

EVENT: Smog in Mumbai, January 2016

CATEGORY: Human Induced aggravated by weather conditions



Mumbai was covered in a blanket of smog on Thursday 28th January morning leading many to concern about air pollution.

Mumbaikars living in the central and southern parts of the city experienced smog on a second consecutive day (28&29). Residents of Chembur, Wadala and Ghatkopar dealt with smog.



Cause: Parts of Mumbai are covered in a thick blanket of smog due to various factors including drop in minimum temperature to 14 degree Celsius, fire incidents at Deonar dumping ground and high levels of particulate pollutants in the city.

Initial reports suggest the smog could be due to the fire in Deonar dumping ground. But there are no confirmation regarding the same yet. The smog is said to have worsened since 28th , due to the fire at

Deonar Dumping Ground. The reason for the hazy blanket was the high levels of particulate matter 2.5 as these tiny particles in the air are known for reducing visibility.

Impacts: The air quality in Mumbai will continue to remain between 'poor' and 'very poor' in the coming days, the weather bureau sources said.



Effects: Residents have begun complaining about the smoke affecting their health. Commuters too were affected as the smog affected the visibility on the roads. Residents even complained of headaches and coughing problems due to the smog. Chembur residents on Friday 29th woke up to an unhealthy smog cover. Residents living near the dumping ground in Mumbai's North East area have been complaining about how the smoke has been affecting their health. Complaints of burning sensation in eyes.

Weather: The maximum temperature recorded yesterday at Santacruz was 28.8 degree Celsius, while the minimum was 14 degree Celsius. The maximum temperature recorded at Colaba was 26.6 degree Celsius and the minimum 18.5 degree Celsius.

Measures: The fire was on the Ghatkopar side of the dumping ground Since the fire was 2,000 feet away from the main road, fire engines had found it difficult to go inside. They were using sand instead of water to control the fire since there was no source of water.

EVENT: Fog in North India, January 2016

CATEGORY: Human Induced aggravated by Weather conditions

Cold conditions intensified across north India on Wednesday claiming two lives in Rajasthan while a dense fog engulfing the region forced cancellation of 89 trains.



Delhi: There was shallow fog and traces of rainfall witnessed in some areas of the national capital on Wednesday 13 January morning with the minimum temperature settling at 12 degrees Celsius. As many as 45 Delhi-bound trains were cancelled and 30 delayed after dense fog engulfed the national capital. The humidity in air oscillated between 95 and 59 per cent.

Kashmir: Many parts of Kashmir, including Srinagar were engulfed in a thick layer of fog affecting visibility even as the minimum temperature went down at most places in the Valley. Leh at minus 13.2 degrees Celsius was the coldest. Motorists negotiated the roads with caution in the poor light. However, there was no fog around the airport, flight operations went on normally.

There was dense fog in Bikaner district and other parts of the state and neighbouring regions of Rajasthan. Fog engulfed most places in the states of Punjab, Haryana and Uttar Pradesh.

EVENT: Fog in Delhi, December 2015

CATEGORY: Human induced aggravated by weather conditions

In Delhi poor visibility due to dense fog in the national capital affected train schedules on 24th December. Two trains were rescheduled and three were cancelled while departures of 24 others were delayed due to dense fog in Delhi and other parts of northern India. Visibility in morning slumped below 200 metres. The minimum temperature today was recorded at 7.2 degrees Celsius, a notch below the season's average, the MeT office said, adding it was a foggy morning. The maximum temperature is likely to hover around 19.2 degrees Celsius, two notches below the season's average, the official said. According to the weather office, the humidity at 8.30 am was recorded 97 percent.

EVENT: Fog in Rajasthan, December 2015

CATEGORY: Human induced aggravated by weather conditions



Rajasthan continued to reel under cold weather conditions with Churu recording the lowest minimum temperature at 3.2 degrees Celsius even as fog disrupted rail traffic at some places in the Northwestern region. 10 trains were running late due to foggy conditions in the northern region. The trains, including Hawrah-Jodhpur Express and Sialdah-

Ajmer Express, are running late from 55 minutes to 4 hour 35 minutes. Sikar saw a minimum of 4.4 degrees Celsius, Piloni 4.5 deg C, Chittorgarh 4.6 deg C, Mount Abu 5 deg C, Sriganganagar 5.5 deg C, Jaipur 6 deg C and Ajmer 7.1 deg C, a Met report said.

EVENT: Toxic Smog in Delhi, December 2015

CATEGORY: Human Induced aggravated by Weather conditions

Many schools have already restricted outdoors activities as record levels of air pollution in the Indian capital are expected to last for months to come. Delhi now the world's dirtiest city, surpassing Beijing for air pollution limits. Authorities in Delhi are considering shutting schools in the sprawling Indian capital as a bout of toxic smog stretches into a second month. The megacity, already the world's most polluted by some measures, has been suffering record levels of pollution which exceed recommended WHO guidelines by between 15 and 30 times.

The smog, a combination of exhaust from cars and lorries, dust, smoke from fires and industrial output which is intensified by cold temperatures, is predicted to last for months to come. Around 70,000 trucks cross Delhi every night because successive governments at state and national level have failed to construct bypasses. Attempts to increase the numbers of buses have failed.

Levels of pollution in Delhi have been consistently higher than in Beijing, where officials have ordered a virtual shutdown to prevent harm and cut soaring pollution levels. Authorities in Delhi have struggled to formulate a coherent strategy to tackle the problem which has been building up over years.

Initiative: Last week the chief minister of Delhi, Arvind Kejriwal, announced a scheme to cut traffic, and thus pollution, by allowing cars with licence plates ending in odd and even numbers to drive only on alternate days. Two coal-burning power stations have also been shut.

Precaution: "We will only take decisions after consulting schools. We have 2.6 million children in Delhi schools, they are big stakeholders. There has been a proposal to shut schools between 1 to 15 January. We are considering it," Manish Sisodia, Delhi education minister, told local media.

Research: Studies in Delhi have shown the smog is causing irreversible damage to the health of millions of children in the city, many of whom walk to school along busy roads at peak times for pollution. Many schools have already restricted outdoors activities.

Drawback: The poor record of authorities enforcing headline measures has made many observers sceptical that these new efforts will have any effect. A ban on diesel vehicles more than 10 years old descended into chaos earlier this year, with traffic jams at checkpoints, and was effectively withdrawn.

EVENT: Smog in India & China, November 2015

CATEGORY: Human Induced aggravated by Weather conditions

The capitals of the world's two most populous nations, China and India, were blanketed in hazardous, choking smog on Monday 30th November as climate change talks began in Paris, where leaders of both countries are among the participants.

New Delhi: In New Delhi, the U.S. embassy's monitoring station recorded an air quality index of 372, which puts air pollution levels well into "hazardous" territory. A thick smog blanketed the city and visibility was down to about 200 yards (metres). Air quality in the city of 16 million is usually bad in winter, when coal fires are lit by the poor to ward off the cold. Traffic fumes, too, are trapped over the city by a temperature inversion and the lack of wind. However, the government has not raised any alarm over the current air quality and no advisories have been issued to the public. Thirty thousand runners took part in a half marathon at the weekend, when pollution levels were just as high.

China: China's capital Beijing maintained an "orange" pollution alert, the second-highest level, on Monday, closing highways, halting or suspending construction and prompting a warning to residents to stay indoors. The choking pollution was caused by the "unfavourable" weather, the Ministry of Environmental Protection said on Sunday 29th November. Emissions in northern China soar over winter as urban heating systems are switched on and low wind speeds have meant that polluted air has not been dispersed.

In Beijing, a city of 22.5 million, the air quality index in some parts of the city soared to 500, its highest possible level. At levels higher than 300, residents are encouraged to remain indoors, according to government guidelines. The hazardous air underscores the challenge facing the government as it battles pollution caused by the coal-burning power industry and will raise questions about its ability to clean up its economy at the talks in Paris.

Beijing has been completely enveloped in smog and the pollution level is very high and the poor air makes breathing hard causing the throat feel particularly uncomfortable

Precautions: The Beijing Environmental Protection Bureau said on Sunday that it had requested factories to limit or suspend output and had also stopped construction work throughout the city. China has vowed to slash coal consumption and close down polluting industrial capacity, but environmental officials admit that the country is unlikely to meet state air quality standards until at least 2030. Reducing coal use and promoting cleaner forms of energy are set to play a crucial role in China's pledges to bring its climate warming greenhouse gas emissions to a peak by around 2030.

Effect: The ministry said the number of cities affected by heavy pollution had reached 23, stretching across 530,000 square km, an area the size of Spain, but a cold front beginning on Wednesday would see the situation improve. State-run Xinhua news agency said more than 200 expressway toll gates in east China's Shandong province were closed on Monday due to smog. The province issued a yellow alert.

China launched a "war on pollution" last year following a spate of smog outbreaks in Beijing and surrounding regions.

Chinese President Xi Jinping and Indian Prime Minister Narendra Modi are both in Paris and both were scheduled to meet U.S. President Barack Obama on Monday to give momentum to the two-week negotiations.

