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Tucson
5/20/66

Pit Operations at the Ray Mines Division

by

D. L. Wilson
Truck & Shovel General Foreman

For Presentation to the AIME Open Pit Mining Subsection, May 16, 1966

Introduction

Slide showing goals

The Pit Operations Department at Ray Mines Division is presently responsible for mining 24,000 tons of ore and approximately 50,000 tons of waste per day. This is accomplished with twelve (12) shovel shifts maintaining an average of better than 6,000 tons each and approximately 1,200 tons per truck shift.

The Pit Operations Department controls the blend of ore, bearing in mind four main factors: total copper, non sulphide copper, concentrate grade and recovery. The concentrate grade is held at 20 and recovery averages about 85%. The effect of ore controls on the mining operation will be discussed a little later.

Organization

Slide showing organization

The Pit Operations Superintendent carries on the mining operation through three department heads. These are the Truck and Shovel General Foreman, the Drilling and Blasting General Foreman and the Dozer and Grader General Foreman.

The Truck and Shovel General Foreman is responsible for the entire production of the mine. This includes primary crushing and train operations between Ray and Ray Junction, as well as the truck and shovel operation. These operations

function on a 24-hour, 3 shift, 7-day week basis. Supervision on each shift consists of one shovel foreman, one ore haul foreman, one waste haul foreman and one relief foreman. These men rotate shifts as a unit with their respective crews every two weeks. The shovel foreman is in charge of the shift as well as having personal direction of the shovel operators on his shift. The ore haulage foreman has charge of the crusher and the train operations while the waste haul foreman gives direct supervision to the truck operations.

The drilling and blasting operation is coordinated under the Drilling and Blasting General Foreman who separates his work into three distinct areas with a supervisor for each area. These areas are rotary drills, primary blasting, and secondary blasting.

The Dozer and Grade General Foreman receives his orders directly from the Pit Operations Superintendent and coordinates the work with the other two general foremen. He personally supervises the dozer operations on day shift and instructs the shift foremen on dozer work to be accomplished by the night shifts.

Drilling and Blasting

Slide showing drill

Primary drilling is accomplished with four 40R Bucyrus-Erie rotary electric drills and one 30R Bucyrus-Erie diesel powered drill. The 40R drills are equipped with 9-inch rotary drill bits and four drill stems which give them a depth potential of 112 feet. The 30R drill uses a 7-7/8-inch bit, and although this drill uses smaller tools and lacks the penetration rate of the bigger drills, it is much more mobile and can be moved into areas that are inaccessible to the 40R's.

The primary blasting operation is carried on during day shift and is coordinated to interfere as little as possible with the truck and shovel operation. Due to the complexity of the ore body, the mining faces are generally narrow and the operation does not lend itself to very large blasts which could be fired during shift changes.

The normal bench height is 40 feet. Blast holes are shot five feet below grade, but an additional three to five feet is drilled to insure that a 5-foot hole will stand until it can be blasted. In general, single row blasting patterns are used, except where narrow or shallow cuts make it impractical. Hole spacing ranges from seven to nine yards, according to the

character of the rock. The distance between drill lines varies from 30 to 50 feet, according to the amount of back breakage from the previous blast.

The powder foreman determines the burden for each hole by measuring its depth, its spacing, and estimating the length of toe. The burden in turn is multiplied by a powder factor which is given in pounds per cubic yard to determine the amount of powder needed. Powder factors vary from 1/2 to 7/8 pounds per cubic yard. Results of previous blasting are our best guide to a good powder factor. Unsatisfactory fragmentation can usually be traced to an insufficient charge or poor distribution of the charge. The penetration rate of the drills is an excellent indicator of the hardness of a given formation. Another indicator is the size of the drill cuttings; the fine cuttings indicating hard ground and the large cuttings indicating a softer formation. The alteration of the rock also gives us information about its breaking properties. All of the heavily silicified rocks are hard, while rocks which have experienced breakdown of feldspars and development of clays are soft.

Slide showing prill truck

The primary blasting is done with prilled ammonium nitrate (Carbamite "P") and Apache slurry, depending on whether the hole is dry or contains water. The use of Carbamite "P" was initiated as a trial to determine whether or not the bulk loaded ammonium nitrate-fuel oil mixture could be used. Carbamite "P" was felt to be a valid substitute in the trials due to the similarity of the two mixtures in density and explosive properties. The results achieved by the Carbamite "P" were better fragmentation and a smaller powder factor. As a result of this, the Carbamite "P" has replaced the Carbamite previously used. A storage bin is being constructed and a mixing truck purchased for handling AN-FO and tests have commenced on the use of this equipment. It is believed that the improved fragmentation achieved by the Carbamite "P" was the result of better distribution by this less dense explosive. The prill storage bin is gravity loaded and gravity discharged. Its capacity is 114 tons. The prill truck will hold 300 cubic feet of prilled ammonium nitrate, more than enough for an average day's use.

Slide showing cat drill

Secondary dillling and blasting is done with two cat-mounted jumbos which drill three-inch holes up to 24 feet in depth. A truck-mounted compressor supplies air to jackhammers when they are needed. Most of the work done by this department is pioneer work in undeveloped areas where blasting is necessary to establish working levels for shovel operation.

Whenever possible the 24-foot holes are sprung three times and given the maximum explosive charge to get best possible fragmentation.

Prilled ammonium nitrate is loaded into these holes through a compressed air supercharger. The explosive charge ranges from 75 to 150 lbs. The charges are primed with one stick of 2 x 12 Amogel 60% dynamite attached to primacord line.

Boulders that are left from primary blasting are drilled to a depth of 2/3 their diameter and blasted with small charges of Amogel according to their size.

Description of Equipment

Slide showing Marion shovel

The mine operates eight shovels, three Marion 4161's with 6-yard buckets and five P & H model 1600's with seven yard buckets. We are presently in the process of installing automatic lubrication on all shovels. This will result in improved lubrication and will permit a force reduction which will be accomplished by combining the work of the dozer operator, who normally takes care of the cleanup around the shovels, and the shovel oiler.

The haulage truck fleet of 34 units consists of six separate truck models. Included in the fleet are three different models of Euclid trucks, two types of KW-Dart trucks, and the Lectra-Hauls.

Slide showing trucks

The smallest members of the fleet are the five 50-ton tandem axles KW-Darts. These are powered by 600 horsepower VT12 Cummins engines with twin disc converters, air operated clutch and starter.

There are fourteen 55-ton trucks, of which seven are 3LLD Euclids and seven are 4LLD Euclids. The 3LLD's are powered by two 325 horsepower 6110 GMC diesel engines and twin four-speed Allison transmissions. The 4LLD's have twin NT380 Cummins power plants producing 330 horsepower each and also have the four-speed Allison transmissions. Presently the NT380 is being modified to produce 380 horsepower and a program is underway to equip these trucks with 65-ton beds.

The next group of trucks in order of increasing capacity are the Euclid 5LLD's. These were originally 55-ton trucks, but have been modified to carry 65-tons by the use of lighter weight T1 steel beds. These trucks, like the 3LLD's, are powered by GMC 6110 diesel engines, but are geared considerably lower in order to handle the additional payload.

The truck fleet also includes three 65-ton single rear axle KW Darts. These trucks are equipped with 700 horsepower VT12 engines, manual shift transmissions, torque converters and the air operated clutches. The manual transmissions are being replaced by six-speed Allison D. P. 8000 series transmissions, which are expected to improve the performance and availability of these trucks.

The largest trucks in the fleet are the two 85-ton Lectra Hauls. The power for this truck is generated by a 700 horsepower V16 GMC diesel engine. The generator and drive motors will handle up to 1000 hp. The drive motors are an integral part of the rear wheels. This eliminates the maintenance of a drive assembly from the motor to the rear wheels. However, maintenance of the generator and the electric motors must be expected.

Dozers and Graders

The necessary road construction and maintenance, and other dozer work necessary to the operation is carried on by the dozer and grader general foreman. He has a fleet of 19 pieces of equipment. This includes nine track type dozers, five rubber-tired dozers, three road graders and two 3-yard front-end loaders.

The heavy dozers such as the Caterpillar D-8 and the Allis-Chalmers 6 HD 21's are used for such heavy jobs as road construction, ramp building and preparation of each dumps.

An Allis-Chalmers HD 16 is equipped with a scarifier for road work too heavy for road graders.

The front-end loaders are used to load flux into railroad cars and repair roads in the pit. They also find application in preparation of pipe locations and in burying pipe lines.

There are seventeen miles of active haulage roads at Ray Mines. The average haul is about 6000 feet and average positive lift about 240 feet. All pit haulage roads are maintained at least 60 feet wide with additional room for high berms wherever needed. Roads are provided with super-elevation when necessary. When the super may cause the slower (up hill) traffic to skid into the down hill lane, a dividing berm is constructed. All roads are crowned to provide drainage and decrease pot holes and other water damages. Most haul roads are designed at 8%, where lift is needed, to fit the types of trucks now in use at Ray. These roads are being widened for three lanes of traffic so that the faster trucks can pass and operate at full efficiency. In areas where space is cirtical, ramps and grades are increased up to 10%. The roads on the dumps are built on a 2% adverse grade since additional height can be obtained in this way with very little loss in truck speed. Runaway ramps are constructed on long down grades. Sharp turns are avoided in designing roads to reduce tire wear. Haulage roads are scarified and graded regularly and are treated with water spray to control dust. Norlig and emulsified asphalt have also been used to improve dust control and to stabilize the road surface.

