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To: FILE


From: INDUSTRIAL ENGINEERING STAFF
CORPORATE ENGINEERING

Subject: CHICAGO BLAST FURNACE PLANT
INCENTIVE STANDARDS
COAL HANDLING-CHICAGO COKE PLANT

Reference:

DEVELOPMENT OF INCENTIVE STANDARDS FOR COAL DUMPING AND RECLAIMING OPERATIONS AT THE CHICAGO COKE PLANT MUST COMPREHEND A CHANGE IN OPERATING PROCEDURES. IN ORDER TO RECOVER THE COST OF COAL HANDLING INCENTIVE STANDARDS, WE MUST BE ABLE TO TAKE FULL ADVANTAGE OF THE DUMPING AND RECLAIMING SYSTEM CAPACITIES.

DURING THE PAST SEVERAL MONTHS, THE INDUSTRIAL ENGINEERING STAFF HAS GATHERED DATA ON DUMPING AND RECLAIMING OPERATIONS. THIS INFORMATION WAS FOR THE PURPOSE OF DETERMINING WHY THE DUMPING RATE PER SCHEDULED OPERATING HOUR IS SO MUCH LOWER THAN THE CAPACITIES OF THE EQUIPMENT. THE ATTACHED REPORT IS A COMPLETE ANALYSIS OF THE CURRENT OPERATING PROCEDURES FOR DUMPING, STOCKING AND RECLAIMING COAL AT THE CHICAGO COKE PLANT. THIS REPORT DETAILS THE VARIOUS DELAY AND IDLE TIMES THAT DETER TAKE ADVANTAGE OF EQUIPMENT CAPACITY. IN ORDER FOR THE INDUSTRIAL ENGINEERING STAFF TO SET PROPER INCENTIVE STANDARDS, IT IS IMPERATIVE THAT THE COAL HANDLING OPERATION BE RUN TO TO THE FULL CAPACITY OF THE EQUIPMENT


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Date: NOVEMBER 15, 1968

To: FILE
From: INDUSTRIAL ENGINEERING STAFF-CORPORATE ENGINEERING
Subject: COAL HANDLING-CHICAGO COKE PLANT

Reference:

I. INTRODUCTION

THE ROTARY COAL DUMPER AT THE CHICAGO COKE PLANT IS CAPABLE OF MAINTAINING AN UNRESTRICTED UNLOADING RATE, INCLUDING ALLOWABLE DELAYS, OF FOUR MINUTES PER CAR. COMPREHENDING AN AVERAGE WEIGHT PER CAR OF SEVENTY FIVE TONS, THE HOURLY DUMPING CAPACITY EQUATES TO 1,125 TONS.

THE CONVEYOR BELTS LEADING FROM THE DUMPER RECEIVING HOPPERS HAVE AN APPROXIMATE CAPACITY OF 600 TONS PER HOUR. THEREFORE, ALTHOUGH IT IS IMPOSSIBLE TO TAKE FULL ADVANTAGE OF THE DUMPER CAPACITY, IT SHOULD BE POSSIBLE TO OBTAIN A DUMPING RATE EQUIVALENT TO THE CAPACITY OF THE CONVEYOR BELTS.

THE AVERAGE COAL DUMPING RATE PER SCHEDULED AND OVERTIME DUMPER HOUR WAS 285.6 TONS IN 1967 AND 301.7 TONS IN 1968, YEAR-TO-DATE. THE MAXIMUM RATE ATTAINED IN ANY ONE MONTH WAS 383.2 TONS PER HOUR. THE MINIMUM RATE WAS 186.9 TONS PER HOUR. THE DUMPING FACILITY IS OPERATED SEVEN DAYS PER WEEK, SEVEN TURNS PER WEEK DURING SUMMER MONTHS AND AS MANY AS FOURTEEN TURNS PER WEEK DURING WINTER OPERATIONS.

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THE SIGNIFICANT DIFFERENCE BETWEEN THE ACTUAL HOURLY DUMPING RATE AND THE CAPACITIES OF THE EQUIPMENT CREATES THE NECESSITY OF DUMPING ON A SEVEN DAY PER WEEK BASIS.

THE IMBALANCE BETWEEN DUMPER CAPACITY, CONVEYOR CAPACITY AND ACTUAL DUMPING RATES PROMPTED THE INDUSTRIAL ENGINEERING STAFF-CORPORATE ENGINEERING, TO INITIATE A STUDY TO DETERMINE THE CAUSES OF THESE DIFFERENTIALS. IN THE OPINION OF THE INDUSTRIAL ENGINEERING STAFF, THE ONLY DIFFERENCE BETWEEN CONVEYOR CAPACITY AND ACTUAL DUMPING RATES SHOULD BE FOUND IN 'ALLOWABLE DELAYS' SUCH AS LUNCH, PERSONAL TIME, NORMAL MAINTENANCE, SAFETY MEETINGS, COLD WEATHER EFFECTS, ETC. THE TEXT OF THIS REPORT SUMMARIZES THE FINDINGS OF THIS STUDY.

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II. SCOPE OF STUDY

METHODS AND TIME STUDIES WERE ACCOMPLISHED ON THE FOLLOWING EQUIPMENT AND/OR OPERATIONS.

