

# **CLEAN AIR ACTION PLAN**

## **KALINGANAGAR**



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# 1. Mandate of framing of Clean Air Action Plan

In pursuance of the directions of the Hon'ble National Green Tribunal (NGT), Principal Bench, New Delhi, dated 8 October 2018, the Government of Odisha vide Notification dated 15 November 2018, has set up a six-member Air Quality Monitoring Committee with representation from the State Transport Authority of Bhubaneswar, Housing and Urban Development Department, Directorate of Industries, Directorate of Agriculture and Food Production, and State Pollution Control Board. This Committee is to be supervised by the Additional Chief Secretary, Forest and Environment Department, and further supervised by the Chief Secretary for intra-sectoral coordination.

Following the NGT order of 8 October 2018, the Committee has prepared appropriate action plans for six non-attainment cities, including Angul, Balasore, Bhubaneswar, Cuttack, Rourkela and Talcher. These plans have been prepared in accordance with the NGT order dated 8 October 2018, that has directed, 'Once the standards have been laid down in the statutory provisions of the Air Act, 1981, all the authorities as well as citizens are statutorily bound to follow the said standards.' The NGT direction among others has stated that the Action Plans may take into account the GRAP (Graded Response Action Plan), and the CAP (Comprehensive Action Plan) and the action plan prepared by the Central Pollution Control Board (CPCB) as well as all other relevant actors. The Action Plans were then forwarded to the CPCB on 31 December 2018.

As per the Hon'ble NGT order, these action plans have been reviewed by a three-member committee under the Chairman, CPCB. NGT has made the Chief Secretaries of the state and Administrators, or Advisors to Administrators, of the Union Territories personally accountable for failure to formulate Action Plans.

After the approval of the Action Plans for six non-attainment cities, the Chief Secretary of the state of Odisha, who heads the task force for the implementation of the plans, held a meeting with all concerned Secretaries of the concerned department (urban and housing, transport, energy, agriculture, industries, district commissioners, Municipal Corporations etc.), municipal commissioner, divisional commissioner and district collectors of all the six cities.

These Action Plans encompass vehicular pollution, industrial pollution, dust pollution, construction activities, garbage burning, residential and indoor pollution etc. The action plans also consider measures for strengthening of Ambient Air Quality (AAQ) monitoring and steps for public awareness, including issuing of advisory to public for prevention and control of air pollution and involvement of schools, colleges and other academic institutions and awareness programmes. The Action Plans indicate steps to be taken to check different sources of pollution, with speedy, definite and specific timelines for execution.

Subsequently, the Hon'ble NGT order dated 6 August 2019 has further added one more city—Kalinganagar in Odisha—to the non-attainment list whose Action Plan has to be submitted by the committee within three months of the order. The Action Plan once submitted will be reviewed by a three-member

committee that shall examine the Action Plans and will then approve to implement the plan. Kalinganagar is a small town, with a panchayat; there is no local urban body administering the city and its Action Plan has to be integrated with a local body such as the Municipal Corporation of Jajpur district.

This report is divided into two parts. Part 1 presents the overview that outlines the mandate of the committee, analysis of air-quality trends and public health evidences, and challenges in each sector that need addressing through the action planning process in the city. The sectors include industry, power plants, vehicles and mobility, and area sources, including construction activities, waste burning, road dust, use of solid fuels in domestic cooking and roadside eateries among others. This report has reviewed the available information from existing studies and reports, official databases, and information available from the implementing agencies. It also takes into account the direction of the Hon'ble NGT that states that the plans need to be linked with the carrying capacity assessment and source apportionment studies and have provided for these in this plan itself. These studies will require a longer time frame to include multiple seasons and spatial assessment and cannot be completed within the current time frame. However, this base action plan is based on the best available information from the existing databases and reports, and field assessment. This helps to identify the major sources of pollution that require mitigation measures.

Part 2 lays out the proposed GRAP and CAP for each of the six cities in tabular form that identifies specific measures in each sector, lists agencies responsible for implementation of measures, and the timeline for action. While a substantial part of the proposed measures are common and uniform as for the six cities, further customization has been done depending on the nature of the local issues and problems. The proposed action plans can be further refined and tightened based on newer evidences and air quality assessment and source apportionment studies to be undertaken in the future. This exercise is expected to be a dynamic process.

Moreover, the framing of the action plans—GRAP and CAP—has taken into account the several ongoing initiatives of the State Government of Odisha to implement strategies in each sector that have a bearing on the air quality. A range of policy measures has been implemented in different sectors of pollution control over time. They have drawn upon the existing plans as well as baseline policy measures already implemented and have been further refined based on the proposed roadmap to have one unified and integrated plan.

# **PART I: OVERVIEW**





## 2. Air-quality concern and public-health imperative

### Air-quality monitoring

Both GRAP and CAP need to be supported by a strong air-quality monitoring grid to track changes in pollution levels over time as well as daily variations. The Odisha State Pollution Control Board (OSPCB) monitors SPM, PM<sub>10</sub>, SO<sub>2</sub> and NO<sub>x</sub>. There are three manual monitoring stations—at the BRPL guest house, the regional office building and the guest house of M/s NINL. After October 2017, only two manual monitors have been functional. The manual stations additionally monitors PM<sub>2.5</sub> but the continuous data is not available.

OSPCB has shared the long-term data from the manual monitoring stations with the Committee. Data for Kalinganagar is available from 2013 for two stations. The station at the regional office was first set up at JCDL building at Pankapal, and later, from November 2018, shifted to the regional office at Dhabalagiri. The second station was at the Tata Steel officer's mess, which was shifted to the BRPL guest house in Duburi from November 2017. The third manual station was at the guest house of M/s NINL in Duburi and it has been shut after October 2017. Currently only two manual monitoring stations are working.

Manual stations provide data for two days in a week. As a result it is not possible to assess the real-time daily trend which is needed for GRAP implementation. Implementation of GRAP—which is an emergency response to daily air quality—requires continuous online reporting of air-quality data of all criteria pollutants monitored in real-time. Manual monitors normally report data twice a week and there is time lag, which is not suitable for GRAP implementation. Criteria pollutants, which include PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, SO<sub>2</sub>, ozone and CO are considered for GRAP implementation as these have serious short-term health impacts (in addition to longer-term health impacts) on those suffering from cardiac and respiratory conditions and asthma.

In view of the Hon'ble NGT order regarding the air-quality monitoring stations, the proposed Action Plan has recommended a plan for further strengthening of the monitoring grid. The NGT has directed that the scope of monitoring should be expanded to include all twelve notified parameters as per Notification No B-29016/20/90/PCI-L dated 18 November 2009 of CPCB. It further stated that continuous ambient air quality monitoring stations (AAQMS) should be preferred to manual monitoring stations. And, all such ambient air quality monitoring stations shall be connected to CPCB's central server to report the analysis of results in a form of an air quality bulletin for the general public at regular intervals at least on weekly basis and ambient air quality on a continuous basis on an e-portal. MoEF&CC will provide requisite funds for the purpose.

An assessment of the current monitoring framework in the city indicates that the city could certainly benefit from expansion of the monitoring grid and the number of monitors especially the real-time monitors. To estimate the number of additional real-time monitors that will be needed, the CPCB criteria have been adopted. The required number of stations has been estimated based on the CPCB's Monitoring Network Distribution Guidelines, 2011. The formula for calculating the number of stations required by a city takes into account the city's population. Given the absence of more recent data, Census 2011 data has been used. It indicates that the minimum number of monitoring stations required by

this city should be four. Currently, all the stations in Kalinganagar are manual and do not provide daily air-quality data. Future expansion will require real-time stations. It is also possible to further explore the possibility of low-cost sensor-based monitoring to develop local area hotspot Action Plans. In fact, the concept note of the Ministry of Environment and Forest and Climate Change, Government of India (MoEF&CC) on the National Clean Air Programme has recommended to assess this possibility. This can help to assess a much larger area that are not yet covered by the regulatory monitors to generate baseline data for local action.

### Air-quality trends in the city

Non-attainment status of cities implies consistent high-level of air pollutants above the national ambient air quality standards. In Kalinganagar, PM<sub>10</sub> and PM<sub>2.5</sub> are the major concerns. The respirable particles come from a variety of sources; they consist of finer particles too that are largely contributed by fossil fuels and combustion sources. While a predominant pollutant is taken as a reason for non-attainment, in reality air in urban areas is laced with numerous pollutants (of these, twelve are regulated under NAAQS). As cities are setting up more monitoring stations, new areas of high exposure/high air pollution can be identified.

The NGT order has directed that the Action Plans should enable compliance with the National Ambient Air Quality Standards (NAAQS). In the longer term, emissions must be permanently reduced so that the National Ambient Air Quality standards are maintained at least for 98 percentile of the days in a year (as per the Air Act, 1981) and peak pollution episodes are prevented. This requires a more comprehensive Action Plan with short- and long-term measures and targeted reduction over time to attain the national ambient air quality standards and to address the non-attainment status. Air-quality monitoring allows assessment of the level of non-compliance from the national ambient air quality standards.

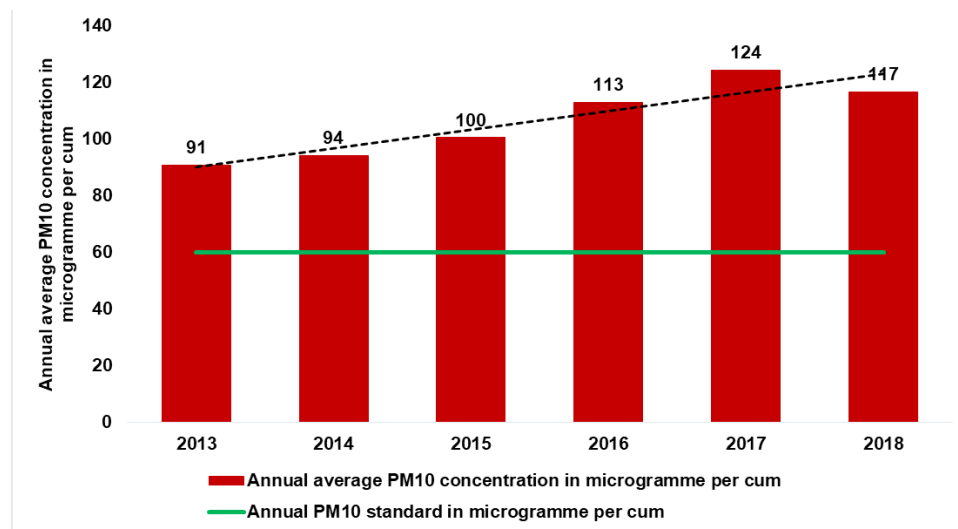
To meet the NAAQS, it may help to assess the target reduction required. Longer-term trend analysis helps to understand impact of action on longer-term ambient concentration as well as to assess the current baseline of the pollution concentration and the target reduction needed to meet the national ambient air quality standards. As per the international best practice such as the method used by the US Environmental Protection Agency (USEPA), an annual average of the immediate past three years is taken to define the base pollution level and, accordingly, the target reduction is set. This helps to assess the level of reduction that is needed to meet the clean air standards. Accordingly, target for pollution reduction is set to guide action and prepare action plans. Setting such targets helps to determine the level of reduction that is needed and, accordingly, work out the detailed measures for all sources of pollution.

If a similar method is applied to the air-quality data of Kalinganagar obtained from Odisha Pollution Control Board, the indicative reduction for the city works out to be 49 per cent for PM<sub>10</sub> and 18 per cent for PM<sub>2.5</sub>. The baseline year for calculating the reduction target is considered to be 2016–18 for PM<sub>10</sub> and 2015–17 for PM<sub>2.5</sub>. These reduction targets to meet the annual average ambient air quality standards and to sustain this over time are significant. This is expected to define the level of detail and stringency needed in action to achieve clean air. However, it is important to emphasize that more effective air quality profile will emerge once the real-time monitoring is established in all cities. It is evident that manual monitoring underestimates pollution compared to real time monitoring.

To understand the longer-term trends in annual average levels, available PM10 data has been analysed. The long-term annual average PM2.5 data is not available. The trend was analysed based on the two sets of data. One was provided by the OSPCB and the other was taken from the CPCB Envis Centre database (see *Graph 1: PM10 trends in Kalinganagar*). The city is showing a rising trend in annual average PM10 levels. According to the data provided by OSPCB, Kalinganagar requires to reduce their PM10 concentration by 49 per cent from the current base level to meet the annual standard. Based on CPCB Envis Centre, the city needs to reduce PM10 levels by 47 per cent to meet the annual standard. In the first case this was calculated using the average PM10 concentration for three consecutive years, which is 2015–17, while in the second case it was taken as 2016–18

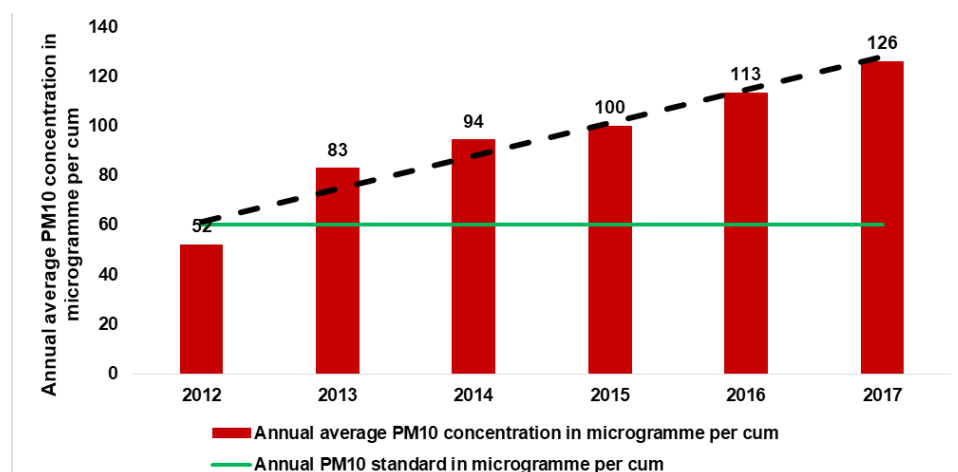
### Graph 1: PM10 trend in Kalinganagar

Based on the data provided by OSPCB (2013–18)



Source: CSE's analysis based on the data provided by OSPCB

Based on the CPCB Envis Centre (2012–17)

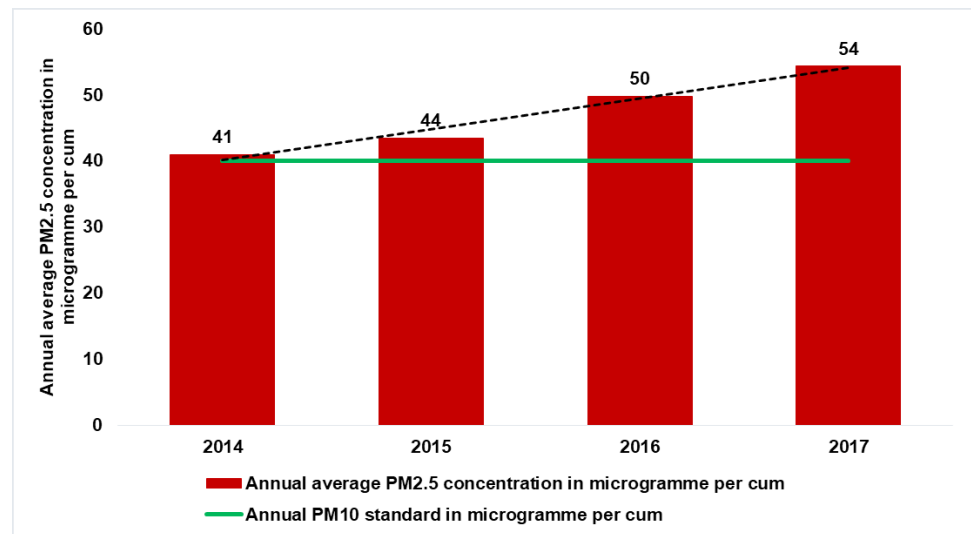


Source: CSE's analysis based on the CPCB Envis Centre air quality database

Some data is also available for PM<sub>2.5</sub>, whose trend was analysed. The trend was analysed based on the two sets of data. One was provided by the OSPCB and the other was taken from the CPCB Envis Centre air-quality database (see *Graph 2: PM<sub>2.5</sub> trends in Kalinganagar*). The city is showing a rising trend in annual average PM<sub>2.5</sub> levels. According to the data provided by OSPCB and CPCB Envis Centre, Kalinganagar requires to reduce their PM<sub>2.5</sub> concentration by 18 per cent from the current base level to meet the annual standard. In both the cases this was calculated using the average PM<sub>2.5</sub> concentration for three consecutive years, which is 2015–17.

