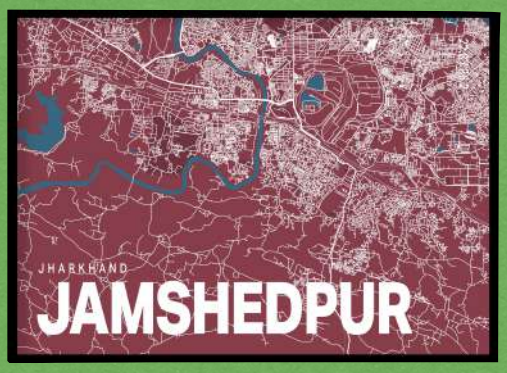
COMPREHENSIVE CLEAN AIR ACTION PLAN

JAMSHEDPUR

MILLION PLUS CITY



PREPARED BY

JHARKHAND STATE POLLUTION CONTROL BOARD (JSPCB)

SEPTEMBER 2021

CONTENT	

CONTENT	

TABLES	

FIGURES

ABBREVIATION	
Jharkhand Bijli Vitran Nigam Limited	JBVNL
Central Pollution Control Board	CPCB
Comprehensive Clean Air Action Plan	CCAAP
Compressed Natural Gas	CNG
Construction and Demolition Waste	C & D
Corporation	Corp
Department of Forest, Environment and Climate Change	DoFECC
Electric Vehicles	EV
End of life	EOL
Environment Protection Control Agency	EPCA
Graded Response Action Plan	GRAP
HC+Nox	Hydrocarbon+ Nitrogen oxides
Indian Council for Medical Research	CMR
Jharkhand State Pollution Control Board	JSPCB
Limited	LTD
Ministry of Environment, Forest and Climate Change	MoEFCC
Ministry of Health and Family welfare	MoFHW
National Air Monitoring Program	NAMP
National Air Quality Index	NAQI
National Ambient Air Quality Standards	NAAQS
National Clean Air Program	NCAP
Nitrozen dioxide	NO2
Operation and Continuous Emission Monitoring System	OCEMS
Particulate Matter	PM10
Particulate Matter	PM
Public Health Foundation of India	PHFI
Sulphur dioxide	SO2
Suspended Particulate Matter	SPM
Pardhan Mantri Ujjwala Yojna	PMUY
Indian Meteorological Department	IMD
District of Science & Technology	DST

EXECUTIVE SUMMARY

Taking cognisance of the deteriorating situation of air quality in Jamshedpur Urban Agglomeration, the Jharkhand State Pollution Control Board (JSPCB) has taken a formidable step in preparing a Comprehensive Clean Air Action Plan (CCAAP) with a Micro level Plan of Action under the mandates of National Clean Air Program (NCAP) and guidelines of Central Pollution Control Board (CPCB). The plan mentioned here envisages a set of actions for cleaning the air and ensuring overall development of the society and the state.

The Particulate Matter (PM) is a matter of concern considering Jamshedpur's deteriorating air quality during 2017-2020 with high levels of PM10, though the concentration of SO_2 and NO_2 is within the prescribed standards. It has been observed that since 2017 the concentration of PM10 in the city is decreasing, though in 2020-2021 the concentration was more than 2 times of the national standard.

The Emission Inventory indicates that the industrial sector is the highest contributor of PM2.5 with 26% followed by transport (23%) and road dust (15%). The contribution from brick kilns and DG sets were limited within the city. Incidences of waste burning and DG sets have a contribution of 3% each, while the brick kilns sector has 2% contribution to the overall pollution load and domestic cooking has 6% contribution in the city. A major proportion (22%) of the estimated annual PM2.5 pollution in the city is coming from outside, which suggests that a proper airshed management plan is required for the city. The emission inventory places the need for adoption of multi pronged strategies involving all relevant departments and agencies and other important stakeholders for executing an effective plan of actions.

Keeping these insights into consideration, the proposed Clean Air Action Plan has been prepared under the guideline of CPCB that identifies various sources that contribute to pollution and puts effective mitigation measures. It has taken into account the several ongoing initiatives of the Jharkhand Government and Central Government. The plan focuses on a result oriented plan of actions in a specific time bound manner with indicating line departments and agencies to bring a greater transparency and accountability mechanism during the implementation phase. A carrying capacity assessment and future emission prediction is currently under the process, and once ready it will further strengthen the action plan through an informed action oriented process.

The report is broadly divided into two parts:

Chapter I: It presents air quality trends, public health evidence and an analysis of the challenges of each source of pollution. Also, a brief overview of emission inventory of air pollution such as industries, solid fuels in domestic cooking, vehicles, construction activities, waste burning, road dust and mining activities is given. Also, information about current policies and programs concerned with each sector is discussed. It also presents the recommendation of the 15th Finance Commission and its objective.

Chapter II: It lays out the proposed CCAAP and Graded Response Action Plan for Jamshedpur Urban Agglomeration in a tabular form. In addition to this, Micro level Action Plan is presented as an integral part of the plan. The plan broadly identifies specific measures in each sector, enlisting the agencies responsible for the implementation of each of the measures with a fixed timeline. The CCAAP also provides short term, medium term, medium to long-term and long-term measures; where short-term measures need to be implemented immediately.

The Comprehensive Clean Air Action Plan (CCAAP) is an exhaustive and comprehensive plan and its implementation requires multi-scale and cross-sectoral coordination. The CCAAP looks for ways to integrate efforts across different departments listed before to take targeted actions recommended in the action plans. In addition to the regulating and coordinated role played by JSPCB, the proposed plan notes an interdepartmental and convergent effort at the state, regional, district and local level with a clear vision of improving air quality and bringing it at par with the mandates of NCAP. This plan meticulously presents the pragmatic and scientifically proven solutions and best practices around the world and India to be implemented in a far sighted manner to achieve the overall aims and objectives of the NCAP to enable Jamshedpur to take lead in adopting sustainable measures and ensure clean and breathable air.

CHAPTER I : INTRODUCTION

Jharkhand has seen a robust growth trajectory in the past two decades for achieving the larger development goals, however rapid pace of industrialisation and urbanisation has led to a manifold increase in the levels of ambient air pollution. As the problem of air pollution has become a health crisis all over the world, continuous high level of pollution is causing both acute and chronic health effects to the people of all ages and socio-economic backgrounds in the state as well. A report by Lancet journal[1] has predicted that nearly 100.2 deaths per 100,000 in Jharkhand occurred due to the air pollution. Higher pollutant levels in the air also deteriorates the ecological and aesthetic balance of the region.

Amidst all the worrying facts of air pollution, the National Clean Air Program (NCAP) has been a formidable attempt to create a national framework for air quality management with a time-bound target to bring down the levels of PM2.5 and PM10 by 20-30% by the year 2024. With the recent focus on pollution in tier II cities, the Ministry of Environment, Forest and Climate Change (MoEF&CC) and Central Pollution Control Board (CPCB) have identified the non-attainment cities. Under the NCAP, city-specific action plans have to be developed for cities falling under this list. Recently, the importance of NCAP has increased immensely for cities / regions that are not the part of the list but have severe level of air pollution.

Though from Jharkhand, only Dhanbad was initially mentioned in the list of non-attainment cities but now Ranchi and Jamshedpur have been added in the updated list as a part of Million Plus cities[2]. Therefore, a Comprehensive Clean Air Action Plan has been prepared for Jamshedpur city with the key objective to evolve a long term action plan having proper action points with specific timelines based upon scientific research and inputs and its effective implementation mechanism in order to bring down the pollution levels.

[1] http://ghdx.healthdata.org/gbd-2017

[2] https://cpcb.nic.in/uploads/Non-Attainment_Cities.pdf

1.1 GOAL

The overall goal of the Clean Air Action Plan is to meet the prescribed annual average ambient air quality standards at all locations in Jamshedpur city within a stipulated time frame.

1.2 TARGET

The global experiences clearly highlight the fact that internationally, the actions had been city specific rather than country oriented and, accordingly, the statistics indicates 35%– 40% $PM_{2.5}$ reduction in five years for cities, such as Beijing and Seoul, whereas cities, such as Santiago and Mexico City have shown 73% and 61% reduction in 22 to 25 years with regard to $PM_{2.5}$ and PM_{10} concentrations, respectively. Recently, a new Lancet study by Peking University School of Public Health on the impact of China's 'Air PollutionPrevention and Control Action Plan (2013–2017) has found that an annual average concentration of $PM_{2.5}$ decreased by 33.3% and PM_{10} levels reduced by 27.8% in the 74 key cities in China where the plan was implemented in the last five years. Sulphur dioxide reduced by 54.1% and CO by 28.2% in five years, but no significant improvements were seen in NO_2 or O_3 concentrations.

TERI and ARAI report (August, 2018) have analysed various interventions and estimated their possible impacts over $PM_{2.5}$ and PM_{10} concentrations in Delhi and NCR. An alternative scenario has been developed considering the interventions which can provide maximum air quality benefits. Taking into account the available international experiences and national studies, the tentative national level target of 20%–30% reduction of $PM_{2.5}$ and PM_{10} concentration by 2024 is proposed under the NCAP. This is keeping 2017 as the base year for the comparison of concentration.

The targets for Jamshedpur city are kept similar to the targets envisaged under NCAP as described above with a modified timeline by 2025 as interventions will be starting in 2021. The yearly targets will be decided so that the emphasis in the first two years will be largely upon taking up the actions for the institutional strengthening and development of infrastructure in consultation with CPCB & MoEF&CC.

1.3 TIME FRAME

Considering 2020-21 as a base year, this action plan is prepared for a term of next five years (mid-term action plan) to begin which is further extendable up to 20-25 years in long-term after mid-term review of the outcomes.

1.4 OBJECTIVES

1. To ensure effective implementation of mitigation measures for prevention, control and abatement of air pollution
2. To carry out scientific apportionment studies of air pollution sources, identification of gaps, tracking hot spots and prioritisation of actions for increasing the effectiveness of mitigations
3. To augment and evolve an effective and proficient ambient air quality monitoring network across the city for ensuring a comprehensive and reliable database.
4. To augment public awareness and capacity-building measures encompassing data dissemination and outreach programmes for ensuring trained manpower and robust infrastructure on air pollution.
5. To evaluate the impact of mitigation measures periodically in order to ensure the effectiveness and realignment of the mitigation strategies

1.5 LOCATION, TOPOGRAPHY & ECONOMIC PROFILE OF JAMSHEDPUR

Jamshedpur is one of the largest urban centers in the state of Jharkhand. Nestled in the heart of the hilly and richly forested East Singhbhum district of the Chhotanagpur Plateau and bounded by the Subarnarekha and Kharkai rivers, it has an average elevation of about 400 feet above sea level. The temperature rises to 43˚C in summers and drops to 6.6˚C in winters. The areas surrounding Jamshedpur are rich in minerals, including iron ore, coal, manganese, uranium and lime stone.

Jamshedpur, named after the founder of the Tata industrial group JamshedJi Tata, is the first planned city of Modern India. It is a prominent industrial city of Jharkhand

where leading companies like TISCO, TELCO, Tinplate production, Adani Thermal Power Plant are situated along with various other small and medium scale industries.

Figure 1: A Representative Map of Jamshedpur Urban Agglomeration (JUA)

Three areas Jamshedpur Notified Area Committee (JNAC), Mango and Jugsalai are together called Jamshedpur Urban Agglomeration (JUA). Mango is a suburb of Jamshedpur, which is a growing residential area situated across the Subarnarekha River. Jugsalai is another suburb of Jamshedpur and it is a business center adjacent to Tatanagar Railway Station.

2. TRENDS OF AIR QUALITY

Jamshedpur is commercial capital of Jharkhand state which has seen exponential growth in expansion of industries, construction and demolition activities, increase in the number of vehicles, and roadside encroachments, which all have collectively resulted in poor regional air quality problems characterised by PM_{10} and $PM_{2.5}$.

2.1 AIR QUALITY MONITORING

Every policy or program needs to be supported by robust air quality monitoring. The air quality monitors generate data on a routine basis, which helps to assess risks and implement control measures. Jamshedpur is covered under National Air Monitoring Program (NAMP) through two operational manual ambient air quality stations.[3] The Jharkhand State Pollution Control Board (JSPCB) monitors criteria pollutants on a regular basis through the manual monitors installed at Bistupur Vehicle Testing Centre and Golmuri Vehicle Testing Centre in the city (see Figure 2 and Table 1).

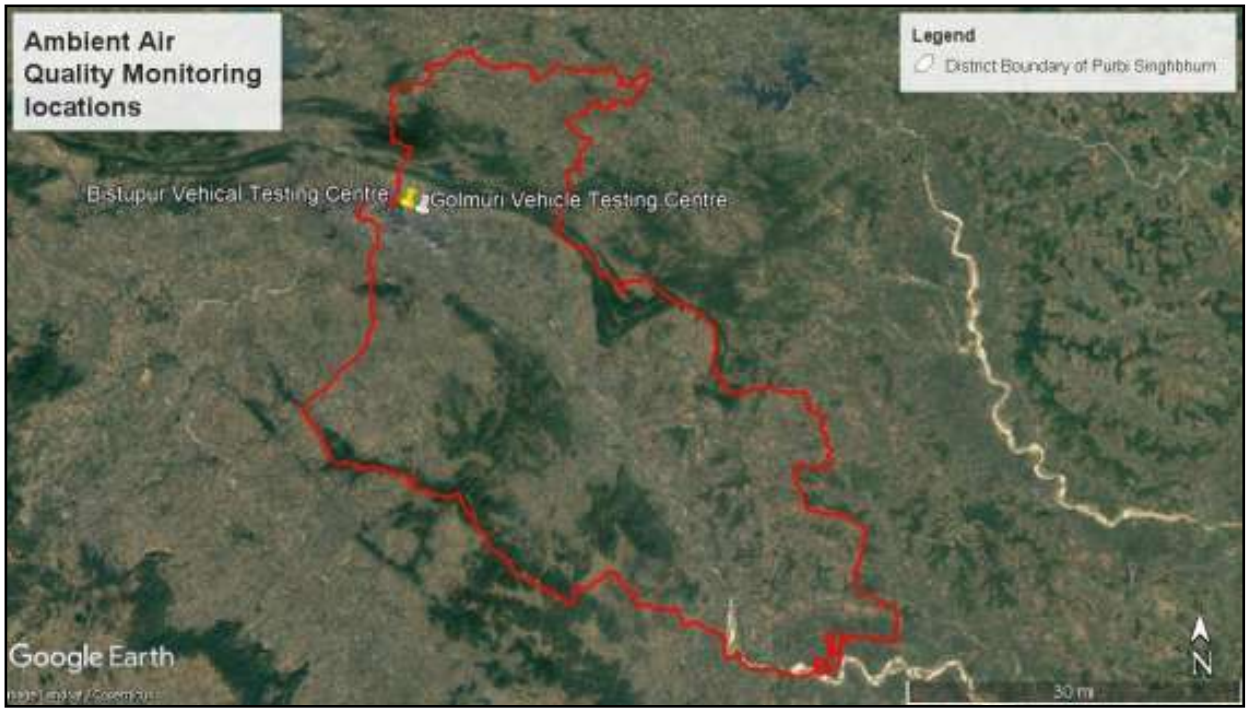


Figure 2 : Location of Ambient Air Quality Monitoring Stations Installed

[3] https://cpcb.nic.in/uploads/Stations_NAMP.pd

Only three criteria pollutants such as PM_{10}, Sulphur dioxide (SO_2) and Nitrogen dioxide (NO_2) are monitored under NAMP in Jamshedpur and do not cover all the pollutants listed in the National Ambient Air Quality Standards (NAAQS).

Table 1: Locations of the ambient air quality monitoring stations		
Type	**Station Name**	**Parameters Monitored**
Manual Monitors (2)	(1) Bistupur (2) Golmuri	SO_2, NO_2 & PM_{10}

The status of the current monitoring network shows the urgent need for expansion of air monitoring capacity with emphasis on real-time air quality monitoring. The manual monitors have certain limitations, and its data accuracy might be dubious. Also, manual air monitor data will not be useful to deal with the episodic incidence of smog. In emergency situations, pollution mitigation schemes such as GRAP and issuance of public health advisory are needed, which relies predominantly on the real-time monitors.

The required number of minimum stations needed for monitoring trends of the pollutants based on population is recommended in the guidelines for ambient air quality monitoring developed and published by CPCB. Based on the thumb rule proposed by CPCB and district level urban and rural population (2011 census), in the long term the minimum number of air quality monitoring stations required in Jamshedpur is mentioned in Table 2.

Table 2 : Required Air Quality Monitoring Stations (as per CPCB guideline)						
Population (Census 2011)	**NGT Direction (O.A. No 681/2018. Dated 06.08.20)**		**Existing Status**		**Gap**	
	Minimum No. of manual station under NAMP	**Minimum no of proposed CAAQMS**	**NAMP**	**CAAQMS**	**NAMP**	**CAAQMS**
1,337,131	3	5	02	00	01	05

Moreover, the low-cost sensor-based air quality monitors and use of satellite air quality data should also be considered. This can help in assessing a much larger area that has not yet been covered by regulatory monitors to generate baseline data for local action.