- A. ROTARY DUMPER-COAL UNLOADING
- B. EUCLID TRUCK COAL STOCKING
- C. EUCLID TRUCK COAL RECLAIMING

THESE STUDIES WERE ACCOMPLISHED DURING WARM WEATHER OPERATIONS AND THEREFORE DO NOT COMPREHEND SEASONAL EFFECTS OF COLD WEATHER. IT IS ANTICIPATED THOUGH, THAT SOME OF THE FINDINGS OF THE STUDY WILL BE AS AFFECTIVE DURING WINTER AS WELL AS SUMMER OPERATIONS.

EACH OF THE AFOREMENTIONED FACILITIES WAS STUDIED FOR THE PURPOSE OF DETERMINING;

- 1. CURRENT OPERATOR AND EQUIPMENT UTILIZATION.
- 2. OPERATING DELAYS AND/OR PROCEDURES THAT INHIBIT TAKING FULL ADVANTAGE OF THE CAPACITIES OF THE CONVEYOR SYSTEMS.
- 3. CAUSES OF MECHANICAL DELAYS.

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III. ROTARY DUMPER

A. OPERATING PROCEDURE

THE ROTARY DUMPER RECEIVES FULL RAILROAD HOPPER CARS, TURNS THEM UPSIDE DOWN TO DUMP THE COAL INTO RECEIVING HOPPERS AND RETURNS THE CAR TO AN UPRIGHT POSITION. THE CARS ARE FED INTO THE DUMPER BY A SMALL LOCOMOTIVE. THE TIME A CAR IS DETAINED IN THE DUMPER DEPENDS ON HOW LONG IT TAKES TO CONVEY THE DUMPED COAL FROM THE RECEIVING HOPPERS UNDERNEATH THE DUMPER.

B. STUDY RESULTS-TIME DATA SUMMARY

STUDIES OF THE ROTARY DUMPER OPERATION COMPREHENDED THE OBSERVATION OF DUMPING 140 HOPPER CARS AND INCLUDED ALL TYPES OF COAL CURRENTLY BEING USED IN THE COAL MIX. THE FOLLOWING TABLE SUMMARIZES TIME STUDY DATA FOR THE DUMPING OBSERVATIONS, PRESENTING AVERAGE TIMES FOR EACH ELEMENT OF THE OPERATION. THE TABLE ALSO PRORATES THOSE ELEMENTS THAT ARE PART OF A TOTAL OPERATING TURN RATHER THAN PART OF A DUMPING CYCLE.

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<u>ELEMENT</u>	<u>AVERAGE MIN. PER CAR DUMPED</u>	<u>% OF TOTAL MINUTES</u>
1. MOVE IN FULL CAR AND REMOVE EMPTY CAR.	.755	7.12%
2. ROTATE DUMPER	1.401	13.21%
3. WAIT COAL RECEIVING HOPPER TO DRAIN.	4.145	39.11%
4. RETURN DUMPER TO UPRIGHT	1.039	9.80%
5. WAIT LOCO. CHANGE CARS	.229	2.16%
6. POKE CAR WITH ROD.	.116	1.09%
7. LUNCH AND PERSONAL TIME	.817	7.71%*
8. SCRAPE COAL FROM RECEIVING HOPPERS.	.154	1.45%
9. MISC. AVOIDABLE DELAYS	1.282	12.10%**
10. WASH-UP TIME	.663	6.25%***
<hr/>		
TOTALS-----	10.601 MINS.	

* 37 MINUTES PER TURN: ** 58 MINUTES PER TURN:

*** 30 MINUTES PER TURN

THE AVERAGE TIME TO DUMP A HOPPER CAR DURING THE STUDY,
WITH AN AVERAGE LOAD OF 75 TONS, WAS 10.601 MINUTES.
THIS EQUATES TO 5.66 CARS AND 424 TONS PER HOUR.

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C. ELEMENT ANALYSIS

DURING THE PERIOD OF STUDY, THE DUMPING RATE OF 424 TONS PER HOUR WAS HIGHER THAN THAT EXPERIENCED DURING ALL WARM WEATHER OPERATIONS, BUT STILL LOWER THAN THE 600 TONS PER HOUR CAPACITY OF THE CONVEYOR BELTS. ELEMENTS THAT ARE RESPONSIBLE FOR EXTENSIVE DUMPING TIMES ARE ANALYZED AS FOLLOWS.

1. ROTATE DUMPER-----THIS ELEMENT INCLUDES SEVERAL OCCURANCES OF STARTING AND STOPPING THE DUMPER DUE TO COAL PILING UP ON THE DUMPER SIDES AND FROM NOT WANTING TO SPILL COAL OVER THE HOPPER SIDES. THE TENDENCY FOR COAL TO OVERFLOW WOULD BE REDUCED IF THE HOPPER FEED APPROACHED THE CONVEYOR SYSTEM CAPACITY.
2. WAIT FOR RECEIVING HOPPERS TO DRAIN-----THIS IS THE LARGEST SINGLE ELEMENT, TIME WISE, IN THE DUMPING CYCLE. EXTENDED WAITING TIMES ARE CAUSED BY IN-EFFICIENT OPERATING PROCEDURES OF THE DUMPER FEEDER OPERATOR. IN ORDER TO DECREASE THE WAITING TIME, THE DUMPER FEEDER OPERATOR MUST RUN THE FEEDER CONVEYORS TO TAKE FULL ADVANTAGE OF THE CAPACITY OF THE CONVEYOR SYSTEM.

