

AVIATION POLLUTION–IMPACT ON ENVIRONMENT

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Introduction

Civil aviation has slowly transformed itself from a mode of transportation for the elite to an essential infrastructure necessity for the society. Environmental issues associated with aviation are critically important to the future development of aviation infrastructure. The science of climate change is still relatively new and the future is uncertain.

It is true that most airports in the world are old and was constructed outside the cities. It is the cities that have grown around the airports. Palam in Delhi and Santha Cruz in Mumbai were outside city limits when they came up. Property developers and investors saw the opportunity for price escalation near the airport. Hence, most property development has taken place with full understanding that pollution will be a factor. However, having purchased, the property owners associations and NGOs protest against the pollution particular noise pollution.

The impact of aviation on Environment is much wider than simply reducing public exposure to noise. The aviation industry is cutting down aircraft noise and emission levels to an impressive level in a relatively short period of time; there is no technological “silver bullet” on the horizon that will further reduce aviation’s environmental impact significantly.

Airports and aircrafts are causing pollution to Air including sound and water at many different elevations and at considerable distances.

This Paper focuses on the pollutants of aviation and environmental impact of those emissions, the laws relating to reduce or control the aviation pollution with special reference to India.

Aviation Noise Pollution

Noise by definition is ‘unwanted sound’. What is pleasant to some ears may be extremely unpleasant to others, depending on a number of factors. Pollution is a noun derived from the verb ‘pollute’, meaning to foul. It is now increasingly understood that pollution from noise is an important component of air pollution.

Noise has been the principal environmental issue for aviation. It remains high on the agenda of public concern particularly the residents who live in the vicinity of Airports. The noise can arise from ground transport and other operational sources in addition to aircraft in the air and on the ground.

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Environmental noise pollution has severe impact on peoples' health and overall well being. Typically, noise pollution refers to any sounds that disrupt the environment. Aviation noise disturbance is a difficult issue to evaluate. The noise impact is not a lasting one on the actual environment, but it can have significant adverse effects on people living close to an airport, including interference with communication, sleep disturbances, annoyance responses, performance effects and psychological effects.

Millions of people are disturbed by aircraft noise and it will get worse. According to a study, 71% of people heard the aircraft noise, 20% bothered to some extent, 7% bothered moderately and 2% very or extremely bothered.¹

A study of the effects of noise on children by the department of design and Environmental analysis at Cornell University in New York, found a variety of problems in children exposed to noise compared to children not exposed to noise: blood pressure elevation, learned helplessness, deficiencies inability to discriminate words and possible delays in cognitive development. Yet another reported health impact of noise is increased anxiety and levels of annoyance. In fact mere loudness accounts for less than 50% annoyance from noise.

Aviation noise has become a big issue in developed countries. It is widely recognized that aircraft flying at a height of at least 10,000 feet above the ground do not usually produce 'significant' noise impact. But this is not an absolute rule. It is normal for aircraft noise to be associated with airports, because of the low height involved. In fact, the level of noise is varying from airport to airport.

Noise is generated by engine and the airframe of the aircraft. Arriving aircrafts are less noisy than on departure because of high-level thrusts are used in departure. Aircraft also create noise on the ground when taxiing, queuing, testing engines and using the auxiliary power unit.

The most widely used unit for measuring noise levels is dB (A) – the A – weighted scale in decibels. The noise level of normal conversation is 50 – 60 dB. But a jet aircraft taking off 25 meters away gives 140 dB. The World Health Organization (WHO) has fixed 45 dB as the safe noise level. Experts believe that continuous noise levels in excess of 90dB can cause loss of hearing and irreversible changes in nervous systems. Metropolitan areas in India, usually register an average of more than 90dB noise. Mumbai is rated the 3rd noisiest city in the world, with New Delhi following closely.

