BCR-MPR--23

TECHNICAL SECTION

of

PROGRESS REPORT NO. 23

on

CONTRACT NO. 14-32-0001-1513

to

OFFICE OF COAL RESEARCH

December 20, 1974

BATTELLE
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201

SUMMARY

During this reporting period Chemico emphasized expediting equipment and materials deliveries to the site, field construction and completion of the scale model of the PDU. They also continued to wind-down the New York office engineering activity. Based on information gained through their increased expediting activity Chemico presented Battelle with a new, updated construction schedule showing completion in about June, 1974.

Battelle continued to monitor the work of Chemico, assisted them in expediting, prepared for and attended hearings associated with increasing our natural gas allocation at the site, and continued building additions and site modifications required for the PDU.

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INTRODUCTION AND PROJECT OBJECTIVE

This progress report describes work completed by Battelle on the Coal Gasification Program during the period November 21, to December 20, 1974. The work completed during this period was nonexperimental and was associated with the installation of the 25-ton-a-day coal gasification process development unit by Chemico for Battelle. Nothing of a patentable nature is disclosed within this report.

The general objective of the current contract is development of a two-stage fluidized-bed process utilizing a self-agglomerating fluidized-bed burner as part of a practical and economical method for producing synthesis gas by steam gasification of coal. The developed process is to be useful as part of a system for producing synthetic pipeline gas or for other purposes.

Pursuant to the general objective, a 25-ton-a-day-of-coal Process Development Unit (PDU) is to be erected and operated and the following aspects of the process explored:

- The operability of a self-agglomerating fluidized-bed coal burner operating on an Eastern bituminous coal under pressure and using air for combustion.

- The mechanical feasibility of continuously circulating a burden of hot-ash agglomerates between fluidized-bed burner and fluidized-bed gasifier vessels at 100 psig of pressure and the rates and temperatures required for effective heat transfer.
- The operability of integrated fluidized-bed burner and gasifier vessels both fed by Eastern bituminous coal (or char in the case of the burner) and operating at 100 psig of pressure. The gasifier is to be fluidized by steam and the endothermic heat of gasification is to be provided by the circulating burden of hot-ash agglomerates.
- The operability over extended time periods of a power-recovery turbine using hot, fluidized-bed burner effluent gases as the turbine working fluid.
- The factors that influence the long-term operability of the process. Included is to be the gathering of data on all key process variables and their effect on the characteristics of the process.

Concurrent with operation of the PDU, sufficient process data and information will be acquired to permit scale-up of the process to its next logical stage of development.

WORK COMPLETED

Detailed Engineering Design and Procurement of the PDU

Chemico provided Battelle with an overall project schedule for the PDU installation on April 4, 1974. This schedule was first presented in Progress Report Number 15. Since then Chemico has been noting the work completed on the schedule and reissuing it. On December 6 Battelle was presented with a new construction schedule by Chemico. This schedule reflects the delays experienced in delivery of equipment and materials to the job site. A completion date for the PDU of June is now

projected by Chemico. A new overall project schedule which reflects the change in the construction schedule has not yet been issued by Chemico.

Chemico has emphasized expediting of equipment and materials to the site by their New York office staff during this reporting period. Work directed at completion of the PDU scale model also continued at Chemico as well as nominal engineering design and procurement activities. The Chemico status report as of December 1 was not received by Battelle on time, consequently, not enough review of their report was possible to allow its inclusion in this report.

Drawings

Virtually all of the Chemico drawings for the PDU have been "issued for construction".

Requisitions and Purchases

At least "initial" purchase orders have been issued for virtually all of the items required for the job. As materials take-offs are completed and checked by the New York and field offices and field modifications are found which must be made it is necessary to revise some of the purchase orders. Change orders on many of the commodity items are being issued almost daily by Chemico. Very few change orders for noncommodity items are being made. The nature of the change orders is normally that of increasing or decreasing quantities, splitting orders, cancellations, etc.

Expediting and Inspection

Expediting and inspection of equipment and materials prior to delivery continue to be the most important activities required for orderly progress of the PDU construction.

