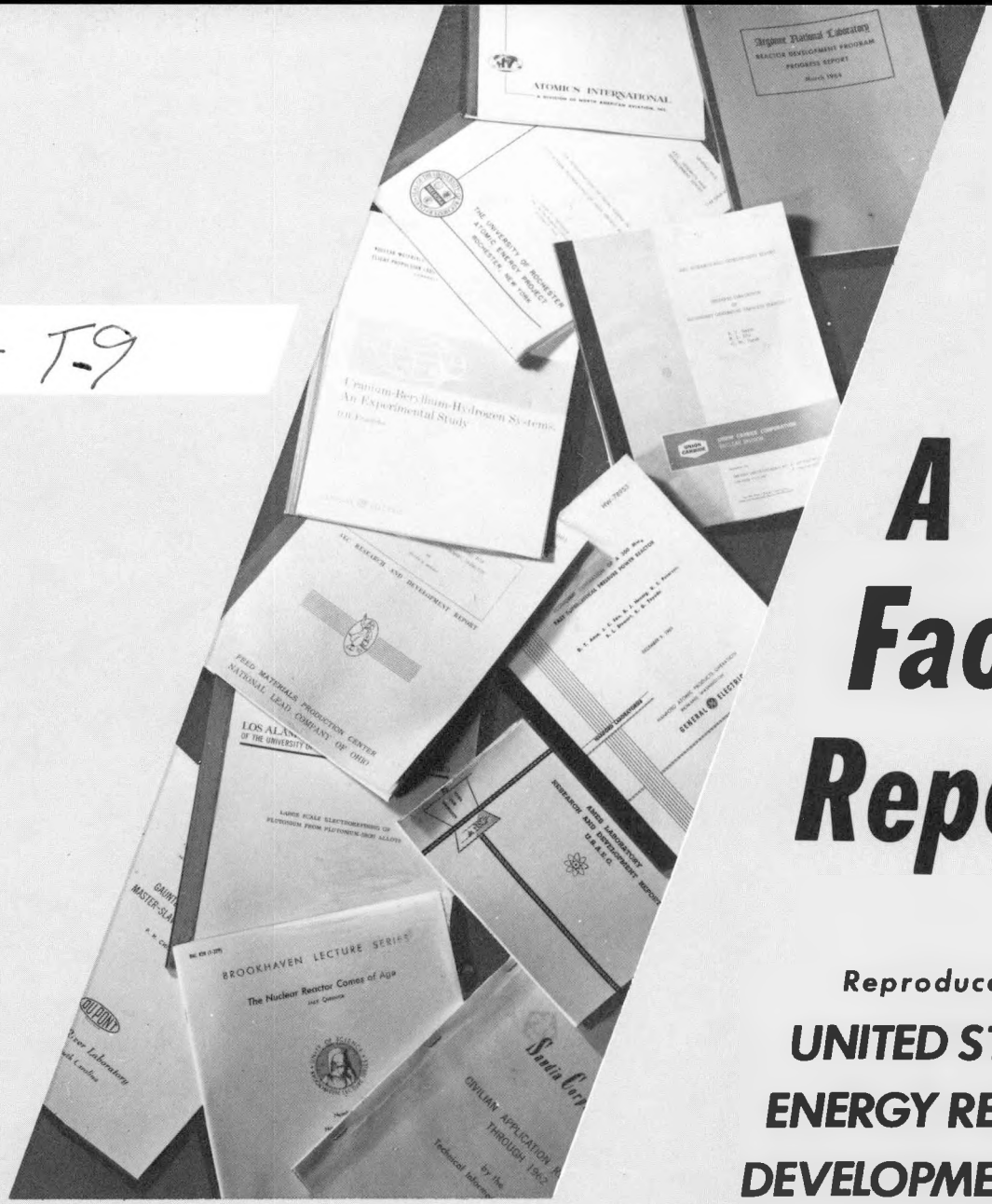
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CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

Monthly Progress Reports for the Period January - December, 1972

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Prepared for

Office of Coal Research
U. S. Department of the Interior

OCR Contract No. 14-01-0001-415(3)
and No. 14-01-0001-415(4)

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Monthly Progress Reports 92 through 103 for each month January 1 through December 31, 1972, respectively

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CCDC-MTR--72

PROGRESS REPORT NO. 92
OCR CONTRACT NO. 14-01-0001-415(3)
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

January 1 to 31, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

An extended hot mechanical test of the gasification and purification sections of the pilot plant was carried out at 150 psig. Gas was recirculated through the recycle heaters and regeneration air heater at design exit temperatures (1500-1700°F) to bring the vessels up to 1400-1600°F. No major problems were encountered and heat losses were acceptably low.

This test will be completed in mid-February and emphasis will then be placed on the correction of mechanical deficiencies and installation of required changes. During this maintenance period, several tests will be carried out on equipment ancillary to the gasification reactors.

Financial

Estimated monthly expenditures are $15,400 by Consol and $365,000 by Stearns. Cumulative expense to date is $13,373,609.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533.00)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534.00)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536.00)

Work continues on the report summarizing the engineering and construction of the pilot plant.

4. Stearns-Roger Construction Subcontract (Project No. 700.00)

This project is still active pending final settlements with vendors. Construction costs as of January 31 total $9,288,100.

5. Library Assistance on Pilot Plant Operations (Project No. 537.00)

Progress review meetings were held in Rapid City on January 12 and 13. A pilot plant schedule for the next four months was presented, indicating that attempts at gasification will be initiated in mid-April, 1972.

Consol, through Conoco Engineering, prepared a metallurgical test program and budget.

Consol attended the second committee meeting of the Task Group for Materials Data for Coal Gasification. The committee arrived at a program for testing various metals under gasification conditions. Contracts are being solicited by the Task Group for carrying out the agreed-upon test program.

6. Consol Guidance on Operations (Project No. 702.00)

The progress report is attached. As indicated by this report and the Stearns report (below), the reactors were successfully heated to 1400-1600°F by gas recirculation at 150 psig. No significant problems due to thermal expansion, furnace operation, scrubber operation, or compressor operation were encountered.

7. Stearns-Roger Operating Subcontract (Project No. 701.00)

a. The progress report is attached.

b. Program

As soon as 200 hours (at 1700°F) of operation have been achieved on the Incoloy process furnace tubes, the hot mechanical tests of Section 200 and 300 area will be terminated. Emphasis will then be placed on correcting the various instrument deficiencies revealed by the test. In addition, concentrated effort will be expended on completing the plant changes necessary for a gasification test. Principal items are the installation of an enlarged invertor (to handle power dips) and the installation of siding and gas detection equipment for personnel protection.

Present scheduling indicates that the critical changes will be completed in late March. During this down period, several tests of isolated portions of the plant will be carried out, including the crushing and drying of Husky char.

8. School of Mines Subcontract (Project No. 703.00)

The January progress report is attached.

C. Subject Inventions

None.

D. Financial Status

Expense	Actual	Budget
Cumulative through December, 1971		
Through June, 1969	$ 1,878,256	$ 1,878,256
Consol	660,553 (1)	492,850
Stearns	10,454,400	10,352,800
	$ 12,993,209	$ 12,723,906
Expended in Period (estimate)		
Consol	15,400 (1)	39,475
Stearns	365,000	211,500
Total, January, 1972	$ 380,400	$ 250,975
Cumulative through January, 1972	$ 13,373,609	$ 12,974,881

(1) Includes payment to South Dakota School of Mines

Att. Monthly Report No. 17 - Project 702
Operations Report No. 23 - Project 701
Monthly Report - SDSM - Project 703
Progress Charts

Project 702.00
CC w/Operations Report:
E. E. Ellington
C. A. Schulz

cc: CF

CONSOLIDATION COAL COMPANY
RESEARCH DIVISION
LIBRARY, PENNSYLVANIA 15129

INTER-OFFICE CORRESPONDENCE

To : John A. Phinney Date : February 7, 1972

From : Carl E. Fink and Uwe D. Marwig At (Office): Rapid City

Subject: Monthly Report No. 17 - Project 702

During January Consol wrote and submitted to Stearns-Roger a series of programs which outline in detail four runs and tests to be completed prior to the initiation of char gasification. These programs describe the following tests:

1. Reactor and piping jacket systems run
2. Char grinding run
3. Lignite lockhopper system run
4. Ash lockhopper system and dolomite lockhopper system run

A program for a fifth test, quench water systems run, was issued in December.

During the month a large amount of freezing damage occurred when the steam boiler could not be restarted after a shutdown. A study conducted by Consol revealed the apparent cause for the inability to restart the boiler as well as other several shortcomings in the boiler controls. The conclusions of this study together with recommendations were transmitted to Stearns-Roger.

During January Stearns-Roger operations has been involved in a mechanical testing program which consists of shakedown of the fired heaters, compressors, and pumps. The plant was pressurized to 150 psig, and inert gas was recycled through the three reactors via the recycle compressors. The fired heaters were placed into service, and by month's end, the recycled gas streams to the gasifier and devolatilizer were at 1700° F and the recycle gas streams to the regenerator were at 1500° F. Despite the fact that the draft controls are not in service, the fired heaters appear to be quite reliable.

Heat loss in the lines between the fired heaters and the reactors seem to be quite low. With normal flows, the gas temperature decreases between 40 and 80° F, or less than 1 degree per foot of line length.

During these operations, the pressure and inlet gas temperature requirements for the char gasification run were achieved; however, no attempt was made to tune the control of the system.

Carl E. Fink

Uwe D. Marwig

CEF-UDM:lmp

Attachment: Stearns-Roger Operations Report No. 23 (2)

CONSOLIDATION COAL COMPANY PROJECT

CSG PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #23

CCC Project No. 701
S-R Job No. B-37400
February 4, 1972

PROGRESS REPORT SUMMARY

Two runs were made during January; a lignite grinding run using all of the remaining lignite and preliminary operation of the gasification system. Preliminary operation of the gasification system consisted of two parts; a mechanical testing program, and break in of all of the gasification equipment to be used in the char gasification, except the lock hopper systems. Reports covering the grinding run and the first phase of mechanical testing are attached. A report for the test run of the preheater system is also attached. The preheater run was carried out in December.

During the grinding run, the position of the velocity separator in the Williams mill was varied to define how particle size is related to moisture content. With the separator set half way down to increase velocity at the exit of the mill, the particle size distribution was reduced; but, the moisture content was 11.8% rather than the target 5%. Next, the temperature out of the mill was increased to decrease the moisture content. This was partially successful in that the moisture dropped to 9.4%, but equipment limitation made further reduction in moisture impossible. During the run about 14,000 pounds per hour of feed was necessary to balance the temperatures while maintaining good (quiet) mill operation. This is 40% more feed than the design rate. Total throughput was 35 tons; 26 ending up as product, 700 pounds as fines and 8 tons as water removed during the drying.

There was no major problem in mechanical testing of the furnace and reactor systems. The furnaces were running at their design temperatures at the end of the month of 1700°F and 1500°F with metal temperatures that range up to 1950°F. No large leaks have been discovered to date and no hot bolting has been required. Minor problems were experienced with cooling in the piping jacket water system, high temperatures on some areas of the insulated jacket process lines, overstressing of the furnace tube supports, and over firing of some of the furnaces. Also, while breaking in and tuning the gasification system, many minor problems with alarms and other instrumentation have occurred and these are being corrected.

GENERAL

Our Plant Manager, W. E. Powell, died on January 22. Everyone at Rapid City misses Bill, especially his smile. We are attempting to reorganize our efforts to re-establish the continuity he instilled in our organization.

This past month has been an especially busy month for all plant personnel. Considerable debugging of the system was carried out in the process of breaking in the 200 Area. Maintenance and instrument personnel extended themselves repeatedly in order to make small revisions "on the fly". Most of these changes are related to the fact that the original design basis for the plant did not include operation at 150 PSI, the pressure which is to be used in the initial char run. The engineering and drafting force also contributed to the debugging at the same time that they finished work on engineering changes necessary for char gasification.

Meetings were held with Mr. Cochran on January 12 and 13 and with Mr. Staber on January 26. The budget estimate and schedules discussed in the meetings are attached.

MONTHLY ACCOMPLISHMENTS - OPERATIONS

Cold weather has plagued operations dur'ng the month. Several lengthy cold spells have resulted in spending a great deal of time in monitoring the plant for freeze protection. Lows of -20°F and below were recorded; the lowest being -23°F at the airport. Chill factors at ground level reached as low as -46°F for extended periods. The installation of siding, now in progress, will help working conditions.

The mechanical testing of the 200 and 300 Area process equipment continued during January. Over the month the ten process heaters were lit, the refractory cured, and brought to design temperature on the process outlets. The final heaters on the gasifier and devolatilizer systems were taken to 1700°F and on the regenerator system were taken to 1500°F. Optical pyrometers are being used to monitor heater outlet tube skin temperatures and outlet header temperatures. Mr. Vic Brant defined the maximum temperature limits on the critical parts of the heaters for 175 psi operation and 330 psi operation. Maximum metal (skin) temperatures range from 1900°F to 1950°F. Electrical and instrument problems were either corrected or bypassed for this run. The system was operated at 150 psig on the reactors. Inert gas and/or nitrogen is being used in the circulating system. The jacket water, quench water, and HPC (using water) systems were operated during January while the reactor systems were operating. Flow orifices in the piping jacket water distribution system were found to be too small to permit circulation of the necessary amounts of water for proper cooling. Bypasses were installed so that the run could continue. The orifices will be corrected during the coming shutdown.

All purge systems were activated during the month. Problems with the A and B purge systems necessitated using inert gas part of the time. The C purge system which is to be CO_2 during gasification used inert gas during the month. The purge systems are extremely important to the operation of the reactor systems; therefore, much effort has been expended in trying to keep these systems operable.

Procedures for starting the jacket water and quench water systems have been written by the operators and are being revised by the shift engineers.

The heater pressure drop test requested by Vic Brant was completed and the data sent to him. No trouble was experienced in starting the recycle compressors under the load of system pressure. Therefore, no special unloaders will be needed during power dips as was the case with the main air compressor.

The remaining lignite in silo FA-102 was ground and dried through the Williams equipment. Minor revisions to this equipment allowed the silo to be emptied. A new enclosed slide valve was installed on the outlet of the silo.

One car of Husky char has been unloaded into silo FA-102 in preparation for a char grinding and drying test through the Williams equipment.

Mr. Vic Brant spent some time with the technical and shift engineers in reviewing his final two-vessel operating procedure. The shift engineers started the operations write-up that will be used to train the operators.

Five C Operators and one B Operator reported for work in January.

Weekly safety meetings were initiated with one shift per week attending. The subject for January was the safe work permit procedure.

We continue to operate the boiler and cooling tower systems on a routine basis. There have been several boiler failures during the month. Only one was of serious consequence. On January 14 at 12:05 A. M., the boiler shut down with the outside temperature of -20°F and a chill factor of -46°F. We were not able to restart the boiler for over one hour which resulted in extensive freeze damage to the steam tracing system and some damage to the process system. We have been unable to pinpoint the reason why the boiler did not restart on January 14. On January 15 and 27 other boiler failures occurred; however, the boiler was restarted in each case with no damage to equipment. The boiler has restarted without difficulty, more than thirty five (35) times. Twice during the month, domestic water to the plant was shut off. Once to repair a leak in the water main and once to tie in a new customer near our plant. Both times we were given sufficient time to store water for the boiler (our critical water usage) in two empty process tanks. We were able to maintain reduced boiler operation for the two outages which lasted about 3 hours each. The inert gas generator was operated during the month supplying purge gas and gas for the circulating reactor system.

Two power failures during the month shut the process system down. The duration of the power outages was 2 to 3 minutes on January 7 and 10 seconds on the 16th. No apparent damage was done either time. The process system entered an ESD mode each time.

Additional fire extinguishers have been received and are being installed. The Factory Mutual Insurance Company representative was in the plant and recommended some inspection procedures for us to follow.

MONTHLY ACCOMPLISHMENTS - MAINTENANCE

The maintenance force was increased to 44 craftsmen as a result of the extra work that was necessary to repair the steam tracing that froze January 14. Even so we lost more than a week on work necessary to complete items for gasification. Also, work on the tracing, especially replacement of insulation, has not been completed and probably will not be completed until spring.

Work continued to enforce the new Federal Register (Health and Safety Act). This included completing the lunchroom and adding specially designed scaffolding used in putting up the siding and numerous miscellaneous work.

1. Work completed on items required for the gasification run includes:

   Completed air tank piping.

   Completed low pressure H_2 piping and level indicators.

   Completed jacket water flow indicators.

   Completed installation of new drains on the inert gas compressor

Relocated piping to clear new siding.

Race ways and tubing for CO analyzer P-5-71-3 were started, the tube bundles, junction boxes and race ways completed. Single tube runs 60%. Need rest of material.

Suction bottle drain valves for the cycle compressors, J-201 A & B, J-203 A & B was completed.

Drain system for J-201A&B, J-203 A & B, J-207 A & B. Knock out pots fabricated, one mounted, iso's back to engineering. Estimate total job is 15% complete.

Additional steam tracing started last month is 90% complete as per piping isos, and work is progressing on the insulation.

Installed manual block valves upstream of Maxon valves on heaters B-201 IB and IIB, B-201 IA and IIA and B-207 IA and IIA.

Installed new slide gate on bottom of the lignite bin.

Poured concrete for office trailer foundation.

Assembled unloading valves for the main air complete J-202.

Set up coal sample grinding building.

Moved ash lock hopper panel to 6th floor from the third floor as part of the complete revision of this system.

Installed steel for siding 8th and 9th floors.

Installed steel for siding 2nd and 7th floors.

Installed siding on 8th and 9th floors on 5 line.

Installed siding on 2nd, 3rd, and 4th floors 4 line.

Installed siding on 2nd and 7th on G line.

Started steel for shed over the Williams generator, U-519.

Started steel for shed 7th floor to house the deaerator and preheater furnace.

Installed steel for windwall 2nd floor col.

Relocated and revise the main pressure controllers, PCV-2052-1 and 2022. The piping is complete. The instrument crew installed the tubing.

2. Regular maintenance included 46 routine items and:

Repair of 106 frozen and damaged steam trace systems.

Installed new head and crosshead in J-502 air compressor.

Installed new mechanical seal in J-201 B.

Replaced packing in J-301, 302, 311, 314, 211, 214 A & B pumps.

Repaired broken distribution valve on cooling tower.

Completed 90 day preventative maintenance on compressors J-209 A, J-215, J-513, J-518, J-201 A and J-309.

Repaired broken "Y" valve (XCV-2115).

Replaced broken frame on pumps J-210B, J-311A, J-302B.

3. Other work during the month included:

Installed the model from Library in the Area 100 building as material permitted, 90% complete.

Installed shades in office building.

MONTHLY ACCOMPLISHMENTS - TECHNICAL DEPARTMENT

1. Data Taking and Analysis of Run Results

Reports have been issued on the runs completed during January and one for December. These reports are listed as follows:

a. Lignite preheater run which was made in December. The report on this run is an attachment to the Operations report.

b. Lignite grinding run which was accomplished in early January to empty the lignite silo. This report is also an attachment to the operation report.

c. Report on the status of the mechanical testing program. All equipment ordered to date has been received for this program. Please refer to the attached report for details on this program.

2. Engineering Work Accomplished on Plant Design Modifications

The status of various jobs are as follows:

a. Five small metal buildings were ordered in late 1971. The laboratory coal grinding and sizing building was erected during January. The foundation for the chart storage building has been initiated. Foul weather has held up the scheduled installation.

b. The high pressure liquid nitrogen pumps and vaporizers were received during January. Installation will be scheduled for February, with final tie-in when the liquid nitrogen tank is empty.

c. The enclosure for the purge rotometers is completely engineered. Nearly all material is on order with installation to start in February. This engineering change order will be installed prior char gasification.

d. A drain system for the recycle compressors J-201, J-203, and J-207 is completely engineered. Installation is about 40% completed and will be completed before gasification is initiated.

e. A new type of slide valve was installed on the bottom of FA-102 lignite storage silo. The installation is complete except for installation of the drain line on the water draw-off connection.

f. The foundation for the office trailer was installed in January. Engineering has been completed for the routing of gas, telephone, electrical, and interplant communication to the trailer. The trailer is expected to arrife the first part of February.

3. Electrical Engineering Accomplishments in January

a. Work was continued on completing the engineering, drafting, and installation of the inverter system in preparation for final tie-in and testing during the scheduled plant shutdown. The auxiliary relay panels for various alarm points were designed and installed. Installation of the panels is complete except for final tie-in.

b. Conduit and wiring were installed for temperature shutdowns for the quench water pumps.

c. Installed the zero speed indicator and alarm on the exhaust fan in the material handling building.

d. Conduit and wiring were installed for ammeters located on the screw conveyors in the material handling area. The ammeters are scheduled to be shipped the first week in February.

e. Engineering was completed for electrical supply to operate the automatic unloaders on J-202, main air compressor.

4. Engineering Required Prior to Char Gasification

a. The engineering has been completed on the sample systems required to obtain samples during char gasification. These will be installed as can be scheduled prior to gasification.

b. The backup instrument air dryer was ordered from Kahn in December. About mid-month we received notification from Kahn that they are holding our order because of a payment dispute with the Denver office on the construction contract. They would not guarantee any delivery date. Therefore, the order was cancelled with the dryer now on order from C. M. Kemp. Also, the pulsation bottles were not ordered because of space limitation on the discharge of the compressors. A small air receiver and knockout pot have been ordered in lieu of the pulsation bottles.

c. The piping spring hangers were released and checked at the following temperatures: Ambient 400°F, 800°F, and 1100°F.

Final check and adjustment is to be made at operating temperatures.

d. Installation of the CO gas monitoring system has started. The analyzers were shipped January 28 and should arrive the first week in February. This item will be installed prior to char gasification.

e. Installation has started on the equipment required to operate the spent dolomite and ash out system.

f. Cold weather has slowed the installation of the aluminum siding on the main structure. This engineering change order is approximately 40% complete.

5. Engineering Required in Solving Operational Problems

a. Material required to revamp the high pressure inert gas compressor and improve the efficiency of the inert gas dryers is on order. This equipment is to be installed in February or early March. The dryers have been fouled by oil emulsion carry-over into the desiccant beds.

b. The reactor system was de-pressured during our initial pressure test on the system because of a frozen process line. During the de-pressurization it was noted that the flare system had a high pressure drop (5 psi). Some data was obtained during the de-pressurization relating to the high pressure drop, but no conclusions were reached. Additional data will be obtained following the "hot testing" of the heaters.

c. Engineering has been completed for installation of automatic unloaders for the main air compressor, J-202. Installation has been started for the required instrumentation and electrical. This item was deemed necessary because of our frequent power dips on the electrical grid in this area.

d. As a result of laboratory testing on a gas mixture reported in the December operations report, flange covers are required for personnel protection. Engineering is essentially complete and we are out for quotations for the flange covers.

e. The lignite grinding system as purchased had a 32 inch rupture disc mounted on the lignite cyclone. This disc has ruptured several times during our lignite grinding runs. The original design made replacement extremely difficult. A new design was engineered at the plant site and installation was started in late January. The installation will be completed the first week in February.

f. Mechanical engineering has been required on the following items:

1. J-502, instrument air compressor
2. Boiler draft problem
3. Revamp of the "garboon" screw conveyor

g. All engineering personnel assisted the operations in thawing out steam tracing and process lines following the boiler failure in mid-January.

6. Personnel

The following work analysis was conducted for January to determine the work load that would be required for char gasification.

Routine Analysis (Including Training)	Man Hours	Percent Total
100 Area Gas Monitoring	70	8.3
200 Area Gas Monitoring	30	3.5
Dew Points	50	5.9
Lignite and Rusky Char	200	23.8
Boiler Feed Water	8	1.0
Atomic Absorption	24	2.8
Special Analyses		
Pyrite in Lignite and Rusky Char	46	5.4
NO_2 in Inert Gas	16	1.9
Flame Color of Gasifier Gas	4	.5
Equipment		
Vacuum Pump Repair	4	.5
Chromatograph Standards	50	5.9
Atomic Absorption Trouble	8	1.0
Nitrogen Distillation and Digestion	32	3.8
Analytical Development		
Wet Sieve Analysis	8	1.0
Moisture Content, Gas (Gravimetric)	8	1.0
Nitrogen and Sulphur from Combustion Bomb	40	4.8
Thermobalance (proximate analysis)	40	4.8
Thermobalance (Acceptor Activity)	40	4.8
Particle Density (Mercury Porisimeter)	24	2.8
Unidentified	138	16.4
TOTALS	840	100

Mr. K. W. Crawford reported to work on January 10, 1972 as our fourth Control Chemist.

One Technical Engineer attended Foxboro's Fundamentals of Mechanical and Pneumatic Instrumentation for two week's instrumentation training during January.

PLANS FOR FEBRUARY

1. Continue test of 200 and 300 Area equipment at 1700°F process heater outlets.
2. Complete revised operating instructions for the two vessel char run.
3. Train all operators for the two vessel char run.
4. Write char grinding instructions and conduct char grinding test.
5. Operate dolomite crushing equipment to test screw conveyor, L-152.
6. Hire a shift engineer, a B operator and three C operators.
7. Continue work on approved engineering change orders.
8. Schedule and obtain information from dolomite grinding system using Tymochtee dolomite. We were unable to schedule this test in January.
9. Continue to interview personnel for Junior Chemist position.
10. Complete initial phase of mechanical testing program at the following conditions: 335 psig and temperatures elevated in steps to design.
11. Continue to use computer as necessary for information retrieval.
12. Provide engineering support to operations for completion of programs outlined by Consol representatives.
13. Complete electrical engineering for the following engineering change orders:
    a. Revisions to Area 200 and 300 control panel.
    b. Revise lignite preheater furnace control panel.
    c. Revise emergency instrument air control system to prevent compressor shutdown until after main air compressor has been unloaded.
    d. Revise the existing restart panels.
    e. Heat trace the mechanical seal cooling system on the jacket water circulating pumps.
    f. Complete tie-ins for the inverter system.
    g. Relocate emergency generator and tie into the emergency bus.
14. Enroll several technical personnel in the first aid courses conducted at the plant. The courses are both the standard and advanced instruction in first aid.
15. A burner consultant from John Zink Company will arrive at the plant on February 6 to inspect the flame pattern of the Thermal Transfer Corporation heaters and make his recommendation. John Zink is a non-interested third party, as the heaters have National Airoil Burners.
16. Operations and engineering to each send a representative to I.G.T. for a conference on their problems with the reactor insulation spalling.
17. Laboratory -
    a. Training will be continued and directed toward refining methods to obtain exact results and to modify methods as necessary to reduce time consumption.
    b. Further calibration work with chromatographs.
    c. Promote familiarization runs on Acceptor activity.
    d. Determine the possibility of obtaining nitrogen and sulphur analysis from the calorimeter bomb.
    e. Use of the Burrell thermobalance for proximate analysis and for moisture determination.
    f. Analyze samples taken during the forthcoming char grinding test.
18. Continuing Projects:
    a. Total shift coverage with "A" Operator in charge of shift.
    b. Operate utilities area including inert gas generator.
    c. Establish fire fighting and disaster plans.
    d. Work on operating manuals.
    e. Training

STAFFING

	Present Payroll	To Be Hired February or March
Management	2	0
Accounting	4	0
Clerical	5	1
Janitorial	2	0
Safety & Pollution	1	0
TECHNICAL DEPARTMENT		
Laboratory	6	4
Engineering	12	1
OPERATIONS		
Supervisors	1	0
Shift Engineers	3 ✓	1
Instrument Engineer	1	0
Operators	33	7
MAINTENANCE		Temporary* / Temporary*
Supervisors	5	0
Crafts	44	16 / 10 / 10
Warehouse & Purchasing	4	1 / 0
Scheduling & Planning	2	0
Electrical Coordinator	1	1 / 0
CONSTRUCTION PERSONNEL		
Ironworkers*	11	11 (for 4 to 6 weeks)
TOTAL	137	

There are presently 16 temporary maintenance personnel hired as a result of the work occasioned by the tracing freeze. An additional ten temporary craftsmen will be required for extra work to complete changes planned before the gasification run. All of the construction personnel are also temporary employees.

COSTS

Accumulated Operations Costs To Date 12-31-71.....	$ 1,531,345.56
Purchase Orders Not Paid & Purchases Placed.....	255,894.00
Actually Spent-January 1972.....	330,053.79

Very truly yours,

STEARNS-ROGER CORPORATION

D. R. Mosher

CC: HLL, FEJ, MHV, DDD, WTB, NRK, JCS, UDM, CEF, CASchulz, J.A.Phinney, C.M.Stone, D.H.Dawson, Shift Engineers

DRM:ska

SUBCONTRACT BETWEEN CONSOL AND SEARS RE CONSOL CO_2 ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR JANUARY, 1972

I. General

The final base map for the transport feasibility portion of the carbonate resources report is nearly complete. The phase diagram of the calcium hydroxide/calcium carbonate system was checked out as final calibration and adjustments of the autoclave were complete. Mixtures equivalent to pure dolomite will be used next. Arsenic determinations have been completed in the noxious elements study and sodium removal via column studies continued. A brief survey of homeowners was made in the sparsely populated area downwind from the pilot plant. Defective equipment in the monitoring system is being replaced.

II. Carbonate Resources (Mickelson)

The base map for the final report will be completed the first week of February. Completion of this map will wrap up the outcrop and transport feasibility portion of the study.

Sample grinding on carbonate samples from South Dakota carbonate sources is about completed. Montana samples will be run this coming month. Samples have been cut and sent out for thin sections on the Spearfish Canyon carbonate section. The Whitewood Creek section in the Black Hills is now being sectioned and these will be stained for dolomite identification.

III. Acceptor Reconstitution (Fuerstenau)

Experimental work in January involved checking the phase diagram of the binary system, calcium hydroxide/calcium carbonate as a function of composition and steam pressure. Work next month will involve producing

melts in the presence of 21.7 percent MgO, the amount of MgO contained in dolomite. Mechanical strength and activity of the acceptor produced in this manner will be measured.

IV. Noxious Elements (Lingard)

Arsenic has been determined in ten different samples of lignite, using the silver diethyldithiocarbamate colorimetric method, and has been found to range from about 1 ppm to 6 ppm in these samples. Reliability of the procedure for arsenic was verified by the use of spiked samples.

A U.S.B.S. certified sample for mercury in coal has been ordered to be used to check our analytical procedure for mercury in lignite. Further work on mercury and lead will be carried out during February.

V. Pre-Gasification Beneficiation (Clarkson)

The study of sodium removal from lignite was continued this month using the column ion exchange technique. One set of wash solutions contained 325 ppm Ca^{++} and runs were made at pH values of 3.4, 4.5, and 6.4. Each solution was run at three different flow rates.

The effectiveness of sodium removal using de-ionized water was also studied. Water solutions at pH 4.3 and pH 5.5 were passed through the column at three different flow rates. Maximum amount of sodium removed with this technique was 40 percent.

VI. Waste Monitoring (Oliver)

A survey of residents downwind of the pilot gasification plant has been made and a copy is attached. Components of the particle detector are being installed in the vent stack adaptor. For wastewater monitoring, the two-channel recorder--received a month ago--has been tested and found to be defective. A recorder to replace it has just been received and will be checked out and calibrated with inputs from the two measuring instruments.

SUBJECT: A Survey of Residents Downwind of the Lignite Gasification Plant

PURPOSE: The purpose of this survey was to detect any pre-operation bias of the residents downwind of the plant relevant to its environmental impact. The conclusions drawn from this survey will provide a basis for comparison to later surveys; thus, it will be possible to monitor the changes in attitudes, if any, that result from the plant's operation.

METHOD: On December 11, 1971, three residents within a five-mile radius downwind of the plant were interviewed at their homes. They were Roy Steinley, Mrs. Robert Stephens, and Ernest Norman. On December 12, 1971, three additional residents were contacted and interviewed by telephone; they were Floyd Warren, Pat Colvin, and John Perli.

All persons interviewed were asked what they thought the impact of the plant would be upon them and their environment. No exact list of questions were used because of the informality of the interviews and the differences in personality.

All persons interviewed expressed a willingness to wait and see if the plant would cause any environmental changes or damage. Two of the six persons expressed concern over the relatively large amount of money being spent on the pilot plant. None of them had any preconceptions that the plant would definitely cause environmental changes.

CONCLUSIONS: It may be concluded from this survey that no significant pre-bias of any sort exists among the residents within a seven-mile radius downwind of the plant. All appear to be willing to judge the plant strictly on the basis of any real and noticeable effect that it may have on them or their surroundings.

Randall J. Oster
Research Assistant
SDSMAT, Dept. of ES
6 JAN 72

CEDC-MPR--93

PROGRESS REPORT NO. 93
OCR CONTRACT NO. 14-01-0001-415(3)
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

February 1 to 28, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

The hot mechanical testing of the gasification and purification sections of the pilot plant was completed on February 14. The final phase consisted of maintaining gas circulation at 150 psig with the reactors at 1400-1600°F and the furnaces at 1600-1700°F for a period of 200 hours. No problems were encountered.

The primary effort following the hot test was to complete a plant turnaround in preparation for gasification runs. Major items on the turnaround include revisions to electrical system for avoiding power dips, adding blinds for two vessel operation, revising ash lock-hopper system, and adding sampling system.

Testing continued on auxiliary system and included a char grinding and drying test, a dolomite preparation test, and extensive testing of the boiler.

Preliminary review was begun on the addition of methanation to the Rapid City pilot plant.

Financial

Estimated monthly expenditures are $15,700 by Consol and $425,000 by Stearns. Cumulative expense to date is $13,796,513.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533.00)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534.00)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536.00)

Work continues on the report summarizing the engineering and construction of the pilot plant.

4. Stearns-Roger Construction Subcontract (Project No. 700.00)

This project is still active pending final settlements with vendors. Construction costs as of February 28 total $9,288,100.

5. Library Assistance on Pilot Plant Operations (Project No. 537.00)

Progress review meetings were held in Rapid City on February 16 and 17. Essentially the schedule given previously still prevails -- gasification attempts will be made in mid-April.

6. Consol Guidance on Operations (Project No. 702.00)

The progress report is attached. As indicated by this report and the Stearns-Roger report on the following page, the gasification system was maintained at 1400-1600°F and 150 psig for a period of 200 hours. In addition there was a short hot test at 285 psi. No problems were encountered.

7. Stearns-Roger Operating Subcontract (Project No. 701.00)

a. The progress report is attached.

b. Program

With the completion of the 200 hour hot pressure test, the current emphasis is to make all necessary changes to ready the plant for two vessel gasification runs. Among the major changes are correction of power dips, blinding to convert to two vessel systems, installation of wind breakers, revision to ash lockhopper system, adding sample systems, and general check and tuning of instrument systems.

The above work will be completed by mid-April.

Preliminary review was begun on the addition of methanation to the Rapid City pilot plant.

8. School of Mines Subcontract (Project No. 703.00)

The February progress report is attached.

C. Subject Inventions

None.

D. Financial Status

Expense	Actual	Budget
Cumulative through January 1972		
Through June, 1969	$ 1,878,256	$ 1,878,256
Consol	676,157 (1)	532,325
Stearns	10,801,400	10,564,300
	$13,355,813	$12,974,881
Expended in Period (estimate)		
Consol	15,700 (1)	39,475
Stearns	425,000	211,500
Total, February, 1972	$ 440,700	$ 250,975
Cumulative through February, 1972	$13,796,513	$13,225,856

(1) Includes payment to South Dakota School of Mines

Stearns' operation's figures have been adjusted for the last four months to reflect actual billings.

Att. Monthly Report No. 18 - Project 702
Operations Report No. 24 - Project 701
Monthly Report - SDSM - Project 703
Progress Charts

T: 3/17/72

Project 702.00
CC w/Operations Report:
E. E. Ellington
C. A. Schulz

cc: Office

CONSOLIDATION COAL COMPANY

RESEARCH DIVISION
LIBRARY, PENNSYLVANIA 15129

INTER-OFFICE CORRESPONDENCE

To : John A. Phinney Date : March 9, 1972

From : Carl E. Fink and Uwe D. Marwig At (Office): Rapid City, SD

Subject: Monthly Report No. 18 - Project 702

The mechanical testing program was completed by the middle of February. This program consisted of shakedown of the fired heaters and recycle compressors at 150 psi and a brief hot pressure test at 285 psi. As noted in January's report, the plant performed admirably.

During the mechanical testing program, the purge gas systems and the inert gas system used to back-up the purge gas systems failed to operate properly. Written suggestions on methods and approaches to improve operation of these systems were submitted to Stearns-Roger.

After completion of the mechanical testing program, the plant was shutdown for maintenance preparatory to beginning the initial gasification run. During this shutdown, a char grinding run, the first in the series of six of prerequisite tests, was made. Consol assistance was provided to prepare a suitable set of operating instructions for this run. After one futile attempt, a satisfactory char grinding run was accomplished.

C. E. Fink

U. D. Marwig

CEF-UDM:lmp

Attachments: Stearns-Roger Operations Report No. 24 (2)

CONSOLIDATION COAL COMPANY PROJECT

CSG PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #24

CCC Project No. 701
S-R Job No. B-37-00
March 6, 1972

SUMMARY

Operation of all the furnaces at the design temperature for a minimum of 200 hours with inert gas was completed on February 14th. Micrometer measurements of all possible hot flanges were made while testing the furnaces. Micrometer-measurements for a cold base case are now being made during the shutdown. These micrometer readings will allow us to follow changes in the flanges due to metal creep and predict their failure, so that they can be replaced.

Work on the 33 major maintenance items included in the time logic schedule issued in January is progressing as expected. We have been able to re-coup time lost due to inclement weather experienced early in the year by utilizing an extended work week. Shutdown was started on February 14th after the breakin and mechanical testing run was completed. Complete shutdown of the plant was effected the evening of February 28th and necessary "tie-ins" were made for the inverter system that night. As of this date, jobs that are complete include (1) The Ash Lock Hopper System, (2) the Hot H_2 Flange Covers, (3) Blinding for two vessel operation, and, (4) Unloaders for J-202 Air Compressor. Also, miscellaneous revisions to utilities were complete per the schedule. Revisions to the main control panel and related inverter equipment are 85% complete. Installation of sample taking stations are 80% complete.

On February 15th, a grinding run of forty minutes was attempted on Husky char using the Williams grinding and drying equipment. The run was terminated when the drop leg from the cyclone separator plugged. Samples taken during the brief run were considered invalid as they were contaminated with lignite remaining from previous runs.

A second char grinding run was made on February 25th. Moisture content of the char was reduced from 21% in the feed to 2.3-3.7%. The run was made using a range of velocity separator positions from one-third to maximum height to attempt changing the product particle size. The roller mill was turned on only at a maximum height of the velocity separator when the designated pressure drop of eight inches of water had been reached. No significant difference in product particle size results were noted. Measured grinding rates, on a dry basis, ranged from 2513 pounds per hour at a separator position of two-thirds maximum height to 4646 pounds per hour at separator position of one-third maximum height. The dry basis grinding rate for lignite at design conditions is 3200 pounds per hour.

On February 23rd, a short dolomite grinding test run, the first on Tynochtee dolomite, was made to evaluate changes made to the equipment. The revisions included changing the screw conveyor bearing support and increasing the size of the screw conveyor motor from 2 to 3 H.P. The feed rate of the screw conveyor (L-152) was checked twice during the run at which times the rates were 3.4 tons per hour and 9.8 tons per hour. The design rate for the screw is 7 tons per hour. Average rate during the November, 1971, grinding run was 5.15 tons per hour. The fines obtained during the run was 72.5% of the feed as opposed to the November, 1971 run; during which the fines were 60.4% of the feed. A method of reducing the amount of fines is now under investigation.

GENERAL

Our additional office space arrived early in February. Later in the month after utility installation, personnel were reorganized into their various groups. Complaints are nonexistent with a higher efficiency from all involved.

Another busy month has passed for all our personnel. The first part of the month saw an end to the hot testing of the reactor system with the plant being shutdown for many revisions. Operators were instructed in all phases concerned with the forthcoming "two vessel" operation. Maintenance has worked considerable overtime to complete the shutdown in our projected period. Much of this was to recover time lost due to inclement weather earlier in the year. Engineering's priority has to complete all items necessary during the shutdown.

Approximately fifty plant personnel attended either a Standard First Aid and Safety course or an Advanced course. This course instructs not only first aid, but the prevention of accidents in the first place.

A meeting was held in Rapid City February 17th and attended jointly by Stearns-Roger and Consol to discuss the schedule for char gasification. It was agreed the schedule was "tight" but could be achieved.

MONTHLY ACCOMPLISHMENTS - OPERATIONS

The circulation test of the 200 and 300 Area equipment with 1700°F on the gasifier and devolatilizer heaters outlets and 1500°F on the regenerator heaters outlets was completed on February 14th. During the last days of the test, the system was cooled to 1500°F and 1400°F respectively on the heaters outlets and a pressure test at 255 psig was made. Only minor leaks, that will be corrected, were found. By February 21st, the entire system was cooled to below 100°F., purged with air, water drained and made ready for the maintenance shutdown. During the circulation, several shutdowns were experienced that were caused by shorting of electrical equipment. The system was restarted each time after the problems were corrected. No major problems were experienced whenever the system was restarted.

Instructions for processing char through the lignite drying and grinding system were written. Two runs were made on char during the month, on February 15th and 25th. The first was prematurely terminated because the drop line from the cyclone separator to the lignite trailer was plugged. The second run was successful in that we found we could dry the char through the system to the cyclone separator and to the lignite trailer. The results were evaluated and are attached in a report by Mr. T. G. Towers. The second car of Husky char was unloaded into the lignite silo, FA-102.

The instructions for inerting the reactor system and operating two vessels for char gasification were revised for use in training the operators. Training of all operators for two vessel operation was started on February 24th. This training is being done on the day and evening shifts. The first shift was taught by the Day Supervisor with the Shift Engineers in attendance. The Shift Engineers will teach the rest of the shifts. The instrument group is also attending these classes.

The dolomite crushing equipment was operated to test screw conveyor, L-152. The results indicated that with the bearing support revision, the conveyor will operate satisfactorily.

A "B" operator, a "C" operator, and two instrument technicians reported for work in February.

A short visit at the Husky char plant in Dickinson, North Dakota, was made with reference to fire and fire fighting problems associated with char and lignite.

The cooling tower system, including the basin, was drained, flushed, and refilled after the circulation test of the reactor system.

The inert gas and purge systems have not been operating satisfactorily in that dry gas has not been maintained. Problems with the inert gas high pressure compressor and the purge gas driers are being corrected. Nitrogen was used as inert gas when necessary. More information concerning these problems are reported in the section by the Technical Group.

Two Standard and three Advanced First Aid courses were conducted by Mr. Hearl Weedman during February. A total of 14 from the operating group attended the Standard courses and 14 attended the Advanced courses.

MONTHLY ACCOMPLISHMENTS - MAINTENANCE

The maintenance force reached a peak during the month. At the end of last month, repair work from freeze damage consituted a heavy load. During the first two weeks of this month, over 90 work orders were processed at the request of operations for minor corrections found during operation at the high temperatures. These were processed during the time of scheduling for the turnaround.

All maintenance supervisors completed an Advanced First Aid and Safety course. Our key craftsmen also completed the beginning course in first aid.

Over 100 maintenance orders, which are scheduled daily, were completed this month. These are an attachment to the Operations Report.

Status of the "major" changes as they were handled in maintenance are as follows:

Completed steel and siding on main structure

Completed windwall at U-519, Inert Gas Generator

Completed windwall at L-109-B1, Dryer Furnace

Completed Lab Storage building

Completed LN_2 Pump House

Completed additional steel on D-101, Lignite Preheater

Completed setting office trailer, set up hallway and moved in furniture

Poured concrete for strip chart building

Continued work on purge rack enclosure

Set and grouted LN_2 pumps and vaporizers and started piping between units

Completed bridge breaker in dolomite fines bin

Completed Ash Lock Hopper system

Poured concrete, disconnected and reconnected piping on emergency generator

Revised rupture disc on L-109-L1, Cyclone Separator

Installed blind flanges and steam traced and insulated drain piping on air holding tank

Installed hydraulic motor on trailer conveyor

Completed blinding for two vessel operation

Completed installation of H_2 flange covers

Continued replacing insulation throughout the plant

Continued general clean up of plant site and structure

Started work on vents on three jacket water flanges

Started work on TE's and drains to jacket water flanges

Work is 98% complete on installing tubing for the CO analyzers

Completed four sets of scaffolds and handrails

Completed work on installation of Inert Gas Compressor drains

Completed installation of drains for Recycle Compressors

Continued work on Library model

Completed gas line to trailer

Completed piping work on additional steam tracing

Continued work on installation of sample stations

Completed piping on Inert Gas Compressor

Completed work on Inert Purge Connections

Relocated 3" valve about F-223 on Ash Lock Hopper system

Reinstalled jacket water orifice plates

Revised sensing lines on heaters (about 30% complete)

MONTHLY ACCOMPLISHMENTS - TECHNICAL DEPARTMENT

1. Data Taking and Analysis of Run Results

A report has been issued for the char grinding runs attempted in February. The first attempt was terminated when the drop line from the cyclone separator to grade became plugged. The test run was attempted later in the month with the results reported in the attached report by Mr. T. G. Towers.

2. Engineering Work Accomplished on Plant Design Modifications

The status of various major change orders are as follows:

a. Installation of the liquid nitrogen system is about 70 percent complete. A low temperature control valve will not be received until early March. The metal building for housing the high pressure pumps was erected.

b. Aluminum siding installation was completed during February. Only items left to be completed are a strip of flashing and one door closure.

c. The purge rotameter enclosure is approximately 75 percent installed. The last item that will be received are the fans which should arrive at plant site in late March.

d. Quotations were received from Denver on equipment needed for a pneumatic conveying system. The quotations were reviewed by Stearns-Roger and Consolidation Coal with a request to obtain new bids on a revised system.

e. The new office trailer arrived February 3rd. Necessary heat, lighting and telephone services were installed and personnel were moved into the unit the last part of February.

f. Engineering is complete to trace and insulate the discharge line of the recycle compressors. Installation will be started in early March.

3. Electrical Engineering Accomplishments in February

a. Work continued on engineering and installing the electrical changes necessary to "ride-out" the power dips. The following items were completed in February:

1.) J-504, High Pressure Inert Gas Compressor power source moved from emergency generator bus to purchased power.

2.) Williams Package controls placed on inverter.

3.) Boiler control panel modifications were completed.

4.) Inverter was "tied-in" near the end of the month.

b. The welding receptacles installation was completed except for checkout.

c. Electrical was installed to unloaders on J-202, Main Air Compressor.

d. Electrical requirements for the Ash Lock Hopper System and Evacuation Alarms were essentially complete by the end of February.

It must be noted that none of the above installations have been checked out. The checkout is scheduled for March 13th to March 24th.

4. Engineering Required Prior to Char Gasification

a. The main control room must be sealed prior to gasification to maintain a positive pressure. The actual sealing and testing must wait until all electrical modifications are completed.

b. Installation of the Consolidation Coal models were completed in February. These models will be used as training aids for operators during March.

c. Minor modifications were completed to the gasifier system this month. These were items noted by operators that required engineering.

d. Engineering was completed to remove condensed water from the expansion joint purge gas in the Lignite Grinding area.

e. Modifications to the Spent Ash and Dolomite system were essentially completed this month. Several of the instruments are to be installed next month.

f. Major piping was installed to permit steam measurement from the reactor steam drums during normal operation; but still provide a safety vent during abnormal operation.

g. The CO analyzers arrived in early February. Essentially all tubing for sample stations are installed. The electrical work is only 30 percent complete at this time. The Beckman representative will be here the week of March 20th to calibrate the instruments.

h. Installation is about 80 percent complete for sample systems required to obtain samples during char gasification. All sample connections will be completed during March.

5. Engineering Required in Solving Operational Problems

a. Data was obtained during depressuring of the reactor system to evaluate the flare system. A very high pressure was noted in the Flare K. O. Drum on several occasions. The results of the study indicated no blockage in the system at this time. The vessel line and stack will be inspected during the shutdown.

b. During the dolomite grinding test last fall, the dolomite screw conveyor would not transfer its design quantity. A revision was made to the center support bearing. A test made in February indicates a capacity of 140 percent of design. However, a change appears to be necessary in the hammermill, as the fines were 70 percent of the material charged to the mill.

c. Installation of the automatic unloaders on J-202, Main Air Compressor was completed this month. The unit was checked out and operated very well. It will unload and reload in about fifteen seconds. The air surge tank, which is to supply air to the reactors during the time of unloading, will supply between one and two minutes of air.

d. The flange covers were installed in February. These items must be painted prior to gasification. The covers were necessary because of the possibility of burning process gases which would be invisible.

e. Mechanical engineering has been required on the following items:

1.) 12 inch rupture disc on the cyclone separator.

2.) Lignite trailer screw conveyor. Apparently, lignite and char requires about 3 to 4 times more power to move than ground cement or limestone.

3.) L-101, belt conveyor was vulcanized. The scrapers will be set in an attempt to assure proper belt cleaning.

4.) J-504, High Pressure Inert Gas Compressor. We are waiting on a report by a Gardner-Denver serviceman who inspected the unit.

5.) J-502, Instrument Air Compressor, appears to be operating properly, except for repeated belt tightening.

f. A major revision to the Inert Gas Generating system was completed. The compressor was "run in" the end of February and appears in good mechanical order.

g. The purge gas dryers have functioned poorly in the past. Recommendations were made to operations along with some minor modifications to the towers.

6. Personnel

An offer was made to Mr. John D. Ryan for the position of Technical Superintendent. This position was open by the promotion of Mr. Marion Vardaman to Operations Superintendent.

Ten applicants have been interviewed for the four Junior Chemist openings. All applicants are either recent graduates or pending graduates from the South Dakota School of Mines and Technology.

Several members of the Technical Group attended an eight hour Standard First Aid course followed by a sixteen hour Advanced course.

7. Laboratory Operations

Laboratory effort during February has been distributed over the areas below, as shown.

ROUTINE ANALYSES (Including Training)	MAN HOURS	PERCENT OF TOTAL
100 Area Gas Monitoring	47	5.6
Dew Pts. in Plant	89	10.6
Lignite/Char	56	6.7
Boiler Feed/Cooling Tower	57	6.8
Waste Pond	16	1.9
Dolomite	4	.5
SPECIAL ANALYSES		
P_2O_5; N_2; S by bomb	27	3.2
Pyrite in Lignite/Char	15	1.8
Metals in Ash	10	1.2
Analyses of "Standard" Lignite	116	13.8
EQUIPMENT		
A A Recheck	16	1.9
Chromatograph Calibration	157	18.7
CO Meter	5	.6
Oven Repair	2	.2
ANALYTICAL DEVELOPMENT		
Moisture Content, Gas	8	1.0
Nitrogen and S by Bomb	9	1.1
CLEAN-UP	36	4.3
UNIDENTIFIED	170	20.2
	840	100

Tests indicate that sulfur and nitrogen can be determined from washings taken from the bomb used for heat-of-combustion measurements. The results are consistent but about 10% below the Eschka and Kjeldahl methods. The advantage is a significant time saving.

The last two months, a total of 139 man-hours has been spent on manual dew-point tests. Permanently installed electric sensors for dew-points have been recommended, as a means to improve the tests and reduce man power.

Tests show that, by using the Burrell Thermobalance, moisture, volatilies, and ash can all be determined on one sample, in a comparatively short time.

A large sample of lignite has been ground and prepared for use as a standard sample. Grand Forks Coal Research Laboratories has agreed to provide a check analysis.

PLANS FOR MARCH

OPERATIONS

1. Begin tests preliminary to gasification.
2. Conduct additional char drying and grinding runs if necessary.
3. Help with electric control run.
4. Complete operator training for the two vessel char run.
5. Hire a Shift Engineer, a "B" operator, and two "C" operators.
6. Continuing projects:
   a. Total shift coverage
   b. Operate utilities area
   c. Establish fire fighting and disaster plans
   d. Training

TECHNICAL GROUP

1. Continue work on approved engineering change orders according to priority.
2. Continue to use computer as necessary for information retrieval.
3. Interview personnel for Junior Chemist position and be prepared to hire when approval is received from Consol.
4. Provide engineering support to operations for completion of programs outlined by Consol representatives.
5. Provide engineering assistance to operations when required for "trouble shooting" and on maintenance engineering items.
6. Complete electrical engineering for the following items:
   a. Revise ESD 1 and 2 systems
   b. Revise Lignite Preheater Furnace, B-102, Control Panel.
   c. Install seals and drains on solenoid valves.
   d. Install CO_2 analyzer system.
   e. Install electrical for liquid nitrogen system.

LABORATORY - ANALYTICAL METHODS

1. Standards analyses are about 90% complete but will run further standards, as required. Need to concentrate on hydrogen sulfide analysis as other gases have been checked out.

2. Will continue training all chemists on chromatograph. All are capable of running analyses; but further training will improve speed and accuracy.

3. Train all chemists on dolomite activity method on thermobalance and on rapid determination of moisture and volatiles.

4. Complete method and training on gravimetric dew point method for the high temperature dew points.

5. Signs that identify all sample stations throughout the plant will be mounted; each sign has number for use in identifying all samples taken at a given sample station.

STAFFING

	Present Payroll	To Be Hired March
Management	2	0
Accounting	5	0
Clerical	5	1
Janitorial	2	0
Safety & Pollution	0	1
TECHNICAL DEPARTMENT		
Laboratory	6	4
Engineering	11	2
OPERATIONS		
Supervisors	1	0
Shift Engineers	3	1
Instrument Engineer	1	0
Operators	37	3
MAINTENANCE	**Temporary***	
Supervisors	5	0
Crafts	57 19	0
Warehouse & Purchasing	4 1	0
Scheduling & Planning	1	0
Electrical Coordinator	1	0
TOTAL.....	135	

Ironworkers, average for month: 7

There are presently 19 temporary maintenance personnel working during the turnaround. The ironworkers completed installation of the siding and all of them were off the payroll by 2-24-72.

COSTS

Accumulated Operations Costs to Date 2-29-72.....	$1,935,334.46
Purchase Orders Not Paid & Purchases Placed.....	248,525.00
Actually Spent-February 1972.....	424,974.46

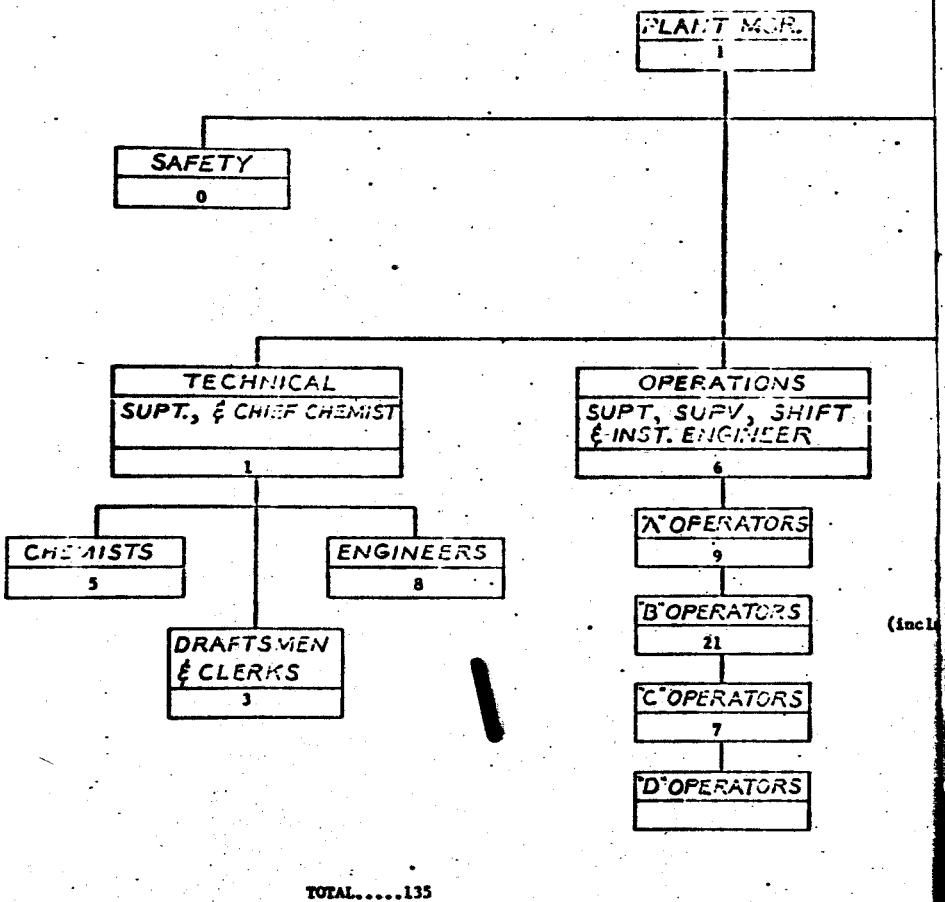
Very truly yours,

STEARNS-ROGER CORPORATION

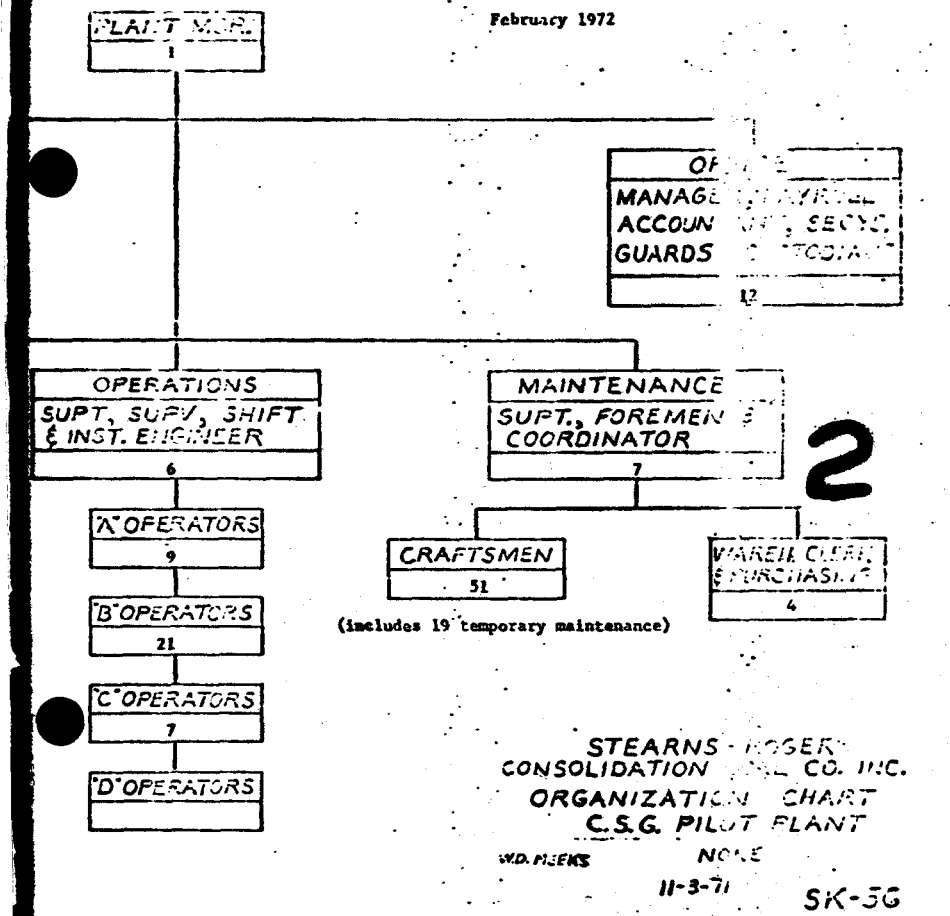
D. R. Mosher
Plant Manager

Attachments

CC: HLL,MHV,DDD,WEB,NRK,JGS,Shift Engrs., JDR
U.D.Marvig-Consol
C.E.Fink-Consol
J.A.Phinney-Consol
C.A.Schultz-Consol
C.M.Stone-Denver
D.H.Dawson-Denver


PLANT MGR.
1
SAFETY
0
TECHNICAL
SUPT., & CHIEF CHEMIST
1
OPERATIONS
SUPT, SUPV, SHIFT & INST. ENGINEER
6
CHEMISTS
5
ENGINEERS
8
DRAFTSMEN & CLERKS
3
"A" OPERATORS
9
"B" OPERATORS
21
"C" OPERATORS
7
"D" OPERATORS
TOTAL.....135

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COMPLETED MAINTENANCE WORK ORDERS FOR FEBRUARY -1-

Order Number	Requested Priority	Description
0983	ASAP	Extend 4" vent piping from PCV-5163 outside enclosed shed area of inert gas generator.
1075	Urgent	AJ-503 Will not deliver at full capacity.
1023	Urgent	Drop-pipe from cyclone - unplug.
1943	Urgent	J-507B Replace bad bearing on outboard bearing of pump.
1919	Shutdown	Level glass of F-321 Repair top valve on sightglass, or replace
1130	Shutdown	Install drain va ve in bottom flange of F-216
1094	2-22-72	Repair or replace broken handle on back pressure control valve at cooling tower.
1129	Shutdown	F-215 Install drain valve in bottom flange.
1941	Shutdown	J-309 Check cooling water piping on CO_2 comp & replace leaking tee.
1093	Urgent	GI-531-6" Valve - Close fuel gas valve on 1st floor pipe rack underneath heaters
1025	Boiler is down	Check out solomatic valves & check valves in line from brine tank.
1100	2-28-72	Replace broken 2" valve on cooling water return relief/bleed line to drain 9th floor
1137	Boiler Shutdown	U-501 Boiler - Check & repair as necessary leaking unions on steam lines.
0739	——	L-504 Install bypass around dollinger filter after inst. air dryers.
0944	Urgent	L-503 Clean air filter downstream of instrument air dryers.
2101	Safety	Safety Signs - Install sign "No smoking except in designated areas" on fence at gate.
0[illegible]	week of 12-20	U-501 sightglass - Clean sightglass on boiler drum
0937	——	FI-3031 & 1032 Install bleed valve on 2nd floor rotometers in 100 area.
1015	Urgent	GI-531-1 Clean plugged line.
0728	——	Install tee and 2 1½" valves for fire hose & for [illegible] on 4" lateral on each floor. Install hose racks
[illegible]	Safety	Misc. Piping - Fa[illegible] floor at approximately 3" in heater area

COMPLETED MAINTENANCE WOR RDERS

Order Number	Requested Priority	Discription
0549	12-15-72	Install 1 x 4 toeboard around floor of mezzaincne floor and stairwell of warehouse.
1814	1-19-72	Repair door closer on outside entrance door by locker room
1907	1-11-72	Repair south door in oil drum storage area.
0913	ASP	J-505 A/B Clean screens on disc pressure gauges - one is in shop - unable to back flush
0619		L-513 Remount relief valve on west inert gas dryer
0930	schedule	Sprinkler system--Weld brackets and/or chains such that valve wheels can be locked in open position (Requested by insurance inspector)
1817	1-31-72	Purchase and install lock for janitor's room
1013	2-7-72	Purge gas "A" dryer L-213 Install sample line ¼" SS on inlet
0951	——	FRC-2115 Replace broken strainer inlet trap on steam tracing
1939	week of 2-7	Repair leaking union on steam line of building heater 6th floor
1033	Urgent	100 Area - Remove rotometers on I.G. on 1st & 2nd floor and remove H_2O
1088	Urgent	L-308 Check out "C" purge gas dryer - it won't depressure when out of service
1087	Urgent	L-306, L-213, L-216 Repair continuous drainers on A, B, C, gas dryers - leak gas through when open
1084	week of 2-14	Clean strainer on suction of J-303 hot-pot pump on 2nd floor
1085	week of 2-14	Big Red Sump Pump - Move pump before ground caves in under it
1086	——	FT-2120 10th floor - Replace broken steam trap bulb transmitter
0163	10-27 & 28	Dolomite Grinding & Screening - Blanket Order: Utilize "cherry picker" for short periods to move & weigh tote bins
0867	week of 1-24	L-503 Air Dryer Vent Line - Steam trace and insulate air dryer vent line outside of Utility Building

COMPLETED MAINTENANCE WOR RDERS

Order Number	Requested Priority	Discription
0909	ASP	FI-2068 & 2070 Repair gas leaks on 6th floor A-2 manifold
1938	2-1-72	PI-3033 Replace pressure gauge on J-314A
0976	Urgent	J-504 Check and clean - blow down traps on J-504
0908	before using delo. lock hopper	F-205 to L-204 Repair flange leak at exit of rotary feeder
1961	schedule	F-320 Flue gas quench water sep - Steam trace and insulate drain valve and piping to header drain
1962	schedule	F-321 Foul Water Stripper - Steam trace and insulate drain valve at bottom of foul water stripper to header drain to UC11-1" Bic
2001	week 1-6	L-314 Steam trace and insulate outlet piping and 1½" drain valve WQ-331-1½" YE over to LV-3078
1028	Shutdown	PCV-5165 Inert gas relief valve - Inspect relief valve and set pressure relief for correct setting
2203	Urgent	L-101 Adjust lignite belt connector to stop side movement
1091	Shutdown	PT-3051 CO_2 suction pressure tap to J-309 -- Move pressure tap for PI-3051 downstream of block valve on suction of J-309 on 2nd floor
0195		J-202 Check out second stage relief valve on J-202
1949	Urgent	PCV-5011 Repair leaking flange at 50 psig reducing station. Tighten before gasket is cut.
0365	Shutdown	"A", "B", "C" Purge manifolds on 6th floor - Install drain valve on each manifold to drain out H_2O
0163		U-501 Install ¼" pressure tap downstream of boiler exit damper. Connect temporary manometer at boiler front to read draft downstream of boiler
1516	ASAP	Move table from Construction Accounting office to Jay Hall's office
0910	Urgent	JH-508 Replace bottom radiator hose on continental engine in pump house. Leaking bad. Radiator empty

COMPLETED MAINTENANCE WO ORDERS

Order Number	Requested Priority	Discription
0929	Urgent	Replace ignition wires on temporary water pump at pond
0978	Urgent	U-50oD Adjust stroke on chemical feed pump
1002	Urgent	L-513 Check & replace as necessary the dessicant & clean pre-filters as necessary
1006	Urgent	B-204 Heater -- Remove and clean burner
980	Urgent	Big red sump pump - Engine won't start - Repair
1009	Urgent	J-504 Check, repair as necessary all suction - discharge valves on J-504. Check and clean all drain lines - Steam
0993	Urgent	J-302A Make necessary repairs - sounds like bearing going bad
0997	ASP	Continenal H_2O pump - Repair starter as it is stuck
0999	week 2-7	J-302B Repack pump leaking bad
1000	2-7	J-301A & J-311A Tighten packing
0900	2-1	J-311B Repair seal
0941	Urgent	D-201 Make repairs at leaking plug on top flange of devolatilizer Weld enclosure or strap over leaking plug
0905	2-4	V-502 Install sunstrand hydrostatic motor on lignite trailer and remove gasoline engine & accessories
1912	Safety	Repair handrail on walkway between section 100 building and lignite unloading pit
1818	today	Move partition in steno pool
951	week 2-14	J-311B Adjust leaking packing on pump
1020	Urgent	Nash-Hytro IG LP comp. - Tighten belts
1061	Urgent	FT-1014 Disconnect and drain water
2076	Urgent	L-109-L5 Replace rupture disc and disc support on top of cyclone separator
1944	Urgent	Big Red Pump -- Repair starter on sump pump
2002	Urgent	F-207A/B Remove and repair cracked weld at "Y" at diverter valve to F-207
1017	schedule	Purge Gas "A" drier system--Blow out coolers & KO pots, check timers and valve switching system, check dessicant & in general check out whole drier system

COMPLETED MAINTENANCE WORK ORDERS

Order Number	Requested Priority	Discription
1143	Urgent	Maint. Start-up Help -- Provide roto-rooter tape to unplug lignite line from cyclone to disposal trailer
1124	ASAP	J-302A - Check and clean suction screen if necessary
1125	ASAP	J-302B Check and clean if necessary suction screen
1051	ASAP	J-301A Check and clean suction screen if necessary
1052	ASAP	J-301B Check and clean suction screen if necessary
1054	ASAP	J-319 Check and clean suction screen if necessary
1056	ASAP	J-311A Check and clean suction screen if necessary
1057	ASAP	J-311B Check and clean suction screen if necessary
1041	Urgent	AJ-503 Do necessary work to make pump servicable
1140	Urgent	Inert gas line - Provide 1" valve between the nitrogen system and 18.5 psig inert gas system.
1123	ASAP	J-210B Check and clean suction screen if necessary
1122	ASAP	J-210A Check and clean suction screen if necessary
1121	ASAP	J-209 Check and clean suction screen if necessary
1120	ASAP	J-211B Check and clean if necessary suction screen
1119	ASAP	J-211A Check and clean if necessary suction screen
1058	ASAP	J-101 Extend air intake and exhaust piping through siding to outside
1059	ASAP	AIT-2001, 2002 -- Vent analyzer to outside of siding (into floor)
1109	ASAP	E-305 Extend piping through siding from PSH-3021
1110	ASAP	E-304 Extend piping through siding from PSH-3022
1060	ASAP	AIT-1231 Vent analyzer to outside of siding 7th floor
1942	ASAP	TVC-3012 Remove and install spool piece
1136	2-24	J-502 Check, clean & repair aftercooler trap on J-502
1071	———	Install drain valve upstream of check valve on steam line to B-104
1069	Shutdown	Install drain plug ahead of check valve in water line into F-302 5th Floor

[redacted] CORPORATION

INTEROFFICE CORRESPONDENCE

TO: M. H. Vardaman

FROM: T. G. Towers

March 2 1972

Subject: Run: RG100-SF4 - Char Grinding Run

I [redacted]:

On February 15, 1972 a grinding run of forty minutes was attempted on Husky char. The run was terminated when the drop leg from the cyclone separator plugged. Samples caught from the run were considered invalid as they were contaminated with lignite from previous runs. Because of the contamination, no results from the February 15 run are reported.

A second char grinding run was made on February 25 in the Williams grinding and drying equipment. The run was made using a range of velocity separator positions from one-third to maximum height to attempt changing the particle size. The roller mill was turned on only at the maximum height position of the velocity separator when the designated pressure drop of eight inches of water had been reached. No significant difference in particle size results were noted. Moisture content of the char was reduced from 21% in the feed to 2.3 - 3.7% in product samples at a furnace firing rate of approximately one million BTU per hour. Measured grinding rates ranged from 2513 pounds per hour at a separator position of two-thirds maximum height to 4646 pounds per hour at separator position of one-third maximum height. Both previous weights are on a dry basis.

Since the conditions of the mill were much different with the velocity separator at the maximum position, it is recommended by the writer that some of the subject program be repeated to clarify the cause of the high pressure drop across the mill.

	Pounds	Percent Water
Total Feed	28,000	21% Avg.
Probable Total Product	22,875	2.7% Avg.
Fines	0	
Moisture Removed	5125	100%

II OBJECTIVE:

As stated in letter to N. R. Krebs from T. G. Towers, February 9, 1972 on Char Grinding.

Demonstrate the ability to produce dry char at nominal 14 x 100 Tyler Mesh as requested by Consolidation Coal.

III RESULTS:

A. First sample of char was taken at a velocity separator 1/3 up from the bottom position.

B. No pattern with regard to particle size was noted with movement of the cone position.

C. Char was dried from 21% moisture in the feed to a range of 2.3 to 3.7% moisture in the product.

D. Product rates on a dry basis were from 2513 lb/hr at a cone position of 2/3 maximum height to 4646 lb/hr at a cone position of 1/3 maximum height.

E. No fines were removed from the fines bin (F-104) at the conclusion of the run.

F. Feed rates noted were from 33% feed time at 1600 hours to 43% feed time at 1800 hours.

G. Product was discharged from the cycline separator for approximately two hours after shutting off the feed. A high dP (11+ inches water gage) was present across the mill during the initial stages of this segment.

H. Full results and readings are reported in the Appendix, Tables I and II.

IV OBSERVATIONS:

A. Furnace Area -

1. Secondary damper was adjusted to achieve an oxygen content of 8-9%.

2. The linkage of TCV-1000 was adjusted to get a firing rate on low fire of approximately one million BTU/hr.

B. Roller Mill -

1. The two-speed motor did not perform well on low speed. Low speed caused the heaters to kick out after a short period of time.

2. The mill was turned on when the velocity separator was raised to its maximum height. A high pressure drop resulted which could not be reduced until the furnace was switched out of the mill. No feed caused high outlet temperatures. In order to unload the mill, the velocity separator had to to be lowered.

3. Temperature control was difficult but rather good since the feed was manually controlled to control the temperature.

C. General -

1. The bulk of the product was put into the lignite trailer, however, three timed runs were made into tote bins. On one timed run, the tote bin filled and backed material up into the cyclone separator invalidating the timed run weight.

2. No fines were removed from the fines bin (F-104).

3. Char bridged in FA-102 silo. The bridge was broken by hammering on the silo rodout tops.

4. Char was hanging up in the line from the surge tank (F-103) at the beginning of the run.

5. The drop line from the cyclone separator to the trailer had to be unplugged shortly after initiation of the run.

V RECOMMENDATIONS:

A. Another run should be made to investigate the condition occurring at a maximum velocity separator position height.

B. Rerun the velocity separator position at half-way to determine the grinding rate at this position.

C. Test run to determine whether the absence of fines is a normal result or what happens to the fines.

D. The baghouse should be inspected to determine if fines remained or bags are broken or loose.

T. G. Towers

TGT:ej

cc: C. M. Stone
D. R. Mosher
N. R. Krebs
H. L. Lawless
H. K. Long
Shift Engineers (3)
Technical Engineers (12)

APPENDIX

TABLE I
SYSTEM READINGS

			2-25-72 1500	2-25-72 1740	2-25-72 1810	2-25-72 1950	2-25-72 1930				
[illegible] Mill		TE-1002	515	610	655	680	655				
[illegible] Mill		TRC-1000	290	290	300	290	290				
[illegible]		TE-1000	275	265	265	265	260				
[illegible]		TE-1029	260	250	245	245	240				
[illegible] Mill		dPI-1007	4	3.9	3.9	5	3.9				
[illegible] dP		dPI-1008	.7	.6	0.6	.6	0.6				
[illegible]		AR-1000	7.3	8.5	8.5	8.5	8.5				
Cyclone Inlet		PI-1005	2	1.1		.5					
[illegible]		PI-1006	6	0		-2.5					
[illegible]		PDI-1000	8	7.5	7	9	7.5				
[illegible] Fan		PI-1003	25	21		17					
[illegible] Fan		PI-1001	22.5	21		17					
[illegible] Gas		PI-1029	23	28		23.5					
[illegible]		PI-1025	0	15	0.2	0.2	0.2				
[illegible]		Position	1/3 up	1/3 down	1/2 up		1/3 up				
XCV-1003		PSI	13	12	12	12	12				
XCV-1007		PSI	12	12	12	12	12				

TABLE II
PARTICLE SIZE AND
MOISTURE CONTENT

		Product 2-25-72 1500	Feed 2-25-72 1535	Product 2-25-72 1740	Product 2-25-72 1810	Product 2-25-72 1915	Product 2-25-72 1950				
[illegible]	%	2.8	21.0	2.6	3.7	2.3	2.4				
[illegible]	%										
Mesh Size	Retained										
4	%	0.1	0.8	0	0	0	0.3				
6	%	0.5	2.5	0.5	Trace	1.1	1.1				
8	%	5.5	6.6	5.1	1.0	3.5	5.4				
10	%	15.6	12.6	9.7	8.7	10.6	12.2				
14	%	20.2	18.0	18.0	25.1	17.5	18.5				
20	%	17.9	15.1	17.9	20.4	16.2	15.3				
28	%	11.4	11.4	14.3	13.1	13.2	11.5				
35	%	7.1	7.2	9.3	7.5	8.7	7.4				
48	%	5.5	5.7	7.1	5.5	11.0	6.1				
60	%	2.2	2.4	2.9	2.2	2.9	2.6				
100	%	4.2	4.7	5.5	4.5	5.4	5.4				
200	%	4.1	4.4	5.0	5.0	4.5	5.9				
Pan	%	5.5	8.5	6.7	7.1	5.4	8.3				
Mean Particle Diameter	Inches	0.0118	0.0434	0.0349	0.0348	0.0361	0.0590				

Mean Particle Diameter Calculated from the Formula:-

$$D_{ave} = \sum_{i=1}^{n} m_i f_i$$; Page 3[illegible]

Studies in Mechanics of Fluo-Solids Systems

Period: July 1961 to June 1968

R & D Report No. 16, Interim Report No. 3, Book 1

by G. P. Curran and Everet Gorin

SUBCONTRACT BETWEEN CONSOL AND SOMAT RE CONSOL CO_2 ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR FEBRUARY, 1972

I. General

The base map for the carbonate resources study is complete and testing of samples continues. Autoclave runs on melts of dolomite composition are being made and various parameters established. Analytic work on trace noxious elements is being continued using wet ashing techniques. Removal of sodium from raw lignite is continuing using different parameters. Waste monitoring equipment is awaiting pilot plant runs.

II. Carbonate Resources (Mickelson)

The base map is now completed. Completion of pertinent geologic information for the map is progressing well. Submitted all samples for chemical analysis. A large block of Tymochtee has arrived. Several engineering property tests will be run on this for comparison with the Pahasapa that has been completed. Thin sections will be made for comparative purposes. If time permits, similar tests will be made of the Minnekahta limestone.

III. Acceptor Reconstitution (Fuerstenau)

Experimental work in February involved producing melts of calcium hydroxide/calcium carbonate in the presence of 21.7 percent MgO, the amount of MgO contained in dolomite. Mechanical strengths and activities of these melts are being measured. Further work on this system will be carried out in March.

IV. Noxious Elements (Lingard)

Analytical work during February involved further studies on determination of mercury, lead, and cadmium in the same solution prepared by wet ashing lignite with nitric acid and potassium chlorate. This work will continue in March using spiked samples to check recoveries.

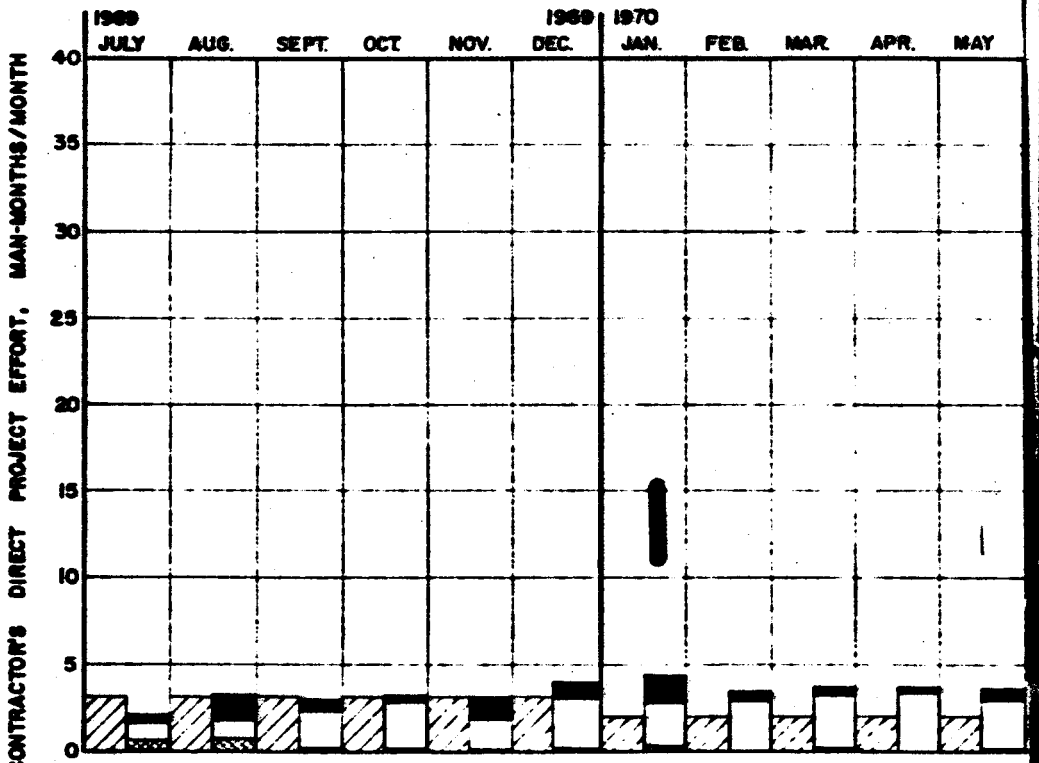
A certified sample for mercury in coal has been received and will be used to check our results.

V. Pre-Gasification Beneficiation (Clarkson)

This month the sodium was removed from lignite using deionized water at pH 3.1 and at three different flow rates. The hydrogen ion very effectively removed the sodium. In addition to this new data, reruns were made on a number of samples previously treated in order to check apparent deviations. This data will be re-examined to determine if other parameters are influencing results.

VI. Waste Monitoring (Oliver)

The adaptor for the vent stack monitoring will be returned to Stearns Roger this week for installation in the vent stack. Calibration of the dissolved oxygen analyzer has been completed. An operational amplifier to facilitate interconnection of the pH meter and the recorder has been procured. This amplifier will now be checked out with the pH meter and recorder. The monitoring instrumentation is at a point where it can be installed and operating as soon as the plant operating status makes the instrumentation desirable.



MONTHLY EXPENDITURES*

PREDICTED	16,215	14,685	14,965	13,155	14,385	17,065	15,595	15,595	12,655	12,875	13,815
ACTUAL	11,745	34,734	9,609	11,925	10,130	15,205	14,378	14,027	15,019	59,228	7,342

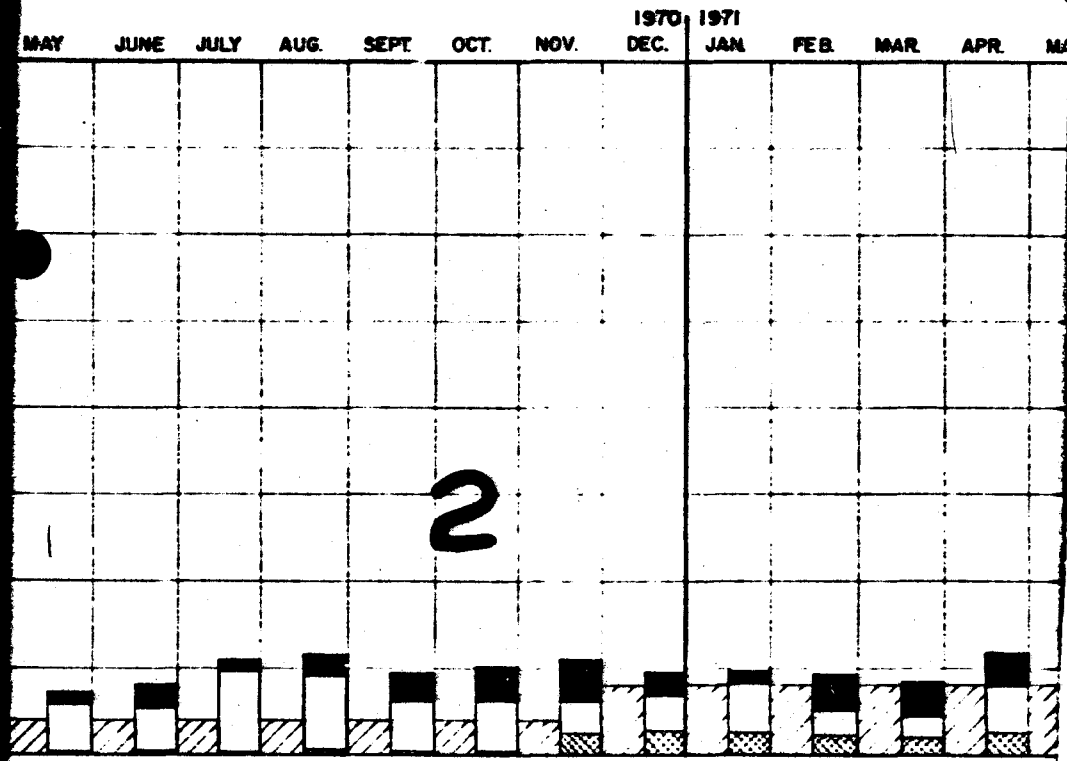
	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY
PREDICTED	16,215	30,900	45,865	59,020	73,405	90,470	108,065	121,650	134,305	147,180	160,995
ACTUAL	11,745	46,479	56,088	67,913	78,043	93,249	107,628	121,655	136,672	89,900	207,242

CUMULATIVE EXPENDITURES*

*Expenditures Include All Costs & Fees By Consol And S. Dakota School of Mines

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13,815	12,659	13,315	12,835	12,505	12,505	12,505	20,155	20,135	23,295	22,295	21,145	
17,342	19,319	20,054	13,955	25,003	21,296	9,584	23,091	16,475	16,663	12,820	22,198	

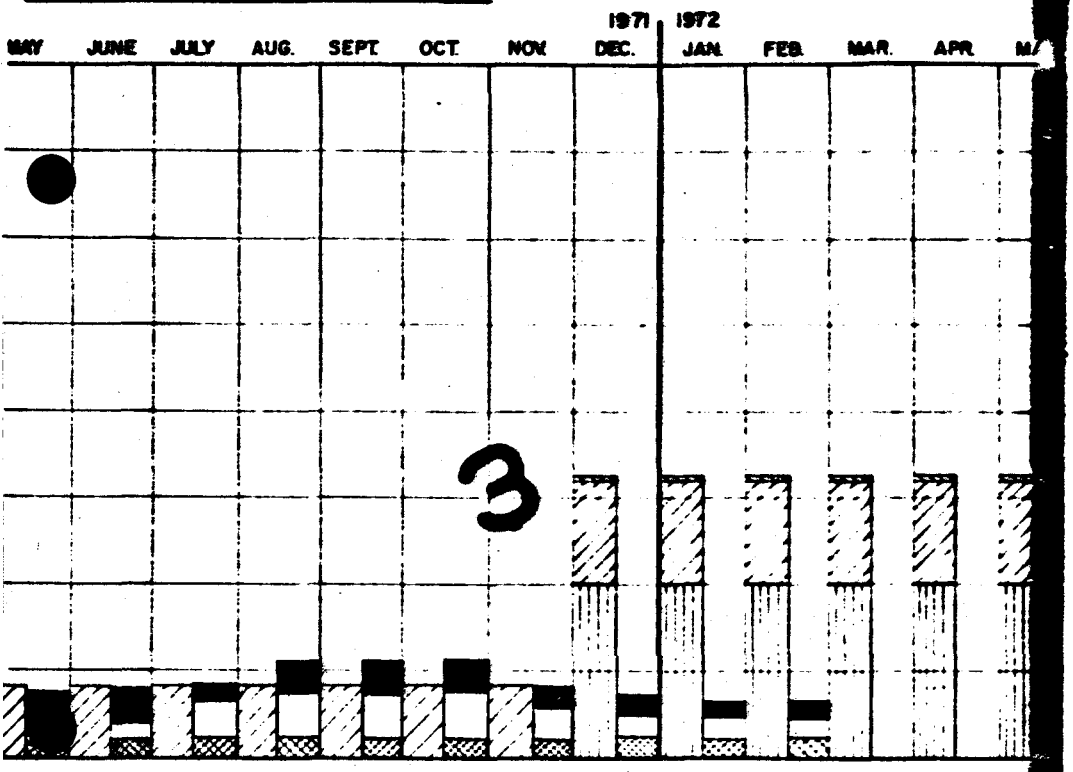
MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	
160,995	173,650	186,965	199,800	212,305	224,810	237,315	297,470	277,605	300,900	323,195	344,340	
207,242	226,561	246,615	260,570	285,573	306,869	316,453	339,544	356,019	372,682	389,502	407,694	

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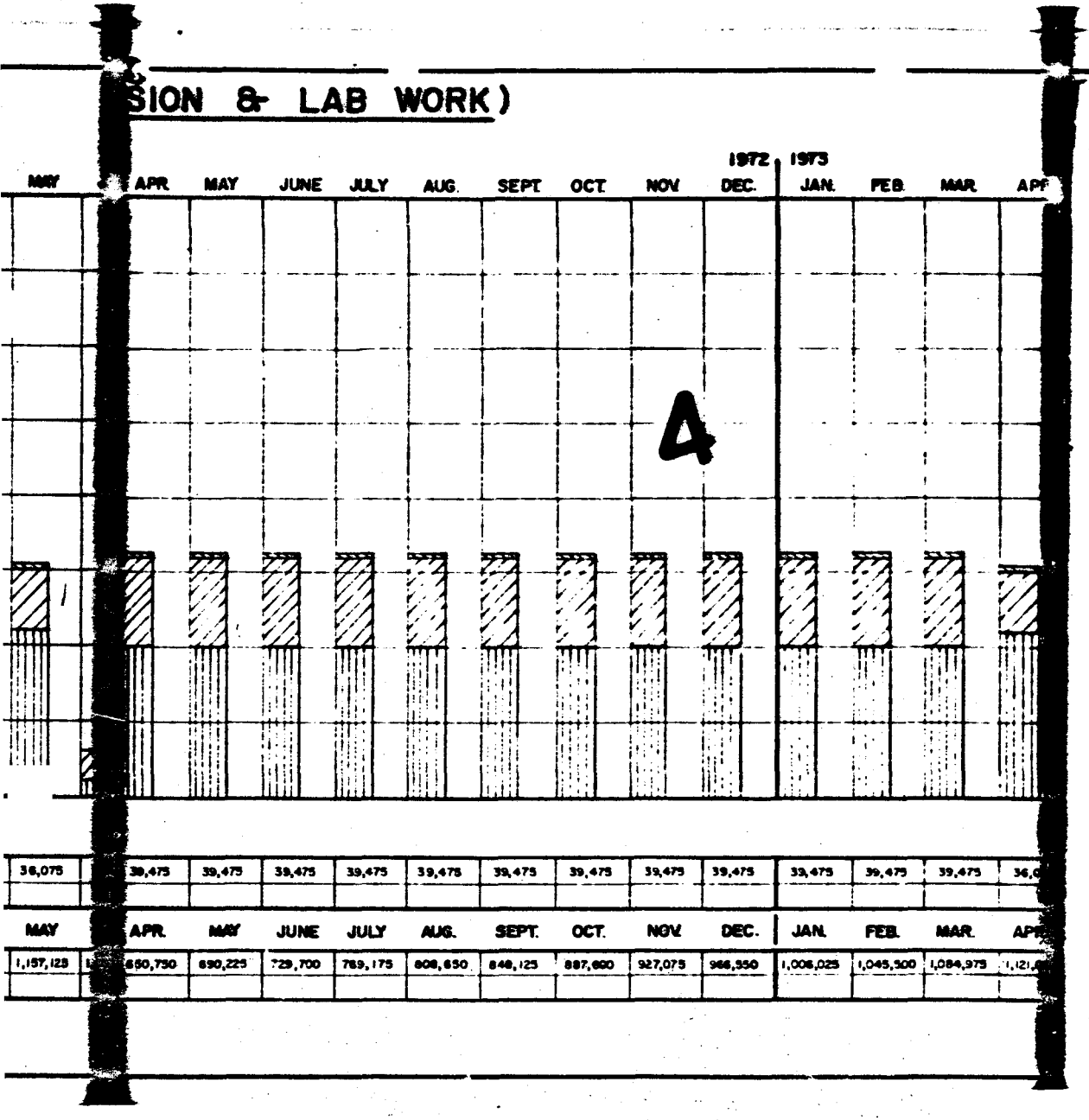
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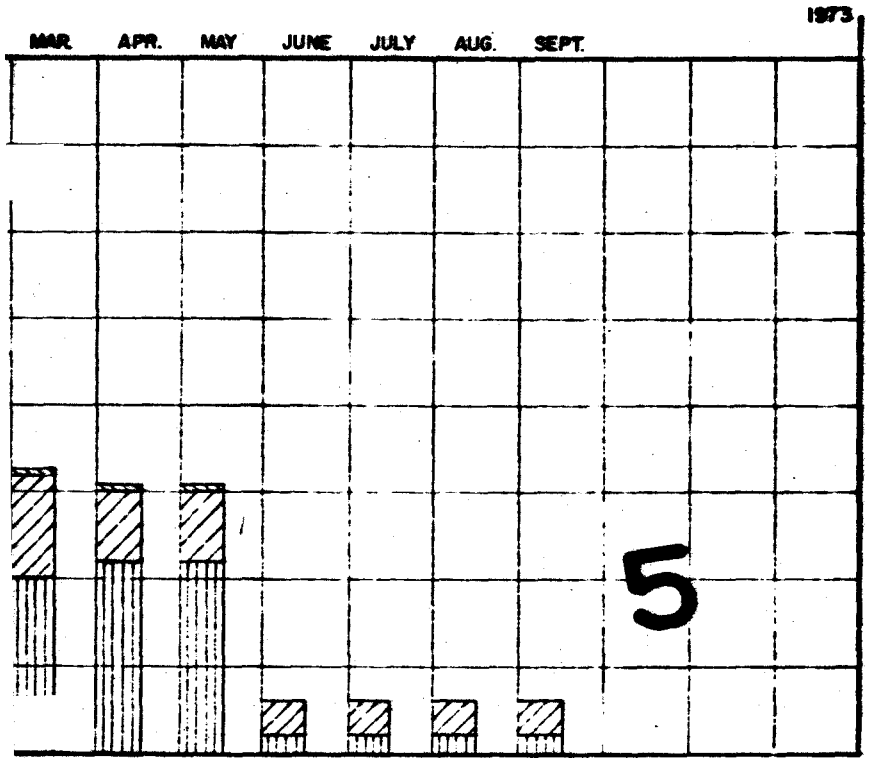
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2,508	15,831	16,923	24,919	97,703	30,575	18,172	36,224	15,604	15,700			

MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	M
3,046	379,000	393,875	408,750	423,625	438,500	453,375	492,850	532,324	571,800	611,275	650,750	6
0,206	436,037	452,960	477,879	575,582	606,157	624,329	660,553	676,157	691,857			

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1,084,975

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39,475	36,075	36,075	11,475	11,475	11,475	41,120			
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④ Includes Supervisory Exempt Technicians.
⑤⑥ Includes Clerical.

