A Summary of Operations at Peko Mines N.L.

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Mine Manager
Peko Mines N.L.

THE PEKO OUTCROP was located and pegged in 1935 by a prospector called Joe Kaminsky.

In 1936, a geophysical survey of the Tennant Creek field which was carried out by the Aerial Geological and Geophysical Survey of Northern Australia (A.G.G.S.N.A.) disclosed a major magnetic anomaly on the Peko leases. This survey did some shallow drilling which indicated low grade gold but no copper.

The present company, which was formed in August 1949, began preliminary operations in a modest way in 1950. In the 16 years from 1935 to 1951, only 6,080 tons of ore, which averaged about 14 dwt to the ton, were extracted.

During 1950-51 a small but rich dome of oxidised copper was driven through on the 300 ft level in the search for gold and the Bureau of Mineral Resources intersected primary chalcopyrite at about 370 vertical ft with a diamond drill hole.

During 1952, and the early part of 1953, the company carried on in a cautious way trying to assess the importance of the copper deposit. The 300 ft level was explored by drives and cross-cuts which opened up a high grade secondarily enriched zone.

It soon became apparent that a copper ore body of some importance had been located. Accordingly, additional capital was called in and towards the latter part of 1953 the company began to develop the mine and erect a plant to produce copper concentrate.

The concentrating plant started operations on June 9, 1954, with a throughput of about 50 tons per day. Plant and mine capacity has since been increased to 500 tons per day.

Geography and Associated Problems

Peko has had the usual problems associated with operating in a fairly remote area. The more important of these problems are discussed below.

Location

Peko is situated 7 miles from the small township of Tennant Creek.
which is 315 and 415 miles respectively from the rail heads at Alice Springs and Mount Isa, 635 miles from the port at Darwin and 1410 miles from the main supply centre of Adelaide.

Points in favor of the location are that some 1700 miles of bitumen highways connect Tennant Creek with Alice Springs, Darwin and Mount Isa. These highways are well cared for and are travelled by adequate heavy transport.

The town also is well serviced by air, being on the main Adelaide-Darwin route, with four south bound and four north bound planes each week, as well as receiving a feeder service from Mount Isa once weekly.

**Housing and Amenities**

The location makes for a high turnover of personnel by southern standards, and special efforts are made to stabilize the community. The area is classified as semi-desert country, and the summers are long and persistently hot; a build up of intense heat being periodically relieved by a thunderstorm. The winters are fairly short and prevailing winds can make them quite cold.

Housing has been supplied for 30 key employees. The houses are built to suit climatic conditions, and are elevated and well louvered. Recently, evaporative coolers have been installed.

Most other employees live in single quarters on the lease, and eat at a communal mess. The mess is run by a committee of men who select their own contractor.

There is a Trading Store and an Amenities and Sports Club on the lease. Both these organisations are controlled by elected committees. The Trading Store is licensed and all profits are retained to provide additional amenities.

The popular sports are night basket ball in the summer and baseball and tennis in the winter. These sports are played competitively and have a large following throughout the district. Teams from Darwin, Mount Isa and Alice Springs attend the sporting carnivals held from time to time.

Other services such as a picture show, school, churches, hospital, etc., are located in Tennant Creek, 7 miles away. Tennant Creek has a population of about 900. The Peko operation has about 228 employees with about 300 people resident on the lease. There are another 32 employees at the Orlando, operating about 25 miles away. The mine has built, and staffs, its own kindergarten which has an average attendance of about 15 children.

**Power Supply**

The mine generates its own power using four Ruston 6 VEBX, one Ruston 7 VEBC and two English Electric 8 SV diesel units which have a total installed horsepower of 4,860. After derating for ambient temperature, altitude and continuous running, a total of about 3,200 kW is available. Effective capacity is about 2620 kW, which is the capacity with the largest machine down for overhaul.

A first class maintenance program on the diesels is required because of high power house temperatures and dusty operating conditions.

Electrical energy is also sold to the township of Tennant Creek.
Each year about 2800 tons of diesel fuel are freighted in from Darwin, providing about 10 mill. kWh of electrical energy per year.

Water Supply
About 2¾ mill. gal. of water are required each month and the supply of this water could be a formidable problem in a semi-desert area.

However, there are strong flows of salt water beneath the surface; the water table is located at about 170 ft. The water used for ore treatment is obtained from drainage of the mine workings and from two surface bores. A new successful bore that yields 1000 g.p.h. at a depth of 400 ft has just been located about a mile and a half from the mine. The bores are equipped with 4½ I.B.C. pumps operated by small Southern Cross diesels.

