STUDY OF METHODS OF DEPILLARING AT CHURI U/G N.K. AREA, CCL

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उप महाप्रबंधक / विभागाध्यक्ष (पर्या० एवं वा)
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INTRODUCTION

Churi U/G mine is located in North Karanpura Coalfield of Central Coalfields Ltd. in Ranchi District of Jharkhand.

Location

The location of the mine is as follows :-

Latitude - 23 deg. 41'05" to 23 deg. 42'04" (N)

Longitude - 85 deg. 03' to 85 deg. 04'20" (E)

Nearest Railway head - Ray Railway station about 4.5 Km. from the inclines lies on the Gomoh-Dehri-On-Sone loop line of the South Eastern Railway.

Road connection - About 33 km. from state Highway connecting Ranchi to Daltonganj and 73 Kms. from Ranchi, the state capital.

GEOLOGY

The Raniganj, Barakar and Karharbari are the main coal bearing series of North Karanpura Coalfield. The main reserves being in Barakar and Karharbari series, Barakar series has all the major coal horizons of the coalfield having 5 coal seams of total 40-70m cumulative thickness. These seams are extensively developed over the coalfield in 3 distinct coal horizons separated by thin shale bands. Some of the important seams of the series are Dakra, Bukbuka, Bishrampur, Karkatta and thin K1 to K6 seams. A small patch in Karkatta area has well developed Raniganj Formation - R1 to R3 of total 15m thickness. The Bachra seam is developed in lower most Karharbari formation in two sections - Lower and Upper Bachra. Talcher formation developed along the fringes of the coalfield is devoid of workable coal horizons. The Upper Bachra

and Lower Bachra seams are known as Churi Top and Churi Bottom seams respectively in the Colliery.

2.1 Sequence of seams with their thickness range

Name of Seam	-	Normal thickness range(m)
Upper Bachra	-	0.13 – 4.42 (Generally 2-3 M)
Parting	-	0.68 – 18.68 (Generally 1-9 M)
Lower Bachra	-	2.49 – 11.24 (Generally 3-5 M)

2.2 Mine Block Boundary

The block boundary of the original Churi block is as follows :-

East	-	Saphi River/Ray Bachra Colliery
West	-	Damodar River/Benti Block
North	-	Damodar River/Ray Bachra Colly.
South	-	Incrop of seams

Recently part of the adjacent Benti Block on the west and Ray block on the north have been annexed to the Churi Block.

2.3 Geological Structure

2.3.1 Faults with their throws and other geological disturbances:

The property is virtually free of faults. Only rolls and minor slips have also been encountered in the actual mine working.

2.3.2 Seam Dip/Gradient and Strike

The dip of the strata generally varies between 2 deg. to 3 deg. (1 in 20 to 1 in 30) in the major part of the property. The strike within the block is roughly NE-SW in the major part of the area which gradually swings to almost north-south in the eastern part.

2.4 **Description of Coal Seams**

As stated earlier, there are only two workable coal seams in the block i.e. Lower & Upper Bachra seams which have been described below :-

2.4.1 **Lower Bachra Seam**

Lower Bachra seam is the bottom seam and occurs 0.68m (NNKC-49) to 18.68m (NNKC-10) below Upper Bachra seam. Lower Bachra seam varies in thickness from 1.71m (NNKC-32) to 11.24m (NNKC-48). However, the thickness normally varies from 3-5m in the south-eastern part which gradually increases to 9m in the western part near Damodar river. There is a persistent dirt band of carbonaceous shale/grey shale occurring about 2 to 2.5m below the roof of Lower Bachra seam. The bottom section of the seam is generally clean and better in quality than the upper section which is commonly inter-banded and often contains thick shaly coal horizons.

Roof & Floor

The immediate roof of the seam is generally carbonaceous shale, gray shale, fine to medium grained sandstone in order of abundance. The floor is normally represented by gray shale, intercalation of shale and sandstone, carbonaceous shale, sandy shale and at times by medium to coarse grained sandstone.

Quality of Seam

The inband quality of the seam varies from Grade B to E. The bottom section of the seam is relatively clean and the grade varies from Grade A to B.