2.2 AIR POLLUTANTS TRENDS (2017-2020)

The annual concentration of pollutants (PM10, SO2 & NO2) during the period of 2016-2020 was analysed to understand the trends and reduction targets for achieving national ambient air quality standards in Jamshedpur. Air quality data are referenced from archives available at CPCB and JSPCB. The trend of pollutants over the years enables us to determine a case for a clean air action plan and to set the target. The available long-term data of PM10, NO2 and SO2 from two manual monitoring stations for Jamshedpur is presented below in graph (Figure 4 and Table 3 & 4). It can be seen that Particulate Matter (PM10) is a major concern for Jamshedpur's deteriorating air quality in the years between 2017-2020. The city consistently has high levels of PM10, although the concentration of SO2 and NO2 is within the prescribed standards.

Table 3 : Categories of Air Quality Index along with the expected impact

Good (0-50)	Minimal Impact
Satisfactory (51-100)	Minor Breathing discomfort to sensitive people
Moderately Polluted (101-200)	Breathing discomfort to the people with lung, heart disease, children and older adults
Poor (201-300)	Breathing discomfort to people on prolonged exposure
Very Poor (301-400)	Respiratory illness to the people on prolonged exposure
Severe (401-500)	Respiratory effects even on healthy people

Table 4 : Average Air Pollution Trend in Jamshedpur City

	PM10	SO2	NO2	PM10	SO2	NO2	PM10	SO2	NO2
Financial Year	Bistupur (μg /m3)			Golmuri (μg /m3)			Annual Average of Jamshedpur (μg /m3)		
2020	99.9	29.0	36.2	101.1	28.8	35.9	100.5	28.9	36.1
2019	137.8	38.4	47.4	137.7	38.0	47.1	137.7	38.2	47.3
2018	128.6	37.7	46.3	129.2	37.6	46.3	128.9	37.6	46.3
2017	139.3	38.0	46.3	137.5	37.2	46.8	138.4	37.6	46.5

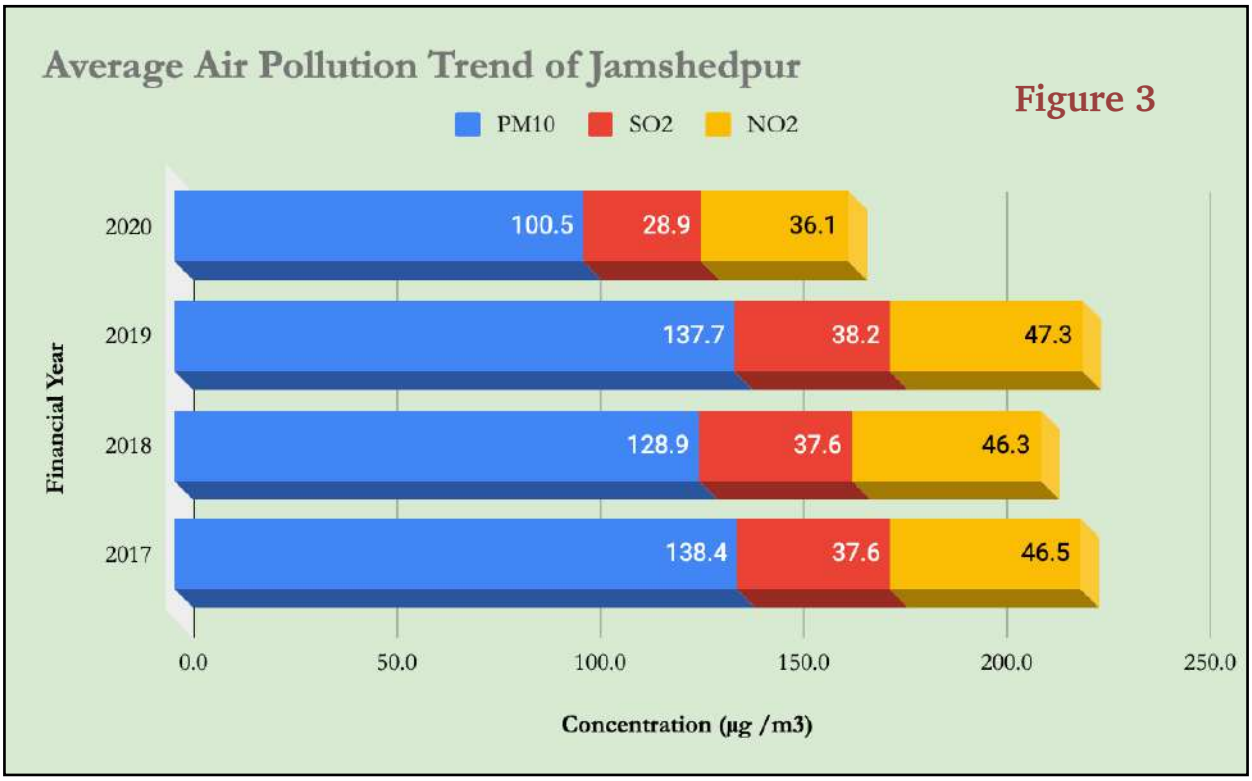

Average Air Pollution Trend of Jamshedpur
PM10
SO2
NO2
Financial Year
2020
2019
2018
2017
100.5
28.9
36.1
137.7
38.2
47.3
128.9
37.6
46.3
138.4
37.6
46.5
0.0
50.0
100.0
150.0
200.0
250.0
Concentration (µg /m3)

Figure 3

(A) TRENDS OF PM 10 CONCENTRATION (2017-2020)

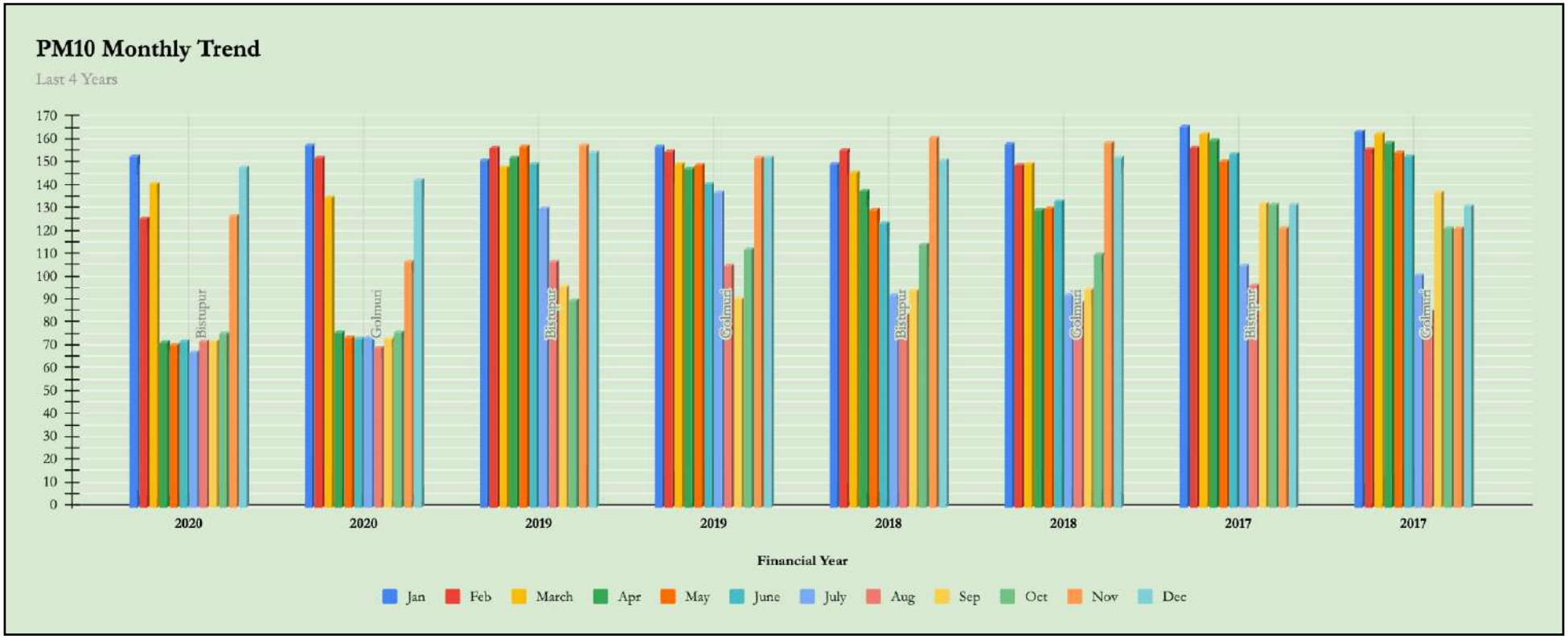
The annual and monthly average PM10 concentration during the last five yars (2017-2020)[4] has been analysed to understand the long-term trends in Jamshedpur (see Table 5 and Figure 4). It has been observed that since 2016 the concentration of PM10 in the city has been decreasing. In the year 2020-2021 the PM10 concentration was noted as 104.4 $\mu g/m^3$ and is more than 2 times of the national standard, which is 60 $\mu g/m^3$ [4].

Table 5 : Monthly & Annual Concentration Trend of PM 10 (2017-2020)

Year	Location	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2020	Bistupur	153.4	125.8	141.1	72.0	70.9	72.1	67.5	72.4	72.6	75.6	127.2	148.4
	Golmuri	157.9	152.4	135.2	76.2	74.1	73.7	74.2	69.5	73.5	76.2	107.2	143.0
	Annual Average	100.50											
2019	Bistupur	151.7	157.0	148.3	152.4	157.6	150.1	130.3	106.9	96.1	90.1	158.2	154.7
	Golmuri	157.5	155.1	149.9	147.9	149.2	141.3	137.4	105.4	91.1	112.4	152.6	152.7
	Annual Average	137.74											
2018	Bistupur	150.1	155.8	146.3	138.2	129.7	123.8	92.6	83.8	94.6	114.8	161.3	151.8
	Golmuri	158.7	149.6	149.7	129.6	130.4	133.7	92.4	89.4	95.4	110.2	159.4	152.4
	Annual Average	128.90											
2017	Bistupur	166.0	156.8	162.9	160.4	151.2	154.2	105.3	96.8	132.5	131.8	121.6	132.1
	Golmuri	164.2	156.4	162.9	158.9	154.8	153.2	100.9	85.5	137.3	121.8	121.9	131.7
	Annual Average	138.38											

[4] The annual concentration of PM10 for year 2018-2021 is average concentration of two manual monitors installed in Jamshedpur

Figure 4 : Trend of monthly average concentration of PM10 (2017-2020)



(B) TRENDS OF SO2 CONCENTRATION

The annual and monthly average concentration of SO2 for the year 2017-2020 in Jamshedpur has been analysed. It can be seen from the graph (Table 6 and Fig. 5) that the concentration of SO2 in Jamshedpur has remained below the national standard (50 mcg/ m3) over the entire period. And this should be kept under standards as SO2 also acts as a precursor to particulate formation in the atmosphere and may contribute to the increasing concentration of particulate matter in Jamshedpur.

Table 6 : Monthly & Annual Concentration Trend of SO2 (2017-2020)

FY	Location	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2020	Bistupur	41.45	40.23	39.24	17.62	19.84	22.32	21.72	21.70	23.39	25.79	34.71	40.36
	Golmuri	41.92	39.76	39.37	17.49	20.00	22.00	23.37	21.55	23.78	26.02	31.18	39.18
	Annual Average	28.92											
2019	Bistupur	40.03	39.38	39.11	39.97	41.63	40.40	38.87	33.55	34.16	33.09	40.34	40.23
	Golmuri	39.49	39.42	39.07	39.82	39.52	38.91	39.66	32.54	32.32	36.56	39.53	39.48
	Annual Average	38.21											
2018	Bistupur	40.05	39.08	40.45	40.04	38.68	37.78	33.66	31.37	33.71	36.86	40.91	39.23
	Golmuri	39.52	40.19	40.98	38.56	38.53	40.25	34.47	31.43	33.48	35.55	38.98	39.25
	Annual Average	37.63											
2017	Bistupur	41.34	40.51	40.79	40.89	38.40	39.01	31.44	30.23	37.93	38.66	35.70	41.00
	Golmuri	39.54	38.04	40.15	39.57	38.12	38.53	31.22	30.53	39.09	35.82	38.01	38.14
	Annual Average	37.61											

Figure 5 : Trend of monthly average concentration of SO2 (2017-2020)

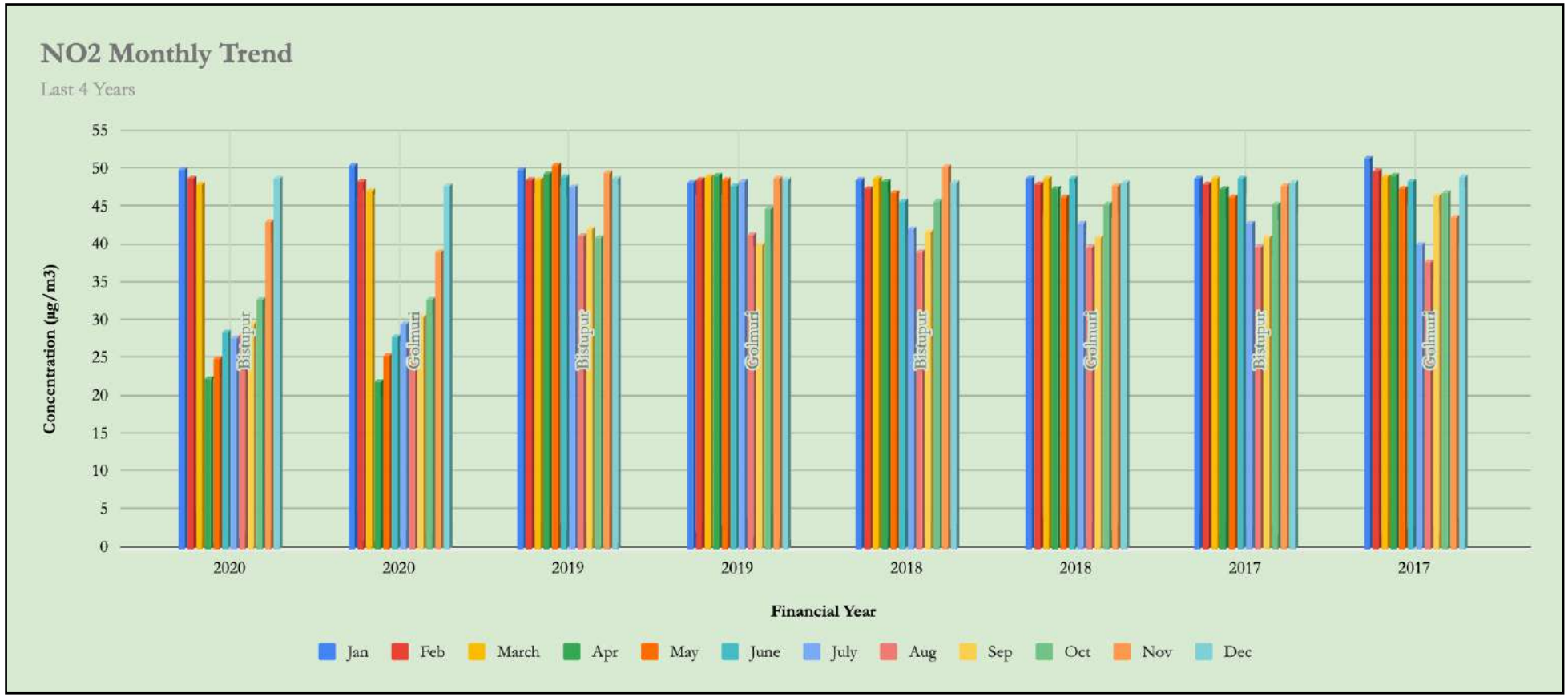
(C) TRENDS OF NO2 CONCENTRATION

The annual and monthly average concentration of NO2 in Jamshedpur is presented in the graph below (Figure 6 & Table 7). The annual concentration of NO2 hovers slightly higher than the National Standard (40 mcg/m3) during 2017-2020.

Table 7 : Monthly & Annual Concentration Trend of NO2 (2017-2020)

Year	Location	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2020	Bistupur	50.07	48.89	48.18	22.41	25.26	28.62	27.9	28.45	29.81	33.05	43.18	49.04
	Golmuri	50.7	48.68	47.34	22.03	25.53	28.11	29.75	27.72	30.67	33	39.21	47.97
	Annual Average	36.07											
2019	Bistupur	50.10	48.76	48.88	49.50	50.77	49.17	47.88	41.45	42.36	41.23	49.78	48.92
	Golmuri	48.46	48.78	49.16	49.31	48.85	48.03	48.56	41.51	40.15	44.94	49.02	48.81
	Annual Average	47.27											
2018	Bistupur	48.80	47.73	49.07	48.66	47.13	45.93	42.29	39.21	41.84	46.01	50.56	48.33
	Golmuri	48.98	48.21	48.94	47.60	46.48	49.04	43.14	39.92	41.23	45.49	47.96	48.40
	Annual Average	46.29											
2017	Bistupur	48.98	48.21	48.94	47.60	46.48	49.04	43.14	39.92	41.23	45.49	47.96	48.40
	Golmuri	51.60	49.88	49.21	49.29	47.60	48.68	40.17	37.95	46.76	47.09	43.86	49.13
	Annual Average	46.53											

Figure 6 : Trend of monthly average concentration of NO2 (2016-2021)



(D) ANNUAL TREND OF POLLUTANTS (PM 10)

In Jamshedpur, classifying days according to the National Air Quality Index (NAQI) is difficult as ambient air quality monitoring is mainly based on manual monitors. However the analysis of the maximum and minimum concentrations (average) of pollutants (PM10) from a manual monitor indicates a situation where episodes of smog would have occurred. Most of the time, PM10 concentrations have exceeded the national 24-hour limit. The analysis of the minimum concentration (average value) also shows that the value of PM10 is 1-2 times higher than the national standard.

