

**Amaravati City
Air Pollution Control
Action Plan**



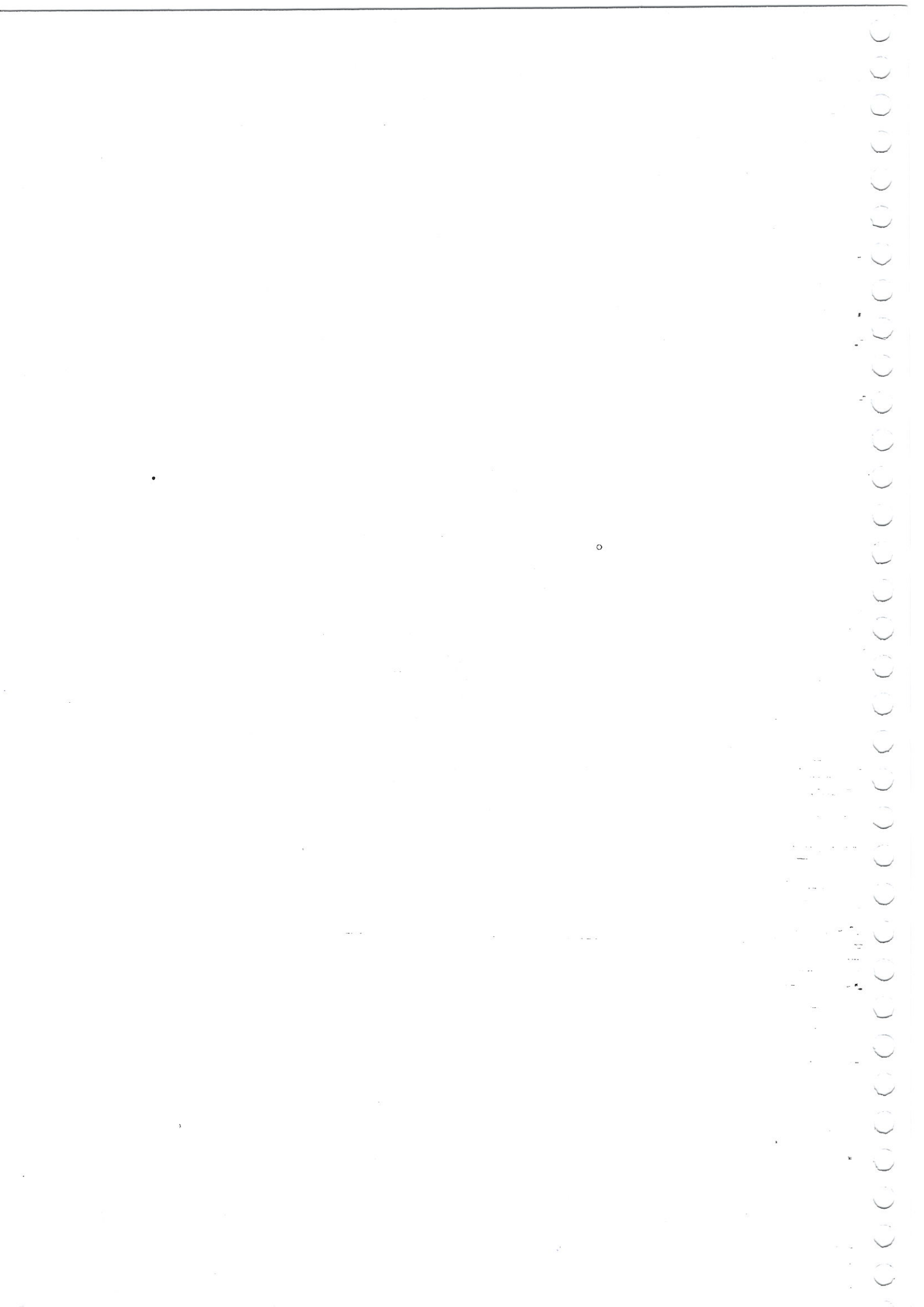
ACTION PLAN FOR CONTROL OF AIR POLLUTION IN NON-ATTAINMENT CITIES OF MAHARASHTRA

AMARAVATI



- **MAHARASHTRA POLLUTION CONTROL BOARD**

KALPATARU POINT, 3rd Floor,
Sion-Matunga Scheme Rd. No.8,
Opp. Sion Circle, Sion (East),
Mumbai-400 022.



ACTION PLAN FOR CONTROL OF AIR POLLUTION IN NON-ATTAINMENT CITY OF MAHARASHTRA

(AMARAVTI)

1. Preamble

Amravati District constitutes 3.96% of the total area of the Maharashtra state and is located in the Vidharbha region on the north eastern side. It is divided into 14 Tahsils and 14 Panchayat Samities. According to the 2001 census, there was 843 Gram Panchayats for the purpose of Rural Development. 75% of the district is covered by Deccan trap while 25% area is covered by Purna alluvium. Amravati city (21.30'-21.50'N; 76.35'-78.27'E) which includes the municipal boundaries has total area of about 121.65 Sq. Km. The population as per 2011 census is 647057. The city is located on the National Highway NH-6 leading to Mumbai in the west and Kolkata in the east. Amravati has good road and rail connectivity with almost all important cities in India. Fig. 1 shows the location map of Amravati city. The summary of demographic structure of the city is given in Table 1a. The ward wise population is given in Table 1b and slum population is given in Table 1c.

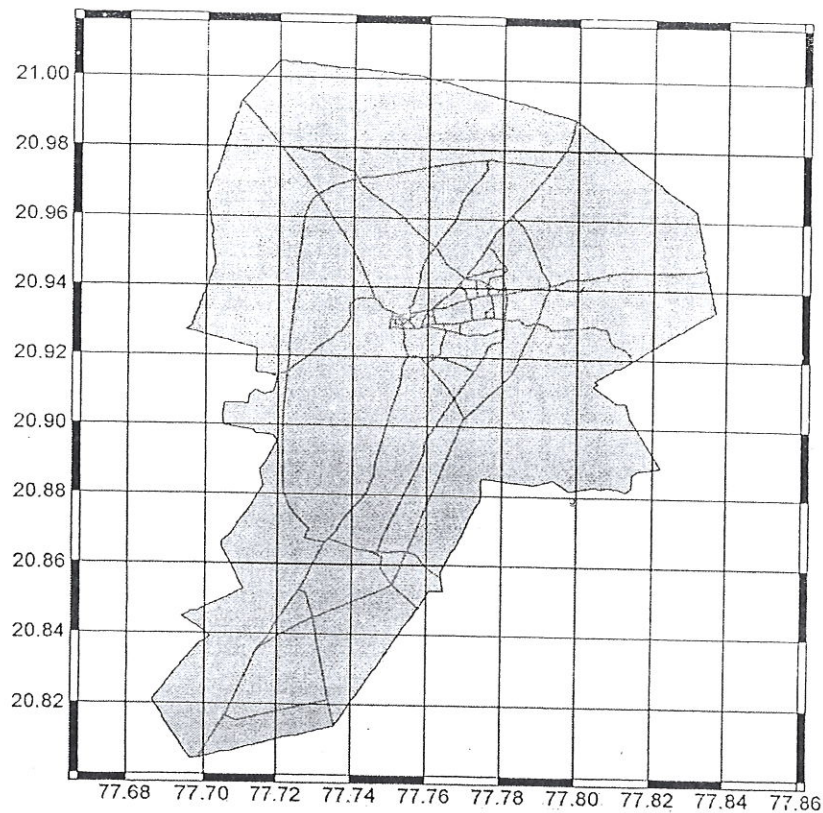


Fig.1. Location map of Amravati city

Table 1a. Summary of Demographic Structure in Study Area

S. No.	Demographic Parameters	Amravati Municipal Corporation
1	State/District	Maharashtra/Amravati
2	No. of Prabhags	22
3	Total No. of Households	136796
4	Total Population	647057
5	Density of Population (Km ²)	5319
6	Sex Ratio (Females/100 males)	961
7	Scheduled Castes	111435 (17.22%)
8	Scheduled Tribes	15955 (2.47%)
9	Literate	535594 (82.77%)
10	Main Worker	189628 (29.31%)
11	Marginal Worker	18908 (2.92%)
12	Non Worker	438521 (67.77%)

Source : Primary Census Abstract, 2011 (Amravati District, Maharashtra state)

Table 1b. Ward wise population of Amravati city

Ward no.	Ward name	Total population
1	Shegaon - Rahatgaon	27457
2	Shri Sant Gadgebbaba P.D.M.C	26952
3	Navasari	30705
4	Navasari colony	31005
5	Mahendra Colony-New Cotton market	29268
6	Vilas Nagar-Morbag	29597
7	Jawahar Stadium	27135
8	Jog Stadium -- Chaparashi pura	26829
9	S.R.P.F. - Wadali	20452
10	Benoda - Bhimtekadi - Dastur Naga	32235
11	Frejarpura	28585
12	Rukhmini Nagar - Swami Vivekanand	26930
13	Ambapeth - Gaurakshan	27848
14	Jawahar Gate - Budhwara	29870
15	Chhaya Nagar - Gavalipura	32705
16	Alim Ngar - Rahmat Nagar	32004
17	Gadgadeshwar	31860
18	Rajapeth - Shri Sant Kanwarram	32501
19	Sai Nagar	30452
20	Sutgirmi	32518
21	Juni Wasti Badnera	32442
22	Navi Wasti Badnera	27707
Total		647057

Source: Census, 2011

Table 1c. Urban and Slum Population in the City

Population Details	Total
City Population	647,057
Slum Population	238,883

Source: Census, 2011

1.1 Climate and Meteorology

Amravati has a tropical wet and dry climate with hot and dry summers and mild to cool winters. Summer lasts from March to June, monsoon from July to October and winter from November to March. The maximum temperature in summer is recorded as 44⁰C and minimum as 29⁰C. In winter, maximum temperature is usually around 28⁰C and minimum is around 19⁰C (AccuWeather, 2018). Wind speed is around 10 mph (16.9 km/hr) from North West and humidity is 12% (World weather online, 2018). The windrose diagram is shown in Fig. 2. It can be seen that the predominant wind direction is from West, NE and NW direction.