Ore Blending

Show map of mine. Use map and point to areas.

One of the outstanding characteristics of the ore body is its inconsistency in all areas except in diabase. Ore grade and milling characteristics vary greatly over short distances.

Diabase ore carries only a moderate grade of copper, has very low oxide content, and in general produces a low concentrate grade. Highly pyritic ore in the West Pit is in schist, chalcocite is the copper mineral and it commonly occurs as a thin coating on the pyrite. This results in a very poor concentrate grade. There is a large tonnage of this type of ore that will concentrate at no better than a 10% grade although maintaining good recovery. The schist ore in the Pearl Handle Extension and East Ray Hill area of the mine in general has good concentrating properties and a good recovery can be made on the copper. In addition to these prevalent types, there are residual pillars of high grade and generally high oxide ores left in the underground block caved portions of the mine.

Weekly quality control meetings are held with mill personnel to determine the ore blending necessary to achieve all of our goals. It is often necessary to blend from several of the above mentioned ores to achieve proper mill headings.

Tucson
5/20/66

LEACHING AND PRECIPITATION

by

C. A. Lefler

Precipitating Plant General Foreman
Kennecott Copper Corporation
Ray Mines Division

To be presented at A.I.M.E. Convention - May 16, 1966

KENNECOTT COPPER CORPORATION
RAY MINES DIVISION
RAY, ARIZONA

LEACHING AND PRECIPITATION

The Ray Mine is one of the pioneers of leaching and precipitation in the southwest, starting many years ago with wooden tanks, using waste water from underground and any scrap iron available.

The possibility of leaching old mine workings by introducing water into caved areas was investigated, and our first unit of approximately 300 gpm capacity was placed in operation in 1937, with effluent grades running as high as 125 pounds per 1000 gallons.

From this small beginning, our system has developed and expanded to its present size, covering the leach areas shown on the attached sketch map of the area.

As leaching followed behind mining, our plant capacity and pumping rate were increased correspondingly. During 1955, underground mining was discontinued, and the entire underground area became available for leaching.

In 1960 the grade of effluent had declined, blockages occurred in caved areas underground and leaching of dumps was started. Dump leaching presently accounts for about 75 percent of total precipitate production.

In order to maintain production, pipelines, pumping facilities, and plant capacity were steadily increased to achieve our present circulation rate of about 7500 gallons per minute. Dump influent solutions consist of tail water from the Precipitation Plant with makeup water from shallow wells. Acid is used conservatively to control penetration.

The method of application of solutions to dumps has varied depending upon the material being leached and results achieved. In general use are ponds, ripper furrows, and dozer-width trenches.

General

Principal problems in connection with the production of precipitate copper at RMD have been, and continue to be, the low grade of solutions from leach dumps, available plant capacity, and a far from abundant water supply. At present, water supply is the least of these problems, since we had a very wet winter season we are operating at the capacity of our present Precipitation Plant. However, with a planned increase in production, water supply will again become of major importance.

The second problem, that of plant capacity, has been temporarily alleviated with construction of an additional precipitator. The construction of a new Precipitation Plant, now in the planning and designing stage, will provide for further increase. Advance of mining operations makes it necessary to construct a new Precipitation Plant by the end of 1968, because the existing plant lies within the limits of future mining. The new plant will be designed to treat 10,000 gpm, as compared with the present plant capacity of approximately 8,000 gpm.

Systematic Dump Leaching

Efforts are being made at the present time to use systematic dump leaching. An extensive piping system is currently being installed on our No. 1 leach dump to enable us to control flows and distribution better. From the exhibit, it can be seen how we intend to distribute solutions.

The type of pipe used is epoxy, fiber glass wrapped ABS plastic tubing in 10-inch and 12-inch sizes. This appears to be adequate for conditions imposed and is the least costly of the alternatives considered, which include transite and polypropylene pipes. The low pressures at the dump level allow simple rubber pinch valves to be used to divert solutions between areas. The leach ponds are of the dozer furrow type and are approximately 200-feet long by 20-feet wide.

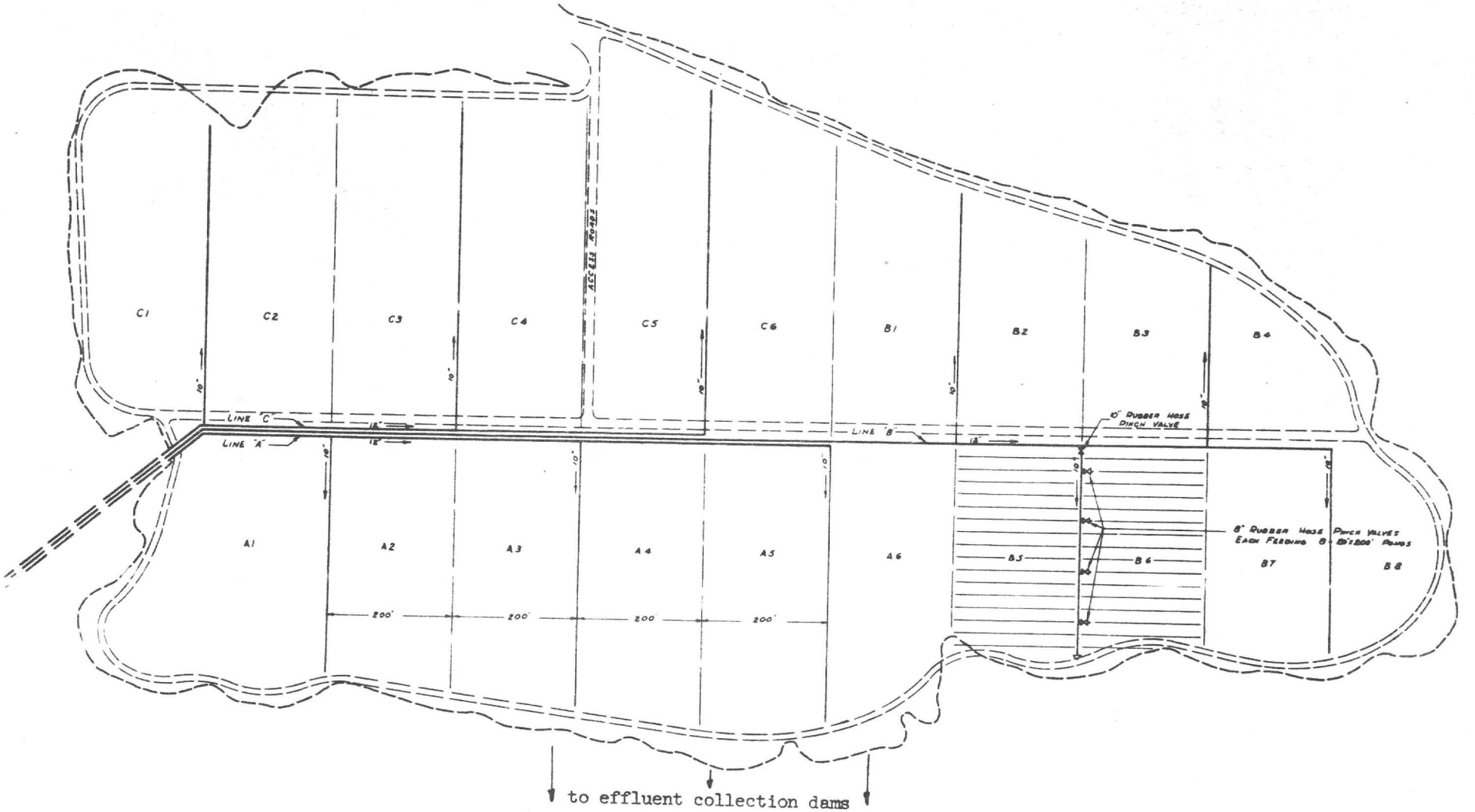
No. 2 dump is currently being leached in dozer-width furrows on a systematic basis. Acid is being added to promote penetration. Currently, this dump is being leached at the rate of 1000 gpm, and effluent solution is averaging approximately seven pounds per 1000 gallons.

No. 3 dump, the oldest dump in the system, is in the process of being converted from pond leaching to dozer-width furrows. No acid is used on this dump at present but will probably be required to promote penetration of solutions.

No. 4 dump is being leached at the rate of 1000 gpm. Ripper furrows have been used successfully for some time on this dump.