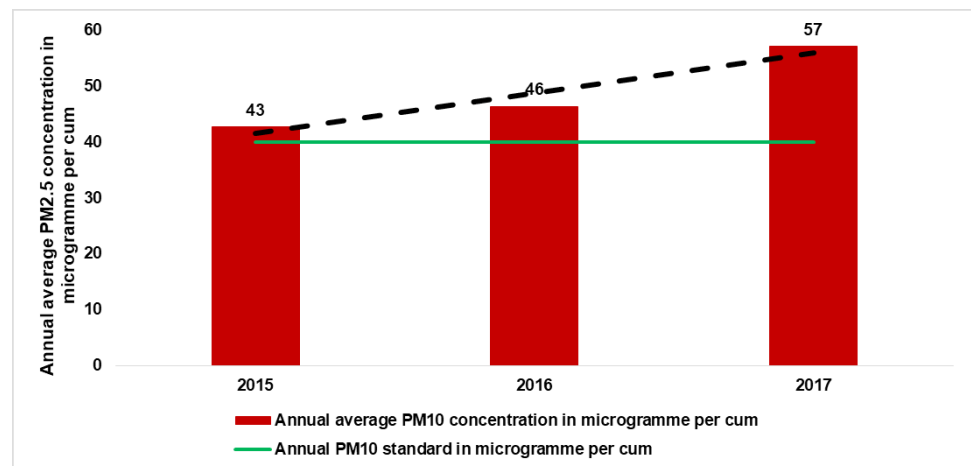
**Graph 2: PM<sub>2.5</sub> trend in Kalinganagar**

Based on the data provided by OSPCB (2014–17)



Source: CSE’s analysis based on the data provided by OSPCB

Based on the CPCB Envis Centre (2015–17)



Source: CSE’s analysis based on the CPCB Envis centre air quality database

Station-wise distribution of annual PM<sub>10</sub> levels over the years: Air quality management also requires identification of pollution hotspots and trends. This helps to define more targeted action for the effective impact on air quality. The

CPCB defines cities as critically polluted if the annual average levels of criteria pollutants are more than 1.5 times the standard. Levels up to 1.5 times the standard are labelled high; levels dipping till 50 per cent of the standard are considered moderate. Below this they are low. For instance, for PM<sub>10</sub> annual average standard or safe level is 60 microgramme per cubic metre. And as per the classification cities with annual average level more than 50 per cent of the standard are termed as (1) ‘critical pollution level’, i.e. annual average levels more than 90 microgramme per cubic metre. (2) Up to 50 per cent above the standard is termed ‘high pollution level’, i.e. 60–90 microgramme per cubic metre. (3) From 50 per cent of the standard to the standard limit is termed ‘moderate pollution level’, i.e. 30–60 microgramme per cubic metre (4) Below 50 per cent is termed ‘low pollution level’, i.e. 0–30 microgramme per cubic metre.

Based on the data available from OSPCB, it is possible to see the trend in air quality status and the monitoring locations in the city based on the CPCB classification since 2013. This shows that all locations in the city where monitoring is done are either highly or critically polluted with respect to PM<sub>10</sub> (see *Table 1: PM<sub>10</sub> status in monitoring locations based on CPCB classification of air quality*). For instance, two monitoring stations in Kalinganagar have worsened from high to critically polluted status since 2013. The third station at the guest house of M/s NINL have remained critically polluted.

**Table 1: PM<sub>10</sub> status in monitoring locations based on CPCB classification of air quality**

Location	Year					
	2013	2014	2015	2016	2017	2018
Regional Office Building	H	C	C	C	C	C
BRPL Guest House (Tata Steel Mess)	H	C	C	C	C	C
Guest House of M/s NINL	C	C	C	C	C	-

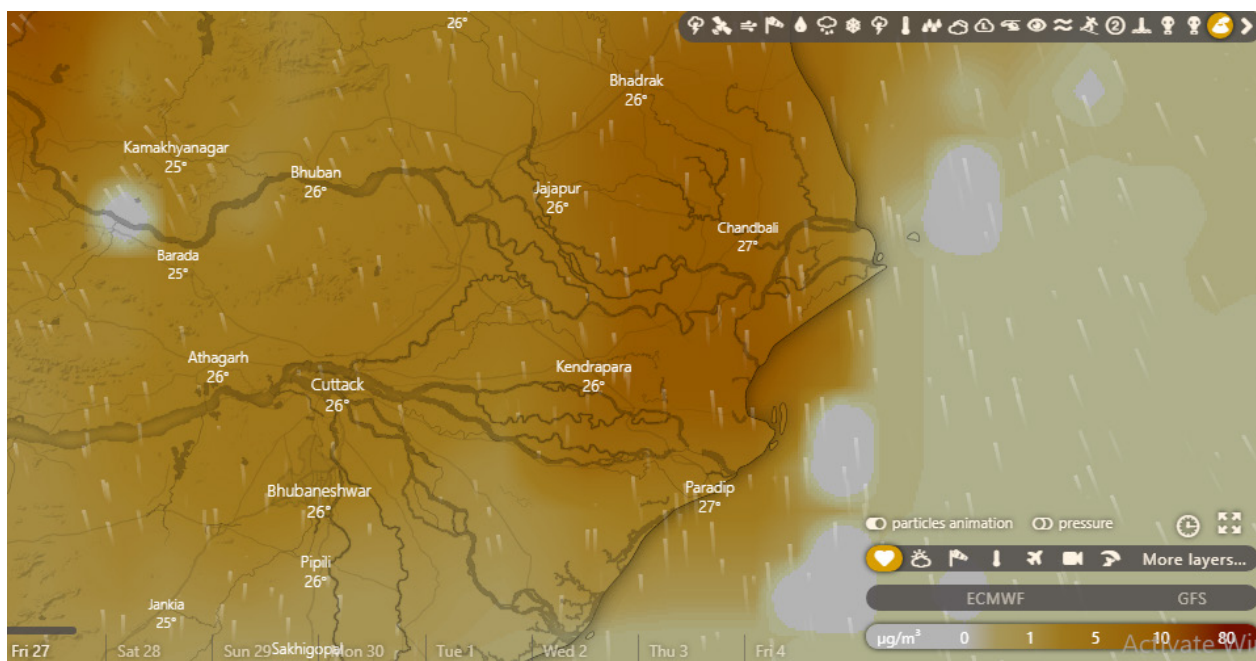
Note: C is critical; H is high

Source: Based on air-quality data provided by OSPCB.

### Trend in NO<sub>2</sub> and SO<sub>2</sub> levels

The concentration of both the pollutants in Kalinganagar have remained well below the standard throughout the period. Nitrogen dioxide levels require special attention as they are strongly correlated with motorization and industrialization. NO<sub>2</sub> also contributes towards ozone formation, another very harmful gas.

However, given the high usage of coal by the industries in the area, SO<sub>2</sub> build-up will require greater scrutiny as studies in India and also that by the CPCB have shown that SO<sub>2</sub> may also contribute to the formation of secondary particulate and increase the particulate concentration in the air. The satellite imagery of the state of Odisha shows build-up of SO<sub>2</sub> (see *Map1: Sulphur dioxide mass cover over Odisha*). The dark-coloured patches over the Odisha state show high SO<sub>2</sub> mass. The main sources of SO<sub>2</sub> in the air are the industrial activities that process materials that contain sulphur, for example, generation of electricity from coal. Some mineral ores also contain sulphur, and sulphur dioxide is released when they are processed. In addition, industrial activities that burn fossil fuels can be an important source of SO<sub>2</sub>. It is also released as a result of fuel combustion in vehicles but then the motor vehicles are not the main source of SO<sub>2</sub> in the air.

**Map 1: Sulphur dioxide mass cover over Odisha**

Source: As per windy.com, as accessed on 25 September 2019

### Trend in daily air-pollution levels and GRAP implementation

As air quality monitoring in the city is based on manual monitors, it is not possible to classify the days according to the severity of daily air pollution levels (24 hours) that is needed for emergency action like GRAP when smog builds up.

GRAP is designed for short-term emergency response to control daily pollution peaks and reduce exposure and associated health risk. Smog episodes largely occur when weather is adverse, with calm atmosphere or no wind, cold temperature and lower mixing height of air that traps air and pollution very close to the ground. This increases exposure drastically. While nothing can be done to control weather or to remove trapped emissions already present in the atmosphere, short-term policy action can control further loading of emissions and prevent higher smog peaks. This is needed to reduce exposure and protect public health.

For this purpose, MOEF&CC notified the National Air Quality Index (NAQI) and a corresponding health advisory in 2015. Based on this index, daily pollutant concentrations are classified and graded as good, satisfactory, moderate, poor, very poor and severe and colour-coded so that the general public can understand the gravity of the problem. The health advisory has also been framed to indicate the expected health outcomes at varying severity of daily air pollution (see *Table 2: National Air Quality Index of India* and *Table 3: Health Advisory at different AQI levels in India*).

GRAP implementation requires automatic real-time air-quality monitoring and daily real-time data gathering and online reporting system to enable decision making on a day-to-day basis. Whichever pollutant is shown to be leading

by the index will determine the nature of interventions as predefined in the GRAP. Thus, GRAP needs to be supported by real-time automatic and online air quality monitoring and continuous reporting of daily air-quality data to assess the rolling daily average to help in decision making.

**Table 2: National Air Quality Index of India**

AQI category (range)	PM10 24-hour	PM2.5 24-hour	NO <sub>2</sub> 24-hour	O <sub>3</sub> eight-hour	CO eight-hour (mg/m <sup>3</sup> )	SO <sub>2</sub> 24-hour	NH <sub>3</sub> 24-hour	Pb 24-hour
Good (0–50)	0–50	0–30	0–40	0–50	0–1.0	0–40	0–200	0–0.5
Satisfactory (51–100)	51–100	31–60	41–80	51–100	1.1–2.0	41–80	201–400	0.5–1.0
Moderately polluted (101–200)	101–250	61–90	81–180	100–168	2.1–10	81–380	401–800	1.1–2.0
Poor (201–300)	251–350	91–120	181–280	169–208	10–17	381–800	801–1,200	2.1–3.0
Very poor (301–400)	351–430	121–250	281–400	209–748*	17–34	801–1,600	1,200–1,800	3.1–3.5
Severe (401–500)	430+	250+	400+	748+*	34+	1,600+	1,800+	3.5+

Note: Ambient concentration values of all regulated pollutants are compared with corresponding standards, and an exceedance factor is used for qualitative assessment of air quality.

Source: Ministry of Environment and Forest and Climate Change

**Table 3: Health advisory at different AQI levels in India**

AQI	Associated health impacts
Good (0–50)	Minimal impact
Satisfactory (51–100)	Minor breathing discomfort to sensitive people
Moderately polluted (101–200)	May cause breathing discomfort to the people with lung disease such as asthma and discomfort to people with heart disease, children and older adults
Poor (201–300)	May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart disease
Very poor (301–400)	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases
Severe (401–500)	May cause respiratory effects even on healthy people and serious health impact on people with lung or heart diseases. The health impacts may be experienced even during light physical activity

Source: Ministry of Environment and Forest and Climate Change

### 3. Public-health imperatives of CAP and GRAP

Significant health impact evidence has emerged nationally and globally to establish immediate trigger effect of air pollution on cardiac and respiratory conditions that increase health risks especially for elderly and children. This is relevant for the GRAP strategy. Moreover, large-scale studies have confirmed long-term impact of air pollution on metabolic diseases and cancers even at annual average levels of pollution that are much lower than what is observed during short-duration smog episodes. This requires a CAP strategy. Therefore, GRAP and CAP are needed to reduce both short- and longer-term health risks.

A 2018 Lancet report on the impact of air pollution on deaths, disease burden, and life expectancy across the states of India estimated that in 2017, 31,118 deaths were attributed to air pollution in Odisha. The death rate per 100,000 population attributable to air pollution in Odisha is 65.3, which is almost same as that of Delhi. Life expectancy at birth in Odisha is 68.5 years, which is less than the average for India, i.e. 69 years. If air pollution concentration could be lowered, the life expectancy in Odisha could increase by 1.2 years. The number of deaths due to household air pollution (17,633) is greater than the number of deaths due to ambient air pollution (11,985) in Odisha. It is important that use of solid fuels for cooking in the state has continued to remain a high-risk factor. The 2015 Air Pollution and Health Impact report of the Ministry of Health and Family Welfare has stated that indoor pollution is responsible for about 25 per cent of the outdoor air pollution in the country. This therefore, indicates clean energy access even for domestic cooking will have to be part of the mitigation strategy.

In 2017, the first ever state-level disease burden estimates released by IHME, ICMR and PHFI showed that air pollution ranks as the second-largest risk factor responsible for the premature deaths in Odisha. In the disease profile of the state, ischaemic heart disease and lower respiratory infections have been identified as the leading cause of productive life year's loss in Odisha. These diseases are greatly influenced by air pollution. Air pollution is a serious short term trigger factor for causing early deaths due to heart diseases.

This risk can be worse if a range of modifiers, including poverty, high levels of pollution etc. that can enhance the health effect due to pollution and increase the burden on the healthcare system of the cities. If the number of days in the cities starts to remain in poor to severe category then the increase in evidences on burden of illness and emergency hospital admissions will increase. These evidences bring out the merit of adopting emergency responsive measures for daily protection and prevention strategies to lower risk for illness, hospital admissions and premature deaths.

The health risk of air pollution has already been borne out by studies in other regions of the world. Studies conducted at a massive scale, such as those carried out in the US, show that an increase of only 10 microgramme/cum of PM<sub>2.5</sub> is enough for significant increase in health risks. High exposure to PM<sub>2.5</sub> is known to lead to increased hospitalization for asthma, lung diseases, chronic bronchitis and heart damage. Long-term exposure can cause lung cancer. Rising levels of nitrogen oxides can also have serious implications for respiratory diseases.



Widely available national and global health evidence shows that when criteria pollutants, including PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>x</sub>, SO<sub>2</sub>, and ozone—exceed the standards or breach higher levels, it can have immediate trigger effect on health conditions related to cardiac and respiratory ailments and strokes. Even short duration exposure to high levels can increase rate of illness among vulnerable and emergency hospital admissions and cause early deaths. Therefore, the health advisory attached to the National AQI states the potential effect of pollution on different groups of population, especially the vulnerable sections, including children, elderly and those suffering from cardiac, respiratory ailments and asthma.