	YEAR	MIN	MAX
JAMSHEDPUR	2013	57.29	224.96
	2014	67.71	190.09
	2015	67.79	191.39
	2016	69.37	187.03
	2017	87.00	186.58
	2018	68.26	204.09

Table 8 : Maximum and Minimum 24 hr concentration of PM10

3. GAPS IN DATABASE AUGMENTATION

3.1 GAPS IN DATA MANAGEMENT OF MONITORING OF POLLUTION SOURCES

A robust data management of various pollution sources with well-defined periodicity is important for preparation of the action plan and also to monitor the impact of various measures for improvement of air quality in the city. Unfortunately, there is a lack of consistent air quality data in most of the cities and Jamshedpur is no exception to this. A successful monitoring strategy requires equipment, skilled manpower and institutional systems to ensure that data should be accurate, properly analysed and communicated to decision-makers for desired objectives.

It must be noted that an emphatic management of air pollution in developing countries like India is hampered by a lack of expertise, technology, and adequate information. In such a scenario, demonstration/pilot projects including a prototype development for the best available technologies and environmental practices for pollution prevention, minimisation, and mitigation strategies are needed. The experience from around the world demonstrates that abatement of air pollution can be done through multi-pronged strategies involving interventions at institutional, policy, and technical levels.

Air quality monitoring is being done by JSPCB through manual monitoring stations. Presently, the regional offices do not have state of art air quality analysis labs, and also the equipment which is needed for air quality monitoring from point and line sources are not available. The human resource and their capacity for data collection, analysis, and data interpretation are also not available. This plan envisages the establishment of an Air Quality Monitoring Lab along with the trained staff & researchers for periodic monitoring of air pollution in the city for a better data analysis/interpretation.

3.2 SOURCE APPORTIONMENT & CARRYING CAPACITY STUDIES

It is necessary to understand the contribution of different sources of pollution for the planning of source-specific focused interventions for meeting the targets of improvement in the air quality in a time-bound manner. The Comprehensive Source Apportionment Study (CSAS) for Jamshedpur city is not available which is identified as a gap in the database augmentation. The comprehensive source apportionment & carrying capacity studies will be conducted in due course of time through organisations of repute having ample experience in carrying out such studies and the action points will be prioritised and reviewed on the apportionment of various sources in the City.

4. INSTITUTIONAL ARRANGEMENT FOR PLANNING & IMPLEMENTING MEASURES

4.1 CIVIC AWARENESS & EDUCATIONAL INITIATIVES

The most important initial step is public awareness and their active support for controlling the level of air pollution. Civic awareness towards prevention, control, and mitigation of air pollution combined with specific information sharing on health advisories is essential, which provides communities with the knowledge and tools to take action and help improve air quality in their locality. In addition to these, problem areas can easily be identified and monitored using citizen science methods, empowering communities, and reducing the risks of exposure to air pollution. It has been rightly noted that extensive awareness and outreach programs for various stakeholder groups need to be taken up for the non-attainment cities. Since building public awareness will be vital in supporting the implementation of the action plan, this will be achieved through national portals, media engagement, civil society involvement, curricula reform, and recognitions / wards, etc.

City-specific awareness programs targeting key stakeholders have been initiated which includes awareness generation in public for the prevention of adverse effects of air pollution and sensitisation of the media for the right interpretation of international reports and data. Information Education & Communication activities are being undertaken for the dissemination of air pollution-related information for the awareness of the general public through various social media platforms of departments engaged in the city action plan. It is also planned to engage educational institutions (schools, colleges, etc.) through workshops, seminars, competitions, etc. With air quality rightly ingrained in public health frameworks and local authority jurisdiction, the public can become more involved in reducing local air pollution impacts in their communities.

4.2 TRAINING & CAPACITY BUILDING

One of the major issues, which is a hurdle for effective implementation of air pollution management plans have been observed to be a lack of capacity of in-house capability and adequately trained manpower on air quality issues due to limited manpower and infrastructure in the JSPCB and Urban Local Bodies (like Mango, Jugsalai & JNAC) and sheer lack of formal training for various associated stakeholders. The state agencies face a limited number of trained individuals in air quality management, limited publications

designed to provide information on local air quality issues, limited collaboration between government, universities, and other research institutions, lack of a forum for sharing of published local research work on air quality, etc. If this is not set right, all other improvements in infrastructure and processes, etc. would not yield expected results. Therefore, the key areas to focus on are:

- ULBs (Mango, Jugsalai & JNAC) – waste management, plantation schemes, maintenance of roads, dust suppression measures, development of green infrastructure, etc.
- JSPCB – Internal training on the handling of machinery and equipment for sampling and analysis
- Industries – best practices for boiler and furnace operation, retrofitting of DG sets, up-gradation of machinery with cleaner technologies, usage of clean fuel
- Construction projects: control measure for fugitive dust, segregation, handling, and disposal of Construction & Demolition (C&D) waste.

Through this action plan, it is envisaged that extensive capacity-building programs for manpower and infrastructure augmentation in the JSPCB & other line departments/ agencies will be formulated and intensive training, comprising national and international best practices and technological options, of all the associated stakeholders will be organised in the plan period.

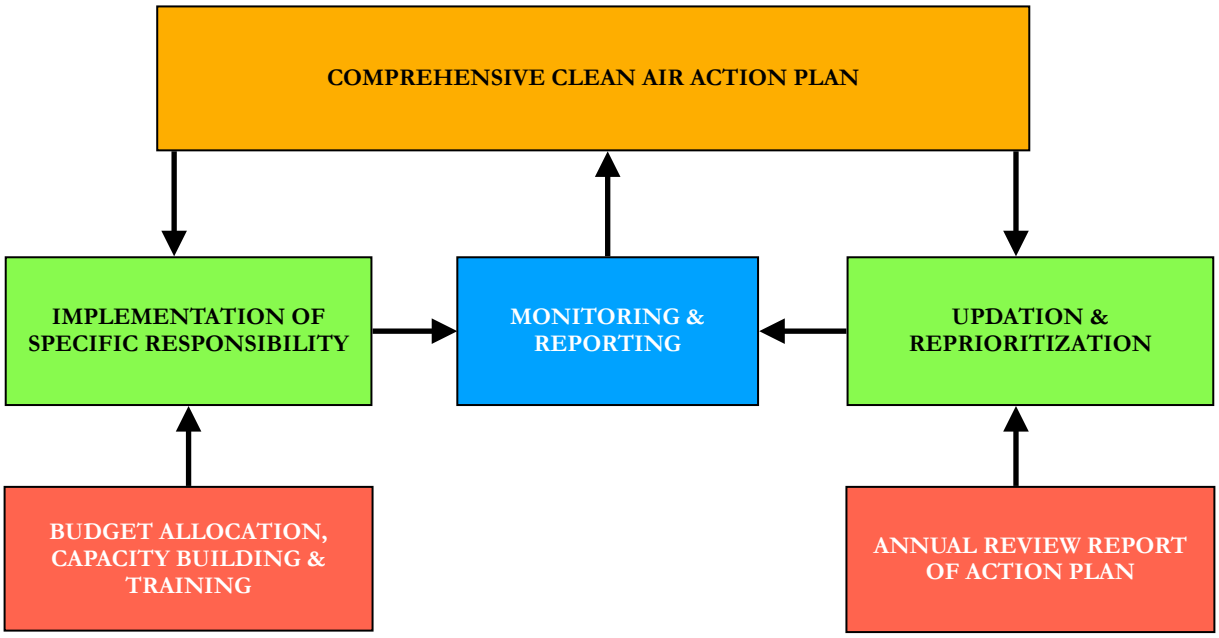
It is also envisaged that online training modules on the subjects of Solid Waste Management, Plastic Waste Management, C&D Waste Management and Operation and maintenance of Air Pollution Control Systems installed in industries and other sources shall be carried out to improve the overall capacity of the human resource for enhancement of clean air actions in the city.

The individuals may also be trained for augmenting their participation/services for monitoring of pollution sources where they may act as skilled personnel. The various aspects on which training shall be provided include sampling and analysis, operation of machinery and equipment related to air quality management and monitoring, etc. All such trained individuals will form a panel through which the trained personnel may be engaged by the concerned department on a pro-rata basis from time to time as per requirement and type of skills.

4.3 MONITORING MECHANISM

According to the National Clean Air Program, the Chief Secretary of the State should head the Steering Committee of the Comprehensive Clean Air Action Plan (CCAAP), with highest-level representation from each department. The State has formulated a comprehensive monitoring mechanism with a well-defined monitoring protocol. The Monitoring mechanism developed by the State is a three-tier mechanism in which regular monitoring is being done at the District and the State level. The monitoring at State is being undertaken at the level of a dedicated Air Quality Monitoring Committee (AQMC) under the Chairmanship of Special Secretary, Environment, Forest & Climate Change. The structure of Monitoring is as detailed below in Figure 7.

Figure 7 : Flowchart of Monitoring of CCAAP



(A) AT STATE LEVEL

The State has developed a monitoring mechanism taking into consideration the requirement of statutes and Action Plans. The detail of AQMC constituted by the State of Jharkhand is as follows in Table 9:

Table 9 : Air Quality Monitoring Committee			
Name of Committee	**Chairperson**	**Members**	**Work area**
Air Quality Monitoring Committee	Special Secretary, Dept of Forest , Environment & Climate Change Dept	Member Secretary-JSPCB; Director-Agriculture Dept; Director-State Urban Development Agency; Commissioner - Transport Dept; Director-Industries Dept;	Effective Air Pollution control in the state and maintaining of ambient air quality

(B) THREE TIER MONITORING STRUCTURE

The detail of Three ties monitoring structure constituted by the State of Jharkhand is as follows in Table 10:

Table 10 : Three Tier Monitoring Structure	
State Level	Chief Secretary (Govt of Jharkhand)
AQMC (State Level)	Special Secretary, Dept of Forest, Environment, & Climate Change
District Environment Committee	District Magistrate

4.4 EXECUTIVE AGENCIES

The action plan has outlined the responsibilities for many agencies that are involved to facilitate a cohesive coordination. Following agencies are responsible for implementation of CCAP.

- Transport department
- Urban Local Bodies (Municipal Corporation)
- Jharkhand State Pollution Control Board
- Urban Development and Housing Department
- Department of Mines & Geology
- Department of Industry
- Department of Environment, Forest & Climate Change
- District Administration
- Department of Energy
- Regional Development Authority

5. SOURCE PROFILING AND EMISSION INVENTORY OF JAMSHEDPUR

The air quality management has two pre-requisite, first the identification and quantification of sources that contribute to pollution levels; and second the evaluation of scenarios for future emissions to assess the effectiveness of mitigation measures to control air quality levels. The Source Apportionment Study helps to identify and quantify the sources of air pollution. It scientifically determines the contribution of various sources of pollution in an area and based on which mitigation measures are planned. The study is also helpful in prioritising some sources or deprioritizing others based on the contribution to overall air pollution. Therefore, an action plan based on the source apportionment study is crucial and will set a direction to achieve the target of clean air

There are two ways to conduct the source apportionment; a top down approach (collecting samples & analysing them in lab) and bottom approach (to use existing data and surveys) as the Figure 8 shows here.

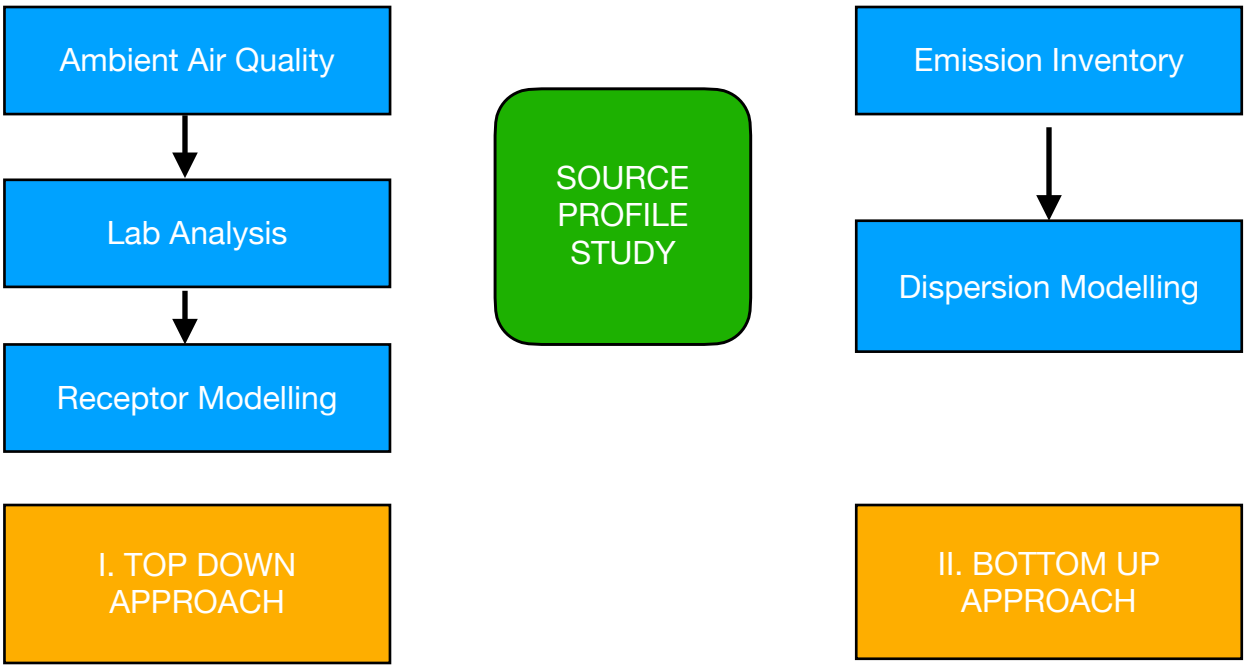


Figure 8: Diagram of process for conducting Source Profile study

Methodological Approach for developing Source Apportionment :

A bottom-up approach has been used to develop the Source Apportionment of Jamshedpur, the process is explained in the flowchart below in Figure 9.

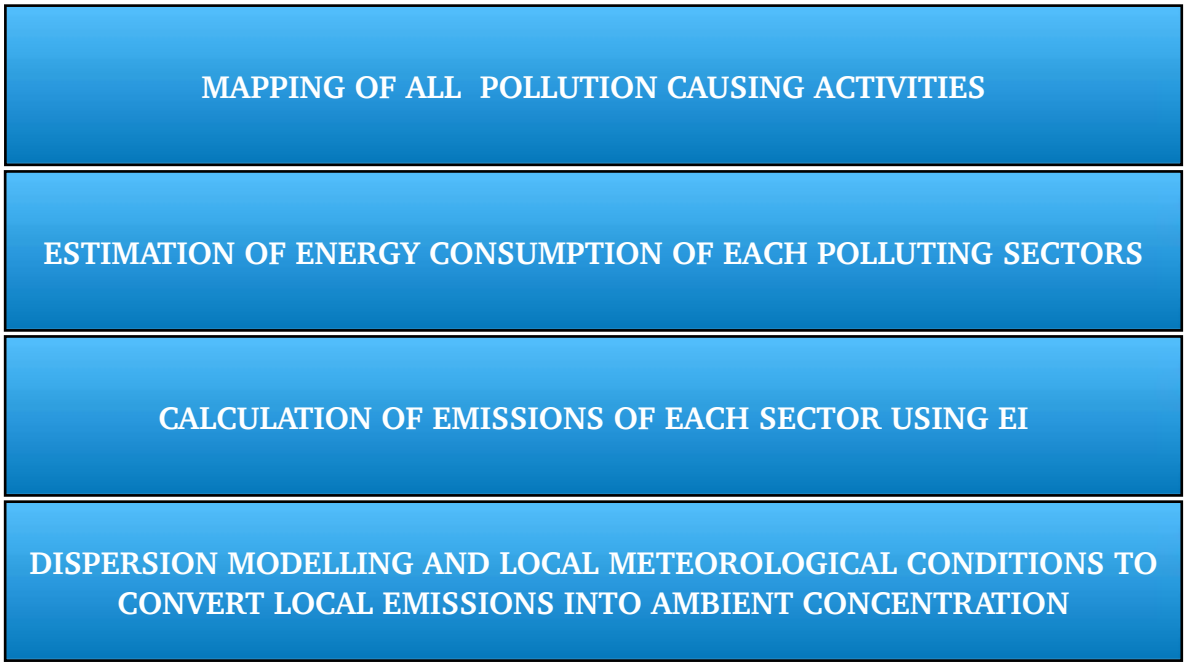


Figure 9: Flowchart of steps employed in source apportionment study

An emission inventory is established for all the known sectors of the regions and processed through meteorology coupled chemical transport models to ascertain their share of contribution to the air shed. The emissions inventory for Jamshedpur has been developed for total PM in size fractions of PM2.5. The major sources of air pollution in Jamshedpur have been identified qualitatively and through assessment of secondary information available. Moreover, meetings, surveys and physical visits have been helpful in assessing the key sources.

After identification of each sector, the energy consumption and emission factor has been assessed. The secondary information has been collated from the pollution control board, census bureau, national sample survey, industries' annual survey, municipal waste management, and publications from academic and non-governmental institutions has been used. For instance, industrial energy consumption has been identified using audits and energy statistics, vehicle population has been analysed using official

transport data, and energy use at household level has been computed using the census 2011 data.

