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COAL LIQUEFACTION PILOT PLANT

CRESAP, WEST VIRGINIA

MONTHLY TECHNICAL PROGRESS REPORT

JANUARY, 1978

Fluor Engineers and Constructors, Inc.

3333 Michelson Drive

Irvine, California 92730

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NOTIFICATION OF TRIPS

<u>Name</u>	<u>Duration</u>	<u>Destination</u>	<u>Purpose</u>
G. O. Fredrickson	1/3-2/3	Cresap, West Va.	ERDA Meeting & LCDC Support
L. Gasendo	1/9-2/3	Cresap, West Va.	Plant Startup
F. U. Leonard	1/9-2/3	Cresap, West Va.	ERDA Meeting
P. R. Young	1/8-1/12	Cresap, West Va.	Reactor Problem Investigation
D. A. Barlow	1/22-2/17	Cresap, West Va.	Inventory

I. SUMMARY

January was a month of extensive repairs and maintenance. Activities in the front-end of the plant, primarily seal repairs, were scheduled for completion on January 20. Hydrotreating area maintenance activities were extended by two weeks in order to modify the piping around the bottom of both reactors so that the bottom head seal rings could be replaced. The severe cold and record snowfall further extended the turnaround by two days. The target completion dates are now January 27 for hydrotreating and January 22 for the front-end of the plant. Integrated plant operations are now scheduled to start the week of March 6, 1978.

Restart of the extraction end of the plant will include a capacity test of the slurry preheater and a checkout of front-end flow instruments. The main objectives of Run 005 are to demonstrate the operability of the plant at a coal rate of 12 tpd in a 25 percent coal slurry and to obtain baseline process data from the solvent deashing test system.

One non-lost-time OSHA-recordable injury occurred during January.

II. MAJOR PROBLEMS AND SOLUTIONS

A. Replacement of Reactor Seal Rings - Section 600

When the bottom heads on hydrotreating reactors D-A601A/D were removed for internal vessel inspection, the silver-plated primary seal rings on the closure assemblies were found to be scored and in need of replacement. The seal rings could not be removed without cutting and rewelding of the 4 inch feed nozzles. To facilitate future seal ring replacement, a 4 inch Grayloc connector will be installed on the inlet line at each reactor bottom head. This modification will permit the seal rings to be removed and replaced as required without cutting and welding the associated piping each time. Although this unanticipated activity extended the current maintenance turnaround by two weeks, these modifications will save an estimated 21 days per year in future turnarounds.

The required quality assurance documentation for the reactor vessels was completed and approved by an ASME Code inspector.

B. Failure of Pump Coating Materials

As noted in Section IV of this report, the PTI-54 ceramic lining in J-A314A, one of the wash hydroclone feed pumps, was inspected during a seal repair and found to be in good condition. The service history of this pump is being compared with the histories of the five other pumps which have had PTI-54 lining failures.

II. MAJOR PROBLEMS AND SOLUTIONS

B. Failure of Pump Coating Materials (Continued)

Potential vendors of systems for hard-coating pump parts are being contacted. A visit was made to Union Carbide to discuss their detonation gun technique for applying tungsten carbide. This method may not be applicable to the complex geometries of pump parts.

C. Pump Seal Problems

Six mechanical seal failures were experienced this month. These are detailed in Section IV. The most common cause of leaks was solids binding the bellows and subsequent scoring of the seal faces. One Viton A O-ring was involved in a leak but the failure appears to have been caused by movement of the supposedly-fixed member of the seal.

D. Slurry Preheater Capacity Limitations - Section 200

Performance of the B-A201 slurry preheater to date indicates that excessive metal temperatures may be experienced when operating at the design conditions of 11.2 gpm slurry feed and 750°F outlet temperature. At the beginning of Run 005, after decoking the pre-heater, a capacity test will be made. The solvent flow rate through B-A201 will be increased in steps to 12 gpm. An outlet temperature of 750°F will be maintained if possible without exceeding 845°F on the tube walls. A profile of the B-A201 tube skin temperatures will be plotted at each flow; pressure drop data also will be obtained. The data collected from the capacity test will be the bases for determining slurry concentrations and throughputs for future operations. They also will provide a set of values for clean solvent service against which future performance may be compared.

