

**URANIUM CORPORATION OF INDIA LIMITED**  
**(A Govt. of India Enterprise)**

**PROJECT REPORT**

**FOR**

**KYLLENG-PYNDENGSOHIONG**

**URANIUM MINING & MILLING PROJECT,**

**MAWTHABAH**

**EXECUTIVE SUMMARY**

## PROJECT AT A GLANCE

• Project Title	:	Kylleng-Pyndengsohiong Uranium Mining & Milling Project, Mawthabah
• Owner	:	Uranium Corporation of India Limited
• Project location	:	West Khasi Hills District, Meghalaya
Uranium Mines	:	Killung & Rangam
Plant	:	Mawthabah
Township	:	Mawthabah
Nearest railway station	:	Guwahati
Nearest Airport	:	Shillong (130km from Project Site)
• Survey of India Map	:	78 O/3, 78 O/7 (both Restricted)
• Ore Reserves & Capacity		
Mineable Ore Reserve	:	9.22 Million Tonnes @ average grade of 0.088% U <sub>3</sub> O <sub>8</sub>
ROM Ore Grade	:	0.085% U <sub>3</sub> O <sub>8</sub>
Plant Capacity	:	3,75,000 MT ore/year 1500 tonnes per day (tpd) ore 271 MT U <sub>3</sub> O <sub>8</sub> per year
• Plant life	:	24 years (approx)
• Land Requirement	:	351 Ha.
• Water Supply		
Source	:	Wahphodthra River
Requirement:		
Process Plant	:	3000 m <sup>3</sup> /day
Mines	:	900 m <sup>3</sup> /day
Township	:	340 m <sup>3</sup> /day
Miscellaneous	:	260 m <sup>3</sup> /day
<b>Total</b>	:	<b>4500 m<sup>3</sup>/day</b>
Distance from Plant	:	2-3 km

- Electricity Supply

Source	:	Nongstoin Sub-station
Voltage Level	:	132 KV
Requirement		
Plant	:	7.0 MW
Township	:	2.0 MW
Mines	:	2.0 MW
<b>TOTAL</b>	<b>:</b>	<b>11.0MW</b>

- Distance between
 

Plant and Mines	:	6Km ( along Road)
Mines & Township	:	4Km    „
Township & Plant	:	2Km    „

- Major Raw Material and Consumables in plant

<u>Raw Material</u>	<u>Consumption per annum</u>	
Uranium ore	3,75,000	MT
Sulphur	11,138	MT
Pyrolusite	4,500	MT
Limestone	15,000	MT
Lime	18,750	MT
Grinding Media	375	MT
Flocculent	26	MT
Precoat material	173	MT
Sodium Chloride	1,313	MT
Magnesia	75	MT
Barium Chloride	15	MT
Ion Exchange Resin	11	m <sup>3</sup>
Caustic Soda Flakes	12	MT
LDO	1,425	KL
Ferric Alum	58	MT

- Major Raw Material and Consumption in mines.

<u>Raw Material</u>	<u>Consumption per annum</u>
Diesel Oil	2,500 KL
ANFO	285 MT
Other Explosives	190 MT
Barium Chloride	493 MT
Ferric Alum	296 MT

- Man Power
 

Mines	:	226
Plant	:	237
<u>Common Services</u>	:	<u>135</u>
<b>TOTAL</b>	:	<b>598</b>
- No. of Quarters : 400 (200 nos. in 1<sup>st</sup> Phase + 200 future)
- Project Execution Schedule : 42 months
- Total Project Cost : 814.66 Crores  
(Based on December, 2003 Price level)

## EXECUTIVE SUMMARY

### 1.0 INTRODUCTION

Uranium Corporation of India Limited (UCIL), a Government of India Enterprise established in 1967 under the administrative control of the Department of Atomic Energy (DAE), owns and operates four uranium mines at Jaduguda, Bhatin, Narwapahar and Turamdih and one ore processing plant at Jaduguda in East Singhbhum district of Jharkhand. UCIL has also opened up another underground mine at Bagjata and one opencast mine at Banduhurang and construction of another ore processing plant at Turamdih is under progress in the Singhbhum belt.