Domestic water comes from three dams or ground tanks excavated on small local catchments at a maximum distance of two miles from the mine. The dams are dispersed to allow for the erratic nature of the rain storms during the wet. Rainfall averages 15 in. per year between November and March; evaporation is high and is about 12 ft per year.

The dams hold about 17 mill. gal. total, which allows a domestic consumption of 400,000 gal. per month over two years. This consumption permits very little water for gardens of residents. Natural vegetation is quite plentiful on the flats, although the growth is fairly stunted, except at waterholes, where the gums can be of considerable size. There is little growth on the low, mesa type hills and rocky outcrops.

Stores and Workshop Facilities
The isolation of Peko requires a high investment in stores (about £170,000 without freight) and self sufficient workshops and services.

Stocks are meticulously recorded in a visible ledger system, with colored flags indicating danger points, order points etc. The object is to maintain a minimum of inventory consistent with maximum protection for the operation.

The three main engineering services are contained in—
1. A fitting and welding shop
2. An electrical shop
3. A carpenters shop.

Other subsidiary workshops are power house maintenance, underground; blacksmiths, and plumbers.

The workshops have handled all recent construction on the mine including the erection of new plant, headframes, houses etc., and any construction connected with prospect development.

Present policy is aimed at reducing workshop personnel to a maintenance and erection basis with all fabrication being done by southern manufacturers. It is difficult and costly to maintain skilled tradesmen on the mine. However, isolation always requires a far greater capacity to improvise than in more favorable localities.

The Peko Production Operation

Geology
The orebody is a lens shaped replacement deposit averaging 300 ft in length and 40 ft in width. Actual widths range from 15 ft to 110 ft.

Strike is east-west and dip is about 70 deg to the north. The orebody pitches to the west at about 80 deg.

The orebody consists of massive iron and copper sulphides and quartz magnetite enclosed within a quartz magnetite envelope. The surrounding country rock consists of fine to medium greywacke and slates.

There are four zones within the orebody:
1. Surface—200 ft. Oxidised medium grade gold ore with no copper.
2. 200-260 ft. Oxidised copper ore with some gold. Mainly cuprite with some native copper.
4. Below 320 ft. Primary sulphides, mainly chalcopyrite, pyrite, pyrrhotite and marcasite with small quantities of galena, sphalerite, bismuthinite and cobaltite—in quartz magnetite.

Head grade of ore mined has ranged from 8.54 p.c. copper in 1955-56 to 5.43 p.c. copper in 1960-61. Gold grade has averaged about 3 dwt, although certain sections of the orebody have yielded well above this. The mine work-
in. oregon frame sets, was started in April 1955. Hoisting in this shaft began from the 680 ft and 830 ft levels in April 1957. This shaft was located in the hanging wall but passed through barren ironstone into the footwall between 280 ft and 530 ft. Its closest position to the orebody is about 50 ft on the 530 ft level.

This shaft was designed for a depth of 2000 ft. It is equipped with a 350 h.p. a.c. second hand winder made by Marfleet and Weight in 1926, with new electrics supplied by English Electric. Electric control is through a liquid rheostat.

The shaft bottom is currently at 1245 ft with the bottom operating level at 1130 ft. Hoisting is done in 2½ ton bottom dump skips, at a maximum rate of 100 tons per hr, from loading stations at 920 ft, 1040 ft and 1190 ft. The top station takes ore from all levels above 830 ft level; the bottom stations service one level only. Level intervals in the shaft are at 150 ft.

Open stoping methods are mainly used apart from a cut and fill stope in the weak secondarily enriched zone above the 400 ft level. In this stope, Holman H.E.A. air scrapers are used to scrape ore to box chutes and to spread mullock fill passed down mullock passes from the surface. Two 25 h.p. triple drum Joy Scrapers have been acquired recently for this stope.

The open stoping consists of conventional underhand benching with a 30 ft sublevel interval and using hand held jack hammers—as well as long hole percussion drilling on 45 ft and 60 ft benches. Two SFH 99 Gardner Denver machines are used with 2¼ in. tungsten bits for long hole drilling. All open stope dirt is loaded in draw points on main levels using Eimeco 12B loaders.

Ore breaking and development statistics are given in the table on page 10.

About 50,000 gal. of water are pumped daily from the mine using Ajax 2L-3 all bronze pumps mounted in tandem units and driven by a 25 h.p. motor. There are two units with independent rising mains on main sumps at 300 to 400 ft intervals.