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3. SCRAPE COAL RECEIVING HOPPER-----IN THIS ELEMENT, THE DUMPER OPERATOR MOVES ONTO THE RAILS OVER THE RECEIVING HOPPERS AND SCRAPES COAL ACCUMULATIONS FROM THE SIDES OF THE HOPPERS. THIS ELEMENT IS CAUSED BY MOIST COAL STICKJNG TO THE SIDES OF THE HOPPERS. THE EFFECT OF THIS WORK ELEMENT CAN BE DECREASED BY INCREASING THE EFFICIENCY OF THE VIBRATORS EITHER BY RELOCATING OR ADDING MORE VIBRATORS.

4. MISCELLANEOUS AVOIDABLE DELAYS-----THIS ELEMENT INCLUDES DELAYS THAT ARE USUALLY BEYOND THE CONTROL OF THE DUMPER OPERATOR BUT CAN BE AVOIDED BY OTHER MEMBER OF THE DUMPING CREW.
 - (A) BELTS STOPPED BY "POINT Q" JAMB-UP-----THIS DELAY IS CAUSED BY THE INADEQUACY OF 'POINT Q' TO HANDLE A HIGH VOLUME OF MOIST COAL, ESPECIALLY POCOHONTAS. A SUGGESTION BY THE I. E. STAFF TO CHANGE THE DESIGN OF THE 'CHUTES' AT 'POINT Q' HAS BEEN ACCEPTED BY OPERATING MANAGEMENT. THE NEW DESIGN, WHEN INSTALLED, SHOULD ELIMINATE MOST OF THE PROBLEMS AT 'POINT Q'.

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(B) CONVEYOR BELTS STOPPED DUE TO 275 TON FEED HOPPER BEING FULL-----THIS DELAY IS CAUSED BY OPERATING INEFFICIENCIES AND CAN BE SOLVED BY A CHANGE IN OPERATING PROCEDURES FOR THE EUCLID TRUCKS AND INCREASED SURVEILLANCE BY OPERATING MANAGEMENT.

(C) BELTS STOPPED DUE TO DUMPER FEEDER OPERATOR NOT AT HIS WORK STATION-----THIS DELAY IS CAUSED BY INATTENTIVENESS OF PERSONNEL. INCREASED SURVEILLANCE BY OPERATING MANAGEMENT WILL ELIMINATE MOST OF THIS PROBLEM AREA.

5. WASH-UP TIME-----IT WAS OBSERVED DURING THE STUDY THAT THE DUMPING CREW LEFT THEIR JOBS OR WORK STATIONS EARLIER THAN SHOULD BE ALLOWED. THIS WASH-UP TIME VARIED FROM 30 TO 45 MINUTES. AGAIN, INCREASED SUPERVISORY AWARENESS WOULD DECREASE THIS DOWNTIME.

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D. TRUE DUMPING CYCLE

ELIMINATION OF ALL MAJOR DELAYS EXPLAINED IN THE PRECEDING SECTION WOULD RESULT IN A DUMPING CYCLE OF 3.817 MINUTES PER CAR. THE DUMPING RATE, AT THIS CYCLE TIME, EQUATES TO 1,148 TONS PER HOUR. THE CONVEYOR SYSTEM THAT TRANSPORTS COAL FROM THE DUMPER HOPPERS HAS AN AVERAGE HOURLY CAPACITY OF 610 TONS. THEREFORE, SOME OF THE WAITING TIME IS ALLOWABLE.

E. CALCULATED DUMPING CYCLE.

THE CALCULATED DUMPING CYCLE RECOGNIZES THE ALLOWABLE WAITING TIME DUE TO CAPACITY DIFFERENCES AND SUFFICIENT UNAVOIDABLE DELAY AND PERSONAL TIME. PERSONAL TIME AND DELAY ALLOWANCES ARE EXPRESSED IN THE FOLLOWING TABLE.

<u>DOWNTIME OR DELAY ALLOWANCE</u>	<u>ALLOWED MIN. PER TURN</u>	<u>% ALLOWANCE</u>
1. START-UP TIME (A.M.)	5.0	1.04%
2. LUNCH BREAK	20.0	4.17%
3. PERSONAL TIME	10.0	2.08%
4. WASH-UP TIME	15.0	3.13%
5. WEEKLY SAFETY MEETING	4.0	0.83%
6. MISCELLANEOUS	6.0	1.25%
	<u>60.0 MINS.</u>	<u>12.5%</u>

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COMPREHENDING SUFFICIENT PERSONAL AND ALLOWABLE TIMES, THE DUMPING CYCLE WOULD BE 8.276 MINUTES PER CAR FOR THE AVERAGE COAL MIX. THE DUMPING RATE WOULD BE 543.8 TONS PER HOUR. THE FOLLOWING TABLE EXHIBITS THESE STATISTICS.

