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**TEST REPORT  
OF  
QUALITY PARAMETERS  
OF  
COKING COAL SEAMS  
UNDER THE COMMAND AREA  
OF  
CENTRAL COALFIELDS LIMITED**



**AUGUST 2023**

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# TEST REPORT OF QUALITY PARAMETERS OF COKING COAL SEAMS UNDER THE COMMAND AREA OF CENTRAL COALFIELDS LIMITED

## 1.0 INTRODUCTION

M/s Central Mine Planning & Design Institute Ltd. (CMPDIL) was entrusted by CIL with the job of testing of quality parameters of 62 coking coal seams under the command area of CCL vide Work Order no. 5700148187 dtd 17.11.2022 (copy enclosed as Annexure III). Work order of 62 seams of CCL was issued but samples of only 43 seams were received. The samples from CCL were received in following seven sets:

**Table-1: Reference of samples received at CMP Laboratory**

Sl.No.	Reference
01	02 nos. of samples were received from CCL vide letter no. GM( R) /Sales/22-23/276 dtd. 07.01.2023
02	10 nos. of samples were received from CCL vide letter no. GM( KTA) /QM/2022-23/64 dtd. 08.01.2023
03	10 nos. of samples were received from CCL vide letter no. GM(H)/QM (H)/2023/835 dtd. 10.01.2023
04	05 nos. of samples were received from CCL vide letter no. GM(K)/QM /2022-23/341 dtd. 10.01.2023
05	07 nos. of samples were received from CCL vide letter no. GM(D)/QM /CMPDIL/2023/41 dtd. 10.01.2023
06	07 nos. of samples were received from CCL vide letter no. AQM/QM Lab,/Seam/B&K/2022-23/345 dtd. 13.01.2023
07	02 nos. of samples were received from CCL vide letter no. AQM/QM Lab,/Seam/B&K/2022-23/356 dtd. 20.01.2023

The coking coal test parameters carried out for each seam is given below:

**Table-2 : Coking coal quality parameters**

Sl. No.	Particulars
1	Ash%
2	Moisture %
3	Volatile Matter%
4	Elemental analysis (C%, H%, N%, O%)
5	Sulphur %, Phosphorous %
6	Crucible Swelling Number/ Free swelling Index
7	Low Temperature Gray King (LTGK)
8	Maceral Composition % (Reactive Content)
9	Mean Maximum Reflectance (MMR%)
10	V- Type distribution
11	Maximum Fluidity
12	Ash Fusion Temperature
13	Total Alkalis

The job is comprised of the following:

- i. Receiving of crushed RoM coal sample at CMP laboratory.
- ii. Mixing and parting (coning and quartering) of received sample into five following parts:
  - a) Part- I** (for proximate analysis (Ash%, Moisture%, Volatile matter%), Ultimate Analysis (Carbon%, Hydrogen%, Nitrogen% & Oxygen%) & determination of Sulphur% and Phosphorous%.
  - b) Part-2** (for determination of Total Alkalis, Free Swelling Index (FSI), Low Temperature Gray King Assay (LTGK) and Ash Fusion Temperature Range (AFTR).
  - c) Part-3** (for determination of Maximum Fluidity).
  - d) Part-4** (for determination of Mean Maximum Reflectance (MMR% / Rr %).
  - e) Part-5** (reserve sample).
- iii. Crushing, Pulverizing and Sieving of Part-1 sample to 60 mesh size.
- iv. Proximate Analysis (Ash%, Moisture%, Volatile matter%), Ultimate Analysis (Carbon%, Hydrogen%, Nitrogen% and Oxygen%) & determination of Sulphur% and Phosphorous% of Part-1 sample.
- v. Crushing, Pulverizing and Sieving of Part-2 sample to 72 mesh size.
- vi. Determination of Total Alkalis, Free Swelling Index (FSI), Low Temperature Gray King Assay (LTGK) and Ash Fusion Temperature Range (AFTR) of Part-2 sample.
- vii. Crushing, Pulverizing and Sieving of Part-3 sample to 40 mesh size.

- viii. Determination of maximum Fluidity of Part-3 sample.
- ix. Screening of Part-4 sample at 6mm screen aperture.
- x. Determination of Mean Maximum Reflectance (MMR% / Rr %) of Part-4 sample.
- xi. Listing of quality parameters block-wise and seam-wise indicating mines.