2.4.2 **Upper Bachra Seam**

It varies in thickness from 0.13m (NNKC-35) to 4.42m (NNKC-47) and is mostly devoid of any dirt bands. The seam is generally 2 to

3m in thickness towards the up dip side of the property. The seam thickness decreases to less than 1.2m in 2 isolated pockets. The biggest patch is localised in the south-western corner of the property in the region of NNKC-26, 28, 33, 35, 40, 48 etc. Within this patch the seam has deteriorated to carbonaceous shale in a small area around NNKC-36. The other patch where seam has thinned down to less than 1.2m is noticed around NNKC-43, 44 and 49 located in the northern part of the property.

Roof & Floor

The immediate roof of Upper Bachra seam is generally grey shale, sandy shale, conglomerate, medium to coarse grained sandstone, carbonaceous shale etc. The immediate floor is predominantly carbonaceous shale and grey shale.

Quality of Seam

The quality of the seam varies from Grade-C to E.

2.5 **Nature of parting between Upper & Lower Bachra Seams**

The parting between Lower and Upper Bachra Seams gradually increases from 3m in the middle of the property to about 18m in the south-eastern region. The parting in the north-western part generally varies between 1 & 3m.

The parting between the two seams is found to be carb. shale, grey shale and fine to medium to fine grained sandstone and is weak in strength. In case of working of both the seams simultaneously the parting of 1-3m is likely to cave in and dilute the coal quality.

In nearly half of the boreholes drilled within the lease hold, carbonaceous shale form the immediate roof of Lower Bachra Seam, while 40% of the boreholes, alternate bands of shale and

sandstone is found to be in the immediate roof. Nearly 10% of the boreholes have sandstones and sandy shale.

2.6 **Minimum and Maximum Depth:**

Upper Bachra = 28.21 - 91.00m

Lower Bachra = 40.23 - 93.65m

2.7 **Watery Condition:**

Moderately wet. Water seepage reported while workings approaching Damodar River.

2.8 **Gassiness of the seam:**

Degree - II

2.9 **Physico-Mechanical Properties:**

The physico-mechanical properties of the block has not been determined. In Ray Bachra colliery which is adjacent to Churi colliery, study has been carried out and the figures are as follows:

(i) Compressive strength = 70.5-281.96 Kg/sq.cm (excluding unconsolidated strata)

(ii) Shear strength = 13.7 - 53.5 kg/sq.cm

(iii) Tensile strength = 8.53-32.5 Kg/sq.cm

(iv) Modulus of elasticity = 0.07-1.509 x 10^5 Kg/sq.cm

(v) Poisson's ratio = 0.110 - 0.198

(vi) Modulus of rigidity = 0.110-0.48 x 10^5 Kg/sq.cm (excluding coal which is 0.031 x 10^5 sg/sq.cm)

(vii) Gravity natural = 1.299 - 2.377 (coal)

(viii) Particle sp.gravity = 1.498 - 2.696 (coal)

(ix) Porosity = 4.6% - 18.26%

3.0 PRESENT STATUS:

The mine has been worked separately in Upper and Lower Bachra Seams via. two sets of inclines in the eastern part of the property called Churi Old Mine. In the western part of the property the

mine has been worked via another set of inclines in Lower Bachra Seam known as Churi Reorganisation Mine.

3.1 **Mine Entry Status**

The details of the existing entries are as follows :-

Sl. No.	Entry Mode Designation	Dimension (m)	Seam	Utility
I.	**CHURI OLD MINE**			
1	Inc.No.-1A	4.8X2.8	LBS	Travelling & Return
2	Inc.No.2A	4.2X1.8	LBS	Haulage (coal/material) & Intake
3	Inc.No.3A	4.6X2.8	UBS	Travelling & Intake
4	Inc.No.4A	4.8X2.8	UBS	Haulage (coal/material) & Intake
5	Air Shaft (Near Incline No.4A)	4.2 dia. (52 m deep)	LBS	Return airway
II.	**CHURI RE-ORGN.**			
1	Incline No.6	4.8X2.8 (400 m ,1 in 4)	LBS	Haulage (Material supply) & Intake
2	Incline No.7	4.8X2.8 (450M , 1 in 4.5)	LBS	Coal transport (Belt conveyors), Travelling and Intake
III.	**CHURI OLD** (Developed & sealed off)	No.2,3,4 and 5		

(l) Precautions should be taken to prevent collapse of workings and over-riding of pillars.