ELEMENT	MINUTES PER CAR DUMPED			WEIGHTED AVERAGE
	ILLINOIS COAL (50%)	SEWELL COAL (25%)	POCO. COAL (25%)	
1. MOVES CARS	.742	.730	.789	.750
2. ROTATE DUMPER	1.228	1.332	1.651	1.370
3. WAIT HOPPER DRAIN	3.874	2.990	5.172	3.964
4. RETURN DUMPER	1.016	1.041	1.064	1.038
5. WAIT LOCOMOTIVE	.147	.164	.140	.151
6. POKE CAR WITH ROD	-----	-----	.337	.084
TOTAL ELEMENT TIME	7.007	6.257	9.153	7.356
DOWNTIME ALLOWANCE (12.5%)	.876	.782	1.144	.920
TOTAL CYCLE TIME	7.883	7.039	10.297	8.276
AVERAGES-----				
CARS DUMPED/HR	7.61	8.52	5.83	7.25
TONS PER CAR	72	64	91	75
TONS DUMPER/HR	547.9	545.3	530.5	543.8

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F. CALCULATED COAL AND DUMPER HOUR REQUIREMENTS

THE FOLLOWING TABLE EXHIBITS COAL AND DUMPER HOUR REQUIREMENTS, BASED ON A 150 OVENS PER DAY SCHEDULE AND A DUMPING TIME AS EXPRESSED IN THE PRECEEDING PARAGRAPH.

1. NO. OF OVENS PUSHED PER DAY-----	150
2. TONS OF COAL REQUIRED PER OVEN-----	17.4
3. TONS OF COAL CHARGED PER DAY-----	2,610
4. TONS OF COAL CHARGED PER WEEK-----	18,270
5. HOURLY DUMPING RATE-----	543.8 TONS
6. HOURS REQUIRED TO UNLOAD WEEKLY COAL REQUIREMENTS-----	33.6
7. DUMPING TURNS REQUIRED PER WEEK-----	4.2

THE DUMPING RATE, AS CALCULATED IN THE PRECEEDING SECTION, WILL ALLOW SEVEN DAYS OF COAL REQUIREMENTS TO BE DUMPED IN LESS THAN FIVE OPERATING DAYS.

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IV. EUCLID TRUCK COAL STOCKING

A. OPERATING PROCEDURE

AFTER COAL IS DUMPED BY THE ROTARY CAR DUMPER, IT IS CONVEYED TO A 275-TON, OVERHEAD, DIVIDED HOPPER. THE COAL IS THEN FED FROM THE HOPPER TO 20-TON CAPACITY, EUCLID EARTH MOVING TRUCKS, WHICH DEPOSIT THE COAL IN PILES IN THE STORAGE YARD. THE TYPE OF COAL WHICH IS CURRENTLY BEING DUMPED, CONVEYED TO THE OVERHEAD HOPPER AND FED DIRECTLY TO THE PROCESSING SYSTEM, BY-PASSES THE NEED FOR HANDLING BY THE EUCLID TRUCKS.

B. STUDY RESULTS-TIME DATA SUMMARY

STUDIES OF THE STOCKING OPERATION COMPREHENDED 520 STOCKING CYCLES OVER A PERIOD OF FIVE DAYS. CONSIDERING THE ACTUAL TIME PER CYCLE, WHICH INCLUDES THE TRIP TO AND FROM THE STORAGE YARD AND THE WAITING TIME TO FILL THE TRUCK, THE STOCKING RATE WAS 500 TONS PER HOUR. HOWEVER, THE ACTUAL STOCKING RATE WAS ONLY 290 TONS PER SCHEDULED OPERATING HOUR. THESE RATE DIFFERENTIALS OCCUR BECAUSE OF AVOIDABLE AND UNAVOIDABLE DELAYS THAT ARE PRESENT IN THE CURRENT OPERATING PROCEDURES.

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C. ELEMENTAL ANALYSIS

THE PRECEDING TABLE OF OPERATING ELEMENTS INCLUDES THOSE RESPONSIBLE FOR THE LOW PERCENTAGE OF PRODUCTIVE TIME. AN ANALYSIS OF THESE ELEMENTS FOLLOWS.

1. WAIT--DIRECT COAL FLOW----DIRECT FLOW OF COAL FROM THE 275 TON OVERHEAD HOPPERS TO THE PROCESSING SYSTEM IS ACCOMPLISHED WHEN THE MIXER BINS HAVE DEPLETED MOST OF THE SUPPLY OF COAL CURRENTLY BEING UNLOADED BY THE ROTARY DUMPER. DURING THE PERIOD OF DIRECT FEED, THE OPERATING PROCEDURE FOR THE STOCKING EUCLID IS TO STAND-BY AND NOT REMOVE COAL FROM THE HOPPERS. IT IS OPERATOR CONTENTION THAT THE 275 TON HOPPER WILL BE DEPLETED OF COAL IF THE EUCLID REMOVES COAL AT THE SAME TIME AS DIRECT FEEDING.

DURING THE PERIOD OF STUDY, THE AVERAGE TIME PER OCCURRENCE OF DIRECT COAL FLOW WAS 12.6 MINUTES. DURING THIS TIME, APPROXIMATELY 105 TONS OF COAL CAN BE CONVEYED TO THE PROCESSING SYSTEM, 100 TONS CAN BE TRUCKED TO THE STORAGE YARD AND 125 TONS CAN BE CONVEYED FROM THE DUMPER TO THE HOPPER IF THE SYSTEM IS USED EFFICIENTLY. THUS, THE 275 TON HOPPERS WOULD BE DEPLETED BY ONLY 80 TONS DURING AN AVERAGE PERIOD OF DIRECT COAL FEEDING.