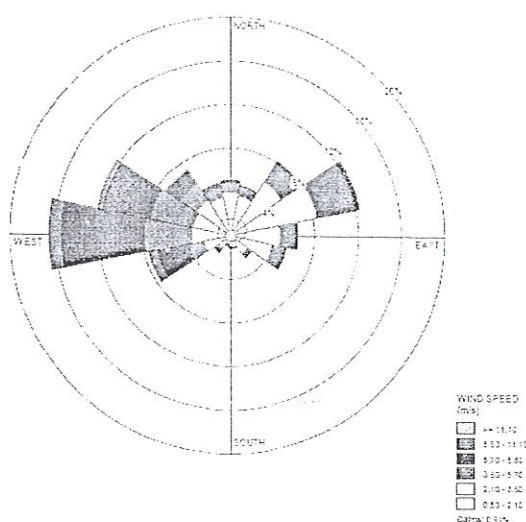


Fig.2. Windrose diagram for Amravati city – based on 2017 data

1.2 Ambient Air Quality – Secondary data

Based on last 5 year data obtained from the MPCB website, RSPM concentration is plotted in Fig. 3 Since MPCB provides the AAQ data on SPM, RSPM only and PM2.5 concentration is not provided by them or any other agency, it was not possible to give the historical picture of PM2.5 concentration. The data is plotted for three sites, Terrace of Govt. College of Engineering, Electronic & Computer Building (Residential), Building of Apurva Oil Industries (Industrial) and Vanita Samaj Building (Commercial). It can be seen that RSPM concentration is lower at residential site, whereas at commercial and industrial sites, it is mostly higher than CPCB standard of 100 ug/m³.

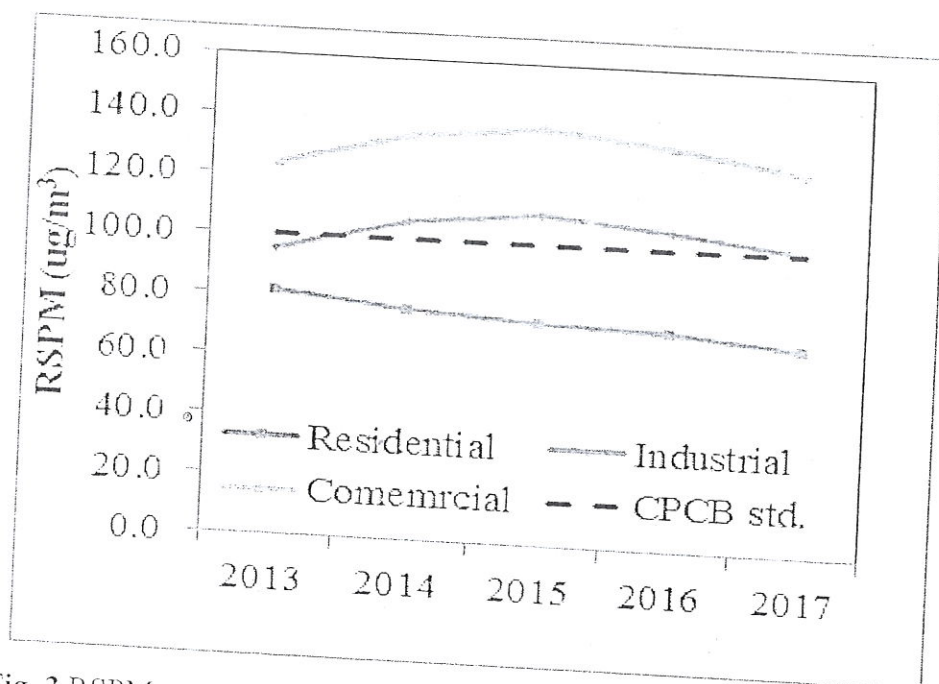


Fig. 3 RSPM concentration at three sites in Amravati during 2013-2017

1.3 Emission Inventory

For the effective emission reduction plan in advance, the knowledge of sources prevailing in the area along with their contribution is the preliminary step to envisage further steps. In order to facilitate the preparation of emission inventory, the general sources based on Point, Area and Line source category are considered. Data requirement for preparation of emission inventory along with its probable sources is presented in Table 2. For area sources, the emissions from domestic fuel consumption, bakeries, hotels, dhabas and open eat outs are considered. The details of the respective sources are given in the appropriate sections. In order to estimate emission load, CPCB and USEPA based emission factors are used. ARAI/CPCB has provided the emission factors for various types of vehicles. Emission factors for various types of vehicles being developed by ARAI/CPCB and other organizations will be utilized to estimate the vehicular emission load.

Table 2. Data Requirement and Probable Sources for Preparation of Emission Inventory

No.	Task	Data Required	Probable Source
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1.	Mapping of road network and other details for delineation of zones / sector	Base maps, road network details, population density, industrial activities	Traffic Commissioner, RTO, Municipal ward office
2.	Emission inventory for vehicular sources	<ul style="list-style-type: none"> • Secondary data on vehicle counts and locations, in-use vehicle population • Registered data on vehicles (year-wise) and growth rate for past 15 years • Vehicle usage characteristics • Number of garages/service centers. • Number of PUC centres • Planned technological interventions • Sale of Petrol/Diesel/ LPG per month • Emission factors for emission load estimation 	<p>Transport commissioner's office, RTOs, Reports, SIAM etc.</p> <p>Primary data through questionnaire Petrol pumps/Local Agencies/Marketing Terminal/PUC centres/Parking lot/ Vehicle service centres/Individual vehicle owner</p>
3.	Emission Inventory for Industrial Sector	Major types of air polluting industries - Fuel usage (quantity), fuel type (quality) and pollutant load from various industries	PCB, CPCB, Industrial Development Corporation, Industries Association, Fuel supply agencies
4.	Emission Inventory for Area Sources (residential and commercial sector)	<ul style="list-style-type: none"> • Population and demography • Data on domestic fuel • Number of registered hotels, Restaurants, bakeries etc., • Number of Crematoria • Data on refuse burning • Data on Incinerators • Sale of LPG/kerosene/coal/ wood 	<p>Census office, Municipal Corporation. District Collector's office, District fuel supply office, Rationing office, Fuel supply dealers, Development Authority, Associations of Hotels, Restaurants, Bakeries, Health department of Municipal Corporation.</p> <p>Primary data through questionnaire Residential/Hotels and restaurant owners/bakery owners /commercial establishments/ crematoria</p>

1.3.1. Area Source

Emission load calculated for area sources is given in Table 3. The details of the major area sources in short are given below. The details on the solid waste generation and construction activities are given in the respective sections.

A.1 Bakery

It was found that most of the bakeries are operating as coal based unit (63.64%-590 kg/d) and wood based unit (36.36% - 845 kg/d).

A.2. Open eat-outs

Most of the open eat-outs are operating as LPG based (82.4%) with kerosene (12.8%), coal (12%), diesel (1.2%) and wood (2.4) based units.

A.3. Hotels and Restaurants

Hotels and restaurants are mostly LPG based (91.1%) with presence of kerosene (3.81%), coal (1.6%) and wood (3.38%) units.

A.4. Crematoria

Crematoria are operating as kerosene based unit (91.6%).

A.5. House Hold Fuel Consumption

There are 10 LPG distributors in the area. Number of LPG consumers are 3.83 lacs with 10.37 TMT quantity sold in 2018 as per the data given by Indian Oil Corporation Limited, Bandar, Mumbai. The emission load is however calculated based on the data from the report of Census of India, 2011.

A.6. Fuel Consumption in Slum Population

A survey of 36 households was conducted, spread over 7 areas within the city which were known to have significant slum population. It was seen that majority of the slum houses used a combination of fuels such as LPG (6.06%), wood (77.79%) and kerosene (16.13%). The kerosene consumption based on ration shops survey was found to be 7179 L/M.

As per emission inventory, PM percent contribution from area sources is very high particularly when compared with emissions from vehicular emissions. Based on the % share contribution, surveys and assessment, few recommendations are suggested to reduce the emissions from area sources as given in Table 4.

