



Ministry of Coal

Sustainable Development Cell & Just Transition

Status Report on Environmental Sustainability (2021-22)



Prepared & submitted by CMPDI
June, 2023

Contents

Contents	i
Chapter I: Introduction	1
1.0 Background	1
1.1 Sustainable Development in India	2
1.2 About the report	3
Chapter II: Coal Sector in India	4
2.0 Coal Sector in India	4
2.1 Coal utilization in India's energy matrix and other sectors	5
2.2 Coal reserves in India	7
2.3 Coal production & import	7
2.4 Public Sector / Joint Sector Companies involved in coal mining	8
2.4.1 Coal India Limited	9
2.4.1.1 Summary of coal mines operated by CIL	9
2.4.1.2 Environmental Management and Sustainability in CIL	10
2.4.2 Singareni Collieries Companies Limited	12
2.4.2.1 Summary of coal mines operated by SCCL	13
2.4.2.2 Environmental Management and Sustainability in SCCL	13
2.4.3 NLC India Limited (NLCIL)	14
2.4.3.1 Summary of coal mines operated by NLCIL	14
2.4.3.2 Environmental Management and Sustainability in NLCIL	14
Chapter III: Projects considered.....	16
3.0 List of project considered for status reporting on environmental sustainability	16
3.1 Report structure	18
3.2 Brief about projects considered	20
Chapter IV: Status of environmental sustainability – Land use	29
4.0 Land use in coal mining sector	29
4.1 Land use break-up across selected projects.....	29
4.2 Observations on land area.....	37
Chapter V: Status of environmental sustainability – Air Quality	38
5.0 Air quality in coal mining sector	38
5.1 Status of Air Quality	38
5.2 Observations on air quality	45
5.3 Mitigation measures implemented for control of air pollution across projects	45

Chapter VI: Status of environmental sustainability – Water Regime	59
6.0 Water regime in mining sector	59
6.1 Quantitative status of mine water discharge across selected projects	59
6.1.1 Observations on mine water discharge vis-à-vis utilization.....	64
6.2 Qualitative status of mine water from selected projects	64
6.3 Observations on mine water quality across selected projects.....	68
6.4 Details on treatment facilities w.r.t water in selected projects	68
Chapter VII: Status of environmental sustainability – Mine Closure.....	84
7.0 Importance of Mine closure	84
7.1 Status of mine closure escrow fund	84
7.2 Status of land reclamation as a part of mine closure	88
7.3 Plantation in coal mines – overall status.....	90
Chapter VIII: Renewable energy and energy efficiency initiatives.....	94
8.0 Renewable energy generation projects installed by coal companies.....	94
8.1 Details on energy efficiency measures installed across selected projects	94
Chapter IX: Categorization of projects	100
9.0 Categorization of Projects.....	100
9.1 Categorization w.r.t Land Use.....	100
9.2 Categorization w.r.t Air Quality Management.....	101
9.3. Categorization w.r.t Water Quality	102
9.4. Categorization w.r.t Mine Closure Aspects	103
9.5 Overall Categorization	104
Chapter X: Conclusion and way forward.....	114
10.0 Conclusion and way forward for sustainable development	114
10.1 Summary of findings	114
10.2 Sustainability Initiatives across companies	116
10.3 Way forward	117

Chapter I: Introduction

1.0 Background

India is on an ambitious pathway of economic growth with an aim to become a USD 5 trillion economy. In order to achieve the same, it is prudent to have a sustainable, self-reliant and efficient energy matrix. Hence, coal will continue to play a formidable role in India's energy security.

Ministry of Coal (MoC) not only envisions to secure availability of coal to meet the rising energy demand of various sectors but also prioritises due care for local environment and communities. The coal sector envisages to promote sustainable development model in which coal production goes hand in hand with environmental protection, resource conservation, care for society and measures to protect our forests and biodiversity.

In order to further this objective, **Sustainable Development Cell (SDC)** was formed at MoC in December, 2019 to promote environmentally sustainable coal mining in the country and to address concerns during mining operation and till the decommissioning or final closure of mines. Subsequently, the SDC emerged as Sustainability & Just Transition Division consisting **Sustainable Development Cell (SDC) & Just Transition (JT) Section**.

The role of SDC & JT Section is to advise, mentor, plan and monitor the mitigation measures taken by the coal companies for maximising the utilisation of available resources in a sustainable way, minimising the adverse impact of mining and mitigating it for further ecosystem services. It deals the matters related to climate change, sustainable development goals (SDGs), just transition and sustainability of coal sector.



Figure 1.1: Thrust areas under SDC, MoC

Coal/Lignite PSUs have also established Sustainable Development Cells at HQ and Area levels for monitoring and implementation of various sustainable initiatives and adoption of best practices in environmental management.

1.1 Sustainable Development in India

India has imbibed the principle of sustainable development in its planning process to secure environmentally conducive growth. India has adopted 17 sustainable development goals (SDGs) to promote a comprehensive development model, out of these, SDG17 relates to affordable and clean energy and SDG13 relates to climate action.

India is critical in determining the success of the SDGs, globally. At the UN Sustainable Development Summit in 2015, Prime Minister Narendra Modi noted, “Sustainable development of one-sixth of humanity will be of great consequence to the world and our beautiful planet. It will be a world of fewer challenges and greater hope; and, more confident of its success”.



NITI Aayog, the Government of India’s premier think tank, has been entrusted with the task of coordinating the SDGs, mapping schemes related to the SDGs and their targets, and identifying lead and supporting ministries for each target. In addition, the Ministry of Statistics and Programme Implementation (MoSPI) has been leading discussions for developing national indicators for the SDGs. State governments are key to India’s progress on the SDGs as they are best placed to ‘put people first’ and to ensuring that ‘no one is left behind’. The UN Country Team in India supports NITI Aayog, Union ministries and state governments in their efforts to address the interconnectedness of the goals, to ensure that no one is left behind and to advocate for adequate financing to achieve the SDGs.

The SDG targets set out for Ministry of Coal¹ are as under:

- *By 2030, ensure universal access to affordable, reliable and modern energy services, and*
- *By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.*

MoC has joined hands with Government of India in its endeavour to ensure universal access to affordable, reliable and modern energy to country. In doing so, it has imbibed

¹ https://www.niti.gov.in/sites/default/files/2019-01/SDGMapping-Document-NITI_0.pdf

the principle of sustainable coal mining with due regard to low carbon, environmentally compatible, socially inclusive coal mining with sustainable mine closure.

1.2 About the report

The **Status Report on Environmental Sustainability** is being prepared by SDC, CMPDI at the directive of SDC, MoC. The reports have previously been prepared for FY 2018-19, 2019-20 & 2020-21 so far.

The report incorporates details on sustainability status for 40 of the largest coal mining projects spanning three coal and lignite PSUs. The aspects covered in the report include details on environmental parameters (land, air and water), provision of infrastructures/control measures to mitigate adverse impacts on the environment and status of mine closure activities. The sustainability status of mines helps to undertake additional measures, if required, to improve the environmental status of mines.

The present report has been prepared for FY 21-22 with updated inputs in line with MoC directives.

Chapter II: Coal Sector in India

2.0 Coal Sector in India

In India, given the natural abundance of reserves, coal has remained a crucial fuel for power supply generation as well as sectors such as steel, cement and other industrial consumers. Given the thrust on economic growth, demand for energy is set to increase in the coming future and coal will continue to play a key role in energy security alongside the ongoing transition into renewable energy sources. New segments such as power demand from use of electric vehicles and upcoming demand for coal in chemicals sector etc. would add to the existing demand apart from the strategic need to reduce dependence on coal imports.

Across the globe, India is the second-largest producer of coal, preceded by China². Coal has remained the mainstay of India's energy sector over the years, and it still accounts for about 50% of the present primary energy mix. Coal continues to be the most significant domestic source of energy supply and electricity generation.

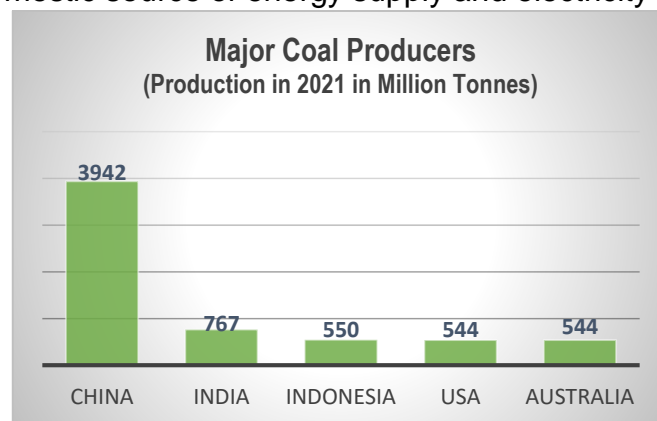


Figure 2.1: Five major coal producers across the globe

As India grows economically, its energy needs will continue to be met by coal, even though renewables will play a major role. Total coal consumption in India is yet to peak. With the present trend of evolving the energy sector, it is likely that coal demand may peak around 2037 or beyond and subsequently undergo a gradual tapering given the rise of share from renewables.

India's coal imports have also increased alongside production, primarily to bridge the demand-supply gap for various industrial sectors, mainly thermal power plants, cement, and sponge iron plants. With the drive to reduce imports to favour domestic production, it is expected that coal production in India would increase in the medium term.

² <https://www.globaldata.com/data-insights/mining/the-top-five-coal-producing-countries-million-tonnes-2021/>

Revenues from taxes and levies also constitute a major source of income for the State & Central governments. Coal transportation by rail is a major source of revenue for Indian Railways. Any impact on the coal sector will affect the railway sector as well. The figure below depicts the volume of coal transported by the Indian Railways.³

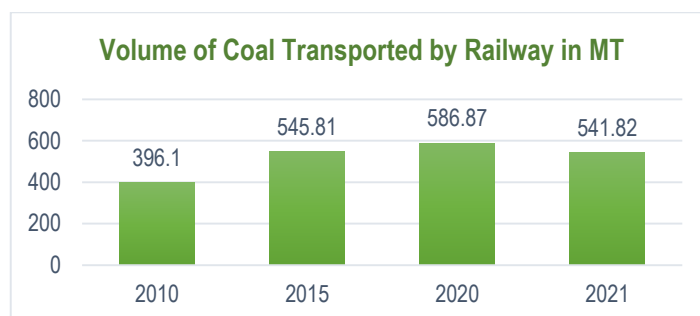


Figure 2.2: Volume of coal transported by Indian Railways during the past decade

Besides being intricately woven into the country's economic fabric, coal plays a central role in the social construct, particularly in mining regions. Coal mining is a crucial source of employment in central coal-producing districts of India. Although the formal (direct) employment in coal mines is estimated at 0.5 million,⁴ due to the high proportion of informal works associated with the coal sector, it is estimated that many more are indirectly dependent on coal for livelihood. It may therefore be concluded that coal mining will continue to support our economies in years to come. However, given the pledge to reduce emission intensity and country to become “Net Zero” by 2070, it is necessary that coal mining is undertaken in a more sustainable manner with due regard to decarbonisation, environmental compliances and socially inclusive manner.

Coal mining in India is led by Coal India Limited (CIL), having around 80% contribution to total domestic coal production. The number of running coal mines in the country is 400 – of which CIL operates 318 mines, SCCL operates 42 mines, NLCIL operates one mine and balance 39 mines operated by captive and others.

2.1 Coal utilization in India's energy matrix and other sectors

Coal presently accounts for the maximum share (49.7%) in the installed generation capacity for the country as on 31.12.2022. This is followed by solar power (15.4%), hydro (11.4%) wind (10.2%), gas (6.1%), other Renewable Energy Sources (RES) (3.8%), nuclear (1.7%), lignite (1.6%) and the rest by small hydro power, diesel and waste-to-energy plants.⁵

As far as sector wise usage is concerned, based on data related to coal despatch between Jan'21 & Nov'21, almost 85.8% of coal is used in power sector (includes utility, captive & CPP) and around 12.6% despatch goes to other sectors. Steel /

³ <https://www.statista.com/statistics/1201974/india-coal-transported-by-railway/>

⁴ IEA, India 2020, Energy Policy Review

⁵ Power Sector at a Glance ALL INDIA | Government of India | Ministry of Power (powermin.gov.in)

sponge iron & CDI account for 0.7% coal despatches and cement sector accounts for the balance 0.9%.⁶

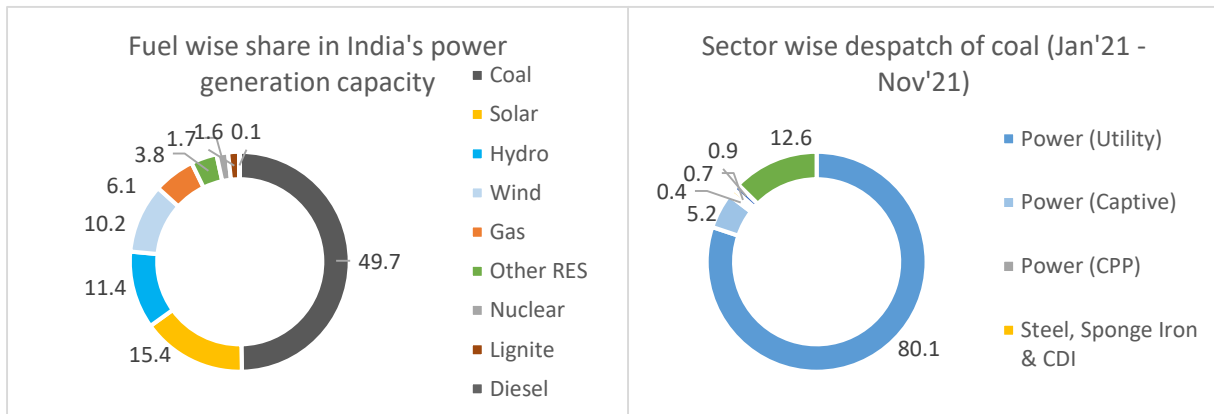


Figure 2.3: Coal in India's power generation capacity & sector wise coal despatch

As per estimated projections, India's coal demand is projected to be 1029 MT in 2022-23, of which demand from power sector is envisaged as 735 MT and demand from non-power sectors as 294 MT. The domestic coal supply during 2022-23 is envisaged as 974 MT and coal imports are envisaged at 186 MT.

Renewed thrust is required to maintain higher trajectory of production levels in order to ensure energy security of the country as well as to eliminate non-essential import of coal. Coal demand is estimated to rise up to 1448 MT in 2029-30.⁷

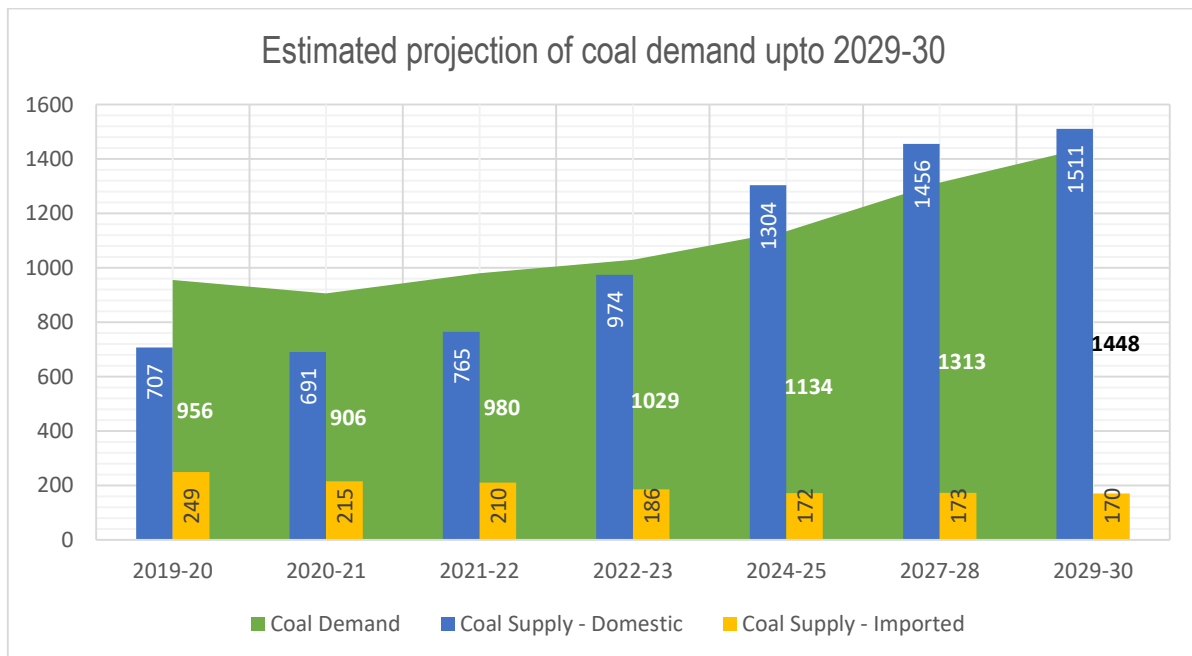


Figure 2.4: Estimated projection of coal demand upto 2029-30

⁶ MoC Annual Report for 2021-22 | chap2AnnualReport2022en.pdf (coal.nic.in)

⁷ Estimated projection of coal demand upto 2029-30 by MoC | coal-demand-projections20052022.pdf

2.2 Coal reserves in India

India has the 5th largest proven coal reserves in the world after US, Russia, Australia & China and is the 2nd largest coal producing country. As per Coal Inventory published by GSI, the total estimated coal reserve (resource) of the country, as on 01.04.2022 is 361411.46 million tonnes.⁸ The graph showing distribution of the reserves across the states is shown in Figure 2.3. Hard coal deposits are spread over 27 major coalfields and mainly confined to eastern and south central parts of the country.

The lignite reserves in the country are estimated at around 46.02 billion tonnes (as on 01.04.2021). The major deposits are located in the State of Tamil Nadu, followed by Rajasthan, Gujarat, Kerala, West Bengal, Jammu and Kashmir and Union Territory of Puducherry.⁹

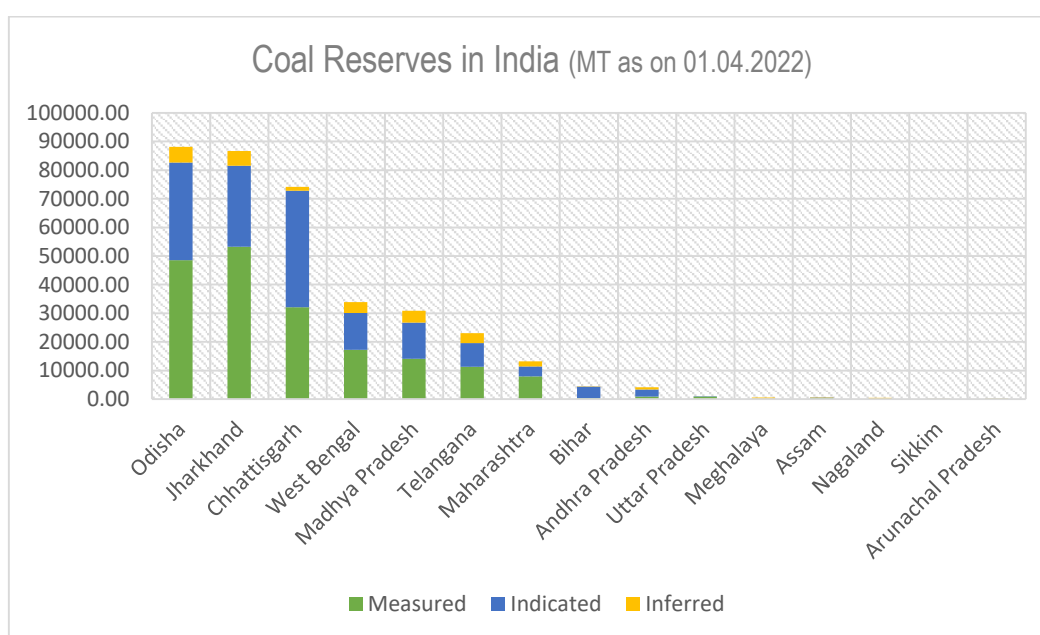


Figure 2.5: Coal Reserves in India

2.3 Coal production & import

The provisional coal production in India during 2021-22 was 778.19 MT, which indicates a growth of 8.67% as compared to the production during 2020-21. The coal and lignite production over the past 10 years is shown in the figure below.

⁸ Based on exploration carried out up to the maximum depth of 1200m by the GSI, CMPDI, SCCL and MECL | <https://coal.nic.in/en/major-statistics/coal-reserves>

⁹ MoC Annual Report for 2021-22 | chap2AnnualReport2022en.pdf (coal.nic.in)

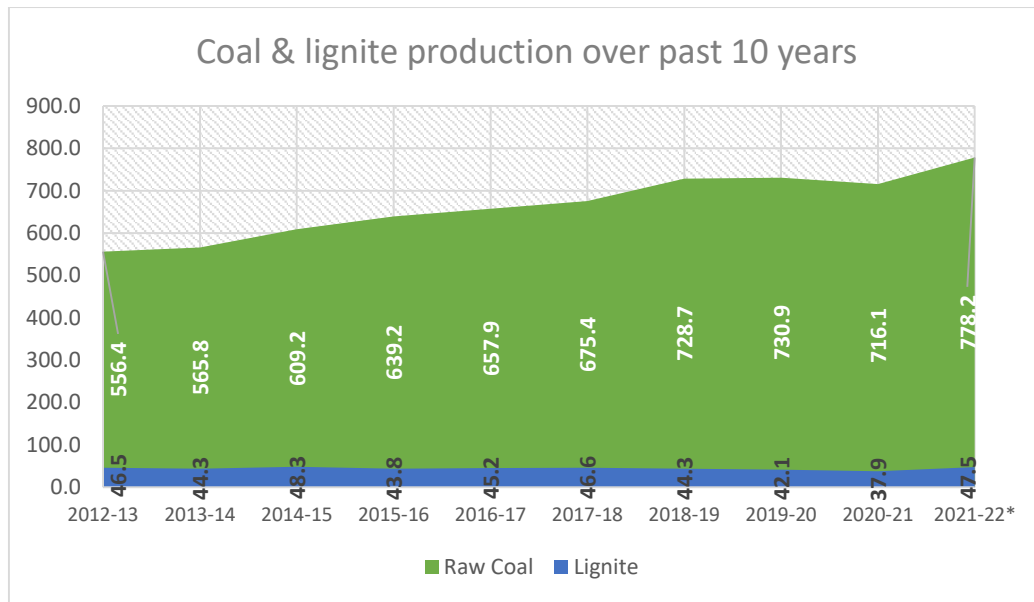


Figure 2.6: Coal & lignite production over past 10 years

India has also imported 57.16 MT of coking coal and 151.77 MT of non-coking coal during 2021-22. The data on import of coking & non-coking coal over the past 10 years is depicted in the figure below.

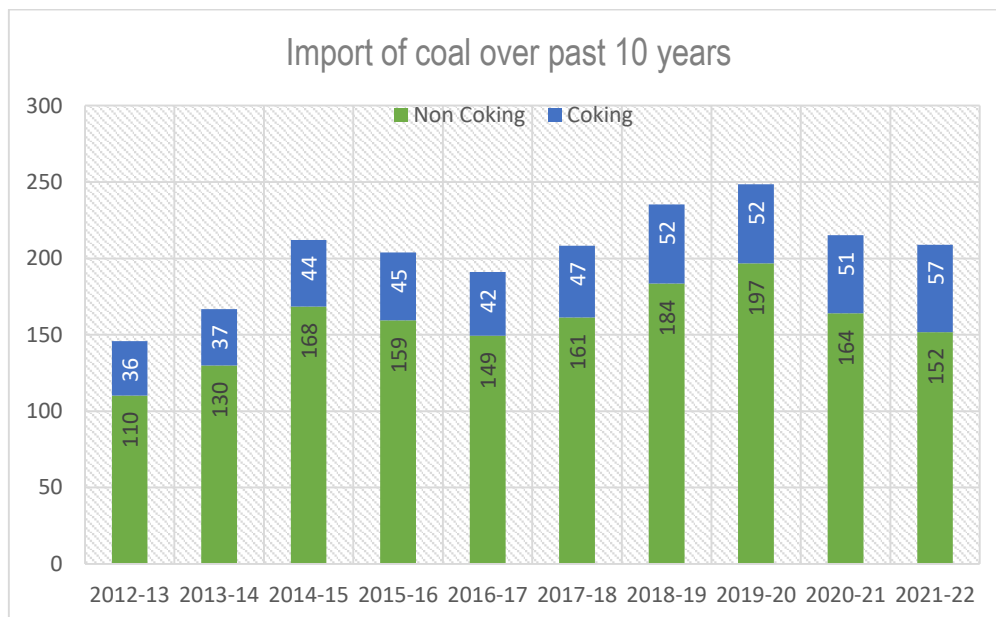


Figure 2.7: Import of coal over past 10 years

2.4 Public Sector / Joint Sector Companies involved in coal mining

Majority of the coal mined in India is produced by three companies, namely:

1. Coal India Limited (CIL),
2. Singareni Collieries Company Limited (SCCL) and
3. Neyveli Lignite Corporation India Limited (NLCIL)

A brief description about the companies is presented in the section hereunder.

2.4.1 Coal India Limited

Coal India Limited (CIL), a “Maharatna” Central Public Sector Enterprise (CPSE), and Government of India undertaking, is the single largest coal producer in the world. Salient features of the company are as stated

- Produces more than 80% of the entire coal output of the country and caters to bulk of the coal requirement from varied sectors
- Consists of seven coal producing companies operating through 84 mining areas spread over eight (8) provincial states of India. CIL has 318 mines (as on 01.04.2022) of which 141 are underground, 158 opencast and 19 mixed mines
- Produced 622.63 MT of coal during 2021-22, of which 312.33 MT (52.32%) was through surface miners
- Among the largest corporate employers with a manpower of 248550 as on 01.04.2022
- CIL also has a host of Joint Ventures (JVs) namely Hindustan Urvarak & Rasayan Limited (HURL) – for setting up of Natural Gas based fertilizer plant at Gorakhpur, Sindri and Barauni, Talcher Fertilizers Limited (TFL) - setting up of Coal based Fertilizer Plant of TFL at Talcher, Jharkhand Coal Rail Ltd (JCRL), Chhattisgarh East Rail Ltd (CERL), etc.



Figure 2.8: Organizational structure of Coal India Limited

2.4.1.1 Summary of coal mines operated by CIL

The summary of running and closed coal mines of CIL are provided hereunder in the tables below:

Table 2.1: Operating coal mines in CIL (as on 31.03.2022)

Sl. No.	Subsidiary	Number of Mines				Mine Leasehold area (in ha)	State of Operations
		OC	UG	Mixed	Total		
1	ECL	15	29	29	73	63176.07	West Bengal, Jharkhand
2	BCCL	16	04	09	29	14950.00	West Bengal, Jharkhand
3	CCL	32	01	0	33	34787.07	Jharkhand
4	WCL	32	18	01	51	39090.44	Maharashtra, Madhya Pradesh
5	SECL	19	46	01	66	51871.81	Chhattisgarh, Madhya Pradesh
6	NCL	10	0	0	10	18418.07	Madhya Pradesh, Uttar Pradesh
7	MCL	15	03	0	18	19170.03	Odisha
8	NEC	02	01	0	03	1784.23	Assam
Total CIL		160	124	42	326	276212.29	

Notes: Mine operations at NEC temporarily have been suspended w.e.f 06.03.2020.

Table 2.2: Closed coal mines in CIL (as on 31.03.2022)

Sl. No.	Subsidiary	Number of Closed Mines				Mine Leasehold area (in ha)	State
		OC	UG	Mix	Total		
1	ECL	-	-	-	-	-	-
2	BCCL	29	6	2	37	13487	
3	CCL	6	28	-	34	7249.13	Jharkhand
4	WCL	22	36	1	59	23230	Madhya Pradesh, Maharashtra
5	SECL	10	17	0	27	12767	Chhattisgarh, Madhya Pradesh
6	NCL	1	-	-	1	459	Madhya Pradesh
7	MCL	3	6	-	9	6875	Odisha
Total CIL		74	101	3	178	70073.81	

Notes:

CCL: Mine leasehold provided under closed mines excludes leasehold area of mines located in Giridih area, Associated Karanpura colliery UG, Hutar colliery UG, Karo seam incline, Khasmahal UG, Semra, Pindra UG, Topa UG, Pipardih UG, Sauna D OC, Hendegir UG.

WCL: Of the 59 non-operational mines, 22 are discontinued mines, 36 are abandoned mines, and 1 mine (Pathakhera - II UG) is closed

2.4.1.2 Environmental Management and Sustainability in CIL

CIL is committed to protect the environment through sustainable mining practices - right from the mine planning stage. Various pollution control measures and initiatives are being taken up concurrently with mining operations, for maintaining acceptable / permissible limits of major physical and chemical attributes of environment viz. air, water, hydrogeology, ground vibrations, noise, land, etc.

CIL, HQ obtained re-certification of ISO 9001:2015, ISO 14001:2015 and ISO 50001:2018 for Quality Management, Environment Management and Energy Management System respectively from Bureau of Indian Standards (BIS) in 2019-20. As on 31st March 2022, ECL, NCL and WCL (83 units) are certified for Integrated Management System (ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018). CMPDI HQ and its seven RIs are certified for ISO 9001:2015. Moreover, CMPDIL HQ, Ranchi has been certified in ISO 37001:2016 (Anti-Bribery Management System).

Highlights for FY 21-22¹⁰:

- In 2021-22, 80.05% of the discharged mined water was utilized for internal & community use and remaining 19.95% was retained for future use and ground water recharging
- CIL has established 27 Eco-parks & Mine Tourism & eco-restoration sites on date
- Land reclamation and restoration studies through satellite surveillance of 76 major OCPs revealed that during 2021-22, 62.53% of the excavated area was reclaimed and active mining area was limited to 37.47%.
- In FY 2021-22, INR 109.93 crores has been reimbursed from the Escrow Fund to the concerned project proponents for mine closure activities
- CIL subsidiaries have planted around 30.42 lakh saplings during 2021-22 in an area covering more than 1,468 ha (around 1,180 ha inside mine lease area & over 288 ha outside mine lease area) with an increase of about 70 % over previous year in terms of area of plantation
- In terms of total coal production, specific energy consumption for CIL as a whole, during 2021-22 was 7.34 kWh/T as against 7.86 kWh/T during 2020-21 with an overall decrease of 6.61%
- During 2021-22, energy Audit was done for 4 mines in CCL, namely Ashoka OCP, KDH OCP, Bokaro OCP & Govindpur UG; for 2 mines in NCL, namely Jayant OCP & Kakri OCP; and 1 mine in BCCL, namely KOCP. In addition, MCL has done energy audit at Lakhanpur OCP. Estimated saving from energy conservation measures in the above mines shall be around 132.72 lakh kWh per year with an estimated reduction of 977 lakhs per year in power bill.
- During 2021-22, subsidiaries of CIL have placed order for LED lights, BLDC fans, autotimers and 5-star rated air conditioners to M/s. EESL and they are in the process of supplying the same. M/s EESL had conducted Investment Grade Energy Audit of motors along with pump sets and submitted its recommendation which is being implemented.
- Additional roof top solar capacity added during 2021-22 - 4.279 MWp
- Across CIL subsidiaries, the total installed solar capacity upto March, 2022 was 9542.3 kWp and corresponding energy generated was 40 lakh units.
- Out of the planned 35 FMC Projects of 414.5 MTPA capacity awarded at a capital investment of INR 10,750 Cr., 6 FMC Projects of 82 MTPA capacity viz. Kusmunda PH-I (10MTPA), Lingaraj (16 MTPA), Krishnashila (4 MTPA), Block-

¹⁰ Annual Report of Coal India Limited for FY 21-22 |

https://www.coalindia.in/media/documents/Annual_Report_Coal_India_Delux_English_Total_Book_21.09.2022_REduce.pdf

B Rail Connectivity, Kusmunda Ph-II (40 MTPA) and Sonepur Bazari (12 MTPA) have been commissioned till 31.03.2022.

