



सत्यमेव जयते

**Report of the
Comptroller and Auditor General of India
on
Performance Audit of Air Pollution Control by
Government of Gujarat**



लोकहितार्थं सत्यनिष्ठा
Dedicated to Truth in Public Interest

Government of Gujarat
Report No. 02 of the year 2022
Performance Audit

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Comptroller and Auditor General of India
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Preface

This report for the year ended 31 March 2021 has been prepared for submission to the Governor of the State of Gujarat under Article 151 of the Constitution of India for being laid before the State Legislature.

The report contains significant results of the Performance Audit of “Air Pollution Control by Government of Gujarat” relating to Forests & Environment and Port & Transport Departments for the period from 2014-15 to 2020-21. The audit has been carried out under the provisions of the Comptroller and Auditor General’s (Duties, Powers and Conditions of Service) Act, 1971 and the Regulations on Audit and Accounts, 2007 (amended in 2020) issued thereunder by the Comptroller and Auditor General of India.

The Performance Audit has been conducted in conformity with the Auditing Standards issued by the Comptroller and Auditor General of India.

Executive Summary

The Air (Prevention and Control of Pollution) Act, 1981, defines air pollution as “presence in the atmosphere of any air pollutant” where air pollutant is defined as any solid, liquid or gaseous substance including noise present in the atmosphere in such a concentration which tends to be injurious to human beings, other living organisms, plants, property or environment.

At the State level, Gujarat Pollution Control Board (GPCB) discharges functions related to pollution control and protection of the environment by effective implementation of various laws of the pollution. Commissioner of Transport, Gujarat is responsible for regulating and monitoring vehicular emissions.

The Performance Audit was conducted between March 2019 and November 2019 and was further updated to cover the period from 2014-15 to 2020-21. Audit findings in the report relate to status of Ambient Air Quality (AAQ) in the State; air pollution due to source emission, fugitive emissions, thermal power plants and automobiles; Critically Polluted Areas in the State; and other issues.

Air pollution caused 16.70 lakh death in 2019 in India and costs Indian businesses about \$95 billion every fiscal year.

(Paragraph 1.2 and 1.3)

Based on the annual average data of two major air pollutants PM₁₀ and PM_{2.5} of 62 stations, between 2011-12 and 2018-19, the concentration of these pollutants increased indicating substantial deterioration of the AAQ in the State. However, in 2019-20 and 2020-21, overall AAQ improved in the areas being monitored.

(Paragraph 4.2)

Consolidated Consent and Authorisation issued by GPCB to an Industry for monitoring of AAQ included only four pollutants (PM₁₀, PM_{2.5}, NO₂ and SO₂) instead of 12 pollutants. The GPCB was also not regularly monitoring noise levels in the premises of the industrial units.

(Paragraph 4.3)

The GPCB monitored AAQ at 62 stations covering only 14 cities. In major industrial estates and areas prone to air pollution, AAQ was not being monitored.

(Paragraph 4.4)

Between 2014-15 and 2019-20, the concentration of benzene and o-xylene increased significantly. However, in 2020-21, the concentration had reduced marginally mainly due to slow down of industrial activities during the COVID-19 pandemic. Exposure to high levels of benzene and o-xylene causes neurotoxic symptoms and persistent exposure to these compounds may cause injury

to human bone marrow, DNA damage in mammalian cells and damage to the immune system.

(Paragraph 4.5)

The CPCB directed GPCB in February 2014 to ensure the installation of the Online Continuous Emission Monitoring System (OCEMS) in 422 highly polluting units of 17 category by March 2015. OCEMS plays a vital role in regulating pollution compliance by industries with minimal human interventions. However, even after a lapse of more than six years, GPCB could not enforce the installation of OCEMS in 67 units. Also, online emission data of 17 category units were not in the public domain.

(Paragraph 5.1)

Source emission monitoring by GPCB was inadequate and in comparison to water sampling, air sampling was insufficient. During 2020-21, under the Air Act, GPCB collected and analysed 4,415 air samples whereas, under the Water Act, 1974, the number of samples collected and analysed were 21,992.

(Paragraph 5.2)

Source Apportionment Studies (SAS) are necessary to assess the future projections of emission level, develop cost-effective action plans and interventions for mitigating emission and evaluation of various control options. GPCB has completed SAS for Ahmedabad and Surat. SAS was under preparation in respect of Vadodara and Rajkot (January 2022). For remaining cities and polluted areas, it was not taken up by the GPCB.

(Paragraph 5.5)

Fugitive emissions are unintended emissions from facilities or activities that cannot reasonably pass through a vent, stack, or chimney system to reduce emissions. Construction activities, solid waste, operation of hot mix plants and brick kilns, stone crushers, sawmills, ice making plants, and cold storage are major sources of fugitive emissions.

(Chapter 6)

Unscientific disposal of solid waste in Gandhinagar city and non-disposal of legacy solid waste in Ahmedabad was major source of fugitive emission in these cities.

(Paragraph 6.3 and 6.4)

Stone crushers and hot mix plants were causing fugitive emission due to non-compliance with the Siting criteria and air control measures.

(Paragraph 6.5 and 6.7)

Brick kilns were causing more fugitive emissions due to non-adoption of cleaner technology.

(Paragraph 6.6)

Thermal Power Plants (TPPs) are a major source of air pollution. Moreover, coal-based TPPs contribute disproportionately higher emissions than emissions due to industries. Gujarat houses 47 TPPs units and its share in thermal power

generation in the national contribution is 10.09 *per cent*. Installation of Flue-gas desulphurisation (FGD) reduces the emission due to TPPs. Audit observed that the timeline of December 2022 for installation of FGD may not be adhered by the TPPs.

(Paragraph 7.1)

Fly ash is one of the major contributors to particulate matter. TPPs were required to dispose of 100 *per cent* legacy fly ash by 31 December 2017. However, with the major TPPs, there was undisposed legacy stock of fly ash of 610.94 lakh tons as of March 2021. Audit also observed that State Government Departments had not made mandatory use of fly ash in Government financed works despite MOEF&CC directions.

(Paragraph 7.5.1 and 7.5.3)

Three TPPs were disposing fly ash in contravention to the MOEF&CC regulations by dumping it in low-lying areas, city areas and riverbanks without the permission of GPCB.

(Paragraph 7.5.2)

Vehicular emission is a major source of air pollution in urban areas. In State, there were only 1,192 centers for issuing Pollution Under Control (PUC) Certificates against 2.52 crore registered vehicles in 2018-19. Technical Audit of each PUC centre was not regularly conducted.

(Paragraph 8.2)

Adulterated auto fuel aggravates vehicular emission. Audit noticed monitoring of 1,506 petrol pumps only against the norms of 33,854 petrol pumps during 2014-15 to 2018-19 by the Directorate of Food and Civil Supplies. Inadequate monitoring of petrol pumps may lead to a sale of adulterated auto fuel.

(Paragraph 8.3)

Audit observed the non-installation of Continuous Ambient Air Quality Monitoring Stations, non-conducting of health studies and lack of monitoring of Remedial Action Plan in critically polluted areas.

(Paragraph 9.2, 9.3 and 9.4)

The State Government delayed the formulation of a scheme for utilization of funds received from forfeiture of bank guarantees obtained from the habitual defaulters. Also, the project approved for utilization of funds was industry-specific instead of being community-oriented.

(Paragraph 10.1)

The Environmental Audit Report does not provide assessment of the degree of pollution potential of a particular industry or class of industries and the environmental information was not available in the public domain.

(Paragraph 10.2)

Greening of highways helps in reduction and control of air pollution and noise pollution. Audit observed lack of policy interventions for the greening of highways.

(Paragraph 10.3)

The GPCB is responsible for monitoring and supervising over 30,964 industries, 42,563 health care units, 34 common effluent treatment plants, 21 common bio-medical waste treatment facilities, etc. The GoG abolished 223 posts in GPCB despite the manifold increase in work over the years and increasing pollution in the State. The GPCB is accomplishing its regulatory function through 505 posts only which adversely impacts effective discharge of its regulatory functions.

(Paragraph 10.4)

Recommendations

In order to enforce the provisions of the Air (Prevention and Control of Pollution) Act, 1981 efficiently and effectively, and to ensure effective discharge of regulatory functions by GPCB, the State Government/ GPCB may consider the following recommendations:

- ***Continue making efforts towards improving ambient air quality by monitoring the concentration of PM₁₀ and PM_{2.5}, particularly with special focus on PM₁₀ as even in 2020-21 concentration was more than 99 µg/m³ in 33 out of 62 stations.***
- ***Strengthen the human resources of GPCB to monitor all 12 pollutants.***
- ***Expedite establishment of AAQ monitoring stations in areas not covered under existing monitoring system and regularly monitor the ambient air quality in other areas.***
- ***Set up AAQ monitoring stations in the industrial estates with GIDC and persuade GIDC to provide capital assistance for setting up of AAQ monitoring stations similar to assistance provided for setting up of common effluent treatment plants and common incineration plants.***
- ***Analyse and reconcile the wide variation between manual and sensor-based data so that quality of data used for monitoring air quality is improved.***
- ***Ensure installation of OCEMS in all the highly polluting industries and ensure its connectivity with CPCB and GPCB server to strengthen monitoring of red category units.***
- ***Evolve a mechanism to get data on import of pet coke in the State from the Gujarat Maritime Board and the Director-General of Foreign Trade and to ensure that bulk consumers of pet coke upload consumption data so that use of pet coke can be monitored and regulated.***
- ***Set up a mechanism to regularly monitor AAQ in ESZ of Thol Wildlife Sanctuary to maintain its ecology as a potential Ramsar site.***

- *Develop a reporting mechanism involving agencies and departments engaged in infrastructure activities for strict enforcement of mitigation measures.*
- *Ensure that the provisions of the Air Act, 1981 and the directions of R&B Department are strictly complied with.*
- *Establish a mechanism in consultation with R&B Department to collect real-time production data of HMPs to check the evasive polluters.*
- *Disseminate directions of CPCB on the adoption of new technology to the brick kiln manufacturers. Besides, non-agriculture permission granted by the revenue authorities to the brick manufacturers may include a condition for adoption of cleaner technology.*
- *Ensure that the stone crushing units follow siting criteria strictly and develop a system for self-regulation and self-monitoring by the stone-crushing units.*
- *Bring saw mills and wood-dependent industrial units under the ambit of the Air Act by issuing CCA in coordination with the PCCF&HoFF.*
- *Consider promoting multi-fuel technology for power generation to meet demand for power in view of air pollution caused by coal-based thermal power plants.*
- *Follow up the compliance with the CPCB's directions and monitor the progress of installation of FGD in CPPs.*
- *Direct its different departments such as Roads and Buildings, Urban Development and Urban Housing, Panchayat and Rural Housing, etc. to coordinate with Brick kilns to promote use of fly ash in their construction and allied activities.*
- *Frame a policy to encourage use of fly ash-based bricks and other building materials.*
- *Ensure strict implementation of PUC norms to control the emission from automobiles. A mechanism needs to be put in place for regular quality checks of auto fuel sold at petrol pumps.*
- *Evolve a system to collect health data on the lines of CPCB and provide such information to the State Health Department for designing necessary interventions to prevent and mitigate the impact of air pollution on the health of the peoples living in the CPAs.*
- *Expedite the installation of CAAQMS in all the six CPAs and million-plus cities (four) of the State to disseminate real-time information on AAQ of the CPAs and to enable timely intervention by the GPCB for mitigation of air pollution.*
- *Frame a policy for greening of highways and ensure its compliance by the implementing agencies.*

Chapter-1

Introduction

Government of India enacted (March 1981) the Air (Prevention and Control of Pollution) Act, 1981 (The Air Act) for prevention, control, and abatement of air pollution. The Air Act defines air pollution as “presence in the atmosphere of any air pollutant” where air pollutant is defined as any solid, liquid or gaseous substance including noise¹ present in the atmosphere in such a concentration which tends to be injurious to human beings, other living organisms, plants, property² or environment. Air pollution is an invisible transboundary phenomenon.

1.1 Air pollutants and sources of air pollution

Air pollutants can be divided into two main groups-particulate and gaseous. Particulates include solid airborne pollutants such as dust, fly ash, smoke, fog, soot, and fumes. Gaseous pollutants include Carbon Monoxide, hydrocarbons and oxides of Sulphur and Nitrogen. These pollutants are known as primary air pollutants which interact with one another to form secondary air pollutants such as ozone³ and other reactive materials. These secondary air pollutants also react with natural chemicals in the atmosphere.

The substances that are generally recognized as air pollutants are Particulate Matter (PM₁₀ and PM_{2.5}), Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Carbon Monoxide (CO), Ozone (O₃), Lead (Pb), Ammonia (NH₃) and Volatile Organic Compounds (VOC). The concentration of pollutants in the air is measured in microgram per cubic meter (µg/m³). Particulate Matter (PM) is a complex mixture of extremely small particles and liquid droplets, made up of several components including nitrates, sulphates, organic chemicals, metals, soil, or dust. The size of the particles is directly linked to their potential for causing health problems. PM is categorized into two groups.

- (i) PM₁₀ or inhalable coarse particles, such as those found near roads, dusty locations, and industries. These are less than 10 micrometres in diameter.
- (ii) PM_{2.5} or fine particles such as those found in smoke and haze. These are less than 2.5 micrometres in diameter.

¹ Inserted by Act 47 of 1987: Air (Prevention and Control of pollution) Amendment Act, 1987 with effect from 01 April 1988.

² For example: impact on beauty of the Taj Mahal is due to emission from the Mathura Refinery.

³ Ozone is a natural as well as man-made product that occurs in the earth's upper atmosphere and lower atmosphere and affects life on earth in either good or bad ways. Ozone at upper atmosphere is good and it is bad at lower atmosphere. Ozone at lower atmosphere is formed primarily from photochemical reactions between two major classes of air pollutants, volatile organic compounds and nitrogen oxides.

Chart-1: Visual presentation of particles as compared to human hair



Chart-1 represents the visual presentation of PM₁₀ and PM_{2.5} as compared to human hair to show its size.

PM_{2.5} particles upon inhalation, can be easily absorbed deep into the bloodstream and can cause far-reaching health effects like asthma, lung cancer and heart disease due to the microscopic size of these particles.

The sources of air pollution are natural and man-made. Natural sources of air pollution include forest fire, windblown dust such as road dust, soot, physical processes of crushing, grinding and abrasion of surfaces, volcanoes, lightning, *etc.* Man-made sources of air pollution comprise burning of fossil fuels (households, thermal power plants and combustion engines), smelting of metals, emissions from vehicles, quarrying, agricultural activities, burning of crop residues, emissions due to chemical, pharmaceutical, cement, petrochemicals, refineries and fertilizer industries, fly ash, *etc.*

Further, air pollution may be caused indoor due to household activities and outdoor due to industries and automobiles.

1.2 Impact of air pollution on human health

Air pollution is responsible for many Non-Communicable Diseases (NCD) and respiratory dysfunctions in humans and other living organisms. It also causes constant depletion of the ozone layer which results in global warming. Thus, air pollution is dangerous to the health of living organisms and the ecosystem.

The Lancet⁴ published (January 2021) an article on “Health and economic impact of air pollution in the states of India: The Global Burden of Disease Study 2019”, in which it was estimated that in India, the number of deaths due to air pollution in 2019 was 16.70 lakh, an increase of 4.29 lakh in comparison to 2017⁵.

⁴ The Lancet is an independent, international weekly medical journal published since 1823.

⁵ In 2017, the Lancet reported 12.41 lakh death due to air pollution in India.

The impact of different types of air pollutants on human health is shown in **Table 1** below:

Table 1: - Impact of pollutants on human health

Pollutants	Sources	Impact
Particulate Matter (PM _{2.5} , PM ₁₀)	Motor vehicles, industries, domestic fuel burning, road dust	Cardiovascular and respiratory diseases, lung cancer, acute lower respiratory infections.
Sulphur Dioxide	Burning of Sulphur-containing fuels for heating, power generation and motor vehicles.	Affects respiratory system and lung functions, coughing, mucus secretion, asthma, and chronic bronchitis. Causes acid rain.
Nitrogen Oxides (NO _x)	Combustion processes (heating, power generation, and vehicles) i.e., burning of fossil fuels.	Bronchitis in asthmatic children. Reduces lung function growth.
Carbon Monoxide	Incomplete fuel combustion (as in motor vehicles)	Reduces the oxygen-carrying capacity of the blood, causes headaches, nausea, and dizziness. Can lead to death at high levels.
Ozone	Formed by the reaction of NO _x and VOCs in sunlight	Breathing problems, asthma, reduced lung function. Ozone is one of the most damaging pollutants for plants.
Lead	Petrol and specific industries (such as smelting, paint, colour).	Affects the intellectual development of children and very high concentrations can result in poisoning, brain damage and organ damage.
Volatile Organic Compounds	Combustion & distribution-of petroleum products as they contain traces of Benzene, Toluene and Xylene (BTX).	Exposure to the high level of BTX causes neuro-toxic symptoms and persistent exposure to BTX may cause injury to human bone marrow, DNA damage in mammalian cells and damage to the immune system.

(Source- State of Environment Report, 2012 Government of Gujarat)

1.3 Impact of air pollution on business and economy

According to an independent report⁶ on “Air Pollution and its impact on business- the silent pandemic” commissioned by the Clean Air Fund (November 2020-March 2021), Air pollution costs Indian businesses about \$95 billion every fiscal year. This is around three *per cent* of India’s GDP. The cost is equal to 50 *per cent* of all taxes collected annually or 150 *per cent* of India’s healthcare budget.

The report had identified the following six ways in which this cost manifests: (i) lower labour productivity (ii) lower consumer footfall (iii) premature mortality (iv) lower asset productivity (v) increased health expenses and (vi) welfare losses. Of these, employee productivity, consumer footfall and premature mortality impact businesses directly. The report had also identified

⁶ https://www.cleanairfund.org/wp-content/uploads/2021/04/01042021_Business-Cost-of-Air-Pollution_Long-Form-Report.pdf

other more physical consequences like fall in tourism and reduced visibility. In 2019, due to reduced visibility, 13 *per cent* of total flights were delayed which adversely affected shipping and cargo handling services.

1.4 Air Quality Index - an indicator of air pollution

The Ministry of Environment, Forests & Climate Change launched (October 2014) The National Air Quality Index (AQI) outlined as ‘One Number- One Colour-One Description’ for the common man to judge the air quality within his vicinity. The formulation of the index was a continuation of the initiatives under the Swachh Bharat Mission.