Table 3. Area Source Emission Inventory

Source	Fuel/Type	PM2.5 (TPY)
Bakery	Wood	1.7
	Coal	1.2
Crematoria	Wood	10.8
	Kerosene	0.0
Open burning	196.1	196.1
Construction	New	407.8
	Ongoing	383.3
	Road dust	24.1
Domestic	Kerosene	5.7
	LPG	270.8
	Wood	654.3

	Coal	20.7
	Crop residue	297.6
	Cow-dung	11.5
Open eatout	LPG	0.5
	Keorsene	0.0
	Coal	0.0
	Wood	0.3
	Diesel	0.0
Hotel	LPG	515.3
	Kerosene	0.0
	Wood	0.4
	Coal	0.3
Brick Kilns	Wood	148.3
	Coal	225.5
Paved Road dust	291.5	291.5
Unpaved Road dust	241.8	241.8

B. Solid Waste emissions

In Amravati, there are 5 zones within which 22 Prabhags are located. For the sake of convenience of management of municipal solid waste; the waste generated, resources available etc. are referred to each prabhags and respective zonal office. The ward wise MSW generation is given in Table 5. The corporation performs its function as per the provisions of the act governing the municipal corporation in the state. Table 6 shows the facilities for collection and transportation of MSW. Based on the survey data, 362 tonnes per day solid waste generation is considered for estimation of PM emission load.

Out of the total waste generated, 35.53% is biodegradable, 15.95% is recyclable and 48.52% is debris and silt (Khandve. P. V, Rai.R. K., 2011. Municipal Solid Waste Management at Amravati City - Present practice and future challenges, I. J. Environmental Sciences 2(2). 625-635). As such only dumping facility at Sukoli depo is available for the whole city. The transportation of waste up to compost depot at Sukhli road is done through open trucks and dumpers. The disposal of solid waste is done at the landfill site, which is approx. 160- 170 MT.

Table 4. Ward-wise Population and Total Solid Waste Generated

Ward No.	Name of wards Cover Door to Door Colletion	Name of Plant waste to energy / Composting, Recycling / Biomethanation	Waste Collection (Ton/Day)	Waste Treated (Ton/ Day)	Remaining Waste (Ton/Day)
1	Shegaon-Rahatgaon	Rathi nagar Garden	18	4.3	13.7
2	PDMC	Rathi nagar Garden	17	4.1	12.9

3	Navsari	Sukali Compost Depot	16	3.8	12.2
4	Jamil Colony	Sukali Compost Depot	17	4.1	12.9
5	Mahendra Colony	Sukali Compost Depot	16	3.8	12.2
6	Vilas Nagar	Sukali Compost Depot	16	3.8	12.2
7	Jawahar Stadium	Sukali Compost Depot	16	3.8	12.2
8	Jog Stadium	Sukali Compost Depot	16	3.8	12.2
9	SRPF	Wadali Garden / Bambu Garden	16	3.8	12.2
10	Benoda	Chhatri Talav	17	4.1	12.9
11	Frezarpura	Sukali Compost Depot	17	4.1	12.9
12	Rukhmini Nagar	Sukali Compost Depot	16	3.8	12.2
13	Ambapeth	Sukali Compost Depot	16	3.8	12.2
14	Budhwara	Sukali Compost Depot	16	3.8	12.2
15	Gawalipura	Sukali Compost Depot	16	3.8	12.2
16	Alim Nagar	Sukali Compost Depot	16	3.8	12.2
17	Gadgadeshwar	Sukali Compost Depot	16	3.8	12.2
18	Rajapeth	Sukali Compost Depot	16	3.8	12.2
19	Sai Nagar	Sukali Compost Depot	16	3.8	12.2
20	Sutgirani	Sukali Compost Depot	16	3.8	12.2
21	Old Town Badnera	Sukali Compost Depot	18	4.3	13.7
22	New Town Badnera	Sukali Compost Depot	18	4.3	13.7
Total			362	86.3	275.7

Source: Survey by Green Health Foundation, 2018

Table 5 Infrastructure for MSW Collection and Transportation

S. No.	Facility/Infrastructure	No.
1	Handcarts	90
2	Ganti Katla (Mechanized)	350
3	Ganti Katla (Organized)	90
4	Hydraulic Auto	43
5	M.O.H	1
6	Medical Officer	1
7	Doctor Incharge	1
8	Sanitary Superintendent	1
9	Sanitary Inspector	48
10	Mukadam deployed	86

Source: Khandve, P. V, Rai.R. K. (2011)

Note: the data is old and many changes may have taken place.

The resolution No. 368 dated 25-11-2016 has been passed by the standing committee for the total 500 TPD plant proposed for the scientific disposal of the 200 TPD daily waste and 300 TPD for old dumping waste

C. Point Source

As per emission inventory, the percent emission contribution to PM_{2.5} is around 28.8% from industrial sector (coal, brick kiln and wood). Based on the report on industrial profile (Brief Industrial Profile of Amravati District, 2015-16, MSME Development Institute, Govt. of India, Ministry of MSME), it is observed that the number of registered industrial units have declined from 1051 to 261 during 2014-15 to 2015-16. There are approximately 57 industrial units in and around the 5km radius of the city that have been considered as air polluting and accounted for in the present study. Fuel based contribution is given in Table 8. There are in all 9 brick kilns in the area. The fuel consumption pattern of the brick kilns is 23.82% wood, 60.25% coal and 15.91% asha. The emission from coal based power plant is 3465 TPY and from other industries, emission load is estimated to be 719 TPY. From brick kilns, the total emission load is 373.8 TPY. Fig. 4 shows the % share of brick kilns, coal based power plant and other industries. The highest contribution is from coal based power plant.

Table 6. Point Source Emission Inventory

Fuel	PM _{2.5} load (TPY)
Coal	2788.7
Furnace oil	4.0
Wood	110.1
Diesel	51.8
HSD	13.2
Methane gas	0.0
Biomass Briquettes	5.0
Bagasse	2.3
LDO	1.1
Total	2976.1

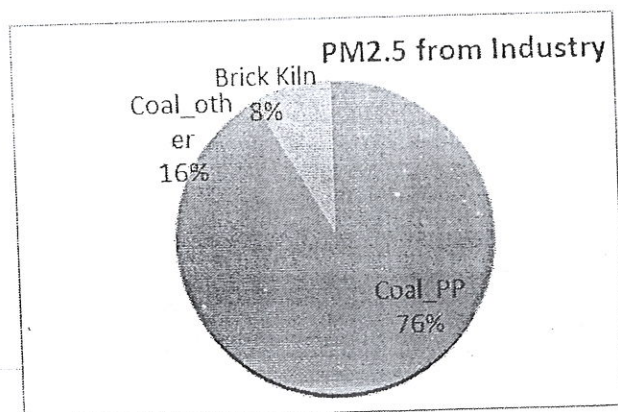


Fig. 7 PM2.5 emissions from industries and brick kilns

D. Line Source

There are about 258925 lakhs registered vehicles in Amravati District. The distribution of vehicles based on RTO data is given in Table 10a. Based on the traffic count data it is observed that overall 569652 vehicles ply on the roads of the city. The distribution of different vehicles is given in Table 10b. There are 5 parking sites in the city, namely, Badnera cycle stand, central railway (pay and park), city hospital, railway station parking, ST bus stand. The numbers of registered vehicles are growing 7% per annum in Amravati (based on RTO data). Public transport in Amravati city is a road based bus, operated by AMC. Currently the city buses operated by AMC are privatized with the operation & maintenance done by the contractors. A royalty of 1.10 Paise per Km is given to the AMC. A total of 27 buses run throughout the city covering a daily run of 3963 Kms. The frequency of these buses is 15 minutes. Apart from the city bus services ST bus service facilities is provided by the ST Mahamandal, Amravati. Considering the number of vehicles in the city, the corresponding infrastructure in terms of parking facilities is not adequate. There are 100 buses that operate in and out of the city. The public transport infrastructure needs to be justifiable in terms of the number of commuters. Action plan for line source emission reduction is given in Table 11.

Table 8a. Number of Vehicles in the City

S. No.	Type of vehicles	No of Vehicles
1	2W	213538
2	Cars_Diesel	10054
3	Cars_Petrol	6771
4	Jeeps_Diesel	2116
5	Jeeps_Petrol	95.2
6	Station Wagons	145
7	Taxi_Diesel	418
8	Taxi_Petrol	248
9	Auto Rickshaws_Diesel	516
10	Auto Rickshaws_Petrol	5886
11	Stage Carriages	222
12	Contract Carriages/Mini bus/ School van	163
13	School Buses_Diesel	105
14	School Buses_Petrol	95
15	Pvt. Service Vehicles	56
16	Ambulance_Diesel	102

17	Ambulance_Petrol	21
18	Trucks & Lorries	3400
19	Tankers	96
20	Delivery Van (4 Wheelers)	3360
21	Delivery Van (3 Wheelers) Diesel	1254
22	Delivery Van (3 Wheelers)_Petrol	557
23	Tractors	5974
24	Trailers	3490
25	Others	243
Total		258925

Source: RTO, 2017

Table 8b. Vehicle count data

Vehicle Type	No. of Vehicles
2W	341394
3W	107270
Car	93454
4W	27534
Total	569652

Source: Green Health Foundation, 2018

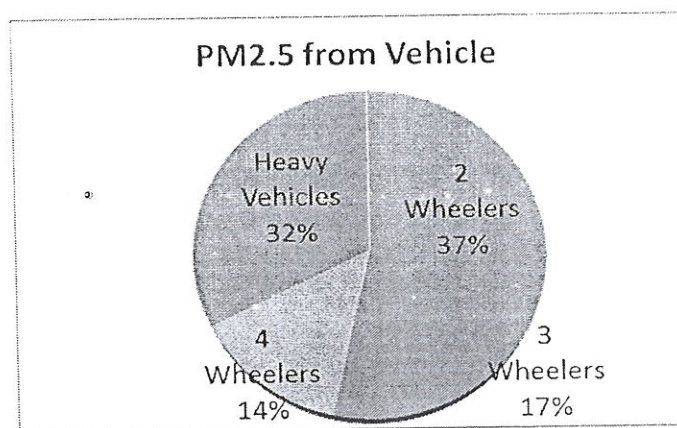


Fig. 5 % contribution of PM2.5 from different type

Overall PM2.5 contribution by various sources

Table 12 shows the PM2.5 emission load contribution by various sources in tonnes per year (TPY). It can be observed from Fig. 6 that Industries contribution is highest followed by

domestic and commercial fuel burning (D&C burn). Vehicles and Road dust also contributes significantly to total PM2.5 load.

