

Waste disposal and pollution control

Hotels are properties where very high intensity of human and machine activities occur day in and day out. This is bound to produce all sorts of pollution and is subject to very stringent pollution control measures.

The various sources of pollution are-

1. Domestic, industrial, and hospitality industry effluent (liquid waste) to water bodies or sewage pollution.
2. Domestic, industrial, and hospitality industry gas emission (furnace, ovens, engine) released to the atmosphere or gas pollution.
3. Solid waste and sewage pollution to soil.
4. Solid waste and sludge pollution to soil.
5. Thermal pollution.
6. Noise pollution.

Hotels produce a lot of wastewater and many of them have now installed their own sewage treatment plant (STP), which contributes greatly in reducing pollution as well gaining economy by way of reuse of clear water. This pollution can be minimized at the source itself by restricting chemicals that mix with water, restricting/eliminating garbage, and oil or unknown chemicals in the waste system (for example, detergent water in the sewage severely affects performance of the septic tank) etc. Hotels produce a lot of grease and fat in kitchen and detergent water in laundry, which go to the wastewater. The presence of detergent makes septic tank treatment less effective. However, hotels have grease traps in the wastewater lines.

Waste material may be broadly classified as a) liquid waste and ii) solid waste.

Liquid waste is commonly known as **sewage**. Although the bulk nature of sewage is liquid, it also contains some solids produced by human called **sullage** and would primarily consist of wash-basin water, faeces, urine, laundry waste, and other material that flow into the drainage system of the holding. Sewers are the conveying pipes for the wastewater and sewage is the total system of collection, transportation, and safe disposal of wastewater.

Hotel wastes and their sources

- Garbage: It is the both solid organic and inorganic waste of varying nature produced from the different sections of a large hotel, like building (from dusting and sweeping), gardens (from wood and waste vegetation), kitchen (from cooked and uncooked food waste), dinning rooms (from left over cooked food waste).
- Sullage: It comprises of wash water waste from bathrooms, building drains and kitchen.

- Sewage: It is the discharge from the water closets
- Exhaust gases: These are the gaseous discharge of stale and spent air from the general building; spent air, odour fumes and oil vapour discharge from the kitchen; poisonous gas and spent air from the generator room.
- Chemical waste: coming from the water treatment plant.

Types of wastes

Garbage: This can be divided in the following components-

- Solid organic waste material: Generally comprises of i) Plastic material scraps, ii) Wooden material scraps, iii) Paper, iv) Linen.
- Solid inorganic materials: Normally comes from i) Dust from sweeping and dusting, ii) Metal scraps, iii) Glass scraps, iv) Chemicals.
- Liquid organic waste material: Usually generates from i) Oils, ii) Soap solutions, iii) Sewage drain water.
- Liquid inorganic waste: Generally comes from i) Sullage drain water, ii) Building wash drain water, iii) Rain water.
- Gaseous organic and inorganic waste: Main sources are i) Water vapour or moisture, ii) Smoke, which is essentially suspension of carbon particulates in air, iii) Stale air exhaust from the buildings, iv) Fuel waste gases from a) kitchen and b) generator exhaust, v) Oil vapours from kitchen as result of cooking.

Established disposal methods

1. Recycling: It is the process of material salvages, i.e. recovery and reprocessing of waste materials to manufacture new objects from the processed material. The materials reused in recycling serve as substitutes for the raw materials obtained from increasingly scarce natural resources such as petroleum, natural gas, coal, mineral ores and trees. Recycling can help in many ways like-
 - i) It reduces the quantity of solid waste to be deposited in the landfills; land filling has become increasingly difficult due to unavailability of vacant land.
 - ii) Recycling reduces the pollution of air, water and land resulting from the waste disposal.
 - iii) Recycling saves power, which is used to excavate and process the raw materials.Typical materials that can be recycled are-
 - a) Solid organic wastes- mainly comprises of paper, wood and plastics.

b) Liquid organic wastes- old lubricating oil from the engines and machines can be recycled to produce cheap quality lubricating oil for ordinary use.