Sustainable Development Policy:

CIL's Sustainable Development Policy was approved by its Board on 03.08.2013. The policy affirms CIL's commitments to protect and safeguard the environment and conserve the bio-diversity for maintaining ecological balance besides effecting socio-cultural and economic betterment of the surroundings of its operations.



Figure 2.9: Sustainable Development Policy of CIL

2.4.2 Singareni Collieries Companies Limited

The Singareni Collieries Company Limited (SCCL) is a Government coal mining company jointly owned by the Government of Telangana and Government of India on a 51:49 equity basis. Salient features of the company are as stated –

- Singareni's coal reserves stretch across 350 km of the Pranahita – Godavari Valley of Telangana with a proven geological reserves aggregating to 8791 million tonnes

- Pioneered mechanization of coal mines in India by adopting coal drilling machines as far back as in 1937
- Currently operating 20 opencast and 24 underground mines in 4 districts of Telangana with a manpower around 43,895

2.4.2.1 Summary of coal mines operated by SCCL

The summary of running and closed coal mines of SCCL are provided hereunder in the tables below:

Table 2.3: Operating Coal Mines in SCCL (as on 31.03.2022)

Number of Mines				Mine Leasehold area (in ha)	State of Operations
OC	UG	Mixed	Total		
18	22	2	42	31051	Telangana

Table 2.4: Closed coal mines in SCCL (as on 31.03.2022)

Number of Closed Mines				Mine Leasehold area (in ha)	State
OC	UG	Mixed	Total		
3	8	0	11	6007	Telangana

2.4.2.2 Environmental Management and Sustainability in SCCL

Considering the continuing dependence on coal continues in near future, a number of initiatives have been taken by SCCL in order to reduce carbon footprints. SCCL has formulated a corporate environmental policy and its objectives as a part of its corporate environmental responsibility. In order to fulfil the objectives of environmental policy, guidelines have been framed in different facets of environmental management for bringing uniformity in planning, execution and monitoring systems thereby ensuring environmentally sustainable coal mining operations.

SCCL has launched a number of 'eco-friendly practices' to mitigate the damage to environment and improve the quality of life. In all mining areas extensive green belts have been developed, and monitoring of air and water quality is done on a regular basis to assess the impact of mining on the environment and corrective steps are being implemented immediately. Opencast mines are being restored to pre-mining conditions.

To encourage plantation and social forestry, free saplings are supplied to all the employees before the onset of monsoon. To reduce air pollution and also meet the social obligations of SCCL, the company supplies free LPG to its employees. SCCL is perhaps the only PSU to have introduced 'environment' as part of the curriculum in all its schools. In another innovative move, company has also introduced Eco Samman Awards to motivate employees who contribute to all round improvement of the environment. A number of other key initiatives taken in the last four years include setting up of sewage treatment plants, effluent treatment plants, bio-engineering of over burdens, clonal & medicinal plantations, development of eco-parks.

2.4.3 NLC India Limited (NLCIL)

NLC India Limited (NLCIL), incorporated in 1960, is a “Navratna” company under the Ministry of Coal, engaged in coal & lignite mining and power generation. The salient features of the company are as stated:

- Operates 3 opencast Lignite Mines of total installed capacity 30 Million Tonnes Per Annum (MTPA) at Neyveli, one opencast Lignite Mine at Barsingsar in Rajasthan with an installed capacity of 2.10 MTPA and an open cast coal mine at Talabira in Odisha with an installed capacity of 20 MTPA
- Operates 4 Lignite based pit-head Thermal Power Stations with an aggregate capacity of 3390 Mega Watt (MW) at Neyveli and one 250 MW Lignite based Thermal Power Station (BTPS) at Barsingsar, Rajasthan. A 1000 MW Coal based Thermal Power Station is also in operation at Thoothukudi, Tamil Nadu through its subsidiary company, NLC Tamilnadu Power Limited (NTPL), a Joint Venture between NLCIL and TANGEDCO (equity participation in the ratio of 89:11)
- Operates 1370 MW of solar power plants in various districts of Tamil Nadu and Andaman & Nicobar Islands and 51 MW Wind Power Plant in Tirunelveli District, Tamil Nadu.
- Is the first CPSE to cross 1 GW capacity in Solar Power Generation in the country and has also become a member of International Solar Alliance (ISA)

2.4.3.1 Summary of coal mines operated by NLCIL

The summary of running coal mines of NLCIL are provided hereunder in the tables below. There are no closed mines in NLCIL.

Table 2.5: Operating Coal Mines in NLCIL (as on 31.03.2022)

Number of Mines				Mine Leasehold area (in ha)	State of Operations
OC	UG	Mixed	Total		
1	0	0	1	1914	Odisha

NLCIL: Also operates 3 lignite mines in Tamil Nadu and 1 mine in Rajasthan.

2.4.3.2 Environmental Management and Sustainability in NLCIL

Keeping up with the changing business trends, NLCIL has diversified into renewable energy and coal mining business in India. NLCIL has included its commitment to environment protection and sustainable development as its corporate objective since inception. NLCIL undertakes a wide range of sustainability development projects and Corporate Social Responsibility measures for environment protection, community and rural development, thus ensuring the sustainable development of the company.

NLCIL maintains a strong focus on sustainable development with conservation of natural resources being integrated into all activities. NLCIL's strategy is to have minimum impact on environment and fulfil the aspirations of various stakeholders. Thrust areas include environment improvement programme such as eco restoration in

mines, massive afforestation programmes, rainwater harvesting, waste utilization, and conservation of bio-diversity, effective water and energy management, pollution control, mitigating the impact of climate change. NLCIL is proactive in training its employees in Environment Management.

NLCIL is also helping in building infrastructure, irrigating large tracts of land, promoting environment and ecology, meeting the power requirement of users and contributing to the overall wellbeing of society. NLCIL has implemented several new initiatives like augmenting water resources through deepening and de-silting of water bodies at different locations in Tamil Nadu and is in the process of replicating the same in the areas of its operation across the country. NLCIL's green initiatives include promotion of aqua culture; water harvesting and providing drinking water through RO based water vending kiosks in various parts of the country specifically at heritage sites, bus terminus where there is a large public gathering, electric operated shuttle vehicles in pilgrimage sites etc.

Chapter III: Projects considered

3.0 List of project considered for status reporting on environmental sustainability

For the present report, 40 of the large coal mining projects across CIL subsidiaries, SCCL and NLCIL have been considered. This includes 36 projects from CIL's seven coal producing companies, 3 projects of SCCL and 1 project of NLCIL. The selected projects are presented in the figures below.

The data pertaining to environmental parameters and sustainability aspects was collected from the coal companies and consolidated at CMPDI.

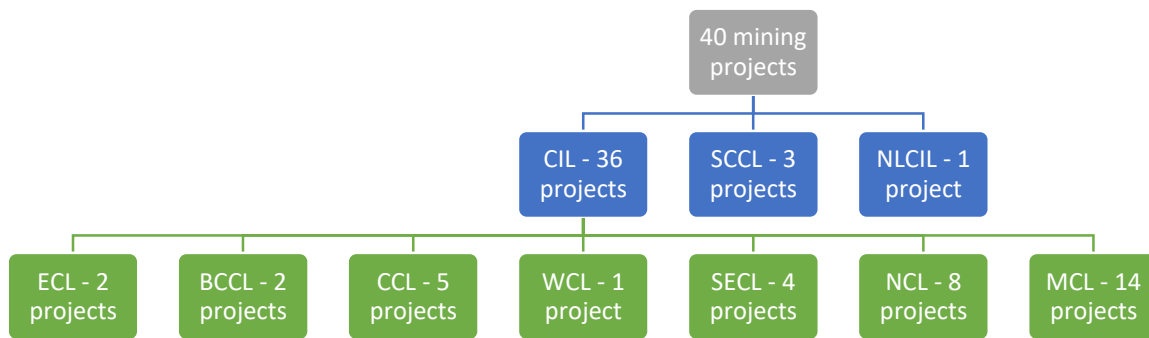


Figure 3.1: Company wise number of projects

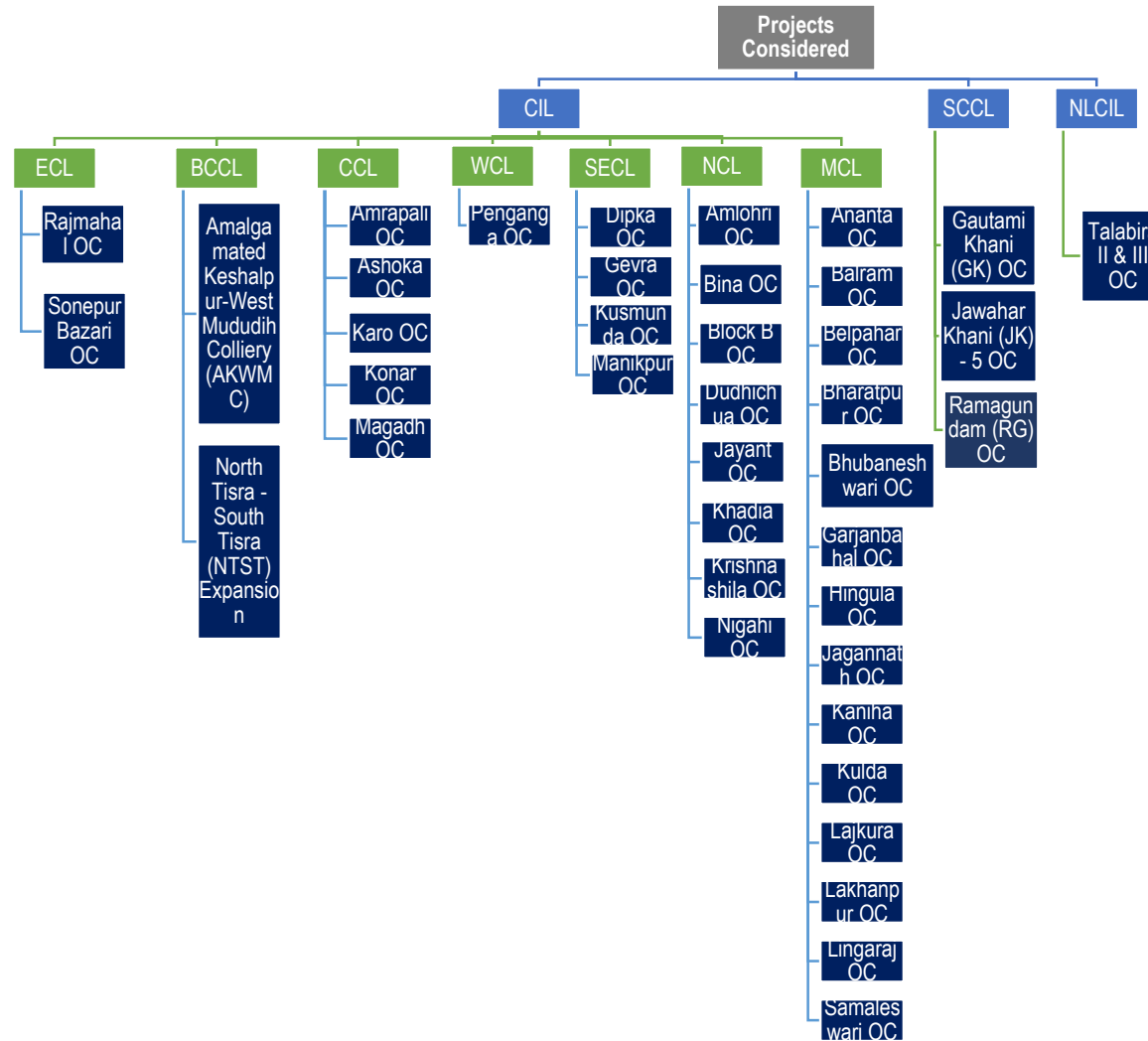


Figure 3.2: Company wise list of projects considered¹¹

¹¹ Piparwar OC, CCL has been closed due to exhaustion of reserves during FY 20-21, hence mine has not been considered.

3.1 Report structure

The reporting structure for the projects is split into five sections:

- **Status of Land (Chapter – IV)**

Details regarding land use in the selected mining projects is sought from coal companies. The major parameters being monitored are active mining area, area under technical reclamation and area under biological reclamation.

- **Status of air quality (Chapter – V)**

Status of air quality for each of the projects is analysed based on the Ambient Air Quality Monitoring (AAQM) undertaken by the respective projects. Based on the reported AAQM data in the core and buffer zones of the project made available, the minimum and maximum range for the major pollutants, namely PM₁₀, PM_{2.5}, SO₂ and NO_x for the period from April, 2021 till March, 2022 were analysed and status of compliance with statutory norms is worked out.

Details on mitigation measures implemented for air pollution control by the companies has also been presented.

- **Status of water regime (Chapter – VI)**

The status of utilization of mine water in the selected projects has been assessed for parameters like captive consumption, availability to communities for domestic usage and irrigation and recharge of groundwater / natural streams.

Further, status of mine water quality for each of the projects has been analysed based on the quality monitoring undertaken by the respective projects. Based on the reported quality data in the projects made available, the minimum and maximum range for the TSS and pH have been analysed.

Details on infrastructure provision w.r.t treatment of wastewater (effluents, mine water & domestic sewage) and raw water treatment facilities has also been consolidated. Information on water conservation measures like checkdams and embankments constructed in the vicinity and measures towards rainwater harvesting have also been presented.

- **Status of mine closure (Chapter – VII)**

Coal companies are depositing amount into Escrow Fund Based against progressive mine closure activities stipulated in the mine closure plan. Based on status of progress w.r.t activities undertaken by coal companies towards the progressive mine closure, amount released from the escrow account was taken into consideration.

- **Categorization of mines (Chapter – VIII)**

Based on reported data pertaining to land utilization, air quality, water quality and mine closure aspects, the selected mining projects have been rated and categorized under the chapter.

The data collection format based on which information for the status report was circulated by MoC vide letter no. F. No. CBA1-11022/2/2019-CBA-1 dated 19.01.2023.

3.2 Brief about projects considered

Summary of the mining projects considered has been provided in this section.

Table 3.1: Brief details w.r.t selected projects

Sr. No.:	Coal Company	Name of mine	Location	Year of commencement of mine	Mine lease area (ha) (rounded off)	Balance reserves as on 31.03.2022 (MT)	Life of mine as on 31.03.2022 (in years)	Average Stripping Ratio m ³ /t	EC Capacity in MTPA as on 31.03.2022	Mode of transportation of coal & FMC status
1.	ECL	Rajmahal OC	Godda, Jharkhand	1988	1978	146.92	07	2.14	23.80	<ul style="list-style-type: none"> • Road • Rail
2.	ECL	Sonepur Bazari OC	Paschim Bardhaman, West Bengal	1990	2294 ¹²	361.50	32	6.53	12.00	<ul style="list-style-type: none"> • Railway siding with silo loading
3.	BCCL	AKWMC OC	Dhanbad, Jharkhand	Pre-nationalization	325	27.17	OC – 4 UG – 16	2.48	9.55 (Cluster IV)	<ul style="list-style-type: none"> • Roads (through covered trucks)
4.	BCCL	NT ST Exp (Cluster 9)	Dhanbad, Jharkhand	Pre-nationalization	755	121.24	22	2.83	8.50 (Cluster IX)	<ul style="list-style-type: none"> • Roads (through covered trucks)
5.	CCL	Amrapali OC	Chatra, Jharkhand	2014	620	48.60	02	1.05	20.16	<ul style="list-style-type: none"> • Road • Rail

¹² Project area is 4681 ha, of which 2294 ha lies under mine lease area of Sonepur Bazari and rest lies under mine lease area of Cluster 12 & 11 of ECL as per approved PR

Sr. No.:	Coal Company	Name of mine	Location	Year of commencement of mine	Mine lease area (ha) (rounded off)	Balance reserves as on 31.03.2022 (MT)	Life of mine as on 31.03.2022 (in years)	Average Stripping Ratio m ³ /t	EC Capacity in MTPA as on 31.03.2022	Mode of transportation of coal & FMC status
6.	CCL	Ashoka OC ¹³	Chatra, Jharkhand	2000	793	20.00	02	-na-	14.00	<ul style="list-style-type: none"> • Roads (till Piparwar CHP/CPP & sidings) • Railway siding
7.	CCL	Karo Exp. OC	Bokaro, Jharkhand	1991	526	82.15	10	0.84	15.00	<ul style="list-style-type: none"> • Road • Rail
8.	CCL	Konar Exp. OC	Bokaro, Jharkhand	2017	471	82.30	13	0.98	11.00	<ul style="list-style-type: none"> • Road • Rail
9.	CCL	Magadh OC	Chatra, Jharkhand	2015	1769	317.63	12	1:1.51	20	<ul style="list-style-type: none"> • 2 Surface Miner deployed in Chamatu Patch and 1 Surface Miner deployed in Kundi Patch
10.	WCL	Penganga OC	Chandrapur, Maharashtra	2015	744	12.46	03	3.67	6.3	<ul style="list-style-type: none"> • Road • Rail
11.	SECL	Dipka OC	Korba, Chhattisgarh	1992	1999	164.93	5	1.80	35	<ul style="list-style-type: none"> • Road • Rail • Belt

¹³ Piparwar OC not considered for present report since production has ceased due to exhaustion of reserves during 2020.

Sr. No.:	Coal Company	Name of mine	Location	Year of commencement of mine	Mine lease area (ha) (rounded off)	Balance reserves as on 31.03.2022 (MT)	Life of mine as on 31.03.2022 (in years)	Average Stripping Ratio m ³ /t	EC Capacity in MTPA as on 31.03.2022	Mode of transportation of coal & FMC status
										<ul style="list-style-type: none"> 2 existing silos of 15 MTY & mechanized siding (25 MTY) under construction
12.	SECL	Gevra OC	Korba, Chhattisgarh	1981	4184	318.23	16 ¹⁴	1.29	49	<ul style="list-style-type: none"> Conveyor Belt Road Rail Washery FMC - Work order for Two additional silo (5&6) with Rapid Load out system (capacity 20 MTY) issued on Oct 2020. RLS completion by March 2023 & Silo by March 2024
13.	SECL	Kusmunda OC	Korba, Chhattisgarh	1978	1656	713.24	15	1.34	50	<ul style="list-style-type: none"> Conveyor Belt (7.012 MTPA FSA / 11.00 MTPA capacity) Road

¹⁴ Based on 70 MTY production plan (as per 52.5 MTY Mining Plan)

Sr. No.:	Coal Company	Name of mine	Location	Year of commencement of mine	Mine lease area (ha) (rounded off)	Balance reserves as on 31.03.2022 (MT)	Life of mine as on 31.03.2022 (in years)	Average Stripping Ratio m ³ /t	EC Capacity in MTPA as on 31.03.2022	Mode of transportation of coal & FMC status
										<ul style="list-style-type: none"> • Rail (3 sidings – 18 MTPA) • 4 no. of Silos (40 MTPA/ under construction)
14.	SECL	Manikpur OC	Korba, Chhattisgarh	1976	1018	56.62	11	2.68	4.9	<ul style="list-style-type: none"> • Road • Rail
15.	NCL	Amlohri OC	Singrauli, Madhya Pradesh	1982	2175	108.35	09	4.71	14	<ul style="list-style-type: none"> • MGR
16.	NCL	Bina OC	Sonebhadra, Uttar Pradesh	2006 ¹⁵	1798	18.77	02	5.04	9.0*	<ul style="list-style-type: none"> • CHP (4.5 MTPA) • Wharfwall • Road*
17.	NCL	Block-B OC	Singrauli, Madhya Pradesh	2006	1339	116.19	13 ¹⁶	4.33	5.47	<ul style="list-style-type: none"> • Road • Rail • CHP*
18.	NCL	Dudhichua OC	Singrauli, Madhya Pradesh & Sonebhadra	1982	2391	229.10	13	4.61	25	<ul style="list-style-type: none"> • Road • Rail • CHP

¹⁵ Inception of Bina OC was in 1974. EC for 10.5 MTPA obtained in July, 2022. 9.5 MTPA CHP is under construction and will be completed by 31.12.2023

¹⁶ Life of mine to be considered 13 years post expansion of project. CHP expansion is under construction

Sr. No.:	Coal Company	Name of mine	Location	Year of commencement of mine	Mine lease area (ha) (rounded off)	Balance reserves as on 31.03.2022 (MT)	Life of mine as on 31.03.2022 (in years)	Average Stripping Ratio m ³ /t	EC Capacity in MTPA as on 31.03.2022	Mode of transportation of coal & FMC status
			, Uttar Pradesh							
19.	NCL	Jayant OC	Singrauli, Madhya Pradesh	1976	3177	199.40	08	3.29	25	<ul style="list-style-type: none"> • Road • Rail
20.	NCL	Khadia OC	Singrauli, Madhya Pradesh & Sonebhadra, Uttar Pradesh	1984	1640	152.50	10	4.23 ¹⁷	14	<ul style="list-style-type: none"> • CHP (10 MTPA) • Jhingurdah Wharfwall Krishnashila CHP • Road
21.	NCL	Krishnashila OC	Sonebhadra, Uttar Pradesh	2007	852	28.50	05	3.38	7.5	<ul style="list-style-type: none"> • Belt Pipe Conveyor • Railway Loading through CHP Silo • CHP (4 MTPA)
22.	NCL	Nigahi OC	Singrauli, Madhya Pradesh	1985	3018	162.83	09	3.68	22.5	<ul style="list-style-type: none"> • Rail through MGR to VSTPP-NTPC • Road
23.	MCL	Ananta OC	Angul, Odisha	1989	1420	264.57	14	0.45	20	<ul style="list-style-type: none"> • Road • Rail

¹⁷ Khadia – Avg stripping ratio is as per EC issued for 14 MTPA

Sr. No.:	Coal Company	Name of mine	Location	Year of commencement of mine	Mine lease area (ha) (rounded off)	Balance reserves as on 31.03.2022 (MT)	Life of mine as on 31.03.2022 (in years)	Average Stripping Ratio m ³ /t	EC Capacity in MTPA as on 31.03.2022	Mode of transportation of coal & FMC status
24.	MCL	Balram OC	Angul, Odisha	1991	1380	67.00	12	2.21	8	<ul style="list-style-type: none"> • Road • Rail
25.	MCL	Belpahar OC	Jharsuguda, Odisha	1992	1444	11.63	02	3.04	9	<ul style="list-style-type: none"> • Road • Rail • MGR
26.	MCL	Bharatpur OC	Angul, Odisha	1985	927	81.47	07	0.88	20	<ul style="list-style-type: none"> • Road • Rail • MGR
27.	MCL	Bhubaneshwari OC	Angul, Odisha	2006	638	93.92	04	0.71	28	<ul style="list-style-type: none"> • Road • Rail
28.	MCL	Garjanbahal OC	Sudergarh, Odisha	2018	654	187.12	12	1.02	13	<ul style="list-style-type: none"> • Road • Rail
29.	MCL	Hingula OC	Angul, Odisha	2007	1742	491.00	23	1.95	15	<ul style="list-style-type: none"> • Road • Rail
30.	MCL	Jagannath OC ¹⁸	Angul, Odisha	1970	554	-	07	-	7.5	<ul style="list-style-type: none"> • Road • Rail
31.	MCL	Kaniha OC	Angul, Odisha	2010	718	71.09	06	1.63	14	<ul style="list-style-type: none"> • Road • Rail • MGR

¹⁸ Data on balance reserves and stripping ratio not available

Sr. No.:	Coal Company	Name of mine	Location	Year of commencement of mine	Mine lease area (ha) (rounded off)	Balance reserves as on 31.03.2022 (MT)	Life of mine as on 31.03.2022 (in years)	Average Stripping Ratio m ³ /t	EC Capacity in MTPA as on 31.03.2022	Mode of transportation of coal & FMC status
32.	MCL	Kulda OC	Sudergarh, Odisha	2007	634	51.56	03	1.02	16.8	<ul style="list-style-type: none"> • Road • Rail
33.	MCL	Lajkura OC	Jharsuguda , Odisha	1984	721	32.12	07	3.4	4.5	<ul style="list-style-type: none"> • Road • Rail
34.	MCL	Lakhanpur OC	Jharsuguda , Odisha	1992	224	117.73	06	2.34	21	<ul style="list-style-type: none"> • Road • Rail • MGR
35.	MCL	Lingaraj OC	Angul, Odisha	1991	1410	168.85	16	0.69	20	<ul style="list-style-type: none"> • Road • Rail
36.	MCL	Samaleswari OC	Jharsuguda , Odisha	1989	1335	110.19	10	3.14	15	<ul style="list-style-type: none"> • Road • Rail
37.	SCCL	Gautami Khani OC	Bhadradi Kothagudem, Telangana	1993	902	0.5	01	5.51	4.0	<ul style="list-style-type: none"> • Road (pit head to CHP & CHP to RCHP) • CHP & RCHP • Rail
38.	SCCL	Jawahar Khani 5 OC	Bhadradi Kothagudem, Telangana	2012	515	2.0	01	4.00	2.50	<ul style="list-style-type: none"> • Road (pit head to CHP) • CHP • Rail

Sr. No.:	Coal Company	Name of mine	Location	Year of commencement of mine	Mine lease area (ha) (rounded off)	Balance reserves as on 31.03.2022 (MT)	Life of mine as on 31.03.2022 (in years)	Average Stripping Ratio m ³ /t	EC Capacity in MTPA as on 31.03.2022	Mode of transportation of coal & FMC status
39.	SCCL	Ramagundam OC – I Exp.	Peddapalli, Telangana	2008	924	0.521	02	5.98	3.3	<ul style="list-style-type: none"> • Road (face to crushers) • CHP (through belt conveyors) • Rail (MGR)
40.	NLCIL	Talabira II & III OC	Jharsuguda, Odisha	2018	1914	547.5	04	1.02	20	<ul style="list-style-type: none"> • Road & Rail (under Construction stage)

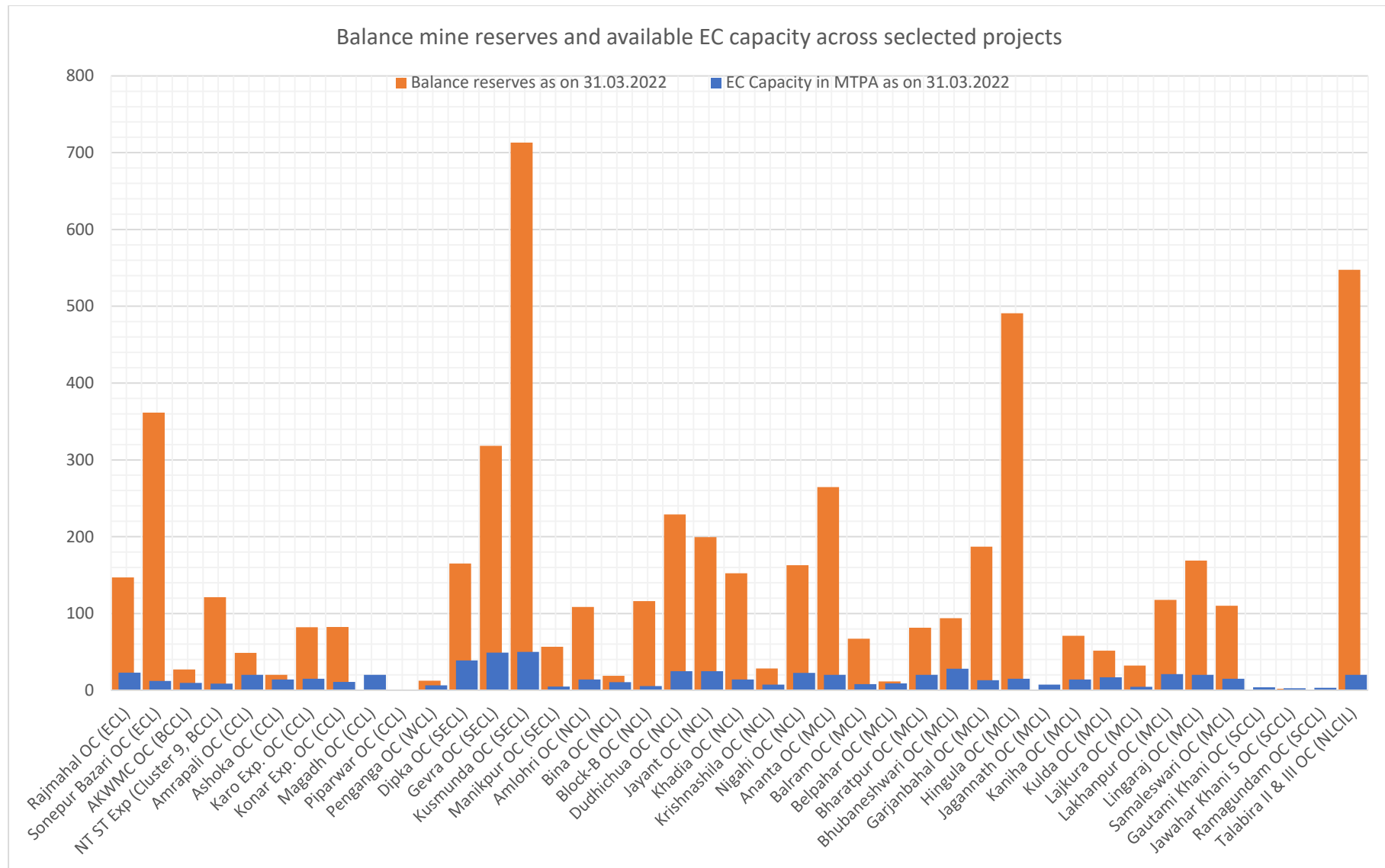


Figure 3.3: Balance mine reserves and available EC capacity for the selected projects

Chapter IV: Status of environmental sustainability – Land use

4.0 Land use in coal mining sector

Coal mining and allied activities have a huge land footprint, especially in the case of opencast mining methods. Considering the scope and magnitude of mining operations, huge tracts of land are subjected to land use changes over time and implementation of intensive amelioration measures is crucial. Major land use changes occur in the quarry area and overburden dump areas and coal companies are focussing on technical and biological reclamation of these areas over time in line with the approved calendar plan for mining operations. Apart from this, certain land patches are also impacted by virtue of infrastructure (workshop, magazines, railway siding and other FMC initiatives, CHP, offices, utilities, colonies, etc), transportation roads, and even mine water sumps. Over time, reclamation activities also involve plantation over the decommissioned land patches. The ultimate aim is to bring back the land use for sustainable uses for the communities in the vicinity. The coal companies are also engaged in monitoring of land reclamation statistics and this is also complemented through periodic satellite based surveillance of the reclamation activities.

