Looking towards the Endako West and Endako East pits

The Endako plant sits beside the 355-acre open pit (Placer Development Ltd photo)

Maintenance at a large open-pit mine: important part of Endako molybdenum operations

R. V. KIRKHAM

Canada's largest molybdenum producer, Placer Development's Endako mine 180km west of Prince George, BC, has made good maintenance practices a prime concern in all areas of its operation.

In the midst of a major expansion of its milling facilities, Endako is also currently building an 1800ft^2 motor rebuild shop adjoining its old pit shop. A second pit shop complex was completed in 1976 at a cost of $2.5-million.

'The pit shop extension will allow us to overhaul our own engines and wheel motors, a job which has previously been contracted out', mine superintendent Sergio Petrucci told *Western Miner*.

In addition, the company is considering adding several new trucks to its fleet and will be making a decision on building a third maintenance shop by early next year, Mr Petrucci said.

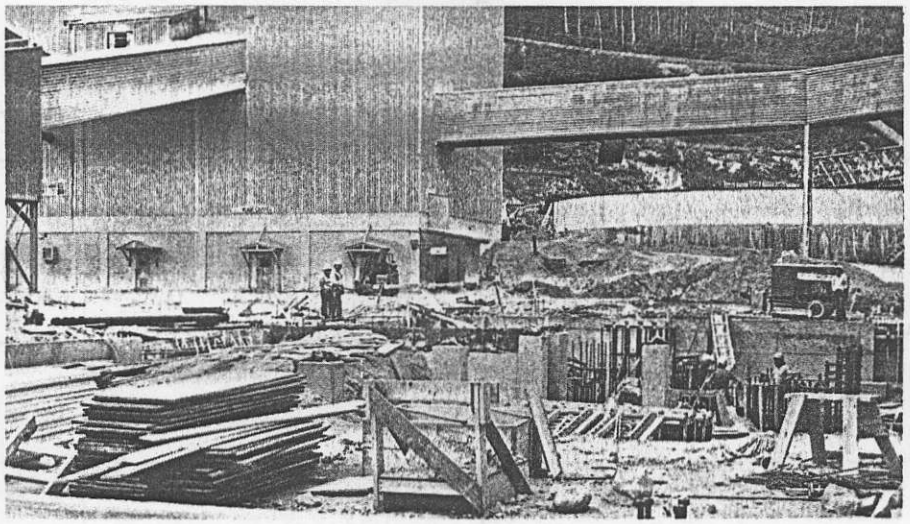
The Endako mine maintenance program was set up in the late 1960s when A T Kearney, Management Consultants, were hired to organize a comprehensive preventive maintenance system.

'The results of the program and the availability of equipment since this time has been impressive', Harvey Rutley, maintenance superintendent reports.

As an example, equipment availability for May 1980 showed mill operating time of 96%; primary crusher 72.5%; secondary crusher 79%; shovels 81.8%; and haulage trucks 70%.

These percentages indicate that planned maintenance is definitely beneficial and the cooperation from all departments for downtime scheduling is most important, notes Mr Rutley.

Construction work is under way on the new molybdenum roasting plant



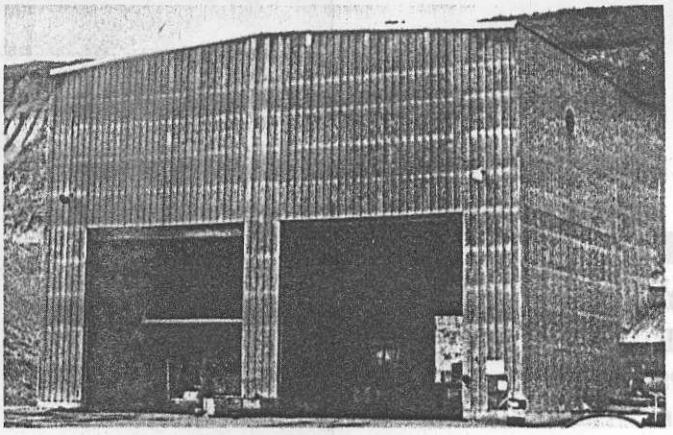
PLANNING DEPARTMENT

The maintenance program begins in the Planning Department under the supervision of Roy Lane, chief planner. Each morning, all plant supervisors meet with the maintenance superintendent to discuss work schedules, job progress and any particular problems.