## **2.0 TEST RESULTS**

The test results are given in Table no.3 and 4 (attached as Annexure I & II).

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Table -3: Test Results of Proximate analysis, Ultimate Analysis, Ash Fusion Temperature Range, Phosphorous%, Total Alkali and Maximum Fluidity

ANNEXURE-I

Sl. No.	Name of Colliery	Name of seam	Test Results																
			Proximate Analysis			LTGK	SI	Ultimate Analysis					P%	Total Alkali	Max. Fluidity (ddpm)	Ash Fusion Temperature Range (°C)			
			Ash%	Moisture %	V. M. %			C%	H%	N%	O%	S%				IDT	ST	HT	FT
1	Kathara OC	Kargali	12.4	1.3	33.3	G1	2.5	69.53	4.51	1.5	11.39	0.67	0.636	2.137	842	1213	>1400	>1400	>1400
2	Jarangdih OC	Karo Major VIII	30.5	0.8	27.0	F	1.5	53.25	3.38	1.31	10.9	0.66	0.398	1.595	3125.65	1218	>1400	>1400	>1400
3	Jarangdih OC	Karo Major X	26.5	0.7	27.4	G	2	55.45	3.54	1.45	12.46	0.6	0.567	1.917	2576	1223	>1400	>1400	>1400
4	Govindpur Ph II OC	Bermo	23.9	0.6	26.3	G1	2.5	58.13	3.66	1.5	12.39	0.42	0.664	1.67	4555	1154	1298	1306	1316
5	Govindpur Ph II OC	Upper Karo X	28.4	0.9	27.6	G	2	55.25	3.49	1.37	10.93	0.56	0.543	1.504	14258	1198	>1400	>1400	>1400
6	Govindpur Ph II OC	Lower Karo VIII	31.1	0.8	26.0	E	1	56.71	3.44	1.29	5.76	0.4	0.363	1.55	0	1316	>1400	>1400	>1400
7	Govindpur Ph II OC	Lower Karo VII Top	19.9	0.8	27.7	G1	2.5	62.12	3.87	1.50	12.18	0.43	1.151	1.488	31527	1186	>1400	>1400	>1400
8	Govindpur Ph II OC	Lower Karo VII Bottom	31.9	0.6	23.3	F	1.5	51.37	3.23	1.31	11.77	0.42	0.3	1.474	4187	1182	>1400	>1400	>1400
9	Govindpur Ph II OC	Lower Karo VI	32.1	0.8	23.1	F	1.5	51.56	3.2	1.24	11.54	0.36	0.317	1.765	4314	1170	>1400	>1400	>1400
10	Govindpur U/G	Lower Sawang C	22.5	0.8	25.8	G1	2.5	60.22	3.73	1.5	11.72	0.33	0.782	1.261	31743	1142	1362	1371	1393
11	Tapin South OCP	VIII	22.7	0.6	27.8	G1	2.5	62.15	3.75	1.38	11.14	0.63	0.104	2.072	9356	1193	>1400	>1400	>1400
12	Tapin South OCP	VII A	35.1	0.7	26.4	E	1	48.66	2.98	0.96	12.22	0.28	0.045	1.807	0	1326	>1400	>1400	>1400
13	Tapin South OCP	VII B	35.6	0.8	25.3	F	1.5	48.94	3.14	1.20	10.02	1.10	0.258	2.449	4427	1242	>1400	>1400	>1400
14	Tapin North OCP	V	52.8	1.3	8.9	A	0	36.38	1.7	0.9	7.86	0.66	0.521	8.09	0	1244	1344	1361	1395
15	Tapin North OCP	VIIA	19.6	1.2	30.2	G1	2.5	62.38	3.98	1.50	11.66	0.88	1.629	3.354	5796.4	1241	1333	>1400	>1400
16	Tapin North OCP	VII B	26.8	0.9	28.4	G	2	56.6	3.51	1.43	11.14	0.52	0.106	3.055	31757	1175	>1400	>1400	>1400
17	Tapin North OCP	VIII	27.9	1.2	27.6	G	2	57.25	3.65	1.38	9.17	0.65	0.08	2.659	3286.5	1238	>1400	>1400	>1400
18	Tapin North OCP	VII	24.0	0.7	28.5	G	2	58.82	3.65	1.33	11.71	0.49	0.25	2.271	31904	1234	>1400	>1400	>1400
19	Jharkhand OCP	III	26.2	0.4	23.5	F	1.5	59.66	3.56	1.5	8.57	0.51	0.473	1.779	3766	1235	>1400	>1400	>1400
20	Parej East OCP	III	26.0	0.7	27.3	F	1.5	62.3	3.74	1.42	6.02	0.53	0.234	1.82	5268	1222	>1400	>1400	>1400