4.1 Land use break-up across selected projects

The land use area break-up for the selected projects (36 projects of CIL, 3 projects of SCCL & 1 project of NLCIL) are provided in the table below:

Table 4.1: Land area break-up within lease area under selected projects

S.N.	Name of Mine	Total Mine Lease Area (in ha)	Area Break-up (in ha)						
			Active Mining Area	Technically Reclaimed Area	Biologically Reclaimed Area	Green Cover / Other plantations	Infra-structure area	Other Areas, if any (like Mine sumps etc.)	Un-disturbed area
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.	Rajmahal OC (ECL)	1978.00	690.45	14.00	234.00	20.04	566.00	359.10	94.41
2.	Sonepur Bazari OC (ECL)	2293.00	933.12	290.72	216.00	97.20	262.66	493.30	0.00
3.	AKWMC OC (BCCL)	325.00	133.46	0.00	43.78	92.00	23.58	31.68	0.50
4.	NT ST Exp (Cluster 9, BCCL)	755.15	328.00	0.00	38.00	0.00	33.00	120.00	236.15
5.	Amrapali OC (CCL)	619.87	295.00	132.00	23.00	13.00	32.00	119.87	5.00
6.	Ashoka OC (CCL)	793.14	80.00	247.00	121.00	17.00	48.13	280.00	0.00
7.	Karo Exp. OC (CCL)	526.32	39.00	55.00	14.00	26.00	45.08	85.25	261.99
8.	Konar Exp. OC (CCL)	471.40	85.00	88.00	30.00	2.00	29.46	28.33	208.61
9.	Magadh OC (CCL)	1769.00	92.00	60.00	0.00	10.00	106.34	1500.69	0.00
10.	Penganga OC (WCL)	743.83	333.31	0.00	9.92	14.08	9.51	377.01	0.00
11.	Dipka OC (SECL)	1999.29	397.32	95.34	331.92	164.91	567.87	367.78	74.15
12.	Gevra OC (SECL)	4184.49	714.15	762.55	504.80	681.70	1103.11	418.17	0.00
13.	Kusmunda OC (SECL)	1655.83	140.70	284.16	399.24	217.28	402.40	33.01	179.03
14.	Manikpur OC (SECL)	1018.93	275.04	99.40	52.80	120.00	89.60	225.69	156.39
15.	Amlohri OC (NCL)	2175.00	796.59	15.41	322.97	521.69	218.40	299.95	0.00
16.	Bina OC (NCL)	1798.00	519.30	2.00	437.58	100.00	450.00	250.37	38.75
17.	Block-B OC (NCL)	1339.00	455.20	5.00	102.88	92.46	224.58	228.14	230.74
18.	Dudhichua OC (NCL)	2390.72	785.76	29.00	491.95	522.23	422.00	129.78	10.00
19.	Jayant OC (NCL)	3177.17	884.00	36.00	658.87	190.01	440.65	886.14	81.50
20.	Khadia OC (NCL)	1640.00	702.12	33.00	161.50	327.00	194.00	219.38	3.00

S.N.	Name of Mine	Total Mine Lease Area (in ha)	Area Break-up (in ha)						
			Active Mining Area	Technically Reclaimed Area	Biologically Reclaimed Area	Green Cover / Other plantations	Infra-structure area	Other Areas, if any (like Mine sumps etc.)	Un-disturbed area
21.	Krishnashila OC (NCL)	851.78	457.12	45.00	138.75	0.20	60.71	140.00	10.00
22.	Nigahi OC (NCL)	3018.40	873.86	43.96	487.62	512.82	453.40	646.74	0.00
23.	Ananta OC (MCL)	1419.82	355.42	44.70	105.60	0.00	90.00	824.10	0.00
24.	Balram OC (MCL)	1380.00	263.91	166.39	122.98	0.00	45.42	781.30	0.00
25.	Belpahar OC (MCL)	1444.05	264.02	85.54	164.13	0.00	382.51	547.85	0.00
26.	Bharatpur OC (MCL)	1324.80	328.54	76.51	164.22	0.00	168.26	587.27	0.00
27.	Bhubaneshwari OC (MCL)	638.34	396.23	118.60	14.00	0.00	10.93	98.58	0.00
28.	Garjanbahal OC (MCL)	653.83	110.87	0.00	0.00	0.00	4.80	538.16	0.00
29.	Hingula OC (MCL)	1741.95	358.29	74.21	22.12	0.00	19.50	1267.83	0.00
30.	Jagannath OC (MCL)	553.95	157.20	73.15	169.62	0.00	41.72	28.19	84.07
31.	Kaniha OC (MCL)	718.00	251.35	0.00	0.00	0.00	21.48	445.17	0.00
32.	Kulda OC (MCL)	634.21	317.32	0.00	8.65	0.00	8.10	300.14	0.00
33.	Lajkura OC (MCL)	721.29	159.38	7.20	67.53	0.00	33.61	316.06	137.51
34.	Lakhanpur OC (MCL)	2240.00	541.52	175.67	147.20	0.00	86.25	1266.77	22.59
35.	Lingaraj OC (MCL)	1410.01	377.30	0.00	139.28	0.00	82.90	810.53	0.00
36.	Samaleswari OC (MCL)	1334.91	417.29	15.57	126.06	0.00	54.01	721.99	0.00
37.	Gautami Khani OC (SCCL)	902.00	363.90	10.00	456.96	0.00	56.28	14.86	0.00
38.	Jawahar Khani 5 OC (SCCL)	514.95	149.48	36.61	210.90	0.00	4.46	113.50	0.00
39.	Ramagundam OC – I Exp. (SCCL)	923.88	122.65	425.96	202.80	0.00	30.52	141.95	0.00
40.	Talabira II & III OC (NLCIL)	1914.06	140.57	0.00	0.00	4.43	5.00	1764.06	0.00

Table 4.2: Forest area and non-forest area break-up under selected projects and plantation outside mine lease area

S.N.	Name of Mine	Total Mine Lease Area	Forest Area	Non-Forest Area	Plantation done outside mine lease area
(1)	(2)	(3) = (4)+(5)	(4)	(5)	(6)
1.	Rajmahal OC (ECL)	1978.00	107.42	1870.58	15.00
2.	Sonepur Bazari OC (ECL)	2293.00	32.65	2260.35	0.00
3.	AKWMC OC (BCCL)	325.00	0.00	325.00	0.00
4.	NT ST Exp (Cluster 9, BCCL)	755.15	0.00	755.15	0.00
5.	Amrapali OC (CCL)	619.87	531.64	88.23	0.00
6.	Ashoka OC (CCL)	793.14	239.31	553.83	0.00
7.	Karo Exp. OC (CCL)	526.32	304.10	222.22	0.00
8.	Konar Exp. OC (CCL)	471.40	360.49	110.90	0.00
9.	Magadh OC (CCL)	1769.00	244.00	1525.00	0.00
10.	Penganga OC (WCL)	743.83	46.04	697.79	0.00
11.	Dipka OC (SECL)	1999.29	409.06	1590.24	0.00
12.	Gevra OC (SECL) ¹⁹	4184.49	1016.41	3168.07	20.00
13.	Kusmunda OC (SECL)	1655.83	205.96	1449.86	18.49
14.	Manikpur OC (SECL)	1018.93	375.90	643.03	0.00
15.	Amlohri OC (NCL)	2175.00	1195.00	980.00	0.00
16.	Bina OC (NCL)	1798.00	1087.83	710.18	0.00
17.	Block-B OC (NCL)	1339.00	447.00	892.00	0.00
18.	Dudhichua OC (NCL)	2390.72	1217.59	1173.13	0.00
19.	Jayant OC (NCL)	3177.17	1180.17	1997.00	0.00

¹⁹ Plantation proposed in Birda Village (over an area of 20 Ha with 50000 saplings) of Katghora Division through DFO & DD amount of Rs.99.92 lakhs submitted to DFO on 27/07/2021

S.N.	Name of Mine	Total Mine Lease Area	Forest Area	Non-Forest Area	Plantation done outside mine lease area
20.	Khadia OC (NCL)	1640.00	933.98	706.02	0.00
21.	Krishnashila OC (NCL)	851.78	493.99	357.79	0.00
22.	Nigahi OC (NCL)	3018.40	1280.66	1737.74	0.00
23.	Ananta OC (MCL)	1419.82	334.36	1085.46	29.98
24.	Balram OC (MCL)	1380.00	85.01	1294.99	24.56
25.	Belpahar OC (MCL)	1444.05	123.22	1320.83	90.80
26.	Bharatpur OC (MCL)	927.42	177.77	749.65	13.00
27.	Bhubaneshwari OC (MCL)	638.34	112.52	525.82	18.26
28.	Garjanbahal OC (MCL)	653.83	88.90	564.93	0.00
29.	Hingula OC (MCL)	1741.95	435.15	1306.80	17.13
30.	Jagannath OC (MCL)	553.95	82.74	471.21	51.29
31.	Kaniha OC (MCL)	718.00	2.31	715.69	6.94
32.	Kulda OC (MCL)	634.21	227.89	406.32	73.03
33.	Lajkura OC (MCL)	721.29	159.18	562.11	0.00
34.	Lakhanpur OC (MCL)	2240.00	233.43	2006.57	91.11
35.	Lingaraj OC (MCL)	1410.01	186.31	1223.70	44.11
36.	Samaleswari OC (MCL)	1334.91	565.73	769.18	295.82
37.	Gautami Khani OC (SCCL)	902.00	540.27	361.73	47.54
38.	Jawahar Khani 5 OC (SCCL)	514.95	0.00	514.95	0.00
39.	Ramagundam OC – I Exp. (SCCL)	923.88	15.64	908.24	0.00
40.	Talabira II & III OC (NLCIL)	1914.06	1038.19	875.87	25.50

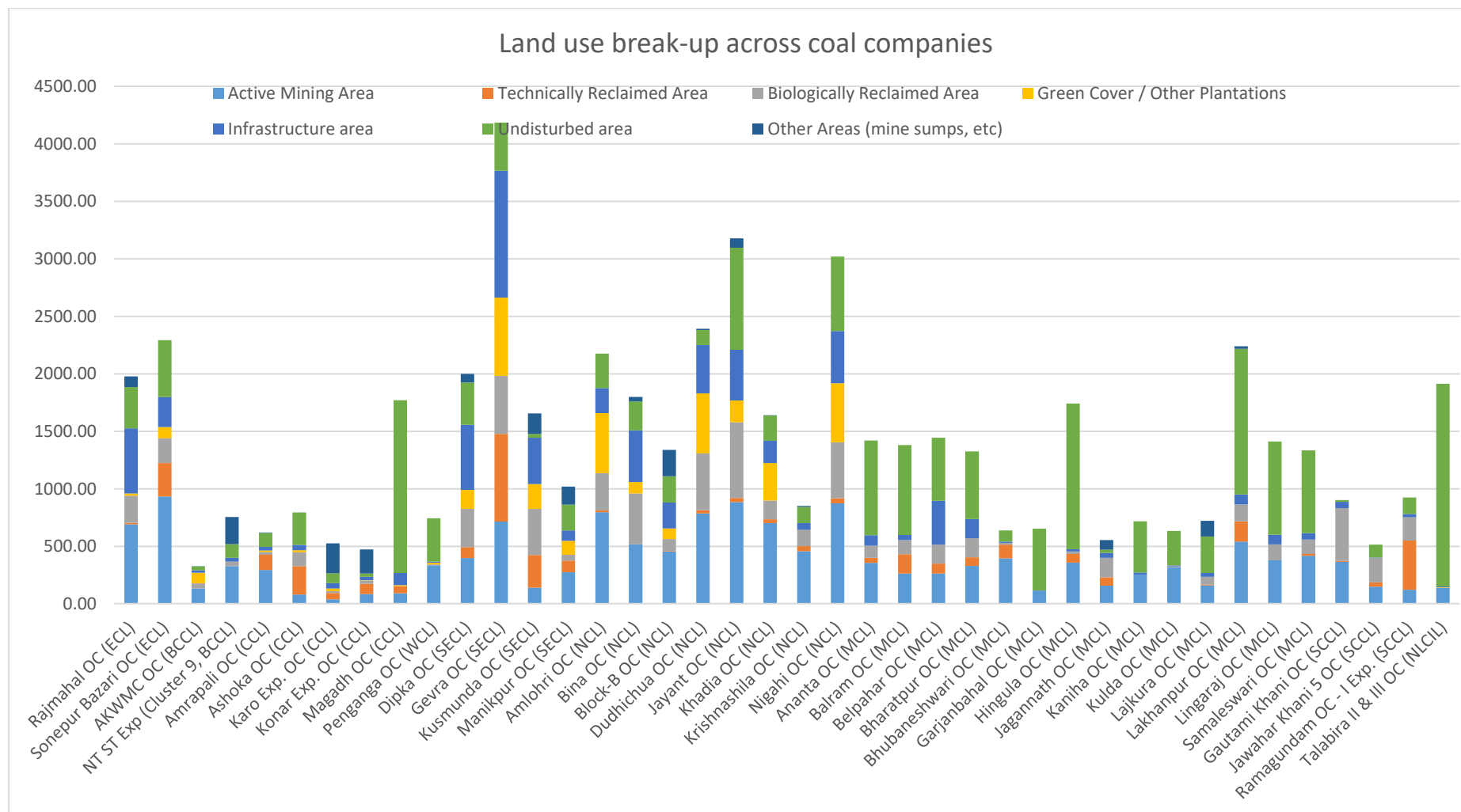


Figure 4.1: Land use break-up across coal companies

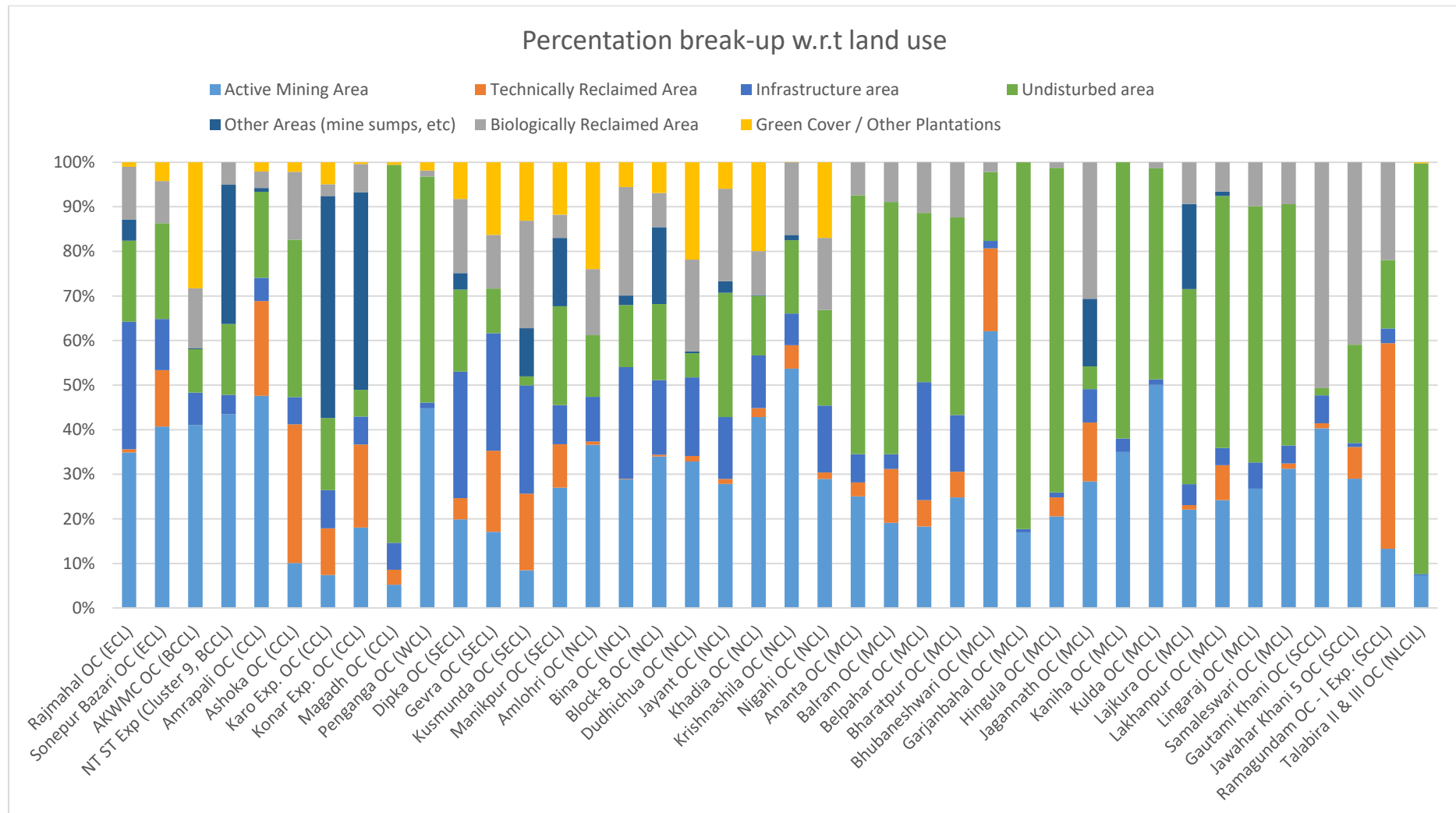


Figure 4.2: Percentage break-up w.r.t land use

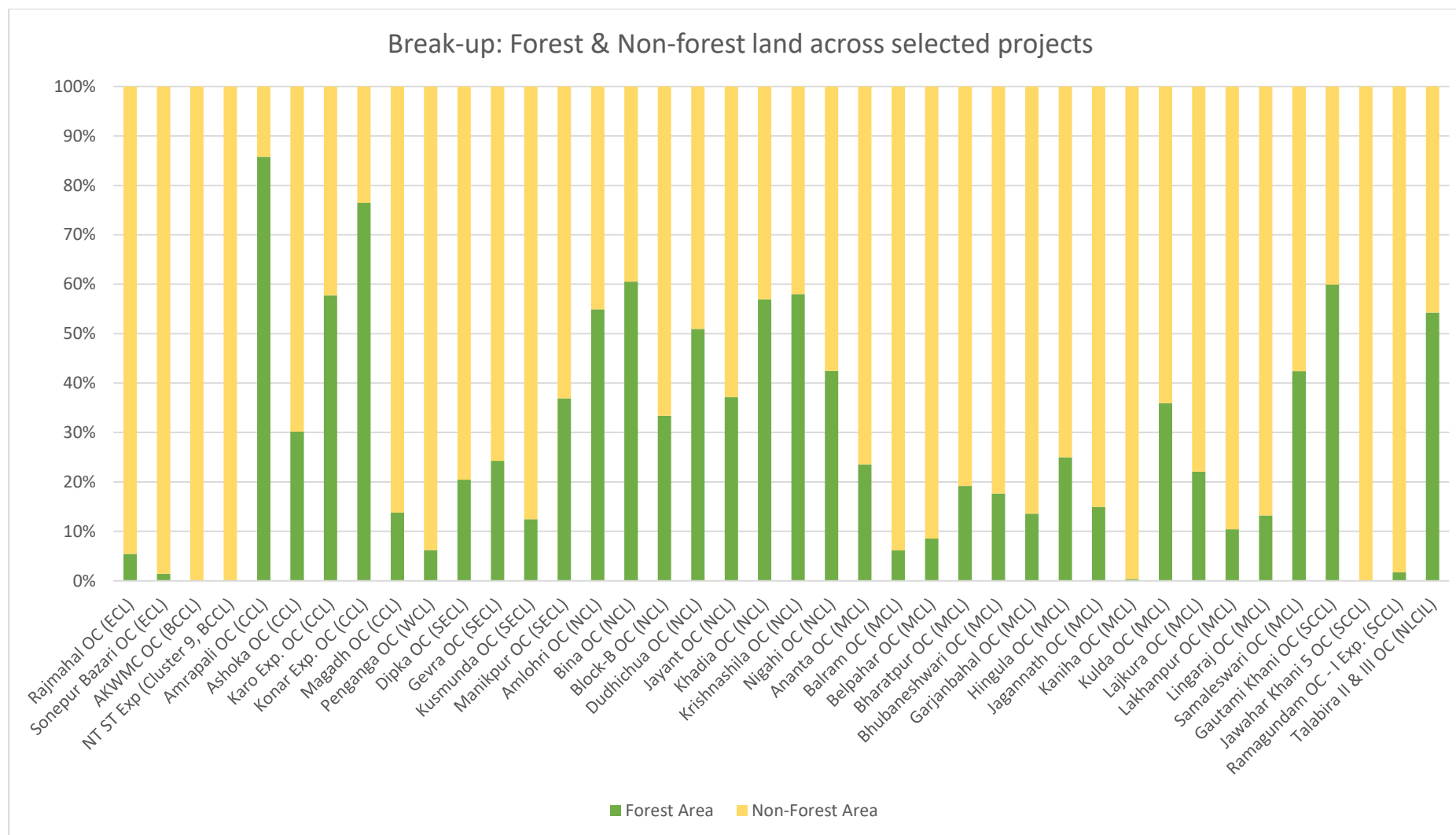


Figure 4.3: Break-up of forest land and non-forest land across selected projects

4.2 Observations on land area

Considering provided data, the following can be inferred.

Table 4.3: Summary w.r.t land area break-up in selected projects

Area segment	Percentage range across selected projects	Average area considering selected projects
Active mining area	5.20 to 62.07	28.95
Area under technical reclamation	Nil to 46.11	7.42
Area under biological reclamation	Nil to 50.66	11.76
Other areas under green cover	Nil to 28.31	4.91
Infra & other areas (mine sumps, etc.)	0.26 to 58.34	15.21
Undisturbed areas	1.65 to 92.16	31.75

Chapter V: Status of environmental sustainability – Air Quality

5.0 Air quality in coal mining sector

Since nature of coal mining operations involves breaking of land strata (drilling, blasting, handling) and transportation of coal and overburden, air quality in mining areas is adversely impacted. Particulate matter (PM₁₀, PM_{2.5}), and oxides of sulphur and nitrogen are the major pollutants in coal mines. In order to minimize the adverse impacts, mining companies are implementing an array of preventive measures and mitigation strategies to control the dust emission and fugitive air emissions arising from mining. New technologies like fog cannons, wheel washing systems, localized dust suppression systems and initiatives like wind barriers as well as Vertical Greenery Systems are also being deployed across the coal mines. Apart from the routine air quality monitoring, coal companies are also installing Continuous Ambient Air Quality Monitoring Systems (CAAQMS) to facilitate data w.r.t air quality and gauge the impact of their mitigation efforts. Air quality in coal mining areas (core zones) are governed by the Coal Mine Standards issued under GSR 742(E) dated 25.09.2000 vide MoEF&CC whereas air quality in areas surrounding the mines (buffer zones) are governed by the National Ambient Air Quality Standards (NAAQS).

5.1 Status of Air Quality

Status of air quality for each of the projects has been analysed based on the Ambient Air Quality Monitoring (AAQM) undertaken by the respective projects. The minimum and maximum range for the major pollutants, namely PM₁₀, PM_{2.5}, SO₂ and NO_x for the period from April, 2021 till March, 2022 were analysed based on the reported AAQM data in the core and buffer zones of the project.

Apart from the above, graphical analysis of status of compliance of air quality parameters and range of concentrations for SO_x and NO_x in core and buffer zones for the period from April, 2020 till March, 2021 in respect of Coal Standards in the core zone and NAAQS in the buffer zone respectively have been presented.

The ranges reported for the pollutants (PM₁₀, PM_{2.5}, SO₂ and NO_x) are given in the table below:

Table 5.1: Status of air quality for projects considered

Sr. No.:	Name of mine & Coal Company	Core / Buffer	PM ₁₀ (Min)	PM ₁₀ (Max)	PM _{2.5} (Min)	PM _{2.5} (Max)	SO ₂ (Min)	SO ₂ (Max)	NO _x (Min)	NO _x (Max)
1.	Rajmahal OC (ECL)	Core	28.8	391.6	2.0	118.2	10.0	10.0	12.8	22.7
		Buffer	34.7	258.0	2.5	80.5	10.0	10.0	11.2	17.2
2.	Sonepur Bazari OC (ECL)	Core	63.1	317.8	15.2	132.7	10.0	10.0	13.8	20.5
		Buffer	33.6	161.1	13.0	73.0	10.0	10.0	11.6	17.6
3.	AKWMC OC (BCCL)	Core	72.0	139.0	34.0	73.0	10.0	13.0	19.0	34.0
		Buffer	66.0	178.0	27.0	79.0	10.0	14.0	19.0	35.0
4.	NT ST Exp (Cluster 9, BCCL)	Core	78.0	132.0	36.0	74.0	10.0	14.0	19.0	34.0
		Buffer	68.0	134.0	29.0	77.0	10.0	14.0	14.0	34.0
5.	Amrapali OC (CCL)	Core	85.0	257.0	34.0	115.0	25.0	25.0	6.0	6.0
6.	Ashoka OC (CCL)	Core	61.0	152.0	24.0	75.0	25.0	25.0	6.0	6.0
7.	Karo Exp. OC (CCL)	Core	42.0	95.0	25.0	53.0	25.0	25.0	6.0	6.0
8.	Konar Exp. OC (CL)	Core	51.0	138.0	31.0	70.0	25.0	25.0	6.0	6.0
9.	Magadh OC (CCL)	Buffer	72.0	133.0	41.0	72.0	25.0	25.0	6.0	6.0
10.	Penganga OC (WCL)	Core	114.0	228.0	54.0	82.0	11.0	22.0	16.0	28.0
		Buffer	54.0	88.0	26.0	54.0	10.0	14.0	10.0	18.0
11.	Dipka OC (SECL)	Core	34.6	286.8	47.2	60.1	27.9	37.3	30.0	40.6
		Buffer	73.0	271.8	48.2	55.3	31.1	38.8	33.8	41.8
12.	Gevra OC (SECL)	Core	237.0	299.8	54.0	74.1	26.5	47.0	28.1	45.8
		Buffer	61.3	104.3	36.0	60.8	26.0	42.5	28.0	42.5
13.	Kusmunda OC (SECL)	Core	50.6	291.0	43.1	84.6	28.6	38.4	29.8	40.2
		Buffer	63.5	300.6	45.8	85.5	27.2	37.8	31.3	76.9
14.	Manikpur OC (SECL)	Core	201.0	261.3	282.7	285.0	56.0	69.4	76.0	76.0
		Buffer	72.0	114.1	277.9	287.0	37.0	48.2	71.5	72.0
15.	Amlohri OC (NCL)	Core	36.0	229.0	13.0	92.0	25.0	36.0	12.0	45.0
		Buffer	36.0	113.0	20.0	46.0	25.0	28.0	12.0	35.0

Sr. No.:	Name of mine & Coal Company	Core / Buffer	PM ₁₀ (Min)	PM ₁₀ (Max)	PM _{2.5} (Min)	PM _{2.5} (Max)	SO ₂ (Min)	SO ₂ (Max)	NO _x (Min)	NO _x (Max)
16.	Bina OC (NCL)	Core	40.0	304.0	15.0	83.0	25.0	38.0	15.0	47.0
		Buffer ²⁰	113.0	181.0	46.0	67.0	27.0	30.0	32.0	35.0
17.	Block-B OC (NCL)	Core	43.0	299.0	12.0	82.0	26.0	42.0	23.0	53.0
		Buffer	36.0	90.0	20.0	32.0	25.0	28.0	12.0	22.0
18.	Dudhichua OC (NCL)	Core	58.0	342.0	18.0	87.0	25.0	43.0	17.0	55.0
	Jayant OC (NCL)	Core	45.0	328.0	10.0	78.0	25.0	37.0	10.0	48.0
19. 20.	Khadia OC (NCL)	Core	25.0	314.0	9.0	76.0	25.0	42.0	14.0	53.0
		Buffer	56.0	112.0	27.0	53.0	26.0	32.0	30.0	37.0
21.	Krishnashila OC (NCL)	Core	66.0	258.0	22.0	75.0	25.0	38.0	16.0	48.0
		Buffer	48.0	112.0	23.0	53.0	25.0	32.0	30.0	37.0
22.	Nigahi OC (NCL)	Core	51.0	337.0	18.0	94.0	25.0	38.0	18.0	45.0
23.	Ananta OC (MCL)	Core	82.5	219.0	31.0	77.0	9.9	26.1	18.5	42.3
		Buffer	62.0	92.5	26.4	48.0	12.4	24.0	24.0	48.7
24.	Balram OC (MCL)	Core	87.5	271.0	35.0	72.5	9.2	21.5	15.7	40.6
		Buffer	64.5	86.9	28.1	48.4	13.9	29.8	21.0	53.2
25.	Belpahar OC (MCL)	Core	95.0	203.0	36.5	58.5	9.5	18.7	14.2	39.7
		Buffer	64.0	94.9	28.5	48.8	11.5	21.2	18.3	40.9
26.	Bharatpur OC (MCL)	Core	63.5	280.5	28.5	71.5	9.8	26.2	18.6	51.9
		Buffer	62.9	85.9	26.6	47.8	13.5	27.6	21.0	45.8
27.	Bhubaneshwari OC (MCL)	Core	58.4	252.4	40.3	59.2	4.6	83.6	4.5	84.1
28.	Garjanbahal OC (MCL)	Core	49.5	201.0	25.5	63.5	8.7	21.6	14.6	32.8
		Buffer	64.3	92.0	27.0	51.5	10.3	22.2	20.3	39.5
29.	Hingula OC (MCL)	Core	86.0	220.5	35.0	70.0	9.3	26.0	16.1	50.0
		Buffer	66.0	84.0	26.9	48.6	11.9	29.7	20.5	53.2

²⁰ Based on buffer zone stations sampled during Dec'21 & Mar'22.

Sr. No.:	Name of mine & Coal Company	Core / Buffer	PM ₁₀ (Min)	PM ₁₀ (Max)	PM _{2.5} (Min)	PM _{2.5} (Max)	SO ₂ (Min)	SO ₂ (Max)	NO _x (Min)	NO _x (Max)
30.	Jagannath OC (MCL)	Core	82.5	221.5	31.0	77.5	9.9	30.9	22.6	51.6
		Buffer	65.3	96.3	27.9	47.2	12.3	24.1	19.5	42.0
31.	Kaniha OC (MCL)	Core	71.0	228.0	31.0	70.0	9.8	38.1	16.0	52.4
		Buffer	68.6	88.4	28.0	49.5	13.0	29.0	23.8	43.9
32.	Kulda OC (MCL)	Core	97.5	183.5	30.0	62.5	11.0	23.7	19.5	41.1
		Buffer	62.1	95.1	26.3	48.1	11.2	21.3	19.0	38.1
33.	Lajkura OC (MCL)	Core	81.5	208.5	29.0	65.5	8.4	20.8	13.2	36.7
		Buffer	60.1	90.0	25.3	45.9	11.1	22.5	19.5	43.9
34.	Lakhanpur OC (MCL)	Core	78.0	205.0	30.0	64.5	10.0	24.7	14.9	37.0
		Buffer	61.9	91.5	26.1	50.6	11.0	20.3	17.8	37.3
35.	Lingaraj OC (MCL)	Core	74.0	237.0	30.0	73.0	10.1	26.8	16.4	55.3
		Buffer	63.4	83.4	26.9	49.9	10.5	19.1	17.4	35.9
36.	Samaleswari OC (MCL)	Core	76.0	225.0	32.5	73.5	9.5	21.1	16.0	51.3
		Buffer	61.6	90.0	25.3	45.9	10.2	22.5	16.8	43.9
37.	Gautami Khani OC (SCCL)	Core	82.0	135.0	25.3	56.8	11.9	14.5	16.9	21.4
		Buffer	48.0	55.0	19.8	23.1	10.3	13.5	14.6	19.9
38.	Jawahar Khani 5 OC (SCCL)	Core	149.0	189.0	35.1	55.6	10.2	11.3	14.5	16.2
		Buffer	49.0	72.0	20.1	23.2	8.2	9.9	14.1	15.1
39.	Ramagundam OC – I Exp. (SCCL)	Core	92.0	188.0	36.8	59.6	8.1	16.3	13.0	21.5
		Buffer	56.0	88.0	33.2	47.2	7.4	11.2	11.0	18.5
40.	Talabira II & III OC (NLCIL)	Core ²¹	69.0	240.0	-	-	7.8	26.1	16.5	37.3
		Buffer	42.0	77.2	22.4	43.5	5.1	17.2	11.8	28.5

²¹ Data on PM_{2.5} monitoring in core zone stations not available.