The demand of uranium is increasing and UCIL is endeavouring to expand its activities to new uranium ore mining and processing plant. Information about uranium ore deposit at Killung and Rangam of West Khasi Hills district of Meghalaya was first learnt in 1983-84. Thereafter, in 1987, intensive and fast exploration work was carried out for quick appraisal of the deposit and estimation of the reserve.

Two uranium ore deposit blocks named Killung and Rangam were identified with a total reserve of 9.22 million tones having average grade of 0.088 %  $U_3O_8$ . The ore body is confined within 45 m depth from the surface with ore: overburden ratio of 1:6.7. The estimated life of these two blocks is about 24 years at the rated annual production of 0.375 million tones. The proposed uranium ore mining and processing project is named as Kylleng-Pyndengsohiong Uranium Project (K-P Uranium Project), Mawthabah.

### 2.0 DESCRIPTION OF THE PROJECT

#### Location

The project area is located on the Southern slopes of Meghalaya plateau in West Khasi Hills District of Meghalaya. It falls in Survey of India Topo Sheet No.78O/3 at Latitude  $25^{\circ} 18' N$  to  $25^{\circ} 19' N$  and Longitude  $91^{\circ} 11' E$  to  $91^{\circ} 13' E$  approximately.

The process plant was proposed to be located towards north of Domiasiat village. Now it has been decided to relocate the process plant at Mawthabah, south-west of Kylleng (mines)

The project area is connected with Shillong via Mawkyrwat and Wakhaji by 74km all weather pitch road from Shillong to Mawkyrwat and 45km all weather kutcha road from Mawkyrwat to Wakhaji. Alternatively it is connected with Shillong via Wakhaji and Nongstoin. The 8km road between Wakhaji & Domiasiat is a fair weather Kutcha road and is presently negotiable by only 4 wheel drive vehicles. A 20km road from Wakhaji to Mawthabah via Nongtynger and Nongbah Jynrin villages is under construction.

## Land Requirement

The estimated land requirement is about 351 Hectares. The detail breakup is as follows:

Description of Facilities	Area Requirement (Ha)
Deposit Area (Killung +Rangam) :	125
Initial OB Dump Area :	39
Initial Tailing Disposal Area :	10
Mine Facility :	28
Mine Plant Road Corridor (Length 4.5 km, width 50m) :	23
Plant Raw Water Intake road Corridor: (Length 3.0km, width 50m) :	15
Process plant :	93
<u>Township</u> :	<u>18</u>
Total :	351

## Topography and Drainage

The physical features of the land in the vicinity of the uranium deposit are southward dipping with deeply cut gorge sections of Umsophew and Wahphodthra rivers. The general drainage in the area is towards southwest through various nullahs viz. Mawkhan Nullah, Phot Rangam are tributaries to Wahphodthra. Sindumdum Nullah and Sngnet Nullah are tributaries to Umsophew river. These rivers flow down to meet Kynshi River also called Jadukata River. The general topography of the area being undulating with occasional steep slopes, locating large plot of land with flat elevation is difficult.

The land is also covered by vegetation of shrubs and bamboo's.

The general elevation of the area under consideration varies between 500 to 1070m above Mean Sea Level. Mawthabah village is at an elevation of 550m above MSL. The Uranium deposit in Killung block is having a variable ground elevation ranging from 750m to 900m above MSL while the same for Rangam block varies between 760m and 880m above MSL. The plant has a general elevation of 500m above MSL, while mine facilities area has a general elevation of 820m above MSL

### **3.0 DESIGN BASIS AND PLANT CAPACITY**

The plant has been designed to treat 3,75,000 TPA of uranium ore to be mined in phases from Killung & Rangam mining blocks considering a plant life of about 24 years. The plant is estimated to produce on an average of 271 TPA ( as  $U_3O_8$  ) of yellow cake.