AQI is a numerical value based on short-term⁷ air quality data of PM₁₀ and PM_{2.5}, SO₂, NO₂, CO, O₃, NH₃ and Pb. The AQI values are divided into six categories namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. Based on the measured ambient air quality concentrations, corresponding standards and likely health impact, a sub-index is calculated for each pollutant. The worst sub-index reflects overall AQI. The numerical values of AQI, corresponding ambient air quality, colour code and associated likely health impact are shown in **Table 2** below:

Table 2: - Levels of AQI and associated impact on health

Numerical Value of AQI	Categories of AQI	Possible associated health impact
0 to 50	Good	Minimal
51 to 100	Satisfactory	Minor breathing discomfort to sensitive people
101 to 200	Moderately polluted	Breathing discomfort with lungs, asthma, and heart disease
201 to 300	Poor	Breathing discomfort to most people on prolonged exposure
301 to 400	Very Poor	Respiratory illness on prolonged exposure
>400	Severe	Respiratory impact even on healthy people and seriously impacts those with existing lung/ heart diseases

(Source: National Air Quality Index Report 2014-15 of CPCB, Ministry of Environment, Forests, and Climate Change)

1.5 Status of air pollution in Gujarat

Gujarat is one of the highly industrialized states in India. The major industry groups/sectors in Gujarat are petrochemicals, chemicals, textiles, cement, paints, pulp and paper, pharmaceuticals, and ceramics. Further, there are coal-based thermal power plants that cause significant emissions⁸ and generate fly ash. In addition, the legacy solid waste and construction and demolition activities in urban areas also contribute to poor air quality. The average annual

⁷ 24-hourly averaging period.

⁸ 67 *per cent* of the total power generation in Gujarat is from fossil fuels (October 2019 report of Central Electricity Authority).

growth rate of vehicles in urban areas of Gujarat is also very significant. In 1999-2000, the total registered vehicles in Gujarat were 51.90 lakh. These increased by 385 *per cent* in 2018-19 to 2.52 crore⁹, contributing significantly to the poor ambient air quality. Moreover, less forest cover (7.57 *per cent* compared to national forest cover of 21.67 *per cent*)¹⁰, mining activities, major ports, railways and road infrastructure activities causing extensive vehicular movement also contribute to air pollution.

The status of air pollution in Gujarat can be gauged from the fact that based on the Comprehensive Environmental Pollution Index (CEPI)¹¹, the Ministry of Environment, Forest and Climate Change (Ministry) had declared (January 2010) six major industrial areas of Gujarat, *viz.* Vapi, Ankleshwar, Vatva, Ahmedabad (Odhav and Naroda), Bhavnagar and Junagadh as Critically Polluted Areas¹² (CPA) and imposed moratorium on setting up of new industries and expansion of existing industries in these areas. As per the latest CEPI score submitted (July 2019) by the Central Pollution Control Board (CPCB) to the National Green Tribunal (NGT), three new cities Vadodara, Surat and Rajkot have been added to the CPA list while Ahmedabad (Odhav and Naroda), Bhavnagar and Junagadh were removed from the list.

The Ministry, finalized and launched (January 2019) the National Clean Air Programme (NCAP) as a time-bound national-level strategy to tackle air pollution comprehensively. Under the programme, Ministry had identified 102 cities as non-attainment cities which failed to meet the prescribed standards of air pollution. Ahmedabad and Surat were among the non-attainment cities in Gujarat. Further as per the Source Apportionment Studies (SAS) of Ahmedabad and Surat cities conducted by the Gujarat Energy Management Institute (GEMI)¹³ and The Energy and Resources Institute (TERI)¹⁴, respectively the prominent sources of emission were domestic fuel, construction, road dust, industries, and vehicles.

In pursuance of the NGT order of October 2018, all the states and union territories having non-attainment cities were required to constitute the Air Quality Monitoring Committee (AQMC) and the AQMC was required to prepare an appropriate action plan.

CPCB approved (April 2019) the Air Action Plan for Ahmedabad and Surat which was in progress (January 2022). GoG constituted (June 2019), Steering Committee, Monitoring Committee and Implementation Committee for Ahmedabad and Surat for implementation of NCAP.

⁹ Data provided by the Commissioner of Transport and its webpage.

¹⁰ India State of Forest Report 2019, Forest Survey of India.

¹¹ CEPI is a rational number between 0 and 100, assigned to a given location to characterize the environmental quality following the algorithm of source, pathway and receptor.

¹² CEPI score more than 70.

¹³ GEMI, set up in February 1999, is an autonomous institute under the aegis of Forest and Environment Department, Government of Gujarat to provide all kind of environment solutions required to ensure sustainable development.

¹⁴ TERI, established in 1974, is a research institute that specializes in the fields of energy, environment, and sustainable development.

Conclusion

The legal provisions for the regulation of air pollution have evolved over time. Backed by these legal provisions and keeping in view the need for desired interventions, the Government of India has launched NCAP in January 2019.

Chapter-2

Institutional framework for prevention of air pollution

Legal framework for prevention of pollution

Environment protection falls under the central list and as such under the purview of the Union Government. The Union Government can delegate powers and functions to the State through the enactment of laws. The 42nd Constitutional Amendment, 1976 included protection and improvement of the environment under the Directive Principles of State Policy. The Government of India (GoI) enacted the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, and the Environment Protection Act, 1986 with the objectives of controlling water and air pollution and environmental degradation. To control the emissions from motor vehicles, the GoI notified (February 2004) vehicular emission standards and authorized the Central Government and State Governments to regulate and enforce them under the Motor Vehicles Act (MVA), 1988 and Motor Vehicles Rules, 1989 (Rule 115).

2.1 Departments responsible for prevention of air pollution

The overall policy intervention is the subject matter of the Ministry of Environment, Forests and Climate Change (Ministry) and CPCB. At the State level, the Forests & Environment Department (FED) is responsible for the protection of the environment. At the apex level, the Environment wing of the FED implements environment related policies. It is assisted by the Gujarat Pollution Control Board (GPCB) in discharging functions related to pollution control and protection of the environment by effective implementation of pollution laws. GPCB is a regulatory body responsible for bringing about all-round improvement in the quality of the environment and control of air pollution.

Other Departments/ offices responsible for controlling air pollution emanating from the activities they are administering over are mentioned in **Table-3** below:

Table-3: Departments/offices administering polluting emanating activities

Department/offices	Activities
Commissioner of Transport	Regulating and monitoring vehicular emissions
Roads and Buildings Department	Operation of Hot Mix Plants and stone crushers for construction of roads
Energy and Petrochemicals Department	Thermal Power Plants, Issue of power connections
Commissioner of Geology and Mining	Mining
Urban Development and Urban Housing Department	Disposal of municipal solid waste and regulation of demolition and construction of buildings including infrastructure developments in urban areas
Directorate of Civil Supplies	Monitoring quality of auto fuel
Principal Chief Conservator of Forests and Head of Forest Force	Greening the highways and issue of licenses to saw mills and wood processing units

2.2 Functions of Gujarat Pollution Control Board

GPCB was set up (October 1974) by the Government of Gujarat (GoG) under Section 4 of the Water (Prevention and Control of Pollution) Act, 1974, with the objective of prevention and control of water pollution (effluents) and abatement of air pollution (emissions). The GPCB performs following key functions: -

- Enforcing the provisions of (i) The Water (Prevention and Control of Pollution) Act, 1974 (ii) The Air (Prevention and Control of Pollution) Act, 1981, and (iii) the Hazardous and Other Wastes (Management and trans-boundary Movement) Rules, 2016 (iv) 15 other rules/ notifications notified by the GOI under the Environment (Protection Act), 1986.
- Issuing Consent to Establish (CTE) and Consolidated Consent and Authorization (CCA) to the activities and ensuring compliance with the conditions of the CCA.
- Monitoring ambient air quality, including noise, at different locations in the State.
- Implementing the orders of the NGT, Gujarat High Court and Supreme Court of India.

2.3 Role of Commissioner of Transport in regulating vehicular emission

The Ministry of Road Transport and Highways (MoRTH) had notified (February 2004¹) of idling emission standards for Carbon Monoxide and Hydro Carbon. Every vehicle is required to comply with these standards. Section 20 of the Air Act authorizes the State Transport Department to control vehicular pollution. The Commissioner of Transport (CoT) must ensure compliance with vehicular emission standards through enforcing six-monthly testing of emission of every motor vehicle and issue of Pollution under Control (PUC) Certificates to the vehicle owner. If the measured value of emission of any vehicle is not found within the prescribed standard, CoT imposes a penalty under section 190(2) of MVA, 1988.

2.4 Good practices

The GPCB while performing regulatory functions for control of pollution, also promoted good practices and new initiatives which can help in controlling air pollution. Some of the good practices/initiatives as observed are discussed below:

- A boiler is an integral part of any industrial process where combustion of fossil fuels takes place. It is a major source of air pollution due to emission of flue gases. As per Journal of Emerging Technologies and Innovative

¹ Central Motor Vehicles (First Amendment) Rules, 2004.

Research (JETIR)², common boiler helps in reduction of air pollution by 65 to 70 per cent in Particulate Matter. GPCB launched (2015) a pilot project in Surat for promoting the use of common boiler for reducing the cost of air pollution control measures, maintenance of equipment and enhancing the level of monitoring of air pollution. Thereafter, common boilers were installed in Vapi, Ankleshwar, Sarigam, Nandesari and Panoli during 2017-2021.

- On the directions (March 2019) of National Green Tribunal, GPCB promoted the use of eco-friendly natural gas instead of coal and lignite, especially in ceramic industries in Morbi. All units of ceramic industries in Morbi have migrated to natural gas for their operations by September 2019.
- Implementation of Air Action Plan in Ahmedabad and Surat involving the promotion of electrically operated vehicles in public transport and disposal of legacy municipal solid waste by converting them into organic manure.
- The GPCB took prompt action on matters pointed out by audit in various instances, such as:
 - i. Revision of the CCA of seven operating units in ESZ of Thol Wildlife Sanctuary.
 - ii. Undertaking air sampling at seven different locations near Ahmedabad and Gandhinagar cities where infrastructure activities were in progress. Issuance of show-cause notice to the implementing agencies for poor ambient air quality.
 - iii. Directing the brick manufacturers to adopt cleaner technology.
 - iv. Inspection of fly ash dumping sites and issue of Show Cause Notice for unauthorised disposal of fly ash.
 - v. Directing the bulk pet coke consumers (cement industries) to upload consumption data of pet coke on CPCB website.

Conclusion

The overall policy intervention at the national domain is the subject matter of the Ministry of Environment, Forests and Climate Change and CPCB. At the State level, the Forests & Environment Department (FED) is responsible for the protection of the environment. At the apex level, the Environment wing of the FED implements environment-related policies with the assistance of the Gujarat Pollution Control Board (GPCB) in discharging functions related to pollution control and protection of the environment by effective implementation of pollution laws. GPCB is a regulatory body responsible for bringing about all-around improvement in the quality of environment and control of air pollution. With resource constraints GPCB has been able to implement some good practices.

² Journal of Emerging Technologies and Innovative Research (JETIR) is a UGC approved International Scholarly Open Access, Peer-reviewed, Multidisciplinary Monthly Journal which is approved by University Grants Commission (UGC). It has an Impact factor of 7.95 (Calculate by Google Scholar and Semantic Scholar).

Chapter-3

Audit framework

3.1 *Audit objectives*

The Performance Audit was conducted to assess whether,

- the system for enforcement of the provisions of the Air (Prevention and Control of Pollution) Act, 1981 was efficient and effective,
- convergence of various schemes, initiatives, and efforts of different line departments of the GoG for abatement of air pollution was adequate; and
- human resources were adequate in the GPCB to regulate and monitor air pollution.

3.2 *Audit criteria*

The pollution control measures implemented by the GoG were assessed against the following criteria: -

- Air (Prevention and Control of Pollution) Act, 1981 and rules made thereunder.
- Noise Pollution (Regulation and Control) Rules, 2000.
- Air Quality Index developed by the Ministry of Environment, Forests & Climate Change.
- Comprehensive Environmental Pollution Index developed by the Indian Institute of Technology, Delhi.
- Standards/ norms notified for various types of activities under Environment (Protection) Act, 1986 by the Ministry.
- Environment Impact Assessment (EIA) Act, 2006.
- National Environment Policy, 2006.
- Guidelines, norms, notification, circulars issued by the CPCB and the GPCB for regulation of emissions.
- Directions issued by the Courts and National Green Tribunal to the GoG/ GPCB.
- Motor Vehicles Rules, 1989 notified under Motor Vehicles Act, 1988 (59 of 1988).
- Study Reports prepared by the CPCB and technical institutions like the Indian Institute of Technology, National Environmental Engineering Research Institute and Gujarat Environment Management Institute.

3.3 *Audit scope*

The Performance Audit was conducted between March 2019 and November 2019 and was further updated to cover the period from 2014-15 to 2020-21. The

audit examined records of the Forests and Environment Department, GPCB, Commissioner of Transport and collected required data, information, and records from other offices relevant for the accomplishment of this performance audit.

3.4 Audit methodology

The Entry conferences were held with the Additional Chief Secretary, Agriculture, Farmers Welfare and Cooperation Department; Principal Secretary, Port and Transport; and Additional Chief Secretary, Forests and Environment Department (FED) in August 2019. During the conferences the audit objectives, scope, criteria, and samples selected were explained. The audit methodology involved interaction with the personnel of auditee units, scrutiny/examination of relevant records, joint site visits to the selected samples and raising of audit queries based on the scrutiny of records.

An Exit conference was held with Additional Chief Secretary to Government of Gujarat, FED, and officials of the GPCB on 03 January 2022 wherein the findings of the Performance Audit were discussed. The reply of the Government was furnished on 08 January 2022 which have been suitably incorporated in the Report.

3.5 Sampling

For sampling, categorization of polluting activities was kept in view. GPCB has identified 440 activities for categorization based on degree of pollution caused by them. Based on the Pollution Index Score¹, (designed and developed by the CPCB) the GPCB has categorized these activities in Red, Orange, Green, and White category as shown in **Table 4** below:

Table 4: - Categorization of polluting activities

Pollution Index score	Category	Types of polluting activities falling under the category proposed by the CPCB	Type of polluting activities falling under the category proposed by the GPCB	Total CCA issued by the GPCB up to March 2021 under all the applicable Acts and Rules ² .
60 and above	Red	60	85	18,526
41 to 59	Orange	83	103	15,230
21 to 40	Green	63	79	8,194
Up to 20	White	36	173	Not Applicable

(Source: Online database of the GPCB for the year 2018-19)

¹ A function of the Emissions (Air Pollutants), Effluents (Water Pollutants) and Hazardous waste generated and consumption of resources.

² The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of pollution) Act, 1981, and the Hazardous and Other Wastes (Management and trans-boundary Movement) Rules, 2016.

As per CPCB guidelines (March 2016), Consent to Establish³ (CTE) and Consolidated Consent and Authorization⁴ (CCA) is not required for activities falling under white category. In Gujarat there are 267 types of activities under Red, Orange, and Green category which required CTE and CCA. Till March 2021, under the Air Act, GPCB has issued 32,967 CCA to Red, Orange, and Green category units⁵.

The Ministry has further classified highly polluting (water, air and hazardous) industries⁶ as 17 category units (out of red category units). Under this category, 541 units were operating in Gujarat as of September 2018. These units were required to ensure stricter compliance to environmental norms such as installation of online continuous emission and effluent monitoring system and environment audit by the GPCB.

Out of 32,967 units, Audit randomly selected 55 units from 17 category units (**Appendix I**) and 34 units⁷ from red and orange categories (**Appendix II**) for checking compliance with CCA issued by the GPCB. For audit of PUC management, audit examined records of CoT and two⁸ Regional Transport Offices (RTOs). Audit also examined role of other departments, offices, and municipal corporations in controlling air pollution (**Appendix III**).

3.6. *Expert opinion*

To understand the subject matter of the performance audit, three workshops were organized (January and April 2019). The subject matter experts from (i) The Energy and Resources Institute (TERI), New Delhi (ii) Centre for Environment Education, Ahmedabad and (iii) Indian Institute of Public Health, Gandhinagar and (iv) Civil Hospital, Ahmedabad attended these workshops and provided guidance.

3.7 *Acknowledgment*

Audit acknowledges the cooperation and assistance extended by the State Government, Gujarat Pollution Control Board, Commissioner of Transport, R&B Department, Office of the Directorate of Civil Supply and Gujarat Maritime Board while conducting the performance audit.

³ CTE is the primary clearance. Once the Industry, Plant, or Process being established according to mandatory pollution control systems, the units are required to obtain consent to operate.

⁴ CCA is required to be obtained at the time of starting of the operation/ production at the industrial plant.

⁵ As on March 2021, total numbers of the CCA issued by the GPCB under Red, Orange, and Green category was 41,950 under the Water, Air and Hazardous Waste Act.

⁶ Aluminium smelter, Cement, Chloro Alkali, Copper smelter, Distillery, Dyes and Dye -intermediates, Fertilizer, Iron and steel, Oil Refinery, Pesticides, Petrochemicals, Pharmaceuticals, Pulp and paper, Sugar, Thermal Power Plants, Zinc Smelter and Tanneries.

⁷ Thirty units from red and orange categories (three red and three orange from five ROs and two red and two orange from the GPCB HQ office).

⁸ Assistant Regional Transport Office, Gandhinagar and Bavla.

3.8 Audit findings

The performance audit revealed the status of air quality in the state, activities contributing to air pollution, adequacy of planning and regulatory interventions and sufficiency of coordination among various departments for control and abatement of air pollution. The audit findings are brought out in the succeeding chapters.

Chapter-4

Ambient air quality in Gujarat

4.1 Framework to measure ambient air quality in the State

Ambient Air refers to any unconfined portion of the atmosphere or outdoor air. The respiratory air consists of Oxygen (20.95 per cent), Nitrogen (78.09 per cent) and Carbon Dioxide (0.04 per cent) and small amount of other gases. Air pollution occurs if there is a change in the composition of the ambient air. Generally, it is caused by smoke, dust, gases, fumes, aerosols, and odorous substances. CPCB has notified (November 2009) standards for 12 pollutants (PM₁₀, PM_{2.5}, Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Ammonia (NH₃), Ozone (O₃), Carbon Monoxide (CO), Lead (Pb), Arsenic (As), Nickel (Ni), Benzene (C₆H₆) and Benzo (a) pyrene (C₂₀H₁₂¹) of Ambient Air Quality (AAQ). The concentration of PM₁₀ and PM_{2.5} in the ambient air is the major indicator of the quality of the air. As per the CPCB notification, annual average concentration of PM₁₀ and PM_{2.5} in ambient air should be 60 µg/m³ and 40 µg/m³ respectively.

GPCB monitors (December 2020) AAQ in the State through 38 stations established under the National Air Quality Monitoring Programme² (NAMP) and 24 stations established under the State Air Quality Monitoring Programme³ (SAMP). In addition to AAQ, the presence of Volatile Organic Compounds (VOC) was also being monitored at 25 stations out of these 62 stations in the State. The presence of metals in the ambient air was also being monitored at Alang and Sosiya ship-breaking yard, Bhavnagar.

For real-time monitoring of AAQ in the State, the CPCB has installed sensor-based Continuous Ambient Air Quality Monitoring Stations (CAAQMS) at six locations⁴. The Ahmedabad Municipal Corporation with the support of the SAFAR⁵ has developed Air Information and Response Plan for Ahmedabad and established CAAQMS in and around Ahmedabad city for monitoring of AAQ and dissemination of information on the AAQ. AMC also issues health advisory to the residents of the Ahmedabad city.