E. Slow Heatup Rate and Low Temperature in Solids Separation - Section 300

Despite low ambient temperatures, F-B331 settler temperatures have been maintained between 500°F and 515°F. Further system modifications to improve Section 300 temperatures may be considered, depending on the performance of the solvent deashing equipment during Run 005.

F. Leaky High-Pressure Valves in Hydrogenation - Section 600

Approximately 38 Conval valves were repacked last month with graphite filament packing in the first and fifth rings. This completes the systematic repacking of all Conval process valves in Section 600 with graphite filament packing in accordance with vendor recommendations. Pressure testing will follow the completion of other turn-around activities in the area.

II. MAJOR PROBLEMS AND SOLUTIONS

G. Elevated Phenol Level in the Industrial Waste Water Effluent

The phenol concentration in the industrial effluent has been dropping through the month of January. All effluent phenol concentrations were below the allowable 1 ppm individual measurement limit but none were below the required maximum monthly average phenol concentration of 0.05 ppm. Laboratory studies have concentrated on locating the source of the material which passes through industrial waste water treatment (Section 1230) and yields a positive response to the wet chemical tests for phenol.

Virtually all chemicals used in moderate quantities on the plantsite were analyzed for positive phenol test interference, then for adsorption by the water treating resins. A chemical used in the gas treating plant (Section 1220) was found to meet these criteria; however, 100 ppm of the chemical is required to produce a 1 ppm phenol response. The assistance of an independent water laboratory will be sought to help in identifying the interfering specie.

H. L-B205 Seal Failures - Section 200

Following repeated power outages during the blizzard of January 26, the lower seal was opened for inspection and cleaning. As expected, loss of flush had caused failure of the inner packing and fouling of the seal with solids. In addition, it was observed that the stationary seal face (Sealide ceramic) had cracked in numerous places. Investigation showed this to be due to improper machining of the seal gland (vendor error) and use of an excessively-long anti-rotation pin. Both dimensional errors were corrected. They are believed to have contributed to previous failures; thus seal performance should be improved. Completion of the fail-safe flush installation is planned for February 10, 1978.

I. Steam Distribution and Condensate Problems

Excessive pressures in the condensate system and in the F-A1011 surge tank have been brought under control. Primary cause was an open one-inch valve in the 1500 Test Section which was feeding line steam into the return system.

Severe problems with steam leakage persist. In addition, many traps are blowing through, resulting in further losses. Both problems are due largely to the use of carbon steel tracing. Leaks result from heavy external corrosion, while scale from internal corrosion interferes with trap operation. The cost of repairs is increased by the need to remove and reinstall insulation as well as difficulty in

II. MAJOR PROBLEMS AND SOLUTIONS

I. Steam Distribution and Condensate Problems (Continued)

getting Swagelok fittings to seal on existing carbon steel tubing. Over the last four months more than 6,000 craft man-hours have been applied to this activity. This amounts roughly to 20 percent of the total maintenance activity during this period.

III. STATUS BY PLANT SECTIONS

Section 100 - Coal Preparation

There was no activity in Section 100 during January. The F-A104 product storage bin contains 70 tons of prepared coal; over 500 tons of raw coal remain in the stockpile at the north end of the plant.

Section 200 - Coal Extraction

Repairs to the L-B205 extractor mixer bottom seal were a major activity this month. Details are given in Section IV of this report. The spare coil for the B-A201 slurry preheater was repaired; an x-ray examination of the welds is in progress. A nitrogen purge was installed on the terminal box of the C-A204 spray solvent heater to prevent electrical malfunctions and to eliminate a potential safety hazard caused by solvent leakage.

At the end of the month, solvent circulation had been resumed in preparation for Run 005. Following a capacity test of B-A201 slurry preheater and a checkout of the more critical flow instruments, coal will be introduced at an initial slurry concentration of 15 percent.

Section 300 - Solids Separation

Hot internal circulation was maintained during the month while repairs were made to front-end equipment. The hot flush solvent system was shut down to allow the repair of a process leak in a butt weld at the outlet of the B-A301 hot flush solvent heater. The weld was cut out and replaced by flanges. Several fitting leaks on the hot flush system were also repaired. To prevent a repeat of present plugging problems the wash solvent addition line connected to the F-B331 settler underflow line was rerouted for top entry.