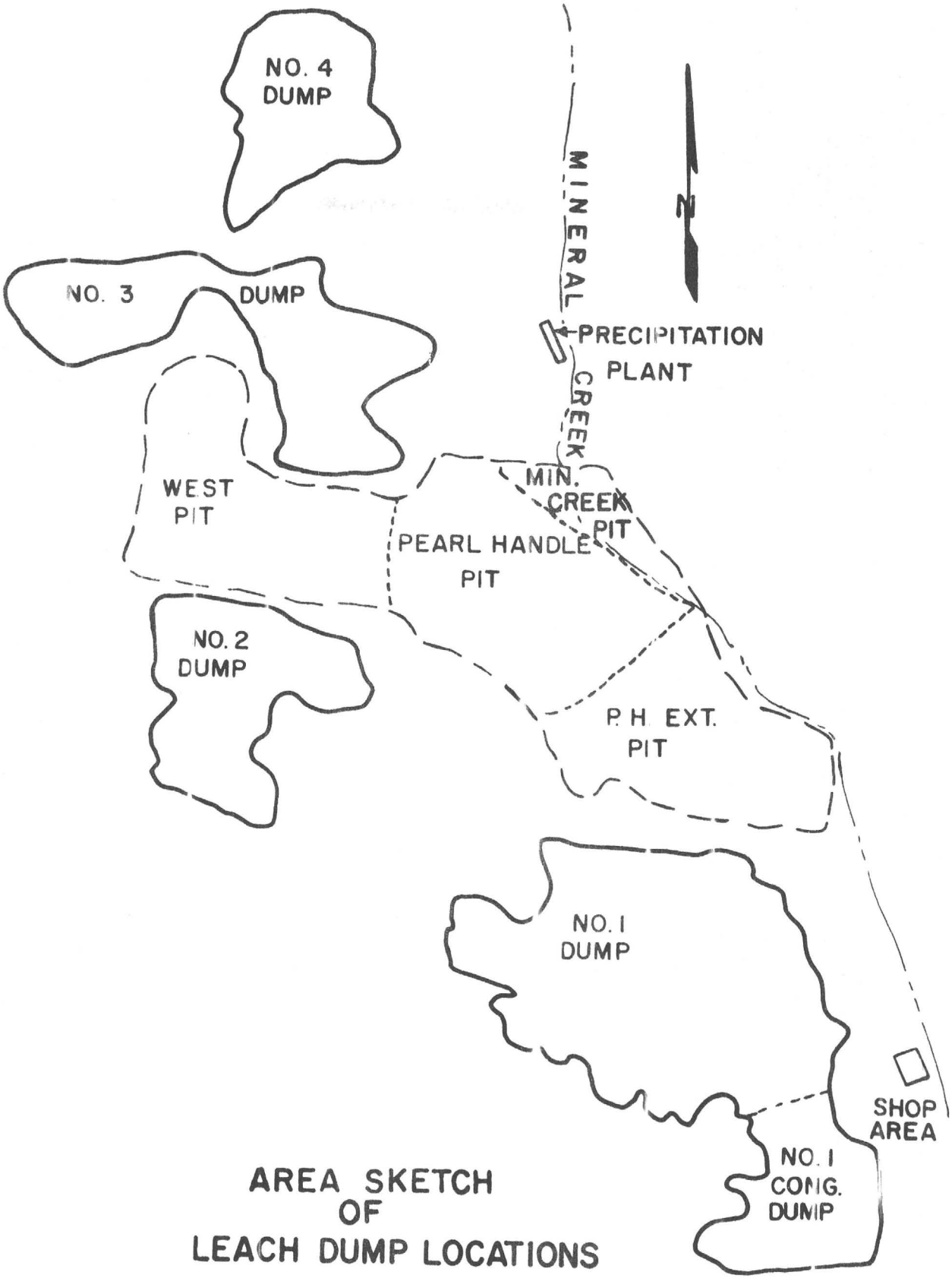
The underground caved area, previously mentioned, had been in production since 1955. Present grade of solution from this area averages approximately six pounds per 1000 gallons. The area has been completely flooded for about four years and grade of solution recovered has steadily decreased. Recently, the water level in the caved area has been lowered to permit mining to proceed on the next level in the West Pit area. Present plans are to successively lower and raise the water level in the caved area to promote oxidation and improve recovery. The success of this plan will depend on adequate flow of solutions to the available dewatering facilities: No. 2 shaft, No. 4 shaft and No. 6 shaft drill hole, and on the availability of water.

Future exp nsion of dump leaching will be to the south of the property in an area underlain by Gila conglomerate. The conglomerate contains limestone, which causes elevation of solution pH and subsequent loss of copper from solution. Recent testing has shown that formation and deposition of salts coats the base surface and prevents the loss of copper from solution after a short time. The coating of the base surfaces should form an impermeable collecting area and give excellent solution recoveries. A distribution and recovery system is currently being designed for the area. An estimated 65 million tons of material can be placed in this location.



#1 LEACH DUMP

Proposed Solution Distribution System
Layout of Piping and Ponds



AREA SKETCH
OF
LEACH DUMP LOCATIONS

Tucson
5/20/66

CONSTRUCTION OF NEW FACILITIES AT THE MINE PLANT

RAY MINES DIVISION, KENNECOTT COPPER CORPORATION

by

F. W. Bishop
Mines Plant Engineer

For Presentation at AIME Convention May 16, 1966

CONSTRUCTION OF NEW FACILITIES AT THE MINE PLANT

RAY MINES DIVISION, KENNECOTT COPPER CORPORATION

There are presently under construction at the Ray Mines Divsion, Mines Plant, the following new facilities which will affect Kennecott's future operations at Ray Mines Division:

1. Primary Crusher - Ore Stockpile and Load-Out Tunnel
2. Silicate Ore Pilot Leach Plant
3. Ammonium Nitrate Prill Storage Bin
4. Three Bay Grease Pit
5. Change House and Foreman's Office

Primary Crusher - Ore Stockpile and Load-Out Tunnel

Prior to 1951 all ore production at Ray came from the underground mine. In 1948 initial stripping was started to convert mining to an open pit operation. The original pit operation was confined to the area called the Pearl Handle Pit.

The present 84" x 60" primary jaw crusher was placed in operation in 1951. At that time, secondary crushing was also performed at the Ray Plant. Ore production during the period of 1951 to 1955 came from both the underground mine and the Pearl Handle Pit operation. Since 1955 all production has been from open pit mining.

The present primary crusher is located near the north rim of the Pearl Handle Pit. Initially production was at the rate of 15,000 tons per day.

In 1960 production was expanded to 22,500 tons per day, at which time new secondary crushing facilities were placed in operation at the Hayden Plant. Average daily production has gradually increased to 24,000 tons per day at the present time.

It was recognized at an early date that the existing primary crusher would have to be relocated, as the open pit mining operation expanded.

Planning for a new primary crushing plant started in 1956. Final site selection was made in 1963 in the area immediately north of the general shops. The site selected is approximately 1-1/4 miles southeast of the existing primary crusher, and is outside future pit limits.

The new primary crusher is being constructed on the side of a ridge with the dump elevation at 2023. Dump elevation of the present crusher is 2130. Since practically all of our ore production now comes from elevations of 2000 feet or lower, the new location will result in a savings of over 100 feet of lift in ore haulage.

Exhibit "A" represents a section through the crusher, stockpile and load-out tunnel. The crusher building is of concrete and steel construction. The crusher is a 54-74 gyratory. All controls are centrally located in a control room above the dumping pocket. Trucks will dump directly into the crusher with no grizzly provided. A 60 ton bridge crane is provided to service the crusher and all other equipment within the crusher building. The pocket below the cursher has a capacity of approximately 135 tons of crushed ore. The design is unique in that there is no feeder under the crusher discharge. Feed to a 72-inch belt is controlled by an adjustable finger gate. The 72-inch belt will serve as a picking belt for removal of wood, and in addition will save wear on the longer 54-inch main belt. The 54-inch belt will discharge crushed ore to an open stockpile located over twin concrete load-out tunnels. Loading of railroad cars will be controlled

by four air operated tunnel gates in each of the two tunnels. The 7500 ton live storage will permit the loading of a full 38 car train of 100 ton ore cars from either tunnel. The open stockpile arrangement provides for an additional dead storage of approximately 15,000 tons which can be dozed to the loading gate area in the event of temporary shutdowns at the crusher. In the event of longer shutdown periods, we will be able to continue production by dumping selected fine ore directly from the pit into the stockpile, by-passing the crusher.

Preliminary design specifications for the crushing plant facilities were prepared by Kennecott Copper Corporation, Western Mining Divisions, Engineering Department, in Salt Lake City. The contract for design and construction was awarded to Roberts & Schaefer Company, Chicago, Illinois. Actual construction started in December 1965, with plant scheduled to be in operation by November 1, 1966.

Silicate Ore Pilot Leach Plant

A twenty-ton per day pilot leach plant is under construction at Ray. This plant is being constructed for the purpose of testing on a pilot scale the flow sheet that has been designed for a proposed leaching plant to treat the silicate ore that is being encountered in sulfide mining, in increasing quantities.