4.2 Improving ambient air quality of the State

The GPCB publishes station-wise annual average of PM₁₀ and PM_{2.5}, measured under NAMP and SAMP, in its Annual Reports. The concentration of PM₁₀ and PM_{2.5} in ambient air between 2011-12 and 2020-21 is as shown in **Table 5:**

¹ It is one of the benzo-pyrenes formed due to incomplete combustion of organic matter.

² CPCB is executing a nation-wide programme of AAQ monitoring. The network consists of 804 operating stations covering 344 cities/towns in 28 States and 6 Union Territories of the country.

³ Under the programme the GPCB is monitoring the ambient air quality in the State.

⁴ Gandhinagar, Vatva, Maninagar, Ankleshwar, Vapi and Jamnagar.

⁵ System of Air Quality and Weather Forecasting and Research, operated by Indian Institute of Tropical Meteorology, Pune, Ministry of Earth Science, GoI.

Table 5: - Concentration of PM₁₀ and PM_{2.5} (Annual Average) in the ambient Air

Year	Total monitoring stations	Concentration of PM ₁₀ in µg/m ³ (Norm is 0-60 µg/m ³)					Concentration of PM _{2.5} in µg/m ³ , (Norm is 0-40 µg/m ³)		
		0-60	61-99	100-150	151-200	201 and above	0-40	41-60	61-100
2011-12	41	02	29	10	-	-	25	09	07
2012-13	44	04	30	09	01	-	28	11	05
2013-14	43	-	31	12	-	-	42	01	-
2014-15	59	-	59	-	-	-	58	01	-
2015-16	62	-	46	16	-	-	62	-	-
2016-17	62	-	12	50	-	-	62	-	-
2017-18	62	-	01	37	24	-	12	49	01
2018-19	62	-	-	08	27	27	02	28	32
2019-20	62	-	09	53	-	-	54	8	-
2020-21	62	-	29	33	-	-	56	6	-

(Source: - Annual Reports of the GPCB for the years 2011-12 to 2020-21)

- In 2011-12, out of 41 stations, at two stations⁶, concentration of PM₁₀ was within the norm of 60 µg/m³ while at 39 stations it ranged between 61 and 150 µg/m³. However, during 2013-14 to 2020-21, at none of the stations, the concentration of PM₁₀ was within the norms. In 2018-19, the concentration of PM₁₀ at 27 out of 62 stations was observed even above 200 µg/m³.
- In 2011-12, at 25 out of 41 stations, concentration of PM_{2.5} was within the norms. During 2015-17, at all the 62 stations, concentration of PM_{2.5} was within the norms. However, in 2018-19 concentration of PM_{2.5}, was within the norms at only two stations and at 32 stations, it was above 60 µg/m³.

Thus, during the period between 2011-12 and 2018-19, concentration of two major air pollutants PM₁₀ and PM_{2.5} had increased indicating substantial deterioration of the AAQ in the State. GPCB stated (December 2019) that Gujarat is a semi-arid region and due to moderate to high wind velocity, air-borne dust remains in suspension for very long time causing increased concentration of PM₁₀. Other factors such as rapid urbanization, industrial growth and increase in numbers of vehicles contributed to escalation in concentration of PM₁₀.

- In 2019-20 and 2020-21, at none of the stations, the concentration of PM₁₀ was above 150 µg/m³. Also, at none of the monitoring stations the concentration of PM_{2.5} was above 60 µg/m³ during the same period. Thus, in 2019-21, overall ambient air quality had improved in comparison to 2017-18.

⁶ GPCB office premises at Vadodara and LD Engineering College, Ahmedabad.

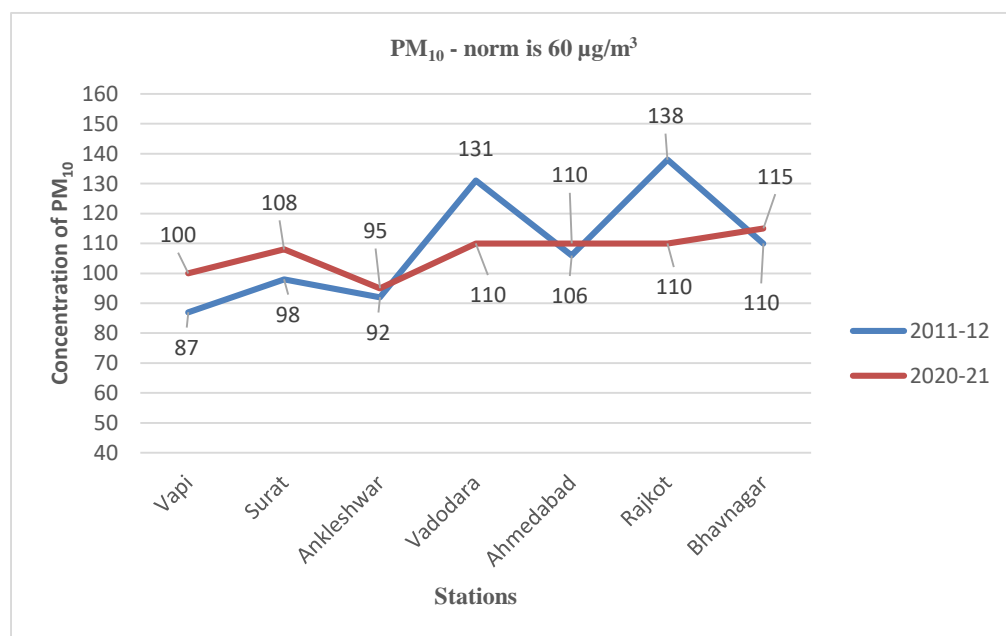
- Comparison of 2020-21 data with 2011-12 reveals that concentration of PM₁₀ worsened as in more than 50 per cent stations (33 out of 62), concentration was more than 99 µg/m³ in 2020-21 compared to about 25 per cent (10 out of 41) in the year 2011-12. Concentration of PM_{2.5} had improved during the period as in more than 90 per cent (56 out of 62) stations, concentration did not exceed 40 µg/m³ in 2020-21 compared to about 60 per cent (25 out of 41) in 2011-12.

The GPCB may continue making efforts towards improving ambient air quality by monitoring the concentration of PM₁₀ and PM_{2.5} particularly with special focus on PM₁₀ as even in 2020-21 concentration was more than 99 µg/m³ in 33 out of 62 stations.

4.2.1 Concentration of PM₁₀ and PM_{2.5} in selected highly polluting stations

Audit reviewed the concentration level of PM₁₀ and PM_{2.5} in seven highly polluting stations out of 41 stations. A comparison of the concentration level of PM₁₀ and PM_{2.5} measured at seven stations⁷ during 2011-12 vis-à-vis 2020-21 is shown in Graph 1 and Graph 2 below.

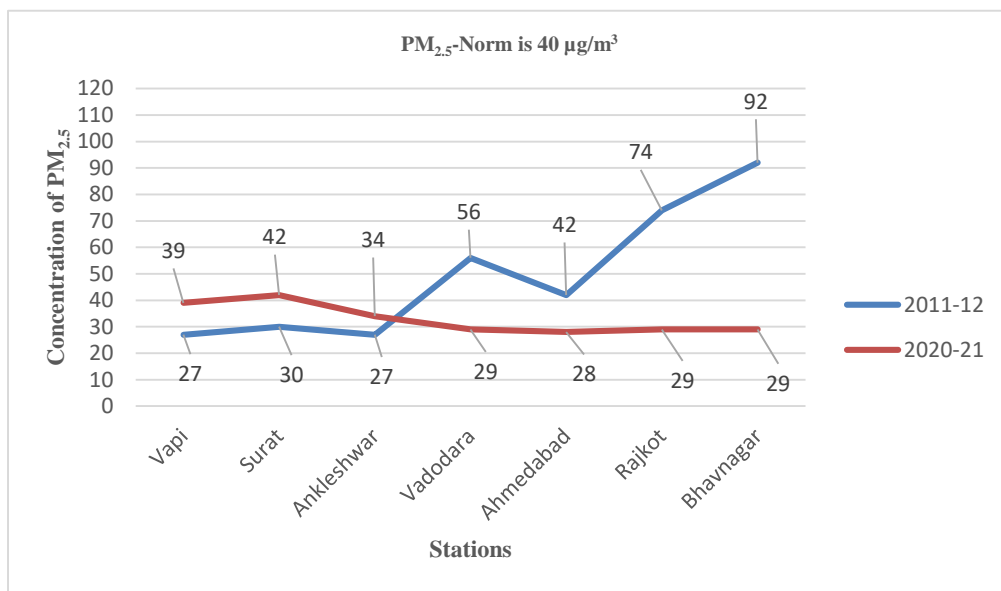
Graph 1



From the above Graph, it may be seen that out of the seven stations, the annual average concentration level of PM₁₀ increased at five stations (Vapi, Surat, Ankleshwar, Ahmedabad and Bhavnagar) in 2020-21 as compared to 2011-12 and was above the norm of 60 µg/m³. At two stations (Vadodara and Rajkot), though the concentration level decreased it continued to remain above 60 µg/m³.

⁷ **Stations:** (i) GEB GIDC Club 3 Building, Vapi, (ii) B.R.C. High School, Udhna, Surat, (iii) Rallis India, Ankleshwar, (iv) GIDC Nandesari, Vadodara, (v) Naroda GIDC, Ahmedabad, (vi) Near Sardhara Corporation, Rajkot and (vii) Chitra GIDC Bhavnagar.

Graph 2



As regards the annual average concentration level of PM_{2.5}, it may be seen from the above Graph that though it increased at three stations (Vapi, Surat and Ankleshwar) in 2020-21 compared to 2011-12, the same remained within the norm of 40 µg/m³ at two stations viz., Vapi and Ankleshwar. The concentration level of PM_{2.5} decreased significantly at other four stations (Vadodara, Ahmedabad, Rajkot and Bhavnagar) and were within the norms.

It could be seen from the above that the concentration level of PM₁₀ in the selected stations continued to remain above the norm of 60 µg/m³ while the concentration level of PM_{2.5} has come down within the norm of 40 µg/m³. This indicates that GPCB may have to take effective measures to improve ambient air quality particularly PM₁₀ which is major contributor in deterioration of the air quality in the vicinity of these stations.

4.3 Insufficient monitoring of ambient air quality and noise emissions

Under section 16 of the Air Act 1981, the CPCB notified (November 2009)⁸ National Ambient Air Quality Standards (NAAQS) for 12 pollutants. Standards of these pollutants were different for Industrial, Residential, Rural and Other Areas and Ecologically sensitive areas (notified by GOI).

As per NAAQS, the concentration of two pollutants (Ozone and Carbon Monoxide) in ambient air at a particular site is to be measured every eight hours, the concentration of six pollutants (SO₂, NO₂, PM₁₀, PM_{2.5}, Pb and NH₃) is to be measured twice a week at uniform intervals⁹ and concentration of remaining four pollutants (Benzene, Benzo (a) pyrene, Arsenic and Nickel) is to be measured on an annual basis.

⁸ Earlier to this, old standards notified in April 1994 were in force.

⁹ Sampling duration is 24 hours.

Further, the Ministry had set Ambient Air Quality Standards in respect of noise for industrial, commercial, residential areas, and silence zone¹⁰ under the Noise Pollution (Regulation and Control) Rules, 2000. Every unit must comply with these AAQ standards and take adequate measures to control pollutants and noise levels¹¹ within the premises.

Audit observed that:

- In all the test checked cases, the CCAs accorded by the GPCB included conditions relating to monitoring of AAQ as per the notification *ibid* but it was restricted to monitoring of only four pollutants (PM₁₀, PM_{2.5}, NO₂ and SO₂) instead of twelve pollutants.
- During 2014-19, the GPCB measured AAQ in only 10 out of 55 highly polluting units test checked in audit.
- In all the test checked cases, the Inspection reports of the GPCB showed that it did not regularly monitor noise levels during 2014-19 in the premises of the industrial units.

Thus, the only source of the AAQ data in the State is the information collected at 62 stations under the NAMP and SAMP. Audit is of the view that in the absence of monitoring of concentration of pollutants in ambient air in the premises of a unit, compliance with AAQ standards cannot be ensured. As a result, the quantity and quality of air pollutants attributed to any activity in areas not covered under NAMP and SAMP were not available with the GPCB.

Government stated (January 2022) that major industries are regularly monitoring AAQ in their premises as a part of the self-monitoring mechanism. Government further stated that AAQ is a time taking exercise and its regular monitoring in every major industrial area and units by GPCB is not feasible due to shortage of manpower. The Government has been apprised about the shortage of human resources in the GPCB.

Regarding monitoring of four pollutants instead of 12, Government stated (January 2022) that as all parameters were not relevant to each and every type of industrial unit, the applicable parameters for major industrial types would be decided and where required CCA would be amended to make it in consonance with the notified parameters.

The reply is not convincing as GPCB was required to monitor all 12 pollutants as per the CPCB's notification of November 2009.

The GoG may strengthen the human resources of GPCB to monitor all 12 pollutants.

¹⁰ Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places, or any other area which is declared as such by the competent authority.

¹¹ For industrial areas, the noise level is 75 dB (A) during daytime (10 am to 06 pm) and 70 dB (A) in the night (06 pm to 10 am).

4.4 Non-inclusion of all areas for monitoring of ambient air quality

For designing interventions for the control of air pollution, GPCB must have a comprehensive database of all the potential polluting areas of the State. GPCB monitors (November 2021) AAQ at 62 stations in 14 cities only whereas in the remaining cities, industrial and mining areas, the AAQ is not being monitored.

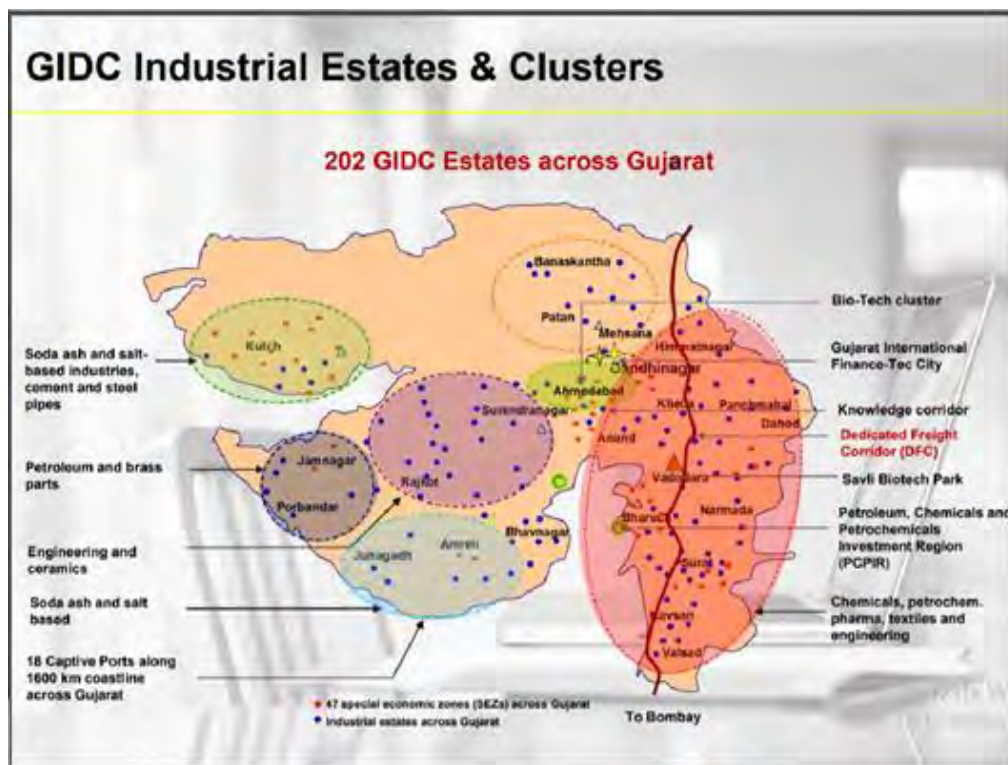
In Gujarat, there are 202 industrial estates administered by the Gujarat Industrial Development Corporation (GIDC). In addition, there are private industrial estates in the State located within or near the cities. All these estates have industries of different categories and contribute significantly to escalation of PM₁₀, PM_{2.5} and other air pollutants. Besides, clusters viz. Vatrak (Dhansura), Chitrasani, Bagasara, Sayla, Ambaji, Sevaliya, Panandhro, Chikhali, Pardi and lignite mines in Kachchh and Surat where mining and stone crushing units¹² have significant presence, are major sources of fugitive emissions (Solid Particulate Matter, SPM).



The Map alongside is showing 14 locations of 62 monitoring stations.

Audit observed that AAQ was not being monitored in some of the major industrial estates in the State such as Viramgam, Dhandhuka, Mandal, Vallabh Vidyanagar, Waghodia, Halol, Ranoli, Vagara, Bardoli, Chhatral, Kalol, Dediyan, Dahod, Porbandar, Sanand, Surendranagar, etc. The Map below is showing major industrial estates and clusters in the state.

¹² As per the data base of the GPCB, number of stone crushers in Gujarat as of November 2021 were 1,681 and total pollution score of stone crusher activity on account of Air pollution is 50.



Disclaimer: Both the Maps are for indicative purpose

Further, in the areas where the stone crusher units are located, the concentration of SPM was not being monitored.

GPCB had proposed (January 2017) to establish 20 additional AAQ monitoring stations under NAMP of which CPCB approved only 13 stations, for which tendering was in process (January 2022). GPCB stated (June 2021) that the instructions had been issued (June 2021) to the ROs to monitor AAQ in the areas which had not been covered under NAMP and SAMP. Though, the process to establish more stations has been initiated, the collection and compilation of data pertaining to air quality that impacts human health and actions to raise awareness about dangers in the air have not been prioritised.

GPCB may expedite establishment of AAQ monitoring stations in areas not covered under existing monitoring system and regularly monitor the ambient air quality in other areas.

GPCB may take up issue of setting up of AAQ monitoring stations in the industrial estates with GIDC. Further, GPCB may persuade GIDC to provide capital assistance for setting up of AAQ monitoring stations similar to assistance provided for setting up of common effluent treatment plants and common incineration plants.

4.5 Increased concentration level of volatile organic compounds

Volatile Organic Compounds (VOC) are organic chemical compounds that evaporate under normal atmospheric conditions of temperature and pressure. The combustion and distribution of petroleum products, containing traces of Benzene, Toluene and Xylene (BTX), are the main outdoor source of the VOC emissions.

Gujarat is a major transitional point for cargo movement due to major ports in the state and industrial development. With 2.52 crore registered vehicles and 4,575 fuel retail outlets, total petroleum consumption in Gujarat in 2019-20 was 10.52 *per cent* of the total consumption of India. Thus, the State is more prone to VOC-induced air pollution.

