The mineable reserves are therefore calculated as follows:

<table>
<thead>
<tr>
<th>In situ reserve (estimated)</th>
<th>MILLION TONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,219</td>
<td></td>
</tr>
<tr>
<td>Less area of 90 N10 stope currently being mined.</td>
<td>0,278</td>
</tr>
<tr>
<td>Actual in situ reserve is therefore.</td>
<td>3,941</td>
</tr>
<tr>
<td>Deduction for a geological loss of 10% and for loss due to regional pillars (4%).</td>
<td>3,389</td>
</tr>
<tr>
<td>Extraction of 90% within stopes (see section 4.4).</td>
<td>3,050</td>
</tr>
</tbody>
</table>

The actual mineable reserve is therefore estimated at 3,050 million tons at a reef width in excess of 2 metres.

**ROCK MECHANICS CONSIDERATIONS**

Certain rock mechanics recommendations have been made and these are discussed below:

4.1 **Overstoping**

The UE1A Reef lies 20 metres to 40 metres above the E8 horizon and it is essential that maximum extraction of the UE1A Reef is achieved; the percentage extraction on the E8 Reef horizon will only be maximised if maximum extraction of the UE1A takes place. This conclusion is the result of observations in current E8 Reef stopes at Cooke 2, where a highly loaded pillar on the UE1A Reef horizon has necessitated that larger than standard pillars be left on the underlying E8 Reef horizon in order to ensure stope stability.

4.2 **Regional Pillars**

All regional pillars on the UE1A Reef horizon should be superimposed on identical regional pillars on the E8 Reef horizon.
4.3 Primary and Secondary Extraction

It is planned that production will take place in two stages; a sequence of primary and secondary extraction operations has definite advantages as follows:

4.3.1 The pillars initially developed in the primary operation will be larger than required and will therefore have a high factor of safety.

4.3.2 The maximum recommended bord(room) spans are 10 metres on primary mining. However, these spans can be allowed to exceed 10 metres following a secondary extraction stage on retreat when the worked out areas will then be abandoned and barricaded.

4.4 Pillar Size and Percentage Extraction

When the E8 Reef is overstoped the E8 Reef horizon will be destressed and consequently the pillar loads will be low. Pillars of widths of 1 to 1.5 times the stowing width will be stable and it is planned that pillar sizes on primary mining will be 7 metres x 10 metres with the final size of pillars, following a secondary extraction stage, being 5 metres x 5 metres. Final extraction is expected to be 90%. A memorandum from the Rock Mechanics Engineer dated 17 January 1984 relating to pillar sizes during primary and secondary extraction stages is in Annexure 1.

5. MINING DESIGN AND PLANNING

5.1 Production Parameters

It is envisaged that the maximum planned production from the operation will be 40 000 tons/month on a double shift basis. If it is assumed that the mineable reserve is of the order of 3 million tons as previously estimated, the life of the operation is therefore considered to be in excess of six years.

The production build-up to March 1986 (planned maximum production of 40 000 tons/month in January 1986) is shown in Schedule IA.
5.2 GENERAL MINING LAYOUT

5.2.1 Primary Development

Development of the area has commenced on 90 level elevation. Initially contour reef drives are being developed from the 90 N11 crosscut and from these drives, decline winzes (access ramps) will be developed on true dip at approximately 150 metre centres. When a decline has holed into a bottom access airway / travelling way, stoping will commence. The general development showing contour drives and winzes is seen in Fig. 4. Dimensions of the drives and declines will be 8 metres wide x 4 metres high.

5.2.2 Primary Stoping

The method of mining selected for this operation is the stepped room and pillar system. The general stoping configuration is shown in Fig. 5 with the detailed layout of rooms and pillars shown in Fig. 6. Rooms will be developed on true strike with access holings 60° down dip of strike being developed at 14 metre centres.

5.2.3 Secondary Extraction

Secondary extraction will be carried out when primary stoping in any winze connection is complete. During secondary extraction operations partial extraction of pillars will take place on retreat; pillars being reduced in size in stages to minimum dimensions, (refer to rock mechanics recommendations in Annexure 1). The stages in the partial extraction of pillars are shown and described in Annexure 2.

CYCLE OF OPERATIONS/...........
FIG. 6

STOP E LAYOUT

2b 2a

PANEL 2

1b 1a

PANEL 1

permanent pillar

STRIKE PILLAR REMOVAL

PLAN

SECTION

TRACKLESS MINING SYSTEM: DETAILED PANEL LAYOUT

Scale 1:200

FIG. 6
5.3 CYCLE OF OPERATIONS

5.3.1 Drilling and Blasting

Drilling during stoping operations will be carried out by electro-hydraulic two boom drill rigs. Blasting will take place twice a day at the end of each shift.

It is planned to use Nonel S.P.D. detonators. The face shape of a panel as depicted in Fig. 6 will provide for a leading face with a slashing panel approximately 3 metres behind. It is expected that by using Nonel S.P.D. detonators that most of the reef blasted on the slashing panel will be thrown into the lower leading panel.

5.3.2 Cleaning Operations

Cleaning operations will be carried out by 3,8m³ L.H.D. units (Toro 350D units) loading into 18 ton Volvo trucks. Loading of the trucks will take place in the access ramps where a height of 4 metres will be available, the L.H.D. units tramming to the access ramps on strike. Loading of reef by L.H.D. unit will mainly take place on the lower panel level, any reef left on the slashing panel being transferred only to the lower panel in order to prevent any machine slipping over the edge of the slashing panel.