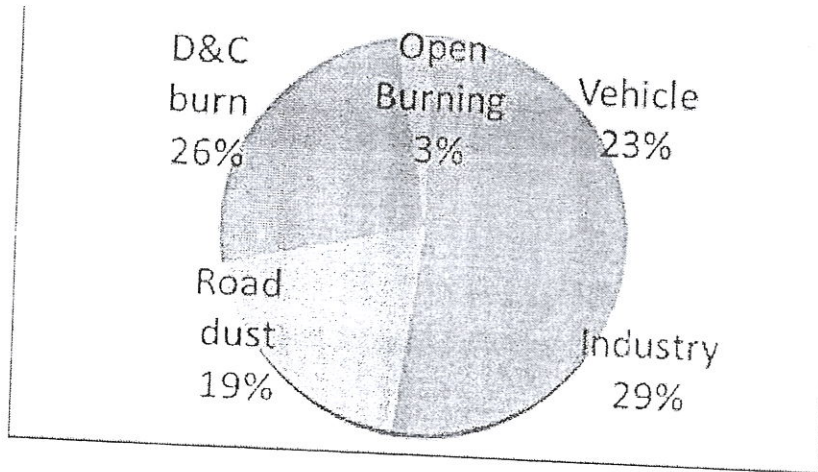


Fig. 6. % contribution to PM2.5 by various sources

Table 9. Emission load contribution by various sources

Source	PM2.5 load (TPY)
Vehicle	1620.5
Industry	2004.6
Road dust	1348.6
D&C burn	1791.2
Open Burning	196.1
Total	6960.9

2. AMBIENT AIR QUALITY DATA

2.1 Month and Annual average data for SO₂, NO_x and RSPM are provided below

Data for Monthly average reading recorded at Amravati

Station Name	year	Month	Average of SO ₂	Average of NO _x	Average of RSPM	
			50	40	60	
Raj Kamal Chowk	2017	Apr	15	16	147	
		May	13	14	138	
		Jun	13	15	119	
		Jul	10	16	110	
		Aug	11	14	108	
		Sep	13	14	119	
		Oct	12	13	122	
		Nov	12	13	107	
		Dec	14	15	115	
		2018	Jan	14	15	121
Feb	13		14	116		
Mar	13		117	122		
Govt. College of Engineering	2017	Apr	13	15	79	
		May	13	14	82	
		Jun	10	11	62	
		Jul	9	10	52	
		Aug	9	14	65	
		Sep	11	12	64	
		Oct	11	14	75	
		Nov	12	13	70	
	Dec	12	13	71		
	2018	Jan	12	13	75	
		Feb	11	13	70	
		Mar	12	61	73	
		Godhadiwala Private Limited	2017	Apr	12	13
May				11	12	105
Jun	9			11	85	
Jul	10			11	82	
Aug	10			14	87	
Sep	10			11	98	
Oct	11			12	103	
Nov	12			13	105	
Dec	12			13	100	
2018	Jan	13	14	101		
	Feb	12	13	89		
	Mar	12	100	101		

Data for Annual average trend of SO₂, NO_x, and RSPM at Amravati

Station Name	year	Average of SO ₂	Average of NO _x	Average of RSPM
		50	40	60
Raj Kamal Chowk	06-07	13	19	79
	07-08	11	16	78
	08-09	12	15	100
	09-10	14	16	125
	10-11	13	15	146
	11-12	15	18	108
	12-13	12	13	109
	13-14	12	13	128
	14-15	12	14	133
	15-16	12	14	135
	16-17	13	14	141
Govt. College of Engineering	17-18	13	23	120
	06-07	10	12	50
	07-08	8	8	40
	08-09	8	10	47
	09-10	10	12	78
	10-11	10	13	79
	11-12	10	12	79
	12-13	11	12	80
	13-14	10	12	80
	14-15	11	12	75
	15-16	11	12	73
Godhadiwala Private Limited	16-17	11	13	73
	17-18	11	16	69
	06-07	12	16	67
	07-08	9	12	58
	08-09	10	13	71
	09-10	12	14	102
	10-11	12	14	125
	11-12	11	13	100
	12-13	12	13	101
	13-14	11	12	94
	14-15	12	14	108
15-16	11	13	110	
16-17	12	13	108	
17-18	11	21	97	

3. Action Plan

Table 10. Action Plan for Area Source Emission Mitigation

Area Sources	Short Term-2019	Long Term-2022	Action required
Fuel burnt Res and commercial Cooking	5% reduction in emissions	20% reduction in emissions	As given below for individual sources
Domestic combustion			Household wood and cow-dung burning is to be reduced. Increase in LPG usage through Ujjwala scheme. Alternate fuel options e.g. solar needs to be assessed and exercised.
Hotels, dhaba and open eat-outs			Use of LPG in Hotels and eateries.
Bakery			In bakeries, reduction in wood usage is to be emphasized through replacement with other options such as electric-ovens.
Crematoria			Total 10 crematorias. Renewable fuel/biomass briquette etc. to be encouraged.
Solid waste/open burning	5% reduction in emissions	7% reduction in emissions	<ul style="list-style-type: none"> • Increase in segregation, collection and proper disposal with increased Green Belt. • Launch extensive drives against open burning. Decrease in waste burning. Public awareness drives. • Proper collection of Horticulture waste and its disposal following composting-cum-gardening approach. • Bio-methanation and biogas plant need to be installed.
Road dust and C&D	2% reduction in emissions	8% reduction in emissions	<ul style="list-style-type: none"> • Reduction in unpaved roads by paving. • Enforcement of construction & demolition rules. • AMC has proposed plan for creation of green buffers along the traffic corridors (AMC has passed the order Vide letter no AMC/ENV/MC/817/2017 dated 07/02/2016 forwarded to GM BSNL, PWD, for proper action). Plantation drive along the road side, Greening of open areas, garden, community places, schools and housing societies. • Wall to Wall paving (brick).

			<ul style="list-style-type: none"> • Ensure carriage of construction material in closed/covered Vessels. Control measures for fugitive emissions from material handling, conveying and screening operations through water sprinkling, curtains, barriers and suppression units.
Point Sources	Short Term-2019	Long Term-2022	Action Plan
Industry	To get the 10% reduction in emissions till 2019	To get the 25% reduction in emissions till 2022	<ul style="list-style-type: none"> • Change in coal quality with less ash content. The need is to focus on the less ash content and high calorific value of the coal to increase the plant efficiency. • For the other industries, the aged boilers need to be replaced, if any. • Conversion of natural draft brick kilns to induced draft, Banning of operation of Brick kilns in city area. • Banning of new air polluting industries in existing city limit. Visit observations: water sprinkling after the arrival of the officials, needs to be a regular practice in fugitive dust areas. Regular audit of stack emissions for QA/QC. • Efficacy of Use of solar power in Industries and other control measures needs to be studied. Technological improvement option as given in Ma et al., Aerosol and Air Quality Research, 17: 636-643, 2017 can be studied.
Line Sources	Short Term-2019	Long Term-2022	Action required
Vehicles	15% reduction in emissions	37% reduction in emissions	<ul style="list-style-type: none"> • Heavy duty vehicles are the major contributors to PM load: Although the number is less, high emissions are observed due to high emission factor and VKT. High number of heavy duty 4W are observed at Shegaon Sq., Dastur Nagar Sq., Old bypass, Welcome gate. Bypass exists for non-destined vehicles. • Retro fitment of Diesel Oxidation Catalyst (DOC) in 4-wheeler public transport. • Retro-fitment of Diesel Particulate Filter in 4- wheeler public transport.

			<ul style="list-style-type: none"> • Inspection/maintenance to all commercial vehicles. Restrict commercial vehicle entering city by having ring roads. • 2W are significant contributor to PM load. With proper maintenance, the emissions are assumed to be same in spite of increase in number of vehicles. • High number of 2W are observed at Railway stn bridge, Pachwati Sq. Shegaon nak, Kathora naka sq. and Tapovan Sq. • For reducing the traffic congestion, no parking zones at the traffic areas need to be delineated. Roads hindering the smooth traffic movement need to be identified and either may be closed and traffic may be diverted or some other suitable option may be exercised. Roads need to be identified for widening. • Maintain potholes free roads for free flow of traffic. Introduce bi-cycle tracks/paths and encourage the use of bi-cycles • Launch public awareness campaigns for air pollution control, vehicle maintenance, minimizing use of personal vehicles, lane discipline etc. NGOs need to be involved for this purpose. Immediate launch of extensive fuel adulteration drive and random monitoring of fuel quality data.
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3.1 Recommendations

A. Fuel burnt in hotels, dhabas, open eat-outs, bakeries and domestic combustion

Recommendations

- Bakeries, hotels, restaurants and open eat-out emissions can be reduced through implementation of fuel shift combined with awareness programmes.