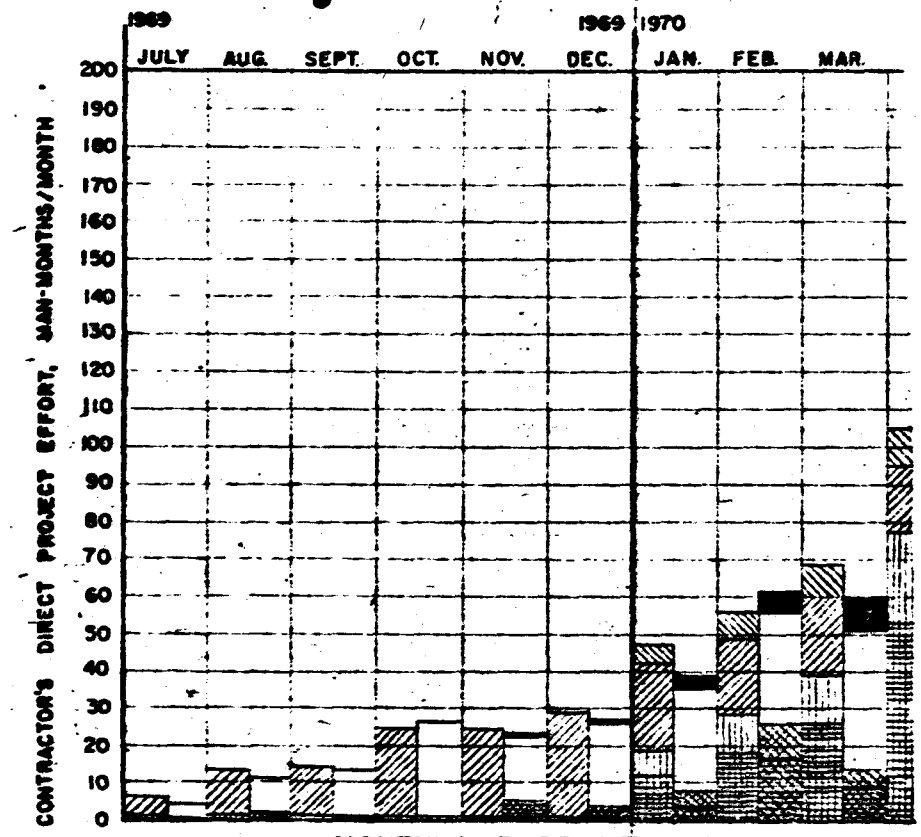
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MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT No. 14-01-0001-415 (3)



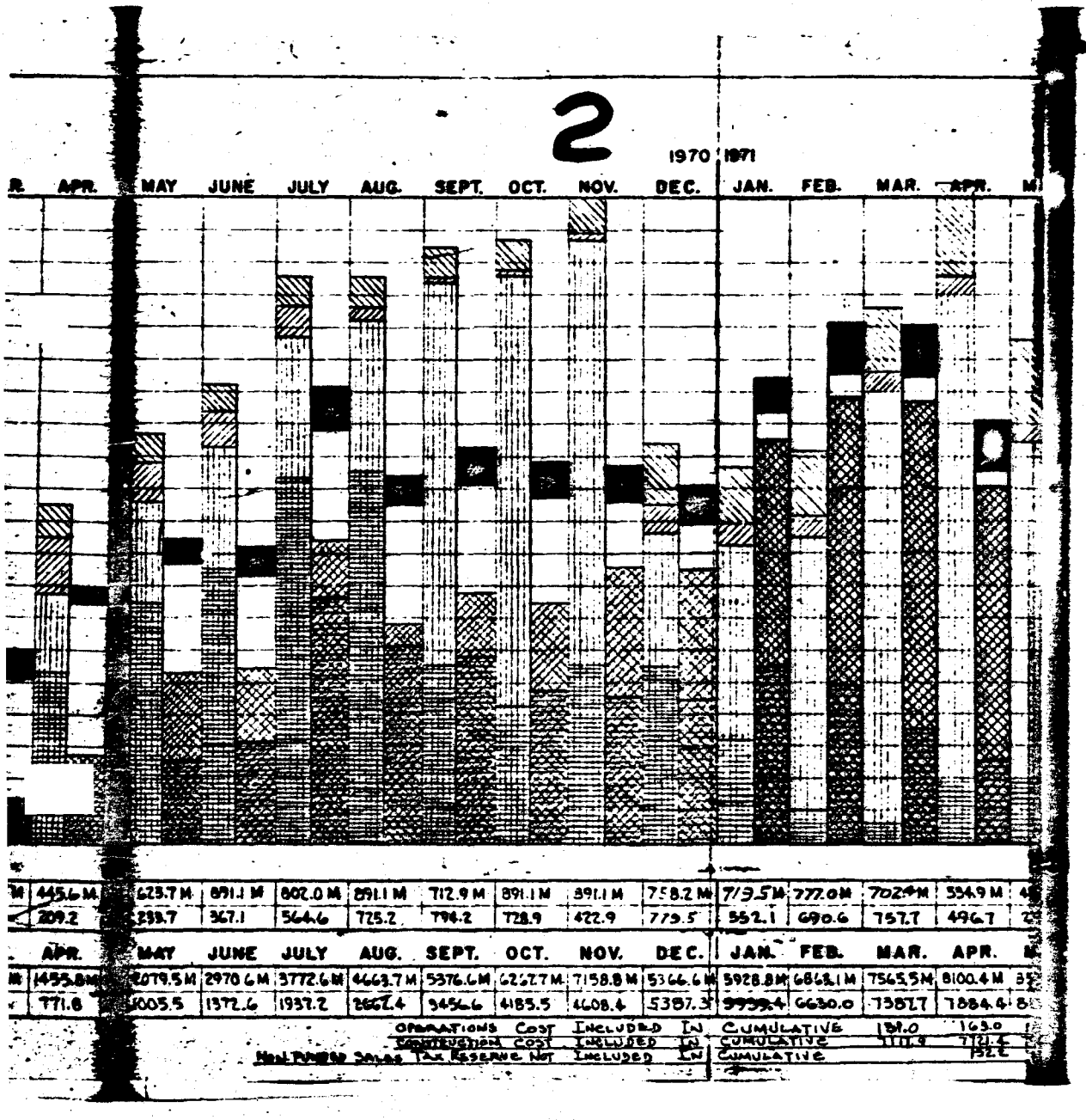
MONTHLY EXPENDITURES *

PREDICTED	0	30.0 M	41.0 M	50.0 M	98.0 M	106.9 M	112.0 M	273.0 M	299.5 M	44
ACTUAL	6.2	25.0	32.8	42.6	39.7	126.2	110.5	76.7	102.9	20

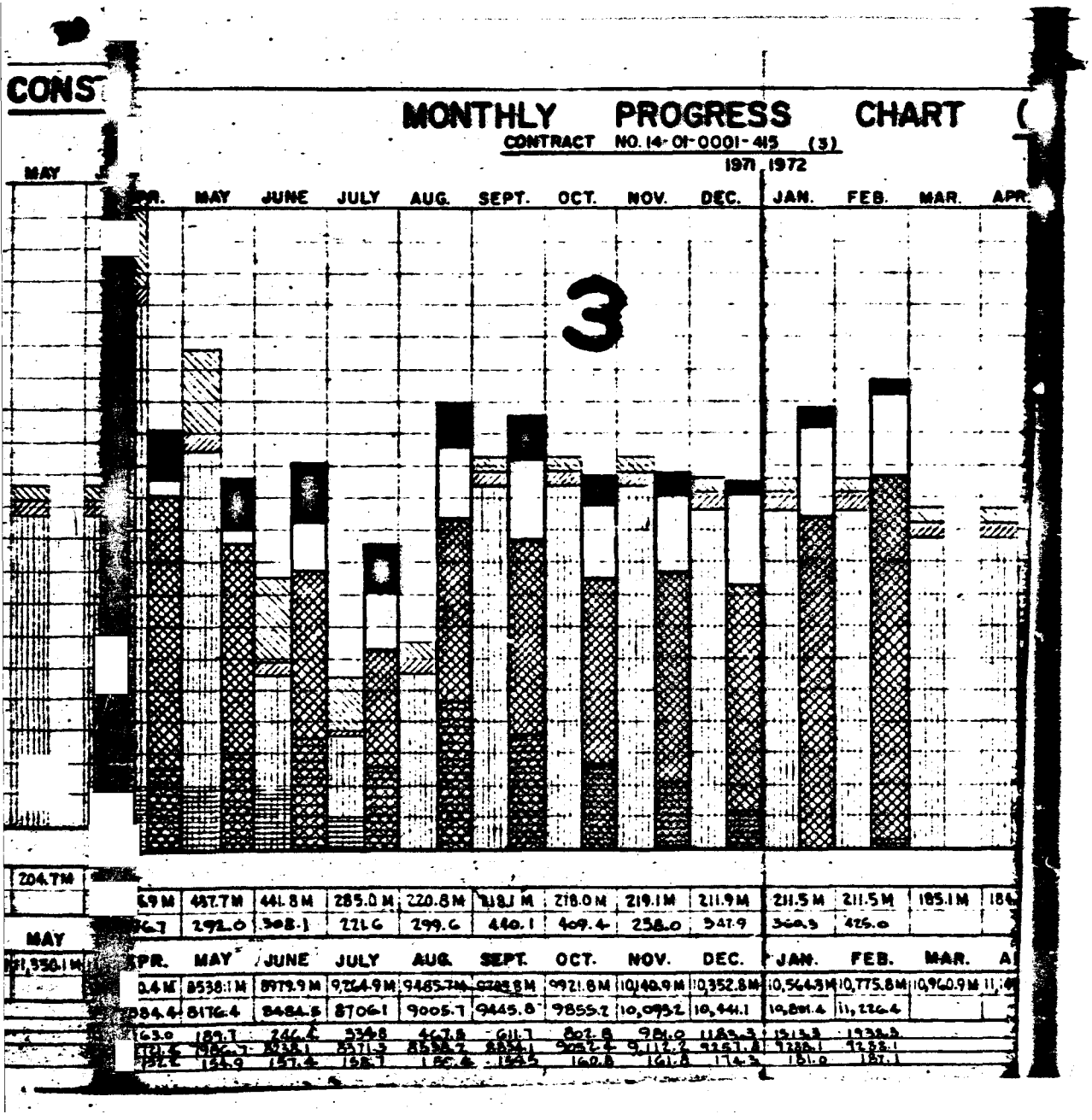
	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	A
PREDICTED	0	30.0 M	71.0 M	121.0 M	219.0 M	325.9 M	437.9 M	710.9 M	1010.2 M	145
ACTUAL	6.2	31.2	64.0	106.6	146.3	272.5	383.0	459.7	562.6	71

CUMULATIVE EXPENDITURES *

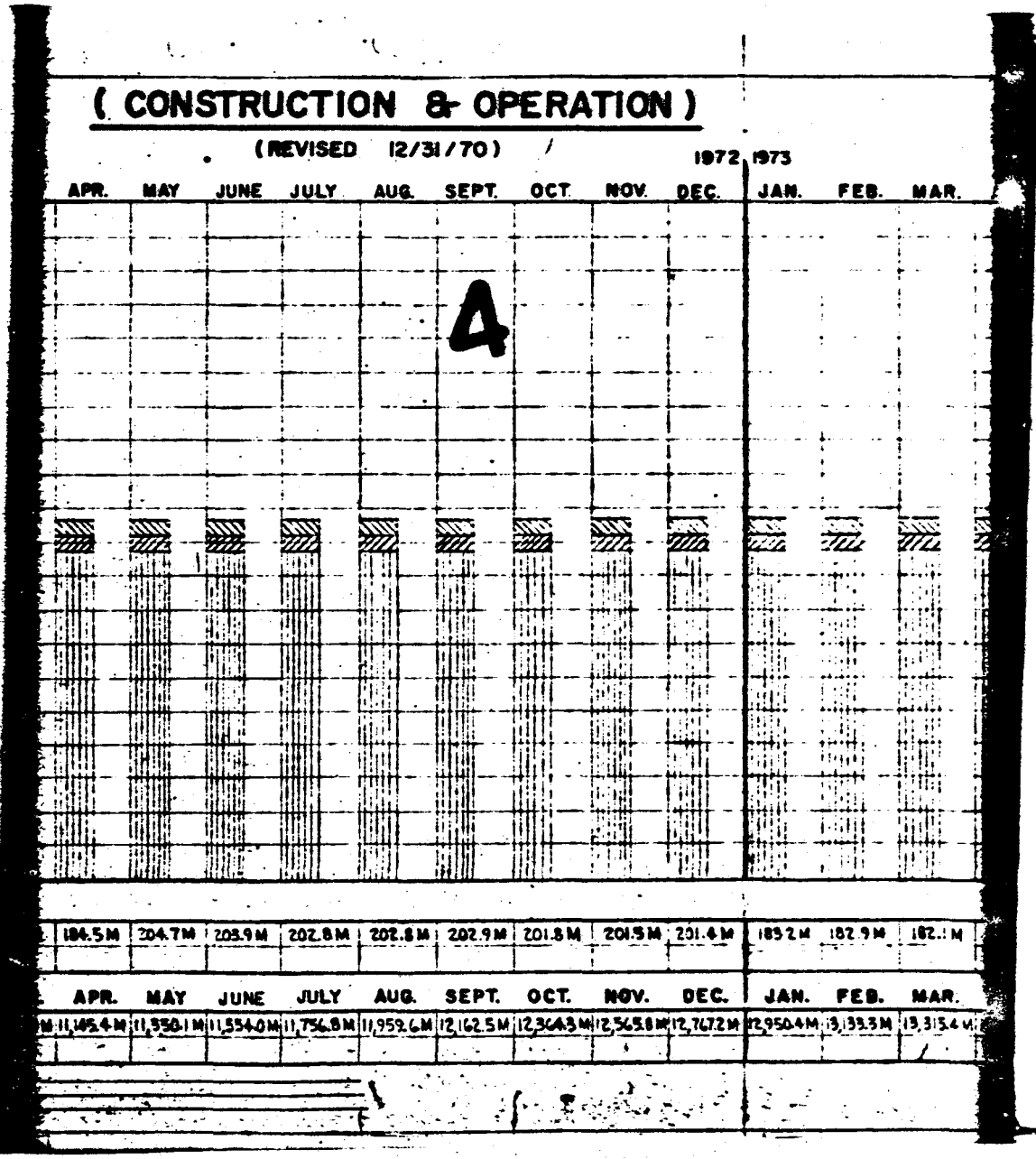
* EXPENDITURES INCLUDE ALL COSTS & FEES


2
1970 1971
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
445.6 M 623.7 M 891.1 M 802.0 M 891.1 M 712.9 M 891.1 M 891.1 M 758.2 M 719.5 M 777.0 M 702.9 M 554.9 M
209.2 238.7 367.1 564.6 725.2 796.2 728.9 422.9 779.5 552.1 690.6 757.7 496.7
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
1455.8 M 2079.5 M 2970.6 M 3772.6 M 4663.7 M 5376.6 M 6262.7 M 7158.8 M 5366.6 M 5928.8 M 6868.1 M 7565.5 M 8100.4 M
771.8 1005.5 1372.6 1937.2 2662.4 3458.6 4185.5 4608.4 5387.3 5959.4 6630.0 7387.7 7884.4
OPERATIONS COST INCLUDED IN CUMULATIVE 151.0 165.0
CONSTRUCTION COST INCLUDED IN CUMULATIVE 111.9 721.4
NOT INCLUDED IN CUMULATIVE 152.2

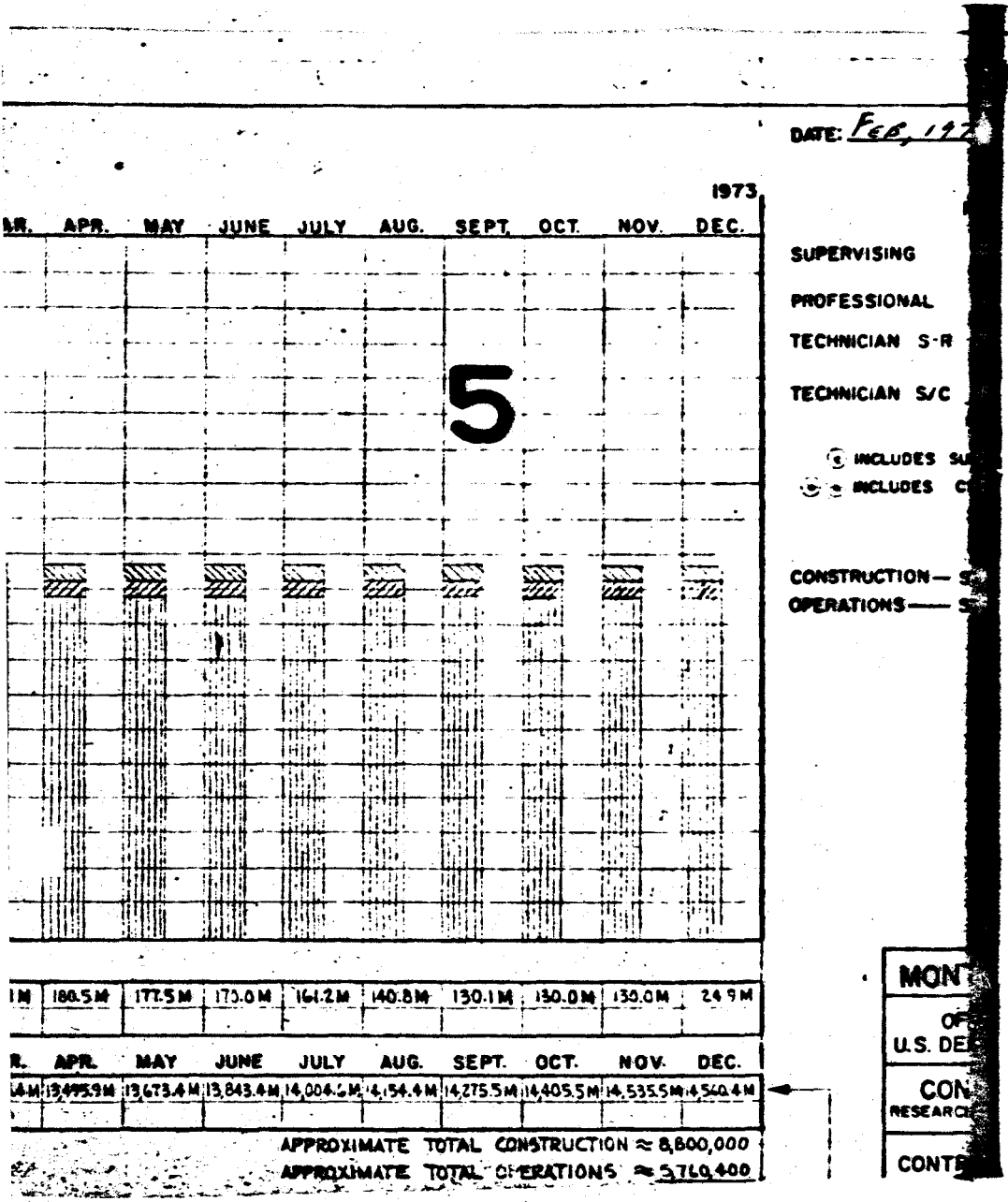
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CONS
MONTHLY PROGRESS CHART
CONTRACT NO. 14-01-0001-415 (3)
1971 1972
MAY
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
3
204.7M
6.9M 487.7M 441.8M 285.0M 220.8M 218.1M 218.0M 219.1M 211.9M 211.5M 211.5M 185.1M
MAY
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR.
0.4M 8538.1M 8979.9M 9,264.9M 9485.7M 9921.8M 10,140.9M 10,352.8M 10,564.3M 10,775.8M 10,960.9M
8384.4 8176.4 8484.5 8706.1 9005.7 9445.8 9855.2 10,093.2 10,441.1 10,891.4 11,226.4
163.0 189.7 246.4 334.8 467.8 611.7 802.8 981.0 1183.3 1513.3 1938.3
8221.4 8366.1 8731.1 9041.3 9473.5 9057.5 9657.4 9,117.2 9625.1 9738.1 9738.1
158.6 154.9 157.4 158.7 160.4 154.5 160.8 161.8 174.3 161.0 187.1

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(CONSTRUCTION & OPERATION)
(REVISED 12/31/70)
1972
1973
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR.
4
184.5M 204.7M 203.9M 202.8M 202.8M 202.9M 201.8M 201.5M 201.4M 185.2M 182.9M 182.1M
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR.
M 11,145.4M 11,350.1M 11,554.0M 11,756.8M 11,959.6M 12,162.5M 12,364.3M 12,565.8M 12,767.2M 12,950.4M 13,133.3M 13,315.4M

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DATE: Feb, 197
1973
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
5
SUPERVISING
PROFESSIONAL
TECHNICIAN S-R
TECHNICIAN S/C
INCLUDES SU
INCLUDES C
CONSTRUCTION—
OPERATIONS—
180.5M 177.5M 175.0M 161.2M 140.8M 130.1M 130.0M 130.0M 24.9M
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
13,495.9M 13,673.4M 13,843.4M 14,004.6M 14,154.4M 14,275.5M 14,405.5M 14,535.5M 14,560.4M
APPROXIMATE TOTAL CONSTRUCTION ≈ 8,600,000
APPROXIMATE TOTAL OPERATIONS ≈ 5,760,400
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DATE: Feb, 1972

1973

EPT. OCT. NOV. DEC.

	PREDICTED	ACTUAL
SUPERVISING		
PROFESSIONAL		②
TECHNICIAN S-R		② ③
TECHNICIAN S/C		

② INCLUDES SUPERVISORY EXEMPT TECHNICIANS
③ INCLUDES CLERICAL

CONSTRUCTION — STEARNS-ROGER JOB B-37000
OPERATIONS — STEARNS-ROGER JOB B 37400

6

0.1M	130.0M	130.0M	24.9M

PT.	OCT.	NOV.	DEC.
5.5M	14,405.5M	14,535.5M	14,560.4M

CONSTRUCTION ≈ 8,800,000
OPERATIONS ≈ 5,760,400
14,560,400

MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT NO. 14-01-0001-415 (3)
(REVISED 12/31/70)

COO-1475-79

PROGRESS REPORT NO. 94
OCR CONTRACT NO. 14-01-0001-415(3)
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

March 1 to 31, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

The plant turnaround was completed by mid-March. Operations were begun and the auxiliary facilities (such as the jacket system, quench system, char grinding, and lock hopper system) were successfully tested. Hot gases were being circulated at the close of the month. Solid circulation tests were to be run in early April, with gasification scheduled for the end of the month.

After a leak test study, a decision was made to line the ponds.

A review of the methanation design is continuing.

Financial

Estimated monthly expenditures are $23,900 by Consol and $400,400 by Stearns. Cumulative expense to date is $14,228,813.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite P.P. (Project No. 536)

The rough draft of the final construction report was completed.

4. Stearns-Roger Construction Subcontract (Project No. 700)

This project is still active pending final settlements with vendors. Construction costs as of March 31 totalled $9,2##,100.

5. Library Assistance on Pilot Plant Operations (Project No. 537)

Progress review meetings were held in Rapid City on March 20 and March 29. The primary effort was to resolve problems which might delay achieving the previously stated schedule of gasifying by mid-April. Consol agreed to originate the detailed valve-by-valve operating programs for review by Stearns.

It was agreed to provide liners to resolve the leaking pond problem.

6. Consol Guidance on Operations (Project No. 702)

The progress report is attached. Stearns successfully completed the following tests:

1. Quench system
2. Jacket system
3. Electrical control system
4. Char grinding
5. Lignite lock hoppers
6. Ash and dolomite lock hoppers
7. Hot gas circulator

Consol prepared the detailed operating programs for the above. These were reviewed and put into operation by Stearns. Programs have also been established for the subsequent steps which include:

1. Hot dolomite addition
2. $MgCO_3$ calcination
3. Char grinding and preheat
4. $CaCO_3$ calcination
5. Char circulation
6. Gasification

The last event is now scheduled for the end of April.

The changes enumerated in last month's report were essentially completed by March 10, and the remaining part of the month was devoted to operations as described above.

7. Stearns-Roger Operating Subcontract (Project No. 701)

a. The progress report is attached.

b. Program

The plant turnaround was essentially completed, and preliminary steps were begun toward achieving two-vessel gasification operations. Auxiliary systems such as the quench, hot potassium carbonate, and lock hoppers were tested and hot gas runs were begun.

The program in April will consist of hot solid (both dolomite and char) circulation runs, with gasification being scheduled in the latter part of the month.

The additional maintenance items as proposed by Stearns-Roger were reviewed and numerous items were deleted as not essential to startup.

Work is continuing on a process review of methanation, with a preliminary report scheduled for mid-May.

8. School of Mines Subcontract (Project No. 703)

The March progress report is attached.

C. Subject Inventions

None.

D. Financial Status

Expense	Actual	Budget
Cumulative through February, 1972		
Through June, 1969	$ 1,878,256	$ 1,878,256
Consol	681,857	571,800
Stearns	11,226,400	10,775,800
	$ 13,786,513	$ 13,225,856
Expended in Period (estimate)		
Consol	$ 23,900[1]	$ 39,475
Stearns	408,400	185,100
Total - March, 1972	$ 432,300	$ 224,575
Cumulative through March, 1972	$ 14,218,813	$ 13,450,431

(1) Includes two months' payments to South Dakota School of Mines

Stearns' operations figures have been adjusted to reflect actual billings.

Att. - Monthly Progress Report No. 19 - Consol Project 702
Stearns' Operation Report No. 25 - Consol Project 701
SREM Monthly Progress Report - Consol Project 703
Progress Charts

cc. [illegible]

PROJECT STATUS REPORT

CONSOLIDATION COAL COMPANY
CSG PILOT PLANT
RAPID CITY, SOUTH DAKOTA

CCC Project No. 536
S-R Job No. B-37000
April 7, 1972

CUMULATIVE EXPENDITURES (1)

	Feb.	M$ Mar.
Operations, B-37400	1,938.2	2,346.6
Construction, B-37400 (2)	9,288.1	(3) 9,288.1
	11,226.3	11,634.7
Non Funded Tax Reserve Not Included in Above	187.1	191.4

(1) These totals are taken from the trial balances, and do not include funds spent by Stearns-Roger but not yet invoiced to Consol.

(2) Credit for surplus construction materials will about offset additional costs that will be involved with final settlement still pending with two equipment vendors. Final cost of construction will be very close to the revised approved Guaranteed Maximum price of $9,291,874.

(3) No invoices were sent to Consol for the construction contract during the month of March.

D. H. Dawson
Project Manager

Distribution:

Consol - 5
W. A. Schulz - 4
H. B. Marwig

Continental Oil Company - 5
E. E. Ellington, CED
John Counter, CED
Dr. C. V. Foster, PED
J. B. Hambleton, CED
L. Thompson, NED

S - R - 7

FCP/HFD/CHS/TGS/File JTH/VLB/CIMcB/JCM WFS
PAH/JAP DHD D.R.Hosher DDD

Project 702
CC w/Operations Report:
E. E. Ellington
J. A. Phinney
C. A. Schuls
Central File

CONSOLIDATION COAL COMPANY
RESEARCH DIVISION
LIBRARY, PENNSYLVANIA 15129

INTER-OFFICE CORRESPONDENCE

To : John D. Sudbury
Date : April 7, 1972

From : Carl E. Fink and Uwe D. Marwig
At (Office): Rapid City, South Dakota

Subject: Monthly Report No. 19 - Project 702

Emphasis during the month of March was on completion of the six prerequisite tests listed below:

1. Quench systems test
2. Jacket systems test
3. Electrical control system test
4. Char grinding test
5. Lignite lockhopper test
6. Ash and dolomite lockhopper tests

Consol prepared and issued to Stearns-Roger detailed procedures for tests 1, 2, and 3 during March. Detail procedures for the remaining tests had been submitted previously. Satisfactory completion of these runs is a prerequisite for beginning the start-up sequence of the initial gasification run. The current status of these runs is discussed below.

Quench Systems Run

Operation revealed many small problems most of which have been solved. One major problem remains unresolved. The SO_2 scrubber in the regenerator quench system exhibited a tendency to flood. Attempts to reorient the internals resulted in damage to the lining of the vessel. A bypass around the scrubber has been added to permit operation of the plant while the vessel lining is replaced.

Jacket Systems Test and Electric Control Test

The objectives of these runs were achieved after minor revisions.

Char Grinding Test

A satisfactory run was performed in February, but a repeat run to refine operating procedure and confirm results remains to be completed.

Lignite, Ash, and Dolomite Lockhopper Tests

Operation of the lignite and ash lockhoppers proved that these systems have enough flexability to allow the use of weigh cells. Dolomite was charged to and fed from these systems to calibrate the weigh cells and the rotary feeders and to demonstrate operability. It was not possible to feed dolomite fines from the ash lockhopper when moisture was present. Special precautions are required to prevent moisture accumulation in the piping between the cyclone and lockhoppers during start up. Although the low level alarm in the dolomite lockhopper did not function, this system was judged to be operable.

Detailed programs for the first three steps in the start-up sequence were completed during the month and submitted to Stearns-Roger. These procedures cover:

1. Hot gas circulation
2. $MgCO_3$ calcination
3. Hot dolomite circulation

Hot gas circulation is scheduled to begin the first week of April.

C. E. Fink

U. D. Marwig

CEF:UDM/lmp

Att. - Stearns-Roger Operations Report No. 25

CONSOLIDATION COAL COMPANY PROJECT

CSG PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #25

CCC Project No. 701
S-R Job No. B-37400
April 7, 1972

Summary

For the month of March, six runs were accomplished in part or completely.

The first run, Electrical Control Run (Run No. 3), was made the weekend of March 11, 12, 1972 and subsequently transmitted on March 14, 1972. This run involved testing some eighty circuits in a series of sixteen test conditions. With a few minor exceptions all checked out well. These few circuits were further checked and/or clarified March 16, 1972 and the results transmitted on March 17, 1972 completing the Electrical Control Run.

The Quench Water System Test (Run No. 1) was completed during the month with the exception of two level alarms on the Gasifier Quench Water Separator which have since been made operative. The Quench Water Systems cool the hot gases from the Gasifier and Regenerator before introduction to the recycle gas compressor. The Jacket Systems Run (Run No. 2), designed to test the operability of the systems used to cool the vessels and hot piping, was also conducted during March. Some minor checkout of the Quench Systems remains to be done. A verbal report of the system status has been made and the run data was transmitted on March 30, 1972.

The Lockhopper Systems, which are designed to remove solids from a pressurized system or add solids to a pressurized system, were operated during the month under Ash and Dolomite Lockhopper Test (Run No. 6) and Lignite Lockhopper Test (Run No. 4).

The Ash Lockhopper Test, simulating the removal of ash and fines from the system, used dolomite fines as the test solids. Results of the operating run were transmitted noting some reservation on the system's operating capabilities.

Sized dolomite was used for the Dolomite Lockhopper Test (Run No. 6). Ability to add solids to a pressurized system and system operability were confirmed at the time as well as proving the low pressure alarm switch. The low level alarm probe for the Lockhopper was removed for repairs.

In the Lignite Lockhopper Test (Run No. 4), sized dolomite was utilized as the test solids. Ability to add solids to the pressurized reactor was proved and the alarm settings for the Lockhopper system were recorded. No major operating difficulties were encountered with the system. Some minor additional data and/or adjustments will be made before a written report is made.

Monthly Accomplishments-Operations and Technical

At the beginning of the month, training for the char gasification run was carried out on both day and evening shifts, using all available technical personnel. As maintenance released parts of the gasification system, pressure tests were run to check piping additions and revisions.

By March 15 the equipment was in condition to bring the system up to pressure and circulate, then heat to 800°F. and circulate. The system was brought down on the 23rd to allow completion of Lockhopper Tests, but was heated again from the 27th to the 29th to prevent freeze-up problems during a cold spell.

Six specific test runs were completed or nearly completed:

Electrical Control Run (Report Issued)
Quench Water Systems Test (Verbal report given-being written)
Jacket Systems Run (Verbal report given-being written)
Ash Lockhopper Test (Report Issued)
Lignite Lockhopper Test (Verbal report issued-additional check before final report)
Dolomite Lockhopper Test (Verbal report issued)

Major equipment checkouts included:

Emergency Generator
Emergency Fire Water Pump
Boiler
Safety Equipment
Thermal Oxidizer (Waste Burner)
Carbon Monoxide Alarm System
Numerous Electrical & Instrument Systems

The new systems installed and checked out were: an 'inverter', which protects against the numerous power dips that occur here; and a high pressure liquid nitrogen system. This system was originally intended to provide backup for the inert gas system. It was decided in January, however, to use nitrogen for the prime system with inert gas as backup to simplify the initial gasification.

All dolomite on hand was crushed and ground. Approximately 30 tons of crushed dolomite were obtained for use in the upcoming gasification run. The system failed to operate anywhere near design conditions, is in a severely deteriorated condition, and provided serious personnel hazard from dust emissions. The decision was reached not to run it again, except perhaps on a test basis. Revisions to the system are being worked on by Stearns in Denver.

The inert gas and main air compressors have suffered from excessive temperatures. After extensive tests and trials the causes were diagnosed and corrected.

The Ash Pond showed signs of leakage. Tests were performed that did in fact show considerable leakage through the bottom of the pond. After draining and inspecting the pond, arrangements were made to have it lined.

The cooling water system has had disturbing signs of corrosion. With the assistance of a water-treating expert and the supplier of treatment chemicals, a program to improve the water and to monitor the system has been drawn up.

Excessive water carry-over was experienced from the SO_2 Scrubber. After extensive testing, the column was dismantled and it was found the internals had been installed wrong. Also, the epoxy plastic lining had been severely damaged, presumably from overheating.

It was discovered that the wrong nozzles had been installed in the flue gas quench tower. Makeshift nozzles were installed and the proper ones ordered.

In the laboratory, set up of equipment is essentially complete. Analytical development work decreased to 17 percent of total activity.

Plans have been formulated to put the four chemists on shift, one per shift, prior to gasification. With initiation of gasification, two chemists per shift will be required; such a schedule cannot be long maintained.

Mr. John D. Ryan reported for work as Technical Superintendent.

Safety

During the month Mr. Kenneth W. Martin assumed the position of Safety Director. Some safety items accomplished were:

Set-up of a complete first-aid station
Installation of foam system in parts of the structure
Test of the emergency evacuation procedure
Initiation of orders to improve operator access to crowded locations, provide yard hose-houses, install protective devices on sample-taking equipment, etc.

All of the major maintenance jobs on the schedule discussed with Mr. Cochran in January were completed in time for operations to phase back in as scheduled.

At the beginning of March the maintenance force was working ten hours per day and the electricians worked three weekends in a row. The schedule for the turn-around was continually updated in order to help work out ways of phasing into startup.

The number of maintenance orders and, consequently, the work level increased as equipment was started up. As a result March was a record month for regular ntenance orders. The list attached at the end of the report contains over orders. Because of this heavy load, we still had nine more men at the end of month than we plan for long term.

The major jobs completed during the month include:

COMPLETED MAINTENANCE THAT REQUIRED ENGINEERING

Maintenance Order Number	Job Description
0202	Sample connections - Note: 4 are completed, 2 are holding due to two vessel operation. 85% complete
0228	Completed steam trace and insulation of recycle compressor discharge lines
1005	Added cooling water to jacket water flanges Piping 100%
0029	Completed installation of thermowell and drains on H_2O cooling to jacket water flanges
0208	Replace 1/4" with 1/2" tubing L-213, L-216, L-308 - Complete
0163	Completed limiting orifices water to recycle comp.
?7	Completed installation of N_2 system
..31	Completed replacement of insulation D-101
0226	Completed installation of strip chart building
0333	Completed drains D-201 and 202 electrode cooling MRJ-249
3034	Completed ash lock hopper CO_2 to F-223
0328	Completed adding blinds to two vessel operation
0159	Rotometer enclosure - 80% complete
3056	CO analyzer - 100% complete.
0328	Completed plug Inst. B-207

0231	Completed grating at GA-210
3004	Completed handrail 100 Building
0230	Completed T.E. heater header
0208	Completed insulation L-213, 216, 308
0186	Completed installation stock 10" R to R valve in F-103 line to L-109-L3
3005	Completed skirting trailer
0160	Completed installation of ash pond catwalk
0135	Completed installing foam packs to fill over beam on east end and other holes in crawl space over 200 Control room to seal for pressurizing.

Electrical

Ash lock hopper system
All jobs complete except tieing in new instrument air dryer on inverter.
CO Analyzer and O_2 analyzer
MSA combustible analyzer (except check-out)
LN_2 system
Sump pump for inert gas generator
Fans and lights on 6th and 7th floors
Fans and lights in rotometer enclosure
T/C's on fired heaters - 2nd floor
Evacuation alarms
Portable pump skids
Locking devices on local start and stops
Strip chart storage building

PLANS FOR APRIL

Our main objective for April is to initiate the Gasification Run. This objective will be accomplished by a successful conclusion of the following steps:

(1) Hot Gas Circulation with the system inerted, pressured to 150 psig and at 1500°F. in the reactors.

(2) Fill the reactor system with sized raw dolomite. Calcine the $MgCO_3$ portion to MgO; then establish levels and circulate the hot dolomite.

(3) Do further char grinding to check out instrumentation and controls. Warm up the Preheater and check out its control system. Then proceed to build level of ground char in the Preheater to satisfy system prior to step 4.

(4) Transfer char from the Preheater to the Lignite Lockhoppers. Flow char into Gasifier and establish char level. Convey char into the Regenerator preparatory to calcining the $CaCO_3$ portion of dolomite to CaO. When the $CaCO_3$ calcining is complete, leave system ready for step 5.

(5) Admit steam to the Gasifier. This operation will start the gasification reaction of char to carbon monoxide, hydrogen and some methane. Line system out and prove operability of dual fluid beds, continuous calcining and solids transport.

The objectives of the technical engineers and laboratory will be to provide all the technical assistance possible during the above five steps. These functions are partially undefined at this time as no one knows what problems may arise. Of course, the group has several prior assignments which may be completed during the above listed steps.

STAFFING

	Present Payroll		To Be Hired April
Management	1		0
Accounting	4		1
Clerical	5		1
Janitorial	2		0
Safety	1		0
TECHNICAL DEPARTMENT			
Laboratory	6		4
Engineering	12		1
OPERATIONS			
Supervisors	2		0
Shift Engineers	3		1
Instrument Engineer	1		0
Operators	37		7
MAINTENANCE		**TEMPORARY***	
Supervisors	5		0
Crafts	40	7	0
Warehouse & Purchasing	4	1	0
Scheduling & Planning	1		0
Electrical Coordinator	1	1	0
TOTAL	125		

COSTS

Accumulated Operations Costs to Date 3-31-72	$2,364,679.83
Purchase Orders Not Paid & Purchases Placed	251,838.00
Actually Spent - March 1972	408,347.93

Very truly yours,

STEARNS-ROGER CORPORATION

D. R. Mosher
Plant Manager

Attachments
DRM:ska
CC: HLL, MHV, DCD, WTB, MRK, JGS, JDR, KMM
MAJ, EBW, CNF, MTH
G. D. Marvig-Consol
C. E. Fink-Consol
J. A. Phimney-Consol
Dr. J. D. Sudbury-Consol
C. A. Schulz-Consol

Dr. Roger Detman, C.F. Braun & Co.

The Maintenance Group has the following items to complete in April according to the plant priorities. These are in addition to normal plant maintenance which will arise.

Continue working O_2 analyzer-MSA Representative check out.

Continue working on installation of exhaust fan and lights for the rotometer enclosure.

Continue work on installation additional Gai-tronics communication sets.

Install electric power to skimmer pump.

Install Gai-tronics in laboratori grinding building and LN_2 pump house.

Continue work on additional shop space for electricians.

Install alarm on I.A. compressor cooling water.

Reinstall conduit wiring that was removed for siding on structure.

Continue work on thermocouple installation for heater and jacket water systems.

Install lighting for stairwell (9th & 10th floor).

Install burner for B-208 stack.

Continue working on installation of guard house elec.gate.

Install additional instrument air drying.

Place instrument air dryers on inverter.

Continue work on installing additional floodlights for area lighting.

Install car heater outlets in parking lot.

Continue work on installing welding receptacles.

Continue work on mechanical testing program.

Continue work on tracing and insulation of compressors.

Continue work on LN_2 system installation.

Continue work on additional instrument air drying.

Continue work on installation of sample stations.

Continue working on installation of solvent building.

Continue working on additional steam tracing.

Continue work on sampling platform for waste pond.

Continue work on dryers for analyzer sample system.

Install manual visual level indicators in Area 100.

Continue work on handrail around roof of area 100 building.

Install ladders and platforms to damper control valves on B-201, 203, 204.

Sample gas bottle enclosure.

Install stairway to 10th floor.

Run conduit and wire Utility Room overhead door.

Revision in AIT-1001 to show new sample point.

Purge Gas "C" to Rotary Feeders, L-207 A/B and L-204.

Change cooling water to F-321 and replace FI-3092.

Rotometer stairway.

Fabricate three tote bin lift spreader bars.

Gasifier ladder and platform D-202.

Install fire plug housing for hose fittings and tools.

C LETED MAINTENANCE WORK ORDERS 1

Main. Order Number	Priority Requested	Job Description
2300	Urgent	Suction J-210A XCV-2052--Line is leaking H_2O under installation line WRJ-202 (4th floor)
2048	ASAP	Clean or change insulation on LG-2024 -- F-212
	ASAP	Clean or change insulation on LG-2012 -- F-219
	Urgent	AJ-503 Make operable the yellow portage gas powered pump to be used because AJ-503 is not adequate
2281	Urgent	F-207A/B Return piping to inlet of ash lock hoppers
1227	Before Startup	Install fire blanket cabinets in area 100 - 200 - 300
2163	Schedule	Finish steam tracing & insulating line UW-505 to flare F-502
1290	Urgent	F-213 - Remove bottom valve & install necessary piping and hose connection to F-213
1289	Urgent	F-216 Install nipple with hose connection in valve at bottom flange of F-216
2084	Urgent	F-206 Remove flange from manway on vessel--inspect for water and replace
1301	Urgent	F-207A/B Break flanges and do necessary work to assist operations in removing dolomite fines from ash lock hoppers
1291	Urgent	F-204A/B Make lift bar per attached drawings and direction from L. Richmond
	Urgent	F-206 Repair leaking gasket and separate drop line as indicated by operations
2384	Urgent	E-302 Remove check valve in WQ-308 to RG quench separator for inspection and nozzle in E-302 for inspection. Prepare 3" blind for use when nozzles are removed.
1286	Urgent	Provide cherry picker to empty dolomite fines tote bins
1281	Urgent	Repair as necessary inlet chute to L-153 Hammer Mill
1279	Urgent	Provide cherry picker to empty dolomite fines tote bins
1152	3-7-72	Fabricate 3 drum racks for 35 gal. drums
0721	3-16-72	Install air supply into analyzer houses (AIT-1001 7th floor; AIT-2001 - 6th floor). Install brass valve inside analyzer house

C LETED MAINTENANCE WORK ORDERS (ntinued) 2

1092	Schedule	Valve won't close & drain underground - hydrant stop w/drain at cooling tower line WP-536
2142		Install pressure tap for gauge on cooling water return - WCR-506-14"
1277	Urgent	Remove side plates on L-153 for cleaning
2164	Urgent	Set spring hangers SH-300 in cold position at 960
0871	Urgent	U-507 Repair or replace water meter to #1 Zeolite water softener
0706	Schedule	Build bottle racks to hold two sample gas bottles -- AIT-5000 I.G. Analyzer
0718	Urgent	F-204A/B Build platforms or scaffolds as necessary for checking load cells on these vessels
1158	Urgent	WRJ-243 Check and replace gasket as necessary in orifice flange line WRJ-243
2112	Urgent	Replace 2xs in barrier and provide holddowns to prevent boards from leaving slots
2132	3-10-72	Cut and install block valve. Disconnect line UW-317-1½"-XE from KCS-315-1½" and cap off KCS-315 side. Run line from block valve to drain
2218	As able	Repair or replace ruptured coils on space heater-6th flo
2227	Urgent	Install block valve on main CO_2 header off F-211
0716	3-13-72	Install 1/4" SS tubing from zero & span gas cylinders to analyzer sample conditioners
711	Schedule	Install self-regulating temperature control valves
2114		Repair as necessary yellow porto H_2O pump
0977	2-14-72	Remove single nozzle and replace with dual nozzle on L-109-B1
1146	Shutdown	Perform maintenance on spring hangers per list and J. Howard
2105	As able	Replace burst strainer on steam tracing located on 2nd floor in middle of north wall in overhead.
2205	Shutdown	WRJ-231 Backweld jacket water nipples at bottom flange on regen.
2210	3-2-72	J-508 Install new spark plugs, ignition coil, and temperature gauge on Continental engine on J-508

0707	Schedule	Install tee and bleed valve on line to bottom of following switches: LSH-3070 E-304; LSH-3077 E-304; LSH-3060 F-304
1034	Routine	L-112 Install tee and bleed valve on emergency gas line to L-112
0931	Schedule	F-501 Install pressure gauge on nozzle N-8 of flare KO tank
1066	Shutdown	Install drain plug in check valve on J-314A pump discharge
1067	Shutdown	Install drain plug in check valve on J-314B pump discharge
1062	Shutdown	Install drain plug in check valve on J-211A pump discharge
1070	Shutdown	Install drain plug in check valve in water line to E-301
1064	Shutdown	Install drain plug in check valve on J-214A pump discharge
1065	Shutdown	Install drain plug in check valve on J-214B pump discharge
1063	Shutdown	Install drain plug in check valve on J-211B pump discharge
1149	3-7-72	Repair and replace exhaust stack for heating unit of building which houses cooling tower pumps etc.
2053	2-22-72	U-549 Repair steam leak at union on unit heater 1st floor
1111	Shutdown	E-309 Extend piping through siding from PSV-3030
1844	3-29-72	Extend boiler blowdown pipe to safe angle - at present is hazard to personnel passig by
1292	Call Out	F-213 Provide maintenance personnel to remove block valve above F-213 and to operate roto-rooter if necessary
0411	Urgent	Make funnel to fit inside 2" pipe -- Hang tarps around F-207A/B for wind break
1307	Urgent	F-225 Repair leaks on air surge drum
1304	Urgent	Check nitrogren pumping system. Low oil pressure on "A" pump. Leaking union on recycle line on "B" pump.
1841	Before Lignite Crushing	Replace belt guard on lignite feeder L-109

1819	2-24-72	Remove old and install new soap dispensers in women's toilet, men's toilet, and toilet by Instrument Shop
0410	3-24-72	Move rotometer from north library model to south library model
1212	Urgent	U-571 Install guard on exhaust fan in 100 Area
2366	Urgent	J-202 Make necessary repairs to noisy valves
2364	3-27-72	J-215 Plug or put flushing water to open tie in of packing of pump.
1302	Urgent	Check first stage valves on J-504
1303		J-504 Remove piping from compressor discharge to after cooler. Install nipple into discharge pipe for pressure gauge.
2149	Urgent	J-504 Inspect suction valves on second stage
2375		U-501 Repair flange leak at north end of copes regulator
0709	Urgent	AR-1000 Install shielded cable for signal wire from AIT-1000 to AR-1000
1047	Urgent	Check valves in second stage J-202
0172		Gas Purification - CO_2 Removal System--Make repairs per punch list
1221	Urgent	J-210A Check alignment on J-210A
1810	When Possible	Make up frame per sketch for scrubbing floor mats to keep them from curling
2287	Urgent	Make following FI's operable: 2163, 2081, 2095, 2160, 2174, 2072, 2070 (6th floor)
2288	Urgent	F-213 Remove piping & valve below ball valve to allow for tote bin
2087	Urgent	Flange on boiler control--Tighten flange to stop leak
1946	Week 2-28-72	Clean inlet air filter on J-503
1096	Week 2-21-72	Exchange drain valve at LCV-1016 for plug valve--UM-101-3" at LCV-1016
1097	Week 2-22-72	Change size of line on condensate return to sample cooler to 3/8 tubing
2208	Urgent	Check out J-509 pump is running rough
2206	Shutdown	GRI-229, 237, 218, GR2-220, GR2-219: Install couplings on purge headers on 6th floor so pressure gauges can be installed

0938		Check sample lines on heater stacks on B-2101IA, B-2101IB, B-205
2130	Urgent	Change out or inspect by removing bags L-112
2128	3-10-72	L-112 Open up for inspection of bags and then close again
0801	Boiler Down	Overhaul LSV and alarm system piping on U-501 boiler
1928	Week 1-3	J-302B Repack or add packing to flue gas quench water pump J-302B
122	Urgent	Repair as necessary J-301B - pump is noisy
1166	Urgent	J-504 Cap discharge bottle and install ell, valve, drain line to sewer on 1st stage jacket water to J-504
1161	Urgent	Blind following lines around E-305 (1) between new valve in line UW-317 & KCS-315 (2) Between valve V-9 in line GQF-317 & E-305; (3) Between E-305 absorber and 1st valve in GQF-305
1213	Urgent	L-153 Reinstall grating at discharge of hammer mill
2143	Urgent	J-504 Remove suction and discharge valves on 2nd stage. Check to see that suction valves are seating.
2120	Urgent	J-302B Repair or replace leak seal
1225	Urgent	Check and repair as necessary check valve in discharge line J-210B
2207		U-546 Repair leaking unit heater on 6th floor
1148	3-2-72	Repair or replace bottom gasket below rotary feeder L-109-L4
1147	3-2-72	Repair as necessary base of L-109-L4 (cracked on one leg)
0624	When Down	Install steam trap upstream of last block valve before steam goes into B-102 heater
2216	Urgent	J-507A Repair seal leak
2219	Urgent	L-152 Replace drive belts - motor to gear reducer
1201	Urgent	J-202 Inspect jacket water cylinders on J-202
2117	3-16-72	J-503 Clean and/or repair suction screen
1205	Urgent	Reverse FSL-2017 & 2018 flow switches to B-201IIB and B201IIA (apparently installed backwards)

1170	Urgent	Inspect jacket water cylinders on J-309. Install block valve on inlet tempered water to J-309
1202	Urgent	L-155 Make necessary repairs to oversize chute on L-155
1168	Urgent	Pull, inspect, clean, flush lines to all tempered water restriction orifices. Check and flush tempered water exchanger. Install blowdown valves on exchanger
1167	Urgent	Inspect cylinder jacket water jackets on J-504
2212	Urgent	Test relief valves on interstage of J-504
2209	3-6-72	Move rotometer from south model to north model and fill manometers
2214		J-504 Install pressure gauge on inlet to second stage of J-504. Also install gauge on outlet of first stage
2215	3-6-72	PCV-5114 Remove and check pressure regulator on propane line at tank. Replace if necessary
1089	Week 2-21-72	Install, after setting at 350 PSIG, PCV-2138 in line GC-307-1½" EIC
1821	Now If Possible	Fix outside door by change room
2213		Inspect rings in second stage on J-202
2104	As Able	Repair leaking steam tracing on discharge line of J-314B
2107	As Able	Steam trace properly and insulate sensing line to AIT-1001 from B-102 on 7th floor
2108	As Able	Replace strainer on steam tracing AIT-1000
2136	Urgent	J-504 Remove discharge pipe from 2nd stage and ascertain fouling. Remove pot at 2nd stage suction and determine fouling. Install TI's at 1st stage discharge, 2nd stage suction.
1156	Urgent	Tighten leaking union at second stage bypass to FT-2028
1155	Urgent	Install chain on chain valve on gasifier line to quench
1172	Before Startup	J-210A Correct piping on jacket water pump
1171	Before Startup	J-209 Correct piping on jacket water pump
0240	4-1-72	J-210B Replace cooling coil in seal flush cooler-freeze
2226	Urgent	AJ-503 Check out chemical sump pump-very noisy

1173	Before Startup	J-210B Correct piping on jacket water pump
1068	3-10-72	Install drain valve on piping loop under FI-3033
0710	3-15-72	Replace burst sensing line and reinsulate FT-2120
2279	Urgent	J-502 Check out - strange noise
328	Urgent	Repair screw in V-151A - hanger bearing support is bent and tip of north flight is bent
1165	3-15-72	L-153 Remove grating on discharge of hammer mill
1164	3-15-72	Remove overhead shaft bearing support in L-152
2129	3-10-72	Replace rupture disc - see G. English
0714	3-15-72	Remove manways in F-317, F-319, F-320 and replace after inspection by Instrument Dept.
1049	Schedule	Solenoid valve on CO_2 line to F-223 needs to be reversed
2202	3-3-72	Obtain sample of dessicant from each tower of following dryers: Inst. Air, Inert gas, purge gas "A", "B", "C"
2211	3-3-72	Tighten belts on J-502
0406	3-14-72	Measure ash pond and organic pond
2355	3-22-72	Repair FI-2081 to obtain flow
2354	3-22-72	Repair to obtain flow on FI-2163
1288	Urgent	Increase 2nd stage cooling water piping to 1½" on J-202 per W. Blalock's recommendation
1724	Schedule	FT-1009 Line ULN-102-10" - Install condensing pots at sensing point valves, re-run sensing lines, steam trace and insulate entire system
2327	Urgent	L-209B will not start
2386	Urgent	Inspect suction valves on second stage of J-504
2401	Urgent	dPCV-2052 Line: WRJ-224 -- Install air supply to regulator mounted on yoke of this valve
2141	Schedule	J-309 Enlarge lines at location of thermocouples on water system to give more clearance. Install isolation valves to block out 309 cooling system
2232	3-21-72	L-308 Make operational (a) Clock timer, (b) grease plug cock valves, (c) unplug purge gas vent line

2223	Urgent	J-504 Repair 1st stage disc high on press. and temp., 2nd suction and disc temper too high
0241		Run raw water flush line to slurry pump packing
2097	3-27-72	F-208A/B Unplug lines from ash lock hoppers to slurry tank
2369	Schedule	Repair GF Jacket water sample cooler - 4th floor
2282	Week 3-27-72	Replace pressure gauges on instrument air dryers
2289	Urgent	J-211B Make operable - Runs 20 to 40 seconds then noisy
2133	Schedule	Modify, construct, and relocate storage platform to meet federal register regulations (Acetylene/O_2 bottle storage)
2293	Urgent	F-152 Replace sock on fresh dolomite drop line with 12 oz. canvas or equivalent
2102	Safety	Construct and install coat rack in 100 area Control Room
2285	3-29-72	F-223 Pull orifice on circulating line from discharge of J-215 to slurry tank F-223 - clear pluggage
1295	3-31-72	Install glass door bulletin board in same place as present bulletin board in front foyer. Move present bulletin board around corner to place in hallway
2089	3-29-72	F-206 Install blind flange on opening where LSL-2028 was removed
0413	3-29-72	J-202 Install pressure tap in elbow at discharge of 2nd stage. Check piping and cooler between 2nd and 3rd stage for restrictions
2403	Urgent	Steam heater in analyzer house 6th floor -- Repair steam leaks on this system
1822	3-31-72	Fix west trailer office door so it closes properly
1298	3-31-72	Move used CO cylinders from Maintenance Shop entrance to cylinder storage rack per K. Martin's request
0412	3-29-72	While pumping slurry from F-223 - slurry discharges out the vacuum breaker - is PSV-2068 installed
2297	3-29-72	Replace gas hose to heater in liquid N_2 pump house-leak
1296	Urgent	Repair as necessary - H.P., I.G. regulator

90 Day PM on Pumps and Compressors Completed During March

J-201B	Gasifier recyle comp.
J-203B	Flue gas recycle comp.
J-502	Inst. air comp.
J-508	Emergency fire water pump
J-211A	Regen. jacket water circ. pump
J-211B	Regen. jacket water circ. pump
J-214A	Piping jacket water circ. pump
J-315	Foul water removal pump
J-319	SO_2 scrubber recycle pump
J-507A	Boiler feedwater pump
J-504	Inert gas HP comp.
J-517	Thermal oxidizer water pump
J-510	Condensate return pump

1215	3-17-72	Check out elec. to place L-151B in interlock system with dolomite solids
1220	Urgent	L-153 Check electrical - will not reset
0722		Disconnect PSL-3034
1218		Check out electrical on J-302 A/B
1219		Check FSL-3016
2121		Check J-203A recycle
2144	Urgent	Check out Utility Area beta alarm panel-alarms with no lights
2145	Urgent	Instrument man and electrician to work with Al Jewell on ash lock hopper system checkout
2330	Urgent	J-210B Check electrical - keeps kicking out
1278	Urgent	J-203B Check electrical
2377	Urgent	B-203 Continuous trip out on maxon valve
2376	Urgent	J-202 When main circuit breaker is on - have no electrical power to compressor panel
2385	Urgent	Check electrical on CO_2 vaporizer
2280	Urgent	B-201 IB Correct electrical problem - pilot won't stay on
2363	Urgent	Replaced burned out solenoid coil on ash slurry tank
2365	Urgent	Connected level and pressure switches in back of main control panel
2371	3-25-72	Run temporary power to LSL-2028
2372	3-25-72	Check tac on main board of L-207A/B

2373	3-25-72	Check tac on main board for L-204
2099	Urgent	Install bypass switch on DPS-2030H

1 MONTHS ENDED March 19 72

OSHA REPORT MINE NAME	MINE NO.	NUMBER OF LOST TIME ACCIDENTS NON-FATAL	FATAL	TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUC
Research Division	100						
Rapid City	200	0	0	0	0	24018	-
Total Research							

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S ENDED March 19 72

CCIDENTS TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUCED	FREQUENCY	SEVERITY	TONS PER LOST TIME ACCIDENTS	MAN COUNT
0	0	24018	-	0	0	-	140

2

SUBCONTRACT BETWEEN CONSOL AND SECRET RE CONSOL CO_2 ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR MARCH, 1972

I. General

Physical characteristics of available carbonate rocks are being studied via thin sections and other engineering properties. Autoclave work on the Ca-Mg systems is progressing satisfactorily as additional equipment modifications are developed. Artificial acceptors are quite abrasion resistant. Trace element determinations in lignite are continuing and data on column sodium exchange is being obtained. Full monitoring should be in effect during the first week or so of April.

II. Carbonate Resources (Mickelson)

The construction of maps showing the distribution of the several carbonate units is in progress. A preliminary report on the engineering properties of the rocks sampled is completed and awaiting final review for the completed report. Thin sections have been prepared and studies are in progress. We are still awaiting equipment to complete engineering tests on the Tymochtee dolomite block received some time ago.

III. Acceptor Reconstitution (Fuerstenau)

As an aid in establishing points on phase diagrams, the temperature sensing system was modified this past month by installing a feedthrough to immerse the thermocouple in the melt. The stirring mechanism was also modified at the same time.

A technique for measuring mechanical properties of the acceptors was devised. This technique involves dry-grinding 50 grams of -48 +100 mesh material in a 6-1/2" x 6-1/2" porcelain mill containing 110 grams

of porcelain balls for one minute. The results of three experiments are listed in the following table:

Material	Initial Weight (gm)	Weight -100 mesh Produced (gm)
Natural Dolomite (Pahasapa)	50	11.2
41 mole % $Ca(OH)_2$ (eutectic)	47.3	3.35
30 mole % $Ca(OH)_2$	47.8	4.13

As can be seen, the abrasion resistance of the acceptors increases with increasing calcium carbonate content and also the abrasion resistance of synthetic acceptor is greater than that of natural dolomite.

Work in April will involve producing melts, measuring mechanical properties, and acceptor activities.

IV. Noxious Elements (Lingard)

Analytical work on elements previously studied in a particular lignite sample was extended to other lignite samples which we have on hand to determine what variations exist between samples from different mines. Some preliminary work was done on the possibility of atomic absorption determination of mercury in undigested lignite samples but the initial results were inconclusive. Both these phases of the work will be continued in April.

V. Lignite Beneficiation (Clarkson)

The room temperature (24°C) studies on sodium removal from lignite using calcium solutions were completed during March. In the first series of experiments, calcium solutions (325ppm-350ppm) at three different flow rates and four different pH values were used. By allowing the solutions to flow through the lignite column as fast as possible, 60

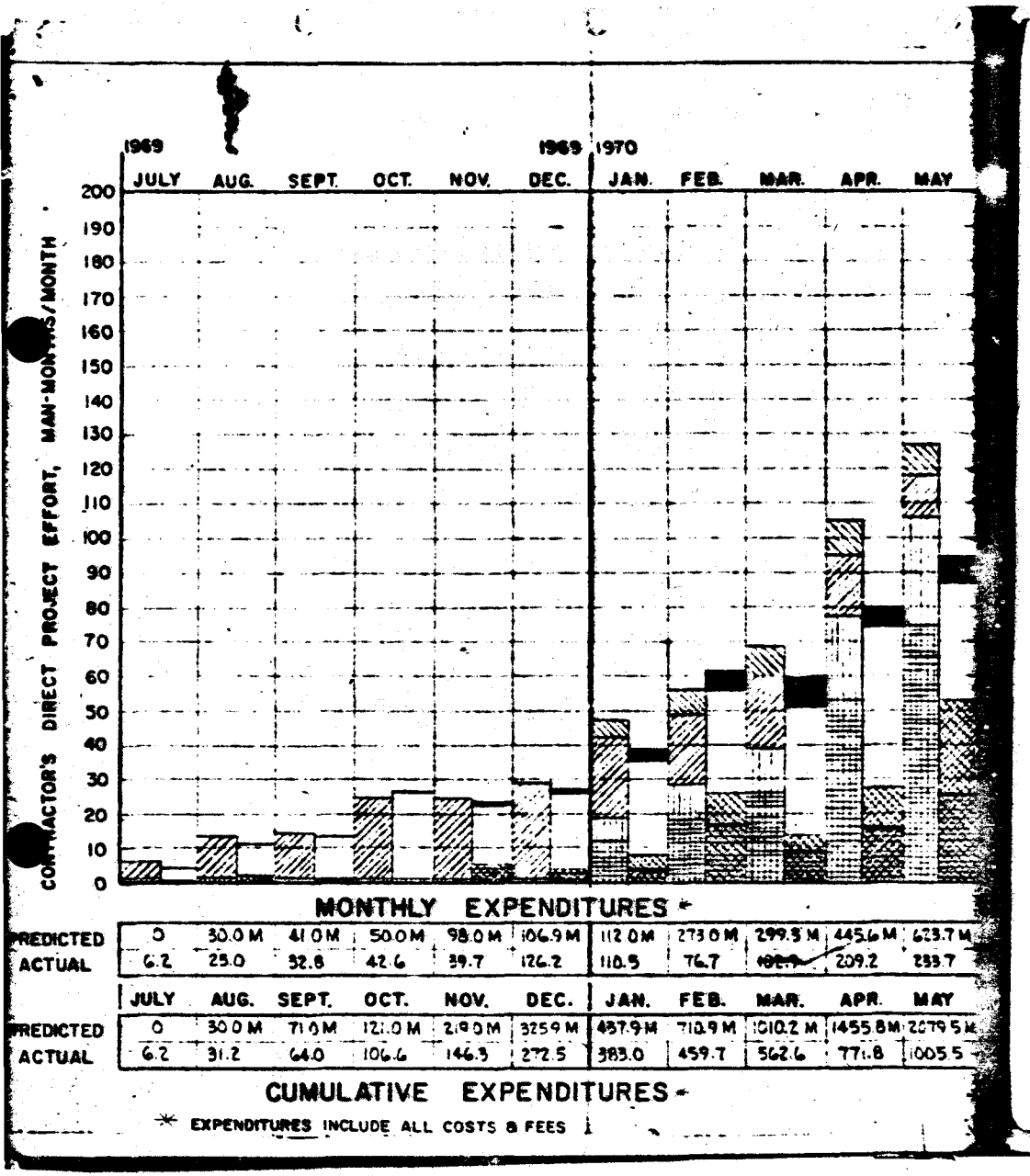
to 70 percent of the sodium is removed in 30 minutes and all of it in 2½ hours.

In the second series of runs, de-ionized water at three different flow rates and two pH values was used to remove the sodium. Water at a high flow rate and pH 3.0 was just as effective in removing sodium as were the calcium solutions.

The experimental arrangement has been altered so that the above series of runs can be repeated at lower temperatures. The experiments during the coming months will remove sodium from lignite at about 5°C.

VI. Waste Monitoring (Oliver)

The adaptor for vent stack monitoring has been returned to Stearns Roger and installed in the vent stack. Fabrication and testing of the particle detector have been completed and it is scheduled to be installed in the vent stack adaptor this week. The pH meter and dissolved oxygen analyzer have been checked out with the recorder. These instruments will probably be installed at the plant within the next week. Monitoring of wastewater and the vent stack should start within a week.



MONTHLY EXPENDITURES *

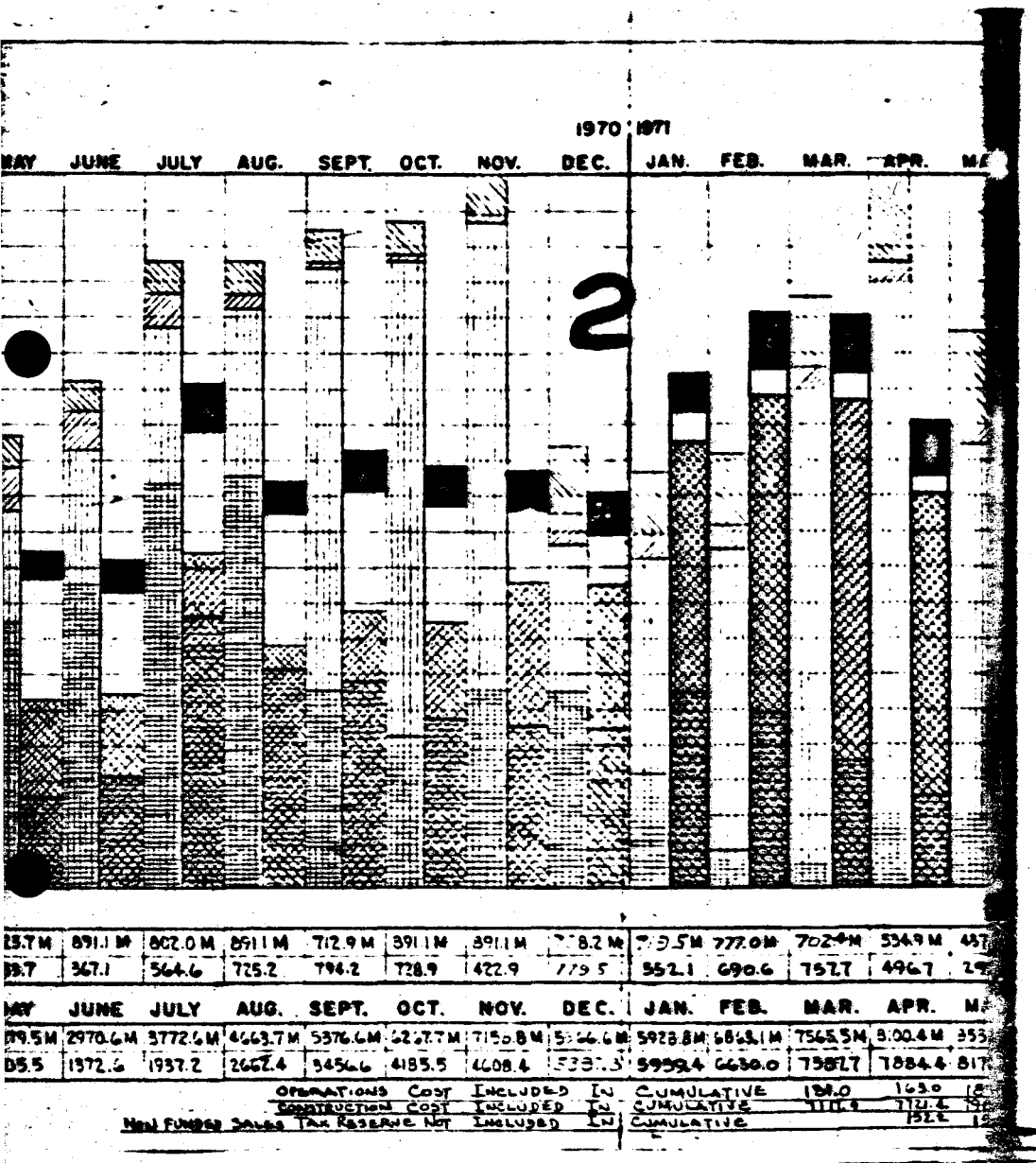
PREDICTED	0	30.0 M	41.0 M	50.0 M	98.0 M	106.9 M	112.0 M	273.0 M	299.5 M	445.6 M	623.7 M
ACTUAL	6.2	25.0	32.8	42.6	39.7	126.2	110.5	76.7	[illegible]	209.2	233.7

	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY
PREDICTED	0	30.0 M	71.0 M	121.0 M	219.0 M	325.9 M	437.9 M	710.9 M	1010.2 M	1455.8 M	2079.5 M
ACTUAL	6.2	31.2	64.0	106.6	146.3	272.5	383.0	459.7	562.6	771.8	1005.5

CUMULATIVE EXPENDITURES *

* EXPENDITURES INCLUDE ALL COSTS & FEES

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25.7 M	891.1 M	802.0 M	891.1 M	712.9 M	891.1 M	891.1 M	8.2 M	7.9.5 M	777.0 M	702.4 M	534.9 M	437
93.7	367.1	564.6	725.2	794.2	728.9	422.9	779.5	552.1	690.6	757.7	496.7	29

MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	M
79.5 M	2970.6 M	3772.6 M	4663.7 M	5376.6 M	6267.7 M	7158.8 M	5366.6 M	5923.8 M	6863.1 M	7565.5 M	8.00.4 M	353
05.5	1372.6	1937.2	2662.4	3456.6	4185.5	4608.4	5387.3	5959.4	6630.0	7387.7	7884.4	817

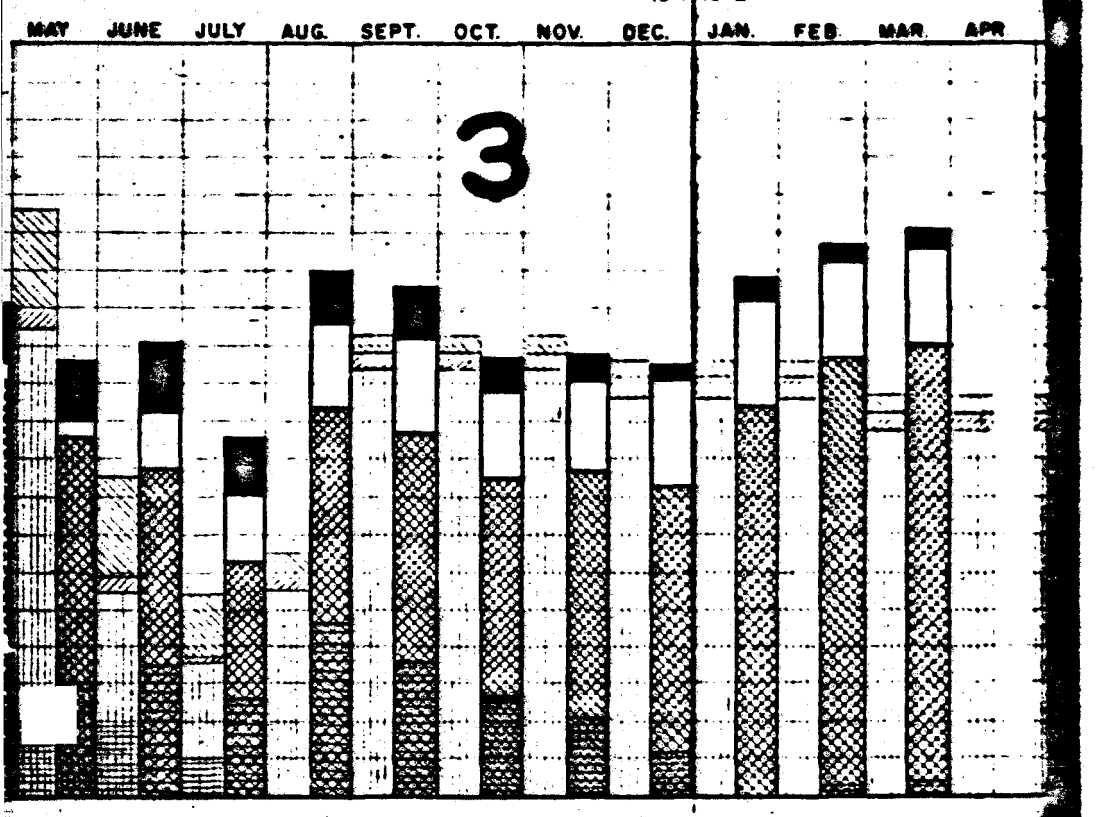
OPERATIONS COST INCLUDED IN	CUMULATIVE	181.0	1630	18
CONSTRUCTION COST INCLUDED IN	CUMULATIVE	311.9	1721.4	18
NEW FUNDED SALES TAX RESERVE NOT INCLUDED IN	CUMULATIVE		152.2	1

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MONTHLY PROGRESS CHART (

CONTRACT NO. 14-01-0001-415 (3)

1971 1972



487.7 M	441.8 M	285.0 M	220.8 M	318.1 M	218.0 M	219.1 M	211.9 M	211.5 M	211.5 M	185.1 M	184.5 M
292.0	308.1	221.6	299.6	440.1	409.4	258.0	341.9	360.5	425.0	408.5	

MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
8538.1 M	8979.9 M	9264.9 M	9485.7 M	9804.8 M	9921.8 M	10,140.9 M	10,352.8 M	10,564.3 M	10,775.8 M	10,960.9 M	11,145.4 M
8178.4	8484.5	8706.1	9005.7	9445.8	9855.2	10,093.2	10,441.1	10,801.4	11,226.4	11,634.7	
180.7	246.2	224.8	467.5	611.7	802.8	981.0	1183.3	1513.3	1938.3	2346.6	
7997.7	8238.1	8521.3	8658.2	8854.1	9052.2	9,112.2	9257.8	9288.1	9288.1	9288.1	
159.9	157.4	158.7	159.4	159.5	160.8	161.8	174.3	181.0	187.1	191.4	

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(CONSTRUCTION & OPERATION)

(REVISED 12/31/70)

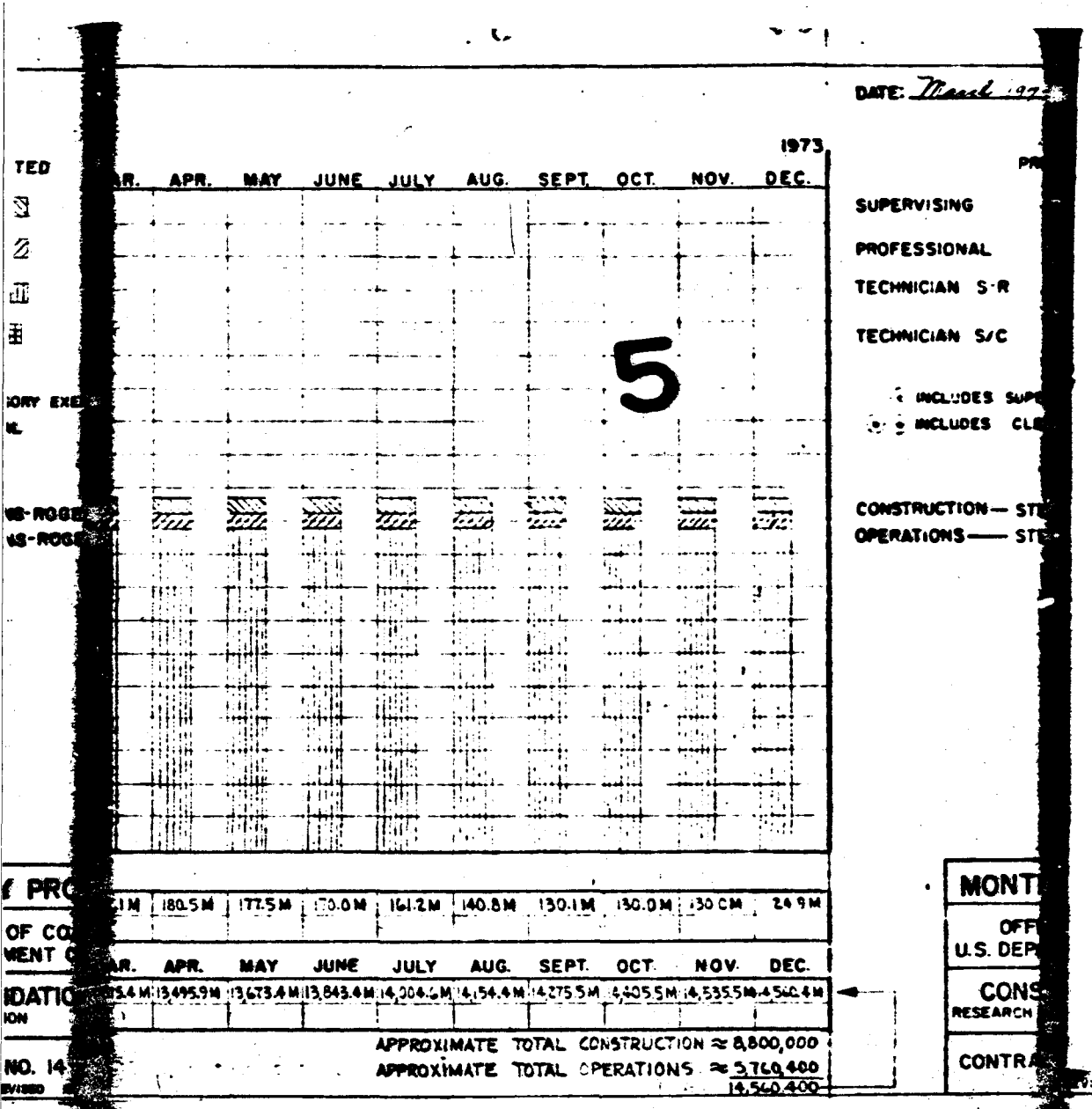
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APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT	NOV.	DEC.	JAN.	FEB.	MAR.	AP
84.5M	204.7M	203.9M	202.8M	202.8M	202.9M	201.8M	201.5M	231.4M	183.2M	182.9M	182.1M	80

APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	AP
345.4M	11,550.1M	11,554.0M	11,756.8M	11,959.6M	12,162.5M	12,368.3M	12,569.8M	12,772.2M	12,950.4M	13,133.3M	13,315.4M	34

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DATE: March 197
1973
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
5
SUPERVISING
PROFESSIONAL
TECHNICIAN S-R
TECHNICIAN S/C
CONSTRUCTION— ST
OPERATIONS— ST
180.5M 177.5M 170.0M 161.2M 140.8M 130.1M 130.0M 130 CM 24.9M
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
13495.9M 13,673.4M 13,843.4M 14,004.6M 14,54.4M 14,275.5M 4,405.5M 4,535.5M 4,560.4M
APPROXIMATE TOTAL CONSTRUCTION ≈ 8,800,000
APPROXIMATE TOTAL OPERATIONS ≈ 5,760,400
14,560,400
MONT
OFF
U.S. DEP
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RESEARCH
CONTRA
REVISED 12/31/70

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DATE: March 1971

1973

OCT.	NOV.	DEC.

	PREDICTED	ACTUAL
SUPERVISING		
PROFESSIONAL		⊕
TECHNICIAN S-R		⊕
TECHNICIAN S/C		⊕

⊕ INCLUDES SUPERVISORY EXEMPT TECHNICIANS
⊕ INCLUDES CLERICAL

CONSTRUCTION — STEARNS-ROGER JOB 8-37000
OPERATIONS — STEARNS-ROGER JOB 8-37400

6

	130.0M	130.0M	4.9M

T.	OCT.	NOV.	DEC.
5M	14,405.5M	14,535.5M	14,560.4M

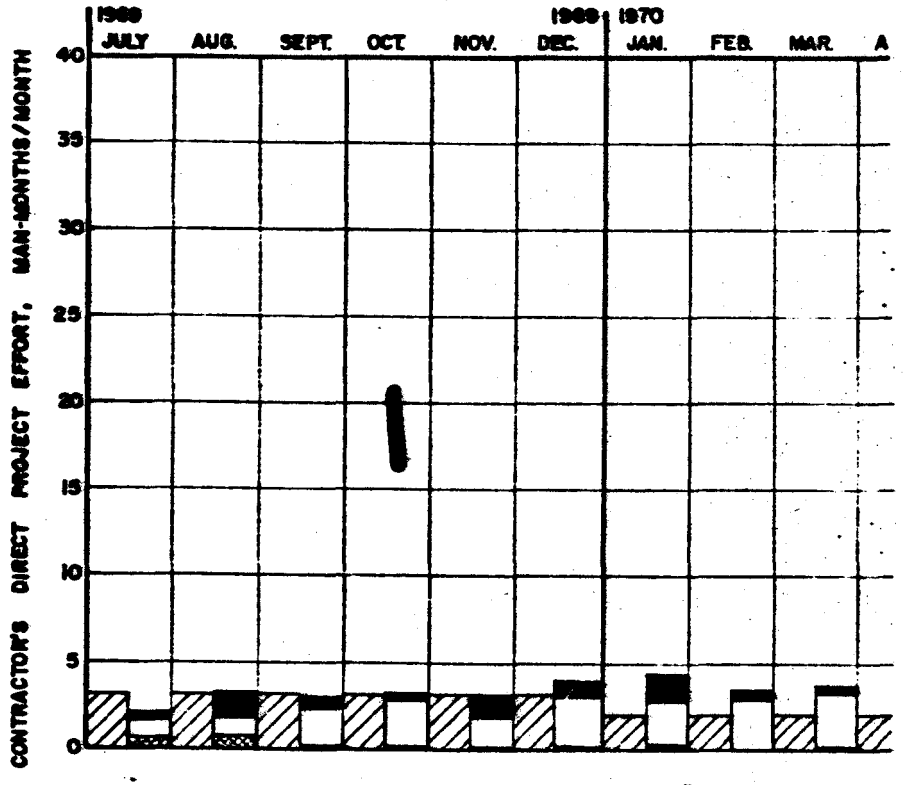
CONSTRUCTION ≈ 8,800,000
OPERATIONS ≈ 5,760,400
14,560,400

MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT NO. 14-01-0001-415 (3)
(REVISED 12/31/70)



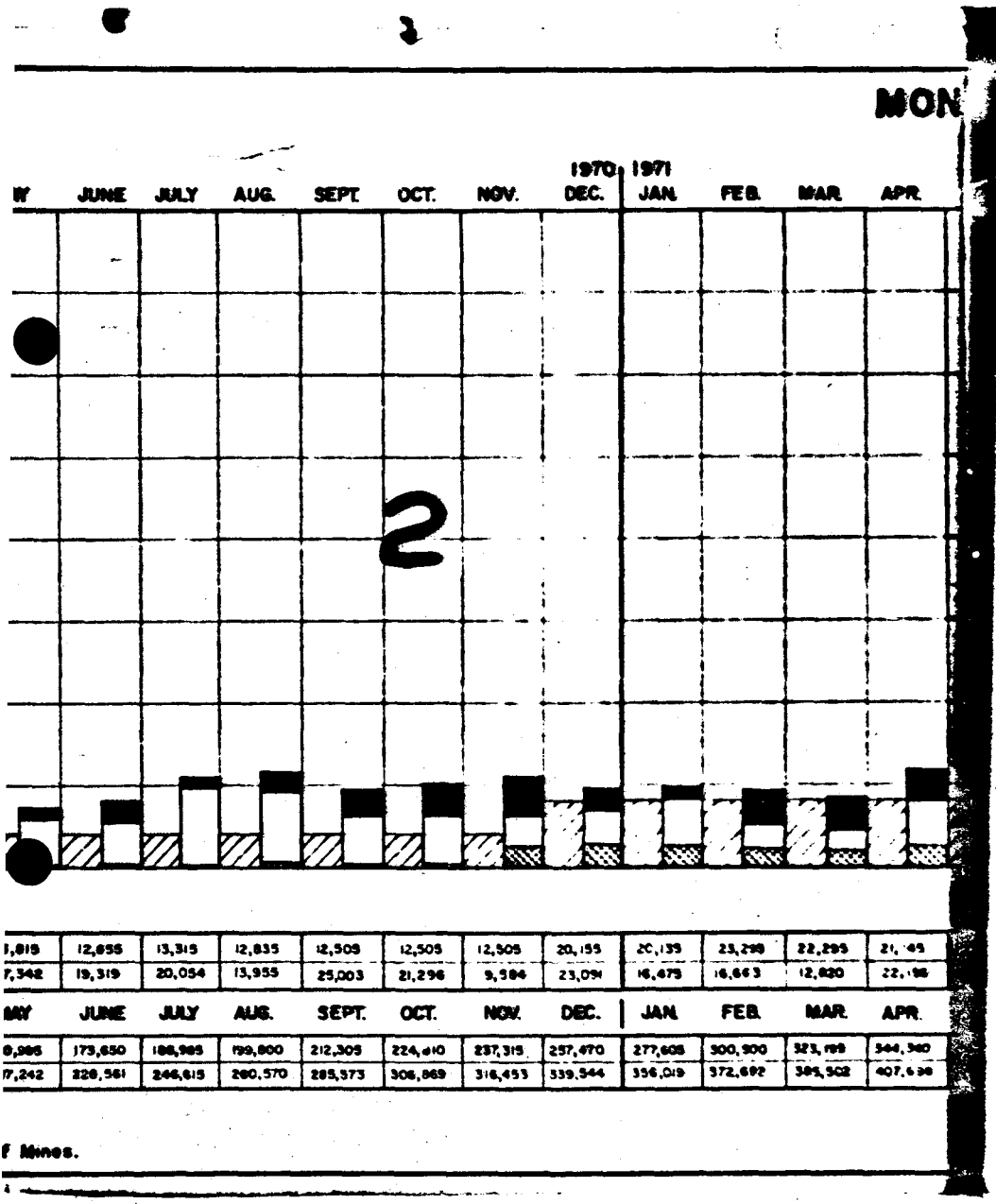
MONTHLY EXPENDITURES*

PREDICTED	16,215	14,685	14,985	13,135	14,385	17,065	15,585	15,595	12,635	12,
ACTUAL	11,745	34,734	9,609	11,825	10,130	15,208	14,378	14,027	15,019	93

CUMULATIVE EXPENDITURES*

	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	AI
PREDICTED	16,215	30,900	45,885	59,020	73,405	90,470	106,055	121,650	134,305	148
ACTUAL	11,745	46,479	56,088	67,913	78,043	93,248	107,626	121,653	136,672	189

*Expenditures Include All Costs & Fees By Consol And S. Dakota S

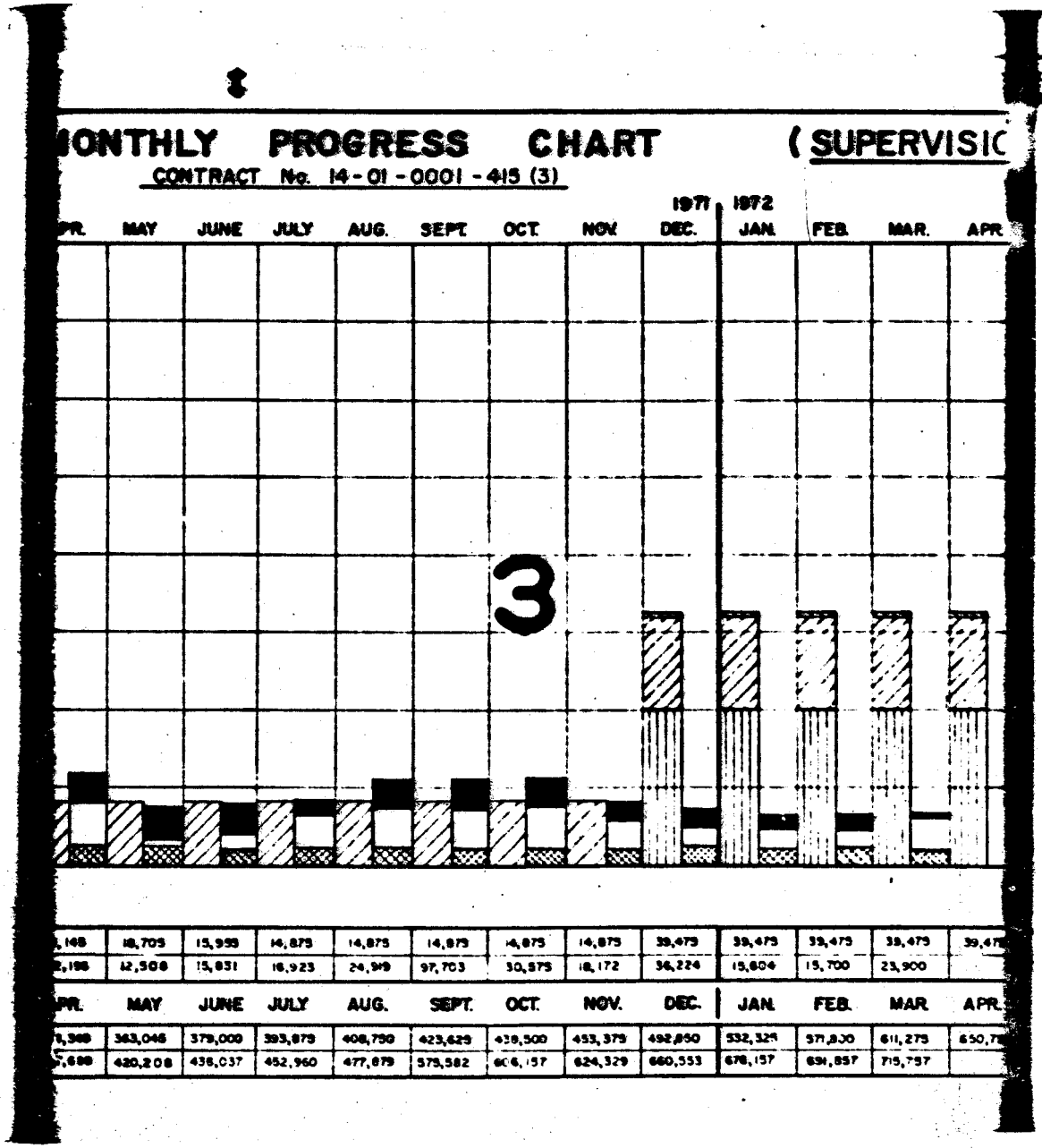


1,815	12,655	13,315	12,835	12,509	12,505	12,505	20,155	20,135	23,298	22,295	21,145
7,342	19,319	20,054	13,955	25,003	21,296	9,584	23,091	16,475	16,663	12,820	22,198

MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
0,985	173,650	186,985	199,800	212,305	224,810	237,315	257,470	277,605	300,900	323,198	344,340
7,242	228,561	246,615	260,570	285,573	306,869	316,453	339,544	356,019	372,692	395,502	407,638

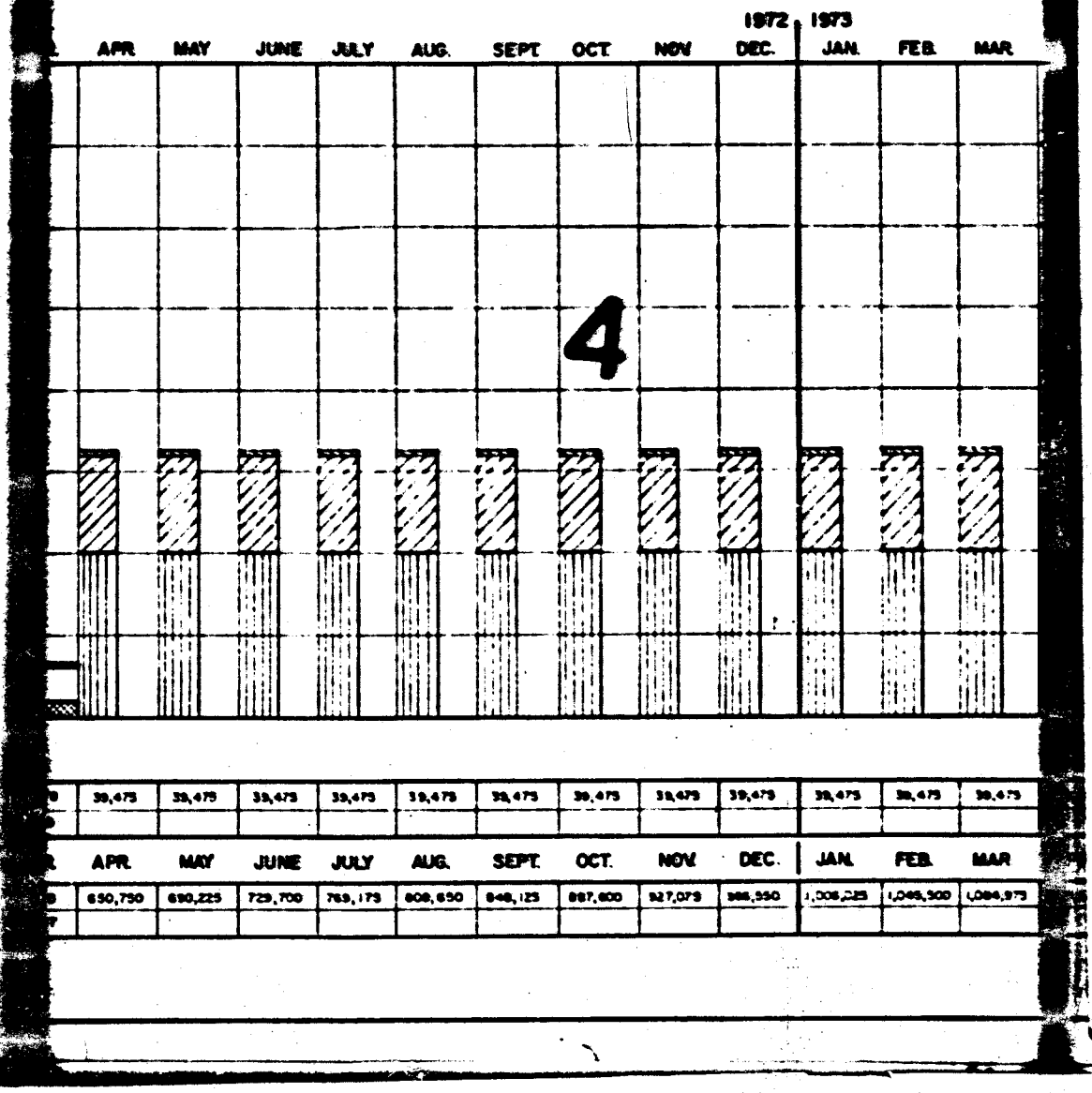
f Mines.

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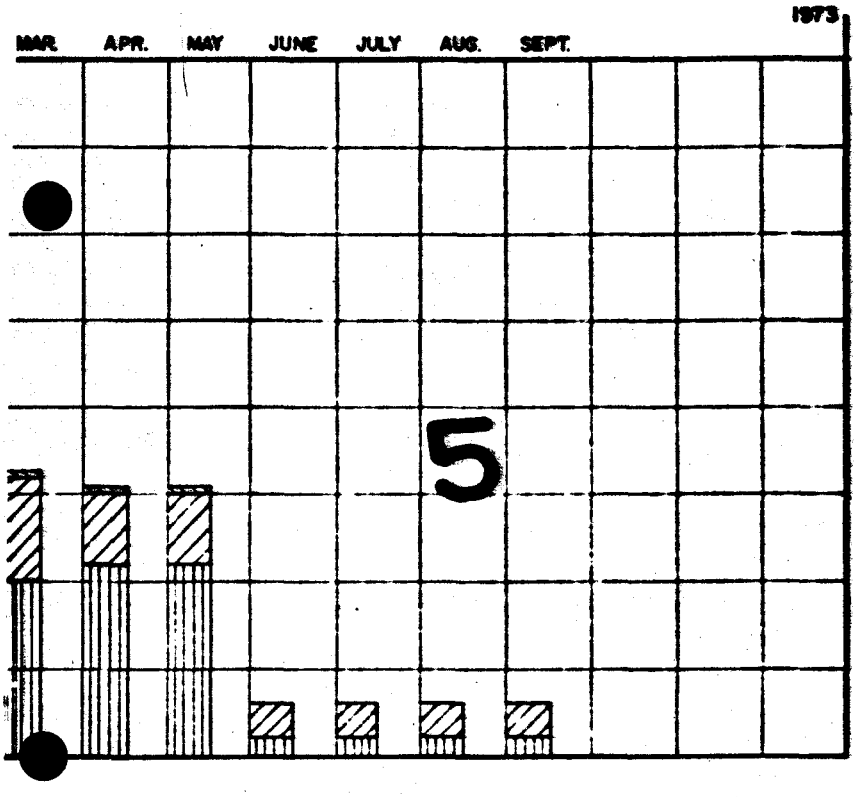

ONTHLY PROGRESS CHART
CONTRACT No. 14-01-0001-415 (3)
SUPERVISIC
1971
1972
PR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
3
148 18,705 15,958 14,875 14,875 14,875 14,875 14,875 39,475 39,475 39,475 39,475 39,475
198 42,508 15,831 16,923 24,949 97,703 30,575 18,172 36,224 15,604 15,700 23,900
PR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
388 383,046 398,000 393,875 408,750 423,625 438,500 453,375 492,850 532,325 571,800 611,275 650,75
698 420,208 436,037 452,960 477,879 575,582 606,157 624,329 660,553 676,157 691,857 715,757

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VISION & LAB WORK)



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38,475	36,075	36,075	11,475	11,475	11,475	41,120			
MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.			
1,084,975	1,121,050	1,157,125	1,168,600	1,180,075	1,191,550	1,232,670			

DATE: Mar

SUPERVISING

PROFESSIONA

TECHNICIAN

(4) Includes

(5) (6) Includes

M

RE

C

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(New '5 Chart)

DATE: March 1972

1973

	PREDICTED	ACTUAL
SUPERVISING	▨	■
PROFESSIONAL	▨	□ ④
TECHNICIAN	▥	▩ ⑤⑤

④ Includes Supervisory Exempt Technicians.
⑤⑤ Includes Clerical.

6

MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT No. 14-01-0001-415 (3)

CCDC-MPR--95

PROGRESS REPORT NO. 95
OCR CONTRACT NO. 14-01-0001-415(3)
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

April 1 to 30, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

Operations began the month of April with a hot gas circulation test in the two-vessel system. Following the gas circulation test, 250 pounds of dolomite were introduced and circulated between vessels. A failure of the gasifier pressure measuring probe necessitated a shutdown. Alternative pressure measuring devices were installed, and by mid-month the plant went onstream again. About 15,000 pounds of dolomite were introduced and circulated. Failure of a relief valve in the purge gas system, followed by a gas leak in a solids control valve, caused a shutdown near the end of the month.

Char grinding runs were also attempted, but a satisfactory performance was not achieved. The size consist was too coarse, and high pressures developed in the baghouse.

Because of the excessive costs of purchased nitrogen, attempts were being made to establish operation of the inert gas system. By month's end the system appeared operable and ready for testing.

The lining of the ponds was completed.

Methanation review continued with the study to be concluded by the third week in May.

Financial

Estimated monthly expenditures are $12,700 by Consol and $483,700 by Stearns. Cumulative expense to date is $14,645,213.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536)

The final construction report was being reviewed.

4. Stearns-Roger Construction Subcontract (Project No. 700)

Settlement with several vendors continues. Construction costs as of April 30 totalled $9,290,000.

5. Library Assistance on Pilot Plant Operations (Project No. 537)

Progress review meetings were held in Rapid City on April 10, and again during the following week on April 24 and 25. Considerable effort was expended in resolving the operability questions of the inert gas generating, drying, and circulating systems, so that use of purchased nitrogen could be minimized.

The plant budget was critically reviewed, particularly with regard to minimizing the unnecessary construction items, reducing overtime, and reducing plant personnel requirements.

6. Consol Guidance on Operations (Project No. 702)

The progress report is attached. Consol observed the operating of the plant, including the hot gas circulation, dolomite addition, dolomite circulation, and the char grinding tests, and modified some the valve-by-valve programs in accordance with the observed operations.

Consol established a program for testing the inert gas system including generation, drying, and circulation. A test was written to permit establishing a reliable purge gas system with inert gas as the primary source and purchased nitrogen as backup.

7. Stearns-Roger Operating Subcontract (Project No. 701)

a. The progress report is attached.

b. Program

The primary achievements included a successful hot gas circulation run, followed by introduction of dolomite, and finally hot circulation of dolomite between the gasifier and regenerator. One shutdown occurred when the gasifier pressure probe failed. The system was restarted using spare side nozzles for pressure taps. Hot dolomite circulation was reestablished, but the run failed when a relief valve on the purge gas system opened and would not reshut. A major gas leak in a solids control valve also accelerated the shutdown.

The char grinding system was operated, but the resulting size consist was too coarse. In addition, an unacceptable pressure drop occurred across the baghouse.

The inert gas system was successfully tested near the end of the month but not put into actual service.

It was estimated that repairs and adjustments to the systems would require approximately two weeks.

8. School of Mines Subcontract (Project No. 703)

The March progress report is attached.

C. Subject Inventions

None.

D. Financial Status

Expense	Actual	Budget
Cumulative through March, 1972		
Through June, 1969	$ 1,879,256	$ 1,879,256
Consol	715,857	611,275
Stearns	11,634,700	10,960,900
	$ 14,228,813	$ 13,450,431
Expended in period (estimate)		
Consol	$ 12,700(1)	$ 39,475
Stearns	403,700	184,500
Total - April, 1972	$ 416,400	$ 223,975
Cumulative through April, 1972	$ 14,645,213	$ 13,674,406

(1)No. S. D. School of Mines invoice was processed during April.

5/12/72
Att. - Monthly Progress Report No. 20 - Consol Project 702
Stearns' Operation Report No. 26 - Consol Project 701
S. D. S. M. Monthly Progress Report - Consol Project 703
Progress Charts

PROJECT STATUS REPORT

CONSOLIDATION COAL COMPANY
CSG PILOT PLANT
RAPID CITY, SOUTH DAKOTA

CCC Project No. 536
S-R Job No. B-37000
May 5, 1972

CUMULATIVE EXPENDITURES

	March	April
Operations, B-37400	2,346.6	2,748.4
Construction, B-37000	9,288.1	9,290.0
	11,634.7	12,038.4
Non-Funded Tax Reserve Not Included in Above	191.4	197.5

(1) These totals are taken from the trail balances, and do not include funds spent by Stearns-Roger but not yet invoiced to Consol. Refer to Operations Report No. 26 for details.