All maintenance is accomplished through the use of work orders which are set in order of priority before work begins. Each piece of equipment on the property has been recorded in a Kardex System where the complete history of parts, part number, materials, dates and mileages are noted from information received on the respective work orders.

Service schedules for preventive maintenance are issued by the Planning Department for each piece of equipment in the mine and mill. These schedules vary on the machine application, but in general, are at 125 hour intervals. Some mobile equipment such as the haul

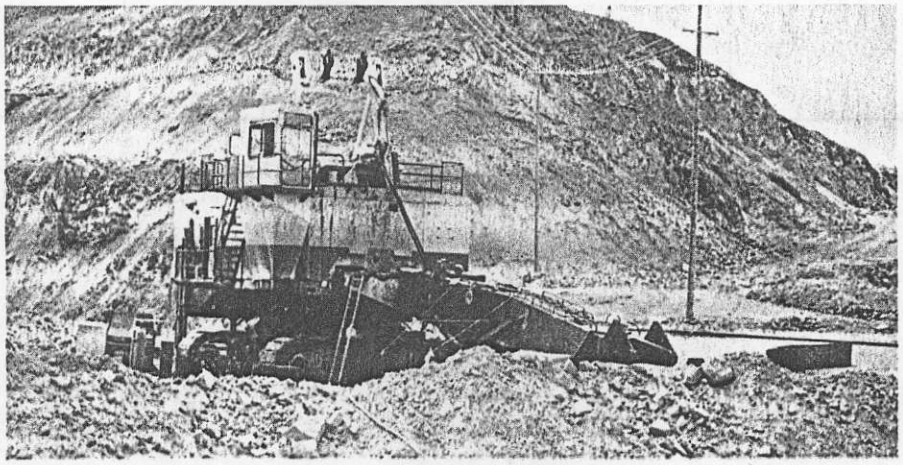
The new pit shop with service vehicles in the foreground



A new motor rebuild shop is being built beside the original maintenance complex

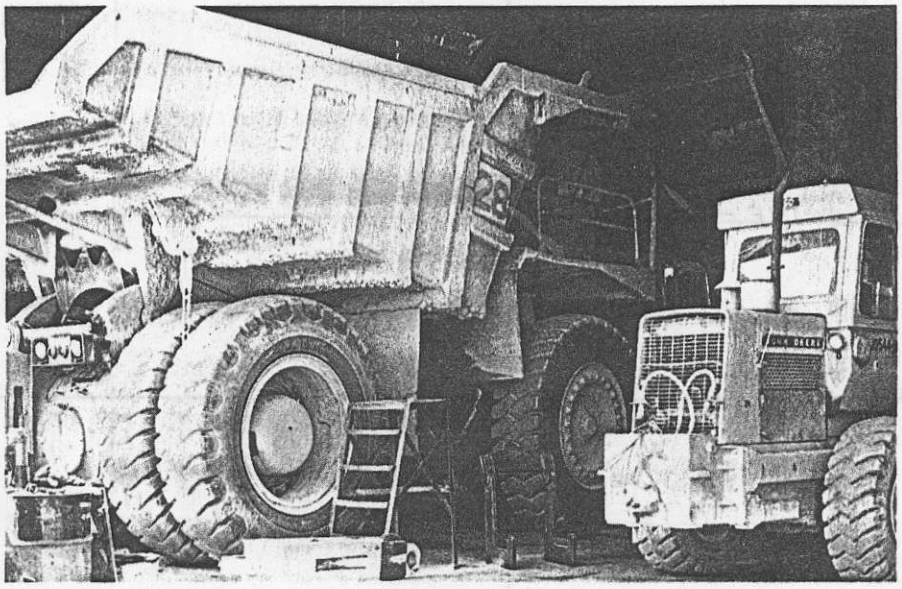
trucks return to the shops every 24 hours for greasing, fueling and general inspection.

The Planning Department also has the responsibility for getting quotes on prices and availability of parts and equipment. Individual planners are responsible for different departments and work with departmental foremen. The Material Coordinator for example, is responsible for lubrication stock and determines lubrication schedules for the crushers and mills, which are also recorded under the Kardex System.