High daily pollution levels can have serious short-term impacts. The health advisory of the national AQI and Delhi–NCR’s GRAP state that those suffering from heart diseases, asthma, and other respiratory disease may consider avoiding undue and prolonged exposure, minimize unnecessary travel, use public transport and avoid using private vehicles among others. Similar advisories in other countries are more elaborate and are widely disseminated. They advise children to discontinue vigorous outdoor activities regardless of duration. Outdoor physical education classes, sports practices, and athletic competitions are rescheduled or cancelled. Those with heart or lung disease need to avoid outdoor activity. Advisories encourage public to reduce unnecessary driving and promote ride share, and encourage employers to limit the amount of time their employees work outdoors. Thus, emergency measures are designed globally to advise people to take precaution and reduce exposure. Additionally, governments take short-term emergency action like GRAP to prevent pollution from worsening.

Simultaneously, longer-term systemic strategies need to be put in place to reduce pollution levels over time and reduce long-term risks of developing and worsening respiratory diseases, metabolic diseases and cancer. Widely investigated links between air pollution and a range of disease profiles have demonstrated an insidious link between air pollution and COPD, ischaemic heart diseases, hypertension, diabetes, effect on brain and a range of cancers. Air pollution is a serious risk factor. In fact, in 2012, WHO classified a group of air pollutants as Class I carcinogens and has specially classified diesel emissions as Class I carcinogen for its strong links with lung cancer. Air pollution is a serious contributory risk factor.

Most metabolic diseases and cancers develop over time and are triggered by longer-term exposures. Studies show that these effects occur at an annual average level that is much lower than the levels recorded in the city. This requires reduction in annual average levels not to the level of national air quality standards but further down to the level of WHO guidelines for public health protection.

As part of this action planning process health impact studies will be carried out to understand the unique factors and other local modifiers that influence health impact of air pollution to further help refine mitigation strategies. Therefore, both emergency response measures like GRAP and a comprehensive action plan (CAP) need to be designed to reduce short-term as well as long-term health risks.

## 4. Air-pollution challenges and baseline policy action in non-attainment city of Kalinganagar

Any air pollution control strategy will need baseline information on the sources of air pollution and their relative contribution to ambient air pollution concentration as well as population exposure. There is currently no official study on source apportionment and source inventory to bring greater precision in the assessment of the pollution profile of Kalinganagar. Once these studies are carried out in the non-attainment cities, the action plans can be further modified/refined. The Action Plan therefore proposes detailed source apportionment and source inventory studies for the city.

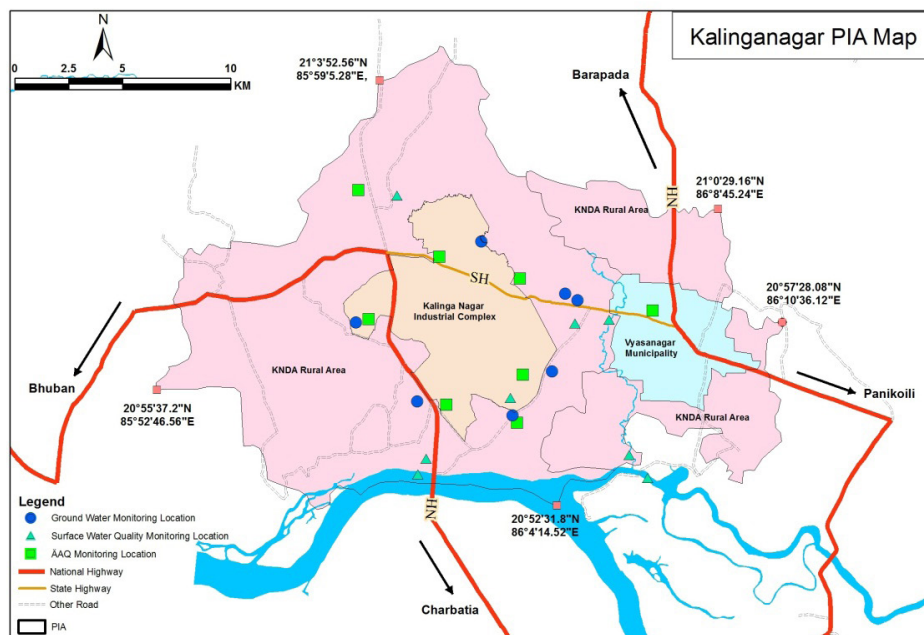
However, for the purpose of the preparation of this base plan, a broad range of information on the gamut of sources in the city is available from OSPCB. It is also possible to piece together the fragmented estimates on the pollution sources that exist from different studies done over time.

For the purpose of this report, a field visit was organized to identify the key pollution sources in the city. Also, feedback was received from the concerned regional office of SPCB. This has helped to map out the key big sources of air pollution—which are industrial, mining, domestic and vehicular. Even though exact quantification is not possible without detailed source apportionment and inventory studies, which will be carried out in the future—it is possible to define the key measures based on the best practices and also keeping in view the desired reduction target that requires deep cuts in emissions from all sources. However, the emphasis has changed depending on the difference in the dominance of pollution sources across six cities.

The Comprehensive Clean Air Action Plan for the city has been developed based on the review of the current challenges in each sector, and existing and emerging policy action. Review of the baseline policy action in each sector is important to align all ongoing and emerging policy initiatives across all sectors with the objective of meeting the clean air targets and identify additional measures that are needed for an effective roadmap. Several pollution control measures and also infrastructure development are underway in different sectors that have bearing on air quality. Recognizing this inter-relationship between different sectoral actions is important to maximize impacts and air quality benefits.

### Industrial pollution

Odisha is a rapidly industrializing state and has well-defined industrial belts and clusters that will require locally appropriate action. The project impacted area (PIA) in the state is dominated with RED category of industries. There are 13 of '17- category' of highly polluting industries (RED-A) and four of '54-category' (RED-B) industries. Given the profile and nature of industry in the state, industrial pollution control and stringent compliance will require special as these have significant impact on the densely populated habitats and urban air quality. There are also slag processing industries (for metal recovery) which comes under orange category—there are 15 of them.

**Map 2: Kalinganagar PIA map**

Source: Provided by OSPCB

The major industries contributing to air pollution are the integrated steel plants of Tata Steel, JSL, JUSL, VISA Steel, NINL, MESCO, Maithan Ispat and Yazdani Steel and sponge iron plants like KJ Ispat besides the cement grinding unit of M/s Emami Cement and the ferro alloy plant of Miriril Mines etc. Apart from the above sources, fugitive emissions from the burning of wood and coal as domestic fuel, transportation of vehicles and emissions from the railway siding also contribute to air pollution in the area.

Around the city, there are approximately 300 stone crushers, which cause heavy pollution in the city. Though notices have been issued to 230 stone crushers and have also been sealed, they still operate at night. Many complaints have been registered. Crushers are largely located in Anjeera, Chadeidhari, Rahadpur, Bajabati, Dankari etc.

A large number of industries are registered with the Odisha Pollution Control Board (OSPCB). OSPCB maintains a record of all regulatory orders, including closure and guidance, on its website. A review of the regulatory orders passed between 2015 and 2017 shows that most industrial set-ups that have boilers or furnaces are equipped with air pollution control system like electrostatic precipitators (ESPs), cyclones and scrubbers etc. However, there are concerns around enforcement and proper operations of pollution control systems. This will require more rigorous on-site continuous emissions monitoring system (CEMS) for compliance.

There is however no clear estimate of the number of informal industrial units across these cities. Since these units are unregulated, there might not be any emission controls in place. These units are known to have high fugitive emissions and are not amenable to stack monitoring. The state pollution control board would need to maintain an inventory of these units. In fact,

comprehensive strategies are needed for overall control of fugitive emissions in the industrial sector.

Individual industries and industrial units will require mapping of the status and operation of the pollution control equipment and their severity for further action. Such efforts are underway. The major power plants in the city are the captive thermal power plants which is owned by the big industries (see Table 4: Air pollution control measures in major air polluting industries).

**Table 4: Air pollution control measures in major air polluting industries**

S. no.	Name of the industry	Product	Capacity	Air pollution control equipment and measures
1	TATA STEEL Kalinganagar	Coke ovens ( Battery no.1 and 2)and byproduct recovery plant, electricity ( 2X 67.5 using LDO/ BF gas only), blast furnace with TRT (4300 m <sup>3</sup> ), sinter plant (496 m <sup>2</sup> ), hot strip mill, steel melting shop, lime calcination plant and oxygen plant	6 MTPA	ESP, bag filters at all individual units. Dry fog type water sprinkling system installed at all raw material handling area. Work zone area has been concreted. Water spray system at screening and crushing area. Online monitoring system at most important Chimney and online ambient air quality monitoring system installed with direct data transfer facility
2	Jindal Stainless Limited	Ferro chrome plant, ferro manganese plant, silico manganese plant, steel melting shop, cold rolling mill, electric power (CPP), metal recovery plant, briquette plant and oxygen plant.	0.8 MTPA	It has installed ESP, bag filters at all individual units. Dry fog type water sprinkling system installed. Work zone area has been concreted. Water spray system at screening and crushing area. Fixed type water sprinkling system installed at all internal roads. Online monitoring system at most important Chimney and online ambient air quality monitoring system installed with direct data transfer facility.
3	Jindal United Steel Limited	Hot strips mill	1.6 MTPA	
4	Jindal Coke Limited	Coke oven	0.425 MTPA	
5	Visa Steel Limited	Ferro chrome plant (FAP), electricity ( 75 MW), blast furnace (250 m <sup>3</sup> ), DRI 2x 500 TPD, SMS and rolling mill	1.5 MTPA	Dry fog type water sprinkling system installed at all raw material handling area. It has installed ESP, Bag filters at all individual units. Internal roads are black topped. Online monitoring system at most important Chimney and online ambient air quality monitoring system installed with direct data transfer facility.
6.	Visa Coke	Coke oven plant	4 LTPA	
7	Neelachal Ispat Nigam Limited	Coke oven and byproduct recovery plant, electricity ( 62.5 MW), blast furnace (1950 m <sup>3</sup> ), sinter plant (1.71 MTPA) and steel melting shop	1.81 MTPA	It has installed ESP, bag filters. Dry fog type water sprinkling system installed at all raw material handling areas. Work zone area has been concreted. Internal roads are black topped. Sensor based water spray system at raw material handling area. Online monitoring system at most important Chimney and online ambient air quality monitoring system installed with direct data transfer facility.

S. no.	Name of the industry	Product	Capacity	Air pollution control equipment and measures
8	MESCO Steel	Electricity (9 MW gas based), blast furnace (2x 0.23 MTPA) and sinter plant 2 x 36 m <sup>2</sup> (29,800 MT/Month each).	0.521 TPA	Internal roads are black topped. It has installed ESP, Bag filters at major dust prone area of all individual units. Dry fog type water sprinkling system installed at all raw material handling area. Fixed type water sprinklers at all internal roads. Work zone area has been concreted.  Online monitoring system at most important Chimney and online ambient air quality monitoring system installed with direct data transfer facility.
9	Maithan Steel	DRI (2 x 350 TPD kiln), Electricity 30 MW (14 MW WHRB + 16 MW AFBC), Blast Furnace (2x 0.23 MTPA) Induction furnace and rolling mill.	0.2 MTPA	It has installed ESP, bag filters. Internal roads are black topped. Dry fog type water sprinkling system installed at all raw material handling area. Fixed type water sprinklers at all internal roads. Work zone area concreted. Online monitoring system at both Chimney and online ambient air quality monitoring system installed with direct data transfer facility.
10	Yazdan Steel & Power Limited	DRI (2 x 100 TPD kiln), Electricity (10 MW (4 MW WHRB + 6 MW AFBC), Induction Furnace and Rolling mill	0.16 MTPA	It has installed ESP, bag filters. Internal roads are black topped. Dry fog type water sprinkling system installed at all raw material handling area. Fixed type water sprinklers at all internal roads. Online monitoring system installed at Chimney with direct data transfer facility.
11	Rohit Ferro tech Limited	Ferro Chrome	1,00,000 TPA	It has installed individual bag filters, pressurized water sprinklers and separate GCP.
12	Kj Ispat Limited	DRI Kiln	2 x 100 TPD	ESPs and bag filters. Online monitoring system installed at chimney with direct data transfer facility
13	Brahmani River Pellets Limited	Pellet Plant	4 MTPA	ESPs, bag filters and wet scrubber
14	Emami Cement Limited	Cement Grinding Unit	2 MTPA	ESPs and bag filters. Online monitoring system installed at chimney with direct data transfer facility
15	Misrilal Mines Private Limited (Ferro Alloy Unit)	Ferro Chrome	15000 TPA	ESPs and bag filters
16	IDCOL Ferro Chrome Limited	Ferro Chrome	1800 TPM	GCPs and bag filters
17	B.C. Mohanty & Sons (Ferro Alloy Unit)	Ferro Chrome	12500 TPA	GCPs and bag filters
18	Balasore Alloys Limited (Ferro Alloy Unit)	Ferro Chrome	15660 TPA	GCPs and bag filters
19	Anand Exports	Chrome ore Concentrate	60000 TPA	Bag filter and dry fog

Source: As provided by the OSPCB

There are eight coke oven plants around the city (within 50 km), out of which four are closed. These also come under red category of industries. Around 30-35km area from the city there are 11 chromite mines, largest deposit of chromite in Asia. Raw materials is transferred to the city from these chromite area.

Emissions standards and siting policy: Industrial pollution management is governed by the emissions standards fixed by the Central Pollution Control Board. Both existing and new standards will have to be implemented with strong compliance and penal requirement. While the ongoing effort will be strengthened further, the new set of emissions standards that have been framed recently will require immediate implementation. The case in point are the new SO<sub>x</sub> and NO<sub>x</sub> standards that have been notified by the MoEF&CC for 16 groups of industries following the direction of the Supreme Court on 29 January 2018. Further strengthening of siting policy for industrial units will help to reduce exposure and public health risk in populated areas.

Star rating system: In order to bring more compliance with pollution standards and transparency in air pollution control efforts in industries and also incentivize quicker uptake of improved emissions control system, Odisha government on September 2018 has launched a 'Star Rating' system for industries, the first-of-its-kind initiative in the state. The programme, will rate industries from 1 to 5 based on their efforts to meet the standards set by Odisha's pollution control board and is expected to strengthen the pollution board's regulatory efforts.

This system is expected to encourage industries to adopt clean technologies. Also 'Star Rating' programme will help public to know if the industries in their vicinity are complying with environmental requirements. It will also recognize the efforts of industries that take responsibility to maintain clean environment. A website has been launched where citizens can access information in this regard.

Clean fuel strategy: In addition to improving and advancing the emission control systems in industry, ensuring use of cleaner fuels will provide more systemic solution. Often due to wide difference in pricing of industrial fuels dirty bottom of the barrel fuels like petroleum coke and fuel oil etc. are widely used. In smaller units unregulated fuels like tyre oil etc. are used. The OSPCB is considering change over to cleaner fuels like oil or gas to reduce particulate emission load from industrial operations. This is a step in right direction and in line with the action being taken in other states to control and discourage dirty fuels.

Clean fuel strategy along with stringent emissions control systems will require incentive policy to make a supply plan and infrastructure for cleaner fuels, adopt favourable taxation and pricing policy to make cleaner fuels competitive vis a vis the dirty fuels and help to phase in clean fuels for industries (such as natural gas, electricity, and low sulphur fuels). Access to natural gas and oil is improving in the state and may leveraged to promote their usage in the industrial sector as much as possible with a proper pricing and regulatory policy. Industries that will be using coal will require stringent emission control system and monitoring.