Initially, air was exhausted from the mine using two 12½ h.p. Richardson 6½ CL fans operating on an old shaft. Recently an Aerex 25 h.p. 54 in. G series fan has been installed on the original main shaft; one of the Richardson fans is still being used in the old set up to exhaust upper levels. Auxiliary ventilation underground is provided by 5 h.p. 15 in. Meco electric fans and by 12 in. Meco air fans.
Milling

Crushing

R.O.M. ore is crushed to minus 5 in. in a 36 in. by 24 in. Hadfield jaw crusher and elevated to a surface stock pile. Until recently this was conveyed to a 28 in. Pegson Telsmith gyratory crushe, which delivered a minus 2 in. product to a ¾ in. mesh Hadfield screening in closed circuit with a 36 in. Pegson Telsmith gyrosphere crushe. The minus ¾ in. product was delivered to either of two 800-ton fine ore bins.

The gyratory and gyrosphere have been replaced with a 4¼ standard Symons crushe fitted with a medium crushing cavity in closed circuit with a ¾ in. mesh Hadfield screen. This gives better crushing costs because of greater capacity (100 tons per hr against 60 tons per hr) and improved layout and maintenance.

Grinding

Mill feed is taken direct from the 800-ton silos over a Blake Denison weightometer and fed into a primary rod mill at about 20 t.p.h. Present budgeted annual throughput is 145,000 tons. The rod mill is a 5 ft 6 in. by 11 ft overflow type mill lined with modified El Oro manganese steel liners and charged with about 12 tons of 3 in. Kroball steel rods. Rod mill discharge at minus 10 mesh goes via a distributor to two secondary ball mills.

Cast alloy balls, 2 in. and 3 in., are used as grinding media and the mills are lined with Ni-hard El Oro liners.

The ball mills are in closed circuit with 24 in. low pressure cyclones which overflow a product of about 80 p.c. minus 300 mesh.

Cyclone overflow at 20 p.c. solids gravitates to a 30 ft dia. primary thickener, and thickener underflow at 30 to 35 p.c. solids is pumped to a conditioning agitator prior to flotation.

Flotation

The flotation circuit comprises roughing, scavenging, cleaning and recleaning sections in conjunction with a 5 ft by 22 in. Hardinge conical regrind mill. The current grouping is as follows:

<table>
<thead>
<tr>
<th>Section</th>
<th>No.</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roughers</td>
<td>12</td>
<td>56 in. Fagergren</td>
</tr>
<tr>
<td>Scavengers</td>
<td>9</td>
<td>56 in. Fagergren</td>
</tr>
<tr>
<td>First Cleaners</td>
<td>8</td>
<td>48 in. Agitair</td>
</tr>
<tr>
<td>Recleaners</td>
<td>4</td>
<td>56 in. Fagergren</td>
</tr>
</tbody>
</table>

Scavenger concentrates and first cleaner tails provide regrind feed, with final regrind product going back to the conditioner. Reclean-

er tails are joined to rougher concentrates as first cleaner feed.

Reagents are: lime for pH control and general conditioning, added as milk of lime to the rod mill; sodium ethyl xanthate as a collector; Aerofroth 65 as a frother; and sodium cyanide to help depress the pyrite.

Concentrate grade is important with heavy freight charges, and a minimum grade of 26.5 p.c. copper is sought.

Thickening and Filtration

Final concentrate is thickened to 65 p.c. solids in a 30 ft dia. thickener and filtered in a 6 ft dia. by 8 disc Peterson filter. Filter product contains about 13 p.c. moisture.

Concentrate Handling

The filter cake at 13 p.c. moisture is delivered to 10-ton containers mounted on small flat-top rail trucks running on a 3 ft 6 in. gauge track. Eighteen of these trucks are coupled to form a rake, which is adequate for a full day's production. Production is planned to filter on one shift and hold any surplus concentrate in a surge agitator.

A Ferguson 35 tractor is used to shunt the trucks with full containers to a weighbridge. A 10-ton gantry straddles the weighbridge. Initially, the company planned to send the containers containing the concentrate with 13 p.c. moisture direct to the Electrolytic Refining & Smelting Company of Australia Pty. Ltd., Port Kembla. It was estimated that the cost of freighting the moisture would be equivalent to, or less than, the cost.

Primary crusher at Peke — mullock chutes at both sides of ore surge bin.

Left — Agitair cells on the flotation floor. Right — Gantry crane handling a 10 ton concentrate container.
General view of the concentrate handling area.