Mr. Thomas Dillon, Chemico's project engineer on our job, is coordinating visitation activity and has made several visits to supplier's shops himself. This activity is intended to supplement Chemico's regular

expediting activity. Another member of the Chemico project staff (J. Perrone) has been assigned to work full time with Mr. Dillon following the purchase orders including visits. Mr. Perrone will concentrate on bulk, commodity purchases.

To further supplement the Chemico expediting and inspection activity, Battelle's project engineer (Mr. Adams) is continuing to make trips to vendor's shops and following up on his trips with phone calls. The Battelle project manager has also visited some vendors.

Equipment and Materials Received at the Site

About 65 percent of the major items of process equipment have arrived at the site; in addition about 40 percent of the instruments are at the site. The equipment is stored at the site and the materials, for the most part, are being used as they are received. Equipment and materials which have arrived to date are as follows:

FLOWSHEET EQUIPMENT ITEMS

	Description
U-100	Control Cabinets
B-180	Equipment Shelter
G-101	Coal Mill Surge Hopper
G-102	Coal Receiving Hopper
R-101	Grizzly
K-201	Main Fan
P-205	Screened Coal Cyclone
D-201	Inert Gas Generator (for Coal Pulverizer)
K-203	Combustion Air Blower
K-202	Auxiliary Fan
K-204	Screened Coal Blower
O-201	Coal Pulverizer
P-201	Cyclone Separator & Support Ring
L-202	Spinner Separator
P-203	Bag Filter
O-205	Ground Coal En Masse Conveyor/Elevator
J-301-A&B	Oil-Solids Pumps
O-301	Screw Conveyor Cooler

FLOWSHEET EQUIPMENT ITEMS (Continued)

	Description
O-303	Rotary Valves
P-301	Pretreater Cyclone
K-303	Pretreated Coal Blower
P-302	Pretreated Coal Bag Filter
P-304	Separator
R-301	Teflon Lined Separator
P-401-A&B	Bag Filters and Bin Vents
G-401-A	Combustor Feed Bin
G-401-B	Gasifier Feed Bin
G-402	Combustor Feed Pressurizing Bin
G-403	Combustor Feed Injection Bin
G-404	Pretreated Coal Receiving Bin
G-405	Gasifier Feed Pressurizing Bin
G-406	Gasifier Feed Injection Bin
P-501	Combustor Cyclone
P-502	Gasifier Cyclone
H-502	Gasifier Vessel and Spare Head
H-501	Combustor Vessel and Spare Head
K-501	Heater Recycle Blower
O-502	Char and Sinter Cooler-Conveyor
O-505	Dump Hoppers
O-506	Dump Hoppers
O-507	Dump Hoppers
O-503	Dump Hoppers
O-509	Dump Hoppers
O-512	Dump Hoppers
U-050	Instrument Panel
R-601	Teflon Lined Separator
R-602	Teflon Lined Separator
P-601	Separator
G-603	Sludge Settler
J-602-A&B	Venturi Circulating Pumps
J-601-A	Venturi Circulating Pump
E-604	Recycle Make Gas Cooler
K-603	Recycle Make Gas Compressor
E-605	Recycle Make Gas Aftercooler
P-602	Separator
D-702	Inert Gas Generator
G-703	Instrument Air Receiver
E-703	Instrument Air Aftercooler
K-701-A&B	Process Air Compressors
G-701-A&B	Process Air Receivers
R-701	Instrument Air Dryer Package

FLOWSHEET EQUIPMENT ITEMS (Continued)

	Description
K-703	Natural Gas Booster Compressor
G-702	Inert Gas Receiver
D-802	Steam Generator
R-804	Cooling Tower Water Treatment System
D-803	Steam Superheater
J-804-A&B	Valve Cooling Water Pumps
V-802	Emergency Electrical Generator
G-802	H. P. Water Surge Tank
J-803A&B	Cooling Tower Water Pumps
R-803	Cooling Tower