At the start of Run 005 the flow instruments will be checked against those in Sections 200 and 500 as well as those within Section 300.

Section 500 - Solvent Recovery

Feeds from Section 300 and the F-A1107A/B slop tanks were processed routinely to recover solvent. The J-A504 recycle solvent pumps were used

III. STATUS BY PLANT SECTIONS

Section 500 - Solvent Recovery (Continued)

to recirculate the B-A502 vacuum column reboiler during the maintenance shutdown of the rest of the section. Shutdown activities included the replacement of the B-A501 flash still heater coil, the return to normal service of the B-A603 start-up oil heater and the installation of a control valve, LCV-501-3, in the granulator extract feed line. Following completion of the maintenance work, B-A501 was recommissioned and the section placed in hot closed-loop standby circulation mode in preparation for Run 005 start-up.

Section 600 - Hydrogenation

The D-A601 reactor attritor loops were removed. Work is in progress to install Grayloc connections on the bottom head assemblies of both reactors to permit quick replacement of failed seal rings as required. This unanticipated work is scheduled for completion the week of January 23.

Prior to the maintenance shutdown of Section 600, solvent was circulated between Section 600 and the vacuum portion of Section 700. The D-A601D reactor was excluded from the circulation loop due to the failure of the J-A608D reactor recycle pump. Repair work to J-A608D is in progress.

Considerable difficulty has been experienced sealing the heads on F-A605 entrainment separator and E-A601 absorber. A new Teflon retaining ring was installed in F-A605 and the Viton O-rings in E-A601 were replaced with Teflon O-rings.

Other significant maintenance items during the month included installation of missing burner tiles in B-A602A/B reactor recycle heaters and the B-A601 hydrogen heater, completion of the effort to upgrade the packing in all Conval process valves, replacement of the improperly-sized low-flow switches on J-A608BX/DX lube oil pumps and connection of LT-6006A/B and LT-6007A/B reactor nuclear density transmitters to the emergency power system.

Plans next month include completion of repairs to J-A608D and operation of the section on solvent at 600°F under 3000 psig hydrogen pressure.

Section 700 - Fractionation

Warm solvent circulation was maintained through both the vacuum and the fractionation loops for freeze protection. The J-A701B stabilizer charge pump was removed for use in Section 800, leaving J-A701C for use in the fractionation loop.

III. STATUS BY PLANT SECTIONS

Section 800 - Low Temperature Carbonization

All liquid loops remain in circulation to prevent freezing. The carbonizer bed was fluidized briefly to verify its readiness for Run 005. The pump head and impeller on the solvent quench pump J-A804A were found to be severely eroded; the J-A701B stabilizer charge pump will be used temporarily in this service. Further information is provided under Test 1100.

Section 900C - Hydrogen Compression

The JC-A900B hydrogen makeup compressor was operated routinely to supply 3000 psig nitrogen to Section 600 for simulated operations. JC-A900A was operated briefly on nitrogen to demonstrate its readiness for operation.

Hydrogen valves have now been installed in the JC-A900B machine. The stud bolts holding the first and second stage valves will be replaced before operation; the studs used for nitrogen valves are too long to hold the hydrogen valves.

Section 900G - Hydrogen Generation

The B-A901 reformer furnace is being fired; steam and nitrogen are flowing through the tubes. Hydrogen production is scheduled to begin the week of January 30. The outlet temperature of B-A901 will be kept as low as possible while maintaining the required product specification of 95 percent purity.

Prior to restarting gas flows, all of the burner nozzles on B-A901 were cleaned. Leak repairs on the C-A906 reboiler, the C-A903 methanator cooler and the D-A903 converter were completed. The emergency quench water supply line to the F-B902 desuperheater was installed, including steam tracing and insulation. A new cast-iron impeller was installed in the J-A901A MEA solution pump.