Sl. No.	Test Results																				
	Name of Colliery	Name of seam	Proximate Analysis					LTGK	SI	Ultimate Analysis					P%	Total Alkali	Max. Fluidity (ddpm)	Ash Fusion Temperature Range (°C)			
			Ash%	Moisture %	V. M. %					C%	H%	N%	O%	S%				IDT	ST	HT	FT
21	Topa OC	V	32.6	2.0	29.3	D	1	52.3	3.47	1.35	9.74	0.54	0.324	1.974	7	1198	>1400	>1400	>1400		
22	Topa OC	VA	25.6	2.0	30.8	D	1	57.06	3.7	1.27	11.81	0.56	0.339	1.955	35	1235	>1400	>1400	>1400		
23	Topa OC	VI	30.6	2.2	28.9	D	1	53.3	3.53	1.37	10.6	0.6	0.4	1.872	10	1175	>1400	>1400	>1400		
24	Sarubera COCP	V	37.8	2.3	27.2	C	1	47.8	3.39	1.15	9.38	0.18	0.425	1.909	15	1312	>1400	>1400	>1400		
25	Sarubera COCP	VI	33.5	2.1	28.6	D	1	52.3	3.52	1.33	8.77	0.58	0.386	2.002	30.8	1207	>1400	>1400	>1400		
26	Rajrappa OCP	VII B	21.9	0.9	30.3	F	1.5	60.68	3.91	1.45	11.51	0.55	0.695	1.8	5981	1205	>1400	>1400	>1400		
27	Rajrappa OCP	VII Top	20.2	1.2	30.1	G1	2.5	63.87	3.97	1.48	9.9	0.58	0.97	1.56	3632.6	1168	1318	1328	1340		
28	SDOCM O/C	Karo Maj. VIII	36.4	0.8	18.2	D	1	49.9	2.97	1.07	9.34	0.32	0.143	1.122	0	1226	>1400	>1400	>1400		
29	SDOCM O/C	Karo Maj. VII & VI	38.7	2.1	17.6	C	0	49.9	2.77	1.07	7.26	0.3	0.147	1.054	0	1263	>1400	>1400	>1400		
30	KARO-OCP	Karo-XI	38.8	0.9	18.0	D	1	47.19	2.82	1.12	9.72	0.35	0.074	2.058	0	1340	>1400	>1400	>1400		
31	KARO-OCP	Karo-VII & VI	37.7	0.5	16.5	D	1	46.88	2.93	1.00	11.2	0.29	0.18	1.055	0	1322	>1400	>1400	>1400		
32	BOKARO-OCP	Bermo	31.9	0.7	23.8	F	1.5	50.83	3.22	1.37	12.18	0.5	0.385	1.38	2945	1250	>1400	>1400	>1400		
33	AADOCM O/C	Bermo	37.1	0.6	18.2	D	1	46.89	2.93	1.02	11.75	0.31	0.165	1.318	0	1325	>1400	>1400	>1400		
34	AADOCM O/C	Karo Maj. VII & VI	36.7	0.7	18.1	D	1	48.19	2.95	1.06	10.81	0.29	0.18	1.337	3016	1349	>1400	>1400	>1400		
35	AADOCM O/C	Karo Maj. (IX-X)	24.0	0.8	20.6	E	1	63.68	3.64	1.23	7.04	0.42	0.112	1.17	5	1250	>1400	>1400	>1400		
36	DHORI KHAS U/G	Karo Spl. III (Chapri)	21.1	0.7	20.3	E	1	66.79	3.81	1.26	6.63	0.41	0.103	1.108	0	1307	>1400	>1400	>1400		
37	KARO-OCP	Karo-X	42.6	0.5	16.3	D	1	46.66	3.41	1.13	5.66	0.54	0.137	0.86	0	1375	>1400	>1400	>1400		
38	AKK-OCP	Karo-X	25.0	0.7	23.9	E	1	59.74	3.59	1.47	9.92	0.29	0.388	1.034	744	1235	>1400	>1400	>1400		
39	AADOCM O/C	Karo Maj. VIII	45.8	0.5	16.5	C	0	41.34	2.46	1.08	9.1	0.22	0.326	0.938	0	1261	>1400	>1400	>1400		
40	KARO-OCP	KARO-IX	34.5	0.7	18.2	D	1	51.63	3.07	1.28	9.23	0.29	0.51	0.997	0	1246	>1400	>1400	>1400		
41	KARO-OCP	KARO-VIII	37.8	0.9	18.1	D	1	49.17	2.89	1.09	8.73	0.32	0.168	1.286	0	1248	>1400	>1400	>1400		
42	AKK-OCP	Karo-VIII	37.1	0.5	21.0	D	1	48.32	2.94	1.21	10.14	0.29	0.414	1.305	0	1224	>1400	>1400	>1400		
43	AKK-OCP	Karo-VII & VI	35.3	0.5	19.6	D	1	49.83	3.04	1.02	10.47	0.34	0.233	1.088	0	1206	1392	1397	>1400		

