1.0 EXECUTIVE SUMMARY:

Narwapahar Uranium Mine is operated by Uranium Corporation of India Ltd Jaduguda (UCIL). It is located in East Singhbhum District of Jharkhand. Besides Narwapahar Mine, UCIL also operates Jaduguda, Bhatin, Bagjata, Turamdih, Banduhurang and Mohuldih Mines and Uranium Ore Processing Plants at Jaduguda and Turamdih in the region. Narwapahar Mine Lease is spread over 456.62 ha land under villages Hartopa, Murgaghutu, Patharchakri and Rajdah. The mine lease area also includes 25.56 ha of Forest Land. Mining lease for Narwapahar Mine was accorded by the Department of Mines and Geology, Government of Jharkhand vide letter reference no. B/M-6-104/95/1115/M, Ranchi dated 24.06.2005 for 30 years w.e.f. 27.01.1983. Lease was valid upto 26.01.2013. Application for lease renewal for next 20 years has been done vide letter reference no. 01/2012 dated 13.01.2012. As per the Gazette of India Notification vide no. 372 dtd. 18.07.2014 under MCR 2014, the lease was deemed renewal till 17.07.2016. In exercise of the powers conferred by section 11B of MMRD Act 1957, the Central Government has notified the Atomic Mineral Concession Rule, 2016 (AMCR, 2016) on 11th July 2016. The rule has become effective from the date of its notification i.e. 11th July 2016. As per the Rule 11 of AMCR 2016, "The mining leases granted under these rules, shall be granted for a period until the entire reserves of such minerals in the mine is exhausted: Provided that an existing mining lease as on date of coming into force of these rules granted to a Government company for extraction of prescribed substances including uranium or thorium shall be deemed to have been granted for a period until the entire reserves of such minerals in the mine is exhausted". According to the above rule, the mining lease of Narwapahar mine has been extended for a period until the entire reserves is exhausted. The project had received environmental clearance from Department of Environment, Forests & Wildlife, Govt. of India vide letter no. J – 11015/13/83/En.2/IA dated 12th November, 1987. Clearance for diversion of Forest Land had been accorded by the Ministry of Environment & Forest, (MoEF) Government of India, New Delhi vide letter No. 8-204/85-FC dated 11th June 1987. MoEFCC has granted ToR vide ToR issued vide letter no. J-11015/530/2008-IA.II(M) dated 01.04.2014. Extension of the validity of ToR issued by MoEFCC vide letter no. J-11015/530/2008-IA.II (M) dated 4th July, 2016 for enhancement of production of Narwapahar mines from 0.3 million TPA to 0.45 million TPA. EAC has recommended the proposal for EC in the meeting held on 21.03.2017.

The mine commenced operation in 1995. Narwapahar mine is one of the most mechanized underground metalliferrous mines in India and has been developed up to a depth of 380 m i.e. 6^{th} level. Entry to the mine is through a vertical shaft and a 7^{o} decline. The present proposal envisages enhancing the production from 0.45 million TPA to 0.60 million TPA without any leasing or acquisition of additional land. Presently the ore is transported to Juduguda Ore Processing Plant by covered trucks. The same shall continue. The additional ore will be transported to the proposed processing facility near the mine.

The salient features of the project include:

Proposal	Augmentation of capacity of Narwapahar from 0.45 million TPA to 0.60 million TPA without increase the mining lease area
Location of Project	Villages Hartopa, Murgaghutu, Patharchakri, Rajdoha Block – Potka; Dist. East Singhbhum, State - Jharkhand
Latitude	22^0 40’ N to 22^0 45’ N
Longitude	86^0 15’ E to 86^0 20’ E
Land Ownership of Lease Area	Narwapahar Mine Lease is spread over 456.62 ha land under villages Hartopa, Murgaghutu, Patharchakri and Rajdoha. The mine lease area also includes 25.56 ha of Forest Land.
Method of Work	Mechanized underground working by Horizontal Cut and Fill (HCF) method.
Mineral Reserve	5.9 Mt as on August 2017
Production capacity	Existing: 0.45 Mt/yr Proposed: 0.60 Mt/yr.
Waste Generation	~1,80,000 t/yr
Waste disposal	100% of the waste rock shall be utilized in stowing u/g voids. However waste rock generated during shaft sinking 25000 t/year (i.e. 75000 t) during three years will be dumped externally in northern part of lease.
Mineral Transport	By trucks to Ore Processing Plants in singhbhum (~15 km haulage)
Mineral Processing	At ore processing plant, the uranium is extracted as Yellow Cake by a hydro-metallurgical process. The Yellow cake is dispatched to Nuclear Fuel Complex Hyderabad for further processing.
Working Regime	3 shifts per day; 300 working days per year.
Life of Mine	11 years from April 2017
Peak Water Demand	Total 3316 m^3/day. Industrial: 1860 m^3/day: Potable: 1456 m^3/day

Source of water	Industrial: Treated Mine discharge and Treated Sewage. Potable: Gara River a tributary of Subarnarekha River. Drawn at UCIL's Barrage at Jaduguda. Raw water is treated in WTP and piped to Narwapahar.
Power Demand	Present: 5.0 MW; Adequate for expansion also.
Source of power	Jharkhand State Electricity Board's Ichra Sub-station
Man Power	Present: 999; Additional 200 persons shall be required for expanded mine.
Explosive Consumption	Present: 1.1 tons /day; Proposed: 1.8 tons /day (total).
Fuel Consumption	Present: 690 kl/yr; Proposed: 850 kl/yr (total)
Infrastructure	New Winding and hoisting system shall be added
Proposed Investment	300 crores.
Production Cost	Classified Information
CSR Budget	2% of net profit

The proposed expansion project will improve the supply of uranium ore which will provide fuel for India's expanding nuclear energy programme. The expansion project will generate both direct and indirect employment. The project will pave the way for peripheral development in a predominantly tribal area.

2.0 INTRODUCTION OF THE PROJECT / BACKGROUND INFORMATION :

2.1 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT:

Narwapahar mine is an existing underground uranium mine spread over 456.62 ha about 9 km south-east of Jamshedpur city in East Singhbhum District of Jharkhand. The mine is presently working with a production capacity of 0.45 million tonnes per year (Mt/yr). It is planned to increase the same to 0.60 Mt/yr without change in mine lease area.

The mine is owned and operated by Uranium Corporation of India Limited (UCIL), Govt. of India Undertaking under the Department of Atomic Energy. UCIL's existing mining operations are spread over Jharkhand and Andhra Pradesh. UCIL is operating six underground mines (Jaduguda, Bhatin, Bagjata, Turamdih, and Mohuldih in Jharkhand and Tummalapalle in Andhra Pradesh) and one open cast mine (Banduhurang in Jharkhand). UCIL also operates uranium ore processing plants at Jaduguda and Turamdih in Jharkhand and Tummalapalle in Andhra Pradesh to extract the uranium present in the ore. The uranium present in the ore is extracted as magnesium-di-uranate (at the Jaduguda and Turamdih plants) or as sodium-di-uranate (in the

Tummalapalle plant) also known as "Yellow Cake". The yellow cake is dispatched to Nuclear Fuel Complex, Hyderabad for further processing.