Wet concentrate being tipped on concrete strips for sun drying.

Loading bags of concentrate for the road journey to Alice Springs, 320 miles away.

of installing and operating a mechanical drier.

However, the company’s plans in this respect were altered when a long term contract was entered into with the Japanese. It became necessary to dry and bag the concentrate to comply with a Navigation Act requirement of less than 15% moisture in the concentrate, which is shipped from Port Augusta.

Therefore, after weighing, the concentrate is tipped into a 10-ton Shawnee Poole rear dump hauler with Fordson diesel prime mover, and spread on concrete drying strips for sun drying. The concentrate is actually harrowed with a Ferguson 65 tractor and heavy duty harrow to ensure rapid drying.

After drying to about 6% moisture the concentrate is bagged manually in paper lined jute bags.

The concentrate dries further in the bags and at a moisture of about 2% the bag is sewn and loaded by light mobile conveyors on to road transports.

The concentrate is weighed and tested for moisture just prior to despatch.

Assay and Research

An air conditioned assay office provides rapid service in copper and gold assaying.

A small research section undertakes research into all day-to-day operating problems. Some fundamental work has been done on different types of ore.

It is not considered practical to undertake complex or large scale research programs.

Seven to eight people are employed in assay and research.

Sale of Product

In February 1960, the company entered a 7-year contract with Sumitomo Shoji Kaisha Ltd. to supply about 30,000 tons of concentrate per year. This constitutes maximum production for the mine on its present operations.

The contract is favorable for Peko, with a fixed realisation charge over the period. The main advantage is the low Japanese charge for smelting and refining. The price received is the E. & M.I. world price average for the month of shipping, less one cent.

The concentrate is road freighted to Alice Springs and thence taken by rail to Port Augusta where it is loaded on ships, mainly
Japanese, each shipment comprising up to 4,800 tons.

An advance payment of 95 p.c. is made on the provisional shipping invoice. Final payment is made on out-turn at the smelters in Japan.

Peko's interests in Japan are watched by F. Duval & Co. and by the Universal Testing and Superintending Company of Tokyo.

Costs
Peko’s entire operations are controlled cost wise by a series of cost schedules prepared at four-weekly intervals on the mine. These schedules tie in with a yearly budget prepared each April. The actual costs in each section of the operation are compared with budget estimates on a monthly as well as a progressive basis.

All department heads are brought in on budget preparation; each operator plans his own budget assisted by the chief accountant, and co-ordinated by the mine manager. This forms an excellent basis for later control on a co-operative and constructive basis between the technical and the costing sections. Great emphasis is placed on the development of cost consciousness in operators through accounting techniques and on the broadening of the accountant’s attitude in his approach to practical costing and direct assistance to the operators. The harmonious and effective blending of costing with operating and engineering, is an extremely worthwhile and vital objective.

Each four-weekly period, the cost schedules are used in the preparation of a statement of operations and balance sheet nine days after the close of the period.

The four-weekly profit, and all factors affecting this profit, thus appear at regular intervals, permitting great flexibility in the control of operations.

The location of the Peko mine makes for a high cost operation; freight and realisation of product, which are virtually uncontrollable costs, form about 40 p.c. of total costs. With such a high proportion of uncontrollable costs, greater emphasis must be made on the mine controllable costs. Over the past four years, controllable unit costs have dropped considerably with the introduction of better metallurgy, full use of plant and mine capacity, improved techniques, and preventive maintenance programs. This reduction in controllable unit costs has helped to cushion the effect of lower grade, rising wages, and a depressed copper price.

Certain cost statistics are given in the table below.

**Exploration**
In exploration, Peko has always shown considerable maturity and a deep responsibility. The fate of all mines is eventual exhaustion; some companies are prepared to accept this philosophically without undue efforts to perpetuate themselves, but Peko has accepted the challenge with vigor and consistent effort.

The current geological team comprises a chief geologist, two assistant geologists, and two field technicians. These are backed by a consulting geophysicist and excellent geological knowhow from the executive directorate.

Routine exploration expenditure is currently running at about £70,000 per year or just over 9/ per ton of ore mined. Additional amounts are allocated for prospect development, an example being the Orlando Prospect, which received special funds for 2½ years for underground exploration. Since July 11, 1961, Orlando has been on a mine development basis.

### Costs — Financial Year 1959-60
 Costs per ton must be considered from two aspects: per ton of ore and per ton of copper. The former is important for gauging mine efficiency; the latter for assessing profit potential and the effect of ore and concentrate grade on costs.