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c) Solid inorganic wastes- these are coming from all the metal scraps and all the broken scraps. After collection from the different sections of the hotel the solid wastes are dumped in different bins. The bin materials are then dispatched for the proper recycling process.

2. Land filling: The waste materials which have no recycle value are used as filling materials to develop the low lying land areas into level lands. But prior permission has to be taken from local authorities. These can be used to establish new colonies, landscape parks and vegetable or agricultural parks around the city. The waste materials are dumped together with lime and insecticides and covered with a layer of the earth. As the layer decomposes and settles down, new layers are added till the level is a bit higher than the required level. The area is left over for a period to weather and get compacted and to settle down to a proper level.
3. Disposal in sea: For the establishment near the sea shores where waste lowlands are scarce, the waste materials can be dumped, with permission of authorities, in the deep sea away from the shores. Proper care must be taken so that the dumped materials should not make any harm to the marine and biotic life near the shore, does not hamper the sea traffic and that the sea waves may not throw the waste back onto the shore.
4. Incinerating: When the dumping facilities are not available or the waste may spread infection, the refuse is burnt in incinerators or large scale refuse burning furnace. The heat developed by burning is used to preheat new moist waste and also to heat water which can be reused for various odd jobs, washing and or heating of the building in winter.
5. Irrigation: The sludge from the baths and the kitchen and building drains is used to irrigate the flora around the hotel site. Care is to be taken that the water is properly treated and disinfected before use.
6. Cattle feed: If the hotel maintains its own cattle and poultry farms, the cooked and uncooked solid food waste may be used to feed the animals of the farms. The waste contains good food value and used to supplement the main diet of the animal. If the hotel has no such farms of their own the food waste may be sold to the local farms. With the permission of local authorities it may be dumped in low-lying areas to decompose and turn into manure for use in vegetable farms. The solid wastes from the kitchen, dining rooms etc. is collected at a central isolated place and then machine-compacted into bundles which can be later dispatched for disposal at sites.
7. Disposal in atmosphere: The general waste gases are vented into the atmosphere. Care should be taken to dispose the gases high up in the atmosphere through chimney, kept in the direction of wind flow. Instead of single discharge, scattered discharge system is used

for better mixing and dilution of the waste gases in the atmosphere. Kitchen exhausts, comprising of fuel waste gases and oil vapours need specialized disposal arrangement.

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8. Disposal of kitchen exhaust gases: The most common source of energy in the kitchen is hydrocarbon fuels. These fuels, on burning, produce wastes like-
- i) Ash: It is a powdered inorganic waste material and causes land pollution.
 - ii) Gases: It forms due to burning and cooking produce the following components:-
 - a) Carbon dioxide- The average normal level of CO₂ in air is 0.02%. Higher levels cause discomfort like headache, dizziness, sleep, nausea etc. The gas is mainly responsible for global warming.
 - b) Carbon monoxide- This is produced due to improper and incomplete burning of the fuel. As a highly poisonous gas it is responsible for the destruction of red blood cells of the blood and for blood clotting and reduces the oxygen supply to the tissues, causing death.
 - c) Smoke- Burning of organic fuels is associated with the production of smoke, which contains micron sized carbon ash particles' suspension in waste gases. The micron size suspended particulate matter lead to respiratory problems.
 - d) Cooking fumes- Oil, spices, and other ingredients are used to cook food. The cooking fumes are composed of water and oil vapours and spice smell-chemicals vapours.
 - e) Waste gases- These produce from fuel burning and cooking fumes and are responsible for
 - i) Breathing and respiratory problems.
 - ii) Dirty building interiors and exteriors.
 - iii) Fire hazard- The thick oil-dart layer may catch fire due to high fuel gas temperature. This fire spreads easily and engulfs the combustible materials fixed on the walls.
 - iv) Food and spice smells cause breathing problem and eye irritation.
9. Methods of controlling kitchen wastes:
- i) Control of ash- The ash content in solid fuels is highest while that of gaseous fuels lowest, resulting its calorific value highest, so use of such fuels (LPG or city gas) is preferred. Electric heating is totally gas and smoke less, but due to high cost the use is restrictive.
 - ii) Control of fly ash- Fly ash traps must be used in the kitchen exhaust pipe to trap the fly ash. The traps should be cleaned at proper intervals. The collected ash may be used in land filling.
 - iii) Control of carbon monoxide and dioxide gases- Properly designed burners which can have complete combustion should be used.