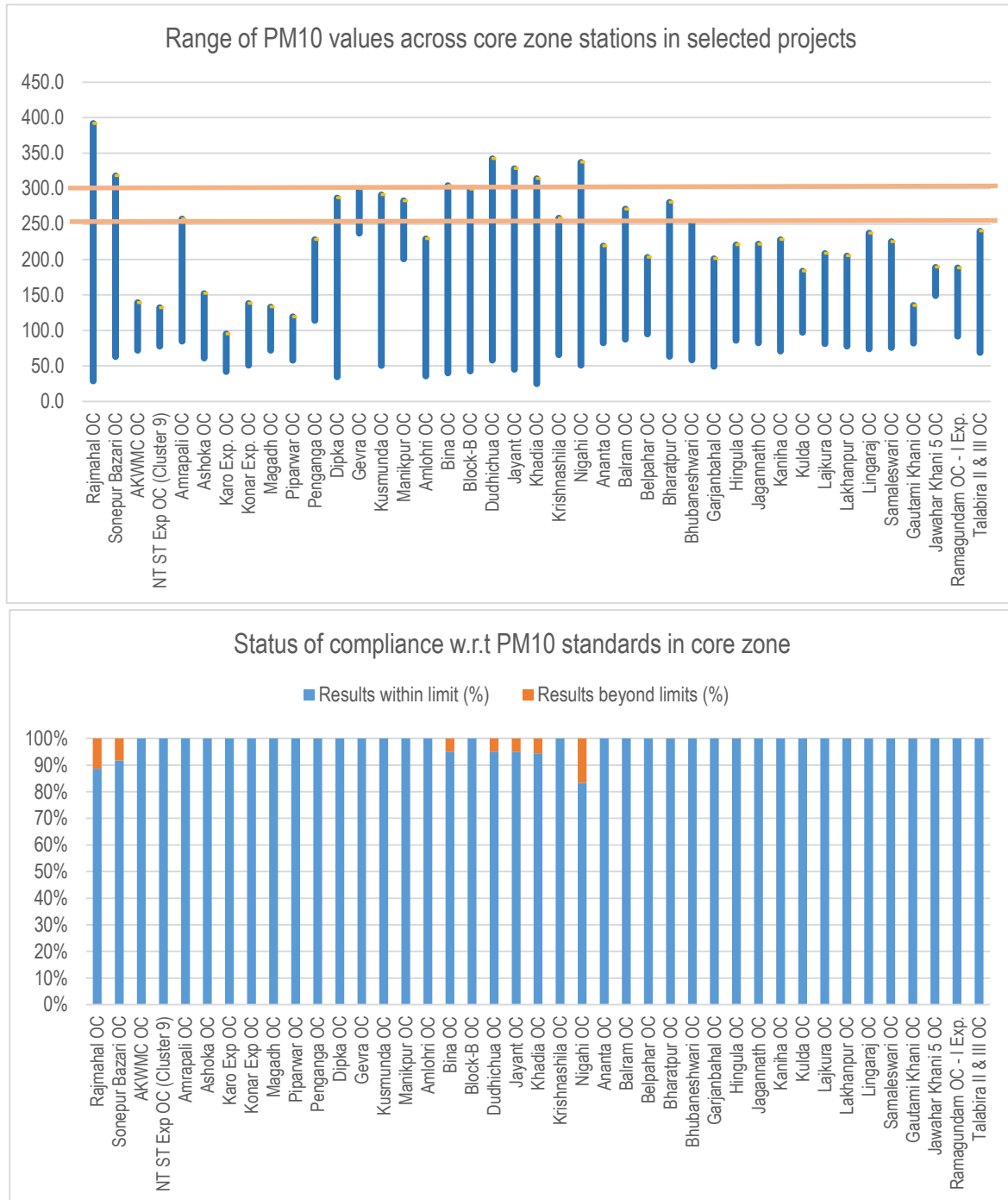


Figure 5.1: Range of PM₁₀ concentration reported across core zone stations in selected projects

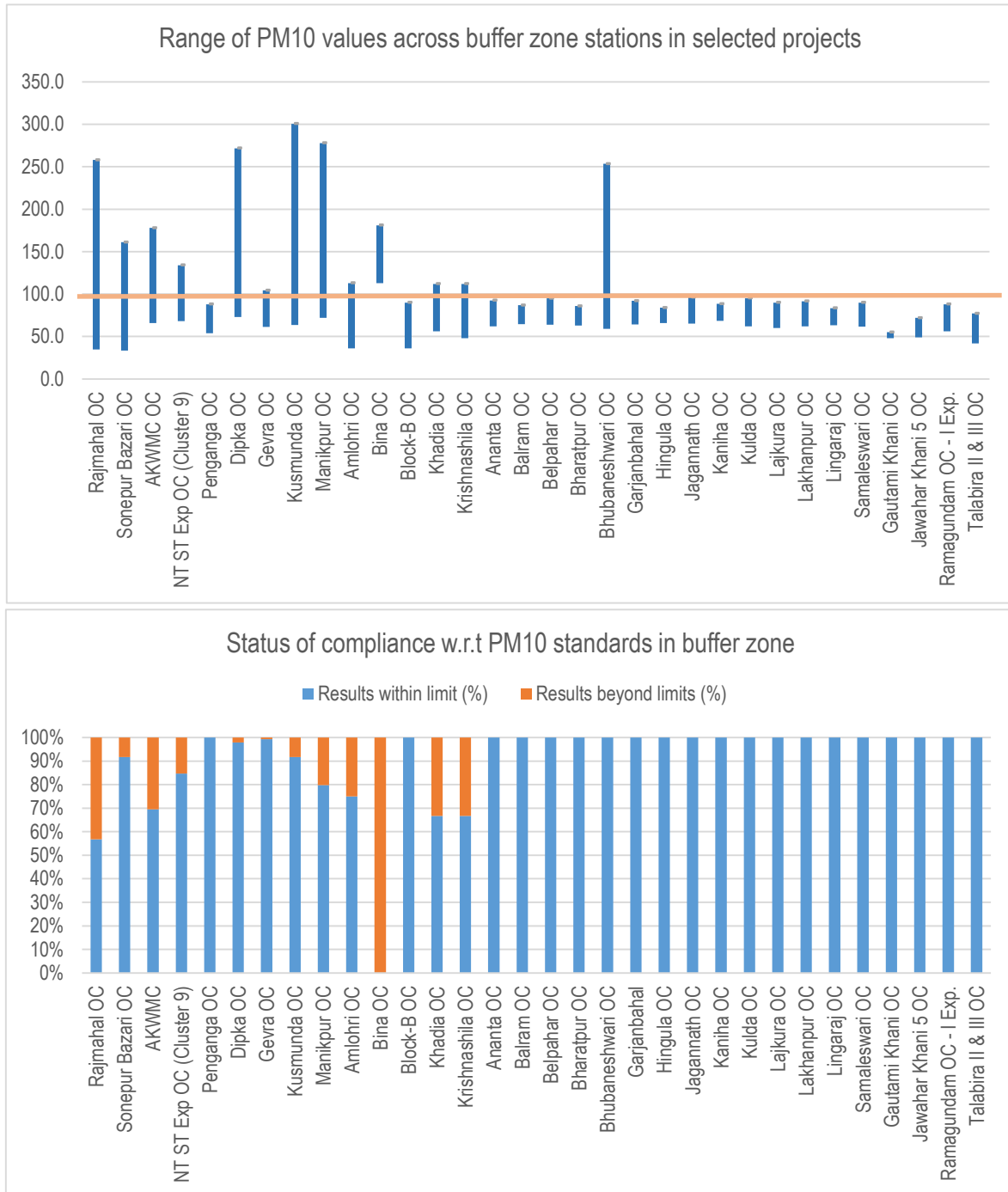


Figure 5.2: Range of PM₁₀ concentration reported across buffer zone stations in selected projects

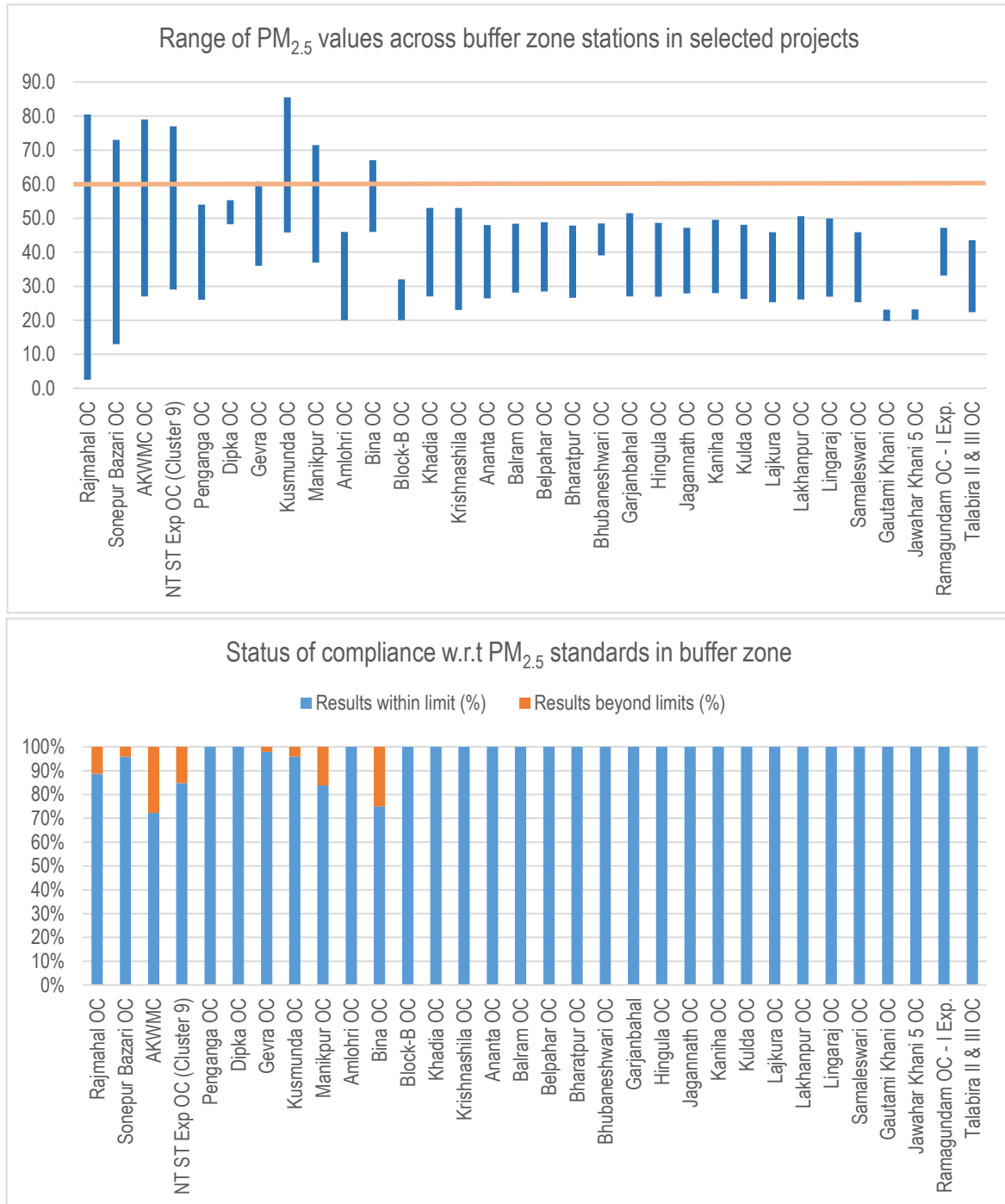


Figure 5.3: Range of PM_{2.5} concentration reported across buffer zone stations in selected projects

5.2 Observations on air quality

Ambient air quality reported across most of the selected projects is within the prescribed norms. The following 24 projects reported 100% compliance with applicable standards Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000) for core zone and National Ambient Air Quality Standards (NAAQS) for buffer zone stations based on provided data.

Table 5.2: Projects reporting 100% compliance with applicable air standards during FY 21-22

Projects reporting 100% compliance with applicable air standards during FY 21-22
CCL (only core stations) - Amrapali OC, Ashoka OC, Karo Exp OC, Konar Exp OC, Magadh OC
WCL - Penganga OC
NCL - Block-B OC
MCL - Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC
SCCL - Gautami Khani OC, Jawahar Khani 5 OC, Ramagundam OC – I Exp.
NLCIL - Talabira II & III OC

W.r.t PM₁₀ values in the core zone, majority of the projects (34) reported compliance with the applicable coal mine standards; whereas compliance in the remaining 5 projects ranged between 83.3% to 95%. Concentrations of SO₂ & NO_x were reported to be with the permissible limits in all selected projects.

W.r.t PM₁₀ values in the buffer zone, percentage compliance with buffer zone standards ranged from 56.8% to 100% (excluding Bina OC of NCL). Percentage compliance w.r.t PM_{2.5} concentrations in the buffer zone range from 72.2% to 100%. Concentrations of SO₂ & NO_x were reported to be with the permissible limits in all selected projects, except for Bhubaneswari OC of MCL, where the values were reported to be slightly above the prescribed limit.

5.3 Mitigation measures implemented for control of air pollution across projects

The details on provisions made for mitigation of air pollution are presented in the table below.

Table 5.3: Mitigation measures implemented for air pollution control across projects

Sr. No.:	Name of mine & company	Water sprinkling systems for dust suppression	Other air pollution mitigation measures	Installation of Vertical Greenery System & Wind Barriers
1.	Rajmahal OC (ECL)	<ul style="list-style-type: none"> Fixed water sprinklers have been installed enroute to RJ Siding and Near CHP Mobile water sprinklers have also been deployed under departmental mode - 28 KL (6 No) & contractual mode - (34 KL (02 No.), 20KL (06 No.)) 	<ul style="list-style-type: none"> Automatic sensor based mist type DSS has also been installed near hopper 	-
2.	Sonepur Bazari OC (ECL)	<ul style="list-style-type: none"> Fixed water sprinkler (1 unit) has been installed at CHP 3 nos. of mobile water sprinkling systems (28 KL) have been deployed around the mine area 	-	<ul style="list-style-type: none"> Wind Barrier system has been installed along a length of 950m
3.	AKWMC OC (BCCL)	<ul style="list-style-type: none"> 5 nos. of mist sprinklers with a capacity of 28 KL, working 10-12 trips/day have been deployed along the haul road, coal transportation route 01 fog canon has been installed and mist sprayer at public road and railway siding 	<ul style="list-style-type: none"> 12 ha block plantation has been done along railway siding using species like <i>Shisham</i>, <i>Chakundi</i>, <i>Chatni</i>, <i>Siris</i>, etc. 	-
4.	NT ST Exp (Cluster 9, BCCL)	<ul style="list-style-type: none"> 02 nos. of mist sprinklers of capacity 28KL each are used for water spraying (averaging 6 trips per shift) 01 no. of truck mounted fog cannon with a capacity 12 KL 	<ul style="list-style-type: none"> 38 ha plantation has been done as green belt 	-
5.	Amrapali OC (CCL)	<ul style="list-style-type: none"> Fixed water sprinklers have been installed along a distance of 1800 m at Shivpur siding and 1300 m along coal transportation road Mobile water sprinkling arrangements - 5 nos. of 28 KL capacity under departmental mode and 13 nos. of 12 KL/ 20 KL under contractual mode 	<ul style="list-style-type: none"> 05 Fog Cannons have been installed Mobile type fog cannon - 01 is under procurement stage and 04 nos. under approval stage 	<ul style="list-style-type: none"> Wind breakers have been installed along a total length of 3000 m at different locations in the mine and at siding
6.	Ashoka OC (CCL)	<ul style="list-style-type: none"> Water sprinkling on haul roads and other roads is being done by mobile & static sprinklers (8 nos. of mist sprayers and 12 nos. of mobile sprinklers) 116 numbers of static sprinklers are functioning which cover about 2.5 km of the coal transport road. 	<ul style="list-style-type: none"> The project has planted about 5.98 Lakh saplings on backfilled areas, roadsides and around infrastructure. PCC road of 7.7 km length from mine to railway siding has been constructed 	-

Sr. No.:	Name of mine & company	Water sprinkling systems for dust suppression	Other air pollution mitigation measures	Installation of Vertical Greenery System & Wind Barriers
7.	Karo Exp. OC (CCL)	<ul style="list-style-type: none"> •45 Nos of fixed sprinklers have been installed along haul road and 25 nos of fixed sprinklers installed at siding •02 nos of 12 KL & 01 no. of 10 KL mobile sprinkler have been deployed 	-	<ul style="list-style-type: none"> •Wind barriers have been installed along 2200 m transportation road & office buildings
8.	Konar Exp. OC (CCL)	<ul style="list-style-type: none"> •30 fixed water sprinklers have been installed at Konar Railway siding •03 nos of 28 KL mobile water sprinklers under departmental mode and 06 nos of 18 KL mobile water sprinklers under outsourcing mode have been deployed 	-	<ul style="list-style-type: none"> •Wind barrier has been installed along Konar Railway Siding covering a length of 600 m, with a height of 20 ft •Plantation has also been done along Konar Railway Siding
9.	Magadh OC (CCL)	<ul style="list-style-type: none"> •3 fixed water sprinkling systems, each having 50 units and throw of 1800 m each have been installed at Phulbasia, Bukru & Balumath •2 nos. of mobile water sprinkling units with a capacity of 28 KL (frequency of 8 hrs per day) have been deployed along the route from Ara to Chamatu Transporting Road, Kundi to Devalgada Road, & Kundi, Chamatu, Devalgada Coal Stock 	-	<ul style="list-style-type: none"> •Wind Barriers using Green Curtain has been installed along 5.4 km length, with 2.5 m height using species like <i>Chakundi</i>, <i>Sakhua</i> & <i>Neem</i>
10.	Penganga OC (WCL)	<ul style="list-style-type: none"> •Total 30 nos. of high radial throw rain guns (50 m throw radius) are under operation along coal transportation road and at coal stock yard •2 Nos. of 12 KL water tankers are deployed at coal transportation road upto Sakhara village •Under departmental mode, 2 Nos. of 28 KL water tankers are deployed for dust suppression at haul roads •Under contractual mode 4 Nos. of 18 KL Water tanker for dust suppression is deployed at various contractual patches 	<ul style="list-style-type: none"> •01 no. of truck mounted mist cannon is in operation 	-

Sr. No.:	Name of mine & company	Water sprinkling systems for dust suppression	Other air pollution mitigation measures	Installation of Vertical Greenery System & Wind Barriers
11.	Dipka OC (SECL)	<ul style="list-style-type: none"> • Fixed Sprinklers – 294 Nos • Rain Guns – 21 Nos • Mist Spray System – 110 Nos • Mobile water sprinkling arrangements: 70 KL Tanker – 5 Nos & 28 KL Tanker – 5 Nos 	<ul style="list-style-type: none"> • Truck Mounted Long Range Fogging Machine – 01 • Mechanized Sweeping Machine – 01 	<ul style="list-style-type: none"> • Vertical Greenery System (VGS) has been installed at railway siding over a length of 750 m
12.	Gevra OC (SECL)	<ul style="list-style-type: none"> • Fixed water sprinkling arrangements have been made along the coal transportation road along 14 km length • Mobile water sprinkling arrangements: 70 KL Tanker – 15 Nos & 09 KL Tanker – 22 Nos 	<ul style="list-style-type: none"> • Long range fogging machines have been installed – 2 nos. Provision has also been made for hiring of 7 nos of truck mounted mist blowers / fog cannons • Mechanized sweeping machine – 2 nos have been installed • Mist sprayers – 48 nos & water sprays – 10 nos have been deployed at CHP 	<ul style="list-style-type: none"> • Vertical Greenery System (VGS) has been installed in downwind direction over a length of 750 m
13.	Kusmunda OC (SECL)	<ul style="list-style-type: none"> • Fixed water sprinkling arrangements have been made at 40 posts covering a length of 2.50 km along the haul roads • Departmental tankers with 70 KL capacity (10 nos.) & 28 KL capacity (05 nos.) and contractual tankers with 09 KL capacity (06 nos.) have been deployed 	<ul style="list-style-type: none"> • One No. of Truck-mounted Long Range Fogging Machine has been installed. • 15 Surface Miners are being used 	<ul style="list-style-type: none"> • Dust breaking arrangements (Wind Barrier) has been provided along 640m length (8 ft. high R.C.C wall fitted with 3.0 m high G.I. Sheet) at NK-II Railway Siding
14.	Manikpur OC (SECL)	<ul style="list-style-type: none"> • Total 63 fixed sprinklers have been installed – 7 nos. in Railway Siding no. 2, 41 nos. along main approach road to the mine, 8 nos. in CHP and 7 nos. along T-line to Substation • 5 mobile tankers have been provisioned: 2 tankers of 9 KL capacity cater to railway siding route, 3 nos. of 12 kl, 9 kl and 18 kl for dust suppression on internal roads 	<ul style="list-style-type: none"> • 2 nos. of mobile long range fog cannon machines of 100 m throw have been installed in CHP 	<ul style="list-style-type: none"> • Wind barrier metal sheet (around 3.5 m high, 18 m long) has been installed along railway siding no. 2
15.	Amlohri OC (NCL)	<ul style="list-style-type: none"> • 130 units of fixed water sprinkling systems have been installed • 15 units of mobile water sprinkling systems have been installed 	<ul style="list-style-type: none"> • Fog cannons / mist sprayers installed – 02 nos. 	<ul style="list-style-type: none"> • VGS / Wind barriers installed – 02 nos.

Sr. No.:	Name of mine & company	Water sprinkling systems for dust suppression	Other air pollution mitigation measures	Installation of Vertical Greenery System & Wind Barriers
16.	Bina OC (NCL)	<ul style="list-style-type: none"> • 428 units of fixed water sprinkling systems have been installed • 20 units of mobile water sprinkling systems have been installed 	<ul style="list-style-type: none"> • Fog cannons / mist sprayers installed – 04 nos. 	<ul style="list-style-type: none"> • VGS / Wind barriers installed – 01 no.
17.	Block-B OC (NCL)	<ul style="list-style-type: none"> • 176 units of fixed water sprinkling systems have been installed • 8 units of mobile water sprinkling systems have been installed 	<ul style="list-style-type: none"> • Fog cannons / mist sprayers installed – 04 nos. 	<ul style="list-style-type: none"> • VGS / Wind barriers installed – 01 no.
18.	Dudhichua OC (NCL)	<ul style="list-style-type: none"> • 89 units of fixed water sprinkling systems have been installed • 15 units of mobile water sprinkling systems have been installed 	<ul style="list-style-type: none"> • Fog cannons / mist sprayers installed – 03 nos. 	<ul style="list-style-type: none"> • VGS / Wind barriers installed – 02 nos.
19.	Jayant OC (NCL)	<ul style="list-style-type: none"> • 324 units of fixed water sprinkling systems have been installed • 43 units of mobile water sprinkling systems have been installed 	<ul style="list-style-type: none"> • Fog cannons / mist sprayers installed – 05 nos. 	<ul style="list-style-type: none"> • VGS / Wind barriers installed – 02 nos. • 1 no Wind Barrier installed at Spur – I & II
20.	Khadia OC (NCL)	<ul style="list-style-type: none"> • 150 units of fixed water sprinkling systems have been installed • 28 units of mobile water sprinkling systems have been installed 	<ul style="list-style-type: none"> • Fog cannons / mist sprayers installed – 02 nos. 	<ul style="list-style-type: none"> • VGS / Wind barriers installed – 02 nos.
21.	Krishnashila OC (NCL)	<ul style="list-style-type: none"> • 157 units of fixed water sprinkling systems have been installed • 4 units of mobile water sprinkling systems have been installed 	<ul style="list-style-type: none"> • Fog cannons / mist sprayers installed – 01 nos. 	-
22.	Nigahi OC (NCL)	<ul style="list-style-type: none"> • 81 units of fixed water sprinkling systems have been installed • 28 units of mobile water sprinkling systems have been installed 	<ul style="list-style-type: none"> • Fog cannons / mist sprayers installed – 02 nos. 	<ul style="list-style-type: none"> • VGS / Wind barriers installed – 01 no. • 1 no Wind Barrier at Township Boundary
23.	Ananta OC (MCL)	<ul style="list-style-type: none"> • Fixed water sprinkling system installed – 6 nos. having 100 m throw 	<ul style="list-style-type: none"> • Fog cannon – 01 unit with 30 m throw has been installed 	-

Sr. No.:	Name of mine & company	Water sprinkling systems for dust suppression	Other air pollution mitigation measures	Installation of Vertical Greenery System & Wind Barriers
		<ul style="list-style-type: none"> Mobile water sprinkling arrangements: 6 nos. of 28 KL capacity tankers under departmental mode and 6 nos. of 16 KL capacity tankers under contractual mode 		
24.	Balram OC (MCL)	<ul style="list-style-type: none"> Fixed sprinklers have been installed on coal stock yard and railway siding over a length of 2.1 km (running time of 12 hours to 16 hours) Mobile water sprinkling arrangements on coal and OB transportation roads : 4 nos. of 28 KL capacity tankers (5 trips) and 5 nos. of 20 KL capacity tankers (6 trips) 	<ul style="list-style-type: none"> Mobile fog canon has been installed on mine working face - 02 Nos having 5 trips each Trolley mounted fog canon installed in coal stock yard and railway siding - 08 nos having 12 hours to 16 hours running time 	<ul style="list-style-type: none"> VGS has been installed at railway siding and coal stock yard over a length of 1500 meters - 6 m high bamboo plantation
25.	Belpahar OC (MCL)	<ul style="list-style-type: none"> Fixed sprinklers have been installed as follows: Siding No. 7 – 21 nos., Siding No. 6 – 23 nos., along coal transportation Road – 35 Nos. 9 mobile water tankers (28 KL- 2 Nos., 20 KL- 2 Nos., 20KL Mobile fog cannons- 2 Nos., 15 KL - 4 Nos.) have been deployed along coal transportation roads, haul roads and working faces 	<ul style="list-style-type: none"> Fixed fog cannons – 4 nos. have been installed at Railway Siding No. 6 	-
26.	Bharatpur OC (MCL)	<ul style="list-style-type: none"> Fixed sprinklers: 19 Nos. have been installed at railway sidings Mobile water sprinkling arrangements - 07 Nos. (28KL) under departmental mode; 05 Nos. (12 KL) and 02 Nos. (18 KL) under contractual mode 	<ul style="list-style-type: none"> 12 Nos. of fixed type fog cannons have been installed at different dust prone places. 01 No. mobile fog canon has been deployed at at CTR, CCR. 	<ul style="list-style-type: none"> Vertical Greenery System has been installed at Stock No. 1 along a length of 1000 m
27.	Bhubaneshwari OC (MCL)	<ul style="list-style-type: none"> Fixed sprinklers - 25 nos with 30 m throw have been installed at Railway Siding 1 & 2 06 nos of 28 KL mist type sprinklers have been installed on haul roads and CT roads. Mobile water tankers (1 Nos. of 34 KL, 03 Nos. of 28 KL, 04 nos. 20KL, 01 no. 22 KL, 01 no. 14KL, and 01 no. 09 KL) have been installed for dust suppression on haul roads, CT road and railway sidings 	<ul style="list-style-type: none"> 04 numbers of fixed type fog canons have been installed at Railway Siding No.03 & 04. 2 mobile fog cannons have been installed at coal face & haul roads 	-

Sr. No.:	Name of mine & company	Water sprinkling systems for dust suppression	Other air pollution mitigation measures	Installation of Vertical Greenery System & Wind Barriers
28.	Garjanbahal OC (MCL)	<ul style="list-style-type: none"> • Total 42 nos. of fixed sprinklers are installed, of which 6 nos. of fixed sprinklers are installed at coal stockyard and 13 nos at Kanika Railway Siding • 4 nos of 28 KL water tankers are running along different locations at the haul roads as per suitability. 2 new 28 KL water will be commissioned shortly. 04 nos of contractual tankers are also operational. 	<ul style="list-style-type: none"> • 3 nos of 12 KL truck mounted mobile fog cannons are running along roads from MTK office to Kripsira Chowk (truck parking), Duduka chowk and Panchayat road. One no. of 12 KL truck mounted fog cannon is deployed at Kanika Railway Siding. • Truck mounted fog cannons are also deployed in the adjoining Kulda OCP adjoining to Garjanbahal OCP CT road. 	-
29.	Hingula OC (MCL)	<ul style="list-style-type: none"> • Fixed sprinklers along coal stock yard - 10 Nos are installed and operation time is between 12 hours to 16 hours • Water tankers Coal and OB transportation roads: 28 KL - 04 Nos running 6 trips & 20 KL – 03 Nos running 8 trips 	<ul style="list-style-type: none"> • 03 Mobile Fog Cannons are installed on mine working face – each running 5 trips • 06 nos. of trolley mounted fog cannons installed in coal stock yard with a run time of 12 hours to 16 hours 	-
30.	Jagannath OC (MCL)	<ul style="list-style-type: none"> • Fixed water sprinkling units have been installed – 4 nos. with 30 m throw and 20 nos. with 20 m throw at FC stock • Water tankers deployed along coal and OB transportation roads: 4 nos. of 28 KL capacity under departmental mode and 3 nos. of 10 KL capacity under contractual mode 	<ul style="list-style-type: none"> • Fixed type Fog cannon (1 no.) with 100 m throw has been installed at FC Stock. • Mobile fog cannon (1 no.) with 40 meters throw has been installed at Coal Corridor Road, CT Road, Haul Road, and Colony Area 	-
31.	Kaniha OC (MCL)	<ul style="list-style-type: none"> • 03 nos of fixed type fog canon with 100 m throw are installed at railway siding 	<ul style="list-style-type: none"> • 01 no of truck mounted mobile fog canon with 40 m throw is installed 	-
32.	Kulda OC (MCL)	<ul style="list-style-type: none"> • 03 nos. of 28 KL mobile water tankers are deployed along haul roads (running along 8 km stretch and 8 trips per day per tanker). 02 nos. of 20 KL mobile water tankers have also been deployed on OB face (running along 6 km stretch and having 8 trips per day per tanker). 02 nos. of 10 KL mobile water tankers 	<ul style="list-style-type: none"> • Mobile Fog Cannons have been installed at following points: Bankibahal to Numbering Point (20 KL) along 2.7 km (8 trips per day), Numbering point to Duduka Chowkn (20 KL) along 2.9 km (8 Tips per day), Embankment Road (12 KL) 	<ul style="list-style-type: none"> • Vertical Greenery System has been installed near coal stock (downwind direction): 600m (L) x 6m (H); • Wind Barrier is under construction near coal stock