The flow sheet provides for crushing to minus one quarter inch. The crushed ore will be classified into a minus 35 mesh slime product and a plus 35 mesh sands product. The slime product will be treated by leach agitation. The pregnant solution from the leach agitators will go to precipitation units utilizing iron in the form of cans, or shredded scrap, as the precipitant.

The sands product will be treated in conventional type leaching vats with a ten day leach cycle. Cement copper, produced from the slime circuit, will be redissolved and the resultant copper solution combined with the pregnant solution from the leach vats will go to electrolytic cells for production of electrowon copper.

Holmes & Narver, Inc., Los Angeles, California, are contractors on this project.

Ammonium Nitrate Prill Storage Bin

For a number of years the blasting agent used at Ray Mines Division has been "Carbamite". This material is delivered in bags and hand loaded into the blast holes. Studies indicate that a savings in blasting costs can be made by converting to ammonium nitrate prills and fuel oil mixture, and the use of a special truck for mixing of the prills and fuel oil which is direct loaded into blast holes.

Conversion to "AN/FO" explosives made it necessary to construct storage facilities for bulk prills. These facilities are presently under construction and will provide for the storage of 112 tons of prills. In designing the bin we considered the possibility of making the entire system gravity flow. This was accomplished by choosing a site where we could make a cut through a ridge. A concrete loading tunnel was designed to support a circular concrete storage bin. The area around the tunnel and bin will be backfilled. This design will permit truck and trailer units to deliver prills on a roadway constructed above the bin and discharge by gravity into the top of the bin.

Three Bay Grease Pit

The existing grease pit is located on the east rim of the Pearl Handle Pit and must be moved to permit pit expansion into the Mineral Creek area to the east. This present two-pit facility was originally built to service the 34-ton trucks in use at the start of pit operations in 1948. With the larger trucks currently in use larger facilities were needed.

The new grease pit now under construction will be located approximately one mile to the southeast and will consist of a 60' x 80' steel building, with three pits provided for servicing of haulage trucks and other large rubber tired mobile equipment. A tire repair shop is scheduled to be located adjacent to the grease pit in the immediate future.

Change Room and Foreman's Office

Present change room and pit foreman's offices are located in the old underground change room about one-half mile west of the present primary crusher.

A new 50' x 120' change room and foreman's office is now being constructed in the general shop area. This new facility will provide office space for pit production supervisors and locker and shower facilities for 340 production and maintenance employees. The new change room location will be closer to the center of operations, and will aid operations by reducing travel time of employees and provide more centralized supervision.

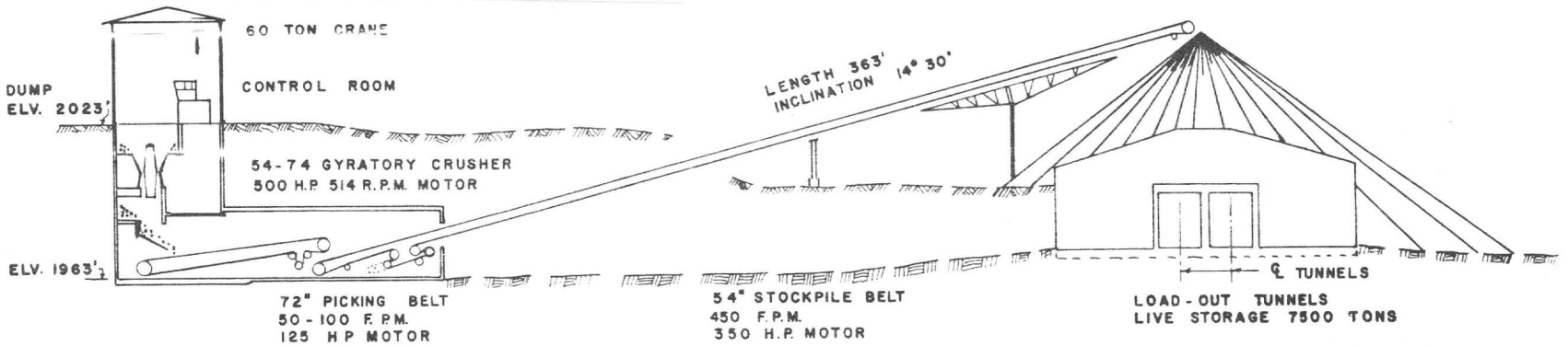

60 TON CRANE
DUMP
ELV. 2023'
CONTROL ROOM
54-74 GYRATORY CRUSHER
500 H.P. 514 R.P.M. MOTOR
LENGTH 363'
INCLINATION 14° 30'
ELV. 1963'
℄ TUNNELS
72" PICKING BELT
50-100 F.P.M.
125 H.P MOTOR
54" STOCKPILE BELT
450 F.P.M.
350 H.P. MOTOR
LOAD-OUT TUNNELS
LIVE STORAGE 7500 TONS

EXHIBIT A

Tucson
5/20/66

HAULAGE DRIVER TRAINING

AT

RAY MINES DIVISION

KENNECOTT COPPER CORPORATION

BY

STANLEY F. JOHNSEN

DIVISION INDUSTRIAL ENGINEER

RAY MINES DIVISION

KENNECOTT COPPER CORPORATION

HAYDEN, ARIZONA

The Ray Mines Division of Kennecott Copper Corporation converted from underground to 100 per cent open-pit mining in 1955, and is presently concentrating 24,000 tons of copper ore per day. With a stripping ratio of two to one, approximately 75,000 total tons of material are produced daily in the three-shift, seven-day week operation. Pit operations' personnel consists of 215 daypay employees and 18 supervisors. Major equipment includes eight 6 and 7 yard electric shovels and a fleet of thirty-four haulage trucks.

Haulage driver training is included in one of the seven basic elements of the Ray Mines Division safety program.

These elements are:

1. Responsibility for safety.
2. An accident record system.
3. Safety education.
4. Safety training.
5. Job and property conservation.
6. Maintenance of safe working conditions.
7. Measure of results.

Our safety program would be considered incomplete without all seven of these elements, and they are all equally important!

Since management accepts its safety responsibility, one very important duty incumbent upon management is providing adequate training wherever and whenever it is needed. Haulage driver training is especially necessary because

of the large amount of driver exposure, the different truck types used, changing traffic situations, and various other safety hazards inherent in an open-pit mining operation.

Haulage driver training at Ray consists of three broad categories, as follows:

1. On-the-job instruction.
2. Classroom training.
3. Weekly safety talks, and special instructions when necessary.

Most of the on-the-job instruction involves the training of new employees. These men are classified as "driver trainees" until they are qualified, at which time they are classified as "pit utilitymen". Utilitymen are used as needed in any of several pit jobs, including haulage truck driver, water truck driver, drill helper, shovel oiler, and bank spray attendent. In other words, while a utility-man is assigned to a certain shift, and remains with this shift, he may be working as a rotary drill helper one day, and a haulage driver the next day. Since these utilitymen are usually assigned as drivers, all new men are required to have a least ten shifts of on-the-job training before they are assigned to a truck by themselves.

When a man is hired, he receives his safety indoctrination at the safety office; at this time he is issued a haulage truck operator's manual. The first day he reports for work, he is given about three hours in which to read through this manual. He is then taken by his supervisor, the truck foreman, for a tour through the pit, during which the operation is briefly explained -- especially

regarding haulage truck operation, traffic procedures, and the like.

The man is then introduced to one of the older drivers and spends the rest of the day with this driver, who starts breaking him in on the haulage truck. The next day the new man is assigned to the same driver, or some other experienced driver, for continued break-in. During the next several shifts, the foreman assigns the new man to work with different-type trucks so the man can become acquainted with the various fleets. The foreman assigns the man to work with the more experienced drivers, interested in training new men, in an effort to provide the best possible training. During this period, the new man is taught by his "driver-instructor" how to check oil, water, and tires before starting, how to start and stop the truck, interpret the gauges, shift gears, raise and lower dump body, safe driving speeds and practices, pit traffic procedures, and numerous other truck operation details and general pit practices. Incidentally, during this break in period, the new man is scheduled for day shift only.

During the training period, the progress of the new man is followed by his supervisor through checking with the man and his "driver-instructor".

After ten shifts, the man is given a check in the various trucks, by either a plant safety representative (a specialist in driver training), or by one of the truck supervisors who is qualified as a driver-instructor. If the man passes the check, his classification is changed from "Haulage truck trainee"

to "utilityman" and he is assigned to his own shift and his own truck. If additional training is indicated, such training is provided and the man checked at a later date.

Most new men are capable of driving safely by themselves after only a few shifts, but the ten-shift minimum training period is required for all men. Only occasionally will more than ten shifts be required of a man before he is deemed "qualified".

A second type of on the job training, which involves all drivers, is the breaking in on a new type of haulage unit which has been purchased, or is being used on a trial basis. In these cases, a manufacturer's representative or a company supervisor will qualify two or three drivers on each shift, and these drivers will in turn check out the other drivers on the shift.