Dirty fuels are also used in small and unauthorized units without pollution control systems. There are also risks of several unregulated oil like recycled oil, tyre oil etc. filtering in causing enormous toxic pollution. Therefore notified approved fuels list can help to counter such risks in all sectors. Some cities like

Delhi have issued notification on the list of approved fuels that can be used in different sectors.

In view of the growing use of heavy furnace oil in the sector it is important to take on board the national level development in this regard for future reference and roadmap. In response to the concerns over the growing use of pet coke and furnace oil (FO) in industry that have very high sulphur and heavy metal content have led to the notification on the emissions standards for SO<sub>x</sub> and NO<sub>x</sub> following the direction of the Hon'ble Supreme Court. This is needed to enable effective uptake of improved emissions control systems to control these gases. Testing of Petroleum Coke and Fuel Oil used for combustion in Delhi for instance was found to contain as high as 75,000 ppm and 20,000 ppm sulphur respectively.

But current transport fuels have 50 ppm sulphur that will be further lowered to 10 ppm sulphur in 2020. Fuels containing high levels of Sulphur lead to high emission of particulates; gaseous emissions like SO<sub>x</sub> and contribute to 'secondary' particulate load. High sulphur fuels also contain heavy metals, which adds to the toxicity and contamination of the environment. It may be noted that the Supreme Court of India vide order of 24 October 2017 has banned use and sale of petroleum, coke and fuel oil, in Haryana, Rajasthan and Uttar Pradesh. Delhi had banned these fuels in 1998. Only those like cement industry are allowed to use this as feedstock but not fuel. Further the order dated 13 July 2018, the Supreme Court has asked for a ban on import of pet coke into India, with specific exemptions given to four categories of Industries. The Ministry of Commerce, GOI has issued order dated 17 August 2018 to this effect. Further, under India's commitments to the WTO, the country's laws are bound to treat imported and domestic pet coke equally. As of November 2018, the Ministry of Commerce and MOE&FCC are considering restricting the usage of all pet coke in India—domestic and imported.

### Brick kilns

There are 11 brick kilns with traditional technology located near Panikoili area, approximately 15–20 km from the city. The pollution control device adopted is mainly gravitational settling and chimney height.

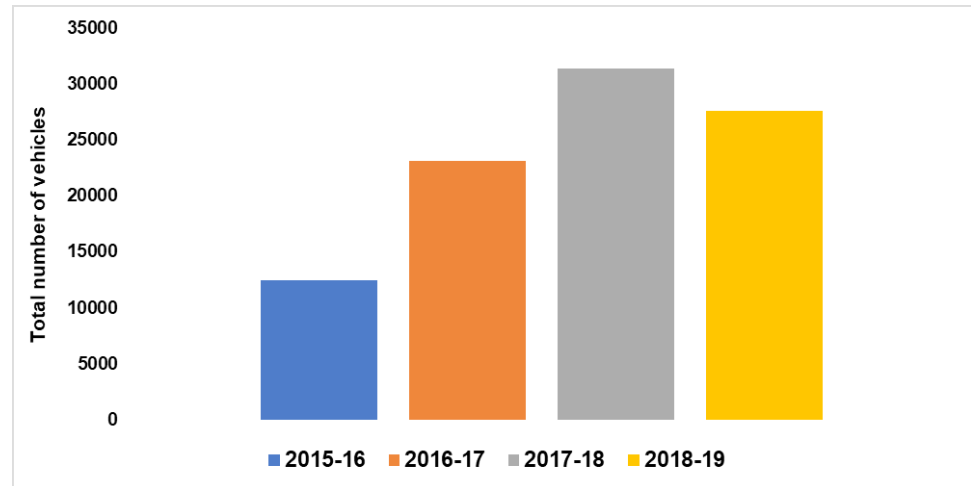
An order was issued by the CPCB in 2017 under the directions of section 18 (1) (b) of the Air (Prevention and Control of Pollution) Act, 1981 for prevention and control of air pollution, for different types of brick kilns. The CPCB issued orders stating that all SPCBs: (i) Must provide consent, failing which brick kilns are to be shut; brick kilns must meet the prescribed norm and siting guideline with immediate effect, (ii) Provide the status on the conversion of natural draft to induced draft brick kilns, (iii) Strictly enforce siting guidelines, (iv) Ensure that all the moving area around brick kilns should be paved, and (v) Ensure that fine dust does not accumulate around the brick kilns. This requires regular inspection and stringent compliance.

### Vehicles

Vehicle numbers are growing rapidly in cities of Odisha. Kalinganagar is experiencing rapid increase in registration of motor vehicles. The growth trends for all vehicle categories shows a positive increase in the number of vehicles in the district between 2015 and 2018, however a slight decline during 2018–19. The total number of vehicles has increased by 121 per cent between 2015–16 and 2018–19. Two-wheelers dominate the registered vehicle fleet in Jajpur district with more than 90 per cent share every year. The total number of

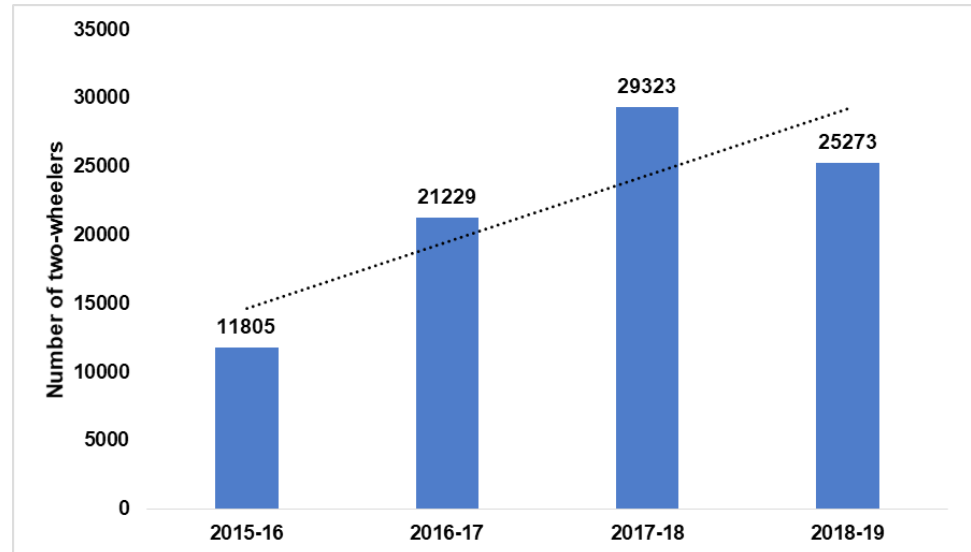
two wheelers has increased by 114 per cent and passenger car has increased by 331 per cent between 2015–16 and 2018–19 (see *Graph 3: Annual registration of vehicles in Jajpur district*; *Graph 4: Growth of two-wheelers in Jajpur district* and *Graph 5: Growth of passenger cars in Jajpur district*).

**Graph 3: Annual registration of vehicles in Jajpur district**



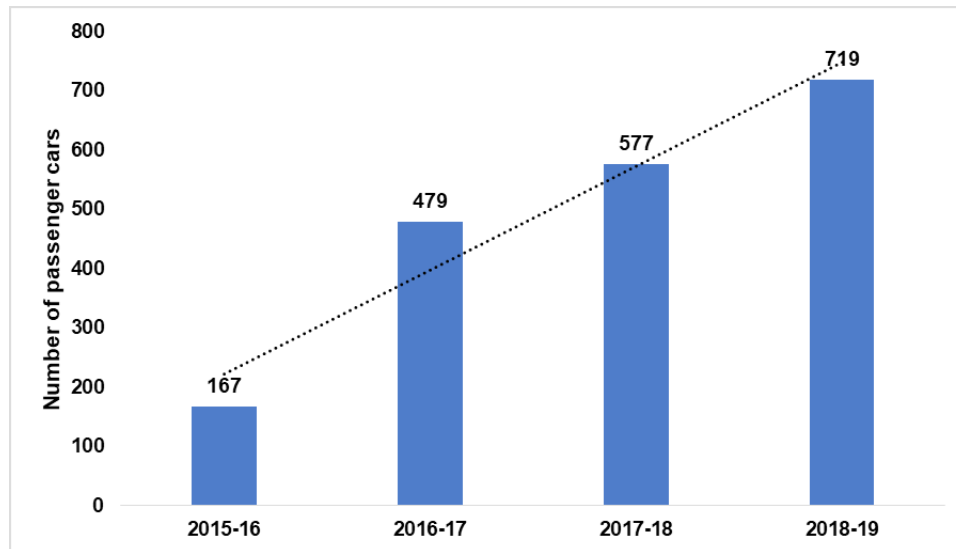
Source: Based on the data provided by RTO

**Graph 4: Growth of two-wheelers in Jajpur district**



Source: Based on the data provided by RTO



**Graph 5: Growth of passenger cars in Jajpur district**

Source: Based on the data provided by RTO

Vehicular pollution control requires action at two levels: i) reduction in tailpipe emissions through improvement in emissions standards and robust emissions inspection and phase out of older vehicles; and ii) Reduction in total vehicle miles travelled in cities by improving public transport and non-motorized transport system, restraint measures to reduce demand for personal vehicle usage, and compact urban planning to reduce distances travelled. All these measures are important and need to align to reduce vehicular emissions. Some of these actions are already underway. These will have to be integrated and aligned for the and further improved for the maximum impact.

### Strategies to reduce tailpipe emissions

**Emissions standards for new vehicles:** As per the national roadmap, Odisha has implemented the Bharat Stage IV (BSIV) emission norms for new vehicles in April 2017. It is scheduled to introduce Bharat Stage VI (BSVI) norms and fuels in April 2020. The BS VI norms are slated to reduce emissions from new vehicles by 80–90 per cent. On-road fleet will also benefit from the introduction of clean BS VI compliant 10 ppm sulphur fuels by April 2020. These emissions standards will come with stronger real-world emissions requirements and management to ensure that vehicles remain low emitting on road. As these new generation vehicles will be equipped with more advanced emissions control system, commensurate improvement in emissions inspection and maintenance will be needed at the city level.

**Emission management of on-road fleet:** With continuous ageing of vehicles, keeping vehicles low emitting throughout their lifetime on road will require multiple strategies including in-use emissions inspection, monitoring of real world emissions, phase out of old vehicles and scrappage, clean fuel substitution and control of heavy duty traffic.

**PUC programme:** The current in-use emissions inspection programme is the Pollution under Control Certificate (PUC) system. Currently, under this programme idling carbon monoxide (CO) and hydrocarbon (HC) concentrations are measured in petrol vehicles and smoke density is measured in diesel vehicles.

The status of implementation of lambda tests as per the 2004 notification of the Ministry of Road Transport and Highways—that is needed to maintain the optimum air to fuel ratio for proper functioning of catalytic converters in petrol cars—is not yet available. Ground assessment shows that there are quality control challenges with regard to the testing methods, calibration of equipment and overall compliance with the programme. There is just one PUC centre for the city of Kalinganagar as reported by RTO.

At the national level under the direction of the Supreme Court order the Ministry of Road Transport and Highways (MORTH) is setting up the system to link PUC certificate with the annual vehicle insurance to ensure full compliance with the programme. Such methods and more are needed at the state level to ensure that everyone turns up for the PUC tests.

As the PUC centres are decentralized and limited they need frequent inspection, robust audit programme to ensure that credible and authentic tests are being done. Such steps have been initiated by the Department of Transport. Steps are needed to further reform the system and also expand the online networking of PUC centres to link with centralised data server for proper audit.

**Centralized vehicle inspection and fitness centres:** The government is establishing vehicle inspection and maintenance centres for commercial vehicles in the state. As per the plan, six automated vehicle testing centres are to come up in Odisha. The state government has decided to set up automated vehicle inspection and certification centres and driving testing tracks. The I&C testing in the automated centres needs to replace or complement and revamp the current visual fitness tests to bring robustness and reliability in the tests. This is an important step forward to improve overall safety and emissions from on-road vehicles. In 2016, it was reported that there were a high number of unfit vehicles on roads in Bhubaneswar. These vehicles can be gross polluters. Centralized vehicle inspection and fitness centres can be set up at the regional level, as in the state capital Bhubaneswar.

**On-road smoky vehicle inspection:** City need strong on road smoky vehicle inspection to identify visibly polluting vehicles and remove them from roads for inspection and repair. A small number of grossly polluting vehicles contribute significantly to the pollution load from on-road vehicles. If these can be identified and addressed substantial emissions reduction is possible.

**Advancement in on-road emissions monitoring:** Introduction of BSIV and BSVI vehicles with more advanced emissions control systems will require advancement in emissions monitoring of on-road vehicles. The current PUC programme will not be adequate for that. The Ministry of Road Transport and Highways has already sent out an advisory to the State Transport Departments that all vehicles manufactured after 2013 that are equipped with On-board Diagnostic System (OBD) should be checked for malfunctioning light on the dashboard of the vehicle when they come for PUC check. If the light is on the vehicle should be returned for proper check in workshop and repair. This needs to be implemented in PUC centres immediately. This kind of upgradation has become important after the introduction of BSIV and upcoming BSVI emissions standards that will bring more advanced and sophisticated emissions control technologies that cannot be adequately monitored through PUC programme that was designed for older generation of vehicles. A check list will have to be prepared to inspect the advanced emissions control systems in the new fleet.

**Regulating movement of heavy duty vehicles:** Yet another area of intervention is the heavy duty truck movement through cities that can contribute hugely to the urban pollution. Usually, cities restrict truck movement during the day and allow them to pass through or do loading and unloading during night. But explicit intervention is needed to design highway alignment in a way that they bypass the highly populated cities and do not cut across. Truck movement and dust control from loading and unloading will be of special concern in industrial cities and mining areas and will require spatial planning to reduce exposure.

**Phasing out of old vehicles:** As of now cities in Odisha do not have age restriction on vehicles. Vehicles of and more than 15 years age are not prohibited from plying within cities. After crossing the 15 years registration time frame, these vehicles are not removed instead they are re-registered for a span of another five years. The non-attainment cities require a phase out plan either through age restrictions or tax policy or restrictions on their movement in city centres. The phase out plan will need to be supported by a scrappage policy especially for the old commercial vehicles and buses. Currently, the Union Ministry of Road Transport and Highways (MORTH) is also working in a national scrappage as policy. But state level policies are also important for scrappage infrastructure. Recently, Delhi has framed a similar policy. Regulatory and fiscal measures are needed to discourage use of old vehicle vintage meeting very old emissions standards.

### Clean fuel initiative: CNG

Substitution of mainstream fuels especially diesel with cleaner fuels like compressed natural gas (CNG), liquefied natural gas (LNG) and liquefied petroleum gas (LPG) can help to improve emissions substantially. City gas distribution project is being implemented. Three companies—Gas Authority of India Limited (GAIL), Bharat Gas Resources and Adani Gas Limited—will invest in 17 districts of the state to provide piped natural gas to households, commercial and industrial segments and vehicles. This programme needs to be scaled up on a priority basis for the non-compliant cities.

Natural gas vehicle programme will require to set targets for different vehicle segments. All auto-rickshaws, taxis that do point-to-point service inside the city, light and medium duty freight vehicles on local permits and a part of bus transport can move to CNG and help to reduce toxic diesel emissions. Creating such a mandate can help to do better infrastructure planning.