Table - 4: Test results of Petrography Analysis											ANNEXURE-II	
Petrography Test Results												
Sl. No.	Name of Colliery	Name of seam	Maceral composition %				Maceral composition (vmmf%)			MMR%	V-type distribution %	
			Vit%	lipt%	int%	vmm%	Vit%	lipt%	int%			
1	Kathara OC	Kargali	77.5	3.3	12.4	6.8	83.2	3.5	13.3	0.89	V7=8% V8=42% V9=50%	
2	Jarangdih OC	Karo Major VIII	44.4	6.1	36.1	13.4	51.3	7	41.7	0.92	V7=10% V8=16% V9=64% V10= 10%	
3	Jarangdih OC	Karo Major X	67.7	5.2	12.6	14.5	79.2	6.1	14.7	0.99	V8=18% V9=22% V10=60%	
4	Govindpur Ph II OC	Bermo	55.1	0.7	23.1	21.1	69.8	0.9	29.3	1.11	V9=08% V10=22% V11=70%	
5	Govindpur Ph II OC	Upper Karo X	60.7	10	14.4	15	71.4	11.7	16.9	0.91	V7:12% V8:14% V9:74%	
6	Govindpur Ph II OC	Lower Karo VIII	63.3	1	19.6	16.1	75.4	1.2	23.4	1.05	V8:10% V9:11% V10:52% V11:27%	
7	Govindpur Ph II OC	Lower Karo VII Top	53.9	3.9	24.3	17.9	65.7	4.8	29.6	1.15	V9:10% V10:20% V11:35% V12:35%	
8	Govindpur Ph II OC	Lower Karo VII Bottom	60.2	2.5	21.4	15.9	71.6	3	25.4	1.13	V9:12% V10:15% V11:52% V12:21%	
9	Govindpur Ph II OC	Lower Karo VI	42.3	1.1	29.1	27.5	58.3	1.5	40.1	1.12	V9:10% V10:14% V11:76%	
10	Govindpur U/G	Lower Sawang C	48	1.1	29.3	21.6	61.2	1.4	37.4	1.09	V9:18% V10:20% V11:62%	
11	Tapin South OCP	VIII	68.7	4.5	16.4	10.4	76.7	5	18.3	1.05	V9:22% V10:52% V11:26%	
12	Tapin South OCP	VII A	34	5.3	26.3	34.4	51.8	8.1	40.1	0.99	V8=10% V9=40% V10=50%	
13	Tapin South OCP	VII B	37.9	2.9	27	32.2	55.9	4.3	39.8	0.98	V8=18% V9=29% V10=53%	
14	Tapin North OCP	V	Burnt Sample									
15	Tapin North OCP	VIIA	73.1	6.5	10.4	10	81.2	7.2	11.6	0.97	V8=25% V9=30% V10=45%	
16	Tapin North OCP	VIIIB	45.6	4.3	24.4	25.7	61.4	5.8	32.8	0.97	V8=21% V9=38% V10=41%	
17	Tapin North OCP	VIII	50.9	4	16.8	28.3	71	5.6	23.4	0.95	V8=15% V9=70% V10=15%	
18	Tapin North OCP	VII	51.1	7.9	25	16	60.8	9.4	29.8	0.91	V7=10% V8=21% V9=69%	
19	Jharkhand OCP	III	64.1	2.8	20	13.1	73.8	3.2	23	1.06	V9=22% V10=46% V11=32%	
20	Parej East OCP	III	47	14	21.3	17.7	57.1	17	25.9	0.99	V8=15% V9=33% V10=52%	