<table>
<thead>
<tr>
<th>Cost of Production</th>
<th>Per ton of Ore Treated</th>
<th>Per ton of Copper Treated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mining</strong> (includes development of about 8/- per ton)</td>
<td>£1 17 0</td>
<td>£34 10 0</td>
</tr>
<tr>
<td>Treatment</td>
<td>£1 17 11</td>
<td>£35 0 9</td>
</tr>
<tr>
<td>Packing and handling</td>
<td>£16 8</td>
<td>£15 8 7</td>
</tr>
<tr>
<td>Mine overheads</td>
<td>£18 1</td>
<td>£16 15 0</td>
</tr>
<tr>
<td>Administration</td>
<td>£13 6</td>
<td>£12 9 1</td>
</tr>
<tr>
<td>Royalties</td>
<td>£3 0</td>
<td>£2 15 11</td>
</tr>
<tr>
<td>Capital redemption and depreciation</td>
<td>£2 9 7</td>
<td>£45 16 9</td>
</tr>
<tr>
<td><strong>Total Production Costs</strong></td>
<td>£8 15 9</td>
<td>£162 10 11</td>
</tr>
<tr>
<td><strong>Exploration, excluding overheads</strong></td>
<td>£11 10</td>
<td>£10 19 2</td>
</tr>
<tr>
<td><strong>Total Mine Costs</strong></td>
<td>£99 27</td>
<td>£173 10 1</td>
</tr>
<tr>
<td>Refining and realisation — freight, smelting, and refining</td>
<td>£6 13 1</td>
<td>£123 1 0</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td>£10 16 0</td>
<td>£296 11 10</td>
</tr>
</tbody>
</table>

As a matter of interest, the issued capital of Peko Mines N.L. as at June, 1960, after six years of operation was £787,500 and fixed assets totalled £2,275,151, of which £1,080,691 had been redeemed. Reserves totalled £451,362 and taxation provision at £350,000. Dividends payments had amounted to £575,961 over the six-year period.

### Production — Financial Year 1959-60

| Ore treated (tons) | 38,917 |
| Head grade — Copper (p.c.) | 5.96 |
| Gold (dwt/ton) | 2.74 |
| Concentrates produced (tons) | 28,606 |
| Assaying — Copper (p.c.) | 26.64 |
| Gold (dwt/ton) | 8.69 |
| Silver (ounces/ton) | 2.93 |
| Copper recovery (p.c.) | 92.1 |
| Gold recovery (p.c.) | 66.9 |
| Metal content of concentrates — Copper (tons) | 7,509 |
| Gold (ounces) | 12,720 |
| Silver (ounces) | 84,087 |

### Production — Financial Years 1954-55 to 1960-61

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons Milled</th>
<th>Copper Grade</th>
<th>Concentrate Produced</th>
<th>Copper in Cons.</th>
<th>Gold in Cons.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>21,437</td>
<td>7.7</td>
<td>6,465</td>
<td>1,523</td>
<td>3,359</td>
</tr>
<tr>
<td>1956</td>
<td>51,000</td>
<td>8.54</td>
<td>16,321</td>
<td>4,095</td>
<td>8,496</td>
</tr>
<tr>
<td>1957</td>
<td>72,359</td>
<td>7.81</td>
<td>21,288</td>
<td>5,323</td>
<td>10,100</td>
</tr>
<tr>
<td>1958</td>
<td>109,418</td>
<td>7.38</td>
<td>29,809</td>
<td>7,669</td>
<td>13,056</td>
</tr>
<tr>
<td>1960</td>
<td>138,917</td>
<td>5.96</td>
<td>28,606</td>
<td>7,509</td>
<td>9,163</td>
</tr>
<tr>
<td>1961</td>
<td>153,287</td>
<td>5.43</td>
<td>28,827</td>
<td>7,669</td>
<td>12,720</td>
</tr>
</tbody>
</table>

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Field Exploration

Field exploration has been centred on the two thousand square miles of the Warramunga gold field. Scattered over this area are several hundred ironstone outcrops, most of which will carry a trace of gold at least.

The prospector has concentrated on these outcrops and a series of "gougers' shows", operating intermittently, has been a feature of the field since its beginning in 1932. Only two of these have developed into producers of any consistency, and they are the Nobles Nob and Eldorado mines.

Peko itself was a prospector's discovery as far as the shallow gold values in the oxidised outcrop are concerned, but Peko also had the strongest magnetic anomaly on the field in spite of its insignificant outcrop; and this led to exploration at depth with the thought that if the ironstone environment was favorable to mineral deposition, then surely there was a large volume of mineral potential in the buried magnetite.