(2) Credit for surplus construction materials needed for operations and maintenance will more than offset additional costs involved with final settlements still pending with vendors. Final cost of construction will be about $19,000 less than the revised approved Guaranteed Maximum Price of $9,291,874.00.

D. H. Dawson
Project Manager

Distribution:

Consol - 5

C. A. Schultz - 4
W. B. Marwig

Continental Oil Company - 5

E. E. Ellington, CED J. B. Hambleton, CED
John Counter, CED L. Thompson, MED
Dr. C. V. Foster, PED

Stearns-Roger - 7

PCP/HFD/CHS/TGS/File JTM/VLB/CIMcB/JCM
PRM/JAP - DMD - WFS - DDD - D. R. Hooker

Project 702
CC w/Operations Report:
E. E. Ellington
J. A. Phinney
C. A. Schulz
Central File

CONSOLIDATION COAL COMPANY
RESEARCH DIVISION
LIBRARY, PENNSYLVANIA 15129

INTER-OFFICE CORRESPONDENCE

To : John D. Sudbury Date : May 8, 1972

From : Carl E. Fink and Uwe D. Marwig At (Office): Rapid City

Subject : Monthly Report No. 20 - Project 702

During the month of April, five of the six runs which are prerequisites for start up were completed and two unsuccessful attempts at start up were made. Tests on the sixth run, char grinding, are continuing parellel to start up operations. Thus far, the char grinding results have been unsatisfactory with respect to size consist.

Both start up attempts were aborted during the second step in the start up sequence, dolomite circulation and calcination of the $MgCO_3$.

The first shutdown occurred immediately after charging a batch of dolomite to the gasifier. The axial pressure tap probe failed when the differential thermal expansion between the probe sheath and the individual impulse lines caused several of the impulse lines to break. Tests showed that the pressure tap probe in the regenerator had also failed. During the shutdown, the solids were drained from the gasifier, and the gasifier probe was removed. Alternate side entry pressure taps were installed in both reactors. Replacement of the pressure probes has been deferred until after the completion of the first gasification run.

During the second start up attempt, the entire plant inventory of dolomite was established and circulation attempts had begun. However, before the pressure balance instrumentation had been properly tuned, a severe upset occurred plugging several key impulse lines with solids. Termination of the run occurred later when a relief valve failed resulting in total loss of purge gas. The plant was shutdown after draining the gasifier dolomite inventory. The regenerator dolomite inventory was left in the reactor.

Although the objectives of the dolomite circulation steps were not completely achieved, the results indicate that the instrumentation, if properly tuned, will function as designed.

Operations during April were plagued with difficulties in maintaining adequate purge gas supply. Nitrogen supplied from a liquid system was used to supply the process purge flows. Use of N_2 was both costly and unreliable. Consol has written a test procedure to tune both the inert gas system and the purge gas system. In addition, a revised start up procedure has been conceived in which air will be used as the permanent gas flow in the regenerator. If the objectives of the purge gas system run are achieved and the revised start up procedure is followed, consumption of liquid N_2 should be virtually eliminated.

C. E. Fink

U. D. Marwig

CEF-UDM:lmp

Att. - Stearns-Roger Operations Report No. 26

CONSOLIDATION COAL COMPANY PROJECT

CSG PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #26

CCC Project No. 701
S-R Job No. B-17400
May 4, 1972

During the month of April, five runs were accomplished in part, or completely.

The first run, Hot Gas Circulation, was started on April 3. This run consisted of verification of flow measuring instrumentation, establishing that the performance of the compressors, fired heaters and quench systems were satisfactory at design rates, and to establish the starting conditions for the next run, Magnesium Carbonate Calcination and Dolomite Circulation.

A major step was undertaken on April 10, Magnesium Carbonate Calcination and Dolomite Circulation. The objectives of this run were fourfold. First, to calcine the Magnesium Carbonate portion of the dolomite and to establish dolomite inventory required for gasification. Second, establish circulation of hot dolomite from the Gasifier to the Regenerator and back to the Gasifier. Third, acquire operating experience of the unit at or close to design conditions. Fourth, establish the starting conditions for the subsequent run.

The above run was not completed because of two shutdowns. One shutdown was necessitated by failure of the differential pressure probe assembly and resulted in a plant shutdown to install temporary sensing points. The second shutdown resulted from losing the entire Inert Gas Purge System followed by a major external leak on a control valve.

Runs three through five were accomplished with the grinding and drying system. The target char size for gasification is not more than five percent greater than fourteen mesh and ten percent less than one hundred mesh. The grinding and drying system, using char feed, has been operated with the roller mill journals crushing and with them held back acting as a stirrer. To date, a satisfactory operation, regarding size distribution, has not been obtained.

General

We missed our target to produce the first gas during April. However, everyone's attention is now fixed on accomplishing that goal in May.

When training for the gasification test was completed, the operators began pressuring the gasification system, circulating inert gas and heating the reactors to startup temperature. These were not new steps to the operators, although the procedures were modified from those used in January and February.

When the new steps toward gasification were started, the Shift Engineers went on shift to make the technical judgements necessary during any new endeavor. Next, all but one of the Technical Engineers (plus three temporary men from the Denver office) went on shift to support the Shift Engineers and to help organize data taking. As the analytical load increased the laboratory personnel, who had just completed calibrating the laboratory equipment, started shift work. When the attempt to produce gas had to be aborted, all of the Technical personnel returned to office work hours in order to design revisions to the plant. Most of the design work was done over a two day period.

During April, the maintenance supervisors shifted from a construction (turnaround) approach to their work, to pure maintenance. When the run ended, they shifted back to a construction approach in one day.

At month's end, we were making about thirty-five revisions to the unit. As of this date, the revisions are essentially complete and we are attempting to start up.

Monthly Accomplishments-Operations and Technical

The Hot Gas Circulation Run (Run 7) was initiated and completed. The system was pressured to 150 PSIG and circulation started. The three furnaces in the regenerator overhead gas recycle system were brought up and maintained at a 1450°F process outlet temperature. The process outlet temperatures of the gasifier recycle gas heaters were raised to 1500°F and maintained at this temperature.

We initiated the Magnesium Carbonate calcination and Hot Dolomite Circulation Run (Run 8/9) during the month. Sized dolomite was added to the gasifier via the lignite lock hoppers with the magnesium carbonate being calcined in the gasifier. After adding over 2500 pounds of dolomite, a problem developed with the gasifier differential pressure probe assembly. The indication was that some of the individual sensing lines had broken within the probe housing. The dolomite was transferred from the gasifier, the system cooled down, depressured, and the probe assembly removed. An alternate system for indicating differential pressures was installed in both the gasifier and regenerator; the system was again pressured, circulated and heated up. This run was continued by returning the partially calcined dolomite to the gasifier and transferring it to the regenerator.

About 30 batches of dolomite (roughly 15,000 pounds) were added to the regenerator via the gasifier prior to establishing dolomite circulation. After circulating dolomite for about a day, the solids seals in the dolomite lines between the regenerator and gasifier, and between the gasifier and the engager pot were lost, resulting in dolomite filling the lift line from the engager pot to the regenerator. This was cleared by routing extra gas through the lift line. After dolomite circulation was reestablished, some difficulty was experienced with plugged purge lines and excessive solids accumulation in the vessels downstream of the reactors.

On Monday, April 24, the relief valve on the Inert Gas Purge Gas System failed resulting in complete loss of all purges. While trying to unplug the purge lines and reestablish circulation a large pinking leak developed on one of the solids control valves.

In view of the above, the system was shutdown the last week of April. The partially calcined dolomite that was in the regenerator was left in during this shutdown. The shutdown continued through the end of the month.

Several char grinding runs and tests were made during the month. One was with the two remaining rollers in the roller mill tied back to try to obtain a better particle size distribution. Product size and moisture content approximated those of the February 25th run. An additional char run still with the rollers tied back, but varying operating conditions, was attempted to more closely obtain the desired particle size distribution. A high bag house differential pressure caused a delay in this run.

The high nitrogen usage of about two truckloads per day during the Run 8/9 resulted in the decision to activate the Inert Gas System as soon as possible. The Inert Gas High Pressure Compressor and Dryers were made operable and were put in operation supplying inert gas to the purge systems. Steps to activate A, B and C purge gas dryers were also taken.

The ash pond and the organic waste pond were each lined during the month to prevent ground seepage. The leakage rate from the ash pond was reported in last month's report.

Chemical treatment of the three jacket water systems and of the two quench water systems was initiated during April. We now have a comprehensive water treatment program for all five clean water systems.

During the shutdown the last week in April, the Shift Engineers were taken off shift and put on days to help with the planning and implementation of the shutdown work. During the month, two "B" operators, one "C" operator and three "D" operators reported for work. One "A" operator has resigned, and another plans to leave in about two weeks. One technical engineer also resigned during the month.

Safety

Two preliminary fire schools were held in conjuction with the Fire Department. Plant equipment was used to familiarize plant personnel in putting out several types of actual fires.

A Rescue and Fire Brigade was organized on each shift. Several drills have been held and one drill will be held every Thursday to sharpen our capability to handle emergencies.

A sound level survey of the plant was made during the dolomite calcination run and ear protection has been defined as necessary in several areas.

Monthly Accomplishments-Maintenance

The number of maintenance orders and, consequently, the work level decreased in April. Our maintenance group completed over 150 work orders, more than twenty fewer than in March. By month's end, the manpower had been reduced to 39, including supervision. No overtime was scheduled.

In addition to the above routine work orders, over thirty work orders requiring engineering were either completed or completed as required for the present operation. Maintenance also accomplished 90 day preventative maintenance on ten items of mechanical equipment. All major tools were checked and accounted for in April.

All of the maintenance supervisors attended the preliminary fire schools which were held. Mr. Roger Cornett, Maintenance Supervisor, retired April 29th. Mr. Kelly Castleman, Electrical Coordinator, temporarily assigned to this project, returned to our Denver office April 28th.

Plans for May

Our objective for April was not reached because of unforeseen mechanical problems. Therefore, our objective for May will be to initiate the Gasification Run. This will be accomplished by a successful conclusion of the following steps:

1) Start up and reestablish calcined dolomite circulation.

2) Do further char grinding to check out instrumentation and controls. Warm up the Preheater and check out its control system. Then proceed to build level of ground char in the Preheater to satisfy the system prior to Step 3.

3) Transfer char from the Preheater to the Lignite Lockhoppers. Flow char into Gasifier and establish char level. Convey char into the Regenerator preparatory to calcining the $CaCO_3$ portion of dolomite to CaO. When the $CaCO_3$ calcining is complete, leave system ready for Step 4.

4) Admit steam to the Gasifier. This operation will start the gasification reaction of char to carbon monoxide, hydrogen and some methane. Line system out and prove operability of dual fluid beds, continuous calcining and solids transport.

STEARNS-ROGER CORPORATION

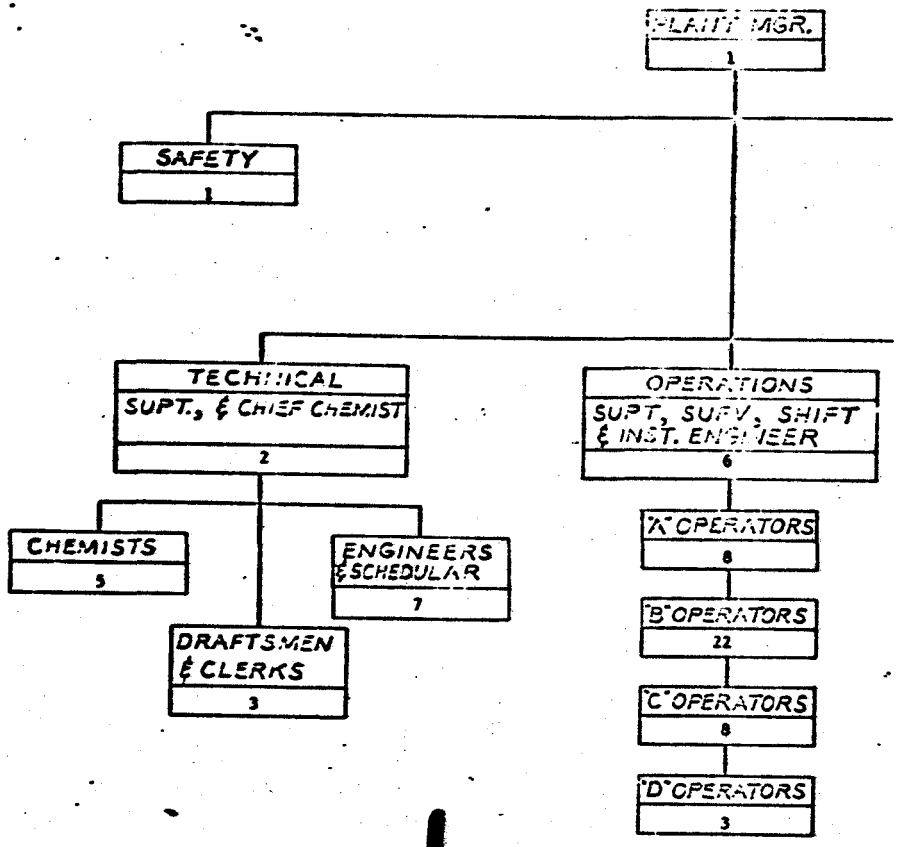
MONTHS ENDED April 30, 19

OSHA REPORT MINE NAME	MINE NO.	NUMBER OF LOST TIME ACCIDENTS NON-FATAL	FATAL	TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED	T
Research Division	100						
Rapid City	200	-0-	-0-	-0-	-0-	24469.5	
Total Research							

CORPORATION
April 30, 1972

DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUCED	FREQUENCY	SEVERITY	TONS PER LOST TIME ACCIDENTS	MAN COUNT
-0-	24469.5	-	-0-	-0-	-0-	115

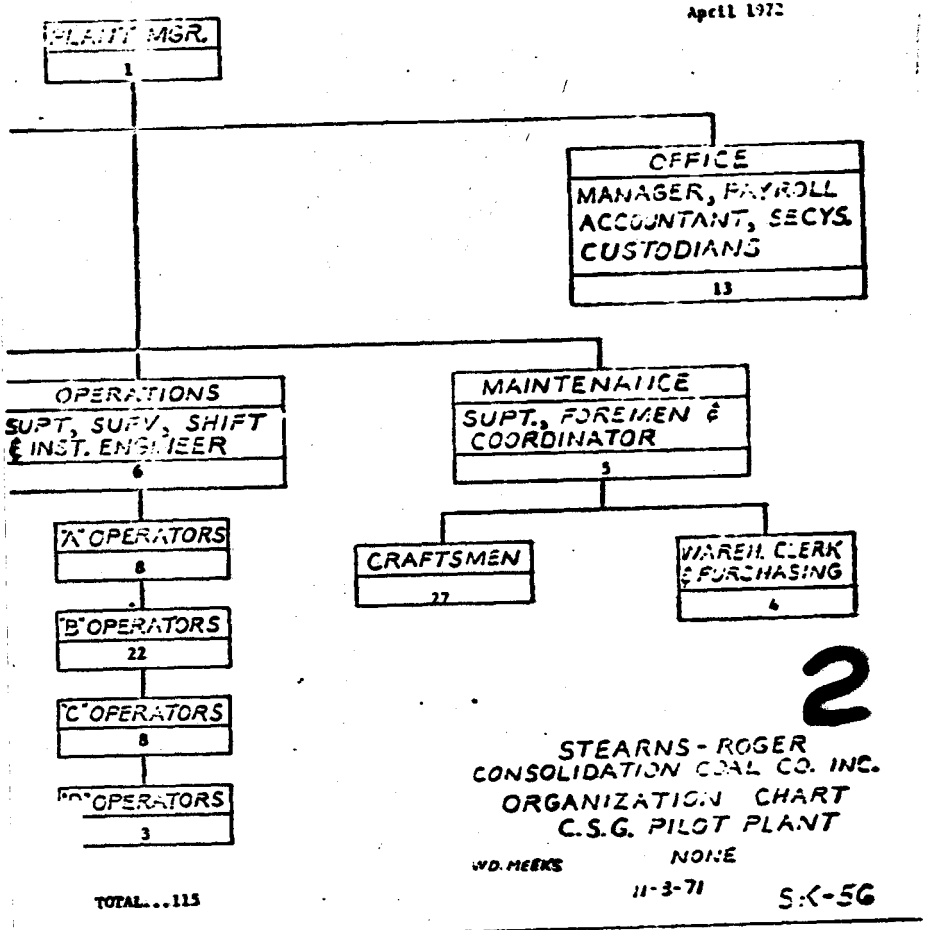
2



1

TOTAL...115

April 1972



SUBCONTRACT BETWEEN CONSOL AND STEARNS ROGER CONSOL CO_2 ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR APRIL, 1972

I. General

A sample of Tynochtee is now available and is being tested under the standard tests used for the carbonate rock samples of the resource study. Progress on other aspects of the carbonate resources is on schedule. Reconstituted $CaCO_3$ from autoclave runs in considerably superior in abrasive resistance to at least one of the natural dolomites. Acceptor activities will be checked next. Determinations of mercury in North Dakota lignites have been completed successfully. Studies on sodium removal at 2-6° C by ion exchange indicate a somewhat lower rate of removal than at 25° C but the rate is still high enough to be encouraging. Some delays and reinstallation of signal cable was necessary in the waste monitoring.

II. Carbonate Resources (Mickelson)

Comparative studies of a sample block of the Tynochtee dolomite are now underway. A new coring head has been obtained and tests will soon be completed. The same type of tests have been completed for the dolomite at the base of the Pahasapa. The preliminary report and map of the transportation study for the northern plains has been completed as well as a distribution map of the carbonate resources.

Studies of the Pahasapa in thin section continue. Not all sections have been returned from the section makers in California. Chemical analyses of samples are complete and this data is being summarized. The big job is to correlate all the information with the engineering

properties study, composition, hand specimen description, etc. This work will occupy the remainder of the contract period.

III. Acceptor Reconstitution (Fuerstenau)

Several $Ca(OH)_2 - CaCO_3$ and $MgO - Ca(OH)_2 - CaCO_3$ melts were prepared and their abrasion resistances were measured using a comminution technique similar to that outlined in the March 1972 report. The weight of grinding media and comminution time were changed to 254 grams and 10 minutes, respectively, to increase the fraction of material reduced to the minus 100 mesh fraction. The results of this work are summarized in the following table:

Material	Initial Weight (gm)	Weight -100 Mesh Produced (gm)
Natural Dolomite (Pahasapa)	50	13.1
20 mole % $CaCO_3$	50	4.1
30 mole % $CaCO_3$	50	*
40 mole % $CaCO_3$	50	3.6
57 mole % $CaCO_3$	50	5.9
36 mole % $CaCO_3$ 10 mole % MgO	50	*

* To be analyzed

In each case the synthetic material exhibits greater abrasion resistance than the natural dolomite.

Work in May will involve producing specific melts to complete this series of experiments, measuring abrasion resistance, and acceptor activities.

IV. Noxious Elements (Lingard)

A method for selective atomic-absorption determination of inorganic mercury and methylmercury in undigested biological samples (by L. Magos. Analyst 96: 847-853, 1971) was tried on lignite samples. Results for lignite were in line with those obtained by other methods but were low for the Bureau of Standards standard coal sample. The method indicated no methylmercury in the lignite.

The most satisfactory method for determination of mercury in lignite by atomic-absorption seems to be by burning the sample in a stream of air and collecting the mercury on gold. The mercury is then determined by flameless atomic-absorption by heating the gold after washing with acetone to remove adsorbed hydrocarbons.

Work during the month of May is expected to include attempts to determine selenium in lignite.

V. Lignite Beneficiation (Clarkson)

The low temperature (2-6° C) studies on sodium removal from lignite using calcium solutions were completed during April. The purpose of these runs was to compare the effectiveness of low temperature sodium removal with room temperature studies at the extremes of pH and flow rates. Under all conditions tested, water solutions of calcium remove the sodium from lignite by ion exchange. The technique is almost as effective near the freezing point as it is at 25° C.

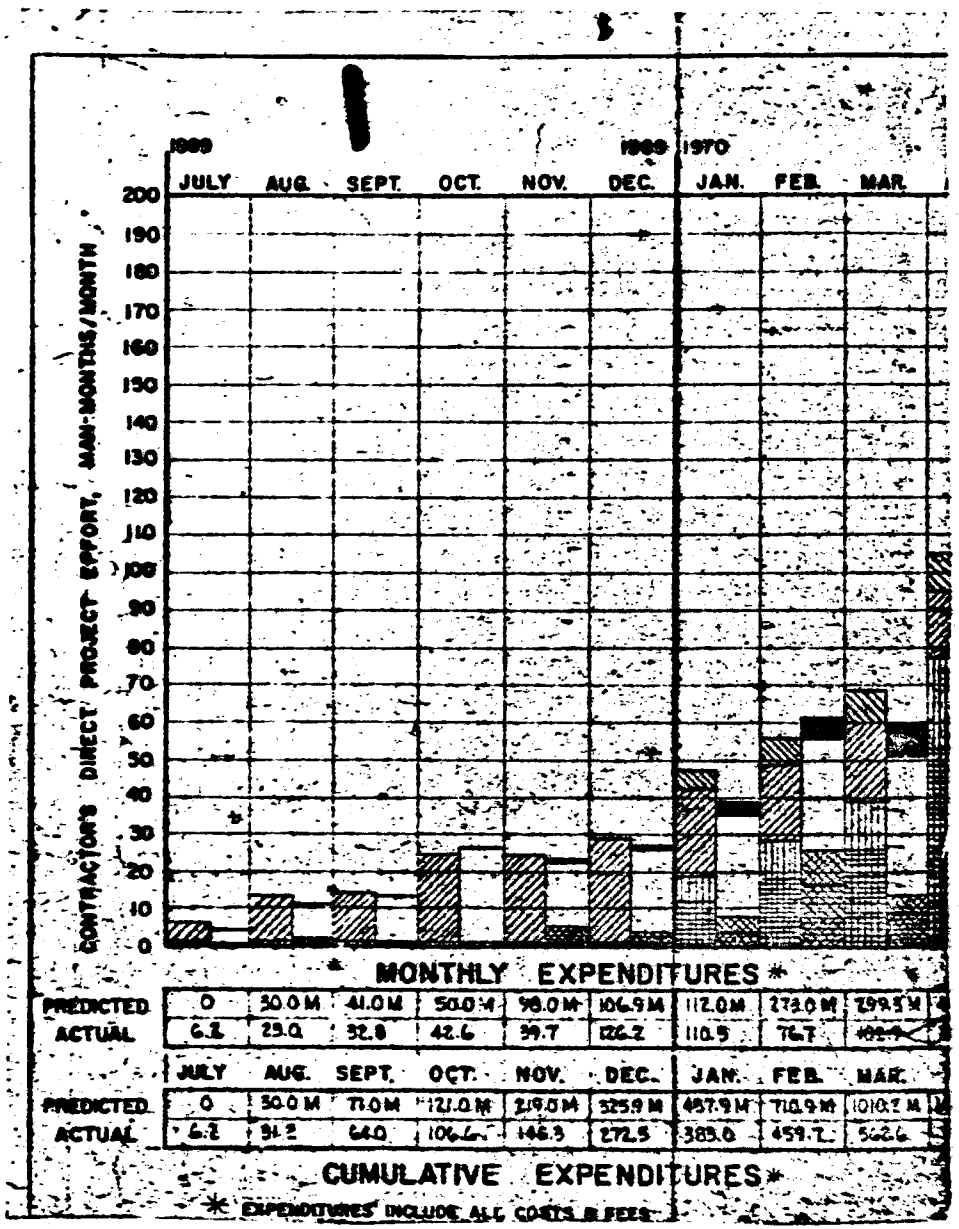
At pH 6.4, 2-6° C and 300 ppm Ca^{++}, 95% to 100% of the sodium is removed from the lignite after three hours depending on the flow rate.

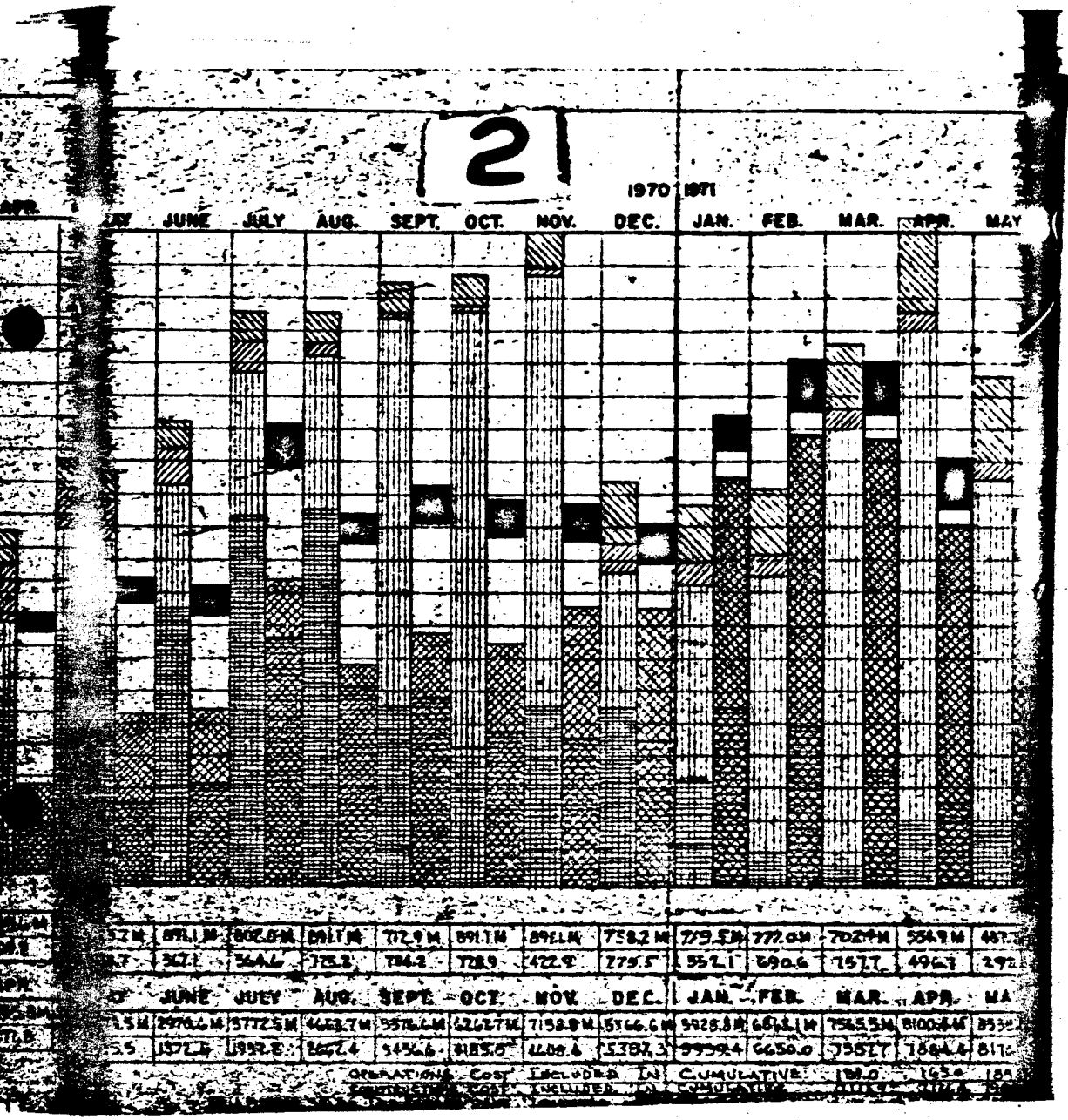
At pH 2.9, 2-6° C and 300 ppm Ca^{++}, 90% to 100% of the sodium is removed from the lignite after three hours depending on the flow rate.

Under both of these conditions, 60% to 70% of the sodium is removed in one hour. The same amount of sodium is removed in 30 minutes at room temperature.

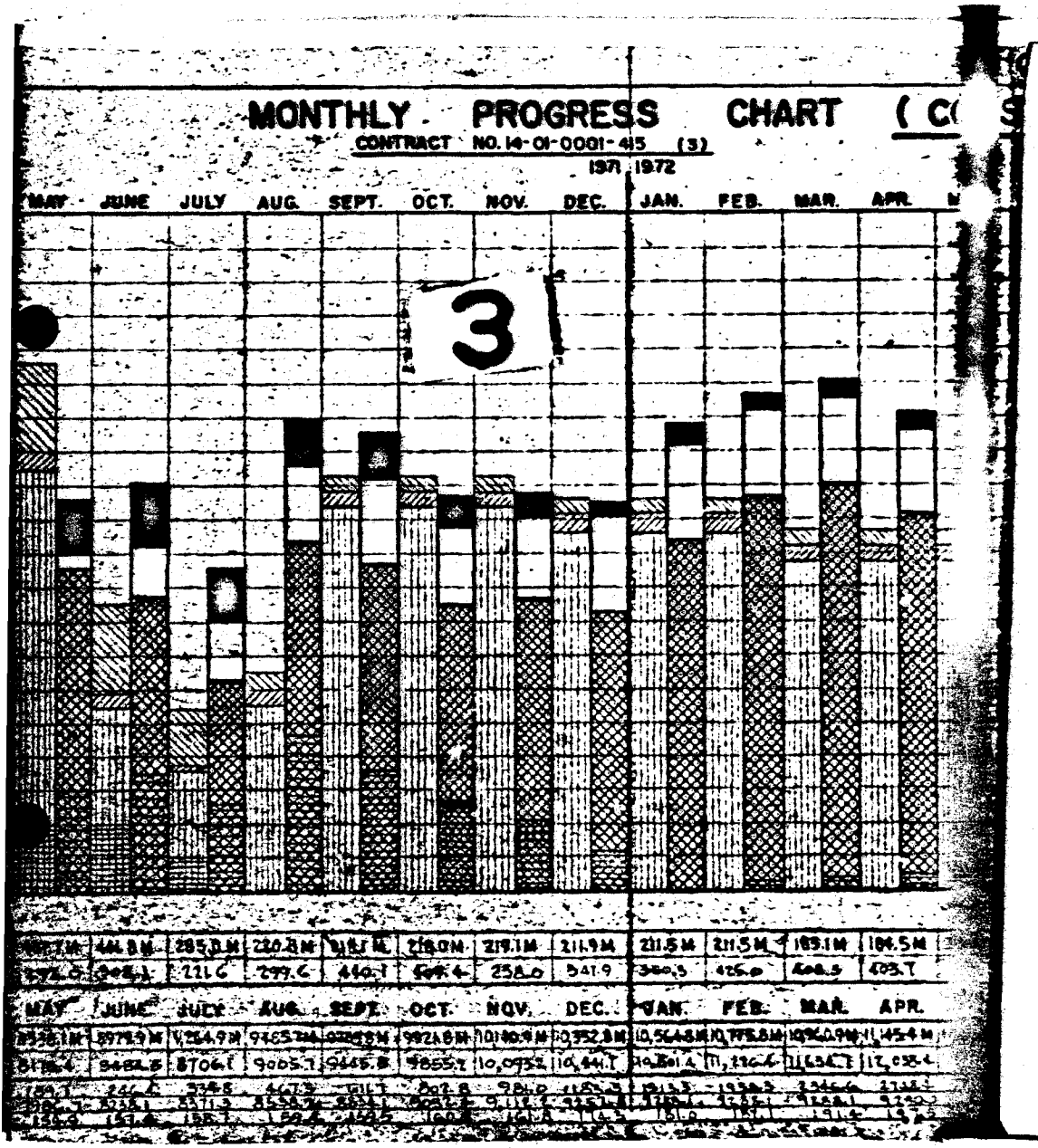
VI. Waste Monitoring (Oliver)

Background samples of air from the vent stack have been taken and analysed with the gas chromatograph. Installation of the gas chromatograph and the particle detector have been delayed pending installation of a.c. power cables to the vent stack adaptor and a conduit to convey a signal cable from the vent stack adaptor to a station in the stairwell at the ninth floor level. A work request has been delivered to Stearns Roger covering the necessary conduit and cabling and also for running the gas sampling tubing to the station in the stairwell. Likewise the installation of the waste-water monitoring instrumentation is being delayed until a conduit is run by Stearns Roger from the instrument shed to the waste-water pond. One such conduit was completed, but the lower end was subsequently covered up by a pond liner; so a new conduit will be required and has been requested of Stearns Roger.

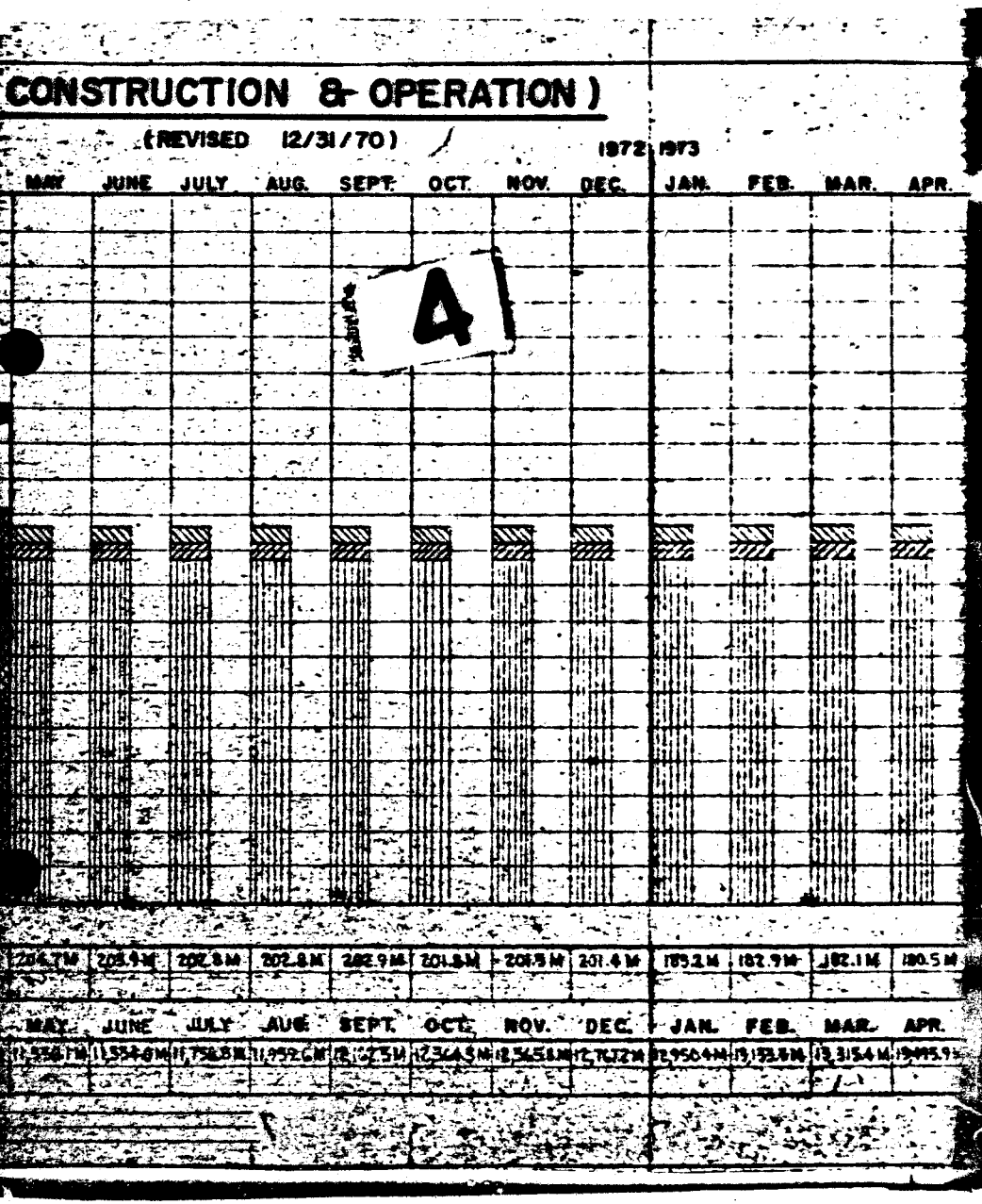




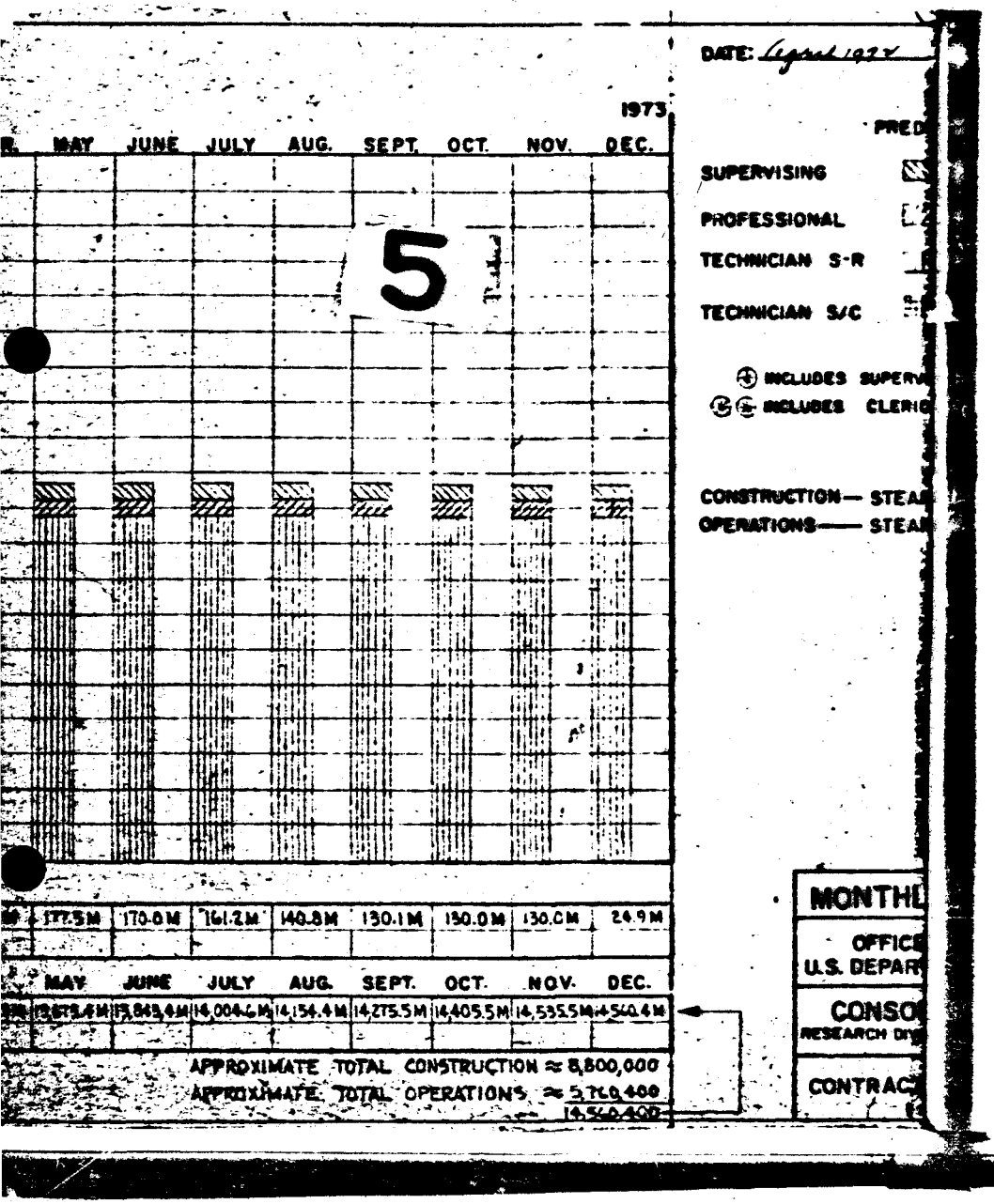
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MONTHLY PROGRESS CHART (C
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CONSTRUCTION & OPERATION)
(REVISED 12/31/70)
1972 1973
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MAY JUNE JULY AUG SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.

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DATE: August 1972
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SUPERVISING
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CONSTRUCTION— STEA
OPERATIONS— STEA
177.5M
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14,004.6M
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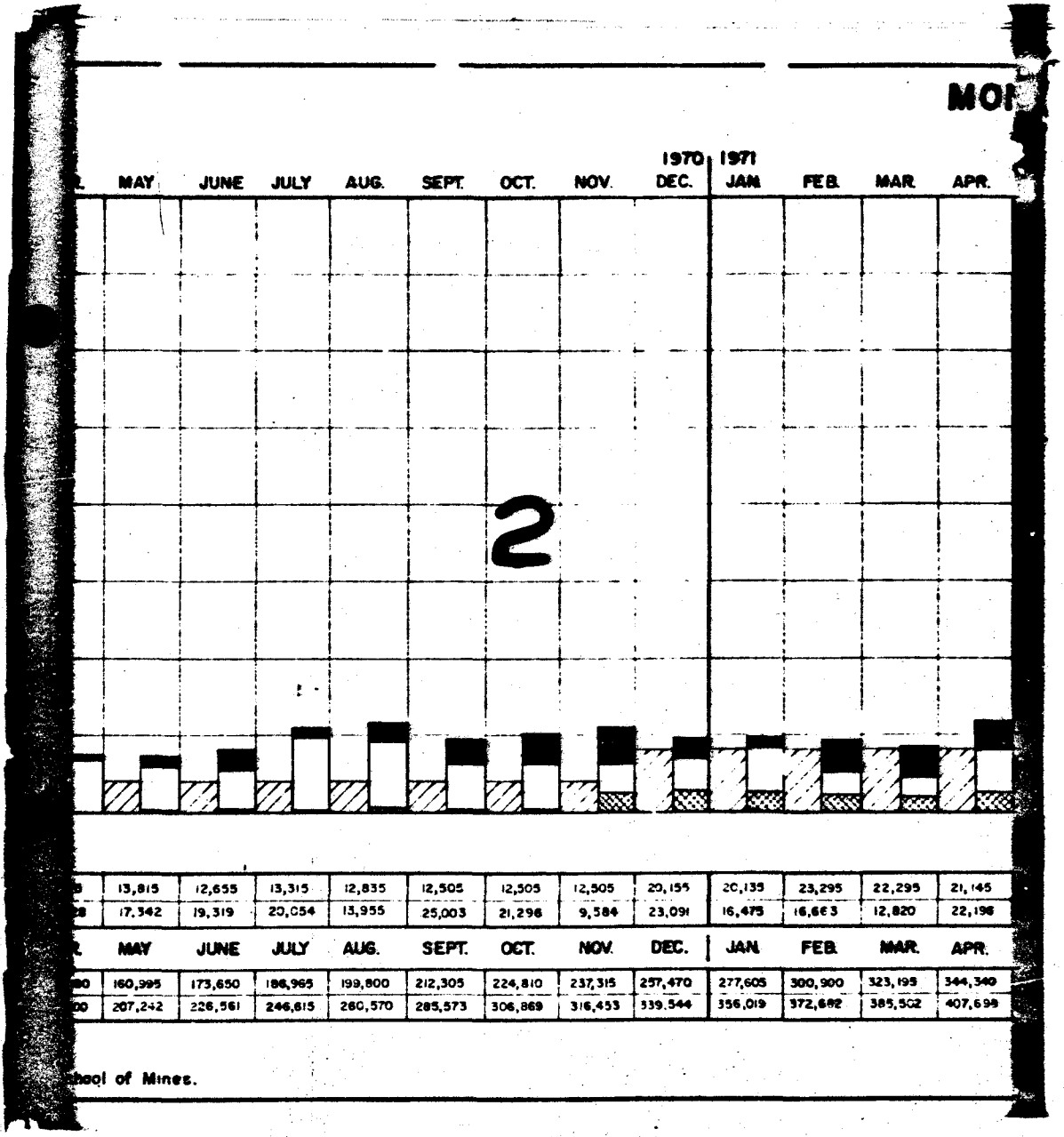
(P) INCLUDES SUPERVISORY EXEMPT TECHNICIANS
(S) (S) INCLUDES CLERICAL

CONSTRUCTION— STEARNS-ROGER JOB S-37000
OPERATIONS — STEARNS-ROGER JOB S-37400

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	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	1970 DEC.	1971 JAN.	FEB.	MAR.	APR.
	13,815	12,655	13,315	12,835	12,505	12,505	12,505	20,155	20,135	23,295	22,295	21,145
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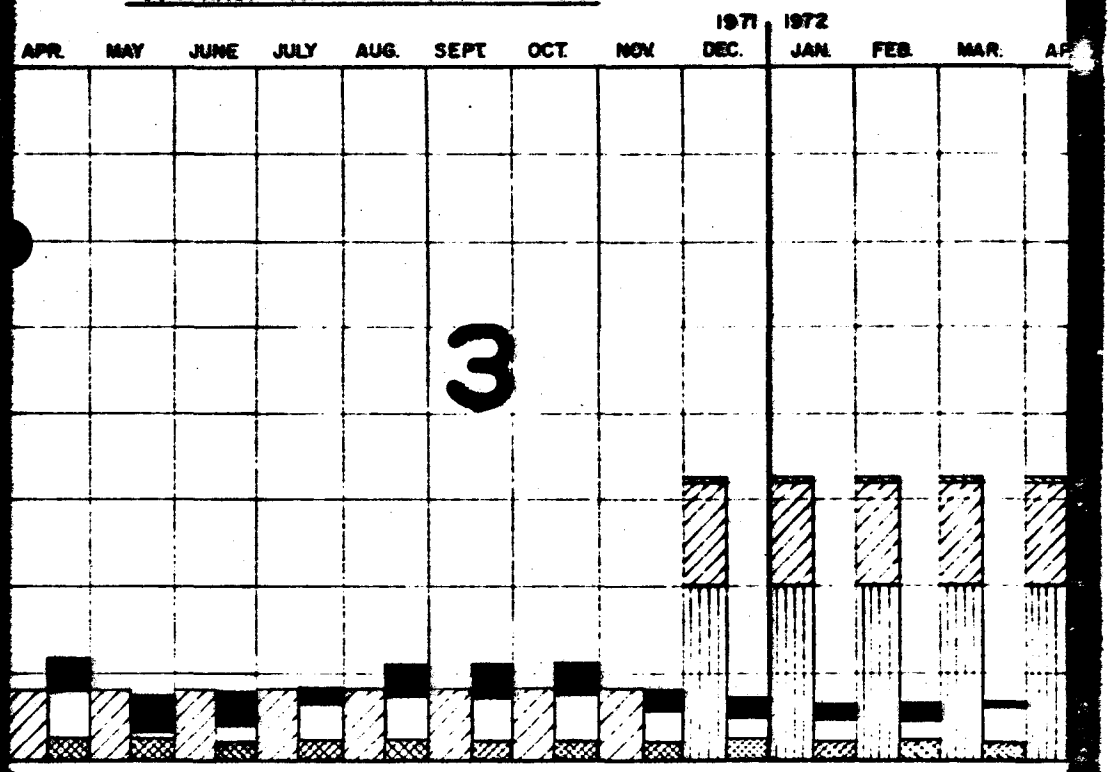
	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
80	160,995	173,650	186,965	199,800	212,305	224,810	237,315	257,470	277,605	300,900	323,195	344,340
00	207,242	226,561	246,615	260,570	285,573	306,869	316,453	339,544	356,019	372,682	385,502	407,698

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MONTHLY PROGRESS CHART (SUPERVISI

CONTRACT No. 14-01-0001-415 (3)

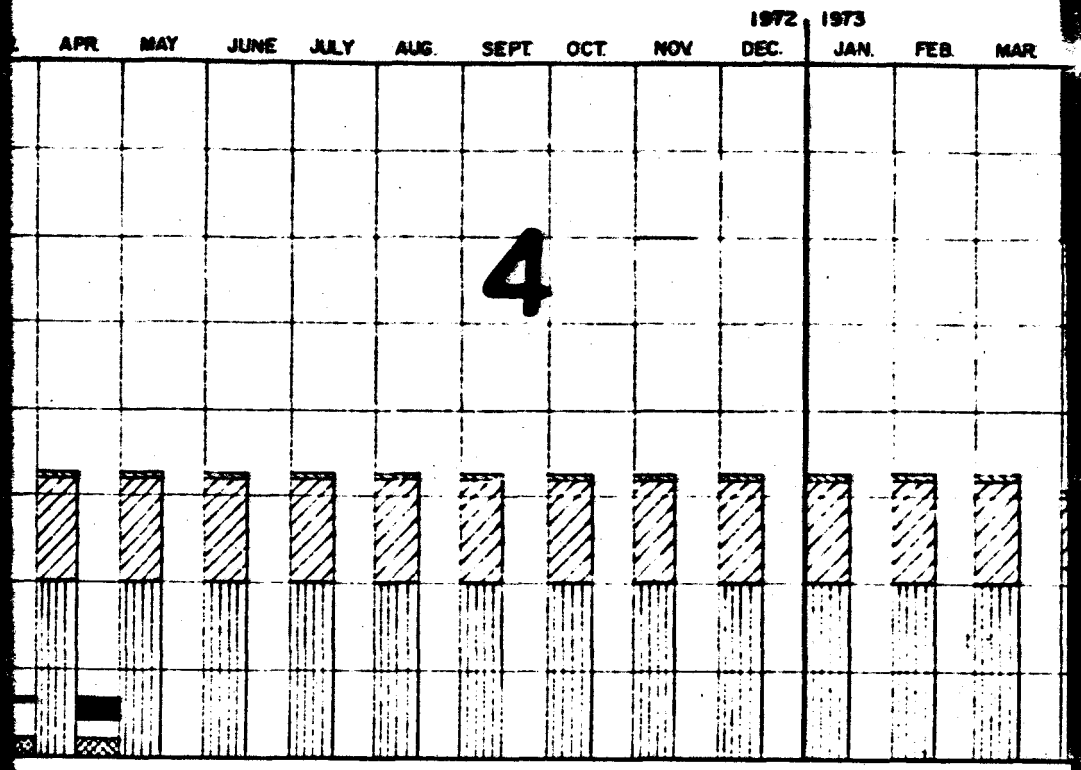


21,145	18,705	15,955	14,875	14,875	14,875	14,875	14,875	39,475	39,475	39,475	39,475	39,
22,198	12,508	15,831	16,923	24,919	97,703	30,575	18,172	36,224	15,804	15,700	24,300	12,7

APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	AP
344,380	363,048	379,000	393,875	408,750	423,625	438,500	453,375	492,850	532,325	571,800	611,275	650
407,698	420,206	436,037	452,960	477,879	575,582	606,157	624,329	660,553	676,157	691,857	715,857	728,

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VISION & LAB WORK)



	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475
	12,700											

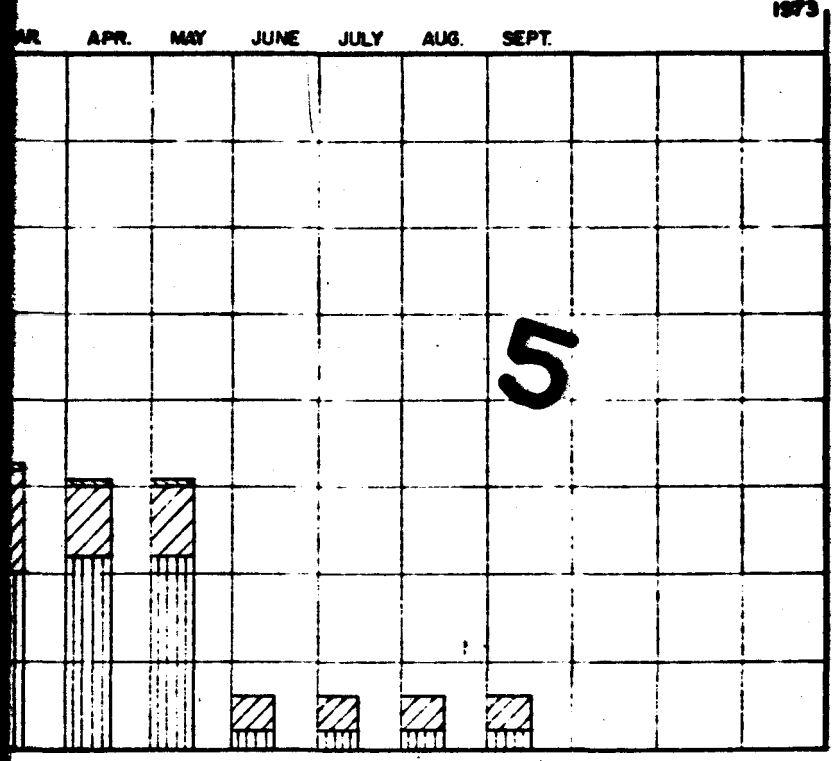
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	690,750	690,225	729,700	769,175	808,650	848,125	887,600	927,075	966,550	1,006,025	1,045,500	1,084,975
	728,537											

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,473	36,075	36,075	11,475	11,475	11,475	41,120			

AR.	APR.	MAY	JUNE	JULY	AUG.	SEPT			
9,979	1,121,050	1,157,125	1,168,600	1,180,075	1,191,550	1,232,670			

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TECHNICIAN		④③

④ Includes Supervisory Exempt Technicians.
③ Includes Clerical.

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MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT No. 14-01-0001-415 (3)

CCDC-MPR--96

PROGRESS REPORT NO. 96
OCR CONTRACT NO. 14-01-0001-415(3)
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

May 1 to 31, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation(1)

Improvements were made in the purge gas system so that (1) recycled process gas, (2) inert gas from the generator, and (3) nitrogen systems were all in good operating condition. The costly liquid nitrogen will be required only when total inert gas requirement exceeds 16,000 SCFH.

Several tests of the char grinding system were performed. The desired particle size distribution was very nearly approached but not quite reached.

A second attempt at maintaining dolomite circulation was started late in the month, but the run was lost due to failure of the instrument air system. Some plugging of lines did occur.

It is obvious that some improvements in the pressure measurement and control systems need to be made before extended successful operations.

Preliminary presentation was made of a pretreatment and methanation scheme based on the packed tube reactor concept. A report will be issued in June.

A new plant manager, Mr. R. Checksfield, began to serve on May 22, 1972.

Financial

Estimated monthly expenditures are $28,000 by Consol and $425,500 by Stearns. Cumulative expense to date is $15,102,847.

(1) The attached Stearns progress report was prepared prior to June 9, the date of the Rapid City flood. As pointed out at the subsequent AGA meeting (Denver, June 14), a pilot plant shutdown of at least four weeks' duration is now planned for extensive inspection and repair of the plant as necessary.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536)

The final construction report is being reviewed prior to submission to OCR.

4. Stearns-Roger Construction Subcontract (Project No. 700)

Settlement with remaining vendors is nearing completion. Construction costs as of May 31 totalled $9,296,700.

5. Library Assistance on Pilot Plant Operations (Project No. 537)

A review was made of bids received by the Metals Council for conducting a coal gasification metallurgical testing program. At a meeting of the Council in New York, a recommendation was made and a single contractor was chosen for further negotiations. Consol requested and was granted an extension of the metal test program to include regenerator conditions as well as the original program for gasifier conditions.

Two progress review meetings were held during the month at Rapid City. At one meeting the process design of a proposed methanator was reviewed. The final report by Conoco is to be issued in the latter part of June.

Work was done in attempting to design and price an exhibit to be used by the Department of Interior.

6. Consol Guidance on Operations (Project No. 702)

The progress report is attached. The major effort was on establishing test runs for the three-component purge gas systems. This work was successfully completed.

Tests of the char grinding system were completed.

7. Stearns-Roger Operating Subcontract (Project No. 701)

a. The progress report is attached.

b. Program

The primary achievement was putting into operation the three-component inert gas system. Char grinding runs very nearly established particle size within specifications.

A further dolomite circulation run was successful until loss of the inert gas.

8. School of Mines Subcontract (Project No. 703)

The May progress report is attached.

C. Subject Inventions

None.

D. Financial Status

Expense	Actual	Budget
Cumulative through April, 1972		
Through June, 1969	$ 1,878,256	$ 1,878,256
Consol	728,301	650,750
Stearns	12,042,500	11,145,400
	$ 14,649,347	$ 13,674,406
Expended in Period (estimate)		
Consol	28,000[1]	39,475
Stearns	425,500	204,700
Total - May, 1972	453,500	244,175
Cumulative through May, 1972	$ 15,102,847	$ 13,918,581

[1] Includes two months' charges from South Dakota School of Mines

6/21/72
Att. - Monthly Progress Reports on Projects 701, 702, 703
Progress Charts

CONSOLIDATION COAL COMPANY
RESEARCH DIVISION
LIBRARY, PENNSYLVANIA 15129

INTER-OFFICE CORRESPONDENCE

To : Dr. John D. Sudbury Date : June 15, 1972

From : Carl E. Fink and Uwe D. Marwig At (Office): Rapid City, SD

Subject: Monthly Report No. 21 - Project 702

The emphasis of operations during the month of May was testing and tuning the inert gas and purge gas systems. At month's end, the use of dried recycled process gas as purge gas was established. The inert gas system was thoroughly tuned and will automatically substitute for recycled process gas should the purge system fail. The costly liquid N_2 system will be used only if high pressure inert gas consumption exceeds 16,000 SCFH. Completion of this test should virtually eliminate consumption of liquid N_2.

During completion of turnaround maintenance items, the flow of air through the regenerator could not be maintained. As a result, the air inlet line to the regenerator plugged eliminating the possibility of starting up without draining the regenerator bed inventory. The bed was drained and heat up was begun in preparation for dolomite addition and circulation. A revised procedure covering hot gas circulation, calcination of $MgCO_3$, and hot solids circulation was issued to Stearns-Roger.

Concurrent testing of the char grinding and preheater systems was also carried out. The optimum conditions for grinding char have not yet been determined. Some operating problems, notably a high pressure drop across the bag house, have hampered testing. The preheater furnace operation was carefully studied and a start up technique developed to heat-up the preheater to a temperature where tempering steam could be added without using excess air, and keeping the gases from the furnace below 600° F.

The refractory of the gasifier and regenerator were observed using a television camera. Several large cracks were observed in the gasifier walls, but, thusfar, there has been no spalling. Observation of the regenerator refractory was inconclusive because the camera could not be adequately focused.

C. E. Fink

U. D. Marwig

CEF-UDM:lmp

Att. - Stearns-Roger Operations Report No. 27

CONSOLIDATION COAL COMPANY PROJECT

CSG PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #27

CCC Project No. 701
S-H Job No. B-37400
June 6, 1972

SUMMARY OF PLANT TESTS

During our first attempt at gasification, we used exclusively liquid nitrogen to supply all of our inert gas. The cost via this route proved to be prohibitive. The decision was made, that before another attempt at gasification, repairs would be completed to the inert gas system and purge gas systems to place them in operable condition.

The first test was designed to check the operability of the inert gas generator, high pressure inert gas compressor, Nash compressor, inert gas dryers and all controls associated with these units. This testing required several days before all adjustments had been accomplished.

The second test was to confirm the operability of the inert gas system combined with the CO_2 purge system. We have two gas storage units which are connected physically, but can be separated by control valves. This system was proven to operate satisfactory for this run.

A third test was designed to prove the reliability of three separate purge gas systems -- A, B and C. These systems are a recycle of the gas that will be produced in gasification. The purpose is to provide a continuous purge to the system instrumentation and prevent solids from plugging sensing lines. Therefore, these gases must be dry and dust free. After about a week's work, these systems were in excellent condition.

Another series of tests were performed in the char grinding and preheating area. Several modes of operation were tried to arrive at a desired particle size distribution. A distribution, somewhat less than optimum, was obtained early in June. Further testing will be tried and if repeatability is possible, the preheater vessel will be filled in preparation for char addition to the reactor system.

MONTHLY ACCOMPLISHMENTS-OPERATIONS AND TECHNICAL

The shutdown taken the last week of April continued into May. The gasification reactor was inspected during the shutdown with the TV camera and found to be in acceptable shape. Partially calcined dolomite was left in the regenerator. After the shutdown work was completed, we tested our ability to clear the air line to the regenerator after gas flow had been stopped. We were unable to do so; therefore, were also unable to lift the dolomite bed in the regenerator with cold gas flow. On May 11, the elbow on the line to the engager pot was removed. We were able to empty the regenerator after disrupting a bridge of dolomite in the line under the regenerator. A material balance of dolomite fed to the reactor system versus the dolomite removed indicated a greater loss than expected. Therefore, the regeneration reactor was opened and inspected. Very little dolomite was found in the regenerator. Apparently, more dolomite ended up as dust in the quench and blowdown systems than had been previously estimated.

During the month, comprehensive testing of the inert gas generator/liquid nitrogen system controls was made. The controls between the CO_2 system receiver and the inert gas system receiver were also tested. The CO_2 system is to be operated on inert gas/nitrogen while not operating the hot potassium carbonate CO_2 removal system. The "A" gas purge (regenerator recycle gas), the "B" gas purge (gasifier recycle gas), and the "C" gas purge (inert gas/nitrogen) systems were checked out and activated. This reduced the liquid nitrogen usage substantially. Each time a shutdown of the reactor system occurred, the purge gas systems were again checked prior to start-up.

Along with activating the "A", "B", and "C" purge gas driers to conserve nitrogen, a study of inert gas/nitrogen consumers versus producers was made. Major losses have been identified and are being corrected. Leaking relief valves between stages of the CO_2 compressor and a leaking pressure controller were found to be the sources of major loss.

Late in the month, a high pressure drop in the gasifier overhead system resulted in shutting down to clear a blockage at the inlet to the gasifier quench tower. Other blockages such as those in the ash lockhopper lines and others caused by dolomite dust plug moisture during startup were also cleared. The reaction system was cleared and started back up by May 28th. Circulation was reestablished, the system heated up, and five batches of dolomite added to the gasifier, partially calcined and transferred to the regenerator by May 31st.

An instrument air failure on June 1 caused the slumping of the beds in the regenerator and gasifier, plugging the following lines:

a. Lift line from the engager pot to the regenerator.
b. Spent dolomite line from the gasifier to the engager pot.
c. Gasifier recycle and char line to the side inlet of the gasifier.
d. The purged dolomite line from the gasifier to the purged dolomite lockhopper.
e. The line from the gasifier to the gasifier emergency dump hopper.

The reaction system was cooled to 800°F to minimize condensation, depressured, and cleared of dolomite pluggages. Revised procedures have been established to help overcome problems with dust and moisture during startups.

Previous operation of the SO_2 scrubber resulted in excessive water carry-over. Tests showed that the tower is liquid load sensitive and floods with too much water recirculation. Satisfactory operation has been achieved with reduced water circulation.

Several char grinding runs were made during the month under differing operating conditions. The proper particle size has yet to be produced consistently. Some of the variables tested were:

a. Tieing back the remaining mill journals. This produced too coarse a product. Subsequent testing has been done with the journals untied.
b. Operating the roller mill intermittently. This definitely has possibilities and timers have been installed. Obtaining a representative product sample is a problem.
c. Recirculation gas flow split between the mill and the baghouse. Excessive baghouse pressure differentials are causing problems when too much gas is routed to the baghouse.

Further char grinding is to be tried in early June.

Problems with high pressure differentials across the baghouse have limited grinding runs. The bags have been removed and cleaned several times. During one run, a blow ring hose came loose resulting in high differentials since the normal bag cleaning operation could not function. Excessive fines from the char may be a cause of high differentials.

During a char grinding run on May 14, ground char was fed to the preheater for about one hour. Flange failure of the preheater furnace terminated this test. The preheater was subsequently emptied and visually inspected in order to allow for further testing of the preheater furnace.

Testing of the preheater furnace was carried out during the month and is continuing. Problems were encountered with the ignitor and the combustion detection element (purple peeper). Realignment of the purple peeper has allowed a "pilot only" operation for heating the preheater prior to steam addition for fluidization of the char bed in the preheater.

Because of operating difficulties with the dolomite crushing equipment, one carload of #7 sized dolomite was purchased. It was unloaded in the raw dolomite silo and most of it screened to the sized dolomite bin. The oversized particles were saved for possible future grinding.

The emergency generator and fire water pump were tested in May under "no load" conditions. The generator was also tested satisfactorily under 25% load conditions. After final testing, the units will be put on automatic standby basis.

Four Technical Engineers were on shift most of the month recording data required for the various runs, and, between times, making special studies and designing changes for the many problems that arose. Two engineers from the Denver office devoted themselves to studies of more complex problems, and also went on shift during crucial periods.

The water treatment program initiated in mid-April under the direction of Mr. Keith Long has resulted in dramatic improvement of conditions in the mine different water systems. The operation has been reduced to near-routine.

Chemists remained on shift during the month performing analyses in support of plant operations.

One Chief Operator resigned during May. This and the previous vacancy have been filled by promoting controlmen. However, because of training requirements, the controlmen positions have not been filled. Partial coverage of the shifts shy of a controlman is being accomplished by using the two remaining controlmen until others can be trained.

Mr. G. D. Funk reported as Shift Engineer on May 1, 1972. An offer has been extended to an engineer to fill the vacancy left by the resignation of a Technical Engineer last month.

SAFETY

Last month, a Rescue and Fire Brigade was organized on each shift. This training has been continued this month.

Several of our personnel had not been trained in the use of air breathing equipment. Ten persons were instructed in the use of air masks and pneulator resuscitation equipment during May.

Considerable dust was released during our shutdowns. A safe work procedure was set up this month and is as follows:

1. Always wear an aspex surgical mask.
2. Cover exposed flesh with Barrier Creme.
3. Wear coveralls.

MONTHLY ACCOMPLISHMENTS-MAINTENANCE

Maintenance work orders more than doubled in May compared with those completed in April. About 50 of the work orders were the result of several shutdowns during May. Ninety work orders marked "urgent", meaning that they are necessary the day issued, were also completed. These two groups of work orders were nearly 50% of the maintenance work for the month. Manpower was not increased, therefore, considerable overtime was necessary to complete the work during shutdowns and to keep the plant in operation.

In addition to the above work orders, about fifteen major items requiring engineering were also completed. Fourteen items of equipment were checked as scheduled for 90 day preventative maintenance. The quarterly check of rigging and hoisting equipment was made during the month.

PLANS FOR JUNE

Again our objective was not obtained in May because of several unscheduled, short shutdowns and to extended checkout of the inert gas systems. However, everything appears to be "go" for a Gasification Run in June.

This will be accomplished by a successful conclusion of the following steps:

1. Start up and reestablish calcined dolomite circulation.
2. Finalize char grinding and then proceed to build level of ground char in the preheater to satisfy the system prior to Step 3.
3. Transfer char from the preheater to the lignite lockhoppers. Flow char into gasifier and establish char level. Convey char into the regenerator preparatory to calcining the $CaCO_3$ portion of dolomite to CaO. When the $CaCO_3$ calcining is complete, leave system ready for Step 4.
4. Admit steam to the gasifier. This operation will start the gasification reaction of char to carbon monoxide, hydrogen and some methane. Line system out and prove operability of dual fluid beds, continuous calcination, solids transportation and gasification.

STAFFING

	CURRENT MANPOWER Effective 6-1-72	TO BE HIRED IN JUNE
Management	1	0
Accounting	5	0
Clerical	6	0
Janitorial	2	0
Safety	1	0
TECHNICAL DEPARTMENT		
Laboratory	6	0
Engineering	10	1
Scheduling & Planning	1	0
OPERATIONS		
Supervisors	2	0
Shift Engineers	4	0
Instrument Engineer	1	1
Operators	41	3
MAINTENANCE		
Supervisors	4	0
Crafts	26	0
Warehouse & Purchasing	4	0
TOTAL	114	

COSTS

Accumulated Operations Cost to Date May 31, 1972	$3,208,069.21
Purchase Orders Not Paid & Purchases Placed	107,559.64
Actually Spent - May 1972	422,934.14
Accumulated Cost Billed to Date	3,171,430.61

Very truly yours,

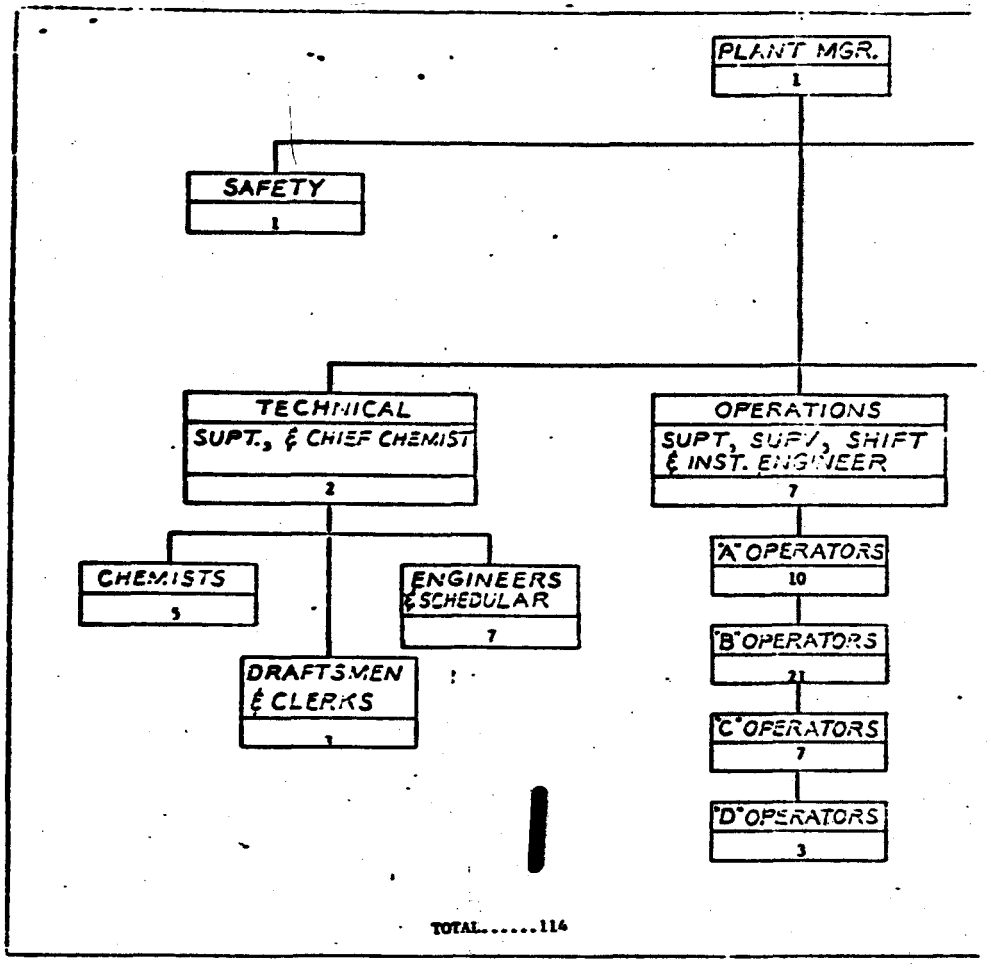
STEARNS-ROGER CORPORATION

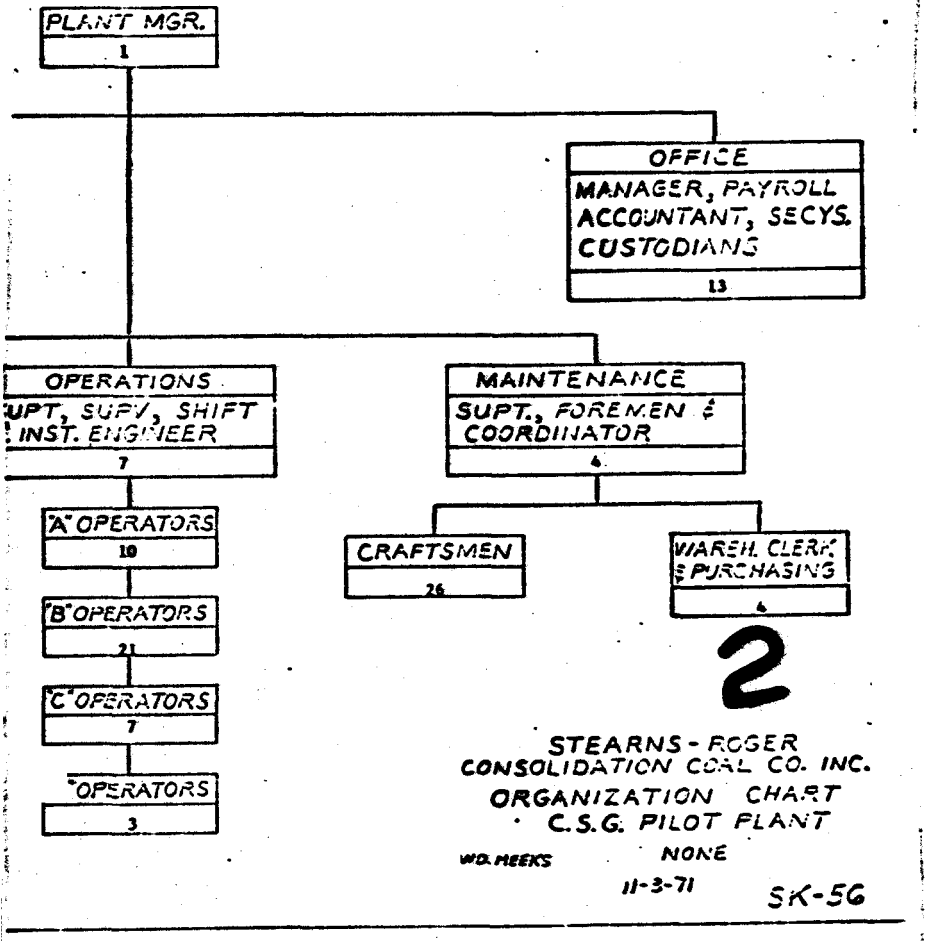
R. G. Checksfield

RGC:ska

cc: U. D. Marvig, C. E. Fink-Consol
J. A. Phinney-Library
Dr. J. D. Sudbury-Library
C. A. Schmiz-Library
C. M. Stone, D. H. Dawson, V. L. Brant-Denver
Dr. Roger Detman, C F Braun & Co.
Dr. D. L. Waller, C F Braun & Co.
HLL, MMV, DDD, WTB, COB, NRK, JGS, JDR, KUM, HAJ, EBM, EMF, MTH, GDF, PL, File

Attachments





MONTHS ENDED May 31

OSHA REPORT

MINE NAME	MINE NO.	NUMBER OF LOST TIME ACCIDENTS: NON-FATAL	FATAL	TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED
Research Division	100					
Rapid City	200	0	0	0	0	20200
Total Research						

31 19 72

DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUCED	FREQUENCY	SEVERITY	TONS PER LOST TIME ACCIDENTS	MAN COUNT
	20200	0	0	0	0	114

2

SUBCONTRACT BETWEEN CONSOL AND BERGBAU FOR CONSOL CO_2 ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR MAY, 1972

I. General

The study of the physical properties of the various carbonate rocks is being completed and much of the remaining contract period will be devoted to the final report. Results of carbonation of calcined calcium carbonate melts show an "activity" comparable to natural dolomite and superior abrasion resistance. Sodium removal by use of calcium-CO_2 solutions has been completed and different wash materials possibly available from a gasification plant will be tested next. Apparent satisfactory determinations of selenium have been completed via a colorimetric method. Monitoring of wastewater is operational but the vent stack monitoring is awaiting installation by the contractor.

II. Carbonate Resources (Mickelson)

Studies of the engineering properties of the Tymochtee dolomite have been completed including compressive and tension tests. It proved to be a very strong rock. Samples of the Minnekahta will be collected and tested for comparative purposes.

Studies of the Pennsylvania thin sections are continuing. A number of completed sections are now at hand. The Box Elder Canyon section is out to be thin sectioned. This completes the suite. The remainder of the contract period will be devoted to the preparation of the report. This will be completed by July 31, 1972.

Berman, Schneider, and Mickelson will devote full time on the project during June and July.

Pahasapa dolomite with very similar Ca/Mg ratios to the Tymochtee can be found in Sec. 10, T. 1 N., R. 6 E., Black Hills Meridian.

III. Acceptor Reconstitution (Fuerstenau)

Mechanical properties and activities of various melts were examined. Abrasion resistance was measured as outlined in the last report. Acceptor activity was determined by calcining a given sample of melt for two hours at 2400° F. Following this step, a portion of the calcine was placed in an acid solution to ensure that calcination was complete. Recarbonation was effected in a tube furnace operating at 1500° F by passing CO_2 over the sample for 15 minutes. Expressing acceptor activity in the following mole ratio:

$$\text{activity} = \frac{CaCO_3}{CaCO_3 + CaO}$$

the following activities using the described carbonation procedure were obtained for the following $Ca(OH)_2$-$CaCO_3$ melts:

Material	Initial Weight (gm)	Wt.-100 mesh Produced (gm)	Activity
Natural Dolomite (Pahasapa)	50	13.1	0.27
20 mole% $CaCO_3$	50	4.1	0.14
30 mole% $CaCO_3$	50	6.5	0.09
40 mole% $CaCO_3$	50	3.6	0.16
50 mole% $CaCO_3$	50	3.2	0.23
97 mole% $CaCO_3$	50	5.9	0.35
36 mole% $CaCO_3$ 10 mole% MgO	50	3.9	0.16

These results show that the higher calcium carbonate base melts exhibit acceptor activities similar to that of natural dolomite.

Work in June will entail examining the properties of MgO-$Ca(OH)_2$-$CaCO_3$ melts.

IV. Noxious Elements (Lingard)

Results of preliminary testing of the Firesteel sample of lignite for selenium indicate a selenium concentration of a few parts per million in this sample. The determination was made by a colorimetric method after digestion of the lignite with a mixture of nitric and perchloric acids.

This work will be continued along with attempts to determine some trace elements by x-ray fluorescence following their concentration by ion-exchange or by chelation and extraction.

V. Lignite Beneficiation (Clarkson)

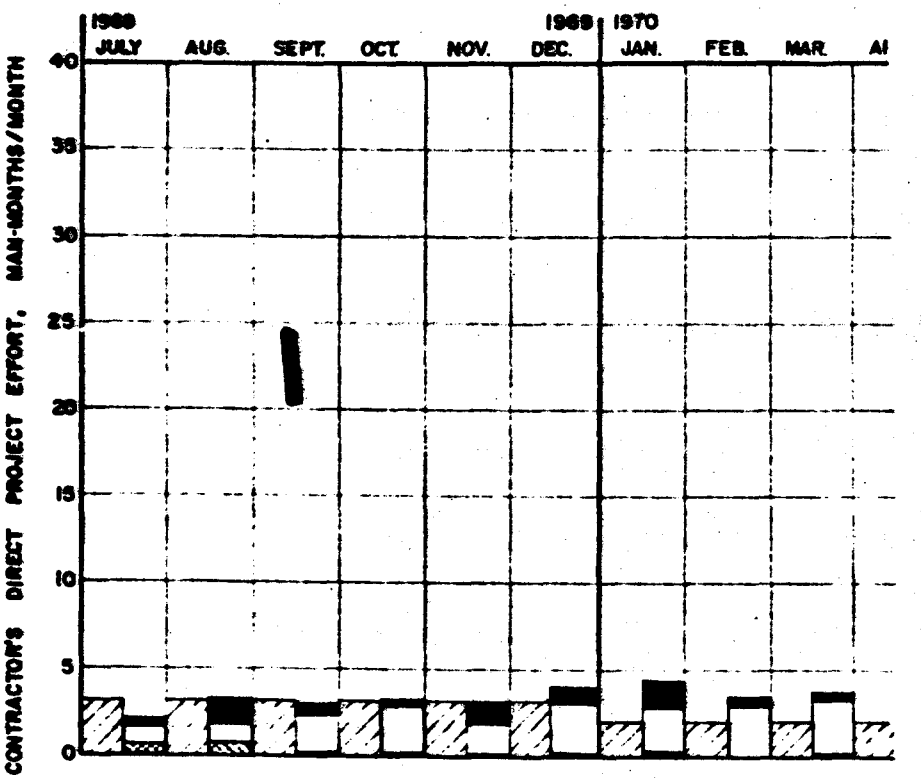
The sodium removal from lignite using calcium solutions prepared by bubbling CO_2 through water in the presence of $CaCO_3$ has been completed. However, several repeat runs were made in May to check some previous data points.

The experimental arrangement has been expanded so that more runs can now be made. We are planning to change our procedure and use different wash solutions which can be prepared from raw materials used or produced at the gasification plant.

VI. Waste Monitoring (Oliver)

Wastewater monitoring instruments and recorder have been installed in the instrument shed by the wastewater pond. pH and dissolved oxygen content of the wastewater are being continuously monitored and recorded. Vent stack gas monitoring is still being held up pending installation of a.c. power cables to the vent stack adaptor and a conduit to convey

a signal cable from the vent stack adaptor to the station in the stairwell at the ninth-floor level. The work request to Stearns Roger for this work is still pending.



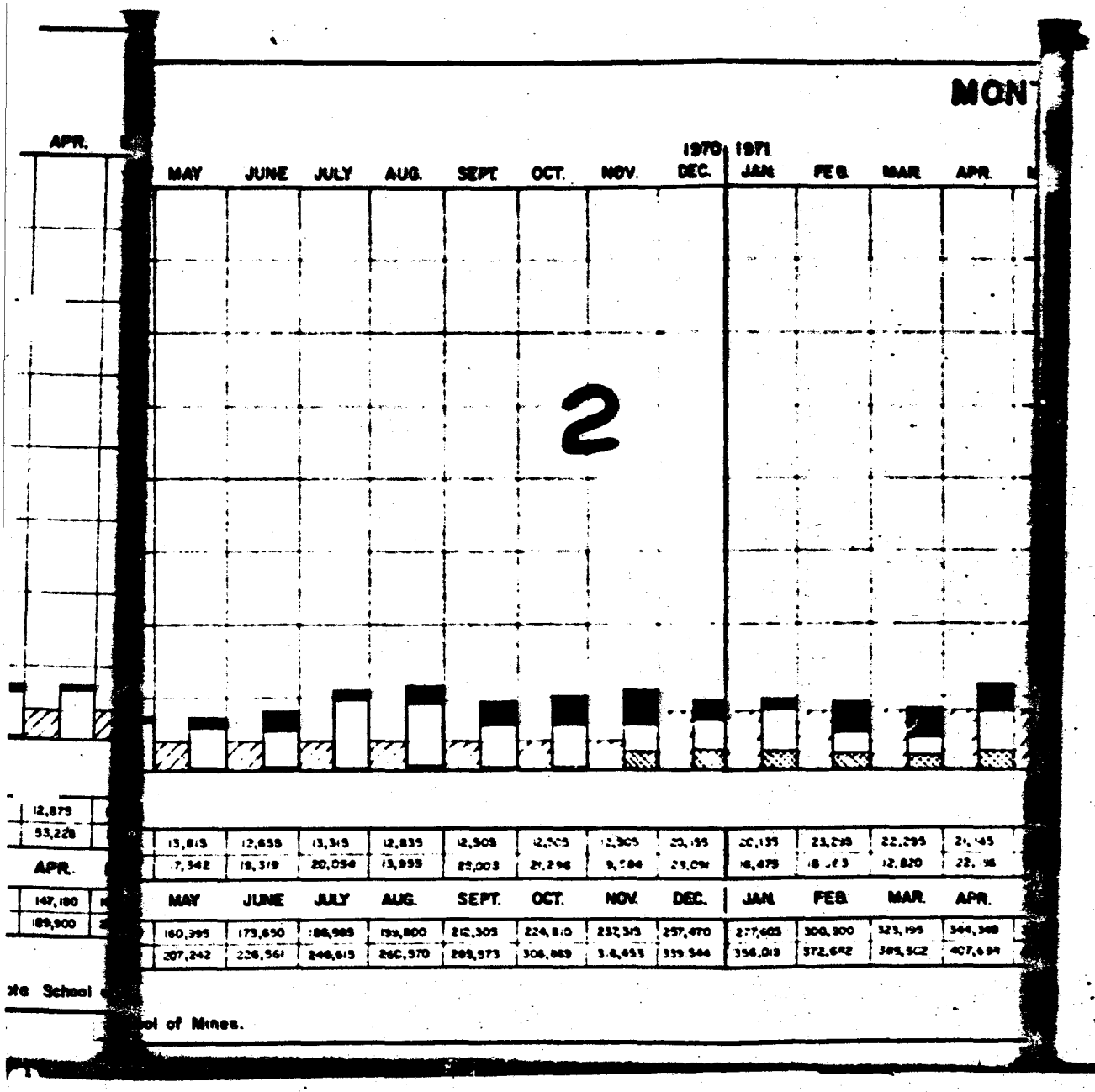
MONTHLY EXPENDITURES*

PREDICTED	16,215	14,685	14,965	13,155	14,385	17,065	15,595	15,595	12,655	12,8
ACTUAL	11,745	34,734	9,609	11,825	10,130	15,205	14,378	14,027	15,019	53,1

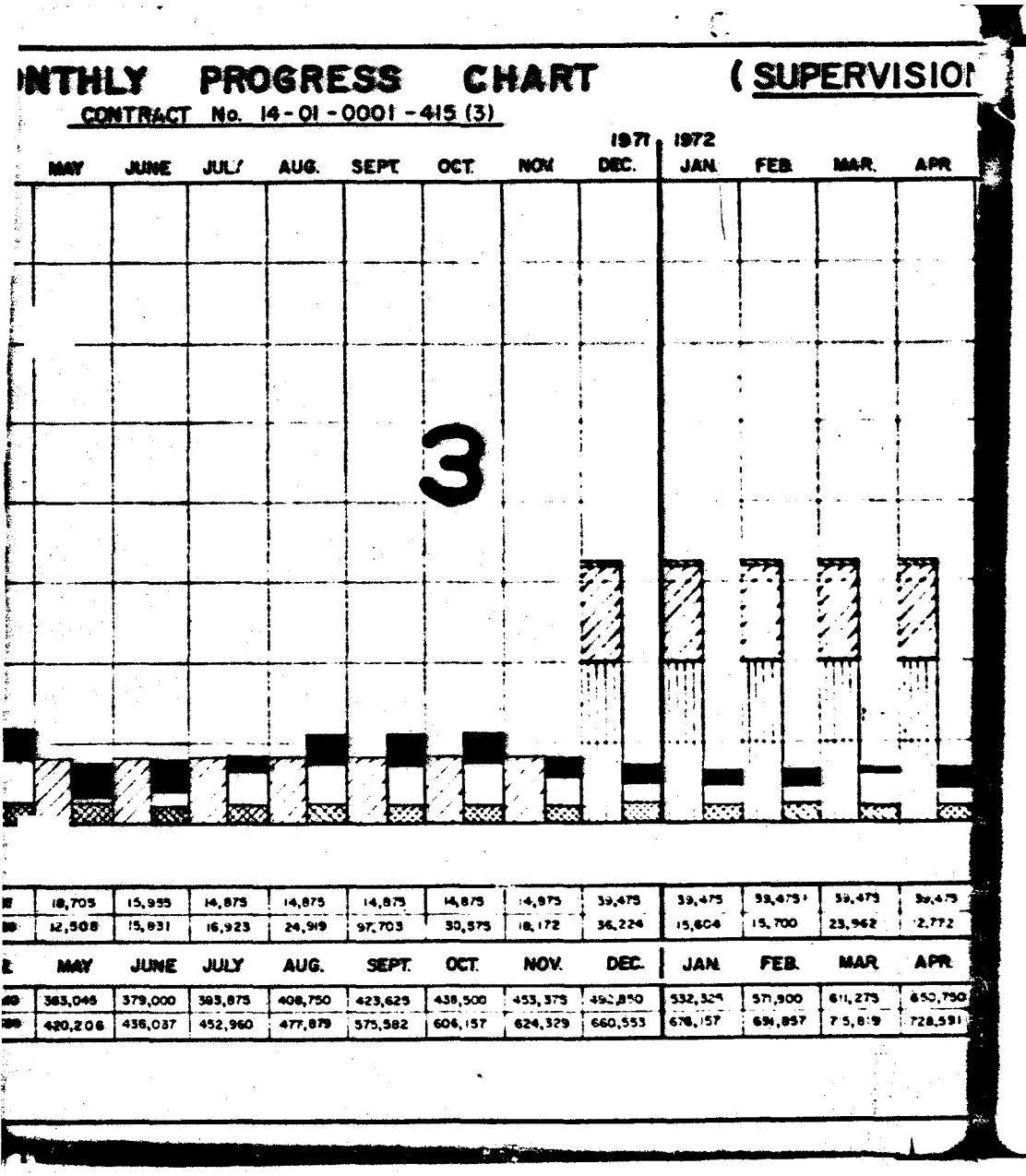
	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	AP
PREDICTED	16,215	30,900	45,865	59,020	73,405	90,470	108,065	121,650	134,305	147,
ACTUAL	11,745	46,479	56,088	67,913	78,043	93,249	107,628	121,653	136,672	89,8

CUMULATIVE EXPENDITURES*

*Expenditures Include All Costs & Fees By Consol And S. Dakota St


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12,879
55,228
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147,180
189,900
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160,395
173,650
186,989
194,800
212,305
224,810
237,315
257,470
277,605
300,900
323,195
344,348
207,242
228,561
246,615
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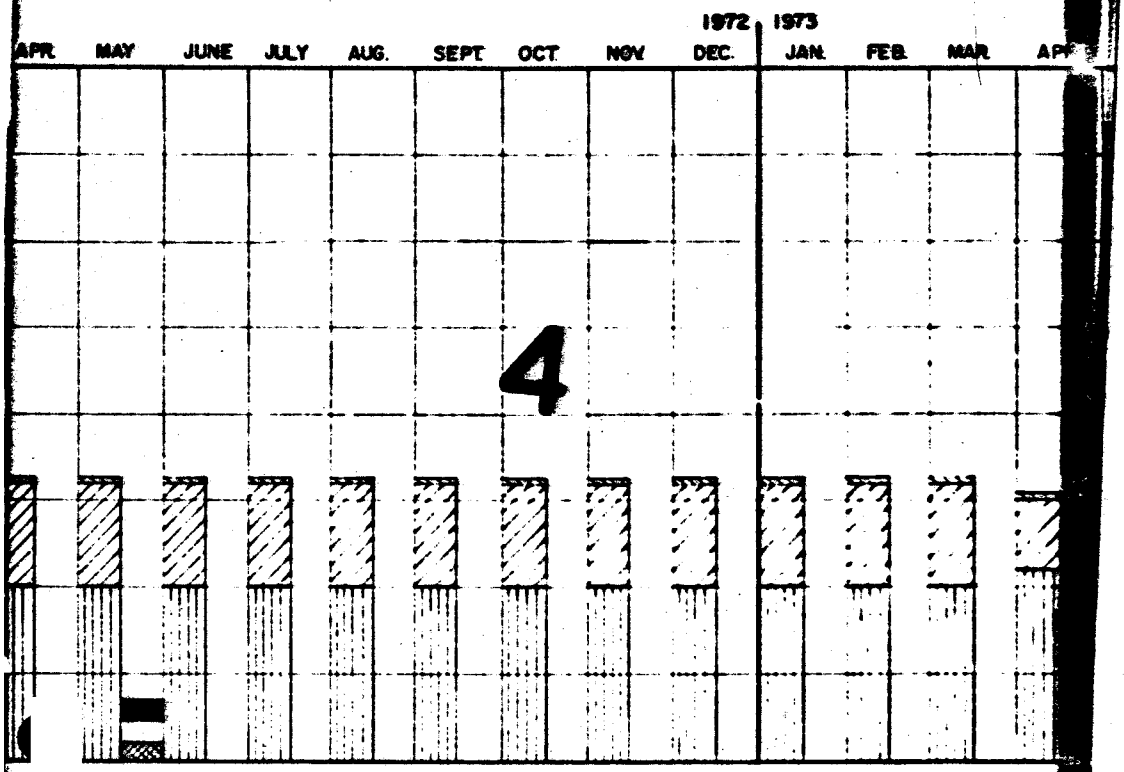


	18,705	15,955	14,875	14,875	14,875	14,875	14,875	39,475	39,475	39,475	39,475	39,475
	12,508	15,831	16,923	24,919	97,703	30,575	18,172	36,224	15,604	15,700	23,962	12,772

	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
	383,046	379,000	393,875	408,750	423,625	438,500	453,375	492,850	532,325	571,900	611,275	650,750
	420,206	436,037	452,960	477,879	575,582	606,157	624,329	660,553	676,157	691,857	715,819	728,591

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SION & LAB WORK)

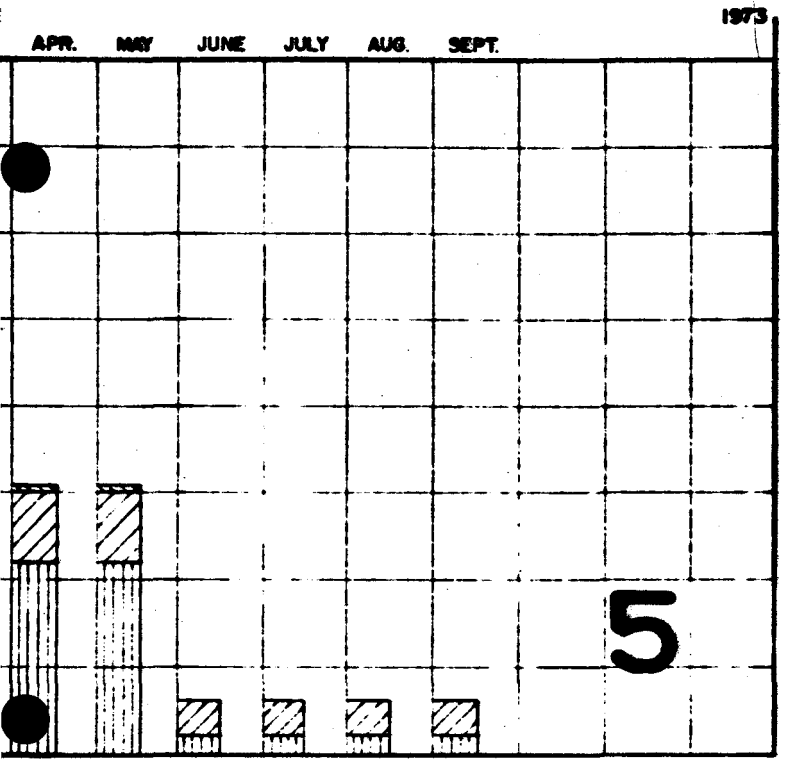


39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	34
2,772	28,000											

APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	AP
680,750	690,225	729,700	769,175	808,650	848,125	887,600	927,075	966,550	1,006,025	1,045,500	1,084,975	1,12
728,591	756,591											

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DATE: May 1974



36,075	36,075	11,475	11,475	11,475	41,120			

APR.	MAY	JUNE	JULY	AUG.	SEPT.			
1,121,050	1,157,125	1,168,600	1,180,075	1,191,550	1,232,670			

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TECHNICIAN

(3) Includes Super

(5) (3) Includes Cleric

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⑤ Includes Clerical.