To assess the air quality of Jamshedpur, an airshed covering 40 km x 30 km is selected and further separated into a 1 km grid to study spatial variations in emissions and pollution loads. This emissions inventory is based on the available local activity and fuel consumption estimates for the selected urban airshed. The emissions inventory was then spatially segregated at a 0.01° grid resolution in longitude and latitude (equivalent to 1 km) to create a spatial map of emissions for pollutants. Below is the gridded PM2.5 emissions and the total (shares by sector) emissions.

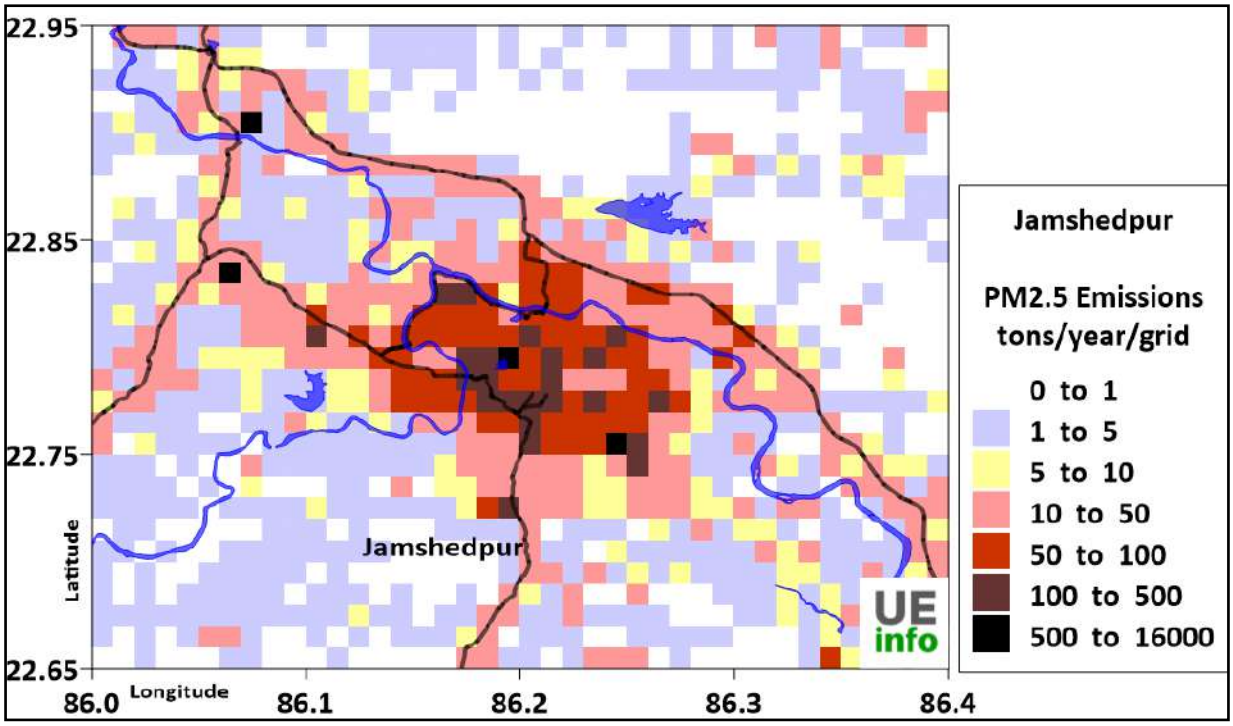


Figure 10 : Gridded PM2.5 Emissions

Ambient PM2.5 concentrations and source contributions were calculated using gridded emissions inventories, 3D meteorological data (from WRF), and the CAMx regional chemical transport model. The model simulates concentrations at 0.01° grid resolution and sector contributions.

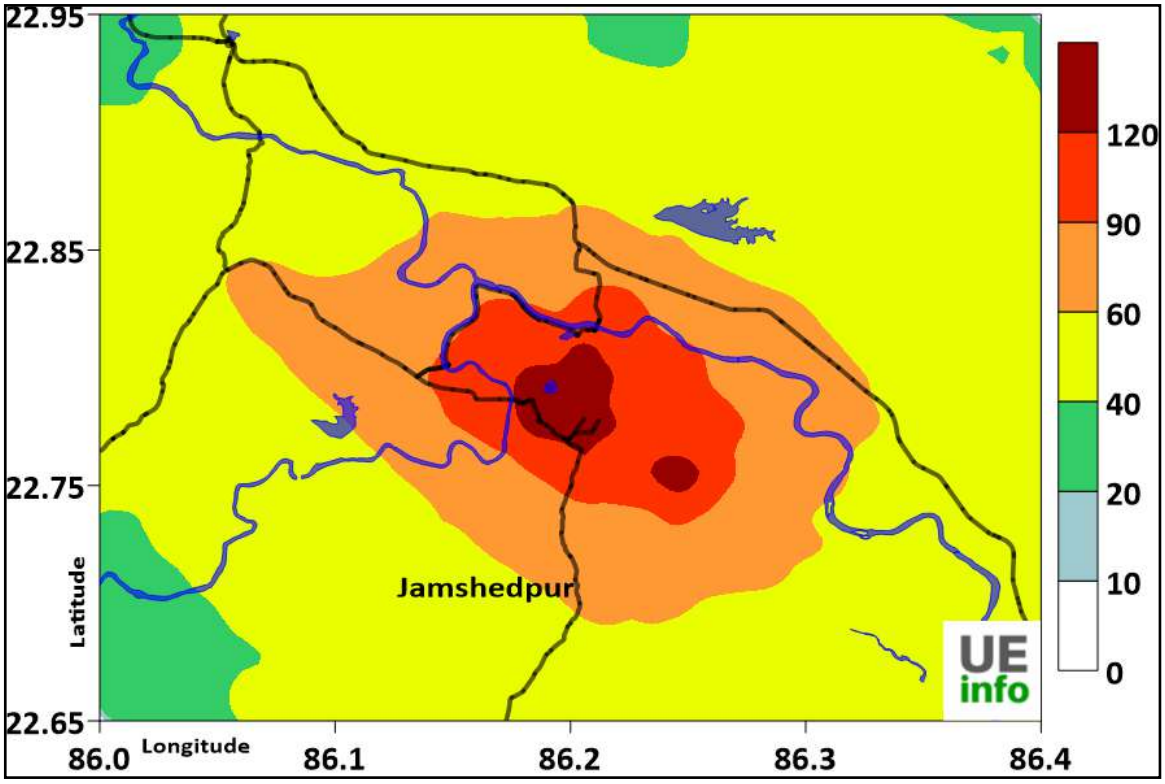


Figure 11 : Modelled PM2.5 concentration

The source profile as given in Figure 6 indicates that the industrial sector is the highest contributor of PM2.5 with 26% followed by transport (23%) and road dust (15%). The contribution from brick kilns and DG sets were limited within the city. Incidents of waste burning and DG sets have a contribution of 3% each while the brick kilns sector has 2% contribution to the overall pollution load and domestic cooking has 6% of the total contribution in the city. A major proportion (22%) of the estimated annual PM2.5 pollution in the city is coming from outside, which suggests that a proper airshed management plan is also required for the city.[5]

[5] Estimates based on the source profile of year 2018 prepared by Urban Emissions.info

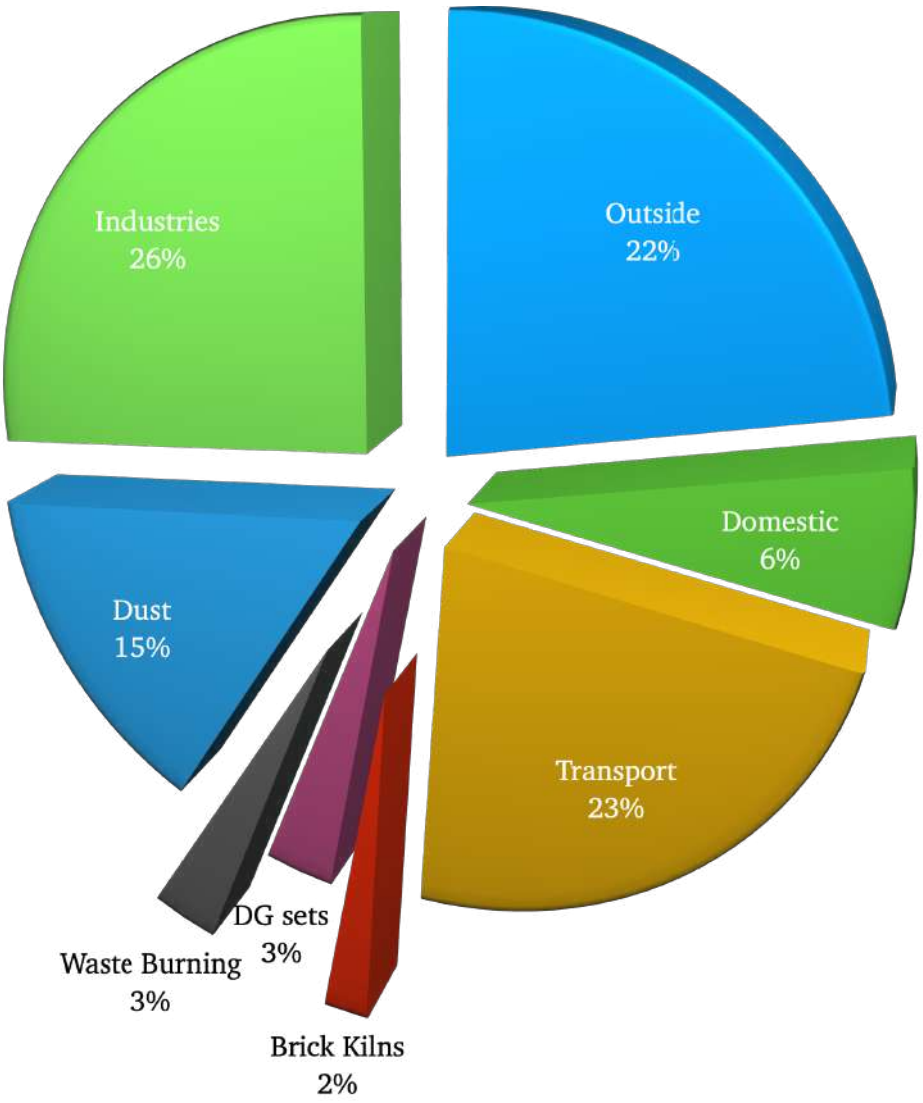


Figure 12 : Source's wise percentage share in Jamshedpur in 2020

- Domestic: Contribution of domestic cooking, space /water heating, and lightning
- Dust: Contribution of re-suspended dust on the roads and construction activities
- DGS: Contribution of Diesel Generator Sets (DGS)
- Brick kilns: Contribution of brick kilns
- Waste burning: Contribution of open waste burning
- Industries: Contribution of industrial activities
- Transport: Contribution of passenger transport and freight transport (heavy and light trucks, non-road vehicles, and shipping)
- Others: Contribution of anthropogenic emissions from outside (and within the modelling domain) and natural emissions

5.1 INDUSTRIES

The source profile of Jamshedpur has clearly pointed industrial emissions as a major contributor with 26% in the total pollution load. Many large industries like Tata Steel and Tata Motors are located in the center of the city and are contributing to the air pollution. In addition to these, Adityapur, one of the largest industrial areas, is only 7 KM away from the main center of the city also adding to the total pollutants. The region houses a large number of small and medium scale industries with some large-scale industries as well.

Table 11 : List of Industries in Jamshedpur Agglomeration Area

Sl. No.	Industry Name	Industry Address	Product Name & Capacity
1	Tata Goods Shed Stationof S E Railway	Tata Goods Shed Station, Jamshedpur.	Unloading & loading of iron ore/Coal/Cement/Slag , POL & SVOC - 5300 T/d
2	UNITED ENGITECH (P)LTD.	AT- GOLPAHARI, P.O.- TATANAGAR, JAMSHEDPUR, E.S.	Auto Component
3	ASOKA INDUSTRIES	B.D'COSTA ROAD, JUGSALAI, JAMSHEDPUR-6.	Copper Casting - 100 MT/year
4	EMPIRE INDUSTRIES	M E SCHOOL ROAD, JUGSALAI, JAMSHEDPUR	Auto Component
5	M/s Jind Industrial &Mfg. Works (P) Ltd,	PRADHAN TOLA, BAGBERA, JAMSHEDPUR-831002	Crow Bar - 300 MTM, Wire Drawaing - 250 MT/month, Barbed Wire - 350 MT/month, Welding Electrode - 50 MT/ month (As per CTE)
6	Tatanagar Station	Office Of The Station Director, Tatanagar Station	STP
7	TATANAGAR STEEL PRODUCTS	PLOT NO-855 & 861, KHATA NO-230, NEAR GURUDWARA, SUNDERNAGAR JAMSHEDPUR	-
8	Electric Loco Shed, SouthEastern Railway, Tatanagar	Electric Loco Shed	Maintenance of Electric Locomotives - 223 Nos./m (As in application)

9	M/s Paul & Co.	Sunder Nagar, Jamshedpur.	Electric switch & Machining of Auto Components
10	Hi-Tech Plastic	Haludbani, (Dattapara)	(1) Plastic Sheet- 01 MT/day, (2) Plastic grannuals- 1100 Kg/d
11	M. A. OIL	M. E. School Road, Near Shiv Ghat, Jugsalai, Jamshedpur	Empty drum- 24000 Nos./ annum
12	Unique Spring & Plastic Works	Vill- Bayangbil, Sundernagar, Jamshedpur	Auto switches & spring- 5500 Nos./day
13	SAI CYLINDERS PVT. LTD.	Purihasa, Sundernagar, Jamshedpur	Empty Gas Cylinders - 5000 Nos./day
14	SHYAM ENTERPRISES	Ramdas oil mill, Manifit, Telco, Jamshedpur-831004	Wire Drawing
15	TRF LIMITED	11, STATION ROAD, BURMAMINES, JAMSHEDPUR- 831007	Apron Feeder - 5 Nos., Crusher - 7 Nos., Side Arm Charger- 3 Nos., Technological Structure - 3024, Tripper - 4 Nos., Wagon Trippler - 5 Nos., Pully - 713, Plough Feeder - 4 Nos., Idler - 71857, Spares/ Mining - 1027 Items.
17	AUTOMOTIVE AXLES LIMITED	OLD KHAKARIPARA, CHHOTA GOVINDPUR,	Drum Breaks - 240000 Nos./year, Tag Trailer Axles - 32000 Nos./year
18	HINDUSTAN PETROLEUM CORPORATION LIMITED	BURMAMINES,STATION ROAD,PO TATANAGAR,JAMSHEDP UR	Petroleum Depot HSD â 4 x 350 KL, Petrol â 1 x 500 KL, 1 X 90 KL, 1 x 70 KL, Ethnol â 1 x 70 KL, LDO â 2 x 120 KL, Kerosene â 2 x 70 KL
19	Tata Steel Downstream Products Limited	Tata Steel Downstream Products Limited, Steel Service Centre, Inside Tube Division - Tata Steel, Burmamines, Jamshedpur	Iron & Steel
20	AUTO WORLD	NEW KALIMATI ROAD, SAKCHI, JAMSHEDPUR	Servicing of Yamaha Motor Cycle (Two Wheeler)
21	M/s. Youth India Auto Components (Pvt) Ltd.	Chhota Govindpur, Jamshedpur	Auto Component

22	MOTHER TRADING AND SALES	GADRA CHHOTAGOVINDPUR JAMSHEDPUR	Plastic Sheet- 350 Kg/day
23	Tata Autocomp Systems Limited	Plot no.5532,Bay 9 & 10,Outer Complex,Tata motors Ltd,Jamshedpur,Jharkhand.	Sheet Molding Compound Molded parts- 250 MT/ Month
24	Air Water India Private Limited (Unit-I)	Near 'L' Town Gate, Sakchi, Jamshedpur - 831001.	Gaseous Oxygen - 1715 TPD, Gaseous Nitrogen - 750 TPD, Liquid Oxygen- 15 TPD , Medical Oxygen - 10 TPD
25	National Engineering Works	5 & 6, Mills & Godown Area, Jamshedpur	Auto Component
26	PAUL And COMPANY	BAYANGBIL SUNDERNAGAR JAMSHEDPUR	Auto Component
27	THE ALCOR (A UNIT OF SRP OIL (P) LTD.	HOLDING NO-4 RAMDAS BHATTA, BISTUPUR JMAMSHEDPUR	Fooding, Lodging & Boarding Facility (Ac Rooms) :- 60 Superior rooms & 5 Suites (i) Meals - 400 No./day , (ii) Snacks - 300 Nos./day (iii) Soft Drinks- 100 Nos./day (iv) Mineral Water - 150 Nos.day
28	NEW ERA COATINGS LLP	Plant - 1, 2nd Bay (Old Frame Shop), Inside Tata Motors Campus, Telco	CED Coating of Auto Components at Vehicles - 480 Sets/day (As per CTO)
29	HOTEL CENTRE POINT	2 INNER CIRCLE ROAD	Bed capacity- 45 AC Rooms.
30	SEWAGE treatment & DISPOSAL PLANT (SDP), Jamshedpur - 17	SEWAGE DISPOSAL PLANT, C/O TATA MOTORS LTD., BARIDIH,	STP
31	The Sonnet	Inner Circle Road, Contractors area	A.C Rooms- 65 Nos.
32	P&M INFRASTRUCTURES LTD	JUGSALAI, BISTUPUR, JAMSHEDPUR, JHARKHAND	Mall
33	VIRAT INDUSTRIES	BAJNADIH, P.O.- LUABASA, P.S.- GOVINDPUR, JAMSHEDPUR	6 BT Cylinder Block- 90 Nos./day

