CHAPTER 8: ENVIRONMENTAL CONSERVATION

8.1 INTRODUCTION

A sewerage system including both on-site and off-site treatment is an infrastructure, which contributes to the improvement and conservation of the environment by reducing pollutants discharged to the water environment. A sewerage system is considered to have overall positive effects on environmental conservation. However, on the other hand, since the system handles insanitary objects, physical, mental and aesthetically negative impacts on the surrounding environment through both construction and operation stages are unavoidable.

Therefore, operational measures are required to minimize odour, epidemiological pollution, soil contamination and water pollution. Plant beautification and landscaping would be also required to maximize the aesthetics.

In addition, since the sewerage system is an essential urban infrastructure, which supports urban domestic, industrial and business activities, the operation of the sewerage system is also required to withstand disasters. This chapter mentions the concept of global warming and gas regulations.

8.2 ODOUR

8.2.1 Odour from the Sewerage System

Odours are a complex combination of a wide variety of compounds; however, there are certain compounds and groups of compounds that contribute specifically to sewage odours, and significantly determine the selection of the control technology. These include the following:

- Hydrogen sulphide, and
- Ammonia.

8.2.2 Odour Control Methods and Technologies

8.2.2.1 Odour Control Procedure

Odour control is a complex and time-consuming challenge, often requiring a combination of methods for treating odorous gases and for removing or reducing the potential causes of the odours. If an odour problem is severe enough to affect the community, an emergency response and solution to the problem must be carried out quickly.

The approach for selecting an odour control method or technology includes the following steps:

A. Identify the odour source and characteristics through sampling and analysis.

B. List and assign priorities to controlling a specific odour problem, recognizing considerations such as cost, plant location, future upgrading of various sewage processes, severity of the odour problem, and the nature of the affected area.

C. Select one or more odour control method or technology for implementation to meet the objectives of steps “a” and “b”, taking into consideration the advantages and disadvantages of each.

D. Monitor odour emissions from the treated air for process adjustments and for feedback to evaluate the solution’s effectiveness.

8.2.2.2 Sampling Methods

Solving any odour problem begins with sampling and analysing gases to identify and characterize the odours. The principal tools for diagnosing an odour problem are the techniques used for odour quantification and characterization. Chemical analysis of odour constituents could be performed. This is an indirect method, because the results of a chemical analysis still need to be related to odour concentration and intensity in some way.

8.2.2.3 Quantitative Testing-Analytical Methods

Gas chromatography can be used on many odorous organic compounds, but the analysis is complex and expensive. Figure 8.1 shows the portable gas-monitoring devices.

Figure 8.1 Detector tubes (left) and Gas sampling pump (right)

The concentrations of individual compounds can be measured via standard analytical methods. For example, a simple apparatus consisting of a gas detector tube can be used in the field.

These tubes are available for a number of compounds. For more accurate and complete results, samples should be collected in bags, stainless steel vacuum canisters, or tubes filled with adsorbent and analysed by gas chromatography in a laboratory.

Gas detector tubes are sealed glass tubes filled with an appropriate indicator chemical, which reacts with a particular gas and gives a colour reaction. To make a determination, the seals are broken at each end of the tube and a definite volume of the atmosphere for sampling is drawn through by a hand-operated or mechanical pump.

The tubes are marked off in scale divisions and the concentration is determined according to the length of discolouration of the indicator for a given volume of atmosphere.

Detector tubes are simple, easy to use devices that can provide reasonably reliable, on-the-spot measurement of gas concentrations. Their accuracy may be in the range of 70 to 90 % of the mean value if sampling is done carefully according to manufacturers' directions. For taking gas samples from difficult locations, extension tubes are available from manufacturers so that the detector tubes can be placed at the desired site. In making use of detector tubes precautions should be noted as per the manufacturers.

8.2.3 Hydrogen Sulphide (H_2S)

Hydrogen sulphide (H_2S) is the most common odorous gas found in sewage collection and treatment systems and results from the reduction of sulphate by bacteria under anaerobic conditions. Its characteristic rotten-egg odour is well known. The gas is corrosive, toxic and soluble in sewage.

8.2.3.1 Effects on Health

Hydrogen sulphide is considered a broad-spectrum poison, meaning it can poison several different systems in the body. Breathing very high levels of hydrogen sulphide can cause death within just a few breaths. Loss of consciousness can result after fewer than three breaths. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and fluid in the lungs. These symptoms usually go away within a few weeks. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory and dizziness.

Refer to Section 9.2.2.1.2 “Risk of Hydrogen Sulphide Poisoning in Confined Space” of Chapter 9 of this manual.