6

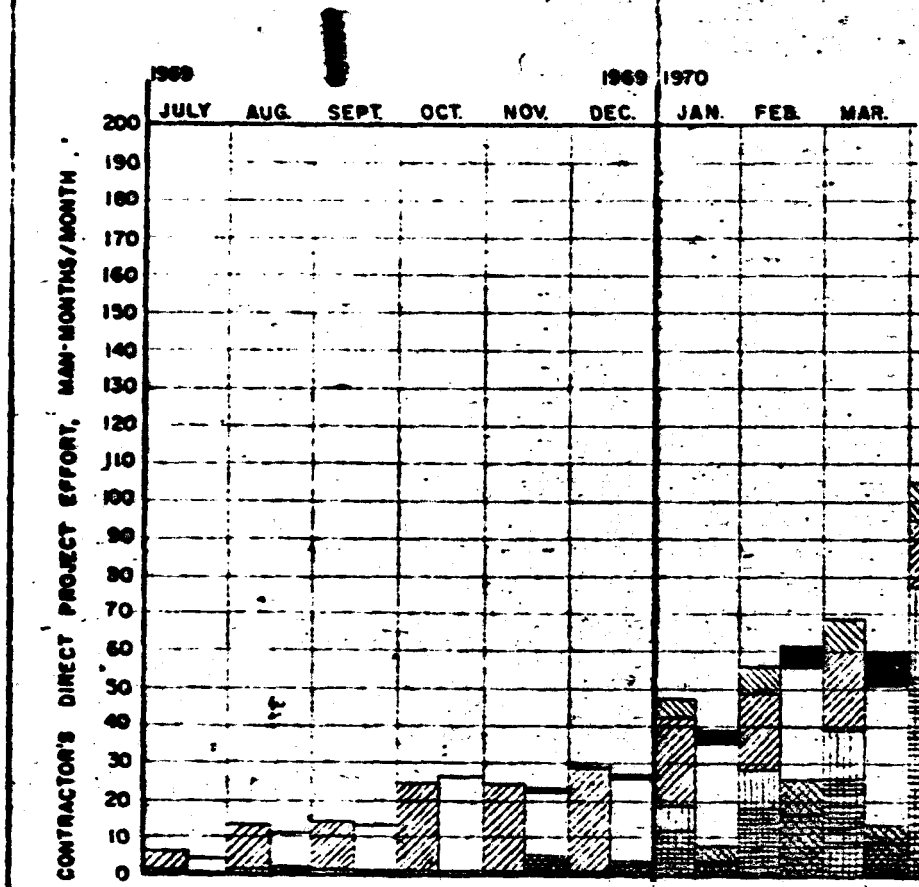
,120			
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MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT No. 14-01-0001-415 (3)

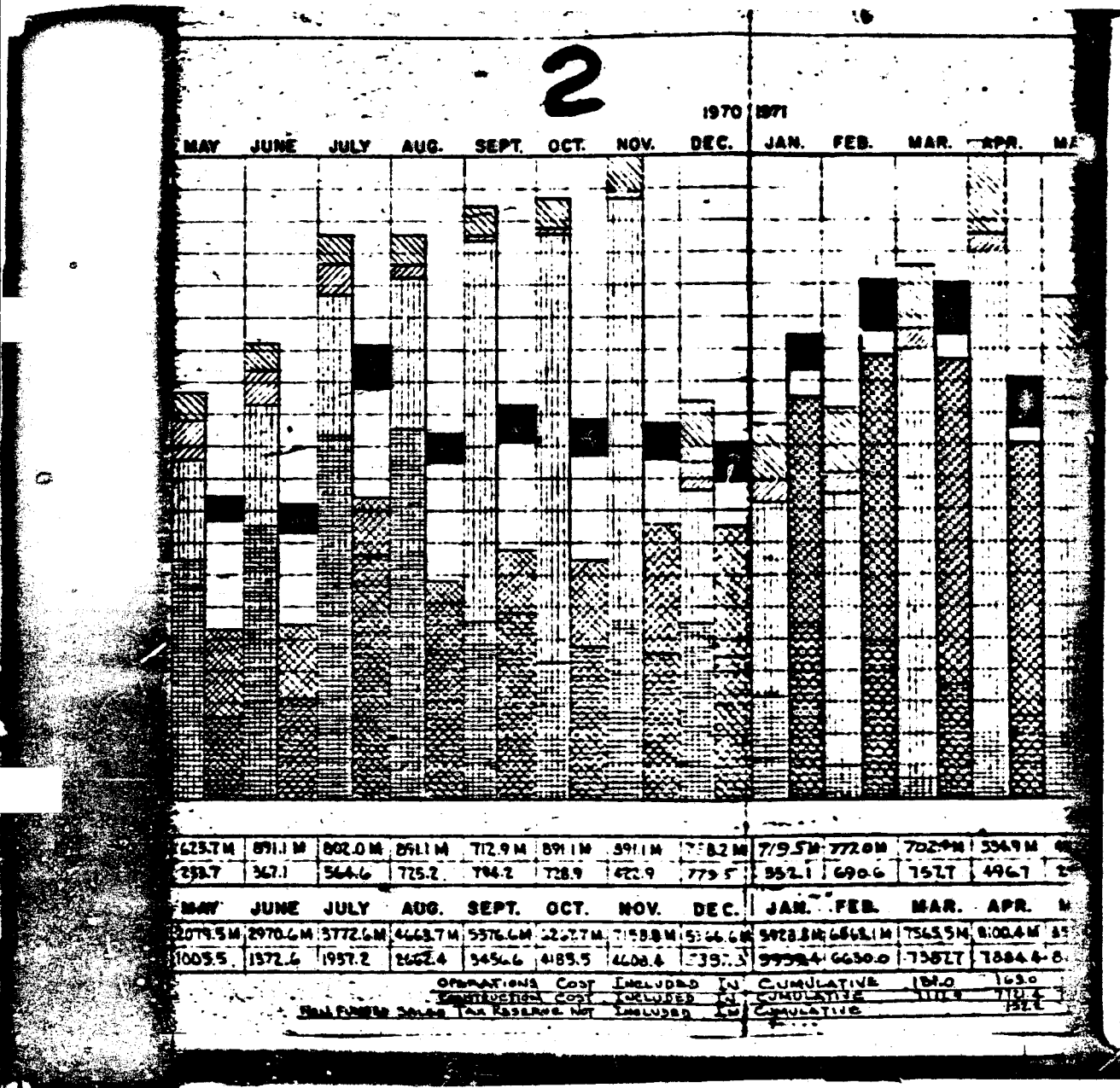


MONTHLY EXPENDITURES *

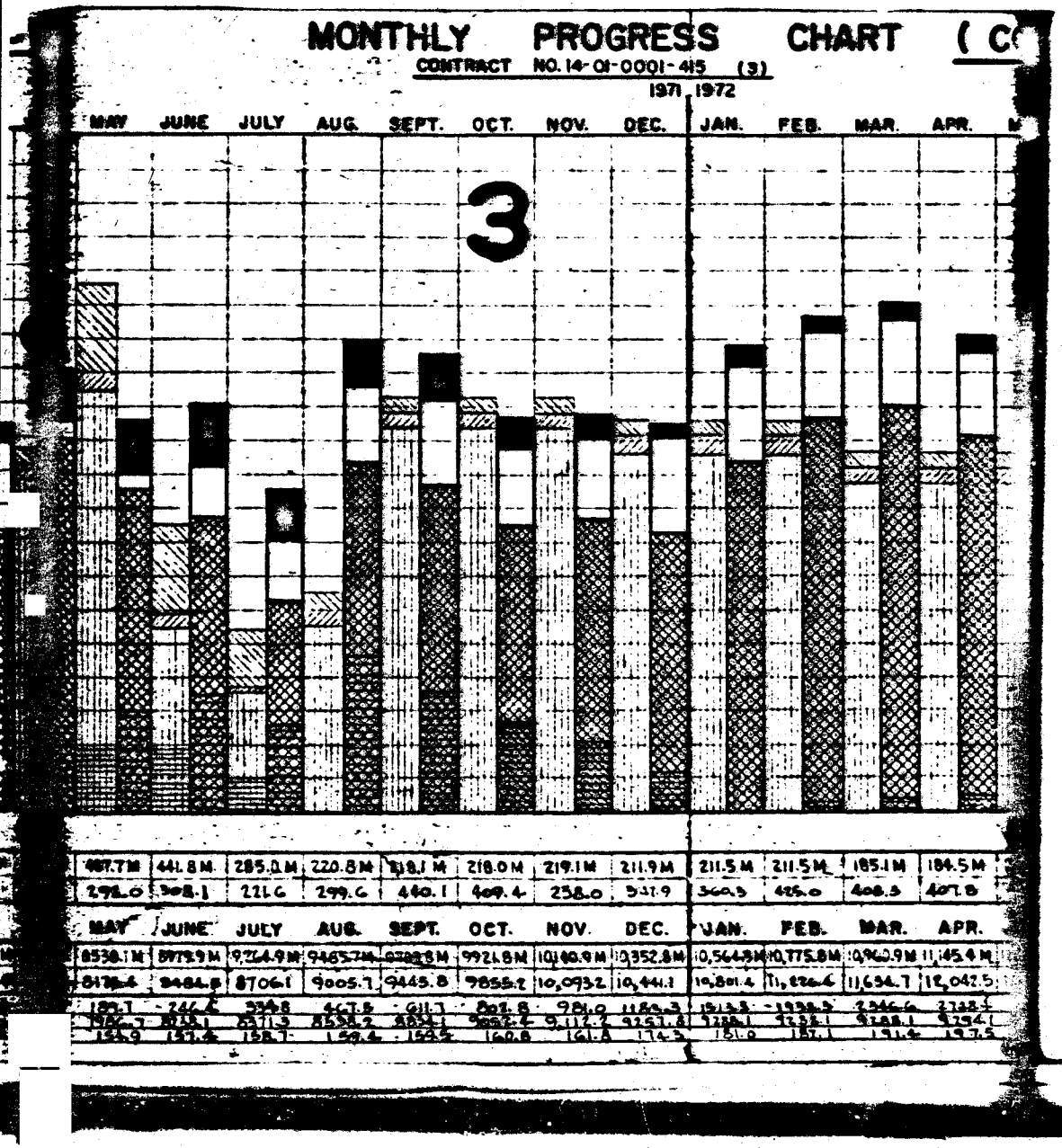
	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	
PREDICTED	0	50.0 M	41.0 M	50.0 M	98.0 M	106.9 M	112.0 M	273.0 M	299.5 M	4
ACTUAL	6.2	25.0	52.6	42.6	39.7	126.2	110.5	76.7	488.9	2

CUMULATIVE EXPENDITURES *

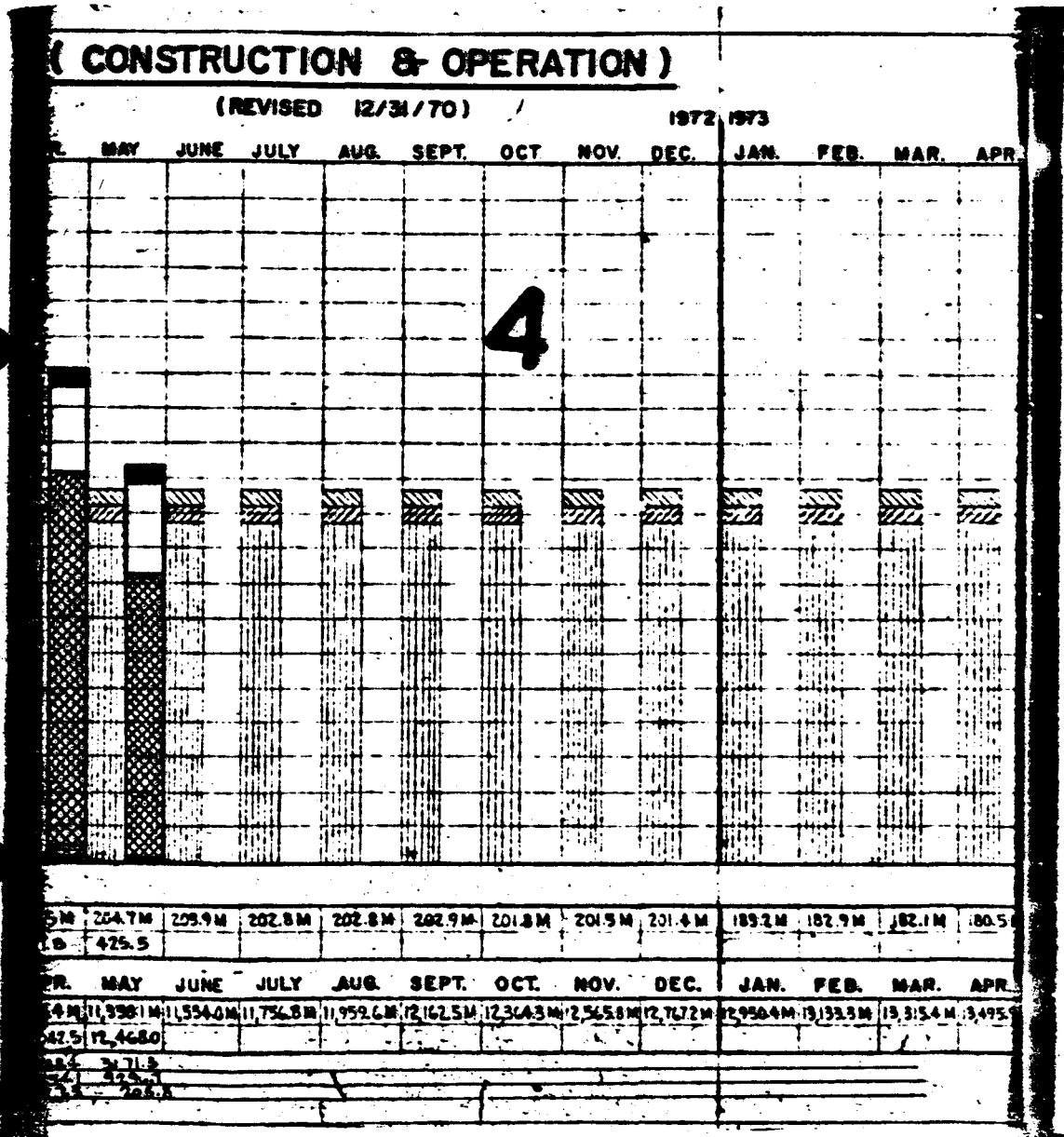
	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	
PREDICTED	0	50.0 M	71.0 M	121.0 M	219.0 M	325.9 M	437.9 M	710.9 M	1010.2 M	14
ACTUAL	6.2	31.2	84.0	106.6	146.3	272.5	383.0	459.7	562.6	9


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6648.1 M
7565.5 M
8100.4 M
1005.5
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1957.2
2682.4
3456.6
4189.5
4608.4
3997.4
6630.0
7387.7
7884.4
Operations Cost Included In Cumulative 180.0 163.0
Construction Cost Included In Cumulative 111.9 71.4
Real Property Sales Tax Reserve Not Included In Cumulative 132.2

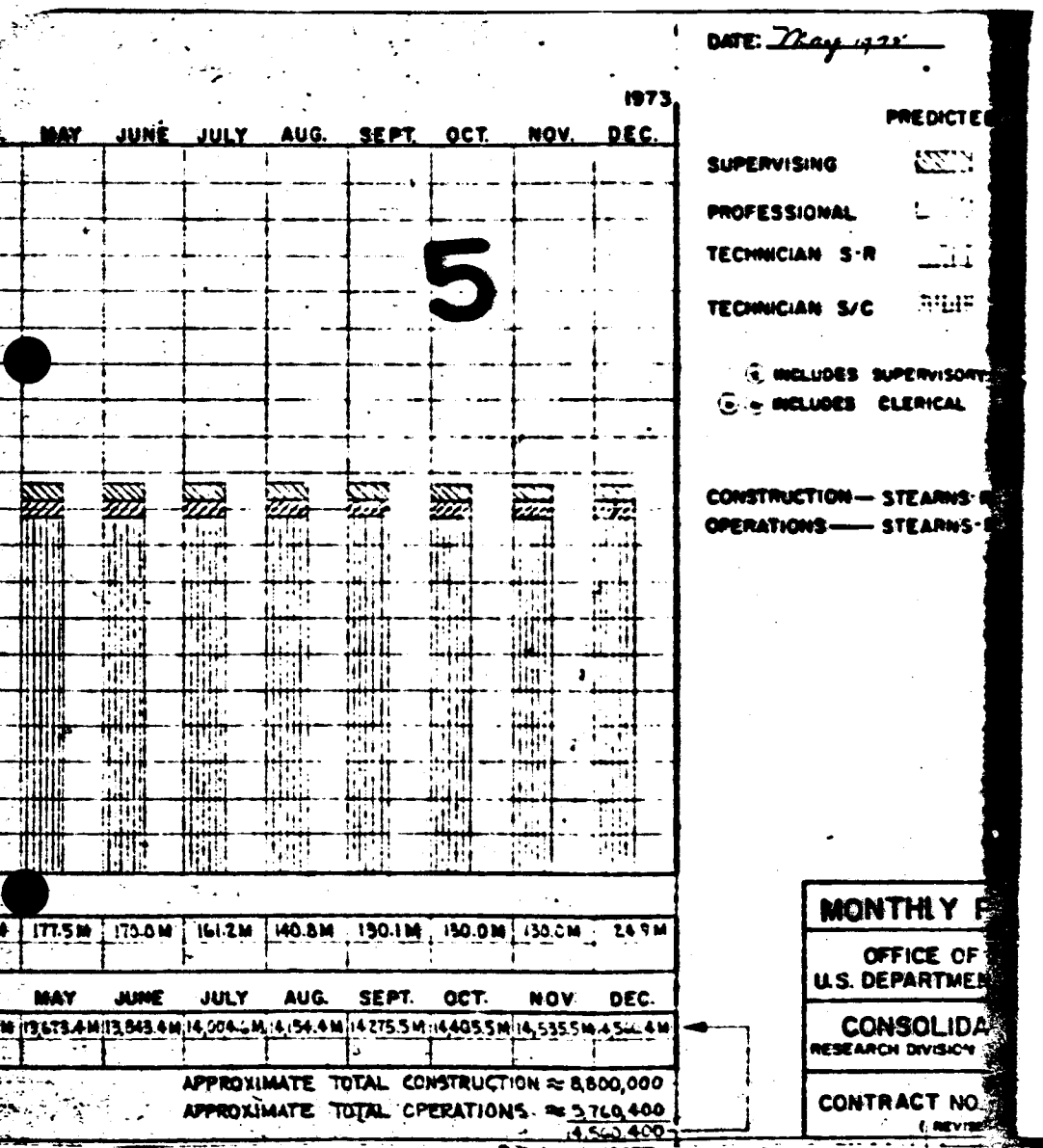
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MONTHLY PROGRESS CHART (C
CONTRACT NO. 14-01-0001-415 (3)
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3
487.7M 441.8M. 285.0M 220.8M 218.1M 218.0M 219.1M 211.9M 211.5M 211.5M 185.1M 184.5M
298.0 308.1 221.6 299.6 440.1 409.4 258.0 321.9 360.3 425.0 408.3 407.8
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8538.1M 8978.9M 9264.9M 9465.7M 9728.8M 9921.8M 10,060.9M 10,352.8M 10,564.8M 10,775.8M 10,960.9M 11,145.4M
8178.4 8484.5 8706.1 9005.7 9445.8 9855.2 10,093.2 10,441.1 10,801.4 11,226.4 11,634.7 12,042.5
195.1 246.2 334.8 467.5 611.7 802.8 981.0 1180.3 1513.5 1938.5 2346.6 2748.5
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8538.1 8733.3 8551.3 8554.2 8854.1 9092.4 9,112.2 9251.8 9288.1 9334.1 9288.1 9294.1
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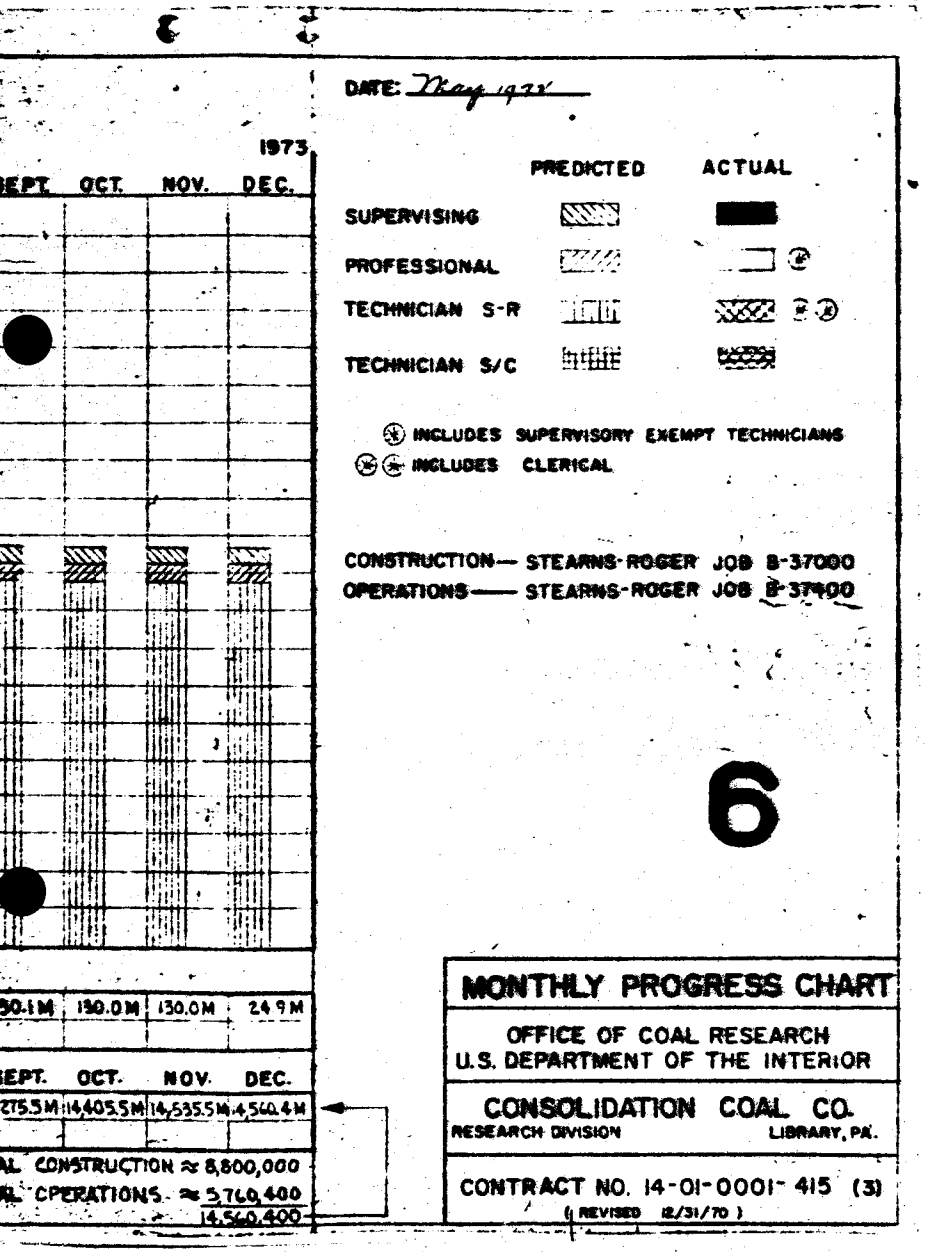
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(CONSTRUCTION & OPERATION)
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4
204.7M 209.9M 202.8M 202.8M 202.9M 201.8M 201.5M 201.4M 189.2M 182.9M 182.1M
425.5
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
11,938.1M 11,554.0M 11,756.8M 11,959.6M 12,162.5M 12,364.3M 12,565.8M 12,767.2M 12,950.4M 13,133.3M 13,315.4M
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DATE: May 1972
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OPERATIONS— STEARNS-
177.5M 170.0M 161.2M 140.8M 130.1M 130.0M 130.0M 24.9M
MAY JUNE JULY AUG. SEPT. OCT. NOV DEC.
13,673.4M 13,843.4M 14,004.5M 14,154.4M 14,275.5M 14,405.5M 14,535.5M 4,560.4M
APPROXIMATE TOTAL CONSTRUCTION ≈ 8,800,000
APPROXIMATE TOTAL OPERATIONS ≈ 5,760,400
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CONSOLIDA
RESEARCH DIVISION
CONTRACT NO.

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PROGRESS REPORT NO. 97
U.S. CONTRACT NO. 14-01-0001-415(4),
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT CCDC-MPR--9

June 1 to 30, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

The Rapid City flood on June 9 caused a loss of utilities to the plant. No damage due to flood waters was incurred in the plant. No lives were lost of Consol or Stearns employees; however, several homes of Stearns' employees were destroyed. Dr. Dieter of the South Dakota School of Mines, who worked on our subcontract, was lost in the flood.

The remainder of the month was spent in extensive inspection and maintenance repair items to the plant while utilities were out. This status was discussed in a meeting with OCR-AGA Advisory Committee in Denver, June 14, 1972. Of special significance were improvements in design of the pressure measuring and control system in the gasifier and regenerator. Plugging of these pressure taps with dolomite fines has been a serious problem in previous start-up attempts. The purge tubes housing the pressure taps were changed from 1/4 to 1/2". Bench-scale tests in Library showed significant improvement in ability to keep the 1/2" tubes swept clean by purge gas. In addition, a rodding system was designed to allow mechanical cleaning of severe plugs without shutdown of the system. Further, the vertical pressure probe assembly was rebuilt and installed in the gasifier. We now have duplicate pressure measuring capability at critical points. These changes should significantly enhance our chances for a successful gasification run in July.

The baghouse problems in the char preparation area were resolved. Successful char grinding runs were accomplished.

The date for dedication of the plant has been set for August 17-18, 1972. Preliminary plans have been made and a small committee established to accomplish this event with a minimum of disruption to the plant operation.

Costs were significantly lower in June. This was partly due to reduced activity after the flood, but much of the reduction was due to stronger controls and due to improved operating efficiencies by the subcontractor.

Financial

Estimated monthly expenditures are $29,800 by Consol and $277,000 by Stearns. Cumulative expense to date is $15,409,694.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533)

No work was done or this project.

2. Supporting Patent and Legal Activities (Project No. 534)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536)

The final construction report is being reviewed prior to submission to OCR.

4. Stearns-Roger Construction Subcontract (Project No. 700)

Settlement with remaining vendors is nearing completion. Construction costs as of June 30 totaled $9,279,800.

5. Library Assistance on Pilot Plant Operations (Project No. 537)

As a result of the run stoppage at Rapid City, Library engineering reviewed the pressure tap design. Some purging tests were done by Library instrument group using dolomite and char of the same size consist as that used at Rapid City. As a result of these tests, it was recommended that the 1/4-inch nominal tubing be replaced with 1/2-inch diameter tubing. Complete designs were provided to Rapid City both for vertical probes and also side entry probes.

One progress review meeting was held during the month at Rapid City.

6. Consol Guidance on Operations (Project No. 702)

The progress report is attached. Most of the effort was on design changes for the pressure measuring system to eliminate plugging problems due to dolomite fines.

7. Stearns-Roger Operating Subcontract (Project No. 701)

The progress report is attached. Many maintenance items were completed during the period of shutdown following the flood. Improvements were made in the pressure measuring and control systems and in the quench system.

8. School of Mines Subcontract (Project No. 703)

The June progress report is attached.

C. Subject Inventions

None.

D. Financial Status

Expense	Actual	Budget
Cumulative through May, 1972		
Through June, 1969	$ 1,878,256	$ 1,878,256
Consol	736,638	690,225
Stearns	12,488,000	11,350,100
	$15,102,894	$13,918,581
Expended in Period (estimate)		
Consol	29,800[1]	39,475
Stearns	277,000	203,900
Total - June, 1972	$ 306,800	$ 243,375
Cumulative through June, 1972	$15,408,694	$14,161,956

[1] Includes payment of $6,875 to Elliott Company.

7/14/72
Att: Monthly Progress Reports on Projects 701, 702, 703
Progress Charts

Project 702
CC w/Operations Report:
D. McCoy
J. A. Phinney
C. A. Schulz
Central File
D. L. Waller - C F Braun & Co.

CONSOLIDATION COAL COMPANY
RESEARCH DIVISION
LIBRARY, PENNSYLVANIA 15129
INTER-OFFICE CORRESPONDENCE

To : Dr. John D. Sudbury
Date : July 6, 1972

From : Carl E. Fink and Uwe D. Marwig
At (Office): Rapid City, SD

Subject: Monthly Report No. 22 - Project 702

A second plant startup was attempted in June. Although an involuntary shutdown occurred before the objectives of the hot dolomite circulation tests were completed, there is no evidence to indicate any inherent instability of the process. Prior to the shutdown, dolomite circulation was carried out for 14 hours without interruption despite pressure surges which occurred when plugs of wet fines at the inlets to the gasifier and regenerator quench towers inlets were broken.

Termination of the run came while the back pressure control functions on both the gasifier and the regenerator were bypassed. When excess pressure was vented off the flare system, the gasifier pressure dropped 7 to 10 psi. With the loss of pressure balance, the inventory of the regenerator slumped into the dolomite lift line as the lift gas flowed into the gasifier rather than the regenerator. The pressure build up in the flare system was caused by a blind which was not removed after construction.

Another problem affecting the ability to circulate dolomite was discovered during examination of the plant after shutdown. A weld had broken causing the internal liner of the pipe which carries dolomite from the gasifier to the engager pot to tear loose. This failure was apparently caused by an inadequate weld. The welds in all of the pipe lines in the dolomite circulation loop have been checked and repaired where necessary.

Operations was plagued with difficulties in measuring pressures in the fluidized beds and in solids filled lines. One pressure tap in the gasifier boot was plugged beyond repair, and a second, in the regenerator bed, had shown signs of plugging just prior to the shutdown.

Extensive revision of the pressure taps has been started. The gasifier pressure probe has been refabricated and reinstalled. The refabricated probe uses 1/2" O.D. tubing rather than 1/4" O. D. tubing for the sensing lines and incorporates flexible hose to allow for movement and expansion. The side entering pressure taps in the reactors

have been enlarged from 1/4" O. D. tubing to 1/2" pipe and are being equipped with roo-out devices. For seven key pressure taps, the purge flows will be controlled using flow regulators mounted as nearly as possible to the measuring point.

The pressure taps and balance gas introducttions in the dolomite lines from the gasifier to the engager pot and from the regenerator to the gasifier are also being revised. A design using 1/4" pipe and flexible hose entering directly into the liner will be used. The original design used 1/4" O. D. tubing which coiled around the liner.

The inlets to the gasifier and regenerator quench towers have been revised to eliminate the plugging problem.

Operations are scheduled to resume on July 10 following the completion of plant revisions.

C. E. Fink

U. D. Marwig

CEF-UDM:lmp
Att. - Stearns-Roger Operations Report No. 28

On June 2, Test 7A, Part III was started. All rotameters in service were set and the transmitters zeroed at 2 lines above zero (where applicable).

After setting the instruments, Run 7/8/9 was initiated which is the hot gas circulation test and the addition of sized dolomite for partial calcination. During the addition of dolomite for Run 7/8/9, the dolomite bridged in the gasifier but was broken. The run then proceeded until June 9 when an upset in the pressure balance caused several line pluggages. The plant was brought down to clear the system. At the time of the line pluggages, the system had near the proper amount of dolomite and solids circulation tests were about to start.

The grinding run started June 2 had some operating difficulties in that the line from the mill to the cyclone appeared to be plugged. Some difficulties were experienced in lighting the dryer furnace. The lignite trailer was filled and the run halted.

Further attempts to run the grinding and drying area were plagued with difficulties lighting the furnace.

After repairing the dryer furnace controls, another run was started. The major problem experienced was high differential across the baghouse.

Problems with the baghouse were eliminated by reconnecting the hose to the blow ring and changing to 18 oz. Dacron bags.

A run was made June 30 without much difficulty and no equipment failures. Particle size made during this run could be used; however, further test runs are to be made to obtain sizes closer to the size desired by Consol.

CONSOLIDATION COAL COMPANY PROJECT

CSC PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #28

CCC Project No. 701
S-R Job No. B-37400
July 6, 1972

MONTHLY ACCOMPLISHMENTS-OPERATIONS AND TECHNICAL

After the June 1st shutdown caused by losing instrument air, the unit was emptied of dolomite. After closing the unit back up, circulation was established, the unit heated up and dolomite addition started. During the initial dolomite addition, a problem with bridging in the gasifier was experienced. This delayed further dolomite addition for about a day. After adding about 9,600 pounds of dolomite to the reactor system, a high pressure drop in the regenerator quench system developed. Apparently dolomite dust plus water at the quench tower inlet created the problem. Hammering on the flange reduced the pressure drop and we were able to proceed with the run and keep the pressure drop under control.

On June 6th after adding about 12,000 pounds of dolomite, it was discovered that the next dolomite to be added was under-sized and extremely fine. Upon investigation, it was found that the screen in the dolomite sizing equipment had failed during screening and had allowed the fines to mix with the sized product. The set of screens which were 9 mesh and 20 mesh were removed and new screens size 6 mesh and 16 mesh were installed. The fines in the sized dolomite bin apparently had stratified so that we were able to remove these fines and continue dolomite addition to the system.

During this run, the bottom pressure sensing tap on the gasifier kept plugging. After plugging and clearing this line several times, it again plugged and as a result, the pressure tap was relocated to the gasifier recycle gas inlet line.

At about 10:15 on the morning of June 9, several things occurred which resulted in upsetting the unit. The upset allowed dolomite to fill the lift leg between the engager pot and the regenerator. Once this line fills, it cannot be cleared except by disconnecting the line and dumping the dolomite. Therefore, the system was depressured and partially cooled so that the dolomite could be dumped.

The plant upset was the result of the differential pressure between the regenerator and the gasifier being thrown out of range. Because of pressure sensing line pluggages, the system pressure control valves were on manual operation and the pressure taps were being blown out when the differential pressure was over-ranged. The over-ranging occurred while attempting to trouble shoot the flare system. Back pressure in the flare system has been experienced from time to time. The flare blowdown drum and flare stack were being investigated. The two-inch drain line from the flare stack to the flare blowdown drum was closed and the vent header pressure increased. The drain line was again opened and the pressure dropped rapidly causing the differential pressure between the regenerator and gasifier to be over-ranged. The main problem with the flare system was found to be a blind which had been left in the 10" flare line between the flare blowdown drum and the flare stack.

On the evening of June 9th, the Rapid City area was hit by a flash flood which disrupted the gas and water supply to the plant for extended periods.

The electrical supply only had two short (about 3 minutes) outages between midnight and 1 A. M. plus several power dips after that. Only the instrument air, nitrogen and cooling tower systems were operated after the flood. Water from the large pond was pumped to the cooling tower basin when needed to maintain a supply of water in case of fire. On June 13th natural gas was restored to the plant and the inert gas system was put in operation. Water was restored at low pressure on the 15th of June, however, usage was curtailed at the request of the city of Rapid City.

On June 13th, a meeting was called between Consol and Stearns-Roger to decide the course of action to be taken prior to an attempt to restart the plant. At the direction of Consol, the following work was to be done prior to start-up:

A. Remove the "tee" section of pipe beneath the gasifier and inspect.
B. Remove and inspect level control valve, LCV-2003.
C. Remove and inspect the line CD-204-4 between the gasifier and level control valve, LCV-2003.
D. Remove the check valve in the steam line to the gasifier quench tower.
E. Unplug and clean solids sample taking systems on the regenerator and gasifier.
F. Clean the seat on valve XCV-2010 and connect the "blast" line to prevent the seat from becoming plugged.
G. Remove and inspect valve, TCV-2030.
H. Remove and inspect line CD-206-4 between the regenerator and valve, TCV-2030.

Consol also requested that the top head of the gasifier be removed to take out the electrode plates, but this item has been put on "hold" and will not be done until a later date.

Additional items which were investigated and modified during the shutdown consisted of the following:

A. Modified and repaired the entrance points of the balance gas to the valves, LCV-2003, and TCV-2030.

B. Modified the gas inlet nozzle to the gasifier quench tower and the regenerator quench tower in an attempt to eliminate the dolomite deposits which have accumulated at the inlet nozzles.
C. K-filters were designed and piping modified so they can be installed at a later date on the discharge of the gasifier recycle compressors, J-201 A and B; the regenerator recycle compressors, J-203 A and B; and the inert gas compressor, J-504.
D. Pressure controllers for the C and inert gas purge systems were modified to give more reliable operation.
E. An instrument air dryer modification was completed with the liquid nitrogen system being tied into the instrument air system in hopes of preventing another shutdown as experienced in May.
F. The baghouse was once again under study. The wool bags have been removed and the Dacron bags installed.
G. The feeders under the ash lock hoppers were removed and spools installed in their place with an inert gas purge in an attempt to prevent the plugging as previously experienced.

H. The differential pressure measuring probe for the gasification reactor was modified and reinstalled in the gasifier. The pressure sensing taps were increased to 1/2" from 1/4".
I. Since the plant was down, this was an excellent time for our annual boiler inspection. The Factory Mutual Insurance representative was on hand to inspect the unit which was found to be in excellent condition. The boiler was put back in service and switched back from propane to natural gas service. Propane had been used briefly after losing natural gas supply during the June 9th flood and before shutting the boiler down.
J. Three side connections on the gasifier will also be used to monitor bed levels as a back up for the probe. Differential pressure transmitters for the devolatilizer will be used. We hope to be able to determine if there is any difference in reliability of side connected dPT's or dPT's connected to the probe.
K. Seven of the purge lines for the dPT's have been fitted with Moore regulators. These regulators should give a constant flow and make these dPT readings more reliable.
L. The heresite lining in the gasifier quench tower separator, F-319, was repaired.
M. The liner on line CD-204 was pulled loose from the connecting disc at the flange and had to be repaired. The "slip" joint was cleaned and made operable in place.
N. Two purge connection joints for differential pressures on CD-204 and CD-206 were modified with flexible connections.
O. Modifications to the piping on the fire water system and cooling water system were made so the fire water pump with the propane engine drive can be used to supply cooling water to the plant in the event of a power failure.
P. The fine solids handling butterfly valves were repacked because they had been packed incorrectly by the vendor which prevented the valve purge lines from working properly.

During the shutdown the operating personnel have been reviewing and updating the operating manuals. The shift engineers, shift instrument technicians, shift technical engineers and the shift control chemists were transferred to days, Monday through Friday, during the shutdown.

The gasification reactor and regeneration reactor were inspected to determine the seriousness of the cracks in the refractory. Refractory specialists from Continental Oil Company and C F Braun Company concurred that it was not necessary to repair the refractory at this time. Repair to the refractory necessitates removing the massive vessel heads.

Our sized dolomite inventory was rescreened. For our next attempt at gasification, a 6 by 16 mesh dolomite will be utilized rather than a 9 by 20 mesh that has been previously used.

Several char grinding and drying runs were made during the month. Two runs were attempted prior to the June 9th flood. Dryer furnace problems consisting of a burned out relay and failure of the furnace stack combustion element prevented a run during the first weekend of June. During the first week of June, these problems were corrected and a run was made that was terminated by a high baghouse differential pressure. It was later found that the hose to the blowrings in the baghouse had become disconnected.

The lignite tractor and trailer used to haul ground char was damaged in the flood. It had been taken to town for repair and was caught in the flood. The trailer has been repaired sufficiently for limited use but the cost to repair the tractor is more than its value. We are currently renting a tractor when it is necessary to empty the trailer.

The char grinding and drying area was operated once during the shutdown. Two sets of conditions were tested before the trailer was filled and a malfunction on the dryer terminated the run. The problem appeared to be in the flame detection device on the outlet of the furnace. The results obtained indicated that the size distribution would be acceptable for char gasification.

Our plans for the coming weeks include finishing the repairs and changes now in progress. When the repairs and changes were completed, the system will be repressurized in preparation for heating up. Numerous check outs will again have to be made to re-zero the transmitters and calibrate the dPT's before solids can be charged to the unit.

The present inventories of char and sized dolomite consist of:

Char	134 tons
Sized dolomite	34 tons

The emergency generator, U-512 was checked out and load tested.

During the early part of the month the chemists were on shift in support of plant operations, but were transferred to day shift following the flood, and during the shutdown.

Chemists are now working on the following technical assignments:

(1) Development of an analytical method to measure the drying capacity of the dessicants used in drying plant gases.

(2) Study of the variations in analyses of lignite and dolomite--first stage is calculation of the standard deviation for analyses at this laboratory.

(3) Verification of the thermobalance method for volatiles in lignite.

(4) Literature search for suitable methods of analysis for ppm levels of sulfur-containing gases: methanation catalysts are sensitive to such compounds.

SAFETY

Thirteen safety meetings were held during the month of June. Four safety meetings were held with Maintenance, five with Operations and four with the Safety Committee. The Operators on all four shifts were given a refresher course on the use and operation of the fresh air masks and pneulator. A fire brigade drill was held with the "C" Shift. First Aid Refresher Courses have been started for the Operations, Chemist and Engineering personnel.

During the shutdown, operations were able to continue the coding of pipes and vessels.

MONTHLY ACCOMPLISHMENTS - MAINTENANCE

During the month of June, 199 work orders were completed of which 68 were marked urgent. In addition to the 199 work orders, ten items of equipment were checked as scheduled for 90 day preventive maintenance. The majority of the maintenance man-hours was spent making changes and modifications while the plant was shut down on items required before attempting to start the plant back up.

PLANS FOR JULY

The objective for July is to complete the modifications, clean-up work and maintenance items started in June. Then we will attempt to carry out the items which were previously listed as plans for June in order to produce gas before the end of July.

Gasification will be accomplished by a successful conclusion of the following steps:

(1) Zero the level instruments and recalibrate and check out all other instruments.

(2) Start up and reestablish calcined dolomite circulation.

(3) Grind char and then proceed to build level of ground char in the preheater to satisfy the system prior to Step 3.

(4) Transfer char from the preheater to the lignite lockhoppers. Flow char into gasifier and establish char level. Convey char into the regenerator preparatory to calcining the $CaCO_3$ portion of dolomite to CaO. When the $CaCO_3$ calcining is complete, leave system ready for Step 4.

(5) Admit steam to the gasifier. This operation will start the gasification reaction of char to carbon monoxide, hydrogen and some methane. Line system out and prove operability of dual fluid beds, continuous calcination, solids transportation and gasification.

STAFFING

	CURRENT MANPOWER Effective 7-1-72	TO BE HIRED IN JULY
Management	1	0
Accounting	5	0
Clerical	6	0
Janitorial	2	0
Safety	1	0
TECHNICAL DEPARTMENT		
Laboratory	6	0
Engineering	9	1
Scheduling & Planning	1	0
OPERATIONS		
Supervisors	2	0
Shift Engineers	4	0
Instrument Engineer	0	1
Operators	42	2
MAINTENANCE		
Supervisors	5	0
Crafts	27	0
Warehouse & Purchasing	3	0
TOTAL	114	4

COSTS

Accumulated Operations Cost to Date, June 30, 1972	$3,512,972.37
Purchase Orders Not Paid & Purchases Placed	70,459.94
Actually Spent - June, 1972	294,061.89
Accumulated Cost Billed to Date	$3,465,492.50

Very truly yours,

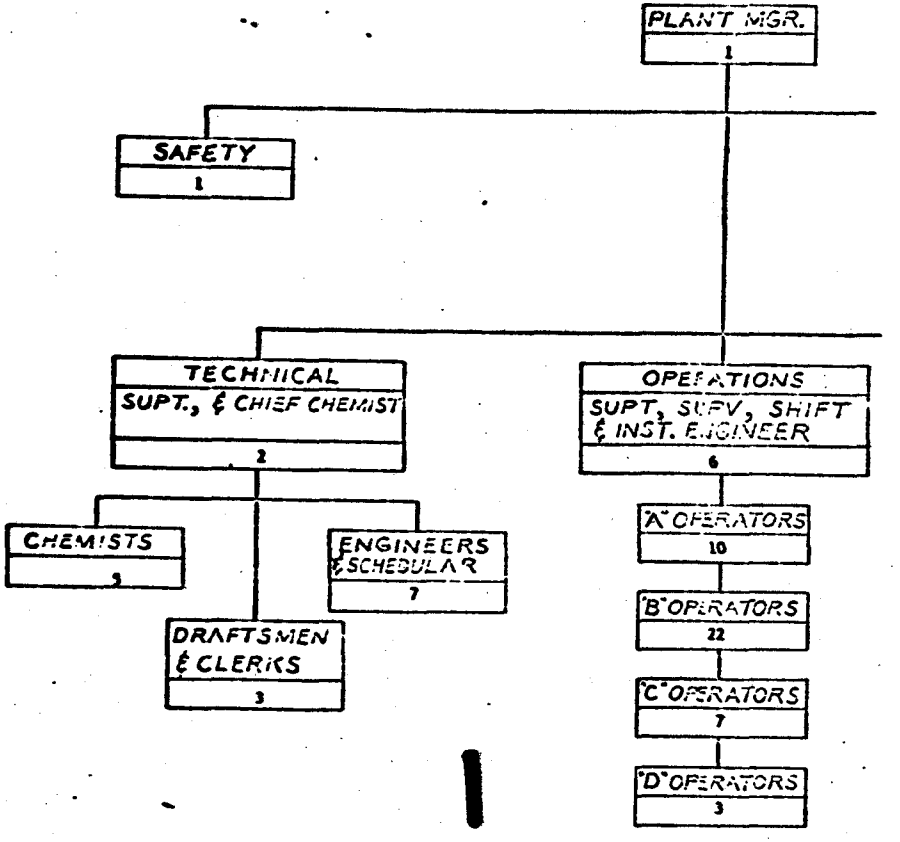
STEARNS-ROGER CORPORATION

R. G. Checksfield
Plant Manager

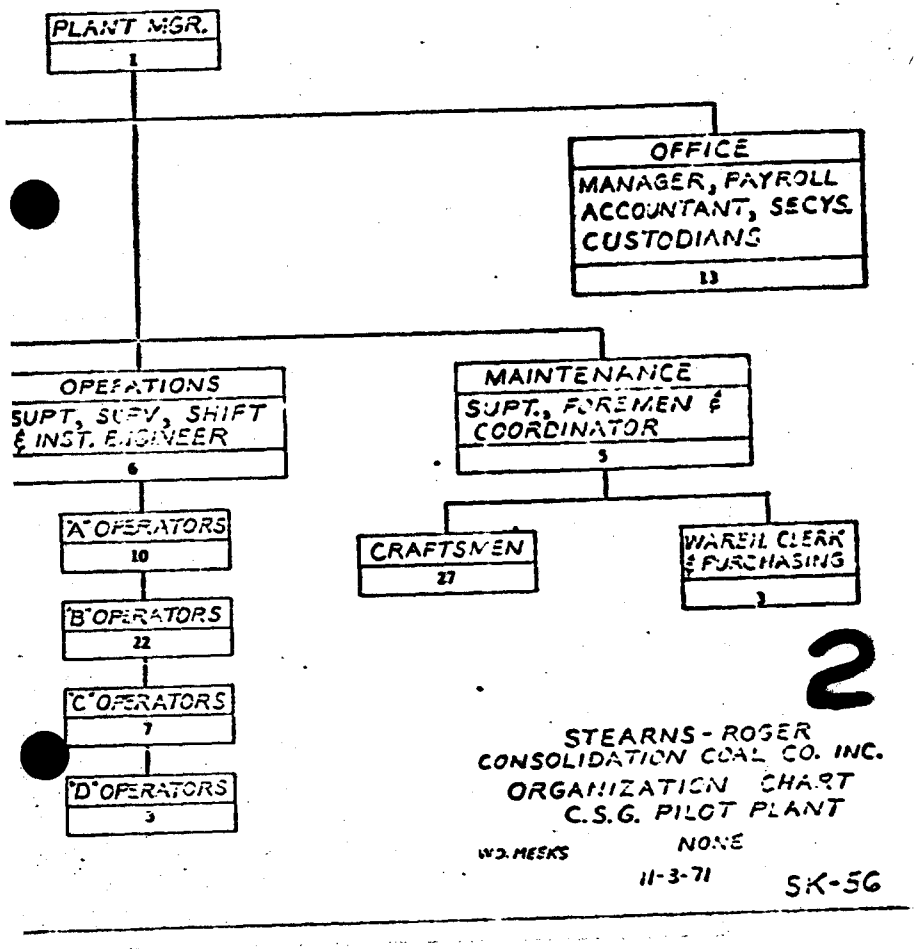
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cc: U. D. Marwig-Consol
C. E Fink-Consol
Dr. J. D. Sudbury-Library
J. A. Phinney-Library
C. A. Schulz-Library
Dr. Roger Detman-C F Braun
Dr. Derek Waller-C F Braun
C. M. Stone, D. H. Dawson, V. L. Brant-Denver
HLL, MHV, DDD, WTB, COB, NRK, IT, KKN, JDR, HAJ, EBW, ENF, GDF, MTH, PL, FILE

Attachments



TOTAL....114



1

June MONTHS ENDED 30th

OSHA REPORT

MINE NAME	MINE NO.	NUMBER OF LOST TIME ACCIDENTS: NON-FATAL	FATAL	TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED
Research Division	100					
Rapid City	200	0	0	0	0	18297
Total Research						

...30th 19 72

DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUCED	FREQUENCY	SEVERITY	TONS PER LOST TIME ACCIDENTS	MAN COUNT
0	19297	0	0	0	0	114

2

SUBCONTRACT BETWEEN COMSOL AND SYMBIOT RE COMSOL CO_2 ACCEPTOR PROCESS
(OCF, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR JUNE, 1972

I. General

The Rapid City flood caused some delay during June because of power outages in the Mineral Industries Building. Dr. Dieter, working on waste monitoring, drowned as a result of the flood. Work on the MgO - $Ca(OH)_2$ - $CaCO_3$ systems indicates dolomite mixtures are impossible to fuse with available equipment and their usage for acceptor reconstitution does not seem favorable. Final sample and report work is being done on the carbonate resources. X-ray fluorescence work on noxious elements agrees relatively well with previous data obtained by atomic absorption. No new work was done on the beneficiation project as the final report is being completed. Dr. Jonte, Chairman of the Chemistry Department, will replace Dr. Dieter on waste monitoring.

II. Carbonate Resources (Mickelson)

Detailed studies of carbonate samples in thin section and hand specimens are continuing using binocular and petrographic microscopes. Compilation of bibliography continues. Preparation of the final report is well underway. Approximately one week was lost due to flood and attendant loss of power. Samples of Winnekahta limestone are being tested for their engineering properties as well as samples of Pahasapa for Los Angeles abrasion tests. Report will be completed in July.

III. Acceptor Reconstitution (Foerstemau)

Progress was limited this past month due to the flood and the ensuing clean-up and power outage. In addition, problems were experienced with temperature measurements which also limited progress. Experiments were

conducted with two $MgO - Ca(OH)_2 - CaCO_3$ systems, however. These were as follows:

Material	Initial Weight (gm)	Wt.-100 mesh Produced (gm)	Activity
32 mole% $CaCO_3$ 48 mole% $Ca(OH)_2$ 20 mole% MgO	50	2.6	*
28 mole% $CaCO_3$ 42 mole% $Ca(OH)_2$ 30 mole% MgO		Incomplete Fusion	

* To be run

Work next month will involve measuring the properties of other $MgO - Ca(OH)_2 - CaCO_3$ melts and also will involve measuring temperature increase as a function of CO_2 addition.

IV. Noxious Elements (Lingard)

Work on the determination of trace elements by X-ray fluorescence following their concentration by ion-exchange or by chelation and extraction was started during June but was interrupted by power failures and other difficulties resulting from the flood. Very limited results for the determination of lead by this method were in fair agreement with previous results obtained by atomic absorption but further work will be required to develop a satisfactory procedure for lead and other elements of interest. Additional studies of this method will be continued during July.

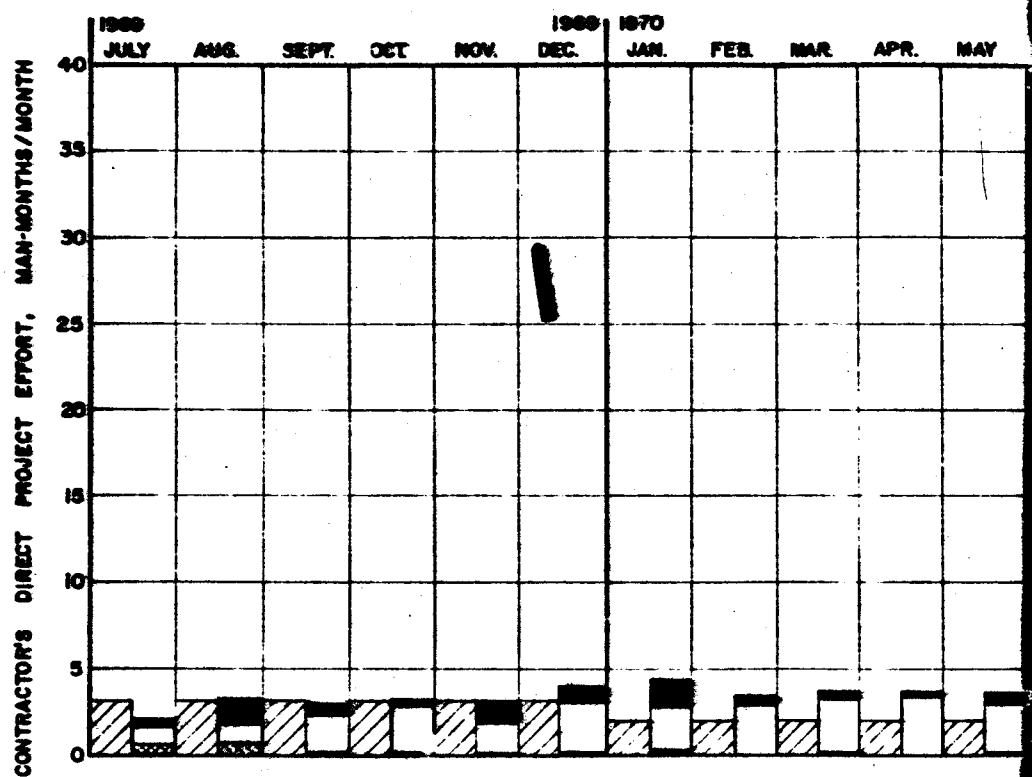
V. Lignite Beneficiation (Clarkson)

No new results were obtained in June and work is confined to the final report due at the end of July.

VI. Waste Monitoring (Oliver)

Dr. Lowell Dieter, co-investigator on this portion of the contract, was killed in the Rapid City flood on June 9. His place on the contract

will be taken by Dr. Haworth Jorte, the Head of the Chemistry Department, SDSMT. Wastewater is being continuously monitored for pH and dissolved oxygen. We are fabricating a d.c. power supply to replace the batteries which power the pH meter, because we have had trouble with the batteries. Progress at monitoring the vent stack gases continues to await the installation of cables and conduits by Stearns Roger.



MONTHLY EXPENDITURES*

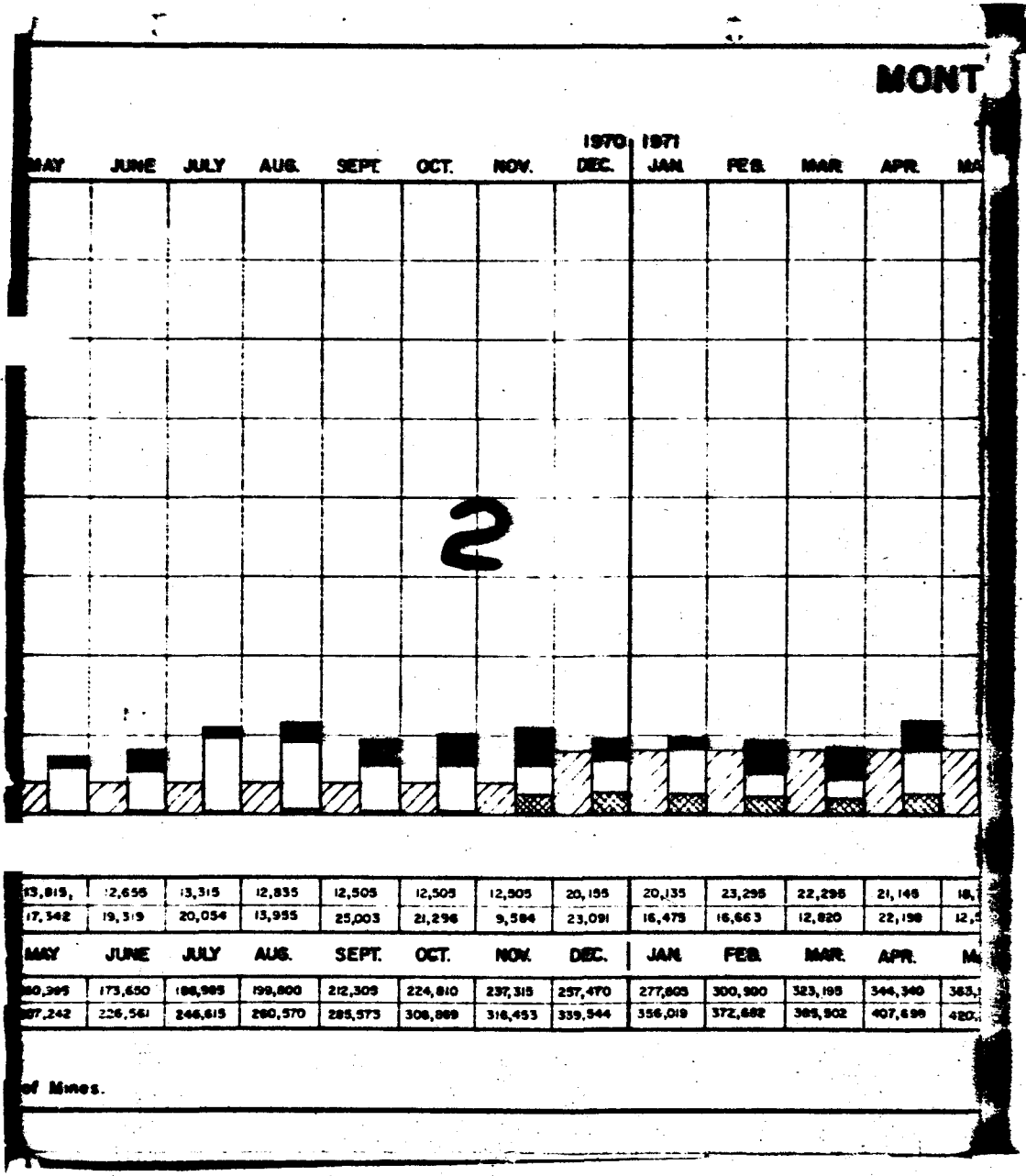
PREDICTED	16,215	14,685	14,965	13,155	14,385	17,065	15,585	15,595	12,655	12,875	13,815
ACTUAL	11,745	34,734	9,609	11,825	10,130	15,205	14,378	14,027	15,019	53,228	17,342

	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY
PREDICTED	16,215	30,900	45,865	59,020	73,405	90,470	108,055	121,650	134,305	147,180	160,995
ACTUAL	11,745	46,479	56,088	67,913	78,043	93,249	107,686	121,653	136,672	189,900	207,242

CUMULATIVE EXPENDITURES*

*Expenditures Include All Costs & Fees By Consol And S. Dakota School of Mine

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13,815,	12,656	13,315	12,835	12,505	12,505	12,505	20,155	20,135	23,295	22,295	21,145	18,
17,342	19,319	20,054	13,955	25,003	21,296	9,584	23,091	16,475	16,663	12,820	22,198	12,

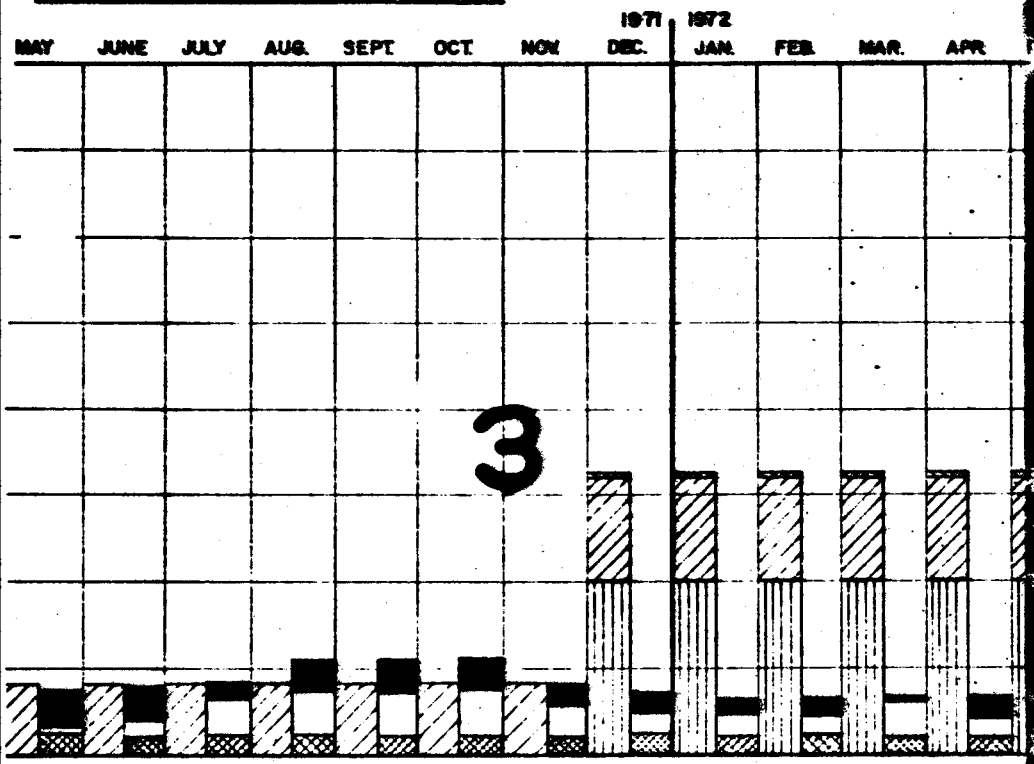
MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	M
30,395	173,650	186,965	198,800	212,305	224,810	237,315	257,470	277,605	300,900	323,195	344,340	363,
37,242	226,561	246,615	260,570	285,573	308,869	318,453	339,544	356,019	372,682	385,502	407,698	420,

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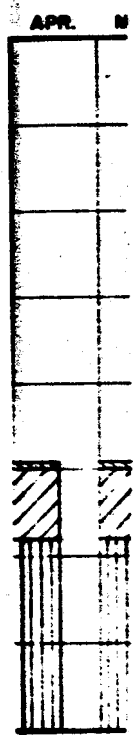
CONTRACT No. 14-01-0001-415 (3)



18,705	15,998	14,875	14,875	14,875	14,875	14,875	38,475	39,475	39,475	39,475	39,475	
12,508	15,831	16,923	24,919	97,703	30,575	18,172	36,224	15,604	15,700	23,962	12,772	

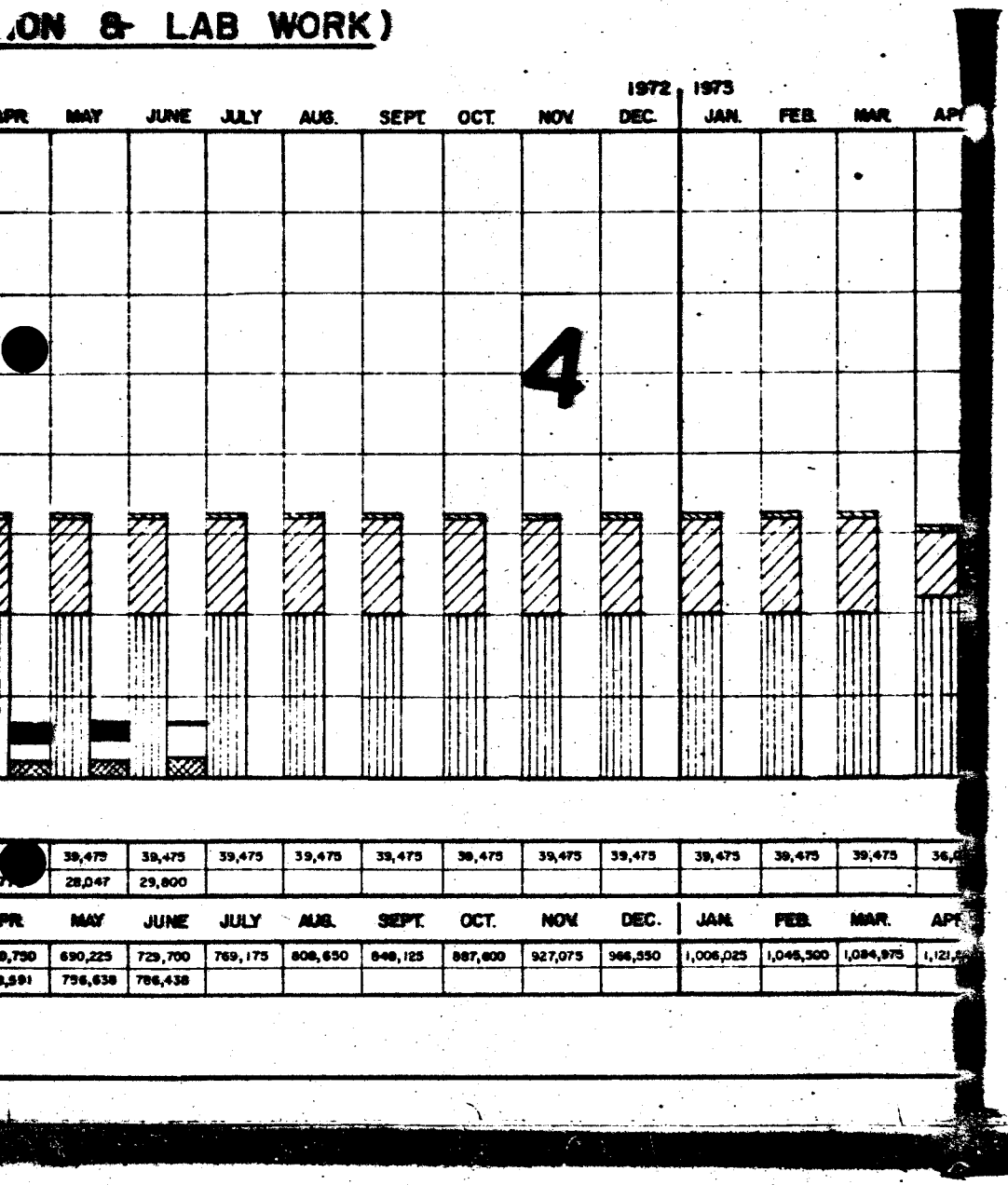
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383,046	379,000	383,875	408,750	423,625	438,500	453,375	492,850	532,325	571,800	611,275	650,750	
480,208	436,037	462,960	477,879	375,582	606,157	624,329	680,553	676,157	691,857	715,819	728,591	

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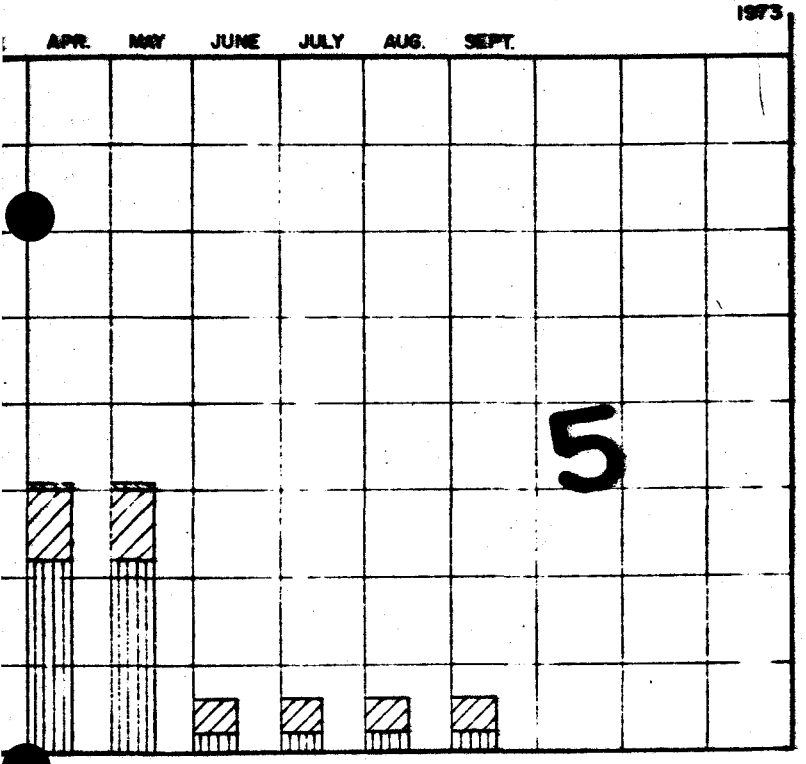
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⑤ ⑥ Includes Cle

5	36,075	36,075	11,475	11,475	11,475	41,120			

	APR.	MAY	JUNE	JULY	AUG.	SEPT.			
75	1,121,050	1,157,125	1,168,600	1,180,075	1,191,550	1,232,670			

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(ow 415 Chart)

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⊛ Includes Supervisory Exempt Technicians.
⊛⊛ Includes Clerical.

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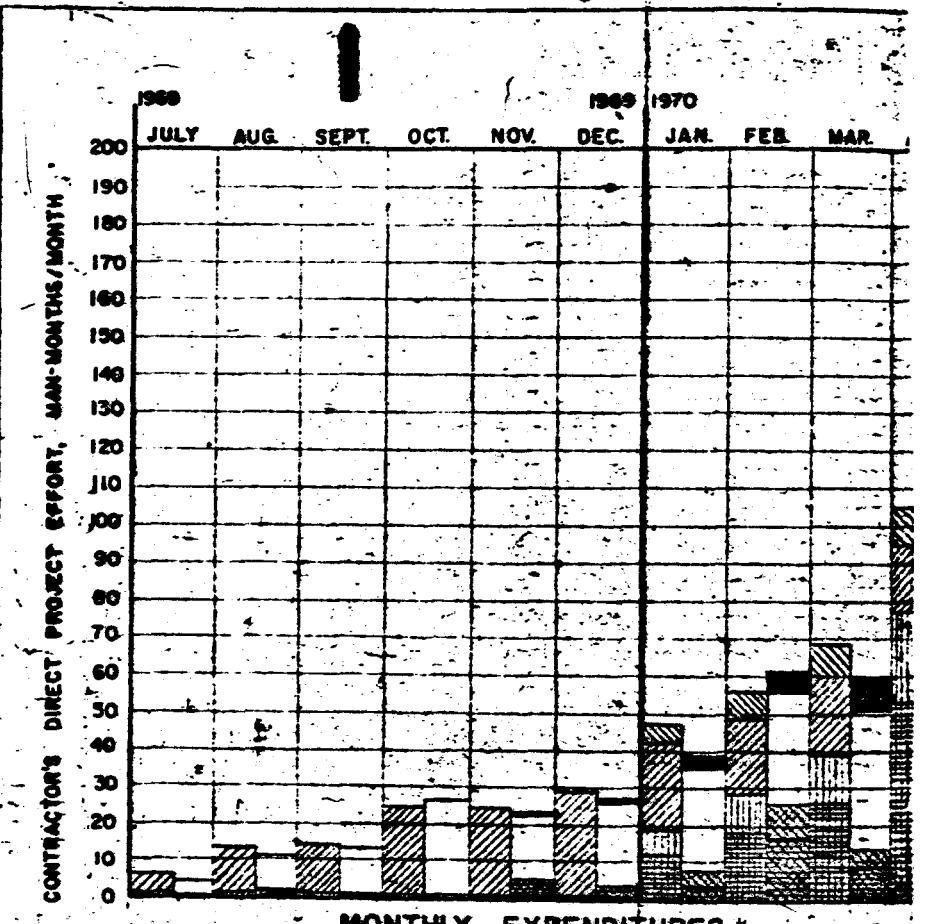
32,670										

MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT No. 14-01-0001-415 (3)



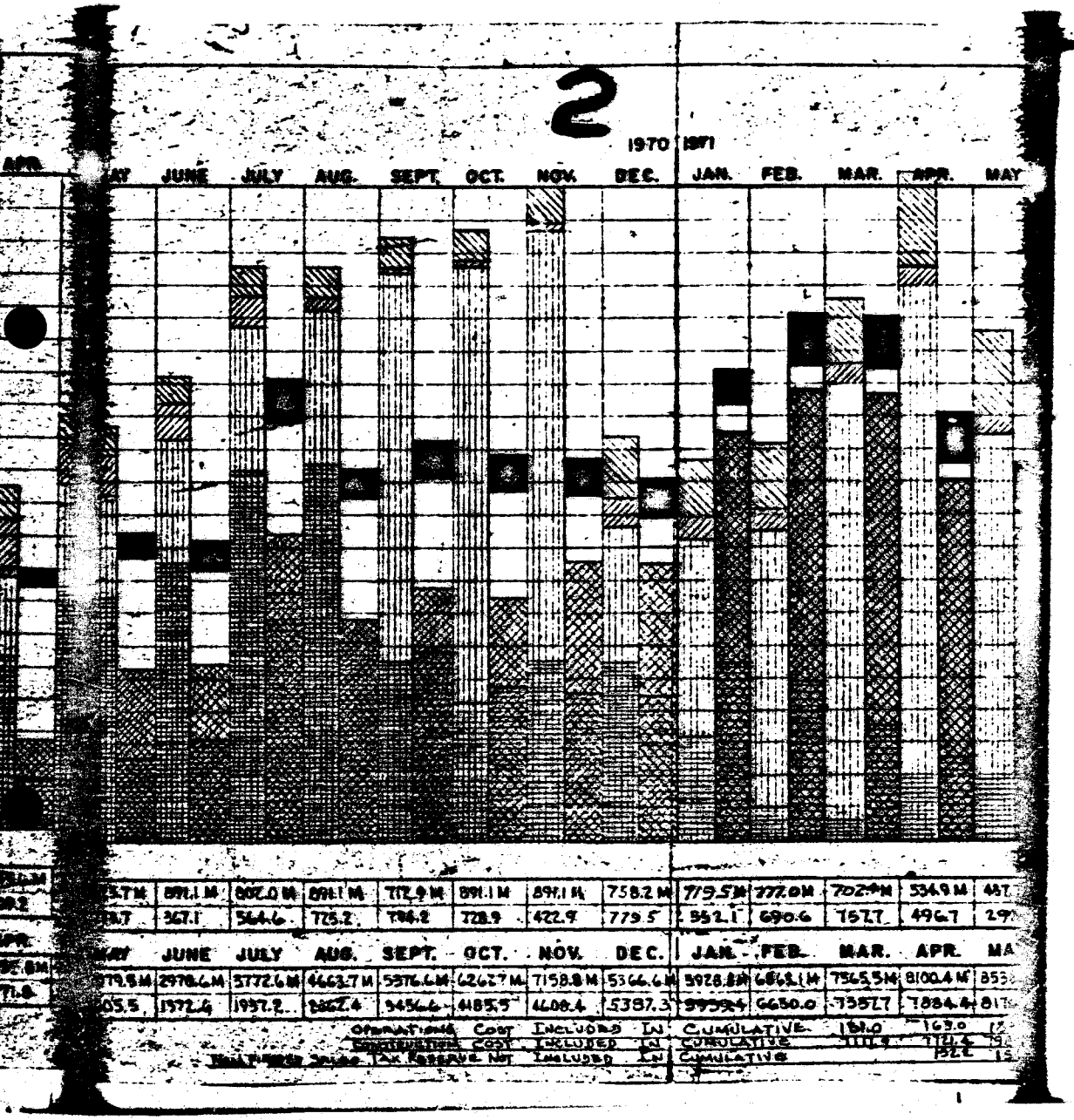
MONTHLY EXPENDITURES *

PREDICTED	0	30.0 M	41.0 M	50.0 M	98.0 M	106.9 M	112.0 M	273.0 M	299.5 M	4
ACTUAL	6.2	25.0	32.8	42.6	39.7	126.2	110.9	76.7	406.9	2

	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	A
PREDICTED	0	30.0 M	71.0 M	121.0 M	219.0 M	325.9 M	497.9 M	710.9 M	1010.2 M	14
ACTUAL	6.2	31.2	64.0	106.6	146.3	272.5	383.0	459.7	542.6	7

CUMULATIVE EXPENDITURES *

* EXPENDITURES INCLUDE ALL COSTS & FEES

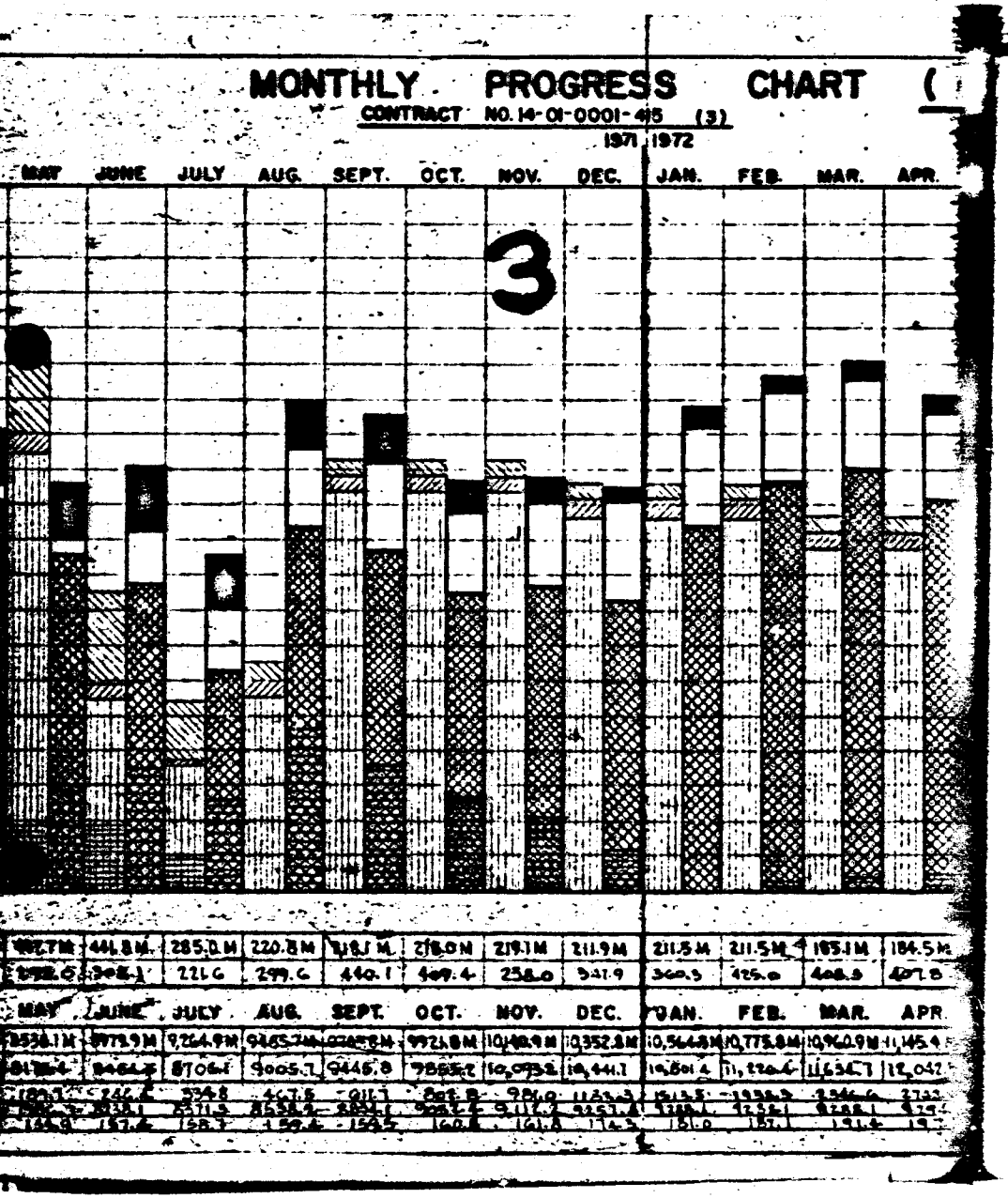


5.7 M	891.1 M	807.0 M	891.1 M	772.9 M	891.1 M	891.1 M	758.2 M	779.5 M	772.0 M	702.4 M	534.9 M	487.
8.7	367.1	564.6	725.2	796.2	728.9	422.9	779.5	552.1	690.6	757.7	496.7	29

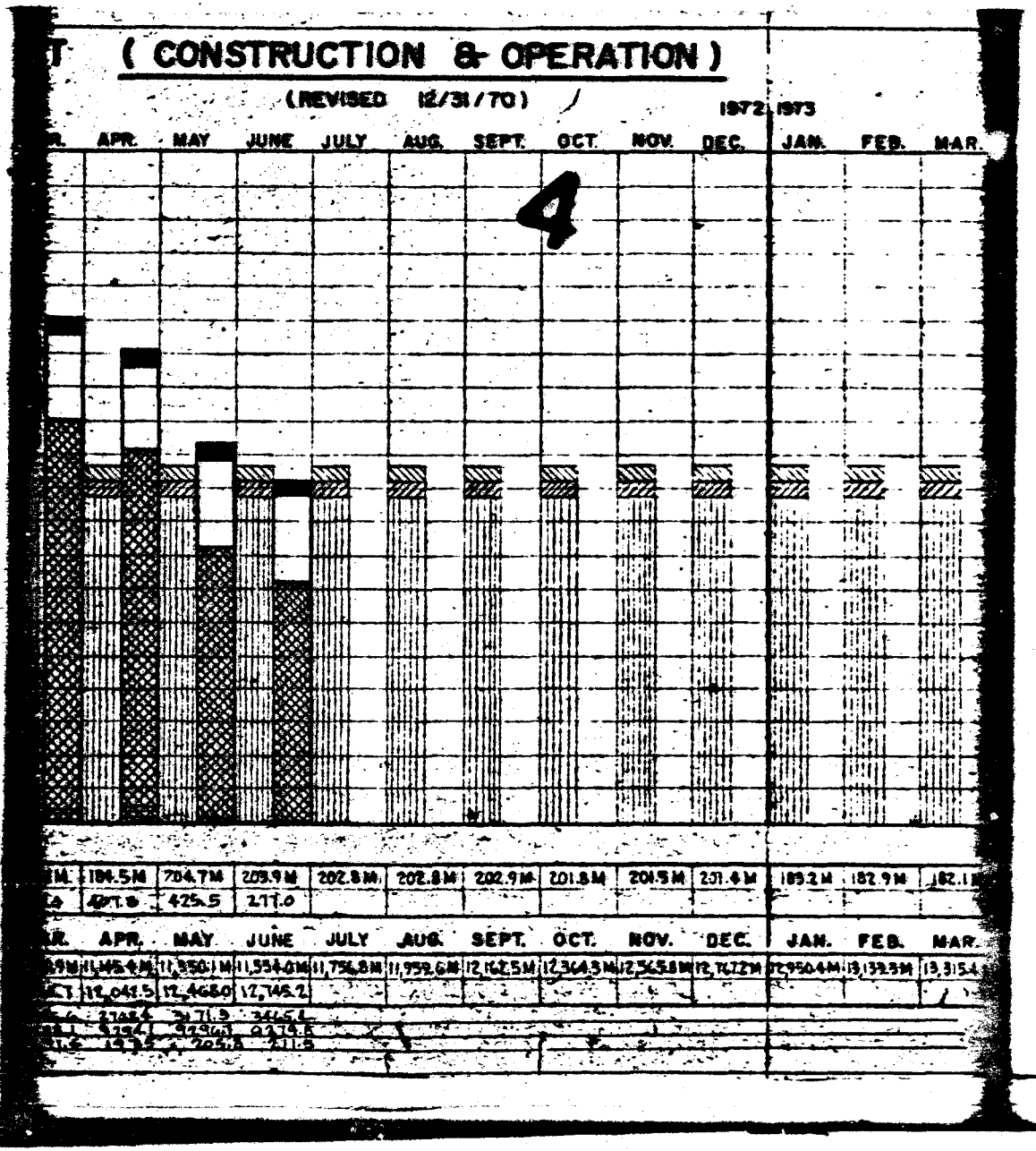
MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MA
79.5 M	2978.6 M	3772.6 M	4663.7 M	5516.6 M	6262.7 M	7158.8 M	5366.6 M	5928.8 M	6648.1 M	7565.5 M	8100.4 M	855
65.5	1372.4	1957.2	2847.4	3454.4	4185.5	4608.4	5387.3	5955.4	6650.0	7357.7	7884.4	817

Operations Cost Included In Cumulative	151.0	169.0	17
Construction Cost Included In Cumulative	111.5	111.4	15
Total Power Sales Tax Revenue Not Included In Cumulative		152.2	15

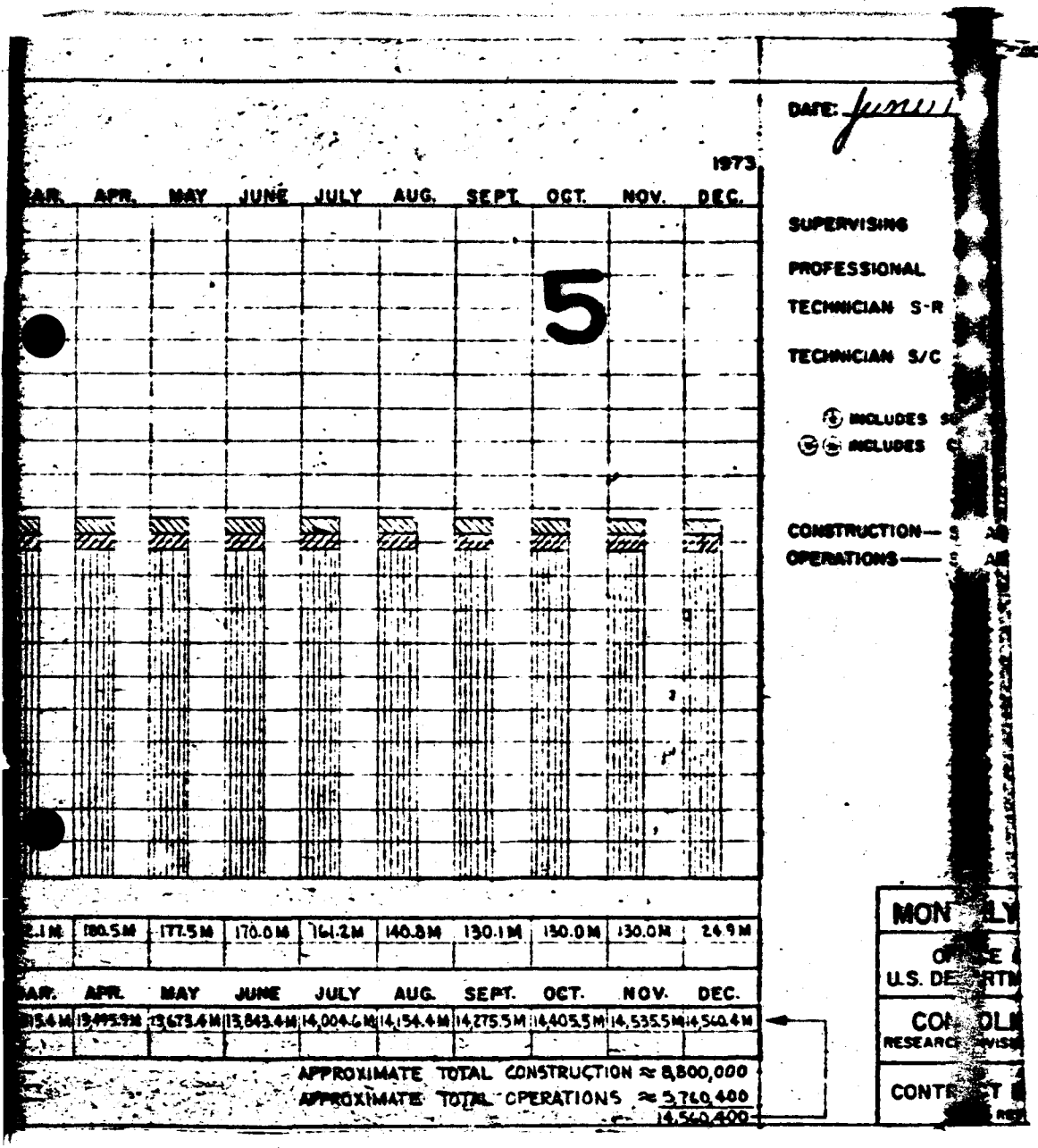
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MONTHLY PROGRESS CHART (
CONTRACT NO. 14-01-0001-415 (3)
1971 1972
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
3
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.

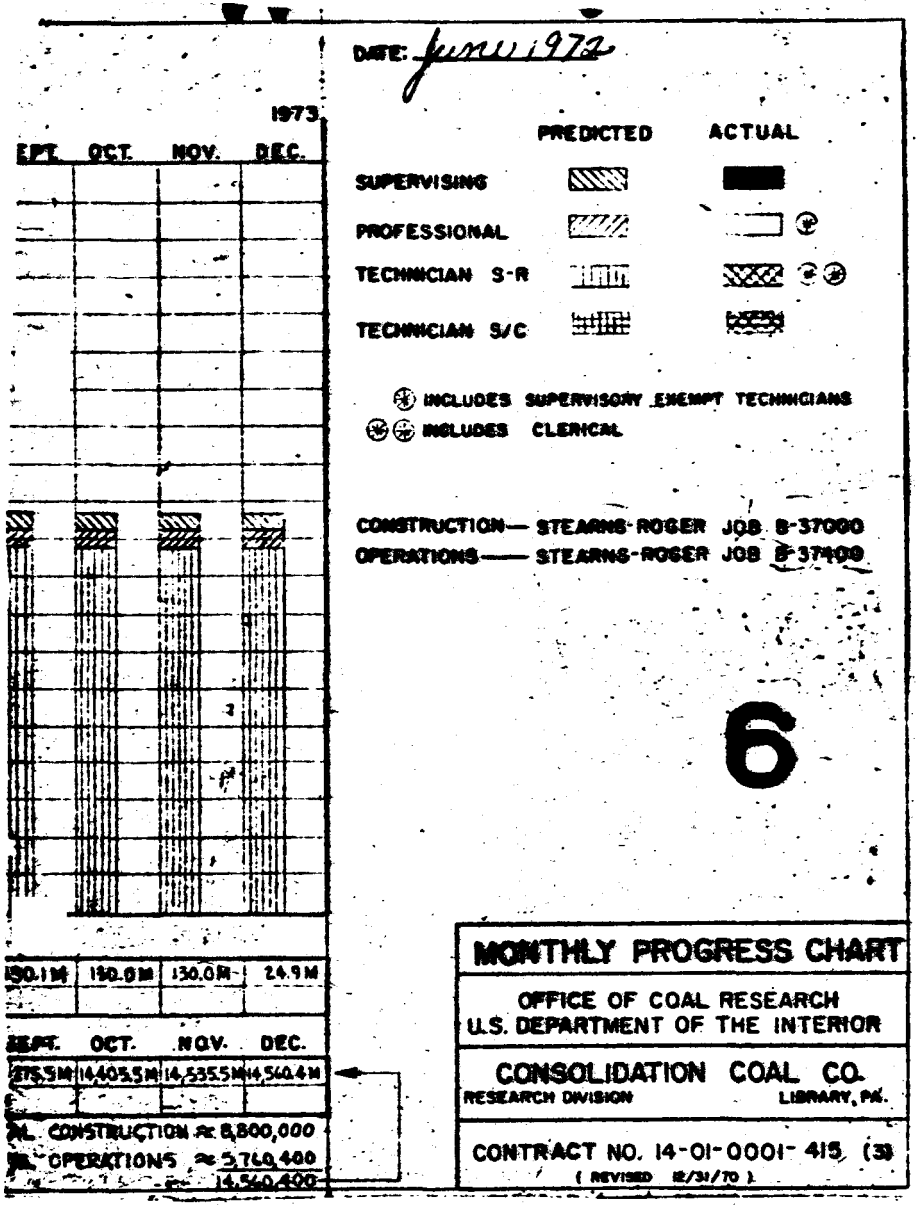
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(CONSTRUCTION & OPERATION)
(REVISED 12/31/70)
1972 1973
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR.
4
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR.

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1973
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DEC.
5
DATE: June
SUPERVISING
PROFESSIONAL
TECHNICIAN S-R
TECHNICIAN S/C
CONSTRUCTION—
OPERATIONS——
180.5M
177.5M
170.0M
161.2M
140.8M
130.1M
130.0M
130.0M
24.9M
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
13,673.4M
13,843.4M
14,004.6M
14,154.4M
14,275.5M
14,405.5M
14,535.5M
14,560.4M
APPROXIMATE TOTAL CONSTRUCTION ≈ 8,800,000
APPROXIMATE TOTAL OPERATIONS ≈ 5,760,400
14,560,400
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JCR CONTRACT NO. 14-01-0001-415 ,
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

July 1 to July 31, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

In the early part of the month three char grinding and drying runs were made to establish the optimum operating procedure for producing a satisfactory size consist. Following these runs, the major plant was pressurized and hot gas circulation begun. A char bed was established in the preheater. Dolomite was introduced on July 11th and successfully transferred from the gasifier to the regenerator. On July 16th attempts to add char to the gasifier by means of the lockhopper were begun. After one successful transfer of a lockhopper's quantity of char, the char appeared to hang up in the lockhopper to gasifier char transfer line. A "shot pot" technique was improvised for improving the char addition but was proven to be only intermittently successful.

On July 19th, while transferring dolomite from the gasifier boot to the regenerator, the transfer line ruptured. Subsequent investigation revealed that 25 feet of the inner liner of Incolloy 800 had either melted or been blown out of the ruptured external pipe.

The cause was that the dolomite boot had not achieved the desired char-dolomite separation, so large quantities of char were being transferred with the dolomite. The lift gas is regenerator recycle gas, and since no char had been added to the regenerator, this lift gas was largely air, and, therefore provided the oxygen to rapidly combust the transfer char.

The remaining part of the month was largely devoted to repairs, and to establish a new operating procedure to prevent reoccurrence of the mishap.

Studies of char transfer were made in the glass model, and indicated that inability to make the purge gases flow with the char into the fluidizing vessel was the probable cause of the char hang-up. Plant changes were made to assure this purge gas flow.

Work continued on the planning and arrangements for the plant dedication on August 17-18, 1972.

Financial

Estimated monthly expenditures are $19,800 by Consol and $243,700 by Stearns-Roger. Cumulative expense to date is $15,673,494.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536)

The final construction report is being assembled for submission to OCR.

4. Stearns-Roger Construction Subcontract (Project No. 700)

Settlement with remaining vendors is nearing completion. Construction costs as of July 31 totaled $9,279,800.

5. Library Assistance on Pilot Plant Operations (Project No. 537)

The final report on methanation was reviewed and cleared for final distribution. Following the shutdown of the Rapid City Pilot Plant due to transfer line break, meetings were held in Library and in Rapid City to assist in the evaluation of causes of the blow-out and to provide assistance in repair and also reprogramming to avoid future occurrences.

One progress review meeting was held during the month at Rapid City.

6. Consol Guidance on Operations (Project No. 702)

The progress report is attached. Most of the effort was on design of a new program to improve operations.

7. Stearns-Roger Operating Subcontract (Project No. 701)

The progress report is attached. 168 maintenance items were completed. Much of the effort was devoted to replacing the transfer line altering the char feed system and preparing the plant for new runs.

8. School of Mines Subcontract (Project No. 703)

The July progress report is attached.

C. Subject Inventions

None.

D. Financial Status

Expense	Actual	Budget
Cumulative through June, 1972		
Through June, 1969	$ 1,878,256	$ 1,878,256
Consol	786,838	729,700
Stearns	12,748,200	11,554,000
	$15,408,994	$14,161,956
Expended in Period (estimate)		
Consol	19,800[1]	39,475
Stearns	243,700	202,800
Total - July, 1972	$ 263,500	$ 242,275
Cumulative through July, 1972	$15,673,494	$14,404,231

[1] Includes payment of $8,600 to S. D. School of Mines.

8/14/72
Att: Monthly Progress Reports on Projects 701, 702, 703
Progress Charts

Project 702
CC w/Operations Report:

D. C. McCoy
J. A. Phinney
C. A. Schuls
Central File

D. L. Waller -
C F Braun & Co.

CONSOLIDATION COAL COMPANY

RESEARCH DIVISION
LIBRARY, PENNSYLVANIA 15129

INTER-OFFICE CORRESPONDENCE

To : Dr. John D. Sudbury Date : August 4, 1972

From : Carl E. Fink and Uno D. Marwig At (Office): Rapid City, SD

Subject: Monthly Report No. 23 - Project 702

During July a third start-up was attempted. The objectives of the hot dolomite circulation tests were completed. Plant pressure balance was maintained over a wide range of acceptor circulation rates despite the occurrence of several major upsets. Proper tuning and operation of the important pressure and differential pressure controllers was the key to the successful performance in this phase.

Operating difficulties began to occur immediately when char was added to the gasifier. First, the char-dolomite interface in the gasifier did not form and a mixture of the two materials was transferred to the regenerator where the char was burned. The circulation was stopped and an attempt was made to establish a char inventory in the gasifier. However, reliable feed from the lignite lockhopper into the gasifier could not be maintained. In addition, the differential pressure measurements in the gasifier bed were distorted by leaks at the taps and in the impulse lines.

Raw dolomite was force-fed through the char feed line via a "shot pot" in order to break the apparent plug in the feed line and simultaneously establish a char-acceptor interface. When some of the char-dolomite mixture in the boot was transferred to the regenerator, a local hot spot developed in the dolomite transfer line causing the line to rupture. The hot spot occurred when char was burned in the regenerator lift line by the regenerator recycle gas which was essentially air.

Based on the experience gained during July's operations, Consol has revised the operating procedure to permit safe and successful operation of the plant without relying on a clean dolomite-char separation in the boot. In the revised procedure, no material will be transferred from the boot until the regenerator recycle gas has become inert. The inerting will be achieved by transferring char from the gasifier via the char transfer line using inert gas as carrier. The presence of an interface, although desirable is not

essential to the success of the process since the char transferred with the dolomite can be compensated for by reducing the amount of char transferred to the regenerator by the char lift line.

The problem of achieving char feed from the lockhopper was studied using a glass model. The model studies showed that a persistent plug formed when char was fed from a leak-free lockhopper into a fluidized bed. Formation of the plug was easily prevented by the addition of small purge flow to the feed line. The lockhopper system purges in the plant were ineffective due to leaks in the piping and through closed valves. Effective operation should be accomplished after eliminating leaks in the system.

Reliable operation of the bed pressure measurements will be achieved by back welding the pressure tap assemblies and thoroughly leak testing the impulse and purge piping.

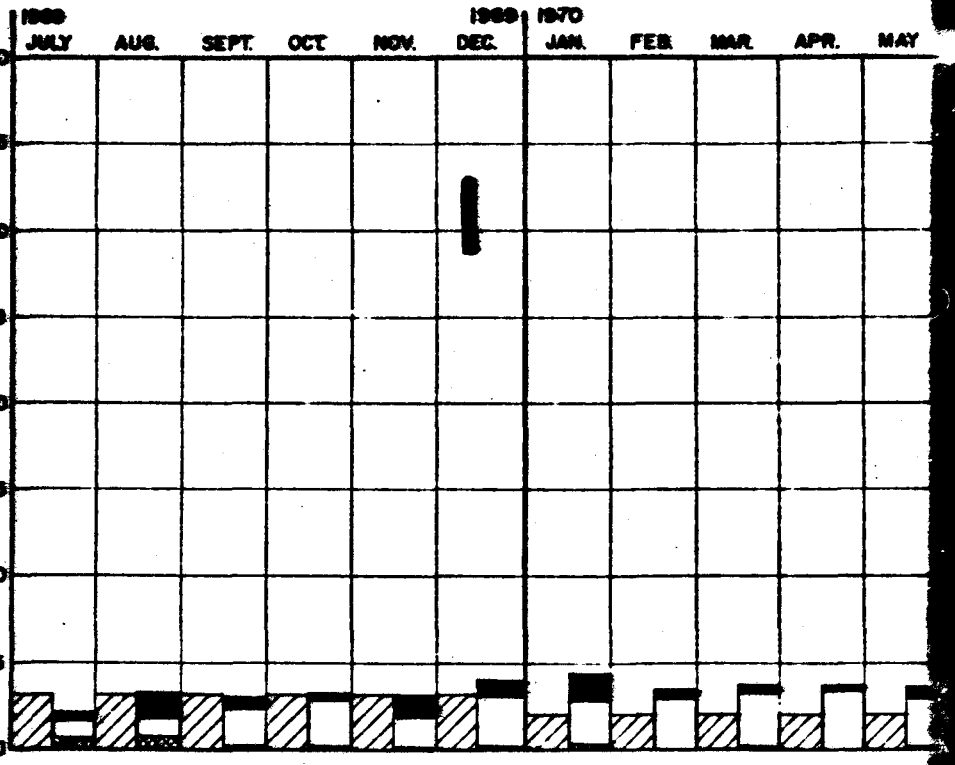
Operations will resume after the ruptured line has been rebuilt.