2.2 BRIEF INFORMATION OF THE PROJECT:

Narwapahar Mine is an underground mine being operated by Uranium Corporation of India Ltd. The mine is located in Potka Block of East Singhbhum District of Jharkhand about 9 km south-east of Jamshedpur city. Narwapahar mining leasehold area of UCIL measures 456.62 ha (1128.32 acres) of which 199.57 ha (493.15 acres) is under village Hartopa, 26.46 ha (65.39 acres) is under village Patharchakri, 196.54 ha (485.65 acres) is under village Murgaghutu and 34.05 ha (84.13 acres) is under village Rajdoha. The leasehold area consists of private land (302.85 ha), forest land (25.56 ha) and government land (128.21 ha). Of the total leasehold area, 162.59 ha (124.37 ha private land + 38.22 ha government land) has been acquired.

Grant of mining lease of 1128.32 acres (456.62 ha) area for 30 years w.e.f. 27.01.1983 as per Rule 22 (i) of MCR, 1960, has been accorded by the Department of Mines and Geology (DMG), Government of Jharkhand (Ref; B/M-6-104/95/1115/M, Ranchi dated 24.06.2005). Lease was valid up to 26.01.2013. Application for lease renewal for next 20 years has been done vide letter reference no. 01/2012 dated 13.01.2012. The project had received environmental clearance from Department of Environment, Forests & Wildlife, Govt. of India vide letter no. J–11015/13/83/En.2/IA dated 12th November, 1987.

Forest diversion Land had been accorded by the Ministry of Environment & Forest, (MoEF) Government of India, New Delhi vide letter No. 8-204/85-FC dated 11th June 1987. At present the mine is operating with rated capacity of 0.3 Mt/yr. It has been planned to raise the annual production to 0.45 Mt/yr. MoEFCC has granted ToR for enhancement of production of Narwapahar mines from 0.3 million TPA to 0.45 million TPA. EAC has recommended the proposal for EC in the meeting held on 21.03.2017. Mining plan for increase in production from 0.3 Mt/yr to 0.45 Mt/yr has been approved by Atomic Minerals Directorate for Exploration and Research (AMD), Hyderabad vide letter no. AMD / MPA / 3M / UCIL (NWP)/456.62 Ha / 2009 dated February 18, 2009. There is no litigation pending against the project.

2.3 NEED FOR THE PROJECT AND ITS IMPORTANCE TO THE COUNTRY OR REGION :

Govt. of India has planned to increase nuclear power generation from 4120 MWe at present to 20,000 MWe by the year 2020. This will lead to increased demand for Uranium. In order to meet the increased demand for uranium, UCIL has planned to increase the production from its existing mines besides developing new mines. Expansion of Narwapahar Mine is part of this programme to meet the increasing demand for uranium for India's nuclear power industry.

India's uranium resources are scarce, only about 0.8% of the world's uranium deposits. However India contains 20 – 25% of the world's thorium deposits. India is developing the technology to utilise thorium in its nuclear power programme in a three stage programme. The first two stages require uranium. India has to exploit the existing uranium deposits. The proposed expansion programme will increase the availability of nuclear fuel for the 1st two stages of the country's nuclear power programme.

The increased ore production from Narwapahar Mine will increase the capacity utilization of Jaduguda Ore Processing Plant. The proposed expansion project will also generate employment for local inhabitants in a predominantly tribal area. UCIL will spend part of the profits from the expanded mine for peripheral development which will benefit local villagers.

2.4 DEMAND AND SUPPLY GAP :

Demand of fuel for nuclear reactor is not fully met by indigenous uranium. At present with 4780 MW of installed nuclear power capacity, about 32% of fuel requirement is met by imported uranium. With addition of more nuclear power reactors, demand and supply gap of uranium is likely to increase.

2.5 IMPORT VS INDIGENOUS PRODUCTION :

Refer clause 2.4 above.

2.6 EXPORT POSSIBILITIES :

There is no possibility of any export of uranium ore or concentrate from India.

2.7 DOMESTIC / EXPORT MARKET:

There is no possibility of domestic and export market for uranium ore supply.

2.8 EMPLOYMENT GENERATION:

The mine employs 999 persons consisting of executives, supervisors and workers. Additional 200 persons shall be deployed in contract.

3.0 PROJECT DESCRIPTION

3.1 TYPE OF PROJECT INCLUDING INTERLINKED AND INTERDEPENDENT PROJECT

The present project envisages capacity increase of an existing underground mining project without increase in mine lease area. The ore from Narwapahar is trucked to Juduguda Ore Processing Plant. The haulage distance is about 10 km. Jaduguda Ore Processing Plant processes the ore from Jaduguda, Bhatin, Bagjata and Narwapahar Mines. The Plant has already received a separate environmental clearance as part of Jaduguda Mine's EC.

3.2 LOCATION:

Narwapahar mine is about 9 km south-east of Jamshedpur city in East Singhbhum District of Jharkhand. The mine lease is spread over 456.62 ha under villages Hartopa, Murgaghutu, and Patharchakri between latitudes 22^{o} 40' N and 22^{o} 45' N and longitudes 86^{o} 15' E and 86^{o} 20' E. This area forms part of Survey of India topo-sheet No. 73 J/6.

3.3 DETAILS OF ALTERNATE SITE:

Since the project envisages capacity increase of an existing underground mine and mining is a site specific activity guided by deposit geology, the question of any alternate site does not arise.

3.4 SIZE AND MAGNITUDE OF OPERATION:

The mine lease is spread over 456.62 ha. The mine's present capacity is 0.45 Mt/yr of ROM ore. The present proposal envisages increasing the ROM production to 0.60 Mt/yr, without any increase in mine lease area.

3.5 MINE DESCRIPTION

3.5.1 Geology and Exploration

In South-east Singhbhum, the Iron ore series of rocks consisting of sand – stone conglomerates, limestones, shales, phyllites, mica – schist, banded- hematite-quartzite's, lavas and agglomerates, have been folded and over thrust. Localisation of economic minerals of copper and Uranium are found along this overthrust and shear zone known as the Singhbhum Shear zone, also known as the Singhbhum thrust belt, or the Singhbhum Copper belts. The thrust belt proper starts from Duarpuram ($22^{o}46'$ N; $85^{o}34'$ E) NE of Chakardharpur, and continues through Kharswan, Sini, Turamdih, Narwapahar, Bhatin, Jaduguda, Rakhamines, Roam, Siddeswer, Kendadih, Surda, Mosabani and Badia. Further south, it dies out on the surface near Singhpura. This zone of shearing along which copper, Uranium and apatite are found, is like an arc in disposition and is about 100 miles long. The various localities in this belt are easily accessible, as the railway line from Kolkata to Mumbai connects most of these places.