8.2.3.2 Locations of Sources

A. On-site

Septic tank, anaerobic filters and mini-package treatment plant

B. Conveyance

Sewers, manholes and closed drains (simplified sewers)

C. SPS

Collection well

D. STP

Collection well, primary settling tank, sludge thickener, sludge digester, digested sludge sump, dewatering centrate/filtrate, sludge drying beds, UASB reactor, anaerobic lagoons, sludge lagoons and septage treatment facility

8.2.3.3 Measurement

- Proper measurements should be performed in accordance with IS 5182 Part 7.
- Short-term detector tubes, portable gas detector, etc., can be used for simplified measurements.

- When measuring concentration at a location where odour is generated (particularly when the concentration level is not known), take care to perform the work after wearing a gas protection mask. If the concentration is high, toxicity may be high; this is dangerous. Refer to Sec.9.3.1.1.1,a "Measurement method" of chapter 9 of this manual.

8.2.3.4 Preventive Measures

Hydrogen sulphide production can be controlled by maintaining conditions that prevent the build-up of sulphides in the sewage. The presence of oxygen at concentrations of more than 1.0 mg/L in the sewage prevents sulphide build-up because sulphide produced by anaerobic bacteria is aerobically oxidized.

Maintaining an aerobic environment inhibits the anaerobic degradation process, which contributes to the generation of hydrogen sulphide. A checklist is given below:

- Prevent corrosion in the collection well of the facility by blowing air through the facility
- Avoid storing screenings and grit generated in the grit chamber for a long time. Dispose of screenings and grit at appropriate intervals
- Retention time of sludge in the sludge treatment facilities should be appropriate (Do not retain sludge for a long time)
- Maintain sewage at neutral pH range because most of the sulphide is present at a pH value of less than 7.
- Impossible to prevent the odour from septic tanks because we cannot expect fine quality water to be used for ablution. Therefore, it is important to ventilate.

8.2.3.5 Control

The operator can

- Remove sand and grit deposited in house service connection or sewer immediately.
- Properly shut doors and windows of building where substances that become sources of foul odours are stored.
- Dispose of scum and sludge in the sedimentation basin at appropriate intervals and do not store them for a long period.
- Thoroughly clean each facility and the areas surrounding the facility.

Measures for septic tank are as follows:

- Open ventilating shaft at the cowl to the atmosphere and provide mosquito-proof netting. The height of the pipe should extend at least 2 m above the top of the highest building within a radius of 20 m. Refer to IS 2470 Part 1 and section 9.3.4 "Conventional Septic Tank" of chapter 9 of Part-A manual.

Operational precautions for deodorisation facilities are described below:

A. Soil (Bio) Deodorisation

This method makes use of oxidation and decomposition effects by micro-organisms to remove substances with foul odour. In actual practice in STP, the ventilated air is led to the reactor or soil bed and the odour is removed.

In this method, substance with foul odour is delivered to the bottom part of the fertile soil bed in highly moist condition, and the substance with foul odour is removed because of the oxidative ability of mainly heterotrophic bacteria.

The Soil (Bio) deodorisation configuration is shown in Figure 8.2.

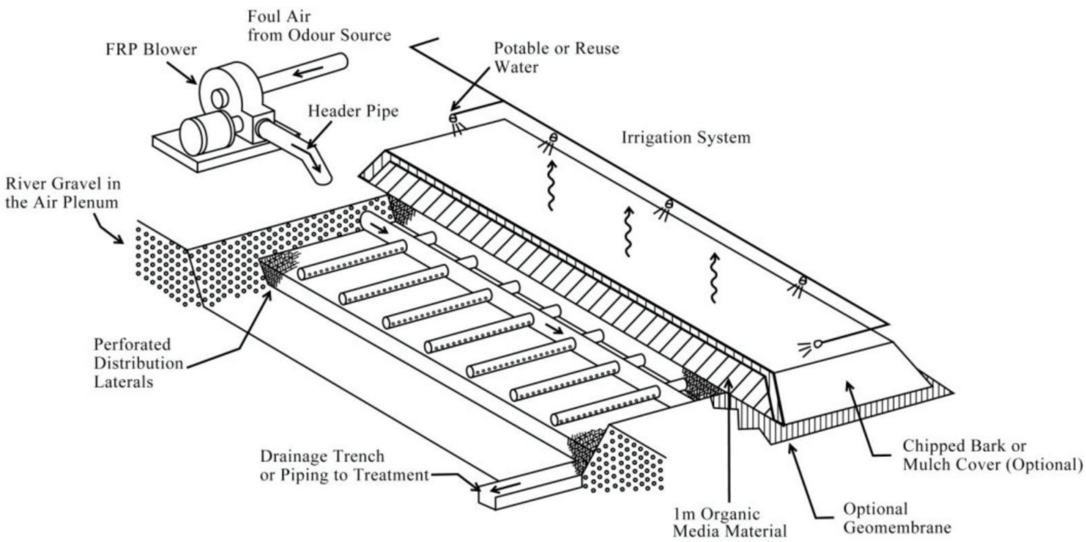

Figure 8.2 Soil (Bio) deodorisation configuration

Notes: Air for ventilation may concentrate in a certain part of the soil. In such cases, hole may have formed on the surface. Dig the soil so that air is vented uniformly.