BULK ITEMS

Chemico Cost Code Number	Description
A-190	Anchor Bolts
T-600 & T-615	TFE-Lined Valves
R-301-2, R-601-s, R-602-2	Raschig Rings for Scrubbers
--	Needle Glove Valve
--	Flow Switches
T-626	Miscellaneous Valves
T-450	Tubing
--	Strainers
--	Tube Fittings
--	Gaskets
T-620 & T-621	Miscellaneous Valves
T-615	Miscellaneous Valve
U-060	Pressure Regulators
R-450	Filter Regulators
T-450	Miscellaneous Valves
U-030	Annunciators
V-020	Transformer Substation (1)
A-190	Reinforcing Bars
U-030/U-041	Weigh Systems (load cells)
T-31A2	Copper Tubing
P-1A5	Seamless Pipe
UGA-42	Gate Valves
6-COS	Expansion Joints
--	Ulukepe Cable
T-550	Miscellaneous Valves
U-060	Miscellaneous Valves
R-301-2, R-602-2, R-602-2	Gaskets
U-041	Pneumatic Pressure Transmitters

BULK ITEMS (Continued)

Chemico Cost Code Number	Description
V-032	Miscellaneous Electrical Supplies
U-060	Control Valves
U-020	Pressure Gauges
B-101	Small Bore Pipe (partial)
U-030	AIT 10-22 Gas Analyzers
"	AIT 30-39 Gas Analyzers
"	AIT 50-11 Gas Analyzers
80-V	Unistut
80-V	Lighting Fixtures
80-T-022	Pipe Fittings
U-100	Lab Panel
U-041	d/p Transmitters
80-T-040	S.S. Pipe
U-060	Valves
80-T-615	Valves
T-450	Swagelock Fittings
V-020	Substation No. 2
80-V	Conduit Fittings
80-V-100	Terminators
U-041	Level Transmitter
V-060	Cable
T-450	Tubing
80-V	Electrical Fittings
80-T-022	Pipe Fittings
T-450	S.S. Pipe
V-100	Motor Control Center
80-V	Conduit Fittings
V-060	Wire
80-T	Shop Fabricated Pipe (partial)
T-450	Valve Manifold-Gauge Siphon
U-050	Main Control Panel
80-T-615	Pipe Fittings
U-020	Thermocouples

In addition to the above listing, partial shipment of various orders for bulk items has been received. These items will be reported as received when the orders are completed.

All structural steel for both the coal feed and the burner-gasifier structure have been received except the stair tread and rails for the burner-gasifier structure.

Construction of the PDU

Chemico issued their first construction schedule on May 23, 1974 (Issue P-1). Several refinements to the schedule have been made since the first issue. Copies of the updated issues have been provided to Dr. R. E. Vener of OCR, Dr. Ab Flowers of A.G.A., and Dr. R. Detman of C. F. Braun with Battelle's monthly reports. The most recent schedule issue transmitted was the one dated October 7 with Progress Report Number 21. A meeting was held between Chemico and Battelle in New York on October 24 for purposes of reviewing the Chemico materials status report. At that time it was obvious to Battelle that there were too many unconfirmed and unsubstantiated delivery dates for Chemico to be making meaningful projections about the overall construction schedule. Based on the increased vendor visitation program directed by Chemico's Mr. Dillon a new construction schedule was presented to Battelle by Chemico on December 6, 1974. Copies of the new schedule are being forwarded to the Operating Committee and to Dr. Detman.

Construction was initiated formally on June 10. Work done prior to mid-December has been reported in our previous monthly reports to OCR. Battelle's field office is in daily contact with the Chemico construction personnel.

Figure 1 shows the construction activity at the site in early December. The partially completed block structure in the foreground is the building being erected by Battelle* to house the process air compressors and other auxiliary equipment. Unseen construction activity by both Battelle and Chemico is in progress within the existing structure (to the extreme left in Figure 1). The essentially completed steelwork for the coal feed structure is shown in the background at the right. In the left background and adjacent to the coal feed structure is the partially completed burner-gasifier structure. The water cooling tower for the PDU can be noted in the far right background. Figure 2 shows the two structures

* Battelle has a local contractor firm (J. J. McCarthy and Co.) doing this building erection and modification work as a part of Battelle's financial contribution to the program.