Formal classroom training consists of an 8 hour course for new employees, and a 4-hour refresher course for experienced employees. The frequency with which the 8-hour course is given depends primarily upon the turnover of haulage truck drivers. When our driver force includes about 15 men who have not had the course, the 8 hour course is scheduled.

The course is presented in two four-hour segments and is scheduled 2 days per week for several weeks running, so that all the drivers on the three rotating shifts will be able to attend the sessions without losing any of their

regularly scheduled working shifts. The drivers are paid for attending the classes.

The classroom training course is presented by the plant fire & safety inspector, a driver training specialist, and is based upon the truck operator's manual. This 60-page manual is revised periodically to keep abreast of new truck development and current pit operating procedures. Slides and other visual aids are used in the classroom course to illustrate various types of equipment and safety practices.

The operator's manual contains 22 sections dealing with proper equipment care and operation, and traffic procedures.

A partial list of the subjects covered in the classroom are: Starting instructions, engine care and operation, standard and power shift transmission operation, brakes, gauges, tires, dump body control, shovel signals, parking procedures, dump procedures, and right-of-way rules. One section contains considerable detail about the recommended downgrade gearing for haulage and water trucks. This section was compiled by a driver-specialist supervisor after extensive field study of the various trucks regarding safe downgrade operating speeds and retarder operation. A section of forty-four operating rules is also included.

In conjunction with the proper care and operation of the equipment, some mechanical aspects are touched upon in order to illustrate results of improper operation of some of the components. Certain replacement, maintenance and repair costs are also presented to impress the drivers with their large responsibility in these areas.

The drivers are encouraged to ask questions during the classes concerning any items presented, or on any subjects relating to the equipment or the operation. Maintenance supervisors are on call, if needed, to discuss and explain mechanical details of the various components.

The 4-hour refresher classroom course is presented to the more experienced drivers about every two years. This course is also based upon the truck operator's manual, but since it is directed to more experienced men serves chiefly as a refresher and reminder of proper truck care and operation and pit traffic procedures.

In addition to on-the-job and classroom training, a third area of driver training includes weekly safety communication meetings, and special day to day instructions.

The weekly safety communication meetings are held at the beginning of the shift, while the men are in the pit assembly room. One or both of the shift

supervisors presents the talk, which usually lasts about 15 minutes. Quite often supervisors are instructed by management to include in their weekly talks specific subjects relating to safety; the safety department also provides material on a variety of subjects for use by supervisors in these talks. While, occasionally, some mention is made in the safety talks of safety statistics and of off-the-job safety, most of the subjects in the weekly talks deal with safety in day-to-day pit operations. A large percentage of the subjects included pertain to the safe operation of haulage trucks, either regarding the truck itself or new traffic patterns.

The talks include a question and answer period regarding the subject discussed or any pit safety area. If the supervisor is unable to answer a question, the answer is obtained through upward communication and later passed on to the men. Supervisors report on their safety talks by completing a communication report form which lists the subjects discussed and also any upward communication and safety recommendations. These report forms are reviewed by management, including the plant superintendent and the general manager.

In addition to the weekly safety talks, special safety instructions are given whenever necessary. These special instructions usually apply to new traffic patterns or procedures. Special talks are always given on the first shifts following a shutdown.

Still another area which contributes to haulage driver training is a job safety analysis program. Job safety analyses are step-by-step breakdowns of specific portions of the duties of a haulage driver. These studies detail the key job steps, potential health and injury hazards, and recommended safe practices. Job safety analyses are compiled by a supervisor and a haulage driver. They are up-dated when necessary and are used in the weekly safety talks.

Safety goals at Kennecott's Ray Mines Division specify a frequency rate of no more than 1 disabling injury, or less, per million manhours worked. To achieve this goal, safety must be a day-to-day responsibility. Our seven point safety program defines our responsibilities. Since safety is a management responsibility, safety training is a necessity not only for the expected safety performance but for the efficient operation of equipment that demands employee skill.

If there are any questions on the details of our driver training, I will be willing to answer them at this time.

Tucson
5/20/66

ANNUAL A. I. M. E. MEETING

OPEN PIT SECTION

May 16, 1966

MINE MAINTENANCE WORK ORDER SYSTEM

KENNECOTT COPPER CORPORATION

Ray Mines Division

Ray, Arizona

by K. Vance

MINE MAINTENANCE WORK ORDER SYSTEM

Kennecott Copper Corporation

Ray Mines Division

A standard work order system is used throughout the Western Mining Divisions of Kennecott. Briefly, each maintenance job of any significance is treated as an individual job would be in a job shop. Smaller jobs of lesser importance are simply grouped together to give a desired cost record.

Work orders are written by any supervisor and submitted to the Planning and Scheduling Office or the Field Repair Office. There they are classified, estimated if necessary, and returned to proper approving authority. After approval, the work order is entered in the maintenance workload to be scheduled.

Work orders are also used as a means of keeping historical equipment records. Because of this, the Maintenance Department actually makes out many of the work orders for operating equipment. The work orders are detailed to give the desired cost and equipment history record.

All maintenance work is divided into three general categories as follows:

1 REGULAR JOBS

Unusual jobs which involve alternate methods, materials, or approval to proceed, require estimates and appraisal before the work starts. These jobs then require accurate accumulation of costs while the work is in process so that estimates can be checked. An example of this type job would be the modification of an Allison transmission from 4-speed to 5-speed.

2. REPETITIVE JOBS

Work of such routine nature that a history of individual jobs is not necessary. Such jobs as replacing a radiator hose or greasing a truck, fall in this category.

3. EMERGENCY JOBS

Usual maintenance jobs for which individual costs and historical data is desirable. Necessary work done to equipment or facilities when it is definitely understood the equipment must be returned to its original operating condition and no individual approval is necessary. Such jobs as overhauling engines or transmissions in a haulage truck would be classified in this category.

WORK ORDER SERIES

Each type of job is assigned to a work order series as indicated by the second digit in the work order number as follows:

Series 0

Regular jobs are assigned Series 0 numbers after estimating and obtaining approval of operating supervision. Most construction jobs or equipment modifications are done on Series 0 work orders which are then closed when the work is completed

Series 2

Repetitive jobs are assigned standard Series 2 numbers, which remain open until disposal of the piece of equipment and until more detailed records are required. This series gives accurate cost reporting for jobs not requiring individual job cost.

Series 3

Emergency jobs are assigned Series 3 numbers before starting usual repairs to production equipment or facilities, fabricating parts or doing small construction jobs. No estimate or special approval is necessary and the number is closed when the job is completed.

Series 4

Expense portions of AFE's are assigned Series 4 numbers. These require estimates and approval of plant engineers.

Series 5

Warehouse stock items manufactured in the shop carry Series 5 numbers. Estimates and approvals of warehouse supervisors are required.

Series 6

Special cost accumulations are assigned Series 6 numbers by cost accounting personnel.

Series 7

Capital portions of authorized expenditure jobs are given Series 7 numbers. Most new equipment purchases are given numbers in this series after estimating and receiving approval by proper authority.

To control the flow of work orders and insure that they are written properly, two control points are used. One control point is the Field Repair Office, and the other is the Maintenance Scheduling Office. The Field Repair Work Center is responsible for maintenance of all pit mobile equipment including

including shovels and drills. At the Field Repair Office, blocks of work order numbers are kept for haulage trucks, dozer equipment, shovels, drills and small mobile equipment. Very few work orders are written by operating personnel for maintenance on these pieces of equipment and generally the equipment is returned to original operating condition. Therefore, most of this maintenance falls under the 'standard job' or 'routine job' categories. To facilitate writing of work orders, the shop foreman judges if the job will cost over $50. If the cost is under $50, the work is performed on the routine Series 2 work order number unless there is some reason to make a record of the job, i.e., warranty claim or establishing a trend, etc.

Attachments 1,2 & 3

The routine Series 2 work orders, for accumulating cost against each piece of equipment or components of the equipment, are set up in the Machine Accounting System and require no paper work other than use of the number to charge time on time cards and materials from the Warehouse. A shop order sheet is used while the job is in process to keep track of its existence and completion.

Attachment 4

If the job is judged to be over $50, the foreman takes the next available work order number from a prepared list and notes the job on the list and on his shop order form. All time and materials are then charged to that number for that particular job. Note the only difference between the two shop orders is in the series of work orders used.

Attachment 5

However, further paper work is necessary to set up this new, never before used, number in the Accounting System. The truck shop clerk

prepares the work order form from the notation of the number list and shop order form. Proper equipment and component numbers are assigned to the work order.

Attachment 6

Any work order requiring an estimate (a non-standard job) is routed through the Maintenance Scheduling Office and approved before the job is performed. Work performed on the field repair equipment by other shops is done on a work order routed through the Maintenance Scheduling Office. The Maintenance Scheduling Office assigns work order numbers and controls the work order system for the other three work centers. A central work order board is kept for assigning Series 0, 2, and 3 numbers and individual shop work order schedule board are kept in each shop.

