Aviation waste management: An insight
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ABSTRACT

Today’s there is unprecedented growth in worldwide tourism, domestic and international movement of goods and services, and mobility becomes an integral factor in lives of people both for recreation and professional reasons. This would not be possible without exponential growth of air transport industry and associated services. As a result commercial aviation today becomes one of the fastest-growing industries in the world. With such growth it is important that aviation of any nature across the globe is safe, comfortable, eco friendly, and imbibles universal hygiene principles in its overall operations. The potentially large environmental impact of aviation industry particularly airports in terms of air quality, noise, and handling of solid hazardous solid wastes, needs to be addressed by developing more sustainable environmental practices followed by its management, and safe disposal. Be it from managing infections due to ever growing burden disposed solid waste, exposure to hazardous materials, noise etc. Technical progress and new developments in aviation industry often goes hand in hand with developments in new environmental and waste recycling technologies for maintaining hygiene and protection of environment both on the ground and in air. As more and more waste related legislation are passed with stringent measures, airports and airlines are struggling to modernize their obsolete waste management systems and recovery processes. Aviation industry is therefore considering to swiftly implementing wide range of measures to keep the environmental impacts to minimum. In the context of above discussion my paper briefly identifies various categories of wastes generated by airlines, airports, and related industry (with emphasis on India) and how such waste generated at airports can be effectively handled for maintaining the sustainable ecosystem at the airports and the surrounding areas.

Keywords: Solid Waste; Waste composition; Recycling; Environmental Management; Food Waste; Airline Industry, Waste Recycling

1. Introduction

Commercial aviation has become one of the fastest growing industry sectors in the global economy nearly contributing to 3.5% of global GDP (ATAG, 2014). Aviation provides speedy worldwide transportation network which is vital part of the increasingly globalized world economy, thus facilitating the growth of international trade and investment, tourism, and connecting people across different continents. With increasing economic liberalization across the world and in emerging economies, trade is expected to increase at an accelerated rate with India, China, and other emerging countries, giving further boost to the commercial aviation sector in these countries. It also plays a vital role in facilitating economic growth, particularly in developing countries like India.
Air transport today carries 0.5% of the volume of trade shipments and it is 35% of total value of goods transported (www.atag.org). It is expected to grow over the next two decades at an average annual growth rate of nearly 6.5% in freight demand and 05% in passenger traffic when nearly 3 billion passengers will board the aircraft somewhere on earth (Airbus Industrie, 2006), (Current Market Outlook, 2007). The aviation industry itself is a major generator of employment supporting nearly 58.1 million jobs worldwide be it airline, airport operations, aircraft maintenance, air traffic management, head offices, and activities directly serving air passengers, such as check-in, baggage handling, on-site retail, cargo, and catering facilities and lounge services etc.

Direct growth impacts also include the activities of civil aerospace manufacturers selling aircraft and components to airlines and related businesses. On the other hand indirect impacts include employment and activities of suppliers to the air transport industry for example, aviation fuel suppliers; construction companies that build airport facilities; suppliers of sub-components used in aircraft; manufacturers of goods sold in airport retail outlets; and a wide variety of activities in the business services sector (such as call centres, information technology, accountancy, and environmental management).

The Aviation Industry in India is the most rapidly growing aviation sector of the world. This is inspite a bad or poorly drafted regulations that undermine aviation’s ability to be a catalyst for India’s economic growth (www.iata.org). It is expected that India will be top three aviation market in the world by 2020. With the rise in the economy of the country and followed by the liberalization in the aviation sector, the Aviation Industry in India went through a complete transformation in the recent period.

The government owned Airports Authority of India (AAI) operates 125 airports and civil enclaves out of a total of 449 airports and airstrips located throughout India. The cities of

Figure 1: Aviation contribution to World Economy (ATAG, 2008)
Bengaluru, Delhi, Hyderabad, Kochi, and Mumbai are served by privately (or joint-venture) operated airports. All operational airports in India handled a total of 169 million passengers (122.43 m domestic and 46.62 m international) during 2013-14 (April-March). The total number of aircraft movements amounted to 1.48 million in 2012-13 and freight handled amounted to 2.32 million tons during 2013-14 registering an impressive growth inspite of Indian market being severely underserved where less than 3% of its people using air connectivity for transportation. The decision by the Airports Economic Regulatory Authority to allow the returns over five years at Delhi Airport to be recovered in under two years contributed significantly to that airport’s enormous 346% increase in charges in 2012. The steep tariff hike in Delhi was followed by a fresh round of increased charges at other Indian airports, including at Mumbai and Chennai. This significantly raises the overall cost of operations in India for airlines to operate.