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IF THE DUMPING SYSTEM IS OPERATING AT CAPACITY, IT IS PROBLEMATICAL THAT A DEPLETION OF THE COAL IN THE 275 TON HOPPER WOULD OCCUR.

2. WAIT BELT STOPPAGE-----THE BELT STOPPAGE CAUSED BY A JAMB-UP OF 'POINT Q' ALSO EFFECTS THE STOCKING OPERATION. AFTER DEPLETION OF THE OVERHEAD HOPPERS, THE STOCKING OPERATION IS DELAYED UNTIL 'POINT Q' IS OPENED UP. THE CHANGE IN CHUTES AT POINT Q, AS PRESCRIBED PREVIOUSLY, WILL ELIMINATE THIS DELAY.
3. WAIT-TRUCK MAINTENANCE-----DELAYS CAUSED BY TRUCK BREAKDOWNS COULD BE MINIMIZED BY UTILIZATION OF THE THIRD EUCLID. THE SPARE EUCLID, AVAILABLE IN GOOD OPERATING CONDITION AT ALL TIMES, SHOULD BE USED WHEN THE TRUCK CURRENTLY IN OPERATION INCURS TROUBLE.
4. IDLE, PERSONAL AND LUNCH-----DURING THE 5 DAY STUDY, THESE ELEMENTS AVERAGED APPROXIMATELY 30 MINUTES TOO LONG. GREATER SUPERVISORY AWARENESS WOULD REDUCE THIS DELAY.
5. WASH-UP TIME-----IT WAS OBSERVED DURING THE SPAN OF THE STUDY THAT THE TRUCK OPERATORS LEFT THEIR WORK AREAS 30 TO 45 MINUTES EARLY. AGAIN, GREATER SUPERVISORY AWARENESS IS NEEDED IN THIS AREA.

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D. TRUE STOCKING CYCLE

THE AVERAGE STOCKING CYCLE TIME THAT WOULD RESULT FROM ELIMINATING THE AVOIDABLE DELAYS AND ALLOWING SUFFICIENT PERSONAL AND DELAY TIME, WOULD BE 2.507 MINUTES PER 20 TON LOAD, AMOUNTING TO 479 TONS PER HOUR. THE ALLOWABLE TIMES ARE EXPRESSED IN THE FOLLOWING TABLE.

<u>DOWNTIME OR DELAY ALLOWANCE</u>	<u>ALLOWABLE MIN. PER TURN</u>	<u>% OF TURN (480 MIN.)</u>
1. START-UP TIME (A.M.)	5.0	1.04%
2. REFUEL	20.0	4.17%
3. TRUCK BREAKDOWN-CHANGE TRUCK	10.0	2.08%
4. LUNCH BREAK	20.0	4.17%
5. PERSONAL TIME	10.0	2.08%
6. WASH-UP TIME	15.0	3.13%
7. WEEKLY SAFETY MEETING	4.0	0.83%
TOTAL ALLOWANCES	84.0 MIN.	17.50%

THE FOLLOWING TABLE EXHIBITS A BREAKDOWN OF THE ALLOWABLE ELEMENTAL TIME WEIGHTED FOR THE CURRENT COAL MIX. ADDED TO THE TOTAL ELEMENTAL TIME IS THE 17.5% ALLOWANCE AS DETAILED IN THE PRECEDING EXHIBIT.

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<u>ELEMENT</u>	<u>ILLINOIS (50%)</u>	<u>SEWELL (25%)</u>	<u>POCO. (25%)</u>	<u>WEIGHTED AVERAGE</u>
1. LOAD TRUCK FROM HOPPER	.459	.489	.984	.598
2. STOCK COAL IN STORAGE YARD	1.310	1.479	2.044	1.536
TOTAL ELEMENT TIME	1.769	1.968	3.028	2.134
ALLOWANCES (17.5%)	.310	.344	.530	.373
TOTAL ALLOWED STOCKING CYCLE	2.079	2.312	3.558	2.507
NUMBER OF LOADS/HR.	28.86	25.95	16.86	23.93
NUMBER OF TONS/HR.	577	519	337	479

E. EQUIPMENT UTILIZATION--COAL STOCKING

EQUIPMENT UTILIZATION FOR THE STOCKING OPERATION IS DEPENDENT UPON THE AMOUNT OF COAL CONVEYED FOR STOCKING IN THE YARD AND THAT AMOUNT FED DIRECTLY TO THE PROCESSING SYSTEM. THE FOLLOWING TABLE EXHIBITS THE REQUIRED UTILIZATION OF THE STOCKING EUCLID, BASED ON THE DUMPING AND STOCKING RATES DEVELOPED FROM THIS STUDY.