Subsidence

The maximum subsidence in the case of simultaneous extraction of seams would be the sum total of subsidence due to the individual seams i.e. 3.19 m, considering the average thickness of Upper and Lower Bachra Seams as 3.0m. The tensile strain in this case would be of the order of 40-45 mm/m which is much above the prescribed limit of 20mm/m by MOEF. In this case also the forest land is likely to be damaged, and it would be cost prohibitive if the forest land is acquired and rehabilitation done.

4.2.2 **Where pillars are not too much out**

If the pillars in the either seam are not too much out of coincident verticality, the galleries may be widened so as to restore verticality. Then the pillars may be extracted simultaneously.

4.2.3 **Where the pillars are too much out**

If the verticality of pillars and the galleries is too much out :-

(a) Pillars of Lower Bachra seam may be split and the voids stowed. The pillars in the top seam may then be caved in, or

(b) As the coal of Upper Bachra Seam is generally inferior to that of Lower Bachra Seam, only the pillars of Lower Bachra seam may be caved in, leaving the pillar of Upper Bachra seam insitu, or

(c) If the coal of Upper & Lower Bachra Seams are at any point is of uniform quality the pillars in both seams will be split as final operation, or

(d) The pillars in Upper Bachra seam may be split and the pillars in Lower Bachra seam may be caved.

The problem with the above two methods is that after splitting the voids would have to be filled with sand. Stowing is technically not feasible as the gradient is very flat.

4.2.4 Allowing a time lag

Another method of extraction of contiguous seams is to extract the upper seam first by caving and allow a time lag of about 5 years for the goaf to settle. After a gap of 5 years the lower seam can be depillared by caving.

The subsidence in the initial stage would be about 1.6 m and tensile strain about 20mm/m. On depillaring of the lower seam subsidence would be less due to the fact that the tensile zone of the caving of upper seam may be the compression zone of caving of the lower seam and vise versa thus minimizing the subsidence.

OBSERVATIONS

5.0 CONCLUSION

The following conclusions can be drawn from the above study:

1. Where only Lower Bachra Seam occurs

a) Where only Lower Bachra seam occurs cable bolting can be done up to 6m height. Subsidence will be of the order of 3.19 m and tensile strain 40 – 45 mm/m which will cause damage to forest land on the surface. Acquisition of forest land and rehabilitation may have to be done which will involve an expenditure of Rs. 62.22 Crore.

b) Depillaring with roof bolting up to 4.5 m height will cause subsidence up to 2.39 m and tensile strain will be about 30-34 mm/m.

c) For tensile strain to be within the permissible limit of 20 mm/m prescribed by MOEF the maximum extraction height should be about 2.7 – 3.0 m depending upon the depth of the panel. In this case subsidence will be about 1.40 – 1.58 m.

d) For extraction up to the full thickness the panel width should be sub-critical i.e. 30 – 40 m, with barrier pillars of about 80 m.

2. Where both the seams occur together and their individual thickness is about 3 m:

a) Depillaring of both seams can be done either independently where they are not contiguous or simultaneously where they are contiguous and the pillars in both the seams are coincident vertically. In both the cases the subsidence and tensile strain would be same as in 1(a) above.

b) Where the workings of both the seams are contiguous and the pillars in the seams are to much out of verticality, the pillars in one or both of the seams may be split and stowed and other caved as the case may be. In this case the subsidence and tensile strain may be below the permissible limit.

c) As a third option a time lag of five years may be allowed between the caving of the lower and upper seams. In this case also the subsidence and tensile strain may be below the permissible limit.

3. The value of subsidence and tensile strain is only indicative in nature based on empirical formulas. The exact amount of subsidence, tensile strain and the nature of the surface profile

and amount of damage to the forest land due to subsidence can be determined only after a detailed study.