C. E. Fink

U. D. Marwig

CEF-UDM:lmp

Att. - Stearns-Roger Operations Report No. 29



MONTHLY EXPENDITURES*

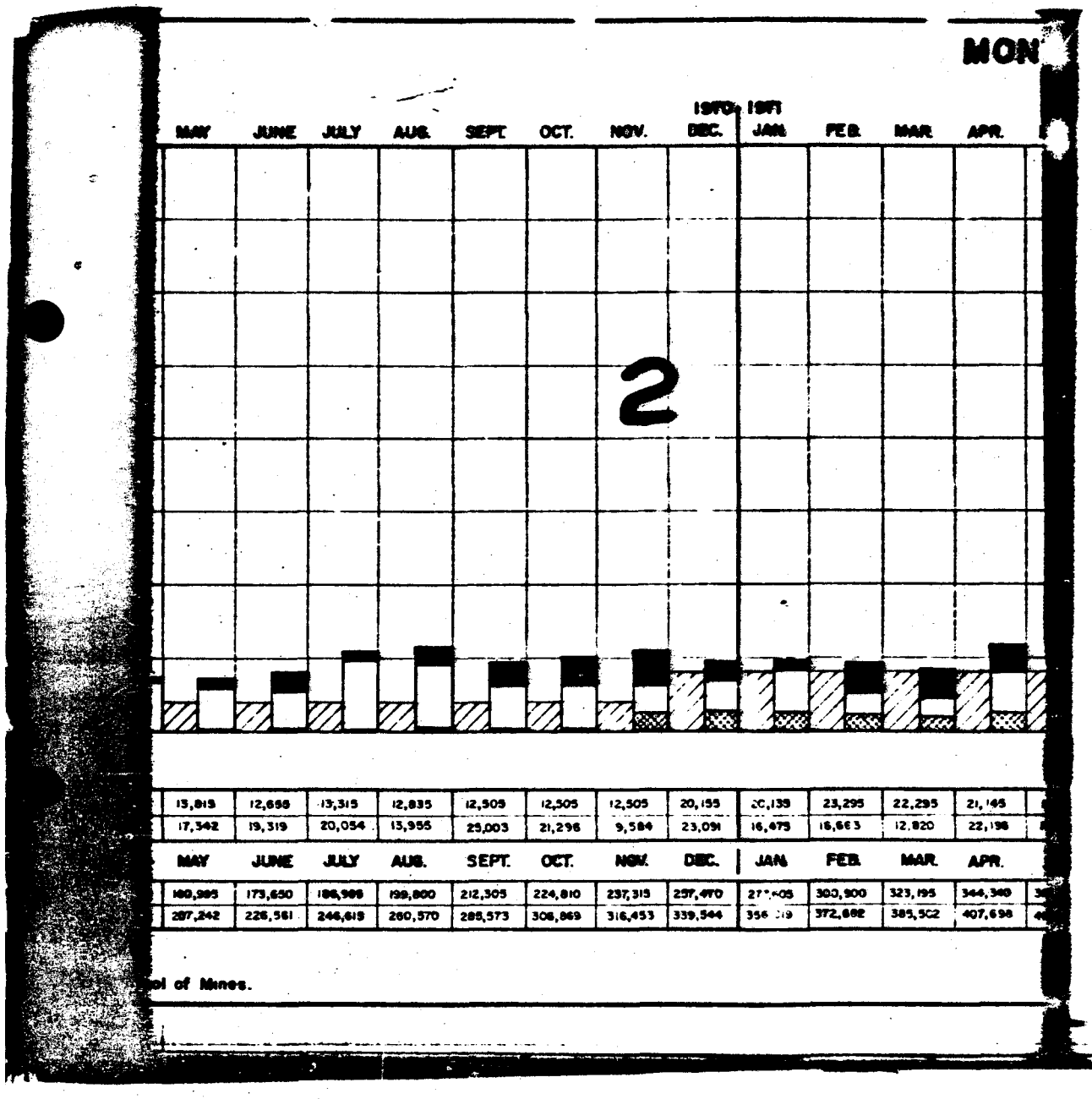
	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY
PREDICTED	18,215	14,685	14,965	13,155	14,385	17,085	15,585	15,595	12,655	12,875	13,815
ACTUAL	11,746	34,734	9,609	11,825	10,130	15,206	14,378	14,027	15,019	53,228	17,342

CUMULATIVE EXPENDITURES*

	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY
PREDICTED	18,215	30,900	45,865	59,020	73,405	90,470	108,055	121,650	134,305	147,180	160,995
ACTUAL	11,746	46,479	56,088	67,913	78,043	93,249	107,626	121,653	136,672	189,900	207,245

*Expenditures Include All Costs & Fees By Consel And S. Dakota School of M.

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	13,819	12,658	13,315	12,835	12,509	12,505	12,505	20,155	20,139	23,295	22,295	21,145
	17,342	19,319	20,054	13,955	29,003	21,296	9,584	23,091	16,475	16,663	12,820	22,198

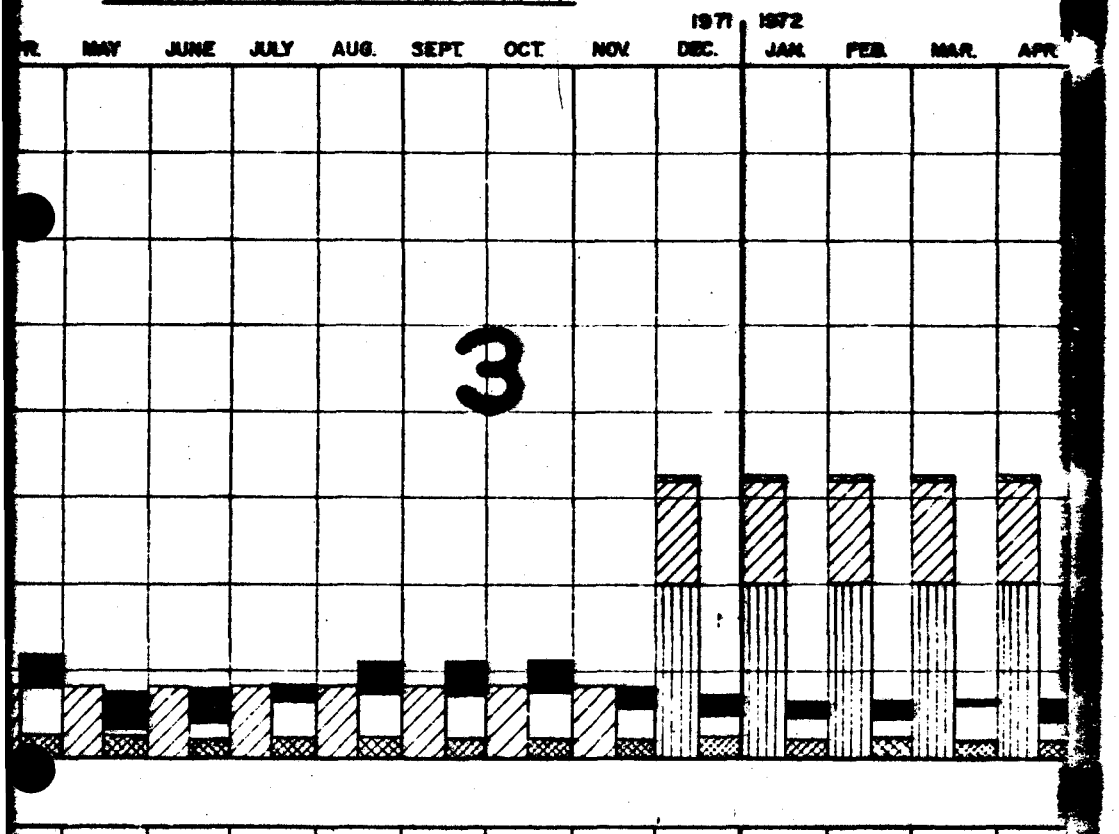
	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
	160,985	173,650	186,988	199,800	212,305	224,810	237,315	257,470	277,605	300,900	323,195	344,340
	287,242	226,561	246,615	260,570	285,573	308,869	316,453	339,544	356,019	372,682	385,502	407,698

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ONTHLY PROGRESS CHART (SUPERVISIC

CONTRACT No. 14-01-0001-415 (3)

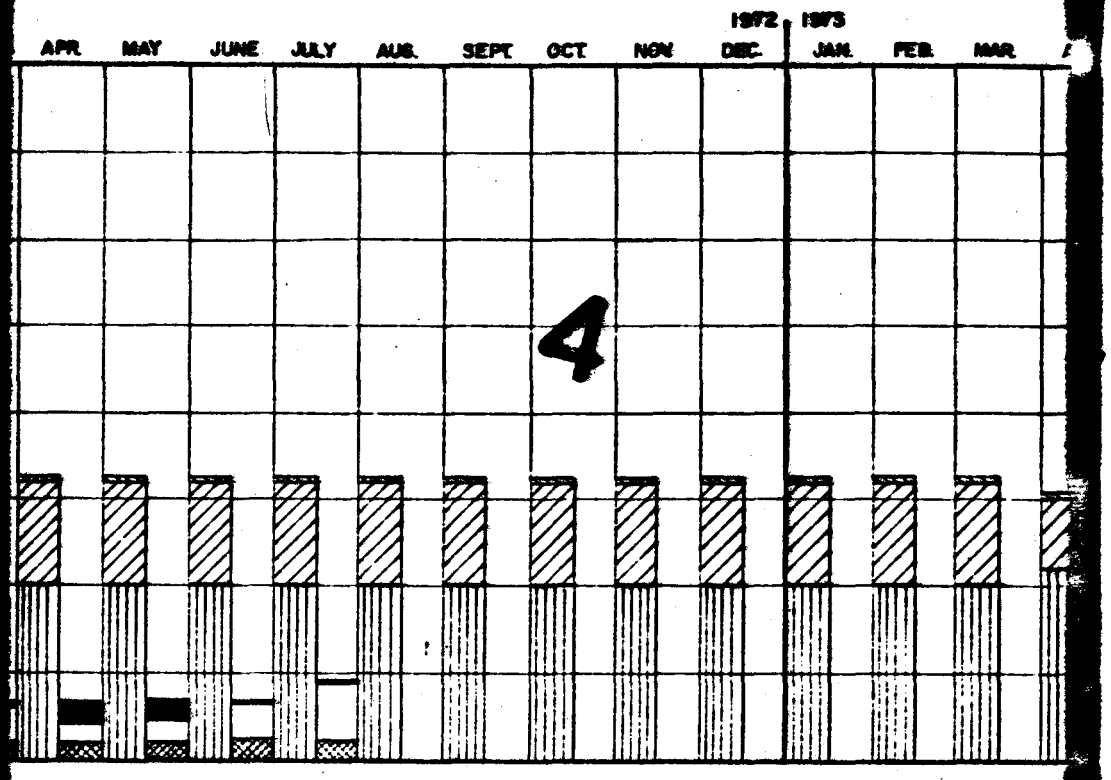


948	18,705	15,956	14,875	14,875	14,875	14,875	14,875	39,475	39,475	39,475	39,475	39,475
198	12,568	15,831	16,923	24,919	97,703	30,575	18,172	36,224	15,604	15,700	23,962	12,772

R.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
340	383,048	379,000	393,875	408,750	423,625	438,500	453,375	492,850	532,325	571,800	611,275	650,750
698	420,206	436,037	452,960	477,879	575,582	606,157	624,329	680,553	676,157	691,857	715,819	728,594

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ISION & LAB WORK)



39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	
12,772	28,047	29,900	19,800									

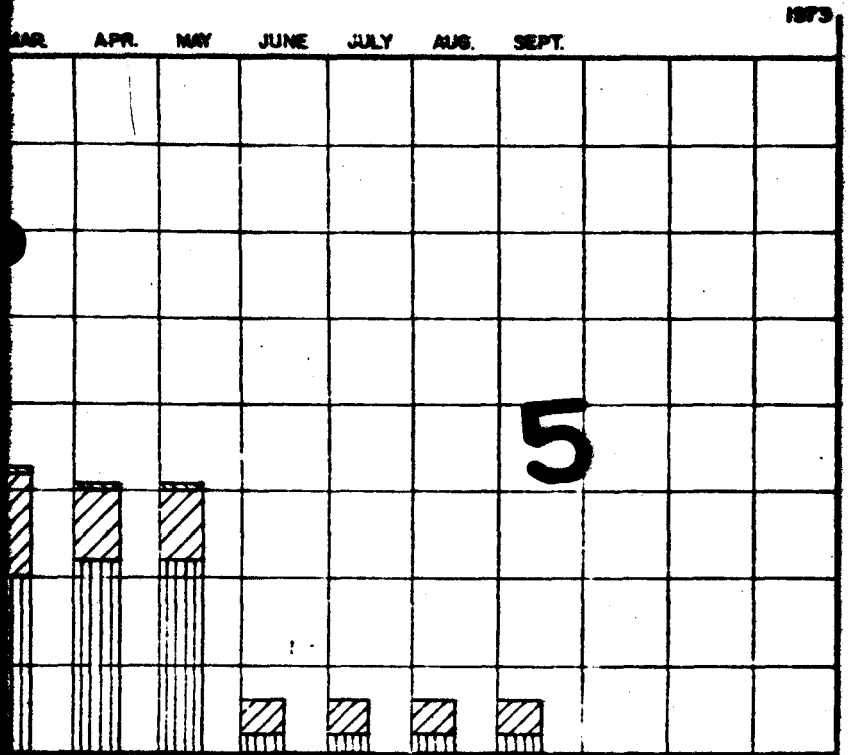
APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	
680,750	690,225	729,700	789,175	808,650	848,125	887,600	927,075	966,550	1,006,025	1,045,500	1,084,975	1,1
728,591	756,638	786,538	806,338									

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(Man 412 Chart)

DATE: July

1973



SUPERVISING
PROFESSIONAL
TECHNICIAN

(1) Includes S
(2)(3) Includes C

,475	36,075	36,075	11,475	11,475	11,475	41,120			

MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.			
4,975	1,121,050	1,157,125	1,168,600	1,180,075	1,191,550	1,232,670			

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[New 413 Chart]

DATE: July 1972

1973

	PREDICTED	ACTUAL
SUPERVISING		
PROFESSIONAL		⊛
TECHNICIAN		⊛⊛

⊛ Includes Supervisory Exempt Technicians.
⊛⊛ Includes Clerical.

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MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT No. 14-01-0001-415 (3)

CONSOLIDATION COAL COMPANY PROJECT

CSG PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #29

CCC Project No. 701
S-R Job No. B-37400
August 3, 1972

SUMMARY OF PLANT RUNS

A char grinding run was made July 5 with the stack flame detector jumpered to allow operation of the furnace without premature shutdown. The product char consist was acceptable for feed during gasification.

A second grinding run was initiated July 7 with the roller mill journals tied back 1/8 - 1/4 inch from the bull ring. It was hoped to obtain a better product char size distribution. However, the product was thought to be too coarse (high percentage larger than 14 mesh).

On July 8, all rotameters were set and pressure transmitters zeroed prior to gas circulation. The process heaters were lit on July 10 and the system was brought up to operating temperatures. Raw dolomite addition was started July 11 and dolomite circulation was initiated July 14. On July 16, char was introduced to the gasifier while circulating dolomite. Apparent mixing of char and dolomite resulted in char being transferred prematurely to the regenerator. Dolomite circulation was stopped and the equipment allowed to line out. Problems occurred with char feed to the gasifier and with plugged pressure taps for level measured at this time. This run was then terminated early on July 19, when a solids transfer line ruptured while transferring solids from the gasifier to the regenerator.

The last grinding run during July was made July 14 and 15 when the preheater vessel was filled. No difficulties were experienced with the grinding area. However, the percentage of char less than 100 mesh increased from 15-20 percent to more than 50 percent in the preheater. This was probably caused by several days fluidization of a stagnant char bed.

MONTHLY ACCOMOLISHMENTS-OPERATIONS & TECHNICAL

Two char grinding runs were made early in the month. On July 5, a run was made with the stack flame detector disconnected as it was thought that previous runs were terminated because of problems connected with this flame detector. A satisfactory run was made with no shutdowns. This run was made with the journals of the roller mill untied, and the size consist of the char was acceptable. A run, on July 7, was made with the journals tied back a distance of 1/8" to 1/4" from the bull ring. Particle size of the char from this run was too coarse and the journals were again untied for subsequent runs.

Revisions to the reactor system were completed sufficiently by July 6 such that a pressure test could be made. Several leaks were found, repaired, and gas circulated in the unit over the weekend of July 8th. The process heaters were lit on Monday, July 10, and Hot Gas Circulation tests again run with outlet temperatures brought up to 1450-1500°F. Dolomite was added to the system on the afternoon of July 11. Batches of dolomite were calcined in the gasifier and transferred to the regenerator as in the past. An operating level of dolomite was established in the regenerator on July 14 and circulation of dolomite started. In preparation for introduction of char to the gasifier, inert gas was introduced to the char lift line to eliminate any leakage of oxygen from the regenerator system to the gasifier. Oxygen is present in the regenerator as it is necessary to use the main air compressor to provide fluidization gas for the regenerator. Recycle gas, high in oxygen, is normally used in the char lift line.

On Sunday evening, July 16, char was introduced to the gasifier. Apparent mixing of char and dolomite in the gasifier boot caused transfer of char to the regenerator while circulating dolomite. This was evidenced by an increase in temperature at the top of the dolomite lift line which extends from the engager pot to the regenerator. This temperature increased from about 900° to 1400°F and back down to 900°F in the course of about 30 minutes. The bottom temperature point in the regenerator at the same time increased to 1650°F and held between 1650°F and 1700°F for about 2-1/2 hours. At the end of this time, solids circulation was stopped to establish a char operating level in the gasifier. Difficulties were also experienced in feeding the char to the gasifier from the lignite lockhoppers. In addition, the dolomite/char interface was difficult to locate, if at all. In an effort to better define this interface, raw dolomite was added from a new batch shot pot directly to the gasifier. After about 700 pounds of dolomite had been added, an apparent dolomite level was established in the gasifier boot. At this time, batchwise transfer of solids from the gasifier to the regenerator was started with continued batch feeding of dolomite to the gasifier.

At 3:30 A.M., Wednesday morning, July 19, the dolomite lift line from the engager pot to the regenerator ruptured. No injuries to personnel resulted. The system was shut down using the ESD systems. The dolomite lift line had over-heated causing the line failure. The gasifier and regenerator were then cooled and emptied.

Char and dolomite samples were used in running the fluidization model. Apparently separation of the char and dolomite in the system occurs only within a narrow range of gas velocities. The char feeding difficulties experienced in the Plant were investigated using the fluidization model after a side feeding line was installed into the char fluid bed area. The feeding difficulties experienced in the Plant were demonstrated in the model. Increasing fluidization velocities, reducing feed rates and adding a positive purge gas flow from the feed source appears to improve the ease of feeding. Over the weekend of July 29, each shift on duty observed and practiced this operation for training. A purge line has been added to the Plant's char feed line.

After the Plant shutdown on Wednesday, July 19, the preheater with about 12 feet of char in it was maintained on standby operation. Flame failures in the preheater furnace caused operating difficulties with the preheater system. The fluidized bed was slumped several times, however, re-fluidization was successfully established. During the weekend of July 22, the preheater and lignite lockhoppers were emptied to the lignite trailer and the char taken to the dump.

The quench tower seperators and foul separator were opened and inspected. The quench tower separators contained about a foot of dolomite/char mud. The separators have been cleaned and closed for future operation.

The gas inlets to the gasifier and regenerator quench towers were again partially plugged with a dolomite/char buildup. Water flow tests through the quench towers were made to determine if flooding occurred. No flooding was apparent, however, water does work its way into the gas inlet nozzles where dust collects and builds.

An obstruction in the regeneration air line near the regenerator inlet was discovered and removed. This obstruction, resulting from distortion and collapse of the heat shield liner sleeve, probably caused the high differential pressure observed across this line during the last run.

An additional 300 pounds of dolomite was removed from the bottom cone of the regenerator after the regenerator was opened for inspection. Besides some agglomerated dolomite, a small amount of clinker type material was found.

During the month, the liquid notrigen system tied-in for back up to the instrument air system was completed and tested. The operation of the emergency power generator on power failure was tested successfully.

Two automatic [illegible]s have been installed in the cooling water system so that upon a power f[illegible]e, cooling water can be supplied from the propane driven fire water p[illegible] Currently this pump is in the manual mode of operation because when the block valves are opened to the fire water system, the pressure bleeds down in a very short time and the propane fire pump starts. Slight modifications are being made so that the pressure does not bleed down from this system and the propane pump can be left in the automatic mode of operation.

The thermal oxidizer was tested successfully on water from the organic waste pond. Since this unit was designed to operate from the make gas from the reactor system, a supplemental natural gas line has been installed to make this unit operational.

Problems are continuing with the inert gas and "C" purge gas dyrer switching valves. These valves have again been replaced because of major leakages. Investigation into these problems is continuing.

The main air compressor second and third stage rings have failed several times recently. A plugged water trap between the first and second stages allowed liquid water into the second stage apparently causing the problem. Periodic blow down and trap maintenance schedules have been established. Tests on the compressor are continuing using a different ring material.

Several Technical Engineers were on shift from July 11 until the shutdown July 19, assisting in operations and recording voluminous data for the runs. Following the shutdown, a massive engineering effort was devoted to over forty inspection or change items to be accomplished during the turnaround. By the end of the month, basic engineering had been finished and all necessary materials ordered.

Following the pipe rupture on July 19, two engineers from the Stearns-Roger office in Denver and a metallurgist from the Conoco Engineering office in Ponca City were here to observe and evaluate the damage and to advise on reconstruction of the line. Results of laboratory metallurgical studies of several fragments and samples taken to the Ponca City laboratory are expected in mid August.

Chemists were on shift during the first part of the month. In addition to routine operating analyses, 107 gas samples and 37 char samples were analyzed. During part of this period the four shift chemists worked 12 hours on - 12 hours off, providing two analysts at all times in order to cope with the heavy load of samples.

Following the July 19 shutdown, chemists have been assigned to day shift. Variance data have been calculated for most analytical methods; two memorandums on the subject have been issued and the remainder will be issued in August. Development of a method for testing dessicant capacity has been deferred pending receipt of information from the manufacturer.

Ms. Mary Lou Mauch reported for work on July 14 as Junior Chemist and is in training on days pending assignment to shift work. Mr. J. W. Meeks reported for work as a "D" operator and is in training.

SAFETY

Seven safety meetings were held during July. Four safety meetings were held with maintenance and three with the Safety Committee. In addition, four fire brigade training sessions were conducted and two First Aid Refresher courses were held with a total of 27 men in attendance.

Sound level tests were made throughout the Plant. Three areas where ear protection must be worn are:

1) Boiler Room
2) Heater area
3) Preheater Furnace Air Compressor area

Two fire water monitor deluge fire nozzles were installed with two shifts being trained on their use. Pipe coding to meet OSHA requirements is near completion.

MONTHLY ACCOMPLISHMENTS-MAINTENANCE

During July, 168 work orders were completed, of which 60 were either urgent or a call out. In addition to the above work orders, seven items of equipment were checked as scheduled for 90 day preventive maintenance. Forty-four of the completed work orders were the result of the line rupture on July 19.

Again this month, over half of the maintenance man-hours were spent in making repairs resulting from plant shutdowns. The largest single item, which was started at month's end, is the reassembly of the transfer line from the engager pot to the regenerator.

PLANS FOR AUGUST

The objective for August is to complete the modifications, clean-up work and maintenance items started in July. Then we will attempt to carry out the items which were previously listed as plans for July in order to produce gas before the end of August.

Gasification will be accomplished by a successful conclusion of the following steps:

(1) Zero the level instruments and recalibrate and check out all other instruments.

(2) Start up and reestablish calcined dolomite circulation.

(3) Grind char into the tote bins rather than use the preheater initially. This will reduce the less than 100 mesh in the char feed to the gasifier.

(4) Transfer char from the tote bins to the lignite lockhoppers. Flow char into the gasifier and establish char level. Convey char into the regenerator thus beginning the calcination of the $CaCO_3$ portion of dolomite to CaO. Complete calcination of the dolomite.

(5) Admit steam to the gasifier. This operation will start the gasification reaction of char to carbon monoxide, hydrogen and some methane. Line system out and prove operability of dual fluid beds, continuous calcination, solids transportation and gasification.

STAFFING

	Current Manpower Effective 8-1-72	To Be Hired in August
Management	1	0
Accounting	5	0
Clerical	6	0
Janitorial	2	0
Safety	1	0
TECHNICAL DEPARTMENT		
Laboratory	7	2
Engineering & Scheduling	11	0
OPERATIONS		
Supervisors	2	0
Shift Engineers	4	1
Instrument Engineer	0	1
Operators	43	1
MAINTENANCE		
Supervisors	4	0
Crafts	26	0
Warehouse & Purchasing	3	0
TOTAL	115	4

COSTS

Accumulated Operations Cost to Date, July 31, 1972	$3,759,192.55
Purchase Orders Not Paid & Purchases Placed	57,398.60
Actually Spent - July 1972	243,686.33
Accumulated Cost Billed to Date	3,709,178.83

Very truly yours,

STEARNS-ROGER CORPORATION

R. G. Checksfield
Plant Manager

BGC:ska
cc: D. D. Marwig, C. E. Fink, D. C. McCoy - Consol
Dr. J. D. Sudbury, J. A. Phinney, C. A. Schulz - Library
Dr. Roger Detman, Dr. Derek Waller - C F Braun
C. M. Stone, D. H. Dawson, V. L. Brant - Denver
MHV, HLL, DLD, WTB, COB, NRK, IT. KWM, JDR, HAJ, EBW, EMF, GDF, MTH, JPL, File

Attachments: OSHA Report, Organization Chart, Schedule (Progress Chart)

STEARNS-ROGER CORPORATION
MONTHS ENDED July 31

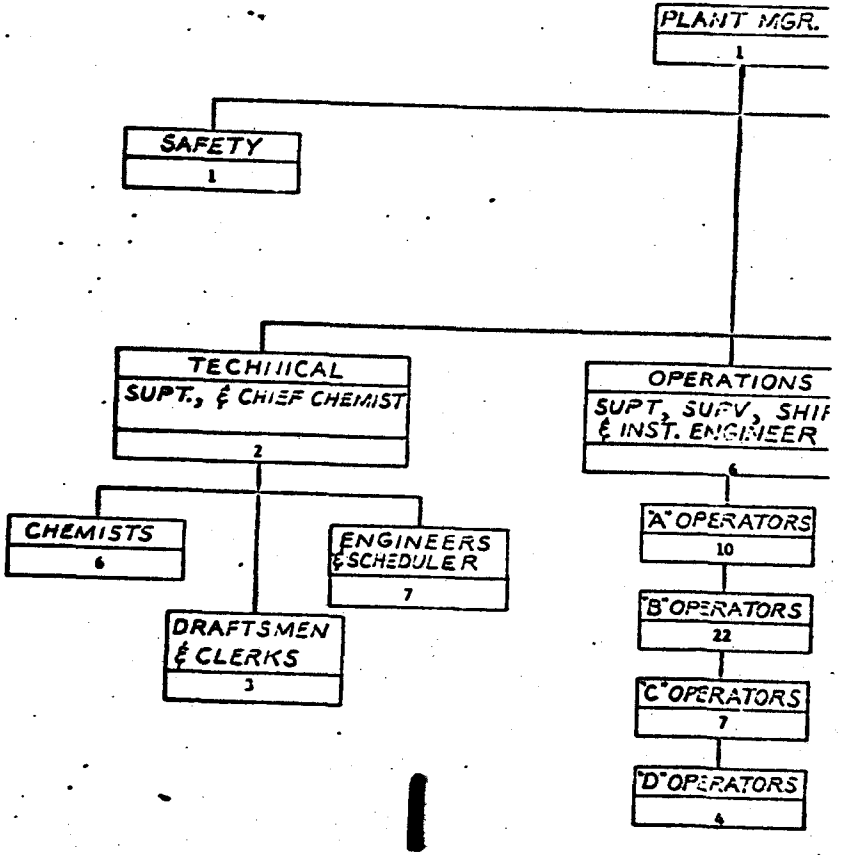
OSHA REPORT

MINE NAME	MINE NO.	NUMBER OF LOST TIME ACCIDENTS: NON-FATAL	FATAL	TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED
Research Division	100					
Rapid City	200	0	0	0	0	20046
Total Research						

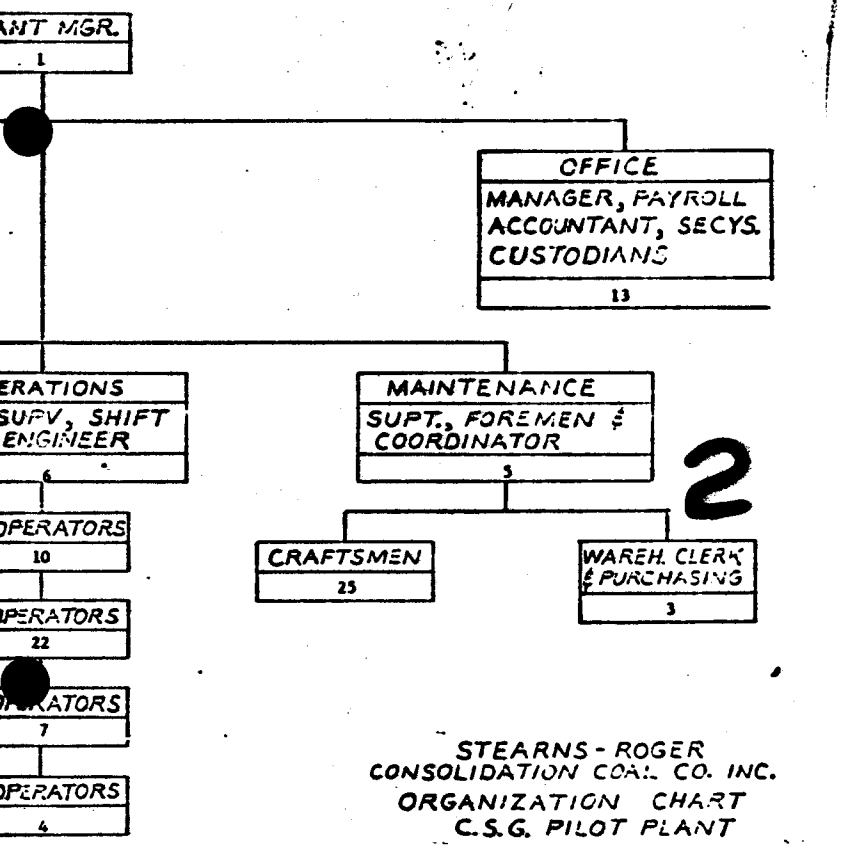
BAKER CORPORATION
July 31, 1972

DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUCED	FREQUENCY	SEVERITY	TONS PER LOST TIME ACCIDENTS	MAN COUNT
0	20046	0	0	0	0	115

2



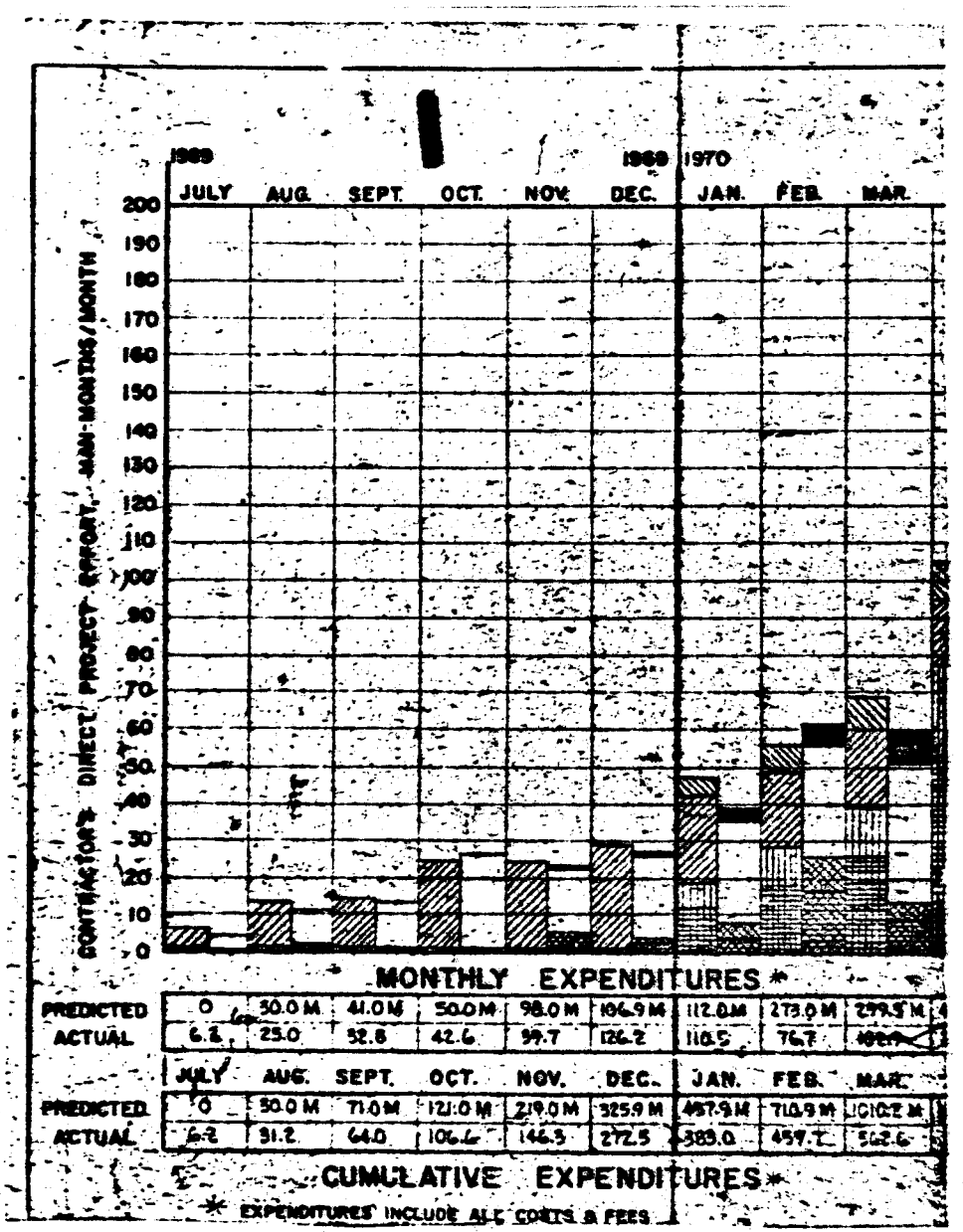
Total.....115

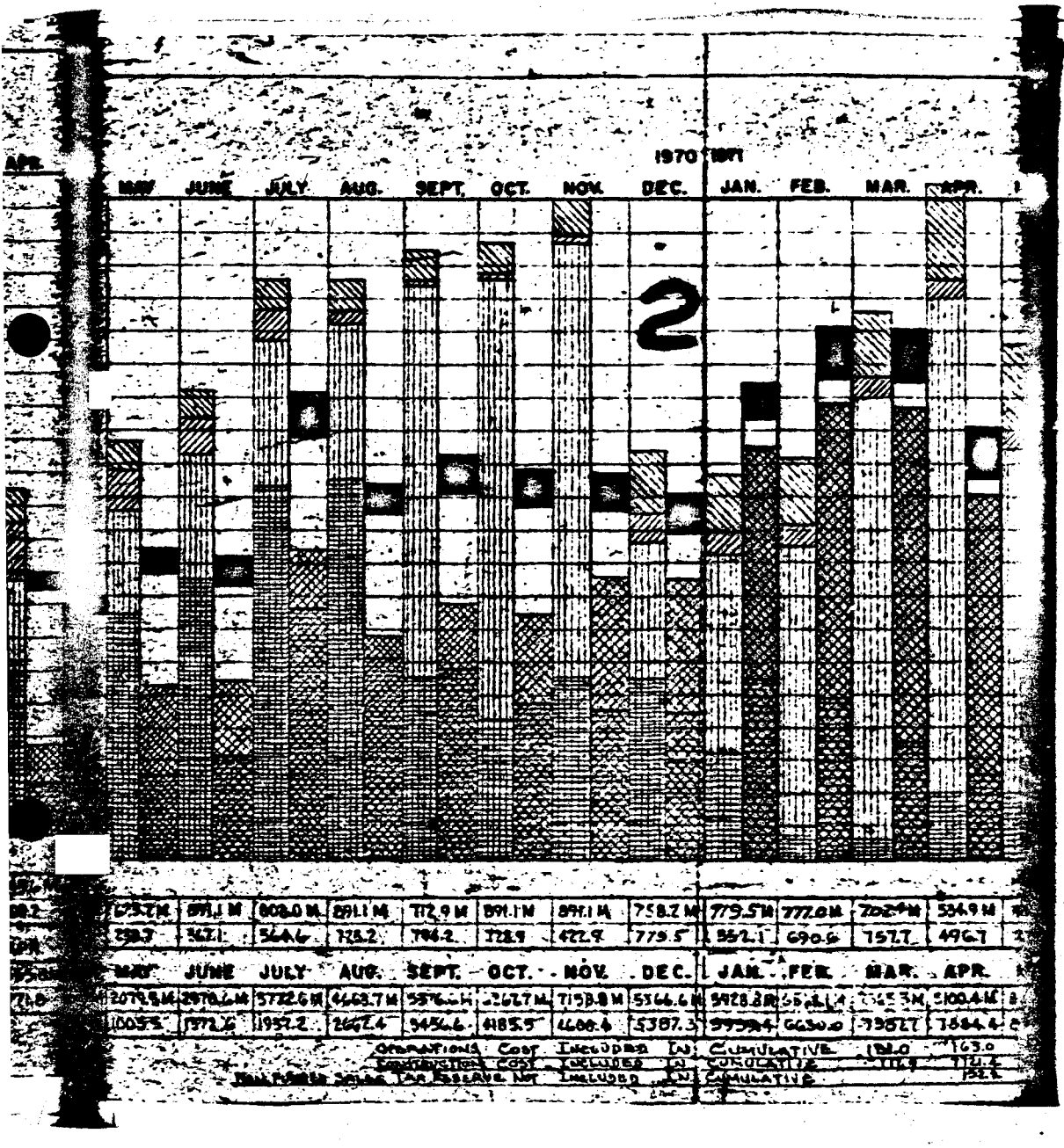


STEARNS - ROGER
CONSOLIDATION COAL CO. INC.
ORGANIZATION CHART
C.S.G. PILOT PLANT

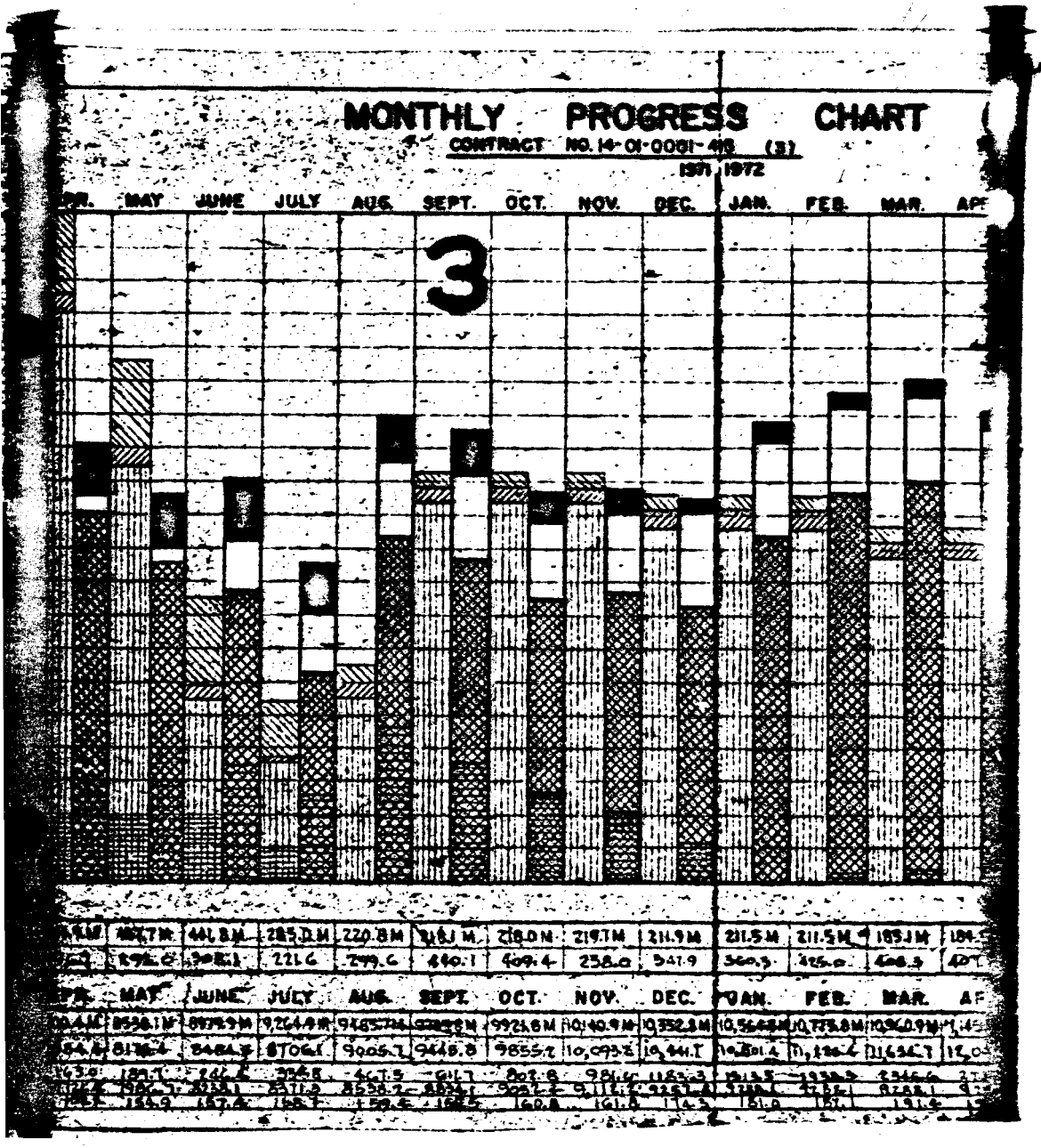
W.D. MEEKS NONE

11-3-71 SK-56

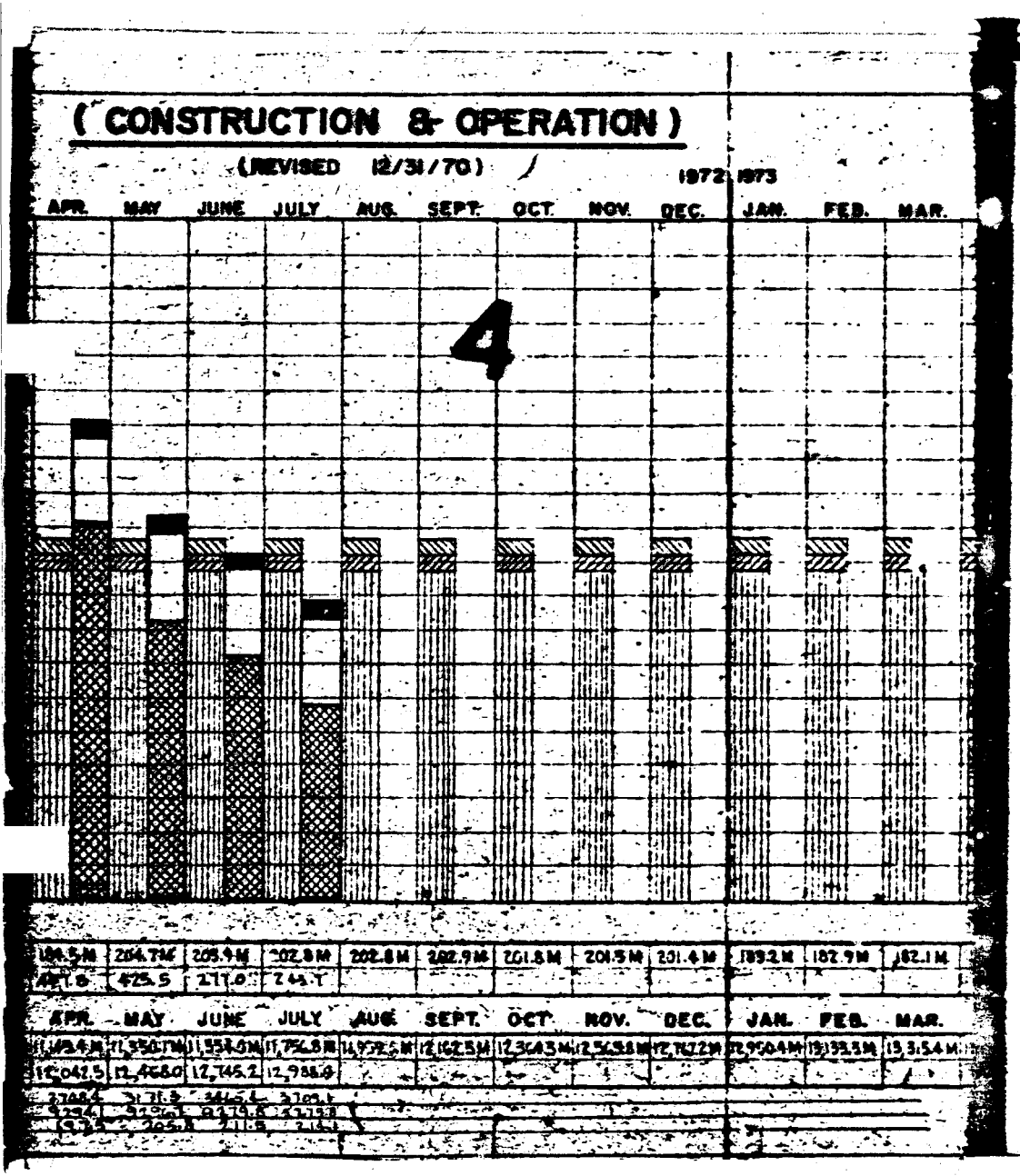




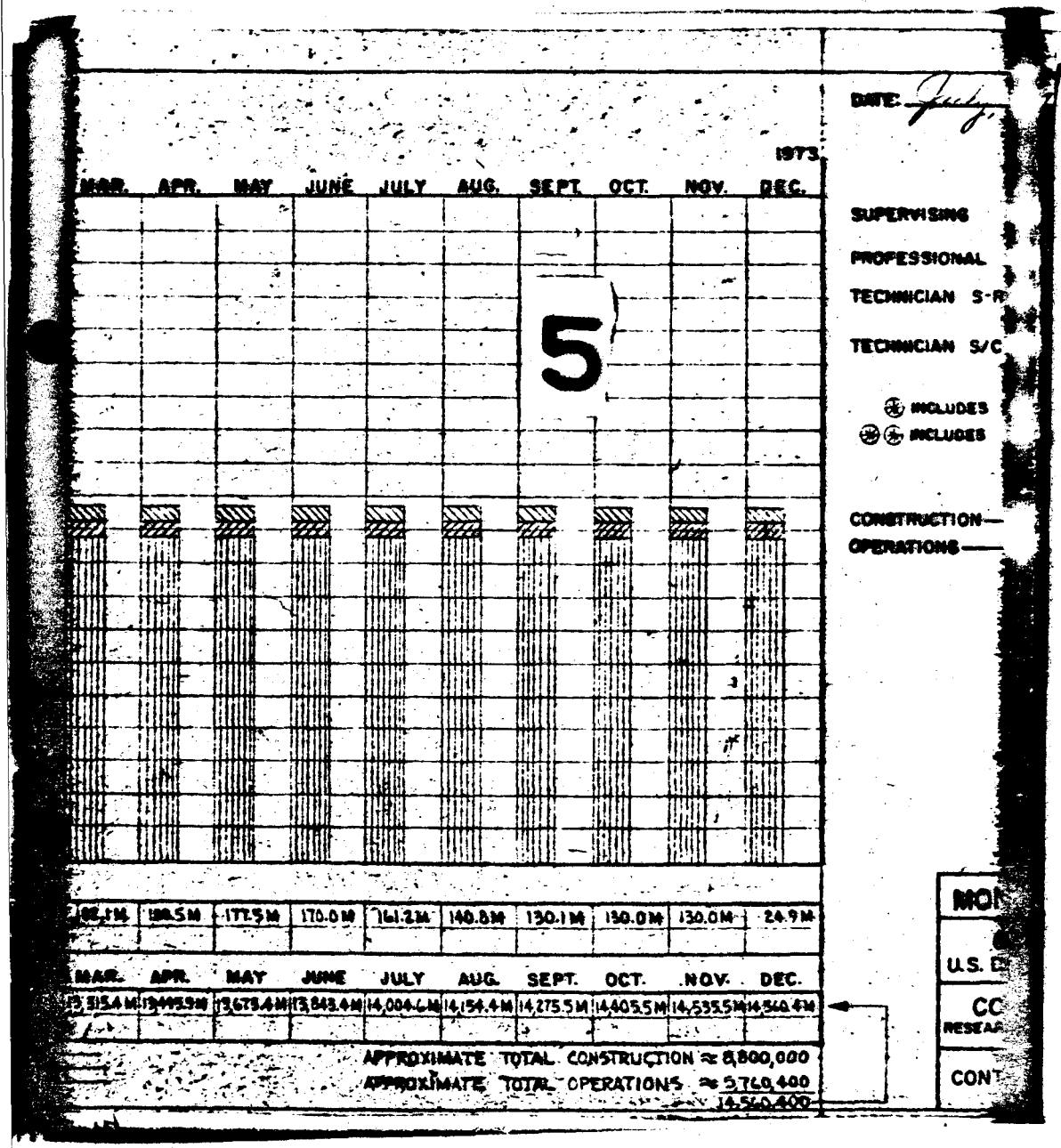
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MONTHLY PROGRESS CHART
CONTRACT NO. 14-01-0001-415 (3)
1971 1972
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR.
3

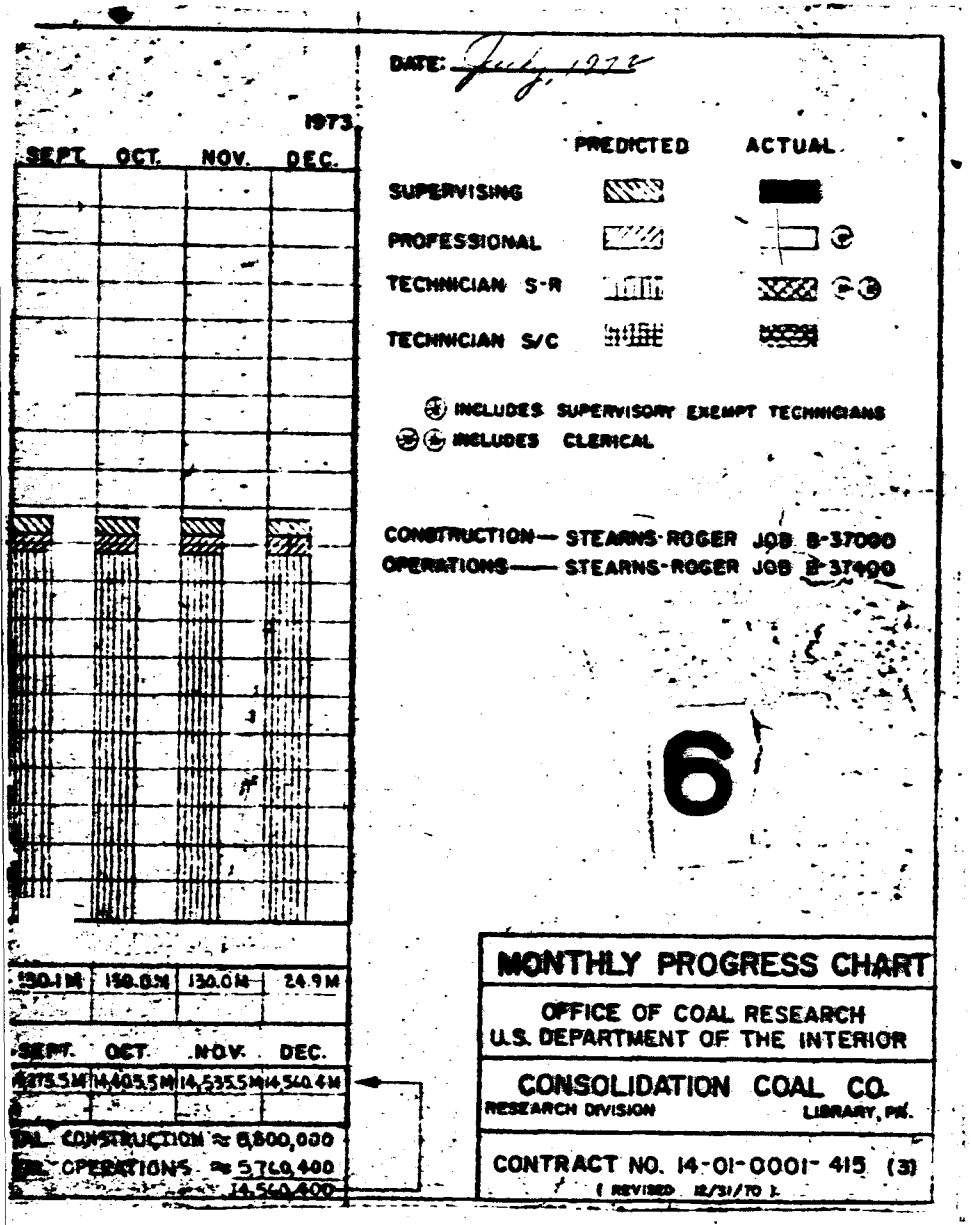
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(CONSTRUCTION & OPERATION)
(REVISED 12/31/70)
1972 1973
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR.
4
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR.

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DATE: July
1973
MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
5
SUPERVISING
PROFESSIONAL
TECHNICIAN S-R
TECHNICIAN S/C
INCLUDES
INCLUDES
CONSTRUCTION
OPERATIONS
188.5M 177.5M 170.0M 161.2M 140.8M 130.1M 130.0M 130.0M 24.9M
MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
3,315.4M 3,493.9M 3,673.4M 3,843.4M 4,004.6M 4,154.4M 4,275.5M 4,405.5M 4,535.5M 4,560.4M
APPROXIMATE TOTAL CONSTRUCTION ≈ 3,800,000
APPROXIMATE TOTAL OPERATIONS ≈ 5,760,400
14,560,400
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CONT

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SUBCONTRACT BETWEEN CONSOL AND BATTELLE CONSOL CO. ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR JULY, 1972

I. General

The subprojects on acceptor reconstitution, carbonate resources, and beneficiation were largely involved in preparation of final or interim reports during July. These are being reproduced and should be transmitted by the middle of August. On noxious element analysis of lignite, atomic absorption techniques are superior to X-ray fluorescence methods and a wet oxidation method using nitric, sulfuric, and perchloric acids is quite rapid and useful for large samples. Data from continuous wastewater monitoring is included but stack gas monitoring still awaits installation by Stearns Roger. A meeting was held on July 26 with John Sudbury and Dan Marwil of CONSOL and Lowell Miller of OCR to discuss potential extension of research areas.

II. Carbonate Resources (Mickelson)

The final report is being typed and tables, data, etc., are prepared for reproduction. The principal investigator had hoped to complete in full by this time but lost time during the flood and in July because of illness. There is much data to reproduce for the appendices but the report should be forwarded during the month of August.

III. Acceptor Reconstitution (Fuerstenau)

A preliminary report summarizing the entire work and data to date is complete and in the typing stage. Transmittal should be by August 10. These diagram data show some deviation from the data of Wylie and Tuttle.

IV. Noxious Elements (Liegard)

Attempts at determination of trace elements by X-ray fluorescence following their concentration by ion-exchange or by chelation and extraction were less successful than previous methods employing atomic absorption methods and have now been abandoned in favor of the atomic absorption techniques.

A method of sample preparation involving wet oxidation with nitric, sulfuric, and perchloric acids has been used to effect a fairly rapid oxidation of significantly large lignite samples. This method of sample preparation and previously developed analytical techniques are being used to analyze samples on hand other than the lignite from Firesteel, South Dakota, for which most of the work has been done.

A request for extension of the project to allow determinations of the fate of the noxious elements during the gasification process has been made.

V. Lignite Beneficiation (Clarkson)

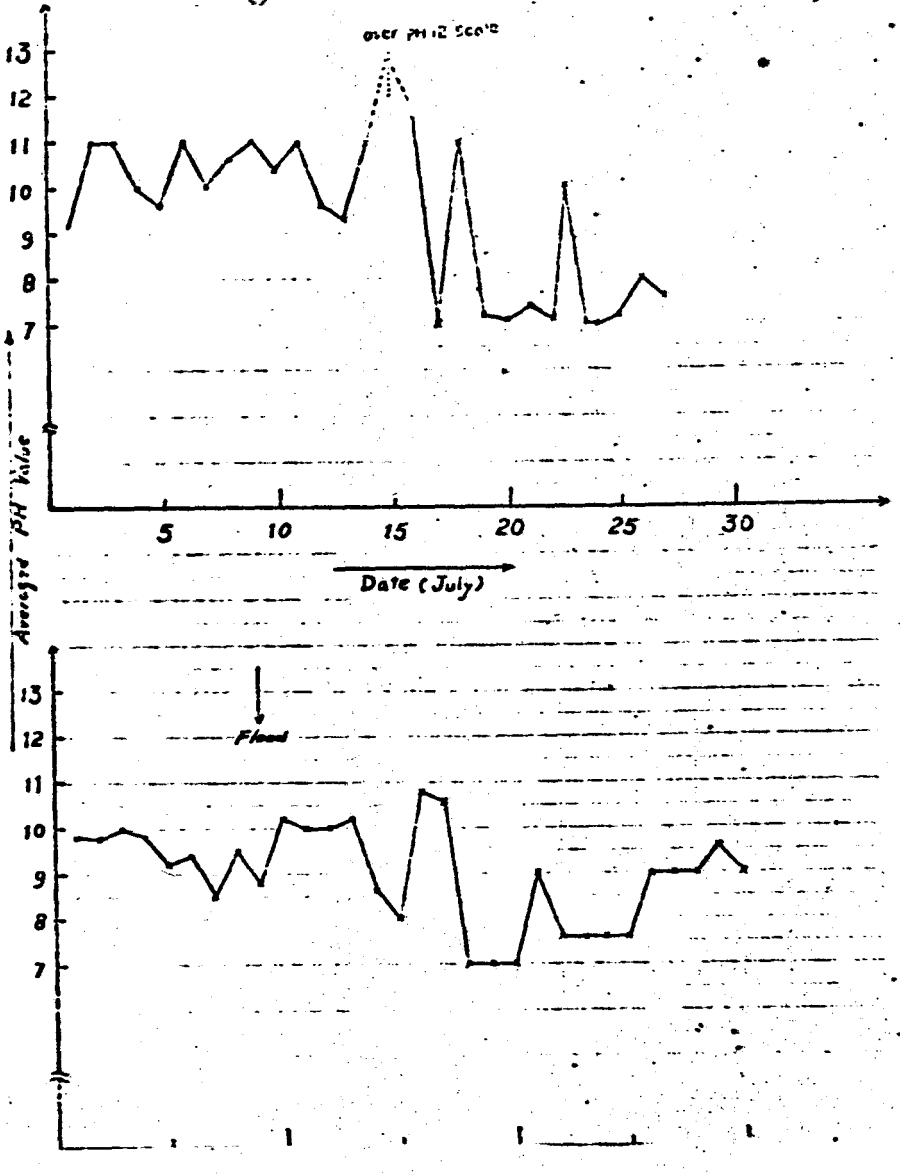
The final report is complete and typed. After completion of an internal review, the report should be transmitted by August 10.

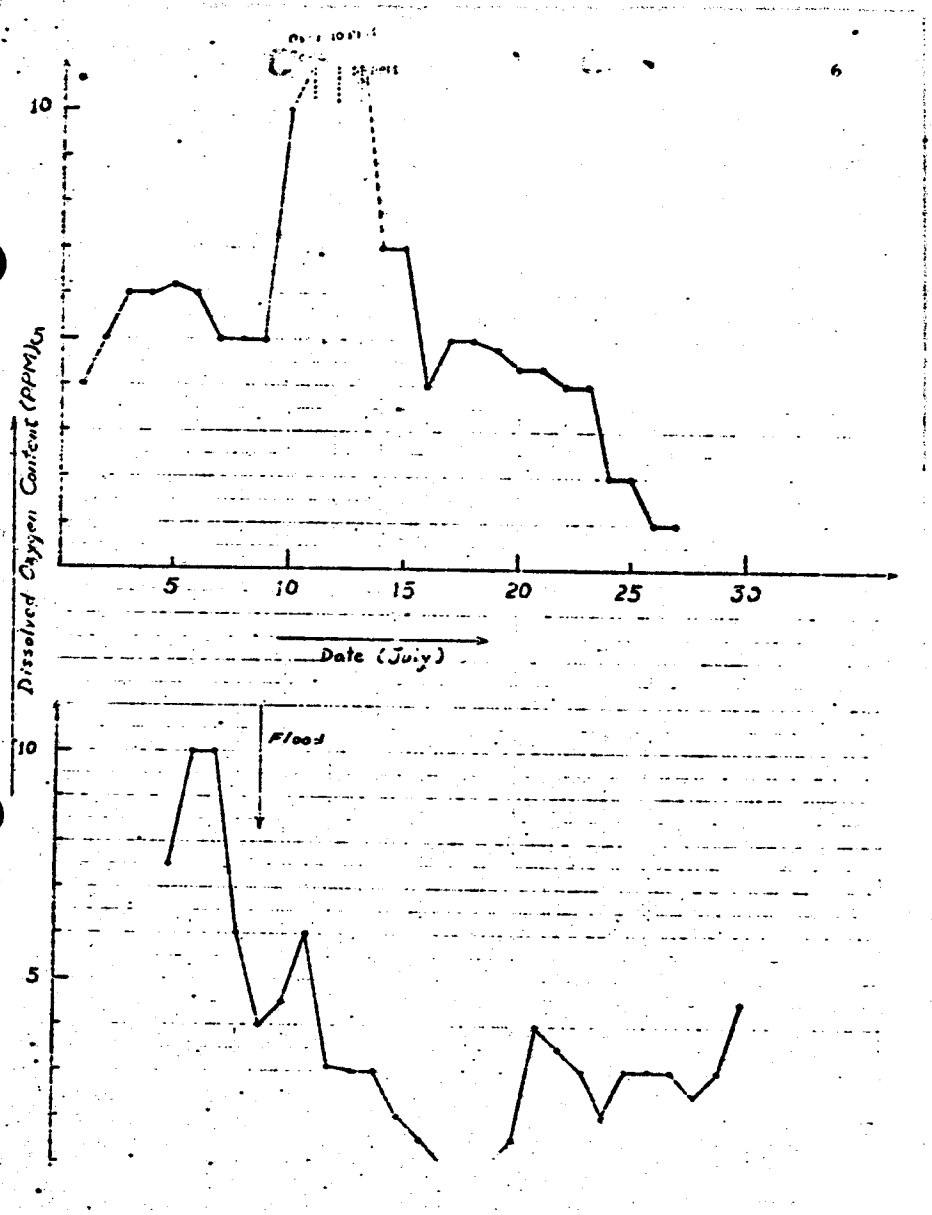
VI. Waste Monitoring (Oliver)

Copies of data from wastewater continuous monitoring are attached. This is presented in the form of a summary. We are retaining chart rolls containing continuous recordings of pH and dissolved oxygen content. Since each chart roll—covering a month's data—is 60 feet in length, duplication and inclusion of chart rolls in the report is impractical. For stack gas monitoring, we continue to await installation of cables, conduits, and an instrument station by Stearns Roger. Formerly it was planned to locate the instrument station, where the gas chromatograph

and several recorders will be located, at the ninth-floor level in the stairwell. Now it is planned that an instrument shed will be located on the tenth-floor level. Conferences and trips to the plant have been made to coordinate on this change in plans.

Mon.	June		July	
Date	PH Value	O_2 content	PH Value	O_2 content
1	9.6		9.2	4.0
2	9.8		11.0	5.0
3	10.3		11.0	4.6
4	9.9		10.8	5.0
5	9.2	7.5	9.6	5.0
6	9.4	10.0	11.0	5.0
7	9.5	10.0	10.2	5.0
8	9.5	6.0	10.6	5.0
9	9.8	4.0	11.0	5.0
10	10.2	4.5	10.8	10.0
11	10.0	6.0	11.0	> 10.0
12	10.0	3.1	9.6	> 10.0
13	10.2	5.0	9.3	14.6
14	8.6	3.0	11.0	7.0
15	8.0	2.0	> 12.0	7.0
16	10.8	1.5	11.5	4.0
17	10.6	1.0	7.0	5.0
18	7.0	1.0	11.0	5.0
19	7.0	1.0	7.2	4.3
20	7.0	1.5	7.1	4.4
21	9.0	4.0	7.2	4.2
22	7.6	3.5	7.1	4.0
23	7.6	3.0	10 → 7.0	4.0
24	7.6	2.0	7.0	2.0
25	7.6	3.0	7.2	2.0
26	9.0	3.0	8.0	1.0
27	9.0	3.0	7.6	1.0
28	9.0	2.5		
29	9.6	3.0		
30	9.0	4.5		
31				
Ave.	9.0	3.7 PPM	9.4	5.8 PPM





PROGRESS REPORT NO. 99
OCR CONTRACT NO. 14-01-0001-415(4)
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

August 1 to 31, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

A series of three (3) start-up attempts were made. These were all terminated due to difficulty in maintaining proper fluidization in the boot of the gasifier. This was determined to be due to by-passing of gases into cracks in the refractory and up along the walls of the gasifier. It was necessary to shut down operations for repair of the refractory. This is anticipated to be completed in September.

Although these runs did not result in gas production, several significant things were learned. Glass model studies pinpointed that gas leakage in the lockhopper system was responsible for problems in char transfer to the gasifier. Successful char addition into the gasifier was demonstrated.

Further, we transferred char through the char transfer system into the regenerator and accomplished a partial calcination of dolomite in the regenerator.

A dedication ceremony was held at the plant on August 18. Attendance and interest were excellent.

Financial

Estimated monthly expenditures are $35,950 by Consol and $269,200 by Stearns-Roger. Cumulative expense to date is $15,921,906.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536)

The final issue of the engineering and construction report was withdrawn to permit the inclusion of a new section describing 150 psi operations.

4. Stearns-Roger Construction Subcontract (Project No. 700)

Stearns' accountants are preparing to submit the final construction costs.

5. Library Assistance on Pilot Plant Operations (Project No. 537)

During the early part of the month, a considerable effort was devoted toward assisting in preparation for the plant dedication, which was held on August 18, 1972.

In the latter part of August several meetings were held both in Library and Rapid City to evaluate the problems that had occurred in the gasifier because of refractory failure. Liaison was maintained with the refractory installer, Bigelow-Liptak, and Consol participated with Stearns in arriving at a new refractory design for the gasifier.

Because of the finding of a blob of material in the hot gas gasifier entry line, Conoco experts were assigned to various metallurgical tasks, including sonic-gauge testing of hot piping and laboratory examination of test specimens.

Conoco also participated in evaluation of the refractory design.

Consol's instrument group initiated contact with various suppliers to find more suitable valves for the hot char lockhopper system.

Analysis of a solid deposit from Rapid City revealed the material to be 36.3% Iron, 33.5% Nickel and 28.6% Sulfur.

6. Consol Guidance on Operations (Project No. 702)

The progress report is attached.

7. Stearns-Roger Operating Subcontract (Project No. 701)

The progress report is attached.

8. School of Mines Subcontract (Project No. 703)

The August progress report is attached.

C. Subject Inventions

None.

D. Financial Status

Expense	Actual	Budget
Cumulative through July, 1972		
Through June, 1969	$ 1,878,256	$ 1,878,256
Consol	749,600	806,338
Stearns	12,988,900	11,756,800
	$15,616,756	$14,441,394
Expended in Period (estimate)		
Consol	35,950[1]	39,475
Stearns	269,200	202,800
Total - August, 1972	$ 305,150	$ 242,275
Cumulative through August, 1972	$15,921,906	$14,683,669

(1) Includes $11,350 payment to S.D.S.M.

CONSOLIDATION COAL COMPANY PROJECT

CSG PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #30

CCC Project No. 701
S-R Job No. B-37400
September 6, 1972

SUMMARY OF PLANT OPERATIONS

The plant was under repair until August 7. The system was leak checked and pressured to operating pressure through August 9. Dolomite addition was attempted on Friday, August 11, however, an inability to transfer dolomite from the gasifier resulted in a short shutdown on Saturday to clear the unit.

Dolomite was again added on Sunday with more gas required for fluidization in the gasifier than normal. As dolomite levels were being established, the regenerator bed slumped. This resulted in a blockage in the dolomite lift line near the regenerator. The unit was again shutdown and cleared of solids.

Early Wednesday morning, August 16, dolomite was added once again to the gasifier. An operating level of char was established in the gasifier by Friday morning. A new point in our operation was reached. Char was transferred successfully from the gasifier to the regenerator for several hours. Then the char transfer line became plugged. Attempts to remove the plug were of no avail. The unit was then brought down and readied for maintenance on Monday, August 21.

The balance of the month was spent in cleaning the system and making necessary repairs and changes.

MONTHLY ACCOMPLISHMENTS - OPERATIONS & TECHNICAL

The month started out with a major power failure on August 2 that resulted from lightning striking the plant feeder power line. The power outage lasted over 4 hours. Inverter power was maintained between 25 and 35 minutes. Since the plant Gai-Tronics communication system and the new telephone system is on inverter power, all plant communications were lost except for one outside telephone line that is set up for power failure situations. This situation has been corrected by the installation of selector switches that can put the communications system on either inverter power or the emergency generator. The lightning damaged the overload switch on the 2400 volt power supply system and the emergency generator switch gear on the transfer panel. A later power outage the same day burned out the transfer gear. The emergency generator could then be operated only in the manual mode until the transfer panel was repaired. Temporary power was supplied to the 2400 volt overload switch system so it too could be operated until permanent repairs were made to the above equipment on Monday, the 7th of August.

A meeting was held on the 3rd of August between Consol and Stearns in which the objectives and conditions for the next run were established. Four major changes were made in the operating procedures.

1) Only one lignite lockhopper would be used for the initial addition of dolomite and later addition of char.

2) The preheater system would not be used and char would be added via tote bins.

3) No dolomite circulation would take place during char addition to the regenerator from the gasifier.

4) The dolomite would be fully calcined prior to dolomite circulation so that the regenerator overhead gas would contain no oxygen.

The fluidization model was operated on freshly ground char. Feeding against a fluidized bed was easier with the new char than with the finer char that was removed from the preheater after the last run and tested in the model. A gas purge was still necessary to help with the feeding of char into the fluidized bed.

The reactor system was turned over to Operations for preliminary pressure testing on Monday, August 7. The system was pressured to 70 PSIG. Leaks were found and repaired on August 8. The system was repressured to 175 PSIG and additional leaks that were found were repaired. On August 9, gas circulation was established and the process heaters were lit off on Thursday, August 10, with the system at 150 PSIG. With process heater outlet temperatures at 1500°F reactor vessels inlet temperatures of about 1250°F were obtained on Friday afternoon. Dolomite addition was initiated Friday evening, but, because of the inability to transfer dolomite from the gasifier to the regenerator, or from the gasifier to the emergency dump hopper or to the purge dolomite dump hopper, the unit was shutdown. The reactors were cleared of dolomite and the unit was started back up with dolomite again being added by Sunday morning. Transfer of dolomite was not as smooth as during previous

runs and more fluidization gas was needed in the gasifier. However, dolomite levels were established by Monday morning in both the regenerator and the gasifier. During establishment of the dolomite levels, dolomite was added both through the lignite lockhopper and through the fresh dolomite lockhopper. Several problems occurred during the dolomite addition. The dolomite line from the gasifier to the engager pot blew back and upset the unit. The regenerator bed slumped and the lift line filled. With the slide valve in the lift line closed, it was possible to empty the lift line into the gasifier. Even though the lift line was cleared, a plug above the slide valve in the lift line could not be cleared, and the unit was brought down late on Monday, August 14. Several other plugged lines and the quench systems water separators were cleaned where necessary. Wednesday morning dolomite again was added to the system and levels were established. Dolomite levels were then maintained by addition of dolomite from the fresh dolomite lockhopper. No dolomite circulation tests were conducted during this run.

On Thursday, August 17, char addition to the gasifier was started. A working level was established in the gasifier by Friday, August 18, and transfer of char to the regenerator was initiated. Char was successfully transferred for several hours before the char lift line from the gasifier to the regenerator plugged Friday evening. Attempts to unplug this line while operating were unsuccessful. The unit was brought down and readied for maintenance by Monday, August 21. Several unusual plugs and deposits were as follows:

1) Gasifier electrode insulator material was found in the bottom nozzle of the gasifier.

2) Lumps of an iron-nickel sulfide material were found in the recycle gas line to the gasifier.

3) Chunks of dolomite were found in the char transfer pot.

By Wednesday, August 23, the bottom head of the gasifier had been removed for inspection of the gasifier "boot". Indications were found of severe by-passing of fluidization gas through the insulation. Refractory in the gasifier was removed up to the area just above the "boot". Some of the problems that continue to plague Operations are as follows:

1) Purge gas system dryer problems which result in high nitrogen usage.

2) Inert gas dryer problems.

3) Ash and spent dolomite lockhopper line and valve pluggages. Op Operating techniques, minor equipment changes and constant surveillance should help eliminate these problems.

Char and dolomite were received at the plant during the month. Over the weekend of August 5, char was ground to establish the amount of char that could be put in a tote bin and transferred to the lignite lockhopper without overfilling the lockhopper. Four tote bins of ground char were readied for the August run. Dolomite was purchased that requires no crushing, only screening for the elimination of fines and a small amount of oversize. The material received contained excessive fines as well as moisture. The moisture is a serious problem as it plugs the screens and proper sizing is not possible. During the month, a screen failed and new screens are on order.

The new lignite trailer tractor replacing the one damaged in the flood, was revised by the addition of the hydraulic drive system for the trailer screw conveyor. This system is being checked out.

Early in the month, the Technical Engineers and Draftsmen completed the numerous shutdown revisions initiated last month. Following that, regular engineering studies, revisions and maintenance assistance were resumed. Technical Engineers assisted operations on shift work for one week during the August run. A new group of approximately 40 engineering change orders were initiated following the August 21 shutdown.

Laboratory personnel were on shift during the August run. Following shutdown, they returned to day work and worked on non-routine projects, including development of new analyses and modification of laboratory equipment.

Some staffing changes were made during the month. G. D. Funk assumed the Shift Engineer duties of "A" shift replacing H. A. Jewell, who then resumed Technical Engineer duties. F. A. Plug reported to work on August 30 as Instrument Supervisor. J. R. Dimock was promoted from Instrument Technician "B" to Instrument Technician "A". R. L. Weaver was promoted from "D" Operator to "C" Operator. D. F. Foster was transferred from Janitor to Operations as a "D" Operator. B. G. Hickenbotham reported to work on August 28 as a Junior Chemist.

Mr. Sidney A. Berry, Electrical Engineer on leave of absence, passed away August 2.

On Thursday, August 17, the plant hosted about 100 visitors, many of which were from the press. They were given a press conference and a plant tour prior to the dedication. On Friday, August 18, our Coal Gasification Plant was dedicated by Mr. Hollis M. Dole, the Assistant Secretary of the Interior. Many visitors were in attendance.

SAFETY

Four safety meetings were held with maintenance and four with the Safety Committee.

The remaining two shifts were trained in the use of fire water monitor deluge nozzles. Also two of the four shifts were trained in the proper procedure using the rescue suit. One employee from the maintenance force received the same training.

MONTHLY ACCOMPLISHMENTS-MAINTENANCE

Seven items of equipment were checked as scheduled for 90 day preventive maintenance. During August, approximately 225 work orders were completed, of which 90 were either urgent or a call out. In addition to the above, 17 engineering work orders were completed.

The major carry over item from last month was the repair of the dolomite lift from the engager pot to the regenerator. The new insulation arrived Wednesday, August 2. Fabrication of the new line, reinsulation and installation was completed by August 7.

A major repair was started this month. That was clearing and cleaning the bottom section of the gasifier prior to reinsulating this vessel. The gasifier will have new refractory installed in the "boot" in September by Bigelow-Liptak.

PLANS FOR SEPTEMBER

The primary objectives for September are as follows:

1) Reinstall the "boot" section refractory in the gasifier vessel.

2) Modify the two quench tower inlets in an attempt to prevent the reoccurring restrictions.

3) Completion of approximately 40 shutdown items deemed necessary prior to another attempt at gasification.

Item one above was estimated to take two and a half to three weeks to install and cure the new refractory and replace both large heads on the gasifier. This item appears to be the critical path for this shutdown.

STAFFING

	Current Manpower Effective 9-1-72	To Be Hired in September
Management	1	0
Accounting	5	0
Clerical	4	1
Janitorial	2	0
Safety	1	0
TECHNICAL DEPARTMENT		
Laboratory	8	1
Engineering & Scheduling	11	2
OPERATIONS		
Supervisors	2	0
Shift Engineers	4	1
Instrument Engineer	1	0
Operators	44	2
MAINTENANCE		
Supervisors	4	0
Crafts	26	0
Warehouse & Purchasing	3	0
	116	7

COSTS

Accumulated Operations Cost to Date, August 31, 1972	$4,024,948.98
Purchase Orders Not Paid & Purchases Placed	49,710.82
Actually Spent - August 1972	269,249.10
Accumulated Cost Billed to Date	3,978,427.93

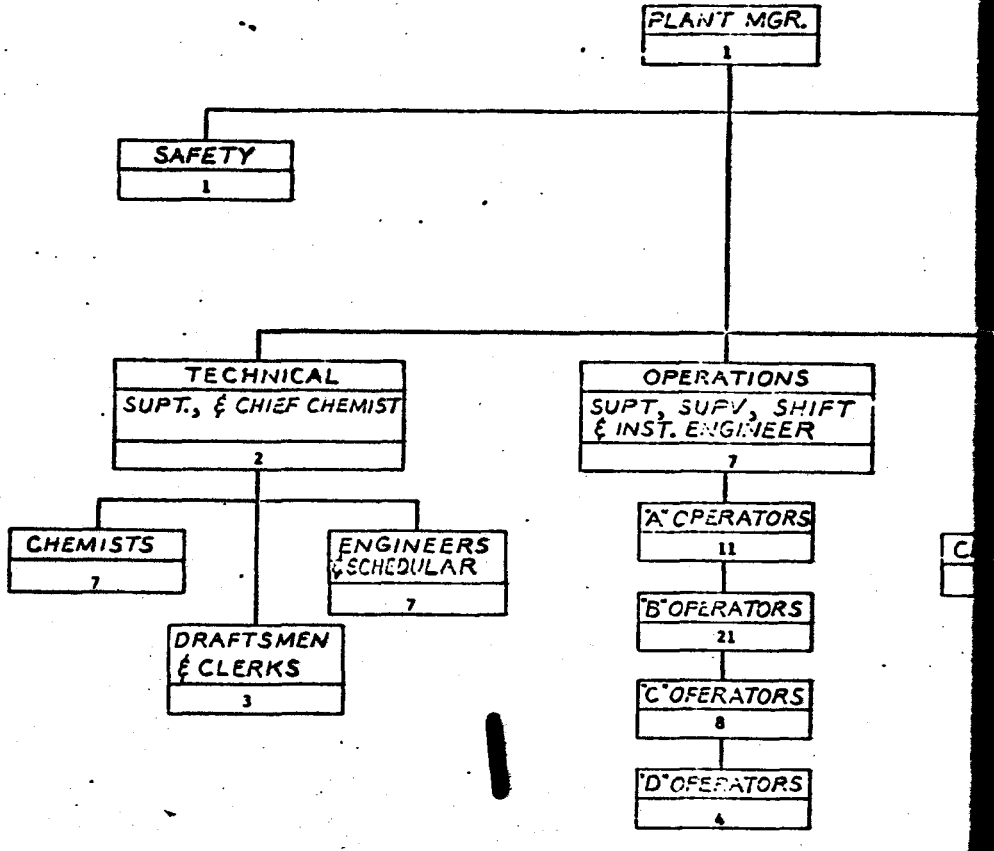
Very truly yours,

R. G. Checksfield
Plant Manager

RGC:ska

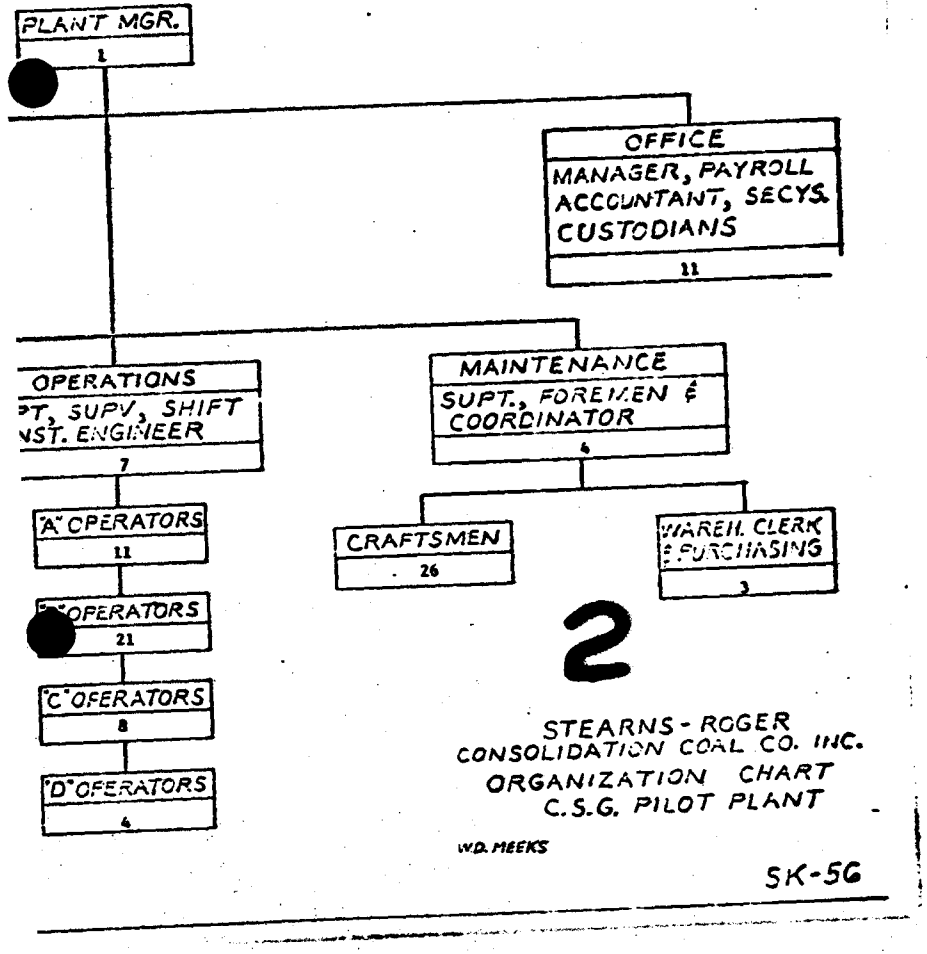
cc: U. D. Marwil, C. E. Fink, D. C. McCoy - Consol
Dr. J. D. Sudbury, J. A. Phinney, C. A. Schulz - Library
Dr. Roger Detman, Dr. Derek Waller - C F Braun
C. M. Stone, D. H. Dawson, V. L. Brant - Denver
MHW, HLL, DDD, WTB, COB, NRK, IT, KWM, JDR, HAJ, EBW, EMF, CDF, MTH, JPL, File (4)

Attachments: OSHA Report, Organization Chart, Schedule (Progress Chart)



Total.....116

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STEARNS-ROGER CORPORATION

August MONTHS ENDED 8-31 19

OSHA REPORT MINE NAME	MINE NO.	NUMBER OF LOST TIME ACCIDENTS NON-FATAL	FATAL	TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED	TO
Research Division	100						
Rapid City	200	-0-	-0-	-0-	-0-	19460.5	
Total Research							

1

LER CORPORATION
8-31 19 72

YS ST	TOTAL MAN HOURS WORKED	TONS PRODUCED	FREQUENCY	SEVERITY	TONS PER LOST TIME ACCIDENTS	MAN COUNT
-0-	19460.5		-0-	-0-		116

2

COPIES TO:

C. E. Fink
J. A. Phinney
C. A. Schulz
Central File

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CONSOLIDATION COAL COMPANY

RESEARCH DIVISION
LIBRARY, PENNSYLVANIA 15129

INTER-OFFICE CORRESPONDENCE

To : Dr. John D. Sudbury

Date : September 7, 1972

From : Duane C. McCoy and Uwe D. Marwig

At (Office): Rapid City, SD

Subject: Monthly Report No. 24 - Project 702

Three attempts were made to start up the plant during August. The first start up lasted 2 days (August 10-12). A plug formed in the gasifier boot which would not allow the transfer of dolomite to the engager pot or to the dolomite out hopper.

The second attempt (August 12-14) ended when the seal was lost in the dolomite transfer line between the engager pot and the gasifier. This caused the regenerator bed to slump and to fill the dolomite lift line between the control valve, XCV-2010, and the regenerator. All attempts to clear the line failed. The plant was shutdown.

The third start up (August 15-20) ended when a plug formed in the char transfer line between the gasifier and regenerator. Dolomite had at sometime, agglomerated in the char disengager pot. The transfer of char to the regenerator broke loose the dolomite causing the disengager pot outlet to plug. Back blowing the regenerator into the disengager pot only moved the plug into the char transfer line. Again the plant was shutdown. A report has been issued covering the three start up attempts.

Following the third shutdown, the bottom head was removed from the gasifier. Inspection of the head revealed that cracks in the hard inner refractory in the gasifier boot had allowed gas to erode channels into the soft outer refractory (J. M. Super X). These channels provided passages for the fluidizing gases to bypass the gasifier boot. The bypassing explains the erratic behavior and loss of boot pressure taps during the course of the these runs. Considerable gas bypassing also occurred in the upper 40 inch bed section. This explains the high char bed densities observed during char addition to the gasifier.

Efforts are now being made to eliminate the bypass problem. A new two-layer, monolithic, refractory liner will be installed in the gasifier boot. The new refractory is much harder than the old Super X

material. To eliminate gas bypassing in the upper bed section, two refractory vapor seals, which are to be 10 feet apart, will be installed.

The August operations provided the following information and benefits:

1. Experiments with the glass model had shown that a tight lockhopper system with properly maintained purges was necessary for char transfer from the lockhopper to the gasifier. This was further demonstrated to be true in the pilot plant.

2. Inspection of the crusted material in the bottom of the regenerator provided a warning. Attention must be given to the proper control of char combustion; otherwise, scale and clinker formation will be future problems in the regenerator.

3. Indications are that the outlet temperature for the gasifier recycle gas furnace must be maintained below 1500° F. Higher temperatures will cause the hydrogen sulfide, contained in the gases, to react with the furnace tubes and form an iron-nickel sulfide. Eventually this corrosion will cause tube failures.

4. Since so many start up attempts were made, operator experience in controlling the plant has improved. Operations are becoming more routine.

On August 17, plant tours were provided for members of the press. The following day, August 18, Mr. Hollis Dole, Assistant Secretary of the Interior, dedicated the plant. Afterward, the open house was well received by the public.

D. C. McCoy

U. D. Marwig

DCM-UDM:lmp

SUBCONTRACT BETWEEN CONSOL AND SDSMT RE CONSOL CO_2 ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR AUGUST, 1972

I. General

Reports summarizing work on the acceptor reconstitution (M. C. Fuerstenau) and sodium removal from lignite by ion exchange (J. Clarkson) were completed and transmitted to CONSOL for evaluation. The carbonate resources report was delayed because the principal investigator, Mickelson, required major surgery. Work summarizing the noxious element content is in progress. Data from wastewater monitoring during the month is included.

II. Carbonate Resources (Mickelson)

It was anticipated that the final report would be completed and forwarded during the month but the principal investigator required major surgery and was unable to get the report in final form. He has returned to work but will be at reduced capacity for several weeks. Briefly summarized, the work indicates there are large reserves of dolomite in minable thicknesses at several localities. However, the distances and rising costs of transportation necessitate considerably higher prices per ton for the dolomite delivered in the lignite areas than those used in the original cost evaluation of the CO_2 process by CONSOL. As a minimum, costs per ton of dolomite delivered to the lignite area would be at least 100 percent over the estimates in R&D Report No. 16, Interim Report No. 4 by Clancey and Marwig.

III. Acceptor Reconstitution (Fuerstenau)

Interim report was completed and transmitted to CONSOL for evaluation. The report is termed interim inasmuch as it is probable that additional

autoclave work will be done. However the report does contain the results of all work done to date.

IV. Noxious Elements (Lingard)

Data on noxious elements in lignite samples on hand is continuing to be accumulated. An interim report on this project is being prepared and is expected to be completed in October.

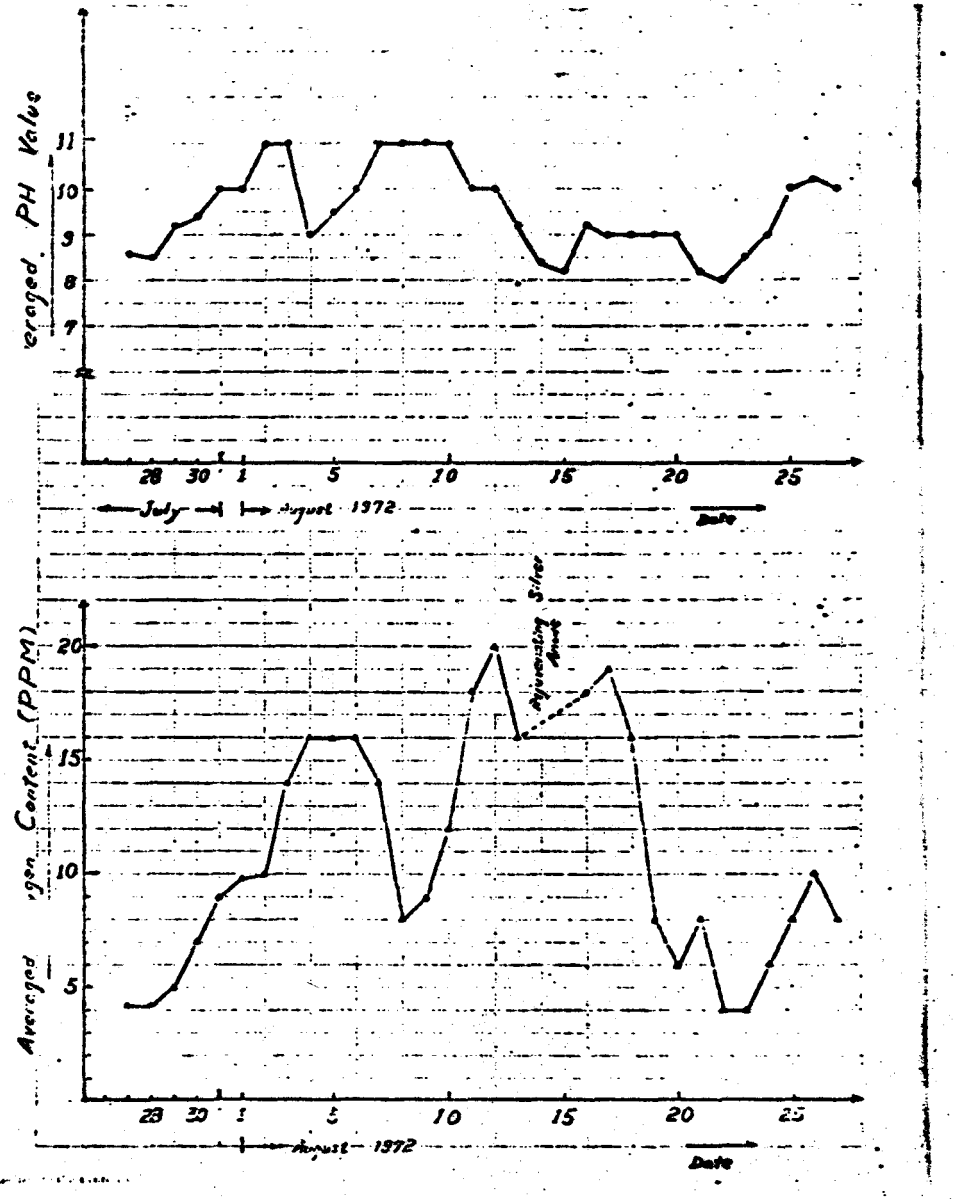
V. Lignite Beneficiation (Clarkson)

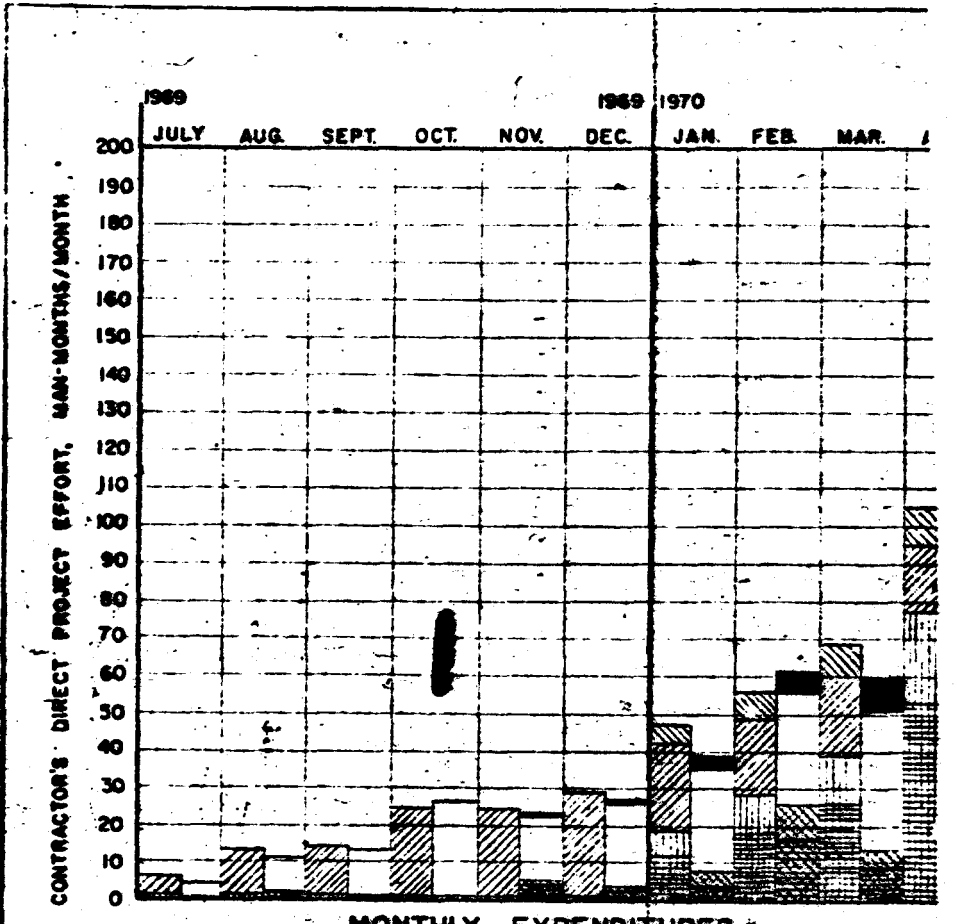
Final report was completed and transmitted to CONSOL for review.

VI. Waste Monitoring (Oliver)

Copies of data from the wastewater continuous monitoring over the past month are attached. For stack gas monitoring, Steerns Roger expects to have the cables, conduit, and instrument station on the tenth floor level completed by mid-September. As soon as this work is completed, the instruments will be installed and checked out and monitoring of stack gases will be started.