When parts are brought to the shop for 'standard job' repairs, the equipment number and work required are written on the work order board by the man delivering the material and assigned the next available Series 3 number. When a job to be done is of an unusual nature and requires an estimate, the job description will be written on the portion of the board designed for Series 0 work orders. For work on routine jobs where a Series 2 number is established, a directory is available so that the proper number can be written on the board with a description of the work required.

Attachment 7

As a review, we will look at the Work Order Flow Sheet. The reason for establishing such a work order system, one that can

give a large amount of information, is quite simple. Maintenance costs are one of the largest items on the cost statement. In order to control these costs, it is necessary to know accurately where and why the money is being spent. Secondarily, a breakdown of cost, such as we are able to obtain, results in the ability to analyze high cost areas, to analyze costs to each piece of equipment, to compare for like equipment, and to take such action as may be necessary to improve or replace the equipment.

What we have shown so far is how we get the information to the Accounting Department. Now, what does it look like when returned to us for use as I just described?

Several regular reports are issued as well as special reports that may be required.

There are currently ten reports being prepared. These reports contain much of the same information but are rearranged to give the cost reporting in the form that may be desired.

Three reporting periods are used: Current month, year-to-date, and to-date for any open work orders.

For cost control purposes, the current month report is the one most used. For examination and evaluation of equipment, the year-to-date reports are used. For control of individual work orders, the to-date report is used.

With this system, it is possible to pin point high cost areas

and show exactly why it was a high cost area. The system is flexible enough that costs can be arranged in any number of ways. For example, let us look at a page from a monthly report showing cost by equipment number within a given operating work center.

Attachment 8

This report groups all cost for the operating work center in one place, in this case, truck haulage. Each piece of equipment is reported complete with every job performed on it by numerical equipment number within the truck haulage work center. It is quite simple to run through this report and find any high cost items that may have caused budget variances.

A longer period of time than one month is usually required for evaluation of equipment. Again using trucks as an example, a year-to-date report is prepared by fleet number, by equipment number, within the fleet and further grouped by component number for each truck.

Attachment 9

Attachment 9 shows a complete year's history of every job performed on one particular truck.

Work orders are written to give the desired detail for all mine equipment. Trucks, shovels, and drills are subdivided into ten components. Most other equipment is not broken down beyond the basic equipment and in some cases like-pieces of equipment are grouped.

It is easy to see how truck costs can be analyzed with this report, not only for evaluation of the whole truck or fleet of like trucks, but components can also be examined. We have used this system as a basis for making modification improvements to our truck fleet.

HAULAGE TRUCK M & R

FLEET #2 - EUCLID 4LLD - 54T (022537)

COMPONENT	DESCRIPTION	160	161	162	163	164	165	166
1	ENGINES, TURBOS	120811	120821	120831	120841	120851	120861	120871
2	TRANSMISSION, CLUTCH, CONVERTER	120812	120822	120832	120842	120852	120862	120872
3	DIFF., AXLES, DRIVELINE	120813	120823	120833	120843	120853	120863	120873
4	BED	120814	120824	120834	120844	120854	120864	120874
5	BRAKES	120815	120825	120835	120845	120855	120865	120875
6	HOIST, STEERING	120816	120826	120836	120846	120856	120866	120876
7	SUSPENSION, FRONT AXLES	120817	120827	120837	120847	120857	120867	120877
8	CAB, CHASSIS, RADIATOR AIR SYSTEM	120818	120828	120838	120848	120858	120868	120878
9	ACCIDENTS, WRECKS, FIRES	120819	120829	120839	120849	120859	120869	120879

ATTACHMENT #2

1 SHIFT	6394 EMPLOYEE NO.	Wands Robert S. EMPLOYEE NAME	Mech Trk. OCCUPATION TITLE	6400 OCCUPATION NO.	W.O. OR CHARGE NO.	1 PL	732 W.C.	3 10 66 DATE

DAILY TIME CARD

LIST OTHER OCCUPATION NUMBERS BELOW	REMARKS	WORK ORDER OR CHARGE NO.	TIME WORKED
	1 Fan belt 160	120811	1
	2 Trans 160	132157	7
	3		
	4		

OR FOREMAN'S APPROVAL KV — TOTAL 8

KENNECOTT COPPER CORPORATION - RAY MINES DIVISION

CODE | DATE O.T. | DAY | SHIFT | CLOCK | PLANT | OCCUPATION TITLE | RATE | SHIFT PREM. | DAILY ATTD. | PAY CL. | EMPLOYEE NAME | WORK CENTER | EMPLOYEE NO | AMOUNT REG/ALLOW. | PR | M. | OCCUP NO | AT WORK | SEQ | WORK ORDER OR CHARGE NO. | HOURS REG. | PREM. | TYPE

CKCR-22R-100M-12/64 PRINTED IN U.S.A. IBM C69607

DESCRIPTION OF ITEM

Belt, fan

Cummins

REQUIRED FOR: (Include NAME and NUMBER of equipment, if any)

BIN ENTRY

MATERIAL & SUPPLY ISSUE CARD

PLANT 1 — DATE 3-9-66

ISSUE NUMBER

MANUFACTURER PART NUMBER 6 0158

ONLY ONE TYPE OF MATERIAL AND ONE WORK ORDER OR CHARGE NUMBER ON EACH ISSUE CARD

DEPT	W.O. OR CHARGE NUMBER	UNIT	CLASS	SUB	M&S NUMBER ITEM	QUANTITY
732	120811	01	54	3	04407	1

AUTHORIZED BY — EMPL NO. 9321 — RECEIVED BY — EMPL. NO. — ISSUED BY

KENNECOTT COPPER CORPORATION - RAY MINES DIVISION

CODE | DATE NO | DAY | MONTH | DESCRIPTION | AUTH. ENTRY | ISSUE COST | PLANT | DEPT. | UNIT COST | WORK ORDER OR CHARGE NUMBER | UNIT | M&S CLASS | M&S ITEM NUMBER | QUANTITY | AMOUNT

CD 108-130M-7/ 0 PRINTED IN U.S.A. IBM C86909

ATTACHMENT #3

ORDER FOR SHOP REPAIRS & MAINTENANCE

EQUIP. No. 160 EQUIP. TYPE 4-LLD

DATE IN: 3-10-66 TIME IN: 10:30 a.m.

DATE OUT: TIME OUT:

REC'D BY: Ray

RELEASED BY:

DESCRIPTION	W. O. Number	PR. No. Classification	TOT TIME
Repair oil leak R.H. [illegible]	120811		
Replace fan belt R.H. engine			

F-D-40

ATTACHMENT #4

ORDER FOR SHOP REPAIRS & MAINTENANCE

EQUIP. No. 160 EQUIP. TYPE 4-LLD

DATE IN: 3-10-66 TIME IN: 10:30 a.m.

DATE OUT: _____ TIME OUT: _____

REC'D BY: Ray

RELEASED BY: _____

DESCRIPTION	W. O. Number (only difference)	PR. No. Classification	TOT TIME
Replace transmission right hand	130157		
S/N 17451 out - hours 4,026			
S/N 17237 in			

ATTACHMENT #5

WORK ORDER AUTHORIZATION

COMPANY/DIVISION: RAY MINES DIVISION | PLANT: 1 | WORK CENTER: 732 | JOB REQUEST NO. 24375 | WORK ORDER NO.

EQUIPMENT NO.: 160-2 | CHARGE NO.: 022537 | A.F.E. NO.: | SAFETY WORK ORDER: ☐ YES ☒ NO | PRIORITY:

TYPE OF WORK ORDER: ☐ 0 - REGULAR ☐ 2 - REPETITIVE ☒ 3 - Standard ☐ 4 - AFE EXPENSE ☐ 5 - STORES ☐ 6 - COST ANALYSIS ☐ 7 - CAPITAL

DESCRIPTION OF WORK:

Replace right hand transmission.
Truck #160

Out - 17451
In - 17237

Operated 4,026 hours - no warranty.

COST SUMMARY	AUTHORIZED	ACTUAL
HOURS LABOR		
AMOUNT LABOR		
MATERIAL		
OTHER		
TOTAL		

WORK ORDER TITLE: Repl trans 17451 - 17237

ESTIMATED LABOR & MATERIAL REQUIREMENTS

PLANT	WORK CENTER	OCCUPATION CODE	OCCUPATION	NUMBER OF MEN	HOURS PER MAN	TOTAL MAN HOURS	LABOR COST	MATERIAL COST
					TOTAL			

SERVICE EQUIPMENT REQUIREMENTS

PLANT	WORK CENTER	EQUIPMENT	HOURS	AMOUNT
		TOTAL		

OTHER REQUIREMENTS

DESCRIPTION	AMOUNT
TOTAL	

DATE REQUIRED: 3-10-66 | DATE STARTED: | DATE COMPLETED:

REQUESTED BY: J.T. | DATE: 3-10-66 | APPROVED BY: J.T. | DATE: 3-10-66 | ACCEPTED BY: | DATE:

ATTACHMENT #6

WORK ORDER AUTHORIZATION

JOB REQUEST NO. 24377

COMPANY DIVISION: RAY MINES DIVISION | PLANT: 1 | WORK CENTER: 732 | WORK ORDER NO. 103351

EQUIPMENT NO.: 160 | CHARGE NO.: 022537 | A.F.E. NO.: | SAFETY WORK ORDER: [ ] YES [X] NO | PRIORITY:

TYPE OF WORK ORDER: [X] 0 - REGULAR [ ] 2 - REPETITIVE [ ] 3 - EMERGENCY [ ] 4 - AFE EXPENSE [ ] 5 - STORES [ ] 6 - COST ANALYSIS [ ] 7 - CAPITAL

DESCRIPTION OF WORK:

Convert L.H. transmission from 4 speed to 6 speed.