Sr. No.:	Name of mine & company	Water sprinkling systems for dust suppression	Other air pollution mitigation measures	Installation of Vertical Greenery System & Wind Barriers
		<p>deployed along coal face (along 3 km stretch running 8 trips per day per tanker)</p> <ul style="list-style-type: none"> • 6 nos. of fixed sprinklers (8 LPS) installed at coal stock, and 6 no. of fixed sprinklers (8 LPS) at CT road & weigh bridges -both running 10 times per day 	<p>along 2.7 km (8 trips per day), Siarmal Chowk to Goaplpur High school (12 KL) along 2.8 km (8 trips per day), Gopalpur High School to Ratanpur (12 KL) along 2.9 km (8 trips per day)</p>	<p>(upwind direction): 1000m (L) x 10m (H)</p>
33.	Lajkura OC (MCL)	<ul style="list-style-type: none"> • Fixed Water Sprinkling System has been installed near coal stock yard, siding & along CT road – 15 nos. having 30 m throw • Mobile Water Sprinkling Systems – 4 nos. of 28 KL each (running avg. 4 trips per machine per shift) under departmental mode and 2 nos. of 18 KL each (avg. 4 trips per shift) & one no. of 12 KL (1 trip per shift) under contractual mode 	<ul style="list-style-type: none"> • 01 no. of mobile fog cannon having 40 m throw for coal stock yard, CT road & siding. 	-
34.	Lakhanpur OC (MCL)	<ul style="list-style-type: none"> • Fixed water sprinkling systems have been installed at Siding no-MGR Chharla – 25 units, Siding no-3 – 38 units and Siding Y-Curve – 32 units • 34 mobile water tankers (28 KL - 07 nos, 9 KL - 04 nos, 20 KL - 19 nos, 12 KL - 02 nos, 8 KL - 02 nos) and 01 nos. of 20 KL mobile fog cannon deployed along coal transportation roads, haul roads and working faces 	<ul style="list-style-type: none"> • Fixed/Trolley mounted fog cannon has been installed at coal stockyard – 9 nos., Siding BOCM 3 – 03 nos. 	<ul style="list-style-type: none"> • Vertical Greenery System has been installed in Siding 3 – 40 m
35.	Lingaraj OC (MCL)	<ul style="list-style-type: none"> • Total no. of fixed sprinklers installed in the mine - 102 nos. (Railway sidings & siding stockyards – 40 nos. CHPs – 11 nos., transportation routes – 41 nos., vehicle movement routes around office premises – 10 nos.). Throw varies from 10 m to 45 m and daily usage frequency is 10 to 15 times with each duration ranging between 10 to 15 mins. • Mobile water sprinkling arrangements - 11 nos. of 28 KL mobile water tankers along CT roads (average 7 trips per day) under departmental mode and 5 nos. (20 KL - 2 nos. and 9 KL - 3 nos) deployed in contractual 	<ul style="list-style-type: none"> • One no. of contractual truck chassis mounted mobile fog canon deployed along permanent concrete CT road (average 8 trips per day). • Sensor based mist spray system is installed in CHPs. • Dry fog dust suppression system is installed at all transfer points of Silo-conveyor belt system. 	-

Sr. No.:	Name of mine & company	Water sprinkling systems for dust suppression	Other air pollution mitigation measures	Installation of Vertical Greenery System & Wind Barriers
		OB patches and contractual OB transportation routes (average 8 trips per day) along with 3 nos. (20 KL - 2 nos. and 12 KL - 1 no.) along coal corridor patch of Lingaraj OCP (average 8 trips per day) under contractual mode.	<ul style="list-style-type: none"> • One no. of sensor based instant system is installed at exit point of quarry. • Two nos. of mechanical road sweepers are deployed from Bankadhara Chowk to Pabitra Mohan Chowk of NH-149 present adjacent to Lingaraj OCP. 	
36.	Samaleswari OC (MCL)	<ul style="list-style-type: none"> • Fixed Water Sprinkling System - 27 units with 30 m throw along coal stock yard, siding & along CT road • Mobile Water Sprinkling system - 6 nos. (28 KL each, avg. 4 trips per machine per shift) under departmental mode and 4 nos. (18 KL each, Avg. 4 trips per shift) and one no. (12 KL, average 2 trips per shift) under contractual mode 	<ul style="list-style-type: none"> • 01 no. of mobile fog canon with 40 m throw for coal stock yard, CT road & siding. 	<ul style="list-style-type: none"> • Wind barrier has been installed along a stretch of 600 m at Siding-II
37.	Gautami Khani OC (SCCL)	<ul style="list-style-type: none"> • Mobile water sprinkling arrangements - 4 Nos of 28 KL and one of 12 KL capacity 	<ul style="list-style-type: none"> • 2 No. of fog cannons are provided at CHP. 	-
38.	Jawahar Khani 5 OC (SCCL)	<ul style="list-style-type: none"> • Mobile water sprinkling arrangements – centrifugal pump with capacity 110 m³/Hr @2900 rpm & 55 m Head Drive Hydraulic motor through flexible coupling, Piping Suction 80 mm, Discharge 50mm, Sprinkling Pressurized Sprinkling Constant Sprinkling velocity Maintained by a Centrifugal pump. • Gravity sprinkling through perforated manifold connected to tank bottom, spreading width 14m 	<ul style="list-style-type: none"> • Mist sprayer system fitted with booster pump (flow rate of the booster pump is 4 to 6 KL per hour), with a required throw of 60m under no wind conditions covering an area of approximately 500 sq. m in a fixed position; all round spraying with a provision to set the degree of rotation as per site requirement. Provision is also available to set the rotation of the system in automatic mode at the local control station and with wireless control station, about 100 m away. The system is having the facility for barrel titling from -100 to 450 (+/- 50) from horizontal for spraying at 15 – 	-

Sr. No.:	Name of mine & company	Water sprinkling systems for dust suppression	Other air pollution mitigation measures	Installation of Vertical Greenery System & Wind Barriers
			25 m height. The machine is tyre mounted (with provision for towing).	
39.	Ramagundam OC – I Exp. (SCCL)	<ul style="list-style-type: none"> • Fixed point water sprinkling system is provided along permanent haul roads (1.5 km length) • Mobile water sprinkling arrangements – 8 nos. of 28 KL and 02 nos. of 12 KL 	<ul style="list-style-type: none"> • Two nos. of mist canons are provided at RG OCP-I CHP. • Four nos. of water guns are provided for wetting of coal at loading points. • Mist spray at crushers – Water spray arrangements with set of nozzles are provided at crushers and coal transfer points at CHP. Water spray line is provided all along belt conveyors with interlocking arrangement. 	-
40.	Talabira II & III OC (NLCIL)	-	<ul style="list-style-type: none"> • Fog Canon (Trolley mounted) - 1 Nos (under hiring mode) 	-



Clockwise from top: (i) Wet drilling in operation at Ashok OC, CCL; (ii) Surface miner at Ashok OC, CCL; (iii) Fixed sprinklers installed along railway siding at Amrapali OC, CCL; (iv) Wind breaking screen along Platform No. 4 at Shivpur Siding, Amrapali OC, CCL

Figure 5.4: Air pollution control measures implemented at CCL projects



Clockwise from top: (i) Black topping & concreting done on transportation route; (ii) Mobile water sprinklers in operation over haul road; (iii) Installation of green curtains along railway siding; (iv) Use of higher capacity tippers (20-25 tonnes) to reduce trips

Figure 5.5: Control measures for air quality implemented at Magadh OC



Figure 5.6: FMC project at Kusmunda OC, SECL



Figure 5.7: Blast-free OB removal at Kaniha OC & Hingula OC of MCL – new initiatives in CIL



Figure 5.8: Mist sprayer at Nigahi OC, NCL

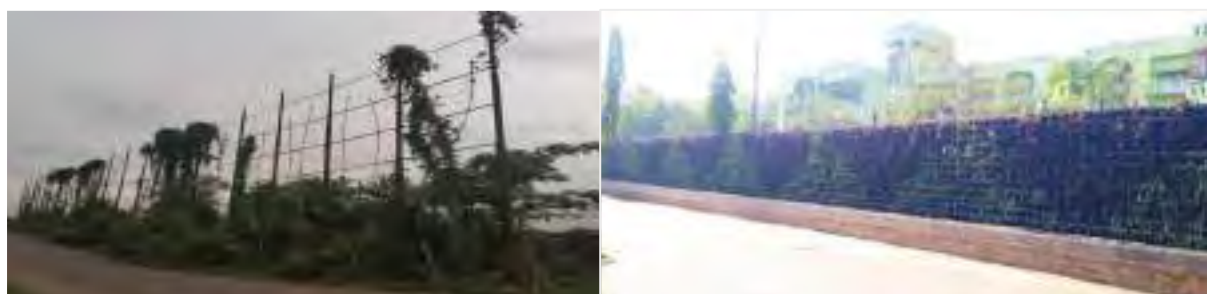


Figure 5.9: Vertical Greenery System installed at railway siding, Lakhanpur Area, MCL (left) and Basundhara Area, MCL (right)



Figure 5.10: Fog cannon along haul roads and water spraying at conveyor belt in Talabira II & III OC, NLCIL



Figure 5.11: Fog cannon deployed at CHP at GK OC, fixed sprinkling at permanent haul roads and mist cannon at CHP at RG OC, SCCL

Chapter VI: Status of environmental sustainability – Water Regime

6.0 Water regime in mining sector

Since mining operations involve breaking across the strata, aquifers present above the coal seam get exposed during the course of mining and groundwater gets accumulated within the mine. For the mining operations to continue, the accumulated groundwater is dewatered to a separate sump for storage. In most cases, post the closure of mines, the accumulated mine water is retained as pit lakes / water sumps which can be a convenient source of freshwater for the surrounding communities. Hence sustainable utilization of mine water utilization is crucial. Coal companies are also going a step further and contributing to recharge potential of the areas through measures like embankments, check dams, rain water harvesting and sustainable livelihood initiatives via sustainable development of mine sumps. Water quality standards in the mining sector w.r.t dewatered mine water is governed through Coal Mine Standards issued under GSR 742(E) dated 25.09.2000 vide MoEF&CC as well as general standards for discharge of environment pollutants under Schedule VI notified vide G.S.R. 422(E) dated 19.05.1993 under Environment (Protection) Rules.

6.1 Quantitative status of mine water discharge across selected projects

Mine water accumulated across mining projects is usually utilized for captive consumption of the mines (for dust suppression, plantation, fire-fighting, etc.) and also made available to the surrounding communities for domestic consumption and irrigation.

The details of mine water discharge volume vis-à-vis its utilization w.r.t the projects considered is given below:

Table 6.1: Status of mine water utilization across selected projects

Sr. No.:	Name of the Mine	Quantity (in cu.m/day)*				
		Mine Water Discharge	Mine Water used for project (industrial & domestic)	Utilization of mine water outside project community purpose	Towards recharge or stored in voids or discharge into water bodies	Losses
1.	Rajmahal OC (ECL)	13370	3598	0	9772	0
2.	Sonepur Bazari OC (ECL)	3410	3305	0	0	105
3.	AKWMC OC (BCCL)	3900	1260	250	2390	0
4.	NT ST Exp (Cluster 9, BCCL)	19285	18863	421	0	0
5.	Amrapali OC (CCL)	4214	4214	0	0	0
6.	Ashoka OC (CCL)	690	542	148	0	0
7.	Karo Exp. OC (CCL)	6542	22	0	6520	0
8.	Konar Exp. OC (CCL)	1816	1816	0	0	0
9.	Magadh OC (CCL)	560	560	0	0	0
10.	Penganga OC (WCL)	1430	1430	0	0	0
11.	Dipka OC (SECL) ²²	8455	2142	0	5843	470
12.	Gevra OC (SECL) ²³	8336	4504		3832	
13.	Kusmunda OC (SECL) ²⁴	10409	8583	0	539	1287
14.	Manikpur OC (SECL)	6596	1517	0	4971	108
15.	Amlohri OC (NCL)	7088	6148	0	0	940
16.	Bina OC (NCL)	7258	6518	0	0	740
17.	Block-B OC (NCL)	3099	2699	0	0	400
18.	Dudhichua OC (NCL)	3458	3000	0	0	458
19.	Jayant OC (NCL)	11438	10085	0	0	1353
20.	Khadia OC (NCL)	5542	4849	0	0	693
21.	Krishnashila OC (NCL)	0	0	0	0	0
22.	Nigahi OC (NCL)	7500	6518	0	0	982
23.	Ananta OC (MCL)	7060	3277	0	2648	1135
24.	Balram OC (MCL)	17211	3326	795	9163	3927
25.	Belpahar OC (MCL)	6918	2090	0	3379	1448
26.	Bharatpur OC (MCL)	21320	6122	205	10494	4498
27.	Bhubaneshwari OC (MCL)	2967	1238	0	1210	519
28.	Garjanbahal OC (MCL)	2364	1499	16	595	255
29.	Hingula OC (MCL)	16460	2236	0	9957	4267
30.	Jagannath OC (MCL)	5159	1937	0	2255	967
31.	Kaniha OC (MCL)	3373	2740	0	443	190
32.	Kulda OC (MCL)	3236	3214	22	0	0

²² Supply from other sources – 1164 cu.m/day²³ Water utilized from right bank canal for domestic purpose (residential colonies) - 6763.15 cu.m/day²⁴ Water from Hasdeo River used for meeting domestic requirements in colonies & office premises – 2800 cu.m/day

Sr. No.:	Name of the Mine	Quantity (in cu.m/day)*				
		Mine Water Discharge	Mine Water used for project (industrial & domestic)	Utilization of mine water outside project community purpose	Towards recharge or stored in voids or discharge into water bodies	Losses
33.	Lajkura OC (MCL)	4192	1279	0	2039	874
34.	Lakhanpur OC (MCL)	14578	14578	0	0	0
35.	Lingaraj OC (MCL)	12748	3022	0	6808	2918
36.	Samaleswari OC (MCL)	12003	4110	7893	0	0
37.	Gautami Khani OC (SCCL)	5180	1750	3430	0	0
38.	Jawahar Khani 5 OC (SCCL)	2350	1020	1330	0	0
39.	Ramagundam OC – I Exp. (SCCL)	6600	2300	4300	0	0
40.	Talabira II & III OC (NLCIL)	65700	65700	0	0	0

Table 6.2: Utilization of mine water by communities reported across selected projects

Sr. No.:	Name of the Mine	Community beneficiaries using mine water (in numbers)	Irrigated Land using mine water (in ha)
1.	AKWMC OC (BCCL)	5100	Nil
2.	NT ST Exp (Cluster 9, BCCL)	4000	Nil
3.	Ashoka OC (CCL)	3000	Nil
4.	Balram OC (MCL)	9000	Nil
5.	Bharatpur OC (MCL)	9200	Nil
6.	Garjanbahal OC (MCL)	4385	Nil
7.	Kulda OC (MCL)	7287	Nil
8.	Gautami Khani OC (SCCL)	8000	60
9.	Jawahar Khani 5 OC (SCCL)	15000	100
10.	Ramagundam OC – I Exp. (SCCL)	20000	150

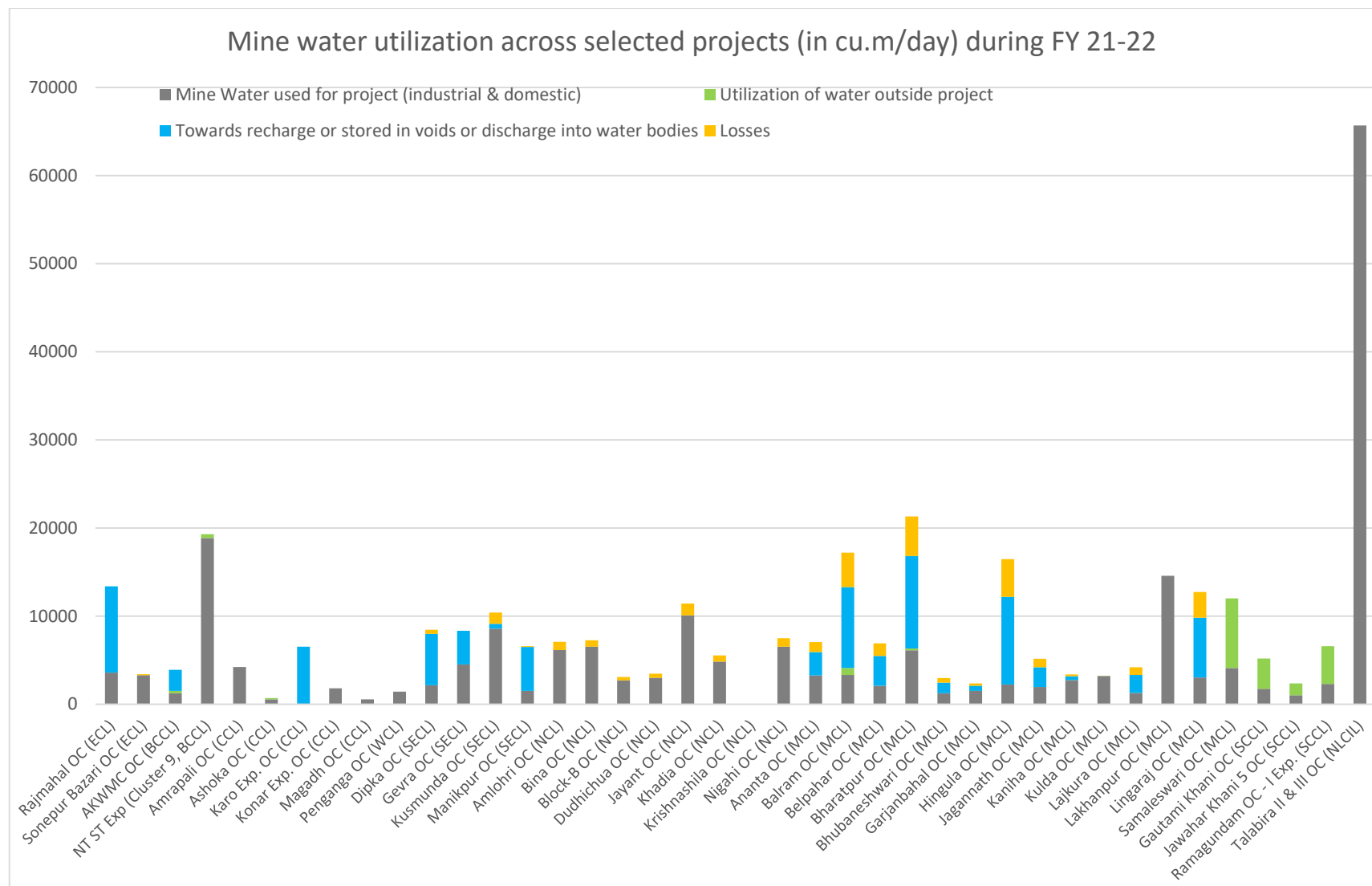


Figure 6.1: Mine water utilization across projects during FY 21-22

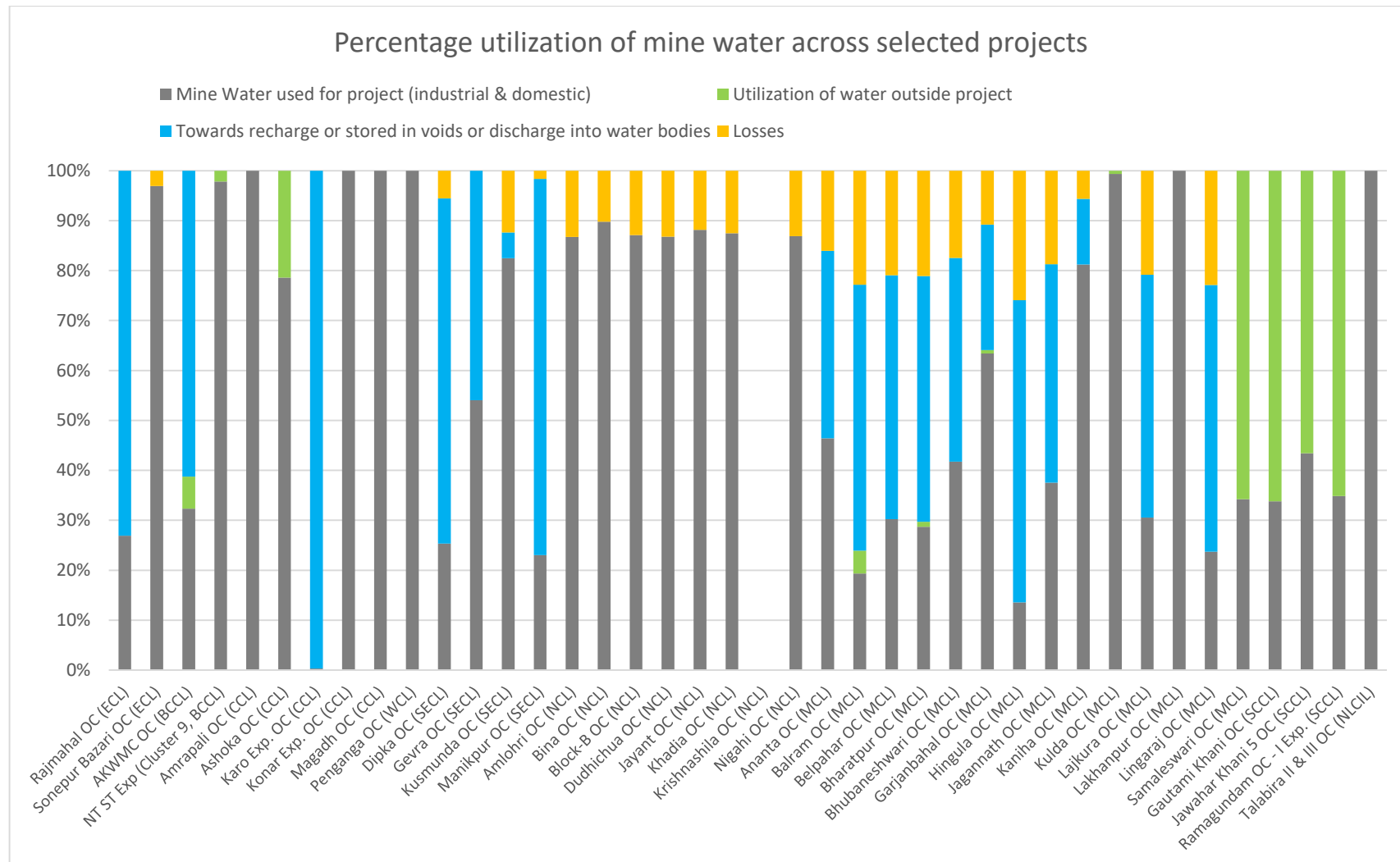


Figure 6.2: Mine water utilization across projects during FY 21-22

6.1.1 Observations on mine water discharge vis-à-vis utilization

- In majority of the projects, mine water is being utilized mostly for captive purposes (industrial uses like dust suppression, HEMM washing, plantation, and domestic usage etc.) On an average, approximately 59.8% of the net mine water is being utilized for captive / industrial purposes.
- Mine water supplied to communities for domestic purpose and irrigation ranges from 0.7% to 66.2% (average 7.3%) from 10 projects (AKWMC & NT ST Exp. Of BCCL, Ashoka OC of CCL, Balram OC, Bharatpur OC, Garjanbahal OC and Kulda OC from MCL and GK OC, JK-5 OC and RG OC of SCCL).
- Apart from these, excess mine water stored in mine sumps and / or discharged into surrounding streams ranges from 5.2% to 99.7% (average 22.6%) reported from 18 projects (Rajmahal OC of ECL, AKWMC OC of BCCL, Karo Exp. OC of CCL, Dipka OC, Gevra OC, Kusmunda OC & Manikpur OC of SECL, Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Bhubaneshwari OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Lajkura OC and Lingaraj OC of MCL).
- Losses in mine water have been reported in the range of 1.6% to 25.9% (average 7.8%) from 22 projects (Sonepur Bazaro OC of ECL, Dipka OC, Gevra OC, Kusmunda OC & Manikpur OC of SECL, Amlohri OC, Bina OC, Block-B OC, Dudhichua OC, Jayant OC, Khadia OC and Nigahi OC of NCL, Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Bhubaneshwari OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Lajkura OC and Lingaraj OC of MCL).

6.2 Qualitative status of mine water from selected projects

Table 6.3: Summary w.r.t range of concentration reported for pH & TSS across companies

S.N.	Name of Mine	Quality of mine water discharged from selected projects					
		pH			TSS (mg/L)		
		Min	Max	Average	Min	Max	Average
1.	Rajmahal OC (ECL)	6.2	8.5	7.3	9.1	81.3	18.8
2.	Sonepur Bazari OC (ECL)	6.6	8.0	7.2	13.9	24.3	18.2
3.	AKWMC OC (BCCL)	7.5	8.4	8.0	36.0	54.0	43.5
4.	NT ST Exp (Cluster 9, BCCL)	7	8.4	7.9	32.0	53.0	41.1
5.	Amrapali OC (CCL)	7.3	8.4	7.7	22.1	84.1	33.9
6.	Ashoka OC (CCL)	7.2	8.0	7.6	24.0	41.2	30.2
7.	Karo Exp. OC (CCL)	7.4	8.8	8.1	21.8	96.6	35.6
8.	Konar Exp. OC (CCL)	7.4	8.6	8.0	20.0	62.5	33.5
9.	Magadh OC (CCL) ²⁵	-	-	-	-	-	-
10.	Penganga OC (WCL)	7.1	8.5	7.7	18.0	36.0	25.1
11.	Dipka OC (SECL)	6.5	7.9	7.4	12.0	59.0	24.2

²⁵ In Magadh OC, mine water is used only for dust suppression. No mine water discharge sampling results for FY 21-22.

S.N.	Name of Mine	Quality of mine water discharged from selected projects					
		pH			TSS (mg/L)		
		Min	Max	Average	Min	Max	Average
12.	Gevra OC (SECL)	6.0	8.4	7.4	10.0	77.0	34.2
13.	Kusmunda OC (SECL)	6.5	8.1	7.4	7.0	160.0	35.9
14.	Manikpur OC (SECL)	6.4	8.5	7.3	10.0	201.0	28.7
15.	Amlohri OC (NCL)	5.8	8.6	7.6	42.0	83.0	58.7
16.	Bina OC (NCL)	6.5	9.3 ²⁶	7.5	40.0	85.1	66.1
17.	Block-B OC (NCL)	6.9	8.8	7.9	24.0	90.0	57.5
18.	Dudhichua OC (NCL)	6.5	8.5	7.9	46.0	84.0	67.5
19.	Jayant OC (NCL)	5.9	8.4	7.5	45.0	86.0	61.7
20.	Khadia OC (NCL)	5.3 ²⁷	8.6	7.5	56.0	110.0	80.3
21.	Krishnashila OC (NCL)	6.5	7.9	7.3	32.0	82.0	58.1
22.	Nigahi OC (NCL)	5.3 ²⁸	7.9	7.1	48.0	96.0	69.9
23.	Ananta OC (MCL)	5.1	7.8	7.2	18.0	82.0	40.6
24.	Balram OC (MCL)	6.5	8.5	7.4	18.0	52.0	36.6
25.	Belpahar OC (MCL)	5.5	8	6.9	20.0	70.0	40.9
26.	Bharatpur OC (MCL)	4.5	7.9	6.9	16.0	68.0	36.4
27.	Bhubaneshwari OC (MCL)	6.8	7.6	7.2	60.0	66.0	62.5
28.	Garjanbahal OC (MCL)	5.9	8.2	7.3	16.0	94.0	47.8
29.	Hingula OC (MCL)	7.2	8.4	7.8	24.0	44.0	35.9
30.	Jagannath OC (MCL)	6.3	8.9	7.2	16.0	56.0	36.2
31.	Kaniha OC (MCL)	6.6	8.1	7.3	16.0	88.0	47.3
32.	Kulda OC (MCL)	6	8.2	7.4	16.0	94.0	32.1
33.	Lajkura OC (MCL)	2.9	7.9	6	20.0	64.0	40.0
34.	Lakhanpur OC (MCL)	5.9	7.8	6.9	18.0	68.0	44.9
35.	Lingaraj OC (MCL)	5.2	8.1	7.3	12.0	66.0	36.7
36.	Samaleswari OC (MCL)	3.1	8.4	6.9	16.0	68.0	32.4
37.	Gautami Khani OC (SCCL)	6.3	8.4	7.2	6.0	24.0	18.4
38.	Jawahar Khani 5 OC (SCCL)	6.7	8.1	7.4	6.0	15.0	9.6
39.	Ramagundam OC – I Exp. (SCCL)	6.9	8.2	7.7	22.0	53.0	33.7
40.	Talabira II & III OC (NLCIL) ²⁹	-	-	-	-	-	-

²⁶ Only single value reported above 9.0, outlet of STP during Jan'22

²⁷ Only single value reported below 5.5, outlet of ETP sampled in Jul'21

²⁸ Only single value reported below 5.5, outlet of W/S ETP sampled in Dec'21

²⁹ No mine water discharge sampling results for FY 21-22.