Date	PH value	Oxygen Content
July 29	8.6	4.2
30	9.4	7.0
31	10.0	8.0
August 1	10.0	8.0
2	11.0	10.0
3	11.0	14.0
4	9.5	16.0
5	9.5	16.0
6	10.0	8.0
7	11.0	12.0
8	11.0	8.0
9	11.0	8.0
10	11.0	12.0
11	10.0	8.0
12	10.0	20.0
13	9.2	16.0
14	8.4	Rejuvenator Silver
15	8.2	
16	9.2	8.0
17	9.0	8.0
18	8.0	12.0
19	9.0	8.0
20	9.6	8.0
21	8.2	8.0
22	8.0	4.0
23	8.5	4.0
24	9.0	8.0
25	10.0	8.0
26	10.2	10.0
27	10.0	8.0
Average	9.53	10.77





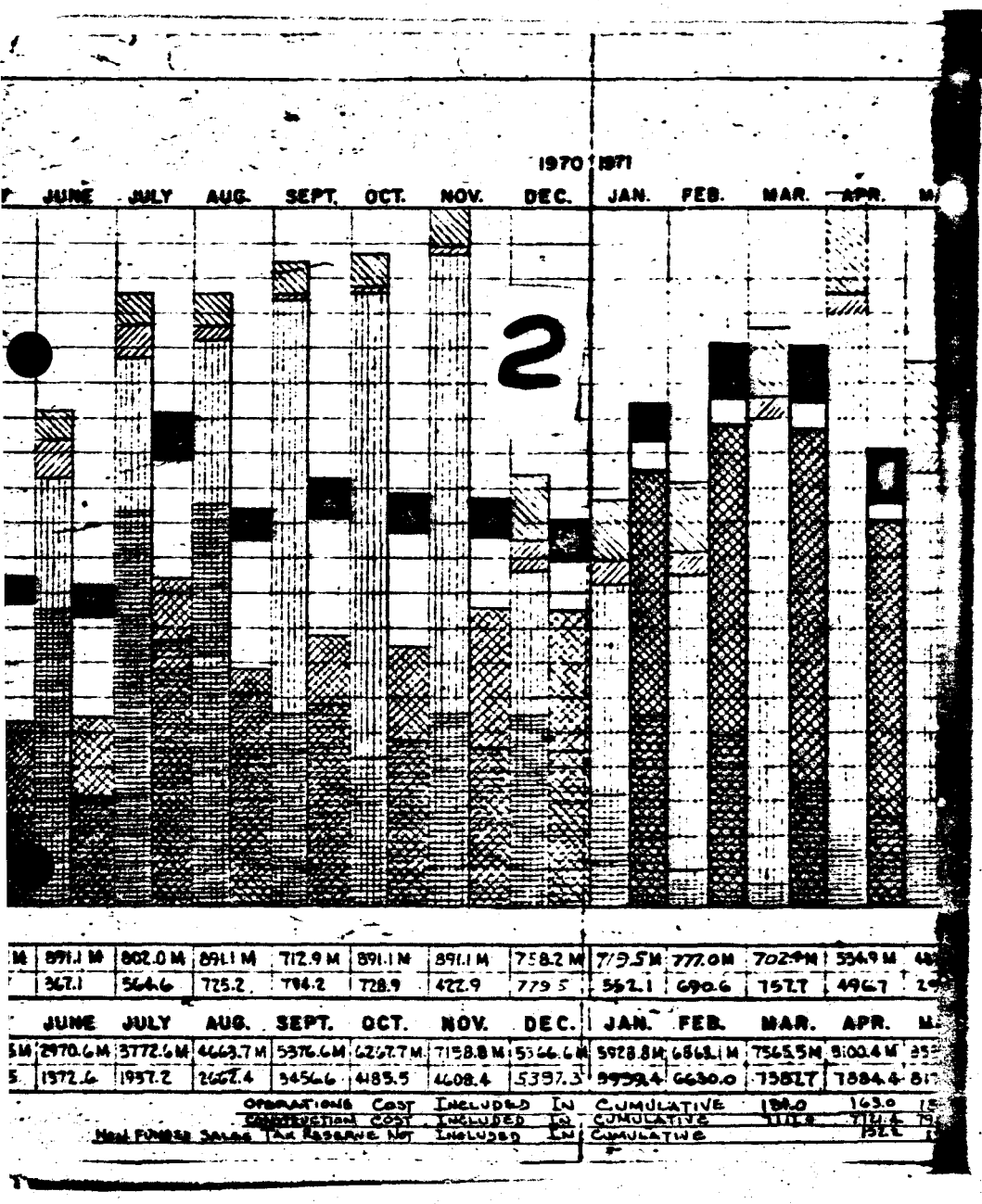
MONTHLY EXPENDITURES *

PREDICTED	0	30.0 M	41.0 M	50.0 M	98.0 M	106.9 M	112.0 M	273.0 M	299.5 M	443
ACTUAL	6.2	25.0	32.8	42.6	39.7	124.2	110.5	76.7	482.9	201

CUMULATIVE EXPENDITURES *

	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	...N.	FEB.	MAR.	AP
PREDICTED	0	30.0 M	71.0 M	121.0 M	219.0 M	325.9 M	437.9 M	710.9 M	010.2 M	145
ACTUAL	6.2	31.2	64.0	106.6	146.3	272.5	383.0	459.7	942.6	77

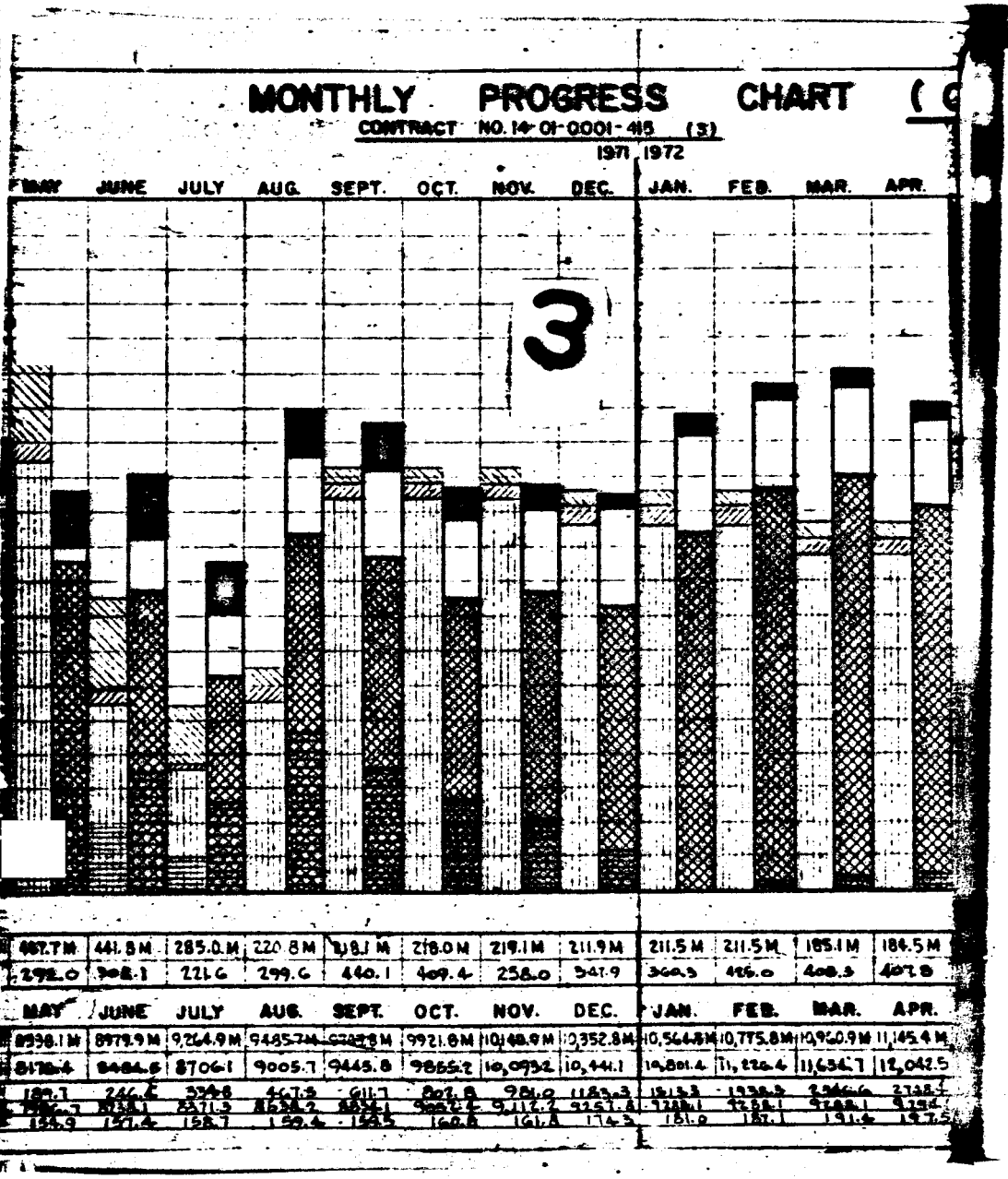
* EXPENDITURES INCLUDE ALL COSTS & FEES



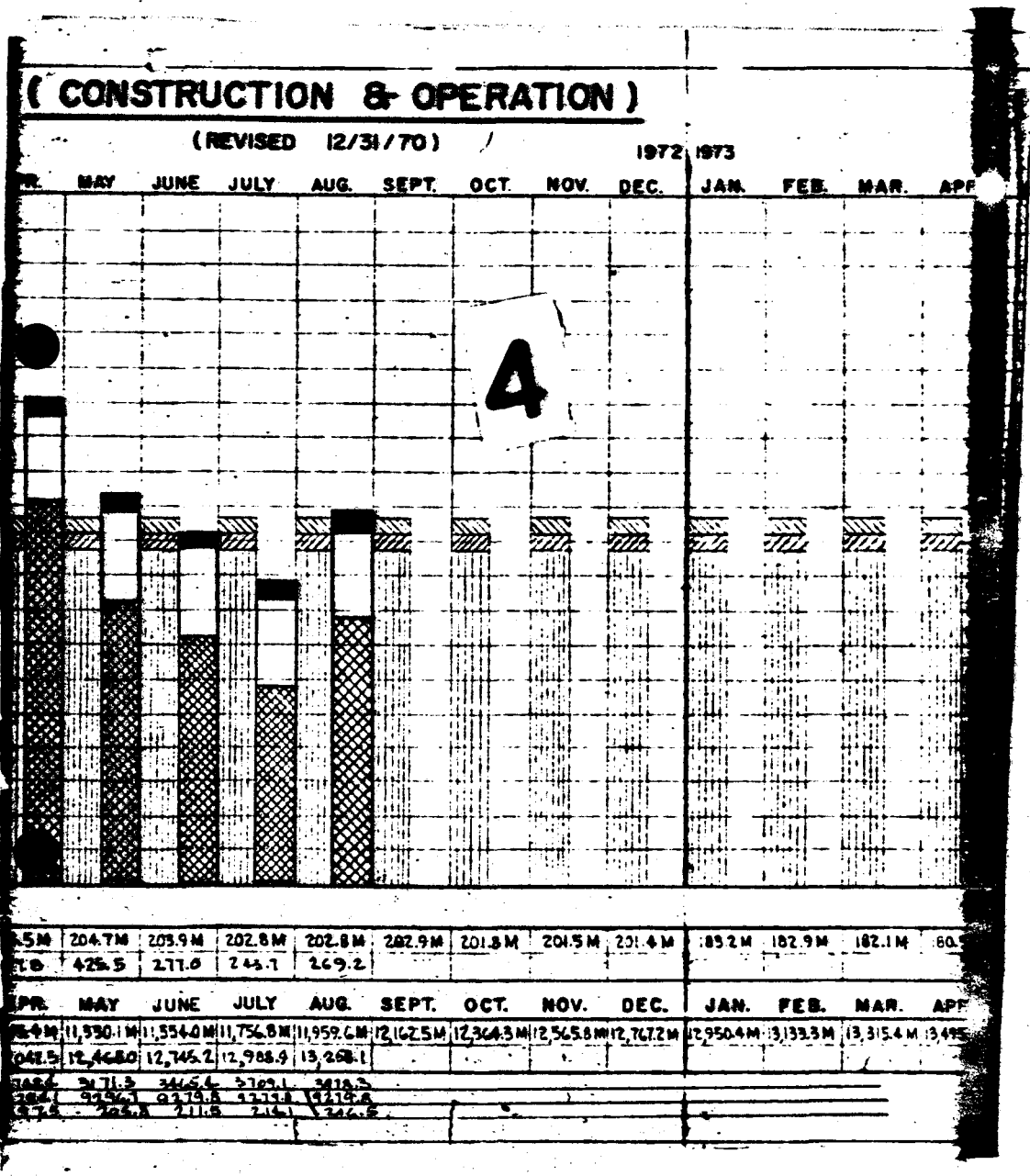
	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
M	891.1 M	802.0 M	891.1 M	712.9 M	891.1 M	891.1 M	758.2 M	719.5 M	777.0 M	702.9 M	534.9 M
	367.1	564.6	725.2	784.2	728.9	422.9	779.5	562.1	690.6	757.7	496.7
M	2970.6 M	3772.6 M	4663.7 M	5376.6 M	6267.7 M	7158.8 M	5546.6 M	5928.8 M	6618.1 M	7565.5 M	8100.4 M
	1372.6	1937.2	2662.4	3456.6	4185.5	4608.4	5387.3	5959.4	6630.0	7387.7	7884.4

OPERATIONS COST INCLUDED IN CUMULATIVE 1810 1630
CONSTRUCTION COST INCLUDED IN CUMULATIVE 1118.8 7718.4
REAL ESTATE SALES TAX RESERVE NOT INCLUDED IN CUMULATIVE 752.2

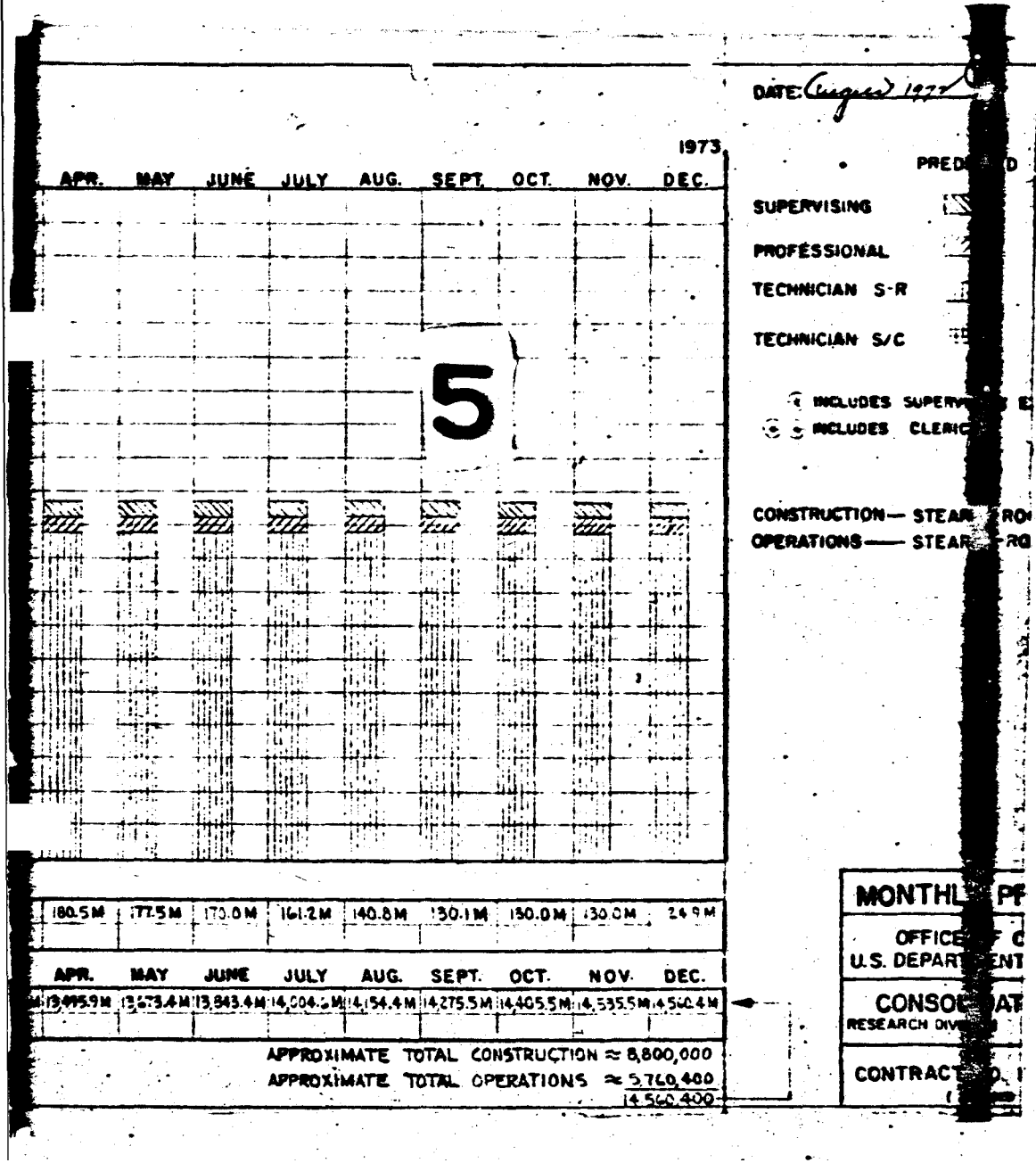
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MONTHLY PROGRESS CHART
CONTRACT NO. 14-01-0001-415 (S)
1971 1972
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
3
497.7M 441.8M 285.0M 220.8M 318.1M 218.0M 219.1M 211.9M 211.5M 211.5M 185.1M 184.5M
298.0 308.1 221.6 299.6 440.1 409.4 258.0 341.9 360.3 426.0 408.3 407.8
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
8938.1M 8979.9M 9,264.9M 9485.7M 9783.8M 9921.8M 10,148.9M 10,352.8M 10,564.8M 10,775.8M 10,960.9M 11,145.4M
8178.4 8484.6 8706.1 9005.7 9445.8 9855.2 10,093.2 10,441.1 10,801.4 11,226.4 11,634.7 12,042.5
760.7 821.3 557.8 479.9 337.9 66.6 55.7 -88.3 -236.6 -450.6 -673.8 -897.1
760.7 821.3 557.8 479.9 337.9 66.6 55.7 -88.3 -236.6 -450.6 -673.8 -897.1
156.9 157.4 158.7 159.4 159.5 160.8 161.8 164.3 165.0 167.1 191.4 197.5

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(CONSTRUCTION & OPERATION)
(REVISED 12/31/70)
1972
1973
MAY
JUNE
JULY
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DEC.
JAN.
FEB.
MAR.
4
204.7M
203.9M
202.8M
202.8M
202.9M
201.8M
201.5M
201.4M
185.2M
182.9M
182.1M
425.5
277.0
245.7
269.2
MAY
JUNE
JULY
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OCT.
NOV.
DEC.
JAN.
FEB.
MAR.
11,930.1M
11,554.0M
11,756.8M
11,959.6M
12,162.5M
12,364.3M
12,565.8M
12,767.2M
12,950.4M
13,133.3M
13,315.4M
12,460
12,745.2
12,988.9
13,258.1

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DATE: (August) 1972
1973
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
PREDICTED
SUPERVISING
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TECHNICIAN S/C
5
INCLUDES SUPERV
INCLUDES CLERIC
CONSTRUCTION— STEAR RO
OPERATIONS— STEAR RO
180.5M 177.5M 170.0M 161.2M 140.8M 130.1M 130.0M 130.0M 24.9M
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
13,495.9M 13,673.4M 13,843.4M 14,004.6M 14,154.4M 14,275.5M 14,405.5M 14,535.5M 14,560.4M
APPROXIMATE TOTAL CONSTRUCTION ≈ 8,800,000
APPROXIMATE TOTAL OPERATIONS ≈ 5,760,400
14,560,400
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DATE: (August) 1971

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SEPT. OCT. NOV. DEC.

	PREDICTED	ACTUAL
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PROFESSIONAL		
TECHNICIAN S-R		
TECHNICIAN S/C		

① INCLUDES SUPERVISORY EXEMPT TECHNICIANS
② ③ INCLUDES CLERICAL

CONSTRUCTION — STEARNS-ROGER JOB # 37000
OPERATIONS — STEARNS-ROGER JOB # 37400

6

	150.0M	130.0M	249M	
SEPT.	OCT.	NOV.	DEC.	
14,275.5M	14,405.5M	14,535.5M	14,560.4M	

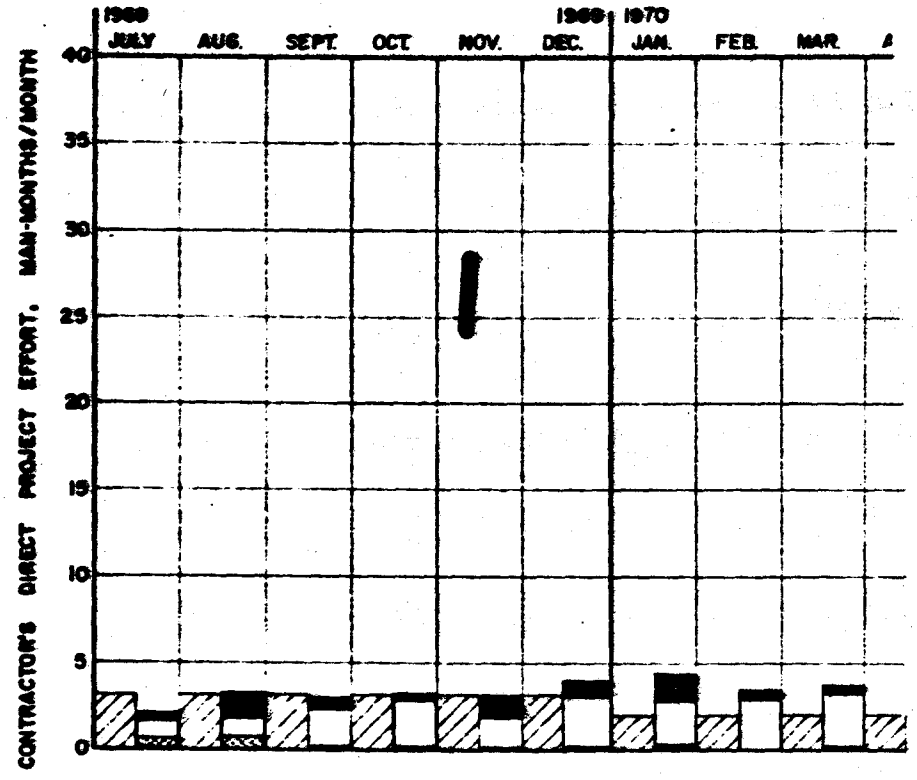
TAL CONSTRUCTION ≈ 8,800,000
TAL OPERATIONS ≈ 5,760,400
14,560,400

MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT NO. 14-01-0001-415 (3)
(REVISED 12/31/70)



MONTHLY EXPENDITURES*

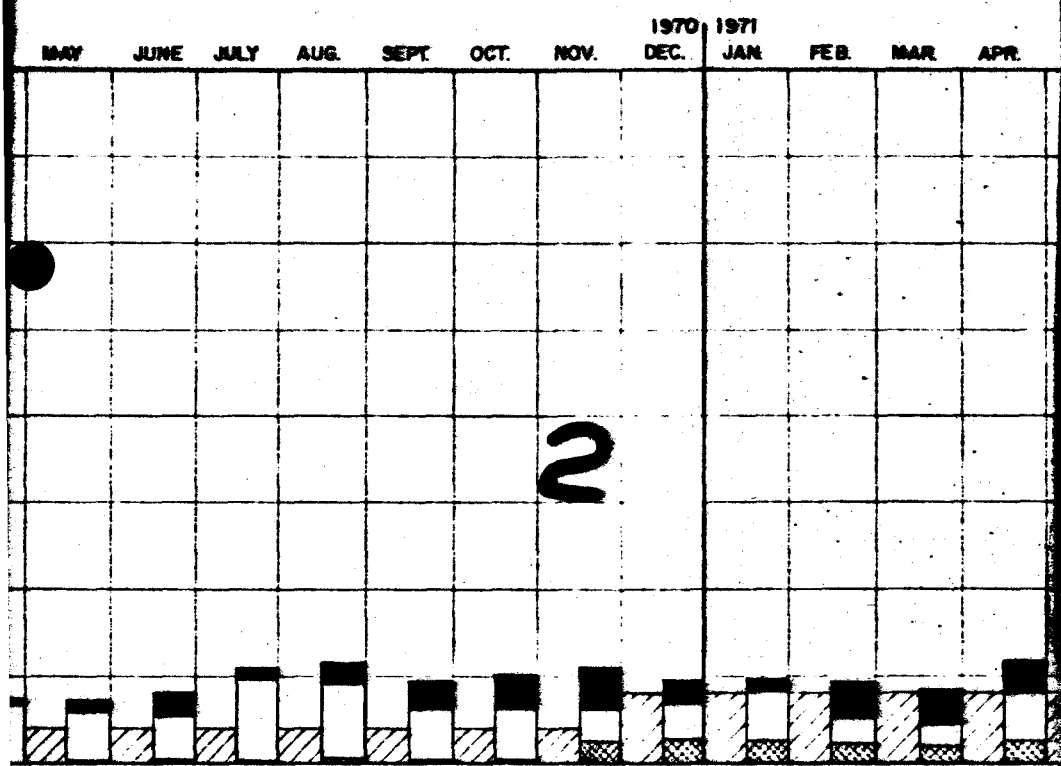
PREDICTED	16,215	14,685	14,965	13,155	14,385	17,065	15,595	15,595	12,655	12,81
ACTUAL	11,745	34,734	9,609	11,925	10,130	15,208	14,378	14,027	15,019	53,2

	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR
PREDICTED	16,215	30,900	45,865	59,020	73,405	90,470	108,065	121,660	134,305	147,
ACTUAL	11,745	46,479	56,088	67,913	78,043	93,249	107,628	121,653	136,672	89,9

CUMULATIVE EXPENDITURES*

*Expenditures Include All Costs & Fees By Consol And S. Dakota St

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13,819	12,655	13,315	12,835	12,505	12,505	12,505	20,155	20,135	23,295	22,295	21,145
17,342	19,319	20,054	13,955	25,003	21,296	9,584	23,091	16,475	16,663	12,820	22,198

MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
160,995	173,650	186,985	199,800	212,305	224,810	237,315	257,470	277,605	300,900	323,195	344,340
287,242	228,561	246,615	280,570	285,573	308,869	316,453	339,544	356,019	372,682	385,502	407,699

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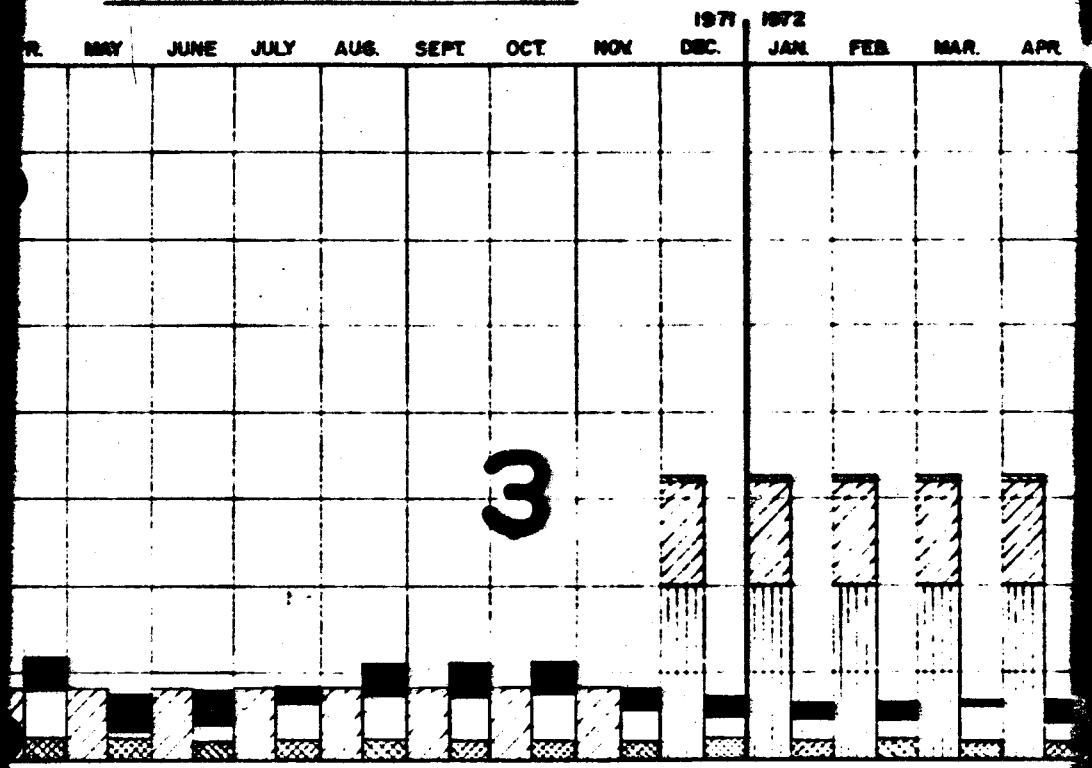
39,475
12,772

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680,750
728,591

ONTHLY PROGRESS CHART (SUPERVISIO

CONTRACT No. 14-01-0001-415 (3)

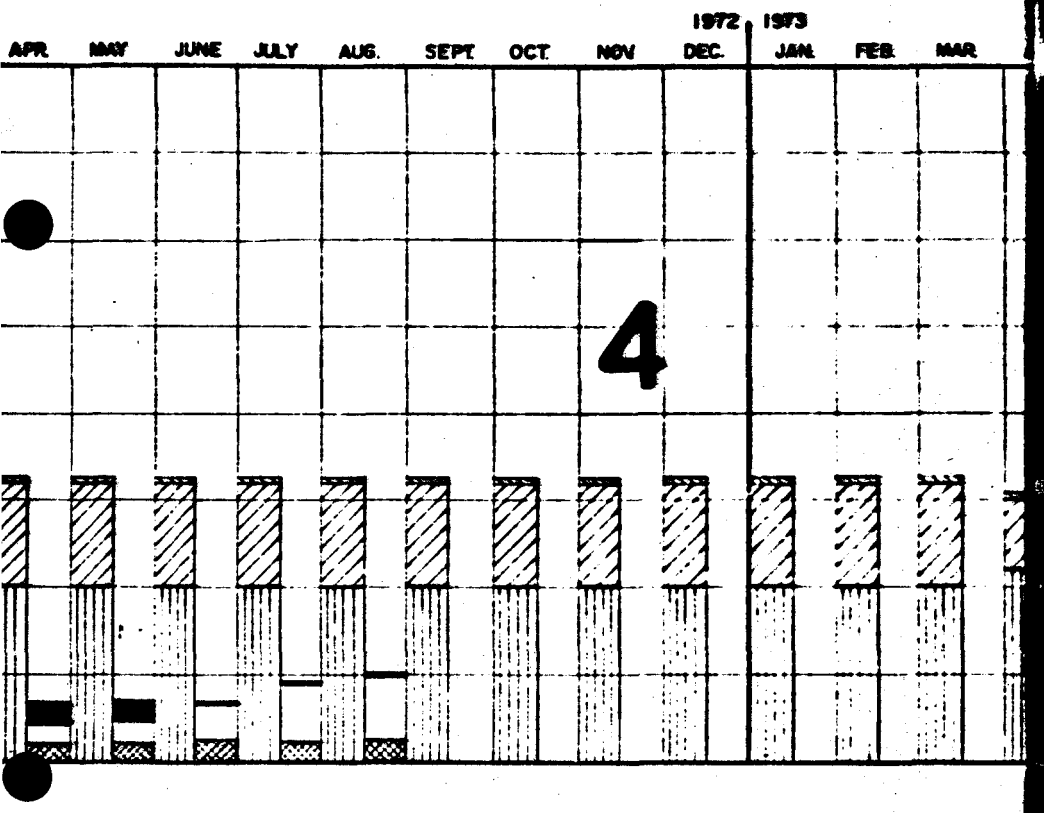


,145	18,705	15,955	14,875	14,875	14,875	14,875	14,875	39,475	39,475	39,475	39,475	39,475
,198	[illegible],528	15,831	16,923	24,919	97,703	30,575	18,172	36,224	15,604	15,700	23,962	12,772

PR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
,348	383,048	379,000	393,875	408,750	423,625	438,500	453,375	492,850	532,324	571,800	611,275	650,75
,698	420,206	436,037	452,960	477,879	575,582	606,157	624,329	660,553	678,157	691,857	715,819	728,59

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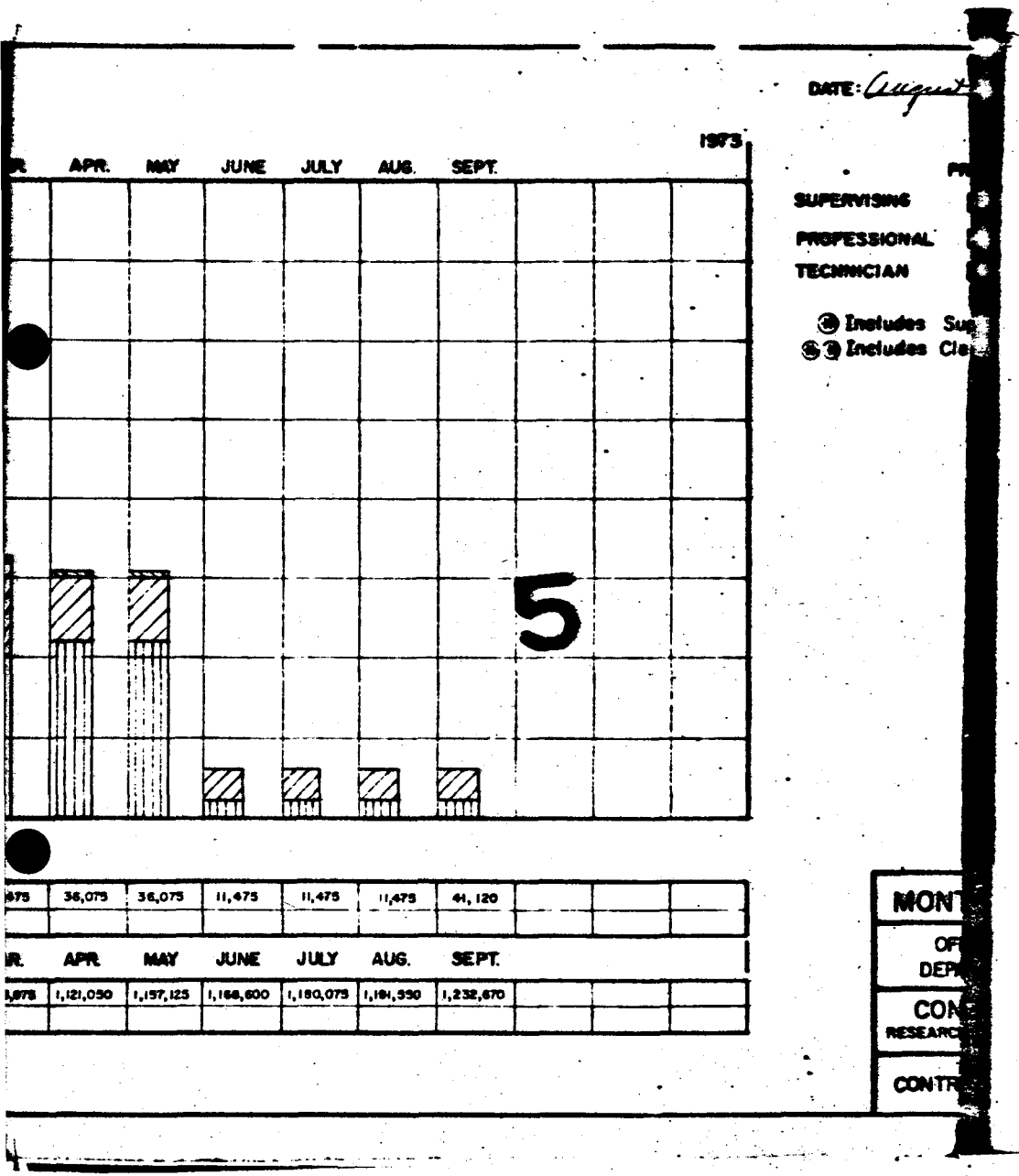
39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475
2,772	28,047	29,900	19,900	35,950							

APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.
90,750	690,225	729,700	769,175	808,650	848,125	887,600	927,075	966,550	1,006,025	1,045,500	1,084,975
28,591	756,638	796,538	806,438	842,388							

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36,075
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11,475
41,120
APR.
MAY
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1,197,125
1,168,600
1,180,075
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(Use 415 Chart)

DATE: August 1972

1973

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	PREDICTED	ACTUAL
SUPERVISING	▨	■
PROFESSIONAL	▨	▭ ④
TECHNICIAN	▥	▩ ④⑤

④ Includes Supervisory Exempt Technicians.
④⑤ Includes Clerical.

6

,120

EPT.

12,670

MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT No. 14-01-0001-415 (3)

CCDC-MPR--10

PROGRESS REPORT NO. 100
OCR CONTRACT NO. 14-01-0001-413(4)
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

September 1 to 30, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

The plant was shut down all month to complete extensive repairs on the refractory lining of the gasifier. The original system failed due to cracks in the boot and cone plus channeling within the porous Superex insulation layer from the boot to the top of the vessel. This severe gas by-passing made it impossible to maintain an adequate fluidized bed.

The revised system included two layers of castable insulation in the boot and cone area with no Superex used. In addition, rings of castable insulation were put on the vertical walls to act as vapor barriers.

While the plant was down a large number of additional repairs and modifications were made. Probably the most significant other change was in the gas inlets of the gasifier and regenerator quench towers to prevent solids plugging. A shield was built over the inlets to prevent water from splashing into the inlet pipe.

Summaries of achievements of the first four start-up attempts were completed and reports issued to a limited distribution.

Financial

Estimated monthly expenditures are $28,300 by Consol and $215,400 by Stearns-Roger. Cumulative expense to date is $18,222,310.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536)

The final issue of the engineering and construction report was withdrawn to permit the inclusion of a new section describing 150 psi operations.

4. Stearns-Roger Construction Subcontract (Project No. 700)

Stearns' accountants are preparing to submit the final construction costs.

**5. Library Assistance on Pilot Plant Operations
Project Nos. 537.10 and 537.20**

No analyses were performed during the month of September.

The progress of the plant turnaround at Rapid City was followed closely.

Other tasks included a survey of the inert gas system to ascertain the failure of the compressor aftercooler and continuation of the search for an appropriate hot solids lockhopper valve.

**6. Library Assistance to Engineering of Methanation Addition
Rapid City Pilot Plant (Project No. 537.30)**

In mid-month a visit was made to the Denver offices of Stearns-Roger to discuss engineering of the proposed methanation facility. After negotiation, a lump sum contract was completed in the amount of $60,000.

Stearns-Roger is to perform the tasks as shown on the following page.

1. Complete specification on major items of machinery.
2. Obtain at least three competitive quotes for all items in (1) above and make final selection.
3. Complete P & I diagrams.
4. Complete utility balances and utility P & I diagrams.
5. Complete instrumentation and single line electrical diagrams.
6. Prepare a plot plan and general layout drawings.
7. Prepare a definitive cost estimate.

It is estimated that the above work can be completed in three months.

7. Consol Guidance on Operations (Project No. 702)

The progress report is attached.

8. Stearns-Roger Operating Subcontract (Project No. 701)

The progress report is attached.

9. School of Mines Subcontract (Project No. 703)

The September progress report is attached.

C. Subject Inventions

None

D. Financial Status

Expense	Actual	Budget
Cumulative through August, 1972		
Through June, 1969	$ 1,878,256	$ 1,878,256
Consol	842,254	808,650
Stearns	13,258,100	11,959,600
	$15,978,610	$14,646,506
Expended in Period (estimate)		
Consol	28,300	39,475
Stearns	215,400	202,900
Total - September, 1972	$ 243,700	$ 242,375
Cumulative through September, 1972	$16,222,310	$14,888,881

10/16/72
Att: Monthly Progress Reports on Projects 701, 702, 703
Progress Charts

CONSOLIDATION COAL COMPANY PROJECT

CSG PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #31

CCC Project No. 701
S-R Job No. B-37400
October 3, 1972

UDS OCT 9 - 1972

SUMMARY OF PLANT OPERATIONS

The entire month was consumed in reinstalling the damaged gasifier boot section refractory and approximately fifty repairs or modifications.

Installation of new refractory in the gasifier progressed somewhat slower than estimated. This was primarily because of more work than was invisioned to install the refractory vapor barriers. However, all refractory work was essentially complete by the end of the month. The only refractory work required in October is to seal the top and bottom heads as they are reinstalled.

Another major repair was a design change to the quench tower inlets. In the past, minor changes have been tried, all to no avail. The decision was made that during this shutdown, the lower heads would be removed and an internal box be fabricated over the inlets, hopefully to prevent moisture from contacting the dolomite dust until in the tower proper.

Many other repairs or changes were engineered and installed during September. The solids butterfly control valves which, in the past, have bound in operation were corrected. Several ball valves which leaked were removed from the system and completely inspected. These were repaired and hopefully, will remain operational for the subsequent run.

Needless to say, operations as such was nill. However, individual operator training has progressed with individuals assigned in one area becoming familiar with equipment operation in other areas.

MONTHLY ACCOMPLISHMENTS OPERATIONS AND TECHNICAL

The shutdown, which occurred in August, continued through September. The month of September was spent working on a list of 55 shutdown items by the Technical, Maintenance and Operation Departments. Several of the major items are discussed in detail below.

The main shutdown item was the reinstallation of refractory in the gasifier boot and transition section. As reported in last month's Operations Report, a large quantity of fluidization gas was found to be by-passing the soft refractory in the gasifier. Bigelow-Liptak was awarded the contract for reinstalling the damaged portions of the gasifier refractory. While they were preparing to do their work, various other repairs were made during the first part of the month.

In order for Bigelow-Liptak to replace the refractory in the gasifier, it was necessary to unbolt and lift the top head of the gasifier. The bottom head of the gasifier had been lowered last month. Bosses were welded in the boot section of the gasifier for holding the Nelson studs. Vapor barrier slots were cut through the refractory to the gasifier shell in three places to prevent future channeling of fluidization gas. These slots were sealed with T-36 cement and filled with Lo-Abrade refractory by midmonth. Surface cracks in the gasifier refractory were repaired with T-36 cement. The supplemental heating electrodes were removed from the gasifier and the openings were converted to additional pressure taps.

The lower density castable (VSL-50) was installed in the gasifier boot, transition section and bottom head by the 21st. After a 24 hour air dry, a 72 hour heated curing period was started on Friday, September 22, followed by a controlled cool down. The Lo-Abrade inner lining in the boot, transition section and bottom head was complete by the 28th of the month. Another 72 hour heated cure was started on Friday, September 29.

The second major repair item for this shutdown was to install protective bones in the regenerator overhead quench tower and the gasifier overhead quench tower gas inlet nozzles so that the previously reported solids plugging of these inlet lines could be eliminated. The inlet nozzles were removed and again found to be partially plugged with solids. The bottom heads of the two quench towers were removed, gas inlet boxes installed and the heads replaced on the vessels by the 22nd of September. On the 29th, these two vessels were hydrostatically tested in the presence of aFactory Mutual Engineering representative. They were tested to 530 PSIG and were found to be satisfactory.

The quench water separators and of the foul water stripper, which are Beresite lined, were found to be pitted and some of the lining missing. The pitting, which occurred behind pinholes in the lining, was filled with weld metal, ground down and recoated. This repair is proceeding.

During the shutdown, it was found that the 4" pipe liner in the dolomite transfer line from the regenerator to the gasifier had broken away at the upper flange. This failure was similar to the one on the dolomite transfer line from the gasifier to the engager pot previously reported. Maintenance was able to repair this line in place.

After removal of the small amount of insulation in the heater stacks, heater B-201-1B/2B were inspected using radiography. The tubes were in good condition. The convection section deflector hangers were loose and broken. These have been repaired along with minor refractory repairs.

Several of the valves in the lignite lock hopper system were removed for testing during the month. It was found that this type of valve, under the conditions operated, would leak. Minor revisions were made to these ball valves with a subsequent successful leak test.

The solids butterfly valves were removed, cleaned and repaired where necessary. We have had problems with these valves sticking in the closed position. It was found that the interlining of the valves had warped sufficiently because of thermalexpansion to cause the butterfly to stick in the closed position. Where necessary these liners were milled so that they were again perfectly round. This should eliminate the sticking of the butterfly.

The aftercooler on the inert gas high pressure compressor (C-504) was inspected and the tubes were found to be severely corroded. This cooler was retubed with stainless steel by the Stearns-Roger Denver Pipe Shop.

On Wednesday, September 27th, radiographs were made of new welds, some piping and several furnace tubes. Only one new weld had to be repaired.

During the last week of the month, a video tape of the regenerator internals was made. This tape was reviewed and was decided that no repairs would be necessary during this shutdown but that a closer look should be made at the next shutdown.

When the coal grinding and drying system was being run for training purposes, the baghouse blower ring assembly chair fouled and jammed the carriage. This was repaired by installing a new chain. The old chain had become corroded and was no longer flexible.

Because of the approaching winter season, a survey of steam tracing repairs and requirements is being made. The overnight low on Tuesday morning, September 26th, was 22°F.

While the plant is down, the operators are concentrating on training. Several char grinding and drying runs have been made. The operators are learning equipment in other areas than their regularly assigned area. This is being done with the help of the experienced operator in that area. Work on revisions to the Plant Operating Manuals continued through the month.

During the shutdown, plant instrumentation is being calibrated, alarm panels checked, and motor valves are being stroked. This is in preparation for our next run.

All Technical Engineers and Draftsmen were assigned various modifications which required engineering, material purchasing and then installation. Nearly all shutdown items have been engineered; therefore, their work assignments now will be to prepare for the plant start-up.

Laboratory personnel returned to shift work at midmonth. They are investigating better methods for dessicant analysis, gasifier overhead dew point measurement and modification of sulfur-in-ash analysis by using bomb-fusion technique. A laboratory fluidized bed furnace for attrition measurements is under construction.

A report, "Differential Pressure Measurement" was prepared outlining the problems and various changes tried in the pilot plant to obtain reliable differential pressure measurement. The report covered a period from April, 1972, to present.

During September the following personnel changes were made: B. W. Fitzgerald was promoted from "D" Operator to "A" Operator. J. C. Adams and F. T. Brennan were promoted from "C" Operator to "B" Operator; M. D. Shellhaas and W. Wilcox were promoted from "D" Operator to "C" Operator; W. H. Anderson was hired as a "D" Operator. W. E. Boudreau, "B" Operator, resigned during the month as did N. J. Moeller, Instrument Technician "A". H. A. Jewell, Technical Engineer, resigned during September. Mrs. Carol Welser reported to work on September 11th, as a Junior Chemist.

SAFETY

Four safety meetings were held with maintenance and four with the Safety Committee.

Three shifts were trained in the use of the rescue suit. One of the four shifts has received training in the use of the pneumopak pressure dressing.

On September 15, 1972, the 1971 Safety Award Dinner was held at the Elks Valley-Hi. Our facility was honored with two awards. One was presented to Mr. William Blalock in honor of the safety record for the construction of the plant. The second award was presented to plant operations for their safety record in 1971.

MONTHLY ACCOMPLISHMENTS MAINTENANCE

Approximately 80 work orders were completed during the month, of which 10 were urgent. In addition, 17 engineering work orders were completed. Seven items of mechanical equipment were checked as scheduled for 90 day preventive maintenance. All rigging and hoisting equipment received a quarterly check.

The major maintenance item scheduled for this month and installed by a sub-contractor, was the refractory in the "boot" of the gasifier, five refractory vapor barriers and the refractory in one bottom head of the gasifier. The time required to install the vapor barriers was longer than estimated. This lengthened the total repair as a limited number (4) can work in and around the vessel at one time. All of the refractory had been installed at month's end with the final 72 hour heat cure started early September 29th. The work remaining is to reinstall probe supports and fit up both the top and bottom heads.

PLANS FOR OCTOBER

The primary objectives for October are twofold:

(1) Complete the shutdown work.

(2) Attempt to gasify char.

Our present schedule forcasts a completion of all repair work by October 13th. This may vary a few days either way.

Gasification will be accomplished by a successful conclusion of the following steps:

(1) Pressure test all equipment that was opened during the shutdown. Be satisfied the system is completely leak free.

(2) Zero the level instruments and recalibrate and check out all other instruments.

(3) Start up and reestablish calcined dolomite circulation.

(4) Grind char into the tote bins rather than use the preheater initially. This will reduce the less than 100 mesh in the char feed to the gasifier.

(5) Transfer char from the tote bins to the lignite lock hoppers. Flow char into the gasifier and establish char level. Convey char into the regenerator thus beginning the calcination of the $CaCO_3$ portion of dolomite to CaO. Complete calcination of the dolomite.

(6) Admit steam to the gasifier. This operation will start the gasification reaction of char to carbon monoxide, hydrogen and some methane. Line system out and prove operability of dual fluid beds, continuous calcination, solids transportation and gasification.

STAFFING

	Current Manpower Effective 10-1-72	To Be Hired In October
Management	1	0
Accounting	5	0
Clerical	5	0
Janitorial	2	0
Safety	1	0
TECHNICAL DEPARTMENT		
Laboratory	9	1
Engineering & Scheduling	11	2
OPERATIONS		
Supervisors	2	0
Shift Superintendents	4	0
Technical Assistant	1	0
Instrument Engineer	1	0
Operators	41	3
MAINTENANCE		
Supervisors	4	0
Crafts	26	0
Warehouse & Purchasing	3	0
	116	6

COSTS

Accumulated Operations Cost to Date, September 30, 1972	$4,248,295.69
Purchase Orders Not Paid & Purchases Placed	54,789.87
Actually Spent - September, 1972	215,410.40
Accumulated Cost Billed to Date	$4,193,838.33

Very truly yours,

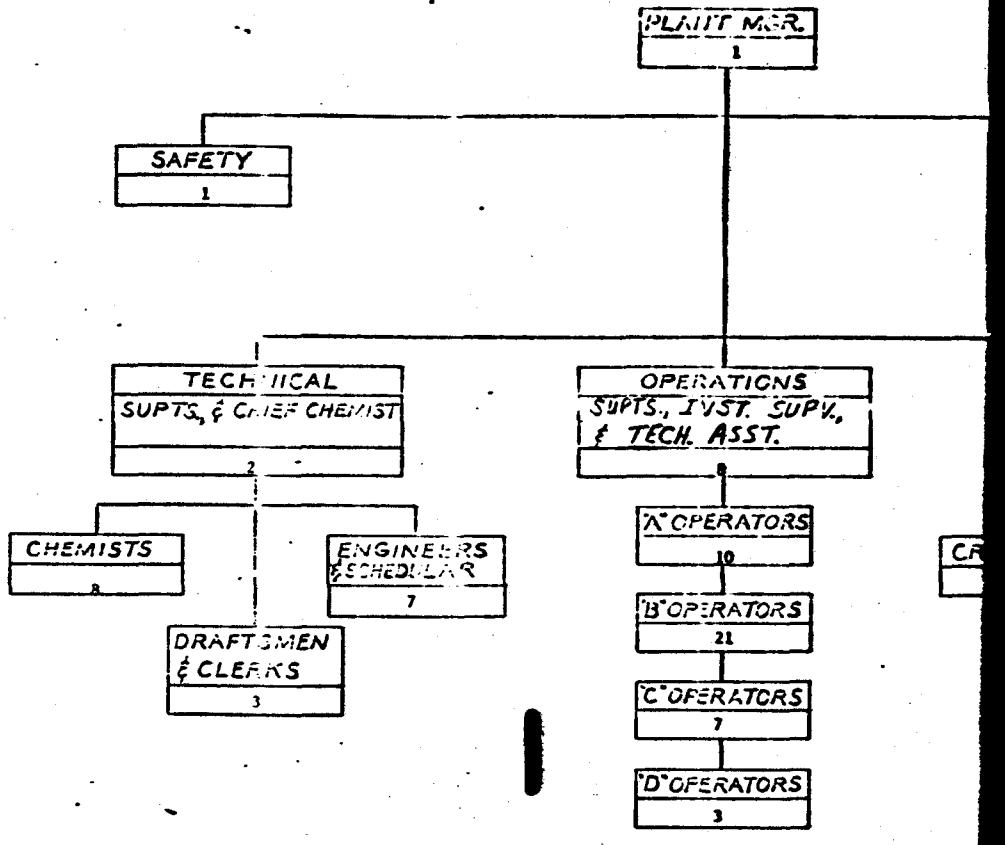
STEARNS-ROGER CORPORATION

R. G. Checksfield
Plant Manager

RGCiska

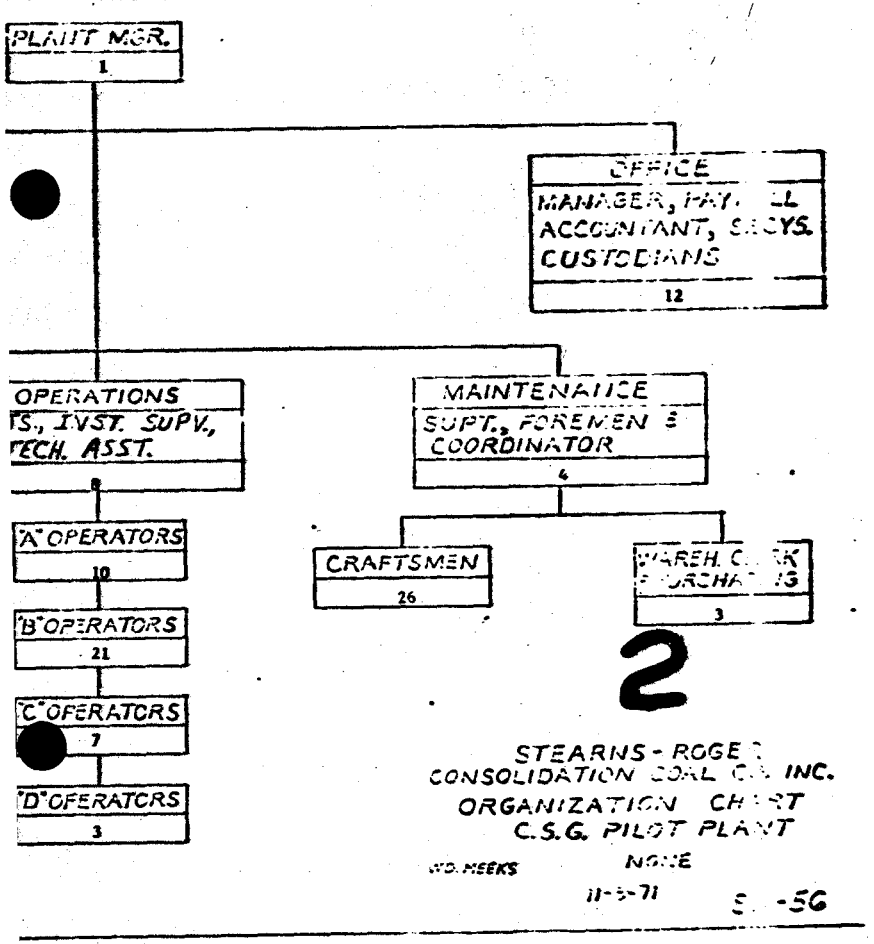
cc: U.D.Marwig, C.E.Fink, D.C.McCoy - Consol
Dr. J.D.Sudbury, J.A.Phinney, C.A.Schulz - Library
Dr.Roger Detman, Dr.Derek Miller - C F Braun
C.M.Stone, D.H.Dawson, V.L.Brant - Denver
MHV, HLL, DOD, WTB, COB, NRK, FAP, KLH, JDM, TGT, EBW, EMF, GLF, RED, MTH, JPL, TJH, LFR, GRE, PJB, JCG, File (4), HAL, JLA, WDM, KKK

Attachments: OSHA Report, Organization Chart, Schedule(Progress Chart)



TOTAL.....116

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MONTH ENDED September 30,

OSHA REPORT

MINE NAME	MINE NO.	NUMBER OF LOST TIME ACCIDENTS NON-FATAL	FATAL	TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED
Research Division	100					
Rapid City	200	0	0	0	0	19212.5
Total Research						

...ENDED September 30, 19 72

...DENTS	DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUCED	FREQUENCY	SEVERITY	TONS PER LOST TIME ACCIDENTS	MAN COUNT
0	0	19212.5					11

Consol issued reports covering operations during the first four runs. The results of a separate study concerning the regenerator heat losses as indicated by the reactor water jacket steam evolution were also reported. The study showed that steam evolution, and, therefore, heat loss had increased during the recent runs. This suggests that some gas bypassing is occurring in the regenerator. However, based on the fluidization characteristics, the bypassing is not yet severe.

C. E. Fink

U. D. Marwig

CEF-UDM:lmp

SUBCONTRACT BETWEEN CONSOL AND SDSMT RE CONSOL CO_2 ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR SEPTEMBER, 1972

I. General

Relatively little new work developed during September. The carbonate resources report is still delayed due to Mickelson's operation. Lingard also required surgery but is recuperating satisfactorily. Meetings with Curran and Marwig clarified points raised by CONSOL regarding the sodium removal work and these will be incorporated in the report. Data from waste monitoring is included.

II. Carbonate Resources (Mickelson)

Mickelson suffered a mild relapse and the best estimate on completion and transmission of the final report is the end of October.

III. Acceptor Reconstitution (Fuerstenau)

No new work is being undertaken although general planning continues while awaiting contract action.

IV. Noxious Elements (Lingard)

The interim report will now be delayed because of Lingard's undergoing major surgery. However, he seems to be recovering well and should be back to normal by mid-October.

V. Lignite Beneficiation (Clarkson)

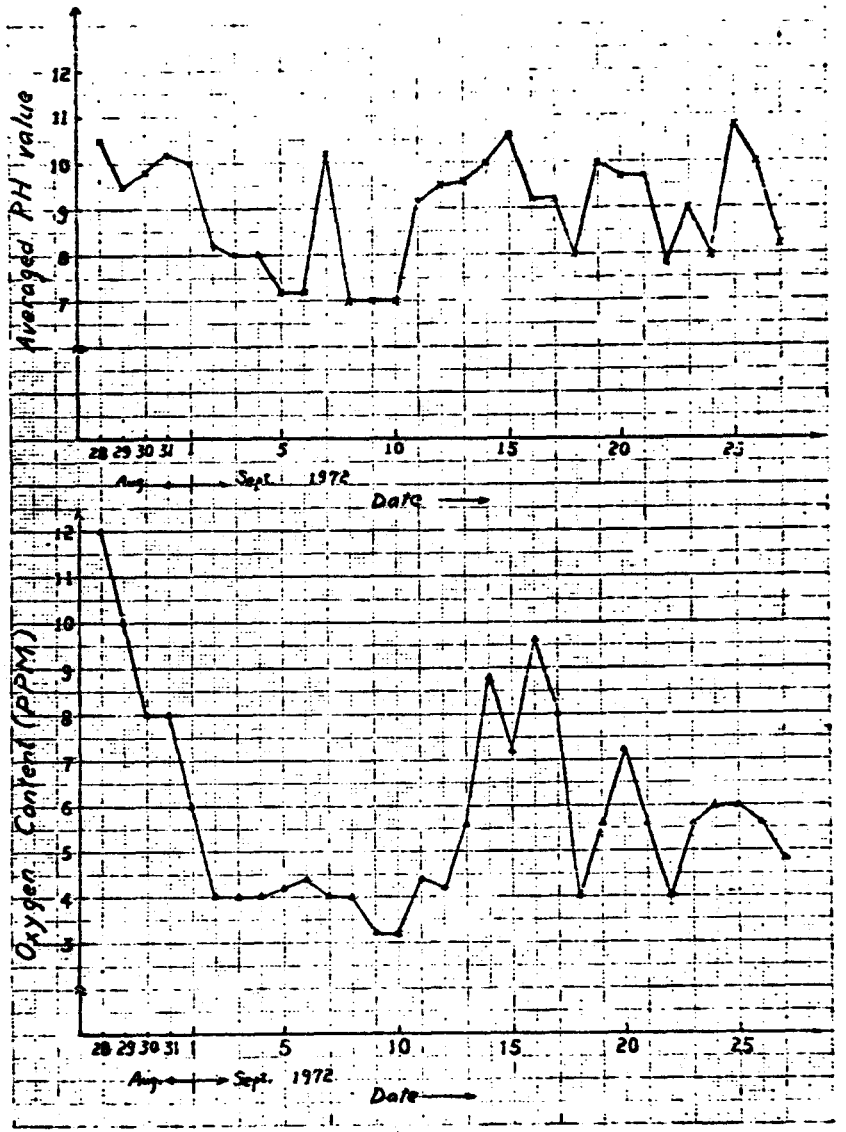
The preliminary report on sodium removal is being revised somewhat after discussions with George Curran and Uwe Marwig on the various comments by CONSOL personnel. The sodium removal from the "higher" sodium lignites certainly needs investigation. All data on earlier phases of the lignite beneficiation will be included in the final report.

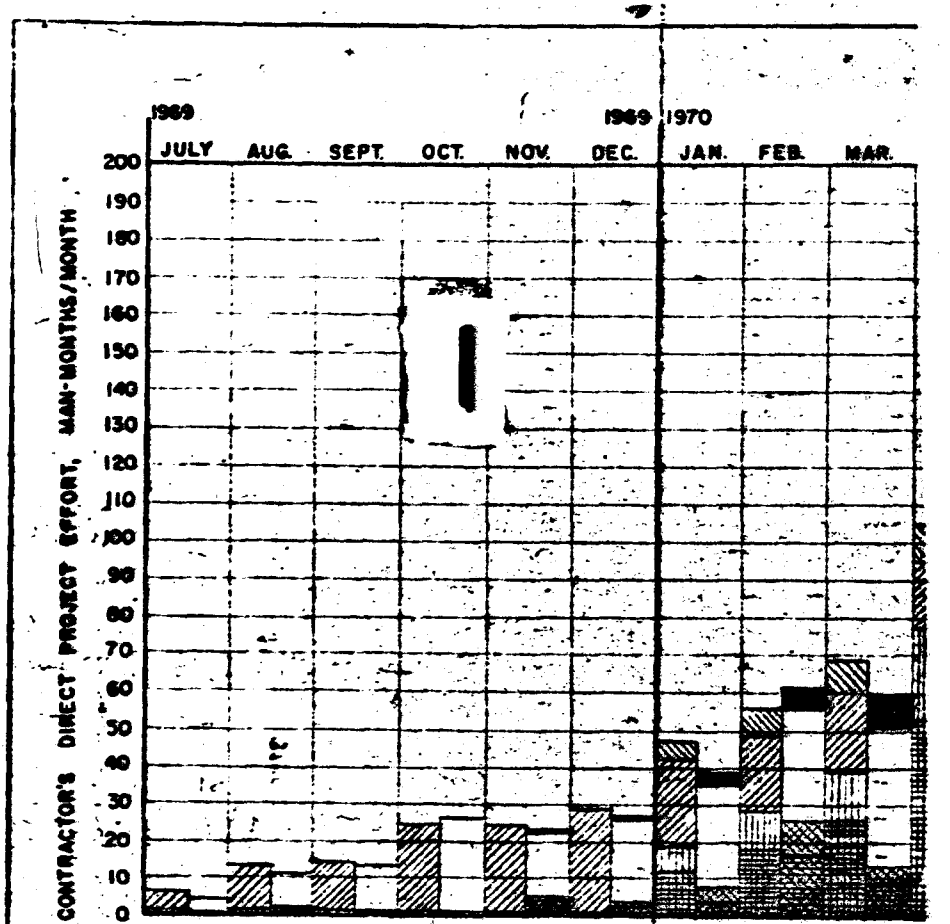
JDS OCT 10 '72

VI. Waste Monitoring (Oliver)

Copies of data from the continuous monitoring of wastewater over the past month are attached. The instrument shed on the tenth-floor level is reported to be in the process of erection. Within a week it is hoped that the instruments for stack gas monitoring can be installed and checked out, and continuous monitoring of stack gases will be started.

Date	Oxygen Content	PH Value
Aug. 28, 1972	[illegible] PPM	10.5
29	[illegible]	9.5
30	8.0	9.8
31	8.0	10.2
Sep. 1 1972	6.0	10.0
2	4.0	8.2
3	4.0	8.0
4	4.0	8.0
5	4.2	7.2
6	4.4	7.2
7	4.0	10.2
8	4.0	7.0
9	3.2	7.0
10	3.2	7.0
11	4.4	9.2
12	4.2	9.5
13	5.6	9.5
14	8.8	10.0
15	7.2	10.6
16	9.6	9.2
17	8.0	9.2
18	4.0	8.0
19	5.6	10.0
20	7.2	9.7
21	5.6	9.7
22	4.0	7.8
23	5.6	9.0
24	6.0	8.0
25	6.0	10.6
26	5.6	10.0
27	4.8	8.2
Average	5.84	8.65





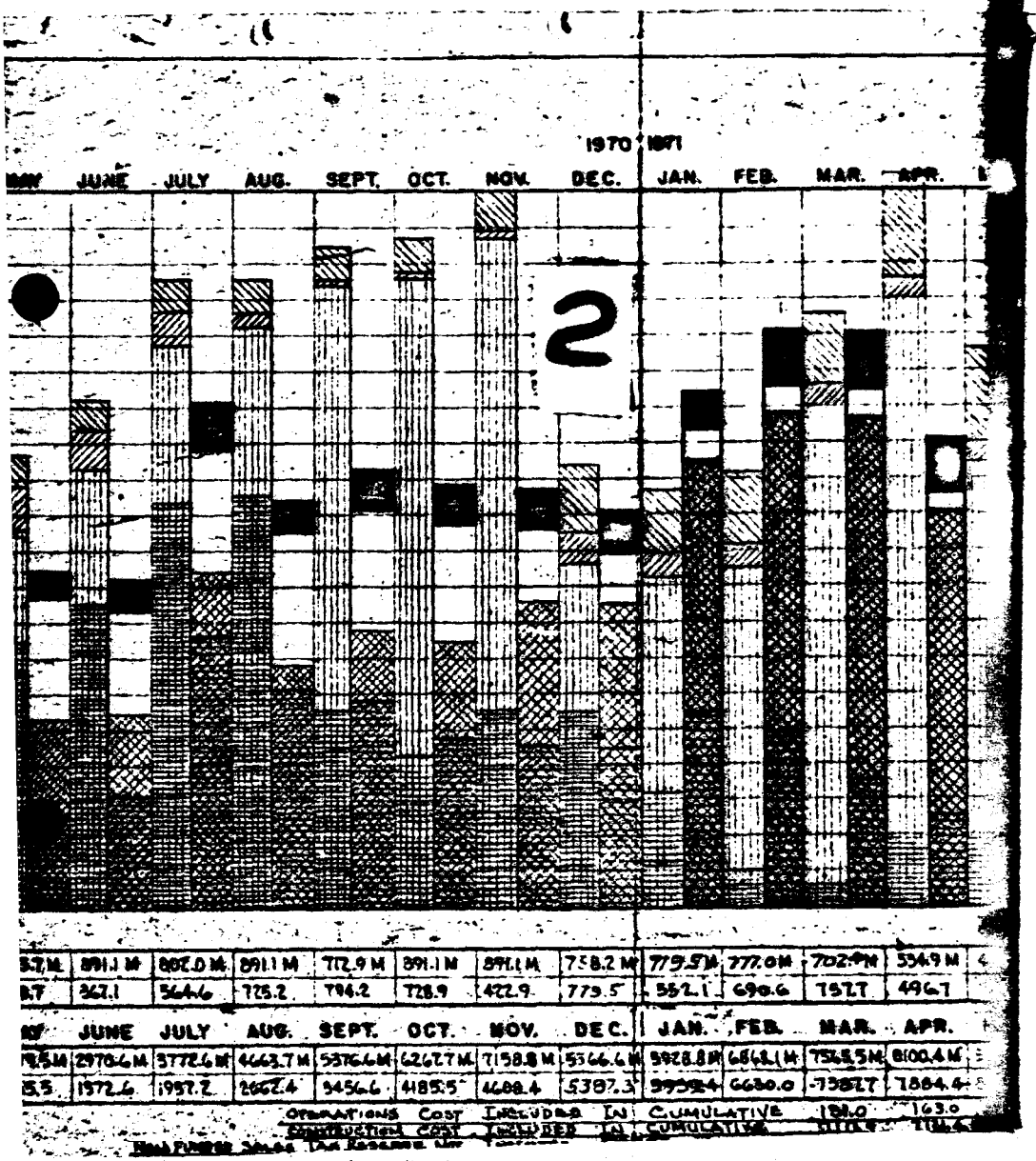
MONTHLY EXPENDITURES *

PREDICTED	0	30.0 M	41.0 M	50.0 M	98.0 M	106.9 M	112.8 M	273.0 M	299.5 M
ACTUAL	6.2	25.0	52.8	42.6	39.7	126.2	110.5	76.7	486.9

	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.
PREDICTED	0	30.0 M	71.0 M	121.0 M	219.0 M	325.9 M	497.9 M	710.9 M	1010.2 M
ACTUAL	6.2	31.2	84.0	106.6	146.3	272.5	383.0	459.7	562.6

CUMULATIVE EXPENDITURES *

* EXPENDITURES INCLUDE ALL COSTS & FEES

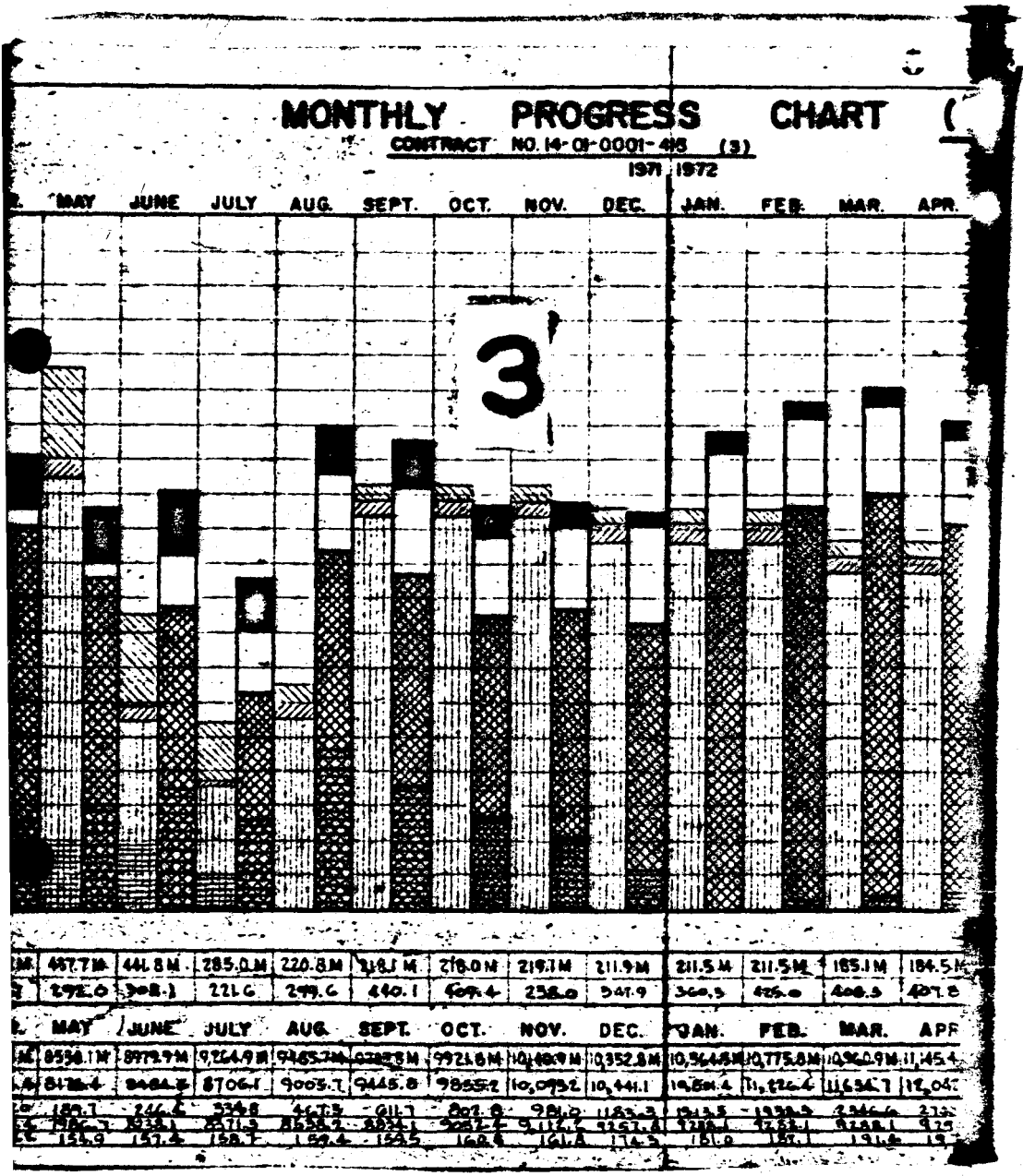


891.1 M	891.1 M	891.1 M	772.9 M	891.1 M	891.1 M	758.2 M	779.5 M	777.0 M	702.9 M	534.9 M	
367.1	564.6	725.2	794.2	728.9	422.9	779.5	552.1	690.6	757.7	496.7	

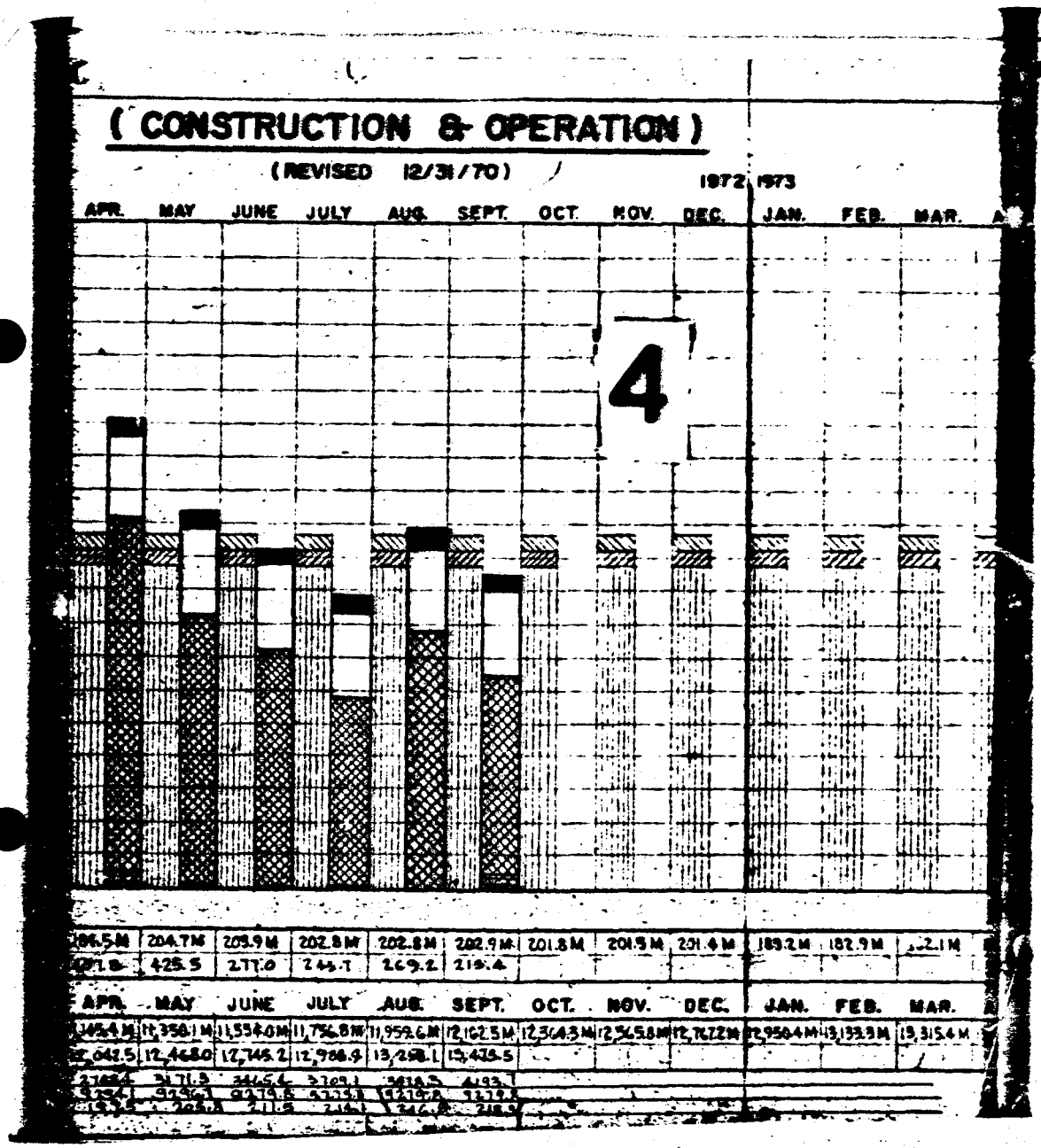
	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
	2970.4 M	3772.6 M	4663.7 M	5576.4 M	6262.7 M	7158.8 M	5566.4 M	5928.8 M	6648.1 M	7545.5 M	8100.4 M
	1972.6	1957.2	2662.4	3456.6	4185.5	4608.4	5387.3	5928.4	6630.0	7385.7	7884.4

OPERATIONS COST INCLUDED IN CUMULATIVE 191.0 163.0
CONSTRUCTION COST INCLUDED IN CUMULATIVE

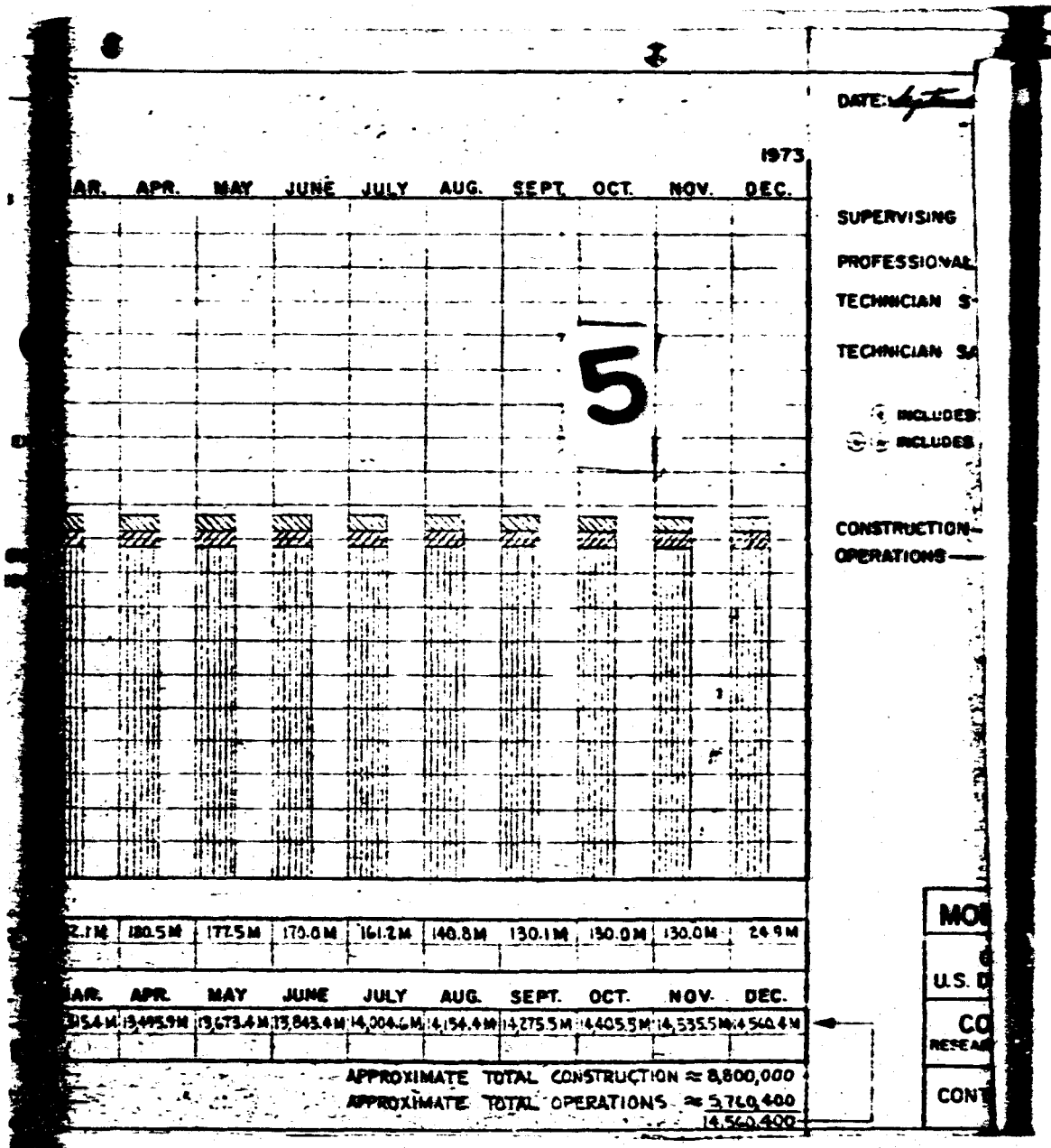
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MONTHLY PROGRESS CHART
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(CONSTRUCTION & OPERATION)
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2.1M 180.5M 177.5M 170.0M 161.2M 140.8M 130.1M 130.0M 130.0M 24.9M
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15.4M 13,495.9M 13,673.4M 13,843.4M 14,004.6M 14,154.4M 14,275.5M 14,405.5M 14,535.5M 14,560.4M
APPROXIMATE TOTAL CONSTRUCTION ≈ 8,800,000
APPROXIMATE TOTAL OPERATIONS ≈ 5,760,400
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8.1 M	130.0 M	130.0 M	24.9 M

SEPT.	OCT.	NOV.	DEC.
5.5 M	14,405.5 M	14,535.5 M	14,560.4 M

CONSTRUCTION ≈ 8,800,000
OPERATIONS ≈ 5,760,400
14,560,400

	PREDICTED	ACTUAL
SUPERVISING		
PROFESSIONAL		
TECHNICIAN S-R		
TECHNICIAN S/C		

(P) INCLUDES SUPERVISORY EXEMPT TECHNICIANS
(S) (R) INCLUDES CLERICAL

CONSTRUCTION — STEARNS-ROGER JOB 8-37000
OPERATIONS — STEARNS-ROGER JOB 8-37400

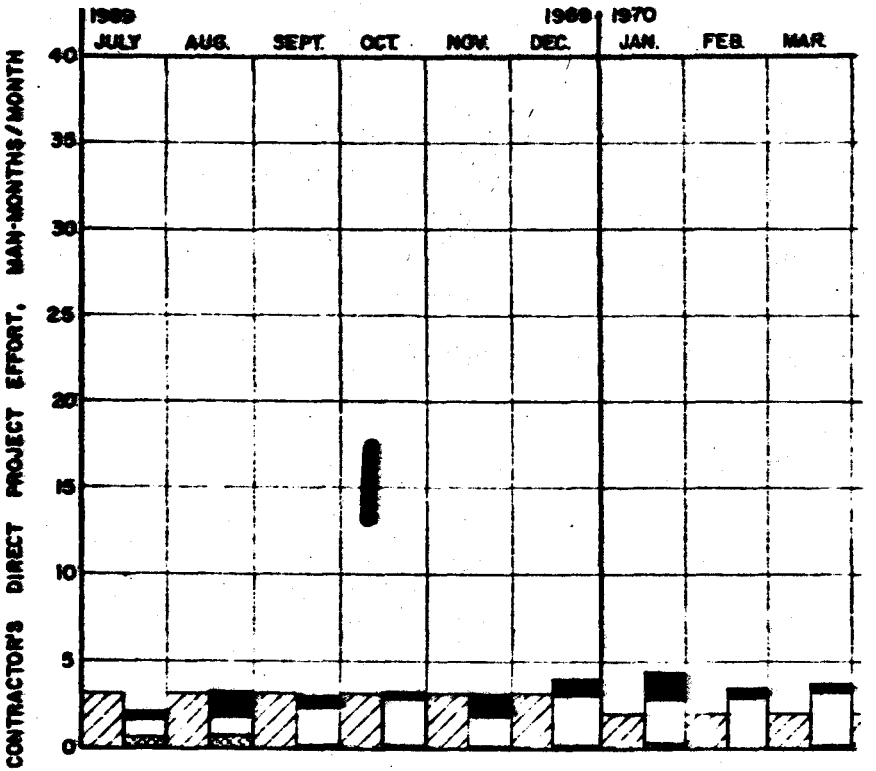
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MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION — LIBRARY, PA.

CONTRACT NO. 14-01-0001-415 (3)
(REVISED 12/31/70)



MONTHLY EXPENDITURES*

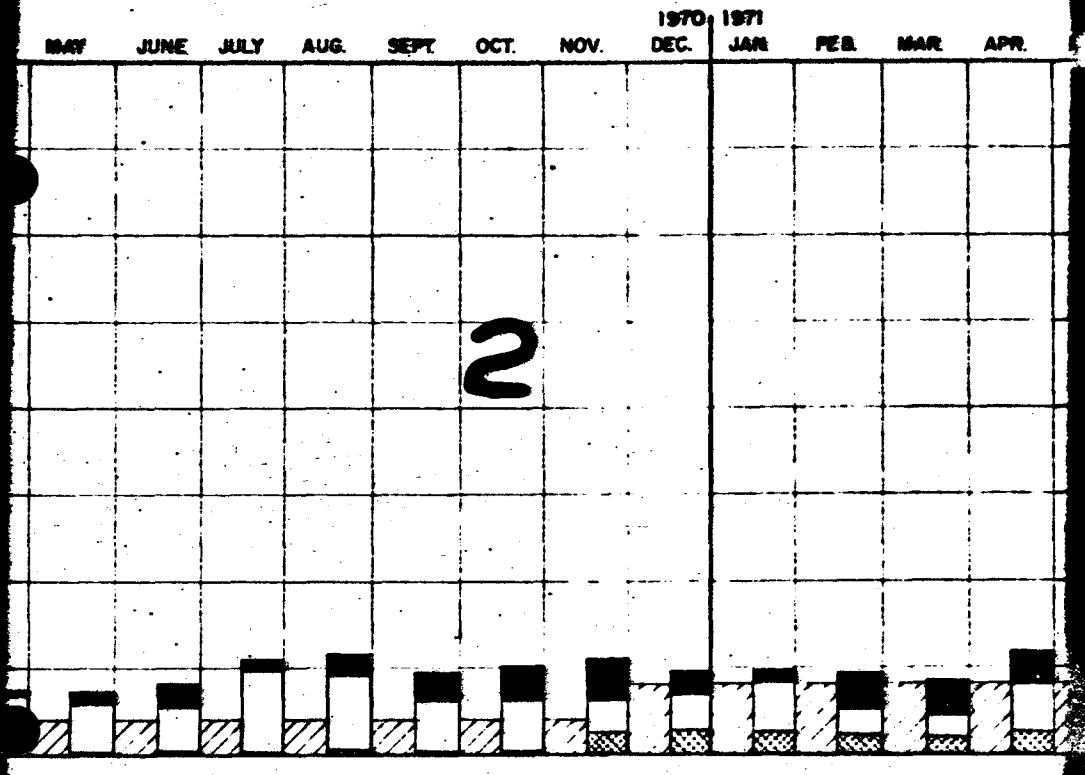
	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.
PREDICTED	16,215	14,685	14,965	13,155	14,385	17,065	15,585	15,395	12,655
ACTUAL	11,745	34,734	9,609	11,825	10,130	15,209	14,378	14,027	15,219

CUMULATIVE EXPENDITURES*

	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.
PREDICTED	16,215	30,900	45,865	59,020	73,405	90,470	106,055	121,450	134,305
ACTUAL	11,745	46,479	56,088	67,913	78,043	93,249	107,628	121,653	136,872

*Expenditures Include All Costs & Fees By Consol And S. Dakota

MON



	13,815	12,655	13,315	12,835	12,505	12,505	12,505	20,155	20,135	23,295	22,295	21,145
	17,342	19,319	20,054	13,935	25,003	21,296	9,584	23,091	16,475	16,663	12,820	22,196

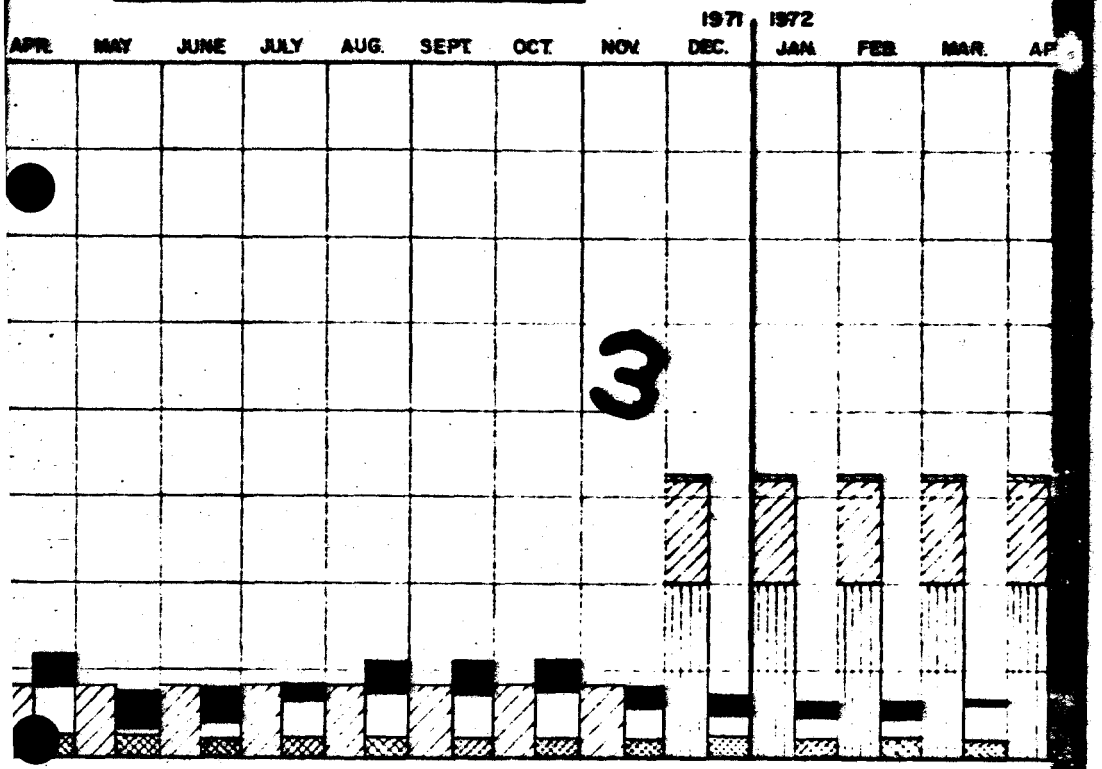
	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
	160,995	173,650	186,988	199,800	212,305	224,810	237,315	257,470	277,608	300,900	323,195	344,348
	207,242	226,561	246,615	260,570	285,573	308,869	316,453	339,544	356,019	372,682	389,502	407,634

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MONTHLY PROGRESS CHART (SUPERVIS

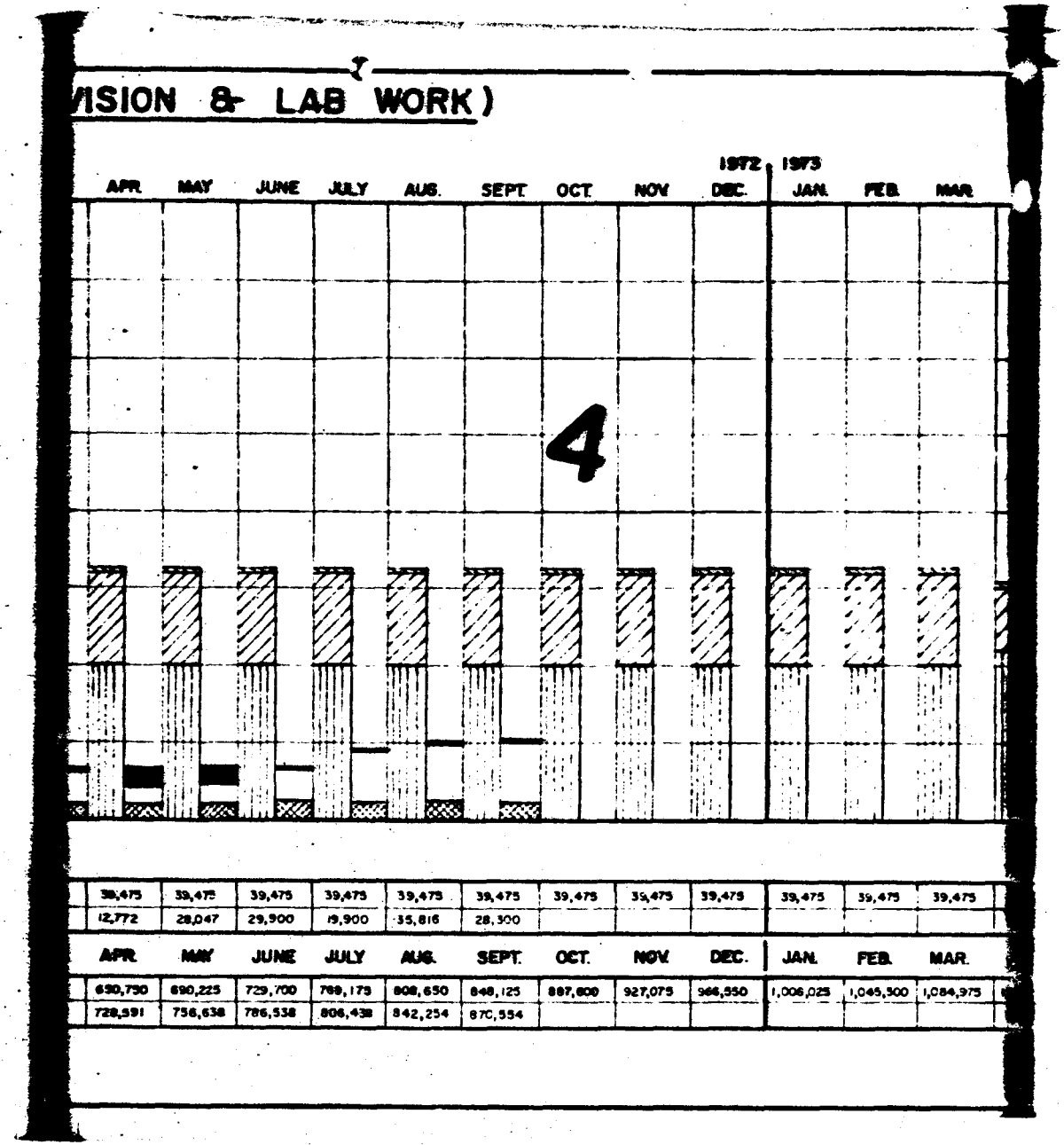
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1,145	18,705	15,955	14,875	14,875	14,875	14,875	14,875	39,475	39,475	39,475	39,475	39,4
2,198	1c,508	15,831	16,923	24,919	97,703	30,575	18,172	36,224	15,604	15,700	23,962	12,7

APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	AP
6,348	383,045	379,000	393,875	408,750	423,625	438,500	453,375	492,850	532,325	571,800	611,275	650,
7,698	420,206	436,037	452,960	477,879	575,582	606,157	624,329	660,553	676,157	691,857	715,819	728,

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VISION & LAB WORK)
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39,475 39,475 39,475 39,475 39,475 39,475 39,475 39,475 39,475 39,475 39,475 39,475
12,772 28,047 29,900 19,900 35,816 28,300
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690,750 690,225 729,700 769,175 808,650 848,125 887,600 927,075 966,550 1,006,025 1,045,500 1,084,975
728,591 756,638 786,538 806,438 842,254 870,554

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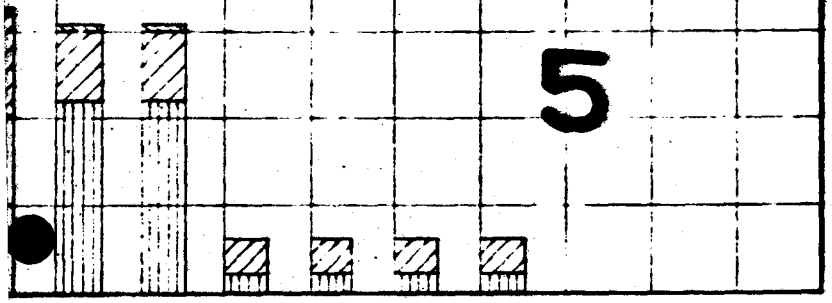
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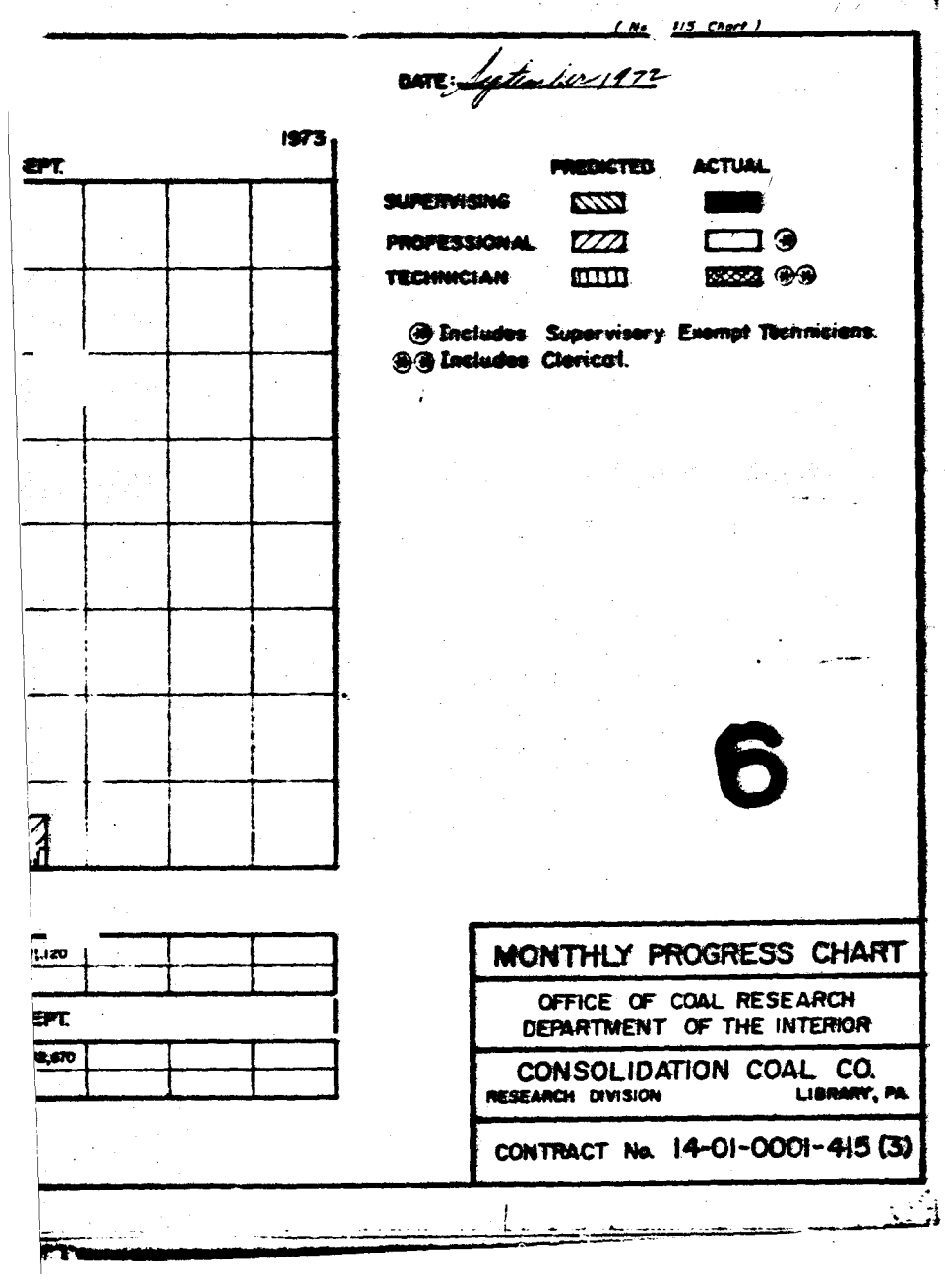
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PROGRESS REPORT NO. 01
OCR CONTRACT NO. 14-01-0001-415(4)
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

October 1 to 31, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

Run No. 5 was accomplished during the month. Although full gasification was not achieved, several significant accomplishments were made.