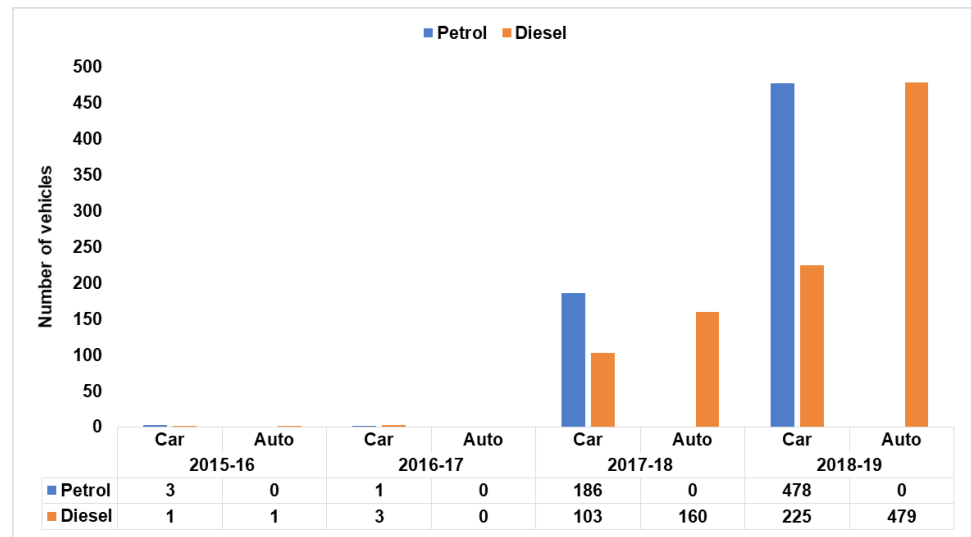
Among the steadily increasing total number of auto-rickshaws in the city, the share of diesel auto-rickshaws is very high. Between 2015–19, the diesel auto-rickshaws make up for 43 per cent of total auto-rickshaws running in the Jajpur district. During the year 2018–19, however, almost 100 per cent auto-rickshaws registered in the district were running on diesel. High rate of use of diesel in transport sector is a matter of concern, as diesel emissions are extremely toxic and according to the WHO are classified as Class I carcinogen for strong link with lung cancer. Diesel vehicles also contribute more to particulate matter and nitrogen oxides that are a matter of concern in cities. High mileage public transport system inside the city including buses, taxis and auto rickshaws can be targeted for phased introduction of CNG programme.

Fuel-wise breakup of fleet shows that use of diesel vehicles have grown in the city. It is also a matter of concern that auto-rickshaws in all cities are predominantly on diesel (see *Graph 6: Diesel and petrol vehicles in Jajpur in 2015–19* and *Graph 7: Number of autos running on diesel in Jajpur in 2015–*

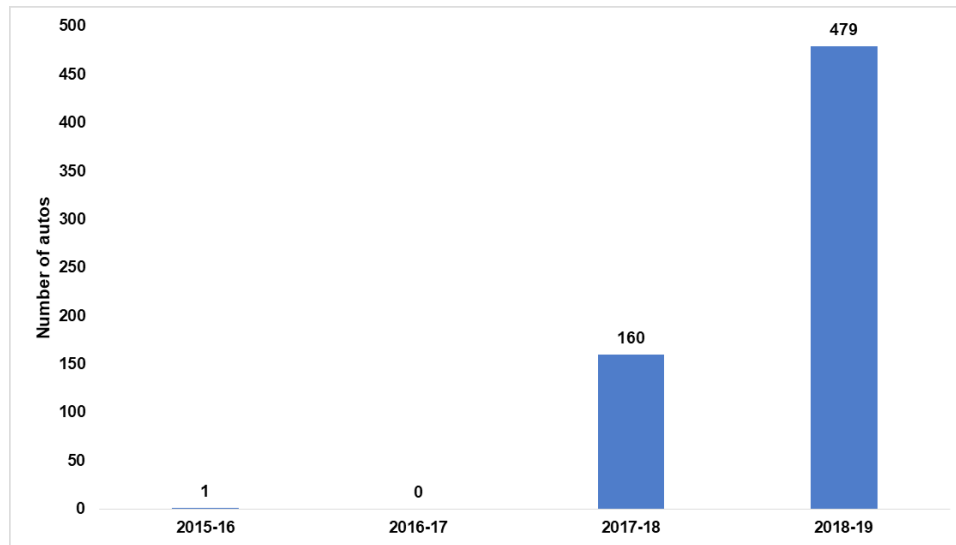
19). Phase out diesel autos is important as these are designed to emit higher emissions than even diesel cars. Under the current emissions standards of BSIV, a diesel auto is legally allowed to emit 1.7 times higher particulate matter and 1.3 times higher NOx+HC than a BSIV diesel car. This gap with diesel cars will further widen under BSVI regulations that will be enforced within two years. Even after meeting BSVI emissions standards, a diesel three-wheeler will emit close to six times higher particulate matter and two times more nitrogen oxide compared to a BSVI diesel car. The big concern is the very high on-road and in-vehicle toxic exposure from these vehicles. These small engines with unstable emissions and high exhaust temperatures limit the scope of application of advanced and effective after-treatment systems that are otherwise used in other diesel vehicles.

City need an early phase-out plan for diesel autos.

**Graph 6: Diesel and petrol vehicles in Jajpur during 2015–19**



Source: Based on data provided by RTO

**Graph 7: Number of autos running on diesel in Jajpur in 2015–19**

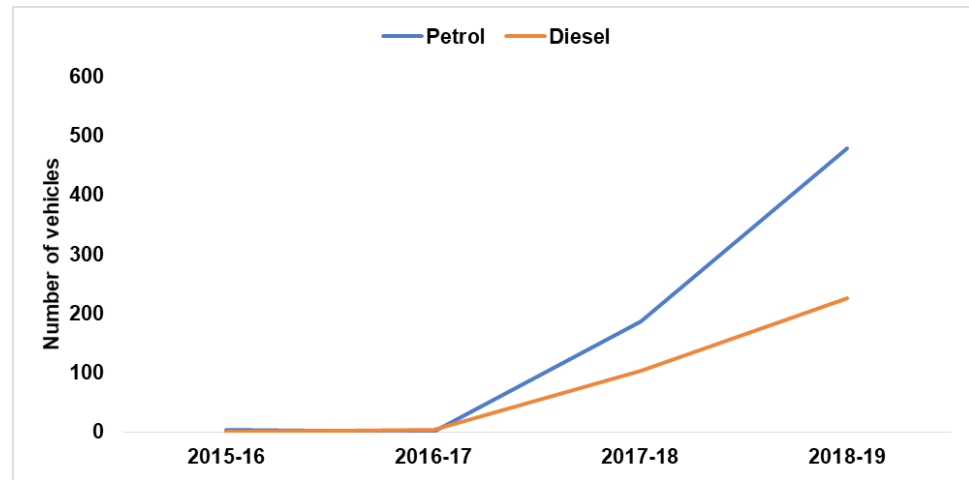
Source: Based on data provided by RTO

## Transportation

Control of vehicular pollution will also require transportation and mobility strategies to reduce traffic volumes and total vehicle kilometres travelled in the city. Such action has already started in Bhubaneswar that include bus sector reform, infrastructure for non-motorized transport (NMT), bike sharing programme, street design guidelines, transit oriented urban planning, parking management, and electric mobility among others. This needs to be scaled up to create a template for other non-compliant cities as well. For the clean air action plan it will be useful and necessary to set a target of achieving an improvement of modal share of public transport to at least 85–90 per cent by a target date. This will help to plan the requisite infrastructure for the desired shift.

According to the City Development Plan prepared by Kalinganagar Development Authority (KMDA), cycle and scooter constitute principal mode of travel having 84 per cent share in the overall modal share, wherein, 33 per cent people use cycle for going to different places. Travel demand is increasing with growing population in cities. A system for movement and transport will have to be designed to cater to the growing demand (see *Graph 8: Trend of motorization in Jajpur in 2015–19*).

**Graph 8: Trend of motorization in Jajpur in 2015–19**



Source: Based on data provided by RTO

While proposing mobility strategies for mitigation of air pollution this plan has adopted distinct strategies for a comparatively large city like Bhubaneswar as well as for smaller cities. Both the categories of cities require distinct strategies. Smaller cities like Kalinganagar, have predominantly a lower volume of travel demand and short-distance travel. This will require more locally appropriate transportation systems. These cities are mostly dependent on smaller and often informal systems like intermediate public transportation, walking and cycling to meet most of their travel demand. They cannot support high volume mass transport. These cities would need to reform these smaller systems for more efficient deployment, last-mile connectivity and pedestrian and cycling infrastructure.

Intermediate public transport: Assessment of travel pattern in almost cities shows very high demand and usage of intermediate public transport (IPT) modes, i.e. cycle rickshaws, auto rickshaw, e-rickshaws and taxis. IPT modes play a paramount role in meeting travel demand. They are the predominant mode of transport especially in smaller cities. The services provided by IPT modes are usually fairly flexible and are dependent on the requirements of the passengers. These are low volume, affordable and high frequency services that are very suitable for catering to the small distance travel needs in the cities. In most cities the average travel distances are very low—even shorter than 5 km. This makes IPTs very important.

The para-transit sector is not recognized by government and is considered a part of informal sector; there are hence very limited initiatives proposed for the development of this mode of transport. There are plans to introduce E-rickshaws to act as a last- and first-mile substitute. This plan will be initiated first in Bhubaneswar and then Cuttack with an aim to promote eco-friendly transport. Para-transit linked e-mobility may be scaled up for other non-attainment cities like Kalinganagar. As is evident from the initiatives from other parts of India it is possible to reorganize this segment for proper deployment, efficient services, and neighbourhood connectivity. This mode is suitable for rapid electrification.

There is considerable opportunity in non-attainment cities to adopt electric mobility policy and zero emissions mandate to reduce the emissions impact

of motorization. The compact city design of the six cities and small distances and dominant use of para transit are favourable for quicker adoption of the zero emissions mandate. On a priority basis a sizeable part of the buses, auto rickshaws, taxis, large delivery fleet can be targeted for electric mobility programme. In addition, given the very large usage of two-wheelers that are very polluting, can also be targeted for this programme for substantial air quality benefits.

Odisha does not have a state-wide comprehensive Electric Vehicle policy yet. However, it has announced policy measures for electric vehicles. This may be leveraged. This initiation of electric vehicle programme in Bhubaneswar can create the template for replication in other non-attainment cities especially targeting the city centres. This initiative can be promoted with a legal zero emissions mandate for targeted phase in and timeline.

### Solid waste management and construction waste

Municipal solid waste management based on decentralised household based segregation, recycling and reuse and composting of vegetative waste need accelerated roadmap and infrastructure to address the problem. Solid Waste Management Rules and Regulations need implementation across the city to address this concern. Clean air action plan will also require a roadmap for zero landfill policy. Across the city landfill sites are becoming source of pollution due to spontaneous fires caused by methane emissions. This is possible only through decentralized waste management and recycling. Adequate and appropriate infrastructure will have to be created to enable this process. In the meantime landfill management will be needed to prevent fires.

In Kalinganagar, door to door collection of waste is present, after which the waste would be taken to the three micro composting and three on-site composting centres which are proposed. Wet waste can be treated and the dry waste is either recycled or reused. The local body also organises awareness campaigns through 26 swacch saathi on how to segregate and handle the waste. But there is no management of the dumping site.

Construction and demolition waste (C&D) is not only the source of dust but these also get dumped in ecologically fragile zones and water bodies that cause environmental degradation. But most of this inert waste is reusable and recyclable and can be brought back to the construction itself. The city directly dumps all the construction and demolition waste to the landfill sites. This will require a strategy of recycle and re-use. The city needs to adopt dust control measures for the construction sites and also link up with the regional level recycling units—yet to be set up—recycle the C&D waste.

### Household and domestic emissions

Use of solid fuels for domestic cooking has significant impact not only on indoor air quality but also on outdoor air quality with serious public health consequences. This is one of the reasons why the advisory on the National Clean Air Programme (NCAP) of the MOEF&CC has recommended installation of rural air quality monitoring as well. The new Lancet study has shown that death rate due to solid fuel use for domestic cooking is among the highest in Odisha. According to the Department of Health and Family Welfare, Government of Odisha, incidence of acute respiratory infection and pneumonia increased by 32.3 per cent between 2014 and 2015, from 1.64 million to 2.17 million incidences. As per the 2017 report *India: Health of the Nation's States*, air pollution is the second largest risk factor driving death and disability in

Odisha in 2016, up from being the third largest risk factor in 1990.

Use of solid fuels remains quite dominant. The rate in growth of use of clean fuels for domestic cooking is rather slow, at 1.15 per cent CAGR across Odisha. Although in urban areas, the growth is faster, even here, more than one in three households continue to use solid fuel for domestic energy requirements (see *Table 5: State of solid fuel usage in rural and urban areas of Odisha*).

**Table 5: State of solid fuel usage in rural and urban areas of Odisha (in per cent)**

% of Households	2005-06 (NFHS-III)	2011 (Census)	2015-16 (NFHS-IV)	Reduction per year in solid fuel usage (2005-16)
<b>Total</b>	89.3	86.2	80.5	<b>1.15</b>
<b>Urban</b>	51.7	45.3	34.4	<b>4.43</b>
<b>Rural</b>	96.1	93.8	88.8	<b>0.87</b>

Source: CSE analysis based on data from National Family Health Survey (NFHS—Rounds III and IV) and Census 2011.

As per the Census 2011, 8.33 million households (86.2 per cent of Odisha's total households) currently use solid fuels (firewood, crop residue, cow dung cakes, coal, lignite or charcoal) for cooking. For urban and rural areas, this figure is 0.69 million and 7.64 million households (45.3 per cent and 93.8 per cent of total households) respectively. This is to be compared against the national average of 67.2 per cent, 26.2 per cent and 86.5 per cent of total, urban and rural households respectively. Coal consumption in massive amounts by households has also led to the increase in the pollution levels. This will have to be strongly curtailed. This will require serious attention as this has serious adverse impact on maternal and child health.

As on 13 December 2018, Odisha had released more than 3.52 million LPG connections under the Ujjwala Yojana. This represents one of the fastest growth rates in the sale of LPG (23.8 per cent in 2016–17) as well as in the number of customers (32.5 per cent between 2016 and 2017).

Several other initiatives have been taken to promote cleaner energy options like biogas plants. About 2.41 lakh family-type biogas plants for domestic cooking and lighting have been developed by the Odisha Renewable Energy Development Agency (OREDA), Department of Science and Technology, Odisha, under the National Biogas and Manure Management Programme (NBMMP).

Under the clean cook stoves initiatives, 247 clean cookstoves (Unnat Chulhas) have been provided by OREDA in 2016–17. About 9,800 clean cookstoves (Parishad Chulhas) have been provided in schools for Mid-Day Meals by OREDA till date, of which 2,500 have been installed in 2016–17. An analysis by the Centre for Science and Environment shows that in Odisha, the growth in customers outstrips the growth in LPG sales, indicating the lack of sustained use of cleaner fuels after the initial connection under LPG. There are 0.79 million inactive LPG connections, as on April 2018.

Availability of cheap solid fuel such as coal, firewood and crop residues must be countered with fiscal incentives to make clean fuels economically viable



for domestic use. The city require 100 per cent LPG coverage of households and reliable supply. This will have to be supported by strong public awareness programme. State level initiative will have to be strengthened for more targeted delivery in the non-attainment cities like Kalinganagar.

### **Diesel generator sets and rooftop solar programme**

Given the state of electricity supply dependence on diesel generator sets is quite significant that causes high local exposure to toxic diesel fume. There is no estimate of the total number of generator sets in the non-compliant cities—residential and institutional—and their installed capacity. Implementation of the emission standards for all diesel generator sets is essential. The ultimate solution to this problem is assured and reliable supply of electricity. This will require full utilization of the installed power generation capacity, revamping of grid and connectivity.