- iv) Control of oil vapours- The oil vapours of the kitchen fumes should be burnt in pre heaters before they reach the ash traps. There are two types of pre heaters, one is electrically heated and other one is gas heated.

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10. Disposal of sewage: If facilities are available, the sewage from the toilets is dumped in the local municipal sewer system. In case such facility is not available the hotel authority will have to establish and maintain its own sewage treatment plant.

Sewage Treatment Plant

The sewage is treated properly and disinfected according to the local rules. The clean water from the treatment plant is used to irrigate lawns and flora of the hotel. The treated sewage slurry is dried in open land in the sun to turn into good quality manure cakes which may be either used in the hotel gardens or sold.

Water is treated in waste water treatment plants or effluent treatment plants. Such treatment plants treat water in three phases:-

- i) Primary treatment: This involves removal of large solids. It is mostly done by using screens and filters. These remove the large solids from the waste water.
- ii) Secondary treatment: In the second step of treatment the biological degradation of organic wastes in waste water is done by micro-organisms.
- iii) Tertiary treatment: Here the removal of balance wastes is done which could not be removed by primary or secondary treatment. There are many methods available depending on the nature of the waste. Some methods which are commonly used are reverse osmosis, activated carbon etc.

Septic Tank- A sewage treatment process commonly used to treat domestic wastes is the septic tank. It may be a concrete, cinder block or metal tank where the solids settle and the floatable materials rise. The partly clarified liquid stream flows from a submerged outlet into subsurface rock-filled trenches through the wastewater can flow and percolate into the soil where it is oxidized aerobically. The floating matter and settled solids can be held from six months to several years, during which they are decomposed anaerobically.

Generator Exhaust

For big hotels it is essential to maintain their own emergency back up electric power arrangement. Diesel generator sets are used for this purpose. The exhaust from the gen sets is very irritating and contains carbon particulates, carbon monoxide and cancer producing gases.

The sets also produce a lot of vibration and noise. To mitigate these conditions following methods are used:-

- i) The gen sets should be installed at proper rooms at a distance from the main hotel building to reduce vibration and noise.
- ii) Vibration absorbing pads and noise suppressing arrangement are to be provided.

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- iii) The gen set room should be so oriented so that the exhaust is driven away from the main building with the natural airflow moist of the time of the year.
- iv) The exhaust is disposed through high chimneys with traps for the solid particulates.
- v) Multi discharge system is used to dilute the waste gases.

Chemical Wastes

If the hotel is not getting the municipal water it has to manage its own water supply through deep tube-wells. The water from these wells may require chemical and disinfecting treatment to make it potable. The chemical waste from the treatment plants should be discharged for dilution in water mass or drying up in pits, according to the local health and safety regulations.

Air Pollution

Presence of harmful gases and solid particles in air leads to air pollution. It is increasing in big cities very rapidly and has an adverse effect not only on human beings but also on other animals and plants.

Causes of air pollution:

1. By burning of fossil fuels in power houses, industries and vehicles. This gives off gases like carbon monoxide, sulphur dioxide and nitrogen dioxide.
2. Sulphur dioxide is formed from burning of coal and car exhaust. When it combines with oxygen and water in the air it forms sulphuric acid. The mixture of acid and rainwater that falls on the earth is called acid rain.
3. Increasing volume of carbon dioxide is a major cause of deforestation.