The rock types exposed in this region are said to belong to the Iron Ore Series and consist of the following stages and rock types, in order of their relative ages :

i. Dalma lavas phyllites and agglomerates.

ii. Dhanjori stage, consisting of conglomerates and quartzites.

iii. Iron ore stage, consisting of banded-hematite-quartzites, phyllites with tuffs, lavas, limestones, conglomerates and quartzites.

iv. Chaibasa stage consisting of sandstone- conglomerates, limestones, shales, phyllites and mica – schists.

The several stages mentioned are not very sharply defined and grade into the one above or below.

The rocks of the iron ore series have been strongly folded and highly metamorphosed. Every grade of metamorphism is represented by the rocks of this area. The Principal tectonic movements were from north to south and the beds were folded into well-defined anticlines and synclines. There are also isoclinal folds, within broader folds, with over-folding towards the south. South of the main fold, tectonic movements were less intense and the changes in the rock types were not so pronounced as to the north of it. The constant tectonic movement towards the south, culminated in a major zone of

overthrust. The rocks to the north of this thrust were completely metamorphosed and thrust bodily against the less metamorphosed rocks to the south of the zone. The zone of overthrusting was completely sheared. This is the zone of sheared rocks along which copper and uranium mineralisations have taken place and is referred to as the Singhbhum thrust Belt or Singhbhum copper belt.

The mineralisations thrust zone in Narwapahar is believed to be between Chaibasa stage of rocks (Mica schist and phyllites) and phyllites of Iron Ore stage. There is very little lithological difference between the rocks of the two stages in this area. This lithological similarity of the rocks makes their division into the different stages difficult. Along with mineralisations the rocks have been chloritised and biotitised and this zone of biotitised and chloritised rocks in Narwapahar is very wide. This indicated that the zone of shearing is comparatively wider in Narwapahar than further east along the shear zone.

The rock types in Narwapahar are essentially chlorite and Biotite Schists but in most places chlorite predominates. There is sericite, apatite and magnetite in addition to uranite and pitchblende in the mineralized zone. The foliation strike of the rocks is generally NW-SE with the following dip to the N.E. The Narwapahar hill proper is made of Dhanjori quartzite and zone of thrusting is along the northern foot hill represented by chlorite and Biotite Schists.

The main regional structural feature is the major over-fold, the axial plane of which is parallel to the foliation strike of the rocks. The axial plane shears along which the mineralisation has taken place are also parallel to the foliation strike of the rocks. Apart from this there are certain cross – folds, whose axial planes are almost at right angles to the regional strike of the rocks. These superposed folds or cross-folds are probably subsequent to the mineralisations.

A few transverse and strike faults have also been met with in the area. Mineralisations in the thrust belt have been broadly, in two phases. An earlier phase, a right temperature oxide phase, consists of apatite, magnetite, illmenite and uranite. The later phase, a lower-temperature sulphide- phase, consists of sulphide minerals proper. Uranium in the form of uranite and pitchblende is associated with the higher temperature oxide – phase. The mineralizing fluids have been localized by the axial-plane shears and thickened up by the crossfolds and confined to the zone of shearing.

Usually along the thrust belt uranite showings are to the hang-wall side of the copper showing.

3.5.2 Mineral Reserve

The original ore reserves were calculated by AMD and UCIL on the basis of the information derived from the 1960's drilling programme. Subsequent adjustments have been made taking into account the enhanced information, as regards grade and persistence, relating to the later underground development. The following criteria are used for defining ore grade material:

1. A cut off grade of average 0.03% U3O8, including low grade zones up to 0.02 % eU_3O_8 grade in selected areas.
2. A minimum thickness of 1.5 m true width.
3. Material above the 100 mRL was considered to be thoroughly oxidized and therefore excluded from the calculation.
4. Indicated ore was defined as that material encompassed wholly by drill hole intersections. Inferred reserves were confined to a 30 m zone, extending along strike or up/ down dip, partially encompassing the areas of indicated material. The specific gravity of the ore was taken to be 2.8.

The ore reserve of Narwapahar Mine was calculated departmentally at 0.03 % eU_3O_8 cut off (including low grade zones up to 0.02 % eU3O8 grade in selected areas) to estimate the residual life of mine. The exact ore reserve and grade have not been furnished in this report as the same is restricted information as per Section 3 of Atomic Energy Act 1962.

3.5.3 Method of Mining

Underground Mining : Existing & Proposed Mining Method

At Narwapahar Horizontal Cut and Fill (HCF) method of mining is practiced. HCF is a method to excavate one slice of ore and filling back the same by waste rock, mill tailings etc. This fill forms the platform for men and machinery to work on to excavate the next slice. The slices are taken from lower level to the upper level leaving requisite sill pillar to for the upper level. The same method is also proposed to be continued during the rest of life of the mine.

The mine works 300 days / year. Narwapahar mine is a highly mechanized underground mine with entry through 7^{o} decline and vertical shaft. Old inclines serve as second outlets since it is commissioned with effect from year 1995. Latest technology of trackless mining system has been adopted in this mine with decline as mine entry and ramps for access in stopes.

ROM and waste are hauled up by trackless method using ST/MT (LHD/LPDT) combination and subsequently by skip hoisting system through shaft.

The various underground equipments used in the mine are Drill Jumbos, LPDTs, LHDs, service Transport vehicles like Supply Truck, Service Truck, Passenger Carrier, Road Grader, Scissor Lift and Explosive Van. Other underground auxiliary equipments are pumps, auxiliary fans, jack hammer drill machine, diamond drill machine etc. The various surface equipments are winders, main mechanical ventilation fans, compressors, dozer, payloader, various transport vehicles, workshop equipments, D.G. set for emergency power etc. Mining of ore is done by cut and fill method of under ground mining. Sand stowing is practiced to fill the voids created by excavation. The ore is transported by dumpers to Jaduguda Process Plant. The major part of waste rock is used for backfilling of voids in underground workings and only small portion is brought to surface. Such waste rock is dumped at designated area, acquired for the project. Mine discharge water is collected at 140 ML and pumped to the surface. Adequate capacity of pumping arrangement has been installed which take care of higher seepage of rain water. Total installed capacity of pump at underground is 900 m^3/hr (120 m^3/hr - 3 nos. and 90 m^3/hr- 6 nos.). Under the expansion pumping shall be carried out in stages the pump chambers shall be constructed at 275 ml, 415 ml and 555 ml.