- The emissions from the stacks of bakeries should be regulated and emission control devices such as bag filter, scrubbers etc. should be installed. These bakeries can be made to operate on electric or LPG.
- Consumption of wood and cow dung burning is high in Amravati. Shift to LPG usage through Ujjwala schemes is envisaged to reduce the emissions from wood burning. Better cook-stove designs can also reduce emissions from LPG combustion which is also the higher contributor to PM2.5 emissions.
- Crematories need installation with efficient pyres and chimneys for release of emissions. Bodies related emissions from the pyre can be reduced by installing efficient PM control measures such as bag filters or cyclones. Wood consumption is higher in all the crematories. Option of shift of fuel to biomass briquettes and electricity needs to be exercised.

B. Solid waste

1. On site segregation of solid waste to separate dry solid waste and wet solid waste needs to be improved to minimize the load on compost depot.
2. Collection and transportation facilities required to be strengthened by providing different category of extra collection vehicles as well as workers.
3. Existing compost depot and proposed Landfill site should be well planned and equipped with new technologies for disposal of municipal solid waste.
4. Utilization of compost manure, recovery of possible materials for recycling, and landfill gas utilization for energy recovery.

C. Construction

There are 109 numbers of building constructions and 7 road constructions. The recommendations are:

- Follow-up of Building construction and demolition rules considering the emission control of PM. Strict norms to be followed if the violations are observed.
- There is poor pedestrian infrastructure in Amravati. RUBs / ROBs / Footpaths, Pedestrian crossing etc. are necessary for proper transport system. Provision should be made from Corporation with appropriate fiscal measures. Special provision for bi-cycle pathways need to be made to reduce PM emissions.
- Regular maintenance of road, sweeping at regular intervals can reduce resuspension of dust contribution to PM in the city.
- To control of resuspension from construction sites, appropriate covering or barricading should

be done to avoid dispersion of the dust. Constructing a water pit at the entry/exit points of the construction site to avoid dispersion of particulate matter through movement of trucks while entering and exiting the site.

D. Road dust

Road length data is given in Table 7, which shows that unpaved road length is higher than paved road length. PM2.5 contribution from paved road dust is 291.5 TPY and unpaved road dust contribution is 241.8 TPY

Table 11. Road Length in the City

Road Type	Length (Km)
Bitumen (Dambar)	366.78
Concrete Road/Paver block	226.49
WBM (Khadikaran)	522.4
Un surface Road	420.14
Total	1535.81

Source: Amravati Municipal Corporation

E. Industry

- Although based on the report by MSME, industries have declined in the city but the overall emission contribution is highest. Some suggestions have been given in Table 9 regarding the fuel shift and inclusion of air pollution control technologies in the existing industries
- Change in coal quality with less ash content will reduce the PM emission to a larger extent.
- It is further to note that information on small scale and medium scale industries is fully not available and accounting for those industries contribution is difficult.

F. Amravati Smart City Vision (Source: Smart City Challenge- AMC, 2015)

G. "Make Amravati city the Agro-Tech Business District (ATBD) especially in textile Industry and in the process improves economic and social well-being of the citizens; Make Amravati the city with the highest quality of life index" Amravati has huge industrial potential and the new textile park will further boost its industrial profile

H. The City is rapidly expanding towards Badnera, 10 km to the south

I. Growing as an industrial centre, with cotton mills leading the way. Home to Vidharbha Sugar Mills.

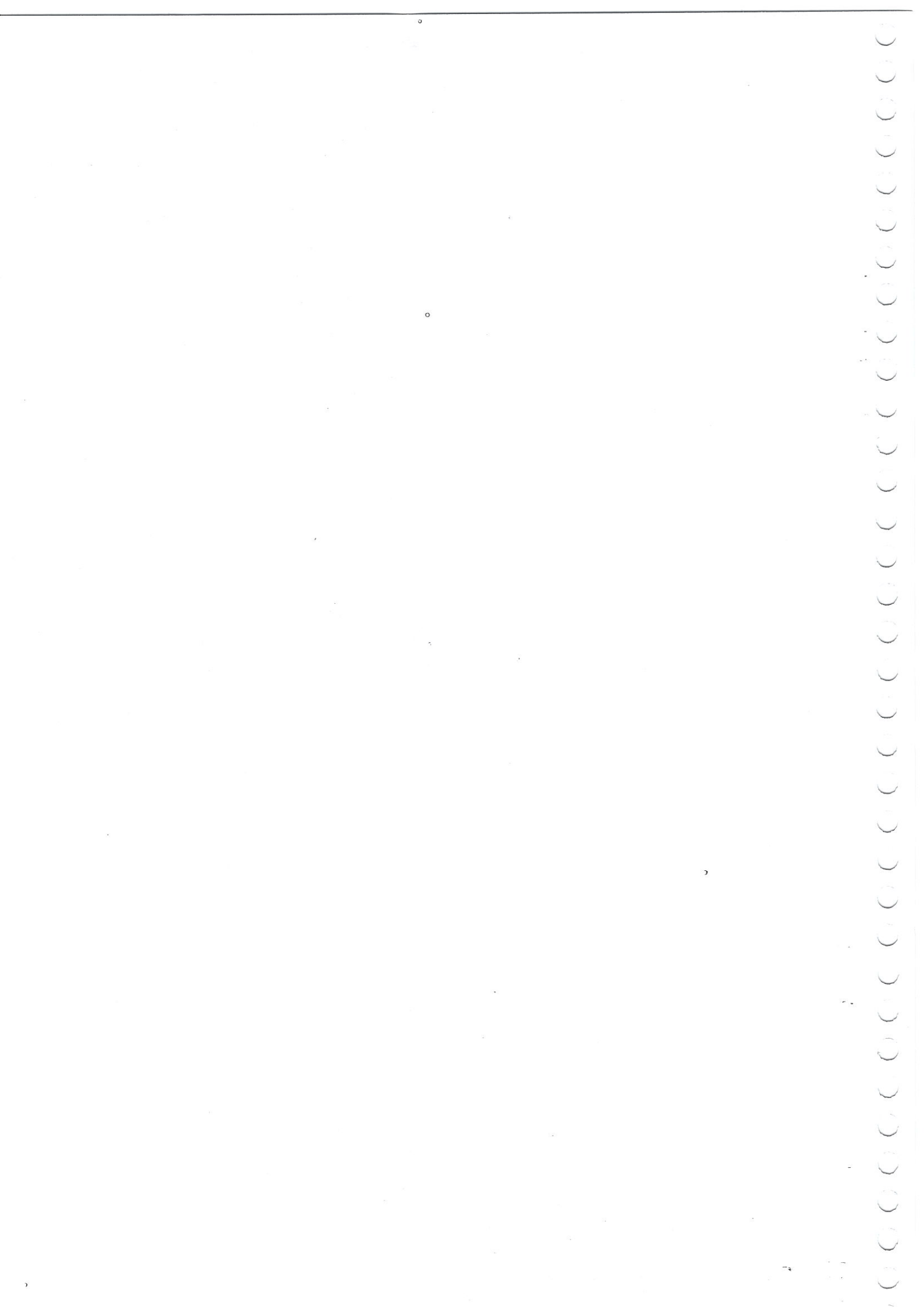
J. At Nandgaon Peth/Saward: 2,700 MW Thermal Power Plant is coming up. Bharat Dynamics Limited (BDL) plans to make air defence missiles.