The International Civil Aviation Organization (ICAO) has prescribed noise certification standards from time to time. All commercial aircrafts must meet those standards. The 33rd ICAO Assembly adopted a Resolution for introducing the concept of a 'balanced approach' to noise management. According to the 'balanced approach' concept comprise four principal elements to mitigate noise. They are:

- a. reduction of aircraft noise at source.

- b. land use planning and management.
- c. noise abatement operational procedures.
- d. operating restrictions.

Some airports are adopted noise quota system at local level for over and above the noise certification standards. Accordingly a limit on the number of movements and a quota or “noise budget” which represents sum of noise over specific period is prescribed.

In *Griggs vs. Allegheny County*,² the court held that the Airport was responsible for acquiring sufficient land adjacent to the airport to reduce the impact of aviation noise and, if it failed to do so, was liable for resulting damages from aircraft noise.

Aviation Air Pollution

Climate change is a change in the “average weather”. Global climate changes over the long term have many implications for natural eco systems. Aircraft engines produce emissions that are similar to other emissions resulting from any oil based fuel combustion. Airports and aircraft cause many types of air pollution at many different elevations and at considerable distances. Aircraft fly overhead emitting toxic compounds in massive amounts and these emissions are spread generally over an area 12 miles long, 12 miles wide on take off, 6-12 miles on landing. Critics charge that taxiing airplanes emit hundreds of tons of greenhouse gases.

Emissions from aircraft below 1,000 feet above the ground are chiefly involved in influencing local air quality. These emissions disperse with the wind and blend with emissions of other sources from the surrounding domestic factory and transport pollution.³

Aviation contributes less than 4% of man-made atmospheric emissions. But some of aviation’s emissions are emitted in the upper atmosphere and may have a more direct effect.⁴

Aviation air quality concerns are principally related to the area on and around airports. The chief local air quality relevant emissions attributed to aircraft operations at airports are as follows:

- a. Oxides of Nitrogen (NO_x)
- b. Carbon Dioxide (CO₂) & Carbon Monoxide (CO)
- c. Un-burnt hydrocarbons (CH₄ and Volatile Organic Compounds (VOCs))
- d. Sulphur Dioxide (SO₂)
- e. Fine Particulate Matter (PM₁₀ and PM_{2.5})
- f. Water Vapour & Odour

According to a report, aircraft emissions include greenhouse gases such as CO₂ 6.3% of British CO₂ emissions are from aviation (2005). Aviation account for around 2% of the CO₂ emissions globally. 50% more emissions from aviation expected by 2020, assuming fuel efficiency improves by 50%.⁵

Kyoto Protocol 2005, which is an amendment to the United Nations Framework Convention on Climate Change (UNFCCC) has ratified by many countries and commits to reduce carbon dioxide and five other greenhouse gases.⁶

About 5 million people's health could be affected as a result of just one airport. There are international standards (ICAO) for aircraft engines which are aimed at reducing greenhouse gas emissions. NO_x is often considered the most significant pollutant from an air quality standpoint. A greater or lesser degree of the above emissions have climate change implications, as does CO₂.⁷

The quantification of airport atmospheric emissions is a complicated topic because emissions to air disperse and mix with emissions from other sources. A loaded Jumbo 747, for instance, uses tens of thousands of pounds of fuel on merely takeoff. At present there are no international standards for air quality quantification methods. However, sampling the local air and analyzing for NO_x, particulates and other important pollution species is one of the methods for measuring the emissions. Another method of assessing the emissions quantity is modelling. In this method an inventory is created for all significant emitters linked to the airport such as aircraft, ground vehicles, fixed plant and fugitive emission sources. The characteristics of emitters are also determined and the data is combined with typical weather patterns in a sophisticated model to predict with reasons accuracy, the degree of contribution of the airport to local pollution levels and what the dispersion patterns are.