A 191-M Marion shovel during a maintenance overhaul in the pit

An 85-ton truck undergoing a routine suspension change



OPEN PIT MINING

Daily mine production is currently around 70,000 tons, of which 30,000 tons is mill feed.

The open pit covers 355 acres and goes to a depth of 600ft. The pit has been developed from east to west, mining first from the Endako East Pit, moving to the Endako West and is now in the Denak pit. Estimated reserves stand at 250-million tons averaging 0.14% MoS_2, with a cut-off grade of 0.08%.

Equipment used in the pit includes nine Unit Rig Lectra Haul 85-ton trucks and 10 Unit Rig 100-ton trucks, all powered with 348 Caterpillar engines.

Five shovels and two drills are electrically powered and receive their source from 4160v trailing cables. In operation are one 290-B1 14-yd Bucyrus-Erie; one 191-M Marion 13-yd; two 2100 P&H 13-yd and one 150B Bucyrus-Erie 8-yd shovel. The drills include one M-4 Marion and one GD120 Gardner Denver, drilling 12¼in diameters to a depth of 45ft.

The open pit maintenance program is headed by Jim Danish with a crew of eleven men working day shift only. They handle the preventive maintenance and major repairs. Each shovel and drill has a scheduled down day, which is arranged at the weekly meetings between production and maintenance.

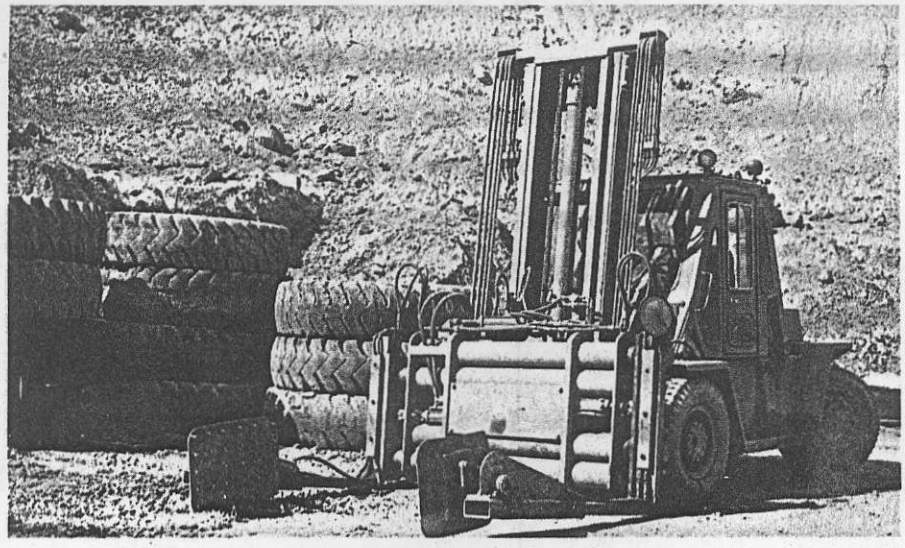
'The mine schedules any major overhauls for the spring, summer or fall months, as work can take twice as long in the winter', Mr Rutley said.

Plans are under way to gradually rebuild the fleet of older trucks and one of the 85-ton trucks has recently undergone a major overhaul.

The average hours for engines working in the pit is around 9000 hours, 10,000 hours for wheel motors and about 2500 hours for the large tires, the *Western Miner* was told.

PIT SHOP

Equipment is repaired in one of two pit shop buildings, which together have a total area of 46,000ft^2. The newer pit



A tire manipulator machine is kept busy replacing tires from equipment used in the open pit

Harvey Rutley, Maintenance superintendent

Bob Rutledge, machinist, works on the lathe in the old pit shop

complex includes offices for pit supervisors and a dry for both men and women employees.

Noel Stewart, Pit Shop Master Mechanic oversees 66 people employed in the shop. Equipment inventory includes the drills, shovels and trucks, as well as D-8 dozers, 14G graders, 988 loaders, and water trucks. In addition, the pit shop maintains numerous smaller machines such as welders, pumps, light plants, forklifts, 60 service vehicles and three mobile cranes.