Yet another important solution to this problem is to promote roof top solar power generation. A study by the Centre for Science and Environment has shown that on a lifecycle basis cost of roof-top solar works out to be cheaper than diesel generator sets especially keeping in view the diesel prices. This creates incentive for the consumers—both domestic as well as institutional and industry—to install roof solar systems. This programme may be further strengthened with stronger incentive policy to encourage quicker adoption of rooftop solar systems especially by the industrial and commercial users, and residential blocks.

In accordance with ‘Odisha Solar Policy—2013’ of Science and Technology Department of Government of Odisha, Odisha receives an average solar radiation of 5.5 kWh/sq. m area with around 300 clear sunny days every year. Odisha’s gross renewable energy potential is 53,820 MW. The feasible potential for power generation in the Solar Photovoltaic and the solar thermal routes have been roughly estimated as 8000 MW and 2000 MW respectively. Odisha has set a target of 2,378 MW of power to be generated from solar power plants. In addition to this, solar rooftop power has also been targeted to accomplish the ‘power for all’ objective. Solar power production in Odisha has been divided into four categories, with 328 MW coming from utility-scale projects, 50 MW from solar panels on water bodies and 1 GW capacity from large-scale solar parks and 1 GW from rooftop (both on and off grid) projects in the commercial and domestic segment.

By 2017–18, Odisha has set a target of achieving 297 MW of total solar installed capacity, with 125 MW coming from rooftops. Rooftop solar programme and greater uptake by the grid needs to be leveraged for all non-attainment cities including Kalinganagar to reduce dependence on diesel generator sets. This will require city wise plan.

### **Road dust**

Road dust and windblown dust can accumulate and carry toxic substances that come from other combustion sources and can be a health hazard. Kalinganagar is polluted due to the unpaved roads present. With expansion of infrastructure—both institutional, transport and basic services—road digging has become common cause of road dust and wind-blown dust. Also in several cities roads and pavements are not well paved and are devoid of vegetative cover.

While road sweeping—both manual and mechanical sweeping—can help, greater benefit will come from improvement in streets and footpath paving—

both hard and soft. Street design guidelines need to be adopted to ensure proper paving and creation of vegetative barrier to douse dust. All infrastructure agencies need to be made liable for adoption of dust control measures during construction phase and also for restoration of the dug up places after completion of the construction.

### **Urban greens and forests**

Urban planning needs to integrate urban greens (parks, district forests etc.) and urban forests in the Master Plans of the cities as well as integrate their requirement in all infrastructure development and urban redevelopment projects. At least 15–20 per cent of the new urban redevelopment projects should be set aside for urban green and tree cover. Urban planning should also provide for green roofs and vertical greens linked to infrastructure development. Green walling with plantations around dust generators and also to be dust barriers are important interventions that should be integrated with the urban forestry and forest policy.

**PART II**  
**COMPREHENSIVE**  
**CLEAN AIR ACTION**  
**PLAN (CAP) AND**  
**GRADED RESPONSE**  
**ACTION PLAN (GRAP)**



## Comprehensive Clean Air Action Plan (CAP)

Comprehensive Clean Air Action Plan Against the backdrop of the challenges outlined in each sector, this pollution source-wise comprehensive action plan has been developed for Kalinganagar. Keeping in view the air pollution reduction targets in the city detailed strategies have been identified to indicate the nature, scale, scope and depth of action needed for effective reduction to make an impact overtime. In view of this instead of listing only broad action points, detailed indicators and action points have been included for all sectors to guide implementation.

This plan has integrated and built on the on-going action and action plans of the state government in each sector that are already underway. Action plan has also been improved further based on emerging good practices. In several sectors good practices have emerged that need to be leveraged and aligned to meet the clean air objective. This creates a good template for upscaling and replication in other cities. The industrial city of Kalinganagar have initiated various industrial pollution control measures that can be further strengthened and be taken forward. This action plan has integrated all these ongoing efforts to chart the roadmap.

Special care has been taken to ensure that sufficient indicators are included in the plan itself to indicate the nature and scope of the strategies outlined for each sector that are needed for implementation to make an effective impact. For instance, often it is not clear how different aspects of transportation and urban planning are linked with air pollution control. It is important to ensure that clean air action plan ensures convergence of planning for road building, public transport infrastructure and non-motorized transport planning to guarantee that people-oriented design are integrated all across to prevent lock in of pollution in the infrastructure itself. Similarly, action in renewable energy sector, urban forestry and a plethora of clean energy and industrial emissions management strategies have been integrated.

Alignment of inter-sectoral action will be critical to leverage the available resources of funding for maximum impact. In all sectors—transport, industry, power plants, construction industry, municipal solid waste management, air quality monitoring, road building and traffic management—budgetary resources have been earmarked for investment, or, investments from other private or bilateral sources are coming in. If these investments are better informed and aligned with this clean air action planning process and objective, significant change at a scale is possible.

This plan also opens up the opportunity for developing fiscal strategies based on polluter pay principle to generate additional resources for funding of the plan. For instance, in other cities such as Delhi, fiscal measures such as environment compensation charge on trucks, big diesel cars and diesel fuel have helped to create dedicated funds that are now available for pollution control efforts. Such measures can be adopted to top up the resource needs in addition to the state and central government funding. In areas where the action depends on private sector participation and investments the detailed guidelines under this plan can guide such investment. This plan has identified the agencies responsible for implementation of each action point and has also indicated the timeline for implementation. This can be monitored for reporting and compliance.

### **Graded Response Action Plan (GRAP)**

Based on the National Air Quality Index Graded Response Action Plan has been framed for daily response to air quality changes. This has predefined the set of measures to be taken for different air quality categories—satisfactory, moderate, poor, very poor, severe and emergency. Once notified these measures will come into force automatically. Available data shows that in most non-compliant cities, barring hotspot areas in industrial cities, the daily levels vary between moderate to poor; sometime touching the very poor level. The GRAP measures will be implemented accordingly. GRAP is also includes the advisory for people to take precaution for self-protection.

### **Institutional arrangement for implementation of the Clean Air Action Plan**

It is proposed that a high-powered committee is set up with representation from all key departments for oversight and monitoring for compliance with both Comprehensive Clean Air Action Plan and Graded Response Action Plan. This high-powered committee may be advised by a scientific Task Force to be set under the aegis of the Department of Environment and Forests/State Pollution Control Board with other expert bodies including meteorological department to report on the daily and annual trends in air quality, pollution forecasting and weather data, emission trend from different sources and assessment.

For proper implementation and oversight the high-powered committee will coordinate with the city level authorities in each six non-compliant city for direction, compliance monitoring and reporting. Each concerned department in a city will appoint a high level officer as a nodal official for coordination, implementation and periodic reporting.

## Comprehensive Clean Air Action Plan (CAP)—Short-, medium and long-term action points

### 1. AIR QUALITY MONITORING AND ASSESSMENT

S. no.	Action points	Agency responsible	Timeline
<b>Short-term priority action</b>			
1.1	To set up adequate number of real time automatic monitoring stations: The grid plan should be representative of population distribution and land use including residential, commercial, industrial, roadside and sensitive areas. As many steel plants are located in Kalinganagar city, these locations will require special monitoring. Also include hotspots such as red category industrial area in the district, landfill sites etc. Refer to the CPCB's thumb rule as prescribed in IS:5182 (Part 14), 2000 on Recommended minimum number of stations, population-wise (Also mentioned in Guidelines for Ambient Air Quality Monitoring, CPCB, 2003). Among all twelve pollutants to be monitored, special focus is needed on PM2.5 and ozone monitoring.	Nodal Agency: Odisha State Pollution Control Board (OSPCB) with support from Central Pollution Control Board (CPCB) and MoEF&CC	Six months
1.2	Use air quality information provided by satellite-based monitoring to complement ground based air quality monitoring and also the unmonitored areas. This is also useful to identify agricultural burning/ forest fires etc. in the region to track regional changes that have bearing on urban air quality.	Nodal agency OSPCB in consultation with CPCB, IMD, State remote sensing centre, (DST)	Six months
<b>Medium-term action</b>			
1.3	Develop capacity for pollution forecasting for implementation of graded response action plan. This will also require monitoring of weather data.	Nodal agency OSPCB in consultation with CPCB, IMD, State remote sensing centre, (DST)	One year
1.4	Set up daily air quality public information dissemination system based on National Air Quality Index and health advisory. Further develop online reporting of daily and annual data for all pollutants and pollution forecasting on SPCB website. To communicate to public through local media.	OSPCB in consultation with CPCB, IMD, state remote sensing centre, (DST)	One year
1.5	Carry out one emission inventory and source apportionment study	OSPCB in consultation with CPCB	One year
1.6	Set up rural and peri-urban air quality monitoring to assess the airshed/influence area. The advisory on National Clean Air Programme (NCAP) from the Union Ministry of Environment and Forest and Climate Change has recommended rural air quality monitoring. Assess application of low-cost sensor based monitoring for base-line data in areas that do not have regulatory monitors for local area action.	OSPCB in consultation with CPCB	One to two years
<b>Long-term action</b>			
1.7	Research studies including source apportionment and emission inventories, health impact studies, exposure impacts, carrying capacity assessment of airshed and regional impacts, hotspot assessment other relevant studies may be undertaken to further inform the action plan: Government to support research works/ scientific studies by academic/research institutions. Expertise will be sought from various institutions to develop protocols for assessment of the research proposals.	DoFE, OSPCB	One year

## 2. INDUSTRIES

S. no.	Action points	Agency responsible	Timeline
<b>Short-term priority action</b>			
2.1	Implementation of SOx and NOx standards notified by MOEF&CC on 29 January 2018 for 35 categories of industries.	OSPCB	Six months
2.2	To strengthen the star rating programme to include full compliance with standards and switchover to low sulfur fuels/ natural gas	OSPCB	Six months
2.3	Prepare and implement a clean fuel policy and provide incentives for clean fuels for the state: for this identify approved and non-approved fuels. Promote relatively cleaner fuels like oil, gas and electricity. Discourage fuels with very high sulphur and heavy metals like furnace oil, pet coke, tyre oil etc. (except where it is used as feedstock like four industries including cement). Need favourable taxation and pricing policy.	DoFE in consultation with OSPCB	Six months
2.4	Implement Continuous Emission Monitoring System (CEMS) across all targeted and applicable polluting industry: Ensure calibration and working of CEMS in all industries in the urban airshed or area of influence and provide information to monitoring agencies to take appropriate action. Ensure quality control and quality assurance of CEMS data and ensure that data is available online and the reported data is compared with applicable prescribed limits and not the older standards. Compliance checking to be enforced routinely to prevent tampering with the CEMS. Kalinganagar hosts the many steel plants.	OSPCB	Six months
2.5	Identification of cumulative impact of industrial emissions and prescribe more stringent pollution control action for industries.	OSPCB	Six months
2.6	Identification and implementation of fugitive emission control measures in ancillary units, material transfer and handling and emissions during industrial processes. Informal industrial units will require stringent monitoring.	OSPCB	Six months
2.7	Enforce restrictions on operations of intensively polluting industries within urban airshed zones during high pollution periods.	Nodal agency OSPCB Department of Industries	Six months
<b>Medium-term action</b>			
2.8	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. Build schedule for inspection of areas of concern and reporting.	OSPCB	One year
2.9	Strengthen the current siting policy for industries to be notified in future	Nodal Agency OSPCB Department of Industries	One year
	Iron and Steel industry: <ul style="list-style-type: none"> <li>• Use of desulphurized coal</li> <li>• Use of pulverized coal injection method</li> <li>• Installation of coke dry quenching (CDQ)</li> <li>• Installation of top gas recovery Turbine (TRT)</li> <li>• Introduction of coal dust injection (CDI)</li> <li>• Introduction of coal dust injection (CDI); waste heat recovery in Sinter Plant; waste heat recovery at blast furnace stove and</li> <li>• Use of byproduct fuel for power generation</li> <li>• Waste heat recovery in Sinter Plant; Waste heat recovery at blast furnace stove</li> <li>• Switch to Direct Reduction Electric Arc Furnace from basic oxygen furnace</li> </ul>	Nodal Agency OSPCB Department of Industries	One year One year Two years Two years One year Two years Two years Two years Two years



S. no.	Action points	Agency responsible	Timeline
	<p>Coke ovens</p> <ul style="list-style-type: none"> <li>Coal fired boilers to be converted to oil/gas fired driers, preferably with coal bed methane (CBM)</li> <li>Switch to coke dry quenching system (CDQ)</li> <li>Increasing carbonization chamber height</li> <li>High pressure ammonia liquor aspiration</li> <li>Wet oxidative desulphurization of coke oven gas</li> <li>Stationary land-based pushing emission control</li> </ul>	<p>Nodal Agency OSPCB</p> <p>Department of Industries</p>	<p>Two years</p> <p>Two years</p> <p>Two years</p> <p>One year</p> <p>Zero year</p> <p>Zero years</p>
	<p>Fugitive emissions:</p> <ul style="list-style-type: none"> <li>Use of hoods and enclosure for all process equipment, hooding of emission controls of the blast furnace tapping operations and discharge of molten metal and slag, covering of ladles containing molten metal</li> <li>Scrap management programme for the prevention or minimization of contaminants in steel scrap and other feed materials</li> <li>Use of covered or enclosed conveyors and transfer points</li> <li>Enclosures for emission controls of the charging and tapping operations. Minimising the number of flanges by welding piping connections wherever possible and using appropriate sealing for flanges and valves</li> <li>Wet quenching of coke as opposed to conventional quenching</li> <li>Use of larger oven chambers and regulation of pressure within oven chambers</li> <li>Water sprinkling mechanism and use of dry fog dust suppression system also reduces the fugitive dust emission.</li> <li>Paving of roads in and around the facility, divert freight traffic from unpaved roads</li> </ul>	<p>Nodal Agency OSPCB</p> <p>Department of Industries</p>	<p>One year</p> <p>One year</p> <p>One year</p> <p>Two years</p> <p>Two years</p> <p>One year</p> <p>One year</p> <p>One year</p>

### 3. POWER PLANTS

S. no.	Action points	Agency responsible	Timeline
<b>Long-term priority action</b>			
3.1	<p>Implementation of new thermal power plant standards in all power plants by an early date. The power plants need to comply with the new emission standards by the outer date of 2022. Check status of compliance and prepare a transition plan for each power plant to meet the new standards.</p> <ul style="list-style-type: none"> <li>Plants found not meeting set emission reduction targets to be penalized</li> <li>Prepare plan for full utilization of fly ash, and effective management of fly ash pond for reduction of fugitive emissions, sprinkling of water (recycled water) especially during summer months, plantation and other stabilization methods to curtail wind-blown ash.</li> </ul>	<p>Nodal agency OSPCB</p> <p>MoEF&amp;CC, Ministry and Department of Energy</p>	Two years
3.2	Progressively close the older and more polluting thermal power plants and to move to cleaner natural gas.	Nodal agency OSPCB and Department of Energy, DoFE	Two years
3.3	Chart a roadmap for cleaner plants and Incentivize their operation by giving them the priority over other polluting plants	OSPCB, DoFE, Department of Energy, power generating companies	One year

### 4. BRICK KILNS

S. no.	Action points	Agency responsible	Timeline
<b>Short-term priority action</b>			
4.1	Enforce restrictions on operations of brick kilns within urban airshed zones; allow brick kilns that comply with zigzag or improved technology.	OSPCB	Six months
<b>Medium-term action</b>			
4.2	Convert all brick kilns to zigzag technology from natural draft kilns to induced draft kilns (zigzag technology).	OSPCB	
4.3	Prescribe design specifications for improved kilns and ensure compliance checking to know that conversion has actually taken place.	OSPCB, DoFE, Department of revenue	