Amravati Municipal Corporation

Evaluation of Emission Control Option as per CPCB Templates

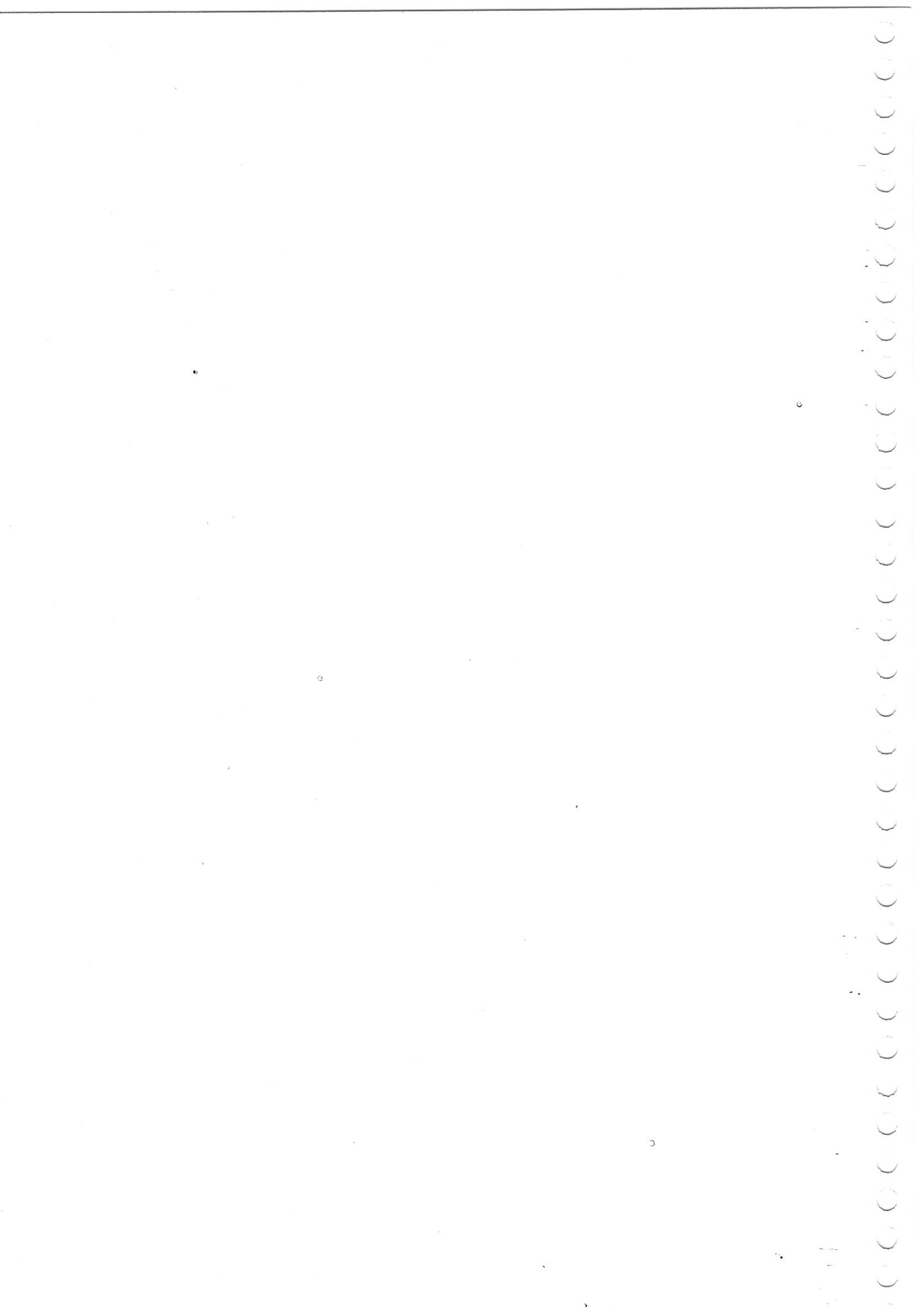
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	Any Other Information
Sr. No/Source Group	Control Option	Expected reduction and impacts	Technical Feasibility	Requirement financial resources	Implementation period (Short/mid/long-term)	Time target for implementation	Responsible agency (ies)	
(i)	Vehicle emission							
1	Launch extensive drives against polluting vehicles for ensuring strict compliance, inspection of commercial vehicles	Medium	Surveys/identification and maintenance/better combustion/ Emission reduction steps/Introduction of Bharat VI Vehicles	Survey work- Rs. 5-10 lakhs., Ref: http://urban.rajasthan.gov.in	Short/Long Term	2018-2019	RTO / Smart city AMC	Major source: 2W followed by Heavy duty diesel vehicles See Annexure D1-D8
2	Synchronize Traffic movements/introduce Intelligent Traffic systems for Lane Driving	Low		Rs. 100 lakhs per traffic intersection Ref: https://parade.com/19972-market-synovosavant-will-at-would-traffic-light-synchronization-cost/	Mid term	2019-2020	Electrical Department, AMC, RTO, Traffic Police, Smart city	
3	For reducing the traffic congestion, no parking zones at the traffic areas need to be delineated. Roads hindering the smooth traffic movement needs to be identified and either may be closed and traffic may be diverted or some other suitable option may be exercised.	Medium	Unauthorized construction of total 348 Private Parking belonging to Hotels, Function Halls, Commercial Complexes was removed and bind them to use only for parking purposes to minimize the traffic congestion, modern traffic signalling system at major junctions have been initialized, re-designing traffic structure to encourage lane-driving.	Rs. 10 lakhs	Short term	2018-2019	Electrical Department, AMC, RTO, City Traffic Police	Continuous efforts have been taken to remove the road side encroachment for smooth flow of traffic. Amravati Public Works Department has already contracted the new bypass in addition to the existing bypass (old bypass) constructed already as per city development within the time frame
4	Launch public awareness campaigns for air pollution control, vehicle maintenance, minimising use of personal vehicles, lane discipline etc. NGOs need to be involved for this purpose.	Low	Maintenance/Strict compliance	Survey work- Rs. 5-10 lakhs., Ref: http://urban.rajasthan.gov.in/contaminant/dam/rajasthan/urbanization	Short term	2018-2022	Traffic Engineer, AMC/Smart city Advertise Dept. AMC MSRTC	
5	Retrofitment of Diesel Particulate Filter in 4-wheeler public transport	Medium	RTO department taking strict action regarding implementation of these new norms	Rs. 0.5-0.7 lakhs per unit		2018-2021	NEERI / IIT, City Traffic Police, RTO	Enforcement of smoke emission standards for containing vehicular exhaust at the manufacturer and user level.
6	Immediate launch of extensive fuel adulteration drive and random monitoring of fuel quality data	Medium	Maintenance/Strict compliance. Refer page no 9 PUC statement from 1.4.2016 to 31.3.2017. Mechanism to check with time requirement of each check to be identified	Survey work- Rs. 50-70 lakhs	Long term	2018-2022	Residence Deputy Collector(RDC), District supply officer & Tahsildar, AMC, RTO	Policy adapt as measure to ensure that all vehicle come for tests, On road inspection if vehicles planned and periodicity and coverage



Amravati Municipal Corporation

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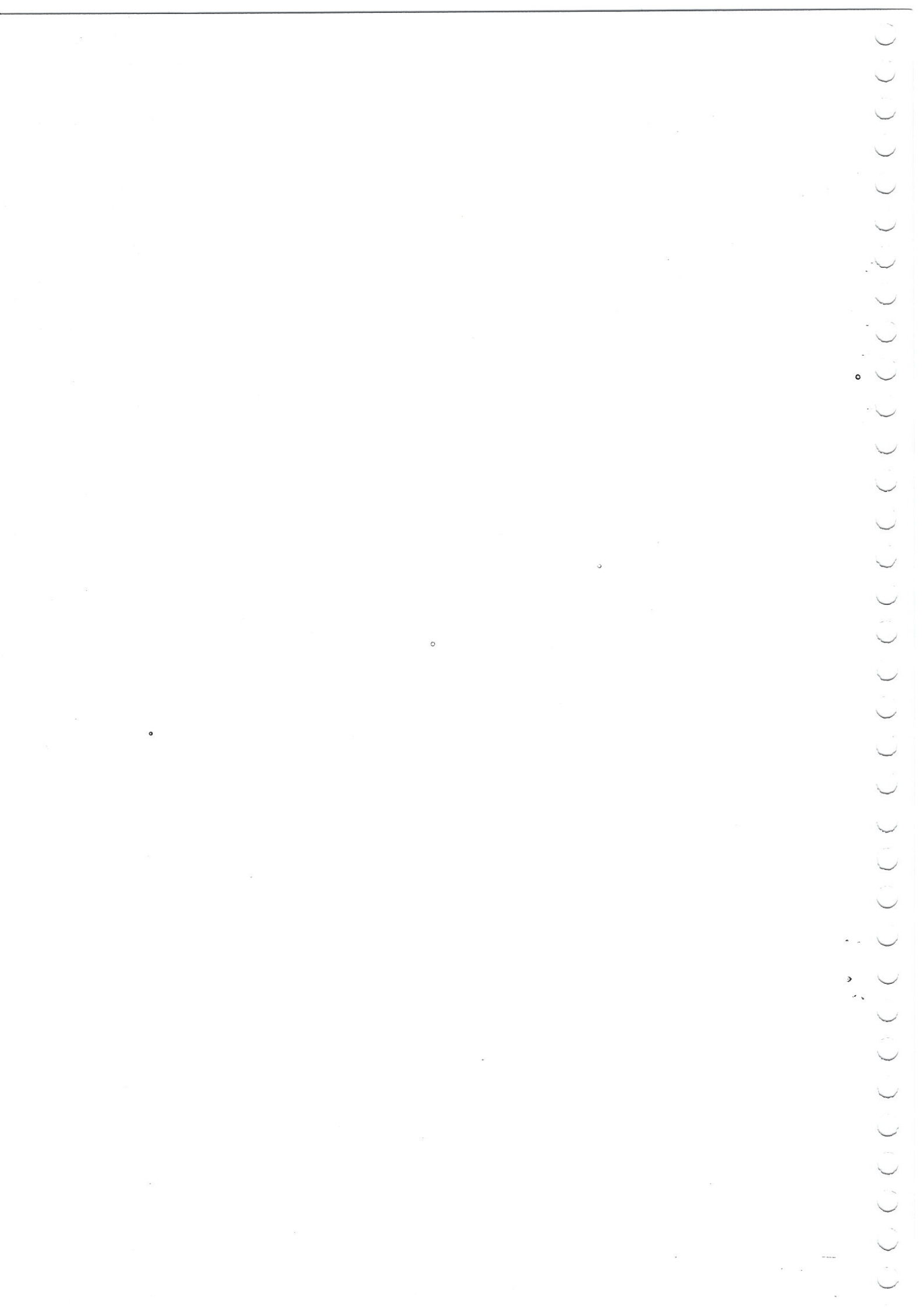
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	
Sr. No	Source Group	Control Option	Expected reduction and impacts	Technical Feasibility	Requirement financial resources	Implementation period (Short/mid/long-term)	Time target for implementation	Responsible agency (ies)	Any Other Information
7	Roads need to be identified for widening. Maintain potholes free roads for free flow of traffic.	Low	AMC prepared the action plan which is already been in implementation such as widening of road and improvement of infrastructure for decongestion of roads. In future also, the work shall be continued as per the directions issued by Hon'ble Board. AMC has developed an extensive network of traffic facilities. These facilities should continue to be implemented, connected and expanded. Roads and footpaths of pathholes or ditches" Along traffic corridors, maintain pathhole-free roads for free flow of traffic, introduce water fountains at traffic intersections and conduct plantation drives in open areas, gardens, community places, schools and housing societies.	Survey work- Rs. 10-50 lakhs, pothol maintenance- Rs. 10000 approx. based on the size	Mid term	2018-2020	AMC, PWD, NHAI	Construction of over bridge to minimize traffic congestion on Amravati Badnera Road near Dhammani Garden Area now if has been opened for vehicle movement. Similarly AMC planned to construct Railway over bridge at R. Upath which is under process and soon completed which will ease the traffic congestion in the area. Improvement in traffic flow through proper maintenance of roads, updated traffic regulation and strict enforcement of prescriberal standards, To promote the public transport system. AMC includes 25 new buses and in addition to that 15 new buses proposed within the city.	
8	Introduce bi-cycle tracks/paths and encourage the use of bi-cycles.	Low		See (v)	Short term	2018-2020	AMC		
9	Restrict commercial vehicle entering city by having ring roads.	Medium		As per sanctioned budget	Task completed	Task completed	PWD, NHAI		
10	Steps for promoting Battery operated vehicles, new technology vehicles	Medium	As per the directions, action plan have been prepared for promoting battery operated vehicles. In smart city action plan, this activity has already been proposed and will be put up for approval in Amravati Smart City Development Board meeting. Regional Transport Authority informed about this action point and they will take appropriate action	Rs. 10-15 lakhs per vehicle Ref. https://dir.india.gov/	Mid term	2020-2022	AMC, RTO		
11	Public transport system: the current status of public transport in terms of number of buses, load factor etc. and proposed plant to augment the fleet	Medium	Implementation Policy Decision	Rs. 20000-50000 per filter Ref. https://dir.india.gov/	Long term	2018-2022	Transport Department, AMC	0	