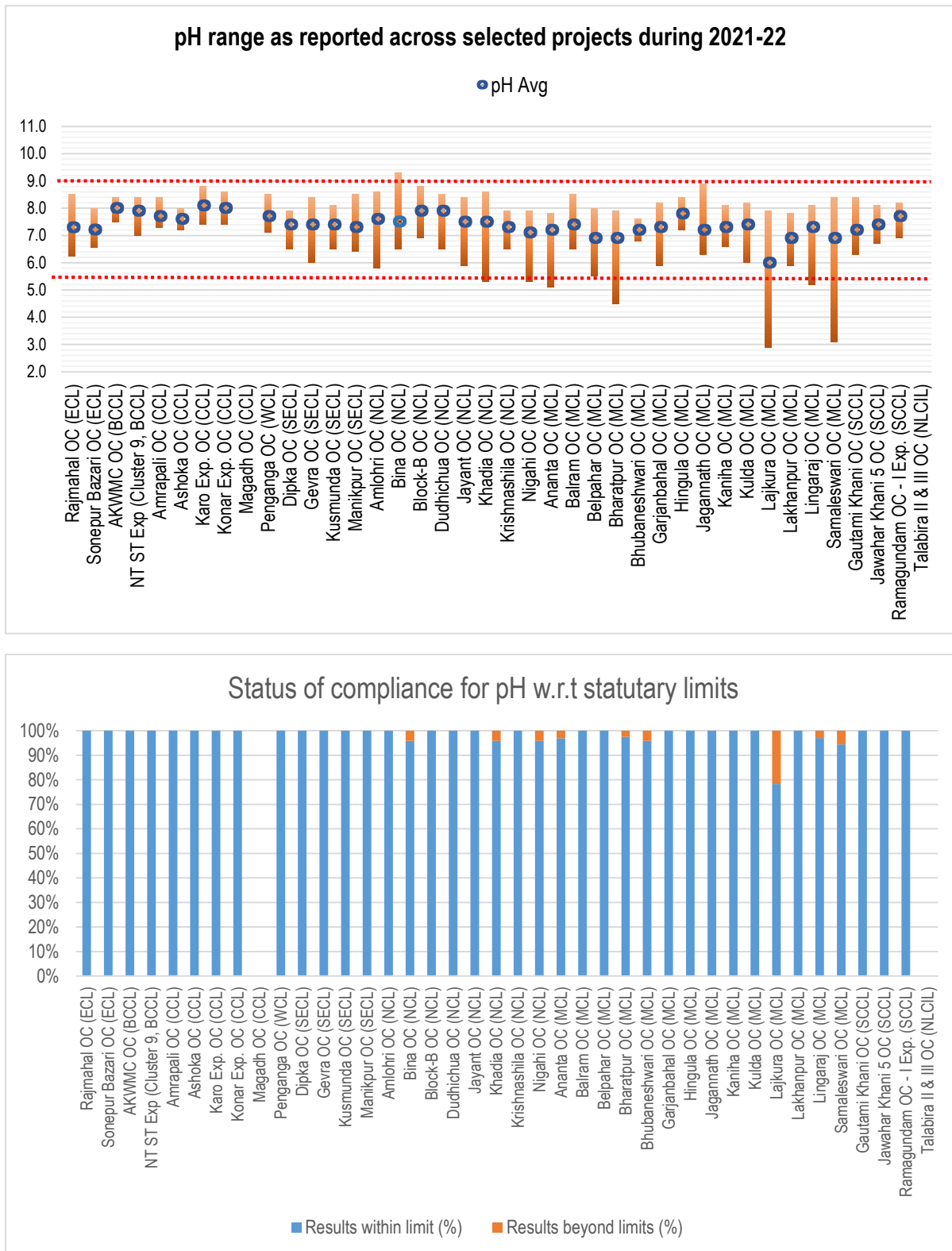


Figure 6.3: Range of concentration of pH values in mine water during 2021-22

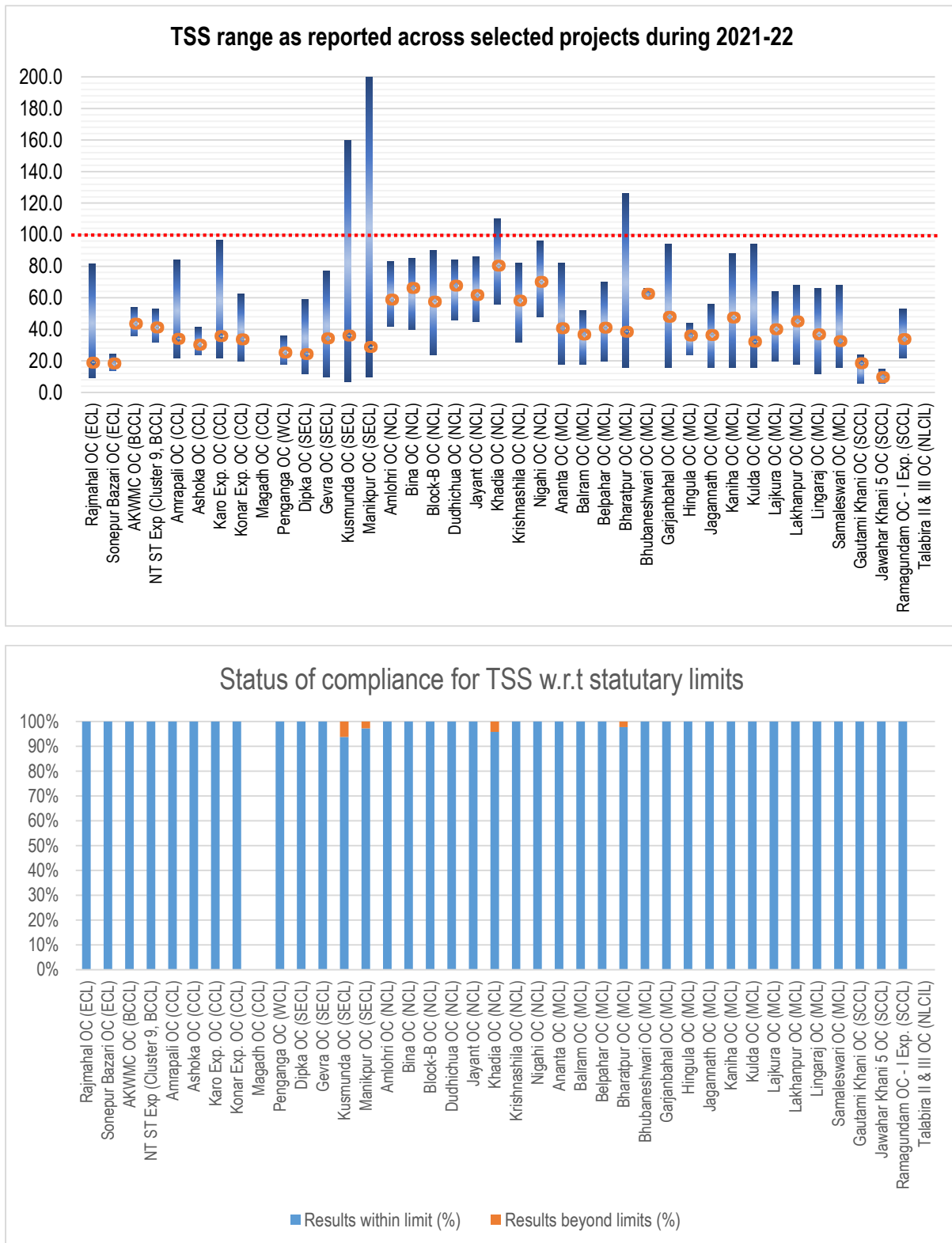


Figure 6.4: Range of concentration of TSS values in mine water during 2021-22

6.3 Observations on mine water quality across selected projects

- W.r.t pH, the reported concentrations were within the prescribed limits in 31 projects (not considering Magadh OC and Talabira II & III OC).
- Instances of low pH (below 5.5) in treated water streams were reported in isolated instances from Khadia OC, Nigahi OC of NCL and Ananta OC, Bharatpur OC, Lajkura OC, Lingaraj OC and Samaleswari OC of MCL. In case of mines of MCL, Zero Liquid Discharge is practiced in most mines and no mine water is being discharged outside projects. High pH value (above 9.0) was reported only from a single sample from outlet of STP in Bina OC of NCL.
- W.r.t TSS, the reported concentrations were within the prescribed limits in 34 projects (not considering Magadh OC and Talabira II & III OC).
- TSS values beyond limits were reported from following projects - Kusmunda OC & Manikpur OC of SECL, Khadia OC of NCL and Bharatpur OC of MCL. In these projects, the results were reported beyond limits in percentage ranging from 2.3% to 6.3%. Hence almost 93% of the reported values were within limits.

6.4 Details on treatment facilities w.r.t water in selected projects

The details w.r.t various treatment provisions provided in the selected projects is presented in the below table (Table 6.4). This includes details on mine water treatment facilities, effluent treatment plants, sewage treatment plants as well as water treatment facilities.

Companies have also undertaken measures for water conservation and flood prevention through construction of checkdams, embankments and implementation of rainwater harvesting measures. Details pertaining to the same are presented under Table 6.5.

Table 6.4: Details on treatment facilities reported across selected projects

S.N.	Name of Mine	Treatment facilities provided & end use			
		Mine Water Treatment Plant (MWTP)	Effluent Treatment Plant (ETP)	Sewage Treatment Plant (STP)	Water Treatment Plant (WTP)
1.	Rajmahal OC (ECL)	Treated mine water is being reused for firefighting and water sprinkling arrangements.	Treatment through oil & grease trap & sedimentation tank	-	Filtration Plant with 10,000 GPH pump capacity installed at Lalmatia. R.O Plant (2 in Nos.) installed in Urjanagar colony.
2.	Sonepur Bazari OC (ECL)	Sedimentation sump has been provided.	ETP of 7200 cu.m/day capacity consisting of oil and grease trap, primary sedimentation tank, secondary sedimentation tank, sludge drying bed, collection tank	STP of 600 cu.m/day capacity consisting of primary treatment followed by ASP and sludge drying	Pressure Filter installed at Haripur Colony having 5000GPH capacity. 80 Litre UV Water Filter installed at V.N Colony, Area Office, Project Office
3.	AKWMC OC (BCCL)	Treatment capacity of 50000 gpd (~189.3 cu.m/day) installed at Ramkanali. It is being used for domestic water supply to the nearby community.	Treated water from ETP (48 cu.m/day) is being reused for plantation purposes	-	-
4.	NT ST Exp (Cluster 9, BCCL)	Treatment capacity of 2,40,000 gpd (~908.5 cu.m/day) – pressure filter plant at South Tisra Workshop	ETP having capacity of 50 cu.m/day consisting of oil & grease trap is installed at South Tisra Workshop.	-	-
5.	Amrapali OC (CCL)	Mine water is collected in main mine sump which acts as a sedimentation pond and then it used for dust suppression.	Treatment through oil & grease trap, sedimentation tank	-	-
6.	Ashoka OC (CCL)	-	Treatment through oil & grease trap available at Ashok Workshop.	-	-

S.N.	Name of Mine	Treatment facilities provided & end use			
		Mine Water Treatment Plant (MWTP)	Effluent Treatment Plant (ETP)	Sewage Treatment Plant (STP)	Water Treatment Plant (WTP)
7.	Karo Exp. OC (CCL)	-	Treatment through oil & grease trap available at Workshop.	-	-
8.	Konar Exp. OC (CCL)	Mine water after siltation, is being used for sprinkling purpose on haul roads and other areas within the mine.	Treatment through oil & grease trap available at Workshop. Siltation pond has also been constructed.	-	-
9.	Magadh OC (CCL)	-	-	-	-
10.	Penganga OC (WCL)	-	ETP is under construction.	Portable STP with 28 KLD capacity is installed.	-
11.	Dipka OC (SECL)	-	ETP having 110 KLD capacity is installed; average 40 KLD is treated daily and reused for HEMM washing	-	100 lph treatment plant is installed for supply of drinking water to colony
12.	Gevra OC (SECL)	-	ETP having 210 KLD capacity with pre-settling, oil & grease trap & chemical dosing; treated water is recycled & reused.	STP having 3 MLD capacity is installed consisting of aerated lagoon, bar screen, grit chamber, aerated pond followed by polishing pond. Treated water is used for dust suppression & golf ground watering.	4.5 MLD treatment plant with clariflocculator cum sedimentation tank, rapid sand filter and disinfection cum chlorination.
13.	Kusmunda OC (SECL)	-	ETP having 416 cu.m/day capacity having primary treatment; the treated water is reused for HEMM washing	2 MLD STP is installed and it is equipped with secondary treatment unit with aeration tank and sludge drying beds. Treated effluent is used for irrigation and	2 MGD treatment plant has been installed for supply of drinking water to colony.

S.N.	Name of Mine	Treatment facilities provided & end use			
		Mine Water Treatment Plant (MWTP)	Effluent Treatment Plant (ETP)	Sewage Treatment Plant (STP)	Water Treatment Plant (WTP)
				green belt development by local communities.	
14.	Manikpur OC (SECL)	-	50 MLD treated water is reused by villagers for agricultural purposes	0.5 MLD treated water is reused for dust suppression in mines	-
15.	Amlohri OC (NCL)	-	ETP having 51 MLD capacity is installed.	STP having 2 MLD capacity is installed.	-
16.	Bina OC (NCL)	-	ETP having 31.2 MLD capacity is installed.	STP having 2.5 MLD capacity is installed.	-
17.	Block-B OC (NCL)	-	ETP having 8.68 MLD capacity is installed.	STP having 0.8 MLD capacity is installed.	-
18.	Dudhichua OC (NCL)	RCC sedimentation pond has been provided for further settlement, dimensions - Top - 23m x 14m, Bottom – 20m x 11m and 1.5m height.	ETP having 30 MLD capacity is installed.	STP having 2 MLD capacity is installed.	-
19.	Jayant OC (NCL)	-	ETP having 32 MLD capacity is installed. A combined ETP with 8 MLD capacity is also installed.	STP having 4 MLD capacity is installed.	-
20.	Khadia OC (NCL)	-	ETP having 38 MLD capacity is installed.	STP having 1.5 MLD capacity is installed.	-
21.	Krishnashila OC (NCL)	MWTP - 3 nos. provided – Sedimentation ponds (8540 KL & 7200 KL capacity) & RCC settling	ETP having 0.4 MLD capacity is installed.	-	-

S.N.	Name of Mine	Treatment facilities provided & end use			
		Mine Water Treatment Plant (MWTP)	Effluent Treatment Plant (ETP)	Sewage Treatment Plant (STP)	Water Treatment Plant (WTP)
		tank (540 cu.m/day). Treated water is reused for dust suppression in mine & CHP			
22.	Nigahi OC (NCL)	0.48 MLD treated water is reused for vehicle washing	ETP having 10.5 MLD capacity is installed at CHP and 4 MLD capacity at Workshop.	STP having 3 MLD capacity is installed.	-
23.	Ananta OC (MCL)	-	240 KLD ETP is installed comprising of settling tanks, oil & grease skimmer, aeration units and multimedia filter with zero discharge circuit. The treated water is reused for vehicle washing.	STP having 0.51 MLD capacity is installed consisting of aeration, clarifier, sedimentation beds and clear water tank.	-
24.	Balram OC (MCL)	300 KLD capacity having collection sump, primary sedimentation tank, oil and grease trap, alum dosing tank, and secondary sedimentation tank -Effluent water is also routed to mine sump for reuse and recharge	ETP of 270 KLD capacity equipped with oil and grease trap has been provided. The treated water is being reused for dust suppression and industrial use. ZLD is practiced, hence no water is discharged outside the mine.	STP having 1.2 MLD capacity is installed having collection sump, screens, aeration tank, clarifier, chlorination tank, sludge drying bed, treated water and sludge drying beds. The treated water is used for agricultural purpose to the neighbouring villages.	-
25.	Belpahar OC (MCL)	4 MLD capacity comprising of primary sedimentation tanks, secondary tanks with clear water tanks. The treated water is used for mining activities.	ETP having 20 capacity, comprising of settling tanks, oil & grease skimmer, aeration units and multimedia filter with zero discharge circuit. The treated	Common STP of 1.7 MLD capacity is installed in Belpahar Integrated Township comprising of aeration units, clarifier units, media filters with sludge drying bed. The treated water is stored	Common IWSS of 7.2 MLD capacity is installed in Belpahar Integrated Township comprising of sand filters, aerators, sedimentation units and RO filter.

S.N.	Name of Mine	Treatment facilities provided & end use			
		Mine Water Treatment Plant (MWTP)	Effluent Treatment Plant (ETP)	Sewage Treatment Plant (STP)	Water Treatment Plant (WTP)
			water is resued for vehicle washing.	in eco tanks and used for mining operations.	
26.	Bharatpur OC (MCL)	-	Wastewater generated from HEMM washing at workshop is being treated at ETP (240 KLD capacity with average inflow of 40 to 60 KLD) and the treated effluent is being reused for HEMM washing (no wastewater is discharged to outside the lease area).	STP with 0.99 MLD capacity already exists in Bharatpur colony to cater the treatment of domestic effluent generated from residential colony. The treated effluent is utilized for irrigation of paddy fields of nearby villages.	-
27.	Bhubaneshwari OC (MCL)	-	ETP of 400 KLD capacity, comprising of one equalization tank, one primary settling tanks, O&G trap and 01 secondary settling tank. Treated water from secondary settling tank is being reused for HEMM washing.	STP having capacity of 50 KLD is installed for treatment of sewage from hostels and canteen and the treated water is reused for horticulture purposes.	-
28.	Garjanbahal OC (MCL)	-	-	-	-
29.	Hingula OC (MCL)	-	ETP having 270 KLD capacity is installed including oil and grease trap and the treated water is being reused for dust suppression and industrial use. ZLD is practiced, hence no water is discharged outside the mine.	-	-

S.N.	Name of Mine	Treatment facilities provided & end use			
		Mine Water Treatment Plant (MWTP)	Effluent Treatment Plant (ETP)	Sewage Treatment Plant (STP)	Water Treatment Plant (WTP)
30.	Jagannath OC (MCL)	400 cu.m/h capacity. The water from the sumps is used for dust suppression at CHP area and on roads, plantation and vehicle washing. No water is being discharged outside the ML area through MDTP.	ETP having 140 KLD capacity comprising of primary settling tank, O&G trap equipped with silicon belt for oil & grease recovery, chemical dosing system, secondary settling tank, multi grade filter and treated water tank. Treated water is reused for vehicle washing.	STP having 410 KLD capacity comprising of equalization tank, 02 aeration units (surface aerator one in each tank) tanks, one clariflocculator and one treated water tank. Sludge drying bed has been provided for the dewatering of sludge generated from clariflocculator. . The treated effluent is utilized for irrigation of nearby agricultural land.	-
31.	Kaniha OC (MCL)	Treatment plant involves screening chamber, alum dosing in flash mixer tank, agitator and sedimentation pond. Water stored in the clear water pond is used for dust suppression and plantation purposes.	ETP consists of primary settling tank, secondary settling tank and O&G chamber. Treated water is used for dust suppression and washing of HEMM	Not required	-
32.	Kulda OC (MCL)	450 KLD capacity comprising of primary sedimentation tanks and secondary tanks with clear water tanks. The treated water is used for mining activities.	ETP having 50 KLD capacity comprising of settling tanks, oil & grease skimmer, and aeration units, multimedia filter with zero discharge. Separate ETP of 190 KLD capacity comprising of settling tanks, oil & grease trap and secondary settling tanks. The	-	-

S.N.	Name of Mine	Treatment facilities provided & end use			
		Mine Water Treatment Plant (MWTP)	Effluent Treatment Plant (ETP)	Sewage Treatment Plant (STP)	Water Treatment Plant (WTP)
			treated water is reused for vehicle washing.		
33.	Lajkura OC (MCL)	2 plants x 4000 cum/hr comprising of 2 units of sedimentation tank and one unit of clear water tank. Treated water is used for mining activities.	ETP with capacity of 40 cum/hr (2 units) with oil and grease trap has been provided for the treatment of effluent from vehicle washing. The treated water is reused for mining purposes.	0.5 MLD STP is installed having aeration tank, clarifier and sludge drying bed. The treated water is used for gardening and washing purposes.	-
34.	Lakhanpur OC (MCL)	1080 KLD capacity comprising of primary sedimentation tanks and secondary tanks with clear water tanks. The treated water is used for mining activities.	ETP of 50 KLD capacity comprising of settling tanks, oil & grease skimmer, aeration units, multimedia filter with zero discharge circuit. Separate ETP of 190 KLD capacity comprising of settling tanks, oil & grease trap and secondary settling tanks. The treated water is reused for vehicle washing.	Common STP of 1.7 MLD capacity is installed in Belpahar Integrated Township comprising of aeration units, clarifier units, media filters with sludge drying bed. The treated water is stored in Eco tanks and used for mining operations.	Common IWSS of 7.2 MLD capacity is installed in Belpahar Integrated Township comprising of sand filters, aerators, sedimentation units and RO filter.
35.	Lingaraj OC (MCL)	6200 KLD capacity comprising of 02 settling tanks (40 m x 80 m x 4 m each) and a clear water reservoir (40 m x 40 m x 6 m) have been constructed near dumper parking for the settling of mine water.	ETP of 100 KLD capacity is provided at Lingaraj OCP for treatment of waste water containing oil and grease. The ETP comprises of 2 nos. of primary settling tanks, oil and grease trap equipped with oil skimmer, aeration tank, clear	STP of 0.5 MLD capacity is under construction.	-

S.N.	Name of Mine	Treatment facilities provided & end use			
		Mine Water Treatment Plant (MWTP)	Effluent Treatment Plant (ETP)	Sewage Treatment Plant (STP)	Water Treatment Plant (WTP)
			water reservoir and pressure filter. The treated clear water generated from ETP is completely reused in vehicle washing.		
36.	Samaleswari OC (MCL)	2 plants with treatment capacity of 400 cum/hr consisting of chemical chamber, flash mixer with MDTP and 2 units of sedimentation tank. Treated water is used for mining activities.	ETP with capacity of 40 cum/hr (2 units) with oil and grease trap has been provided for the treatment of effluent from vehicle washing. The treated water is reused for mining purposes.	0.5 MLD STP having aeration tank, clarifier and sludge drying bed. Treated water is used for gardening and washing purposes.	-
37.	Gautami Khani OC (SCCL)	Filter beds (02 nos) of 1,20,000 KL capacity each are provided; the treated water (after SS filtration and disinfection) is utilized for domestic purposes.	60 KLD ETP consisting of settling tanks (3 units of 25500 gallons capacity) and collection tank (6000 gallons capacity); treated water is being used for mining purposes viz. haul road dust suppression, green belt development etc.	1.5 MLD STP consisting of extended aeration and ASP; treated water is being reused for plantation.	02 units (50,000 lph at canteen and 250 lph at Base Workshop) for drinking water supply to mine personnel
38.	Jawahar Khani 5 OC (SCCL)	A filter bed of 2,00,000 KL capacity is provided; the treated water (after filtration and disinfection) is utilized for drinking purposes.	60 KLD ETP consisting of settling tanks (3 units of 13200 gallons capacity) and collection tank (8450 gallons capacity); treated water is being used for mining purposes viz. haul road	100 KLD STP is installed with MBBR technology and the treated water is being reused for plantation.	One treatment plant of 200 LPH capacity for drinking water supply to mine personnel

S.N.	Name of Mine	Treatment facilities provided & end use			
		Mine Water Treatment Plant (MWTP)	Effluent Treatment Plant (ETP)	Sewage Treatment Plant (STP)	Water Treatment Plant (WTP)
			dust suppression, green belt development etc.		
39.	Ramagundam OC – I Exp. (SCCL)	Four nos. of sand filter beds (2 lakh gallon capacity - 01 no. and 0.40 lakh gallon capacity - 03 nos.) are provided.	60 KLD ETP consisting of settling chamber (285 cu.m capacity), oil chamber (25 cu.m capacity), recycling chamber (18 cu.m capacity); treated water is being used for mining purposes viz. haul road dust suppression, green belt development etc.	STP having 1.5 MLD capacity consisting of extended aeration and ASP; treated water is being reused for plantation.	One treatment plant of 30 KLD capacity for drinking water supply to mine personnel
40.	Talabira II & III OC (NLCIL)	Involves settling, clarification and filtration. The treated water is utilized for vehicle washing.	50 KLD ETP has been provided.	-	-

Table 6.5: Details on other facilities for water conservation and supply reported across selected projects

S.N.	Name of Mine	Check dams / embankments or similar infra built on nearby rivers / water bodies to aid flood control / water level fluctuations, if any	Details on Rain Water Harvesting measures employed
1.	Rajmahal OC (ECL)	-	1830 sq.m of area covered under harvesting through 7 nos. of rainwater harvesting units.
2.	Sonepur Bazari OC (ECL)	-	Recharge of 4500 cu.m reported through rainwater harvesting measures implemented.
3.	AKWMC OC (BCCL)	-	Recharge of 1000 cu.m per year reported through rainwater harvesting measures implemented at Parasnath Udhyan Reservoir
4.	NT ST Exp (Cluster 9, BCCL)	-	-
5.	Amrapali OC (CCL)	Construction of 1 no check dam at Dhudhmata Nallah near Binglat OB dump and 4 nos of check dams at Amrapali Mine (Parsna Village, near Godwar Village Temple and Honhe village) has been completed to aid ground water recharge and to prevent siltation.	11 nos. of rainwater harvesting units have been installed.
6.	Ashoka OC (CCL)	11 ponds have been constructed.	Rain water harvesting scheme has been implemented in PO office, Workshop and colonies 3 nos. of RWH units with capacity of approx 1.5 KL has been installed.
7.	Karo Exp. OC (CCL)	Two check dams have been constructed and one check dam is under construction (envisaged to be completed by March 2023)	2 Nos of RWH units installed
8.	Konar Exp. OC (CCL)	Check dam has been constructed on Goddo nallah.	2 no. of rainwater harvesting structures installed - Recharge of 60488 cu.m reported.
9.	Magadh OC (CCL)	-	-
10.	Penganga OC (WCL)	Check dam of length – 350 m, width – 15 m and depth – 1.5m along nallah; recharge – 2362 cu.m/yr	Roof top rainwater harvesting systems installed at SAM office (recharge – 271 cum/yr), Manager office (recharge – 172 cum/yr) and canteen building (recharge – 211 cum/yr)
11.	Dipka OC (SECL)	-	Rooftop rainwater harvesting systems installed at 11 locations with annual recharge – 18192 cu.m/yr 16 nos. of recharge ponds with total annual recharge – 55479 cu.m/yr

S.N.	Name of Mine	Check dams / embankments or similar infra built on nearby rivers / water bodies to aid flood control / water level fluctuations, if any	Details on Rain Water Harvesting measures employed
12.	Gevra OC (SECL)	Dump areas are provided with contour trenches (per trench – 7200), check dams (per cu.m – 7200) and bunds with stone boulders (per cu.m – 7500)	Rooftop rainwater harvesting systems installed at 12 locations with provision for artificial recharge to the tune of 27033.7 cu. m/yr
13.	Kusmunda OC (SECL)	1 R.C.C. check dam (20 m x 3 m x 1.50m) exists on Laxman Nallah for groundwater recharge	There are 3 nos. of mine quarry (sumps) with a recharge potential of 27014 cum/year and 01 old abandoned waterlogged quarry with a recharge potential of 15866 cum/year 8 Artificial Rooftop RWH Structures with a recharge potential of 21121 cum/year are available 2 Sedimentation ponds within the mine with recharge potential of 2045 cum/year are present Also, 02 village ponds in R&R site near mine with a recharge potential of 1930 cum/year
14.	Manikpur OC (SECL)	-	One Roof top rainwater harvesting system with a recharge potential of 73.46 cum/year and one abandoned quarry converted into lake (Pilot quarry) with recharge potential of around 280 cum/day
15.	Amlohri OC (NCL)	-	Total 9 nos of rainwater harvesting units installed at GM Office, Officer's Club and Kalyana Mandapam. Reservoirs located near GM office, Dozer workshop, ETP and substation have a total capacity of 2,02,000 cu.m.
16.	Bina OC (NCL)	-	Total 4 nos of rainwater harvesting units installed at DAV school, hospital and VIP guest house / Officer's Club. Reservoir located near central haul road has a capacity of 50,000 cu.m.
17.	Block-B OC (NCL)	-	Total 5 nos of rainwater harvesting units installed at GM Office, Worker's Institute, Guest house, Hospital and Officer's Club. Reservoir located near ETP has a capacity of 50,000 cu.m.
18.	Dudhichua OC (NCL)	-	Total 5 nos of rainwater harvesting units installed at GM Office, Surya Kiran Bhavan, Hospital, and Sector-A Guest house. Reservoir located near mid entry has a capacity of 50,000 cu.m.
19.	Jayant OC (NCL)	-	Total 11 nos of rainwater harvesting units installed at GM Office, Officer's Club, VIP Guest House, Executive/GET Hostel, Sports Complex and Expert Hostel.

S.N.	Name of Mine	Check dams / embankments or similar infra built on nearby rivers / water bodies to aid flood control / water level fluctuations, if any	Details on Rain Water Harvesting measures employed
			Reservoirs located at main mine sump and sedimentation pond at main ETP have a total capacity of 10,50,000 cu.m.
20.	Khadia OC (NCL)	-	Total 07 nos of rainwater harvesting units installed at GM Office, Guest House, Worker's Club, DAV School, A-type hostel, Dispensary and CHP. Reservoirs located near CHP and New Time Office have a total capacity of 1,00,000 cu.m.
21.	Krishnashila OC (NCL)	-	Total 5 nos of rainwater harvesting units installed at GM Office, Worker's Club and Officer's Club. Reservoir located near ETP has a capacity of 50,000 cu.m.
22.	Nigahi OC (NCL)	-	Total 05 nos of rainwater harvesting units installed at GM Office, Composite Building, Ambedkar Bhavan, DPS School and Dispensary. Reservoirs located near 3 rd cluster of quarters, Bareja pond – old & new and Sector-6 of Nada Gaon have a total capacity of 3,30,000 cu.m.
23.	Ananta OC (MCL)	Embankment has been constructed along Bangaru nallah	Recharge potential reported - 494210 KL
24.	Balram OC (MCL)	-	Rain water harvesting systems (6 nos.) with a recharge potential of 5 cu.m/hr/pit
25.	Belpahar OC (MCL)	-	Rain water harvesting systems (3 nos.) with a recharge potential of 5 cu.m/hr/pit
26.	Bharatpur OC (MCL)	-	Rain water harvesting systems (6 nos.) with a recharge potential of 5 cu.m/hr/pit
27.	Bhubaneshwari OC (MCL)	-	Rain water harvesting systems – 4 nos. with a recharge potential of 5 cu.m/hr/pit and 2 nos. with a recharge potential of 10 cu.m/hr/pit
28.	Garjanbahal OC (MCL)	-	-
29.	Hingula OC (MCL)	-	Rain water harvesting systems (3 nos.) with a recharge potential of 5 cu.m/hr/pit
30.	Jagannath OC (MCL)	-	Rain water harvesting systems (23 nos.) with a recharge potential of 5 cu.m/hr/pit
31.	Kaniha OC (MCL)	-	Approximate recharge potential of 375 cu.m through RWH at Project Office of Kaniha OCP
32.	Kulda OC (MCL)	Embankment at a stretch of 2.7 km constructed near Basundhara river. Check dams - 03 numbers (Garland drains) have also been constructed.	-

S.N.	Name of Mine	Check dams / embankments or similar infra built on nearby rivers / water bodies to aid flood control / water level fluctuations, if any	Details on Rain Water Harvesting measures employed
33.	Lajkura OC (MCL)	-	Mine sumps - 2 nos. over a total area of 159168 sq.m contributing to recharge of 31834 cu.m
34.	Lakhanpur OC (MCL)	02 Nos. of check dams across Puljore Nallah to avoid siltation	Rain water harvesting systems (3 nos.) with a recharge potential of 5 cu.m/hr/pit
35.	Lingaraj OC (MCL)	-	Rain water harvesting systems (7 nos.) with a recharge potential of 5 cu.m/hr/pit
36.	Samaleswari OC (MCL)	-	Mine sumps – 3 nos. over a total area of 332056 sq.m contributing to recharge quantity of 100281 cu.m Water bodies created on ext. OB dump area – 3 nos. over a total area of 1.069 sq.m contributing to a recharge quantity of 0.323 cu.m Water bodies created on back filled area - 8 nos. over a total area of 2.287 sq.m contributing to a recharge quantity of 0.457 cu.m
37.	Gautami Khani OC (SCCL)	02 check dams have been constructed.	4 nos. of rainwater harvesting pits constructed in GKOC PO Office premises.
38.	Jawahar Khani 5 OC (SCCL)	01 check dam has been constructed.	3 nos. of rainwater harvesting pits constructed.
39.	Ramagundam OC – I Exp. (SCCL)	-	120 nos. of rainwater harvesting pits (each with storage capacity of 10.125 cubic meters) were constructed in surrounding villages with expenditure of INR 240.00 lakh. The recharge from the water conservation structure is 1.12 hectare meter (gross storage) with recharge factor of 0.4.
40.	Talabira II & III OC (NLCIL)	-	-



Figure 6.5: Catch drain & Siltation pond at Top Soil & OB dump, Amrapali OC, CCL



Figure 6.6: ETP at Nigahi OC, NCL



Figure 6.7: Pisciculture & water sports centre developed at abandoned Quarry No.6 of Bishrampur OC by SECL



Figure 6.8: Workshop ETP at GK OCP, SCCL

Chapter VII: Status of environmental sustainability – Mine Closure

7.0 Importance of Mine closure

Mine closure comprehensively refers to actions that must be taken with regard to the physical infrastructure of a mine, actions around the natural environment and the socio-economic situation, measures that must be taken regarding the employees (labour issues) and the financial implications.

Mine closure primarily includes progressive and final mine closure planning activities. The **progressive mine closure plan** identifies and includes the mine closure and other allied activities required to be executed continuously and sequentially during the entire period of mining operation since the inception of the project. The primary aim of progressive mine closure plan is to limit the disturbances as early as possible after it is created by mining activities. The **final mine closure plan** identifies and includes the mine closure and other allied activities required to be executed towards the end of mine life and may continue even after the final closure of mining activities till a self-sustained ecosystem is created in and around the project area. Initially, the final mine closure plan is based on available inputs at the time of preparation and the likely future development in mines.