EVENT: Hazardous Air Pollution levels in Delhi, November 2015

CATEGORY: Human Induced aggravated by weather conditions



Pollution soared to hazardous levels in Delhi on the night of Diwali, the Hindu festival of lights, reaching 40 times the limit recommended by the World Health Organisation, reports say.

Massive quantities of fireworks go up in smoke during the festival. On Wednesday 11th November night, the levels of PM10 particulates, which are very hazardous to health, rose to 2,000 micrograms per cubic metre, reports said. The WHO recommends a maximum of 50 micrograms per cubic metre.



Cause: Apart from fireworks on Diwali, Delhi's pollution in winter is aggravated by a drop in temperature which leads to the city's poor burning rubbish at night to stay warm. Agricultural waste is also set on fire across thousands of hectares around Delhi to clear cropland, which burns for days on end and thus adds to the pollution.

Precautions: Ahead of the festival, the government in Delhi had appealed to residents to stay away from fireworks.

Drastic deterioration: [The Times of India](#) reported that the air quality in the Indian capital "deteriorated drastically" on Wednesday evening "breaching all safety standards by several times". The newspaper said that PM10 levels in many parts of the city had crossed 1,000 micrograms per cubic metre, with Delhi's most polluted area Anand Vihar, recording a high of 2,000 micrograms per cubic metre. Levels of sulphur dioxide, which can lead to a spike in asthma, bronchitis and bronchiolitis, were also found to be very high in many areas.

EVENT: Smog & Haze conditions in Delhi, November 2015

CATEGORY: Human induced aggravated by weather conditions

Smog from illegal farm fires shows task of enforcing curbs and small-particle pollution 27 times safe level in Indian capital.

The air pollution meter buzzed and spat out a stunning result: levels of PM2.5 -- tiny, toxic particles that lead to respiratory diseases -- were 27 times the safe limit near the Indian parliament in New Delhi on Wednesday morning. The reading of 675 micrograms per cubic meter of air recorded by Bloomberg News exceeded the highest measured this year in Singapore, where PM2.5 levels touched 471 in October as Indonesian plantation fires led to some of the murkiest haze the city state has seen.



U.S. satellite images indicate the smog in New Delhi is being thickened by smoke billowing south from Punjab state, where farmers are flouting a ban on the use of fires to clear straw and waste crop. The U.S. embassy in New Delhi on Wednesday morning classed the city's air as hazardous. It advised avoiding all physical activity outdoors, adding that vulnerable people and children should stay inside. Tiny particulate matter in high amounts can cause respiratory disease by going deep into the lungs, as well as harm the heart and enter the bloodstream. The World Health Organization's 24-hour mean guideline for PM2.5 is 25 -- a fraction of the reading in New Delhi on Wednesday.

Vehicle fumes, another contributor to the city's pollution. Aside from cars and trucks, millions of India's poor burn fires for domestic use as well as farming. Wealthier folk use belching diesel generators as grid electricity is unreliable.

Air pollution claims an estimated 650,000 lives annually in India, according to Johannes Lieveld, a professor at the Max Planck Institute for Chemistry in Germany.

EVENT: Smog in Capital, November 2015

CATEGORY: Human Induced

Several people in Delhi who stepped out of their houses on 7th November complained about their eyes stinging and watering. They also reported an uncomfortable feeling of "being choked". This wasn't surprising because air pollution levels in the city had reached alarming proportions. Experts said that heavy vehicular traffic in the run-up to Diwali compounded the problems caused by respirable particles that had accumulated in the past few days from the burning of crop stubble in the neighbouring states.



Already considered one of the global cities with the worst air to breathe, Delhi saw levels of PM2.5 (fine, respirable particles) reach an astounding 750 micrograms per cubic metres - 12 times the safety range for the pollutant in India and 30 times the World Health Organization's global safety benchmark. This peak level was measured at Anand Vihar for a few hours around noon on Saturday. Even otherwise, the measured level of 350-450 micrograms per cubic metres there was way beyond the Indian safe level of 60 microgram per cubic metre. At RK Puram and Mandir Marg too, the PM2.5 levels hovered between 250 and 450 micrograms per cubic metre.

The levels of nitrogen dioxide (NO₂) were also very high during the day, measuring between 200 and 250 micrograms per cubic metres at RK Puram and 100-150 micrograms per cubic

metre at Anand Vihar and Mandir Marg against the safe limit of 80 micrograms per cubic metre.

Cause: The Diwali traffic has played a major role in the increased air pollution levels as is evident from the high NO₂ levels. Vehicular pollution is usually behind this problem. Since vertical wind was almost absent, whatever pollution was being generated lay trapped close to the surface. Despite the government's directions, there are evidences that the burning of crop stubble is continuing in places near the capital

Effects: Uncomfortable going out in the dense smog. The traffic fumes seemed more intense causing eyes burning, stinging and watering, breathless, cough.

The Central Pollution Control Board air quality index categorised the pollution at Mandir Marg, Anand Vihar and RK Puram as "severe". The health warning for such an occurrence is dire even for healthy individuals, and people are advised to minimize exposure to pollution by avoiding outdoor activities, especially heavy exercise outdoors.

According to the data provided by the System of Air Quality and Weather Forecasting and Research (SAFAR), the average PM10 (coarse particles) level on Saturday 7th November was 400-450 micrograms per cubic metre (safe limit is 100 microgram per cubic metre) and that of PM2.5 was 235 micrograms per cubic metres. Experts said these high levels could be partly accounted for by the moisture in the air that held together the accumulated pollutant particles.

EVENT: Fog in Delhi, January 2015

CATEGORY: Human induced aggravated by weather conditions

Fog and cold wave conditions continued to prevail in most parts of north and east India on Sunday. Delhi and NCR region witnessed heavy fog. Visibility at Delhi's Palam airport was reported to drop to nil. The minimum temperature settled at 6.4 degrees Celsius in Delhi. Around 100 flights and 60 trains were affected. The minimum temperature was one notch below normal, while humidity was recorded at 97 per cent at 8.30am. Fliers at Delhi airport had a tough time as around 100 flights, including international flights, were affected due to dense fog and low visibility which was below 50 meters. One flight was cancelled, while three international flights were diverted to other airports due to weather conditions. Besides, nearly 100 flights, including domestic departures, were also delayed. 60 north-bound trains, including Rajdhani trains coming from Ranchi, Bhubneswar, Kolkata, Sealdah, Dibrugarh were running late by several hours due to dense fog.



EVENT: Fog in Northern India, January 2015

CATEGORY: Human induced aggravated by weather conditions

The north remained in the grip of cold conditions today with dense fog affecting rail and air traffic in the region even as Uttar Pradesh announced that school for students up to Std XII in the state would be shut till Jan. 14 in view of the chilly weather. According to a Northern



Railway official, a thick fog cover in the morning also delayed 51 north-bound trains as visibility stood at less than 800-m.

- In the plains, the intense cold wave threw life out of gear in Uttar Pradesh with temperatures falling at a number of places in the state where low visibility due to fog also claimed the lives of two students when their motorcycle collided with a

truck in Jalaun district.

- The fog also hit rail traffic and a number of trains were running several hours behind schedule.
- A thick blanket of fog in many places across the two states Punjab & Haryana continued to affect the movement of road, rail and air traffic. Thus, two flights between Delhi and Chandigarh stood cancelled while a few were behind schedule.



- Fog in the neighbouring states of Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Delhi continued to affect North-Western Railway services in Rajasthan.

- About two dozen trains were running late between 20 minutes and 7:25 hours later while two other trains had to be rescheduled, a railway official

said.

- In Delhi, the forecast is for fog in the morning tomorrow followed by partly cloudy skies during the day while rain or snowfall has been predicted at isolated places in Himachal Pradesh from January 13 onwards.
- Similar scenario was witnessed in Amritsar and Agra, which also reported nil visibility. Most parts of east India reported shallow fog as well.
- Siliguri of West Bengal and UP's Gorakhpur reported visibility of upto 500 meters. This was followed by Agartala and Gaya at 600 meters and Patna at 800 meters.
- Airports including Gaya, Varanasi, Lucknow and Gorakhpur recorded dense fog with visibility reducing to 0-50 metres in many areas.

EVENT: Particulate Carbon and Dust Deposition Discolouring the Taj Mahal 2014

CATEGORY: Human induced

The white marble domes of the Taj Mahal are iconic images of India that attract millions of visitors every year. Over the past several decades the outer marble surfaces of the Taj Mahal have begun to discolour with time and must be painstakingly cleaned every several years. Although it has been generally believed that the discoloration is in some way linked with poor air quality in the Agra region, the specific components of air pollution responsible have yet to be identified.

A recent study of ambient particulate matter (PM) samples over a one- year period found to contain relatively high concentrations of light absorbing particles that could potentially discolour the Taj Mahal marble surfaces, that include black carbon (BC), light absorbing organic carbon (brown carbon, BrC) and dust. Analyses of particles deposited to marble surrogate surfaces at the Taj Mahal indicate that a large fraction of the outer Taj Mahal surfaces are covered with particles that contain both carbonaceous components and dust.