PLANT MAINTENANCE

Following a troubled year in 1979, when production was adversely affected by an 8½-month strike, concentrate production is now at an all-time high. Production for 1979 was 2,697,000 kg of molybdenum, or approximately 40% of the 6,929,000 kg originally planned.

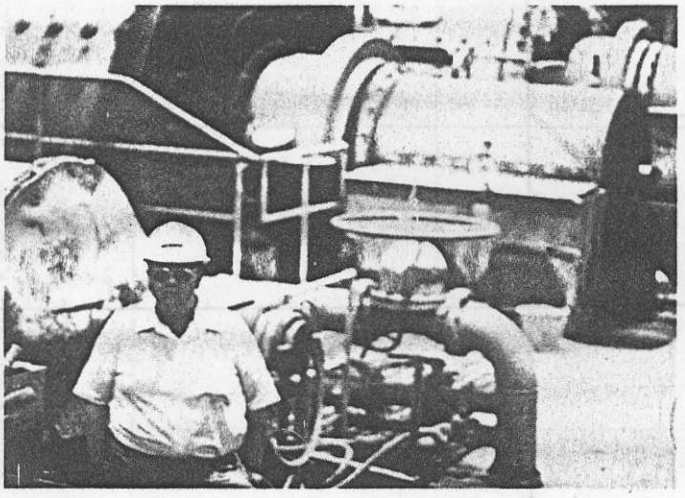
A $4-million 6400ft^2 expansion of the rougher flotation circuit is currently under way and a 6400ft^2 lubricant grade molybdenum plant, costing around $2.5-million is scheduled to come on-stream in July 1980. The plant will produce an ultra-pure molybdenum base lubricant which is used as an additive in grease and oils.

At the time of our visit, construction work had just begun on a 7300ft^2 building to expand molybdenum roasting capacity. The new 21.5ft diameter roaster is expected to be operational in the first quarter of 1981. The expansion program will increase annual production of molybdic oxide from 7,700,000 kg to 10,800,000 kg.

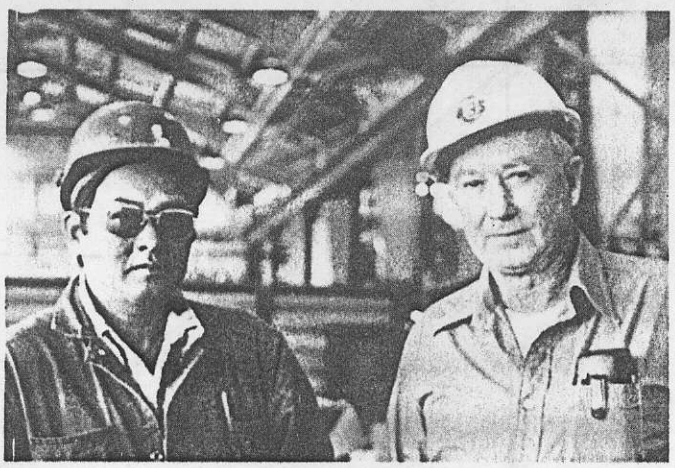
Expansion of the plant facilities comes under the supervision of Plant Mechanical Engineer Paul Pilon, while preventive maintenance is carried out under the direction of Plant Master Mechanic, Karl Misling.

The crushing system which consists of one 42in x 65in gyratory crusher; two 13in x 84in hydrocone crushers, two 5in x 84in hydrocone crushers, 12 belt conveyors and three 8ft x 20ft vibrating screens, is shut down one day every

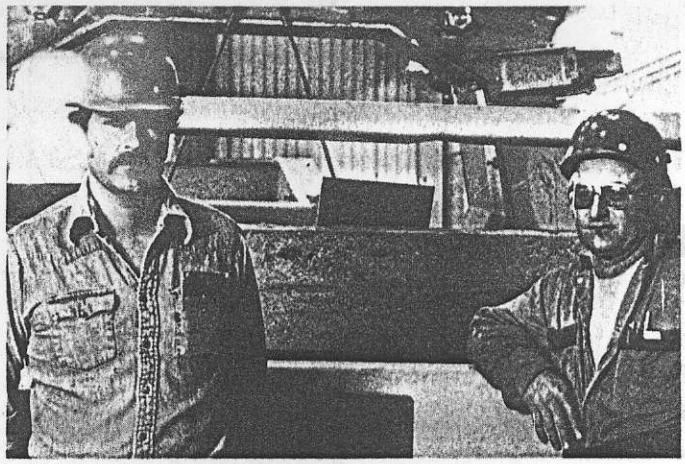
Jack Davey, mill superintendent beside one of the ball mills