It is important to note that the emissions vary for different operation types for the same equipment. Scientists estimate that effect of aviation emissions on the climate is upto five times the impact of emissions occurring on the ground. A recently disclosed report finds that airlines could hit 1.5 billion tons of carbon dioxide a year by 2025.⁸

India has revised the national ambient air quality standards in 2009 after 15 years. According to the "Minister of State for Environment and Forests, the notified ambient air quality standards in India are equivalent to the European level and exceeds the standards prevalent in the United States.

Under the revised National Ambient Air Quality Standards (NAAQS) of India, 12 pollutants will be measured compared to six in the previous to calculate the level of air pollution.⁹

The most important part of the revised standards in India is that distinction between industrial and residential areas have been removed. Now, the industries have to conform to the same standards as residential areas and will be compelled to take necessary measures to check air pollution.

Aviation Water Pollution

Airports are known to be major source of water pollution. They dump toxic chemicals – used to de-ice airplanes during winter storms – into waterways. Millions of gallons of glycols are used for aircraft de-icing at airports. Glycols are the most voluminous water pollutants from airports.

During de-icing, the airlines mix 55% glycol and 45% water, heat the mixture to about 185°F, and spray the planes down with it. 50 – 80% of the glycols may end up in the local waterways. Ethylene glycol is more effective and more toxic than propylene glycol. Both consume high levels of oxygen during decomposition and this can deplete waterways of oxygen and kill fish. A small number of airports are successful in recapturing glycols following use and few of them to be recycled for other uses.

Recycled glycols are generally used for coal companies, paint manufacturers and general motors. But the recycled glycols are never used for de-icing in the United States unlike in Europe.

Position In India

Commercial aviation in India began in 1911. Construction of civil aerodromes was taken up at Dum Dum in Calcutta, Baramati in Allahabad and Gibbert Hill in Bombay in 1924. In 1947, 44 airports were being operated by Civil Aviation Department. There are 1,61,393 aircraft departures during 1999-2000 have been escalated to 5,09,567 in 2008-09.¹⁰

Indian aviation sector has transformed from an over regulated and under managed sector to a more open, liberal and investment friendly sector in the recent years. The sector is undergoing significant development with the changing scenario in the country. India is gradually becoming a focal point in the global aviation map with the growing air traffic, route expansion followed by major airport infrastructure developments. It is estimated that India would be world's fastest growing aviation market over the next 20 years not in terms of passenger and cargo traffic but also in the area of equipment supply, technology up-gradation, maintenance, repair and overhaul (MRO), training, ground handling, cargo handling and other non aeronautical revenues as well.¹¹

Rabindranath Tagore says that in ancient times in India, man lived close to forests, and loved nearby surroundings. Today, however man has only plans for constant air travel, spoiling the fragile mother earth.

There can be National Committee to consider new goals for aviation in harmony with environments, and in accordance with the ecological economies.

There are no standards ascribed to noise pollution inside the airport or related to aircraft noise in India. It is a known fact that noise pollution is bound to be higher at airports than any other places. On the petition of the Indian Spinal Injuries Centre, a hospital and the Bijwasan Gram Vikas Samithi, a non-governmental organization, the Delhi High Court on March 3, 2010 directed the

Directorate General of Civil Aviation (DGCA) with no deadlines fixed to implement measures to check the growing level of noise pollution near Delhi airport. On the last date of hearing, the Court had barred Delhi International Airport Pvt. Ltd., (DIAL) from using two of the runways that are used at the Indira Gandhi International (IGI) Airport. The petitioners complained about the environmental noise pollution levels that disturb them during plane landings. The noise created by these planes spanned 75dB-A to 95dB-A, which went beyond the stipulated standards lay down under the Noise Pollution (Regulation and Control) Rules, 2000. Interestingly, India ranks 123rd in pollution control, according to the 2010 Environmental Performance Index (EPI).