34	JAMIPOL LIMITED	NAMDIH ROAD	Desulphurising Compound - 30,000 MT/year, Cored Wire- 1000 MT/Month
35	Colony (Town) Water Purification Plant	COLONY (Town) WATER FILTRATION PLANT, TATA Motors Ltd., Jamshedpur City:JAMSHEDPUR Block:BAHRAGORA District:EAST SINGHBUM Pin:831004	Treated Water fo Colony Supply - 4.27 MGD
36	INDUSTRIAL ENERGY LIMITED	Industrial Energy Limited, POWER HOUSE # 6 (Inside Tata Steel Works), Sakchi, Jamshedpur – 831001	Electricity
38	1290 TPD ASU, Tata Steel Limited	Long Tom Area, Behind NML, Burmamines	Oxygen- 2550 TPD, Nitrogen - 4343 TPD, Argon - 102.5 TPD (As per CTE issued to the unit)
39	Tata Toyo Radiator Ltd	TATA TOYO RADIATOR LTD	Radiator- 200 Nos./day
40	M/s BMW Industries Ltd.	Ramdas Oil Mill Compound, Manifit	Slitting, Cut to length and corrugation- 6000 MT/ Month
41	AIR WATER INDIA PRIVATE LIMITED (Unit-II)	Near 'L' Town Gate, (adjacent to Garamnala) Beside Vishwakarma Technical Institute. Sakchi.	Gaseous Oxygen- 1400TPD, Gaseous Nitrogen - 1850 TPD, Liquid and gaseous Argon - 40 TPD, Liquid Oxygen - 40 TPD, Liquid Nitrogen - 90 TPD and Medical Oxygen - 30 TPD (as per CTE)
42	JUSCO BATCHING PLANT	JAMSHEDPUR UTILITIES AND SERVICES COMPANY LIMITED, Circut House Area, Northern Town, Jamshedpur	Concrete mixture- 1000 MT/ Day
43	Linde India Limited	Mona Road, Burmamines, Jamshedpur 831007	Refilling of O2 - 165000 m3/ m, Argon Mixture - 60,000 m3/m, Nitrogen - 5000 m3/m.
44	YAZAKI INDIA PRIVATE LIMITED	PLOT NO. 5532, BAY 10 & 11, INSIDE TATA MOTORS LTD.	Electric Swith
45	K.B. PLASTIC	59, Tatanagar Mills & Godown Area, Burmamines, Jamshedpur	Plastic sheet bag & Tirpal-1.5 MT/day

46	SRI DASHMESH ENGG WORKS	GADRA JAMSHEDPUR	Machining & grinding- 11 T/d
47	Linde India Limited 225 TPD Plant	225 TPD Plant, Linde India Limited	Gaseous Oxygen 225 TPD
48	S S AUTOMOTIVE	NEAR GANESH MANDIR	-
49	R K Construction	Namdih Road Near Burma Mines Jamshedpur	Ready mix concrete- 100 MT/d
50	Linde India limited (IGP)	Long Tom Area, Bumamaines, Jamshedpur, Jharkhand	Industrial Gas.
51	Linde India Limited(2550 TPD Plant)	Linde India Limited, 2550 TPD Plant, Long Tom Area,Behind NML, Burmamines, Jamshedpur-07	G.O. - 2550 TPD, Argon - 4343 TPD, Argon - 102.5 TPD
52	Radhe Engineering Works	Plot No. 5695, 5697, 5690, 5987, 5698, 5699 & 602, Mouza: Jojobera, P.S. Govindpur, District: East Singhbhum, Jamshedpur, Jharkhand	Short Blasting of casted block- 75600 Nos./yr
53	Jamshedpur Roller Flour Mill (P) Ltd	Sundernagar	Atta, Maida & Suzee- 50 MT/d
54	M/s Tatanagar Cold Storage Co. Pvt. Ltd	N- ROAD, EAST BISTUPUR, JAMSHEDPUR	ICE Block-10 T/day & Cold storage- 750 MT/day
55	Balaji Industry	Vill- Kharbani, P.S Govindpur	-
56	LINDE INDIA LTD. JM-PGP	Linde India Limited, PGP Plant, Long Tom Area, Burmamines, Jamshedpur 831007	Medical Oxygen - 1.00 Lac Cum/ month, Industrial Oxygen - 2.00 Lac Cum/ month, Argon Mixture - 2.00 Lac Cum/month & Nitrogen - 25,000 Cum/ month
57	M/s Delux Plastic	Plot No.- 63, 64, Mauza- Kitadih, Parsudih, Dist- East Singhbhum.	Plastic
58	RASHI POLYPACK	9 Sakchi Mills Area, Jamshedpur, East Singhbhum	Carry Bags
59	M/s Sarkar & Company	Namdih Road Near Burma Mines Jamshedpur	Ready Mix Cement Concrete

Figure 14

60	M/s Leading Construction	Namdih Road Near Burma Mines Jamshedpur	Ready Mix Cement Concrete
61	M/s Eastern Synpacs	Kalimati, Govindpur, Jojobera, Jamshedpur.	Nails- 300 MT/month, Suspension Assembly- 900 Pcs/m
62	M/s Adient India Private Limited.	Plot No.- 2909(P), P.O.- Telco Works, Village- 19, JNAC, Jojobera, Jamshedpur.	Assembling of Seat- 9680/ Month
63	PENWAL PLASTIC PVT LTD	Professor Lane, Old Purulia Road, Mango, Jamshedpur	Plastic Auto Components- 125 Kg/d
64	UNISON RETREADS	PLOT NO. 1653,1654,KHATA NO. 29. DIMNA ROAD, MANGO, EAST SINGHBHUM	Tyre - 20 Nos./day
65	M/s A.K.Trader	Road No.- 17, Mango, Jamshedpur, E.S.	Plastic granules.
66	M/s STP LIMITED	MIRZADIH, DIMNA ROAD, P.O.- M.G.M. MEDICAL COLLAGE, JAMSHEDPUR	Coal Tar
67	M/s RSPL Ltd.	Bhilaipahari, Jamshedpur, East Singhbhum	Detergent Powder
68	TATA INTERNATIONAL DLT PRIVATE LIMITED	PLOT NO 385/386/387/336/586/587/ 33 8/339/340	Manufacturing & Painting of Body of Tippers, Trailers, - 3000 nos./year
69	FOUNDRY MINERALS & CHEMICAL CO.	ROAD NO.- 15, JAWAHARNAGAR, MANGO, JAMSHEDPUR- 832110	Foundry Flux - 25,00000 No./day
70	SARDUL AUTO WORKS (P) LTD	ROAD NO. -12, JAWAHARNAGAR, P.O.- AZAD NAGAR, MANGO, JAMSHEDPUR	Auto Component
71	M/s SRG IRON & STEEL (P) LTD,	Gerua, P.O.- Patamda, Dimna, Jamshedpur	Agriculture Equipment
72	S.I. ENTERPRISES	ROAD NO.- 17, GREEN VALLEY ZAKIRNAGAR, MANGO, JAMSHEDPUR	Auto Component
73	JINDAL FORGING PRIVATE LIMITED	Jawahar Nagar, Mango, Jamshedpur	Auto Component
74	M/s ASK Chemicals India Pvt. Ltd.	Road No.- 16, Jawaharnagar, Mango, Jamshedpur.	Metafinish G21 â 2MT/day

75	Synergy Power Equipment Private limited	Road No.-17, Jawahar Nagar, Mango, Jamshedpur	Transformer
76	Ashiana Anantara	Ashiana Anantara, N.H.-33, Pardih, P.O. & P.S., Mango, Jamshedpur.	Housing Flat - 450 Nos. (As per I/R)
77	M/s Tata Steel Ltd. Lat.- 22°47'50' to 22°46'39' & Long.- 86°11'07' to 86°12'42'	Sakchi, Jamshedpur, Telco, Jamshedpur.	Steel - 9.7 MTPA
78	M/s Tata Motors Ltd. Lat.- 22°46'06' N to 22°45'37' N & Long.- 86°13'41'E to 86°15'03'E	Telco, Jamshedpur.	Heavy Vehicle Engine & Asembling
79	M/s Tata Blue Scope Lat.- 22°14'48.76" N Long.- 86°14'08.78"E	At: Bara,PO:Agrico,Jamshedpur -831009	1) Zinc Alumunium Coated Steel Strips (Galvalue / Zinc Column - 100,000 TPY 2) Polyester Paint Coated Strip - 150,000 TPY
80	M/s Tinplate Co. of India Ltd. Lat.- 22.78998 N & Long.- 86.22625 E	Golmuri, Jamshedpur, Jharkhand	
81	M/s Tata Cummins Lat.- 22.7666788 N & Long.- 86.2810347 E	Tata Cummins Private Limited,Cummins Road,Telco Township,District Purvi Singhbhum,Police Station Telco,Block Jamshedpur(NA).Pin No 831004	Diesel Engine & its Components - 15,000 MT/month (
82	M/s Timken India Ltd. Lat.- 22.806 N to 22.809 N & Long.- 86.228 to 86.233	BARA, P.O.- AGRICO, JAMSHEDPUR-831009	Iron Briquette -42 MT/month
83	M/s Nuvoco Vistas Corporation Lat.- 22°44'59' N to 22°45'38' N & Long.- 86°14'13'E to 86°15'01'E	JOJOBERA, RAHARGORA, JAMSHEDPUR	PSC Cement- 3.2 MTPA, PPC Cement- 1.4 MTPA
84	M/s Tata Power Ltd. Lat- 22.8003802, Long- 86.1650014	Rahargora, Jamshedpur.	Unit-5- Electricity- 120 MW & Unit- 1 to 4- 427.5 MW
85	M/s ISWP Ltd. Lat- 22.8003802, Long- 86.1650014	Indira Nagar, Jamshedpur.	Bolts & Nuts - 610 MT/ month, Wire Rod - 18000 MT/month, Wire - 6000 MT/month (As p[er Appl.)

86	M/s JEMCO Ltd. Lat.- 22.7857015, Long.- 86.1629801	Telco Works,Jamshepur-831004, A Division of ISWP	Nails 600 MT/month
87	M/s Tata Pigment Ltd. Lat.- 22°48'20' N to 22°48'18' N & Long.- 86°12'11'E to 86°19'60'E	Bistpur, Jamshedpur.	Inorganic Synthetic Red & Yellow Iron Oxide Pigments (Prime) â 4470 T/Year
88	M/s Steel Strips Wheel Lat.- 22.8003802, long-86.1650014	Jojobera, Chhota Govindpur, East Singhbhum, Jharkhand	Automotive Wheels (Steel Wheels)- 3500 Nos./day (Existing), Capacity after expansion â 5,500 Nos./ day
89	M/s CRM Bara Lat.- 22.791901, Long.- 86.1684728	Cold Rolling Mills Complex (CRMC), Bara, Jamshedpur	HR Coil â 2,50,000 TPA, HR Pickled Coil â 50,000 TPA
90	M/s Tata Steel Ltd. (Tube Division) Lat.- 22.7869038, Long.- 86.1575122	Namdih Road, Burmamines, Jamshedpur.	Standard Tubes- 235000 MT/ Y, Precision Tubes85000 MT/Y

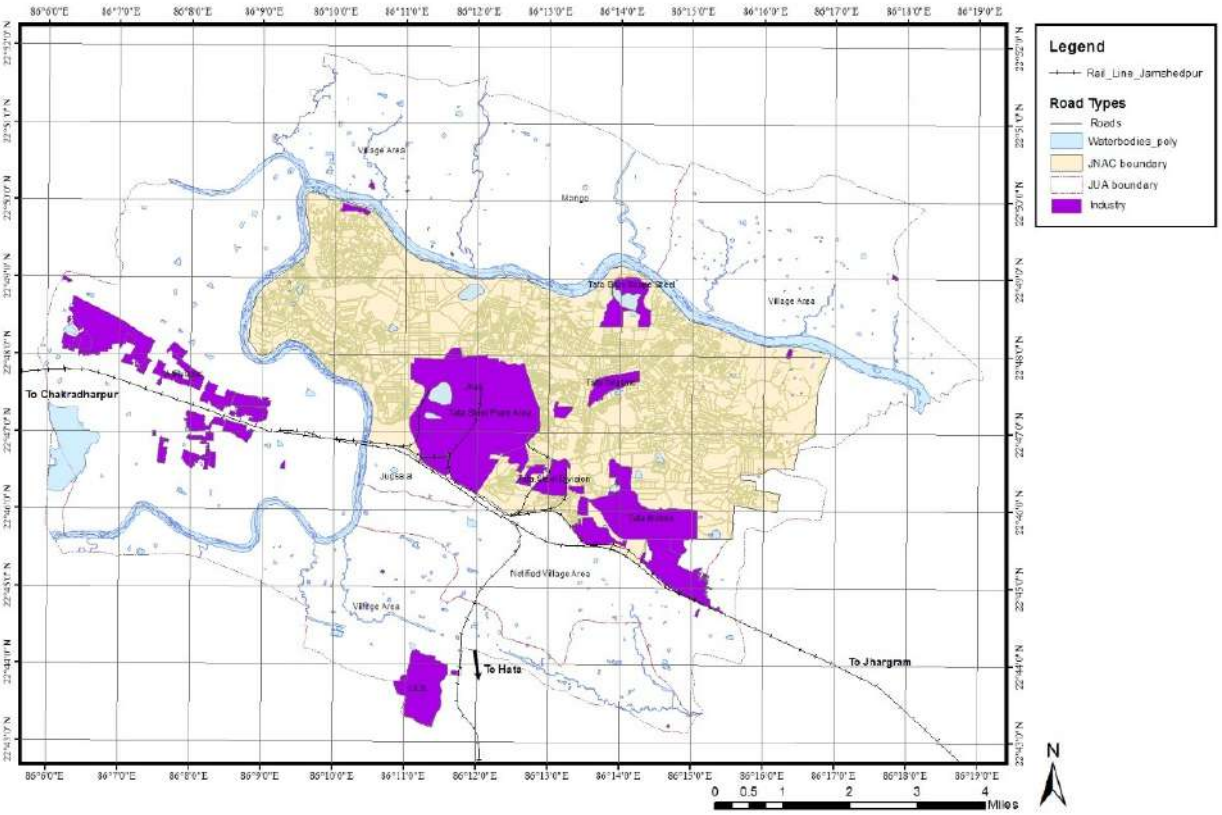
(A) MAJOR ISSUES OF INDUSTRIAL POLLUTION & ITS MANAGEMENT

- Many industries either did not have data on fuel consumption or accurate inventory of the pollution sources and their capacities, thus making the evaluation of pollution load a bit challenging. Similarly, there is little to no data on small scale industries or other unorganised sectors. A complete, updated, and accurate inventory of the industries is needed which will further assist in identifying the areas or sectors of concern from the perspective of environmental pollution.
- Most of the industrial areas have poor road conditions with the movement of heavy vehicles on them which led to the high amount of PM10 fugitive emissions in the area. The condition of the roads is very poor resulting in traffic congestion of heavy vehicles. Many MSMEs don't have effective Air Pollution Control Devices particularly which contribute to pollutant release in ambient air without treatment.
- A clear fuel policy is required which can regulate in identifying which fuels are banned and which clean fuels are recommended for industries in the future. Many industrial areas have access to natural gas as proper infrastructure is available, but the cost of shifting from conventional fuel to piped natural gas doesn't go well with the most of the industries resulting in their unwillingness to switch over to PNG. There should be proper timelines for the implementation of such a policy to fast-track the change in fuel use and subsequently reduce the pollution load.
- One of the most important issues is the management of industrial waste which is generated in some areas. It has been observed in most of the industrial areas that

waste disposal is not proper. This calls for proper solutions with scientific disposal of the wastes.

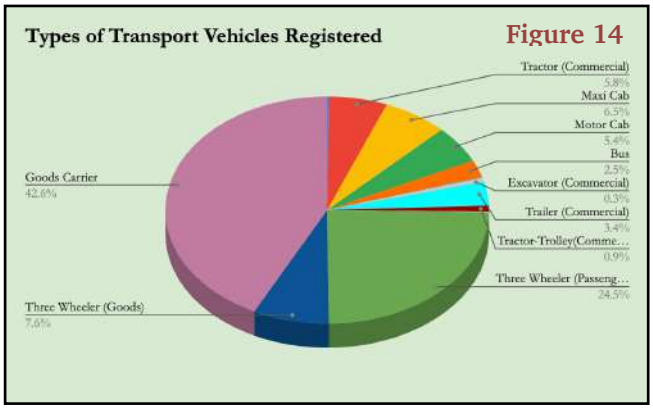
- For promoting best practices, industrial associations should be identified and given a timeframe to adopt best mitigation measures since they are considered as major stakeholders in the air pollution action plans.
- All the industrial area development agencies and urban planning departments should properly coordinate to clearly demarcate industrial and residential areas, and come up with remedial measures or buffer zones to prevent the residential population from the effects of air pollution from industries.