At Narwapahar mine, production of uranium ore commenced in 1995 – 96. The production in 1995 – 96 during the first year was 95000 t. Since then the production has gradually increased to about 400,000 t/yr. The year-wise productions of ore from Narwapahar Mine have not been furnished in this report as the same is classified as “Restricted Information” as per Section 3 of the Atomic Energy Act, 1962.

3.5.3.2 Mine Design Parameters

- Cross section of drive, drift and cross cuts will be 5.5 m X 3.5 m.
- During jumbo drilling, depth of hole will be 3.2 m to get a pull of 3.0 m.
- Back support by rock-bolting at 2 m x 2 m grid pattern. However, this pattern varies with experience.

3.5.3.3 Mode of entry (Adit/incline/shaft/decline)

Decline of size 5 m X 3.5 m size at 7^0 inclination from surface for flexible movement of all trackless diesel equipment is in use. Presently decline has been excavated up to 250 mRL and will be driven further to lower levels for faster development and transportation of waste muck to upper level for back filling in stopes. Vertical shaft of 5m finished diameter up to a depth of 355.3 m from surface is in use. Vertical shaft is concrete lined for entire depth and connected to 100 mRL, 140 mRL, 185 mRL, 230 mRL, 275 mRL, 295 mRL (crushing chamber) and 315 mRL (loading point). The shaft houses the cage, the skip, and counter weights. It is proposed to construct a new vertical shaft of 700 meter depth as the present vertical shaft cannot hoist more than 1500 tpd. Also the hoisting depth of present shaft is limited to 315 meter depth upto VIII Level only. The mine section is shown **Fig1.**

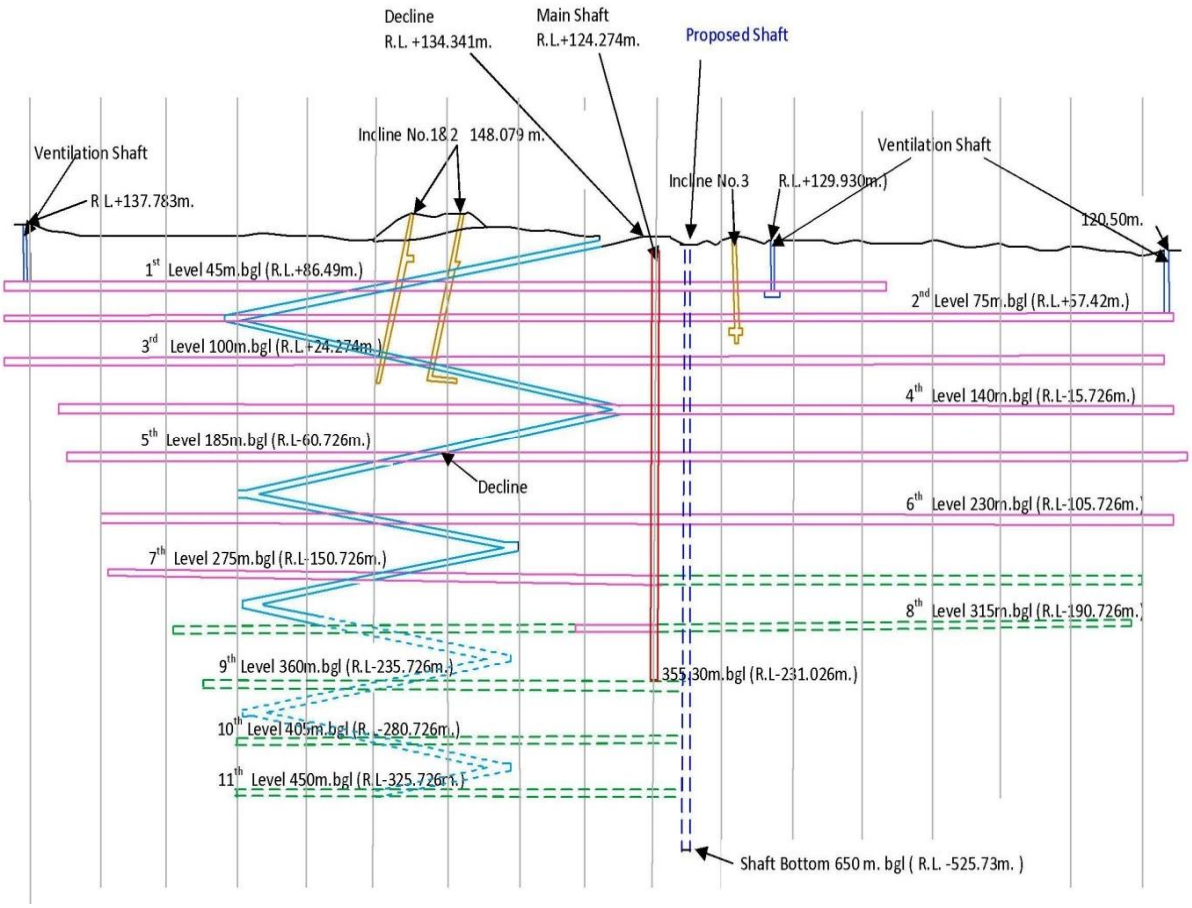

Fig1: Vertical Section through mine

3.5.3.4 Underground Layout

The mine is accessed by 7^0 and a vertical shaft. Horizontal cut & fill method is being adopted for exploitation of ore and same is proposed to be continued in near future.

Presently 12 nos. of stopes are in operation, out of this 6 stope is under production, 3 stopes are under stowing and 3 stopes are under preparation for stowing. Out of present 1500 t/d ore, 1200 t/d is produced from 6 nos. of stopes and 300 tpd ore is from development faces. About 400 t/d of waste rock is generated from development works. It is proposed to develop more stopes to increase the production. Total 16 stopes shall be required. 8 stopes shall be under production and 4 stopes each under stowing and other preparatory jobs. The stoping activities will produce 1500 tpd and rest 500 tones shall be produced from development faces.

Rock bolt system is being practiced to support the rock wherever necessary. The spacing of the rock bolts are determined on case to case basis based on the experience acquired on the rock strength during the operation of the mine.

3.5.3.5 Method and sequence of stoping

The sequence of operation followed at Narwapahar for the horizontal cut and fill method are as follows:

- Since, the ore body at Narwapahar is lenticular and is of irregular shape in horizontal as well as vertical directions, it is necessary to define stope extremities establish the exact ore geometry before regular slices can be taken.
- The ore drive, approximately 5.0 m X 3.2 m is developed along the footwall contact from one end of the proposed stope block to other end along the strike. Often each stope is a distinct ore lens and the above development of ore drive establishes the length and behavior of the ore body at the level. Ore drives are developed in similar manner at the upper and the lower levels.
- The ore drives as developed above are widened to expose the hangwall subject to a maximum width of 10.5 m. Above this width regular 4 m X 4 m pillars are left in the dip direction systematically. This establishes the exact width of the ore body in the proposed stope block.
- The drift along the strike and in footwall rock approximately 20 m to 40 m away from footwall contact of the ore body is developed. This follows the development of the ore

drive maintaining a lag of about 50 m. This is done to provide permanent access to the level and serves as the hauling roadway as the ore drives get filled on commencement of stoping operations.