Results indicate that deposited light absorbing dust and carbonaceous particles (both BC and BrC from the combustion of fossil fuels and biomass) are responsible for the surface discoloration of the Taj Mahal. Overall, the results suggest that the deposition of light absorbing particulate matter in regions of high aerosol loading are not only influencing cultural heritage but also the aesthetics of both natural and urban surfaces.

On the timescale of several years the outer marble surfaces of the Taj Mahal become discolored and must be cleaned in a time consuming process. Many measures have been undertaken to avoid the impact of local air pollution, including restricting traffic within 1 km of 53 the grounds and limiting the emissions of industrial pollution in the city of Agra, where the Taj Mahal is located. Despite efforts to keep the outer surfaces of the Taj Mahal white, it continues to become discoloured with time, and the reason for the discoloration is not currently understood.

While detailed scientific studies have not been reported in the literature, past efforts focusing on the discoloration have hypothesized that local air quality is responsible and suggestions have included surface reactions with gas-phase SO₂, as well as aqueous phase chemistry linked with the deposition of fog droplets, and water condensation, as well as dust .

Recent work has reported poor air quality throughout the Indo-Gangetic plain, including relatively high concentrations of particulate matter in Agra. Particulate matter in the region includes the light absorbing components black carbon (BC), light absorbing organic carbon (a fraction of which can absorb light preferentially in the UV region and is often termed brown carbon, BrC), and dust. Both organic carbon and dust have the potential to preferentially absorb solar light in the blue region of the spectrum, which can give the atmosphere a brown hue and has thus been dubbed the Atmospheric Brown Cloud. The presence of these light absorbing aerosols, and in particular those that can take on a dark hue against a light colored background, suggest that the deposition of ambient particulate matter may be playing a role in the discoloration of the outer white marble surfaces of the Taj Mahal.

The discoloration impacts not only cultural artifacts but also the aesthetics of the environment through the modification of surface albedo, and hence perceived color.

EVENT: Smog in Delhi, 2014

CATEGORY: Human induced aggravated by weather conditions

Smog intensified in the city as wind speeds reduced, leading to an accumulation of pollutants and aerosols. A NASA satellite image showed agricultural fires in Punjab and Haryana were contributing to pollution in the region in a big way. According to IGI's Met office, a 20-25kmph wind had helped clear the pollution over the city, leading to a good visibility of 4,000 metres. The wind calmed and visibility dropped to about 1100 metres in most parts of the city. It was forecasted that a western disturbance (WD), currently moving across Jammu and Kashmir, may bring fresh moisture and help in intensifying the smog.

Assessment showed that air pollution levels have gone up in Delhi because of biomass burning in Punjab in October 2014. It stands to reason as Patiala has been recording very high PM_{2.5} and PM₁₀ levels. The winds blowing towards Delhi from the northwest are passing by the area where a lot of agricultural waste is being burned. PM 2.5 (fine, respirable particles) was 189 micrograms per cubic metre, three times more than the safe level of 60. PM 10 (coarse pollution particles) was about 320 microgram per cubic metre as against a safe level of 100 microgram per cubic metre. Experts say biomass burning is only adding to the already high local emissions.



Images released by National Aeronautics and Space Administration (NASA) from its Moderate Resolution Imaging Spectroradiometer (MODIS)'s aqua satellite shows low visibility and smog forming a channel from north-northwest region, fed by smoke coming from Punjab and Haryana where farmers are currently burning leftover stubbles from the paddy crop.

Effects: The combination of pollution from neighbouring states and local emissions is already taking its toll. Every year after Diwali (Oct-Nov), complaints from people with asthma and bronchitis go up. Their aggravated condition is clearly linked to high air pollution which also leads to more hospitalization. Nasal and sinus problems also increase. Those who are healthy often experience with cough or throat problems.

EVENT: Extreme CO event during Unusual Monsoon Progression over Delhi, 2014

CATEGORY: Human induced aggravated by weather conditions

Delhi falls under monsoon-influenced humid subtropical semi-arid climate type, where the normal onset of summer monsoon brings in cleaner air and reduces the level of gaseous pollutants while the monsoon onset during 2013, registered a reversal with a dramatically high CO (Carbon monoxide) level compared to the past years. The air quality in the city worsened owing to a dramatic rise in carbon monoxide (CO) levels in some areas. Many parts of Delhi, including Dheerpur and Mathura Road, have almost double the limit of 1,700ppb. This is mainly because the winds blowing in Delhi are emerging from Bay of Bengal and sweeping through the Indo Gangetic plains, where CO levels are already very high because of the burning of firewood and emissions from the transport sector. CO takes much longer to dissipate and can stay in the atmosphere for almost a month. It can also travel great distances. Parts of southwest Delhi like IGI airport, Aya Nagar as well as Noida are less likely to be affected.

Ozone levels, which had gone up in the month of June, but were again within the safe range below 50ppb in most areas. Particulate pollution, levels of both PM2.5 (fine, respirable particles) and PM10 (coarse particles), also come down with the increase in humidity. But the CO level was building up with the advancing monsoon winds which were predicted to continue to rise for some more days.

Effect: Increased CO levels can lead to shortness of breath, weakness and impact oxygen delivery to organs. According to the US Environment Protection Agency, heart patients already

have a reduced capacity for pumping oxygenated blood to the heart, which can lead to myocardial ischemia, a condition often accompanied by chest pain (angina), when exercising or under stress. Short term CO exposure further affect their body's already compromised ability to provide extra oxygen for exercise or exertion. An eight hour standard is generally considered for CO levels.

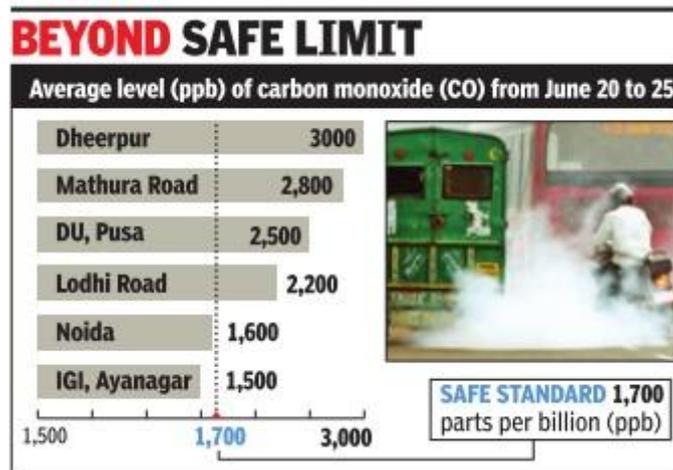


Figure shows the CO concentration from June 20 to 25, 2014

EVENT: Air pollution turning Charminar black 2013

CATEGORY: Human induced

The bad effects of pollution are prevailing all around the world. The increase in vehicles has given a wide upgradation to the air pollution. The 400-year-old Charminar, the most recognizable symbol of Hyderabad -and other ancient monuments within the 300 metre



heritage zone in the area are turning black due to pollution and their plasters are peeling off due to constant vibrations caused by passing vehicles, opinions expressed by conservation architects and environmentalists.

Over the past five years, the Charminar precincts, home to several ancient structures like Mecca Masjid, Jama Masjid, Char Kaman (the four arches) and the Badeshahi Ashoorkhana, have recorded the highest pollution figures.

Cause: The major damage to the monument was on account of vibrations caused by relentless movement of vehicles around it. Heavy traffic movement, particularly the fleet of RTC buses, which make about 2,000 trips touching the monument, has been a cause of concern. Recently, some of the buses have been diverted in the downward direction as part of the Charminar Pedestrianisation Project. Construction activity within 100 metres of the Charminar, is also posing a big threat to the structure's stability.

Charminar was in most polluted area the TSPM recorded in 2010 was 267.5 and in 2012 it was 287. Some of the other oldest structures like Jama Masjid, Mecca Masjid and Badeshahi Ashoorkhana are all affected by dust particulates. Architects notice that high levels of the TSPM are the biggest threat to monuments.

According to the experts the measurable total particulate suspended matter (TSPM), respirable suspended particulate matter (RSPM) and oxides of sulphur and nitrogen are all

posing huge threats to the ancient structures. The dust forms a layer after accumulating over a period of time. This is causing blackening of the surface. The organic matter that settles on the structure along with the dust leads to moth formation when it rains. Architects say high levels of the TSPM are the biggest threat to structures, particularly monuments.

Effects: The formation of the layer happens much faster on structures with a rough surface. Mecca Masjid, compared to the structure with smooth and plastered surface like Charminar. It has also been identified that it may take about eight to twelve month for a layer of 1 mm to form over the surface of Charminar, but it happens faster on structures like Mecca Masjid where the rugged stone is exposed. Charminar is the most famous icon of Hyderabad, now it has been suffering from deadly effect of air pollution. It was identified that the minarets of the monuments have developed air cracks at some places. Moss and Lichen growth has been identified on the walls facing the mosque on the second floor and it was also noticed on the steps leading to the upper portions. It was decided by Archaeological Survey of India (ASI) to take up repair activities at a cost of Rs 10 lacks. According to the available sources it was believed that the air cracks formed might be the result of climatic change. The heavy rains that lashed the city recently were believed to form precipitated matters on the surface of the structure. The seepage of rain water and the dampness have also shown their impact on air cracks.