### 5. ACTION TO REDUCE VEHICULAR EMISSIONS

S. no.	Action points	Agency responsible	Timeline
<b>Long-term action</b>			
5.1	Emission standard and fuel quality for new vehicles Ensure on-schedule implementation of BS VI fuel and emission standards on April 1, 2020. Ensure that only BS VI compliant vehicles are registered from this date. Supreme Court order of October 24, 2018 has directed that no vehicle that is not BSVI compliant can be registered from 1 April 2020.	Transport department	Two years
5.2	ALTERNATIVE CLEAN FUEL POLICY FOR VEHICLES		

S. no.	Action points	Agency responsible	Timeline
<b>Medium-term action</b>			
5.2.1	<p>Electric vehicle programme: Need zero emissions mandate for targeted vehicle segment-wise phase in of electric vehicles— two-wheelers, three-wheelers/para transit, and large delivery fleet.</p> <ul style="list-style-type: none"> <li>• Development of Kalinganagar city E-mobility plan</li> <li>• Mandate registration policy for auto-rickshaws, taxis, delivery fleet, and two wheelers to target 25 per cent of all registration by 2025 on electric mode.</li> <li>• Plan infrastructure for charging and battery disposal.</li> <li>• This can be incentivized by lower road tax, motor vehicle taxes and registration charges, preferential licensing and permit system, allowing them in low emissions zones etc.</li> <li>• Identify and notify commercial areas with high footfalls and good public/para transit connectivity to pedestrianize supported by zero emission battery-operated vehicles: Ensure organized deployment to reduce congestion.</li> </ul>	Transport department and Urban Local body	One year
5.2.2	Introduce gaseous fuel programme when gas becomes available. Plan CNG refuelling infrastructure for delivery and use.	Nodal agencies Transport department and Department of Energy MoPNG	One to two years
5.2.3	Bio fuel policy: There is potential of generating biogas from waste and sewage to run buses in cities.	Department of Energy, Oil marketing companies	One year
5.2.4	Need favorable tax measures to promote clean fuels and vehicles and zero emissions vehicles.	Department of, Energy and Finance	One year
5.3	EMISSION CONTROL MEASURES FROM ON-ROAD VEHICLES		
<b>Short-term priority action</b>			
5.3.1	Plan and implement adequate number of PUC centres and strengthen periodic auditing and oversight of PUC centres and calibration of equipment and third party checks.	Transport Department	Six months
<b>Medium-term action</b>			
5.3.2	Improve and strengthen PUC programme: Ensure universal linking of PUC centres with remote server and eliminate manual intervention in PUC testing. Ensure implementation of all test parameters for diesel and petrol vehicles including Lambda testing for petrol cars as notified by MORTH in 2004.	Transport Department	One year
5.3.3	Integrate on-board diagnostic (OBD) system fitted in new vehicles with vehicle inspection. As per the MORTH advisory PUC centres have to check malfunctioning indicator light on dash boards of vehicles. If the light is found on vehicles to be sent back for testing in authorized workshops; Additionally, PUC centres need to check if the OBD is functioning properly.	Transport Department	One year
5.3.4	Improve compliance with PUC programme. Link PUC certificates with annual vehicle insurance to ensure 100 per cent compliance as per the Directive of the Hon'ble Supreme Court. Need strong penalty for non-compliance with PUC. Vehicles without valid PUC certificates should be prohibited from plying.	Transport Department and MoRTH	One year
5.3.5	Enforcement of law against visibly polluting vehicles: remove them from road, impose penalty, and launch extensive awareness drive against polluting vehicles.	Transport Department, Traffic Police	One year
5.3.6	Set up modern centralized vehicle inspection centres for upgraded emissions and fitness tests for commercial vehicles and diesel vehicles.	Transport Department, MoRTH	One year

S. no.	Action points	Agency responsible	Timeline
5.4	Phase out old vehicles and vehicle scrappage policy: Phase out old vehicles with the help of age cap and age linked road tax policy. Set up scrapping infrastructure for scientific dismantling and disposal of old vehicles. Set up recycling units that are authorized with proper guidelines.	Transport Department	One year
5.5	Vehicle labelling or sticker programme: The July 26, 2018 directive of the Supreme Court has approved the MoRTH's Colour Coded HSRP Hologram Stickers. This programme to come into effect on April 1, 2019, across the country will require, each vehicle, both old and new to be provided with colour-coded non-tamperable High Security Stickers, along with the number plates. At a later date, older and polluting vehicles may be discouraged in city centres or earmarked low emissions zones by using these stickers for identification of vehicles.	Transport Department,  Traffic Police	One year
5.6	<b>FREIGHT TRANSPORTATION</b>		
<b>Short-term action</b>			
5.6.1	Use of off-peak passenger travel times to move freight and restrict the entry of heavy vehicles into cities during the day to continue	District and local administration, urban local body	Within six month
5.6.2	Provide truck rest areas/parks along national and state highways to prevent entry of trucks into cities during peak hours.	PWD, NHAI	Within six months
5.7.3	Install weigh-in-motion bridges and monitoring equipment. Ensure better quality and more efficient vehicles  Promote high capacity trucks for freight transport of mining material instead of smaller trucks to reduce numbers	NHAI, district and local administration	Within six months
5.7.4	Diversion of truck traffic: Kalinganagar is a small city with the main arterial/ highway cutting through the city. Some parts are also unpaved. Entire truck traffic comes into the city. This creates enormous pollution. Check feasibility of diversion and realignment of roads to divert substantial number of trucks from the city. Alternate routes need to be identified and improved to ensure that commercial traffic does not enter the city. Also fix entry and exit timings of trucks and a management plan for warehousing, loading unloading.	District and local administration, Traffic Police, Transport Department	Within six months
5.7.5	Check overloading: Use weigh-in-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.	District and urban local administration, Traffic Police, Transport department	Within six months
5.7.6	Develop urban freight consolidation centres in relation to location of warehouses relative to suburban areas.	District and urban local administration, Transport Department	One year
5.6.7	Create management systems for loading and unloading of goods in city areas.	District and local administration, Transport department	Six month
5.6.8	Develop a Safe-to-Load programme to ensure fitness and roadworthiness of trucks.	Transport Department,	Six month
5.6.9	Intra-state freight transport plan: Prepare plan for inter- and intra-state freight transport plan to improve rail-based freight traffic to reduce dependence on trucks.	Transport Department, Railways	Two years

S. no.	Action points	Agency responsible	Timeline
5.7	<b>FUEL QUALITY TESTING TO CHECK ADULTERATION</b> Prepare an action plan to check fuel adulteration and random monitoring of fuel quality data. To ensure that periodic routine and surprise fuel testing is done for all transport and non-transport fuels. For this an action plan need to be prepared in consultation with oil companies and ministry of petroleum and natural gas.	Local administration Department of Energy Oil marketing companies	Six months
5.8	<b>Emission Control at Refueling Stations</b> Install vapour recovery systems in fuel refueling outlets to reduce benzene and VOC emissions. CPCB has issued direction for installation of stage I and Stage II vapor recovery system in all retail outlets with capacity 3000 kilolitre and more in 46 million plus cities by December 2017. Retail outlets across the city should comply with this	Department of Energy Oil marketing companies Transport Department	One year

## 6. PUBLIC TRANSPORT SYSTEM

S. no.	Action points	Agency responsible	Timeline
6.1	Intermediate public transport (IPT) and bus system		
<b>Medium- to long-term action</b>			
6.1.1	Define routes, permits, fares, vehicle design and safety standards, and vehicle technology standards for para-transit vehicles. Strengthen para-transit driver training and licensing procedures. This strategy is very important for smaller cities.	Transport Department	One to two years
6.1.2	Enforce through IT-based systems that track traffic violations, with repeat violations leading to increased penalties including fines, increased insurance, and cancellation of licenses	Transport Department	One to two years
6.1.3	Ban and phase out diesel auto-rickshaws. Introduce CNG/electric auto-rickshaws. Provide appropriate fiscal or regulatory incentives	Transport Department	One to two years
6.1.4	Regulate the taxi industry in as integrated a manner as possible—as a feeder service or otherwise—to complement and promote NMT and public transport	Transport Department	One year
6.1.5	Assess and introduce a city bus system of appropriate fleet size of small buses and desirable bus type replete with GPS tracking, ETVMs for fare collection and Passenger Information Systems. Develop route plan for bus operation; target trunk roads. A shuttle service can be provided for workers in industrial clusters.	Urban local body	One to three years
6.2	Non-motorized transport and safe access		
<b>Medium-term action</b>			
6.2.1	Develop pedestrian and cycling friendly corridors and street clusters. Target roads for developing walking and cycling infrastructure and safe access. Also pedestrianize parts of roads with heavy traffic. To do so, adopt urban street design guidelines that will prioritize design for public transport access, walking and cycling infrastructure, safe and universal access, street furniture, facilities for parking, inter-modal transfer hubs, road markings, signage and traffic signals, pick up and drop off points for taxi, auto, three- wheelers stands, spaces for street vending and service lanes. Design drainage to provide co- benefit of capturing run-off and prevent flooding. Assess feasibility of constructing a bypass road	Urban local body/NHAI	One to two years

S. no.	Action points	Agency responsible	Timeline
6.2.2	<p>Prepare and implement zonal plans for developing an NMT network. This should include the following action:</p> <ul style="list-style-type: none"> <li>• Implement network plan for footpaths on all roads</li> <li>• Target specific lengths of footpaths and cycle tracks to be completed in a phased manner and cover the entire city</li> <li>• Implement a network plan for more secondary street networks and un-gated streets to provide direct shortest routes for pedestrians and cyclists. Vehicular traffic can also be redistributed from major junctions through multiple routes to decongest. Signal-free corridors should be avoided as more road-space only attracts more traffic and impedes people's movement</li> <li>• Plan and upgrade pedestrian/NMT crossings at least every 250 m, with pedestrian signals and signages. These should preferably be at-grade. Reduce block sizes to reduce walking and cycling distances</li> <li>• Implement synchronization of signals on a priority basis with an integrated IT-based traffic management system so that despite having frequent at-grade pedestrian crossings, traffic can move swiftly across signals. Introduce cycle sharing systems and expand as feeders to public transport.</li> <li>• Identify and notify key commercial areas with high footfalls and good public transport connectivity to create pedestrian plazas</li> <li>• Make safety and walkability audits of walking and cycling infrastructure mandatory</li> <li>• Make encroachment of NMT lanes punishable offence under the current provision of law</li> <li>• Need dedicated funding</li> </ul>	Urban local body	One to two years
6.3	Compact city development to reduce distances and improve access		
<b>Medium-to long-term action</b>			
6.3.1	Adopt compact urban form code for all new development and redevelopment to create high density, mixed-use, mixed-income development and high-density accessible streets to reduce travel distances and emissions	Urban local body	One to three years
6.3.2	Kalinganagar has both high density and low density areas. In low density areas and in urban sprawl maximize densities and planned mix land use with good transport connectivity, in order to facilitate maximum number of people walking or cycling or use NMT or feeder services easily to access public transport.	Urban local body	One to three years
6.4	Travel demand management and restraint measure: Parking Management		
	Implement Parking Area Management Plan (PAMP) for all delineated neighborhoods and land uses for demarcation of all types of legal parking spaces for all modes as well as essential street amenities—on-street, off-street and multi-level parking facilities, vending zones, multi-modal integration facilities, green open spaces along with the allied traffic and pedestrian/ NMT circulation plans, signage plans and pricing strategy. PAMPs to be prepared in consultation with local stakeholders, planning bodies/ departments. This should include among others:		
<b>Short-term action</b>			
6.4.1	Demarcate the emergency vehicle route on all public roads within the neighbourhood	Municipal Agencies/ Development Authorities	Six months
6.4.2	Ensure no parks and green areas are converted to parking	Municipal Agencies/ Development Authorities	Six months

S. no.	Action points	Agency responsible	Timeline
6.4.3	Where shared multilevel parking facility is provided demarcate ingress-egress plan and ensure that no major disruption occurs on main thoroughfare traffic. Also indicate pedestrian circulation plan.	Municipal Agencies/ Development Authorities	Six months
6.4.4	Eliminate free parking and introduce effective variable parking charges based on duration of parking and 'user pay' principle as per the National Urban Transport Policy.	Municipal Agencies/ Development Authorities	Six months
6.4.5	Do not allow annual or monthly lump sum payment for parking in commercial areas. Annual passes allow unlimited use and do not reduce demand.	Municipal Agencies/ Development Authorities	Six months
<b>Medium- to long-term action</b>			
6.4.6	Physically demarcate legal parking areas. Equip them with metering systems, proper signage, IT for information on parking availability to reduce cruising time and on-street management	Municipal Agencies/ Development Authorities	One to three years
6.4.7	Penalty for illegal/wrong parking especially parking within the emergency lanes and non-designated areas to be prohibitive.	Municipal Agencies/ Development Authorities	One to three years
6.4.8	Bundle existing/planned public parking facilities and on-street and off-street parking (including multi-level) facilities for management by a single agency/ operator. New stand-alone parking only sites are mostly not required since parking is permitted in all use zones.	Municipal Agencies/ Development Authorities	One to three years
6.4.9	Earmark a part of parking revenue for local area improvement that includes footpaths, public amenities and parking facilities within the PAMP area	Municipal Agencies/ Development Authorities	One to three years
6.4.10	Introduce residential parking permit for regular parkers for use of public parking space and these may be monitored	Municipal Agencies/ Development Authorities	One to three years
6.4.11	In order to optimize utilization of land, ensure that in all new projects (e.g. commercial, institutional, housing, etc.), at least 50 per cent of the available parking spaces is made available for shared parking facility.	Municipal Agencies/ Development Authorities	One to three years
6.4.12	Ensure in the parking contractual agreement that the revenue sharing model is dynamic and flexible, allowing for flexibility in charging and varied usage and rates of the parking spaces; specify the investment that Contractor will have to make for upgradation of the PAMP area including metering, ITS application for commuter information, signage	Municipal Agencies/ Development Authorities	One to three years
6.4.13	Plan and implement parking provision for buses, commercial vehicles and IPT-NMT modes, and for the differently abled.	Municipal Agencies/ Development Authorities	One to three years

S. no.	Action points	Agency responsible	Timeline
6.4.14	Parking charges should be optimal and ensure that at least 85 per cent of the available parking spaces are occupied during peak time. About 15% of parking spaces can be vacant and available at any time to encourage short term parkers.	Municipal Agencies/ Development Authorities	One to three years
6.4.15	Introduce and further upgrade variable time-based pricing, as per market demand. Coordinated off-street and on-street / surface pricing in commercial and residential areas, and parking permits in residential areas. Parking should be charged as per duration, location in city and size of the vehicle. Parking rates (even if differential) should be applied to the entire PMAP area and not to a few streets.	Municipal Agencies/ Development Authorities	One to three years
6.5	Traffic management		
<b>Short-term action</b>			
6.5.1	Create electronic monitoring of traffic violations	Traffic Police	Six months
6.5.2	Conduct audit of traffic intersections and install functional traffic signals at all major intersections	Traffic Police	Six months
6.5.3	Enforce lane driving through heavy fining	Traffic Police	Six months
<b>Medium-to long-term action</b>			
6.5.4	Prepare traffic management plan for the city and continuously update it and monitor its performance.	Traffic Police/ Development Authorities	One to three years
6.5.5	Introduce early alarm system during traffic congestion for the benefit of commuters on major routes, to facilitate route diversion	Traffic Police/ Development Authorities	One to three years
6.5.6	Consider introducing plan for flexi/staggered timings to minimize peak movement of vehicles on roads	Traffic Police/ Development Authorities	One to three years
6.5.7	Formulate action plan for controlling decongestion of fuel stations including increasing the number of dispensing machines	Traffic Police/ Development Authorities	One to three years
6.5.8	Examine existing framework for removing broken down buses / trucks from roads and create a system for speedy removal and ensuring minimal disruption to traffic from such buses / trucks	Traffic Police/ Development Authorities	One to three years