Thus, anomaly investigation has logically formed an important part of exploration.

In this respect, the Bureau of Mineral Resources, with its geochemical survey work, has assisted tremendously, initially in 1937 by ground work and in recent years, and currently, by aerial borne mag.

netometers as well as ground parties. Assisted by the Bureau's magnetic maps, Peko's ground parties can go in and read selected anomalies in greater detail.

Another method of geophysical prospecting used is the electrical resistivity method. Some success has been achieved in defining the junction of different rock types beneath the featureless bulldust. Geochemistry also has been used to help define anomalies of residual copper on leached outcrops. This method was used at Orlando.

Great attention has been given to the regional geology of the field and original thinking has been developed on the formation of the host rock and ore localisation. A paper on this subject was published in the proceedings of The Aus.I.M.M. This paper is by J. Elliston, chief geologist of the company, and it is called "Ore Localisation by Preconsolidation Structures".

Final target selection is a culmination of closely co-ordinated thinking between geologist and geophysicist.

Two or three surface drills are kept operating continuously on prospect testing. These drills are operated by outside contractors.

Current areas of drilling interest are Explorer V, 15 miles west of Orlando, and Explorer IX located between Tennant Creek and Orlando.

Exploration in the Peko Environment

It is fairly obvious that ore discoveries close to home have a great advantage. The location of sympathetic ore bodies from existing underground workings are more advantageous still; with an existing shaft and services the development ratio is most favorable.

Up to date, the main Peko orebody has been well defined with sharp walls, very consistent and with medium to high grade ore. This picture is changing below the 980 ft horizon. Ore grade is dropping and the nature of the ore deposition is becoming more sporadic. There is a poorly defined split in the orebody below the 980 ft level.

However, to compensate partly for this, small deposits of economical ore have been located in the hanging wall section of the ironstone mass and in a parallel footwall ironstone body between the 800 and 1000 ft horizons.

These bodies are being investigated by underground diamond drilling and exploration drives. The drives extend from 400 to 500 ft from the main body.

The next important phase of exploration in the Peko orebody will be a series of holes from the shaft bottom at 124 ft.

Slightly further afield, but still in the Peko environment, are the company's eastern leases. Several anomalies were drilled on the leases with minor results. One drilling pattern, on the anomaly closest to Peko, requires further investigation.

The anomaly at West Peko was drilled recently by the Bureau of Mineral Resources. This was a deep seated target requiring a hole of 2500 ft, but results were negative.

The Orlando mine, about 25 miles from Peko. Powerhouse and workshops in foreground.
Prospect Development

The main development has been the Orlando prospect, which is about 25 miles from Peko. This operation emerged from the prospecting stage when a decision was made in June 1961 to erect a plant capable of treating 100 tons per day of gold-copper ore. This plant will be operating by June 1962.

Drilling initially started on the Orlando leases in September 1957, with a program of seven holes. The information obtained from the seven holes was encouraging enough for the company to plan an underground operation with the idea of further assessment.

A four compartment shaft, 15 ft 6 in. by 3 ft 8 in. inside the timbers, has been taken to a depth of 765 ft with levels at 260, 380, 550 and 720 ft. The shaft is timbered with 6 in. by 6 in. Oregon frame sets at 6 ft centres and closely lagged with bush mulga for most of its length.

- One compartment is for ladders, pipes and electrical cables, and is also used as a sinking compartment below the lowest level. Two compartments are used for balanced hoisting and are large enough to allow an Eimco 128 mechanical shovel to be lowered in three sections. The fourth compartment is for ventilation ducts.

Considerable driving, cross-cutting and underground drilling has been done at Orlando. Deep leaching and oxidation and the extent of the shear zone (possibly 3000 ft long and 80 ft wide) have made assessment slow. The main channel is still leached and oxidised at 800 ft, but the disturbed footwall zone has primary mineral deposition and sufficient ore reserve has been established here between the 380 ft and 720 ft levels for initial production.

The current ore grade estimate is 11 dwt of gold and 1.5 p.c. copper. Random patches with a much higher average gold ore grade do occur. Current ore reserves give a life of five years.

R.O.M. ore will be crushed at Orlando by a 14 in. by 24 in. Hadfield jaw crusher and a 36 in. Pegson Telsmith gyrosphere in open circuit to a nominal 3 in. size, and elevated to a 200-ton bin. The ore will be carted by 20-ton Thornycroft Mastiff diesel trucks, with trailer tippers, 25 miles to a 350-ton sub-surface bin at Peko.