Conservationists blamed the government for failing to protect the Charminar precincts, a key requisite for acquiring UNESCO's world heritage status. They have urged the government to immediately implement the long-pending pedestrianization project, which involves traffic management and development of environs to conserve the heritage identity of the precinct. The archaeology department and the GHMC are solely responsible for the bad state of monuments and their failure to educate the government on the importance of taking immediate steps to protect the structures.

EVENT: Poisonous event in Delhi Oct- Nov, 2012

CATEGORY: Human induced

Megacities are the engines of growing economy where local emissions are steadily leading to a significant rise in air pollution. However, it is for the first time in recent history that Delhi, the capital of India, experienced a unique extreme pollution event where level of fine particulate matters rich in organic carbon concentration crossed from moderate to dangerous unhealthy level within overnight without any additional local emission source and lasted for prolonged 12 days. It prompted about half a million additional hospital visits and admissions with respiratory ailments and increased mortality rate treating environment sustainability and ecosystem. An interpretation to this extreme event was provided by the SAFAR (System of Air Quality Forecasting And Research) monitoring and modelling network established by India and piloted by WMO. It is triggered by unusual synoptic weather conditions which pumped huge amount of biomass plume of north Indian crop burning. What followed was a vortex like fringe formation within which a stratified stationary condition prevailed with extremely low boundary layer prevented dispersion.

Delhi is industrialized and urbanized megacity of India which is about 1100km away from the nearest coast of Arabian Sea and surrounded by the Thar Desert of Rajasthan in its west and plains of central India in its south. It has a semiarid climate with extremely hot summer and very cold weather during the winters. The city is known for its high levels of air pollution and hazy skies during the winter. Wind speeds are typically higher in the summer and monsoon periods, and generally calm in the winter season. Delhi usually experiences surface inversions

and heavy fog events during the winter season. This leads to restriction of dilution of the emissions from specifically motor vehicles and episodic events in Delhi. In December, reduced visibility leads to disruption of road, air and rail traffic.

There is no doubt that the composition of the atmosphere is changing because of human activities, and today particulate pollution by both natural and anthropogenic activities become very serious issue to increased problems like premature deaths, respiratory diseases, and heart attacks. Results showed that apart from local emissions, non-local emissions (either natural or anthropogenic) also played a key role in degradation of air quality in 2012 over Delhi. There are varying sources of emission for particulate pollutants in the winter months, due to an increase in the bio-mass burning for heating purposes which explains higher peaks of PM10 at residential sites at Delhi in winter. Measured values along with satellite imagery revealed that the transport of anthropogenic fine particulate pollutants originating from a distant biomass burning source, rich in organic carbon contributed to solar dimming which along with post westerly disturbance cooling (by 4-5°C) and unusual wind trajectory, forced an vortex like fringe formation over Delhi. Injected and trapped pollutants levels of PM10 and PM2.5 has touched 800 µg/m³ and 500 µg/m³ respectively, which are more than double the level assigned for emergency or critical category and highly unexpected under normal conditions. The vortex like fringe broken on 14th day with the return of sunlight and change in wind direction which rapidly dispersed the pollutants within overnight and made an end to event and brought back normal winter pollution days. The level of particulate pollution during Diwali has touched all time high during the past 2 years. The highest particulate pollution (PM2.5) 682 µg/m³ is observed at Pusa and Noida on 13th November which is just 90% increase from the already elevated background level of 11th November. But this level is more than 2.5 times higher than the “critical” (or very unhealthy level of 253 µg/m³).

Back trajectory analysis indicates that suddenly the wind direction has changed and clouds of pollutants emerging from seasonal crop residue burning from neighbouring Punjab and Haryana states started to envelop Delhi. Thereafter, winds have become significantly calm and with a perfect condition of cold temperature and high humidity, boundary layer has come down and vortex (envelop) is formed where pollutants got trapped (or arrested) which has elevated the pollution. Both natural and anthropogenic activities are deteriorating air quality over megacity Delhi in 2012. The main sources, contributing to the deterioration of air quality in New Delhi, are motor vehicle traffic, domestic fuel burning, industrial sources and power plants. The major source of aerosol particles in Indian mega cities is transportation.

EVENT: Acid Rain in Pune & Nagpur, September 2007

CATEGORY: Human induced

Analysis of rainwater quality over the decade in Nagpur and Pune by the Indian Meteorological Department (IMD) shows a disturbing rise in levels of acid in rainwater.

Analysis of rainwater quality over the decade in Nagpur and Pune by the IMD shows a disturbing rise in levels of acid in rainwater. A study shows a substantial rise in sulphate and nitrate concentration in rainwater in almost all parts of the country. Environmentalists warn that the trend, if not checked, may pose a grave risk to public health.

The IMD has a network of 10 stations across the country to collect and analyse rainwater samples. For the past 26 years, the centres have been monitoring and documenting long-term changes in the chemical composition of rainwater, as part of a world-wide survey under the aegis of the World Meteorological Organisation (WMO).

Analysis of the samples reveals the mean sulphate concentration in rainwater at Pune rose from 0.94 mg/l in 1986-95 to 1.62 mg/l in 1996-2005, while nitrate levels went up from 2.43 mg/l to 3.04 mg/l. In Nagpur, for the same timeframe, sulphate concentration saw a sharp increase from 1.06 mg/l to 3.48 mg/l, while nitrate levels went up marginally from 4.67 mg/l to 4.73 mg/l. The study attributes this increase to rapid industrialisation and urbanisation in and around the two cities. Though Nagpur recorded a slight recovery in 2007, rainwater samples from Pune largely remained in the 'safe range'.

In 2006, only 5 of the 88 samples collected in Pune were found acidic, but all the monthly samples in Nagpur the same year were acidic. Pune has not recorded any acid rain in 2007 so far. However, at Nagpur, rainwater samples for the months of March, May and June were found acidic.

Scientists at the National Environmental Engineering Research Institute (NEERI), Nagpur, warn that the low pH levels (acidity) in rainwater may affect human health, vegetation, forests and aquatic life adversely. Research has shown a rise in the frequency of chest colds, cough and allergies. High acid content in rainwater may pollute ground water, impacting farm yield and quality of produce.

Compared to the worldwide figures, India is better off than other countries as far as acid rain is concerned. Actions like introduction of regulations regarding ultra-low sulphur emission norms for vehicles and automobiles, which have been extended to cover the whole country, will considerably arrest the identified acidification trend.

EVENT: Bhopal Gas Tragedy 1984

CATEGORY: Human induced

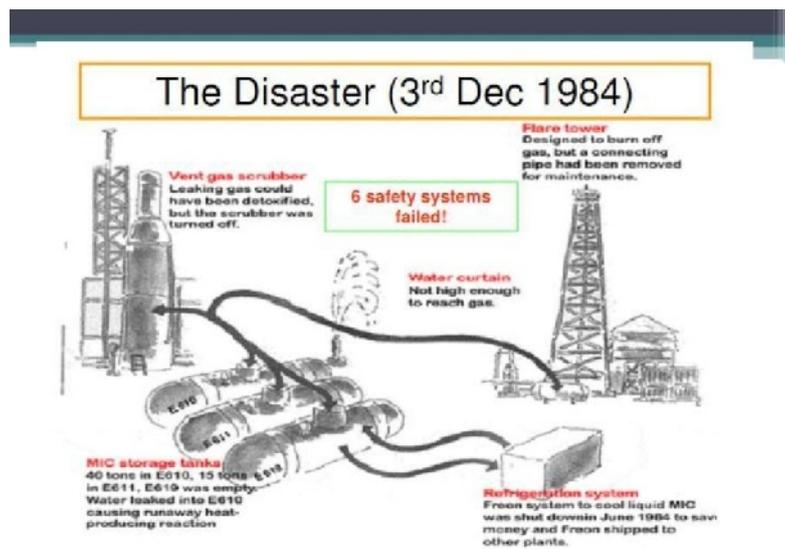
The Bhopal Gas Tragedy, 1984 was a catastrophe that had no parallel in the world's industrial history. In the early morning hours of December 3, 1984, a rolling wind carried a poisonous gray cloud from the Union Carbide Plant in Bhopal, Madhya Pradesh (India). Forty tons of toxic gas (Methy-Iso-Cyanate, MIC) was accidentally released from Union Carbide's Bhopal plant, which leaked and spread throughout the city. The result was a nightmare that still has no end, residents awoke to clouds of suffocating gas and began running desperately through the dark streets, victims arrived at hospitals; breathless and blind. The lungs, brain, eyes, muscles as well as gastro-intestinal, neurological, reproductive and immune systems of those who survived were severely affected. When the sun rose the next morning, the magnitude of devastation was clear. About 5,00,000 more people suffered agonizing injuries with disastrous effects of the massive poisoning.

Cause: The Union Carbide India Limited (UCIL) pesticide plant in Bhopal, India. A leak of methyl isocyanate gas and other chemicals from the plant resulted in the exposure of hundreds of thousands of people. The UCIL factory was built in 1969 to produce the pesticide Sevin (UCC's brand name for carbaryl) using methyl isocyanate (MIC) as an intermediate. An MIC production plant was added in 1979.