Amravati Municipal Corporation

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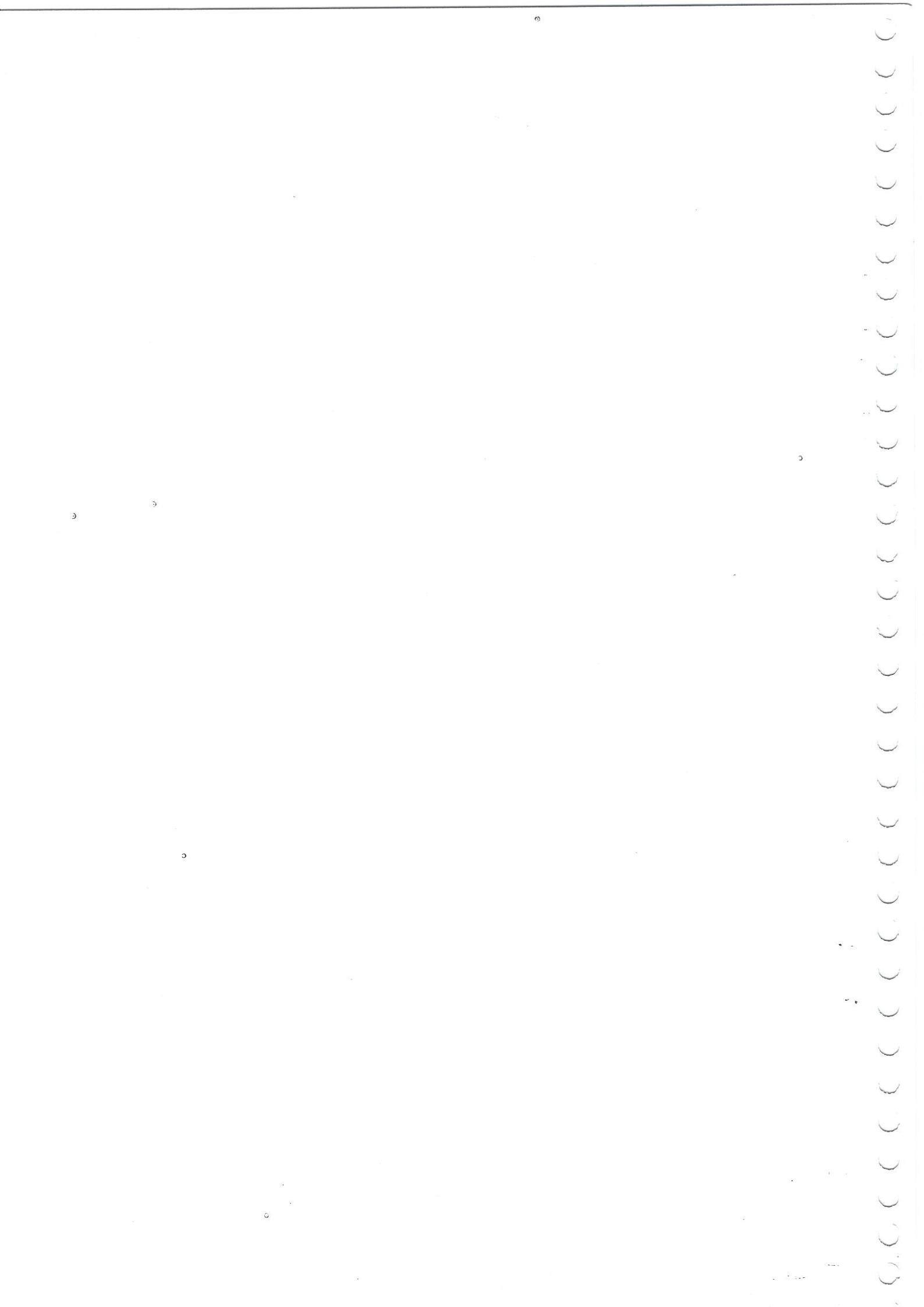
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	Any Other Information
Sr. No	Source Group	Control Option	Expected reduction and impacts	Technical Feasibility	Requirement financial resources	Implementation period (Short/mid/long-term)	Time target for implementation	Responsible agency (ies)
12		Ethanol blending (E10-10% blend)-bus	Medium	Implementation/ Policy Decision/ Feasibility study	Rs. 1.20 cr. per bus Ref: https://timesofindia.indianexpress.com/city/nagpur/Ethanol-friendly-not-pocket-friendly/articleshow/46602245.cms	Long term	2018-2022	
13		Banning of 10 year old commercial vehicles	Medium	Implementation/ Policy Decision/ Alternative option	-	Long term	2018-2022	RTO
(ii) Resuspension								
1		Creation of green buffers along the traffic corridors	Low	The buffer zone has been created to following road: Irvin to Bhyani square, Police petro pump to Rathi High School, At welcome points, Hamalpara to Science Score Ground (AMC has passed the order Vide letter no AMC/ENV/MC/817/2017 dated 07/02/2016 forwarded to GM BSNL, PWD, for proper action)	Rs. 1000 per sq. ft Ref: www.sanjaynursery.com/vermicul-garden	Task Completed	2018-2019	Building and Construction Department, AMC, PWD
2		Plantation drive along the road side, Greening of open areas, garden, community places, schools and housing societies.	Low	Total 3100 plantation has been carried out last year along the open areas, gardens, community places, schools and housing societies. The city has a tree cover distributed throughout the urban scope. A tree census is being conducted by AMC. 3700 trees were planted in the year 2014-15 & 300 trees are planted in the year 2015-16 For creation of green buffer zone, total 3000 tree plantation in year 2016-17 with 100% survival rate along the roadside. This activity will continue to implement to cover maximum area to minimize the pollution.	PPP basis, Rs 1 cr For 10 km (approx.) Ref: https://economictimes.indianexpress.com/news/politics-and-nations/1000cr-fund-to-plant-trees-along-highways-in-the-work/articleshow/51592606.cms	Mid term	Task completed. Further plantation drive will be conducted in July 1st of each year	Garden dept, AMC / Garden Dept, Building and Construction Dept, Environment Dept, AMC
								See Annexure C2-C6
								Amravati city has 69 gardens. 6 new gardens are proposed to be supplemented within the city. The school curriculum is an effective way to deliver messages to households. Greenery development of Shiv Tekadi which locates in the centre of the city to tackle carbon footprints. Development of eco-tourism spot within AOC jurisdiction such as Wadali Lakes and Chhatra Lake.