Derek Kowlski at work in the welding bay

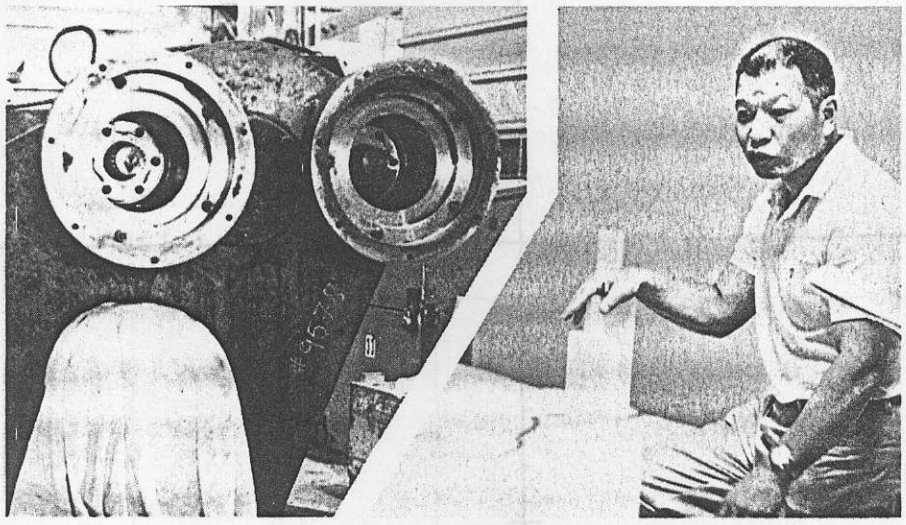


Lead Hand Welder Orlando Cruz (left) and Harvey Rutley, maintenance superintendent in the pit shop.



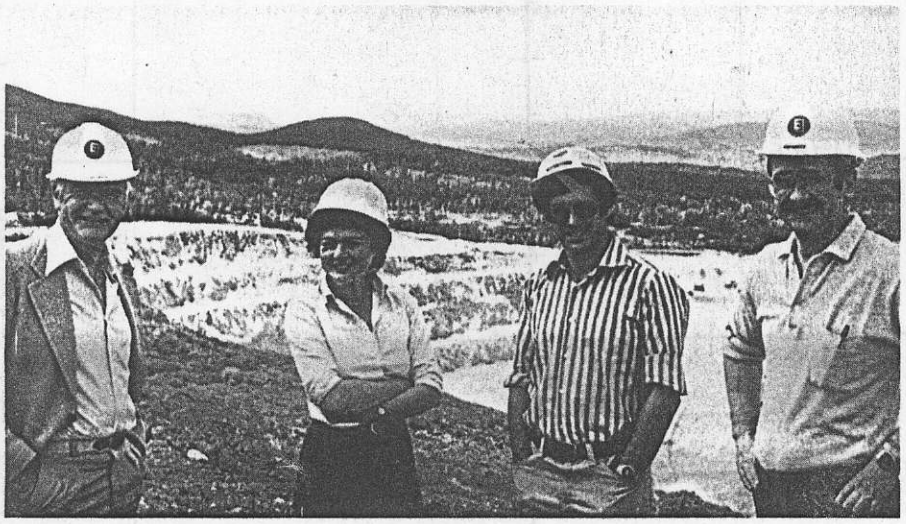
Shift Foreman John Forrest (left) and Welder Pat Hurley in the new pit shop complex

A drive transmission off one of the shovels in for repair



Ed Kimura, chief engineer explains long range planning using a scale model of the Endako mine

With the Denak pit in the background (from left) are Placer's Don Hallum, corporate secretary; Donna Bevelander, employee communications supervisor; Sergio Petrucci, mine superintendent; and Bill Thompson, manager, corporate communications



week for preventive maintenance work.