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	TYPE OF COAL---TONS			WEIGHTED AVERAGE
	ILLINOIS	SEWELL	POCO.	
DUMPING RATE PER HR.	547.9	545.3	530.5	543.8
LESS-DIRECT FEED COAL/HR.	163.1	81.5	81.5	122.3
REQUIRED STOCKING RATE/HR.	384.8	463.8	449.0	421.5
CALCULATED STOCKING RATE PER HOUR.	577.0	519.0	337.0	479.0
REQUIRED EQUIPMENT UTILIZATION--%	66.7%	89.4%	133.2%	88.0%

BOTH ILLINOIS AND SEWELL COAL HAVE UTILIZATION FACTORS OF LESS THAN 100.0% IN RELATION TO THE CALCULATED STOCKING RATES. THEREFORE, ONE EUCLID TRUCK, UNDER PRESCRIBED OPERATING CONDITIONS, SHOULD BE ABLE TO MEET THE REQUIRED STOCKING RATE PER HOUR. POCOHONTAS COAL REQUIRES AN EQUIPMENT UTILIZATION OF 133.2% IN ORDER TO MEET STOCKING REQUIREMENTS. ASSISTANCE FROM THE RECLAIMING EUCLID IS NECESSARY TO MEET THE STOCKING COMMITMENT. THE AVAILABLE HOURS OF THE RECLAIMING EUCLID ARE PRESENTED IN THE NEXT SECTION.

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V. EUCLID TRUCK-COAL RECLAIMING

A. OPERATING PROCEDURE

THERE ARE TWO METHODS OF SUPPLYING COAL TO THE PROCESSING SYSTEM. ONE IS A DIRECT FEED AS EXPLAINED IN A PREVIOUS SECTION. THE OTHER CONSISTS OF A EUCLID TRUCK RECLAIMING COAL FROM THE STORAGE YARD AND DUMPING IT INTO AN UNDERGROUND HOPPER. FROM THIS HOPPER THE COAL IS FED INTO THE CRUSHING AND PROCESSING SYSTEM. THE MIXER BUILDING OPERATOR ALERTS THE RECLAIMING CREW AS TO THE TYPE OF COAL NEEDED .

B. STUDY RESULTS--TIME DATA SUMMARY.

THE EUCLID TRUCK RECLAIMING RATE, COMPREHENDING THE TOTAL TIME OF THE STUDY, WAS 218 TONS PER HOUR. WHEN CONSIDERING ONLY THE PRODUCTIVE TIME, THE RECLAIMING RATE IS 498 TONS PER HOUR. THE DIFFERENCE IN THE ABOVE TWO RATES IS A RESULT OF WAITING AND DELAY TIMES THAT ARE EXPERIENCED THROUGHOUT THE OPERATING TURN.

THE FOLLOWING TABLE SUMMARIZES THE OBSERVED AVERAGE RECLAIMING CYCLE TIME, INCLUDING THE PRORATED TIME FOR THE DELAY AND WAITING ELEMENTS.

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<u>ELEMENT</u>	<u>AVERAGE MIN. PER 20 TON LOAD</u>	<u>% OF TOTAL MINUTES PER TURN</u>
1. RECLAIMING COAL FROM THE STORAGE YARD	2.398	43.61%
2. STOCKING COAL IN YARD	.217	3.95%
3. WAIT--DIRECT COAL FLOW TO SYSTEM	.638	11.60%
4. WAIT--CHANGE OVER TYPE OF COAL TO SYSTEM	.486	8.84%
5. WAIT--RECLAIM HOPPER FILLED	.450	8.18%
6. WAIT--BELT STOPPAGE	.345	6.27%
7. WAIT--TRUCK MAINTENANCE	.103	1.87%
8. TRUCK REFUELING	.323	5.87% (25 MIN)
9. IDLE AND PERSONAL	.077	1.40% (6 MIN)
10. LUNCH	.201	3.66% (39 MIN)
11. WASH-UP TIME	.210	3.82% (41 MIN)
12. WEEKLY SAFETY MEETING	<u>.051</u>	<u>.93%</u>
TOTALS-----	5.499 MIN.	100.00%

THE AVERAGE TIME TO RECLAIM ONE, 20 TON TRUCK LOAD OF
COAL WAS 5.499 MINUTES, RESULTING IN A RECLAIMING RATE
OF 218 TONS PER HOUR.

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V. C. ELEMENT ANALYSIS AND SUGGESTED CHANGES

THE ELEMENTS WHICH ARE RESPONSIBLE FOR THE LOW PERCENTAGE OF PRODUCTIVE TIME ARE ANALYZED BELOW.

1. WAIT-DIRECT COAL FLOW TO SYSTEM----DURING THE PERIOD OF DIRECT COAL FLOW, THE RECLAIMING EUCLID STANDS IDLE UNTIL THE PERIOD ENDS. THIS IDLE TIME ACCOUNTED FOR 11.60% OF THE TOTAL STUDY TIME. THIS IDLE TIME CAN BE UTILIZED BY PERFORMING THE FOLLOWING TASKS.
 - a. ASSIST STOCKING EUCLID
 - b. REFUEL
 - c. TAKE PERSONAL BREAK
 - d. TAKE LUNCH BREAK
 - e. CLEAN EXCESS COAL FROM AROUND WORK AREA
 - f. WET DOWN WORK AREA.