Due to heavy rainfall in the area, round the year mine/plant operation is not feasible. Therefore, it is assessed that mine and plant will effectively operate for 225 and 250 days per year respectively. Salient features of the design basis is presented below:

## PLANT CAPACITY

Ore mining	TPA	3,75,000 (Dry)
Ore processing rate	TPD	1500
U <sub>3</sub> O <sub>8</sub> content in ore	% (w/w)	0.085
Overall recovery (U <sub>3</sub> O <sub>8</sub> )	%	85
Production rate (as U <sub>3</sub> O <sub>8</sub> )	TPA	271
Ore Density	T/m <sup>3</sup>	2.5
Ore Moisture content	% by wt.	5

## PLANT OPERATION SCHEDULE

Effective Number working days	Days/year	250
Number of shifts per day (Crushing)	Shifts/day	2
Number of shifts per day ( Process Plant)	Shifts/day	3
Working hours per shift	Hours/shift	8

## 4.0 PROJECT FACILITIES

The major project facilities consist of uranium mines, process plant and associated infrastructure, which are summarized as follows:

### MINES

#### Exploration and ore reserves

The deposits have been explored in detail by AMD with the help of 384 nos. of boreholes covering 16,575m of drilling. Computerized ore body modeling and geo-statistical application have been utilized to define deposit parameters and for ore reserve estimation. Mineable reserves at 0.02% U<sub>3</sub>O<sub>8</sub> cut-off are estimated to be 9.22 million tones. Estimated overburden and interburden waste is about 62 million tones.

### Mining

Mining is proposed to be carried by drilling and blasting. While the blasted overburden is loaded by hydraulic shovels and sent to overburden dumps using dumpers, the blasted ore is loaded on hydraulic excavators onto dumpers and then hauled to the primary crusher at the loading station in the mine. The mining method envisages concurrent back filling in mined out areas by overburden and tailings produced in the plant.

## Mine Capacity and operating Schedule

• Mine productions (Ore)	:	3,75,000 tpy
(Waste)	:	2.5 mtpy
• Effective No. of Days	:	225
• No. of Shifts/day	:	2
• Working Hrs./Shift	:	8
• Daily Ore Production (Dry basis)	:	1667 tpd
• ROM Ore Grade	:	0.085% U <sub>3</sub> O <sub>8</sub>
• Moisture in Ore	:	≈ 5%

## Mining Equipment

Following mining equipment are proposed

• Rear Dumpers	25 T	29 Nos.
• Hydraulic Front Shovels	2.2m <sup>3</sup>	4 Nos.
• Hydraulic Back Hoes	1.6m <sup>3</sup>	3 Nos.
• Wheel Loaders	3.3m <sup>3</sup>	2 Nos.
• Blast Hole Drills	100-112mm	7 Nos.

## Schedule of mining operation and mine life

The block-wise mineable estimates for ore and overburden formed the basis for detailed mine planning. The annual ore tonnage is fixed at 3,75,000 with corresponding overburden production of about 25,00,000 tonnes. This gives an ore to overburden ratio of 1:6.7. It is assessed that the plant production build up would be 80% in the first year, 90% in the second year and 100% from 3<sup>rd</sup> year. The ore produced shall have an average grade of 0.085% U<sub>3</sub>O<sub>8</sub>. The estimated life of the mine shall be approximately 24 years.

## PROCESS PLANT

The process technology adopted for the proposed plant at Mawthabah is similar to that being followed at UCIL's uranium ore processing plant at Jaduguda. The process plant will treat sandstone based uranium ore mined from captive mines at Killung and Rangan. Primary crushed ore from mines shall be transported to the process plant by means of dumpers.

A rod mill-ball mill combination for wet grinding of ore with closed circuit hydro-cyclones is envisaged. Ground and classified ore (cyclone overflow) is thickened in high rate thickener and filtered to produce neutral cake having about 20% moisture. The cake is repulped to produce 60% slurry and pumped to the acid leaching section.