The aviation sector in India has been relatively free of major environmentally driven regulations in past, because the sector is considered a key contributor to driving the global economy and the only mode of rapid trans-national travel on offer to customers. However airport development has not kept pace with significant increases in aviation activity in India. Like virtually every area of human activity, air transport has a large impact on the environment. This impact takes several forms, including the disturbance caused by aircraft noise and aircraft engine emissions, waste generated in airplanes, at airports, support services including flight kitchens. Airport development may create a wide range of impact on the environment by construction work, reclamation, landfills, noise and emissions from aircraft effecting air quality and ground sources, cargo operations, and other airport related activities. Knowledge of the sources and types of solid wastes, along with data on the composition and rates of generation, is very important to the design and operations of the functional elements associated with the management of solid waste (Tchobanolous, G., et al., 1993), (Daskalopoulos, E., et. al., 1998).

Sustainable development is answer to development of aviation industry. Sustainable development takes the three areas of economy, society and environment and finds ways of balancing the three interests to produce the results that will benefit most people. The subject of sustainable development hit the global spotlight in 1992 at the Rio Earth Summit where the world's governments developed a number of key international agreements, including the United Nations Framework Convention on Climate Change (UNFCCC). The aviation industry is conscious of aviation environmental impacts and its contribution to climate change. Airlines produced nearly 705 million tonnes of Carbon dioxide in 2013, which is 2% of the total carbon emissions of over 36 billion tonnes (Global Carbon Project , 2012). Many airlines have recognized the benefits of environmental management systems (EMS), but the standards and frameworks for EMS are challenging to implement in the airline industry context.

2. Types of Waste Encountered at an Airports

The terminal building is the heart of an airport complex and normally has the biggest concentration of people generating the most waste. An airline waste includes waste generated by passenger airplanes, ticketing counters, and gate areas. Such thrash typically includes food and drink containers, waste food, newspapers, magazines, computer printouts, tags and other paper based waste generated at airline counters and gates. The characteristics and quantities of waste generated on an international flight varies by the load factor and duration of flight, capacity and configuration of aircraft, duration of flight, number of meals served, delays in
flight, catering packaging, salvage policy of airline and passenger etc. International flights having more extensive in-flight service generate more waste as compared to low cost airlines, which do not generate in-flight waste associated by meal service; however most of the waste comes from beverage cans, water bottles, plastic glasses, napkins, newspapers, and magazines.

Retail and restaurant waste generated by food joints and duty free areas includes cardboard boxes, paper and plastic packaging, food wrappers, aluminum cans, glass bottles, and disposed food scraps in restaurant kitchens, in shops including airport dining areas. In addition to this terminal building area also generates rest room wastes, and waste generated by offices, and public area of the passenger terminal. Off all the waste generated by airports almost 75% of the generated waste is recyclable or compostable. Such recyclable or compostable waste includes paper products, plastics, aluminum, glass, and food waste.

Although there is some similarity between municipal solid waste and waste generated from airport, much of wasted characteristics and specifications are different. Most airports in India lack the infrastructure to recycle waste generated at airports and from airplanes. Such waste is disposed off without segregation (recyclable waste is mixed with non-recyclable waste) and ends up in incinerators, where it is burned through a combustion process that releases toxic emissions into the air, or the landfill, where materials will lay for a long duration leading to contamination of soil and ground water.