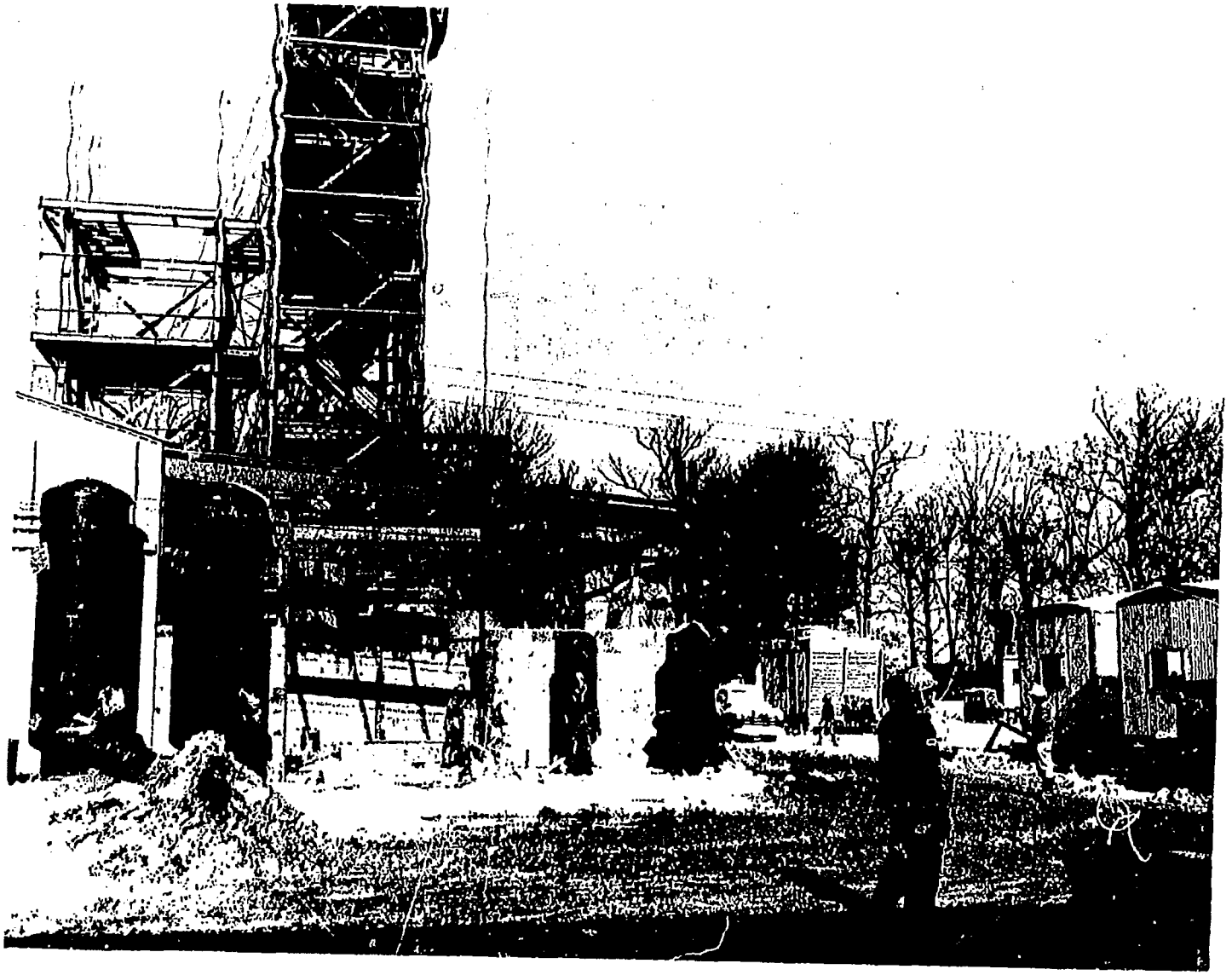

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FIGURE 1. ACTIVITY AT THE PDU SITE IN EARLY DECEMBER 1974

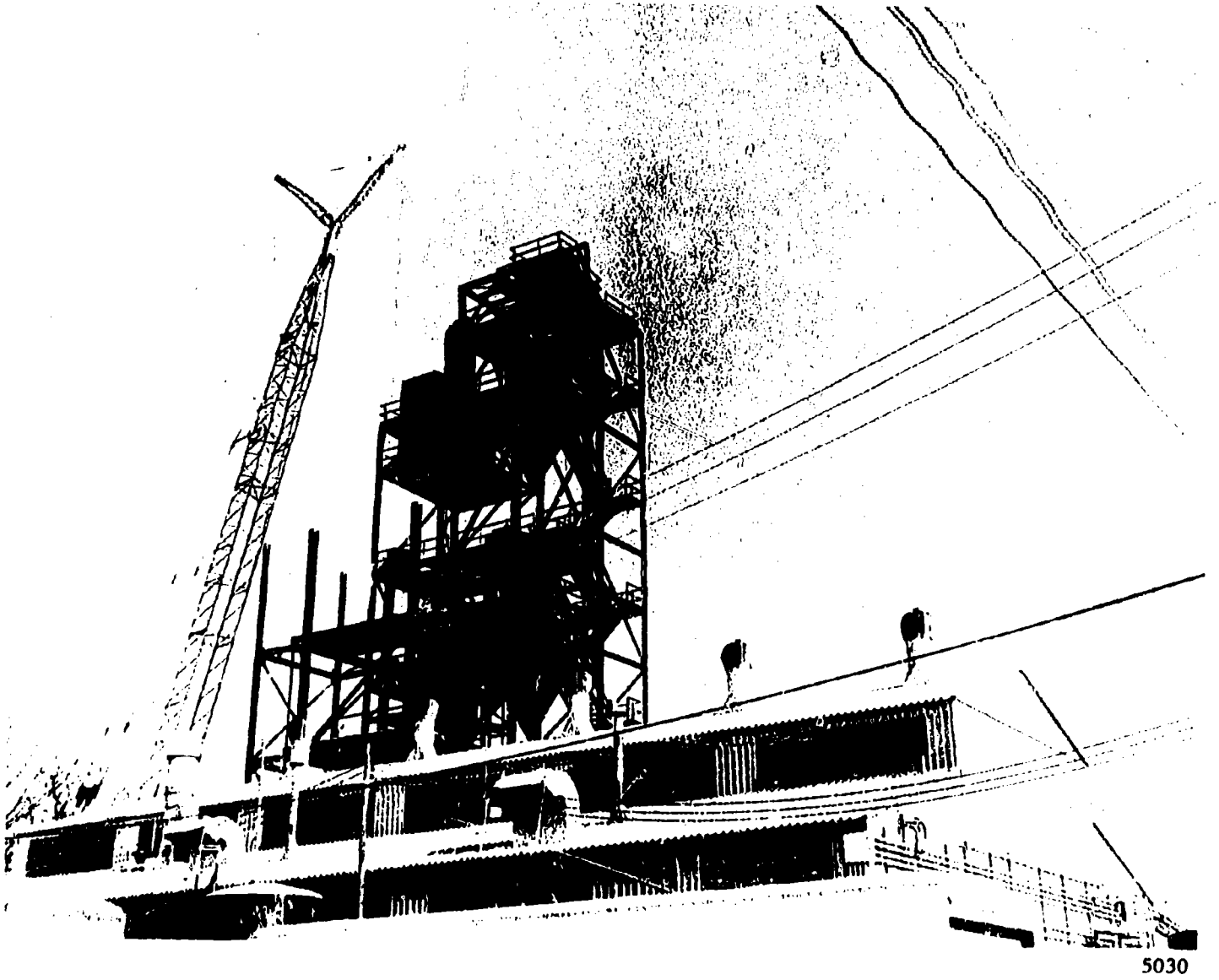

FIGURE 2. COMPLETED COAL FEED STRUCTURE AND PARTIALLY COMPLETED BURNER-GASIFIER STRUCTURE VIEWED FROM THE WEST SIDE OF BUILDING JS-2

as viewed from the west. At the time these photographs were made, the burner and gasifier vessels, while at the site, had not been installed in their structure.