Section 1000 - Utilities

1010: Attention focused on a number of interrelated problems which limited steam generating capacity. The boiler feed water pump suction lines were cleared of pieces of deaerator internals and the J-A1101A boiler feed water pump was rebuilt. Design pump performance was restored but in approximately two weeks the discharge pressure had decreased by 20 psi. At the current demand of approximately 16,000 pph, the pumps are not limiting steam generation capacity.

Over-pressuring of the condensate system was alleviated when an open bypass valve was found on a piece of filtration equipment (Test 1500) not

III. STATUS BY PLANT SECTIONS

Section 1000 - Utilities (Continued)

in service. Some trap malfunctioning continues due to corrosion of carbon steel tracers. The filming amine injection has been started and should provide corrosion protection to the tracers and condensate system.

1020: An underground cooling water leak was repaired. Some freezing problems were experienced in the soft water system but no damage resulted.

1030: Very cold weather caused some problems in the plant air system when accumulations of condensate froze at low points.

Section 1100 - Offsites

1110: Low ambient temperatures caused some freeze-up problems with Sure-Sol 180 circulation in the tank farm. No damage resulted. Additional heat may be required on some tanks to sustain operation in cold weather. The Sure-Sol pour point has been measured at approximately -4°F; the manufacturer's specifications allow for a freeze point as high as +7°F.

Section 1200 - Environmentals

1210: The C-A1211 sour water column overhead condenser developed a process leak. The tube will be plugged before Run 005 begins.

1230: The industrial waste water treatment plant is on a 48 hour regeneration cycle while coal is not being processed. Close observation of the regeneration cycle revealed no obvious mechanical problems. Bench scale laboratory studies have indicated the presence of a material in the waste water feed which, unlike phenol, is not absorbed by the resin, but produces a positive response to the wet chemical test used to measure phenol concentration. Further information is available in Section II of this report.

Attached are the monthly analytical summaries of the treated industrial and sanitary waste effluents.

IV. TEST PROGRAMS

General

Approximately 50 test equipment items were located and identified as part of a plant-wide project to tag equipment with correct property-book identification.

IV. TEST PROGRAMS

Test 1100 - Pumps

Pump Linings

During the inspection of J-A314A for the seal failure noted below, the PTI-54 ceramic coating was found to be in good condition. The J-A314A pump which is in the J-A806B tar quench service exhibited some erosion. There was a circular wear pattern on the casing and considerable tear-off at the outlet which is the high velocity point of the volute. The removal of Triballoy did not have the flaking characteristics of the ceramic coating failures. The other parts coated with Triballoy were in good condition.

A visit was made to Union Carbide to review tungsten carbide coatings applied by Carbide's detonation gun technique. Although limited in their ability to coat complex geometries, Carbide is evaluating one of the Pacific pumps which was left with them.

Mechanical Seals

J-A313B Primary Feed Pump	Inspection revealed several broken springs and worn shear pins. The shaft sleeve was worn in the packing area. A new seal assembly and a shaft sleeve from the J-A313D pump were installed.
J-A314A Feed Pump	Inspection indicated that the rotating element was stuck; ten springs were broken. The hard chrome shaft sleeve was worn in the areas of the set screw lock and the outboard Durafite packing. The assembly was rebuilt with a new shaft sleeve, springs and Durafite packing. The seal faces were lapped and reused.
J-A314C Feed Pump	The seal on this pump was used to test Viton A O-rings in place of the Durafite packing. The O-rings were generally in good condition with the exception of the one at the stationary carbon seat. The carbon seat was free to spin. The seal faces were lapped and reinstalled using a pin to prevent rotation of the carbon seat.
J-A504A/B Recycle Solvent Pumps	The "A" pump seal bellows was jammed with fine solids and the seal faces on both pumps were found to be scored. New rotary and stationary seal members were installed.

IV. TEST PROGRAMS

Test 1100 - Pumps

Mechanical Seals (Continued)

J-A704 Vacuum Column Bottoms Pump	Both seal faces were scored and fine solids were packed against the seal bellows. New rotary and stationary seal members were installed.
J-A806B Tar Quench Pump	The seal faces were scored slightly and the bellows were packed with car fines. New seal members were installed.