3. Categorization of Wastes

Waste from airports is mainly categorized into 8 broad categories namely

1. Municipal Solid Waste which includes everyday items like packaging materials, bottles, food scrapes newspaper, cans etc.
2. Construction and Demolition Waste is non-hazardous solid waste from land clearing, excavation, construction, demolition, renovation or repair of structures, roads, and utilities areas inside the airport generating materials like concrete, wood, glass, carpets, piping, debris, and salvaged building components.
3. Green Waste mostly generated from the air side operations of the airport includes, trees, shrubs, grass clippings, leaves, weeds etc. which are generated from landscape maintenance activities.
4. Food Waste is mainly generated from in-flight kitchens, discarded during food preparation activities, and leftovers from flights.
5. Wastes from Aircraft are a specific type of municipal solid waste that is removed from passenger aircraft. These materials include bottles and cans, newspaper, mixed paper, wrappers, plastic cups, service wares, paper towels, napkins etc. Usually typical composition of such waste is 1% Aluminum, 2% Glass, 2% Plastic bottles, 9% other plastics items, 12% Cardboard, 14% Newspaper, 14% other paper, 20% Compostable materials, and remaining 26% Non-Recyclables. This waste nearly represents 20% of an airport’s total municipal solid waste. Waste quantity varies with the type of aircraft, passenger load, and duration of flight.
6. Lavatory Waste falls under the category of a special waste and is generated when the lavatory tanks of the airplanes are emptied via hose and pumped into a lavatory service vehicles. After the aircraft’s lavatory tanks are emptied they are filled with a mixture of water and a disinfecting concentrate. Such waste contains chemicals and potential enteric
pathogens, and can present a risk to the environment and human health if it is not properly treated before discarding it to sanitary sewage system.

7. Spill Cleanup and Remediation Waste is generated during cleanup of spills of various types like leakages from storage tanks, oil spills, vehicular leaks, and spills from maintenance activities etc. Such waste materials must be disposed as per applicable regulatory requirements.

8. Hazardous Wastes includes solvents, caustic parts washes, heavy metal paint waste and paint chips, waste sludge’s from metal etching and electroplating, waste fuel and other ignitable, unusable water conditioning chemicals, illegal dumping of containerized chemicals, batteries, waste pesticides etc. Servicing equipment results in a number of predictable type of wastes, such as oil, grease, hazardous chemicals, batteries, tires, and other fluids.

3.1 Methods of Airport Waste Management

In order to improve environmental compliance and decrease the cost of aviation solid waste disposal, recycling is a critical aspect waste management by airports, airlines, and flight kitchens. Businesses that prevent and recycle waste can save money, generate revenue, and increase efficiency. With growth in aviation industry (e.g., airports, airlines, and flight kitchens) continues to improve, implement, and expand recycling processes by creating synergy among various recycling programs. Collecting, separating, and storing materials on board aircraft during flight for removal and recycling on the ground poses many logistical challenges including meeting the legal requirements, capabilities and infrastructure at recycling centres, and airside safety concerns. As a result, airport recycling programs across the country differ significantly. Currently, deplaned waste and recyclables typically are directed to one of the following

1. An airport-managed system centralized system, in which cabin service crews or terminal maintenance personnel take materials to waste or recycling containers owned or operated by the airport or its contractor.

2. An airline-managed system which may be decentralized, in which one of the following occurs: Flight kitchen crews take materials back to flight kitchens and in-house airline provisioning operations for handling, or cabin service crews place materials in containers owned or operated by the airline or its contractor.

Deplaned materials may either be disposed of or recycled through one of these systems, depending on the airport, airline, and flight kitchen location and therefore recycling reduces the cost of waste disposal and can generate revenue through the sale of valuable materials. It has been studied that 25 to 35% of waste material generated from passenger aircraft (both disposed of and recycled, by weight) consists of valuable and commonly recyclable materials (Seattle-Tacoma International Airport Report, 2011). Recycling saves energy, conserves natural resources, and reduces emissions of greenhouse gases and other pollutants.

Human waste contained in tanks aboard the airplane are serviced during each stopover where tanks are emptied, flushed and refilled to an optimum level with chemical mixed with water (dilution of nearly 1:400). This chemical which is very effective bactericide can kill pathogens within 12-15 minutes at 18º to 20ºC. The waste collected from the toilets is disposed of by discharge into airport drainage system at the disposal location provided for. The waste is passed through the screens to remove solids and is followed by washing and disinfecting. During the whole process of collection and disposal of airplane toilet waste,
strict procedures are followed so that customers, airline staff, and other persons are not exposed to any risk including risk of infections.