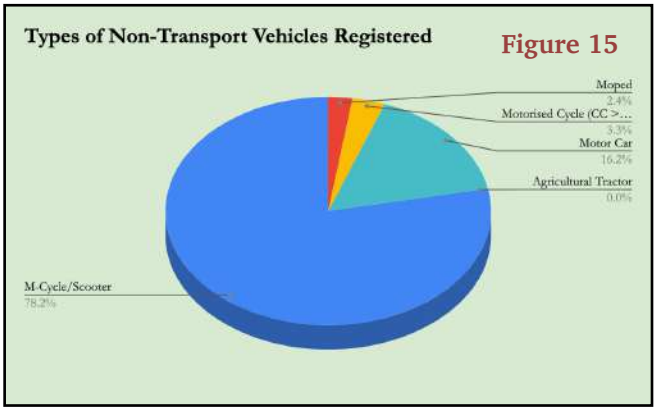
Industrial Cluster in JUA

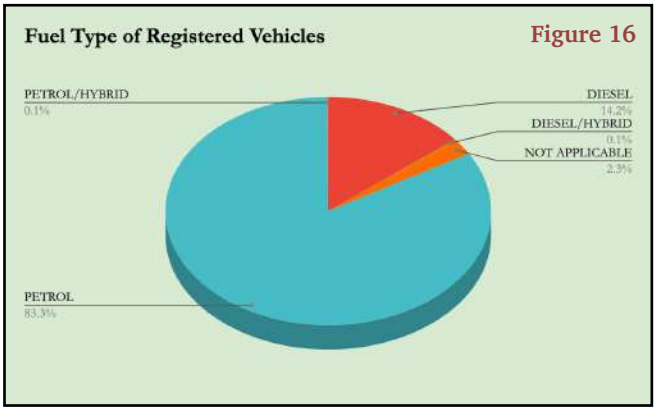


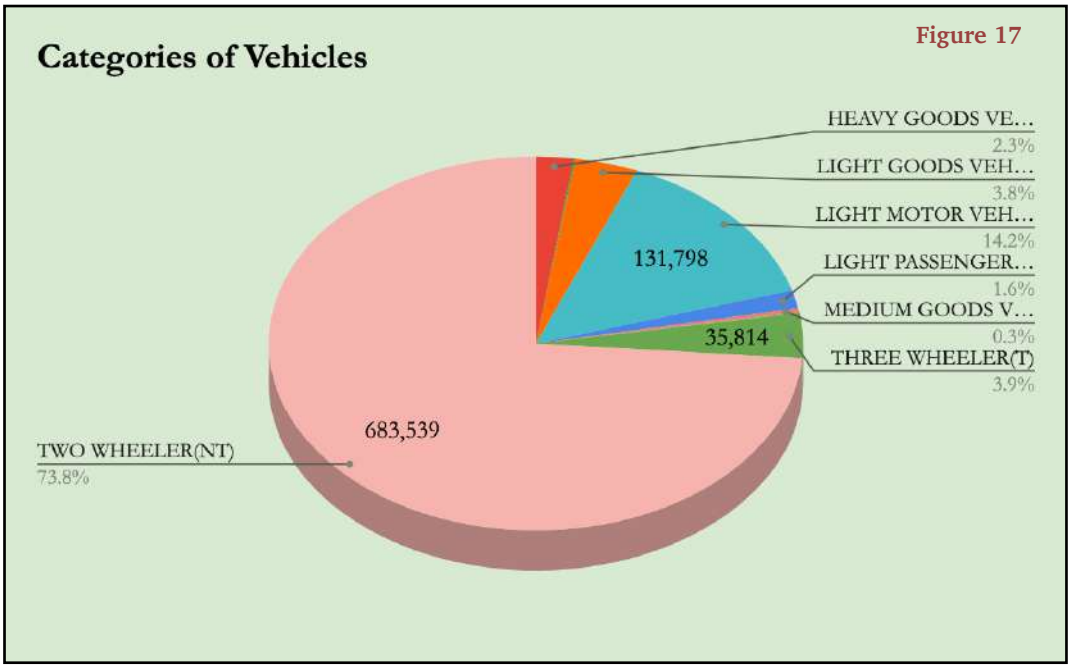
5.2 VEHICLES & TRANSPORT

The road transport sector has 23% contribution in total emission load in Jamshedpur. In the last few decades the exponential growth of private vehicles has been seen (see Figure 7). Analysis of data from Ministry of Road Transport & Highway reveals that personalised vehicle population share is more than 95% of the total vehicle population in Jamshedpur.









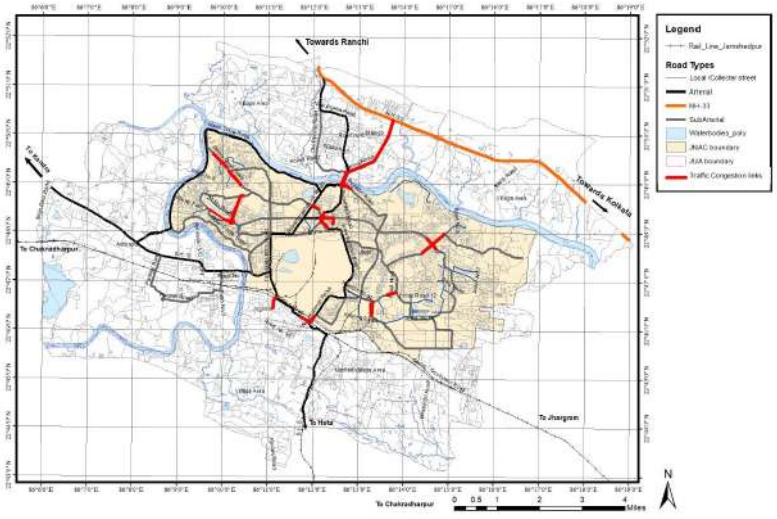
(A) COMMON ISSUES FACED BY TRAFFIC & TRANSPORT SECTOR

- Most of the roads in the area are encroached by permanent or temporary encroachments, leading to diminution of road width and capacity as a result the roads have capacity constraint in inner built-up areas, inner cordon roads, and even at some points the regional and outer cordon roads have lesser width/related infrastructure.

- No comprehensive Traffic Management Plan has been prepared for the city; the only methodology adopted is the traffic plan by police is done in a non-technical way.
- The quality of roads is of poor quality which also affects smooth traffic and lifecycle of the vehicles.
- The Pedestrian facilities on all most all the roads of different levels are inadequate, promoting less pedestrian but more traffic movement

- Limited provision for bicycles: In the entire city provision required infrastructure to promote cycle movement in the city is very limited
- The city also faces informal marketing on the roadside as hawkers, roadside vendors, and informal arrangement of vegetable / grocery item vendors is a serious problem in the city, affecting road efficiency.
- A large number of markets, commercial and other activity centers on various roads in Jamshedpur are

Road Network of Jamshedpur Agglomeration Area



suffering from inadequate parking facilities. On most of these stretches, the root cause of the congestion on the street is caused due to on-street parking.

(B) FUTURE STRATEGIES & PLAN:

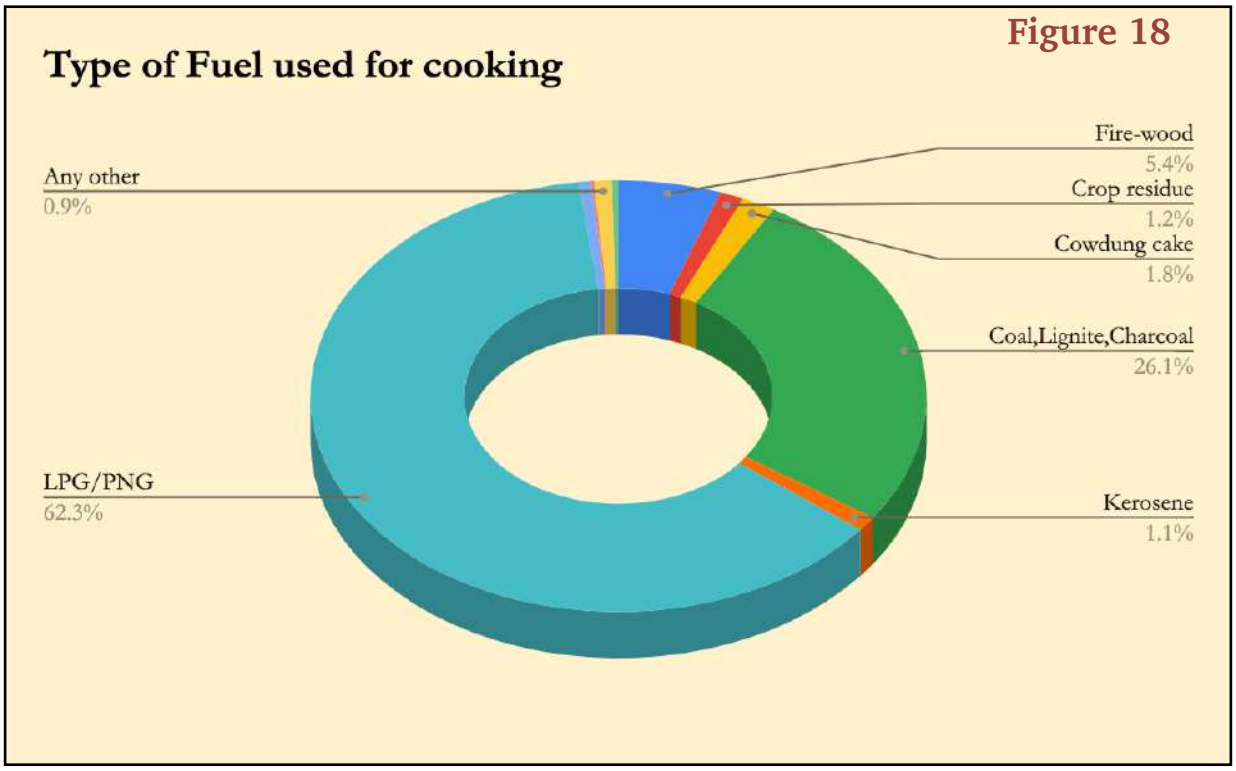
A good quality Comprehensive Mobility Plan needs to be updated and implemented with clearly defined timelines. The plan envisages various elements indicated here:

- Mobility corridor plan, road capacity augmentation, promoting public transport system with fleet augmentation and its Infrastructure,
- Establishment and relocation of Inter-city bus terminals,
- Promoting, Non-motorised transport with separate pedestrian crossing, dedicated cycle track, freight management and parking management,
- Use of alternative fuel cleaner like CNG, LPG, electricity, ethanol-blended fuel,
- Regular checks on vehicle fitness and Phasing out of old unfit vehicles

5.3 SOLID FUEL FOR COOKING & HEATING IN DOMESTIC PURPOSE

The coal consumption in households for cooking also contributes 6% to the pollution load in Jamshedpur, although not much. Due to Pradhan Mantri Ujjwala Yojana (PMUY) and many other efforts, the number of households using solid fuels has also reduced but the situation is still not favourable. Clean fuels are economically viable for domestic use as compared to cheaper solid fuels such as coal, firewood and crop residues. Jamshedpur requires 100 percent LPG penetration and reliable supply for domestic and commercial usage, which will also require strong public awareness program support.

Figure 18



5.4 SOLID WASTE BURNING

Though Jamshedpur has efficient waste management systems, there are still incidences of waste burning to free up space at dumpsites, to facilitate scavenging of non-combustible materials (such as metals) for profit, or for use as a heat source. The source emission profile of Jamshedpur indicates open waste burning contribution as only 3% of the total PM emissions. Since this is a low hanging fruit and can be easily controlled, the clean air action plan has also looked for the measures to control such activity.

5.5 CONSTRUCTION, DEMOLITION & ROAD DUST

The construction and road dust share a major proportion of burden in the PM10 concentration in Jamshedpur. Around 15% of the total emissions come from dust from Road and construction activities. Measures like strict compliance of construction and demolition wastes including other measures like penalty and use of C&D debris in road making/recycling, etc. has been proposed in the action plan. The measures like end to end road pavement, plantations along road sides, strict compliance of existing policies and the introduction of mechanical sweepers, spraying of water through mist sprinklers can also help to reduce suspended road dust particles.

(A) CONTROL MEASURES RELATED TO ROAD DUST

Edge to edge paving/greening, road shoulder (unpaved part) should be covered with interlocking tiles or grass. Water sprinkling on unpaved roads and Night washing of the paved roads using treated water. Whenever road washing is not possible, dense sprinkling through treated sewage mixed with dust suppressant should be done regularly. Continuous operation of fountains at main roads crossing and parks should be done regularly. Making the roads pothole free and Anti-smog guns should be installed. Roads should be regularly cleaned using mechanical sweeping machines and collected dust should be dumped at proper place, so that it could

not deposit again on the roads. Ensuring that the building material is fully covered while transporting and Ensuring no C & D Waste stored on the road side.

(B) BEST PRACTICES FOR C&D WASTE MANAGEMENT

- The Construction and Demolition Waste Rules and Regulations, 2016 have mandated reuse of recycled material. A significant proportion of construction waste can be recycled and reused and brought back to construction to substitute naturally sourced material. This demands a circular economy that can turn C&D waste into a resource. This can help reduce energy intensity and environmental footprints of buildings and infrastructure. Usage of recycled aggregates can not only preserve the finite raw materials but also reduce energy consumption and overall construction costs.
- Certain components of demolition waste such as plasterboard are hazardous once landfilled as it is broken down in landfill conditions releasing hydrogen sulfide, a toxic gas. It is important for having a proper in-situ Construction waste management plan for Gorakhpur city with the facility of sorting and transformation.
- All areas for storing C&D wastes/construction material to be demarcated and preferably barricaded particularly those materials that have the potential to be dust borne. Use of demolition waste as a raw material in the brick-making as a substitute for fertile soil.
- Fine material, such as sand, dust, etc. can be used as cover material over the sanitary landfill. Wet suppression is the most convenient method for controlling construction dust at the site. Speed of transportation vehicles at the construction site must be minimized to avoid fugitive emission.

5.6 BRICK KILNS AND OTHER SOURCES

As per the data available with JSPCB, more than 20 fly ash brick kilns are operational in Jamshedpur district. The source profile also indicates The commercial use of diesel genset and brick kilns in Jamshedpur has contributed 3% and 2% respectively of the total PM emissions. Thus, adoption of cleaner and efficient production technologies such as vertical shaft kilns, Hoffman kilns, and tunnel kilns for brick manufacturing is needed. Further, solar rooftop programs in big commercial establishments can reduce the dependence on DG sets.

The brick sector is a resource-intensive and highly air polluting sector. It is a largely

unorganised labor-intensive sector. Bricks can be of many types and the most popular type is fired clay brick. Clay fired bricks are produced in small enterprises mostly located in peri-urban and rural areas.

Green bricks are fired at approximately 1000^{O} C temperature for high strength and durability. Brick firing is an energy-intensive process. Coal, wood, and many agricultural wastes such as mustard stalk, rice husk, etc. are used as fuels for firing bricks. There is heavy dependence on coal for firing which results in high particulate matter emissions, CO_2, and black carbon.

Fixed Chimney bull trench kiln (FCBTK) is the most used firing technology which accounts for approximately 80% of total kilns present in the district. There is a trend of adopting cleaner firing technology like zigzag Kiln but the number of such kilns is very less.

(A) MAJOR ISSUES RELATED TO BRICK KILNS SECTOR

- Use of low-quality coal generates more ash content, SO_2 emission.
- The simple reason behind the use of agricultural waste is its easy availability and lower price. Apart from this, many other hazardous wastes such as carbon from tyre pyrolysis plants, rubber waste, shredded plastics, etc., were seen being used at few kiln sites.
- The sources of fugitive emissions are Coal Crushing Unit, openly stored fuel, loading and unloading of bricks, dust on the road within the premises of the kiln, rubbish stored at the kiln, and the area where green bricks are prepared.

(B) BEST PRACTICES IN THE BRICK KILNS SECTOR

Capacity building of regulators and Stakeholders - Setting up of an expert committee at the state/district level to monitor the conversion of the kilns. District level seminars and exposure visits to Zig-Zag kilns for brick entrepreneurs to acquaint them with the new technology. Also, regular training programs and courses on cleaner kiln technology and their viability will be designed and organised for kiln entrepreneurs, workers, and technicians at institutes, etc.

Advanced cleaner Production Technology: Zig zag kilns produce more class 1 bricks at lesser coal consumption and pollutant emission than FCBTK. Retrofitting existing FCBTK to Zigzag kiln structure is a win-win approach for brick entrepreneurs and the environment. There is a need to study the scope and techno-economic aspects for implementing energy efficient technologies like Tunnel Kiln, Hoffman Kilns, etc.

Shift toward Resource-efficient Bricks (REBs): Production of perforated and hollow burnt clay brick synergize in saving clay and fuel, reducing manpower requirements, and production cost. There is a need for establishing the demand/market for resource-efficient products.

Control of Fugitive emission: Pavement of approach road and the road around the brick kiln, crushing of coal in enclosed equipment/ area, covering ash layer in the preheating zone with plastic sheet/tirpal, etc can help in controlling fugitive emission

Use of Solar energy: Machines like pug mill, crushing roller, extruder, etc can be operated on solar energy.

Improving operational practice: Adoption of single man fuel feeding process, double-wall wicket gate closing mechanism & use of insulated feed hole cover.

Use of Air Pollution Control Devices (APCD): This can help in controlling stack emission of brick kilns. The particulate removal efficiency of different designs of Gravity Settling Chamber (GSC) generally ranged from 20-63%.

(C) BETTER REGULATION & MANAGEMENT OF DG SETS

Central Pollution Control Board (CPCB), has been regulating emissions from diesel generators at the manufacturing stage (through product certification) since 2005. Besides manufacturing reforms, better operational and management practices are essential to maintain the performance of DG sets. Inadequate operational and management practices like Poorly maintained fuel injection pump, Faulty nozzle, blocked fuel filters, improper cooling water circuit, loading below optimal, reduction in the air-fuel ratio(higher air intake temperature) due to poor cross ventilation, etc. should be timely addressed and resolved to control high fuel consumption and pollutant emission. Installation of a retrofitted emission control system in DG sets will also help in reducing emission.

