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REPORT ON A VISIT TO EGYPT

18 FEBRUARY TO 2 MARCH 1979

BY

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WEST SABAEYA PHOSPHATE MINING PROJECT

INTRODUCTION

1. A detailed technical/economic feasibility study of the project has been completed by Seltrust Engineering Ltd (SEL) in association with the Economic Studies Group of Rendal, Palmer and Tritton (RPT). Alternative methods and types of equipment suitable for overburden removal and mining were evaluated in terms of operating costs, technical and practical considerations. The study also included a review of the beneficiation test work undertaken by the Warren Spring Laboratory, reports prepared by Cremer & Warner Ltd (C & W) and all available geological data.

2. When the phosphoric acid plant and associated superphosphate facilities become fully operational in 1985, between 450,000 and 470,000 tonnes/year of beneficiated phosphate will be required for delivery to the Abu Zaabal factory, based on a moisture content of 3%. This will involve the removal of 3.5 million tonnes/year of overburden, 390,000 tonnes/year of waste rock between the upper and lower phosphate beds, and the production of about 800,000 tonnes/year of run-of-mine ore averaging 23.0% P_2O_5 for transport to the mine beneficiation plant. The excavation of such large tonnages will require a fully mechanised open pit operation, with all the associated workshop and infrastructure requirements. The present inefficient, wasteful, labour intensive, high cost, small scale quarrying operations will be closed down as soon as the new mining/beneficiation complex and associated facilities have been established and fully commissioned.

3. The project was reviewed by Mr J T Roberts (MEDD) and the writer during a visit to Cairo from 18 February to 2 March 1979. Technical discussions were held with Eng Galal, Chairman, and senior engineers of the Abu Zaabal Company, Eng M Ghoneim of GOFI, Mr P Baldwin and Mr P White of C & W, Dr K R Dymott, Mr G J Coslett and Mr I A Johnson of SEL, Mr J G Ody, Mr W A Dell and Mr A Vaher of RPT. Mr E T Barnes accompanied us to West Sabaeya on 24 February to inspect the present mining and barge loading operations, and to discuss the plans for future development.

GEOLOGY AND ORE RESERVES

4. The deposits have been geologically mapped and the phosphorite zones tested over an area of 130 Km^2. The reserves of weathered oxidised ore have been estimated at 86.9 million tonnes based on a cut off grade of 16.0% P_2O_5 and a maximum overburden thickness of 20 metres. However, at least 70% of these reserves are in the possible and geologically inferred category and are subject to significant downward revision. Only the higher quality oxidised ore is at present regarded as economically mineable. The grades range from less than 20.0% P_2O_5 up to 27.5% P_2O_5 with variations in impurities, mainly iron and aluminium oxides, organic matter, silica and chlorides.

5. The deposits are almost horizontal and no major faulting occurs within the proposed mining areas. The phosphate is present in two separate beds, each about one metre in thickness, separated by about one metre of waste rock. The overburden consists of alluvium, gravels, marly sandstones, clays and intrusions of impure limestones.

6. Following a study of all the available borehole sections, assay results, survey plans and other appropriate data, the consultants have selected three mining sites for initial exploitation during years one to five with stripping ratios of 3.5/4.5 overburden to one of phosphate rock. The drill proven reserves total 3.7 million tonnes with an average grade of 23.16% P_2O_5.

7. A further five mining sites have been outlined containing 5.0 million tonnes averaging 22.2% P_2O_5 with a slightly higher stripping ratio. This tonnage will be adequate to provide the run-of-mine requirements during years six to ten.

8. Additional reserves of 10.0 million tonnes will be available for mining during years eleven to twenty. Although closer spaced drilling in this sector of the deposits will be required in due course, present data indicates that the grade will fall to 22.0% P_2O_5 and the overburden to ore ratio is likely to exceed 5 to 1.

MINING AND OVERBURDEN REMOVAL

9. To obtain satisfactory grade control, it will be necessary for three quarries to be operated simultaneously. The overburden will be excavated by a combination of draglines and scrapers. Two of the quarries will be equipped with 3.8 m^3 diesel powered crawler mounted draglines each capable of moving at least 300 tonnes/hour. The third quarry will be operated by a fleet of five 10.6 m^3 scraper units, supporting bulldozers and rippers. This highly mobile plant will be available for use in the dragline quarries as necessary, and all the overburden will be discarded into adjacent mined out areas. The flexibility of the equipment and its designed capacity will permit an adequate rate of ore exposure and provide access to the two phosphate beds for accurate sampling and assaying before extraction.

10. The subsequent mining of the two phosphate beds and the intervening waste rock will be undertaken by six diesel powered track mounted back-hoe hydraulic excavators equipped with 1.3 m^3 buckets. The ore will be delivered to the beneficiation plant by twelve 15 tonne capacity rear dump trucks. Auxiliary operations such as road construction and maintenance, clean up operations in the quarries and other general duties will be handled by rubber tyred bulldozers, motor graders and water bowsers.