The acceptor was circulated between gasifier and regenerator for an extended period with no difficulties.

Char feeding into the gasifier was accomplished and transfer of char to the regenerator was accomplished with resultant successful burning of char and full calcination of the acceptor bed.

Several severe upsets occurred during the 17 day run, but in each case it was possible to make adjustments, remove plugs, etc., without shutting down the run.

The ΔP measurements indicated difficulty in maintaining adequate control over the fluid beds in each vessel. The run was terminated to determine causes for our erratic ΔP measurements.

Inspection revealed a severe failure of refractory lining in the regenerator. A complete relining will be required. The previous repair job in the gasifier proved to be intact and no refractory repair is required.

During the period of repairs to the regenerator, it is planned that we will operate the gasifier independent of the regenerator. We hope to achieve a better understanding of the relation between ΔP measurements and the nature of the fluid bed. Some changes will be required in the means of introducing gas into the gasifier to achieve adequate separation of char and dolomite. It is anticipated that these problems can be resolved in the single bed operation.

Financial

Estimated monthly expenditures are $19,000 by Consol and $229,200 by Stearns-Roger. Cumulative expense to date is $16,489,991.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536)

The calculations for heat and material balances for the 150 psi pressure case were completed during the month. A revised issue of the report will be ready for approval by December 1, 1972.

4. Stearns-Roger Construction Subcontract (Project No. 700)

Stearns' accountants are preparing to submit the final construction costs.

5. Library Assistance on Pilot Plant Operations (Project Nos. 537.10 and 537.20)

No analyses were performed during the month of October.

During the period while the plant was operating, the engineering group was studying some alternate refractory design systems in the event the present refractory proved unsatisfactory.

Mr. J. Leterle attended a Metals Council meeting in New York for a discussion of the metallurgical laboratory testing program as well as a plant test program.

6. Library Assistance to Engineering of Methanation Addition Rapid City Pilot Plant (Project No. 537.30)

Process design of equipment proceeded during the month. A meeting was held October 4, 5 and 6 to discuss general process design. This was followed by a meeting October 18 and 19 to approve inquiry data sheets for fired heaters, heat exchangers, the oxide blower and a pump. Inquiries have been sent to vendors. A third meeting will be held November 1 to approve inquiry data sheets for vessels and remaining major equipment.

Stearns-Roger have process and instrument drawings well underway. They will be completed about the middle of November and will be presented for approval.

Work has started on the preliminary layout plot plan. Details will be sufficient to permit computation of a reasonably accurate cost estimate.

7. Consol Guidance on Operations (Project No. 702)

The progress report is attached.

8. Stearns-Roger Operating Subcontract (Project No. 701)

The progress report is attached.

9. School of Mines Subcontract (Project No. 703)

The October progress report is attached.

C. Subject Inventions

A decision was made to submit our modified pressure measuring design to OCR for possible patent filing.

D. Financial Status

Expense	Actual	Budget
Cumulative through September, 1972		
Through June, 1969	$ 1,878,256	$ 1,878,256
Consol	870,035	848,125
Stearns	13,473,500	12,162,500
	$16,221,791	$14,888,881
Expended in Period (estimate)		
Consol	19,000	39,475
Stearns	229,200	201,800
Total - October, 1972	$ 248,200	$ 241,275
Cumulative through October, 1972	$16,469,991	$15,130,156

11/17/72
Att: Monthly Progress Reports on Projects 701, 702, 703
Progress Charts

CONSOLIDATION COAL COMPANY PROJECT

CSC PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #32

CCC Project No. 701

S-R Job No. B-37400

November 3, 1972

SUMMARY OF PLANT OPERATIONS

A seven week turnaround was completed October 9 and the plant turned over to operations. Some 152 items of maintenance and revision were completed during the turnaround, the most time-consuming being repair and revision of the gasifier insulation.

The first few days of operations were used in pressure testing, and in correcting leaks, obstructions, and malfunctioning valves.

By October 16, the system had been heated and filled with dolomite, and hot dolomite circulation established. Tests were performed to show the effects of varying gas flows.

On October 22, addition of char to the gasifier was initiated and by the 25th, the level in the gasifier was 26 feet. Flow tests were conducted, the level raised to 30 feet, and additional flow tests conducted.

Batch transfer of char from the gasifier to the regenerator was started October 27, and was continued intermittently for three days, together with feed of fresh char and dolomite to the gasifier. After each batch of char was transferred to the regenerator, it was burned under controlled conditions and total calcination of dolomite was achieved.

During the above operations there were numerous upsets to the plant, particularly line plugs and control instrument difficulties. The mounting frequency and seriousness of these upsets, combined with an inordinately high generation of steam in the regenerator jacket during char burning led to the decision to shut down. As the month ended, the shut down was essentially complete and the equipment nearly ready for opening, cleanout, and inspection.

Although the objectives of the run were not fully accomplished, both the quality and the quantity of technical data obtained were substantially greater than in previous runs. (These data are now being analyzed and results will be published soon.) Through training and experience, the operating staff succeeded in bringing the plant through numerous upsets that, in earlier months, would have caused immediate shut down.

The month of November will be devoted to maintenance and plant revisions in preparation for the next run.

MONTHLY ACCOMPLISHMENTS--OPERATIONS AND TECHNICAL

The first part of October was spent finishing up the shutdown work. Installation of refractory in the gasifier was the major item. The 72-hour cure of the gasifier boot and transition refractory was completed on Monday, October 2, 1972. The probe supports were then installed. The top head of the gasifier was installed on October 4. The bottom head was bolted into place on the 5th. The breaching on the gasifier heaters was also replaced on the 5th of October.

The following items were worked on the first week of October prior to the next plant run. The oil pump on the regeneration air compressor was replaced. All of the rotameters on the sixth floor were cleaned before startup. The inert gas generator aftercooler tube bundle was cleaned and reinstalled. The baffles were badly corroded and may have to be replaced in the near future. The inert gas high pressure compressor aftercooler, which was retubed in Denver, was reinstalled. The final Heresite lining coat was applied to the quench tower separators. The lignite and dolomite rotary feeders were run to establish a curve of RPM versus weight transferred. The lignite rotary feeders had been modified in so that every other section was blanked off. One of the remote operated ball valves on the ash lock hopper system was binding and not operating smoothly. This valve was removed and it was found that dolomite dust had gotten around the ball, past the seats and had filled the void space. To prevent the reoccurance of dolomite fines filling this space, a plastic material was inserted in the void space prior to reassembling the valve. This method was suggested by our Instrument Supervisor, Frank Plut, and did a fine job of preventing the valve from binding during subsequent operations. Other valves in the plant have been treated in this same manner since then.

The Maintenance Department had enough equipment buttoned up by Monday, October 9th, that preliminary pressure testing with air was done Monday night in preparation for Run 5. The system was pressured to 175 PSIG. Some of the leaks that were found were repaired while under pressure. The valves around the ash lock hopper system leaked badly so the system was depressured and the two valves between the ash lock hopper system and the reactor system were removed, repaired and reinstalled. Since these valves would then hold the system pressure, the rest of the valves could be repaired while we were pressuring up the reactor system. The lignite lock hopper valves had been removed, repaired and reinstalled during shutdown, and no leaks were found at this time.

Upon repressuring with air on Wednesday, October 11th, a plug was found in the char lift line between the gasifier and the regenerator. Indications were that this plug was in the line between the first and fourth floors. The unit was again depressured and a dolomite plug, 16 feet above the bottom flange, was removed. The system was again pressured to 150 PSIG but this time with inert gas. On Thursday, the purge flows were set and instruments zeroed. A reading of 10% on the differential pressure instruments was established as the zero point. This allowed us to tell if any of the differential pressure readings were negative.

On Friday, October 13th, gas circulation was started. A high differential across the dolomite lift line from the engager pot to the regenerator was experienced. It was determined that there was a restriction in this line between the first and fourth floors. The unit was depressured and the 150 degree bend on the bottom of the engager pot was pulled. The line was rodded and the plug of raw dolomite removed. This raw dolomite came from either spillage during filling of the line from the regenerator, the gasifier above the butterfly valve prior to startup, or had been flown out of the line during our preliminary startup operations. After the plug was removed, the 150 degree bend was replaced and the unit repressured with inert gas.

On Saturday, the system was circulated and heated up. The first dolomite was introduced into the system by noon on Sunday, October 15th. Batches of dolomite was introduced into the system by noon on Sunday, October 15th. Batches of dolomite totaling around 2000 pounds were fed to the gasifier, partially calcined, and then transferred to the regenerator. Then dolomite was added both batchwise through the gasifier and continuously through the raw dolomite lock hopper to the regenerator.

Dolomite operating levels were reached late on Monday, October 16th, and dolomite circulation from the regenerator through the gasifier started at about 10:00 P.M. System performance at various circulation rates was studied.

On Tuesday, two problems arose. The raw dolomite that we were to add to the system for make up contained large amounts of fines. Also, this dolomite was wet. We used what we could and the rest was dumped for rescreening. During this run, we rescreened dolomite with a blast of air in an attempt to dry the dolomite somewhat before introduction into the reactor system. The second problem consisted of high pressure drops through the regenerator recycle system. The high pressure drop was mainly because of the two-inch bypass around the hot potassium carbonate absorber. This small two-inch line also contains a two-inch globe valve. On Friday, a three-inch bypass was installed which essentially paralleled the two-inch bypass. When this three-inch bypass was put into service, the compressor suction gained 30 PSI.

On Wednesday, the 18th, dolomite was circulated while gas flow rates in the regenerator were varied in an effort to reduce bed densities. Even at higher than normal flow rates, the apparent density remained higher than desired or expected. Early Wednesday morning, a high pressure was experienced in the regenerator which caused dolomite to flow to the gasifier and also caused the plugging of the dolomite lift line from the engager pot to the regenerator. This upset was caused by the vent valve from the regenerator system sticking closed. By Thursday, the plugged line was cleared after blowing gas up the raw dolomite line to tote bins on the fourth floor. The dolomite that had been dumped to the gasifier was removed to these tote bins until a normal operating level in the gasifier had been established. Gas flows were reestablished, differential pressure recorders and differential pressure transmitters checked. A small amount of dolomite was transferred from the gasifier to the regenerator to make sure this transfer line was clear. Raw dolomite was started back to the system late on Thursday. Raw dolomite was fed to the gasifier and partially calcined dolomite, removed from the gasifier previously, was fed to the regenerator via the engager pot. After a short time of feeding the partially calcined dolomite, the line from the feeder plugged. This line was finally unplugged on Friday. During the time the line was plugged, dolomite feed to the system was discontinued. Upon unplugging the line, raw dolomite was again started to the system. When the dolomite level in the regenerator was sufficient

to spill over into the line above the butterfly valve between the reactors, dolomite circulation was started. Dolomite addition continued until operating levels in the regenerator and gasifier were established. By Sunday afternoon, October 22nd, char was added to the gasifier in order to establish an operating level. The feeding was slow in order to keep the gasifier temperature above 1100°F.

Several upsets occurred because of high line pressure drops. The largest drop was found to be in the line from the regenerator quench tower to the SO_2 scrubber. When pluggages occur, the lines are vibrated externally. When the pluggage suddenly moves, the system is upset. These upsets were handled successfully, however.

The char bed level reached 26 feet on Wednesday, October 25th. Gas flow tests through the char bed were conducted. The char bed level was then raised to 30 feet and flow tests again run. During these tests the boot gas flow is reduced and then gradually increased. As the boot gas flow was reduced to 20,000 SCFH, a high cyclone differential in the gasifier was noted and reactor pressures were slightly upset. The boot flow was raised to 30,000 SCFH and the system seemed to line out.

During the high cyclone differential, char was carried overhead into the gasifier quench system. Severe plugging of this system occurred. Apparently, at the low boot gas rate, the char in the gasifier moved in plug fashion and was carried overhead. Approximately 2600 pounds of char was carried into the quench systems. This is the amount to raise the char bed level from 26 feet to 30 feet in the gasifier.

When char is carried overhead from the gasifier, severe plugging of the quench systems occurs. Considerable time and effort is required to keep this system functioning. The quench systems are not designed to handle this large quantity of solids.

Additional flow tests were conducted and completed on Friday, October 27th.

Data from the flow tests on both the gasifier and regenerator were used by Consol to establish conditions for char burning. Char was introduced to the regenerator via the char lift line around noon on Friday, October 27th, and initially fed for about 40 minutes. A temperature of 1450°F was reached on the bottom temperature element of the temperature probe. Char was started to the regenerator again at around 1:45 P.M. Controlled burning of char in the regenerator was accomplished this run.

A serious system upset occurred about 6:00 P.M. on Friday, which was caused by the plugging of the line between the regenerator quench tower and water separator. Water could not go to the water separator and the quench tower flooded. Water was carried over to the SO_2 scrubber, to the new knockout pot after the SO_2 scrubber, and also to the recycle compressor suction scrubber. The pluggage was moved by vibrating the flanges on the line between the quench tower and the water separator. Subsequently, this system had to be watched very carefully, and when additional pluggages occurred, this flange had to be vibrated.

Early Saturday morning, October 23th, all the temperature elements in the regenerator temperature probe ceased operating except the very top one. Without these temperature elements, it was not possible to burn char in the regenerator because we would not have a temperature indication in the dolomite bed. A temporary thermocouple was installed midway in the regenerator at a pressure sensing point. This, then, gave us three points at which to read temperatures: (1) The very top of the regenerator; (2) The middle of the regenerator; and (3) The bottom of the regenerator. This last thermocouple was installed during the previous shutdown through a bottom nozzle on the regenerator. By late Saturday evening, char feed had been resumed.

Char transfer to the regenerator, char feed to the gasifier and raw dolomite to the regenerator continued intermittently on Sunday, October 29th. Total calcination of the dolomite (calcium and magnesium) was accomplished during Run 5.

Operations were plagued by further pluggages between the regenerator quench tower and water separator. When these occurred, two methods were used to restore circulation: (1) As mentioned before, vibrating the flanges between the vessels helped and, (2) Venting the separator to the atmosphere to reduce its pressure in order to force water from the quench tower into the separator. These pluggages occurred, apparently, from dolomite being carried overhead from the regenerator while burning char which gave high temperatures in the regenerator, and therefore high gas velocities.

Early Sunday afternoon, high gasifier cyclone differentials were again experienced with subsequent char carry over. From Saturday night, until the system was cooled, depressured and opened at the end of the run, it was a continual fight to keep the quench systems operating at all. Several times no water was going down through the gasifier quench tower, and subsequently we had char carry over as far as the compressors and even through the compressors.

The decision was made on Monday, October 30th, for an orderly shutdown. It was planned to batch transfer char to the regenerator from the gasifier and burn it rather than empty it from the system. On the evening and night shifts Monday night, excessive steam production from the regenerator steam drum was noted. This extra steam production coincided with char burning in the regenerator and was verified several times. It was decided that no more char should be transferred and both reactor systems were inerted.

On Tuesday, we started to cool the unit down and tried to remove char from the gasifier through the purged dolomite lock hopper. However, the line was plugged and char removal at this time was not possible. After cooling and depressuring this system, this line was cleared and the gasifier was emptied to tote bins. A total of about 9100 pounds (mostly char) was removed from the gasifier.

After depressuring, the 150 degree bend under the engager pot was removed. Only a small amount of dolomite fell from the regenerator. At the end of the month, efforts were directed toward emptying the solids from the reactors.

During the month, two char grinding runs were made. One run was on the 16th and the other run was on the 24th. A total of about nine tote bins (about 2000 pounds each) were filled. No problems were encountered during these char grinding runs.

Some of the problems associated with Run 5 have already been stated. In addition, the following caused problems during this run.

(1) The vent valve from the regenerator system continues to build a deposit of dolomite fines. This causes the valve to become sluggish and to stick. On the 19th, the valve stuck closed. On the 20th, the valve stuck open. Both of these times, upsets in the system resulted. Daily stroking of the valve with periodic cleaning was necessary to keep control during the run. A new Vee ball control valve will be installed in parallel with the existing cage-trim valve, and will probably be used initially during the next run.

(2) The level device on the slurry tank into which the ash lock hoppers dump is not reliable. Several times during the run, this tank was overfilled with water which causes problems in the flare system and in emptying the ash lock hoppers.

(3) The lignite lock hopper remotely operated ball valves developed leaks during the run. These six valves had been repaired during the previous shutdown. During this run, four of the valves were removed and repaired and reinstalled. Also the hand ball valves have been repaired so that if leakages occur through the remotely operated valves, they can be repaired during a run. Leakage through the lock hopper valves inhibits the feeding of char into the gasifier.

(4) The gas dryers on the various purge and inert gas systems continued to give problems during this run. The "C" gas dryer desiccant was changed during the run. Hand operated valves have replaced the automatic operating valves on this system. The four-way valve on the inert gas dryers is extremely hard to operate. The automatic operator has to be helped by hand during each switching.

(5) During the run, Montana Dakota Utilities supplied us with a high BTU content gas which upset the inert gas generator and the process heaters. Compensation had to be made both when we received the high BTU content gas, and when the gas BTU content returned to normal. This happened twice during our Run 5.

During October the following personnel changes were made: R. E. Davis was promoted from Chief Operator to Shift Superintendent. J. C. Gerken was promoted from "B" Operator to Technical Assistant to the Operations Superintendent, J. W. Phipps from "B" Operator to Controlman and J. H. Ekberg from "C" Operator to "B" Operator. B. G. Ward, Controlman resigned during the month. Jim Witherow reported to work on October 16th as a Junior Chemist.

A Process Group consisting of four Process Engineers and the laboratory was formed October 1st, headed by E. M. Fox. The purpose of this group is to provide the necessary process technology to support operations and to acquire the maximum data and information from each test run.

SAFETY

In October, 24,043 hours were worked without an accident requiring medical attention. Since the start of the job, 290 thousand man hours have been worked without a lost-time accident.

Regular weekly meetings were held which included: Safety Committee, operator training, and maintenance safety.

MONTHLY ACCOMPLISHMENTS-MAINTENANCE

During October, 267 Maintenance Work Orders and 39 Engineering Work Orders were completed. Of these, 86 were "Urgent" and ten were "Call-Out".

Shutdown work was essentially complete in the first week. The large number of "Urgent" and "Call-Out" orders represents a continuing priority effort to sustain operation in the face of equipment malfunctions and failures.

PLANS FOR NOVEMBER

November will be devoted to:

(1) Maintenance of equipment.

(2) Design and installation of revisions in an attempt to correct problems encountered in the October run.

(3) Analysis of the Technical data obtained in the October run.

(4) Preparation for the next run.

STAFFING

	Current Manpower effective 11-1-72	To Be hired in November
Management	1	0
Accounting	4	0
Clerical	5	0
Janitorial	2	1
Safety	1	0
TECHNICAL DEPARTMENT		
Laboratory	10	0
Engineering & Scheduling	10	2
OPERATIONS		
Supervisors	2	0
Shift Superintendents	4	0
Technical Assistant	1	0
Instrument Engineer	1	0
Operators	40	4
MAINTENANCE		
Supervisors	4	0
Crafts	26	0
Warehouse & Purchasing	3	0
	114	7

COSTS

Accumulated Operations Cost to Date, October 31, 1972.....	$4,479,872.36
Purchase Orders Not Paid & Purchases Placed.....	49,568.19
Actually Spent - October, 1972.....	229,224.04
Accumulated Cost Billed to Date.....	$4,423,062.37

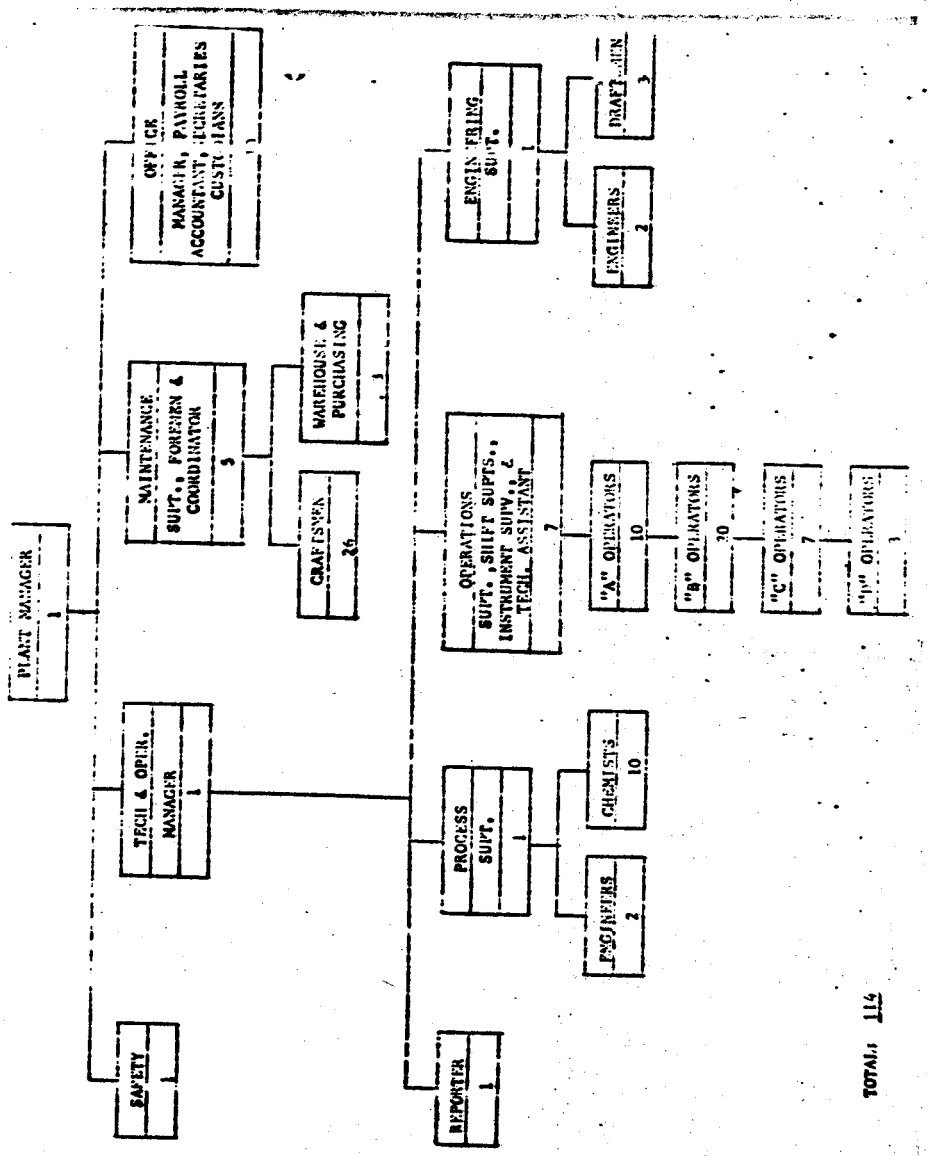
Very truly yours,

STEARNS-ROGER CORPORATION

R. G. Checksfield
Plant Manager

RGC:ska

Attachments: OSHA Report, Organization Chart, Schedule (Progress Chart)



October MONTHS ENDED 31 19 72

OSHA REPORT MINE NAME	MINE NO.	NUMBER OF LOST TIME ACCIDENTS: NON-FATAL	FATAL	TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUCED
Research Division	100						
Rapid City	200	0	0	0	0	22043.5	-
Total Research							

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31 19 72

DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUCED	FREQUENCY	SEVERITY	TONS PER LOST TIME ACCIDENTS	MAN COUN
0	22043.5	-	-	-	-	114

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CONSOLIDATION COAL COMPANY

RESEARCH DIVISION
LIBRARY, PENNSYLVANIA 15129

INTER-OFFICE CORRESPONDENCE

To : John D. Sudbury Date : November 8, 1972

From : Carl E. Fink and Duane C. McCoy At (Office): Rapid City, SD

Subject: Monthly Report No. 26 - Project 702

During the month of October, the repair of the gasifier refractory was completed and another demonstration run (Run 5) was attempted. Although the goal of gasification was not reached, a successful period of char combustion was achieved during which the regenerator bed was heated to the acceptor calcination temperature (about 1750 °F). Acceptor circulation in the absence of char and char feed to the gasifier were also accomplished during Run 5. The run was terminated when acceptor could not be circulated after calcination of the regenerator bed.

Acceptor Circulation and Fluidization Tests

Trouble free acceptor circulation was demonstrated during Run 5. Severe gas bypassing through the boot refractory had prevented circulation during Run 4. During circulation a severe upset occurred when the regenerator back pressure control valve stuck in the closed position. The subsequent loss of pressure balance forced the regenerator-acceptor inventory back into the gasifier resulting in plugs in the acceptor lift line and transition section above the gasifier boot where the acceptor was not fluidized. These plugs were removed without depressuring and the run resumed.

A series of fluidization tests were made to determine the effects of fluidizing velocity on bed expansion in both the gasifier and regenerator. The results of these tests are summarized below:

Fluidized Bed	Velocity Range Ft./Sec.	Bed Density Range Lb./Ft.^{3}
Gasifier Boot (Ex. Char)	1.42 - 2.51	68.3 - 62.9
Gasifier Boot (W. Char)	0.89 - 2.09	42.7 - 49.1
Gasifier Char Bed	0.370 - 0.609	41.7 - 40.9
Regenerator Bed	1.86 - 2.71	72.3 - 65.0

The response of the bed densities with changes in fluidizing velocities was far less than expected. The low densities in the boot with char present indicate a char-acceptor mixture, and the fact that the boot density increased with increasing velocity suggests that some stripping of char occurred.

Gas bypassing of the refractory in both the gasifier and regenerator beds is a likely reason for the unusual fluidization behavior. The refractory liners of both reactors will be inspected as soon as possible to determine whether or not bypassing occurred. Other factors, such as gas distribution, will also be investigated.

Char Feed to the Gasifier

Char was fed to the gasifier to bring the char bed height to an operating level 28 feet into the 40-inch section of the reactor. Within 1 1/2 hours after the first char addition to the gasifier, the boot bed density had increased from 65 lb./cu. ft to 72 lb./cu. ft. Gradually, the boot density decreased and became equal to the char bed density of about 45 lb./cu. ft. Evidently, the char bed retained the fine material which was thrown out of the dolomite bed and did not allow this material to resettle into the boot. This would explain the initial increase in the boot density. Total loss of the dolomite interface occurred as the char bed floated all the dolomite out of the boot. Raising and lowering the boot gas flow from a minimum of 20,000 SCFH to a maximum of 45,000 SCFH failed to reestablish the interface.

Char Combustion

During the first regenerator calcination attempt, char was fed at a minimum rate of 155-175 lb./hr. with 20,000 SCFH air. Particular attention was paid to the regenerator jacket water steam production and the temperature gradient between the top and bottom of the regenerator bed. Although the bed temperature increased from 1250 °F to 1750 °F, steam production remained constant throughout the run. Good control of the regenerator bed temperature was also maintained. The bed temperature gradient normally varied between 20 °F and 60 °F.

Calcination temperature of 1750 °F was attained just prior to a major upset in the regenerator quench system. Solids plugged the 6-inch line between the regenerator quench tower and the separator drum. This caused flooding of the quench tower and the carry over of water into the SO_2 scrubbed and the flue gas knock-out pot. Vibration of the line between the quench tower and separator removed the plug. Upsets of this nature, in both the gasifier and regenerator quench system, continually plagued the operation.

The system was again lined out. Soon after char addition to the regenerator, all thermocouples except the top thermocouple in the regenerator temperature probe failed. Gradually, the probe tore apart and dropped to the bottom of the regenerator. A temporary thermocouple

was installed in the low side pressure tap of dPR-2015. Temperature readings were available for the top, middle, and bottom of the regenerator. Since the bottom thermocouple (installed in the bottom Grayloc hub) did not respond as rapidly to bed temperature changes as did the bottom thermocouple on the temperature probe, the new arrangement was not satisfactory. The variability of the char feed rate and the slow response of both the bottom thermocouple and the gas analysers (CO, CO_2, and O_2) made control of the regenerator temperature and CO concentration difficult. After the first char burn, no attempt was made to control the combustion under reducing conditions (0-3% CO).

Subsequent char burnings were of an intermittent nature since both quench systems required nearly constant attention. During the final char burning, an increase in the regenerator jacket water steam production was observed. The steam production varied with the char feed rate. The indication was that refractory degradation had occurred in the regenerator.

Before the final char burning, the regenerator dP's indicated that the regenerator bed had either fused together or severe channeling was occurring. Inspection of the regenerator following the shutdown revealed that both fusion and channeling had occurred.

Independent Gasifier Operation

While modifications to the present system are being made, plans are to operate the gasifier independently of the regenerator. Tests will be made to determine (1) if an interface can be obtained with closely sized dolomite, (2) whether showering of dolomite with simultaneous withdrawal of material from the gasifier boot will improve the chances of obtaining and interface, and (3) the applicability of the Consol fluidization correlation to scaled up equipment of the pilot plant size.

C. E. Fink

D. C. McCoy

CEF-DCM:lmp

SUBCONTRACT BETWEEN CONSOL AND SOBERT RE CONSOL CO_2 ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR OCTOBER, 1972

I. General

Although the formal contract for extension has not been received, work on new areas is underway. Complete outlines and timetables of the new work are under preperation and should be available during the coming month. The carbonate resources report is still in revision but should be transmitted during November. Additional work on impurities in the reconstituted acceptor melts was begun using various impurities. The corrosion of materials project has tested the use of copper crucibles for use in the dissolution rates of stainless steel in $CaCO_3$-$Ca(OH)_2$ melts and is proceeding on equipment design. Additional re-running of some samples for selenium has been done under the noxious elements project. Dr. Lingard plans to visit Ponca City prior to selection of equipment for the sulfur studies. Monitoring of wastewater is proceeding normally.

II. Carbonate Resources (Mickelson)

Although it was hoped to complete and transmit the carbonate resources report during October, this was impossible due to other academic committments of the principal investigator. Progress was made on the revision and we believe that the revised report will be transmitted by the end of November. Fortunately, we have not planned any work on the contract extension during the last half of calendar 1972.

III. Acceptor Reconstitution (Fuerstenau)

Experimental work on the effect that added impurities impart to the properties of reconstituted melts was started this past month. Eutectic composition melts were made with $NaHCO_3$, K_2CO_2, and $MnCO_3$ added as impurities. The effect of the presence of these impurities will be established by measuring activities of the melts upon cycling between calcination and carbonation in a fluo-solids bed reactor. Bids for the reactor are expected this month.

Work this month will involve conducting experiments with different levels of addition of the same three impurities.

VI. Corrosion of Materials in Contact with $CaCO_3$-$Ca(OH)_2$ Melts (Palmer)

Work on the corrosion study this month involved selection of a suitable nonferrous crucible in which melts could be contained. Materials examined were graphite, silica, silver-plated Type 316 stainless steel, and copper. It was established that copper crucibles could be used to contain $CaCO_3$-$Ca(OH)_2$ melts without significant dissolution of the container. Several melts were made in this crucible to establish the suitability of the crucible with respect to degree of metal oxidation, completeness of acceptor fusion, and endurance of welded seams.

The sample stirring mechanism was also designed this month and materials were ordered for its construction.

Work in the month of November will involve assembly of the stirring mechanism and determination of the dissolution rate of stainless steel as a function of degree of melt agitation.

V. Noxious Elements (Lingard)

Additional work on the determination of a number of noxious elements in lignite is being done to try to improve reproducibility of results. This was prompted by poor reproducibility of selenium determinations on samples other than the Firesteel sample. The interim report is still in preparation and is expected to be completed in November. The principal investigator has recovered from the illness reported in September.

VI. Sulfur Studies (Lingard)

A survey of equipment needed to set up experimental work on this project has been made. A visit to the Conoco lab at Ponca City is contemplated prior to any final decision concerning purchase of equipment.

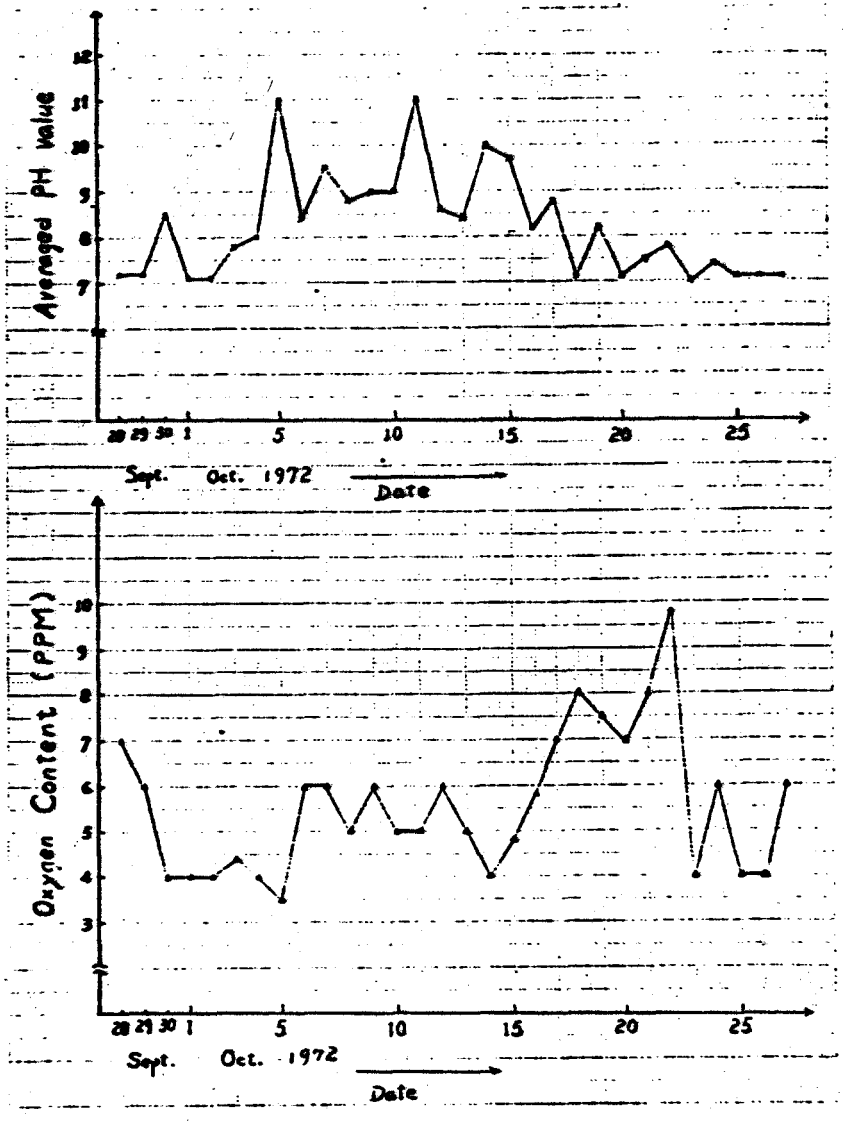
VII. Lignite Beneficiation (Clarkson)

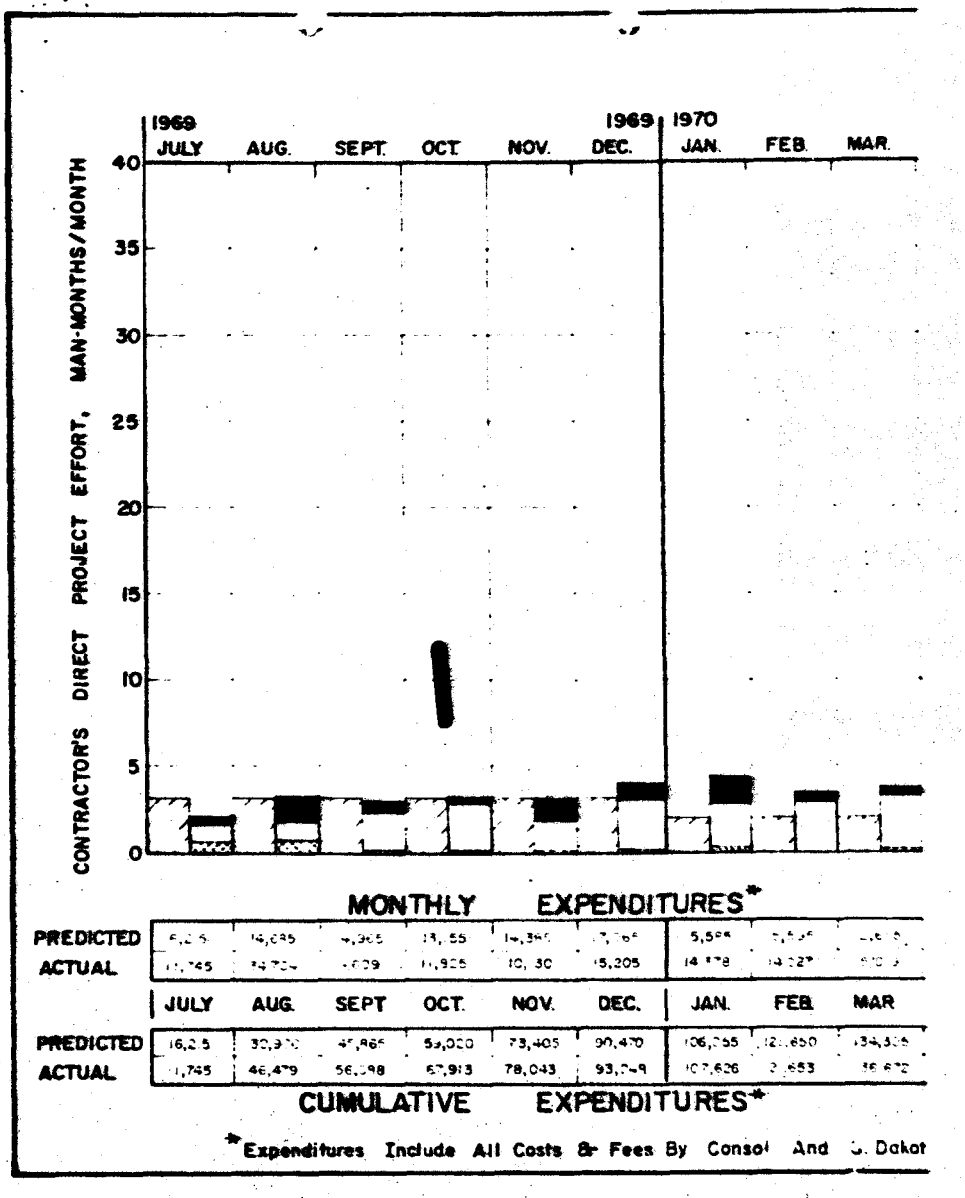
Revision of the preliminary report is in progress and an outline of additional work needed is being prepared.

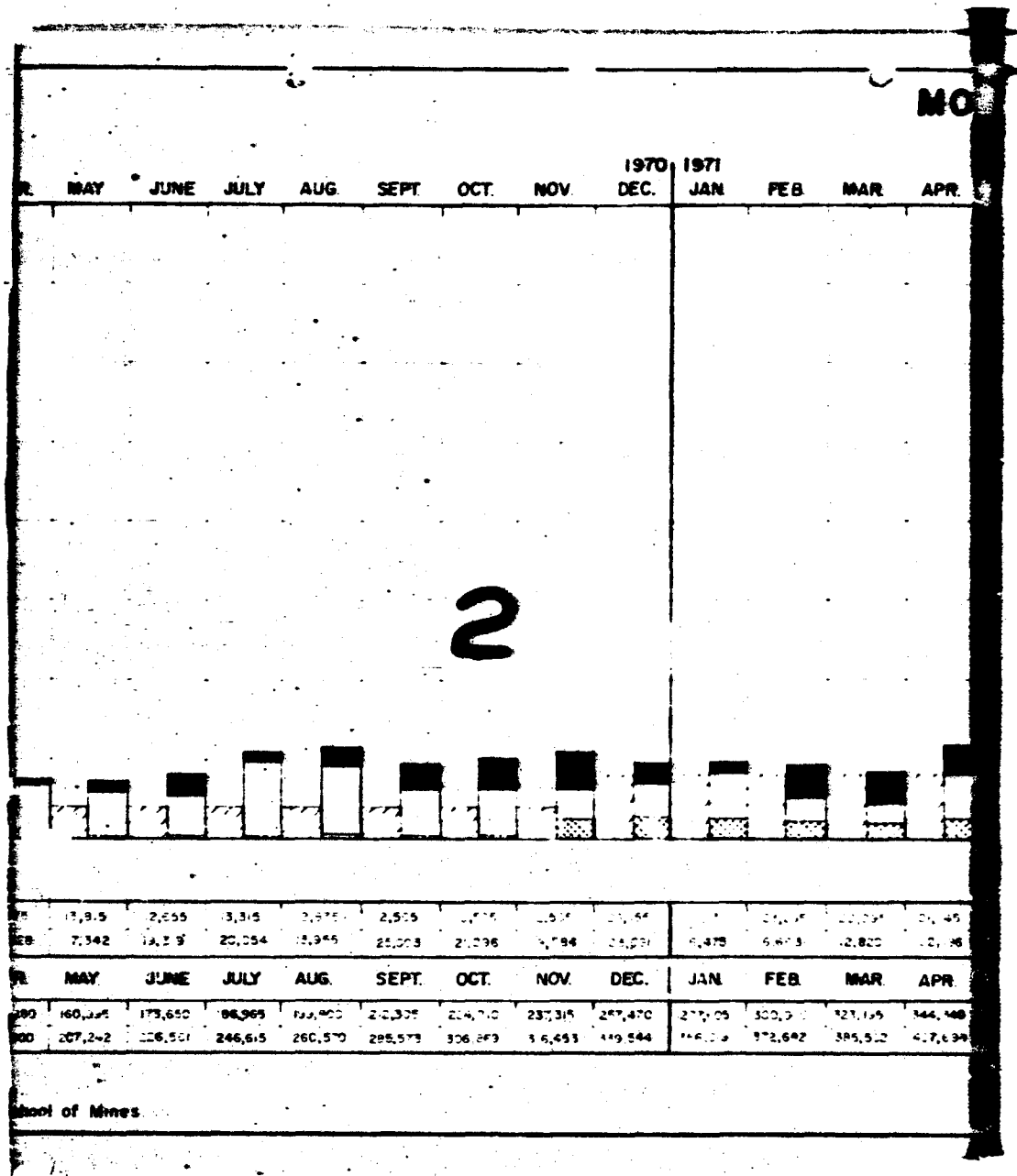
VIII. Waste Monitoring (Oliver)

Copies of data from wastewater monitoring over the past month are attached. The instrument shed on the tenth floor has been erected. A work request has been sent to Stearns Roger for a platform to be constructed to enable us safely to install the particle monitoring devices in the vent stack adaptor. It appears that all that is needed to enable us to analyze gas samples with the gas chromatograph is to extend the gas sampling tube into the instrument shed.

Date	Oxygen Content (PPM)	PH value
Sept. 28	7.0	7.2
29	6.0	7.2
30	4.0	8.5
Oct. 1	4.0	7.1
2	4.0	7.1
3	4.4	7.8
4	4.0	8.0
5	3.5	11.0
6	6.0	8.4
7	6.0	9.5
8	5.6	8.8
9	6.0	9.0
10	5.0	9.0
11	5.0	11.0
12	6.0	8.6
13	5.0	8.4
14	4.0	10.0
15	4.8	9.7
16	5.8	8.2
17	7.0	8.8
18	8.0	7.1
19	7.5	8.2
20	7.0	7.1
21	8.0	7.5
22	9.8	7.8
23	4.0	7.0
24	6.0	7.4
25	4.0	7.1
26	4.0	7.1
27	5.0	7.1
Average	5.5	8.2


Averaged PH Value
Sept.
Oct. 1972
Date
Oxygen Content (PPM)
Sept.
Oct. 1972
Date

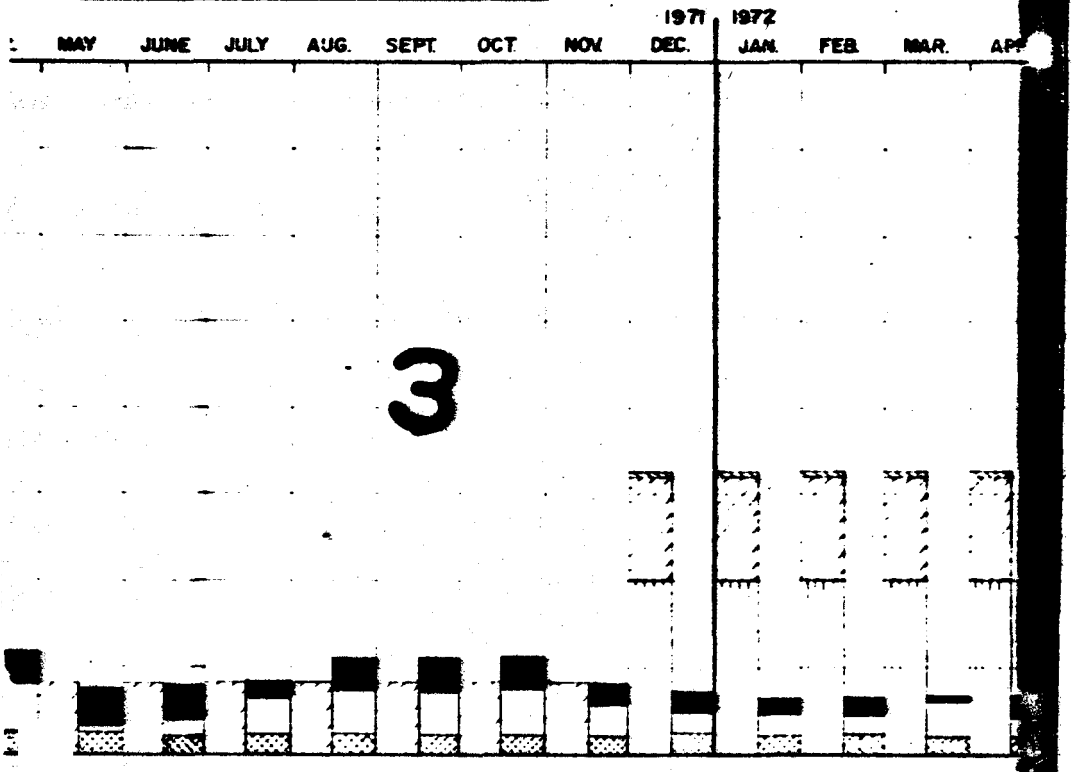

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CONTRACTOR'S DIRECT PROJECT EFFORT, MAN-MONTHS/MONTH
MONTHLY EXPENDITURES*
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PREDICTED
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30,970
4[illegible]
59,000
73,405
90,470
106,055
121,650
134,535
ACTUAL
11,745
46,479
56,398
67,913
78,043
93,049
107,626
2 653
CUMULATIVE EXPENDITURES*
*Expenditures Include All Costs & Fees By Consol And S. Dakot


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ONTHLY PROGRESS CHART (SUPERVISI

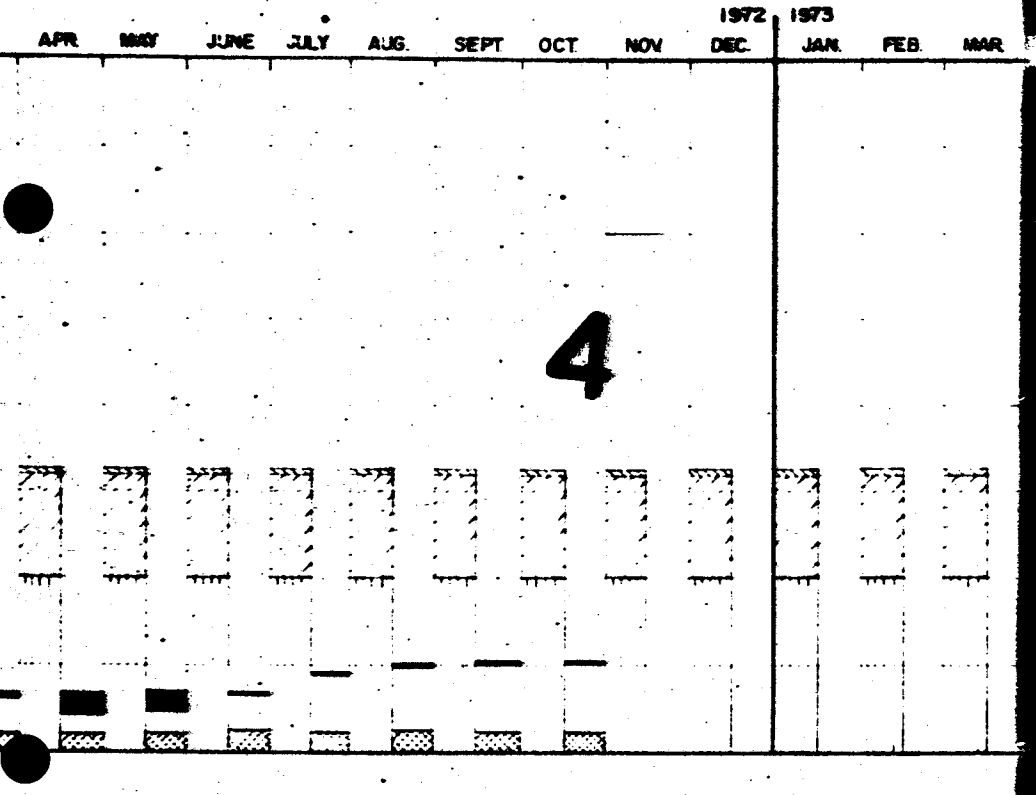
CONTRACT No. 14-01-0001-415 (3)



	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
	365,046	379,000	393,875	409,750	425,625	441,500	463,375	492,950	532,3[illegible]	57[illegible],800	6[illegible],275	650,[illegible]
	420,206	435,[illegible]	452,960	477,879	575,582	606,157	624,329	660,553	678,157	691,857	75,819	728,[illegible]

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VISION & LAB WORK)



39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475
2,772	28,047	29,900	9,9[illegible]	35,8[illegible]	27,791	3[illegible]					

	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.
	650,750	690,225	729,700	769,175	808,650	848,125	887,600	927,075	966,550	1,006,025	1,045,500	1,084,975
	728,591	756,638	796,538	806,434	842,254	877,035	844,035					

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39,475	36,075	36,075	11,475	11,475	1,675	41,120

MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
384,975	1,221,050	1,257,125	1,168,650	1,140,075	1,191,550	1,232,670

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* Includes Supervisory Exempt Technicians.
** Includes Clerical.

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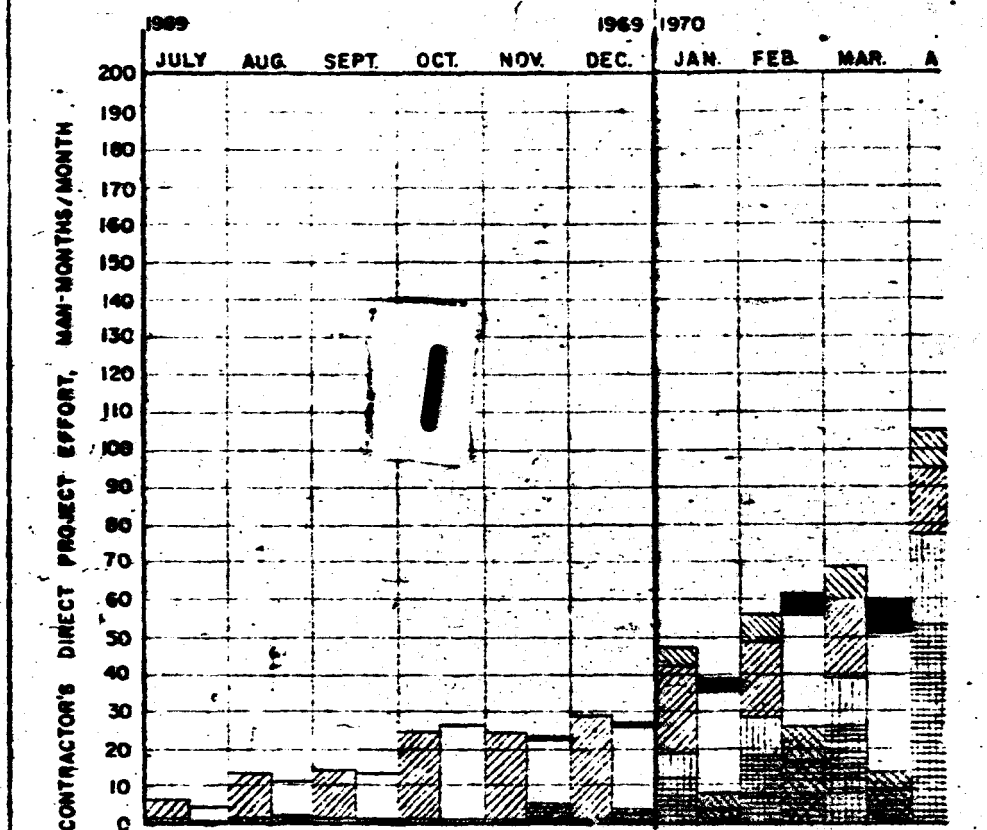
MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA.

CONTRACT No. 14-01-0001-415 (3)

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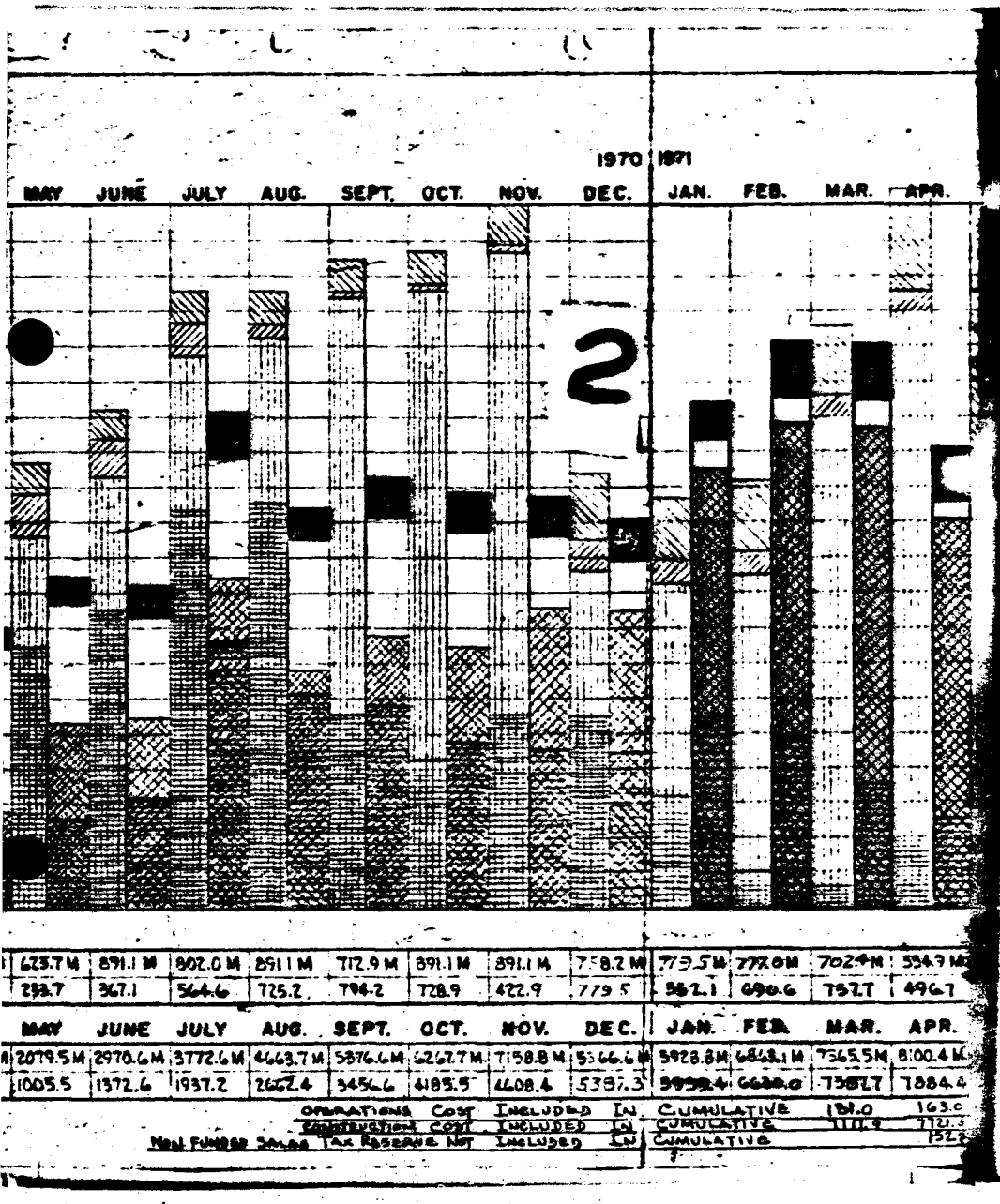
MONTHLY EXPENDITURES *

	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	A
PREDICTED	0	30.0 M	41.0 M	50.0 M	98.0 M	104.9 M	112.0 M	273.0 M	299.5 M	445
ACTUAL	6.2	25.0	32.8	42.6	39.7	126.2	110.5	76.7	[illegible]	209

CUMULATIVE EXPENDITURES *

	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	AP
PREDICTED	0	30.0 M	71.0 M	121.0 M	219.0 M	325.9 M	437.9 M	710.9 M	1010.2 M	145
ACTUAL	6.2	31.2	64.0	106.6	146.3	272.5	383.0	459.7	562.6	77

* EXPENDITURES INCLUDE ALL COSTS & FEES



623.7 M	891.1 M	802.0 M	891.1 M	772.9 M	891.1 M	891.1 M	758.2 M	779.5 M	772.0 M	702.9 M	554.9 M
238.7	367.1	564.6	725.2	794.2	728.9	422.9	779.5	562.1	690.6	752.7	496.7

	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
A	2079.5 M	2970.6 M	3772.6 M	4663.7 M	5876.6 M	6267.7 M	7158.8 M	5566.6 M	5928.8 M	6843.1 M	7365.5 M	8100.4 M
	1005.5	1372.6	1937.2	2662.4	3456.6	4185.5	4608.4	5387.3	5959.4	6649.0	7387.7	7884.4

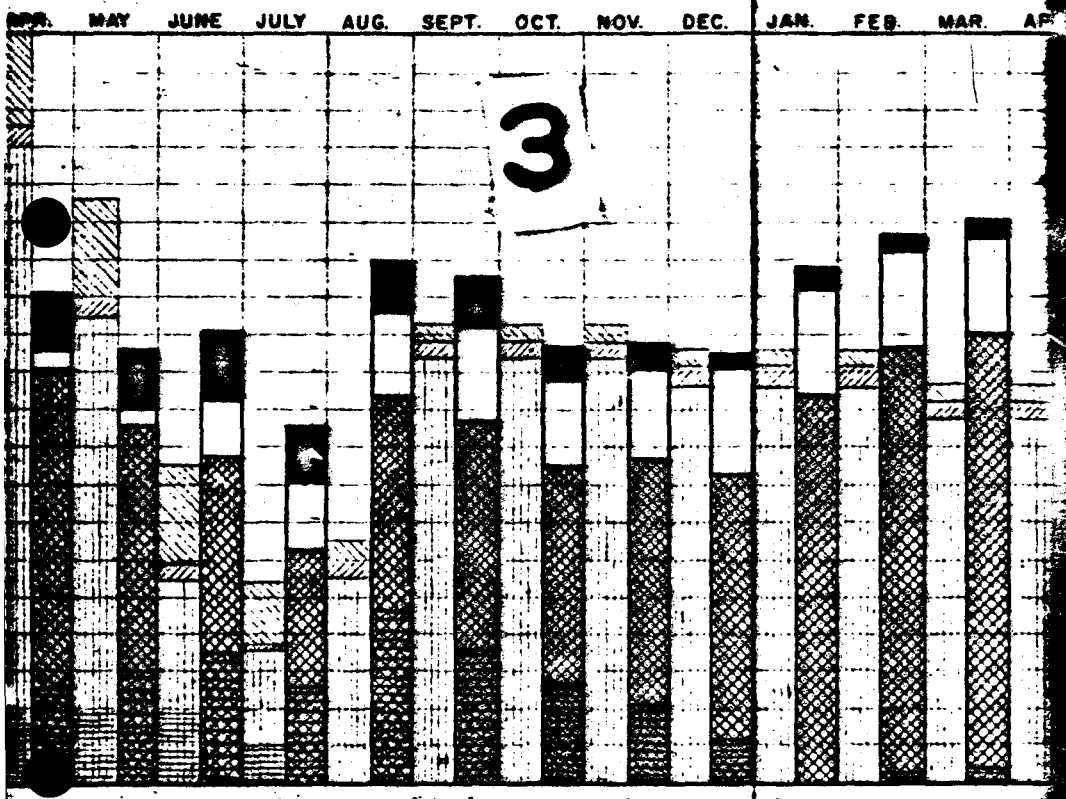
OPERATIONS COST INCLUDED IN CUMULATIVE 151.0 163.0
CONSTRUCTION COST INCLUDED IN CUMULATIVE 1111.9 1121.3
NEW FUNDED SINKING FUND RESERVE NOT INCLUDED IN CUMULATIVE 152.8

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MONTHLY PROGRESS CHART

CONTRACT NO. 14-01-0001-415 (3)

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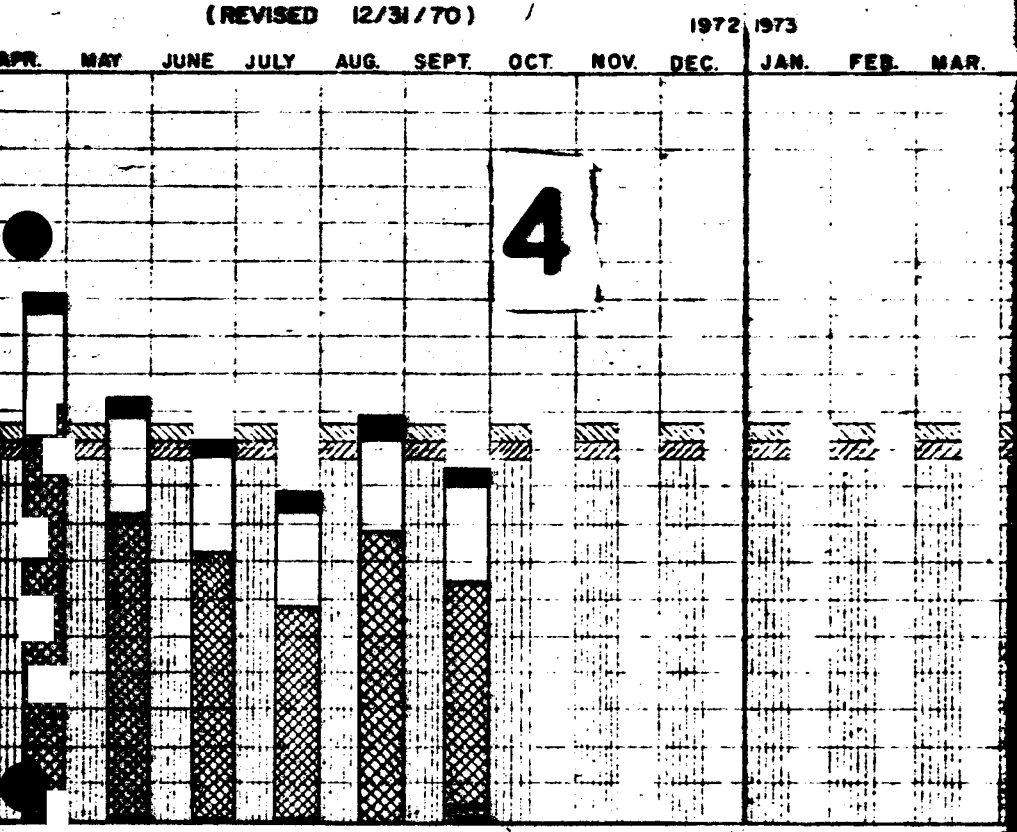
APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
487.8 M	487.7 M	441.8 M	285.0 M	220.8 M	218.1 M	219.0 M	219.1 M	211.9 M	211.5 M	211.5 M	185.1 M	186
296.7	292.0	308.1	221.6	299.6	440.1	409.4	258.0	541.9	360.3	425.0	408.3	40

APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
8440.4 M	8538.1 M	8979.9 M	9264.9 M	9485.7 M	9703.8 M	9921.8 M	10140.9 M	10352.8 M	10,564.3 M	10,775.8 M	10,960.9 M	11,14
8884.4	8176.4	8484.6	8706.1	9005.7	9445.8	9885.2	10,093.2	10,441.1	10,801.4	11,226.6	11,634.7	12,0
163.0	189.7	246.6	334.8	467.6	611.7	803.8	981.0	1183.3	1533	1938.3	2346.6	2
8721.4	8366.1	8731.2	8571.3	8538.2	8834.1	9082.4	9,112.2	9257.8	9268.1	9288.1	9288.1	9
1926	194.9	197.4	198.7	199.4	194.5	160.8	161.8	174.5	181.0	187.1	191.4	1

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(CONSTRUCTION & OPERATION)

(REVISED 12/31/70)



4.5M	204.7M	205.9M	202.8M	202.8M	202.9M	201.8M	201.5M	201.4M	183.2M	182.9M	182.1M
PT.®	425.5	271.0	243.1	269.2	215.4	229.2					

APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.
46.4M	11,350.1M	11,554.0M	11,756.8M	11,959.6M	12,162.5M	12,364.3M	12,565.8M	12,767.2M	12,950.4M	13,133.3M	13,315.4M
042.5	12,460.0	12,745.2	12,988.9	13,208.1	13,423.5	13,702.7					
2748.4	3171.3	3446.4	3709.1	3918.3	4183.1						
9394.1	9425.1	9279.8	9279.8	9279.8	9279.8						
1974	205.8	211.5	216.1	246.5	218.9						

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OPERATIONS— S

2.1 M	180.5 M	177.5 M	173.0 M	161.2 M	140.8 M	130.1 M	130.0 M	130.0 M	24.9 M

MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
3154 M	3,495.9 M	13,673.4 M	13,843.4 M	14,004.6 M	14,134.4 M	14,275.5 M	14,405.5 M	14,535.5 M	14,560.4 M

APPROXIMATE TOTAL CONSTRUCTION ≈ 8,800,000

APPROXIMATE TOTAL OPERATIONS ≈ 5,760,400

14,560,400

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① INCLUDES SUPERVISORY EXEMPT TECHNICIANS
② ② INCLUDES CLERICAL

CONSTRUCTION — STEARNS-ROGER JOB 8-37000
OPERATIONS — STEARNS-ROGER JOB 8-37400

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MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA

CONTRACT NO. 14-01-0001-415 (
(REVISED 12/31/70)

51 M 150.0 M 30.0 M 24.9 M

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85 M 14,405.5 M 14,535.5 M 14,560.4 M

CONSTRUCTION ≈ 8,800,000
OPERATIONS ≈ 5,760,400
14,560,400

CCDC-MPR--102

PROGRESS REPORT NO. 102
OCR CONTRACT NO. 14-01-0001-415(4)
GENERAL LIGNITE GASIFICATION PROCESS DEVELOPMENT

November 1 to 30, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

The regenerator head was removed and the vessel cleaned and completely stripped of insulation. Seven metal vapor stops were installed. Welding of supports for the new insulation system was initiated. Specifications for a new refractory system not using the soft permeable Superex were issued for quotations.

A total of about 150 maintenance and engineering orders were issued to be completed during the present down time. Changes in the quench and lockhopper systems were especially needed.

Revisions were made to the glass fluidization model and to the plant gasifier in preparation for fluidization tests in these vessels during the current shut down. These tests are well under way at the writing of this report. It is anticipated that these runs will be continued until mid-January.

Financial

Estimated monthly expenditures are $37,100 by Consol and $200,300 by Stearns-Roger. Cumulative expense to date is $16,716,501.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536)

The calculation for the heat and material balances for the 150 psi case were completed by the staff at Rapid City and then incorporated into the report in Library. An attempt will be made to complete the report by early January.

4. Stearns-Roger Construction Subcontract (Project No. 700)

Stearns' accountants are preparing to submit the final construction costs.

5. Library Assistance on Pilot Plant Operations (Project Nos. 537.10 and 537.20)

When the plant was shut down, the engineering group assisted in examination of the refractories and preparation of design and specifications for a new system in the regenerator.

The Stearns-Roger plant force proposed new designs in the quench systems. These systems were reviewed and approved.

C. A. Schulz attended a Metals Council meeting in Chicago and subsequently arranged for a separate meeting with Braun in Rapid City for setting up a corrosion study program.

6. Library Assistance to Engineering of Methanation Addition Rapid City Pilot Plant (Project No. 537.30)

Review of equipment design worksheets has been completed and all equipment is now out for bids. Stearns-Roger will furnish us with a copy of each bid along with other pertinent data.

The preliminary P & I drawings for the process were reviewed in a meeting at Stearns-Roger on November 28 and 29. Numerous instrument and piping changes were made. Utility P & I drawings were available for the first time at this meeting. They will be reviewed at Library and comments will be forwarded by Stearns-Roger.

Equipment layout drawings were also available November 28. In the review of these drawings, it was agreed that a separate methanation control room would be provided at the equipment site abutting the existing chemical storehouse. This location will minimize length of instrument lines and will not interfere with existing operations. For safety reasons, it was agreed that the Dowtherm vaporizer would be isolated from the Dowtherm expansion tank by a firewall. The expansion tank with auxiliaries will be diked to contain the flammable materials in case of fire or leakage. Factory Mutual standards will be used in design of the two fired heaters.

Stearns-Roger will issue the revised P & I drawings early in December. They expect to complete the methanation cost estimate later in December.

Consol and Conoco are planning a meeting about January 15 to review all the work on methanation thus far with emphasis on process design. We also intend to assemble a suitable bid package for obtaining quotations on construction of the Methanation Section.

7. Consol Guidance on Operations (Project No. 702)

The progress report is attached.

8. Stearns-Roger Operating Subcontract (Project No. 701)

The progress report is attached.

9. School of Mines Subcontract (Project No. 703)

The November progress report is attached.

C. Subject Inventions

A decision was made to submit our modified pressure measuring design to OCR for possible patent filing.

D. Financial Status

Expense	Actual	Budget
Cumulative through October, 1972		
Through June, 1969	$ 1,878,256	$ 1,878,256
Consol	889,045	887,600
Stearns	13,702,800	12,364,300
	$16,470,101	$15,130,156
Expended in Period (estimate)		
Consol	37,100	39,475
Stearns	209,300	201,500
Total - November, 1972	$ 246,400	$ 240,975
Cumulative through November, 1972	$16,716,501	$15,371,131

12/15/72

Att: Monthly Progress Reports on Projects 701, 702, 703
Progress Charts

CONSOLIDATION COAL COMPANY PROJECT

CSG PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #33

CCC Project No. 701

S-R Job No. B-37400

December 8, 1972

SUMMARY OF PLANT OPERATIONS

The plant was cooled down and depressured on November 1st after termination of Run No. 5. Equipment was emptied, cleaned, and inspected. About 150 maintenance and engineering orders were initiated to prepare the plant for subsequent runs.

The head of the regenerator had to be removed to get out dolomite because broken probe supports and pieces of the broken thermocouple probe obstructed the openings normally used. A twelve inch diameter hole was found in the interior insulation opposite the air inlet. When more insulation was removed in preparation for repairs, a "chimney" was found in the insulation next to the vessel wall. Complete reinsulation of the vessel was decided upon, and specifications were issued for quotations. All existing insulation was cleaned out, seven metal vapor stops next to the wall were installed, and preparations were made to install new supports and insulation anchors.

Inspection of the gasifier showed no damage to the insulation other than normal expansion-contraction cracks. New probe supports were designed and revisions were designed for the dip leg on the internal cyclone separator.

Design was completed and installation started on several revisions to the quench, lock hopper and other systems.

Tests were made on several proposed solid sampling designs.

Revisions were made to the glass fluidization model, and the plant gasifier was isolated with blinds, in preparation for fluidization tests in these vessels during the current shutdown. South Dakota limestone was ground and screened in the plant and hand screened in the laboratory for use in these tests.

Data from the October run (Run No. 5) were analyzed for presentation in a report on that run.

A switching coil burned out during a test of the emergency generator. Following repairs, a successful test was run.

Some freeze-ups occurred in the extreme cold at the end of the month, but major problems were avoided through constant operator surveillance.

MONTHLY ACCOMPLISHMENTS--OPERATIONS AND TECHNICAL

The first several days of the month were occupied in completing the shutdown initiated at the end of October, and in emptying, cleaning and inspecting the equipment. Approximately 150 engineering and maintenance orders were drawn up to accomplish repairs and alterations to the plant for the next operating run.

The dolomite in the regenerator would not flow down the lift line nor were attempts at air lancing or removing the material through other connections successful. The top head of the regenerator was removed so that the dolomite could be lifted out by buckets. Some of the dolomite had crusted and agglomerated, and the nozzles were blocked by support brackets that had broken off and by pieces of the thermocouple probe which had broken into three pieces. One piece of thermocouple piping had lodged in a valve in the lift line.

Inspection of the inside of the regenerator showed that the refractory insulation had a hole about one foot in diameter opposite the air inlet line. It was planned to reinsulate the bottom section of the regenerator but when the insulation was removed at the bottom, it was found that there was a chimney of burned out insulation running up the wall of the vessel approximately twenty feet. Thus, it was decided to reinsulate the entire vessel.

With the assistance of insulation specialists from Continental Oil Company, a specification for reinsulation of the entire vessel was drawn up and sent out for quotations. The entire interior surface of the regenerator was cleaned. The old insulation supports were removed and 7 vapor stops at the surface of the vessel were designed and installed and preparations were made to install new "bull Anchor" supports for the insulation. The pressure probe was redesigned to conform to the earlier change in the gasifier pressure probe, and new supports were designed for both the temperature and pressure probes to provide greater strength. New side entry thermocouple and pressure taps were also designed.

The solids were removed in normal fashion from the gasifier without difficulty. When the head of the gasifier was removed, it was found that very little solid material remained in the vessel. One probe support had broken loose. New supports were designed to provide greater strength. Inspection of the new insulation that had been installed during the last shutdown showed no damage except for normal expansion-contraction cracks.

A design was completed for modification of the dip leg under the cyclone separator in the gasifier. The dip leg contained a 30° offset in order to clear the heating elements that subsequently have been removed from the gasifier, whereas the manufacturer recommends a maximum of 15° offset. The dip leg was redesigned to eliminate all of the offset, to eliminate the connecting flange to the cyclone separator, and to include a 6" section of pipe between the separator and the 2" dip leg. A "trickle valve" (backflow preventer) was also added to the bottom of the dip leg.

Considerable solids were found in the quench water system. Char had carried overhead from the gasifier quench tower, presumably when water feed was interrupted due to plugging of the strainers and filters. Piping has been designed to bring water from the foul water stripper pump as an alternate source of supply. The bottom of the regenerator quench tower has also been redesigned to allow better removal of solids. The overhead gas line from the regenerator

quench tower has been redesigned to eliminate unnecessary elbows to decrease the possibilities of plugging.

The ash lock hopper system was found to have several hundred pounds of residual material including hard crusted deposits. The entire system including the cyclone separator is being studied to find improvements to eliminate this blockage.

Problems were encountered during the last run in feeding char from the lignite lock hopper system. Purges have been installed on the hoppers to aid in fluffing the beds. A timer has been added to delay the closing of shut-off valves until the feeders have been stopped. Quotations have been requested on knife edge gate valves for positive shut-off.

Solid sampling was not achieved during most of the last run. Studies have been made to devise possible alternate methods of sampling and several possible systems have been experimented with in the Plant.

The inert gas generation system has failed to provide the intended amount of inert gas. Adjustments have been made to the instrumentation on the generator and a new driver pulley has been installed on the high pressure compressor drive motor. With these revisions, the design rate of 10,000 SCFH was obtained. The current drawn by the motor, however, was beyond name plate rating and into the service factor.

A test on the emergency electrical generator resulted in burning out a switching coil. This electrical gear was repaired and a subsequent test proved satisfactory. The boiler had to be taken out of service for the electrical repairs and, during this shutdown, miscellaneous repairs and revisions were made to the steam system and to the propane and natural gas inlet lines and controls.

The waste water holding and settling pond was emptied for inspection. The buildup of solids in the bottom of the pond was not sufficient to require cleaning at this time.

A severe spell of cold weather at the end of the month caused some freezing in lines, strainers and steam traps. Constant surveillance by the operators prevented the occurrence of major problems.

Preparations were made for extensive fluidization tests during the shutdown both in the glass model and in the plant gasifier. Revisions were made to the glass model to allow testing of different air inlet nozzles and measurement of differential pressure at various distances from the wall of the vessel. The plant gasifier was blanked off to isolate it from other systems so that it could be tested with air under atmospheric conditions with the head off. Two truckloads (13 tons) of South Dakota limestone were ground and screened in the plant for these tests. Portions of the screened material were rescreened by hand in the laboratory.

A small furnace was constructed and installed in the laboratory for testing of hot fluid beds. This will be used initially for tests of dolomite attrition.

A study was made of the hot pottasium carbonate scrubbing system, which has not been used up to this time. A report on the system has been issued which includes a revised operating procedure and suggests minor changes to equipment

to improve operability.

Data from the October run (Run No. 5) were analyzed in depth. Preparation of a report on Run No. 5 was started.

There were several personnel changes during the month. Mr. D. L. Glaser reported as assistant to the Plant Manager. Mr. G. D. Funk was transferred from Shift Superintendent to Technical Engineer. Mr. P. E. Stigler, B Operator, resigned. The following were promoted: W. W. Daniel from Chief Operator to Shift Superintendent, T. G. Murphy from Controlman to Chief Operator, L. M. Carr from B Operator to Controlman, R. P. Apa from C to B Operator, and J. W. Necks from D to C Operator. Promotion of Mr. J. P. Lennox to Engineering Superintendent was inadvertently omitted from the November report.

Attrition of the operating staff has created a need for experienced operators. An interview trip was made to Paducah, Kentucky, where 17 experienced operators were contacted. Five were interviewed and two have been invited to visit the Plant. One Instrument Technician was hired to report in December.

SAFETY

In November 17,034 manhours were worked without an accident requiring medical attention. Regular weekly safety meetings and training sessions were held with Maintenance and Operations, and the weekly Safety Committee meeting was held. Material was prepared for a series of December safety programs on the subject of motivation.

MONTHLY ACCOMPLISHMENTS-MAINTENANCE

During October, 21 engineering work orders and 126 maintenance work orders were completed. Twenty-nine of these orders were urgent and two required call-out. A 90-day plant maintenance check was completed on 7 pumps during November. 90-day checks on 17 items including pumps, compressors, batteries, and mobile equipment is planned for December.

PLANS FOR DECEMBER

December will be devoted to:

(1) Design of further revisions to the equipment in preparation for the next run.

(2) Continuation of equipment repairs and modifications.

(3) Completion of data analysis and preparation of a report for the October run.

(4) Fluidization tests, first in the glass model, and subsequently, in the plant gasifier.

STAFFING

	Current Manpower Effective 12-1-72	To Be Hired in December
Management	2	0
Accounting	4	0
Clerical	5	0
Janitorial	2	0
Safety	1	0
TECHNICAL DEPARTMENT		
Laboratory	10	1
Engineering & Scheduling	11	2
OPERATIONS		
Supervisors	2	0
Shift Superintendents	4	0
Technical Assistant	1	0
Instrument Engineer	1	0
Operators	38	6
MAINTENANCE		
Supervisors	4	0
Crafts	26	0
Warehouse & Purchasing	3	0
	114	9

COSTS

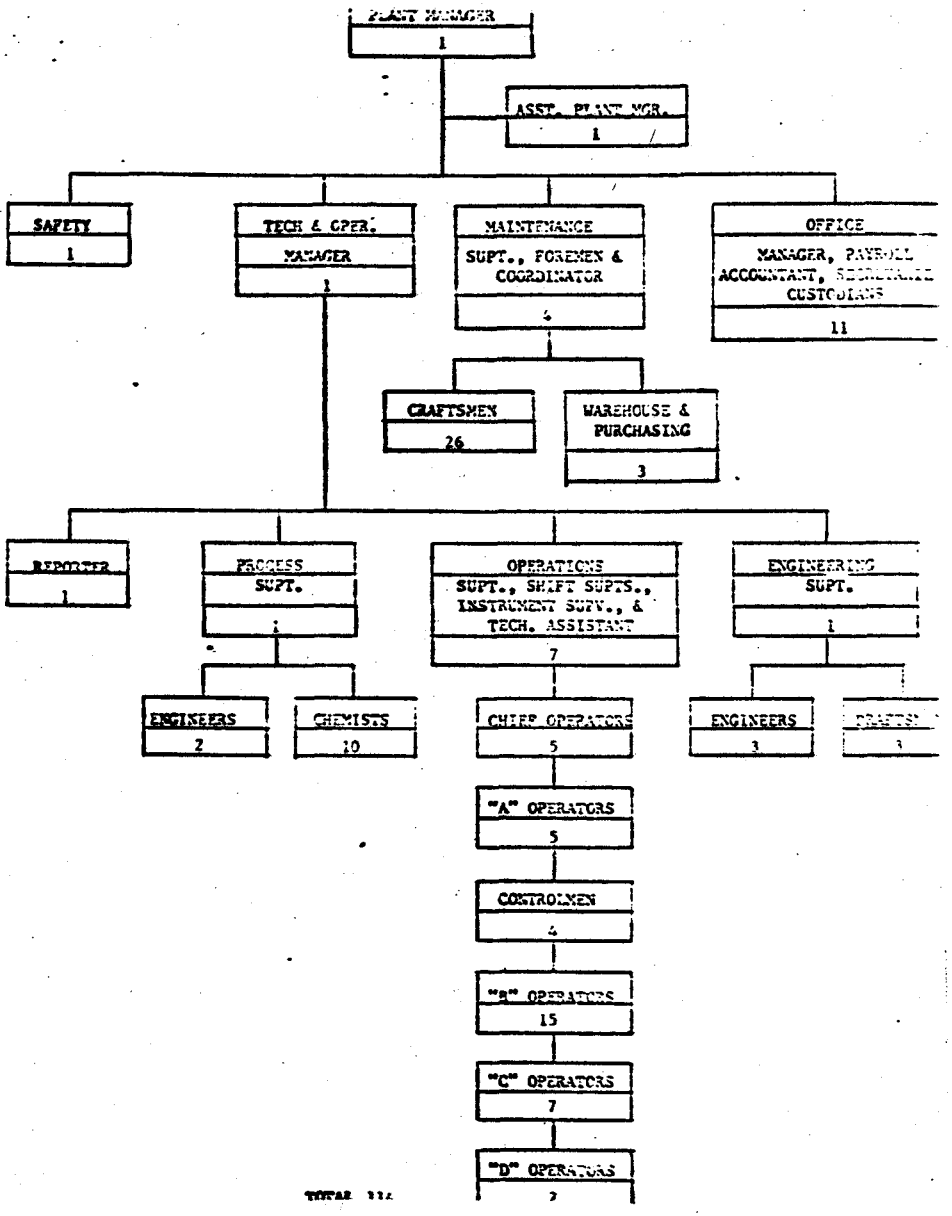
Accumulated Operations Cost to Date, November 30, 1972	$4,691,090.64
Purchase Orders Not Paid & Purchases Placed	64,322.67
Actually Spent - November, 1972	209,316.54
Accumulated Cost Billed to Date	$4,632,378.91

Very truly yours,

STEARNS-ROGER CORPORATION

R. G. Checksfield
Plant Manager

RGC:ska
Attachments: OSHA Report, Organization Chart, Progress Chart Schedule



November MONTHS ENDED 30, 1972

OSHA REPORT MINE NAME	MINE NO.	NUMBER OF LOST TIME ACCIDENTS NON-FATAL	FATAL	TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED	TONS PROD
Research Division	100						
Rapid City	200	-0-	-0-	-0-	-0-	17,034	-
Total Research							

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...ON COAL COMPANY
...30, 1972

...TS ...AL.	DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUCED	FREQUENCY	SEVERITY	TONS PER LOST TIME ACCIDENTS	MAN COUNT
	-0-	17,034	-	-	-	-	114

Other major plant changes were reviewed with Stearns-Roger. Agreement has been reached as to design changes for the following: ash lockhopper system, gasifier internal cyclone, regenerator quench tower, and the solids sampling stations.

In order to better understand the fluidization characteristics which are so important to operation of the plant, a series of tests have been designed utilizing both the gasifier and a glass model. These tests will determine the effects of range of particle size, gas distribution, and L/D ratio on the character of fluidization. Differential pressures will be measured and compared with the densities calculated by the weight of solids and the measured volume of bed. The calculated densities will also be compared with the values predicted by the Consol correlation. A program for the study which will be designated Run 6 has been written and transmitted to Stearns-Roger.

Consol has worked jointly with Stearns-Roger to accumulate and analyze the data from Run 5. A report covering Run 5 will be issued in December.

C. E. Fink

CEF:lmp

SUBCONTRACT BETWEEN CONSOL AND STEARNS ROGER CONSOL CO_2 ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR NOVEMBER, 1972

I. General

The carbonate resources report is undergoing final typing and should be transmitted by December 15. Eutectic compositions in the presence of 0.1 mole percent of Na, K, Mn, Fe, Cu, carbonates and Al_2O_3 and SiO_2 have been completed in the acceptor reconstitution. Analytic procedures have been confirmed for the corrosion studies. A preliminary progress report on the noxious elements is enclosed as well as data on wastewater monitoring during November. Work plans for the acceptor reconstitution, corrosion by $CaCO_3$-$Ca(OH)_2$ melts, and sulfur studies are included. An outline of proposed ion exchange work on high-sodium lignites was transmitted during the month.

II. Carbonate Resources (Mickelson)

The report on past work is undergoing final typing and upon completion and duplication, should be transmitted by December 15.

III. Acceptor Reconstitution (Fuerstenau)

Work on the effect of added impurities on the properties of reconstituted melts was continued this past month. Eutectic composition melts were completed in the presence of 0.1 mole percent impurity ($NaHCO_3$, K_2CO_3, $MnCO_3$, $FeCO_3$, $CuCO_3$, Al_2O_3, and SiO_2). Similar experiments with 1.0 mole percent impurity have been started and will be completed in December.

IV. Corrosion of Materials in Contact with $CaCO_3$-$Ca(OH)_2$ Melts (Palmer)

The stainless steel required for the initial phase of this investigation did not arrive this month as scheduled, so work was undertaken to develop an analysis scheme for metals contained in the frozen acceptor. The $CaCO_3$-$Ca(OH)_2$ mixtures were analyzed for iron and chromium. The results of this work established that iron levels can be measured by dissolution of the solid in dilute hydrochloric acid followed by analysis of the metal-bearing solution by atomic absorption spectrophotometry. Chromium levels can likewise be ascertained in a similar manner by colorimetry.

Work will be initiated during December to establish the corrosion rate of stainless steel as a function of degree of system agitation.

V. Noxious Elements (Lingard)

A preliminary report on the results of work done to date is attached. Additional work will include determinations of Be and Mo. Ultimately samples from the operating pilot plant will be analyzed to determine distribution of these minor elements.

VI. Sulfur Studies (Lingard)

The attached work plan outlines the approach to be used. A visit to the Ponca City lab may be postponed a few weeks due to an operation needed by Lingard.

VII. Lignite Beneficiation (Clarkson)

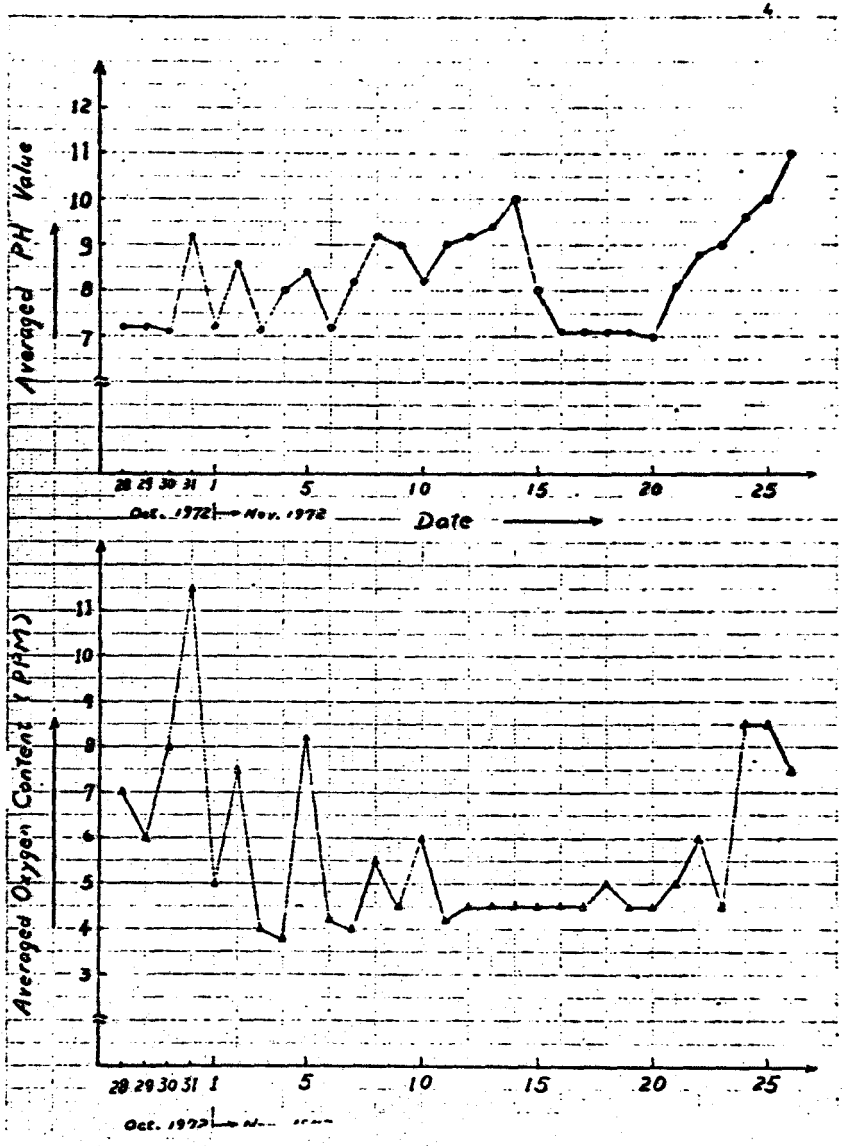
Rechecking of data and revision of the final report is continuing. A revised proposal on work covering the removal of sodium by column ion exchange was transmitted to CONSOL during the month.

VIII. Carbonate Grinding Properties (Mickelson)

This will not be activated until early 1973.

IX. Waste Monitoring (Oliver)

Copies of data from wastewater monitoring over the past month are attached. It is expected that the safety platform to enable installation of the particle monitoring equipment will be erected about the first of the year. Gas samples can be analyzed as soon as the plant is back in operation.



Date	Oxygen Content (PPM)	PH Value
October 23 1972	7.0	7.2
29	6.0	7.2
30	8.0	7.1
31	11.5	9.2
November 1	5.0	7.2
2	7.5	8.6
3	4.0	7.1
4	3.8	8.0
5	8.2	8.4
6	4.2	7.2
7	4.0	8.2
8	5.5	9.2
9	4.5	9.0
10	6.0	8.2
11	4.2	9.0
12	4.5	9.2
13	4.5	9.4
14	4.5	10.0
15	4.5	8.0
16	4.5	7.1
17	4.5	7.1
18	5.0	7.1
19	4.5	7.1
20	4.5	7.0
21	5.0	8.1
22	6.0	8.8
23	4.5	9.0
24	8.5	9.6
25	8.5	10.0
26	7.5	11.0
27		
28		
29		
30		
Average	5.7	8.3

WORK PLAN FOR LIME-BASE ACCEPTOR LIFE (Fuerstenau)

October, 1972

Work schedule laid out and experiments started with $NaHCO_3$, K_2CO_3 added as impurities at a level of 0.1 mole percent in eutectic composition melts.

November, 1972

Experiments will be continued with 0.1 mole percent for $FeCO_3$, $MnCO_3$, $CuCO_3$, SiO_2, and $Al(OH)_3$. Experiments with 1 mole percent will be started.

December, 1972

Experiments with 1 mole percent impurity will be concluded. Experiments will be conducted to become familiar with techniques used with flue-solids reactors.

January, 1973

Experiments with 10 mole percent impurity will be started. Activity determinations of melts made in the presence and absence of impurities will be established as a function of cycling between calcination and carbonation.

February, 1973

Experiments with 10 mole percent impurity will be concluded. Acceptor activities will be measured.

March, 1973

Depending on the results obtained with 0.1, 1.0, and 10 mole percent impurity, the effect of other impurity levels will be investigated.

April, 1973

Experimental work started in March will be continued in April.

May, 1973

Experimental work with impurity levels other than 0.1, 1.0, and 10 mole percent to be concluded. The effect of CaS on melt properties will be started.

June, 1973

Experimental work on the effect of CaS on melt properties will be concluded. Final report will be prepared.

WORK PLAN FOR CORROSION OF MATERIALS IN CONTACT WITH LIME-BASE MELTS (Palmer)

October, 1972

Establish materials suitable for crucible construction, and test crucibles to ascertain durability over several melting cycles. Design sample stirring mechanism.

November, 1972

Test experimental technique for determination of iron, chromium, and nickel content of melt. Construct sample stirring mechanism, and measure corrosion rate as a function of stirring rate for stainless steel.

December, 1972

Determine corrosion rate of stainless steel as a function of degree of melt agitation and melt composition.

January, 1973

Establish rate of dissolution of stainless steel as a function of temperature and partial pressure of water vapor. Purchase alumina samples for second phase of study.

February, 1973

Complete study of effect of water vapor on rate of dissolution of stainless steel. Study corrosion rate as a function of oxygen partial pressure.

March, 1973

Establish corrosion rate of alumina as a function of degree of melt agitation.

April, 1973

Measure dissolution rate of alumina as a function of melt composition.

May, 1973

Determine corrosion rate of alumina as a function of melt temperature and partial pressure of water vapor.

June, 1973

Prepare final report.

WORK PLAN FOR STUDY OF SULFUR COMPOUNDS IN CO_2-ACCEPTOR PROCESS GAS (Lingard)

October, November, December, 1972

Work during this period will involve a review of the literature and a survey of equipment suitable for this study. It is planned to visit the Conoco Lab at Ponca City to discuss the problems involved, methods used, equipment available, and limitations in the determination of sulfur compounds in gases. Following this visit, equipment will be selected and ordered.

January and February, 1973

Equipment will be set up and tested. Methods of preparing standards will be studied.

March and April, 1973

Operating parameters will be studied using standards containing known concentrations of sulfur compounds.

May and June, 1973

Interference effects and limits of detection will be studied using standard mixtures of gases.

July and August, 1973

Gas produced in the pilot plant will be monitored for sulfur compounds.

September, 1973

A report will be prepared.

WORK PLAN FOR NOXIOUS ELEMENTS IN LIGNITE (Lingard)

October, November, December, 1972

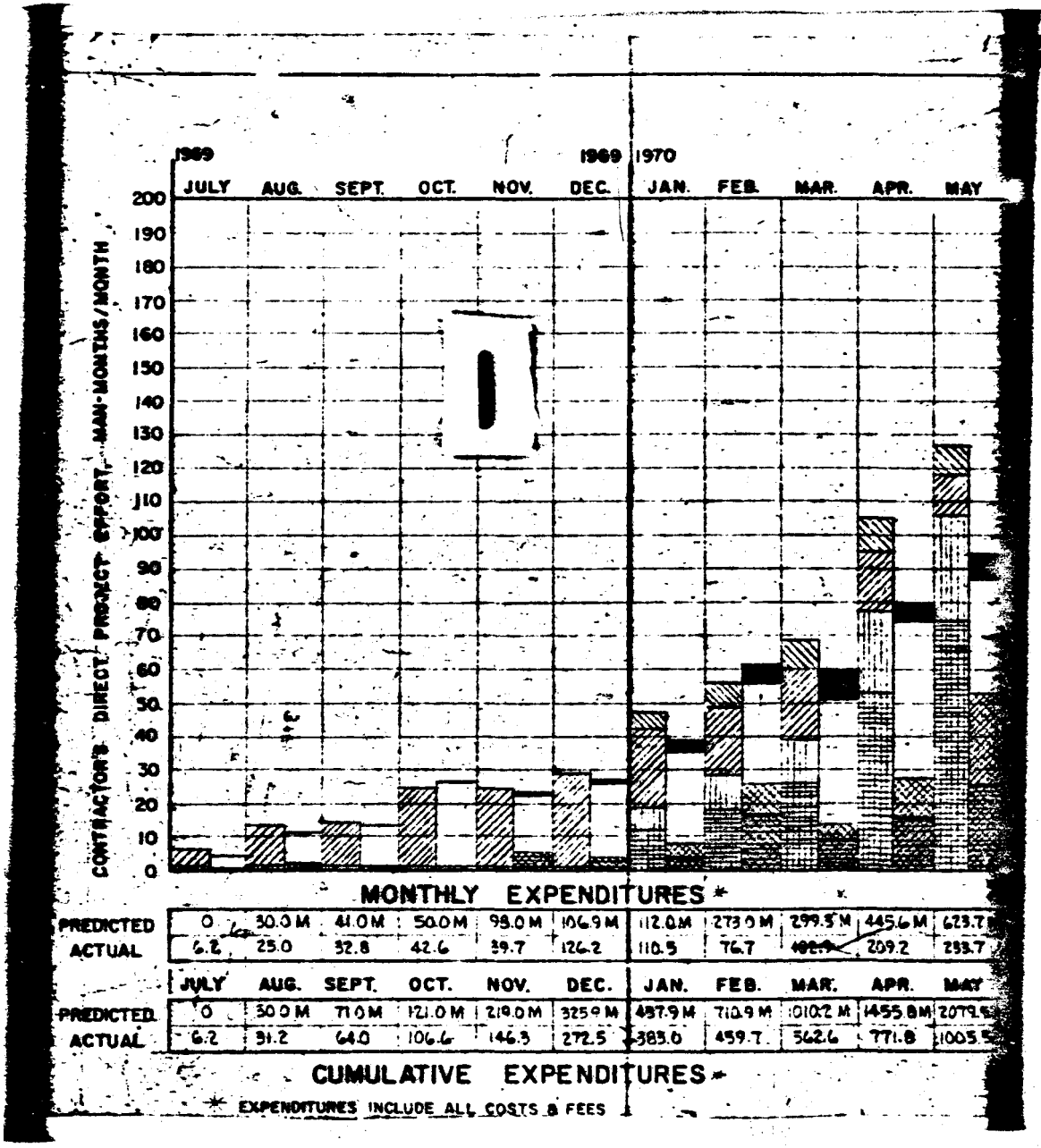
Work will continue on analytical methods for trace quantities of the noxious elements with the objective of improving accuracy and reproducibility in the determination of these elements.