GPCB collects data of concentration of 16 parameters of VOC at 25 stations in a month. The change in annual average concentration¹³ of five main components of VOC (Benzene, Toluene, p-xylene, m-xylene, and o-xylene) in Gujarat during the period 2014-15 to 2019-20 is shown in **Table 6** below: -

Table 6: - Trends of concentration of VOC (in µg/m³)

Annual Average	Benzene	Toluene	p-xylene	m-xylene	o-xylene
2014-15	3.04	4.50	3.22	3.12	2.48
2019-20	4.52	4.05	2.40	2.40	2.96
2020-21	4.22	3.95	2.48	2.47	2.59
Percentage change from 2014-15 to 2019-20	(+) 48.82	(-) 10.08	(-) 25.37	(-) 23.08	(+) 19.39
Percentage change from 2014-15 to 2020-21	(+) 38.82	(-) 12.22	(-) 22.98	(-) 20.83	(+) 4.44

(Source: - Annual Reports of GPCB)

It can be seen from the table that from 2014-15 to 2019-20, concentration of Benzene and o-xylene had increased significantly. However, in 2020-21, the concentration had reduced marginally mainly due to slow down of industrial activities during the COVID-19 pandemic. VOC levels lead to formation of ground-level ozone. The exposure to high levels of Benzene and o-xylene causes neuro-toxic symptoms and persistent exposure to these compounds may cause injury to human bone marrow, DNA damage in mammalian cells and damage to the immune system. Though GPCB collects the data of concentration level of VOC at 25 stations, it does not analyse or monitor it for taking appropriate measures to control VOC-induced emission.

GPCB stated (April 2020) that norms for all VOC were not prescribed in NAAQM 2009 except for Benzene and Benzo (a) Pyrene which was within the permissible limit. It was further stated that the data in respect of 16 parameters of VOC was being collected from 25 stations for future planning.

Audit is of view that GPCB should monitor concentration level of VOC at all 62 stations. Based on the analysis of this data, GPCB should design and implement mitigation measures to control the VOC-induced emission.

4.6 Variation between SAMP and CAAQMS monitoring data

The reliability of data is a prerequisite of an effective regulatory mechanism. To monitor all the 12 parameters of AAQ in addition to VOC and weather data continuously, the GPCB has installed sensor-based Continuous Ambient Air Quality Monitoring Stations (CAAQMS) at Maninagar and Vatva in Ahmedabad, Ankleshwar, Vapi, Gandhinagar and Jamnagar and linked them with the server of the GPCB and CPCB.

¹³ Based on data of 16 components of VOC at 25 stations in Gujarat collected by the GPCB.

Audit noticed (September 2019) that at Vatva CAAQM station, manual monitoring of AAQ was also being done under SAMP. Audit compared the sensor-based data of six major parameters of AAQ with the manual data on nine different days as shown in **Table 7** below:

Table: 7 - Manual (SAMP) and Sensor (CAAQMS) base data in $\mu\text{g}/\text{m}^3$

Date	Source of data	SO ₂	NO _x	NH ₃	PM ₁₀	PM _{2.5}	Benzene
03.05.19	CAAQMS	12.32	127.49	82.50	144.97	55.00	0.31
	SAMP	27.4	35.0	<20	137	36	1.89
07.05.19	CAAQMS	30.09	114.90	69.38	134.26	56.17	1.47
	SAMP	46.0	42.6	< 20	149	42	2.14
10.05.19	CAAQMS	40.12	184.18	107.66	93.31	37.18	8.08
	SAMP	19.8	30.2	< 20	116	33	1.36
14.05.19	CAAQMS	32.81	146.99	85.46	122.08	45.04	7.80
	SAMP	19.0	30.8	< 20	122	28	1.24
17.05.19	CAAQMS	33.34	118.05	76.97	116.27	41.40	4.68
	SAMP	21.0	23.9	< 20	112	33	2.41
21.05.19	CAAQMS	75.30	111.70	9.71	106.55	45.54	6.06
	SAMP	20.6	38.5	< 20	117	26	1.62
24.05.19	CAAQMS	142.18	129.34	6.18	147.91	60.83	4.92
	SAMP	21.3	37.4	<20	111	24	1.47
28.05.19	CAAQMS	96.89	113.35	11.17	145.16	61.90	7.69
	SAMP	19.7	28.8	< 20	106	19	1.22
31.05.19	CAAQMS	103.32	107.46	17.36	129.13	59.19	5.83
	SAMP	22.9	34.9	< 20	121	31	2.36

(Source: CAAQMS and SAMP data at Vatva)

It can be seen from the above table that there was large variance between sensor-based data and manual data. The sensor-based data were very high compared to manual data for SO₂, NO_x, PM_{2.5} and Benzene on most of the days. Audit is of the view that since manual, as well as sensor-based monitoring, were being done at the same station, the data (24 hours' average) on any day of sampling should have been identical. No reasons for variance in monitoring data were available on record.

GPCB stated (April 2021) that CAAQMS results were based on continuous monitoring and analysed by sensor-based instruments while in SAMP stations, samples were collected on an interval ranging from one hour to eight hours. Government further stated (January 2022) that reasons for variation were being analysed by the Technical Committee of GPCB.

Audit recommends that there is a need to analyse and reconcile the wide variation between manual and sensor-based data so that quality of data used for monitoring air quality is improved.

Conclusion

Rapid urbanization, industrial growth, and increasing density of vehicles on road are contributing to the increased concentration of PM₁₀ and PM_{2.5}. AAQ was not being measured in major industrial estates and other areas in the State. No new AAQM station has been set up since 2015-16. The GPCB has not created facilities at diverse locations to collect more comprehensive data on AAQ of the State which is necessary for designing interventions to mitigate the impact of air pollution and to improve the ambient air quality.

Chapter-5

Air pollution due to source emission

5.1 Installation of online continuous emission monitoring system

In the era of rapid industrialization, there is a need to regulate pollution compliance by industries with minimal human interventions. One such mechanism is to install online emission and effluent monitoring systems and transfer reliable data to regulatory authorities (SPCBs/CPCB and other government agencies). Online emission and effluent monitoring systems need to be installed and operated by system developers and the industries on the 'Polluter Pay Principle'¹.

To track the release of pollutants through emissions and effluent discharge from industries with high pollution potential, CPCB directed (February 2014) 17 categories of highly polluting industries and common effluent treatment plants (CETPs), sewage treatment plants (STPs), common bio-medical waste and common hazardous waste incinerators, *etc.* to:

- Install online continuous emission monitoring system (OCEMS) for online monitoring of emission to measure the parameters of PM, NH₃, SO₂, NO_x and other sector-specific parameters, and simultaneous transmission of this data to the GPCB and the CPCB by March 31, 2015;
- Installation of surveillance system with industrial-grade internet protocol cameras having Pan-Tilt-Zoom (PTZ) with leased line real-time connection for data streaming; and
- Ensure regular maintenance and operation of the online system with tamper-proof mechanism having facilities for online calibration such as onsite/ offsite and Remote.

CPCB directed (March 2015) GPCB to obtain bank guarantee equivalent to 100 *per cent* of the cost of OCEMS from the targeted units for ensuring timely installation by June 30, 2015. Further, the Ministry notified (January 2018) mandatory installation of OCEMS in the industries using boilers under Environment (Protection) Act, 1986.

As of December 2021, 422 units under these 17 categories were in operation, out of which 67 had not installed OCEMS. GPCB issued notice of direction/show-cause notice to only 11 units and in case of remaining units, no action was taken by the GPCB. Of all the units having OCEMS, 94 units were connected with GPCB server and remaining were connected with CPCB server.

¹ In environmental law, the polluter pays principle is enacted to make the party responsible for producing pollution responsible for paying for the damage done to the natural environment.

Audit review of records indicated that GPCB has not established any monitoring mechanism to examine the efficacy of the OCEMS installed in 355 units and to check whether the equipment installed were as per the CPCB guidelines. GPCB conducts events such as rallies, exhibition, padyatras, essay competitions, paintings and drawing contests, seminars, workshops, etc., on Earth day, World Environment day, etc., to educate and raise awareness among stakeholders about the various requirements for environment protection and pollution control. However, GPCB has not been able to reach individual industrial units due to limited workforce.

Government stated (January 2022) that GPCB has directed all the ROs to ensure that (i) the units which required OCEMS and its connectivity with the GPCB and CPCB server should install the same at the earliest (ii) defaulter units deposit Bank Guarantee as per the CPCB directions.

The reasons for non-availability of the online emission data of 17 category units in public domain were not furnished to audit.

Facts remained that even after lapse of more than six years since CPCB had issued directions (February 2014), GPCB neither obtained bank guarantee in place of cost of OCEMS nor initiated any action against non-complying units. Also, only 94 units were connected with GPCB server indicating that GPCB had no data on emissions from the remaining units. Not installing OCEMS despite CPCB directions did not fulfil the very purpose of online monitoring of emission of red category units.

GPCB may ensure installation of OCEMS in all the highly polluting industries and ensure its connectivity with CPCB and GPCB server to strengthen monitoring of red category units.

5.2 Insufficient source emission monitoring

The Ministry has prescribed different standards of flue and process emission for different types of activities such as Refineries, Steel, Fertilizer, Thermal Power plants, Chemical, etc. through various notifications under the Environment (Protection) Act, 1986. Further, CPCB guidelines (December 1985) stipulate that for emission regulation, the industrial units should monitor Ambient Air Quality and stack emission (Flue/ process) within the industrial premises. The guidelines also stipulate frequency for source emission monitoring-stack sampling² for major industries based on plant capacity/boiler capacity. For cement, fertilizer, thermal plants, and other major air polluting units, it ranges from once a week to once in eight weeks. For ensuring compliance with emission norms, the GPCB must carry out air sampling.

Audit analysis revealed that as of March 2021, a total of 32,967 units had been granted CCA under the Air Act, 1981. For ensuring compliance with emission norms by these units, GPCB collected and analysed 4,415 air samples during 2020-21. Audit noticed that under the Water Act, 1974, the GPCB collected

² Stack sampling is a method of collecting representative samples of pollutant laden air/gases at the place of origin of pollutants to determine the total amount of pollutants emitted into the atmosphere from a given source in a given time.

and analysed 21,992 samples from 41,993 units which were granted CCA under the Water Act. Thus, the samples analysed for air were quite less as compared to water.

Between April 2014 and November 2019, GPCB had carried out only 906 stack sampling (**Appendix I**) in 46 out of 55 units, test checked under 17 categories in Audit. No stack sampling was done in nine units. Audit observed that GPCB has not stipulated any norms for the frequency of air sampling of stacks for different types of industrial activities. Thus, air sampling for monitoring compliance with emission norms of air pollution was inadequate.

Government stated (January 2022) that stack sampling as a part of the regulatory mechanism of GPCB was hampered due to acute shortage of technical staff in GPCB and stack sampling is time consuming. GPCB further stated that though major industrial units were being monitored on real time basis through installation of OCEMS, stack sampling in other units remained insufficient due to the stated reasons.

Audit is of view that in view of inadequate staff and infrastructure, GPCB may devise a suitable mechanism for stack sampling to monitor the concentration of emission and ensure compliance with emission norms and to sensitize and encourage highly polluting industrial units for self-monitoring.

5.3 Monitoring and regulation of the use of pet coke as fuel

Pet coke, a by-product of the oil refining process, has over 90 *per cent* carbon content. It is cheaper than coal and has a very high calorific value which makes it susceptible to use by industries without specific permission of the PCBs. On burning, it emits 30 to 40 *per cent* more CO₂ per unit of weight. Further, due to its high Sulphur content, it poses a health hazard. All the Sulphur will be released into the atmosphere if an industry uses pet coke without having any Sulphur abatement facility³.

NGT issued (May 2017) directions to the PCBs on the use of pet coke as 'industrial fuel' because of the non-regulated use of pet coke. Accordingly, the GPCB notified (October 2017 and February 2018) use of Pet coke as approved fuel subject to the following conditions: -

- Sulphur content shall not be more than seven *per cent*.
- Use of pet coke shall not be permitted in Eco-Sensitive Zone.
- Compliance with Siting⁴ criteria for new projects authorized to use pet coke.
- Use of pet coke in specific industries⁵.

³ Desulfurization or Circulating Fluidized Bed Combustion technology.

⁴ Related to site.

⁵ (i) Cement manufacturing units (ii) Thermal power plants/ captive power plants of capacity above 25 MW, cogeneration plants as combined heat and power (CHP) where boiler steam generation capacity should be 80 Ton per hour or more (iii) Glass manufacturing up to 25 *per cent* of total fuel consumption (iv) Refractories, etc.

Further, the Ministry also issued (September 2018) guidelines for regulation and monitoring of imported pet coke in India which *inter alia* included the following: -

(i) Only registered industrial units with valid consent from SPCBs/ Pollution Control Committees (PCCs) shall be permitted to directly import pet coke and the consignment shall be in their name and for their use only.

(ii) Authorized importers of pet coke shall furnish details of opening and closing stock of imported pet coke to the concerned SPCBs/ PCCs on quarterly basis.

(iii) SPCBs/ PCCs shall develop an electronic record system for uploading of consent, registration, and record of use of imported pet coke by the industrial units and share this data with the CPCB on quarterly basis.

As per the information provided by Gujarat Maritime Board, during 2017-21, 72.10 lakh MT pet coke was imported by the users through the ports in Gujarat.

As informed (November 2019) by GPCB, no quarterly reports were submitted by the authorized importers of pet coke. GPCB further stated that units falling under the criteria specified in the notification are allowed to use pet coke and if any industry is found using pet coke without permission, legal action is taken including closure of the unit. GPCB issued (January 2015/July 2019) notices to two units for unauthorised use of pet coke in the ceramic industries at Morbi.

After the matter was pointed out by Audit, in pursuance of directions of the Ministry, GPCB directed (June 2021) the bulk consumers (cement industries) of pet coke to upload consumption data of pet coke on CPCB website.

Government stated (January 2022) that the issue would be taken up in line with other PCBs and data would be uploaded as per the MOEF&CC guidelines.

GPCB may evolve a mechanism to get data on import of pet coke in the State from the Gujarat Maritime Board and the Director-General of Foreign Trade. It may also ensure that bulk consumers of pet coke upload consumption data so that use of pet coke can be monitored and regulated.

5.4 Non-reduction in emission standards of units operating in eco-sensitive zone of Thol Wildlife Sanctuary

For the Eco-Sensitive Zone (ESZ), norms for ambient air quality are stricter and the prescribed limit of annual concentration of SO₂ and NO₂ in ambient air is 20 µg/m³ and 30 µg/m³, respectively⁶. The Ministry had notified (18 October 2013) the area up to 2.244 kilometres from the boundary of the protected area of the Thol Wildlife Sanctuary⁷ as ESZ and prohibited establishment of sawmills, industries causing pollution (Water, Air, Soil, Noise), the establishment of commercial hotels, discharge of untreated effluent and solid waste in natural water bodies or terrestrial area. The Norms Committee of

⁶ National Ambient Air Quality Standards issued by the CPCB (November 2009).

⁷ It is an important protected wetland and a potential Ramsar site, supporting more than 20,000 waterfowl, 15 bird species which are globally rare, vulnerable, threatened, and endangered.

GPCB identified seven units (five units of Red category and two units of Orange category) in ESZ of the Sanctuary and decided (December 2014) to reduce emission norms for PM₁₀ for stack emission⁸ from 150 mg/Nm³ to 100 mg/Nm³.

Audit observed (September 2019) that the norms of SO₂ and NO₂ for AAQ were not modified in the CCA of the seven units while the emission norms of PM₁₀ for stack were modified in one case only. Further, neither GPCB nor the units themselves were monitoring AAQ. Therefore, compliance with the AAQ standards within the ESZ could not be ascertained by Audit. However, analysis of stack air emission data from 2014-19 revealed that in four units⁹, concentration of PM₁₀ (of stack) was substantially above the norms (ranging between 20 mg/Nm³ to 1052 mg/Nm³ against the norms of 100 mg/Nm³) and in one unit¹⁰, the concentration of SO₂ ranged between 48.85 ppm and 300 ppm, against the norms of 20 ppm. Out of 28 samples taken for PM₁₀, only eight samples were within the norms in these four units.

At the instance of Audit, GPCB revised (December 2019) CCA of all these seven units. Further, GPCB stated that RO, Gandhinagar has been directed to carry out monitoring of AAQ in ESZ of the Thol Wildlife Sanctuary.

The Government stated (January 2022) that revised norms were being monitored by the field offices on regular basis.

The GoG may set up a mechanism to regularly monitor AAQ in ESZ of Thol Wildlife Sanctuary to maintain its ecology as a potential Ramsar site.

5.5 Non-preparing vision documents for emission control

As per Section 17 of the Air Act, GPCB is required to collect and disseminate information relating to air pollution and prepare a comprehensive programme for prevention, control and abatement of air pollution and ensure execution of this comprehensive program. This could be done through Source Apportionment Studies (SAS) and the preparation of vision documents. SAS includes preparation of emission inventories, monitoring of ambient air quality for various pollutants, chemical speciation of ambient PM₁₀ and PM_{2.5} of source emissions to assess the contribution from various sources.

Source apportionment studies

In pursuance of the provision of the Air Act, GPCB collects data on air pollution to assess the quality of air only at selected locations. However, SAS are necessary to assess the future projections of emission level, develop cost-effective action plans and interventions for mitigating emission and evaluation of various control options were not being done by the GPCB except for Ahmedabad and Surat.

⁸ Stack emission is monitored at the source of emission *i.e.*, at the stack and ambient monitoring is done at open-air in the premises.

⁹ Units operating without PNG, (i) Turakhiya Overseas Pvt Ltd (ii) Jalaram Ceramics Limited (iii) Shah Tiles Limited and (iv) Olympic Laminates Limited.

¹⁰ Olympic Laminates Limited.

Vision documents

The GoG has not prepared any vision document except preparation of Air Action Plan for Ahmedabad and Surat which were prepared in pursuance of the order of NGT (October 2018). It was under preparation (December 2021) for Vadodara and Rajkot under NCAP. Action Plan for prevention, control, and abatement of air pollution for other polluted areas/cities of the state and industrial clusters were not prepared (January 2022).

Audit further observed that based on the AAQ data, no interventions either in form of policy or schemes were made. Any interventions during 2014-15 to 2020-21 for improvement of AAQ in Gujarat were initiated by the NGT viz. Air Action Plan for Ahmedabad and Surat, regulation of use of pet coke as solid fuel, regulation of use of fuel in ceramic industry in Morbi, NCAP, regulation of construction and demolition of waste, disposal of municipal solid waste or unit-specific directions by CPCB based on OCEMS data captured by them. GPCB has *Suo-moto* not intervened to bring air quality within the norms prescribed by CPCB and prevent deterioration of air quality where it was within the norms in the State.

Government stated (January 2022) that Air Action Plan of Ahmedabad and Surat were under implementation and SAS of Vadodara and Rajkot were under preparation.

Fact remained that Air Action Plan and SAS prepared by the GoG were under National Clean Air Programme.

Audit is of the view that considering the rapid urbanization and industrial growth of the State, a comprehensive policy with time-bound targets must be formulated by the State Government for abatement of air pollution.