Pump Corrosion/Erosion

The J-A804A solvent quench pump was disassembled following a period of low-head performance. The carbon steel impeller and stuffing box had erosion patterns similar to those found in the J-A804B after it failed several months earlier. A carbon dioxide corrosion mechanism was suspected as being a contributing factor. The stainless steel J-A701A pump which was placed in the J-A804B service was recently inspected and found to be in good condition. The J-A701B pump will be substituted temporarily for the J-A804A.

Other Pump Problems

The J-A652 catalyst/solvent pump impeller was replaced with an available 7-1/2 inch diameter impeller. This modification will provide greater flow velocities in the catalyst removal system. The char slurry pumps J-A803A/B have experienced chronic char plugging problems in the closed impellers. A quick-opening basket strainer will be installed on the suction to J-A803A.

Test 1300 - Fired Heaters

The installation of a new-type 321 stainless steel coil in the B-A501 flash still heater was completed. Eleven of the 13 skin thermocouples are functional. The interpass process temperatures and pressures will not be available due to elimination of the external process loops from the design of the new coil.

Test 1800 - Extractor

Repairs to the top and bottom mechanical seals of the L-B205 extractor mixer were completed. The work involved in rebuilding the seals for Run 005 included the following:

IV. TEST PROGRAMS

Test 1800 - Extractor (Continued)

1. The shaft sleeve, including the bottom packing sleeve, was refinished and coated with tungsten carbide.
2. New seal faces were installed on top seal.
3. The seal face on the stationary member of the bottom seal was replaced; the seal face on the rotary member which had been rebuilt previously was relapped.
4. Tie-ins were made to permit the installation of a fail-safe purge system for the lower seal. This will prevent lifting of the spring-loaded packing during short duration upsets.

V. LABORATORY

The phenol and pseudo-phenol presence in the waste water treating section received major attention during January. A list of five laboratories who can provide assistance in identifying the pseudo-phenol was obtained from EPA.

The Waters liquid chromatograph required service by the vendor. The problems experienced with the pump and injector were corrected and the instrument has been returned to normal service.

Three types of materials were submitted by Crowley Tar Products Company as candidates for instrument purge solvent. All three had a freezing point above 0°F and were eliminated. Toluene was recommended for this service.

As time becomes available retained samples from Run 003 will be analyzed in greater detail to provide baseline stream characterization data.

VI. SAFETY AND HEALTH

During January first-aid injuries numbered 26. In addition a possible gas inhalation produced one non-lost-time OSHA-recordable injury; two doctor cases were not classified as recordable under OSHA rules of record keeping.

The Central Safety Committee meeting reviewed items brought up by the Employee/Management Safety Committee on those which arose as employee action categories during meetings with all LCDC employees.

Three sessions were held with each member of plant supervision to review the Job Safety Instruction Manual. This was done in preparation for their initiating job safety instruction training for their employees in monthly safety meetings.

VII. DEPARTMENTS

Administrative

Staffing: The plant draftsman who was to report to work January 3 did not show up; the position remains vacant. A candidate for this position has been scheduled to visit the plant January 25. Dwight Wilmot, Shift Engineer, reported to work January 16; Bill Cook, Mechanical Engineer, and Harry Foose, Electrical and Instrument Engineer, are scheduled to report January 23.

At present vacancies exist for a chemical engineer, a mechanical engineer and two draftspersons.

Personnel: A total inventory of all shirts, pants and jackets in the hygienic program was taken to help provide a basis for improving the program. Efforts are moving forward to establish a Plant Communications Committee. The first joint meeting will be held during the week of January 23.

Operations

A significant amount of effort has been necessary this month in snow and ice removal from plant roads, parking lots and operating areas. The extremely cold weather has also caused much line and equipment freezing which has required on-going attention.

Bagged "road salt" has been purchased and spread as necessary to alleviate slipping hazards. Although this has halted the use of the more expensive water treatment salt for this purpose, it will impact costs in a minor way.