The infestation of insects and other pests and transmission of disease by such pests on board has been long recognized and the problem has been dealt with by disinfection of the aircraft through pest control activities including fumigation. Such activity may have serious consequences when aromatic vapours from sprayed chemicals can affect the ground handling staff, crew members, and customers. Treatment must follow established practice to endure the safety of all persons involved. It has been laid down in different Articles of International Health Regulation 1969 (World Health Organization). Operations activities like combustion of fuels, cleaning of aircrafts and aprons, aircraft and vehicle maintenance, fuelling and De/anti-icing operations results in generations of wastes like cationic, anionic, and non-ionic detergents, deicing salts, formaldehyde, phenols, poly aromatic hydrocarbons, polychlorinated biphenyls compound, gets into environment along with airport runoff waters. They toxic chemicals then enter the soil, surface water, and ultimately enter ground water causing sever pollution.

4. Waste Recycling Opportunities

Based on above discussion and analysis if types of wastes, it is very much evident that waste avoidance and reduction measures can be implemented to foster better waste and resources management in the commercial aviation industry. Considering the high potential of material recyclability and marketability of the in-flight services operations on commercial airlines, the waste items generated from in-flight services can be reduced or recycled for eco-sustainability.

- Paper waste is generated in bulk quantities (nearly 35-70%) from aircraft cabin can be reused by collecting and sorting them after the flight. News-paper and other reading materials can also be recovered and sent to waste recycling. Periodic collection by cabin crews during flight can reduce substantial quantities of waste.
- Polystyrene products in form of cups, plastic food covers, and glasses form nearly 2-10% of total in-flight waste. This type of material use should be minimized in order to increase recycling opportunities.
- Aluminum Cans, metal trays, and foils generated from beverage service during flight accounts for nearly 2-4% of the total in-flight waste and have high recovery value.
- Food Waste generated during in-flight service nearly accounts for 9-20% of waste which can be recycled and used as animal feed.

Thus nearly 60% of the waste generated during the flight can be easily recycled. However one of the major challenges to recycling materials is that there is not a single national program established for all airports (Public Airports Managed by Airport Authority of India or Privately Managed Airports) in the country. Due to the complexity and variability of recycling and waste collection, it is challenge to implement “one size fits all” approach to recycling for airports and airlines.

4.1 Barriers for Effective Waste Management at Indian Airports

1. Low public awareness and among its users who are from diverse socio economic and cultural backgrounds.
2. Financial and technical constraints of the Airport Authority, Airline, and other service provider.

3. Poorly managed waste handling mechanism by airport operators and its concessionaires including use of outdated and damaged equipments.

4. Lack of uniform policies and strategies on solid waste management at airports across the country and among different airlines.

5. Unclear responsibilities amongst airport operators, airlines, concessionaires, and other ground handling agencies.

6. Lack of centralized monitoring system, and punitive regulations which are mostly not practiced or enforced.

7. Waste handling and management is a low priority activity to the licensing authorities and economic regulators.

8. Lack of planning for waste management while constructing new terminals or refurbishing old airports.

9. Lack of technically trained manpower and other resources.

10. Lack of community involvement in airport operational matters.

5. Conclusions

It is very clear from the discussion that Indian aviation market is severely underserved with nearly 03% population using air routes to travel. The growing economy and burgeoning middle class will translate into more people preferring to fly putting aviation as high growth sector of Indian economy. This will result into huge amount of waste generation by airline and airports. As such waste handling and management will become an important area of the environment management policy of the airport operator, airline, and other service provider. Quantities of most of the waste generated during flight can be reduced to significant extent if properly planned followed by its segregation and its proper disposal by recycling. An efficient waste management program may contribute to economic, environmental, operational, and social benefits to all the stake holders. For eco-friendly aviation, the objective to develop and continuously upgrade waste collection and disposal system which incorporate waste separation, waste volume reduction, and more recycling of reusable materials.

6. References

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