2. WAIT TIME-COAL CHANGEOVER----DURING THE RECLAIMING OPERATION, THE TOP MIXER ATTENDANT NOTIFIES EITHER THE CONVEYORMAN OR THE EUCLID OPERATOR FOR THE NEED OF A CHANGEOVER TO A DIFFERENT TYPE OF COAL. THE EUCLID OPERATOR THEN RECLAIMS THAT TYPE OF COAL, TRAVELS TO THE UNDERGROUND HOPPER AND WAITS UNTIL THE HOPPER IS EMPTY OF THE PREVIOUS COAL. THIS IDLE TIME ACCOUNTED FOR 8.84% OF THE TOTAL STUDY TIME. THIS IDLE TIME CAN BE USED AS EXPLAINED IN THE ABOVE SECTION

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V. C. 3. WAIT TIME-RECLAIMING HOPPER FILLED----THIS WAITING TIME RESULTS FROM THE FOLLOWING REASONS.

- a. COAL FLOWING DIRECT FROM THE OVERHEAD HOPPERS.
- b. CONVEYOR BELT STOPPAGE
- c. THE RATE OF COAL RECLAIMING IS GREATER THAN THE FLOW OF COAL FROM THE UNDERGROUND HOPPER.

DURING THE STUDY, THIS IDLE TIME ACCOUNTED FOR 8.18% OF THE TOTAL TIME AND CAN BE UTILIZED AS DETAILED IN THE ABOVE SECTIONS.

4. WAIT TIME-BELT STOPPAGE----6.27% OF THE TOTAL STUDY TIME WAS SPENT IDLE DUE TO BELT STOPPAGE. THIS IDLE TIME CAN BE UTILIZED AS DETAILED IN THE ABOVE SECTIONS.

5. IDLE, PERSONAL AND LUNCH TIME----DURING THE FIVE DAY STUDY, THESE ELEMENTS AVERAGED APPROXIMATELY 15 MINUTES TOO LONG. GREATER SUPERVISORY AWARENESS WOULD REDUCE THIS DOWNTIME.

6. WASH-UP TIME----IT WAS OBSERVED THAT THE OPERATOR LEFT HIS WORK AREA 35 TO 45 MINUTES TOO EARLY. AGAIN, GREATER SUPERVISORY AWARENESS WOULD CUT DOWN ON THIS EXCESSIVE TIME.

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V. D. TRUE RECLAIMING CYCLE

THE AVERAGE RECLAIMING CYCLE TIME, COMPREHENDING SUFFICIENT DOWNTIME ALLOWANCES, CALCULATES TO 2.64 MINUTES PER LOAD. THE ALLOWANCES ARE AS FOLLOWS.

<u>DOWNTIME ALLOWANCES</u>	<u>MINUTES PER TURN</u>	<u>% OF TURN (480 MIN.)</u>
1. START-UP TIME (A.M.)	5.0	1.04%
2. REFUEL TRUCK	COMPREHENDED IN STOCKING CYCLE	
3. TRUCK BREAKDOWN-CHANGE TRUCK	10.0	2.08%
4. LUNCH BREAK	COMPREHENDED IN STOCKING CYCLE	
5. PERSONAL TIME	"	"
6. WASH-UP TIME	15.0	3.12%
7. WEEKLY SAFETY MEETING	4.0	.83%
8. MISCELLANEOUS	2.0	.43%
TOTAL ALLOWANCES	36.0	7.50%

THE AVERAGE CALCULATED RECLAIMING TIMES, RECOGNIZING CURRENT COAL MIXES, ARE PRESENTED BELOW.

	<u>ILLINOIS (50%)</u>	<u>SEWELL (25%)</u>	<u>POCO. (25%)</u>	<u>AVERAGE</u>
TOTAL RECLAIMING TIME	2.30	2.16	3.07	2.46
DOWNTIME ALLOWANCES	.17	.16	.23	.18
TOTAL CALCULATED TIME PER RECLAIMING CYCLE	2.47	2.32	3.30	2.64
NUMBER OF LOADS PER HOUR	24.3	25.9	18.2	22.7
NUMBER OF TONS PER HOUR	486	518	364	454

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V. E. EQUIPMENT UTILIZATION-COAL RECLAIMING

EQUIPMENT UTILIZATION IS A FUNCTION OF THE TYPE OF COAL CURRENTLY BEING DUMPED. THE FOLLOWING TABLE PRESENTS THE EQUIPMENT REQUIREMENTS FOR EACH TYPE OF COAL AND FOR THE AVERAGE REQUIREMENT.

	TONS REQ'D. PER OPER. DAY	RECLAIMING HOURS WHEN			AVG. TIME
		DUMPING ILLINOIS	DUMPING SEWELL	DUMPING POCO.	
RECLAIMING ILLINOIS COAL	1,305	-----	2.69	2.69	
RECLAIMING SEWELL COAL	652.5	1.26	-----	1.26	
RECLAIMING POCO. COAL	652.5	1.79	1.79	-----	
TOTAL REQUIRED EUCLID RECLAIMING HOURS AT CALCULATED RATES		3.05	4.48	3.95	3.63
RECLAIMING EUCLID % UTILIZATION		38.1%	56.0%	49.4%	45.4%
NON-RECLAIMING TIME--%		61.9%	44.0%	50.6%	54.6%

THE ABOVE STATISTICS INDICATE THAT THE RECLAIMING EUCLID TRUCK HAS AN AVERAGE WORK-LOAD OF 45.4%, THUS ALLOWING SUFFICIENT TIME TO HELP THE STOCKING EUCLID OR FOR OTHER ELEMENTS OF THE STOCKING AND RECLAIMING OPERATION.