Maintenance down time will be utilized by replacing steel wear liners in the surge bin and chutes with the mantle and concave liners changed at five to six month intervals. On such weekly shutdowns, all pending work in the respective circuit, such as screen cloth replacement, roller repair, skirting and liner replacement will be executed.

The mill grinding section consists of ten 12.5ft x 15ft rod and ball mills; three 6ft x 12ft ball mills; 90 pumps and 25 flotation banks. Rod mill shell liner changes are every 14 months and ball mills average 24 months. There are variables due to the RPM of individual mills and ore conditions.

Cyclone overflow pumps are taken apart every 1000 hours for an impeller or liner replacement and the discharge pumps every 900 hours to 1600 hour intervals. Here again the majority of all shutdowns are scheduled by the life of wear components.

In the roaster and canning section, repair to the 10ft Dryer; 16ft and 18ft Nichols roaster; Eimco filter; bucket elevators; screw and drum conveyors are carried out on a day-to-day basis with few scheduled shutdowns.

All the Plant equipment is monitored each shift which also takes care of running maintenance and any scheduled preventive maintenance. Information gathered on these shifts are logged and made available to plant maintenance staff. About 80 people are employed in the plant maintenance division.

ELECTRICAL SHOP

The Electrical department is under John Lukasek, chief electrician. Presently, the Powerhouse is being modified to accommodate the roaster and flotation expansion as well as installing extra motor control centres in the mill and

secondary crusher to allow for modifications.

The open pit powerlines are maintained and installed by the electrical crew. At present more than two miles of 69KV powerline have been erected, complete with a 3.5MVA substation to handle all the pit equipment.

Emergency power is supplied by two diesel generators (total 2.25MVA) for lights, heat and essential loads.

Power to Endako is supplied at 69KV from BC Hydro to the main substation. Here it is transformed to 4.16KV by a 20MVA and 7.5MVA transformer for the plant area. 4.16KV is distributed to the individual building where it is transformed to 600 volts and supplied to 800 amp motor control centres.

About 25 people, including tradesmen and apprentices are employed in the electrical department.

SURFACE DEPARTMENT

Surface Foreman, Tom Blomquist heads a staff of 46 people who are responsible for the maintenance of all plant buildings, yards, roads and tailings lines. The surface department includes carpenters, painters, caretakers, equipment operators and labourers. Surface equipment operators are versatile and skilled in the operation of loaders, backhoes, graders, trucks and cranes.

In addition, surface maintains 40,000ft of tailings dam piping with the responsibility of relocating 10,000ft of pipe each year. The tailing dams are constructed from the recovered solids from the mill tailing stream, and spiggots welded at various intervals maintain the face above the pond level.

In total, the Endako mechanical area employs 255 men and women. Of these, there are 73 certified journeymen and 68 apprentices working as millwrights, welders, machinists, electricians, heavy duty mechanics, automotive mechanics, painters and carpenters.

The company encourages on-the-job training in various areas. The electrical crew for example, is rotated to all areas of the mine to ensure a thorough working knowledge of all facets of the operation. Besides the formal apprenticeship training, electrical apprentices draft and design some electrical systems to gain a background in electrical prints and schematics.

Millwrights and heavy duty mechanics are rotated through two month exposures in each area of welding and machine shop with six months on shovel and drill repair in the pit. The plant department is currently studying several alternate training programs in all technical areas to supplement the apprentices' training.

ACKNOWLEDGEMENT

This review of maintenance at Placer's Endako mine was made possible with the help of many people involved with the Endako maintenance operation. Special thanks are due to Harvey Rutley, maintenance superintendent; Sergio Petrucci, mine superintendent; Jack Davey, mill superintendent; D G Lindsay, roaster superintendent; and John Dodge, mine manager. **WM**

VEHICLE FIRE PROTECTION: Brochure on fixed fire suppression systems for large off-road vehicles in construction, mining and waste disposal industries is available from R J Larsh, The Ansul Company, Marinette, Wisconsin 54143.

LINER PLATE: Liner plate, a simple, strong and economical structure used primarily for tunneling applications is described in 18-page brochure (CPCL 8-1162). Covers dimensions, shapes, applications, design choices, pressure limits, depth of tunnels and arch configurations. Available from Armco Canada Ltd, Construction Products Division, Box 3000, Guelph, Ontario N1H 6P2.