## 7. GENERATOR SETS

S. no.	Action points	Agency responsible	Timeline
<b>Short-term priority action</b>			
7.1	Ensure that only those DG sets that meet the standards in terms of emission or design of chimneys/exhaust and acoustic enclosures, also verify and check whether design specifications are followed or not thereafter the genset to be allowed to operate.	OSPCB, district and local administration	Six months
7.2	Curtail use of DG sets in social events by providing temporary electric connections	OSPCB, district and local administration, power distribution companies	Six months
<b>Medium-term action</b>			
7.3	Alternate power systems should be promoted in cell towers, and use of DG sets discouraged	OSPCB, district and local administration,	One year
7.4	Leverage roof top solar programme to reduce dependence on DG sets	Department of Energy, power distribution companies	One year
7.5	Ensure access to quality electricity supply		One to two years



## 8. OPEN BURNING (INCLUDING SOLID WASTE AND AGRICULTURAL RESIDUES)

S. no.	Action points	Agency responsible	Timeline
<b>Short-term priority action</b>			
8.1	Enforce a complete ban on garbage burning in the entire region. Evolve a monitoring mechanism for this. Take stringent action against open burning of biomass, leaves, tyres etc. to control such activities	Municipal corporations, Regional Development Authority, Resident Welfare Associations, OSPCB, District and local administration	Six months
8.2	Ensure proper collection of horticulture waste (biomass) and composting-cum-gardening approach; municipal zonal offices should be responsible for controlling burning of leaves and garbage on roads/ parks. All horticulture agencies should have compost pits in parks. Organize public outreach programme to promote household and community based composting systems (composting pits, shredders etc.) of vegetative waste to prevent burning.		Six months
8.3	Implement provisions of Solid Waste Management Rules 2016. Decentralize waste management for hotels, apartments, institutions as per SWM Rules 2016. Implement penal provisions to spot fine on waste burning. Strictly ban open burning of hazardous industrial waste		Six months
8.4	Use of satellite based monitoring as well as mobile spot check squads for enforcement	Municipal corporations, Regional Development Authority, RWAs, State Police Department, PCB GIS cell	One to two years
8.5	Proper management of landfill sites to prevent spontaneous fire		
8.6	Adopt roadmap for zero landfill policy to promote decentralized waste segregation, reuse and recycling		
8.7	With a good decentralized and segregated waste management system, a waste-to-energy plant will not be needed. In case any location requires strong siting policy should be adopted to keep it away from habitation; stringent implementation of emissions norms; use state of the art technology and provide emissions data to SPCB.	OSPCB, Municipal Corporation, Regional Development Authority, incinerator facility operator, RWAs	

## 9. COOKING FUELS AND OPEN EATERIES

S. no.	Action points	Agency responsible	Timeline
<b>Medium- to long-term action</b>			
9.1	A targeted programme to be implemented for 100 per cent coverage of households by distribution of LPG/PNG in all non-compliant cities. Leverage policies like Ujjwala and other state government schemes etc.	DoFE, Department of Energy, district and local administration	One to two years
9.2	In low-income neighborhoods, as well as roadside eateries/dhabas/ restaurants etc. promote and give access to LPG and electricity. Mandate and link commercial license of eateries etc. to clean fuels.	DoFE, Department of Energy, Power and Natural Gas, urban local bodies	One to two years
9.3	Prohibit use of coal in hotels and restaurants, phase out use of kerosene for cooking in the city and incentivize move to LPG also check feasibility of natural gas pipeline for residential and commercial use	DoFE, Department of energy, power and Natural gas, civil supplies department	One to two years

## 10. ROAD DUST

S. no.	Action points	Agency responsible	Timeline
<b>Short-term priority action</b>			
10.1	Sprinkling of recycled water (without compromising other uses); introduce water fountains at major traffic intersections, wherever feasible	District and local administration, PWD, Road owning agencies	Six months
10.2	Phase-in mechanical/vacuum-based street sweeping wherever feasible; introduce wet/mechanized vacuum sweeping of roads		Six months
<b>Medium- to long-term actions</b>			
10.3	Implement truck loading guidelines; use of appropriate enclosures for haul trucks; gravel paving for all haul routes.	Department of Transport, Traffic Police, District and local administration	One to two years
10.4	Maintain pot hole-free roads for free flow of traffic to reduce emissions and dust.	Municipal corporation, regional development authority, District and local administration	One year
10.5	Increase green cover in the region. Undertake greening of open areas, gardens, community places, schools and housing societies. Create tree barriers towards mining areas in the district.	DoFE, Municipal corporation, regional development authority, local bodies, RWAs	One to two years
10.6	Enforcement of air pollution control in concrete batching (use of water spray and wind breakers, bag filter at silos and enclosures, hoods, curtains etc.)	OSPCB, Department of industries, District and local administration	One to two years
10.7	Adopt street design guidelines for paving of roads and footpaths (hard and soft paving) and vegetative barriers		One to two years

## 11. CONSTRUCTION DUST

S. no.	Action points	Agency responsible	Timeline
<b>Short-term action</b>			
11.1	Develop and implement dust control measures for all types of construction activities -- buildings and infrastructure. This should be strictly enforced. Regulators can refer the check list for inspection of construction sites prepared under directions of NGT and EPCA.	District and local administration, municipal corporation, development authorities, RWAs	Six months
11.2	Undertake control measures for fugitive emissions from material handling, conveying and screening operations through water sprinkling, curtains, barriers and dust suppression units. Introduce steeper penalties for non-compliance. Needs enforcement.	District and local administration, municipal corporation, development authorities, RWAs	Six months
11.3	Enforce restrictions on construction activities within urban airshed zones during high pollution period	District and local administration, municipal corporation, development authorities, and real estate companies	Six months

S. no.	Action points	Agency responsible	Timeline
<b>Medium- to long-term action</b>			
11.4	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.	District and local administration, municipal corporation, development authorities	One to two years
11.5	For material handling, construction and demolition, it should be obligatory on part of the developers to provide evidence of debris on-site recycling and/or disposal at designated sites.	District and local administration, municipal corporation, development authorities, real estate companies and RWAs	One to two years
11.6	Promote recycling of construction and demolition waste. Implement provision of Central regulations for construction and demolition waste management rules 2016. Set up facilities for recycling of C&D waste. Mandate that a certain percentage of the new construction should be recycled C&D waste.	District and local administration, municipal corporation, development authorities, real estate companies and RWAs	One to two years

## 12. EPISODIC EVENTS

S. no.	Action points	Agency responsible	Timeline
12.1	Measures to control forest fire/biomass/ crop residue burning: Use satellite based monitoring and on-ground enforcement to control biomass burning episodes.	OSPCB, GIS cell, Department of Agriculture, Department of Science and Technology, district and local administration	Ongoing
12.2	Firecrackers: regulate and control its usage including restrictions on timing as per the Supreme Court and CPCB and PESO guidelines.	District and local administration, Police Department, OSPCB, RWA's, Chief Controller of Explosives, Petroleum and Explosive Safety Organization (PESO)	Ongoing

## 13. RENEWABLE ENERGY

S. no.	Action points	Agency responsible	Timeline
<b>Medium- to long-term action</b>			
13.1	Solar rooftop policy should be implemented and should be linked with transition from diesel genset to solar power, also the electric public transport can be linked with solar power plans to shift to zero emission target. Identify canals and open spaces for installation of solar power system  Identify and target commercial and industrial establishments for installation of roof top solar system Organize consumer outreach programme on solar rooftop programme	Department of renewable energy, Department of power/energy, Odisha Renewable Energy Development Agency, District and local administration	One to two years

#### 14. URBAN GREENS AND FORESTS

S. no.	Action points	Agency responsible	Timeline
<b>Medium-term action</b>			
14.1	<p>Avenue plantation along roads with more traffic.</p> <p>Urban planning to integrate urban greens (parks, district forests etc.) and urban forests in the Master Plans of the cities and all infrastructure development and urban redevelopment projects. At least 15-20 per cent of the new urban redevelopment projects should be set aside for urban green and tree cover.</p> <p>Urban planning to provide for green roofs and vertical greens linked to infrastructure development. Green walling with plantations around dust generators and also to be dust barriers to be integrated with the urban forestry and forest policy.</p>	DoFE, Department of Forest	One year

#### 15. IMPROVE TRAINING AND CAPACITY

S. no.	Action points	Agency responsible	Timeline
15.1	Training and skill development will be required of public officials and other public functionaries for planning and management and execution of the plan. This will also require extensive capacity building in all sectors and infrastructure planning.	DoFE, Department of Personnel and Training, District and local administration	Ongoing

#### 16. NEED FOR PUBLIC AWARENESS AND COOPERATION

S. no.	Action points	Agency responsible	Timeline
16.1	<p>Organizing deeper public engagement and forums for public consultation for public understanding of the nature of solutions needed to address the complex problem of sustainable industrial development and urban mobility.</p> <p>Set up system for public communication, information dissemination and outreach</p>	DoFE, OSPCB, district and local administration	Ongoing

### Graded Response Action Plan (GRAP) for reducing air pollution in non-attainment cities of Odisha

The proposed graded measure approach for each pollution source according to the Air Quality Index (AQI) categories includes appropriate measures for each level of pollution (PM10 / PM2.5). While the comprehensive clean air action plan must be implemented round the year, the GRAP measures are meant to be temporary measures for duration of smog episodes and are implemented according to the severity of the air pollution levels. Once the levels come down and stabilize, measures are withdrawn. The objective of the GRAP is to prevent pollution from getting worse when adverse weather conditions trap and spike pollution.

The proposed GRAP includes set of measures to be implemented with greater vigour and stringency to prevent and avoid high level of air pollution in cities. This is linked to the national air quality index that categorises daily air quality as good, satisfactory, moderate, poor, very poor, severe, and emergency. All actions suggested for each category are cumulative and add up to the level of emergency as air quality worsens.

For GRAP implementation the scientific Task Force under OSPCB will advise the High-powered committee on the daily pollution levels and forecasting based on real time monitoring. Accordingly the High-powered Committee may issue notices to the city authorities to implement the pre-defined action. Each implementing department will appoint a nodal officer to facilitate implementation. The action notified for moderate and poor that are largely about stringent enforcement in different sectors, can become default action for continuous implementation throughout the year. Additional measures meant for very poor and severe may be notified which such situation develops especially during calm and inversion conditions.

This will require daily air quality data reporting on the SPCB website and public dissemination system on air quality and health alert. The GRAP measures can be customized based on the special needs and the unique pollution profile of the city.

<b>Severe + or Emergency</b>	
<b>When PM2.5 levels cross 300 microgramme per cum or PM10 levels cross 500 microgramme per cum (or five times above the standard) or persist for 48 hrs or more</b>	
<b>Action to be taken</b>	<b>Agency responsible</b>
Stop entry of diesel truck traffic into city (except essential commodities)	Traffic Police, municipal corporations, development authorities
Stop construction activities	Pollution Control Board Municipal Corporations development authorities
Introduce odd and even scheme for private vehicles based on license plate numbers Or introduce low emissions zones in the city to stop entry of polluting vehicles (old and ageing and polluting diesel vehicles etc). For this purpose introduce sticker system as per MORTH guidelines to indicate fuel and date of manufacture of vehicles.	Transport Department Traffic Police
State Pollution Control Board Task Force to take decision on any additional steps including shutting of schools	
<b>Severe</b>	
<b>When PM2.5 levels are above 250 microgramme per cum or PM10 levels are above 430 microgramme per cum</b>	
<b>Action to be taken</b>	<b>Agency responsible</b>
Close brick kilns, hot mix plants, stone crushers and other highly polluting units or as applicable locally	State Pollution Control Board District Administration Police
Shut down / minimize operation of polluting coal based power plant and incentivize power generation from existing natural gas based plants or as needed locally	State Pollution Control Boards
Intensify public transport services. Introduce differential rates to encourage off-peak travel.	Transport Department State Transport Corporations
Increase frequency of mechanized cleaning of road and sprinkling of water on roads. Identify road stretches with high dust generation.	All road owning agencies including municipal corporations, development authorities, Public Works Department and National Highway Authority of India
Restrict movement of trucks inside the coal field mine areas	State pollution control board, Department of Steel and mines

<b>Very poor</b> When PM <sub>2.5</sub> levels are 121–250 microgramme per cum or PM <sub>10</sub> levels are 351–430 microgramme per cum	
Action to be taken	Agency responsible
Stop use of diesel generator sets	State Pollution Control Boards
Enhance parking fee by three to four times	Municipal corporations, development authorities,
Augment public transport services by increasing frequency	Department of Transport State Transport Corporation
Stop use of coal/firewood in hotels and open eateries	Municipal corporations, development authorities
Residential societies and individual house owners to provide electric heaters during winter to security staff to avoid open burning	Municipal corporations, Resident Welfare Associations, development authorities
Alert in newspapers/TV to advise people with respiratory and cardiac patients to avoid polluted areas and restrict outdoor movement.	State Pollution Control Board
<b>Moderate to poor</b> <b>Poor: When PM<sub>2.5</sub> levels are 91–120 microgramme per cum or PM<sub>10</sub> levels are between 251–350 microgramme per cum; Moderate: When PM<sub>2.5</sub> is 61–90 microgramme per cum or PM<sub>10</sub> is 101–250 microgramme per cum</b>	
Action to be taken	Agency responsible
Stringently enforce/stop garbage burning in landfills and other places and impose heavy fines on person responsible	Municipal corporations, development authorities,
Close/stringently enforce all pollution control regulations in brick kilns and industries	State Pollution Control Board
Stringently enforce pollution control in thermal power plants through Pollution Control Board monitoring	State Pollution Control Board
Do periodic mechanized sweeping on roads particularly in roads with heavy traffic and water sprinkling every two days	Municipal Corporations Traffic Police PWD, development authorities
Strict vigilance and no tolerance for visible emissions—stop plying of visibly polluting vehicles by impounding or heavy fine	Department of Transport Traffic Police
Stringently enforce rules for dust control in construction activities and close non-compliant sites	District Administration, Police
Deploy traffic police for smooth traffic flow at identified vulnerable areas	Traffic Police
Divert non-destined truck traffic	Municipal corporations, traffic police, development authorities
Strictly enforce Supreme Court orders on firecrackers	SPCB, District Administration in consultation with Chief Controller of Explosives, Petroleum and Explosive Safety Organization (PESO); Police
Ensure fly ash ponds are watered every alternate day during summer months (March-May)	Plant in charge of power plants
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.	State Pollution Control Board District Administration

### Action to be taken by public

While the National Air Quality Index (AQI) and health advisory will inform people about the dangers of exposure, people are also expected to take precautionary measures to protect themselves. Suggested actions by public are listed below:

Level according to AQI	Action
Very poor, severe and emergency	Those suffering from heart diseases, asthma, and other respiratory disease may consider avoiding undue and prolonged exposure
	Schools to suspend all outdoor activities and sport events
	Report visible emissions from vehicles, industries, power plants, garbage burning, and other non compliances to the respective control rooms
	Do not use diesel and kerosene generators
	Maintain vehicles properly (PUC certificate, replace car air filter, maintain right tyre pressure)
	Minimize unnecessary travel, use public transport & avoid using private vehicles

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