COST SUMMARY

	AUTHORIZED	ACTUAL
HOURS LABOR	32	
AMOUNT LABOR	$105.00	
MATERIAL	700.00	
OTHER		
TOTAL	$805.00	

WORK ORDER TITLE: L. H. Trans 4 sp to 6 sp.

ESTIMATED LABOR / MATERIAL REQUIREMENT

PLANT	WORK CENTER	OCCUPATION CODE	OCCUPATION	NUMBER OF MEN	HOURS PER MAN	TOTAL MAN HOURS	LABOR COST	MATERIAL COST
1	732	6400	Mech. trk.	2	16	32	105.00	700.00
					TOTAL	32	105.00	700.00

SERVICE EQUIPMENT REQUIREMENTS

PLANT	WORK CENTER	EQUIPMENT	HOURS	AMOUNT
		TOTAL		

OTHER REQUIREMENTS

DESCRIPTION	AMOUNT
TOTAL	

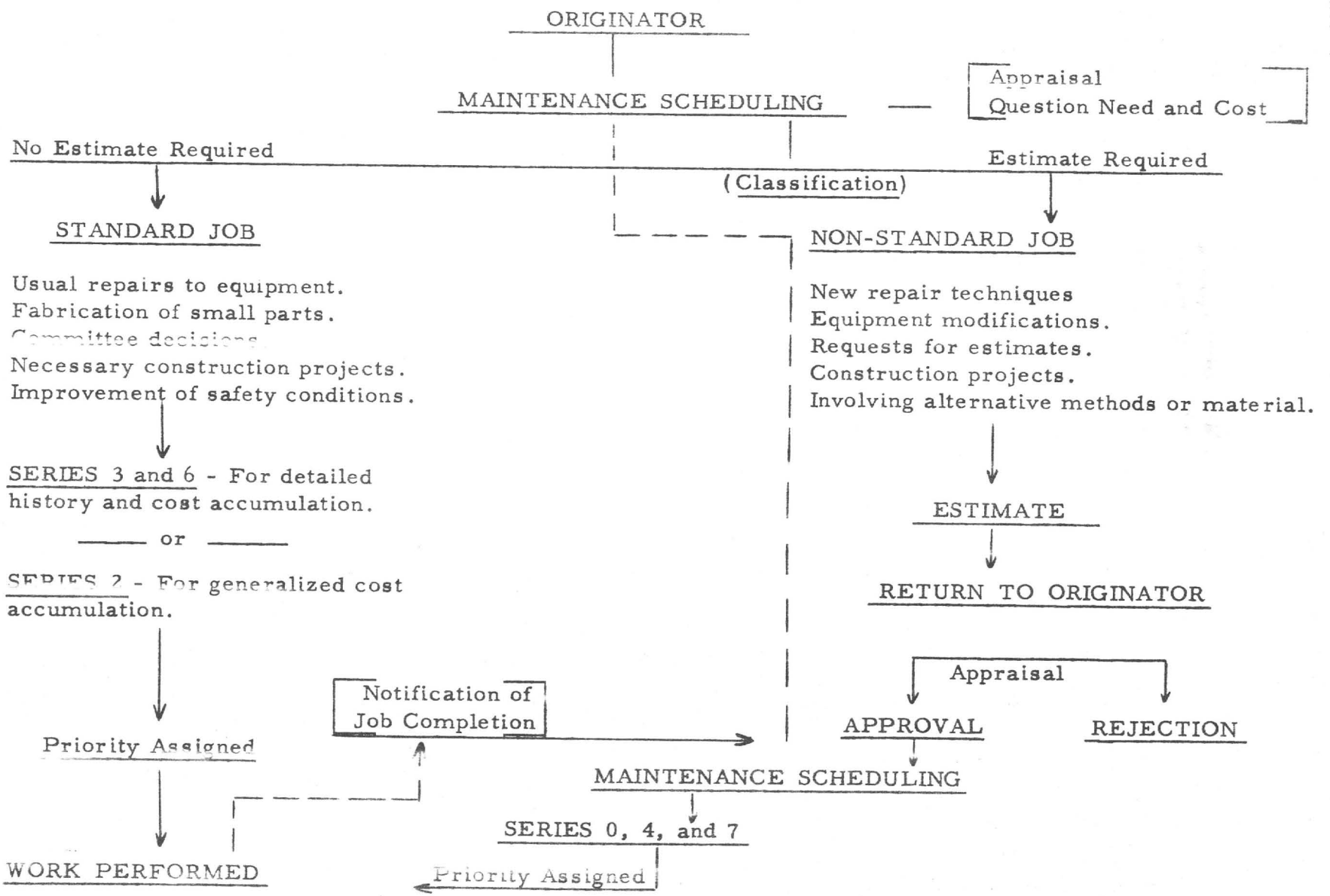
DATE REQUIRED: 3-10-66 | DATE STARTED: | DATE COMPLETED:

REQUESTED BY: KV | DATE: 3-10-66 | APPROVED BY: KV | DATE: 3-10-66 | ACCEPTED BY: | DATE:

C-1175 65M 3/62 PRINTED IN U.S.A.

ATTACHMENT 2

Change Designation of Series 3 Work Order Form Emergency Job to Standard Job



Attachment 8

KENNECOTT COPPER CORPORATION
RAY MINES DIVISION

WORK ORDERS

TRUCK HAULAGE-FLEET 2 WORK CENTER 1 022 NO. 4 DATE 12/31/65

PLANT	SUB WORK CENTER	EQUIPMENT NUMBER	EQUIPMENT COMPONENT	DATE OF WORK ORDER	A F E NO	CHARGE NO	WORK ORDER NUMBER	DESCRIPTION	LABOR	MATERIAL	OTHER	TOTAL	W O STATUS
1	342	160	21	8-63		022540	120811	MTCE ENG/TURBOS					
1	342	160	22	8-63		022540	120812	MTCE TRANS/CL/CONV					
1	342	160	23	8-63		022540	120813	MTCE DIFF/AXL/DL					
1	342	160	24	8-63		022540	120814	MTCE BED					
1	342	160	25	8-63		022540	120815	MTCE BRAKES					
1	342	160	26	8-63		022540	120816	MTCE HOIST/STEER					
1	342	160	28	8-63		022540	120818	MTCE CAB/CHAS/RAD/ELEC					
1	342	160	29	8-63		022540	120819	MTCE ACC/WRECK/FIRE					
1	342	160	2	11-65		022540	131524	RPL LH TRAN					
1	342	160	7	12-65		022540	131553	RPL RR SPRING					
1	342	160	3	12-65		022540	131583	RPL DL RH					
1	342	160	3	12-65		022540	131597	RPL LF AXLE					
1	342	160	7	12-65		022540	131624	RPL RF SPRING					
1	342	160	3	12-65		022540	131654	RPL X SHAFT					
1	342	160	5	12-65		022540	131692	RLN ALL DRVRS					
1	342	161	21	8-63		022540	120821	MTCE ENG/TURBOS					
1	342	161	22	8-63		022540	120822	MTCE TRANS/CL/CONV					
1	342	161	23	8-63		022540	120823	MTCE DIFF/AXL/DL					
1	342	161	25	8-63		022540	120825	MTCE BRAKE					
1	342	161	26	8-63		022540	120826	MTCE HOIST/STEER					
1	342	161	28	8-63		022540	120828	MTCE CAB/CHAS/RAD/ELEC					
1	342	161	1	11-65		022540	131462	RPL # INJ RH					
1	342	161	2	11-65		022540	131546	RPL SHIFT CABLE					
1	342	161	7	11-65		022540	131554	RPL LR SPRING					
1	342	161	8	12-65		022540	131558	RPR STARTER					
1	342	161	5	12-65		022540	131585	RLN LFD BRK					
1	342	161	5	12-65		022540	131640	RLN RFD & RRD BRKS					
1	342	161	7	12-65		022540	131650	RPR LOW TRQ ARM					
1	342	161	3	12-65		022540	131684	RPR RFD PLANETARY					
1	342	161	3	12-65		022540	131685	RPR #2 RH DL					
1	342	161	7	12-65		022540	131687	RPL LF SPRNG					
1	342	161	3	12-65		022540	131728	RPL DL					
1	342	161	7	12-65		022540	131729	RPL UPPER TRQ ROD					
1	342	161	7	12-65		022540	131729	RPL UPPER TRQ ROD					
1	342	161	7	12-65		022540	131745	RPL RH LOW TRQ ROD					
1	342	161	7	12-65		022540	131751	RPR FR WHEELS					
1	342	162	21	8-63		022540	120831	MTCE ENG/TURBOS					
1	342	162	22	8-63		022540	120832	MTCE TRANS/CL/CONV					
1	342	162	23	8-63		022540	120833	MTCE DIFF/AXL/DL					
1	342	162	25	8-63		022540	120835	MTCE BRAKES					
1	342	162	26	8-63		022540	120836	MTCE HOIST/STEER					
1	342	162	27	8-63		022540	120837	MTCE SUSP/FR AXLE					
1	342	162	28	8-63		022540	120838	MTCE CAB/CHAS/RAD/ELEC					
1	342	162	29	8-63		022540	120839	MTCE ACC/WRECK/FIRE					
1	342	162	8	12-65		022540	131556	RPL LH FAN & RADIATOR					