Maintenance and Engineering

Efforts of the Maintenance and Engineering Department have been concentrated on the plant shutdown that began January 3, 1978. All work is now expected to be complete January 27. During this period the following has been accomplished:

Plant Modification Requests completed	22
PMR's partially completed (tie-ins)	2
Major Repairs (>40 man-hours)	18
Construction Deficiencies Corrected	6

(included installation of burner tiles in
the five heaters and the pouring of more
than 100 conduit seals)

VII. DEPARTMENTS

Maintenance and Engineering (Continued)

In addition, numerous minor repairs were completed. Much time has been spent on instrument checkout in both Section 600 and in the front-end. More than 800 man-hours were spent on steam leaks and winterization during this period. The projected completion date of January 27, 1978 reflects a slippage of two days from the planned date of January 25. This date was established when the decision was made to modify D-A601A/D. It should be noted that work has been hampered by severe cold and near-record snowfalls. This has doubled craft absenteeism (from 9.9 percent average to 19.5 percent for the weeks of January 9 and January 16) and reduced productivity. It has delayed also arrival of critical materials and inspection services.

A Status Report on Plant Modification Requests issued January 31, 1978.

A simplified form for DOE Failure Reports was approved by the Client on January 12, 1978. A schedule defining failure report backlog was issued. The aim is to work off this backlog and have this activity current by the end of March 1978.

A formal quality assurance program was implemented covering repairs and modifications to vessels and process piping. It provides for identification and followup of all items needed to ensure compliance with Fluor specifications and applicable codes (e.g., welding procedures and qualifications, inspection requirements, ASME documentation, etc.). Essentially, this provides better control and documentation of methods that have been followed from the outset.

A program has been formulated to ensure that electrical and instrument changes are documented and appropriate drawings and specifications updated. An instrument designer is being temporarily assigned to Cresap E&I Group to support this work.

The electrical load for the administration building and adjacent trailers has been redistributed to balance the load on each phase. All currents are now within rated capacity. It is believed that this will prevent further power outages in this area.

Maintenance Planning and Warehouse personnel have begun a systematic review of the Spare Parts EDP Catalog. The objective is to maximize parts availability by ensuring that: (a) all parts are correctly identified in the catalog; (b) all parts are located in the correct bin; and, (c) interchangeability data are complete and correct. Work order activity during January was as follows:

VII. DEPARTMENTS

Maintenance and Engineering (Continued)

	<u>Mech.</u>	<u>E&I</u>	<u>Total</u>
Work Orders Opened	90	50	140
Bills of Material Issued	14	-	14
Work Orders Completed	109	37	146
Histories Entered	158	26	184
Work Orders Closed	Not Categorized		69

Technical

Reporting and run plan preparation continued to be major process engineering activities. The draft plan for Run 005 was issued for approval. The December monthly report was completed; preparation of the annual report and the performance analysis of Run 003 continued. These reports will be issued in February.

The extraction runs made to date comprise a series of start-up attempts which are aimed at demonstrating satisfactory operation of the front-end of the plant while processing 12 tpd coal in a 25 percent slurry. Run 003 which extended over six days did not include any periods of sufficient duration that steady-state conditions were achieved; however, certain baseline data were developed at 12 percent coal:

Section 200: An extraction depth of 60 percent is achievable with start-up solvent.

Section 300: At these more dilute conditions extract recovery exceeded 80 percent and contained less than 0.5 percent ash.

Section 500: More than 95 percent of the solvent was recycled.

Section 800: On an MAF basis 25 percent of the coal was recovered as char.

Run 003 was terminated because of the inoperability of the extract granulation system. A detailed run report is being prepared.

The Shift Engineering Group finally reached full strength. The newer engineers concentrated on plant familiarization. Early in the month training focused on Section 600; later it shifted to Section 900G as preliminary start-up activities commenced. In addition the shift engineers assisted in troubleshooting the phenols contamination, monitored Section 1230 regenerations and worked closely with Operations to improve boiler efficiencies and reduce condensate pressures.

VII. DEPARTMENTS

Technical (Continued)

In Data Processing the process and laboratory files for Runs 003 and 004 were transferred to a history tape and the computer files were prepared for Run 005. The Scanivalve was activated to log data during the prerun instrument checkout. A revised Laboratory File Index and Warehouse Inventory Catalog arranged by equipment tag number were issued.

Several chronic problems were experienced in the computer area. Four high temperature (80+°F) alarms were caused by malfunction of the heating system. Seven maintenance calls were made by DEC service engineers. The line printer and disc problems were repaired and the tape drive motor will be replaced when the part is received.