- At both extremities of the proposed stoping block, raises are put up to connect the lower level to the upper level.
- A ramp is developed in ore/footwall rock either from upper level to lower level or from lower level to upper level or a combination of the two to provide access for the trackless equipments like Jumbos & LHDs to the stope.
- The back of the ore drive is stripped up to a height of 5 m to provide access to Physics and Geology personnel to establish the vertical geometry of the ore body.

The above completes the development and stoping commences by cyclic slicing and filling. This progresses from the lower level to the upper level.

The schematic method of mining is illustrated as **Figs. 2, 3** and **4**.

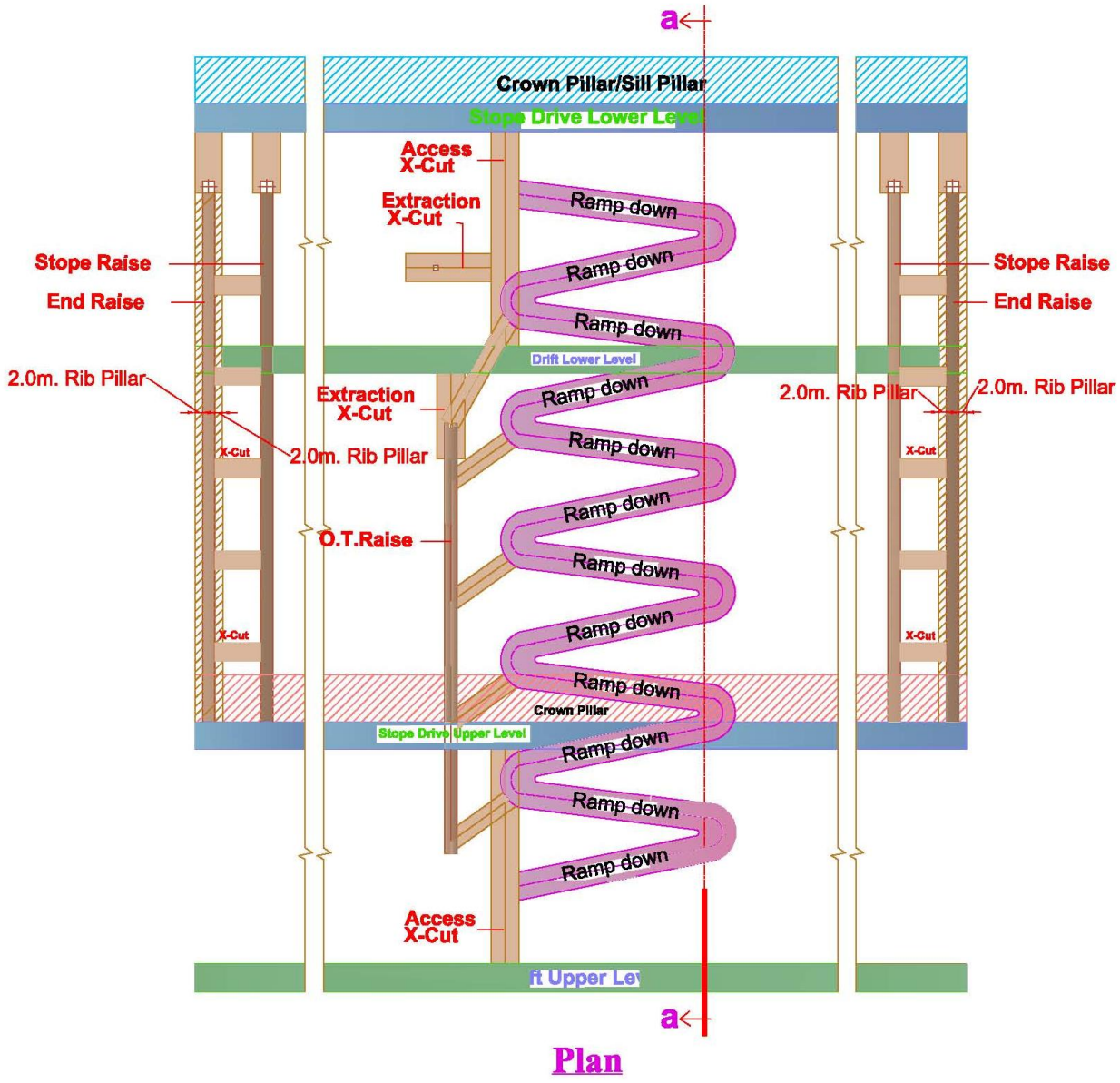

Fig. 2: Stope Plan

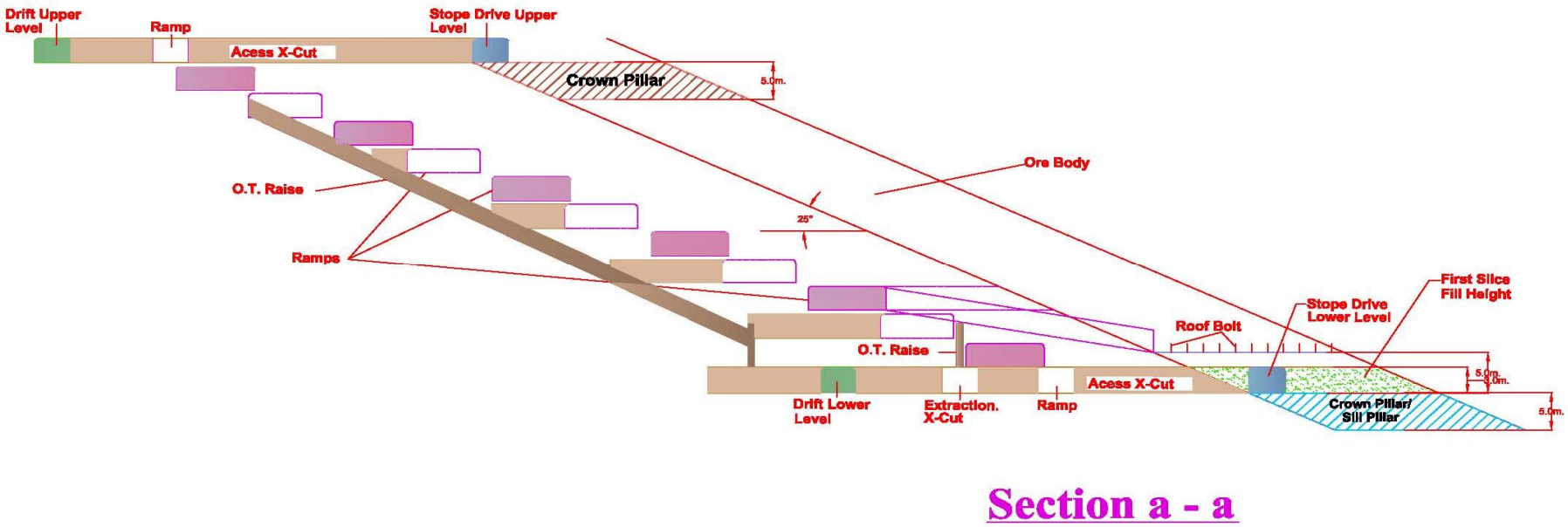

Fig. 3: Stope Section

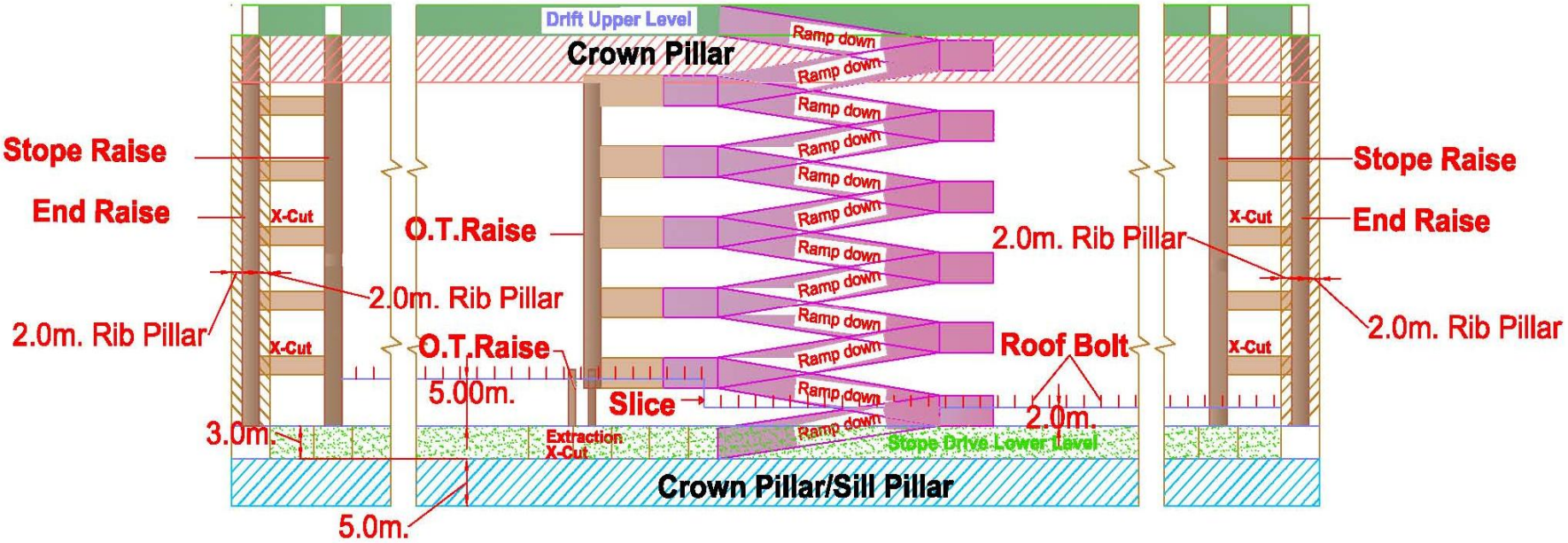

Fig.4: Longitudnal Section of Stope

3.5.3.6 Drilling and Blasting

Narwapahar is a mechanized hard rock mine, where excavation of rock is done by breaking it by conventional drilling and blasting method. There are two types of blasting practiced in Narwapahar**:** Inverted 'V' pattern for slice blasting at stopes and Burn cut pattern for development headings. In case of inverted V patterns, on an average 150-160 kg of explosive is consumed for breaking a rock mass of (2.8 m x 8.4 m x 3.2 m) and the average powder factor achieved is estimated as 0.53 kg/t. However, in case of burn cut, the achieved powder factor is around 1.02 kg/t.

3.5.3.7 Equipment

The Jumbo drills along with Jack hammers are deployed for drilling purpose. For loading the muck from the face, trackless equipment have been preferred. After a face blast for 5 m x 3 m x 3m size about 45 m^3 muck is generated. To clear the face high capacity loader will be essential. As such, LHD (load haul dump) of about 3.0 m^3 capacity has been selected for this purpose. Since LPDT