5.7 MINES

Though the available source profile has not specified the contribution from mining activities, its contribution to pollution cannot be ignored and is crucial to control fugitive emissions from such activities. Many iron mines and stone mines exist in and around the city. Mining activities that involve distinct physical operations including quarrying (like drilling, blasting, loading, hauling) and plant process operations (such as crushing, screening, conveying storage and transfer operations) usually generate considerable emissions. Further, in the mining area the internal transportation also

contributes to particulate matter emission.

(A) MEASURES FOR REDUCING EMISSION AT MINES SITES

- Applying treated water to mitigate dust generation on the construction site. Water can be applied by a variety of methods, for instance, Anti-Smog Guns, trucks, water pulls, water cannons, hoses, fire hydrants, sprinklers, etc. Use of Dust Suppressants and its various techniques are important.

- Designing the layout of the construction site to minimise fugitive dust generation potential, including access roads, entrances and exits, storage piles, vehicle staging areas, and other potential sources of dust emissions. Use of Fencing, scaffolding sheets/nets for dust control at the site is important.

- Utilise enclosures/coverings for storage piles e.g. tarpaulins for storage piles. Storage pile activity (Loading & unloading) should be conducted downwind. There should be properly shaped storage piles so that they do not have steep sides or faces. Besides, sharp changes of shape in the final storage pile should be avoided.

- For better material handling, remove material from truck underbodies and tires prior to leaving the site as well as implement techniques to periodically remove mud/dirt track out/carryout from paved streets at the access point(s). Mandatory PUC Certificate for vehicles used for transport of materials.

- Monitoring of sites is very important to ensure proper adherence of the norms. Installation of display board in construction site mentioning the details of statutory environmental clearance, Name, address, contact no. & email of site in charge and owner.

5.8 LOCATION BASED SOURCES OF POLLUTION

Various pollution sources have been identified across the city which includes places of heavy traffic congestion, construction and demolition activities, use of more than 15 years old commercial vehicles, open cast mining locations, brick kilns, locations of pothole patches in the city, polluting industries, residential areas using fossil fuels for cooking and residential complexes having open spaces (see Table 12).

Table 12 : Location based Source of Pollution			
S. No.	**Source of Pollution**	**Location**	**Responsibility of the agencies/bodies**
1	Traffic congestion	Bhalubasa Chowk, Adityapur, Mango Chowk & Bus Stand, Sakchi, Jugslai, Tatanagar Railway Station Road, Bistupur	Urban Local Bodies (Jusalai, Mango and Jamshedpur Notified Areas Committee), Transport Dept and Traffic Police
2	Construction and Demolition activities	Baridih, Mango, Sakchi, Bistupur Adityapur & Gamharia region	ULBs (Jusalai, Mango and Jamshedpur Notified Areas Committee)
3	Plying of more than 15 Years old commercial vehicles	Mango, Jugsalai, Golmuri, Sakchi	Transport Dept
5	Pothole patches of roads	Mango, Jugsalai, Sakchi, Bistupur, Gobindpur, Bagbera area	Road Construction Dept / Mines Dept JSPCB
6	Parking in non-designated areas	Adityapur, Mango	ULBs
7	Brick kiln	Periphery of the city area	ULBs/ JSPCB
8	Stone crushers	Outskiirts of the city area	JSPCB
9	Residential complexes having non green spaces	Baridih, Mango region, Bistupur, Bagbera area, Gobindpur	ULBs/Urbam development Dept
10	Polluting industries	Adityapur region	Industries dept/JSPCB
11	Cooking and burning fossil fuel	Mango, Golmuri, Gobindpur etc	JSPCB/ Industry Dept.

6. HEALTH IMPACTS CAUSED BY AIR POLLUTION

Air pollution is one of the most serious public health risks and over the last two decades many scientific studies have demonstrated that particulate matter is a matter of concern from a health perspective. The National Health Policy Document of the Ministry of Health and Family Welfare (MoHFW), which was released for the first time in 2017, listed air pollution exposure as a priority area for action. The state-level Disease Burden estimates released by IHME, ICMR and PHFI showed that air pollution ranks as the third-largest risk factor responsible for the premature deaths in Jharkhand. Various diseases such as Ischemic heart disease and lower respiratory infections have been identified as the leading cause of disability in 2017. The air pollution exposure, both household and ambient, is associated with a broad range of health effects ranging from minor physical morbidity to death from acute respiratory and cardiovascular disease. Considering the severity and extent of exposure, a well-defined strategy can be in place with emergency response action and a sustained action is required in this regard.

Generally, the high exposure and incidences of smog episodes largely occur when weather is adverse with calm atmosphere, cold temperature, and lower mixing height that traps pollution very close to the ground. In this case the emergency response action (e.g. GRAP) can control further loading of emissions and reduce exposure and associated health risk. It identifies control strategies to reduce pollution from every source within a definite time frame involving all stakeholders and shared responsibility. It is also equipped with stringent regulations to ensure the enforcement. The CCAAP also fixes reduction targets for achieving the National Air Quality Standards (NAAQS).

7. PUBLIC AWARENESS AND COMPLAINTS REDRESSAL MECHANISM

A Public Grievance Redressal Portal (similar to SAAMER APP) has been developed for the public. This is a mobile app which can be downloaded through Google play store by using this link in Google play store https://play.google.com/store/apps/details?id=com.aeologic.pollutionjharkhand. After downloading (through installation and OTP based registration of mobile number) one can put his grievance of his area regarding pollution problem. The problem will be monitored and addressed by the Jharkhand State Pollution Control Board.

8. KEY POLICIES AND PROGRAMS TO MITIGATE AIR POLLUTION

Over the last few years JSPCB has undertaken many steps to improve the regulatory framework for vehicular emissions, industrial emissions and others. The aligned policies & programs both at the center and state level are discussed below:

8.1 COMPLIANCE OF EMISSION STANDRAD, OCEMS & ENVIRONMENT (SITING FOR INDUSTRIAL PROJECTS) RULES-1999

Power, Cement, Iron & Steel, Pulp & Paper, Textile, Tanneries including other categories of industries release large quantities of air pollutants. In order to regulate such emissions to safe limits, CPCB has prescribed standards for various pollutants emitted by the industries as notified under the Environment (Protection) Act-1986. Furthermore, to strengthen the compliance monitoring and ensure that industries and facilities comply with emission standards of June 2015, installation of OCEMS in 17 categories of highly polluting industries has been mandated[6]. All the industries falling in these categories of highly polluting industries have installed OCEMS in Jamshedpur.

8.2 STAR RATING PROGRAM

JSPCB is also implementing the Star-rating program. The program utilises the continuous monitored emissions data from major industrial plants to categorise industry from least complaint to most compliant. The program is bringing more transparency to control emissions from industries and also incentivises quicker uptake of improved emissions control systems.

8.3 VEHICULAR EMISSION NORMS

The vehicle emission standards were set by the Central Government to keep a check on the pollutant levels emitted by vehicles that use combustion engines. Following the national roadmap, Jharkhand has implemented the Bharat Stage VI (BSVI) emission norms for new vehicles since April 2020.[7] As per BS-VI emission norms, it is expected to reduce the pollution level in the state; petrol vehicles will have 25% reduction in their

[6] www.indiastat.com/transport-data/30/transport/30/vehicles/289/stats.aspx

[7] http://www.indiaenvironmentportal.org.in/files/file/Revised%20Guidelines%20for%20Real-time%20Effluent%20Quality%20Monitoring%20System.pdf

NOx, while diesel engines will reduce their HC+NOx by 43%, NOx level by 68% and particulate matter by 82%.

8.4 CNG & ELECTRIC MOBILITY

Compared to petrol and diesel, CNG vehicles are pollution free as it is made up of methane and results in less carbon emissions. In a major push towards CNG transportation in the personal mobility space, rollout of 200 to 250 CNG stations within the next few years has been announced for Jharkhand.[8] Three CNG stations in Jamshedpur are already operational as part of the government's of push to reduce the dependence on fossil fuel.

The Jharkhand government has adopted an E-mobility program for the deployment of Electric Vehicles (EVs) in the city and currently the Jamshedpur has 304 EVs plying in the city and there a plan to have more than 30000 EVs in next five years. However, the state does not have a statewide comprehensive Electric Vehicle policy yet. The state wise number of electric/battery operated vehicles in India statistics shows that as on 9 July 2019, 5257 electric/battery-operated vehicles exist in Jharkhand. The Union Government's National Urban Electric Mobility Mission and Smart City program gives a considerable opportunity in Jamshedpur to adopt electric mobility. Converting the maximum fleet to electric powered will result in reduction in air pollution to a large extent. Further, Jamshedpur is favourable for quicker adoption of the electric vehicles because of compact periphery, urban design and small area.

8.5 PHASING OUT OF OLD VEHICLES

Many studies have highlighted that the emission rate of vehicles generally increases with usage over time. Diesel and petrol vehicles should be scrapped as they reach their end-of-life (EOL) stage after 10 and 15 years respectively. Jharkhand has been articulating the need to phase out all the old polluting vehicles.

8.6 MOVEMENT OF HEAVY DUTY VEHICLES

The heavy-duty vehicles (trucks and trolly) play a major role in the economy of the city;

[8] https://auto.economictimes.indiatimes.com/news/oil-and-lubes/cng-png-project-launched-in-jharkhand/70815043

the vehicle movement and operations like hauling coals from mines to industries and transporting thousands tonnes of raw materials around cities. These vehicles also greatly affect the air pollution and public health. A spatial planning and development of the road network is important to bypass the city, as well as criteria like covering the loading and the pavements of pathways in coal yard is important.

8.7 PUBLIC TRANSPORT

Public transport produces significantly less air pollution per passenger than a standard car carrying a single driver. Further, it also helps to keep traffic congestion lower, which in turn reduces air pollution from idling vehicles. However, in Jamshedpur the personalised vehicle population is more and will tends to increase because of many factors. Apart from rising affluence and economic progress, lack of effective and convenient public transport can be seen as the major reason for high growth of private vehicles. The city needs to be de-congested by reducing the number of private vehicles and introducing integrated public transport system.

8.8 STRENGTHENING POLLUTION UNDER CONTROL SYSTEM

The on-road emissions from vehicles are also important to regulate. Due to the presence of a large number of ill-maintained vehicles in the city, the benefits of strict emission norms and introduction of BS VI vehicles will not be reflected in the ambient air quality.

To check emissions from these vehicles and to ensure proper maintenance, Central Motor Vehicle Rules (1989) mandates every one-year-old transport and non-transport vehicle to be tested for emission compliance and obtain a Pollution Under Control (PUC) certificate.[9] A robust implementation of the current emission control system (PUC) is important to effectively mitigate vehicular emission.

8.9 GREENING & AFFORESTATION

The role of green infrastructure in addressing the challenges of the 21st century cannot be underestimated. It is a natural, service providing infrastructure that is often more cost effective, more resilient, and capable of meeting social, environmental, and economic objectives than 'grey' infrastructure.

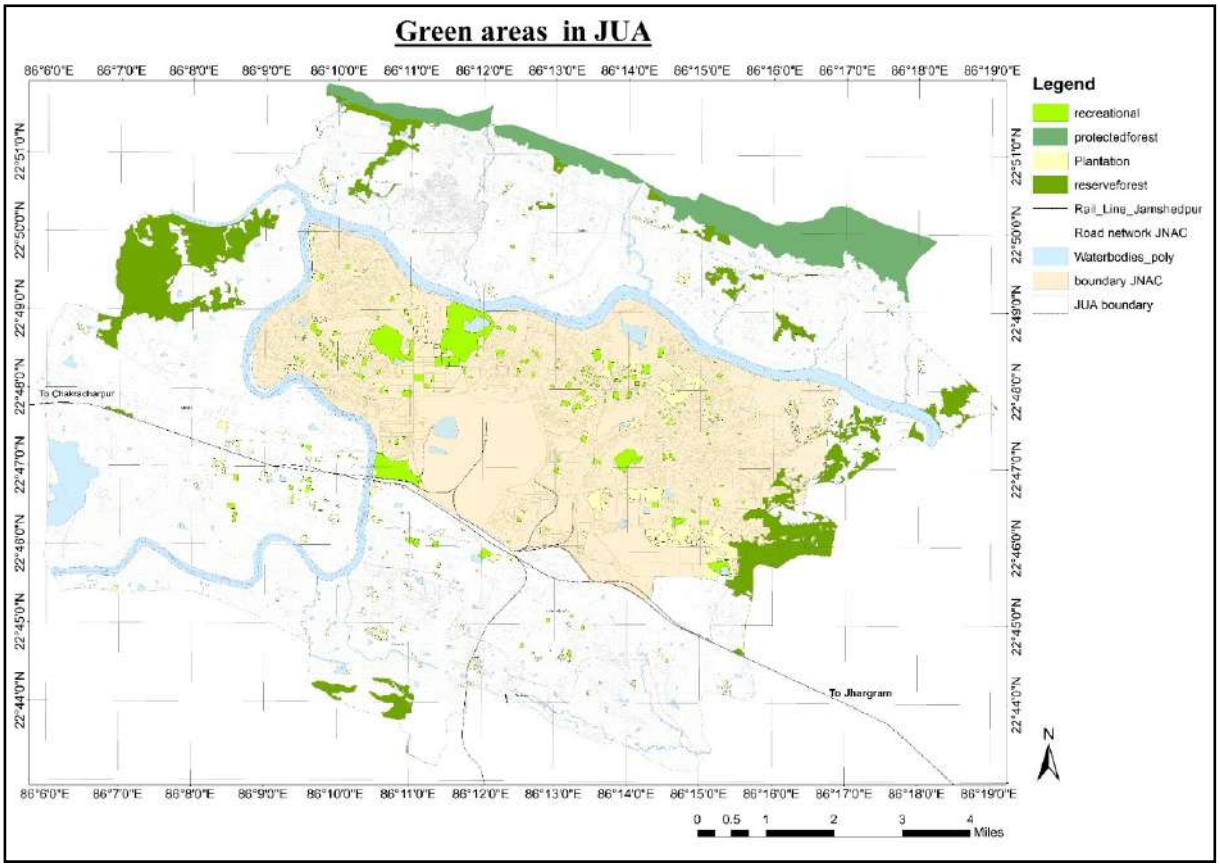
The growth of future cities depends upon how well we can plan for the 'unplanned'. The generic theme evolving is that as cities expand, the 'informal' sector grows faster than the 'formal' sector. This means that our plans will need paradigmatic change to deal with the heterogeneous housing and mobility needs of growing city populations. We will have to plan spaces for activities that cannot always be well-defined and predicted. It is better to plan for what is inevitable than to turn a blind eye to the future.

In many cases a substantial transformation of city environments will be required to create effective Green Infrastructure and achieve a better balance between green and grey. However, by recognising nature as an opportunity for an effective solution and by

[9]http://chdtransport.gov.in/Forms/CMVR_1989.pdf

realising that green infrastructure can be integrated and linked into existing and future built developments in an attractive way, the potential is there to create more livable cities with reducing impact of air pollution in particular on the people living in the cities.

Green Infrastructure including trees within cities can remove fine particles from the atmosphere and consequently improve air quality and human health.



9. GRANT SUPPORT FROM 15TH FINANCE COMMISSION

As per the 15th Finance Commission (FC-XV) constituted in 2017, Urban Local Bodies (ULBs) were divided into two categories: (a) Million plus urban agglomerations/cities, excluding Delhi and Srinagar; and (b) all other cities and towns with less than one million populations. The commission (FC-XV) has recommended grants for Million plus cities, which is allotted for Ambient Air Quality and Solid Waste Management & Sanitation. And for all other cities the Commission (FC-XV) has recommended a grant of which 50% will be untied and the remaining 50% will be tied grant.

Further to release grants for Million plus urban cities and to achieve the target on ambient air quality, the Ministry of Environment, Forest and Climate Change (MoEF&CC) is the nodal ministry to develop city wise and year wise targets on ambient air quality targets for 2020-25 based on annual average concentrations of PM10 and PM2.5.[10] Besides ambient air quality improvement, grants to Million Plus cities have also been linked for improving conservation, supply and management of water and efficient solid waste management. For this component, the Ministry of Housing and Urban Affairs is the nodal Ministry and is entrusted with development of city-wise and year-wise targets and recommend disbursals of grants to these cities.[11]

As recommended by the Commission (FC-XV), Urban Development and Housing Department (UD&HD) in consultation with Jharkhand State Pollution Control Board (JSPCB) and other stakeholders has designed the Action Plans for the control of air pollution in Jamshedpur, which is based in the operational guidelines for the implementation of the recommendation on urban local bodies by Ministry of Finance, (Finance commission Division), Govt. of India.

9.1 PERFORMANCE BASED GRANTS

As recommended in the 15th Finance Commission report to encourage the improvement in air quality in Million plus cities, the second instalment shall be disbursed against the stipulated performance-based outcomes in terms of year-on-year

[10] http://www.mohua.gov.in/upload/whatsnew/5ee874a82ec60ULBs_15FC_Operational%20Guidelines_for_2020-21.pdf

[11] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1709146

improvement in air quality in January 2021. The recommended basis of allocation of the 2nd tranche is as mentioned in Table 13 & 14.