Amravati Municipal Corporation

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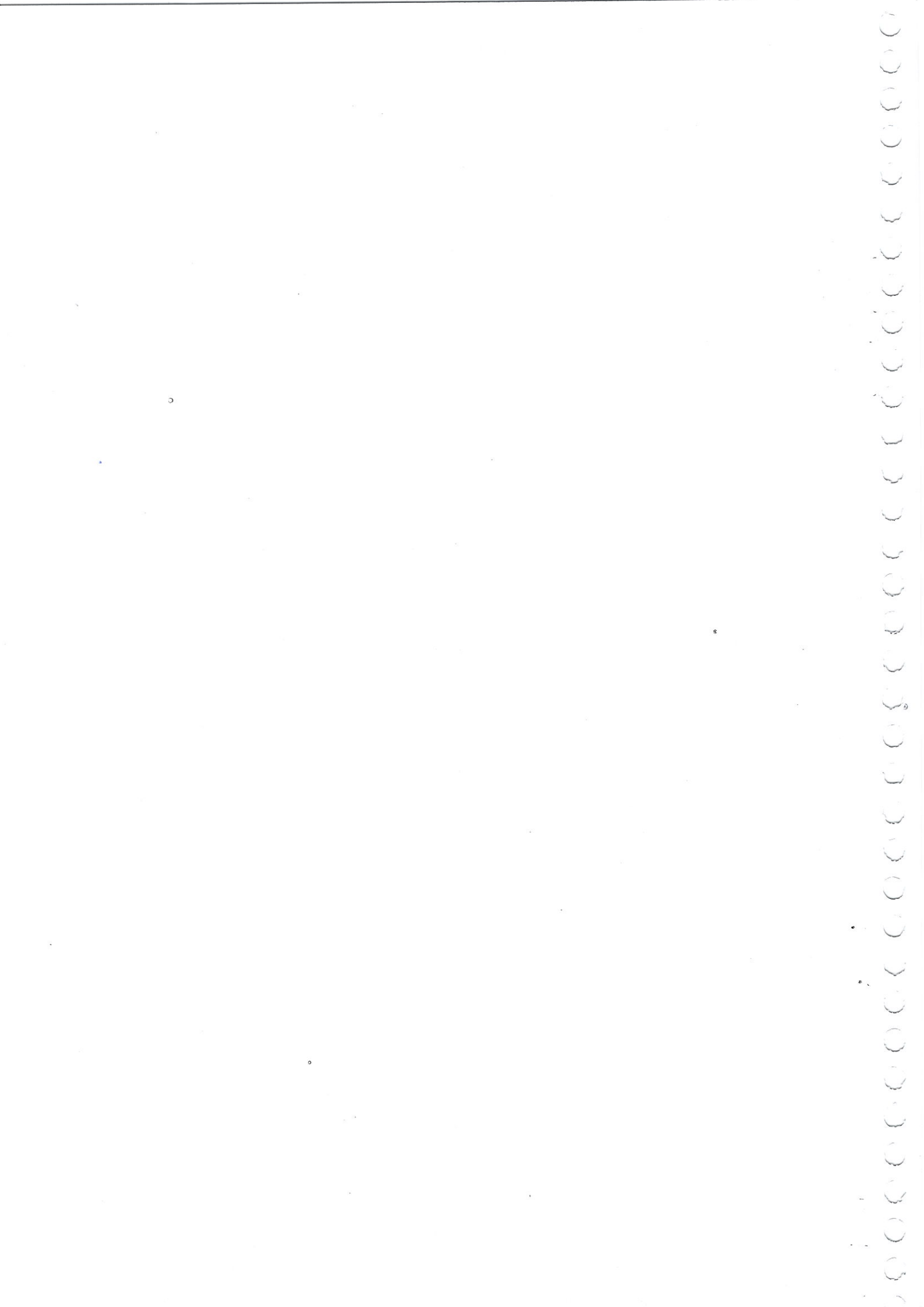
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	Any Other Information
Sr. No	Source Group	Control Option	Expected reduction and impacts	Technical Feasibility	Requirement financial resources	Implementation period (Short/mid/long-term)	Time target for implementation	Responsible agency (ies)
3	Wall to Wall paving (brick)	Low	Implementation	Rs. 100 per sq ft Ref: https://www.indiamart.com/proddetail/natural-stone-wall-bricks-16478046533.html	Long term	2018-2020	AMC	
(iii)	Biomass/trash burning, landfill waste burning							No segregation of waste is done at present. Dumping Site-Sukali (landfill/dumping). Biomedical Waste management TPD
1	Launch extensive drives against open burning of biomass, crop residue, garbage, leaves etc. Strict compliance of ban on open burning in municipal area.	Medium	Resolution has been passed to ban the burning impose fine of Rs. 5000 -25000 as per NGT order. Statuary body legal compliances by APC and its action plan: Air Environment: Air Pollution direction u/s 18(1)(b) and 31 (A) of the Air (Prevention and Control of Pollution Act, 1981).	Survey work- Rs. 5-10 lakhs	Already implemented	2018-2022	Health Department, AMC, Environmental Department, AMC	Solid waste generated - 132130 tons /a, 31500 is treated and remaining unmanaged. This emits about 365 TPY of PM Recovered the fine 9.21 lakh from burning and plastic banned
2	Regular check and control of burning of Municipal Solid waste. Public awareness about the effect of burning and current law	Medium	Sanitary inspector at each zone has monitored the situation. Daily announcement on waste collection vehicles by hoardings, programme organizing in the school.	Survey & monitoring	Already implemented	2018-2022	Health Department, AMC, Environmental Department, AMC, Police, Agricultural Office	See Annexure A1-A4
3	Proper collection of Horticulture waste and its disposal following composting-cum-gardening approach, installation of recycling machine	Medium	Implementation studies	Rs. 20 lakhs per machine Ref https://www.indiamart.com/proddetail/horticulture-waste-recycling-machine-10677170191.html	Short term	2018-2019	Health Officer (S) / Garden Suptd., AMC	



Amravati Municipal Corporation

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Sr. No/Source Group	Control Option	Expected reduction and impacts	Technical Feasibility	Requirement financial resources	Implementation period (Short/mid/long-term)	Time target for implementation	Responsible agency (ies)	
2	Ensure carriage of construction material in closed/covered Vessels (as well as in the site)	High	Depending on state or local by-laws, member of corporation can organize regional co-operations according to their specific needs. Through the corporation, public and private decision makers can be brought together to consider a regional strategy in the direction of MPCB. If regionalization seems promising, the corporation can then plan and implement the program.	to be included in contract	Short term	2018-2019	AMC and MPCB	CPCB report to be followed
3	Control measures for fugitive emissions from material handling, conveying and screening operations through water sprinkling, curtains, barriers and suppression units.	High	The provision made to control measures for fugitive emissions from material handling, conveying and screening operations through water sprinkling, curtains, barriers and dust suppression units.	No additional cost. It will be added in maintenance part in each contract work to the contractor.	Short term	2018-19	Building and Construction Department, AMC, PWD, Notice will be issued by Environmental Department	As per CPCB report
4	Banning of operation of Brick kilns in city area.	Medium	Implementation/feasibility	Not required	Short term	2018-19	Revenue RDC	
5	Reduction in unpaved roads by paving	Medium	Implementation/feasibility	Rs. 15 cr. for 100 km of cement road	Short term	2018-2020	PWD	
(vi)	Domestic fuel burning							Major source: Wood burning followed by LPG
1	Shift to LPG from solid fuel & kerosene for domestic applications. Making clean sources available. Making ubiquitously available sources (i.e. biomass) clean.	Medium	Implementation/feasibility	Ujjawala scheme in operation (Rs. 500 per cyl. Refilling)	Short term	2018-2020	Ujjawala scheme in operation, RDC, In the case of former, issues such as fiscal policies and distribution systems designed to make clean energy affordable and accessible to the poor	See Annexure B1
2	Better cook-stove designs	Medium	Implementation/feasibility	Rs. 20000 per stove (for residential purpose)	Short term	2018-2020	MINRE stoves	
(vii)	DG sets							
1	Strict action against old DG sets which are not complying standard emission norms. Public awareness about effects of DG set pollution	Medium	The old DG set replaced by new one as per CPCB norms 2014	Survey work- Rs. 5-10 lakhs	Short term	2018-2019	DGP Traffic, MPCB (Diesel generator sets, primarily located in residential areas or in commercial buildings, are significant contributor to pollution load in city)	



Amravati Municipal Corporation

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Sr. No	Source Group	Control Option	Expected reduction and impacts	Technical Feasibility	Requirement financial resources	Implementation period (Short/mid/long-term)	Time target for implementation	Responsible agency (ies)
2		Reduction in DG set operation /Un-interrupted power supply. Pollution control as well as clean fuel use	Medium	Implementation/feasibility	15 KVA (NG based)-Rs. 3.7 lakhs. 100 KVA (NG based)- Rs. 14 lakhs Ref. https://dir.indiamart.com/impca/natural-gas-generators.html	Short term	2018-2019	Director, MSEDCL (Electrical Inspector)
(viii) Bakeries /Crema foria								
1		Use of LPG in Hotels and "Dhabas" and renewable fuel/oil/Electricity/gas etc in Crematoria	Medium	Total 10 Cremetoria, at one cremetorial, Amba Devi Area 2.Badnera Area -2to 3.Shankar Nagar 4.Vilas Nagar 5.Navasari 6.Faisalpura 7.Lalkheddi 8.Rahatgaon -Furnace has been installed to minimize the impact, on emore proposed at Vilas Nagar	Cyl. (commercial) cost per unit-Rs. 1000 approx.	Mid term	2019	AMC, District Supply Officer

Preferably, quantify each priority pollutant. Otherwise, a qualitative statement (low/ medium/ high) may be given.

- Whether it is technically feasible (e.g., replacing coal with natural gas may not be feasible, if its sustained availability is not assured); whether any implementation issues exist (e.g., low- income group may not have finances to use liquefied petroleum gas for cooking).
- Estimate the total costs (investment and maintenance costs) over the duration of implementation period, and provide sources of financing.
- Define the expected start and completion year (e.g., 2017 – 2020).