Two stages acid leaching has been envisaged for maximizing extraction efficiency. In the Acid Leaching section, the ground ore cake is subjected to sulphuric acid leaching to extract uranium from ore body into liquor phase. Leaching is carried out at temperature of 45-50<sup>o</sup> C achieved with direct steam injection. Pyrolusite is added to maintain an oxidation environment. The leached slurry is filtered and washed in horizontal vacuum belt filters. The washed cake is subsequently neutralized and disposed off to tailings pond. The leach liquor is further filtered in pre-coat filters to remove suspended solid particles. The resultant liquor, called pregnant liquor is sent to ion exchange unit for recovery of uranium from leach liquor.

In the Ion-Exchange section, the pregnant liquor is passed through a set of ion exchange resin beds where uranium from pregnant liquor is adsorbed on resin material. The adsorbed resin is eluted with sodium chloride salt solution to desorb uranium from resin body into aqueous solution. The liquor thus obtained is subjected to precipitation of excess ferric ion in iron precipitation, thickening and filtration circuit. The purified liquor is sent for MDU precipitation.

In the MDU section, Magnesia solution is added to the purified liquor in a series of precipitation tanks where Magnesium di-uranate is precipitated. The precipitated cake is thickened, filtered & washed. The washed cake is dried in a Spray Drier to produce the final product known as yellow cake containing about 70% by weight of U<sub>3</sub>O<sub>8</sub>. The dry powder having about 3% (max) moisture is weighed and packed in steel drums for final storage and transportation to Nuclear Fuel Complex (NFC), Hyderabad.

Prior to disposal, tailings slurry shall be neutralized in two steps in this unit. The bulk of acid shall be neutralized by raising the pH to 3.5 with addition of limestone slurry and the final pH rise to 10.5 shall be achieved by dosing of lime slurry.

The neutralized tailings shall be thickened in a TTD thickener and disposed off in a separate area near plant for initial 5 years. After 5 years the thickened tailing slurry shall be sent to the mines for back filling. Overflow from the TTD thickener will be separately disposed to the environment after treatment in the Effluent Treatment Plant (ETP)

## **INFRASTRUCTURE FACILITIES**

Major facilities considered for the project are

- Township
- Raw water supply, treatment and distribution.
- Drinking water supply to Township & mines.
- Power supply to plant, township & mines.
- Communication system.
- Mines-Plant Link Road.
- Construction facilities.

## 5.0 ENVIRONMENTAL POLLUTION CONTROL MEASURE.

Solid, liquid and gaseous effluents are generated in various processing and non-processing areas, which are required to be contained in an environmentally acceptable manner. Keeping in view the requirements of the environment protection, adequate pollution control measures have been adopted in the design of proposed Uranium Ore Processing Complex.

## 6.0 PROJECT SCHEDULE & EXECUTION PHILOSOPHY

The Project implementation philosophy aims to ensure mechanical completion of 40 months from zero date. Its key ingredients are listed below:

- Project Execution under the responsibility of a small Project Team headed by UCIL Project Manager.
- Process Technology Package from UCIL is available.
- Project is implemented by competent Engineering, Procurement & Construction Management (EPCM) consultant.
- Equipment Sourcing is done from competent national and international suppliers.
- A contract strategy to ensure an optimized number and size of turnkey and supply packages including site contracts.
- Early development of site infrastructure & communication system.

A period of 2 months is envisaged for the commissioning of the Plant.

As per the schedule, mine shall be ready for the regular production of Ore in the 38<sup>th</sup> month. The gap of 4 months completion time between mine & plant shall be used to create various stockpiles and overcome initial difficulties of operation.

## 7.0 ORGANISATION AND MANPOWER

Manpower requirement for operation of the mine, process plant and related facilities have been estimated based on the general practices followed in the similar industries and inputs from existing facilities from UCIL. It is envisaged that some of the services like light vehicle operation, cleaning, canteen facilities etc. shall be carried out through contracts. The manpower estimates are summarized as follows:

Mines	:	226
Process Plant	:	237
Common Services for mines, plant and township	:	<u>135</u>
<b>Total</b>	<b>:</b>	<b>598</b>