BENEFICIATION

11. All the run-of-mine ore will require beneficiation to improve the grade and reduce the impurities to an acceptable level before despatch to the fertilizer plant at Abu Zaabal. The recommended process includes coarse crushing followed by hand picking to reject the oversize siliceous material. Secondary crushing will produce a feed material suitable for processing through a scrubbing (washing), screening and desliming unit to recover a primary product grading 28.0% P_2O_5 to meet the requirements of the phosphoric acid plant. The oversize from the washing section will be processed in a milling and desliming circuit prior to flotation to produce a final concentrate for the manufacture of superphosphate.

12. The plant will be constructed in a worked out section of the deposits adjacent to the proposed mining areas about 4.5 km from the Nile barge loading quay. Tailings from the plant will be pumped by a 3 km pipeline for disposal in a low lying barren desert area.

13. The two phosphate products will be transported to the barge loading station in slurry form by pipeline. Dewatering and drying plant facilities will be provided with associated material handling installations.

BARGE LOADING

14. Two 15,000 tonne capacity stockpiles of dried phosphate (3% moisture) will be maintained at the quay, and four retractable belt feeder conveyors each rated at 500 tonne/hour will be provided for barge loading. The quay will be designed to berth the various types of barge used in the transportation of the raw materials to Shubra, and separate unloading facilities for incoming equipment and stores will be constructed.

MINE AND PLANT SERVICES

15. All the facilities and equipment required for servicing the project, including fully equipped workshops, assay laboratory, stores and office accommodation will be provided within the beneficiation plant area. Routine maintenance of the mining equipment will be undertaken by truck mounted lubrication units, and mobile diesel generator sets will be supplied for emergency lighting in all operating areas.

16. The East Sabaeya substation has a capacity of 25 Mw of which only 3.5 Mw is at present in use. Two submarine cables will therefore be installed to meet the power requirements of the West Sabaeya mining project, and 11 Kv substations will be provided as required.

17. Fuel oil will be delivered to the Nile quay by tanker barge, and distribution to underground storage tanks at the main plant site will be by pipeline.

18. The present plan provides for the construction of housing for all management staff and 50% of the technicians. Manpower requirements will total 692 covering a wide range of skills.

PERIOD OF CONSTRUCTION

19. The project is scheduled to produce run-of-mine ore at an annual rate of 640,000 tonnes by April 1981 to meet the requirements of the phosphoric acid plant, with a progressive increase to 800,000 tonnes/year by 1985. Additional drilling, sampling and assaying in the proposed mining areas, the recruitment of senior management staff and technicians, training, final mine planning, detailed engineering, civil construction work and equipment procurement must therefore proceed without delay.

PROJECT IMPLEMENTATION

20. Due to the very limited time available (two years) it is proposed that a Management Agent (Seltrust Engineering Ltd) should be appointed to assist the Abu Zaabal Company and GOFI in the implementation of the project. The Managing Agents would -

(a) Prepare detailed mine plans.

(b) Undertake detailed engineering design work for the beneficiation, loading and service installations.

(c) Act as Purchasing Agents for the procurement of all off shore equipment, prepare detailed plant specifications, issue enquiries to appropriate suppliers, evaluate tenders with representatives of the Abu Zaabal Company and GOFI in London, place orders, expedite manufacture, inspect on completion, arrange shipment, check and certify all invoices prior to submission to the Crown Agents for payment.

(d) Provide a Resident Engineer and staff to manage and supervise construction following delivery to site.

(e) Monitor the performance of selected contractors, maintain appropriate records and assist with commissioning trials.

PROJECT MANAGEMENT AND TRAINING

21. A fully integrated management organisation will be required to operate the project and it is recommended that the General Manager should be a Director of the Company. He would be supported by a Chief Engineer and an Administration Manager in accordance with detailed recommendations made by the consultants.

22. Due to the isolated location of West Sabaeya, both from the head office in Cairo and the fertilizer factory at Abu Zaabal, the mining operation will have to be completely self supporting. Senior management personnel must therefore be recruited as soon as possible. The possibility of transferring experienced engineers, staff and technicians from the Aswan iron ore mine which is scheduled for closure in the near furure should receive early consideration by GOFI and the Abu Zaabal Company.

23. Short term training of selected engineers in the UK will be necessary, including attendance at courses provided by manufacturers and visits to appropriate mining/beneficiation plants. Operator training during the field commissioning period will also be required, with on-site assistance by UK engineers for a further period of at least three years.

RECOMMENDATION FOR FURTHER STUDY

24. The exploration work previously undertaken at a grid spacing of 200 metres shows that the grade, bed thickness and topography of the base of the phosphate beds can all change rapidly in the proposed mining areas. A further programme of pitting and diamond core drilling, consisting of 96 holes spaced at 100 metre intervals, each about 12 to 15 metres deep, is therefore required to obtain a clearer understanding of the variations that can be expected. A suitable diamond core drill and operating personnel can be provided by the Geological Survey Department. It is recommended that this further geological work should be supervised by the consultants (SEL) in accordance with the request made by the Abu Zaabal Company.

S D Day
Mining Adviser

16 March 1979