The trucks will transport the reef to a main tip via the access ramps and along strike haul roads (reef drives). These roadbeds will be prepared using crushed stone from the development operations and concreted where necessary. These haul roads developed at 8 metres wide will allow two vehicles to pass each other without the necessity for passing loops. The detailed layout of the main tip in the 90 N11 crosscut is shown in Fig. 7. Transfer will take place to 101 level via a main ore pass (still to be developed by raise borer in January 1983), layout given in Fig. 8. Reef will then be trammed to the station on 101 level streamlined transport system.
Plan of 90 Nt Tip

NOT TO SCALE.

DOUBLE GRIZZLEY

SLIPING
TO BE
DONE

RAISE
BORE
HOLE
2.4m DIAM.

THIS AREA TO BE
6m HIGH FOR TIPPING

SOLID
14m x 4.8m.

90 Nt x-CUT N.

SLIPING
TO BE DONE

5m

TRUCK TURNING POINT
Section not to scale showing 101 and 90 NII.

Raisebore 101 to 90
106m @ +75° (2.4m diam)

Frackless mining area.

Airway - Travelling way from 101
118m @ +34½° 4.0 W x 3.5 H
5.3.3 Support

Recommended support system in the development and primary stoping operations consists of 2.7m x 25mm full column resin rebar on a 2 m x 2 m pattern.

Rock mechanics recommendations showing detailed sketches of the support systems for development and primary stoping are given in Annexure 3.

During secondary extraction, because operations are being carried out on retreat it will not be necessary to install the above support when pillars are being reduced in size (see Annexure 2), and depending on actual experience, support recommendations will be made when secondary mining takes place.

5.4 VENTILATION

5.4.1 Air Required

The total volume of air required to satisfy all criteria for this project including double shift multi-blast operations (fixed time blasting at the end of each shift), is 140m³/sec.

5.4.2 Stope Ventilation

Stope faces will be ventilated by air jet fans operating in conjunction with force fans and flexiduct tubing (refer to Fig. 9 for a sketch of the proposed stope ventilation layout).

It is envisaged that a three hour re-entry period at the end of each production shift will be approved by the I.O.M. in terms of this layout and the overall ventilation reticulation system.
5.5 **EQUIPMENT**

Details of equipment available for Phase 1 of the project and the total equipment now required for Phase 2 of the project is detailed in Schedule 1B.

The actual delivery dates of all equipment required for Phase 2 of the project are given in Schedule 1B.

The production build-up (Schedule 1A) will depend on the timeous delivery of this equipment; if the delivery of the equipment is not according to Schedule 1B planned production from this project could be jeopardised.

5.6 **WORKSHOP REQUIREMENTS AND OTHER ENGINEERING CONSIDERATIONS**

5.6.1 **Workshops**

Workshop facilities are available in the 90 N11 crosscut in close proximity to the E8 Reef development (refer to Fig. 10 for actual layout of the No. 1 Workshop).
This workshop can service all present equipment being operated as at December 1984.

A second workshop No. 2 Workshop is currently being developed inbye of the No. 1 Workshop in the 90 N11 crosscut.
This workshop, when complete will (in conjunction with the No. 1 Workshop) provide for full workshop and maintenance facilities for the total fleet of equipment for Phase 1 and Phase 2 of the project (refer to Fig. 11 for layout of the No. 2 Workshop).

Rock mechanics considerations have been taken into account in the development and layout of these workshops with cognizance taken of the stoping layout on the E8 Reef horizon.
5.6.2 Maintenance of Equipment

Maintenance of all trackless equipment is being carried out strictly in accordance with planned schedules.

5.6.3 Fuel Supply

At the present time fuel is being transported underground by rail fuel tankers to 90 level and pumped into temporary storage tanks in the 90 N11 crosscut. However, it is planned to install an automatic bulk diesel fuel transfer system whereby fuel will be pumped from a surface storage tank (installed) down the Auxiliary Shaft via 90 level haulage by pipeline to bulk storage tanks positioned between the No. 1 Workshop and the No. 2 Workshop. Full details of the system are detailed in Annexure 5 page 55).

5.6.4 Access of Equipment to the Mine

All trackless equipment has been transported through Cooke 2 Shaft to 90 N11 crosscut via the 90 level haulage. The dimensions of the compartment of the Cooke 2 Main Shaft have dictated that all the equipment be stripped on surface and re-assembled underground. No problems have occurred during these operations except for the obvious inconvenience and time constraints.

LABOUR

Full details of all labour complements (C.W.S., N.C.W.S. for mining and engineering) are given in 1C, 1D, 1E and 1F; these schedules reflect the increases in complements as the production build-up takes place.
7. TRAINING

Training of all operators and artisans is of vital importance to this project and this training has commenced. All suppliers of trackless equipment provide training programmes for their equipment which comprises part of any package deal when positioning such equipment. Additional training programmes have been devised and implemented for all responsible officials.

3. EFFICIENCIES

8.1 N.C.W.S. Labour

Current labour planning in the conventional wide reef stopes is of the order of 9 tons/N.C.W.S./shift (stope labour) and in general this figure is being achieved. It is therefore necessary to plan for a N.C.W.S. stope complement (mining only) of 185 in order to achieve 40 000 tons/month production in conventional wide reef stopes. In addition stope preparation crews and winch moving crews will increase the mining complement by 54 N.C.W.S. labour for the preparation of the conventional wide reef stopes. Further tramming crews, transport crews and haulage maintenance personnel for tramming of reef from conventional stopes will require an ancillary N.C.W.S labour force of 78 (for haulages).

The engineering complement (N.C.W.S) for conventional wide reef stoping at present is for (4 artisans) 4 aides and 8 unskilled labourers; a total N.C.W.S. complement of 12.

A total N.C.W.S. complement for the trackless operation for 40 000 tons/month is calculated to be 102 (detailed in Schedule 1D and 1F).

The comparison of these complements and calculated efficiencies are as follows:

CONVENTIONAL/TRACKLESS............