January through August, 1973

Work during this period will be linked to the operation of the pilot plant. Raw materials, intermediate products, and ash will be analyzed for noxious elements to determine the fate of these elements during the gasification process. These analyses will be repeated as changes in operating conditions of the pilot plant warrant further testing.

September, 1973

A final report will be prepared.



MONTHLY EXPENDITURES *

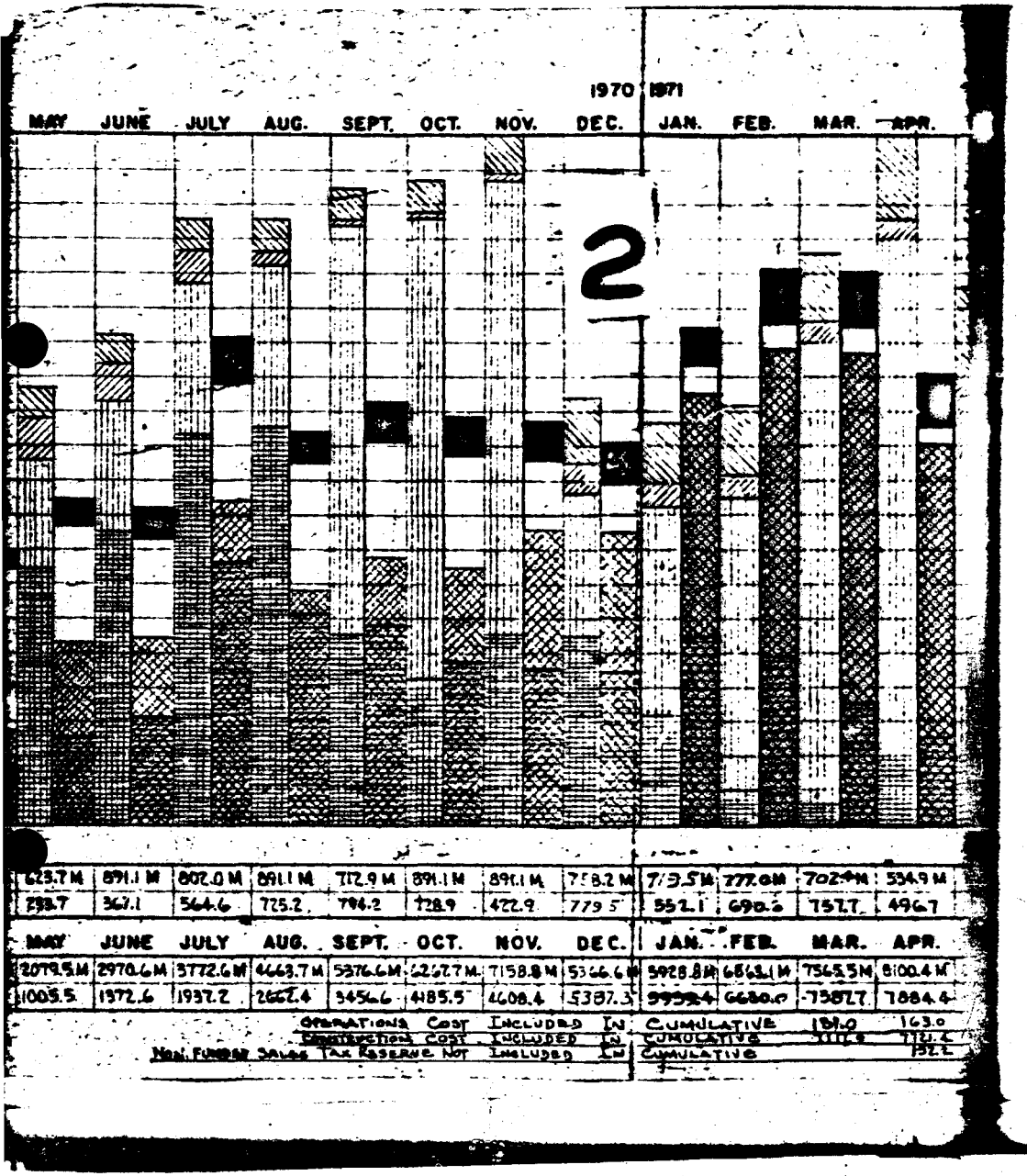
PREDICTED	0	30.0 M	41.0 M	50.0 M	98.0 M	106.9 M	112.0 M	273.0 M	299.5 M	445.6 M	623.7
ACTUAL	6.2	25.0	32.8	42.6	39.7	126.2	110.5	76.7	[illegible]	209.2	233.7

	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY
PREDICTED	0	30.0 M	71.0 M	121.0 M	219.0 M	325.9 M	437.9 M	710.9 M	1010.2 M	1455.8 M	2079.5
ACTUAL	6.2	31.2	64.0	106.6	146.3	272.5	383.0	459.7	562.6	771.8	1005.5

CUMULATIVE EXPENDITURES *

* EXPENDITURES INCLUDE ALL COSTS & FEES

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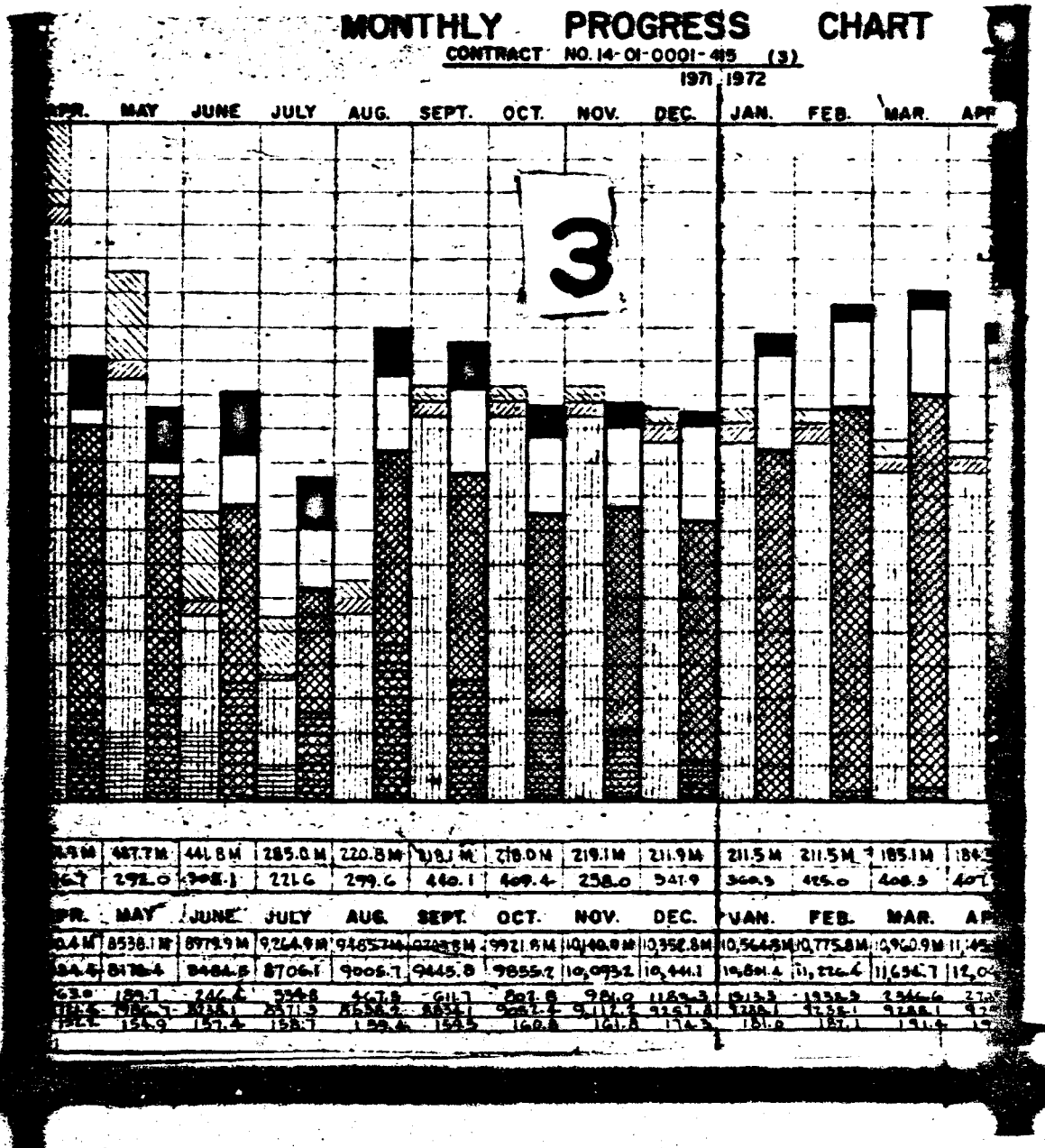


623.7 M	891.1 M	802.0 M	891.1 M	772.9 M	891.1 M	891.1 M	758.2 M	713.5 M	777.0 M	702.4 M	534.9 M
233.7	367.1	564.6	725.2	794.2	728.9	422.9	779.5	552.1	698.6	757.7	496.7

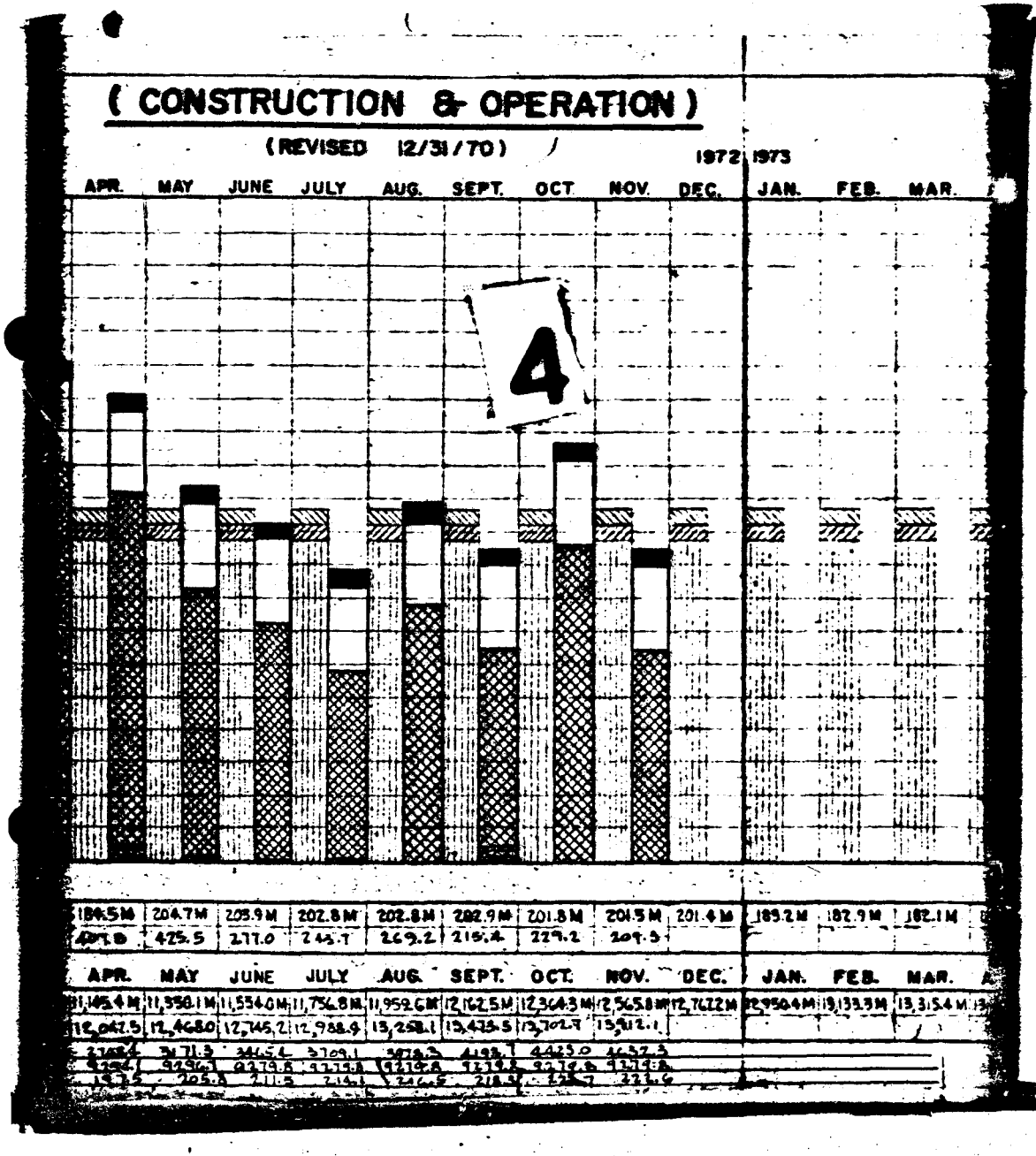
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2019.5 M	2970.6 M	3772.6 M	4663.7 M	5376.6 M	6267.7 M	7158.8 M	5366.6 M	5928.8 M	6683.1 M	7545.5 M	8100.4 M
1005.5	1372.6	1937.2	2662.4	3456.6	4185.5	4608.4	5387.3	5928.4	6680.0	7387.7	7884.4

OPERATIONS COST INCLUDED IN CUMULATIVE 181.0 163.0
DEPRECIATION COST INCLUDED IN CUMULATIVE 311.6 311.6
NON-FUNDED SALES TAX RESERVE NOT INCLUDED IN CUMULATIVE 132.2

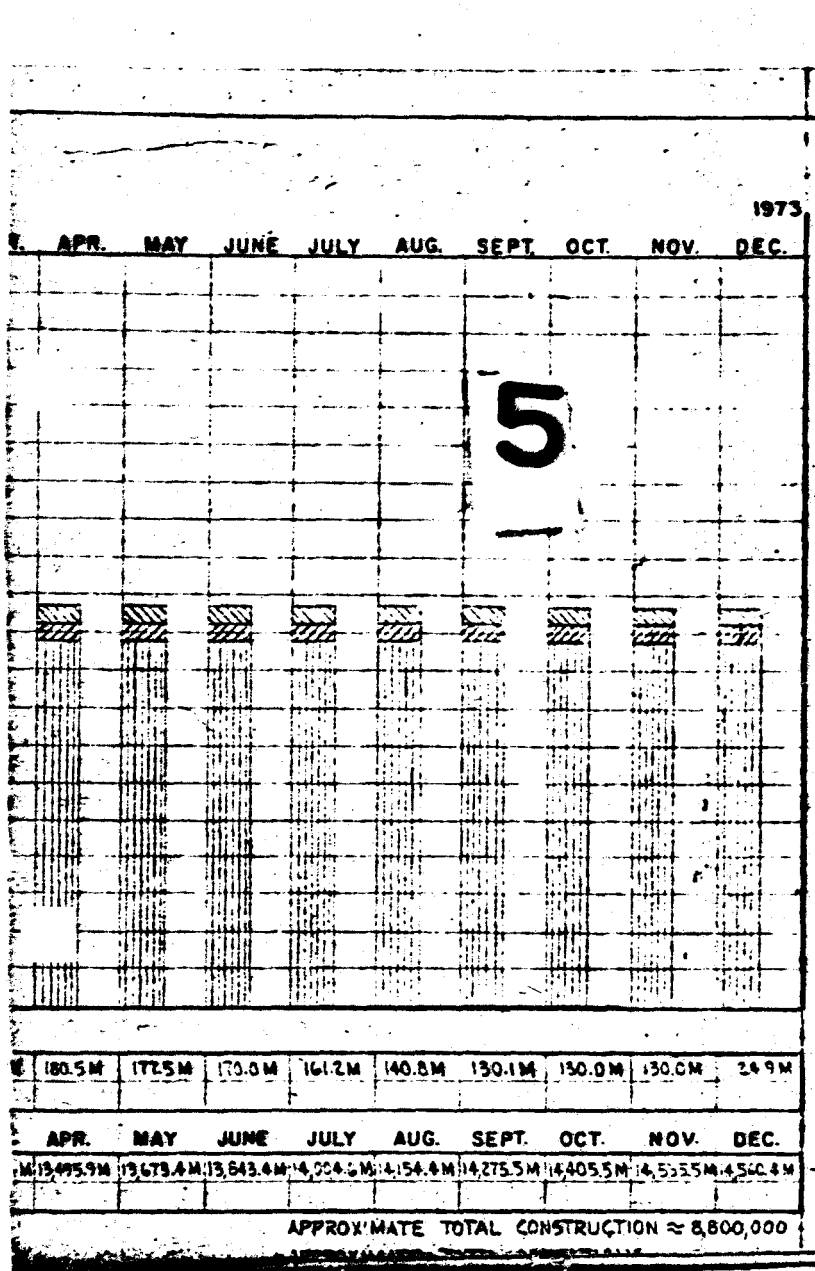
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MONTHLY PROGRESS CHART
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184.5M 204.7M 205.9M 202.8M 202.8M 202.9M 201.8M 201.5M 201.4M 185.2M 182.9M 182.1M
425.5 277.0 243.7 269.2 215.4 229.2 209.5
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11,165.4M 11,358.1M 11,554.0M 11,756.8M 11,959.6M 12,162.5M 12,364.3M 12,565.8M 12,762M 12,950.4M 13,133.3M 13,315.4M
12,042.5 12,460.0 12,745.2 12,988.9 13,258.1 13,473.5 13,702.9 13,912.1

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OPERATIONS — STEARNS-ROGER JOB B-

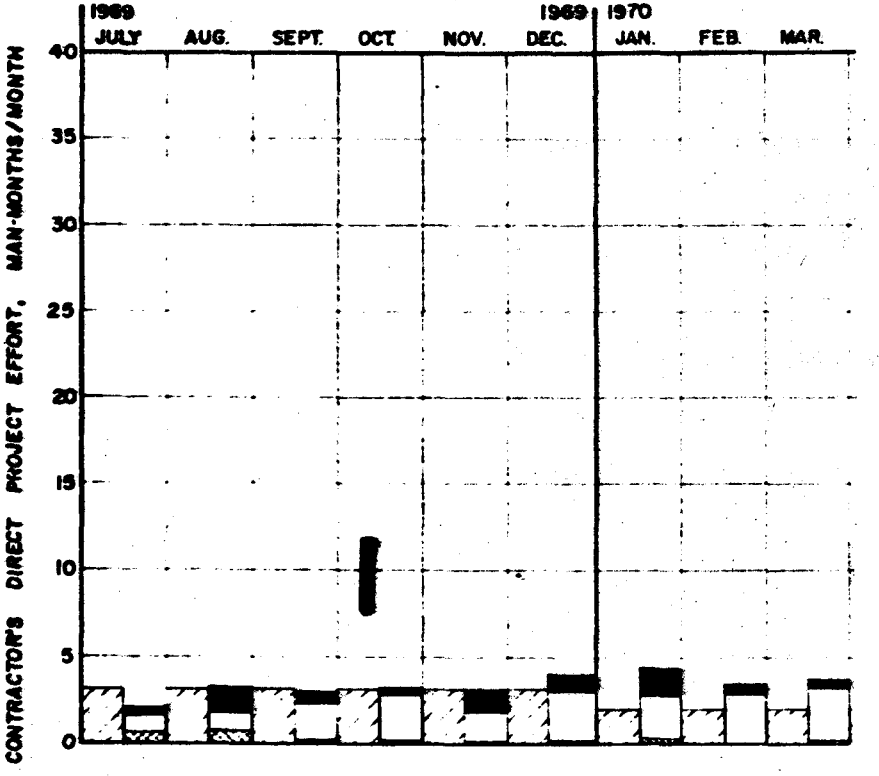
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AUG.	SEPT.	OCT.	NOV.	DEC.
14,154.4M	14,275.5M	14,405.5M	14,535.5M	14,560.4M

ESTIMATE TOTAL CONSTRUCTION ≈ 8,800,000

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MONTHLY PROGRESS C
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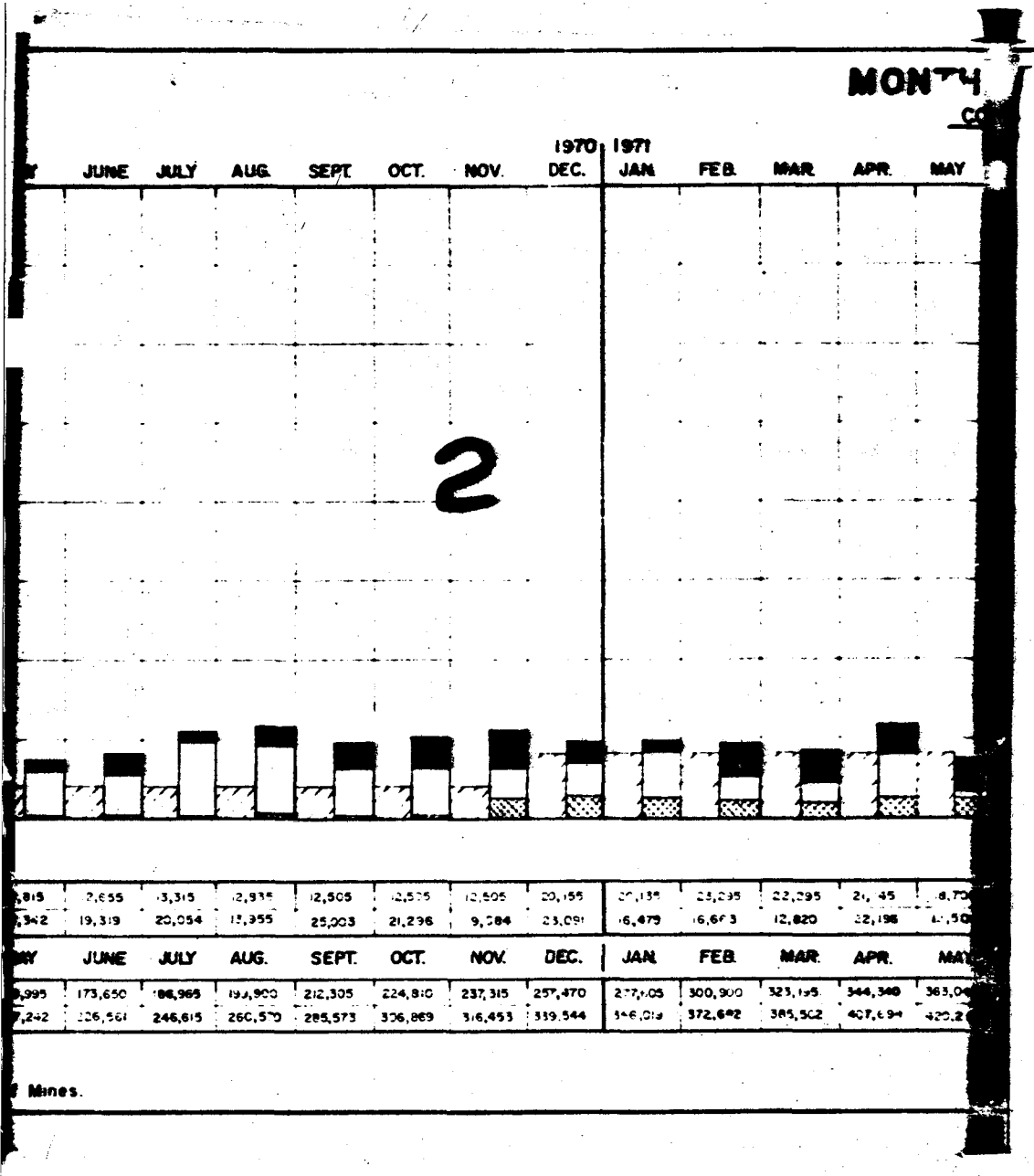
MONTHLY EXPENDITURES*

PREDICTED	6,215	14,655	24,965	33,155	46,395	57,065	85,595	95,595	102,655
ACTUAL	11,745	34,734	39,639	51,925	60,130	75,205	94,178	104,327	115,013

	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.
PREDICTED	16,215	30,900	45,865	59,020	73,405	90,470	108,055	121,650	134,305
ACTUAL	11,745	46,479	56,098	67,913	78,043	93,248	107,626	121,653	136,672

CUMULATIVE EXPENDITURES*

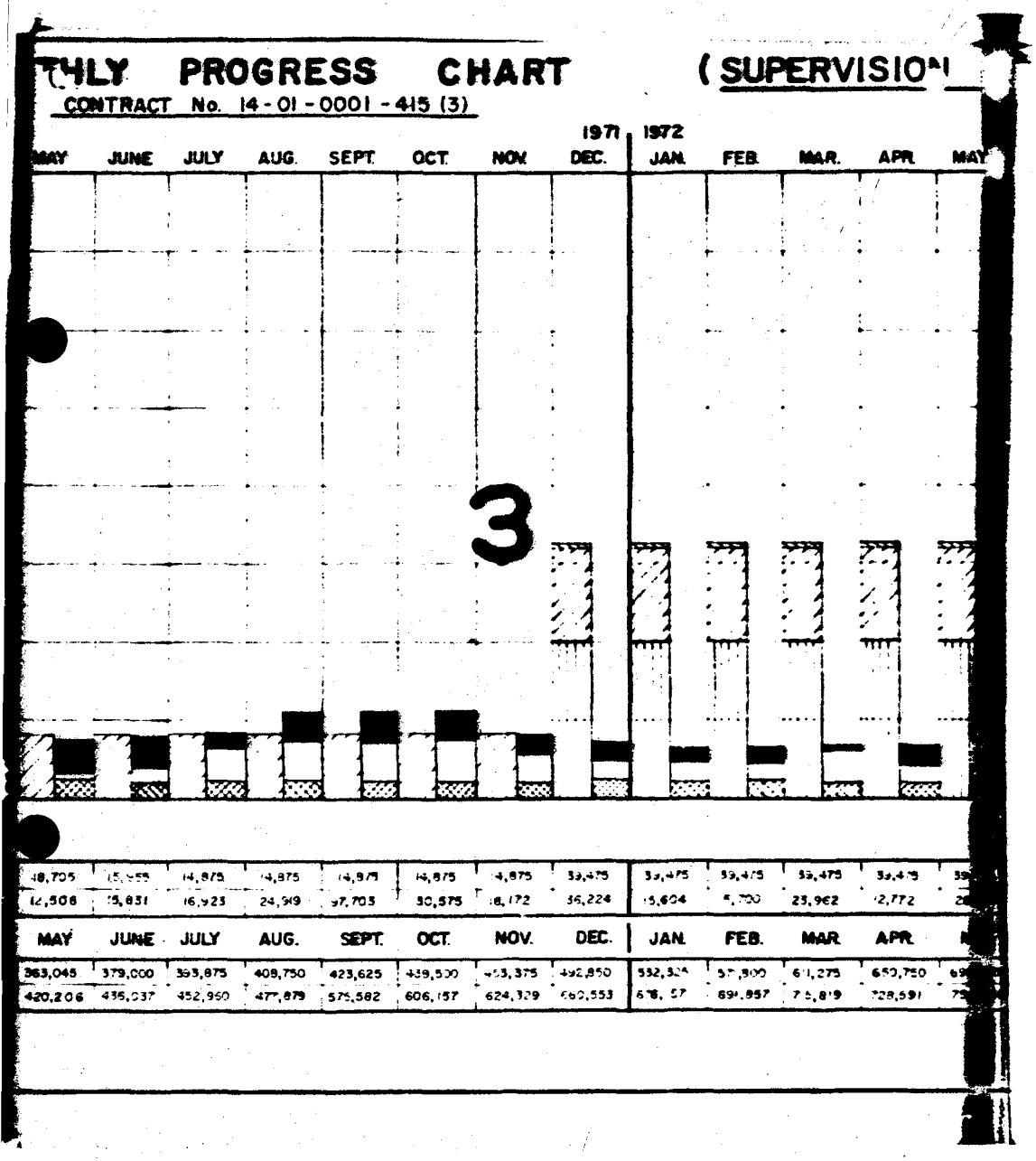
*Expenditures Include All Costs & Fees By Consol And S. Dakot



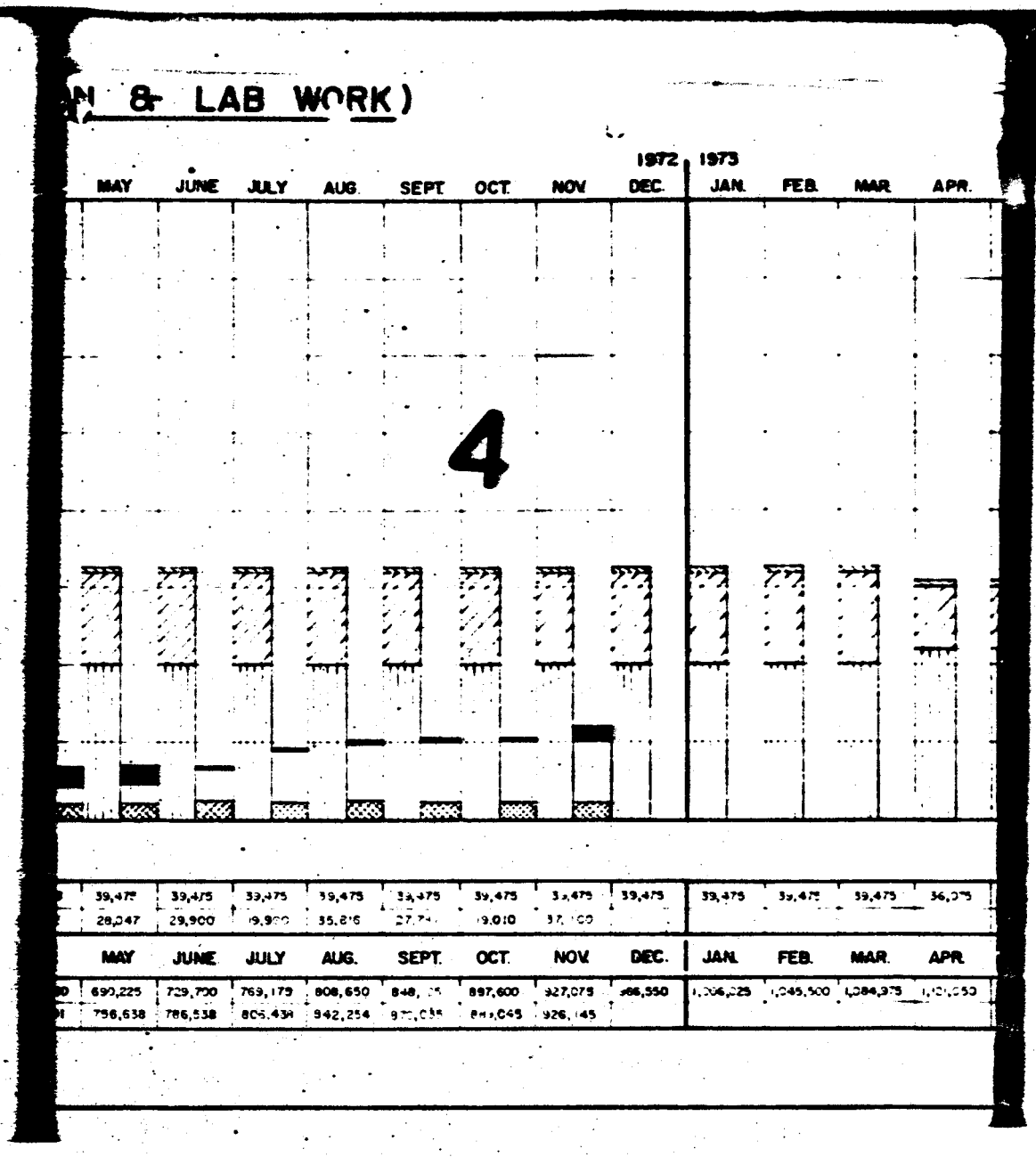
	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY
	173,650	186,965	199,900	212,305	224,810	237,315	257,470		300,900	323,195	344,340	
		246,615	260,570	285,573	306,869	316,455	339,544		372,692	385,502	407,694	

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383,045 379,000 393,875 408,750 423,625 439,500 453,375 492,850 532,324 591,800 611,275 650,750
420,206 435,037 452,960 477,879 575,582 606,157 624,329 660,553 678.57 694.957 715,819 728,591

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JUNE
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29,900
35,816
690,225
729,700
769,179
808,650
897,600
927,075
1,006,225
1,045,500
1,084,975
756,638
786,538
805,434
942,254

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DATE: November 1972

1973

	MAY	JUNE	JULY	AUG.	SEPT.

5

PREDI

SUPERVISING

PROFESSIONAL

TECHNICIAN

(#) Includes Super

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5	36,075	11,475	11,475	11,475	41,120

	MAY	JUNE	JULY	AUG.	SEPT.
50	1,157,125	1,168,600	1,190,075	1,191,550	1,232,670

MONTHL

OFFICE DEPARTI

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CONTRACT

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Date: November, 1972

1973

	PREDICTED	ACTUAL
SUPERVISING		
PROFESSIONAL		(*)
TECHNICIAN		(**)

(*) Includes Supervisory Exempt Technicians
(**) Includes Clerical.

6

MONTHLY PROGRESS CHART

OFFICE OF COAL RESEARCH
DEPARTMENT OF THE INTERIOR

CONSOLIDATION COAL CO.
RESEARCH DIVISION LIBRARY, PA

CONTRACT No. 14-01-0001-415 (3)

CCDC-MPR--103

PROGRESS REPORT NO. 103
OCR CONTRACT NO. 14-01-0001-415(4)
CONSOL LIGNITE GASIFICATION PROCESS DEVELOPMENT

December 1 to 31, 1972

A. Summary

Phase I - Feasibility Study

Complete.

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

Fluidization tests were carried out under cold conditions in the 12" glass system and in the gasifier. These studies showed the importance of installing a sparger system on the fluidizing gas inlet in order to maintain a more homogeneous fluid bed. The ability to establish and maintain a sharp interface between acceptor and char while showering acceptor through the char bed was repeatedly demonstrated.

The existing pressure tap system was shown to be effective in establishing conditions for a good interface, to measure location of interface in the boot and to closely approximate the total bed height. Considerable evidence is being accumulated to show that two immersed pressure taps do not give reliable indication of actual bed density under fluidizing conditions. This knowledge is not essential to successful, extended gasification runs.

The preparation of the regenerator vessel for a new refractory system continued on schedule. The actual lining job was given to the McC lum Company and was scheduled to begin during the week of January 8, 1973.

Preliminary technical reports from the BDSM&T were received bas on three of their programs including (1) carbonate resources, (2) sodium removal, and (3) noxious element studies. These have been approved and will be issued in final form as soon as possible.

The methanation process study by Stearns was completed on schedule in December, 1972. This study included P & I Drawings, equipment layout, and cost estimates. This will be reviewed by Consol during January and recommendations prepared for OCR/AGA.

Financial

Estimated monthly expenditures were $35,700 by Consol and $227,600 by Stearns-Roger. Cumulative expense to date is $16,975,176.

B. Technical Results and Program

Phase II - Bench-Scale Research

Complete.

Phase III - Pilot Plant Engineering

Complete.

Phase IV - Pilot Plant Construction and Operation

1. Supporting Process and Economic Analysis (Project No. 533)

No work was done on this project.

2. Supporting Patent and Legal Activities (Project No. 534)

The current reports and memoranda were reviewed for Subject Inventions.

3. Consol Assistance on Construction of Lignite Pilot Plant (Project No. 536)

The final construction report will be submitted for approval during January, 1973.

4. Stearns-Roger Construction Subcontract (Project No. 700)

Stearns' accountants are preparing to submit the final construction costs.

5. Library Assistance on Pilot Plant Operations (Project Nos. 537.10 and 537.20)

No analyses were performed for Project No. 537.10 during the month of December.

The engineering group participated in the selection of McCollum Company for the regenerator rebuild.

G. C. Curran was active in following the fluidization test program being conducted in the 12" Ø glass model and the gasifier.

6. Library Assistance to Engineering of Methanation Addition Rapid City Pilot Plant (Project No. 537.30)

Review of the revised P & I Drawings and equipment layout continues. Piping and instrumentation are also being considered.

Stearns-Roger issued a "Definitive Cost Estimate for Methanation Facilities" the third week in December. Costs and specifications from this report are being studied.

Work has started on a "bid package" for the Methanation Section utilizing the Stearns-Roger report as a basis, along with the P & I Drawings and the preliminary layout work. A pre-qualification letter was sent to 11 major construction companies to elicit their interest in this work.

7. Consol Guidance on Operations (Project No. 702)

The progress report is attached.

8. Stearns-Roger Operating Subcontract (Project No. 701)

The progress report is attached.

9. School of Mines Subcontract (Project No. 703)

The December progress report is attached.

C. Subject Inventions

A decision was made to submit our modified pressure measuring design to OCR for possible patent filing.

D. Financial Status

Expense

	Actual	Budget
Cumulative through November, 1972		
Through June, 1969		
Consol	$ 1,878,256	$ 1,878,256
Stearns	926,520	927,075
	13,912,100	12,565,800
	$16,716,876	$15,371,131
Expended in Period (estimate)		
Consol	35,700	39,475
Stearns	222,600	201,400
Total - December, 1972	$ 258,300	$ 240,875
Cumulative through December, 1972	$16,975,176	$15,612,006

1/15/73
Att: Monthly Progress Reports on Projects 701, 702, 703
Progress Charts

CONSOLIDATION COAL COMPANY PROJECT

CRG PILOT PLANT

RAPID CITY, SOUTH DAKOTA

OPERATIONS REPORT #34

CCC Project No. 701
S-R Job No. R-37400
January 5, 1972

SUMMARY OF PLANT OPERATIONS

December was devoted principally to fluidization tests, design and installation of plant revisions, and maintenance in preparation for the next operating run.

A series of fluidization tests, identified as Run No. 6, were conducted in the glass model and the plant gasifier. In the first set, Run No. 6-IIA, local limestone was fluidized with air in the twelve inch glass model. Twenty-four tests were run with different combinations of limestone size, bed depth, and air inlet configuration. For each test, differential pressures across the bed were measured at several air flow rates that gave fluidization ranging from none to massive spouting or slugging. Bed condition and depth were noted visually and recorded.

A similar series of tests, Run No. 6-IA, was conducted in the plant gasifier. The top head of the gasifier was left off. Dust obscured the surface of the bed for observation from the top, but good pictures were obtained by lowering a TV camera near the surface; the pictures were recorded on video tape.

A four inch "boot" was added to the glass model. Further fluidization tests, Run No. 6-IIB, were then conducted with limestone in the boot and char in the upper section. In Run No. 6-IIC, various sizes of limestone were showered down through the char bed to the limestone bed in the boot.

Data from the above runs are being assimilated and analyzed. Additional tests will be conducted in January.

There were three brief boiler outages during the month, two planned and one unexpected. There was one fifty minute power interruption and a series of forty-one outages over a four hour period; the outages were from conditions outside the plant. The emergency power system performed satisfactorily. One of the two cooling water pump motors failed and was out of service a week for repairs.

Excessive corrosion has been experienced in the inert gas system. Analysis of water condensate from the compressor interstages, and of absorption solutions through which raw gas had been bubbled, showed the presence of corrosive quantities of nitrogen oxides.

Cleaning and revisions to the interior surface of the regenerator were completed in preparation for reinsulation by a sub-contractor in January. The regenerator quench gas tower was prepared for addition of a conical bottom head and a venturi gas inlet when they are received in January. New test valves were installed, replacing ball valves that have been particularly troublesome. Numerous maintenance and engineering work orders were completed and an extensive maintenance and periodic overhaul program on rotating equipment was conducted.

In 1972, 269,795 manhours were worked with no lost-time accidents.

MONTHLY ACCOMPLISHMENTS-OPERATIONS & TECHNICAL

Fluidization tests were conducted throughout the month in the glass model and in the plant gasifier. The tests followed the general outline of Mr. C. E. Fink's letter to Dr. J. D. Sudbury, dated November 22, 1972. This series of tests has been designated as Run No. 6. Throughout the tests, local Minnelusa limestone was used, rather than the dolomite used in previous operations.

The first series of tests, Run No. 6-IIA, were performed with air and limestone only, in the twelve inch glass model with no boot section. Two sizes of hand screened limestone, 6 X 9 mesh and 6 X 16 mesh; three depths of limestone bed; and four configurations of air inlet were used. The various combinations resulted in twenty-four separate tests. For each test, pressure drops across the bed were measured at several air flows ranging from no fluidization or bed expansion to massive fluidization with spouting and/or slugging.

Difficulty was experienced in controlling and accurately measuring air flow during the above tests. After the series was completed, the air flow instrumentation was revised and the tests were rerun.

Differential pressure measurements were taken with a vertical probe that could be moved across the diameter of the fluidization tube. For most of the tests, measurements were made at the center, the wall, and intermediate points. Bed heights at various levels of fluidization were measured visually and descriptions of the condition of the bed were recorded.

When limestone fluidization tests in the model were completed, a similar set of tests, Run No. 6-IA, were conducted in the plant gasifier. Two sizes of limestone (plant-screened rather than hand-screened) and various bed depths were tested; two air-inlet configurations were used, the original design and a three-inch vertical capped sparger with horizontal 5/3 inch holes.

The top of the gasifier was left off during this set of tests for observation. Dust at the top surface of the bed precluded direct visual observation, but a television camera lowered near the surface gave good pictures which were recorded on video tape. Bed depth was sounded by lowering a float from the top.

Some of the tests on the gasifier were rerun to see the effects of dampeners, surge pots, and pressure probe location on instrument readings.

Following the limestone tests in the gasifier, additional tests were run in the model. A four inch diameter boot was placed on the bottom of the twelve inch tube and an air inlet at the transition was added.

In Run No. 6-IIB, tests were run with limestone in the boot and char in the large section. In Run No. 6-IIC various sizes of limestone were showered down from the top through the char to the limestone in the boot.

During all the above fluidization tests, an attempt was made to have each shift run a portion of each set. Several tests were rerun specifically for this purpose. In this way, all operating personnel had an opportunity to observe the tests and acquire more "feel" for the response of the bed to changing operating variables.

Data on the above tests are being assimilated and analyzed.

A report on Run No. 5, October 9 to November 1, was issued December 20.

Severe cold was experienced in December, particularly in the early part of the month, with the temperature continuously under 0°F for seven days. Freeze-ups were averted through constant operator vigilance.

The boiler was out of service three times, once unexpectedly when the suction screen of the forced draft fan plugged with snow and ice, and twice for planned repairs to a sight glass and an electrical timer. The outages were short and there were no ill effects.

There was a fifty minute power outage on December 5 and a series of forty-one failures over a four hour period on December 30. These failures resulted from difficulties outside the plant that were corrected by Black Hills Power and Light. During the above outages and a planned test, the emergency power system behaved satisfactorily, except that, in the early outages, the emergency generator did not turn off automatically when commercial power was restored. The problem was traced to a faulty timer, which was repaired.

One of the cooling water pump motors shorted out for unknown reasons. It required about one week to have the motor repaired. It was suspected that a sludge accumulation in the system might have overloaded the pump motor, but inspection of the sump, piping, and screens revealed only minimal dirt. The alternate water pump kicked off while the motor was out for repairs and the situation went undetected for about ten minutes. Alarms for low cooling-water pressure are being installed in the control room and the utility area.

The inert gas system was revised and tested. With a new sheave on the compressor, the inert gas system achieved design rating, but the drive motor drew almost 110 percent of nameplate rating. Inspection of various parts of the inert gas system indicated excessive corrosion. Samples of water condensate taken from three discharge stages of the compressor were acidic and contained as much as 350 parts per million nitrogen oxide. Uncompressed gas absorbed in various aqueous solutions indicated that the raw gas contains about 2.5 parts per billion of nitrogen oxide.

Extensive housekeeping efforts were required during the month to combat dust generated in the fluidization tests and in removing insulation from the regenerator, and to remove ice and snow.

Several compressors and pumps were run in following maintenance and overhaul.

Changes, repairs, and additions were made to numerous instruments. An extensive program of check-outs and calibrations was carried out.

In an attempt to eliminate the many problems that have been experienced with ball valves, particularly in hot gas-solid service, various tests have been instigated. A new method of packing the dead-space in several existing valves has been tried. Two new Posi-Seal valves have been installed in series in one of the inlet lines to the lignite lock hoppers. A Cameron valve has been installed in series with an existing valve in the other inlet line. A W-K-M valve for testing is expected soon. Use of all these valves has been reviewed in detail with the manufacturers.

The regenerator quench tower was redesigned. The dished head on the bottom will be replaced with a conical head to facilitate flushing out solids. A venturi will be added to the hot-gas inlet, and the bottom twelve disc-and-donut trays have been removed to make room for the changes. Calculations were run to assure workability of the tower with the lesser number of trays.

Revisions to this and other vessels were reviewed in detail to assure compliance with the ASME code. A code inspector will be present to witness the pertinent parts of the fabrication process.

Calculations were made to determine that the additional weight of insulation in the regenerator will not overload the vessel or the various elements of the support system.

The gasifier internals, probe supports and internal cyclone separator were redesigned. The lift-gas distributor has also been redesigned.

The laboratory worked on three analytical methods that have promise of giving better results, or equal results with less efforts, compared to methods now in use. Tests of these new methods have not been completed.

Experiments have been started in a small high-temperature laboratory fluidizer tube to explore possible causes of dolomite attrition experienced in the plant during Run No. 5.

M. M. Morton reported for work December 4 as an Instrument Technician. K. W. Crawford, Chemist, resigned December 1. J. A. Witherow was promoted from Junior Chemist to Chemist.

Interviews were conducted for vacancies of B, C, and D Operators, Junior Chemists, and Technical Engineer.

MONTHLY ACCOMPLISHMENTS - MAINTENANCE

During December, seventy-eight maintenance work orders and thirty-eight engineering work orders were completed.

Advantage was taken of the long shutdown to complete thorough 90-day or annual maintenance on 20 pumps and compressors, in addition to the 7 completed last month.

The most time consuming job was preparation of the regenerator for reinsulation of the vessel by Joseph McCollum Company in January. The internal surface was thoroughly cleaned, support posts repaired or replaced, and the old insulation anchors removed. Approximately 1000 new "bull-nose" anchors were welded in.

The maintenance force was reduced by one electrician in December.

SAFETY

19,700 manhours were worked in December and 263,793 manhours in the year 1972 with no lost time injuries. In December, one injury received medical attention.

The regular safety and training meetings with operations and maintenance were devoted to "motivation" and to OSHA requirements for personal protective equipment. The latter program was presented with a series of slides.

Weekly safety committee meetings and the monthly safety inspection were held. Specific instructions were issued requiring full face protection when operating the cut-off saw and the grinders in the maintenance shop.

In an annual inspection, all fire extinguishers were weighed, reseeled, and retagged.

PLANS FOR JANUARY

January will be devoted to:

(1) Completion of fluidization tests in the glass model and gasifier, and analysis of acquired data.

(2) Completion of the 24 outstanding maintenance and engineering orders related to the shutdown. (The Joseph McCollum Company supervisor arrived January 3 and insulation work on the regenerator starts January 8.)

(3) Preparation of a PLAN for the next operating run, Run No.7.

Operation will be resumed when the above items are finished, which should be in late January or early February.

STAFFING

	Current Manpower Effective 1-1-73	To Be Hired in January
Management	2	0
Accounting	4	0
Clerical	5	0
Janitorial	2	0
Safety	1	0
TECHNICAL DEPARTMENT		
Laboratory	9	1
Engineering & Process	11	2
OPERATIONS		
Supervisors	2	0
Shift Superintendents	4	0
Technical Assistant	1	0
Instrument Engineer	1	0
Operators	39	6
MAINTENANCE		
Supervisors	4	0
Crafts	25	0
Warehouse & Purchasing	3	0
	113	9

COSTS

Accumulated Operations Cost to Date, December 31, 1972	$ 4,921,030.97
Purchase Orders not Paid & Purchases Placed	$ 81,590.00
Actually Spent - December 1972	$ 227,609.29
Accumulated Cost Billed to Date	$ 4,859,988.20

Very truly yours,
STEARNS-ROGER CORPORATION

R. G. Checksfield
Plant Manager

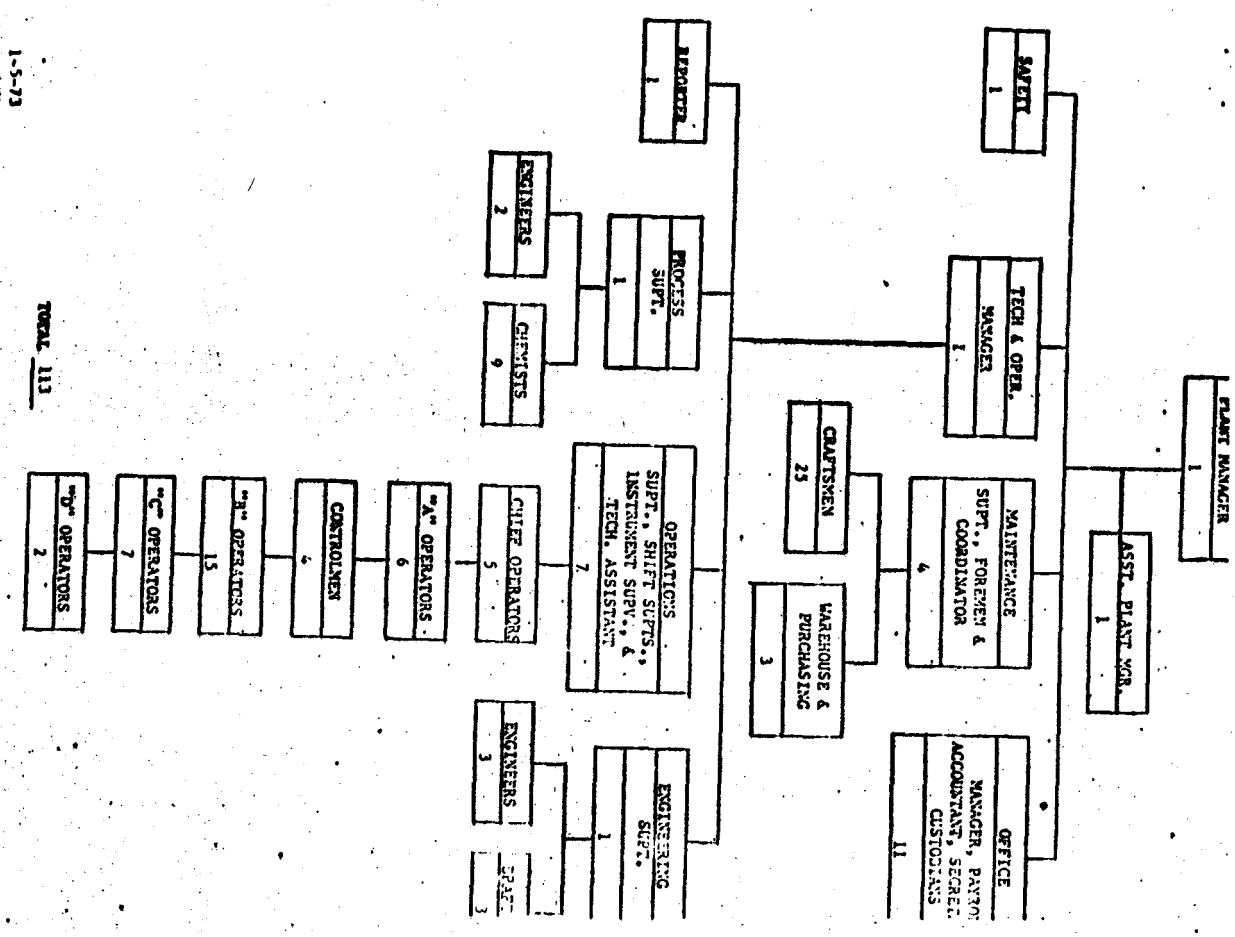
RGC:ska
Attachments: OSHA Report, Organization Chart, Progress Chart Schedule

OSHA REPORT

STEARNS-ROGER CORPORATION
Rapid City, South Dakota

December MONTHS ENDED Thirty First (31st) 19 72

MINE NAME	MINE NO.	NUMBER OF LOST TIME ACCIDENTS: NON-FATAL	FATAL	TOTAL	DAYS LOST	TOTAL MAN HOURS WORKED	TONS PRODUCED	FREQUENCY	SEVERITY	TONS PER LOST TIME ACCIDENTS	MAN COUNT
Research Division	100										
Rapid City, S.Dak.	200	-	-	-	-	19,700	-	-	-	-	1.5
Total Research											



CONSOLIDATION COAL COMPANY
INCORPORATED
RESEARCH DIVISION
LIBRARY, PENNSYLVANIA 15129

INTER-OFFICE CORRESPONDENCE

To : John D. Sudbury Date : January 8, 1973

From : Carl E. Fink At (Office): Rapid City, SD

Subject: Monthly Report No. 28 - Project 702

The main effort during the month of December was on the gasifier fluidization tests. Tests were carried out in a 12-inch diameter glass column and in the 18-inch diameter gasifier boot with two different size consists of Minnekahta Limestone at ambient conditions. Both straight comical and sparger type fluidizing gas inlets were used. The purpose of these tests was to determine the fluidized bed density as a function of gas velocity based on measured weights of material and bed volumes. These bed densities are being compared to those predicted by the Consol correlation and those measured by pressure taps immersed in the bed.

Analysis of the data obtained during December is not yet complete. However, the correlation appears to be an accurate means of predicting bed densities. In the glass model, the differential pressure measurements across one foot of bed were insensitive for a range of bed densities from 85 lb/cu ft to 40 lb/cu ft. The differential pressure measurements can be used to determine the incipient fluidizing velocity. Data obtained in the gasifier boot seem to confirm these conclusions.

In the model, the sparger type gas inlet was clearly superior to a straight cone inlet from the standpoint of eliminating spouting. Video tapes were obtained with both types of inlet in the gasifier boot. Although there is no evidence from the video tapes that spouting occurred with the comical inlet, the sparger will be installed for the upcoming pressurized tests.

In January, further tests will be made using the model with char. Also, showering will be studied by attaching a 4-inch diameter boot. The gasifier will be operated at temperature and pressure. The purpose of this test is threefold. First, to establish a startup technique wherein the char-acceptor interface is maintained; second, to test the use of differential pressure measurements to determine the level of the interface; and, third, to demonstrate showering of acceptor through the char bed.

The contract for relining the regenerator has been awarded to the Joseph McCollum Company on the basis of competive bids. Relining is expected to begin on January 8, 1973.

A report covering Run 5, prepared jointly by Consol and Stearns-Roger, was issued during December.

C. E. Fink

CEF:lmp

SUBCONTRACT BETWEEN CONSOL AND SRSMAT RE CONSOL CO_2 ACCEPTOR PROCESS
(OCR, Prime Contract No. 14-01-0001-415(3))

MONTHLY REPORT FOR DECEMBER, 1972

I. General

A draft of the preliminary report on carbonate resources was transmitted during December. In the acceptor reconstitution studies, runs were made of one mole percent concentrations of Na, Cu, Si, K, Mn, and Al during the month. Single phase melts are obtained using the latter four impurities. In the corrosion studies, modifications of equipment permitted studies of rate as a function of system agitation. Studies on additional minor elements in lignite other than those previously reported were begun in December. Dr. Lingard was recovering from major surgery in December but will visit the Ponca City laboratory to confer with various people in early January. Final report of the early work on sodium removal should be completed in January. The installation of the particle monitoring equipment is still pending contractor's modifications at installation site.

II. Carbonate Resources (Mickelson)

The preliminary report on the past work was transmitted in mid-December. No additional work was done during the month. During January preliminary background work and literature search on additional carbonate deposits will begin.

III. Acceptor Reconstitution (Fuerstenau)

Experimental work in December involved forming melts in the presence of one mole percent impurity. With this level of addition of Na_2CO_3, two phase melts were obtained. In the case of $CuCO_3$, copper was noted to precipitate out on the sides of the crucible.

Single phase melts were observed in the presence of one mole percent SiO_2, K_2CO_3, $MnCO_3$, and $Al(OH)_3$. Experiments with these later four impurities will be conducted at a level of ten mole percent in January 1973.

IV. Corrosion of Materials in Contact with $CaCO_3$-$Ca(OH)_2$ Melts (Palmer)

Work during the month of December involved modification of the autoclave stirring assembly to allow variation of the stirring speed for the determination of corrosion rate as a function of degree of system agitation. Dissolution experiments were also initiated in December, and work involving determination of the corrosion rate as a function of degree of system agitation will be completed this month. It is anticipated that the corrosion rate of stainless steel will likewise be established as a function of melt composition during the month of January.

V. Noxious Elements (Lingard)

Work has started on the determination of additional elements in lignite, other than those previously reported, including molybdenum and beryllium. This work will be continued in January.

VI. Sulfur Studies (Lingard)

Arrangements are being made for a visit to the Ponca City lab early in January. This trip was delayed because of surgery needed by Lingard in December. The previously outlined work plan will be put in effect as early as possible.

VII. Lignite Beneficiation (Clarkson)

All re-checking of previous work on sodium removal is complete and the final report should be completed in January.

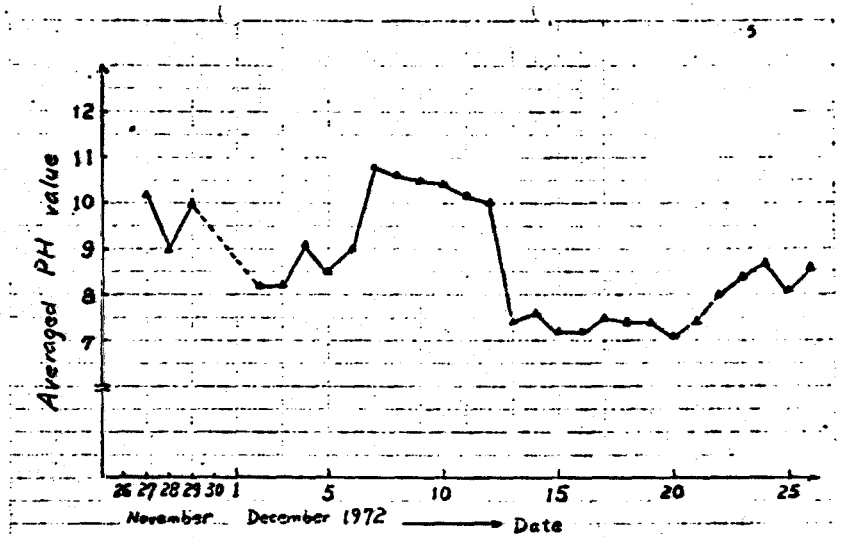
VIII. Carbonate Grinding Properties (Mickelson)

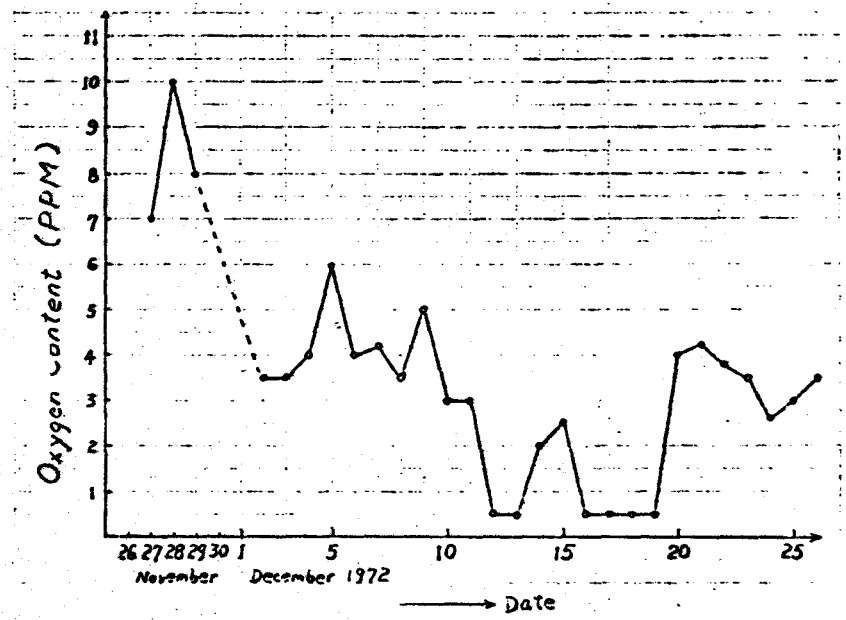
This work will not be activated until early in 1973.

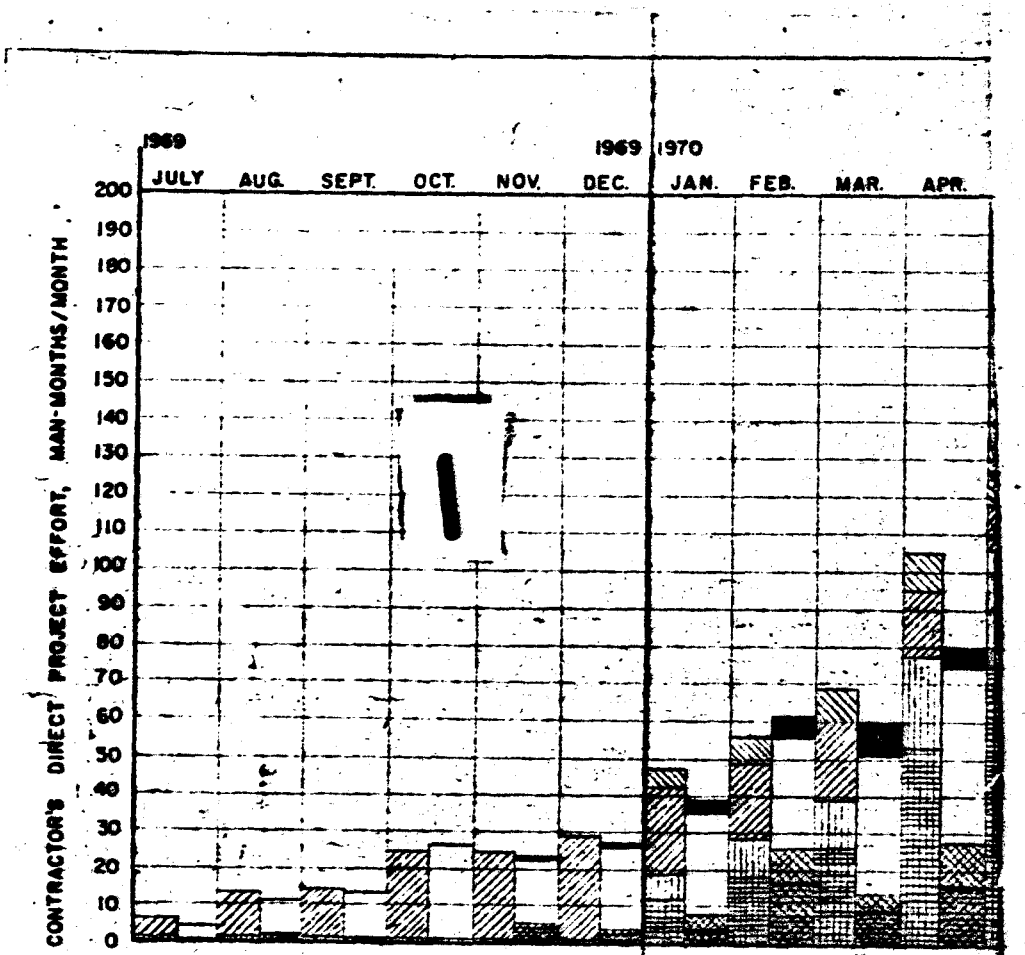
IX. Waste Monitoring (Oliver)

Copies of data from wastewater monitoring over the past month are attached. No gas samples have been analyzed because the plant has been down. Safety platform to enable installation of the particle monitoring equipment has not yet been installed.

Date	Oxygen Content (PPM)	PH value
November 27, 1972	3.0	9.2
28	10.0	9.0
29	3.0	10.2
30		
December 1		
2	3.5	9.3
3	3.5	9.6
4	4.0	9.1
5	6.0	8.5
6	4.0	9.0
7	4.2	10.3
8	3.5	10.0
9	5.0	10.5
10	3.0	10.4
11	3.0	9.2
12	0.5	10.3
13	0.5	9.4
14	2.0	7.4
15	2.5	9.3
16	0.5	7.6
17	0.5	7.5
18	0.5	9.1
19	0.5	9.4
20	4.0	7.4
21	4.2	9.4
22	3.3	9.0
23	3.5	9.2
24	3.6	9.5
25	3.0	9.3
26	3.5	9.3
Average	3.46	8.72







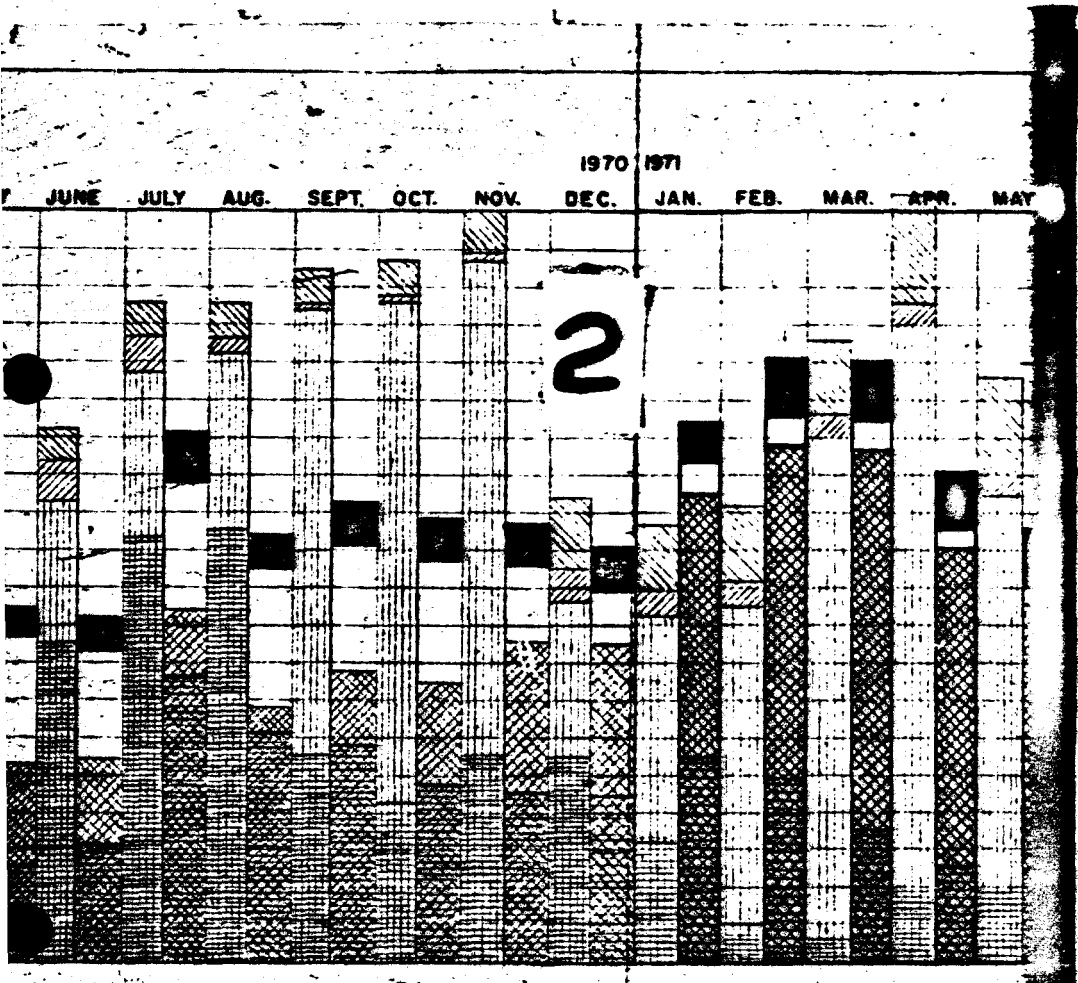
MONTHLY EXPENDITURES *

	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
PREDICTED	0	30.0 M	41.0 M	50.0 M	98.0 M	106.9 M	112.0 M	273.0 M	299.5 M	445.6 M
ACTUAL	6.2	25.0	32.8	42.6	39.7	126.2	110.5	76.7	[illegible]	209.2

CUMULATIVE EXPENDITURES *

	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
PREDICTED	0	30.0 M	71.0 M	121.0 M	219.0 M	325.9 M	437.9 M	710.9 M	1010.2 M	1455.8 M
ACTUAL	6.2	31.2	64.0	106.6	146.3	272.5	383.0	459.7	562.6	771.8

* EXPENDITURES INCLUDE ALL COSTS & FEES

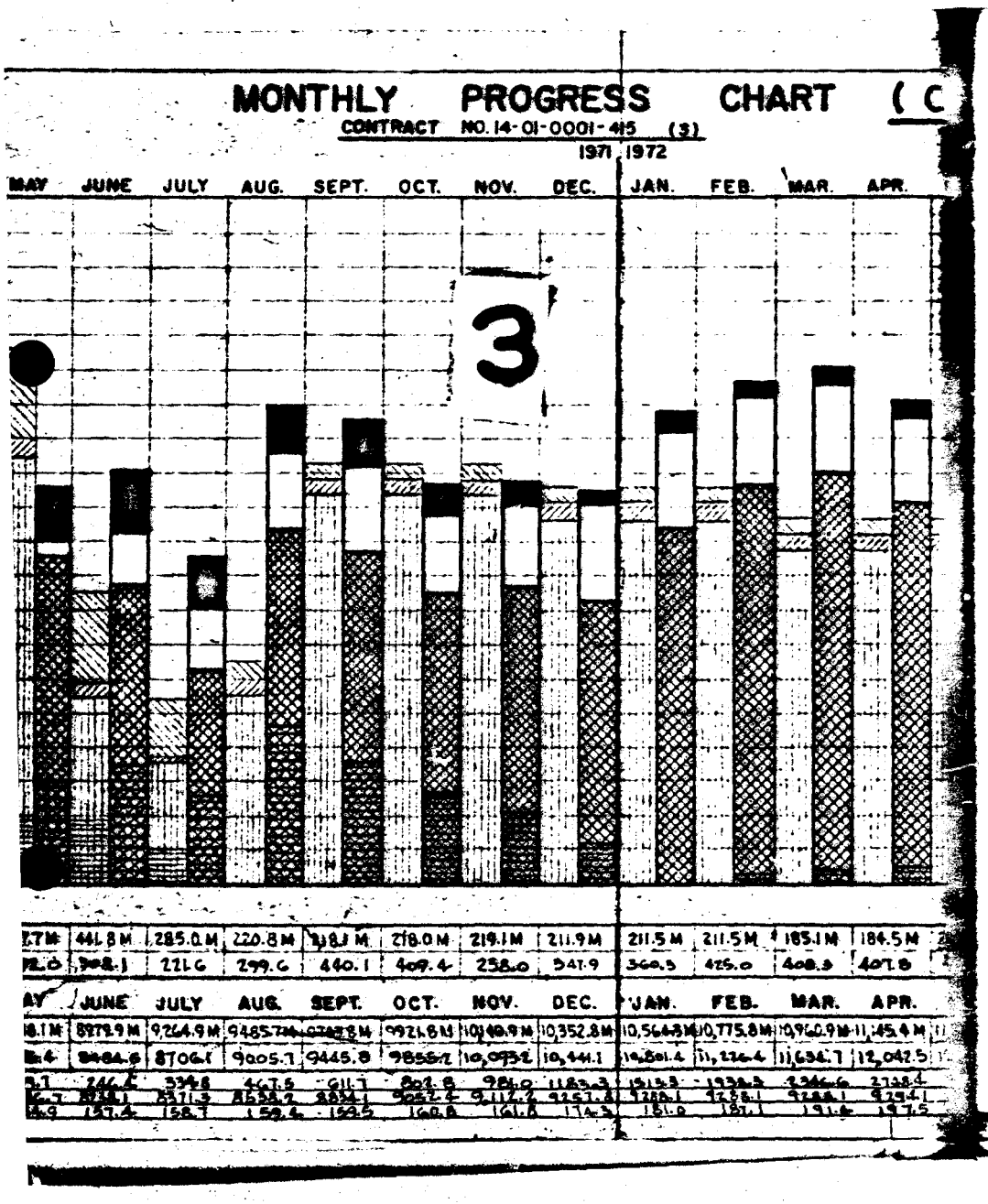


M	891.1 M	802.0 M	891.1 M	772.9 M	891.1 M	891.1 M	758.2 M	719.5 M	777.0 M	702.9 M	534.9 M	437.3
	367.1	564.6	725.2	794.2	728.9	422.9	779.5	552.1	690.6	757.7	496.7	292

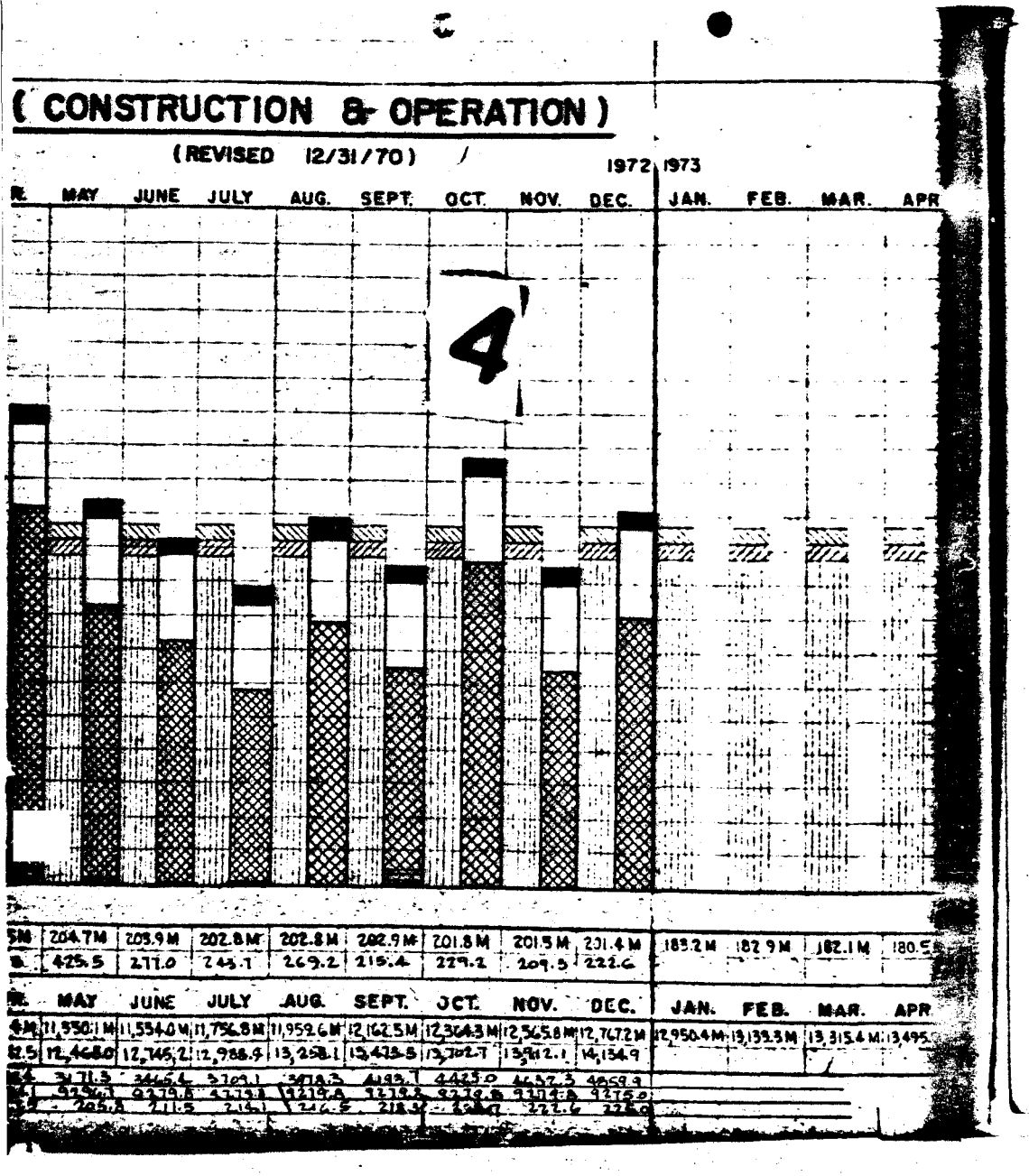
	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY
M	2970.6 M	3772.6 M	4663.7 M	5376.6 M	6267.7 M	7158.8 M	5566.6 M	5928.8 M	6868.1 M	7565.5 M	8100.4 M	8538
5	1372.6	1937.2	2662.4	3456.6	4185.5	4608.4	5387.3	5939.4	6630.0	7387.7	7884.4	8178

	OPERATIONS COST INCLUDED IN CUMULATIVE									151.0	163.0	189
	CONSTRUCTION COST INCLUDED IN CUMULATIVE									1117.9	1218.4	198
	MAU FUNDS SHALL THE RESERVE NOT INCLUDED IN CUMULATIVE										1982	154

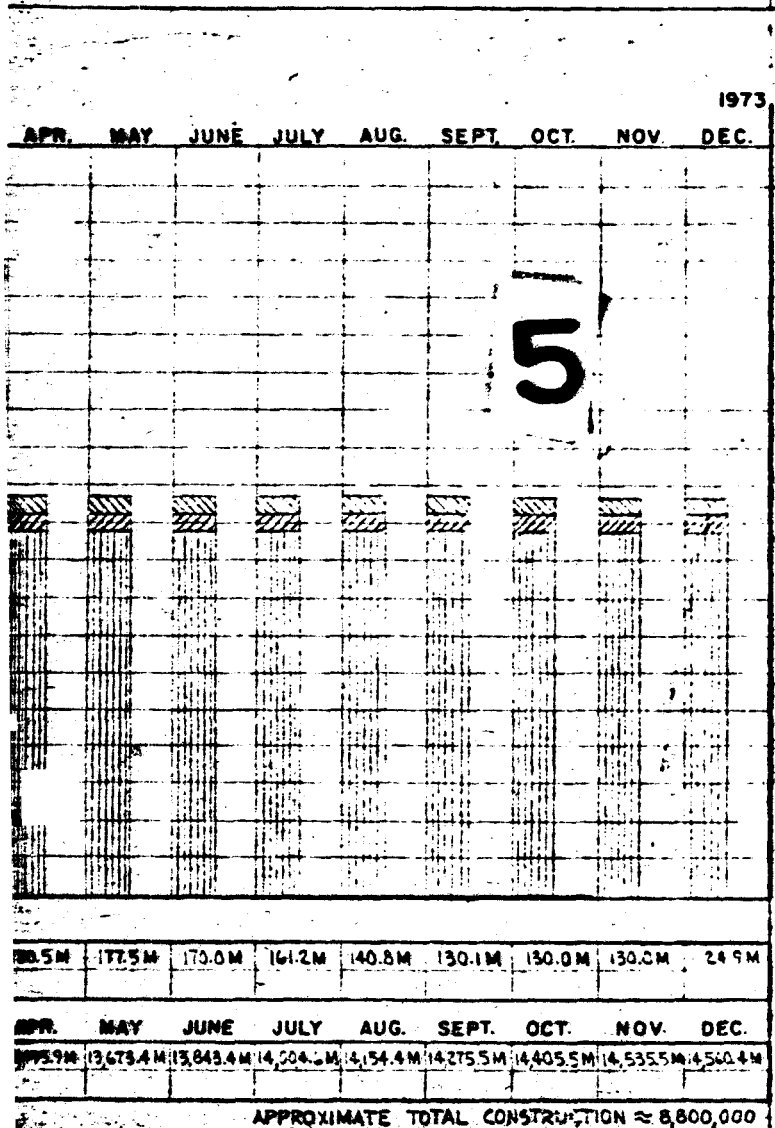
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MONTHLY PROGRESS CHART (C
CONTRACT NO. 14-01-0001-415 (3)
1971 1972
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
3
441.8 M 285.0 M 220.8 M 218.0 M 219.1 M 211.9 M 211.5 M 211.5 M 185.1 M 184.5 M
308.1 221.6 299.6 440.1 409.4 258.0 347.9 360.5 425.0 408.3 407.8
JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
9279.9 M 9264.9 M 9485.7 M 9785.8 M 9921.8 M 10,040.9 M 10,352.8 M 10,564.3 M 10,775.8 M 10,960.9 M 11,145.4 M
8706.1 9005.1 9445.8 9855.2 10,093.2 10,441.1 10,801.4 11,236.4 11,634.7 12,042.5
346.4 334.8 467.5 411.7 804.8 984.0 1183.3 1913.3 1938.3 2346.6 2738.4
8571.3 8858.7 8894.1 9082.4 9112.4 9251.8 9268.1 9258.1 9288.1 9194.1
157.4 158.7 159.4 159.5 160.8 161.8 174.5 161.0 187.1 191.6 197.5

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(CONSTRUCTION & OPERATION)
(REVISED 12/31/70)
1972
1973
R. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR
4'
SM 204.7M 203.9M 202.8M 202.8M 202.9M 201.8M 201.5M 201.4M 183.2M 182.9M 182.1M 180.5
B. 425.5 277.0 245.1 269.2 215.4 229.2 209.5 222.6
R. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR
4M 11,950.1M 11,554.0M 11,756.8M 11,959.6M 12,162.5M 12,364.3M 12,565.8M 12,767.2M 12,950.4M 13,139.3M 13,315.4M 13,495.
82.5 12,468.0 12,745.2 12,988.9 13,258.1 13,473.5 13,702.7 13,912.1 14,154.9

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DATE: Dec 1st 1972

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SUPERVISING

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TECHNICIAN S/C

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INCLUDES CLE

CONSTRUCTION— STE

OPERATIONS— STE

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DATE: December 1972

	PREDICTED	ACTUAL
SUPERVISING		
PROFESSIONAL		
TECHNICIAN S-R		
TECHNICIAN S/C		

① INCLUDES SUPERVISORY EXEMPT TECHNICIANS
② INCLUDES CLERICAL

CONSTRUCTION — STEARNS-ROGER JOB 8-37000
OPERATIONS — STEARNS-ROGER JOB 8-37400

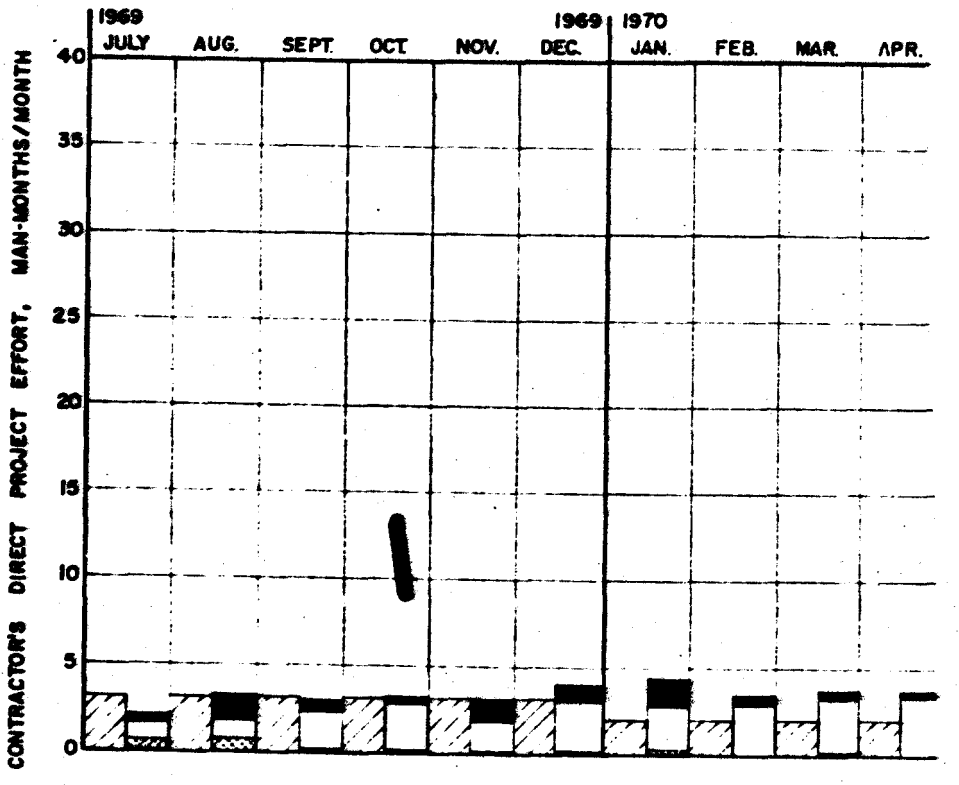
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MONTHLY PROGRESS CHART

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CONTRACT NO. 14-01-0001-415 (3)



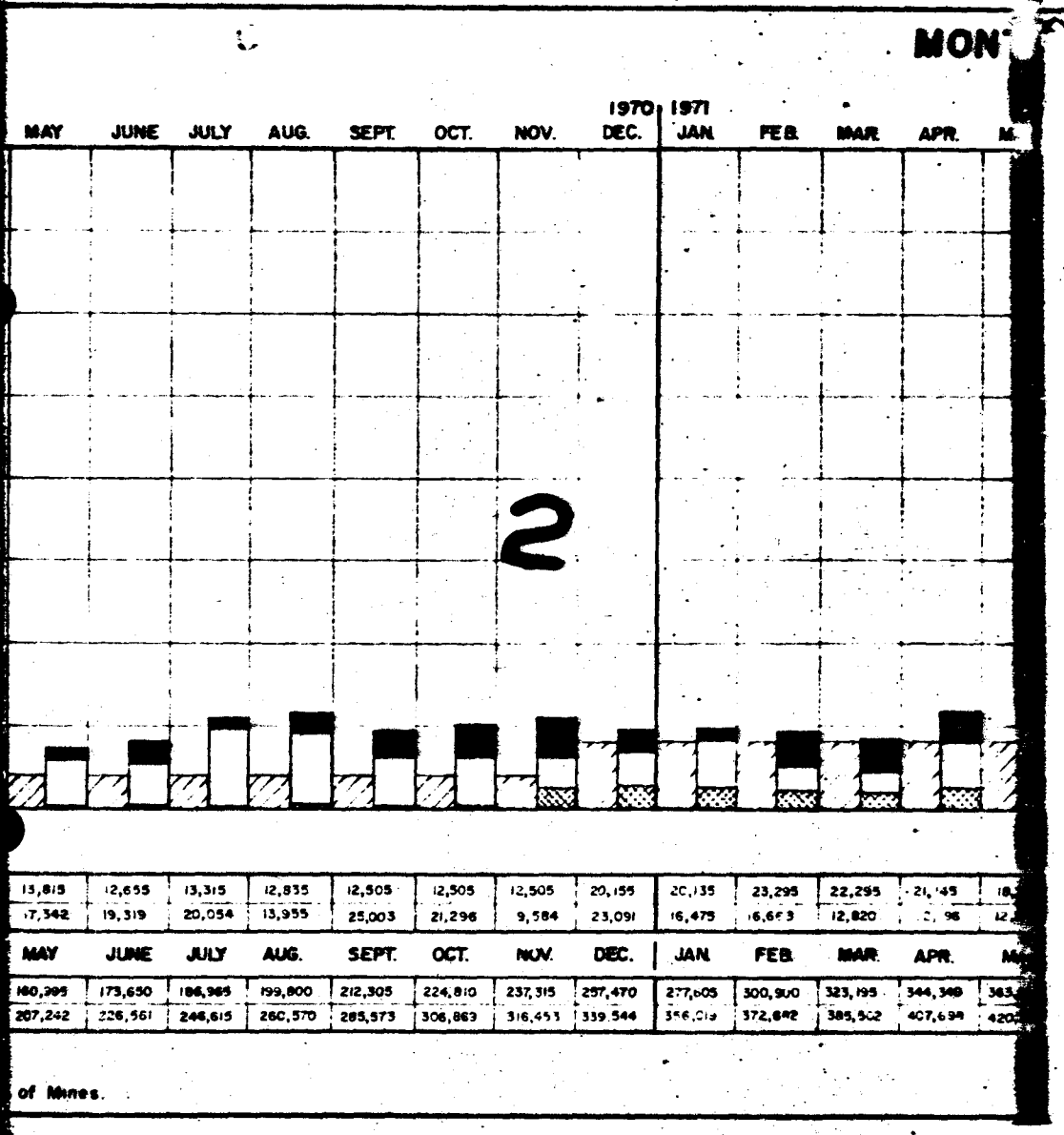
MONTHLY EXPENDITURES*

	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
PREDICTED	16,215	14,685	14,965	13,155	14,385	17,065	15,585	15,595	12,655	12,975
ACTUAL	11,745	34,724	9,609	11,925	10,130	15,205	14,378	14,027	15,019	53,228

CUMULATIVE EXPENDITURES*

	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
PREDICTED	16,215	30,900	45,865	59,020	73,405	90,470	106,055	121,650	134,305	147,190
ACTUAL	11,745	46,479	56,088	67,913	78,043	93,249	107,626	121,653	136,672	89,900

*Expenditures Include All Costs & Fees By Consol And S. Dakota Schoo



13,815	12,655	13,315	12,835	12,505	12,505	12,505	20,155	20,135	23,295	22,295	21,145	18,
17,342	19,319	20,054	13,955	25,003	21,296	9,584	23,091	16,475	16,663	12,820	21,198	12,

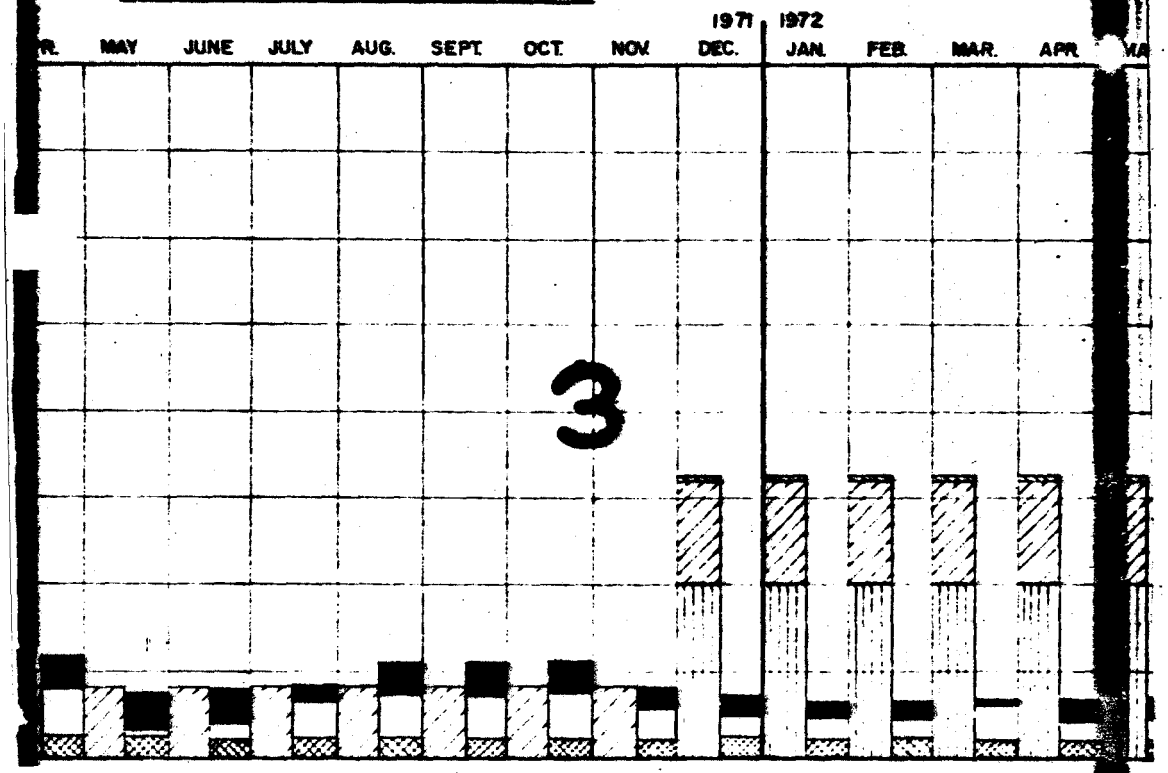
MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	M
180,395	173,650	186,965	199,800	212,305	224,810	237,315	257,470	277,605	300,900	323,195	344,340	363,
207,242	226,561	246,615	260,570	285,573	306,869	316,453	339,544	356,079	372,842	385,502	407,698	420

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CONTRACT No. 14-01-0001-415 (3)

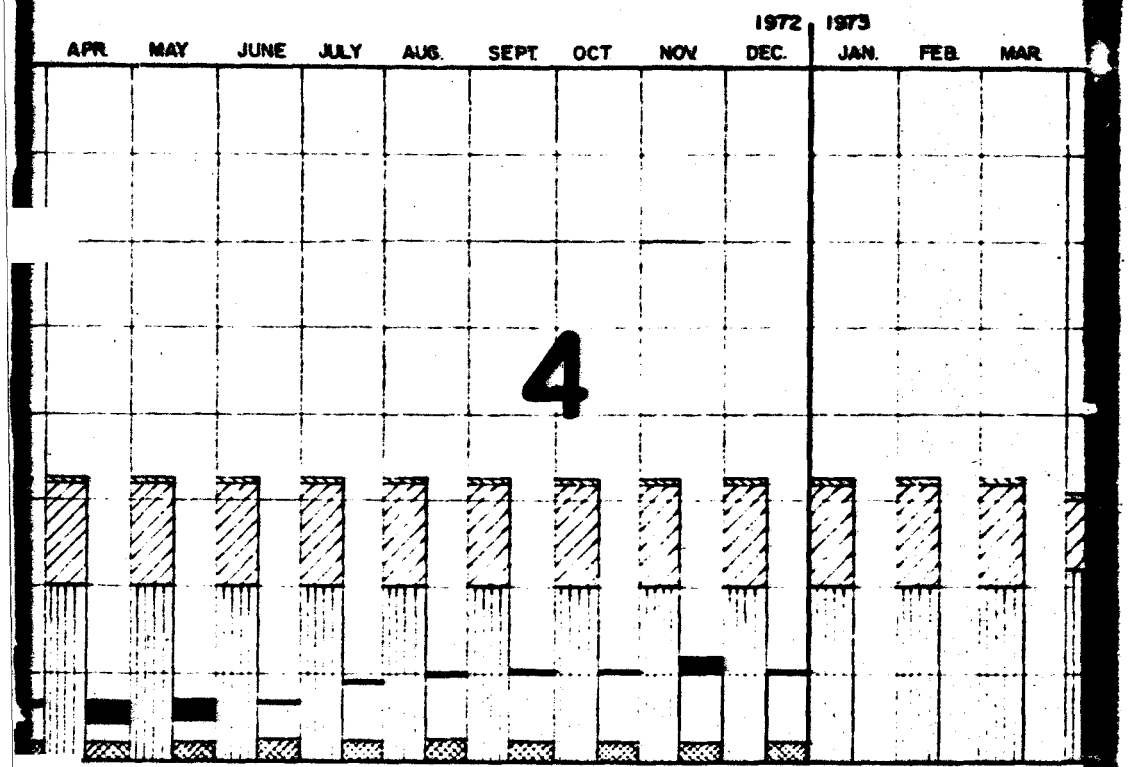


65	18,705	15,955	14,875	14,875	14,875	14,875	14,875	33,475	39,475	39,475	39,475	39,475	
96	12,508	15,831	16,923	24,949	97,703	30,575	18,172	36,224	15,804	15,700	23,962	12,772	

R.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MA
40	383,045	379,000	393,875	408,750	423,625	438,500	453,375	492,850	532,329	571,800	611,275	650,750	
99	420,206	436,037	452,960	477,879	575,582	606,157	624,329	660,553	676,157	691,857	715,819	728,591	

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39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475	39,475
12,772	28,047	29,900	19,900	35,815	27,791	19,010	27,475	35,700			

APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.
650,750	690,225	729,700	769,175	808,650	848,125	887,600	927,075	966,550	1,006,025	1,045,500	1,084,975
728,591	756,638	786,538	806,438	842,254	870,035	886,045	926,520	962,220			

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1973

MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.



SUPERVISING
PROFESSIONAL
TECHNICIAN

(2) Includes S
(2) (3) Includes C

973	36,075	36,075	11,475	11,475	11,475	41,120			

R.	APR.	MAY	JUNE	JULY	AUG.	SEPT.			
,973	1,121,050	1,157,125	1,168,600	1,190,075	1,191,550	1,232,670			

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New 415 Chart 1

DATE: December, 1972

1973

	PREDICTED	ACTUAL
SUPERVISING		
PROFESSIONAL		⊛
TECHNICIAN		⊛⊛

⊛ Includes Supervisory Exempt Technicians.
⊛⊛ Includes Clerical.

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MONTHLY PROGRESS CHART

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