Incident: During the night of December 2-3, 1984, water entered a tank containing 42 tons of MIC. The resulting exothermic reaction increased the temperature inside the tank to over 200 °C (392 °F) and raised the pressure. The tank vented releasing toxic gases into the atmosphere. The gases were blown by north-westerly winds over Bhopal. The problem was made worse by the mushrooming of slums in the vicinity of the plant, non-existent catastrophe plans, and shortcomings in health care and socio-economic rehabilitation.

The composition of the gas, as per Union Carbide report, was 26,000 pounds of reaction products along with 54,000 pounds of un-reacted MIC got released into the atmosphere of

Bhopal that night. The mixture of gas contains more than two dozens of different types of chemicals and, that also included hydrogen Cyanide.



Factors leading to the magnitude of the gas leak include:

- Storing MIC (methyl isocyanate) in large tanks and filling beyond recommended levels
- Poor maintenance after the plant ceased MIC production at the end of 1984
- Failure of several safety systems (due to poor maintenance)
- Safety systems being switched off to save money—including the MIC tank refrigeration system which could have mitigated the disaster severity



Effects: Estimates vary on the death toll. The official immediate death toll was 2,259 and the government of Madhya Pradesh confirmed a total of 3,787 deaths related to the gas release. Others estimate 3,000-8000 {Greenpeace} died within weeks and another 8,000-20,000 {Greenpeace} have since died from gas-related diseases. According to the Indian Council for Medical Research, 25,000 people have died from exposure since the initial explosion. But this is not some quarter-century-old tragedy to shake one's head over and move on. It's estimated that 10 to 30 people continue to die from exposure every month. A government affidavit in 2006 stated the leak caused 558,125 injuries including 38,478 temporary partial and approximately 3,900 severely and permanently disabling injuries.

Battle: Union Carbide negotiated a settlement with the Indian Government in 1989 for \$470 million – a total of only \$370 to \$533 per victim – a sum too small to pay for most medical bills. In 1987, a Bhopal District Court charged Union Carbide officials, including then CEO.

Union Carbide was bought by Dow Chemical (the company that made napalm for the U.S. to use in the Vietnam War) in 2001, and Dow claims the legal case was resolved in 1989, with responsibility for continued cleanup now falling to the local state government.

In June 2010, seven ex-employees, including the former UCIL chairman, were convicted in Bhopal of causing death by negligence and sentenced to two years imprisonment and a fine of about \$2,000 each, the maximum punishment allowed by law. An eighth former employee was also convicted, but died before judgment was passed.

EVENT: Acid Rain effects on Taj Mahal since 1970s

CATEGORY: Human induced

The Taj Mahal, one of the Seven Wonders of the World, and India's pride, greatest land mark is also being threatened from air and water pollution. Agra, where the Taj Mahal stands, has been polluted heavily by industries and traffic over the past decades. Illegal factories are springing up around the Taj Mahal and uncontrolled construction around the monument seems to be endless. The air in this place contains serious levels of sulphur and nitrogen oxides. This polluted air at the end leads to acid rain. Acid rain has reacted with the marble (calcium carbonate) of Taj Mahal. This caused damage to this wonderful structure, which had attracted many people from different parts of the world. Taj is changing colour due to deposition of dust and carbon-containing particles emitted in the burning of fossil fuels, biomass and garbage.

The white marble domes of the Taj Mahal are iconic images of India that attract millions of visitors every year. Over the past several decades the outer marble surfaces of the Taj Mahal have begun to discolour with time and must be painstakingly cleaned every several years. Although it has been generally believed that the discoloration is in some way linked with poor air quality in the Agra region, the specific components of air pollution responsible have yet to be identified.



Cause: The Mathura Refinery, owned by Indian Oil Corporation, is located in Mathura, Uttar Pradesh. The refinery processes low sulphur crude from Bombay High, imported low sulphur crude from Nigeria, and high sulphur crude from the Middle East. The refinery was in the news for allegedly causing the white marble of the Taj Mahal to yellow. It is located about 50 kilometres away from the Taj Mahal. It was found that the air has high levels of suspended particulate matter, caused by factory emissions, dust, construction, and exhaust from automobiles. These are causing the Taj Mahal to change colour. The other reasons are the carbon particles which come from a variety of sources, including fuel combustion, cooking and brick-making, trash and refuse burning and vehicle exhaust or from distant sources. The sources could be local and the government has already taken steps to reduce vehicle and industrial emissions in the area.

Many experts declared that the measurable Total Particulate Suspended Matter (TSPM), Respirable Suspended Particulate Matter (RSPM) and Oxides of sulphur and nitrogen are all posing huge threats to the ancient monumental structures.

Effects: Beginning in the 1970s, observers noted a brownish cast to the white marble that makes up the structures. Black carbon gives a greyish colour to the surface while the presence of brown carbon and dust results in yellowish-brown hues. The pollution has been turning the

Taj Mahal yellow. In 2010, cracks appeared in parts of the tomb, and the minarets which surround the monument were showing signs of tilting, as the wooden foundation of the tomb may be rotting due to lack of water. In 2011 it was reported that some predictions indicated that the tomb could collapse within 5 years.

Measures: At the end of the last century the government realized the growing problem and started a program to save the monument's shiny white marble facade because it was turning yellow. Over \$150 million were spent on restoration but it did not help much. Corrosion has continued and acid rain has also caused a change in the color of the facade. Some years ago restoration experts started putting mud packs around the facade to bring back the building's shiny white color.

The government of India is constantly enacting laws to prevent the factories from causing pollution in to the atmosphere which would directly cause adverse change to Taj Mahal. To help control the pollution, the Indian government has set up the Taj Trapezium Zone (TTZ), a 10,400-square-kilometre (4,000 sq mi) area around the monument where strict emissions standards are in place. A series of serious banning measures have been taken including avoiding running of vehicles 500 meters away from the structure and sophisticated devices are arranged to provide running count of air pollution. To cut back on pollution, cars and buses are not permitted to drive to the Taj Mahal but must be parked at a lot about 2km away, where visitors can take battery-run buses or horse-drawn carriages. Factories and industries around Agra should be persuaded to change to cleaner forms of energy.

EVENT: Acid rain in India Overview

CATEGORY: Human Induced

Urban air pollution is probably the most well-known problem created by rapid industrialisation. Air pollution around major factories, thermal power plants, open mines and quarries has attracted a lot of attention. Rain over India is much less acidic than most of the other countries in Asia, Europe and North America. However, it has become more and more acidic over the last few decades.

The pH of rain in India ranges from 5.9 to 8.4, and the average is about 6.7. India seems to be much better off than the USA (4.15–6.19), Canada (4.23–5.96), Germany (4.05–4.25), Norway (4.10–4.40), and most other countries. However, there are places in India where things are not so good. Parts of south Bihar and West Bengal are likely to be the worst affected, along with the southernmost tip of the Indian peninsula. Occasional rains with a pH of 4.8 have been reported from Chembur in Mumbai and a pH of 4.5 from Delhi. The more worrying trend is the gradual acidification of the rain in India over the last couple of decades – the pH has decreased from 7.0 to 6.1 in Delhi, and from 9.1 to 6.3 in Agra.

Causes and impacts: Thermal power plants in India, which generally use coal with relatively high sulphur content (0.5 per cent to three per cent), are the major source of oxides of sulphur – they release about 2,500 tons per year. Oxides of nitrogen are produced during high-temperature combustion. The greatest source of nitrogen oxides is road vehicles.

India has been rather lucky to have predominantly alkaline-rich soils. For example, in the Thar Desert in the northwest of India, the aerosols from coastal areas help reduce the acidity to a considerable extent. Higher temperatures prevalent in India also contribute towards transforming the oxides of sulphur to sulphates and oxides of nitrogen to nitrates. India also does not have natural sources of sulphur emission like volcanoes. These factors have kept the acid rain in check so far. However, the emissions from the increasing number of power plants,

industries, fossil-fuel burning and vehicles have gradually begun to overcome the natural checks. In 1990, none of the ecosystems in India was threatened by acid rain. However, if steps are not taken to control emissions, by the year 2020 about 85 per cent of the ecosystems will be threatened by acid rain.

Possible solutions: India's solutions are similar to that of many other countries: the use of cleaner fuels, a gradual switching to renewable energy and the use of catalytic converters.

SMOG

CATEGORY: Manmade Aggravated By Natural Conditions

Smog an alarming kind of air pollution, originally named for the mixture of smoke and fog in the air. Smog is a visible example of air pollution.

Classic smog results from large amounts of fossil fuels burning in an area and is caused by a mixture of smoke and sulfur dioxide. Smog usually is produced through a complex set of photochemical reactions involving volatile organic compounds (VOC's) and nitrogen oxides in the presence of sunlight that result in the production of ozone. What we typically call "smog" today is a mixture of pollutants but is primarily made up of ground-level ozone. In the 1950s a new type of smog, known as Photochemical Smog, was first described. Smog-forming pollutants come from many sources, such as automobile exhausts, power plants, factories, and many consumer products, including paints, hair spray, charcoal starter fluid, solvents, and even plastic popcorn packaging. In typical urban areas, at least half of the smog precursors come from cars, buses, trucks, and boats.