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VI. GENERAL COMMENTS

SEVERAL FACTORS THAT AFFECT COAL HANDLING OPERATIONS,
WHICH HAVE NOT PREVIOUSLY BEEN MENTIONED, ARE;

- A. SAFETY
- B. EQUIPMENT CHANGES
- C. PREVENTIVE MAINTENANCE AND INSPECTION PROGRAMS
- D. CREW SIZE REDUCTIONS

THESE FACTORS ARE ANALYZED BELOW.

A. SAFETY

AFTER TALKING TO HOURLY PERSONNEL AND OBSERVING THE
DUMPING OPERATIONS, A NUMBER OF SAFETY HAZARDS BECAME
OBVIOUS. IT APPEARS, DUE TO THE REPITITIONS OF THE
COMPLAINTS, THAT A DIRECT APPROACH HAS NOT BEEN APPLIED
TO THE ELIMINATION OF SAFETY HAZARDS.

IT IS THEREFORE RECOMMENDED THAT THE PLANT SAFETY EN-
GINEER CONDUCT THE WEEKLY SAFETY MEETING AT LEAST ONCE
A MONTH. WITH THE SAFETY ENGINEER HEARING FIRST HAND
ABOUT SAFETY HAZARDS, IT IS PROBABLE THAT UNSAFE
CONDITIONS WILL BE ACTED UPON EXPIDITIOUSLY.

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VI. B. EQUIPMENT CHANGES

A TIMESTUDY OF THE THREE DUMPER FEEDER CONVEYORS INDICATED THAT NO. 3 CONVEYOR IS APPROXIMATELY 45% SLOWER THAN THE OTHER TWO CONVEYORS. A SUMMARY OF TONNAGE HANDLED BY ALL THREE CONVEYORS SHOWED THAT DURING 25% OF THE TIME, APPROXIMATELY 300 TONS/HOUR CAPACITY WAS LOST DUE TO THE SLOW SPEED OF NO. 3 CONVEYOR. THE I. E. STAFF RECOMMENDS THAT NO. 3 CONVEYOR BE UPGRADED TO EQUAL THE CAPACITY OF THE OTHER TWO FEEDER BELTS.

C. PREVENTIVE MAINTENANCE AND INSPECTION PROGRAMS

TO INSURE THAT EQUIPMENT WILL FUNCTION NORMALLY, A PREVENTIVE MAINTENANCE PROGRAM SHOULD EXIST. THE PRESENT PROGRAM RECOGNIZES NEED FOR ATTENTION ONLY WHEN EQUIPMENT BRAKES DOWN. THIS MAINTENANCE PRACTICE TENDS TO BE COSTLY BECAUSE OF PRODUCTION LOSS DUE TO EQUIPMENT BRAKEDOWN. IT IS RECOMMENDED THAT A PROGRAM OF PREVENTIVE MAINTENANCE AND INSPECTION BE INITIATED. THE EXTENT OF THE PROGRAM SHOULD BE DETERMINED BY A SEPARATE I. E. STUDY COMPREHENDING THE COST OF THE PROGRAM VS. SAVINGS IN DOWNTIME.

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VI. D. CREW SIZE REDUCTION

AS A RESULT OF THE TIME AND METHODS STUDIES, THE I. E. STAFF CONCLUDES THE EXISTING EIGHT MAN DUMPING CREW CAN BE REDUCED TO FIVE MEN. A DETAILED STUDY, SHOWING THE METHODS FOR ELIMINATION AND THE ECONOMICS OF SUCH A CHANGE, WILL BE ACCOMPLISHED IN THE NEAR FUTURE. THE CREW MEMBERS ANTICIPATED TO BE ELIMINATED ARE:

1. DUMPER HELPER.
2. DUMPER CLEANER.
3. DUMPER FEEDER.

VII. SUMMARY

THE DATA SUMMARIZED IN THE TEXT OF THIS REPORT VERIFIES THE EXISTANCE OF INEFFICIENT OPERATING PROCEDURES IN RELATION TO COAL HANDLING. THE PROJECTED REQUIRED HOURS TO DUMP AND STOCK A WEEKS SUPPLY OF COAL, COMPREHENDING TAKING FULL ADVANTAGE OF THE SYSTEM CAPACITY, INDICATES THAT AT LEAST TWO OPERATING TURNS PER WEEK CAN BE SAVED. THIS SAVINGS EQUATES TO APPROXIMATELY \$ 26,000 PER YEAR.

SECTION VI-D OF THIS REPORT PRESENTS PROPOSALS FOR THE POSSIBILITY OF REDUCING THE DUMPING CREW SIZE BY THREE MEN. A REDUCTION OF THIS MAGNITUDE WOULD RESULT IN A YEARLY SAVINGS OF AT LEAST \$ 25,000 YEARLY.

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SINCE THE ABOVE PROJECTED SAVINGS ARE AVAILABLE WITH A MINIMAL AMOUNT OF EXPENDITURE, IT WOULD BEHOVE COKE PLANT SUPERVISION TO IMMEDIATELY INITIATE CHANGES IN COAL STOCKING AND RECLAIMING PROCEDURES.

JOHN A. KASMAN

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