around 20 t capacities is only matching hauling equipment with LHD 3.0 m^3 capacity, the same has been selected. For handling of ore, 6 sets of ST-MT are required. The existing fleet of major mining and auxiliary equipment are given in **Table 1**. To enhance production additional machines shall bev required which is tabulated as under.

Table 1: List of Mining Equipment

Machine	Existing fleet Strength	New fleet strength
Load Haul Dump (LHD)	9	12
Mine Truck (MT)	9	12
Drill Jumbo	7	9
Service equipments	9	12

Ore from levels are dumped at main ore pass grizzlies at different levels .The ore from the main ore pass is fed into the underground jaw crusher. Capacity of crusher is 80 t/hr of –200 mm size. Crusher feed size is 600 mm x 900 mm. The crushed material is hoisted by skip to surface and discharged in the ore bin. Skip is having 5 t capacity and can make average 20 trips/hour. So the present hoisting system can handle 1500 t ore by operating 15 hours/day. Some of the ore have also been transported to the surface by LPDT and stored at the designated stock piles. The ore from ore bin / stock piles are

loaded onto trucks/ dumpers for onward dispatch to Jaduguda Ore Processing Plant. Distance from mine to Jaduguda mill is 10 Km.

A list of the other equipment necessary for carrying out miscellaneous mining operations are given in **Table 2.:**

Table 2: List of auxiliary equipment

Type	Nos.
Bull Dozer	1
Pay loader (Cap. 3.4 m^3)	1
Explosive van	1
Lub truck	1
Scissor lift	3
Supply truck	1
Passenger carrier	3
Weigh Bridge	1
Arch Room	1
Ambulance van	1
Jeep	3
Car	1

3.5.3.8 Mine ventilation

The mine is ventilated by three nos. axial flow main fans each of 100 m^3/sec capacity. These fans are installed at the mouth of east ventilation shaft, west ventilation shaft & KND shaft respectively. All fans jointly take out air from underground. The raises, drives and old workings form the return air path for ventilating circuit.