Major smog occurrences often are linked to heavy motor vehicle traffic, high temperatures, sunshine, and calm winds. Weather and geography affect the location and severity of smog. Because temperature regulates the length of time it takes for smog to form, smog can form faster and be more severe on a hot and sunny day. When temperature inversions occur (warm air stays near the ground instead of rising) and winds are calm, smog may stay trapped over your city for days. As traffic and other sources add more pollutants to the air, the smog gets worse. Smog is often more severe away from the pollution sources because the chemical reactions that cause smog occur in the atmosphere while the reacting chemicals are being moved by the wind.

Smog is a problem in a number of cities and continues to harm human health. Smog is made up of a combination of air pollutants that can injure health, harm the environment, and cause property damage. Ground-level ozone, sulfur dioxide, nitrogen dioxide carbon monoxide are especially harmful for senior citizens, children, and people with heart and lung conditions such as emphysema, bronchitis, and asthma. It can inflame breathing passages, decreasing the lungs' working capacity, and causing shortness of breath, pain when inhaling deeply, wheezing, and coughing. It can cause eye and nose irritation and it dries out the protective membranes of the nose and throat and interferes with the body's ability to fight infection, increasing susceptibility to illness. Hospital admissions and respiratory deaths often increase during periods when ozone levels are high.

Strategies that may be required by law to reduce and control air emissions include state permitting programs, changes in the composition of gasoline, use of alternative fuels (such as natural gas and electricity), and use restrictions imposed by individual communities. Innovative approaches are being taken by local governments across the country to reduce air pollution in nonattainment areas. These include: banning charcoal barbecues and wood burning in stoves or fireplaces when pollution levels are high; developing programs to encourage carpooling and voluntary "ozone actions"; restricting traffic in congested areas; expanding or improving public transportation systems; requiring employers to contribute to employee mass transit costs; assessing "smog fees" on cars in proportion to the number of miles driven and vehicle emissions produced; and even buying and scrapping older, "super-dirty" cars.

EVENT: Mumbai under Fog Cover. Weather, Not Pollution, Says Met Office. For A Second Day, Mumbai under A Thick Blanket of Smog, January 2016

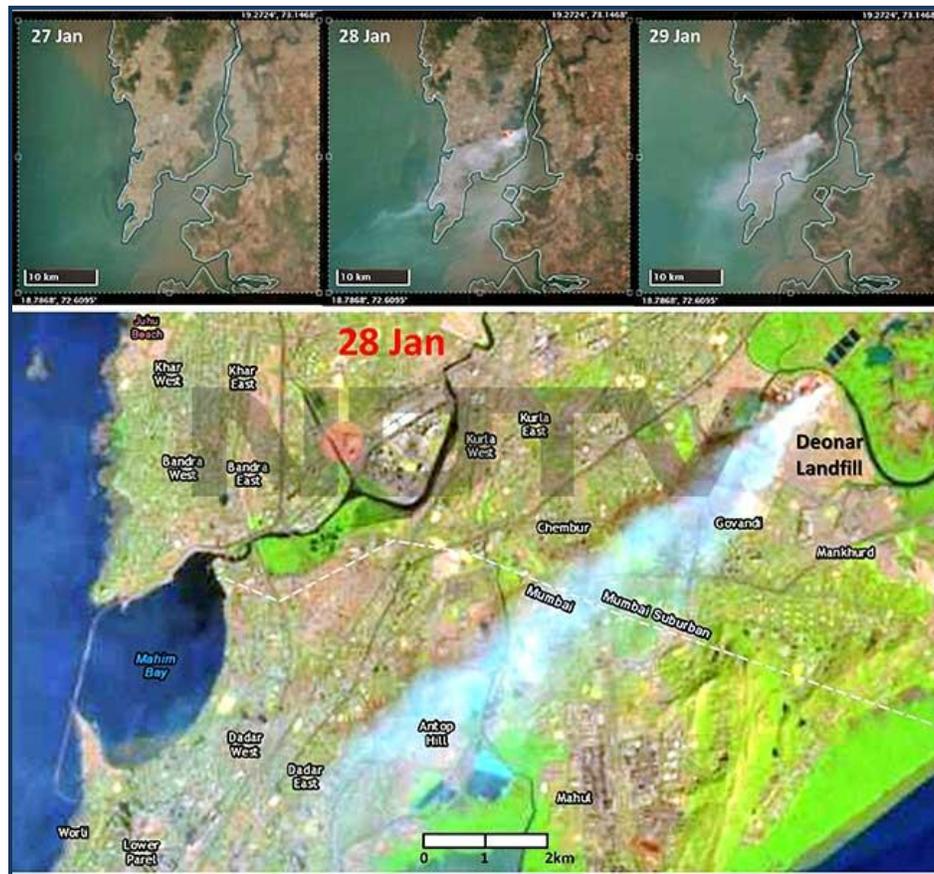
CATEGORY: Manmade Aggravated By Natural Conditions



A met official said while there was an increase in fog, pollution levels HAS not necessarily increased. The air quality in Mumbai will continue to remain between 'poor' and 'very poor' in the coming days, the weather bureau sources said

MUMBAI: An unusually dense cover of smog had enveloped large parts of Mumbai on Thursday morning January 28th 2016, the met department said. The sudden spike in fog was a result of cold and warm winds meeting, officials explained. "Minimum temperatures have been lower than normal in Mumbai. Westerly winds from the Arabian Sea which are warmer and bring in moisture have mixed with colder winds, which have created the fog," said Ajay Kumar, a senior official at the meteorological department in Mumbai. Mr Kumar, however, said while there was an increase in fog, pollution levels have not necessarily increased. "This is more of a meteorological phenomenon. And with existing pollution levels, the end result is smog," he said. A thick blanket of smog due to various factors including drop in minimum temperature to 14 degree Celsius, fire incidents at Deonar dumping ground and high levels of particulate pollutants in the city. Fire incidents at Deonar dumping ground caused heavy smoke, which soon spread across the eastern suburbs, causing breathing difficulties, weather bureau sources said. The maximum temperature recorded on 29th January 2016 at Santacruz was 28.8 degree Celsius, while the minimum was 14 degree Celsius. The maximum temperature recorded at Colaba was 26.6 degree Celsius and the minimum 18.5 degree Celsius. The reason for the hazy blanket was the high levels of particulate matter 2.5 as these tiny particles in the air are known for reducing visibility.

NASA Satellites Capture the Worrying Mumbai Smog



The images from NASA show a thick plume of smoke engulfing a large swathe of Mumbai.

The smoke from the fire at Mumbai's dumping ground has entirely swallowed South Mumbai and the eastern suburbs, adding to the smog that's affecting the financial capital for the third consecutive day. Images taken by NASA's satellites from January 27 to 29 clearly show how a plume of smoke from the fire at the Deonar dumping ground at the eastern fringe of Mumbai, had not only covered the entire Island city but had spread deeper into the Arabian Sea and has also affected the coastal areas of Maharashtra in Raigad district. "The images were taken at 1:30 pm on all three days and it clearly shows how on January 27 the skies are clear. Then on January 28 the fire starts and the smoke has blanketed much of Mumbai. And by the next day it has spread further into the sea," explained Dr Ritesh Gautam, Assistant Professor at the Centre of Studies in Resources Engineering at the Indian Institute of Technology (IIT) Bombay, who collated relevant data and images. From the images it can also be inferred that the wind is blowing from the North-East and pushing the smoke in the South-West direction. That is why the western and northern suburbs have been spared. Around 70 government schools have been shut on those two days around the Shivaji Nagar and Deonar areas because of the smog and smoke. Residents at Deonar were the worst affected with reports coming in of the old and infirm being hospitalised. "Trash burning in the dumping grounds is one of the major factors in causing poor air quality, and affecting respiratory health of people. Clearly, these practices should be strongly discouraged by the government", advised Dr Gautam

EVENT: Fire In Mumbai's Deonar: Area Under Thick Smog, Schools Remain Shut, February 2016

CATEGORY: Manmade Aggravated By Natural Conditions

Government schools in central Mumbai's Shivaji Nagar and Deonar remained closed for the fourth consecutive day due to thick smog caused by a fire at Deonar garbage dumping ground last week of January 2016. Parts of Mumbai were engulfed in a thick blanket of smog due to a huge fire at the Deonar garbage dumping ground on the city's eastern fringe, compounded by factors including a drop in temperature and vehicular pollution. Number of people falling ill due to the smoke has increased as fire continues to simmer at the dumping ground. At least 14 fire engines, eight water tankers were working round the clock to douse the fire. Air quality in Mumbai would continue to remain between 'poor' and 'very poor' in the coming days, weather officials had said. The financial capital found itself among the top 10 most polluted cities in the country. Taking stock of the situation the Brihanmumbai Municipal Corporation or BMC had shut down the schools. Satellite images showed a plume of smoke from the fire at the Deonar dumping ground on the eastern fringe of Mumbai, has not only covering the entire Island city but has spread deeper into the Arabian Sea and also affected the coastal areas of Maharashtra in Raigad district. Experts have blamed a lack of solid waste management policy and crammed dumping yards Mumbai Municipal Corporation's for the fire in Deonar. Deonar is one of the biggest dumping grounds in Mumbai and the amount of garbage has been increasing since years.