The DGCA is looking at introducing continuous descent approach (CDA) at the IGIA in Delhi as an immediate measure to reduce noise pollution following the order of the Court. The CDA is a method by which aircraft approach airports before landing to reduce fuel consumption and noise. It involves maintaining a constant three-degree descent angle during landing, until meeting the instrument landing system. The DGCA recommended that use of new runway 29 for landings be restricted at night to benefit residents living near the approach path. Unlike the West where airports are closed at night and noisy old planes are banished even during day, authorities are now trying to finish this exercise at the earliest following the High Court Order.

Although a regulatory environment has slowly been built up around many activities, these do not usually address noise pollution specifically. The laws usually confine themselves to other matters, or do not adequately address noise issues.

In the absence of an adequate regulatory framework specific to noise pollution the status quo has been determined partly by the interpretation of other laws. Important among those have been Article 19 and 25 of the Indian Constitution. Unless the connections between noise and health are first judicially established, prohibition or control against their use are difficult to pass. The judiciary has nonetheless weighed in on questions of noise pollution.

The Noise Regulation Rules (2000) to Section 3 of the Environment Protection Act 1986, regulate noise levels in industrial (75dB), Commercial (65dB) and residential (55dB) Zones and also establish silence Zones (100 meters) near schools, courts, hospitals etc. The rules are clearly a step forward although they do not attempt to create comprehensive legislation on noise pollution and continue with the piece-meal approach to specific problems encountered over the years.

In recent times (2009), the Government of India have revised the National Ambient Air Quality Standards that are equivalent to the European level.¹²

Legal Provisions For Controlling Aviation Pollution

In the days before the development of environmental jurisprudence, the Common Law remedy against nuisance was the only means available to curtail

excessive noise, and this was wholly based on the discretion of the Judge. Whether a particular noise constitutes a nuisance, after all, is often a question of degree.

Modern environmental law started with Declaration of the United Nations Conference on the Human Environment made at Stockholm on 16th June 1972. In 1982, United Nations made a Charter for Nature. In 1989 'Hague Declaration on the Environment' to protect Ozone layer around the globe, and prevent global warming of the atmosphere is another milestone of the United Nations. The last United Nations Declaration was made in 2002 in Johannesburg, South Africa for Sustainable Development.

For sustainable global environment, it is necessary to revise global and national policies on civil aviation in order to provide harmony with the natural environment and maintain atmosphere in a pollution free state.

The European Community has been incorporated the 'Balanced Approach concept of aircraft noise management' into legislation as Directive to its member countries.

The European Community has enacted legislation-setting limits for different pollutants together with a requirement for Member States to quantify and publish Air Quality impact to operate planes and controls.

In 1990, the American Congress passed the Airport Noise and Capacity Act, which require that, by the year 2000, all aircraft in commercial fleets weighing more than 75000 pounds must be either stage-3 aircraft or stage-2 aircraft that have been retrofitted to dampen noise. A United State Senate bill, the Quiet Communities Act of 1997, would re-establish the office of noise abatement and control in the Environment Protection Authority (EPA) and would "challenge the FAA (US Federal Aviation Administration) to listen to the EPA and seriously consider the environmental impact of noise.

There are no specific legislations in India on control of Aviation Pollution. However, the Indian Constitution clearly stated that it is the duty of the State to 'protect and improve the environment and to safeguard the forests and wild-life of the country.' Reference to environment has also been made in the Directive Principles of State Policy as well as the Fundamental Rights.

The Constitutional provisions are backed by a number of Laws – Acts, Rules and Notifications. The Environment Protection Act (EPA) 1986 was enacted under Article 253 of the Constitution and came into force soon after the Bhopal Gas Tragedy and is considered as umbrella legislation as it fills many gaps in the existing laws. Thereafter a large number of laws such as Water Act and Air Act came into existence as the problems began arising.

The potential scope of the Environment Protection Act is broad, with "environment" defined to include water, air and land and the inter relationships which exist among water, air and land and human beings and other living creatures, plants, micro-organisms and property.

According to Environment Protection Act "Environmental Pollution" means the presence in the environment of any environmental pollutant and "environment Pollutant" means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to environment.