The delay of winter weather, as well as slow receipt of materials, has continued to retard construction progress during this reporting period. Construction is progressing at a slightly better rate than last month but at a significantly lower rate than desired.

Work on the burner-gasifier structure is now at the 55-foot level and, with a couple of days of good weather, Chemico should be ready to install the gasifier vessel.

Battelle has nearly completed the compressor shed shown in Figure 1. The roof should be installed the week of December 16. With the exception of the boiler feed water treatment system, all of the PDU equipment to be installed in the compressor shed has been emplaced. This includes the process air compressors, the steam boiler, the inert gas generator, and the emergency electrical generator.

Work has started on the installation of the Sprout-Waldron pulverized coal conveying system as well as on the duct work for the Williams mill.

The prefabricated pipe from the piping fabricator is being installed as rapidly as its availability permits. Approximately one-third of the order has been received, but not necessarily as complete lines

Additional shipments of bulk pipe fittings were received, and substantial progress has been made on the field fabrication of the small-bore piping. Continued progress has been made on the installation of the electrical conduit. Some electrical wire has been pulled through the conduit; however, this activity is limited by the temperature. There is a tendency for the insulation to crack if the wire is pulled when it is too cold.

The field labor force averaged about 35 during this reporting period and had increased to 40 at the end of the period.

There were no lost-time accidents.

Battelle Activity Directly Related to Detailed Design and Installation of the PDU

In addition to the Battelle activity related to monitoring Chemico's design and construction work and assisting in expediting already noted, the Battelle staff have been participating in other areas directly related to the PDU design and installation.

Members of our Applied Solids Mechanics Section have continued to provide the project staff assistance in inspecting the construction of the major vessels for the PDU. Materials of construction specialists at Battelle have assisted the project staff in making selections of substitute materials in some cases to expedite deliveries and in obtaining needed HK-40 alloy pipe.

No significant progress was made on the turbine procurement during this reporting period.

On December 12 a hearing was held before the Ohio Public Utilities Commission on Battelle's request to have our natural gas allocation at the site increased. Representatives of the Battelle Coal Gasification Project and Plant and Physical Facilities Department participated in the hearing as did representatives of Columbia Gas of Ohio. The question of whether Battelle can have an increase in allocation at the site for the PDU operation was not resolved at this hearing. Battelle was instructed to continue reevaluating the possibilities of converting some of our other fuel consuming operations to alternate sources (other than natural gas) to free enough of our current allotment for PDU use. We also are to continue our dialogue with Columbia Gas and to report back to the Commission in 30 to 45 days.

Battelle presently has a permit from the State of Ohio Environmental Protection Agency to construct the PDU. This permit was granted based on the Ohio EPA's review of our process flowsheets, data, and planned operation. It is our understanding that applications for permits to operate will not be accepted by the Ohio EPA more than 6 months prior to planned operation. Consequently, until now, we have the only permit

we can obtain. Battelle's Environmental coordinator has now been asked to proceed with whatever procedures are required to obtain the operating permit.

PROBLEMS AND RECOMMENDATIONS

Practically all technically related problems at present continue to be due to the slower-than-desired delivery of equipment and materials to the field and inclement weather. Both problems are delaying construction. Continued emphasis on expediting by Chemico and by Battelle is required to improve this situation.

Work Plant and Schedule

Major emphasis by Chemico must be on expediting materials and equipment deliveries to the site and field construction during the forthcoming reporting period. It is also expected that delivery of the scale model of the PDU to Battelle will be made in the forthcoming reporting period.

The new construction schedule from Chemico based on information gained by their increased number of visits to vendors is being evaluated currently by Battelle. A meeting is tenatively planned for the week of January 6 with the OCR/A.G.A. Operating Committee to discuss the schedule and other aspects of the program.