Conclusion

Sixty-seven highly polluting units have not installed OCEMS, though it is mandatory. The source monitoring by GPCB was found inadequate. The use of Pet coke in the State is not being monitored. The GoG has not prepared vision documents as a long-term policy measure for regulation and control of air pollution in the State.

Chapter-6

Air pollution due to fugitive emission

Introduction

Fugitive emissions are unintended emissions from facilities or activities that cannot reasonably pass through a vent, stack, or chimney system to reduce emissions. These mainly consist of PM₁₀ and PM_{2.5}. The type of activities causing fugitive emissions, reasons and mitigation measures are shown in **Table 8** as under: -

Table 8: Fugitive Emission

Sl No	Type of activity	Institutions responsible for enforcement of regulation	Reasons of fugitive Emission	Mitigation measures
1	Highway construction	Roads and Building department, National highway authority of India, Local Bodies	Loss of tree coverage and top soil, encroachment on water bodies, hot mix plants, stone crushers, and transportation of road construction material and generation of waste.	Barricading the site, regular water sprinkling, and transportation of construction material in a closed vehicle and debris disposal as per the Indian Road Congress guidelines and applicable specifications.
2	Infrastructure activities	Urban Local Bodies		
3	Solid waste	Urban Local Bodies	Heaping up solid waste near the urban areas, rivers and seas ultimately pollute the environment and the eco-system due to the emission of foul and methane gas.	Scientific disposal of solid waste, segregation of waste at source, development of Treatment, Storage, and Disposal Facilities.
4	Hot Mix plants	Roads and Building department, National Highway Authority of India, Local Bodies	Dust and noise pollution due to not providing enclosures and non-compliance of the siting criteria in addition to flue gas emission as they operate on fossil fuels.	Strict compliance to Siting criteria, providing enclosures to the work area, and compliance to the SOP.
5	Brick kilns	Revenue Department, Local Bodies	Movement of tractors and trucks on the unpaved areas.	Adoption of Induced Draft Brick kiln (zigzag brick setting with the rectangular shape of the kiln)

				technology and paving of all moving areas within the premises of the kiln.
6	Stone crushers	Commissioner of Geology and Mining	Stone crushers generate fine dust.	Planting trees, constructing metal roads within the premises, making wind-breaking walls, sprinkling water, and covering the conveyor belt.
7	Sawmills and wood dependent industrial units	Forests and Environment Department issues license to operate under the Forests Act 1927.	Sawmills generate a vast quantity of bark; sawdust, shavings and trimmings, toxic and non-toxic particulates, veneer dryer emission and glue waste disposal.	Providing Bag Filters, Cyclone Collectors, and wet scrubbers.
8	Ice making and cold storage plants	Power distribution companies release power connections without ensuring CCA of the GPCB	Leakage of ammonia and gases.	Strict compliance to the gas leakage detection system.

Specific audit observations on each type of fugitive emission are as under: -

6.1 Emission due to highway construction

The site of the ongoing six laning of the Ahmedabad-Rajkot Highway passes near the AAQ monitoring station, Changodar, Ahmedabad. The AAQ data (24 hours average of PM₁₀) at the station before commencement of work (September 2017) ranged between 100 and 125 µg/m³. However, when work was in progress (July 2018-February 2019), it ranged¹ between 141 and 311 µg/m³ against the norms of 100 µg/m³. Thus, the concentration level of PM₁₀ increased during highway construction.

6.2 Emission due to infrastructure activities

At the request of Audit (February 2021), GPCB undertook air sampling (February-March 2021) at seven different locations where infrastructure activities were in progress in Ahmedabad and Gandhinagar. It was observed that concentration of PM₁₀ level ranged between 117 and 232 µg/m³ (24 hours average) against the norms of 100 µg/m³. The GPCB issued (June 2021) show cause notice to the implementing agencies for poor ambient air quality.

¹ Source: AAQ monitoring reports under NAMP and SAMP.

The increased levels of PM₁₀ during road construction and infrastructure activities indicate that required mitigation measures such as watering, barricading the site, *etc*, was not enforced by the local bodies/Roads & Building Department.

GPCB instructed (June 2021) ROs to monitor fugitive emissions and to ensure that the local bodies and implementing agencies take necessary action to control them.

GPCB may develop a reporting mechanism involving agencies and departments engaged in infrastructure activities for strict enforcement of mitigation measures.

6.3 Non-scientific disposal of solid waste by Gandhinagar Municipal Corporation

Gandhinagar Municipal Corporation (GMC) dumps Municipal Solid Waste (MSW) near the bank of river Sabarmati at Gandhinagar. GPCB observed (October 2016 and May 2019) pungent smell, burning of waste causing smoke, presence of stray animals, non-segregation of plastic waste, *etc*. at the dumping site. GPCB observed (February 2017) concentration of PM₁₀ and PM_{2.5} as 323 and 139, µg/m³ respectively, which was high in comparison to AAQ standards². In June 2021, the PM₁₀ level at the dumping site was 333 µg/m³. Thus, the existing MSW site was a source of air pollution and foul smell, causing discomfort to the residents of the nearby areas and a cause of fugitive emission. CPCB had directed (October 2017) the Commissioner, GMC to provide hazardous waste deposition facilities for safe handling and disposal of domestic hazardous waste. However, the same remained to be developed (November 2021).

6.4 Non-disposal of legacy solid waste by Ahmedabad Municipal Corporation

Ahmedabad Municipal Corporation (AMC) is dumping and stacking unsegregated solid, construction, demolition, and industrial waste of Ahmedabad city at Pirana since 1982. Over the period, the waste has occupied 84 acres of land in the form of three 75 feet high mounds of solid waste aggregating 95 lakh MT. Fugitive emissions from landfills are a significant source of non-methane volatile organic compounds (NMVOCs) in urban environments. NMVOCs play an important role in atmospheric chemistry, and elevated concentrations of some compounds are responsible for air quality deterioration. It has been causing air pollution due to the burning of waste.

² Standard values (24-hour average) for PM₁₀ and PM_{2.5} are 100 µg/m³ and 60 µg/m³, respectively.

Picture-1: Municipal Solid Waste dumping site, Ahmedabad (August 2019)



(gujaratinews18.com AUGUST 28, 2019)

CPCB directed (October 2017) AMC to dispose of MSW as per the existing rules and to submit a time-bound action plan before 25 October 2017. However, AMC did not initiate any action till July 2019. The issue of non-disposal of legacy waste came to finality when NGT directed (July 2019) GoG to constitute a Committee to clear the legacy waste (segregation of waste and its end utilization) and as a measure of punitive action directed to transfer a sum of ₹ 75 crores to an Escrow account. Till February 2021, AMC had completed segregation of 24 lakh MT of legacy waste and cleared 14-acre land.

Picture-2: Municipal Solid Waste dumping site, Ahmedabad as on 27 December 2021



(Photos taken during site inspection)

Thus, AMC did not initiate any *Suo-moto* action but acted only after the intervention of the NGT in the matter. The Pirana dumpsite, included in the approved Air Action Plan of Ahmedabad city is a major source of air pollution in Ahmedabad.

6.5 Emission due to hot mix plants

As per the extant directions (October 2009) of the Roads & Buildings (R&B) Department, a certificate for establishing Hot Mix Plants should be issued by the SE, Mechanical (R&B) after the operator obtains CTE and CCA from the GPCB and complies with applicable air pollution control measures.

Audit observed (June 2019) that the SE, Mechanical (R&B) had issued 526 certificates (during April 2016 to March 2019) for establishing HMPs with the condition that the concerned agency will obtain CTE and CCA from the GPCB within three months from the date of issue of certificate failing which their certificate for establishing the HMP would stand cancelled.

Audit verified (March 2019) the records of GPCB and observed that only 275 HMPs obtained CCA and the remaining 251 HMPs were operating without CTE and CCA. During a test check of the records of Regional Office Vatva, Ahmedabad, Audit observed (September 2019) that out of 17 HMPs operating in their jurisdiction, only five units had CTE and CCA while the remaining 12 units were operating without CTE and CCA. Audit examined the Inspection Report of four HMPs inspected by the GPCB in October 2019 and noticed that none of the units were complying with the air pollution control measures.

Thus, SE, Mechanical (R&B), did not insist upon obtaining CTE and CCA before issuing the certificate, contrary to the instructions of the R&B Department.

Government reply (January 2022) to the draft performance audit report was silent on this issue.

GPCB may ensure that the provisions of the Air Act, 1981 and the directions of R&B Department are strictly complied with.

GPCB may also establish a mechanism in consultation with R&B Department to collect real-time production data of HMPs to check the evasive polluters.

6.6 Emission due to brick kilns

Audit examined (August-September 2019) records of three test-checked ROs of Ahmedabad (East) Vatva, Ahmedabad (Rural), and Gandhinagar. It was noticed that only four (out of 40), 12 (out of 137), and three (out of 108) brick kilns respectively had valid CCA. Audit also observed that:

- Under RO Ahmedabad (East), Vatva, during 2014-19, GPCB did not carry out stack emission and ambient air quality sampling in any of the 40 brick kilns.

- In 2020-21 too, GPCB did not carry out stack emission and ambient air quality sampling in any of the brick kiln units operating under the jurisdiction of the ROs at Vadodara, Ahmedabad (Rural) and Gandhinagar.
- Under RO Ahmedabad (Rural), two brick kilns monitored by GPCB were operating without adopting anti-pollution measures and one of these was operating without renewal of CCA.
- Under RO, Gandhinagar, seven brick kilns monitored by the GPCB were operating without adopting anti-pollution measures and six of these were operating without CTE.

On being pointed out by Audit, GPCB, directed (June 2021) the brick manufacturers through Gujarat Bricks Manufacturers Federation, Gandhinagar to adopt cleaner technology. GPCB stated (June 2021) that it had issued 465 show cause notices/closure notices/ closure directions to brick kiln units operating without consent.

GPCB may disseminate directions of CPCB on the adoption of new technology to the brick kiln manufacturers. Besides, non-agriculture permission granted by the revenue authorities to the brick manufacturers may include a condition for adoption of cleaner technology.

6.7 Emission due to stone crushers

CPCB issued guidelines (February 2009) based on the Ministry’s notifications of August/December 1990 for Siting³ criteria for stone crushing units and prevention and control of emissions due to those. As per guidelines, the concentration of PM in ambient air at 3 to 10 meters from the crusher/ quarry shall not exceed 600 µg/m³. Further, the stone crusher units must ensure compliance with the Siting criteria. As per GPCB database of November 2021, 1,681 stone crusher units were issued CCA in the State.

Audit scrutiny (November 2019) of inspection reports of 15 stone crushing units revealed that in every unit, GPCB had observed heavy dusting, non-installation of equipment/ mechanism required for control of fugitive emission, not watering of the operating area, insufficient plantations, and not covering of conveyer belt. Thus, none of the units were complying with the Siting criteria. Further, without sampling and measuring fugitive emission, GPCB in its inspection report stated that ambient air quality is insufficient.

GPCB has not provided any reply on the issue (December 2021).

GPCB in coordination with Commissioner, Geology and Mining may ensure that the stone crushing units follow siting criteria strictly. Further, a system needs to be developed for self-regulation and self-monitoring by the stone-crushing units.

³ Related to site.

6.8 *Emission due to sawmills and wood dependent industrial units*

As per the database of the GPCB, as of January 2020, only 347 sawmills and wood-dependent industrial units had valid CCA. However, as per Gujarat Forests Statistics 2018-19, 5,714 sawmills and wood-dependent industrial units were having licenses⁴ to operate. Thus, 5,367 sawmills and wood-dependent industrial units were operating (January 2020) without the consent of GPCB. The GPCB confirmed (June 2021) that it had not brought to notice of the Principal Chief Conservator of Forests & Head of Forest Force (PCCF&HoFF) the applicability of provisions of the Air Act for operating sawmills and wood-dependent industrial units.

GPCB may consider bringing sawmills and wood-dependent industrial units under the ambit of the Air Act by issuing CCA in coordination with the PCCF&HoFF.

6.9 *Emission due to ice making plants and cold storages*

To ensure strict compliance of provisions of the Air Act by cold storage and ice-making plants, GPCB had directed (December 2014) the power distribution companies not to release power connection to such plants without ensuring that the operator has obtained CCA from the GPCB.

Audit observed (November 2019) that in May 2019, 2,690 ice-making plants and cold storage were operative in the State (as per the details furnished by the DISCOMs of Gujarat⁵ excluding Torrent Power Limited). However, as per the database of the GPCB, only 290 CCA were issued to such plants. Thus, 2,400 cold storage and ice-making plants were operating without CCA.

GPCB stated (December 2019) that boilers are not used in such plants and therefore they do not cause considerable air pollution. It was added that however, these would be covered under the Air Act. The reply is not convincing. The ammonia-based ice plants may cause loss of human life in case of leakage of ammonia and are also a source of air pollution.

Thus, many activities which cause considerable fugitive emissions were operating without CTE and CCA primarily due to lack of coordination and dissemination of information/data between various departments and the GPCB and due to the inability of GPCB to check/monitor all these activities. A system needs to be evolved to ensure better coordination among various departments of GoG and GPCB through sharing of data continuously and involving them in enforcing the Air Act.

In response to audit observation on air pollution due to fugitive emission, the Government stated (January 2022) that (i) various sources of fugitive emission as enumerated by audit had been covered in consent mechanism and control on fugitive emission is done through close inspection of units, (ii) various SOPs

⁴ Sawmills (5322), veneer units (57), veneer plywood units (248), plywood (76) and particle board manufacturing units (9), MDF (2).

⁵ Madhya Gujarat Vij Company Ltd, Paschim Gujarat Vij Company Ltd, Uttar Gujarat Vij Company Ltd and Dakshin Gujarat Vij Company Ltd except Torrent Power Limited.

had been prepared by GPCB for the control of fugitive emission and SOP made by the CPCB for various sectors were also followed through prescribing conditions in the consent, and (iii) Brick Kiln manufacturers have been directed to adopt new technology.

Audit acknowledges the positive response of the Government. However, Audit is concerned that the various sources of fugitive emission are poorly regulated, operating out of consent mechanism and therefore remained non-monitored.

Conclusion

Fugitive emission is another controllable source of air pollution. The GPCB must evolve administrative departments for regulating fugitive emissions. Infrastructure activities, highway construction, hot mix plants, slow action in the disposal of solid waste, bricks kilns, stone crushers, sawmills, and ice-making plants, which are a major source of fugitive emission, need to be regulated.

Chapter-7

Air pollution due to thermal power plants

Introduction

Coal-based Thermal Power Plants (TPPs) are responsible for a disproportionately higher share of emissions than the industrial sector (60 per cent of PM, 45 per cent of SO₂, 30 per cent of NO₂ and 80 per cent of mercury (Hg))¹. The CPCB has categorized TPP as highly polluting activities. Not modernizing old TPPs, poor quality of coal (high ash and sulphur content in the indigenous coal), legacy fly ash stocks, fugitive emissions due to coal and ash handling are the factors contributing to air pollution.

Gujarat accounts (November 2020) for 10.09 per cent of the total thermal power installed capacity of India and has 47 TPPs of different installed capacities. In January 2010, the installed capacity of TPPs in the State was 10,590.85 MW (including gas based) which increased to 23,347 MW (by 119 per cent) in November 2020. Out of this, 16,761.04 MW was from coal and lignite based.

To address the air pollution due to TPPs, the Ministry amended (December 2015) emission standards and made them more stringent. The old and revised emission standards for TPPs are shown in **Table 9** below:

Table 9: - Standards for emission for Thermal Power Plants

Year of Installation	Standards in mg/Nm ³			
	PM	SO ₂	NO _x	Hg
Before 31-12-2003	100	600 for <500MW 200 for ≥500MW	600	0.03 for ≥500MW
After 01-01-2004 & Up to 31-12-2016	50	600 for <500MW 200 for ≥500MW	300	0.03
On or after 01-01-2017	30	100	100	0.03

(Source: Ministry notification of December 2015)

The TPPs were required to attain revised standards by December 2017. An action plan for the adoption of Flue Gas De-Sulphurisation (FGD) technology in TPPs was initiated by the Ministry of Power, GOI which suggested installation of the FGD in phases for SO₂ reduction to be completed by 31 December 2022 by all the TPPs. For NO_x reduction, a change in the design of the burner was to be adopted by December 2022.

¹ Report (Policy brief) of Centre for Science and Environment on using the National Clean Energy Fund to clean Coal Power Plants, 2017.

Case study of Mundra, Gujarat

Mundra located in Kachchh district has 14 units of coal base TPPs having total installed capacity of 8,620 MW which is 37 per cent of the total installed capacity of TPPs of Gujarat (November 2020). These units were commissioned between August 2009 and March 2013. The GPCB had conducted (May 2009) baseline environment quality studies through Gujarat Industrial and Technical Consultancy Organisation Limited (GITCO)². The study report of the GITCO had mentioned that with the installation of TPPs in Mundra, the carrying capacity of Mundra for SPM, SO₂, and NO_x would be exhausted and there would be a need to reduce the pollution level. Satellite imagery (by NASA) of SO₂ emission of 2016 over India showed that a high concentration of SO₂ was occurring over the Mundra Region. As per another study, based on data obtained from the Tropomi³ for the period from February 2018 and May 2019, Mundra is the worst NO_x hotspot contributing hugely to air pollution. Thus, with the installation of 8,620 MW TPP in Kachchh, Air pollution has increased substantially and needs intervention like equipping units with FGD.

7.1 Status of Flue-gas desulphurisation installation in TPPs

Of the 47 TPPs units in Gujarat, three units were equipped with FGD⁴, two units have compatible technology (CFBC Boiler)⁵ and seven units required up-gradation of Electrostatic Precipitator. The remaining 35 units required installation of Flue Gas De-Sulphurisation (FGD). It was observed (June 2021) that out of 35 units, feasibility study was in progress for installation of FGD in three units, Letter of Intent was issued in case of 15 units, and in the remaining 17 units, tendering process was ongoing. Looking at the pace of installation of FGD, its commissioning may not be achieved by the due date of December 2022.

The emissions due to TPPs is a matter of concern. Audit is of the view that the timeline for installation of FGD should have been adhered to.

7.2 Emissions due to coal-based v/s natural gas-based TPPs

Audit worked out emission load per annum (in MT) per million units based on the GPCB’s Environment audit reports for the year 2017-18 of the coal-based TPP, Wanakbori, and natural gas-based power plant, Kawas (Surat), (owned by the NTPC Limited), and observed that the gas-based power plant causes less emission/pollution load compared to the coal-based thermal power plant as shown in **Table 10** below: -

² A premier Technical Consultancy Organisation that provides consulting services to accelerate the growth of industrial and services economy of Gujarat.

³ The Tropospheric Monitoring Instrument (TROPOMI) is the satellite instrument on board the Copernicus Sentinel-5 Precursor satellite.

⁴ Units 7,8 and 9 of AP(Mu)L.

⁵ Two units of Gujarat State Electricity Corporation Limited at Bhavnagar.

