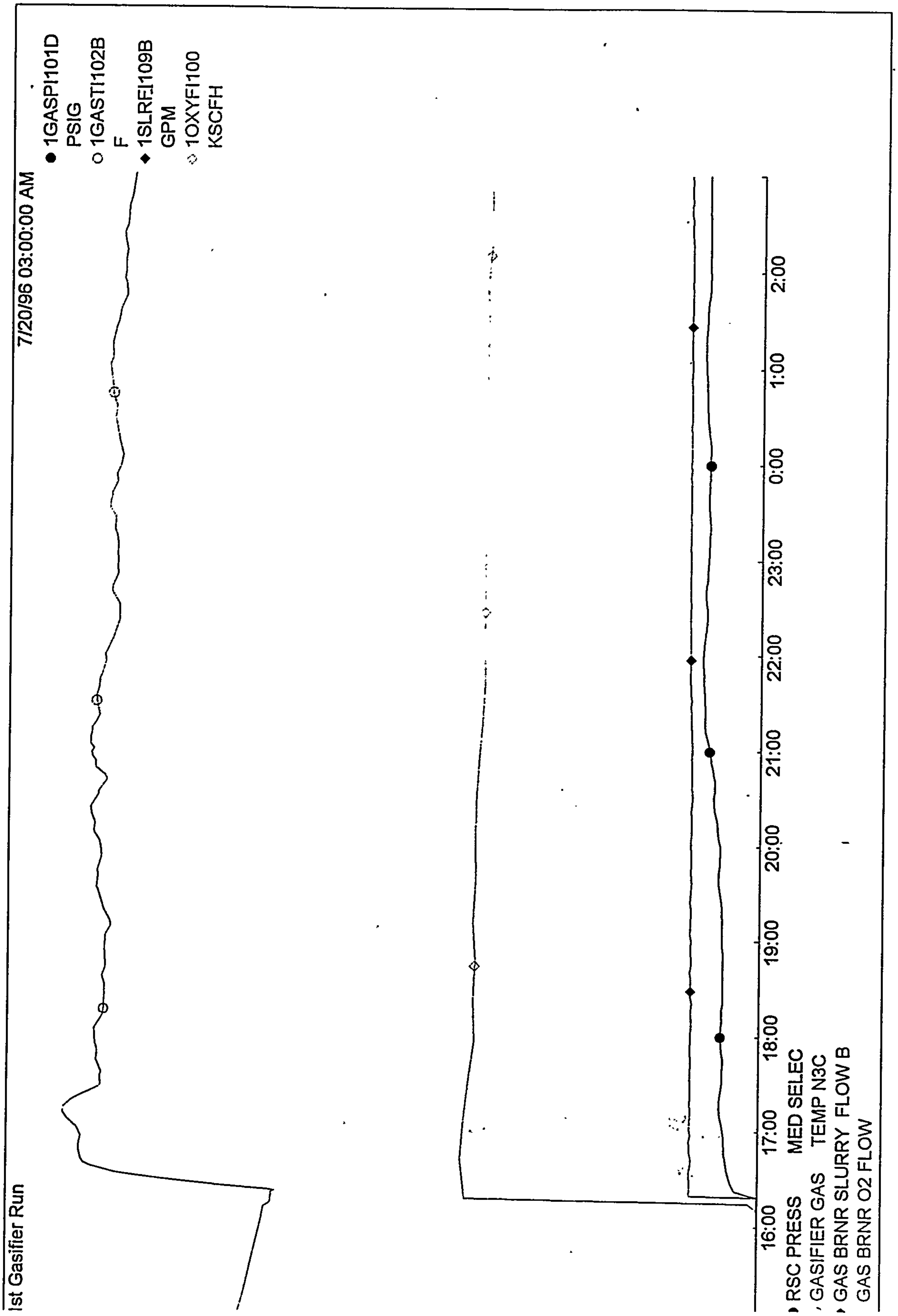
Sincerely

D.E. Pless

D.E. Pless
Project Manager

cc:
Mr. C.R. Black
Mr. C.A. Shelnut
Mr. D.A. Cowdrick
Mr. R.N. Howell
TRIMCO - M11.8.1

ATTACHMENT #1



ATTACHMENT #2

SAMPLE PROGRESS REPORT

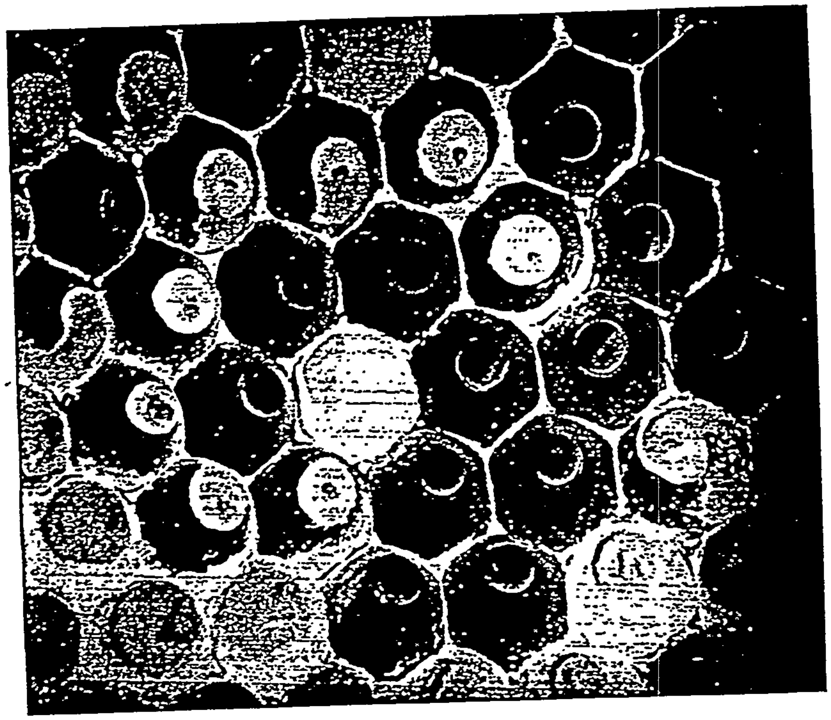
TECO - Corporate Environmental Lab
Date: 12-09-1996 Time: 13:14:16