The legal requirement of mine closure in coal sector was introduced in the year 2009 by the Ministry of Coal, Government of India coming up with mine closure guidelines for the coal mines. These guidelines were revised in 2013 and have been further revised in the year 2019 and 2020. Coal companies are required to prepare approved mine closure plans for all operating mines in accordance with the Mine Closure guidelines issued by MoC along with opening a fixed deposit Escrow Account with scheduled Bank for depositing annual mine closure cost as per approved Mine Closure Plan.

7.1 Status of mine closure escrow fund

The Coal Controllers' Office has been entrusted to perform the implementation and monitoring of Mine Closure activities of the mining areas as per approved Mine Closure plans (Progressive and Final) and certification of works is being done from Government Notified Institutes like CMPDIL / NEERI, Nagpur / ISM, Dhanbad / IIT KGP / IIST, Shibpur regarding environment protection, complete safety zone fencing, expenditure incurred for protective and reclamation, rehabilitation works and opening up of Escrow Account. The details on mine closure fund deposited in the Escrow Account for each mine and disbursement from the fund on account of implementation of progressive mine closure activities during the year is provided in the below table.

Table 7.1: Status of amount deposited in escrow account and disbursal against the same for selected projects

S.N.	Name of Mine	Escrow amount deposited as on 31.03.2022 (INR in lakhs)	Escrow Amount released so far for implementation of progressive mine closure as on 31.03.2022 (INR in lakhs)	% release of escrow funds against implementation of MCA
1.	Rajmahal OC (ECL)	13609.57	4076.77	30.0
2.	Sonepur Bazari OC (ECL)	9273.21	1212.88	13.1
3.	AKWMC OC (BCCL)	1551.80	184.27	11.9
4.	NT ST Exp (Cluster 9, BCCL)	4273.48	618.72	14.5
5.	Amrapali OC (CCL)	4474.19	Nil	0.0
6.	Ashoka OC (CCL)	8014.98	1516.17	18.9
7.	Karo Exp. OC (CCL)	2002.75	349.61	17.5
8.	Konar Exp. OC (CCL) ³⁰	-	-	-
9.	Magadh OC (CCL)	7930.21	Nil	0.0
10.	Penganga OC (WCL)	4474.20	833.24	18.6
11.	Dipka OC (SECL)	11159.99	3322.41	29.8
12.	Gevra OC (SECL)	17517.11	5147.21	29.4
13.	Kusmunda OC (SECL)	7722.36	2284.12	29.6
14.	Manikpur OC (SECL)	3412.30	652.66	19.1
15.	Amlohri OC (NCL)	10684.00	3329.00	31.2
16.	Bina OC (NCL)	12500.00	3696.00	29.6
17.	Block-B OC (NCL)	6061.00	1850.00	30.5
18.	Dudhichua OC (NCL)	11352.00	5714.00	50.3
19.	Jayant OC (NCL)	20198.00	11014.00	54.5
20.	Khadia OC (NCL)	7558.00	1954.00	25.9
21.	Krishnashila OC (NCL)	4508.00	1123.00	24.9
22.	Nigahi OC (NCL)	13237.00	3752.00	28.3
23.	Ananta OC (MCL)	7338.69	762.29	10.4
24.	Balram OC (MCL)	4870.67	Nil	0.0
25.	Belpahar OC (MCL)	13099.41	1476.64	11.3
26.	Bharatpur OC (MCL)	8492.18	1896.07	22.3
27.	Bhubaneshwari OC (MCL)	5211.33	189.58	3.6
28.	Garjanbahal OC (MCL) ³¹	2036.70	Nil	0.0
29.	Hingula OC (MCL)	6233.51	Nil	0.0
30.	Jagannath OC (MCL)	3766.64	Nil	0.0

³⁰ Escrow account is yet to be created for Konar Expansion OCP (commenced in 2017) after merging escrow accounts of Khasmahal OCP and Konar OCP

³¹ Mine commenced in 2018

S.N.	Name of Mine	Escrow amount deposited as on 31.03.2022 (INR in lakhs)	Escrow Amount released so far for implementation of progressive mine closure as on 31.03.2022 (INR in lakhs)	% release of escrow funds against implementation of MCA
31.	Kaniha OC (MCL)	3615.22	Nil	0.0
32.	Kulda OC (MCL)	4272.06	Nil	0.0
33.	Lajkura OC (MCL)	2805.00	Nil	0.0
34.	Lakhanpur OC (MCL)	13376.95	2097.00	15.7
35.	Lingaraj OC (MCL)	7667.30	Nil	0.0
36.	Samaleswari OC (MCL)	9321.83	4647.13	49.9
37.	Gautami Khani OC (SCCL)	6224.00	344.00	5.5
38.	Jawahar Khani 5 OC (SCCL)	4759.00	786.00	16.5
39.	Ramagundam OC – I Exp. (SCCL)	13093.00	5058.00	38.6
40.	Talabira II & III OC ³² (NLCIL)	2269.00	0.00	0.0

³² Mine commenced in 2018

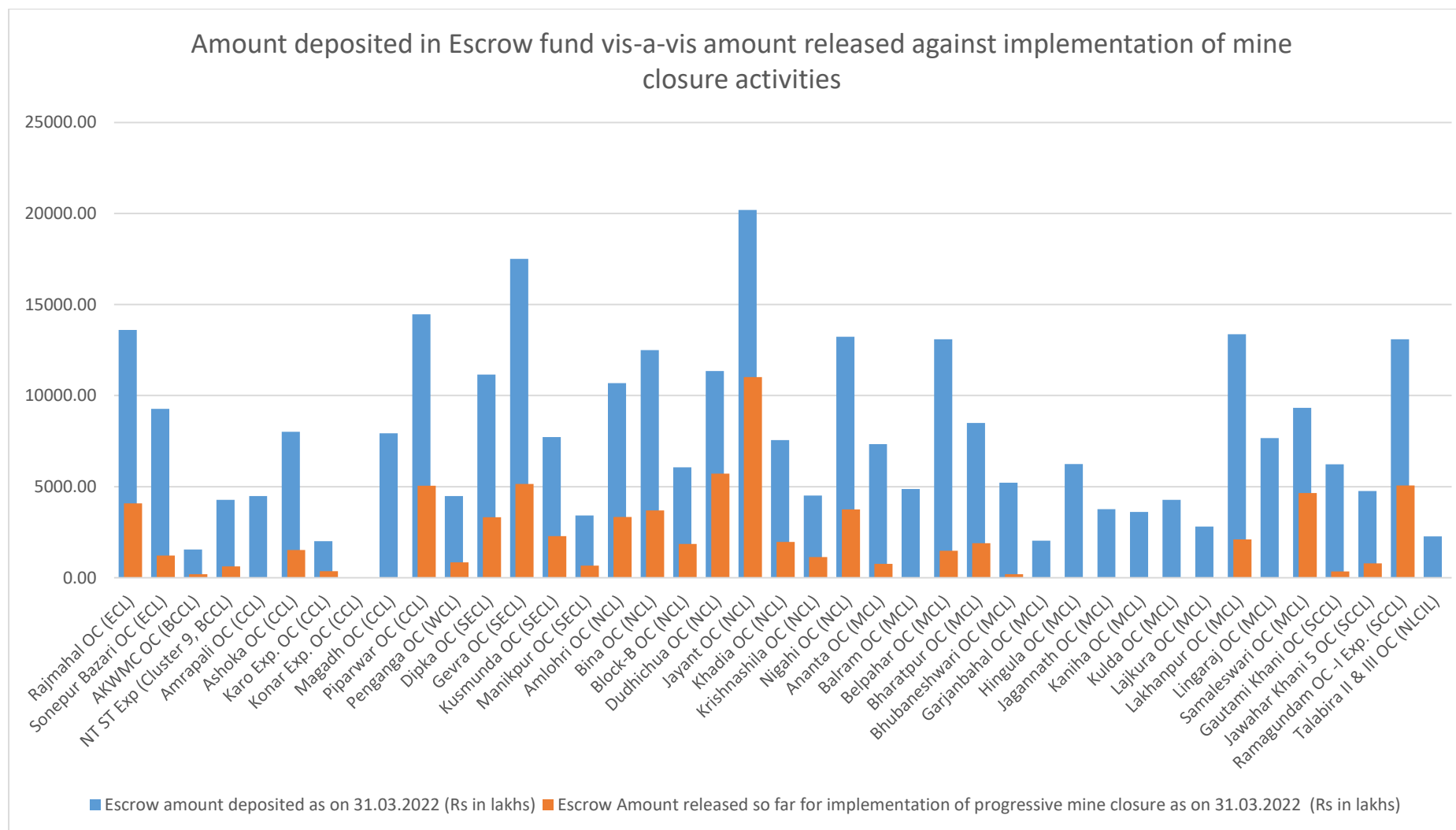


Figure 7.1: Amount deposited in Escrow fund vis-a-vis disbursement against mine closure activities implemented

7.2 Status of land reclamation as a part of mine closure

The areas affected by mining activities are progressively reclaimed through technical reclamation followed by biological reclamation after topping with top soil. In order to assess the status of progressive mine closure activities, the area disturbed by mining activities has been divided into three parts – active mining area, area under technical reclamation and biologically reclaimed area. The breakup of the working area in the selected 40 projects in terms of active mining area, total technically reclaimed area and total biologically reclaimed area is given in the figure below.

Overall, the active mining area ranged between 16.3% to 100% (average 62.9%), technically reclaimed area ranged from 0.21% to 56.7% (average 14.7%) and biologically reclaimed area ranged from 2.65% to 55% (average 22.4%). Green cover developed over other areas in the mine ranged from 0.02% to 28.3% (average 4.9%).

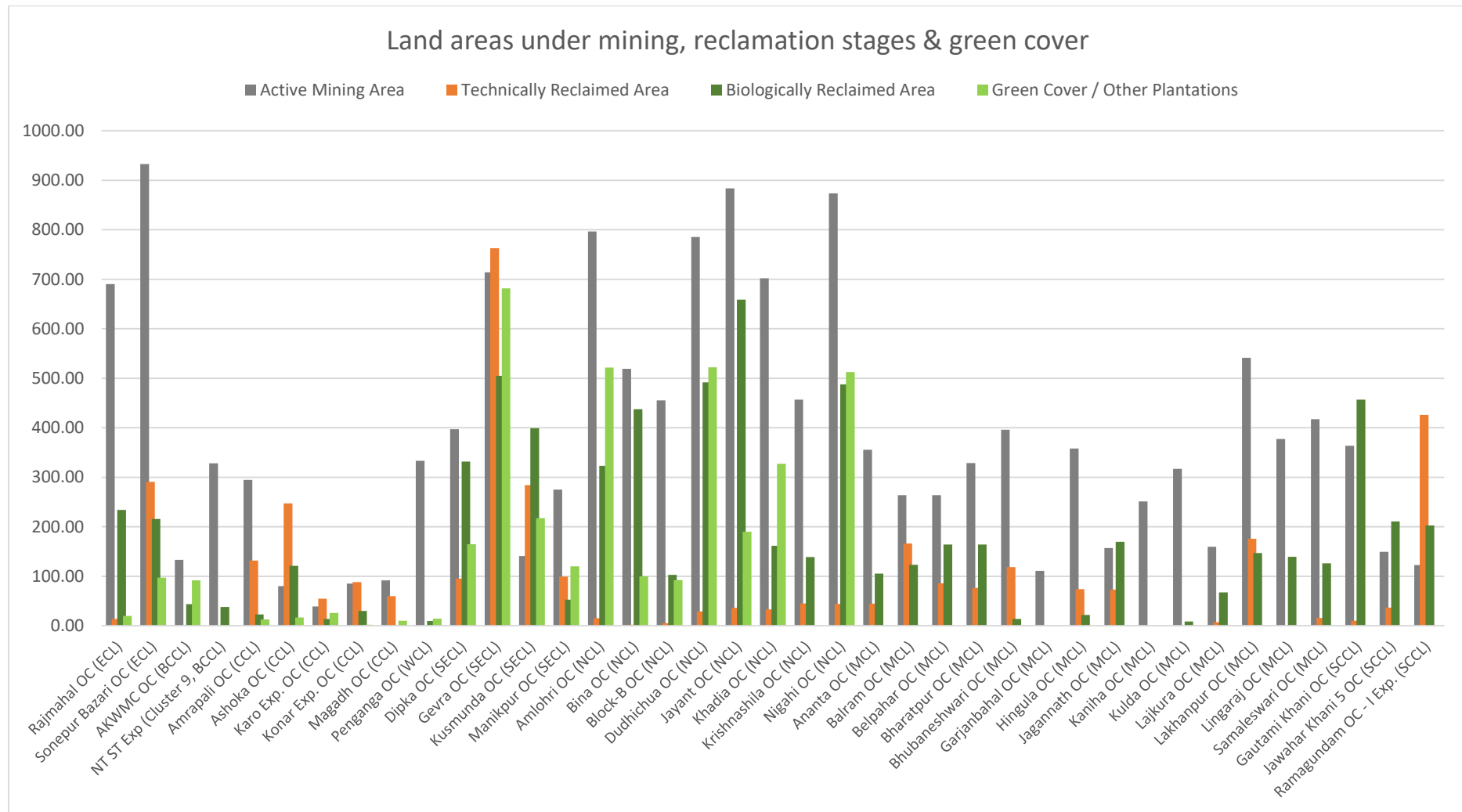


Figure 7.2: Land area break-up (active mining area, areas under reclamation and green cover)

7.3 Plantation in coal mines – overall status

The details on plantation undertaken by the coal companies (CIL, SCCL & NLCIL) during FY 21-22 are presented in the table below:

Table 7.2: Subsidiary wise break-up of plantation done by coal companies during 2021-22

Company wise break-up for plantation done by coal companies during 2021-22		
Coal company	No. of plants	Land Area (in ha)
ECL	300795	154.90*
BCCL	186408	90.1
CCL	256832	133.64**
NCL	634568	242.6
WCL	470268	183.91
SECL	713460	276.00
MCL	116303	60.49
CIL (Total)***	2678634	1141.64
SCCL****	4414284	580.12
NLCIL	271864	137.92

*Incl 16.50 ha seedball plantation

**Includes 30.81 Ha. Seed ball plantation

*** Outside mine lease area is 1468.45 Ha (i.e. 1141.64 + 38.11 + 95 + 193.7), (excluding 159 ha. grass/cultivation). CIL has distributed 1,93,794 saplings during Vriksharopan Abhiyan-2021, which will translate into plantation of about 193.7 ha (considering 1 ha for every 1000 saplings distributed). For FY 2021-22, achievement as on 31.03.2022, plantation inside (Including Bamboo) and number of bamboo saplings planted is included in plantation numbers.

****Excludes distribution of plants - 1029830 nos.



Figure 7.3: Eco-restoration of mined out areas in Sijua Tetulmari undertaken by BCCL



Figure 7.4: Reclamation over OB dumps, Magadh OC, CCL



Figure 7.5: View of Lilari Eco-park under development at MCL



Figure 7.6: Chandrashekhar Azad Eco-park and various amenities, located at Orient UG Mine No.4, MCL



Figure 7.7: Indoor method of vegetable production (using poly greenhouse structures) and production of Lab Lab vegetable species through hi-tech methods in open field at NLCIL mining sites

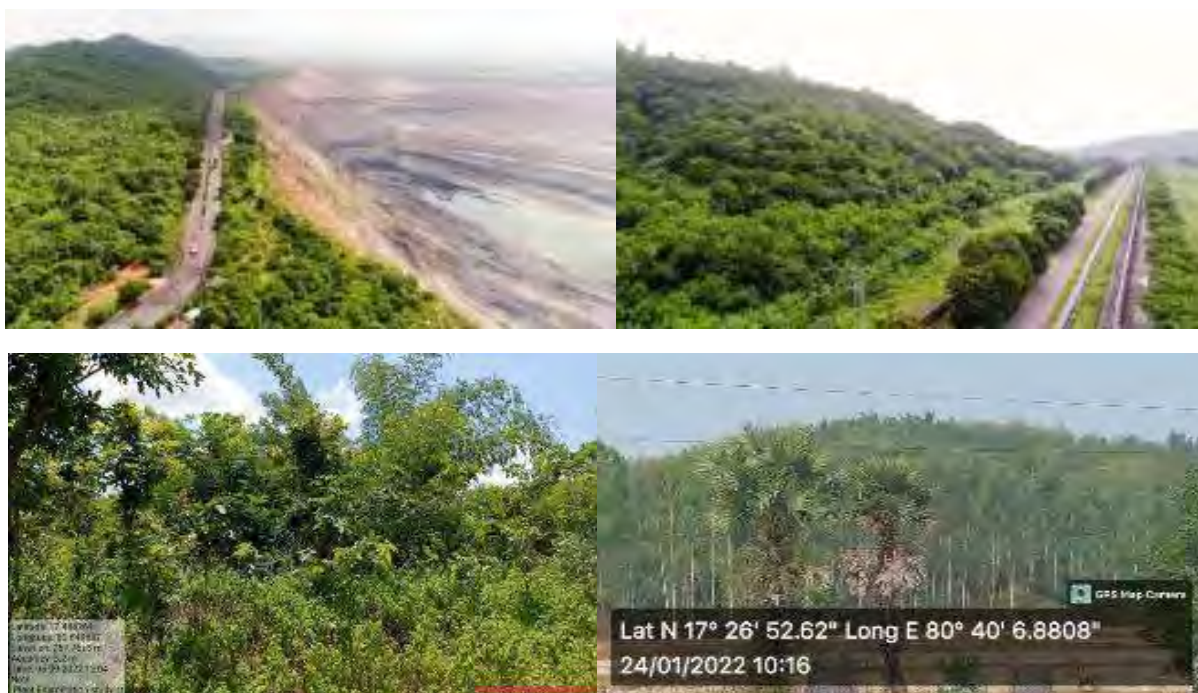


Figure 7.8: Plantation across mines of SCCL



Figure 7.9: Ecopark developed at Gauthami Khani (GK) OC project of SCCL

Chapter VIII: Renewable energy and energy efficiency initiatives

8.0 Renewable energy generation projects installed by coal companies

Coal companies are increasingly turning to renewable energy generation sources in order to offset their carbon footprint and promote sustainability initiatives. The details on solar and wind power generation capacity reported across the various coal PSUs till FY 21-22 is presented in the table below:

Table 8.1: Installation of renewable energy sources by coal companies till FY 21-22

Coal company	Solar Power - Installed capacity as on 31.03.2022	Others (wind / other renewables, if any) - Installed capacity as on 31.03.2022
ECL	1046 KW	Nil
BCCL	356 KW	Nil
CCL	1250 KW	Nil
WCL	997 KW	Nil
SECL	Nil	Nil
NCL	470 KW	Nil
MCL	3150 KW	Nil
NLCIL	1370.06 MW	51 MW
SCCL	224 MW	Nil

8.1 Details on energy efficiency measures installed across selected projects

Coal companies have also initiated various energy efficiency measures across the mining projects to reduce energy consumption and increase efficiency across equipment and machinery. These measures include installation of LED lighting fixtures, energy efficient machines (pumps, ACs, superfans and water heaters), auto-timers and capacitor banks among others. The details on project wise energy efficiency measures implemented are presented in the table below.

Table 8.2: Details on energy efficiency measures implemented and proposed target by select projects

S.N.	Name of Mine	Energy efficiency measures implemented during FY 21-22 (LED lighting, energy efficient pumps/AC/superfan/water heater, auto-timers, capacitor banks, and others)	Savings in electricity upon installation of energy efficiency measures (% reduction in energy consumption envisaged)	Future plans for energy efficiency
1.	Rajmahal OC (ECL)	LED lights of different wattage - 727 Nos, AC -14 Nos, Auto Timers- 4 Nos , Capacitor Bank- 225kVAr	Saving of approx 9.72 lakh units, 2.05% reduction in energy consumption	Target for overall reduction in energy consumption by 3-4 % by further implementation of EE measures in coming financial years
2.	Sonepur Bazari OC (ECL)	LED Lights- 695 Nos, AC -4 Nos, Auto Timers- 4 Nos , Capacitor Bank- 181.5kVAr	Savings of approx 7.13 lakh units, 1.63% reduction in energy consumption	Target for overall reduction in energy consumption by 2-3 % by further implementation of EE measures in coming financial years
3.	AKWMC OC (BCCL)	Data provided for BCCL as a whole: LED lights – 2700 nos., Energy efficient ACs – 71 nos., Super fans – 209 nos., Energy efficient water heaters – 74 nos., energy efficient motors – 2 nos., auto timers in switches – 70 nos..	-	Data provided for BCCL as a whole: Target - LED lights – 8800 nos., Energy efficient ACs – 79 nos., Super fans – 591 nos., E-vehicles – 20 nos., energy efficient motors – 28 nos., auto timers in switches – 180 nos., capacitor banks – 10 sets
4.	NT ST Exp (Cluster 9, BCCL)			
5.	Amrapali OC (CCL)	-	-	-
6.	Ashoka OC (CCL)	-	-	-
7.	Karo Exp. OC (CCL)	100 nos of Solar Street lights installed in FY-21-22 along the roads of nearby village (Karo Basti) in Karo Expansion OCP	-	100 nos of Solar Street lights is proposed in FY-22-23 along the roads of nearby vilages in Karo Expansion OCP
8.	Konar Exp. OC (CCL)	-	-	-
9.	Magadh OC (CCL)	Energy Efficient AC: -10Nos, (SAP Reservation No. 950079913 Dated: 12.01.2022)	Reduction in Energy Consumption due to 1.5 Ton 5 star Ac instead of 3 star Ac=31%	Energy Efficient Ac:20, LED light:300 No., Auto timer:5 No.,E vehicle 5No., Solar Street Light: 50 No.(30 Watt)

S.N.	Name of Mine	Energy efficiency measures implemented during FY 21-22 (<i>LED lighting, energy efficient pumps/AC/superfan/water heater, auto-timers, capacitor banks, and others</i>)	Savings in electricity upon installation of energy efficiency measures (% reduction in energy consumption envisaged)	Future plans for energy efficiency
10.	Penganga OC (WCL)	100 nos. of 300 W and 50 nos. of 150 W LEDs installed	39600 KWH electricity was saved in 2021-22 as a result of installation of 100 nos. of 300 W and 50 nos. of 150 W LEDs (installed for 60 days in 2021-22)	02 nos. of Solar Heaters
11.	Dipka OC (SECL)	1000 nos. of LED lights have been provided.	-	-
12.	Gevra OC (SECL)	1. LED tube light & bulbs -1000 nos 2. LED street /flood lights -500 nos 3.Capacitor Bank -10690 KVAR	Reduction of 0.198KWH consumption in per cum composite production	1. 150 nos energy efficient ACs are to be replaced 2. 500 nos LED street /flood lights are to be replaced 3. 26500 KVAR capacitor banks are to be added. 4. 50 nos energy efficient water heaters are to be provided 5. 500 nos BLDC ceiling fans are to be replaced
13.	Kusmunda OC (SECL)	Expenditure towards energy conservation for the FY 21-22 is 2.18 crores upon re-organisation of transport system	-	Work has been awarded for installation of solar panels/rooftops (65 nos.) vide no. 1566100 on 05.01.22 for a quantity of 65 units at a cost of 26.43 lakhs for Kusmunda Area. Site visit has been completed and locations have finalized at GM Office, Kusmunda Bhavan and Rescue office for installation.
14.	Manikpur OC (SECL)	450 nos. of different power of LED lights have been provided in the Manikpur OC for reducing the use of energy.	-	-

S.N.	Name of Mine	Energy efficiency measures implemented during FY 21-22 (<i>LED lighting, energy efficient pumps/AC/superfan/water heater, auto-timers, capacitor banks, and others</i>)	Savings in electricity upon installation of energy efficiency measures (% reduction in energy consumption envisaged)	Future plans for energy efficiency
15.	Amlohri OC (NCL)	LED-1000, AC-40	337023(0.5%)	LED-1500, ACs-77, Super Fan-3000, E-vehicle-0, Water Heater-10, Motors-4, Auto Timers-24
16.	Bina OC (NCL)	LED-5565, AC-10, SUPER FAN-3199 AUTO TIMERS-10, CAPACITOR BANK-2800 KVAR	1777114(5.85%)	LED-2000, AC-0, Super Fan-5001, E-Vehicle-2, Water Heater-25, Motors-0, Auto Timers-10
17.	Block-B OC (NCL)	LED-1240 SUPER FAN-553	375198(2.17%)	LED-1600, AC-67, Super Fan-0, E-Vehicle-1, Water Heater-10, Motors-4, Auto Timers-20
18.	Dudhichua OC (NCL)	LED-11621	3068214(4.54%)	LED-26200, AC-125, Super Fan-1500 E-Vehicle-2, Water Heater-20 Motors-5, Auto Timers-80
19.	Jayant OC (NCL)	LED-15000, AC-78, WATER HEATER-22 AUTO TIMERS-70, CAPACITOR BANK-4000 KVAR	4129125(5.38%)	LED-6980, AC-132, Super Fan-5000 E-Vehicle-3, Water Heater-20 Motors-45, Auto Timers-0
20.	Khadia OC (NCL)	LED-1725	455440(0.94%)	LED-855, AC-0, Super Fan-400 E-Vehicle-0, Water Heater-10 Motors-0, Auto Timers-20
21.	Krishnashila OC (NCL)	LED-950, AC-53, SUPER FAN-400 WATER HEATER-12	387806(2.85%)	LED-850, AC-38, Super Fan-350 E-Vehicle-3, Water Heater-0 Motors-4, Auto Timers-12
22.	Nigahi OC (NCL)	LED-4525, AC-106, AUTO TIMERS-40 CAPACITOR BANK-1200	1388155(1.64%)	LED-2235, AC-21, Super Fan-1200 E-Vehicle-6, Water Heater-8 Motors-8, Auto Timers-160
23.	Ananta OC (MCL)	LED Lights – 588, ACs – 16, Water heaters – 02, Auto-timers - 10	0.24%	Complete replacement of conventional lights (HPSV/fluorescent/etc.) with LED Achievement of year-wise EEM Targets given by CIL.
24.	Balram OC (MCL)	LED Lights – 256, Auto-timers - 10	0.10%	
25.	Belpahar OC (MCL)	LED Lights – 210, Auto-timers - 40	0.09%	

S.N.	Name of Mine	Energy efficiency measures implemented during FY 21-22 (LED lighting, energy efficient pumps/AC/superfan/water heater, auto-timers, capacitor banks, and others)	Savings in electricity upon installation of energy efficiency measures (% reduction in energy consumption envisaged)	Future plans for energy efficiency
26.	Bharatpur OC (MCL)	LED Lights – 800, ACs – 4, Auto-timers - 14	0.32%	Deployment of E-Vehicles - 4 nos. have been deployed in 2022-23 and it has been proposed to deploy 10 nos. E-vehicle at HQ in 2023-24. Capacitor bank wherever required will be added as per need basis.
27.	Bhubaneshwari OC (MCL)	LED Lights – 280, ACs – 7, Auto-timers - 6	0.11%	
28.	Garjanbahal OC (MCL)	LED Lights – 1000, Auto-timers - 24	0.39%	
29.	Hingula OC (MCL)	LED Lights – 168, Auto-timers - 6	0.07%	
30.	Jagannath OC (MCL)	LED Lights – 450, ACs – 5, Water heaters – 5, Auto-timers - 10	0.18%	
31.	Kaniha OC (MCL)	LED Lights – 300, Auto-timers - 12	0.12%	
32.	Kulda OC (MCL)	LED Lights – 1300, Auto-timers - 35	0.51%	
33.	Lajkura OC (MCL)	LED Lights – 500, ACs – 2, Auto-timers - 7	0.20%	
34.	Lakhanpur OC (MCL)	LED Lights – 130, Auto-timers - 30	0.06%	
35.	Lingaraj OC (MCL)	LED Lights – 150, ACs – 02, Auto-timers - 23	0.07%	
36.	Samaleswari OC (MCL)	LED Lights – 500, ACs – 02, Auto-timers - 10	0.20%	
37.	Gautami Khani OC (SCCL)	Energy Audit: Energy auditing conducted by an accredited energy auditor in a specified manner in different mines of SCCL regularly and carried out the following as per their recommendations. a) Re-organisation of dewatering pumps b) Reorganisation of coal transport belts in underground mines Lighting: Use of energy efficient LED lamps in place of Incandescent lamps. Energy efficient appliances: Purchased 5 star rated air conditioners, refrigerators, ceiling fans, water coolers etc.		
38.	Jawahar Khani 5 OC (SCCL)			
39.	Ramagundam OC – I Exp. (SCCL)			

S.N.	Name of Mine	Energy efficiency measures implemented during FY 21-22 (<i>LED lighting, energy efficient pumps/AC/superfan/water heater, auto-timers, capacitor banks, and others</i>)	Savings in electricity upon installation of energy efficiency measures (% reduction in energy consumption envisaged)	Future plans for energy efficiency
		<p>Lower room temperatures: As per the guidelines from central ministry, temperature setting of the room Air conditioner is fixed at 26°C throughout the company and issued circular accordingly.</p> <p>Usage of Day Light: Usage of maximum day light is encouraging in buildings, sheds of Area Stores, Workshops, Auditoriums, community Halls and clubs. For this arranged to fix transparent acrylic sheets on top of roof and the same also made mandatory.</p> <p>Street Light Timers: Using street light timers in street lighting.</p>		
40.	Talabira II & III OC (NLCIL)	<p>302 nos LED light installed</p> <p>10 nos energy efficient AC installed</p> <p>2 numbers energy efficient AC installed</p>		All the Energy Efficiency measures listed are proposed for the upcoming years also with the aim to fulfill the complete replacement of LED lights in the FY 2023-24

Chapter IX: Categorization of projects

9.0 Categorization of Projects

The selected mines were categorized into 'Excellent', 'Very Good' and 'Good' based on overall scoring which was calculated based on the performance of the mines w.r.t the attributes namely – land use, air quality management, water quality and mine closure aspects. The attribute wise categorization is explained hereunder.

9.1 Categorization w.r.t Land Use

The projects were scored based on the optimal management of active mine area and maximization of reclamation (biological reclamation and green cover) as compared to the total leasehold area. In case of projects where mining has commenced within the past 5 years, i.e. mines where production began post 2016, reclamation activities would not have commenced on a measurable scale. Hence such projects have been awarded full score by default.

Table 9.1: Basis of rating w.r.t Land Use

Basis of rating				
% Active mining area		% Reclamation (Bio. reclamation + Green Cover)		Net Rating
% Range	Score	Score Range	Score	Average of rating awarded to % active mining area and % reclamation (bio. reclamation + green cover)
20 & below	100	80 & above	100	
Between 20 & 40	80	Between 60 & 80	80	
Between 40 & 60	60	Between 40 & 60	60	
Between 60 & 80	40	Between 20 & 40	40	
80 & above	20	20 & below	20	

Table 9.2: Categorization of mines w.r.t Land Use

Category	Score	No. of Mines	Name of Mines
Excellent	80% and above	3	CCL – Konar Expansion OC* MCL – Garjanbahal OC* NLCIL – Talabira II & III OC*
Very Good	60 - 79%	17	CCL – Ashoka OC, Karo Exp. OC, Magadh OC SECL – Dipka OC, Gevra OC, Kusmunda OC NCL – Amlohri OC, Bina OC, Dudhichua OC, Jayant OC, Nigahi OC

Category	Score	No. of Mines	Name of Mines
			MCL – Balram OC, Belpahar OC, Jagannath OC SCCL – Gautamikhani OC, Jawaharkhani 5 OC, Ramagundam OC – I Exp.
Good	Below 60%	20	ECL – Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC OC, NT ST Exp. OC CCL – Amrapali OC WCL – Penganga OC SECL – Manikpur OC NCL – Block B OC, Khadia OC, Krishnashila OC MCL – Ananta OC, Bharatpur OC, Bhubaneshwari OC, Hingula OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC

**New projects – commenced post 2016*

9.2 Categorization w.r.t Air Quality Management

The projects were scored based on status of compliance of applicable standards of 4 major pollutants (PM₁₀, PM_{2.5}, SO₂ and NO_x) in core and buffer zone.