Sl. No.	Name of Colliery	Name of seam	Maceral composition %				Maceral composition (vmmf%)			MMR%	V-type distribution %
			Vit%	lip%	int%	vmm%	Vit%	lip%	int%		
21	Topa OC	V	48.3	12.3	26.6	12.8	55.4	14.1	30.5	0.8	V6=15% V7=35% V8=36% V9=14%
22	Topa OC	VA	52.2	7.4	16.9	23.5	68.2	9.7	22.1	0.76	V6=12% V7=62% V8=26%
23	Topa OC	VI	47.5	6.3	26.2	20	59.4	7.9	32.8	0.78	V6=10% V7= 53% V8=37%
24	Sarubera COCP	V	58.7	9.4	16.4	15.5	69.5	11.1	19.4	0.80	V6=9% V7=34% V8=57%
25	Sarubera COCP	VI	38.2	5.4	42.6	13.8	44.3	6.3	49.4	0.75	V6=25% V7=48% V8 = 27%
26	Rajrappa OCP	VII B	58.2	8.5	20.4	12.9	66.8	9.8	23.4	0.83	V7=9% V8= 43% V9=48%
27	Rajrappa OCP	VII Top	45.2	9	35.5	10.3	50.4	10	39.6	1.02	V9=42% V10=46% V11=12%
28	SDOCM O/C	Karo Maj. VIII	44.8	0.5	32.3	22.4	57.7	0.6	41.6	1.4	V12=08% V13=30% V14=62%
29	SDOCM O/C	Karo Maj. VII & VI	53.2	Trace	29.8	17	64.1	Trace	35.9	1.4	V13=48% V14=52%
30	KARO-OCP	Karo-XI	40.3	1.5	31.3	26.9	55.1	2.1	42.8	1.24	V11=16% V12=74% V13=10%
31	KARO-OCP	Karo-VII & VI	42	Trace	23.8	34.2	63.8	Trace	36.2	1.38	V12=20% V13=30% V14=50%
32	BOKARO-OCP	Bermo	43.9	2.4	37.2	16.5	52.6	2.9	44.6	1	V8=10% V9=20% V10=70%
33	AADOCM O/C	Bermo	54.7	0.5	18.2	26.6	74.5	0.7	24.8	1.18	V11=70% V12=30%
34	AADOCM O/C	Karo Maj. VII & VI	45.3	0.5	17.4	36.8	71.7	0.8	27.5	1.25	V11=12% V12=76% V13=12%
35	AADOCM O/C	Karo Maj. (IX-X)	34.3	0.6	46.5	18.6	42.1	0.7	57.1	1.30	V12=51% V13=49%
36	DHORI KHAS U/G	Karo Spl. III (Chapri)	38.9	1.6	43.4	16.1	46.4	1.9	51.7	1.31	V12=37% V13=63%
37	KARO-OCP	Karo-X	25.6	Trace	35.7	38.7	41.8	Trace	58.2	1.48	V13=13% V14=42% V15=45%
38	AKK-OCP	Karo-X	33	2.7	45.2	19.1	40.8	3.3	55.9	1.34	V12=10% V13=90%
39	AADOCM O/C	Karo Maj. VIII	26.7	1.9	35.2	36.22	41.8	3	55.2	1.32	V12=32% V13=68%
40	KARO-OCP	KARO-IX	28.3	Trace	45.5	26.2	38.3	Trace	61.7	1.38	V12=10% V13=50% V14=40%
41	KARO-OCP	KARO-VIII	33.6	Trace	49.8	16.6	40.3	Trace	59.7	1.37	V12=12% V13=60% V14=28%
42	AKK-OCP	Karo-VIII	37.5	2	28.5	32	55.1	2.9	41.9	1.23	V11=22% V12=78%
43	AKK-OCP	Karo-VII & VI	17	0.5	48	34.5	26	0.8	73.3	1.21	V11=38% V12=62%

(Note :Vit : Vitrinite; Int :Inertinite; VMM :Visible Mineral Matter; Vmmf :Visible Mineral Matter Free Basis ; MMR : Mean Maximum Reflectance