EVENT: Smog Chokes Delhi, Leaving Residents with Respiratory Problems, November 2016

CATEGORY: Manmade Aggravated By Natural Conditions

'Cowering by Our Air Purifiers' Levels of the most dangerous particles soared over the 1st weekend of November 2016 in some places to more than 16 times the limit India's government considers safe. Open a window or a door, and the haze enters the room within seconds. Outside, the sky is white, the sun a white circle so pale that you can barely make it out. The smog is acrid, eye-stinging and throat-burning, and so thick that it is being blamed for a 70-vehicle pileup north of the city. If in past years Delhi's roughly 20 million residents shrugged off wintertime pollution as fog, in November they viewed it as a crisis. Schools were ordered closed for three days — an unprecedented measure, but not a reassuring one because experts say the concentration of pollutants inside Indian homes is typically not much lower than outside. Levels of the most dangerous particles, called PM 2.5, reached 700 micrograms per cubic meter, and they soared in some places to 1,000, or more than 16 times the limit India's government considers safe. The damage from sustained exposure to such high concentrations of PM 2.5 is equivalent to smoking more than two packs of cigarettes a day, experts say.



A family rode a scooter during heavy smog and dust in Delhi on Sunday

“There is so much smog outside that today, inside my house, I felt as though someone had just burned a few sheets of paper,” said Amaan Ahuja, one of dozens who shared their families’ experiences in response to a request from The New York Times. “You can literally see smoke in the air, and when you breathe, you can smell it, too,” he said. “We are trying to keep the kids indoors with all the windows closed.”

Another reader, Tulika Seth, described her family’s life over the past week as “unnatural and disturbing.” Asked where she lived, she responded, “a gas chamber.”

In that case, a layer of dense pollution — caused largely by emissions from burning coal — dissipated after four days, when the weather changed. But an uptick in deaths continued for weeks afterward, so shocking the public that it spurred a wave of environmental regulations.



Runners struggled through a 10-kilometer race on a November Sunday. A game of cricket amid heavy smog on Sunday

Among the persistent problems for policy makers is that the sources of the pollution — vehicles, construction, [crop burning](#) and holiday fireworks — fall under the authority of half a dozen city, state and federal government bodies, which are in some cases at odds with one another politically, Mr. Krishna said.



A blanket of smog hung over observations of the Chhath Festival on Sunday as a Hindu devotee offered prayers in a pond.

Great smog of Delhi

Smog was visible at 10:00 AM from Gurgaon, Haryana. The same level of air pollution and smog is visible in this early week of Nov 2016 in New Delhi, India and adjoining areas

Date: 1–9 November 2016

Location: Delhi, India

The Great Smog of Delhi is marked as one of the worst visualization of how bad air quality had become in New Delhi and adjoining areas in the National Capital Territory of India, between 1 to 9 November 2016. Air Pollution at this time peaked on both PM 2.5 and PM 10 levels. This is reported as one of the worst levels of Air Quality in Delhi since 1999. The current majority of analysis sources hinted towards colder weather, stagnant winds trapping the various sources of smoke. Primary sources of smoke being those from the burning of crop stubbles, lit garbage and road dust. This period also coincided with the Indian festival Diwali, which is celebrated by firing firecrackers. Air quality can be measured by the amount of PM 2.5 and PM 10 particulates suspended in air. During the reported Smog in Delhi. On Nov 7th, 2016 the PM 2.5 levels shot up to 999, while recommended is 60 micrograms. At the same time PM 10 shot to 999, instead of the recommended limit of 100. Visibility had reduced to about 200 meters around Nov 7th, 2016. The temperature in New Delhi in this period was between 19 to 21 degree c (~66 degree f). The Chief Minister of Delhi at that time, Arvind Kejriwal came out with the below proposed action items to attempt reduce the air pollution

1. All Delhi schools will remain shut for the next 3 days.
2. For the next 5 days, no construction and demolition work will take place in Delhi.
3. All diesel generator sets have been banned for the next 10 days, except at hospitals and in emergencies.
4. The Delhi government will supply power to unauthorized colonies which use diesel generators.
5. The coal-based Badarpur power plant will be shut down for 10 days. There will be no fly ash transportation from the power plant.
6. The Environment department will launch an app to monitor the burning of leaves.
7. Vacuum cleaning of roads will start from November 10.
8. Water sprinkling will start on all roads from tomorrow.
9. People should stay at home as much as they can and they should try working from home.
10. If need be, the odd-even traffic scheme+ will be brought back for a short while.

It has been under public debate how much, if any, of the above steps actually helped curtail the pollution. Various bodies blamed various sources for the cause of the smog.

Longer term measures

On November 25, 2016, the Supreme Court of India banned the sale of firecrackers in Delhi to alleviate pollution. In another measure, the Badarpur power plant will remain shut at least until January 31, 2017. This power plant is very old and polluting, and even before the Great Smog, environmentalists had advocated for its permanent shutdown. NASA reveals why New Delhi is blanketed with deadly smog. The festival Diwali may have contributed to severe air pollution in India's capital New Delhi, but a far more worrisome practice in the country could be its major cause. Until now, many were pointing to bursting of crackers (a norm during Diwali) as the main cause of the severe air pollution, but images published by NASA suggest that burning of crops in the neighboring states of Punjab and Haryana could be the biggest reason why the air quality in the world's most polluted city refuses to clear.

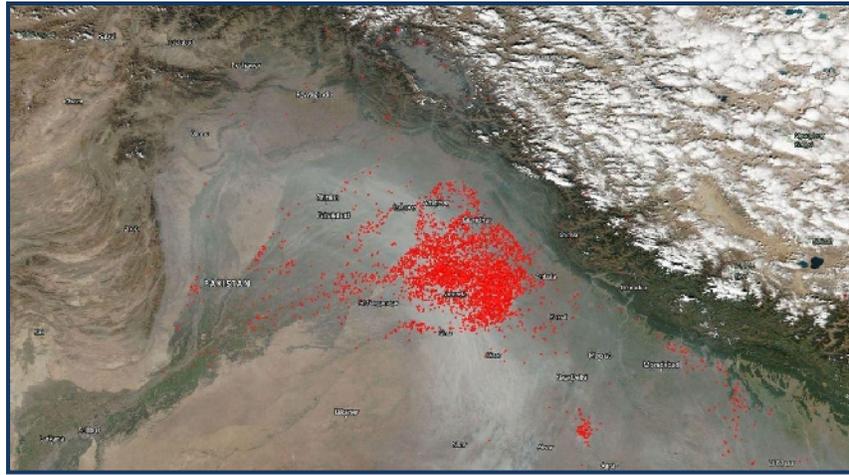


IMAGE: NASA

This is an age old practice, and though the government has suggested alternative methods and support (such as using seeders that don't required crop burning and subsidizing half of the cost of these equipment), farmers still find them unfeasible.



IMAGE: CLONEWDELHI

At the time of writing, the air quality in the capital city read 943 AQI PM2.5, more than 15 times the healthy limit set by the Indian government. PM2.5 describes tiny particles suspended in the air with diametre of 2.5 micrometres or less. These particles can lodge into the lungs and cause respiratory diseases. Amid all of this, the day to day life of people in the national capital is severely impacted by the air quality, with an increasing number of people visiting hospitals for breathing issues. Thousands of people in Delhi are signing petitions to urge the government to take immediate steps to curb the air pollution.



EVENT: Delhi Witnesses High Pollution Levels As Thick Blanket Of Fog Covers City, December 2016

CATEGORY: Manmade Aggravated By Natural Conditions



Air quality was in the 'severe' category in Punjabi Bagh, Anand Vihar, Mandir Marg, and Shadipur

High pollution levels persisted in Delhi in 1st week of December as a thick blanket of fog enveloped the city and respirable particulates, trapped by moisture, hung low in the absence of strong wind movement. The Central Pollution Control Board's (CPCB) air quality index (24-hour average) was in the 'severe' category with a reading of 403, which may affect healthy people and seriously impact those with existing respiratory ailments. Five out of the nine monitoring centres of CPCB - DTU, Punjabi Bagh, Anand Vihar, Mandir Marg, and Shadipur - recorded air quality as severe.

The Palam weather office recorded visibility at zero metre at 8.30 AM. At Safdarjung observatory, it was marginally better at 150 metre. The 24-hour-average (rolling) of PM 2.5 and PM 10, ultrafine particulates, were 188 and 350 micrograms per cubic metre respectively, violating the prescribed standards of 60 and 100 respectively by multiple times. "PM 2.5 levels are 3-5 times higher than prescribed standards. Levels are going up with meteorological adversity in the absence of stringent emission control measures," TERI expert Sumit Sharma said. Mr Sharma said the city government's plan to install air purifiers in major traffic intersections will only have a "limited impact" on air quality in a very small area around the equipments. According to experts, adverse conditions (like very low wind speed) do not allow pollutants to disperse due to which high pollution concentrations develop subsequently.