Effects of air pollution:

1. It causes irritation of eyes, dizziness, headache and respiratory diseases like bronchitis and asthma.
2. Automobile exhaust gases cause damage to liver and reproductive organs.
3. Excess carbon dioxide gas in the atmosphere traps the heat of the sun leading to a rise in the temperature of the earth over a period of time. This is called Greenhouse effect. Also this effects global warming.

4. Acid rain corrodes metals and damage marble. This also affected the marbles of Taj Mahal, responsible for the death of many aquatic animals, soil fertility by making the soil acidic etc.

Control of air pollution: Following measures can check the pollution to some extent-

1. Changing the energy source from fossil fuel to renewable energy sources like solar, wind, bio gas.

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2. Use of pollution control equipments like fabric filters, wet scrubber and electrostatic precipitator etc. in related industries.
3. Use of CNG as fuel for buses instead of diesel.
4. Use of unleaded petrol.
5. Use of car pool by office goers and school children.
6. Industries to treat gases released from the chimney.
7. Shifting of industrial units from residential areas to industrial areas which are far away from the cities.
8. Creating awareness and education among the masses.
9. Hotel industry must conduct research work and find better eco-friendly technology that reduces pollution.
10. Follow the norms already set by the respective authorities.

Water Pollution

Water pollution refers to the presence of harmful material in water. Pollution makes water unsafe for drinking, washing, cooking and sometimes even for recreation. According to the World Health Organization (WHO), water related diseases could kill 135 million people by 2020.

Causes of water pollution:

1. When untreated sewage (waste water from sinks, showers and toilets) is released into rivers, it is broken down by bacteria and oxygen is consumed in this process. This causes the deficiency of required level of oxygen in water and death of living organisms.
2. Industries often release waste (contains certain metals) into rivers which are harmful for living organisms.
3. Throwing of dead animals and dumping of other solid wastes into water.
4. Bathing and washing of clothes by human beings in ponds and rivers.
5. Excessive use of detergents.
6. Excessive use of fertilizers and pesticides cause water pollution as they are carried to water sources with rainwater.

Effects of water pollution:

1. Can cause water-borne diseases like typhoid, jaundice, dysentery, cholera etc.

2. It destroys aquatic plants and animals.
3. Because of the pollutants abnormal growth of certain plants may be there at the same time these may lead to death of flora and fauna.
4. Many pollutants released from the industries have got adverse effect on human health. For example, mercury damages nervous system; cadmium makes bones fragile etc. Pesticides may cause cancer and affect our immune system.

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Control of water pollution:

1. Sewage water should be treated before being released.
2. Chemical waste released by factories should be treated before being released into rivers.
3. Dead bodies of animals should not be thrown into water bodies.
4. Creating awareness amongst masses regarding importance of clean water.
5. Usage of inorganic fertilizers and pesticides in agricultural fields should be reduced.
6. Existing laws and regulations should be properly enforced.

Noise Pollution

The word noise derived from the Latin term nausea. It has been defined as unwanted sound, a potential hazard to health and communication, dumped into the environment, with regard to the adverse effect it may have on unwilling ears.

Understanding noise:

1. In simple language, noise is the unwanted and or unpleasant sounds, which masks (covers) the intelligible sounds and makes hearing difficult.
2. Noises are random (unpredictable and unsystematic) and undesirable sound signals, which produce an unpleasant hearing effect and at the same time mask the desired intelligible sound signals.
3. In acoustics, noise means any undesired sound, which is an irritant and objectionable or, which interferes with other intelligible sounds that are being listened to.