Cost for 1 month for
Truck #160

2

Attachment 9

WORK ORDERS

54-TON EUC W/CUM NT-380

WORK CENTER

DATE YEAR TO DATE 12/31/85

				DATE OF WORK ORDER	A.F.E. NO	CHARGE NO	WORK ORDER NUMBER	DESCRIPTION	LABOR	MATERIAL	OTHER	TOTAL
1	342	160	1	12-64		022540	107835	RPL CYL HEADS RH				
1	342	160	1	3-65		022540	109212	RPL #3 CYL HEADS				
1	342	160	1	3-65		022540	109231	RPR R ENG				
1	342	160	1	6-65		022540	109696	RPL ENG CYL HDS				
1	342	160	1	7-65		022540	109858	RPL CYL HEADS PRESSUR CHK				
1	342	160	1	7-65		022540	109890	RPL RH ENG				
1	342	160	1	8-63		022540	120811	MTCE ENG/TURBOS	Engine & Turbo Cost			
1	342	160	1	9-65		022540	131035	RPL #1 CYL HEAD RH				
1	342	160	1	9-65		022540	131092	RPL HEADS PSTN & LIN				
1	342	160	1	9-65		022540	131116	RPL LH TURBO				
1	342	160	1	9-65		022540	131196	RPL LH TURBO				
1	342	160	1	10-65		022540	131315	RPR RH ENG				
1	342	160	1	10-65		022540	131325	RPL LH EXHAUST MANIFOLD				
1	342	160	1	10-65		022540	131597	RPL #3 LH HEAD				
1	342	160	2	2-65		022540	109038	RPL L TRAN 15802				
1	342	60	2	3-65		022540	109162	RPL SEALS&BRG R&L ST SHFT				
1	342	60	2	4-65		022540	109331	RPL RH TRAN #9771				
1	342	160	2	5-65		022540	109562	RPL CONV HEAT EX	Transmission Clutch & Convertor Cost			
1	342	160	2	6-65		022540	109621	RPL LH TRAN 15821				
1	342	160	2	6-65		022540	109674	RPL R & L STUB SH				
1	342	160	2	8-63		022540	120812	MTCE TRANS/CL/CONV				
1	342	160	2	11-65		022540	131442	RPL LH TRAN & RH				
1	342	160	2	11-65		022540	131483	RPL L & R TRAN				
1	342	160	2	11-65		022540	131524	RPL LH TRAN				
1	342	160	3	1-65		022540	107928	RPL LRD & RRD AXLE SHAFT				
1	342	160	3	1-65		022540	107980	RPL RFD AXLE				
1	342	160	3	2-65		022540	109010	RPL #2 LH DL & DIFF YOKE				
1	342	160	3	2-65		022540	109029	RPL FR DIFF - 101				
1	342	160	3	2-65		022540	109041	RPL REAR DIFF #141				
1	342	160	3	2-65		022540	109064	RPL DL				
1	342	160	3	2-65		022540	109099	RPL X SHAFT	Differential Axle & Drive line			
1	342	160	3	2-65		022540	109134	RPL FR DIFF IN #101				
1	342	160	3	3-65		022540	109328	RPL FR DIFF YK & X DL				
1	342	160	3	5-65		022540	109497	RPL DL				
1	342	160	3	5-65		022540	109598	RPL RFD WHEEL SEAL				
1	342	160	3	6-65		022540	109764	RPL #2 R DL				
1	342	160	3	7-65		022540	109855	ALIGN FR DIFF ASSY				
1	342	160	3	7-65		022540	109896	RPL HYD PUMP				
1	342	160	3	7-65		022540	109898	RPR SCOPES				
1	342	160	3	8-63		022540	120813	MTCE DIFF/AXL/DL				
1	342	60	3	10-65		022540	131311	RPL #1 RH DL				
1	342	60	3	10-65		022540	131418	RPR X SHAFT				
1	342	60	3	11-65		022540	131471	RPL DL & YK				
1	342	60	3	12-65		022540	131583	RPL DL RH				
1	342	60	3	12-65		022540	131597	RPL LF AXLE				
1	342	60	3	12-65		022540	131654	RPL X SHAFT				
1	342	60	4	8-63		022540	120814	MTCE BED	Bed Cost			
1	342	60	5	1-65		022540	107919	RLN RFD & RPL SL ADJ				
1	342	60	5	2-65		022540	109136	RLN RRD BRK				
1	342	60	5	3-65		022540	109196	RPR BRK RRD RFD LRD				
1	342	160	5	5-65		022540	109518	RLN RFD BRK				
1	342	160	5	6-65		022540	109669	RPL LRD BRK LIN & DRN				
1	342	160	5	6-65		022540	109725	RLN RR BRK				
1	342	160	5	7-65		022540	109804	RLN BRAKE LINING RFD	Brake Cost			
1	342	160	5	8-63		022540	120815	MTCE BRAKES				
1	342	160	5	9-65		022540	131031	RLN RFD BRK				
1	342	160	5	9-65		022540	131197	RLN BRKS LFD				
1	342	160	5	10-65		022540	131271	RLN RRD BRK				
1	342	160	5	10-65		022540	131372	RLN BRK				
1	342	160	5	12-65		022540	131696	RLN ALL DRVRS				
1	342	160	6	5-65		022540	109519	CHG L H SCOPE				
1	342	160	6	6-65		022540	109659	RPL STEER BSTR PUMP				
1	342	160	6	7-65		022540	109800	RPL STEERING PUMP	Hoist & Steering			
1	342	160	6	7-65		022540	109899	RPL RETARDER CABLES				
1	342	160	6	8-65		022540	109938	RPL STEERING BOOSTER				
1	342	160	6	8-63		022540	120816	MTCE HOIST/STEER				
1	342	60	7	1-65		022540	107868	RPL TRQ ROD PIN & NUT				
1	342	60	7	1-65		022540	107893	RPR RR SPRING				
1	342	160	7	6-65		022540	109627	RPL RF SPRING	Suspension & Front Axle			
1	342	160	7	6-65		022540	109703	RPR R SPRNGS				
1	342	160	7	8-63		022540	120817	MTCE SUS/FR AXLE				
1	342	160	7	10-65		022540	131373	RPL RF SPRING				
1	342	160	7	12-65		022540	131553	RPL RR SPRING				
1	342	160	7	12-65		022540	131624	RPL RF SPRING				
1	342	60	8	4-65		022540	109357	RPL LF FENDER				
1	342	60	8	4-65		022540	109394	RPL GENERATOR				
1	342	60	8	5-65		022540	109561	RPL LH EXHAUST MANIFOLD	Cab, Chassis, Radiator & Electrict			
1	342	60	8	8-63		022540	120818	MTCE CAB/CHAS/RAD/ELEC				
1	342	60	8	10-65		022540	131282	RPL LH RAD				
1	342	60	9	8-63		022540	120819	MTCE ACC/WRECK/FIRE	Accidental Damage			
									Total All Maint. Cost			

R Hy

APR 11 1960

WILLIAM C. BROWNING
MINING ENGINEER
1211 PACIFIC MUTUAL BUILDING
LOS ANGELES

Los Angeles, California
April 8, 1960

Mr. R. B. Mulchay,
Anaconda Company,
818 Kearns Building,
Salt Lake City, Utah.

Dear Mr. Mulchay:

I regret very much that I was not in the office when you called here the latter part of last month, and I wish to thank you for your information about the drilling you have been doing on the Fortuna property.

In regard to the porphyry dike near Superior and south of Magma, it has been at least forty years since I last saw the property so I imagine the roads must have changed very considerably. At the time I was there was before the construction of the concrete highway between Superior and Ray and, as I remember, the old road was considerably east of the present highway and was some little distance from the old dirt highway. The old dirt highway went over the pass from the more or less flat Superior Valley and, after going over this pass, went down a rather steep road to the camp of Ray. My recollection is that the property is located at least a mile or two north of this pass.

I expect to be in Salt Lake sometime this fall and, if you are in town, shall call on you and try and give you more detailed information.

Please give my best regards to Mr. Druby and with the best of good wishes to yourself,

Sincerely yours,

W. C. Browning

WCB-Z