Table 13 : Recommendation for second tranche allocation (Source: XV FC report)	
Year on Year improvement in air quality in January 2021 (%)	**Share of its allocated fund (%)**
>5	100
4-5	80
3-4	60
2-3	40
1-2	20
<1	0

In case of non-achievement targets, 50% of unallocated funds to be distributed to The top performers based on criteria prescribed in the below table, while remaining 50% to be distributed to non-million plus cities in proportion to their population.

Table 14 : Performance based criteria (Source: XV FC report)	
Year on Year in Air Quality in Jan 2021 (%)	**% of allocation of unallocated funds**
Cities with improvement > 5	40
Cities with improvement 4-5	35
Cities with improvement 3-4	25

CHAPTER II - COMPREHENSIVE CLEAN AIR ACTION PLAN

1. CLEAN AIR ACTION PLAN (CCAAP)

The Comprehensive Clean Air Action Plan identifies strategies to reduce pollution from every source in a time bound (Small, Medium and Long term) manner with control strategies involving all stakeholders with a shared responsibility. To ensure proper enforcement, the action plan will also be equipped with monitoring provisions and will also set interim mile-stones.

The Plan (see Table 15) identifies specific measures in each sector, enlisting the agencies responsible for the implementation of each of the measures with a fixed timeline. It provides short term, medium term, medium to long-term and long-term measures; where short-term measures need to be implemented immediately. On the other hand, medium-term measures should be implemented within a 1 year period. Medium to long-term measures should be implemented in 1-2 years. Long term should be implemented in 2-3 years. A draft Emergency Response Action Plan based on GRAP of Delhi and National Capital Region has also been prepared which will help in taking stringent measures and reducing emissions during severe air pollution days. Institutional arrangements to ensure timely implementation of suggested action has also been discussed. Similarly, the establishment of Project Management and Audit Units are also mentioned.

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR

Sector/ Source group	Action	Steps Being Undertaken	Time target for Implementation	Responsible Agency(ies)
Capacity building, monitoring network and source apportionment	Installation & Commissioning of Monitoring Stations	Establishment of CAAQMS	March, 2022	JSPCB, Urban Local Bodies (ULBs) like Mango, Jugsalai & JNAC

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
Public outreach		Establishment of Manual Stations	March, 2022	JSPCB, ULBs
	Air Quality Forecasting	Release regular air quality data through Quarterly and Annual Bulletin reports. An APP to be developed by JSPCB to forecast of air quality data on a regular basis	December, 2021 & March, 2022 for air bulletin reports. March 2022 for APP	JSPCB
	Assessment of Sources	Emission Inventory	November, 2021 December, 2021	JSPCB
		Source Apportionment & Carrying Study	December, 2022	JNAC
		Health Impact Studies	September, 2022	Department of Health & Family Welfare, GoJ
	Training & Capacity Building	Training & Skill Development of Public Officals	November, 2022	ULBs, JSPCB, DoEFCC & other Departments
		Infrastructure Development (Laboratory/ AQM Cell)	March, 2022	JSPCB
		Enforcement Unit	March, 2022	ULB
		Establishment of Project Management Unit (PMU) to coordinate, monitor, evaluate & future planning to contain air pollution with various departments	March, 2022	JSPCB
		MoU with IoR	Completed	JSPCB & JNAC
	Emergency Response System	Setting up of Graded Response Action Plan (GRAP)	March, 2022	JNAC

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
	Public Outreach	Daily Air Quality Public Information Dissemination System	March, 2022	JSPCB
		Sensitization for Media/ journalists	Regular intervention throughout the year	JNAC, JSPCB
		Social Media Platforms	Regular intervention throughout the year	JNAC, Mango(JUA), Jugsalai(JUA)
		Issue Public Health Advisory for prevention and control of air pollution	Regular	JSPCB/ ULB
		Deeper public engagement and consultation (workshops/ programmes in schools/ colleges)	December, 2022	JNAC, Mango(JUA), Jugsalai(JUA)
		Launch of mobile app to update public about status of air quality	March, 2022	JSPCB
		Public Outreach with residential societies & Resident Welfare Associations (RWAs)	December, 2022	JNAC, Mango(JUA), Jugsalai(JUA)
		Information, Education & Communication (IEC) Activities	Regular	ULBs
	Public Grievance Redressal System	App Based System	July 2020	JSPCB
		Helpline Number	March, 2022	JSPCB
Road dust and construction & demolition	Control of Road dust	Immediate lifting of solid waste generated from desilting and cleaning of municipal drains for its proper disposal	Regular	ULBS

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
		Maintain potholes free roads	March, 2025	ULBS
		Regular cleaning of street surfaces and spraying of water to suppress dust	March, 2022	ULBS
		Black-topping of unpaved road	February, 2023	ULBS
		Appropriate action to remove road dust/silt regularly by using mechanical sweepers	FY 2021-22	ULBS
		End-to-end paving of the road	March, 2025	ULBS
		Introduce water fountain at major traffic intersection	March, 2025	ULBS
		Widening of Roads	December, 2025	ULBS
		Improvement of infrastructure for decongestion of road		
		Implement truck loading guidelines; use of appropriate enclosures for haul trucks; gravel paving for all haul routes	March, 2022	PRD and ULBs
		Identify road stretches with high dust generation	March, 2022	ULBS
		Create Proper Pedestrian Infrastructure	March, 2024	ULBS
	Creation of Green Cover	Creation of green buffers along the traffic corridors and its maintenance	March, 2025	ULBS

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
		Necessary changes in bye-laws for Greening of open areas, gardens, community places, schools and housing societies	September 2022	ULBS
		Urban Greening with Vertical Garden	March, 2023	ULBS
		Builders should leave 15% area for green belt in residential colonies to be made mandatory	Regular	ULBS
		Implementation of maintaining at least 10% tree cover area in the city in master plan.	Regular	ULBS
	Control on Construction Activities	Ensure transportation of construction materials in covered vehicles	Regular	ULBS
		Strict enforcement of CPCB guidelines for better construction activities (use of green screens, side covering of digging sites, etc.)	Regular	ULBS
		Restriction on storage of construction materials along the roads	Regular	ULBS
		Covering of construction site.	Regular	ULBS
		To create separate space/ zone to handle solid waste, C&D waste and other wastes in the city	March, 2024	ULBs

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
		To mandate facility of tar road/gravel lined roads inside the construction site for movement of vehicles carrying construction material	Regular	ULBS
		Enforcement of Construction and Demolition Waste Rules	Regular	ULBS
		Control measures for fugitive emissions from material handlingconveying and screening operations	Regular	ULBS
		Develop and implement dust control measures for all types of construction activities, buildings and infrastructure.	Regular	JSPCB/ ULBS
		Frame and implement policy for segregation of construction and demolition waste and provide a network of decentralized C&D waste segregation and collection sites across the city.	Regular	ULBS
Steps to control emissions from vehicular pollution	Improve and strengthen PUC programme	Increase Number of Pollution Under Control (PUC) centers in the city	March, 2022	Transport Dept.
		Regular checking of Vehicular emission and issue of PUC Certificate	March, 2022 and continuous process	Transport Dept./Traffic police
		Auditing and reform of PUC certification	March 2022	Transport Dept.

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
		Linking of PUC centers with remote server and eliminate manual intervention in PUC testing.	March 2022	Transport Dept.
		Link PUC certificates with annual vehicle insurance	Sep, 2022	Transport Dept.
		Vehicle labeling or sticker programme	March 2022	Transport Dept.
	Freight transport	Use of offpeak passenger travel times to move freight and restrict the entry of heavy vehicles into cities	March 2022	Transport Dept.
		Provide truck rest areas/ parks along national and state highways to prevent entry of trucks into cities during peak hours	Dec 2022	Transport Dept.
		Diversion of truck traffic	Round the year	Transport Dept.
		Check overloading: Use Weighin-Motion bridges / machines (WIM) and Weigh bridges at entry points to the city to check the payload of commercial vehicles. As per the CMVR, a penalty of 10 times the applicable rate for overloaded vehicles is applicable.	December 2022	Transport Dept.
	Clean fuel and fuel Quality	Check on fuel adulteration and random monitoring of fuel quality data	December, 2026	Transport Dept.
		Alternative clean fuel policy for vehicle	December, 2022	Transport Dept.
		Use of Biofuel	December, 2022	Transport Dept.

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
	Parking Management	Prevent parking of vehicles in the nondesignated areas	Round the year	Transport Dept.
		Development of Multi-layer parking	Round the year	ULBS/ Transport Dept.
		Penalise parking of vehicles in nondesignated areas	Regular	Transport Dept.
	Strengthening of Public Transportation	Regulate the taxi industry	December, 2026	Transport Dept.
		CNG infrastructure for auto gas supply in the city and transition of public transport vehicles to CNG mode Introduction of e-buses for Public transport in metro cities	December 2026	Transport Dept.
		Steps for promoting battery operated vehicles like E-rickshaw/E-Cart	December 2026	Transport Dept. /JNAC
		Charging infrastructure	December, 2026	Transport Dept. /JNAC
	Traffic Congestion	Conducting audit of traffic intersections and install functional traffic signals at all major intersections	Round the year	Transport Dept.
		Synchronize traffic movements/ Introduce intelligent traffic system for lane-driving	December 2026	Transport Dept.
		Prepare plan for construction of diversion ways/ bypasses to avoid congestion due to nondestined vehicles.	September, 2022	Transport Dept.

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
		Launch Public awareness campaign for air pollution control, vehicle maintenance , minimizing use of personal vehicle, lane discipline, etc.	December 2026	Transport Dept.
	Phase out old vehicles and vehicle scrappage policy	Inspection / maintenance to all BSII & BS III	Round the year	Transport Dept.
		Restriction on plying and phasing out of 15 years old commercial diesel driven vehicles.	Dec, 2026	Transport Dept.
		Initiate steps for retrofitting of particulate filters in diesel vehicles, when BS-VI fuels are available	Round the year	Transport Dept.
	Non Motorized Transportation (NMT)	Introducing cycle tracks along with the roads	FY 2021-22	Transport Dept.
		Prepare and implement zonal plans to develop an NMT network	FY 2022-23	Transport Dept.
Step to control industrial pollution	Industrial Air Pollution Control	To intensify monitoring of industries to reduce emission	Ongoing enforcement activity	JSPCB
		Action against non-complying industrial units	Ongoing	JSPCB
		Shifting of polluting industry	Ongoing	JSPCB
		Ban on Polluting Industries	March 2022	JSPCB

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
		Random auditing for air pollution measures and online reporting systems in the industries	Regular activity	JSPCB
		Ensuring installation/ Up-gradation and operation of Pollution Control Devices (PCDs) in industries	Regular activity	JSPCB
		Action/closure against defaulting/ unauthorized industrial units.	Regular activity	JSPCB
		Ensuring emission standards in industries	Regular activity	JSPCB
		Prepare and implement local area action plan for pollution hotspots and strict enforcement of air pollution control measures in all industries, including those located in unauthorized areas.	Ongoing	JSPCB
	OCEMS in Industries	Implement Continuous Online Emission Monitoring System (OCEMS) across all targeted and applicable polluting industry	Ongoing	JSPCB
		Development of mobile facility/van for continuous ambient air quality monitoring for different localities.	FY 2021-22	JSPCB
	Clean fuel in Industries	Introduction and shifting towards cleaner fuels in industries	September 2021	DoEFCC

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
		Conversion to CNG/ PNG from pet coke / wood / coal and urgent ban on furnace oil, pet coke, which are dirty industrial fuels with high sulphur and heavy metals	September 2021	DoEFCC
	Control of air pollution from Brick kilns	Adapting new technologies for Brick kilns	March 2022	JSPCB
	Control of air pollution from Diesel generator sets	Allow only DG sets meeting emission and design of chimney/ exhaust, acoustic enclosures standards to operate	Regular	JSPCB
		Discourage use of DG sets in cellular towers. Promote use of alternate power	Regular	JSPCB
Waste and biomass-dumping and burning	Control on Biomass Burning	Regular check and control of burning of municipal solid wastes	Ongoing	ULBS
		Defaulters for open burning to be imposed fines	March, 2024	ULBS
		Identify garbage burning locations	FY 2021-22	ULBS
		Prohibition/ complete ban on garbage burning.	FY 2021-22	ULBS
		Launch extensive drive against open burning of biomass, crop residue, garbage, leaves, etc.	March, 2021	ULBS
		Regular collection and control of control of municipal solid waste	March, 2023	ULBs
		Burning of dead bodies	August 2022	JNAC

Table 15 : CLEAN AIR ACTION PLAN OF JAMSHEDPUR				
Sector/ Source group	**Action**	**Steps Being Undertaken**	**Time target for Implementation**	**Responsible Agency(ies)**
		Proper collection of horticulture waste and its disposal following compostingcum gardening approach	March, 2023	ULBs

2. GRADED RESPONSE ACTION PLAN

In the longer term, the Clean Air Action Plan is required to permanently reduce emissions by taking strong and sustained action, while the Graded Response Action Plan (GRAP) serves as an emergency response plan to rising pollution. GRAP is critical for ensuring emergency response actions and reducing high exposure during sudden spike of air pollution. Generally during winter months, the pollution levels may increase drastically due to anthropogenic and natural phenomena-combined impact of meteorological factors.

The GRAP (Table 16) includes the measures, which will immediately kick in under a particular air quality category with well-defined executing agencies. India established NAQI in 2015 to effectively communicate how clean or unhealthy air is and what associated health effects might be a matter of concern. Based on this index, daily pollutant concentrations are classified and graded as "Good, Satisfactory, Moderate, Poor, Very Poor and Severe". Each category is colour-coded so that the general public can understand the different levels of concentration and health risks associated with it. To control this unexpected increase in pollution levels, the State Government must develop a responsive action plan, and simultaneously start issuing health advisory. However, it is to be noted that the GRAP implementation requires a daily AQI level for which installation of real-time monitors is important.

Ministry of Environment, Forests and Climate Change, Govt. of India (vide its notification S.O. 118 (E), dated January 12, 2017) and CPCB has formulated Graded Response Action Plan for Delhi & NCR based on Air Quality Index and concentration of particulate matter. In consistent with the same, GRAP has been formulated for Jamshedpur as hereunder.

Table 16 : Graded Response Action Plan	
Severe + or Emergency (ambient PM2.5or PM10 concentration values of 300μg/m3 or 500 μg/m3 respectively persist for 48 hours or more)	**Agency responsible/ Implementing Agency**
Stop entry of truck traffic in city (except essential commodities)	Municipal Corporations and Traffic Police
Stop construction activities	JSPCB and Municipal Corporations
Introduce odd and even scheme for private vehicles based on license plate numbers and minimize exemptions	Transport Department,
Task Force to take decision on any additional steps including shutting of schools	District Administration
Severe (ambient PM2.5or PM10 concentration value is more than 250 μg/m3 or 430μg/m3 respectively)	**Agency responsible / Implementing Agency**
Close brick kilns and Stone Crushers	JSPCB and District administration
Increase frequency of mechanized cleaning of road and sprinkling of water on roads. Identify road stretches with high dust generation.	Municipal Corporations, Public Works Departments
Very Poor (ambient PM2.5or PM10 concentration value is between 121-250µg/m3or 351-430 µg/m3 respectively)	**Agency responsible/ Implementing Agency**
Stop use of diesel generator sets	JSPCB
Enhance parking fee by 3-4 times	Municipal Corporation
Stop use of coal/firewood in hotels and open eateries	Municipal Corporation
Alert in newspapers/TV/radio to advice people with respiratory and cardiac patients to avoid polluted areas and restrict outdoor movement.	JSPCB
Moderate to poor(ambient PM2.5 or PM10 concentration value is between 61-120 µg/m3 or 101-350 µg/m3 respectively)	**Agency responsible/ Implementing Agency**
Strictly enforce/stop garbage burning in landfills and other places and impose heavy fines on person responsible	Municipal Corporation
Close/strictly enforce all pollution control regulations in brick kilns and industries	JSPCB

Strictly enforce pollution control in thermal power plants through PCB monitoring	Plant companies/ JSPCB
Do periodic mechanized sweeping on roads with heavy traffic and water sprinkling also on unpaved roads every two days	Municipal Corporations, Traffic Police
Strict vigilance and no tolerance for visible emissions – stop plying of visibly polluting vehicles by impounding or heavy fine.	Transport Department and Traffic Police
Strict vigilance and enforcement of PUC norms	
Strictly enforce rules for dust control in construction activities and close non-compliant sites	Traffic Police
Deploy traffic police for smooth traffic flow at identified vulnerable areas	Traffic Police
Strictly enforce Supreme Court order on diversion of non-destined truck traffic	Municipal Corporation
Strictly enforce Supreme Court ban on firecrackers	Chief Controller of Explosives
Information dissemination Social media, mobile Apps should be used to inform people about the pollution levels, contact details of control room, enable them to report polluting activities/sources to the concerned authorities, and actions that will be taken by government based on the level of pollution.	JSPCB

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Under the 15th Finance Commission (XV-FC) revised COMPREHENSIVE CLEAN AIR ACTION PLAN OF JAMSHEPUR CITY has been prepared by the State Air Quality Monitoring Committee, Jharkhand.

The signature of the concerned committee members are as follows:

Member Secretary
SPCB, Jharkhand

Director
Agriculture, Animal Husbandry and Co-Operative Department, Govt. of Jharkhand

Director
State Urban Development Agency, Urban Development and Housing Department,
Govt. of Jharkhand

Commissioner,
Transport Department,
Govt. of Jharkhand

Director
Industries Department,
Govt. of Jharkhand

Special Secretary
Forest, Environment and Climate Change
Govt. of Jharkhand