Table 10: - Emission load of Gas and Coal based Thermal Power Plant

Description	NTPC, Kawas (Gas base)	Wanakbori TPS (Coal base)
Total emission load (MT/ Day)	22.63	323.55
Total emission load per annum in MT	8,259.95	1,18,095.75
Total energy production in Million Unit in 2017-18	2,405.84	7,704.00
Emission load per annum in MT per Million unit	3.43	15.33

(Source: - GPCB Environment Audit Report for 2017-18)

Thus, natural gas power plants generate much less emission as compared to coal-based power plants. A study conducted by the National Environmental Engineering Research Institute on behalf of the Ministry of Statistics and Program Implementation on environmental aspects highlighted that the health effects attributable to NO_x from a natural gas plant even within a two-km radius are negligible. The study further indicated that 6.5 *per cent* of the population living within a two-km radius of a coal-based thermal power plant suffer from respiratory disorders. In response to the audit query, the GPCB stated (December 2019) that no such study was undertaken by them to assess the emission impacts of coal-based and gas-based power plants.

Audit considers that as the gas based TPP is more environment friendly, policy intervention for the promotion of the same would be desirable.

The State Government may consider promoting multi-fuel technology for power generation to meet demand for power in view of air pollution caused by coal-based thermal power plants.

7.3 Installation of Flue-gas desulphurisation technology in Captive Power Plants

The new emission norms notified by the Ministry in December 2015 were also applicable to 84 Coal Based Captive Power Plants (CPP) of Gujarat. After consultations with Industrial Associations and Technology Providers for implementation of FGD and other technologies to meet new emission norms in CPP, the CPCB fixed (April 2018) the following timelines for implementation of new emission norms: -

- CPPs based on Fluidized Bed Combustion boilers were required to comply with new emission norms for PM and SO₂ by December 31, 2018.
- CPPs are required to install FGD shall comply with new norms for PM by December 31, 2018, and SO₂ by June 30, 2020.
- CPPs commissioned before December 31, 2003, were required to achieve NO_x emission of 600 mg/ Nm³ by December 31, 2018.
- CPPs commissioned between January 2004 and December 2016 were required to comply with the NO_x emission limit of 300 mg/ Nm³ by June 30, 2020.

Audit observed (March 2021) that GPCB has no database/information regarding compliance with the timelines fixed by the CPCB despite the deadlines getting over. This indicates lack of follow-up and ineffective monitoring mechanism in GPCB.

Government stated (January 2022) that the CPCB directly monitors implementation of norms of installation of FGD.

Reply is not convincing as GPCB was required to monitor compliance by the CPPs as they fall under its jurisdiction.

The GPCB may follow up the compliance with the CPCB’s directions and monitor the progress of installation of FGD in CPPs.

7.4 Non-inclusion of emissions due to TPPs in the Air Action Plan of Ahmedabad and Surat

On the intervention of the NGT, the GoG prepared (February 2019) Air Action Plan for Ahmedabad and Surat which was approved by the GoI in April 2019. In Ahmedabad city, Torrent Power Limited (TPL) is operating a coal-based thermal power plant of 362 MW.

However, while preparing the Air Action Plan for Ahmedabad city, emissions due to TPL which contributes significantly (66 *per cent*) to the total ambient air pollution was not considered by the GPCB. Similarly, fossil fuel based TPPs of a total 500 MW capacity were also operating in and around Surat but emission load due to these TPPs was not considered in the Air Action Plan of Surat.

GPCB stated (June 2021) that the Source Apportionment Study (SAS) of Ahmedabad city was being done by the Gujarat Energy Management Institute (GEMI). Based on the outcome of the study, if required, emissions caused due to TPL will be included in the Plan.

Government also stated (January 2022) TPPs are part of an action plan of the Ahmedabad and Surat cities as the industrial source and the format provided by CPCB for the preparation of the Air Action Plan of the city had not envisaged separate inclusion of TPPs as an individual entity.

The reply is not convincing as SAS of Ahmedabad city prepared by the GEMI in 2018-19 mentions that the total emission load (PM, NO_x and SO₂) of Ahmedabad city in 2018-19 was 69,123.17 kg per day of which TPL alone contributed 45,794.66 kg per day (66 *per cent*). No justification for non-inclusion of emission due to TPPs in the Air Action Plan of Ahmedabad was found on record.

The non-inclusion of a major source of air pollution in the Air Action Plan may have an impact on designing mitigation measures.

7.5 Air pollution due to fly ash

Fly ash is a by-product generated from the coal burnt in a TPP and it includes all types of ash generated in TPPs such as Electrostatic Precipitator (ESP) ash, dry fly ash, bottom ash, pond ash and mound ash. Fly ash is one of the major contributors to particulate matter, a major pollutant around thermal power plants, and contributes around 26 *per cent* of PM₁₀ and PM_{2.5}, in summer⁶. TPPs generate large quantities of fly ash which require large areas as landfills or ponds for their disposal. Fly ash becomes dry as temperature increases and gets airborne causing fugitive emission. As fly ash contains toxic and heavy metals, it pollutes air and water too. Apart from causing various diseases, it also leads to a reduction in the recharging of groundwater.

However, fly ash is an excellent construction material source for brick making, road and embankment construction, etc. Over the years, huge stocks of fly ash have stockpiled in the ash ponds due to a lack of timely and effective disposal. To save scarce land resources of ash ponds and to control fugitive emissions, the Ministry (September 1999) fixed August 31, 2007, as the deadline for 100 *per cent* utilization of fly ash which was further extended to December 31, 2017, with the following stipulations for its utilization:

- (i) Every agency engaged in construction activity within a radius of 300 km of coal-based thermal power plant must use ash-based products for construction.
- (ii) The transportation cost of (a) ash used in road construction, manufacturing of ash-based products or use as a soil conditioner in agricultural activity within the radius of 100 km of any coal-based thermal power plant and (b) ash used in road construction projects under Pradhan Mantri Gramin Sadak Yojna, construction of Government buildings, dams, and embankments within the radius of 300 km of the power plant will be borne by the power plant.
- (iii) Mandatory use of fly ash-based bricks or products in all government schemes and programmes such as MGNREGA, Swachhh Bharat Abhiyan, urban and rural housing schemes where the built-up area is more than 1,000 square feet, and in infrastructure activities in designated industrial estates, parks, and special economic zones.
- (iv) Use of fly ash for filling the low-lying land as part of reclamation projects and in backfilling of mine voids.

Audit reviewed the records regarding the handling of fly ash by TPPs and its monitoring by GPCB and observed the following: -

7.5.1 Non-Disposal of legacy stocks of fly ash

In November 2020, coal and lignite based TPPs with a total generating capacity of 16,761.04 MW were functional in the State, thereby generating a huge

⁶ Media Report of The Economic Times Titled as “Here’s a lesser- known reason behind air pollution” which was based on Report of Indian Institute of Technology, Kanpur.

quantity of fly ash. The disposal of fly ash during 2014-15 to 2020-21 in the six TPPs test checked by Audit is shown in **Table 11** below:

Table 11: - Fly ash Generation and disposal (in lakh ton)

Name of TPP	Opening balance as of 1 st April 2014	Fly ash generation during 2014-15 to 2020-21	Fly ash disposal during 2014-15 to 2020-21	Closing balance as of 31 st March 2021
GSECL, Gandhinagar	100.87	40.48	83.89	57.46
GSECL, Wanakbori	371.49	104.67	94.86	381.30
GSECL, Jamnagar	22.25	7.52	20.18	9.59
TPL, Ahmedabad	8.45	23.34	21.77	10.02
CGPL, Mundra	6.97	52.13	41.51	17.59
Adani Power Ltd	4.98	66.56	66.11	5.43
GSECL, Ukai	NA	NA	NA	129.55
Total	515.01	225.55	328.32	610.94

(Source: Information furnished by GPCB)

NA – Not available.

As could be seen from the above, 610.94 lakh tons of fly ash were required to be disposed of in an environment-friendly manner as of March 2021. The huge stock of fly ash indicates that the Ministry's stipulation of 100 *per cent* disposal of fly ash by December 31, 2017, could not be met. Huge quantity of legacy fly ash with GSECL plants at Ukai and Wanakbori required Government interventions. However, there was a reduction in the overall legacy quantity of fly ash of the TPPs located at Gandhinagar and Jamnagar. CGPL submitted (January 2018) a plan to GPCB for disposal of legacy fly ash but it could not dispose of the same.

The CPCB imposed (July 2020) an Environmental Compensation of ₹ 3.57 crore on five TPPs in pursuance of the NGT order dated 12 February 2020, due to the non-disposal of 100 *per cent* fly ash.

7.5.2 Non-compliance of Regulations on dumping of fly ash

The TPPs are required to submit details of fly ash utilization on annual basis to the Ministry. All the TPPs of the State except GSECL-Wanakbori and CGPL-Mundra were reporting 100 *per cent* utilization of fly ash. Audit observed that the data shown by the TPP were of the utilization of ESP fly ash whereas utilization of legacy stock of fly ash lying in their ash pond was not included in reports.

For dumping of fly ash in low laying area, GPCB accords prior permission keeping in view compliance with SOP and Environmental safety. Audit examination of reported details of fly ash utilization by following three TPPs revealed that these TPPs were dumping fly ash in low lying areas without the permission of GPCB. This is discussed as under: -

Torrent Power Limited, Ahmedabad

- Total quantity of undisposed fly ash (pond ash) with the Torrent Power Limited, Ahmedabad (TPL) was 8.45 lakh MT in April 2014 which increased to 10.87 lakh MT in March 2019. However, TPL reported 100 *per cent* utilization of fly ash in 2017-18.
- Between 2014-15 and 2018-19, TPL, Ahmedabad, reported disposal of 16 lakh MT of fly ash. Audit scrutiny revealed that out of this, the TPL had dumped 1.92 lakh MT fly ash at four different sites (farmlands near Gandhinagar city and at the bank of Sabarmati River) during 2014-15 to 2018-19 with the consent of landowners.
- After being pointed out in audit, GPCB monitored these four sites in September 2019 and observed that at one of these sites, fly ash was dumped in adjoining land towards riverbank without protection wall and ash spread towards the river bank due to rain. At two other sites, fly ash was dumped for levelling of land. The remaining site was surrounded by residential and commercial areas and dumped ash was not covered and levelled.
- GPCB issued show-cause notice (January 2020) to TPL after four months. TPL had not furnished specific compliance to dumping of fly ash in violation of the Ministry's notification. No action has been taken by GPCB against TPL (June 2021).

Adani Power (Mundra) Limited, Mundra

- Filling low-lying areas with fly ash requires prior approval of GPCB. The Adani Power (Mundra) Limited (APL) utilized 15.42 lakh MT fly ash for filling low-lying areas between 2014-15 and 2018-19 without the approval of GPCB and reported 100 *per cent* utilization. Further, the Ministry directed (March 2016) APL to install an online monitoring system in the plant premises and at locations of fly ash disposal to capture and report data. However, no such system was installed (December 2021) by the APL.

GPCB did not take any action against APL for dumping the fly ash in the low-lying areas without its approval and for incorrect reporting of 100 *per cent* utilization of fly ash.

Coastal Gujarat Power Limited (CGPL), Mundra

- As per the conditions of EC, CGPL was to achieve 100 *per cent* utilization of fly ash by March 2016 but it could not achieve. Therefore, CPCB directed (March 2017) CGPL to submit an annual implementation plan. The GPCB also issued directions (March 2018) to the CGPL to achieve 100 *per cent* utilization of fly ash as during site visit (January 2018), GPCB had observed 16.39 lakh MT ash pond and 1.50 lakh MT fly ash in stock.

- Audit observed that the CGPL had dumped 0.796 Lakh MT fly ash in low-lying areas within the plant premises during 2018-19 though as per EC order, there was no such low-lying area within the plant premises. Further, the CGPL did not obtain permission from the GPCB for the dumping of the fly ash in the low-lying area.
- GPCB confirmed (June 2021) that the CGPL was not complying with fly ash rules and regulations and the RO had proposed suitable action against CGPL which was under the process for necessary approval.

Thus, the GPCB has not taken stringent action against these TPPs for dumping of fly ash in low lying areas without its permission.

7.5.3 Non-compliance of GoI regulations for the utilization of fly ash

Ministry directions (November 2009) for utilization of fly ash stipulate that the CPWD, Public Works Department in States, National Highway Authority of India (NHAI), and other constructing agencies including those in private sectors shall prescribe the use of ash and ash-based products in their respective tender documents, schedule of specifications, *etc.*, within four months. The directions also included the constitution of the State Level Monitoring Committee (SLMC). The Ministry also notified minimum fly ash content for building materials or products and mandatory use of fly ash-based bricks in cities having a population of one million or more by amending Building Bye-laws by the State Authorities. The GoG constituted the SLMC in December 2014.

Road and Building Department (R&B) included provision for use of fly ash-based items in the Schedule of Rates (SOR) on the directions (July 2015) of SLMC. The R&B Department also informed that it had not been able to enforce the provision for use of fly ash due to resistance from the contractors. In this reference, Audit called (April/May 2019) for details of utilization of fly ash and inclusion of fly ash-based items in SOR. Three R&B circles confirmed that fly ash was not being used in Government funded public works except those used in the construction of Mahatma Mandir, Gandhinagar in 2014-16.

Audit examination of records revealed that the R&B Department had not included fly ash-based items in their SOR, though they confirmed it in the SLMC. Audit noted that the CPWD, Gandhinagar, and NHAI have included fly ash-based items in their SOR and the tenders. As per the data submitted by the Regional Officer, NHAI, Gandhinagar, the NHAI had already utilized 12.03 lakh MT fly ash in their road widening projects⁷ and made provisions for utilization of 37.32 lakh MT fly ash in the estimates of ongoing six works in the State. Audit noticed that though, R&B Department was executing similar types of road works, it had not made provision for mandatory use of fly ash in their works.

As per Ministry’s directions, the bricks manufactured from fly ash are to be used mandatorily for buildings in cities with population of one million or more. The Ministry assigned the responsibility for implementing its directions to the Urban

⁷ Chiloda- Himmatnagar six laning project of National Highway Authority of India.

Development and Urban Housing Department of the State Government. The policy of using fly ash for building materials is already in place as per Ministry's directions. Though the fly ash-based bricks are used in private construction, the intervention of Urban Development and Urban Housing Department would provide further impetus to the use of fly ash-based bricks in the Government financed works.

The GPCB stated (June 2021) that the matter was taken up with the R&B Department and Urban Development and Urban Housing Department in December 2017 and February 2021, and their responses were awaited (January 2022).

Audit observed that non-compliance by the State Government Departments violated the Ministry's directions.

The State Government may direct its different departments such as Roads and Buildings, Urban Development and Urban Housing, Panchayat and Rural Housing, etc. to coordinate with Brick kilns to promote use of fly ash in their construction and allied activities.

The State Government may also frame a policy to encourage use of fly ash-based bricks and other building materials.

Government stated (January 2022) that Gujarat is one of the pioneer state in the utilization of fly ash in the cement industry and all efforts were being made to ensure that fly ash is disposed of in an environmentally sound manner. Though, there has been sincere attempts to utilise fly ash, there was a huge stock of legacy fly ash of 610.94 lakh MT with the TPPs.

Conclusion

Gujarat houses 47 TPPs units and its share in thermal power generation in national contribution stands at 10.09 per cent. As coal based TPPs contribute disproportionately higher to emission than emission due to industries, these TPPs are a major source of air pollution. These TPPs required the installation of FGD by December 2022, which is not likely to be achieved. Non-disposal of legacy stock of fly ash and non-compliance with norms on the utilization of fly ash caused fugitive emission. There is a lack of emphasis by the various line departments on use of fly ash.

Chapter-8

Air pollution due to automobiles

Introduction

One of the major causes of air pollution is vehicular emission. The Source Apportionment Study carried out (2010) by the Ministry revealed that (a) automobile tailpipe emissions are an important component of air pollution, (b) given the growing pace of vehicle ownership and use, vehicle tailpipe emissions will only grow in quantum, and (c) the only way to deal with rising air pollution due to the automobile is to make the quality of vehicles and fuel much better.

The Expert Committee of GoI constituted (December 2012) to devise Auto Fuel Vision and Policy 2025, in its report (May 2014) suggested vehicle pollution strategy consisting of four components (i) increasing stringent new vehicles standards, (ii) specifications for clean fuel, (iii) proper inspection and maintenance of in-use vehicles and (iv) transport and travel management. To control the menace of air pollution due to automobiles, it suggested actions such as the policy of retiring more than 15 years old vehicles, stringent compliance of Pollution Under Control (PUC) checks, idling emission standards (Rule 115 of the Central Motor Vehicle Rules, 1989) for Carbon Monoxide and Hydro Carbons, control on overloading of vehicles and efficient public transport.

Audit observations on issues in the regulation of auto emission in Gujarat are as under: -

8.1 Auto fuel emission load in the State

The total geographical area of the Gujarat is 1.96 lakh square kilometres. The growth of vehicles (transport and non-transport) and population since 2000-01 and ratio of vehicles are shown in **Table 12** below: -

Table 12: - Growth of vehicles and population

Year	Total numbers of Registered Vehicles (In crore)	Population (In crore)	Density of vehicles per sq. km (in ones)
2000-01	0.56	5.07	28.44
2011-12	1.44	6.04	73.53
2018-19	2.52	6.93	128.56
<i>Per cent</i> increase	352	36.86	

(Source: Website of Commissioner of Transport and Census data of Gujarat)

During 2000-01 to 2018-19, Gujarat witnessed 352 *per cent* increase in vehicle growth against a population increase of only 36.86 *per cent*. The increase in vehicle density contributed to the deterioration of ambient air quality, specifically in urban areas due to the higher density of vehicles per square kilometre.

8.2 Poor compliance of PUC norms

Section 20 of the Air Act empowers the State Transport Department to control vehicular pollution. The Commissioner of Transport (CoT) is authorized to check emissions of every motor vehicle on six monthly basis to ensure that its emissions are within the prescribed limit and issue Pollution under Control (PUC) Certificates to the vehicle owners. The CoT can take penal action under section 190 (2) of MVA, 1988 if the emission is not within the prescribed limit. The CoT issues licenses to the emission testing stations (PUC centres) for issue of PUC certificates.

Review of compliance with PUC norms revealed the following:

(i) For issuing PUC certificates to 2.52 crore registered vehicles in 2018-19, there were only 1,192 registered PUC centres operating in Gujarat (February 2019). In a drive conducted (February 2019) by the CoT for checking performance of PUC testing centres, the CoT either served notices or suspended/cancelled licenses of 162 centres out of 798 testing centres checked, for not complying with government norms on operation and issue of PUCs. However, Technical Audit of each PUC centre was not regularly conducted by the licensing authority (Regional Transport Offices).

(ii) During 2016-17 to 2018-19, the CoT registered offences for overloading, fitness and not having PUC certificates as shown in **Table 13** below: -

Table 13: - No. of offence cases against registered vehicle (In lakh)

Year	Total numbers of registered vehicles			Offences registered for not- having PUC (per cent of total vehicles)
	Transport	Non-Transport	Total	
2016-17	24.21	196.16	220.37	0.53 (0.24)
2017-18	25.66	212.55	238.21	0.54 (0.23)
2018-19	26.81	225.21	252.02	0.56 (0.22)

(Source: Information provided by Commissioner of Transport, Gujarat)

It can be noticed from the above Table that the registered offences for not having PUC, in comparison to number of registered vehicles, were almost negligible. The negligible number of registered offence cases indicate the possibility of ineffective monitoring on overloading, fitness, and PUCs.