Under Section 15 of the Environment Protection Act, whoever fails to comply with or contravenes any of the provisions of this Act, or the rules made or orders or directions issued there under, shall be punishable with imprisonment for a term which may extend to five years with fine which extend to one lakh rupees or with both in respect of each such failure or contravention. In case the failure or contravention continues, with additional fine which may extend to five thousand rupees for every day during which such failure or contravention continues after the conviction for the first failure or contravention.

Under Section 17 of the Act, where an offence under this Act has been committed by any department of Government, the Head of the Department shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly unless it is proved that the offence was committed without his knowledge or that he exercise all due diligence to prevent the commission of such offence.

Conclusion And Suggestions

The National Air Transport Association (NATA) of United States propagating that the "theories about high altitude CO₂ and NO_x effects are just that, theories" and "no scientific proof that this is significant" – On the other hand the Environmentalists are concerned about the growth of aviation on the environment citing an FAA forecast that greenhouse gases (GHGs) from domestic aircrafts are expected to grow by 60% by 2025. However, aviation contributes approximately 3% GHGs worldwide, compared to other transport modes and power plants.

At the global level, some countries have requested the ICAO to review the night curfew restriction imposed by some countries on the operation of airlines and arguing that the imposition of night curfew creates a mismatch in utilizing infrastructure round-the-clock and hampers the growth of airlines.

In conclusion, it can be said that aircrafts and airports are no doubt causing environmental pollution to a recognizable extent. But in the changing scenario, aviation is gradually becoming an essential infrastructure for the overall development of a country. Therefore, instead of imposing strict restrictions on aviation, ensuring strict adherence of the measures which reduce the pollution levels of the aircrafts and airports. The following are some of the suggestive measures to conserve fuel and reduce the aviation pollution:

1. Establish a Coordination Committee between airport air traffic control and aircraft operators for aircraft noise management.

2. Depicting preferred noise routes to avoid residential areas as far as possible.
3. Avoid over flying sensitive sites viz., schools and hospitals.
4. Optimum use of runways and routes.
5. Adopting continuous descent approach, low-power-low-drop techniques and departure techniques for abatement of noise and emissions.
6. Avoiding unnecessary use of auxiliary power units of aircraft reduces sound as well as emissions.
7. Towing aircraft instead of using jet engines to taxi reduces noise pollution and emissions. Single engine taxiing reduce the emissions. But some airplanes lack the ability to taxi on one engine. The crew must be properly trained in the technique of single engine taxiing.
8. Limiting night operations. Night landings should be restricted to only aircraft with new engines, which produce less noise.
9. Providing noise insulators for the most severely affected houses of surrounding the airports.
10. Monitoring individual noise levels of aircrafts and penalizing any breach.
11. Applying different operational charges according to the noisiness of the aircraft.
12. Avoiding aircraft queuing on the ground with engines running.
13. Increase the use of public transport and pedestrian access to airports.
14. Use of electric vehicles or less polluting fuels in airport and airport buildings.
15. Energy management in buildings and for airfield systems.
16. Using fugitive emission controls.
17. Conserve fuel by making routes more direct, increasing load factor and capacity of more fuel optimised routes, operating more fuel efficient aircrafts etc.,
18. The small airlines and airports may be revived to avoid mega airports. The domestic and international hubs are to be separated to avoid congestion in airspace and on ground.
19. Mega cities need to be de-congested by careful planning of global civil aviation.
20. A nice exercise has to make a planning for better world order based on unity and diversity of global life with international cooperation,

confidence building measures among nations, regional and federal approach to suit various ecological systems and cultures and people of the world belong one human species i.e. mankind is one species.

21. Aircraft weight must be reduced to save CO₂ emissions and make engines with longer combustion zones to reduce NO_x.

Endnotes

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7. The Noise Pollution (Regulation and Control) (Amendment) Rules 2002.