Fresh air from surface enters the mine through the main vertical shaft, decline and inclines 2 & 3. Intake air is distributed to each level through these inclines, decline and shaft as per requirement. All working stopes have separate intake and return paths. Intake air enters the working through the access X-cut / ramps and ventilate the face and the exhaust air pass the stope raise located at the stope boundary. The stope raises are connected to the main fans by a system of end raises and ventilation drives. Since fresh air is taken to the level first, the mineworkers work in fresh air.

The blind headings are ventilated by auxiliary fans whenever necessary. Air from auxiliary fans is taken to the working face by means of ventilation duct. Ducts of different sizes are used depending upon the requirement. Ventilation doors, stopping and regulators are also used in underground for proper coursing the ventilating air.

The total designed capacity of the three main fans i 300 m^3/sec. The Future quantity requirement is about 400 m^3/sec. As the enhancement of production to 0.6 Mt/yr ore will be achieved from present working points, the future requirement of ventilation air will increae. One additional fan shall be required.

3.5.5 Mine De-watering

Adequate capacity of pumping arrangement has been installed upto 275 meter depth. As the mine will be deepened multi stage pumping shall be required. Total installed capacity of pump at underground is 900 m3/hr (120 m^3/hr - 3 nos. and 90 m^3/hr- 6 nos.)

3.5.6 Mineral Processing

ROM ore is crushed to -150mm size u/g, raised to the surface and stored in a covered ore bin. Crushed ore from the ore bin is loaded onto road trucks and dispatched to UCIL's ore processing plant at Jaduguda, which also processes ore from UCIL's existing Jaduguda, Bhatin and Bagjata mines.

The existing road from Narwapahar to Jaduguda is adequate to handle the increased traffic between Narwapahar mine and the ore processing plant, which is expected to increase by 50%.

At the ore processing plant, the crushed ore is ground to –200 mesh size. The uranium present in the ore is extracted through a hydro-metallurgical process as magnesium diuranate / uranium peroxide. This product is dispatched to Nuclear Fuel Complex, Hyderabad for further processing.

3.5.7 Mineral Transport

Ore will be transported to Ore Processing Plants at Jaduguda / New plant near the mine.

3.5.8 Life of the Project

Life of the will be 11 years from April 2017

3.6 RAW MATERIALS

The only raw materials required for the project are explosives for blasting ore and HSD for fuelling mining and allied machinery and vehicles.

The present explosive consumption is 1.1 tons per day, which is expected to increase to 1.8 tons per day . The present HSD consumption is 690 kilolitres per year, which is expected to increase to 850 kilolitres per year.

3.7 RESOURCE OPTIMIZATION / RECYCLING AND RESOURCE

2700 m^3/d of water is discharged from the mine. 880 m^3/d of sewage is generated from the mine township and is treated in a sewage treatment plant. The mine's peak water demand is estimated to be 1860 m^3/d inclusive of 150 m^3/d required for green belt and plantation irrigation. 1710 m^3/d of mine discharge water is utilised for meeting the entire industrial water requirements and part of the water requirements for green belt / plantation irrigation. 150 m^3/d of treated sewage and effluent is also utilised for meeting the balance requirements for green belt / plantation irrigation. The unutilized mine discharge water (950 m^3/d) and treated sewage (770 m^3/d) is pumped to Jaduguda Ore Processing Plant for meeting the plant's industrial water requirements.

3.8 SITE SERVICES

3.8.1 Water Requirement:

Industrial water requirement for the expanded mine is estimated to be 1860 m^3/day. This requirement is met by utilizing treated mine discharge water (1710 m^3/day) and recycle of treated sewage & effluent (150 m^3/day).

~136 m^3/day of drinking water is supplied to the mine. 1320 m^3/day of drinking water is supplied to the township. The drinking water is drawn from Gara River, a tributary of the Subarnarekha River, at Jaduguda. The water drawn at Jaduguda is treated at Jaduguda Water Treatment Plant and pumped to Narwapahar.

3.8.2 Power Requirement

The present power consumption is 5.0 MW. The power demand is not expected to increase in the expanded mine. The power is supplied by Jharkhand State Electricity Board (JSEB) through its main sub-station at Ichra sub- station. Two nos. 1000 KVA DG sets (1 working, 1 standby) have been installed to meet the emergency power requirement. Additional DG set of 500 kva shall be required.

3.8.3 Amenities

Narwapahar Mine is an operating mine with a sound infrastructure in place. The following facilities have been created and no additional facility is required for the proposed expansion project.

1. Compressor House and Compressors
2. Electric Sub Station and Power distribution net work
3. Surface workshops
4. Main Ventilation system
5. Explosive Magazine
6. Lamp Room
7. Time Office
8. Canteen
9. Pit head baths & Locker Room for workers
10. Office complex

A housing colony spread over 35.463 ha already exists within the lease. This township has 990 dwelling units. Expansion of the township is not envisaged. Two schools (Atomic Energy Central Schools), one up to Middle school, the other up to higher Secondary standard are located within the township. It has a small post office, a bank, a shopping centre, entertainment facilities etc. A 20 bedded hospital meets the immediate medical needs of the residents.

3.9 WASTES

About 1,50,000 t of waste rock is will be generated during operation of the expanded mine. ~95% of the waste rock will be utilised for stowing underground voids. Only about 7500 t/yr of waste rock will be brought to the surface and dumped in the northern part of the mine lease.

4.0 SITE ANALYSIS

4.1 CONNECTIVITY

Narwapahar mine is located at an aerial distance of about 4 km west of Asanboni railway station on the Tatanagar – Ghatsila section of Howrah-Mumbai BG line of SE Railways, but there is no road linkage to this station. The nearest stations with proper road linkages are Tatanagar Junction and Rakha Mines, both ~ 15 km away by road. The mine is linked to Jaduguda mine and Jamshedpur city by a metalled road. From

Jamshedpur to Sundarnagar the road is a State Highway. From Sundarnagar to Jaduguda, the road has been constructed by UCIL. Although this road is a public road, it is maintained by UCIL to facilitate transport of men and materials. At present the road is adequate to handle the traffic.

The nearest functional airport is Sonari at Jamshedpur which is about 20 km NW of the mine.

4.2 LAND FORM, LAND USE, OWNERSHIP

The leasehold area consists of private land (302.85 ha), forest land (25.56 ha) and government land (128.21 ha). Of the total leasehold area, 162.59 ha (124.37 ha private land + 38.22 ha government land) has been acquired. The forest land has been preserved.

About 61% of the lease area (278.77 ha) was agricultural land of which part has been used for setting up the mine (124.30 ha) and the balance (154.47 ha) left untouched. 21.8% of the lease area (99.54 ha) was barren land of which 38.29 ha has been used up. The lease area includes 25.56 ha of unclassified forest land. Although forestry clearance has been obtained, the entire forest land has been preserved. Under the expansion programme, there will be no further change in land use within the lease area.