The ambient air quality results provided by each project were analysed for the four major parameters and percentage compliance against the applicable standard (core / buffer) was calculated for values reported during the Routine Environment Monitoring (REM) by companies during FY 21-22. The percentage compliance values for each parameter in the core and buffer zone were then averaged to arrive at the final consolidated scores.

Table 9.3: Basis of rating w.r.t Air Quality Management

Percentage Compliance of pollutant concentrations (PM ₁₀ , PM _{2.5} , SO ₂ and NO _x) based on reported data in core & buffer zones	Score*
Compliance > 98% & ≤ 100%	100
Compliance > 90% & ≤ 98%	80
Compliance > 80% & ≤ 90%	60
Compliance > 70% & ≤ 80%	40
Compliance ≤ 70%	20

**Final scoring calculated considering average scores of core and buffer zones.*

Table 9.4: Categorization of mines w.r.t Air Quality Management

Category	Score	No. of Mines	Name of Mines
Excellent	80% and above	29	CCL – Amrapali OC, Ashoka, Karo Exp. OC, Konar Exp. OC, Magadh OC WCL – Penganga OC SECL – Dipka OC, Gevra OC, Kusmunda OC NCL – Block B OC, Dudhichua OC, Jayant OC MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC SCCL – Gautamikhani OC, Jawaharkhani 5 OC, Ramagundam OC – I Exp. NLCIL – Talabira II & III OC
Very Good	60 - 79%	10	ECL – Rajmahal OC, Sonapur Bazari OC BCCL – AKWMC OC, NT ST Exp. OC SECL – Manikpur OC NCL – Amlohri OC, Khadia OC, Krishnashila OC, Nigahi OC MCL – Bhubaneshwari OC
Good	Below 60%	01	NCL – Bina OC

9.3. Categorization w.r.t Water Quality

The projects were scored based on status of compliance of applicable standards of 2 major pollutants (PH and TSS) in the mine water discharge.

The water (effluent) quality results provided by each project were analysed for the two major parameters and percentage compliance against the applicable standard was calculated for values reported during the Routine Environment Monitoring (REM) by companies during FY 21-22.

Table 9.5: Basis of rating w.r.t Water Quality

Percentage Compliance of pollutant concentrations (pH & TSS) based on reported data in outlet water samples	Score*
Compliance > 98% & ≤ 100%	100
Compliance > 90% & ≤ 98%	80
Compliance > 80% & ≤ 90%	60
Compliance > 70% & ≤ 80%	40
Compliance ≤ 70%	20

Table 9.6: Categorization of mines w.r.t Water Quality

Category	Score	No. of Mines	Name of Mines
Excellent	80% and above	32	ECL – Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC OC, NT ST Exp. OC CCL – Amrapali OC, Ashoka, Karo Exp. OC, Konar Exp. OC, Magadh OC WCL – Penganga OC SECL – Dipka OC, Gevra OC, Manikpur OC NCL – Amlohri OC, Block-B OC, Dudhichua OC, Jayant OC, Krishnashila OC MCL – Ananta OC, Balram OC, Belpahar OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lakhanpur OC, Lingaraj OC SCCL – Gautamikhani OC, Jawaharkhani 5 OC, Ramagundam OC – I Exp. NLCIL – Talabira II & III OC
Very Good	60 - 79%	07	SECL – Kusmunda OC NCL – Bina OC, Khadia OC, Nigahi OC MCL – Bharatpur OC, Bhubaneshwari OC, Samaleswari OC
Good	Below 60%	1	MCL – Lajkura OC

9.4. Categorization w.r.t Mine Closure Aspects

The projects were scored based on conduction of mine closure activities as per an approved mine closure plan and percentage of land reclaimed in comparison to total area under mining influence. In case of projects where mining has commenced within the past 5 years, *i.e.* mines where production began post 2016, reclamation activities and associated mine closure would not have commenced on a measurable scale. Hence such projects have been awarded full score by default.

Table 9.7: Basis of rating w.r.t Mine Closure Aspects

Status of percentage of land reclaimed (Biologically reclaimed area + Green Cover) / Mine Lease Area and corresponding rating		Net Score
Criteria	Score	Average of ratings awarded for mine closure and % land reclaimed
80 and above	100	
70 – 79	80	
60 – 69	60	
50 – 59	40	

Status of percentage of land reclaimed (Biologically reclaimed area + Green Cover) / Mine Lease Area and corresponding rating		Net Score
<50	20	

Table 9.8: Categorization of mines w.r.t Mine Closure Aspects

Category	Score	No. of Mines	Name of Mines
Excellent	80% and above	-	-
Very Good	60 - 79%	4	BCCL – AKWMC OC NCL – Dudhichua OC SCCL - Gautamikhani OC, Jawaharkhani 5 OC
Good	Below 60%	36	ECL – Rajmahal OC, Sonepur Bazari OC BCCL – NT ST Exp. OC CCL – Amrapali OC, Ashoka, Karo Exp. OC, Konar Exp. OC*, Magadh OC WCL – Penganga OC SECL – Dipka OC, Gevra OC, Kusmunda OC, Manikpur OC NCL – Amlohri OC, Bina OC, Block-B OC, Jayant OC, Khadia OC, Krishnashila OC, Nigahi OC MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Bhubaneswari OC, Garjanbahal OC*, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC SCCL – Ramagundam OC – I Exp. NLCIL – Talabira II & III OC*

*New projects – commenced post 2016

9.5 Overall Categorization

Scores obtained on four attributes (land use, air quality, water quality and mine closure aspects) were added to arrive at the overall rating of the mines.

Table 9.9: Basis of overall rating

Score (Out of 100)	Rating
80 and above	5 (Excellent)
60 to 79	4 (Very Good)
40 to 59	3 (Good)

Score (Out of 100)	Rating
20 to 39	2
Below 20	1

Table 9.10: Overall categorization of mines

Category	Score	No. of Mines	Name of Mines
Excellent	80% and above	6	CCL – Konar Expansion OC* NCL – Dudhichua OC MCL – Garjanbahal OC* SCCL - Gautamikhani OC, Jawaharkhani 5 OC NLCIL – Talabira II & III OC*
Very Good	60 - 79%	32	ECL – Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC OC, NT ST Exp. OC CCL – Amrapali OC, Ashoka, Karo Exp. OC, Magadh OC WCL – Penganga OC SECL – Dipka OC, Gevra OC, Kusmunda OC, Manikpur OC NCL – Amlohri OC, Bina OC, Block-B OC, Jayant OC, Khadia OC, Krishnashila OC, Nigahi OC MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC SCCL – Ramagundam OC – I Exp.
Good	Below 60%	2	MCL – Bhubaneswari OC, Lajkura OC

* New projects – commenced post 2016

Table 9.11: Ratings and Scoring – attribute wise and overall

Sr. No.:	Projects	Scoring				
		Land	Air	Water	Mine Closure	Overall
1.	Rajmahal OC (ECL)	50	80	100	20	62.5
2.	Sonepur Bazari OC (ECL)	40	80	100	20	60
3.	AKWMC OC (BCCL)	50	80	100	60	72.5
4.	NT ST Exp (Cluster 9, BCCL)	40	80	100	20	60
5.	Amrapali OC (CCL)	40	100	100	20	65
6.	Ashoka OC (CCL)	60	100	100	20	70
7.	Karo Exp. OC (CCL)	60	100	100	20	70
8.	Konar Exp. OC (CCL)	100	100	100	20	80
9.	Magadh OC (CCL)	60	100	100	20	70

Sr. No.:	Projects	Scoring				
		Land	Air	Water	Mine Closure	Overall
10.	Penganga OC (WCL)	40	100	100	20	65
11.	Dipka OC (SECL)	70	100	100	40	77.5
12.	Gevra OC (SECL)	70	100	100	40	77.5
13.	Kusmunda OC (SECL)	70	100	80	40	72.5
14.	Manikpur OC (SECL)	50	80	100	20	62.5
15.	Amlohri OC (NCL)	60	80	100	40	70
16.	Bina OC (NCL)	60	60	80	40	60
17.	Block-B OC (NCL)	50	100	100	20	67.5
18.	Dudhichua OC (NCL)	70	100	100	60	82.5
19.	Jayant OC (NCL)	60	100	100	40	75
20.	Khadia OC (NCL)	50	80	80	40	62.5
21.	Krishnashila OC (NCL)	40	80	100	20	60
22.	Nigahi OC (NCL)	60	80	80	40	65
23.	Ananta OC (MCL)	50	100	100	20	67.5
24.	Balram OC (MCL)	60	100	100	20	70
25.	Belpahar OC (MCL)	60	100	100	20	70
26.	Bharatpur OC (MCL)	50	100	80	20	62.5
27.	Bhubaneshwari OC (MCL)	30	80	80	20	52.5
28.	Garjanbahal OC (MCL)	100	100	100	20	80
29.	Hingula OC (MCL)	50	100	100	20	67.5
30.	Jagannath OC (MCL)	60	100	100	40	75
31.	Kaniha OC (MCL)	50	100	100	20	67.5
32.	Kulda OC (MCL)	40	100	100	20	65
33.	Lajkura OC (MCL)	50	100	60	20	57.5
34.	Lakhanpur OC (MCL)	50	100	100	20	67.5
35.	Lingaraj OC (MCL)	50	100	100	20	67.5
36.	Samaleswari OC (MCL)	50	100	80	20	62.5
37.	Gautami Khani OC (SCCL)	60	100	100	60	80
38.	Jawahar Khani 5 OC (SCCL)	70	100	100	60	82.5
39.	Ramagundam OC – I Exp. (SCCL)	70	100	100	40	77.5
40.	Talabira II & III OC (NLCIL)	100	100	100	20	80

Table 9.12: Comparison with status of projects during previous SDC report for FY 2020-21

		Status as per SDC report 2020-21		Status as per SDC report 2021-22	
		Attribute – Land			
Category	Score	No. of Mines	Name of Mines	No. of Mines	Name of Mines
Excellent	80% and above	02	MCL – Garjanbhal OC NLCIL – Talabira II & III OC	3	CCL – Konar Expansion OC* MCL – Garjanbahal OC* NLCIL – Talabira II & III OC*
Very Good	60 - 79%	23	ECL – Sonepur Bazari OC BCCL – AKWMC CCL – Amrapali OC, Ashoka OC, Karo OC, Konar Exp. OC, Magadh OC, Piparwar OC NCL – Amlori OC, Bina OC, Jayant OC, Nigahi OC WCL – Penganga OC SECL - Dipka OC, Gevra OC, Kusmunda OC, Manikpur OC MCL – Balram OC, Belpahar OC, Jagannath OC, Samaleswari OC SCCL – GK OC, JK-5 OC	17	CCL – Ashoka OC, Karo Exp. OC, Magadh OC SECL – Dipka OC, Gevra OC, Kusmunda OC NCL – Amlori OC, Bina OC, Dudhichua OC, Jayant OC, Nigahi OC MCL – Balram OC, Belpahar OC, Jagannath OC SCCL – Gautamikhani OC, Jawaharkhani 5 OC, Ramagundam OC – I Exp.
Good	Below 60%	15	ECL – Rajmahal OC NCL – Block-B OCP, Dudhichua OC, Khadia OC MCL – Ananta OC, Bharatpur OC, Hingula OC, Kaniha OC, Lajkura OC, Lakhanpur OC, Lingaraj OC	20	ECL – Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC OC, NT ST Exp. OC CCL – Amrapali OC WCL – Penganga OC

		Status as per SDC report 2020-21		Status as per SDC report 2021-22	
			Krishnashila OC*, Bhubaneshwari OC* & Kulda OC* BCCL – NTST Exp. OC* <i>*Mines with score less than 40</i>		SECL – Manikpur OC NCL – Block B OC, Khadia OC, Krishnashila OC MCL – Ananta OC, Bharatpur OC, Bhubaneshwari OC, Hingula OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC
Attribute - Air					
Category	Score	No. of Mines	Name of Mines	No. of Mines	Name of Mines
Excellent	80% and above	34	ECL - Rajmahal OC, Sonepur Bazari OC BCCL- AKWMC, NT-ST Expansion OC CCL - Amrapali OC, Ashoka OC NCL – Amlohri OC, Bina OC, Block-B, Dudhichua OC, Khadia OC, Krishnashila OC, Nigahi OC WCL- Penganga OC SECL – Dipka OC, Manikpur OC, Kusmunda OC MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Bhubneshwari OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC, SCCL – GK OC, JK-5 OC NLCIL – Talabira OC	29	CCL – Amrapali OC, Ashoka, Karo Exp. OC, Konar Exp. OC, Magadh OC WCL – Penganga OC SECL – Dipka OC, Gevra OC, Kusmunda OC NCL – Block B OC, Dudhichua OC, Jayant OC MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC SCCL – Gautamikhani OC, Jawaharkhani 5 OC, Ramagundam OC – I Exp. NLCIL – Talabira II & III OC

		Status as per SDC report 2020-21		Status as per SDC report 2021-22	
Very Good	60 - 79%	06	CCL – Karo OC, Konar OC, Magadh OC, Piparwar OC SECL – Gevra OC NCL – Jayant OC	10	ECL – Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC OC, NT ST Exp. OC SECL – Manikpur OC NCL – Amlohri OC, Khadia OC, Krishnashila OC, Nigahi OC MCL – Bhubaneshwari OC
Good	Below 60%	Nil	-	01	NCL – Bina OC
Attribute - Water					
Category	Score	No. of Mines	Name of Mines	No. of Mines	Name of Mines
Excellent	80% and above	21	ECL - Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC OC, NTST Exp. OC CCL - Amrapali OC, Ashoka OC, Karo OC, Konar OC WCL - Penganga OC SECL- Dipka OC, Manikpur OC MCL - Ananta OC, Bharatpur OC, Bhubaneshwari OC, Garjanbahal OC, Kaniha OC, Kulda OC, Samaleswari OC SCCL - JK-5 OC, GK OC NLCIL - Talabira II & III OC	32	ECL – Rajmahal OC, Sonepur Bazari OC BCCL – AKWMC OC, NT ST Exp. OC CCL – Amrapali OC, Ashoka, Karo Exp. OC, Konar Exp. OC, Magadh OC WCL – Penganga OC SECL – Dipka OC, Gevra OC, Manikpur OC NCL – Amlohri OC, Block-B OC, Dudhichua OC, Jayant OC, Krishnashila OC MCL – Ananta OC, Balram OC, Belpahar OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lakhanpur OC, Lingaraj OC

		Status as per SDC report 2020-21		Status as per SDC report 2021-22	
					SCCL – Gautamikhani OC, Jawaharkhani 5 OC, Ramagundam OC – I Exp. NLCIL – Talabira II & III OC
Very Good	60 - 79%	12	CCL- Piparwar OC NCL – Bina OC, Block B, Jayant OC, Khadia OC, Krishnashila OC, Nigahi OC SECL –Gevra OC, Kusmunda OC MCL – Belpahar OC, Lakhanpur OC, Lingaraj OC	07	SECL – Kusmunda OC NCL – Bina OC, Khadia OC, Nigahi OC MCL – Bharatpur OC, Bhubaneshwari OC, Samaleswari OC
Good	Below 60%	07	CCL – Magadh OC NCL – Amlohri OC, Dudhichua OC MCL – Balram OC*, Hingula OC*, Jagannath OC*, Lajkura OC	1	MCL – Lajkura OC
Attribute – Mine Closure					
Category	Score	No. of Mines	Name of Mines	No. of Mines	Name of Mines
Excellent	80% and above	10	BCCL – AKWMC OC CCL - Ashoka OC, Piparwar OC WCL – Penganga OC SECL - Gevra OC, Kusmunda OC, Manikpur OC MCL – Jagannath OC SCCL - JK-5 OC, GK OC	-	-

		Status as per SDC report 2020-21		Status as per SDC report 2021-22	
Very Good	60 - 79%	30	<p>ECL- Rajmahal OC, Sonepur Bazari OC</p> <p>BCCL – NTST Exp. OC</p> <p>CCL – Amrapali OC, Karo OC, Konar Expansion OC, Magadh OC</p> <p>NCL – Amlohri OC, Bina OC, Block-B OC, Dudhichua OC, Jayant OC, Khadia OC, Krishnashilla OC, Nigahi OC</p> <p>SECL – Dipka OC</p> <p>MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Bhubaneshwari OC, Garjanbahal OC, Hingula OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC</p> <p>NLCIL- Talabira II & III OC</p>	4	<p>BCCL – AKWMC OC</p> <p>NCL – Dudhichua OC</p> <p>SCCL - Gautamikhani OC, Jawaharkhani 5 OC</p>
Good	Below 60%	Nil	-	36	<p>ECL – Rajmahal OC, Sonepur Bazari OC</p> <p>BCCL – NT ST Exp. OC</p> <p>CCL – Amrapali OC, Ashoka, Karo Exp. OC, Konar Exp. OC*, Magadh OC</p> <p>WCL – Penganga OC</p> <p>SECL – Dipka OC, Gevra OC, Kusmunda OC, Manikpur OC</p> <p>NCL – Amlohri OC, Bina OC, Block-B OC, Jayant OC, Khadia OC, Krishnashila OC, Nigahi OC</p>

		Status as per SDC report 2020-21		Status as per SDC report 2021-22	
					<p>MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Bhubaneswari OC, Garjanbahal OC*, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC</p> <p>SCCL – Ramagundam OC – I Exp.</p> <p>NLCIL – Talabira II & III OC*</p>
Overall rating					
Category	Score	No. of Mines	Name of Mines	No. of Mines	Name of Mines
Excellent	80% and above	10	<p>ECL – Sonapur Bazari OC</p> <p>BCCL – AKWMC OC</p> <p>CCL – Ashoka OC</p> <p>WCL - Penganga OC</p> <p>SECL - Manikpur OC</p> <p>MCL - Garjanbahal OC, Samaleswari OC,</p> <p>SCCL - JK-5 OC, GK OC</p> <p>NLCIL – Talabira II & III OC</p>	6	<p>CCL – Konar Expansion OC*</p> <p>NCL – Dudhichua OC</p> <p>MCL – Garjanbahal OC*</p> <p>SCCL - Gautamikhani OC, Jawaharkhani 5 OC</p> <p>NLCIL – Talabira II & III OC*</p>
Very Good	60 - 79%	25	<p>ECL – Rajmahal OC</p> <p>BCCL – NT ST Exp. OC</p> <p>CCL – Amrapali OC, Karo OC, Konar OC, Piparwar OC</p>	32	<p>ECL – Rajmahal OC, Sonapur Bazari OC</p> <p>BCCL – AKWMC OC, NT ST Exp. OC</p> <p>CCL – Amrapali OC, Ashoka, Karo Exp. OC, Magadh OC</p>

		Status as per SDC report 2020-21		Status as per SDC report 2021-22	
			<p>NCL – Amlohri OC, Bina OC, Block – B OC, Jayant OC, Khadia OC, Krishnashila OC, Nigahi OC</p> <p>SECL – Dipka OC, Gevra OC, Kusmunda OC</p> <p>MCL – Ananta OC, Belpahar OC, Bharatpur OC, Bhubaneshwari OC, Jagannath OC, Kaniha OC, Kulda OC, Lakhanpur OC, Lingaraj OC</p>		<p>WCL – Penganga OC</p> <p>SECL – Dipka OC, Gevra OC, Kusmunda OC, Manikpur OC</p> <p>NCL – Amlohri OC, Bina OC, Block-B OC, Jayant OC, Khadia OC, Krishnashila OC, Nigahi OC</p> <p>MCL – Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC</p> <p>SCCL –Ramagundam OC – I Exp.</p>
Good	Below 60%	05	<p>CCL – Magadh OC</p> <p>NCL – Dudhichua OC</p> <p>MCL – Balram OC, Hingula OC, Lajkura OC</p>	2	MCL – Bhubaneswari OC, Lajkura OC

Chapter X: Conclusion and way forward

10.0 Conclusion and way forward for sustainable development

Coal mining has undoubtedly played a crucial role in ensuring India's energy demands over the years and will continue to do so for yet some time. However, the challenges in terms of sustainable coal mining are considerable and needs to be monitored and addressed.

Land degradation, air pollution and mine water management are crucial thrust areas in terms of sustainable coal mining. Prevalent regulations require mining companies to undertake land reclamation and rehabilitation measures after mining operations cease. However, the effectiveness of these measures may vary, and it requires periodic monitoring desired outcomes.

Over the years, coal companies have shown tremendous foresight to identify and develop sustainability initiatives across coal mines. These initiatives target various resource like land, water and energy and mainly include bio-reclamation, mine tourism, community use of mine sumps, gainful use of overburden, energy efficiency and generation of renewable energy.

10.1 Summary of findings

Based on the details covered in the previous sections, the status of environment in the projects considered with regard to land, air environment, water environment and mine closure aspects have been summarized hereunder.

Land Use

- The percentage active mining area across the selected projects on an average was 28.95% (ranging from 5.20% to 62.07%).
- On an average 19.18% of the mine lease areas are under various stages of technical and biological reclamation
- Maximum technical reclamation (> 40%) was reported from Ashoka OC (CCL), Karo Exp. OC (CCL), Konar Expansion OC (CCL) & Ramagundam (RG) OC – I Exp. (SCCL)
- Maximum biological reclamation (> 40%) was reported from Dipka OC (SECL), Kusmunda OC (SECL), Bina OC (NCL), Jayant OC (NCL), Jagannath OC (MCL), Gautami Khani (GK) OC (SCCL) and Jawahar Khani (JK) 5 OC, SCCL
- Green cover in other areas within the project averaged at 4.91%, with maximum (> 20%) green cover reported from AKWMC OC (BCCL), Amlohri OC (NCL) and Dudhichua OC (NCL)

Air Regime

- The following 24 projects reported 100% compliance with applicable standards Coal Mines Standards (G.S.R. 742(E) dated 25th Sep, 2000) for core zone and National Ambient Air Quality Standards (NAAQS) for buffer zone stations based on provided data.
 - CCL (only core stations) - Amrapali OC, Ashoka OC, Karo Exp OC, Konar Exp OC, Magadh OC
 - WCL - Penganga OC
 - NCL - Block-B OC
 - MCL - Ananta OC, Balram OC, Belpahar OC, Bharatpur OC, Garjanbahal OC, Hingula OC, Jagannath OC, Kaniha OC, Kulda OC, Lajkura OC, Lakhanpur OC, Lingaraj OC, Samaleswari OC
 - SCCL - Gautami Khani OC, Jawahar Khani 5 OC, Ramagundam OC – I Exp.
 - NLCIL - Talabira II & III OC
- W.r.t PM₁₀ values in the core zone, majority of the projects (34) reported compliance with the applicable coal mine standards; whereas compliance in the remaining 5 projects ranged between 83.3% to 95%.
- Concentrations of SO₂ & NO_x were reported to be with the permissible limits in all selected projects in core zone stations.
- W.r.t PM₁₀ values in the buffer zone, percentage compliance with buffer zone standards ranged from 56.8% to 100% (excluding Bina OC of NCL). NCL may review pollution load on air environment in order to evaluate impacts and upgrade mitigation measures and preventive strategies.
- Percentage compliance w.r.t PM_{2.5} concentrations in the buffer zone range from 72.2% to 100%. Concentrations of SO₂ & NO_x were reported to be with the permissible limits in all selected projects, except for Bhubaneswari OC of MCL, where the values were reported to be slightly above the prescribed limit.

Water Regime

- W.r.t pH, the reported concentrations were within the prescribed limits in 31 projects (not considering Magadh OC and Talabira II & III OC).
- Instances of low pH (below 5.5) in treated water streams were reported in isolated instances from Khadia OC, Nigahi OC of NCL and Ananta OC, Bharatpur OC, Lajkura OC, Lingaraj OC and Samaleswari OC of MCL. In case of mines of MCL, Zero Liquid Discharge is practiced in most mines and no mine water is being discharged outside projects. High pH value (above 9.0) was reported only from a single sample from outlet of STP in Bina OC of NCL.
- W.r.t TSS, the reported concentrations were within the prescribed limits in 34 projects (not considering Magadh OC and Talabira II & III OC).
- TSS values beyond limits were reported from following projects - Kusmunda OC & Manikpur OC of SECL, Khadia OC of NCL and Bharatpur OC of MCL. In these projects, the results were reported beyond limits in percentage ranging from 2.3% to 6.3%. Hence almost 93% of the reported values were within limits.

Mine Closure

- The selected 40 projects have reported deposit into Escrow Fund to the tune of INR 314431 lakhs as on 31.03.2022.
- Companies are undertaking activities related to progressive mine closure and overall, INR 74941 lakhs has been released across these 40 projects as on 31.03.2022 – which accounts for almost 24% of the deposited amount.
- Highest disbursements from the escrow amount released so far for implementation of progressive mine closure as on 31.03.2022 were reported from Dudhichua OC (NCL), Jayant OC (NCL) and Samaleswari OC (MCL).

Categorization of mines

- Based on overall categorization made considering the above mentioned aspects, the following mines five have been found to fall under “Excellent” category:
 - Konar Expansion OC (CCL) (*new project*)
 - Dudhichua OC (NCL)
 - Garjanbahal OC (MCL) (*new project*)
 - Jawahar Khani 5 OC (SCCL)
 - Talabira II & III OC (NLCIL) (*new project*)

10.2 Sustainability Initiatives across companies

Sustainable Development Cell (SDC) & Just Transition (JT) constituted at the Ministry of Coal and at company level have been instrumental in the success of initiatives/practices towards sustainable mining in the coal sector.

Some of the good practices of coal sector for sustainable mining are enumerated below –

- ✚ Blast free overburden removal have been initiated at Kaniha OC and Hingula OC projects in MCL – these initiatives are implemented for the 1st time in CIL
- ✚ Surface miners are contributing to almost 96% of the coal production in CIL
- ✚ 248 fog cannons have been installed at various projects in CIL – of which 73 are truck mounted and 175 are trolley mounted
- ✚ Four OB-to-sand plants have been commissioned by CIL subsidiaries, namely Bhanegaon & Gondegaon (WCL), Kajora Area (ECL) and Amlohri (NCL) – these account for a daily sand production capacity of 4250 cu.m. Additionally, five more OB-to-sand plants are in various stages of development at Ballarpur & Durgapur (WCL), Manikpur (SECL), Kathara (CCL) and Barora Area (BCCL) with a planned sand production capacity of 5500 cu.m/day
- ✚ Development of 20 MW floating solar power project over an area of 42 ha has also been proposed in Piparwar OC, CCL
- ✚ Water spraying system over conveyor belt system has been implemented by NLCIL
- ✚ Development of orchards with fruit bearing trees like mango, guava, jackfruit, etc. in backfilled mine areas has been done by NLCIL. Hi-tech methods for

vegetable production and indoor farming using poly green structures is also being practised at NLCIL mines.

- ✚ Three OB-to-sand projects are also being planned by NLCIL by 2023-24
- ✚ 224 MW solar power generation capacity has been reported by SCCL
- ✚ SCCL has also developed eco-parks with novel features like trekking arrangements and bird watching arrangements in OB dumps in Gautami Khani OC mines.

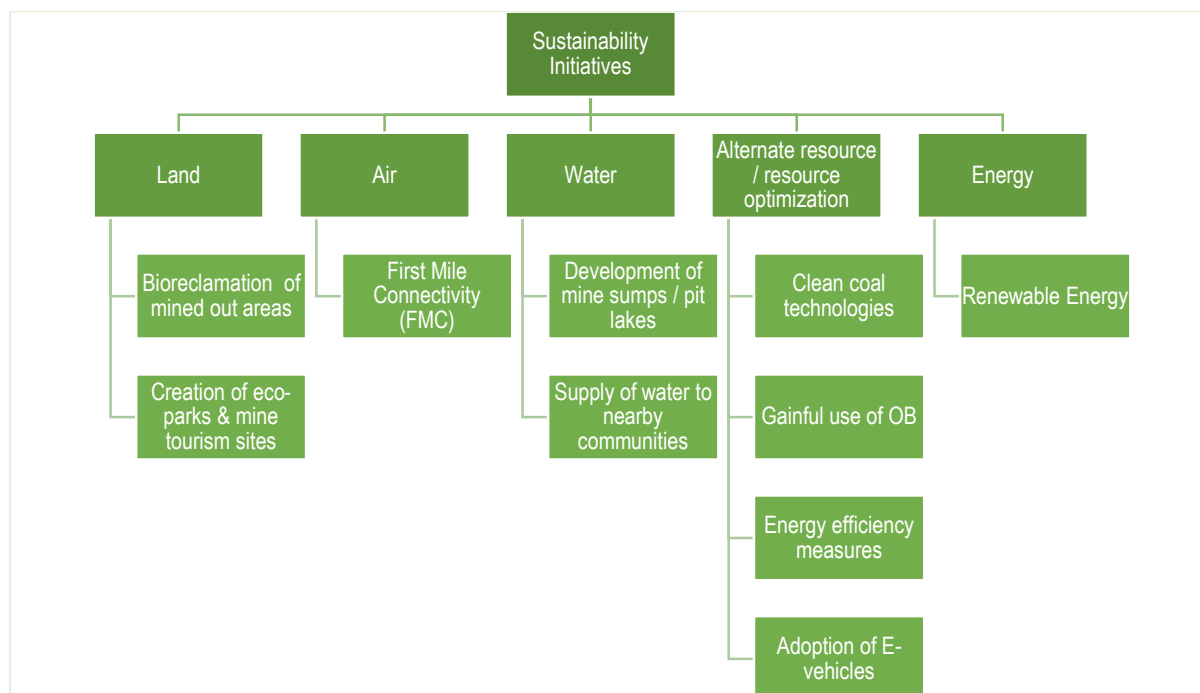


Figure 10.1: Sustainability initiatives across coal companies

10.3 Way forward

To conclude, sustained efforts, periodic monitoring as well as stakeholder engagement are crucial to enable success of sustainable mining.

Specific thrust areas in this regard are summarized below:

- FMC projects: Coal evacuation by conveyor belts & silo and transportation through railways to minimize particulate matter and exhaust gases, reducing the carbon footprint.
- Adoption of clean coal technologies such as coal gasification, coal-to liquid, coal mine methane, coal bed methane and coal washeries.
- Adoption of innovative technologies of extracting resources from overburden, for instance - sand.
- Promote renewable energy uses for domestic and industrial purposes.
- Adoption of innovative farming & afforestation practices for land reclamation like Miyawaki forests
- Utilization of mine water more efficiently for community use and contributing to water conservation measures on a community level

- Enhancing green cover at all locations to counter negative impact on the environment through native tree plantation programs
- Development of eco-parks & promotion of mine tourism
- Procurement of machines that are more efficient and productive, especially having lower carbon footprint.
- Mapping of areas according to dust pollution levels and source apportionment studies must be carried out to demonstrate the actual contribution from coal mining.
- Just Transition and monitoring of mine closure activities.
- Fixing of goals for reduction of emission intensity from coal mining operation to help country achieve its target of 45% emission intensity reduction by 2030 from 2005 level.