Dust Storms

CATEGORY: NATURAL

A most common meteorological phenomenon in arid and semi-arid regions is a dust storm. Also known as sandstorm (in case of larger sand particles), it arises when a gust front or other strong wind blows loose sand and dirt from a dry surface. Particles are transported by saltation and suspension, a process that moves soil from one place and deposits it in another.

Dust storms can carry large amounts of dust, with the leading edge being composed of a wall of thick dust as much as 1.6 km (0.99 mi) high. Dust storms have also been shown to increase the spread of disease across the globe. Virus spores in the ground are blown into the atmosphere by the storms with the minute particles and interact with urban air pollution. Health Effects are more on lungs (causing silicosis, asthma) and eyes (kerato-conjunctivitis sicca "dry eyes")

Dust storms cause soil loss from the dry lands, and worse, they preferentially remove organic matter and the nutrient-rich lightest particles, thereby reducing agricultural productivity. Dust storms also reduced visibility affecting aircraft and road transportation. In addition dust storms also create problems due to complications of breathing in dust.

EVENT: Large dust storm and strong winds sweep Delhi, India, March 2016

CATEGORY: NATURAL



A massive dust storm accompanied by strong winds lashed Delhi, India on March 12, 2016. According to media reports, the storm led to trees falling in some areas, power cuts and traffic disruption in several parts of west and south Delhi. The storm came after showers in the morning and was again followed by rain as well as hail, NDTV said. "The dust storm resulted in traffic snarls between 16:00 and 19:30 in many parts of west Delhi including Azadpur, Jahangirpuri and Punjabi Bagh. In south Delhi, the affected areas included Moti Nagar and Vasant Vihar. According to IMD, to dust storm was a result of western disturbances and such conditions are expected to last until Monday.

EVENT: Deadly dust storm plunges Kanpur into darkness, India, May 2016

CATEGORY: NATURAL



A massive dust storm followed by heavy rains that lasted for nearly two hours wreaked havoc in the industrial city of Kanpur, Uttar Pradesh, India on Monday, May 23, 2016, The Times of India reports. Across the state, the storm claimed at least five lives, uprooted trees, and caused heavy damage. The storm hit Kanpur at 21:30 (local time) and was followed by torrential rains and strong winds that brought vehicular traffic to a standstill. According to The Times of India, meshes used to uphold the roadside hoardings tore apart, and many fell on roads causing traffic snarls and blockages. Strong winds uprooted trees and tilted a number of electricity poles leading to power cuts in major parts of the city. It may take about 24 hours to fully restore the power, the report said. One person was killed in Kanpur rural due to an incident related to the dust storm. In other parts of the state, the dust storm claimed at least four more lives and caused heavy damage to mango crops, electric poles, and other infrastructure, Indo-Asian News Service reported. One man was killed in Meerut district when a hoarding ripped apart from the poles hit him. An infant was killed in Daboi Khurd village of Sambhal district when a wall collapsed on her. More incidents of wall collapse claimed a life each in Hardoi and Unnao districts. The overhead wire on the railway tracks near the Mathura oil refinery snapped leading to halting of trains for more than an hour. The news service added that railway traffic was also hit at many other places. The storm and subsequent torrential rains also hit Delhi, Punjab, Haryana and the plains of North India including North Rajasthan. According to Skymet Weather, more than 20 flights were diverted from the Delhi airport and many others were delayed in the wake of the dust storm, squally winds, and thundershowers. Their report said a signboard near the DLF Mall of India in Noida Sector 18 collapsed and fell on a car due to thunderstorm and killed one and injured two other. The maximum temperature in Hisar, Narnaul, Rohtak and Delhi had touched 40 °C (104 °F) in the afternoon hours. However, rain and thundershowers brought down temperatures significantly; from a high of 40.9 °C (105.6 °F) by 14:30 in Delhi, the temperature dropped to 27 °C (80.6 °F) around 17:30. This spell of rain could be attributed to a cyclonic circulation over North Rajasthan and adjoining Punjab, which has been induced by an active Western Disturbance over Jammu and Kashmir. A trough from this system is also extending up to Gangetic West Bengal, across Uttar Pradesh and Jharkhand. Moist easterly winds were reaching up to Haryana and Punjab, during the reign of cyclonic storm Roanu. After its

dissipation, the east-west trough increased moisture content over the plains of North India. The combined effect of these weather systems led to thundery cloud formation over many parts of North India, which brought good thundershowers at many places, Skymet explained.

Wildfires

CATEGORY: NATURAL

A wildfire also known as a wild land fire, forest fire, vegetation fire, grass fire, peat fire, bushfire, or hill fire is an uncontrolled fire often occurring in wild land areas, but which can also consume properties and other valuable resources. Common causes of wildfires include lightning, human carelessness, arson, volcano eruption, and pyroclastic cloud from active volcano. Heat waves, droughts, and cyclical climate changes such as El Niño can also have a dramatic effect on the risk of wildfires. Although, maximum wildfires are caused by people. Wildfires can occur anywhere, but are common in the forested areas and semi arid region. The climates are sufficiently moist to allow the growth of trees, but feature extended dry, hot periods. Fires are particularly prevalent in the summer and fall, and during droughts when fallen branches, leaves, and other material can dry out and become highly flammable. Wildfires are also common in grasslands and scrublands. The other major cause is Santa Ana winds which are hot, dry winds that aggravate the fire danger in forests and bush lands. These winds characteristically appear in Southern California and Northern Baja California weather during autumn and early winter. In southern California, under the influence of Santa Ana winds, wildfires can move at tremendous speeds, up to 40 miles in a single day, consuming up to 1,000 acres per hour. Dense clouds of burning embers push ahead of the flames crossing firebreaks without a problem.

EVENT: Uttarakhand forest fires, May 2016

CATEGORY: NATURAL



Forest fire in Almora district of Uttarakhand state

Location: Uttarakhand and Himachal Pradesh

Date: April – May 2016

Burned area: 4,048 hectares (10,000 acres)

Fatalities: 7 (as of 4 May 2016)

In 2016, forest fires were noted in numerous places across the Indian state of Uttarakhand. These fires, set mainly in pine forests in the slopes of the sub-Himalayan region, produced clouds of smoke. Widespread comments in the Indian news media led to the government taking action, deploying the National Disaster Response Force and making use of Indian Air Force Mi-17 helicopters fitted with "Bambi buckets" to douse the fires with water. The forest department estimated that 3,500 hectares (8,600 acres) of forest had been burnt. Nearly 1,600 incidents of fires were detected which were brought under control by 2 May. The rains on 3 May helped to reduce the impact of the fires. Fires destroy biodiversity directly and have more indirect long-term impacts including the encouragement of fire and pioneer species. It has been suggested that the dark carbon dust emitted by the fires deposited

on Himalayan glaciers could hasten their melting. This could affect the hydrology of the rivers that are a source of water for human populations in northern India. The average temperature of northern India saw increase of 0.2 °C.



Burnt Chir pine

Seven fatalities were reported as of 4 May 2016. The Pinegrove School, a boarding school at Kasauli, was evacuated as fires had reached the compound walls. Tourism and wildlife at the Corbett National Park and Rajaji Tiger reserve regions were affected. Various other locations in these Himalayan states of Uttarakhand and Himachal Pradesh are tourist attractions in summer, and they faced heavy air pollution. The forest fires also disrupted the functioning of the Kalka–Shimla Railway line. On 3 May, the forest department estimated the monetary losses at approximately Rs. 29 lakh (US\$43,000). The estimate is based on the standard rule book followed by the department with empirical formulae for such calculations. Various ecologists and environmental activists have disregarded the estimate, noting that it does not take into account ecological and wildlife losses. They added that these fires have also destroyed vegetation which holds rainfall, which might result in floods in the monsoon season. Scientists of the Govind Ballabh Pant Institute of Himalayan Environment and Development formed a team to survey the area and study the effects of the fires on the melting of glaciers. Ecologists suggested that clearing of forest floors of the fallen pine leaves, which are readily combustible, should be undertaken by forest department as well as locals on a grassroots level to prevent such major fire outbreaks. Production of biomass briquettes from these pine needles should be promoted, serving as a source of fuel as well as a solution to prevent wildfires.

National Disaster Response Force was deployed for rescue operations in the Kumaon and Garhwal areas. Around 6,000 personnel from the Forest Department were deployed. As of 30 April 2016, 922 incidences of fire were reported affecting around 2,000 hectares (4,900 acres) of forest area. The Mi-17 helicopters of the Indian Air Force with "Bambi buckets" were used to douse the fires with water. However, the heavy smog that developed in the area affected the aerial operations of the army. The affected area later increased to around 3,500 hectares (8,600 acres), extending into Himachal Pradesh. The regions saw rainfalls on 3 May ranging from 7 mm to 11 mm, which helped in controlling the fire.

Soaring temperatures reignited the forest fires on 18 May, 2016 covering an area of nearly 180 hectares of green land being spread over 111 districts. Rangers and Divisional Forest Officers were asked to rush to the spot and extinguish the fire as soon as possible so as to reduce the damage done. This was the result of the temperatures of Uttarakhand which are about 4 to 5 degrees higher than the average temperatures at this time of the year. According to government sources, the forest fires combined have destroyed nearly 4048 hectares of land in 1857 incidents.