(iii) In PUC centres test checked (August 2019) by audit in Gandhinagar and Ahmedabad, it was observed that the register containing information of vehicles and PUCs issued each day, which was to be kept for period of minimum one year, was not maintained.

Thus, the PUC management was not effective and efficient and needs technical interventions like sensor-based PUC certification and data integration with the existing software of the CoT.

8.3 *Insufficient inspection of quality of auto fuel*

Vehicular emission is aggravated due to adulterated auto fuel. Fuel adulteration increases the emission of hydrocarbons, carbon monoxide, nitrogen oxides and particulate matter and thereby increases air pollution.

The office of the Director of Food and Civil Supplies (the Directorate, FCS) is responsible to ensure that quality of motor spirit and high-speed diesel conforms to BIS¹ specification IS 2796 and IS 1460, respectively. Food, Civil Supplies and Consumer Affairs Department, GoG circulated (February 2016) norms for inspection of fair price shops, LPG gas stations, dealers of kerosene and petrol pumps. The circular stipulated that every petrol pump is inspected at least once in six months by a joint team of district and taluka level offices.

Audit observed (September 2019) deficiencies in inspection of petrol pumps. The number of petrol pumps functional in the State during 2014-15 to 2018-19 ranged between 2850 and 3845. As per norms, the Directorate, FCS was to carry out at least 33,854 inspections of petrol pumps between 2014-15 and 2018-19. Against this, the Directorate, FCS inspected only 1,506 petrol pumps (excluding 135 inspections carried out based on public complaints) and found 11 petrol pumps selling adulterated fuel. Inadequate monitoring of petrol pumps may lead to sale of adulterated auto fuel thereby aggravating vehicular emissions.

The State Government may ensure strict implementation of PUC norms to control the emission from automobiles. A mechanism needs to be put in place for regular quality checks of auto fuel sold at petrol pumps.

Conclusion

Vehicular emission is a major source of air pollution in urban areas. Emission from vehicles could be minimized by using good quality fuel and through maintenance of the vehicle in a timely manner. The mechanism developed by the GoG to check vehicular emission and issue of PUC is inadequate. The frequency of checking of quality of auto fuel is also not sufficient.

¹ Bureau of Indian Standards.

Chapter-9

Critically polluted areas in the State

Introduction

CPCB in collaboration with the Indian Institute of Technology, Delhi had developed (2009-10) Comprehensive Environmental Pollution Index (CEPI) based on an algorithm of source, pathway, and receptor. CEPI is a function of the Environment Pollution Index (EPI) based on the quality of air, surface water, ground water and soil. An industrial cluster is defined as a Critically Polluted Area (CPA) if its CEPI score is 70 and above and a Severely Polluted Area (SPA) if its CEPI score is between 60 and 70.

9.1 Critically polluted areas of Gujarat

Based on the CEPI score of 2009-10, the Ministry had declared (January 2010) (i) Vapi (ii) Ankleshwar (iii) Vatva (iv) Ahmedabad (Odhav and Naroda) (v) Bhavnagar and (vi) Junagadh as CPAs and imposed (January 2010) moratorium on approval of projects up to August 2010 in these areas for environment clearance. Based on the Remedial Action Plans (RAP) proposed by GPCB, approved by CPCB (September 2010) for the abatement of pollution in these CPAs, the Ministry lifted the moratorium from Vapi (October 2010), Bhavnagar (February 2011), Junagadh (March 2011) and Ahmedabad (September 2013). The moratorium was re-imposed in Vapi in September 2013 due to poor CEPI scores.

CPCB on the representation of SPCBs, State Governments, Industrial Associations, and other stakeholders revised (April 2016) the calculation method of CEPI score by eliminating the subjective factors and retaining the factors that can be monitored. The Ministry finally lifted the moratorium on Vapi, Ankleshwar and Vatva in November 2016 based on the re-assessed CEPI score, subject to strict compliance of the following specific conditions by the GPCB:

- (i) Any new project/ activity, expansion or modernization of existing project or activity, or any change in product mix is in line with the overall approved action plan of the CPA.
- (ii) Quarterly review of the implementation of the action plan of CPA by the Chairman, GPCB, and submission of review report to CPCB. It is to be ensured that there is no slippage either in terms of time frame or the activities to be completed relating to the action plan.
- (iii) Third-party monitoring of CPA for computing CEPI. Every year the monitoring will be done during December-February followed by the submission of the report to CPCB by April.
- (iv) The Expert Advisory Committee (EAC)/ State Expert Advisory Committee (SEAC) will take extra precautions during appraisal of projects proposed

to be located in the CPAs and prescribe requisite stringent safeguard measures so that the environmental quality does not deteriorate further in the CPA.

CEPI score of 10 most polluted areas of Gujarat based on environment quality monitored during 2009-2018 by the CPCB in industrial areas of India, is shown in **Table 14** below:

Table 14: - CEPI score of PAs

Sl. No.	Name of PA	2009	2011	2013	2016	2018
1	Vapi	88.09	90.75	85.31	68.2	79.95
2	Ankleshwar	88.50	85.75	80.93	68.0	80.21
3	Vatva (Vatva-Narol)	74.77	87.46	83.44	54.2	70.94
4	Ahmedabad (Naroda & Odhav)	75.28	78.09	69.54	*	57.11
5	Bhavnagar	70.99	69.73	62.79	*	61.94
6	Junagadh	70.82	67.85	52.75	*	51.64
7	Vadodara	66.91	*	*	*	89.09
8	Rajkot	66.76	*	*	*	70.62
9	Morbi	*	*	*	*	54.24
10	Surat	*	*	*	*	76.43

(Source: NGT order dated 10 July 2019), * Data not available
Low CEPI score below 70 is desirable.

From the above table it can be inferred that in 2018, reduction in CEPI scores of Vapi, Ankleshwar, Vatva (Vatva-Narol), Ahmedabad (Naroda and Odhav), Bhavnagar, and Junagadh ranged between 3.83 to 19.18 points in comparison to 2009. However, CEPI score of Vadodara, (now highest in the State) and Rajkot increased by 22.18 and 3.86 points respectively in comparison to 2009 and these cities became CPA from SPA.

Audit examined the compliance of the specific conditions of the moratorium and observed the following:

9.2 Non-assessment of impact of air pollution on health in critically polluted areas

CPCB directed (March 2011) all SPCBs to conduct health impact assessment in surrounding areas of industrial clusters once in four to five years with the assistance of recognized health institutions like National Institute of Occupational Health, Public Health Foundations, Indian Council of Medical Research and local Government and Medical Colleges. Further, CPCB collected the data on airborne diseases like Asthma, Bronchitis, Cancer, Acute respiratory infections of three to five major hospitals of each CPA from 2012-13 to 2016-17 to evaluate the impact on health due to pollution and calculation of CEPI index.

Audit observed that during 2012-13 to 2016-17, hospitals located in industrial areas of Ahmedabad (three), Vapi-Valsad (eight) and Ankleshwar (four) had reported 80,443 patients with Asthma, Bronchitis and Acute Respiratory Infections as mentioned in **Table 15** below:

Table 15: - Year-wise number of patients

Year	Number of patients	Increases vis-à-vis previous year	
		Number	Percentage
2012-13	14,001	-	-
2013-14	15,052	1,051	7.51
2014-15	17,075	2,023	13.44
2015-16	16,766	-309	-1.81
2016-17	17,549	783	4.67
Total	80,443		

(Source: Information furnished by GPCB)

An increasing number of patients depicts the severity of the impact of air pollution on health. This fact is also corroborated by the Lancet Report 2019. Industries Association carried out health impact assessments in CPA with experts. However, GPCB has not undertaken any such assessment.

Government stated (January 2022) that health impact assessment in CPA were carried out by Industries Association of respective CPA through third party credible expert industry of the subject.

The Government reply is not convincing as Audit is of the view that such studies were to be conducted by GPCB through recognized health institutions once in four to five years instead of by Industries Association.

GPCB may evolve a system to collect health data on the lines of CPCB and provide such information to the State Health Department for designing necessary interventions to prevent and mitigate the impact of air pollution on the health of the peoples living in the CPAs.

9.3 Non-installation of Continuous Ambient Air Quality Monitoring Stations in Critically Polluted Areas

For monitoring of the AAQ continuously in the CPAs, CPCB directed (April 2016) GPCB to install at least two Continuous Ambient Air Quality Monitoring Stations (CAAQMS) within a year in each CPA. The GPCB was required to coordinate with industrial associations or any other appropriate agency for the installation of CAAQMS at strategic locations in the CPAs on the “Polluter Pays Principle”. One CAAQMS was supposed to be in windward (upwind direction) and the other one at leeward (downwind direction). The data so acquired was to be published on the website of GPCB. These directions also formed part of the Remedial Action Plan for the CPA. The CPCB also directed GPCB to install CAAQMS in all million-plus cities of the State *i.e.*, Ahmedabad, Surat, Vadodara, and Rajkot.

Till March 2021, the GPCB had installed a total of six CAAQMS in Gujarat¹. It was observed that the CAAQMS installed in CPA was not based on the Polluter Pays Principle *i.e.*, by the industrial associations, as GPCB was operating these CAAQMS from its resources. The Industrial Associations of

¹ One each in Maninagar (Ahmedabad), Gandhinagar, Jamnagar, Vapi, Ankleshwar and Vatva (Ahmedabad).

Vapi and Vatva had assured to install of CAAQMS, but the same was yet to be installed (March 2021).

The GPCB was yet to comply with the directions of CPCB regarding the installation of at least two Continuous Ambient Air Quality Monitoring Stations in each CPA (June 2021).

Government stated (January 2022) that as per revised instructions of the CPCB (September 2021) only one CAAQMS is to be installed in each CEPI area and tenders had been invited to install CAAQMS in Vadodara and Surat.

The GPCB may expedite the installation of CAAQMS in all the six CPAs and million-plus cities (four) of the State to disseminate real-time information on AAQ of the CPAs and to enable timely intervention by the GPCB for mitigation of air pollution.

9.4 Lack of monitoring of Remedial Action Plan in critically polluted areas

The Ministry directed (May 2011) the GoG to constitute a State Level Committee (SLC)² under the chairmanship of Chief Secretary and a District Level Committee (DLC) under the chairmanship of District Magistrate or a senior Revenue Officer to review the implementation of Remedial Action Plan (RAP) approved by the CPCB in September 2010 every quarter. The RAP was required to address various environmental issues like the management of wastewater, industrial air pollution control, municipal and other solid waste management including vehicular pollution for the identified CPAs.

State Level Committee

The GoG constituted (June 2011) a SLC under the chairmanship of Principal Secretary, FED to review the implementation of cluster wise action plan for the CPAs. The first meeting of SLC for Vapi, Ahmedabad, Vatva, and Ankleshwar was held in April 2013 followed by another meeting for Vapi in December 2016 (after lifting of the moratorium in November 2016). In the SLC meeting of April 2013, all Regional Officers of the GPCB of CPAs were directed to coordinate with the District Collector for regular review of action plan at the district level.

The CPCB reiterated (June 2014) the constitution of the SLC for the effective implementation of RAP. CPCB also desired that (a) RAP is reviewed and monitored periodically at least every quarter, (b) RAP for CPAs is incorporated in the State Environment Policy, (c) Monitoring of Environment Quality of Severely Polluted Areas (SPAs) is done and (d) Action plan for SPAs is prepared by the GPCB on the same line of CPAs.

² The Principal Secretary, Forests and Environment Department is the Chairman of the SLC. The Member Secretary, GPCB is the Member Secretary of the SLC. The Principal Secretary -Industries and Mines Department, Vice Chairman and Managing Director- Gujarat Industrial Development Corporation, Director (Environment) and Additional Secretary- Forests and Environment are the other members of the SLC.

Audit observed (March 2021) that no meeting of the SLC was convened after 2016 and the outcome of the implementation of RAP was also not available on records.

District Level Committee

The GoG constituted (May 2015) DLCs for Vapi, Ankleshwar, Vatva (Vatva and Narol), Ahmedabad (Naroda and Odhav), Bhavnagar, Vadodara, Rajkot, and Surat to ensure the effective implementation of RAP i.e., almost after four years from the Ministry directions of May 2011. The DLC was required to ensure the implementation of an action plan for these industrial clusters and review the status of implementation every quarter.

Audit observed that only six meetings of the DLC in Ahmedabad (three), one each in Ankleshwar, Bhavnagar and Valsad were held in 2015-16, and thereafter, no DLC meetings were held (March 2021).

The GPCB stated (June 2021) that the Industries Association did not fully agree with the concept of CEPI considering various technical limitations. The GPCB further stated that in many areas, the action plan was monitored at the district level through the platform of the district environment committee. However, no details related to monitoring by the district environment committee have been provided in reply.

Due to non-holding of meetings of SLC and DLC on regular basis, implementation of RAP in CPA was not monitored and monitoring of environmental issues in CPA did not receive priority.

Conclusion

Between 2009 and 2018, three new cities, i.e., Vadodara, Rajkot, and Surat have been added to the list of CPA. The GPCB has not developed a system for periodic review of health impact assessment in CPA. The GPCB is yet to install the AAQMS in CPA as per norms, thereby leading to non-monitoring of AAQ on a real-time basis in CPA.

Chapter-10

Other important issues

10.1 Utilization of funds received from forfeiture of bank guarantees

GPCB imposes a penalty and collects Bank Guarantee (BG) under the “Polluter Pays” Principle towards compensation of environmental damage and forfeits the BG in case of further non-compliance. The NGT promulgated (January 2014) that the forfeited BG shall be strictly used for the compensatory purpose or restoration of the degraded environment resulting from emission and discharge of effluent and other pollutants.

GoG introduced (December 2018) a scheme with an objective to utilize the forfeited BG amount for activities such as (i) establishment of spent acid management plant/ recovery of spent acid management (ii) improvement in existing biological system (iii) establishment of common steam boiler projects and (iv) common solar sludge drying system. The scheme provided finance up to 10 *per cent* or ₹ one crore whichever is less for the earmarked projects. As of December 2020, GPCB had a balance of ₹ 48.72 crores on account of forfeited BGs. Under the scheme, GPCB had approved (June 2021) financing of seven projects¹ worth ₹ 5.18 crore. Out of these, only one project was community-based (common boiler facility) and the remaining projects were industry-specific.

Audit observed that the GoG took almost five years in formulating the scheme for utilization of forfeited BG, thereby delaying the action required for reducing the air pollution. Further, the projects approved under the scheme were industry-specific instead of being community-based. Thus, there was a need for the implementation of interventions to control emissions.

10.2 Effectiveness of environment audit scheme

At the directions of Gujarat High Court, GPCB launched (1996) “Environment Audit Scheme” (EAS) in the State with a view to assessing (i) the degree of pollution potential of a particular industry or class of industries; (ii) how an individual unit has provided treatment plants and facilities for liquid effluents, air emissions and solid waste; (iii) and whether the said plants and facilities are adequate and efficacious to achieve pollution control norms.

Under EAS, GPCB assigns environment audit of industrial units to environment auditors every year. The Environment Audit Reports² (EAR) is submitted to the GPCB, which scrutinises it. Audit reviewed the EAR of 26 units (power, textile, steel, sugar, cement, fertilizer, refinery, and petrochemical) for 2017-18 and 2018-19 to examine whether the implementation of EAS has achieved its objectives and observed the following: -

¹ Total project cost of ₹ 59.55 crore.

² The EAR is prepared by the Environment Auditors empanelled by GPCB.

- Air emission load was assessed in six reports out of 26 EARs test checked in Audit. Only in the case of Torrent Power Ltd (SUGEN), Surat major emission parameters (SO₂, NO_x and PM) were calibrated in mg/Nm³ and emission load was worked out. In the remaining five cases,³ except for Particulate Matter, the emission level of SO₂ and NO_x was measured in ppm and was not converted into mg/Nm³, thus the emission load calculated was incorrect. The GPCB did not take up the matter regarding missing emission load data in the EAR with the Environment Auditors (EAs). As a result, the degree of pollution potential of a particular industry or class of industries is not available in the EARs which would have been a guiding factor for policy formulation and regulation of industry or class of industries.
- GPCB did not instruct the EAs to calculate emission load for major polluting units such as thermal power plants, refineries, cement plants, petrochemicals, and fertilizers.
- The EARs are not in the public domain; therefore, the public is deprived of the data/ information of pollution due to large industries.
- Data mismatch was observed between the air sampling data of stacks and flue (of PM₁₀, SO_x and NO_x) and the data available in the Inspection Report of GPCB and OCEMS (wherever installed).
- The Adequacy Certificate appended with the EARs lacked emission load.
- Noise is regulated under the Air (Prevention and Control) Act, 1981. As per the CCA and noise standards, the permissible limit for noise is different for day and night time. However, the samples for measuring noise levels in all the test-checked cases were collected in the daytime only. The GPCB had not taken up non-compliance with the EAs.

Government stated (January 2022) that there was still scope and opportunities in the implementation of the existing process which is under consideration. On the issue of reporting emission load, Government stated that emission norms were concentration-based and not load-based. However, Environment Auditor had been directed to check and calculate emission load. It was added that placing Environment Audit Report in the public domain as suggested would be considered for implementation.

Thus, orders of the Gujarat High Court were not being followed prudently. Due to the non-assessment of the degree of pollution potential of a particular industry or class of industries and the non-availability of environmental information in the public domain, the very purpose of the EAS is defeated. The emission load data, if computed even only for the red-large category units operating nearby the heavily populated and in urban areas, may provide important feedback for designing policy interventions and executive action to control and regulate air pollution.

³ Gujarat Industries Power Limited (2017-18), Surat; Shree Kantha Vibhag Sahkari Khand Udoyg Mandali Limited (2018-19); Krishak Bharati Cooperative Society Limited, Surat (2018-19); NTPC, Surat (2018-19) and Pidlite Industries Limited, Vapi (2018-19).

10.3 Non-greening of highways

Plantation in the Right of Way (strip plantation/ avenue plantation) and median (in case of four-lane highways) helps in the reduction/control of (i) Air pollution and dust as trees and shrubs are known to be natural sinks for air pollutants and (ii) impact of ever-increasing noise pollution caused due to increase in the number of vehicles on the road. Indian Road Congress (IRC)⁴ SP-21 stipulates specifications for avenue and median plantation along the highways which are included in tender conditions and the cost of plantation is in-built in the cost of highway construction. During 2011-19, the Ministry approved the diversion of forest land for various highway development projects. In every in-principle approval accorded by the Forests Department for diversion of forest land, it has been mentioned that the user agency shall raise and maintain the strip plantation on either side of the road and central verge at the project cost as per IRC specification (IRC SP 21) and the user agency shall submit the annual compliance report in respect of the above condition. Therefore, it is the responsibility of the highway development agencies (Roads and Buildings Department) to offset the losses by complying with environmental rules.