4.3 TOPOGRAPHY

The leasehold area is situated at the bottom of series of hills on southern side. Ground level within leasehold area slopes from southern side towards northern periphery of the lease area. Most of the lease area lies at altitude between 120 m AMSL and 150 m AMSL. However, on the southern side of the lease area there is a steep hill (Narwapahar) rising to 327 m AMSL. The area is bounded by hill on the southern side, Gara River on the eastern side, a small Harkarjuriya nala on the western side and villages on the northern side.

Most of the 10 km radius area is plain or gently undulating with scattered hillocks. In the south eastern part of the study area there is a steep escarpment, Ranga pahar, which rises to 560 m AMSL. This escarpment originates from the southern part of the lease area and runs in the NW – SE axis. This escarpment is covered with sal forests.

The west central part of the study area is marked with three numbers of prominent ridges with east-west to NW-SE trend at Talsa Pahar, Nandup and Banduhurang. Banduhurang ridge extends for 2.5 km with a lateral extension of about 1 km. The highest level of the ridge has been recorded at 228 mRL with steep slopes along northern and southern flanks. The ridge confluences the general ground level of the surrounding area at 148 mRL in the north and 166 mRL in the south. The ridge has been marked with 3 nos. of protrusion occurring along the axis of the ridge with maximum elevations of 226 mRL, 228 mRL and 207 mRL in the eastern, central and western part respectively. The elevations of the area vary from 120m to 150m above main sea level. The area is bounded by hill on the southern side, Gara River on the eastern side, a small juria nallah on the western side and on the northern side villages exist.

The land area is mainly covered by thick soil cover and the rocks are mica schist.

There is no national park, biosphere reserve, sanctuary, and habitat for migratory birds, archeological site, defense installation, and airports within 10 km of the periphery of core/ buffer zone. The area does not fall in seismically active or land slide prone zone.

4.4 LAND USE

Land-use break ups of the lease hold area is as follows:.

Land Use	Existing (ha)
Agricultural Land	154.47 (33.83%)
Forest Land	25.56 (5.60%)
Roads	5.76 (1.26%)
Water Bodies	22.90 (5.02%)
Barren land	61.25 (13.41%)
Waste Dumps	2.14 (0.47%)
Plantations	80.0 (17.52%)
Settlements	59.55 (13.05%)

Vacant Areas within acquired land	37.36 (8.18%)
Mining infrastructure	7.63 (1.67%)
TOTAL	**456.62 (100%)**

Out of 456.62 ha lease area, only 162.59 ha has been acquired of which 125.23 ha (27.43%) has been utilized at present. Under the expansion programme, no change in land use within the lease area is envisaged.

4.5 EXISTING INFRASTRUCTURE

Refer Clause 3.8.3 above

4.6 SOIL CLASSIFICATION

As per the District Planning Map of Purbi Singhbhum, published by National Atlas and Thematic Mapping Organisation, Kolkata the soil of the area where Narwapahar Mine is located is classified as “Red Loamy Soil”.

4.7 CLIMATE

The study area lies in tropical region where climate is characterized by very hot summers and cool winters. The nearest observatory of India Meteorological Department (IMD) is at Kadma Colony in Jamshedpur, about 16 km away.

Summer is typically from mid March to mid June when temperature ranges from a maximum of 40.1°C during day time to a minimum of 18.6°C at night. Winter is from December to February when the maximum temperature during day goes up to 29.4°C and minimum temperature at night becomes 11.6°C. The average annual rainfall is 1321 mm. The South-west monsoon lasts from mid June to mid September and the area gets more than 80% of the annual rainfall during this period.

4.8 SOCIAL INFRASTRUCTURE AVAILABLE:

The mine is located in a rural area. The nearest town / city Jamshedpur is about 15 km from the mine, which has all necessary social infrastructure.

The social infrastructure available in the mine township has been described under clause 3.8.3 above.

5.0 PLANNING BRIEF:

5.1 PLANNING CONCEPT:

The entire infrastructure necessary for the expanded mine are already in place. All the machineries are also available. The higher production will be achieved by increasing machinery utilization. The rated capacity of the expanded mine 0.60 Mt/yr shall be attained after 3 years from the receipt of necessary statutory clearances.

5.2 LAND USE PLANNING:

The existing land use in the mine lease has been given in clause 4.4 above. The land use shall remain unchanged during the operation of the expanded mine.

When the reserves are exhausted, the mine will be shut down as per the Approved Mine Closure Plan. Some of the infrastructure will be dismantled. Others will be handed over to the State Government or the local village panchayats. The waste dumps will be stabilized and biological reclaimed. Plantations will be carried out on benches and floors of unfilled quarries.

5.3 ASSESSMENT OF INFRASTRUCTURE DEMAND

Most of the infrastructure such as Mine Office, surface material handling plant, electrical sub-station, stores, explosive magazine, workshop, weigh bridge, rest shelter, canteen, vocational training centre, medical unit etc. are already in place. Some of these such as surface material handling plant, explosive magazine and workshop will have to be expanded to cater to increased excavation and handling of ore.

5.4 AMENITIES / FACILITIES

All necessary amenities such as rest shelters, canteens, pit head baths, vocational training centre etc. already exist.

6.0 PROPOSED INFRASTRUCTURE:

As mentioned earlier, the mine has been operating since the 1995. All the infrastructure is already in place.

Green Belt and Plantations : 80 ha of green belt and plantations have already been developed. About 5 ha of plantations will be developed in the north-eastern corner of the lease over the next 5 years. Details of greenbelt and plantations developed / to be developed are given in below.

15.096 ha : 30 m wide green belt along lease boundary (5.032 km)

64.904 ha : In vacant areas and township.

5 ha : Will be developed in waste dump yard.

2.14 ha : Will be developed on waste dump

7.0 REHABILITATION & RESETTLEMENT (R&R) PLAN :

The mine is operating since 1995. Since the proposed expansion project does not envisage any leasing and / or acquisition of additional land no rehabilitation & resettlement is required for this project.

8.0 PROJECT SCHEDULE & COST ESTIMATE

8.1 LIKELY DATE OF START OF CONSTRUCTION AND LIKELY DATE OF COMPLETION:

Refer Clause 5.1 above.

8.2 ESTIMATED PROJECT COST ALONG AND ECONOMIC VIABILITY OF THE PROJECT

New Winding and hoisting system shall be added. The estimated project cost is Rs. 300 crores.

9.0 ANALYSIS OF PROPOSAL (FINAL RECOMMENDATION)

The proposed expansion project will have the following benefits:

- Improve supply of indigenous uranium ore and thereby increase supply of fuel for India's nuclear programme.
- Generate direct as well as indirect employment.
- Pave way for further peripheral development of a predominantly tribal area.

The expanded mine will not employ any additional persons. However indirect employment is likely to be generated on account of increased mineral transportation and ancillary services. Peripheral development by UCIL will benefit local villagers most of whom are tribals.