Sample I.D. PK01176
Status: Complete and inactive
Purchase Order Number:
Project account code:
Site Identification: G-9
Sample collector: JOE AYCOCK
Proc Ln#: TSY-2002-JG389

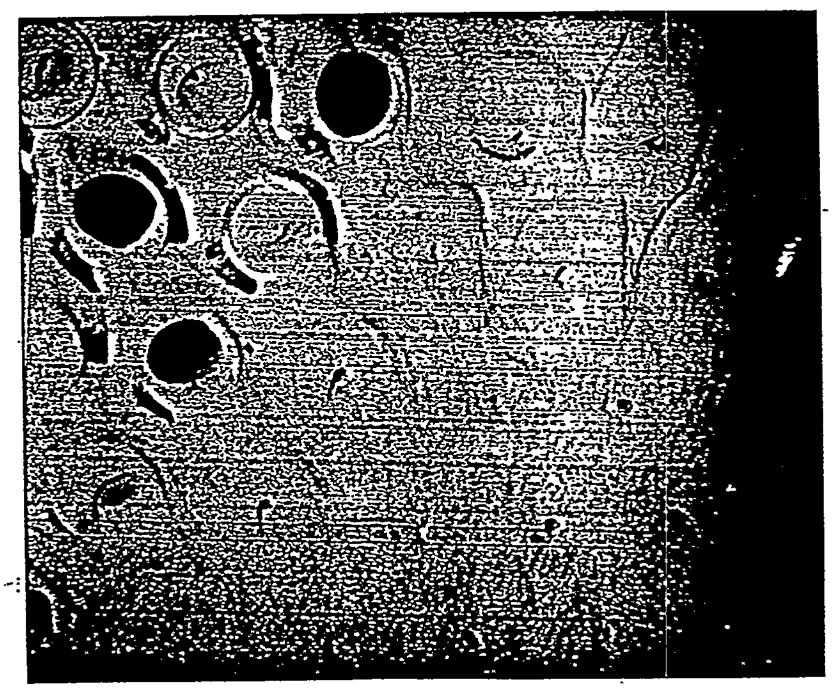
Date collected: 09/12/96
Date submitted: 09/12/96
Due date: 09/26/96
Specification checking: off
Descript: Clean Syngas
Strm S/D: MDEA KO Drum Overhead

Analysis	Result	Unit	Finished	Anl
Carbon Dioxide	15.095	%	09/12/96	CRC
Hydrogen Sulfide	0.0805	%	09/12/96	CRC
Carbonyl Sulfide	0.0275	%	09/12/96	CRC
Oxy/Argon	0.8467	%	09/12/96	CRC
Nitrogen	3.327	%	09/12/96	CRC
Methane	0.0	%	09/12/96	CRC
Carbon Monoxide	43.342	%	09/12/96	CRC
Hydrogen (Mass Balance)	37.2813	%	09/12/96	CRC

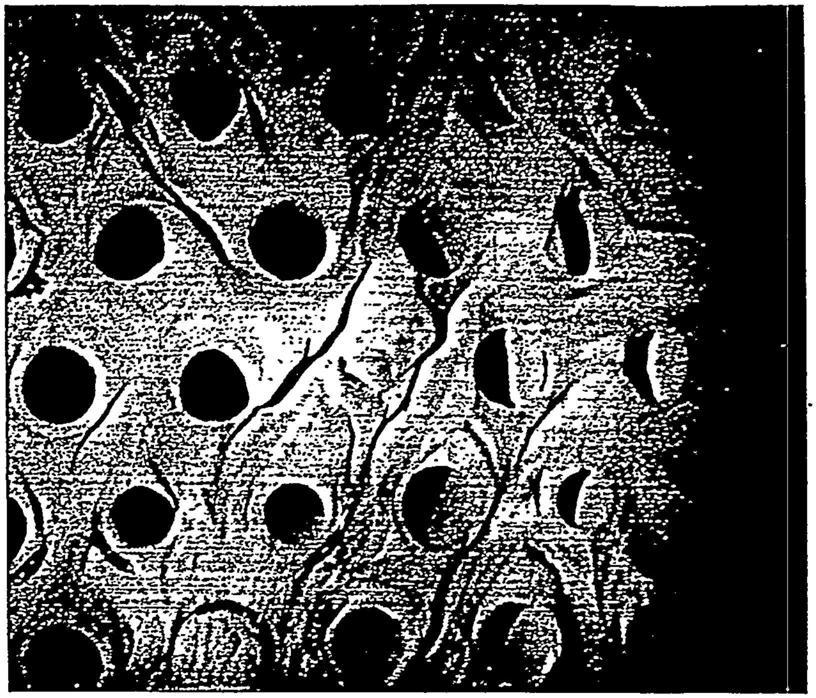
End of progress report on sample: PK01176



RGINE
1ST Stage Inlet
9/16



RGINE
1ST Stage exit
9/16



RG/CG 9/16
1st stage exit Js

RG/CG 9/16
2nd stage inlet

ATTACHMENT #4