Roads and Building Department⁵ developed state highways during 2012-14 under public-private partnership. In eight annuity-based road projects, the GoG restricted the annuity payment⁶ to the concessionaires for their failure to develop avenue plantations. In nine other roads developed by Gujarat State Road Development Corporation (a State PSU), avenue plantations were noticed (November 2021) only on one road⁷. In the case of three roads⁸ of Rajkot District, Forest and Environment Department (December 2019) informed that the R&B department had not carried out roadside and median plantation and there is no mechanism with the Forest and Environment Department to monitor roadside plantation. Thus, despite the inclusion of conditions for avenue plantation and median plantation in the in-principle approval/ formal approval accorded for diversion of protected forest, plantation (Strip /Avenue) in Right of way and median/ central verge was either not carried out or was deficient in quantity and quality. Moreover, the user agencies were not submitting annual compliance of terms and conditions of in-principle approval/ formal approval to the FED.

Thus, lack of monitoring of compliance of the terms and conditions and IRC specification by the user agency was observed in road construction works. Further, the FED has not framed a policy to encourage the greening of highways as done by GoI in the case of National Highways by launching of Green Highways (Plantation and Maintenance) Policy 2015.

Government stated (January 2022) that coordination with other agencies like R&B and NHAI would be done.

⁴ The IRC is the Apex Body of Highway Engineers in the country, set up in December 1934 with the objective of Road Development in India.

⁵ Gujarat State Road Development Corporation Limited Gandhinagar and Superintending Engineer, Gujarat State Highway Development Project, Gandhinagar.

⁶ The issue had featured in Para 3.3.3.1 of Report No. 6 of the year 2016 of Government of Gujarat.

⁷ Rajkot-Vadinar State Highway.

⁸ Atkot-Gondal, Upleta-Kolki, Tankara- Latipur state highways.

The State Government may frame a policy for greening of highways and ensure its compliance by the implementing agencies.

10.4 Human-resources of the GPCB- availability vis-à-vis requirement

GPCB initially established to implement the Water (Prevention & Control of Pollution) Act, 1974, is currently entrusted with the implementation of four major Acts and around 20 Rules and Notifications made under these major Acts. Besides this, the GPCB is the only implementing agency for directions received from CPCB, GoG, Supreme Court of India, NGT and Gujarat High Court. Starting with a staff of 25 in 1974, the sanctioned strength of the GPCB, in January 2018, was 728 in 38 categories. Audit analysis of prevailing workload of GPCB and staff strength revealed as under: -

(i) Between March 2008 and March 2020, there was 354 *per cent* increase in the grant of cumulative CCA by the GPCB from 21,010 to 73,527 under the Water Act, Air Act, Hazardous Waste Management Rules, 1989 and the Bio-Medical Waste (Management and Handling) Rules, 1998.

(ii) Under the Water Act, Air Act and Hazardous Waste Management Rules, 1989, in 2007-08, the GPCB collected and analysed 19,567 samples while in 2019-20, it collected and analysed 24,542 samples only despite an increase of cumulative CCA granted from 9,251 to 30,964 under these Acts and Rules.

(iii) GPCB is responsible for monitoring and supervising over 30,964 industries, 42,563 Health Care Units, 34 Common Effluent Treatment Plants, 21 Common Bio-Medical Waste Treatment Facilities, 32 (18 commons and 14 individual) TSDF⁹ sites under the Hazardous Waste Rules and other landfill sites under the Municipal Solid Waste rules in the State.

(iv) Despite the manifold increase in work over the years and increasing pollution in the state, the GoG abolished (February 2018) 223 posts and left the GPCB to accomplish its regulatory function through 505 posts only. As of 01 March 2021, the sanctioned strength of the GPCB was 513. Against this, 105 posts were vacant since 2008. In technical cadres (environment engineers and scientists), there were 17 *per cent* vacancies while in other cadres, there were 30 *per cent* vacancies (March 2021). Thus, GPCB is running with inadequate human resources. The impact of an acute shortage of staff can be gauged from fewer sampling/monitoring activities.

(v) NGT directed¹⁰ (July 2017) all SPCBs to submit comprehensive proposals for capacity building including additional manpower and infrastructure to the State Government within two months and State Government was required to decide within three months thereafter. Consequently, CPCB directed (August 2017) GPCB to prepare a draft proposal as per the indicative guidelines and submit the same to the State Government following the time limit schedule as directed by the Tribunal. GPCB constituted (26 September 2017) a committee for assessment of manpower/staff in consonance with CPCB’s Guidelines.

⁹ Treatment, Storage, and disposal facility.

¹⁰ M.C. Mehta v/s. Union of India (O. A. No. 200 of 2014, judgment date 13.07.2017).

GPCB assessed its staff requirement and finalization of the draft report was in progress (November 2021).


Government stated (January 2022) that continuous effort had been made to shorten the staff crunch. It agreed with the audit observation that increase in industrial units has increased the need for technical manpower continuously.

With the expansion of the various types of activities, GPCB needs to be sufficiently provided human resources to enforce all the applicable Acts.

Conclusion

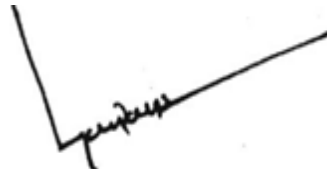
GPCB is slow in utilizing the fund received from the habitual defaulter units. Environment audit reports are not in the public domain and are not inclusive of emission load and data on stack emission, thus defeating the very purpose of the Environment Audit Scheme. The State lacks policy intervention for the greening of highways. The activities of GPCB have increased manifold over time; the human resources have decreased substantially leading to an adverse impact on the monitoring and regulatory function of GPCB.

Ahmedabad
The 25 May 2022


(H. K. DHARMADARSHI)
Principal Accountant General (Audit-II),
Gujarat

Countersigned

New Delhi
The 26 May 2022


(GIRISH CHANDRA MURMU)
Comptroller and Auditor General of India

Appendix I

(Reference: Paragraph 3.5 and 5.2)

List of 17 category units selected in Audit and air sample taken by GPCB during April 2014 to November 2019

Sl. No.	Regional Office	Sector	Name of unit	PCB ID ¹	Total number of stack and ambient air samples	Number of the ambient air samples
1	Ahmedabad-Rural	Fertilizer	Narmada Bio Chem Limited	34985	1	0
2			Dhanlaxmi Bio Chem Private Limited	45680	1	0
3		Pharmaceuticals	Concord Biotech Limited	11026	1	0
4	Ahmedabad	Dyes & Intermediates	Associated Dyestuff Private Limited (Unit - I)	33740	4	0
5			Meghmani Dyes & Dyes intermediates	12530	0	0
6		Pesticides	Meghmani Industries (Unit-II)	12533	0	0
7		Pharmaceuticals	Dishman Pharma and Chemicals	11178	0	0
8		Thermal Power Plant	Torrent Power, Sabarmati,	14465	70	0
9	Ankleshwar	Dyes & Intermediates	Astik Dyestuff Private Limited.	14939	0	0
10			Subhasri Pigments Private Limited	15750	10	0
11		Pesticides	UPL Limited (Unit-II)	15832	12	0
12		Pharmaceuticals	Bakul Pharma Private Limited.	14957	4	0
13	Bharuch	Fertilizer	Gujarat Narmada Valley Fertilizers and Chemicals Limited (Unit-1)	15121	38	0
14		Petrochemicals	INEOS Styrolution India Limited. (Formally Styrolution India Private Limited.,)	14959	0	0
15			ONGC (CPF Gandhar)	15433	0	0
16	Bhavnagar	Thermal Power Plant	Bhavnagar Energy Company Limited	31872	2	0
17		Cement	Ultratech Cement Limited; Gujarat Cement Works, Kovaya, Amreli	14813	34	4
18	Gandhinagar	Cement	J K Lakshmi Cement Limited	27736	3	0
19		Fertilizer	Indian Farmer Fertilizer Cooperatives Limited	16444	21	0
20		Thermal Power Plant	Gujarat State Electricity Corporation Limited (GSECL), Gandhinagar Thermal Power Station (TPS)	16422	62	0
21	Jamnagar	Cement	Shri Digvijay Cement Co. Limited, Sikka Jamnagar	17132	17	4
22		Oil Refinery	Reliance Industries Limited (RIL) SEZ area, Jamnagar	34444	35	0
23		Oil Refinery	RIL, Jamnagar	17091	99	1
24		Petrochemicals	RIL, Jamnagar	30633	22	0
25	Junagadh	Cement	Ambuja Cement Limited	17221	32	4
26			Sidhee Cement Limited	17228	20	1
27	Kheda (Nadiad)	Pulp & Paper	Riddhi Siddhi Recyclers Private Limited	30805	10	0
28		Thermal Power Plant	GSECL, Wanakbori TPS	17415	28	0
29	Kutch	Cement	Sanghi Industry Limited (SIL) (Grinding)	18025	16	0

¹ Pollution Control Board Identification Number.

Sl. No	Regional Office	Sector	Name of unit	PCB ID ¹	Total number of stack and ambient air samples	Number of the ambient air samples
30			SIL (Clinkerisation unit)	18026	29	6
31		Iron and Steel	Global Hi Tech Industries Limited	Unit closed	Data not available	
32	Kutch (East)	Iron and Steel	Welspun Steel Limited (Sponge Iron and 12 MW Power Plant)	18109	5	0
33			Electrotherm (India) Limited (Sponge Iron & Di Pipe Plant)	17826	20	2
34		Thermal Power Plant	Adani Power Limited (Phase-I)	29389	11	0
35			Adani Power Limited (Phase-II)	29389		
36			Adani Power Limited (Phase-III)	29389		
37			Coastal Gujarat Power Limited.	19716	13	3
38		OPG Power Gujarat Private Limited, Bhadreshwar	21228	11	2	
39		Morbi	Pulp & Paper	Aricon Papers Private Limited	51133	1
40	Palanpur	Cement	Balaram Cement, Palanpur	18696	9	0
41	Porbandar	Cement	Saurashtra Cement Limited Ranavav, Porbandar	19323	55	0
42	Rajkot		Hi-Bond Cement (India) Private Limited, Rajkot	29926	7	0
43	Surat	Fertilizer	Krishak Bharti Co-Operative Limited (KRIBHCO), Hazira, Surat	20887	10	0
44		Iron and Steel	Essar Steel India Limited (HRC Division), Hazira, Surat	20680	12	4
45		Pulp & Paper	B.N. Papers, Surat	28837	3	0
46		Sugar	Shree Kantha Vibhag Sahkari Khand Udyog Mandli Limited	13672	3	0
47		Thermal Power Plant	Gujarat Industries Power Company Limited (Surat Lignite Power Plant)	20747	3	0
48	Vadodara	Fertilizer	Gujarat State Fertilizers and Chemicals Ltd (GSFC Ltd)	21968	94	0
49		Oil Refinery	Indian Oil Corporation Limited (Gujarat Refinery)	21967	47	0
50		Petrochemicals	RIL, Vadodara Mfg Division	22501	36	0
51			GSFC Ltd (Polymer Unit),	21996	0	0
52		Sugar	Vadodara District Co. Op. Sugar Cane Growers Union Limited, Gandhara, Karjan	22899	0	0
53	Vapi	Dyes & Intermediates	Pidilite Industries Limited, Vapi	24119	8	0
54		Pharmaceuticals	Gujarat Themis Biosyn Limited, Vapi	23513	15	0
55		Pulp & Paper	Kherani Paper Mills Private Limited, Valsad	23761	3	0
Total					937	31

Appendix II

(Reference: Paragraph 3.5)

List of red, orange and green categories units selected in audit

Sl. No.	Regional Office	Name of unit	PCB ID	Category of unit
1.	Ahmedabad (City)	Adarsh Industries	49026	Green Category
2.		AmanPetroleum	34061	Orange Category
3.		Amneal Pharmaceuticals Pvt Ltd	56200	Orange Category
4.		Anup Engineering Ltd	10411	Red Category
5.		Arvind Ltd, Naroda, Ahmedabad	10476	Red Category
6.		Ashima Ltd (Spin Fab Unit)	10496	Red Category
7.		Diesel Shed Sabarmati (Western Railway)	13521	Orange Category
8.	Ahmedabad (Rural)	ACC Ltd	10058	Green Category
9.		Acu Life Health Care Pvt. Limited	12852	Red Category
10.		Agri Nova Pesticide	40378	Orange Category
11.		Arjun Stone Quarry	34100	Orange Category
12.		Ashutosh Metal Pvt. Limited	10520	Orange Category
13.		Asiatic Composite Limited	36679	Red Category
14.		CIL Nova Petro Chemicals	39475	Red Category
15.	Ahmedabad (East)	Bhagwati Spherocast Pvt. Limited	10691	Orange Category
16.		Chiripal Industries (Shanti Industries)	11003	Red Category
17.		Classic Corrugated Pvt. Limited	38936	Orange Category
18.		Gwaliya Sweets	11557	Orange Category
19.		Kankariya Textiles Industries Pvt. Limited	33947	Red Category
20.		Pranav Chemicals	13131	Red Category
21.	Gandhinagar	Anand Ply Industries, Vadsar	16328	Orange Category
22.		Ashish Enterprise, Chhatral	42356	Orange Category
23.		Gandhinagar Mahanagarpalika	26578	Red Category
24.		Jay Copper & Alloys Pvt. Limited	27367	Red Category
25.		J R Pharma	16453	Red Category
26.		Vishal Containers Limited	40703	Orange Category
27.	Vadodara	Amar Food & Beverage	32394	Orange category
28.		Apollo Tyre Limited	21629	Red category
29.		Bell Granito Ceramica Limited	35580	Red category
30.		Bodal Chemical Limited (sulphur Division)	33329	Red category
31.		Shree Mukesh Quarry Works	22704	Orange category
32.		USV Pvt. Limited	59775	Orange category
At Board Office				
33.	Vapi	Raymonds Limited, Vapi	24240	Red Category
34.		Welspun India Limited, Vapi	24819	Red Category

Appendix III

(Reference: Paragraph 3.5)

List of Departments / offices audited

Sl. No.	Name of Department/Office	Name of Branch Office/Regional Office
1	Agriculture, Farmers Welfare and Co-operation Department, Gandhinagar	--
2	Central Public Works Department	Central Public Works Division, Gandhinagar
3	Commissioner of Geology and Mining, Gandhinagar	--
4	Directorate of Food and Civil Supply, Gandhinagar	--
5	Energy & Petrochemicals Department	UGVCL, MGVCL, SGVCL, PGVCL
6	Forest & Environment Department, Gandhinagar	Principal Chief Conservator of Forests and Head of Forest Force, Gandhinagar
7	Gujarat Pollution Control Board, Gandhinagar	Regional officer, GPCB, Ahmedabad (city), Gandhinagar
		Regional officer, GPCB, Ahmedabad (Vatva), Ahmedabad
		Regional officer, GPCB, Ahmedabad (Rural), Changodar, Ahmedabad
		Regional officer, GPCB, Gandhinagar
		Regional officer, GPCB, Vadodara
8	Industries and Mines Department	Industries Commissioner, Gandhinagar
9	National Highway Authority India	Regional Officer, NHAI, Gandhinagar
10	Port and Transport Department	Assistant Regional Transport Officer, Gandhinagar and Bavala
		Commissioner of Transport, Gujarat, Gandhinagar
		Gujarat Maritime Board
		Gujarat State Road Transport Corporation
11	Road and Building Department, Gandhinagar	Superintending Engineer, R&B (Mechanical) Circle, Ahmedabad
		Gujarat State Road Development Corporation
		Superintending Engineer, R&B (Capital) Circle, Gandhinagar
		Superintending Engineer, R&B (National Highway) Circle, Gandhinagar
		Superintending Engineer, R&B Circle-1, Ahmedabad
12	Urban Development and Urban Housing Department, Gandhinagar	Ahmedabad Municipal Corporation
		Gandhinagar Municipal Corporation

Glossary of Abbreviations		
1	AAQMS	Ambient Air Quality Monitoring Station
2	APCM	Air Pollution Control Measures
3	AQI	Air Quality Index
4	BG	Bank Guarantee
5	BTX	Benzene, Toluene and Xylene
6	CAAQMS	Continuous Ambient Air Quality Monitoring Station
7	CCA	Consolidated Consent and Authorisation
8	CEPI	Comprehensive Environmental Pollution Index
9	CETP	Common Effluent Treatment Plant
10	CO	Carbon Monoxide
11	CO ₂	Carbon Dioxide
12	CPA	Critically Polluted Area
13	CPCB	Central Pollution Control Board
14	CPP	Captive Power Plant
15	CTE	Consent to Establish
16	CTO	Consent to Operate
17	EA	Environment Auditor
18	EAC	Expert Advisory Committee
19	EAR	Environment Audit Report
20	EAS	Environment Audit Scheme
21	EC	Environmental Clearance
22	EIAS	Environment Impact Assessment Study
23	EP Act,1986	Environment (Protection) Act, 1986
24	ESP	Electro Static Precipitator
25	ESZ	Eco-Sensitive Zone
26	FGD	Flue-Gas Desulfurization
27	GEMI	Gujarat Environment Management Institute
28	GPCB	Gujarat Pollution Control Board
29	HMP	Hot Mix Plants
30	ICMR	Indian Council of Medical Research
31	IRC	Indian Road Congress
32	MoEF &CC	Ministry of Environment, Forests and Climate Change
33	MoRTH	Ministry of Roads, Transport and Highways
34	MSW	Municipal Solid Waste
35	NAAQS	National Ambient Air Quality Standard
36	NAMP	National Air Quality Monitoring Programme
37	NGT	National Green Tribunal
38	NH ₃	Ammonia
39	NIC	National Informatics Centre
40	NO	Nitrogen Oxide
41	NO ₂	Nitrogen Dioxide
42	NO _x	Oxides of Nitrogen
43	O ₃	Ozone
44	OCEMS	Online Continuous Emission Monitoring System
45	PCCF& HoFF	Principal Chief Conservator of Forests and Head of

		Forests Force
46	PUC	Pollution Under Control
47	PWD	Public Works Department
48	PM ₁₀	Particulate Matter with Particles of Aerodynamic Diameter < 10 µm
49	PM _{2.5}	Particulate Matter with Particles of Aerodynamic Diameter < 2.5 µm
50	RMC	Ready Mix Concrete
51	RSPM	Respirable Suspended Particulate Matter
52	SAMP	State Air Quality Monitoring Programme
53	SCN	Show Cause Notice
54	SEIAA	State Level Environment Impact Assessment Authority
55	SEZ	Special Economic Zone
56	SO ₂	Sulphur Dioxide
57	SOP	Standing Operating Procedures
58	SPCB	State Pollution Control Board
59	SPM	Suspended Particulate Matter
60	STP	Sewage Treatment Plant
61	TPPs	Thermal Power Plants
62	TERI	The Energy Research Institute
63	VOC	Volatile Organic Compound
64	VRS	Vapour Recovery System
65	WHO	World Health Organisation
66	XGN	Xtended Green Node

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