Subsequent treatment will be a conventional grinding and jigging circuit to remove the coarse gold, followed by flotation to produce a copper-gold concentrate. A 6 ft by 5 ft Ruwolt grate discharge ball mill will be used in closed circuit with a 16 in. by 24 in. Duplex Denver mineral jig and 10 in. cyclone.

Orlando has its own mess, living quarters, minor workshops, etc. It also generates its own power; the two main units being a 4VEB Russian of 240 h.p. and a 45RK English Electric of 450 h.p. Major services such as surveying, assaying, accounting, engineering, etc. come from Peko.

A recent development has been the decision by the Commonwealth Government, to subsidise on an approximate 50-50 basis, the construction of 17 miles of new road to Orlando from Tennant Creek. A contract has been let to Thiess Bros., who have undertaken to complete the road in 18 weeks. This road will be primarily for ore haulage and a hard surface was considered necessary for the desired haulage cost to be achieved. Hard surfacing is expensive and an economic balance was obtained by specifying a 12 ft (single lane) strip of bitumen, except on inverts and creek crossings, where standard widths will be used.

Certifiable representative statistics for various aspects of Peko’s operations are quoted below.

Northern Territory Mineral Production

In 1960, mineral production in the Northern Territory was valued at about £6 million, including about £2.3 million from Peko’s operations. Other primary industry production in 1960 was valued also at about £6 million.

Underground Development at Peko (for a typical twelve month period)

<table>
<thead>
<tr>
<th>Ft Advance</th>
<th>Explosives Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor Shift</td>
<td>Lb/ft</td>
</tr>
<tr>
<td>Main driving 8 ft x 7 ft</td>
<td>1.86</td>
</tr>
<tr>
<td>Sub-level driving 7 ft x 6 ft</td>
<td>1.83</td>
</tr>
<tr>
<td>Rising 5 ft x 5 ft</td>
<td>2.2</td>
</tr>
<tr>
<td>Winzing 5 ft x 5 ft</td>
<td>1.52</td>
</tr>
<tr>
<td>Shaft sinking 15 ft x 4 ft 10 in. inside timber (including timbering)</td>
<td>0.34</td>
</tr>
<tr>
<td>Underground diamond drilling, E500, ft per machine shift</td>
<td>31.0</td>
</tr>
</tbody>
</table>

Ore Breaking at Peko (for a typical twelve month period)

<table>
<thead>
<tr>
<th>Tons Broken</th>
<th>Explosives Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>per Minor Shift</td>
<td>Lb/Ton</td>
</tr>
<tr>
<td>Bench stopping, 30 ft sub-level interval</td>
<td>58.7</td>
</tr>
<tr>
<td>Long blast hole stopping, 60 ft sub-level interval</td>
<td>78</td>
</tr>
<tr>
<td>Undercutting and belling</td>
<td>47.1</td>
</tr>
<tr>
<td>Overall tons per man-shift in underground department</td>
<td>8.65</td>
</tr>
<tr>
<td>2,515 ft of development (shaft 114 ft) were completed and 138,318 tons of ore were milled for this particular period.</td>
<td></td>
</tr>
</tbody>
</table>

Powerhouse Statistics (for twelve months ending June, 1961)

| Total installed b.h.p. | 3,960 |
| Capital cost of units including building and auxiliaries | £260,000 |
| Total fuel oil used (gal.) | 670,505 |
| kWh per gallon of fuel | 15.04 |
| Power generated (kW) | 388 |
| kWh per ton of ore milled | 3-4.01 |
| Total kWh per ton of ore for entire mine establishment | 65.76 |
| Average powerhouse load (kW) | 1,292.57 |

Reagents Used (a typical month)

<table>
<thead>
<tr>
<th>lb/ton ore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balls 1 in.</td>
</tr>
<tr>
<td>Balls 2 in.</td>
</tr>
<tr>
<td>Balls 3 in.</td>
</tr>
<tr>
<td>Rads 3 in.</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Sodium Ethyl Xanthate</td>
</tr>
<tr>
<td>Lime</td>
</tr>
<tr>
<td>Aerofloat 65</td>
</tr>
<tr>
<td>Sodium Cyanide</td>
</tr>
</tbody>
</table>
**Organisation**

Peko Mines N.L., merged its interests with that of The Wallsend Holding & Investment Co. Ltd. in June 1961. Peko is now a subsidiary of the holding company, Peko-Wallsend Investments Ltd.; other subsidiaries are Newcastle Wallsend Coal Company Pty. Ltd., Hexham Sales & Agency Pty. Ltd., and National Minerals Holdings Ltd.