Types of noise:

1. In music, the effect of the complete range of audible sound wave frequencies heard simultaneously (at the same time), is analogous to white light, which contains all the frequencies of the light spectrum seen simultaneously. This is known as white noise. The sounds of cymbals and big drums have white noise characteristics. White noise is a periodic sound of non-uniform wave pattern of constituent frequencies and of random amplitude, occurring at random intervals.
2. The detrimental effects of noise are increasing day by day due to the increase of industries, types and number of transport vehicles, advances in information and entertainment technologies etc. has added further to the natural noise sources.

3. Due to the above reasons noise is present in every walk of our lives like, at home, workplace, during travel on roads and also during leisure activities.

Sources of noise:

The sources of noise can be divided into two categories, like

- i) Natural- Any sound created by natural sources which disturb hearing. Example, sound of big streams, waterfalls, storm, animal noise etc.
- ii) Artificial- Any noise created by manmade sources or machines such as :-

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External Sources:

1. Transport- a) Roads: Due to different types of transport modes and transport generated noise. b) Air: Planes and helicopters. c) Water: Steamers and powerboats. d) Rail transport: Trains, subway trains and trams etc.
2. Construction- a) Of big buildings b) Sport stadia.
3. Industry- Depends on the type, location and process of the industry.

Internal Sources:

Equipments and systems fixed in the building, like air conditioners and air conditioner plants, ventilation systems, exhaust fans, compressors, lifts and elevators, ice machines, laundry machines etc.

Modes of Entertainment:

Open areas- music groups, games, function areas, public gathering and revelry.

Covered areas- discos, theatres, feasts and public gathering.

Effects of noise on environment : Noise effects the bio world largely. It impedes the growth of the plant world, while it has got very adverse effect on animal world, specially on human, like-

Human health: * Retards the process of growth, * Induces high blood pressure (hypertension), * Effects the digestive process and promotes the chances of ulcers, * Damage to hearing system. Noise at 60 db become unbearable, while noise at 120 db may cause permanent deafness, * Nervous breakdown, * Induces irritation and aggressiveness, * Circulatory disturbances like palpitation, breathlessness and dizziness.

Privacy: Infringement of privacy

Disturbed environment: *Communication, * Difficulty in concentration.

Measure of Noise

A decibel is the standard for the measurement of noise. The zero on a decibel scale is at the threshold of hearing, the lowest sound pressure that can be heard, on the scale. According to Smith, 20 db is whisper, 40 db is the noise in a quiet office, 50 db is normal conversation, 80 db is the level at which the sound becomes physically painful.

The loudness of noise is measured in logarithmic units known as decibels (db) while the intensity is measured in watts per square metre (watts/m^2). Unit of sound level intensity (Loudness) is bell (ten decibels), named after Alexander Graham Bell. A list of common sound levels is given below:-

1. Jet aircraft – 120 db,
2. Heavy machinery – 90 db,
3. Busy street – 70 db,
4. Conversation – 50 db,
5. Whisper – 20 db.

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Difference between intensity of sound and loudness

While the intensity is the actual measure of force per unit area created by a sound signal, loudness is the level of sensation by a person. For example, a sound may be very loud for a small baby; it is normally loud for an adult while it may be very feeble for an old man with impaired hearing.

Sensitivity to sound

It depends on the factors like, * Age, * Sex, * Present health condition, * Present stress condition, * Time of the day, * Present activity, * Acoustic factors.

Control of Noise Pollution:

1. A green belt of vegetation (green muffler) could be used. The extra expanse of trees will absorb the noise.
2. Zoning should be specified. In each zones, the limit to which noise can be caused is specified.
3. Proper lubrication of machines and equipment will reduce friction and noise.
4. Ear plugs and ear muffs could be used in higher noise areas.
5. Noise pollution can be curbed by creating awareness and education.
6. Proper research work to be done to find better eco-friendly technology that reduces noise pollution.

According to the Ministry of Environment and Forests Notification of 14th February, 2000, following are the standards of noise pollution:

Area Code	Category of area/zone	Limits in Db (A)	
		Day time	Night time

A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence zone	50	40