Peko Mines has retained its identity and organisation and is an autonomous operation within the group.

Peko Mines has an executive board of five, whose members concern themselves with mine planning and mine problems of a broad nature. The chief executive director of Peko is also chairman of the board of the holding company and the mine manager is also an executive director. The executive board can call in metallurgical and geophysical consultants.

Control on the mine rests with the mine manager whose span of control covers the following departments: production, mechanical, electrical, accounts, exploration, prospect development, purchasing, and welfare. Exploration, because of its specialised nature, has direct contact and instruction from time to time from the chief executive director.

The production department is controlled by a production superintendent. This department is kept as a tight operating unit, since the underground superintendent, mill superintendent (with assay and research) and the concentrate handling foreman all operate under the control of the production superintendent.

The accounting and costing sections are combined and operate with a chief accountant, accountant, six clerks and four female office workers.

Purchasing and storekeeping are controlled by one officer; on account of size it is impractical to separate the two duties. There are four persons in this section.

The standard sequence of a foreman and shift bosses applies to underground and the mill.

Three foremen, in control of mechanical, building, and powerhouse maintenance, operate under the mechanical engineer, who is also responsible for construction.

The electrical engineer also operates through an electrical foreman.

The Orlando operation is controlled by a supervisor who is responsible to the Peko mine manager.

At all times the endeavor of the Peko management is to build up strong, self-reliant, co-operative groups, but with the controlling principle that important and contentious matters should readily flow to the top for decision. A spirit of friendly and constructive co-operation is essential in all operations in relatively remote areas.

About 260 persons are employed by Peko Mines N.L., depending on
the state of activity in construction and development. The distribution is: staff 42; Peko employees 186; and Orlando employees 32.

Owing to general employment difficulties there is an average of about 18 persons who can be considered "ineffective", because of duplication of jobs in personnel training, A.W.L., sickness, accident, authorised leave etc. Turnover of employees (non-staff) is fairly high, with the figures for the last four years as follows:

- 1958 - 188 p.c.
- 1959 - 118 p.c.
- 1960 - 127 p.c.

In the early days (1954-55) before the company established suitable amenities and services, and the town responded, turnover was as high as 300 p.c. Some of this high turnover, of course, was due to the high demand for labor in Australia at that time, and also because the worthwhile effects of the Commonwealth Government's immigration policy still had to be felt in the Northern Territory.

In relatively isolated areas, a hard core of permanents must be encouraged and developed. These employees form the backbone of the operation and carry it through the employment fluctuations. Peko now has an expanding core of permanents, and turnover on the fringes is not so disturbing.

A small company is limited in its capital expenditure on amenities and services, but in Peko's experience this is not serious since even the large, well-serviced communities, in similar areas, have considerable upheavals at times. Nothing can change geography and location, and at Peko we have found that a progressive co-operative effort between company and employees brings a satisfying final result.

In operating on the smaller mines, it is important to achieve stability so that a reasonable state of "normality" is reached as soon as possible. Many small mines, through lack of staff with adequate ability in organising, planning, controlling and leading, can live in a state of crisis, working expensive overtime continuously and sometimes taking precipitate and ill-conceived action because of the overruling pressure on production and survival. Although some confusion is possibly inevitable in the early stage of development of a mine, especially if capital is limited, an atmosphere of "normality" should be sought after as an urgent thing, so that stability and efficiency can be achieved as soon as possible.

**Conclusion**

Since September 1953, when preparations to mine and treat copper ore began, the company has followed a vigorous course of expansion, from 50 tons per day throughput to 500 tons per day. Optimum production for the size of the orebody has now been reached.

Coupled with the expansion at Peko, there has been a vigorous and scientific search for new orebodies. The Orlando prospect now being developed for production is a direct result from this program. As well as Orlando there have been other intersections of interest, some of which warrant further investigation. Actually, in exploration, there is really no such thing as a negative result, because something is always learnt and much knowledge and exploration know how has been acquired by Peko in the last five years.

- And tied in with Peko's expansion has been a determined effort, in proportion to Peko's resources, to improve methods in production and control, to cut costs which are the essence of existence in outback localities, and to apply scientific management principles to the greatest practical extent.

Peko is Australia's youngest important copper mine; it has great aspirations to become the oldest.