B. ASP(Activated Sludge Process) - Deodorisation

This method makes use of decomposition effects by micro-organisms to remove substances with foul odour. In actual practice in STP, the ventilated air is led to the reactor and the odour is removed.

Ventilated air is delivered to the inlet side of the blower. The substance with foul odour is oxidized and decomposed by aerobic micro-organisms in the reactor. The mechanism of ASP-deodorisation is shown in Figure 8.3 overleaf.

C. Activated Carbon Deodorisation

Foul odours are passed through the adsorption tower filled with activated carbon (charcoal or coconut shell charcoal) and removed by physical adsorption. The effect is more pronounced when the substance with foul odour has large molecular weight.

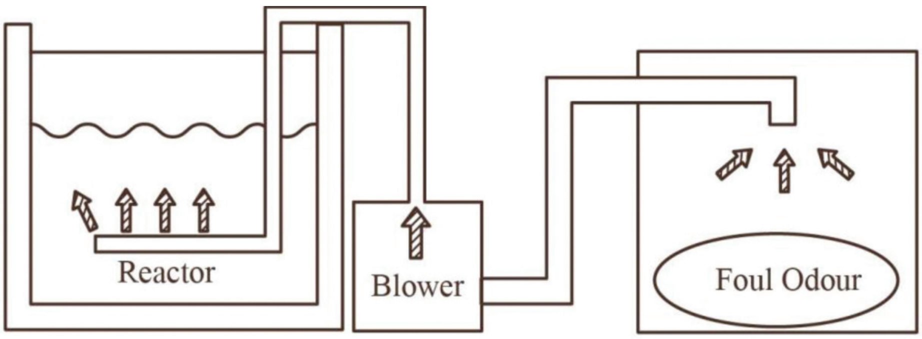

Figure 8.3 Mechanism of ASP-deodorization

Caution: Pipes used underwater are likely to clog easily; so periodically clean such pipes and remove the clogged material.

Odours are selective and the method is more effective in case of hydrogen sulphide and methyl mercaptan. However, it does not have any effect on ammonia and amines. It is suitable for faint odours, and is used as a finishing deodorising agent.

The normal activated carbons are acid, chlorine-based or halogen-attached activated carbons. These are effective in removing substances like hydrogen sulphide and ammonia. A typical setup is shown in Figure 8.4.

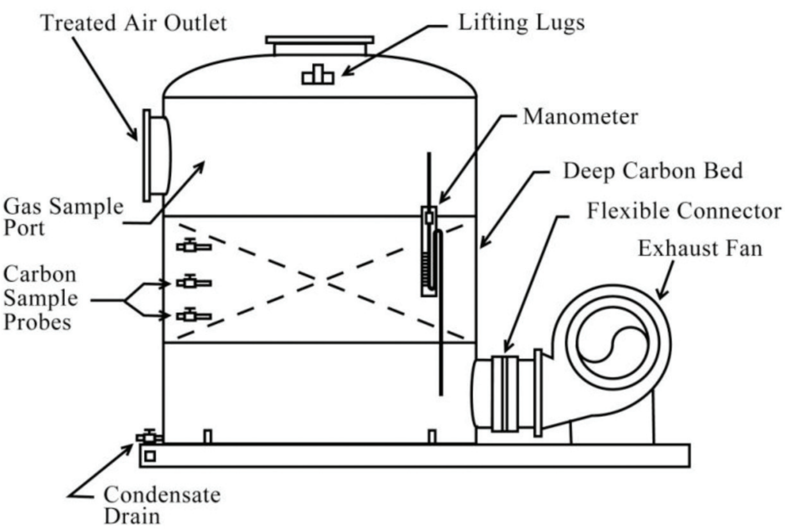

Figure 8.4 Activated-carbon deodorization

A differential pressure gauge is installed between the inlet and outlet of gas in this equipment. When the value indicated by this differential pressure gauge is large, clogging has probably occurred. This is a sign that the activated carbon is to be replaced or the pipe is to be cleaned.

Measure the concentration periodically near the outlet. When the value shows a sudden increase, it is time for replacement. (However, breakdown in the equipment may have occurred; confirm the equipment carefully and then perform work.)

The disposal of used activated carbon shall be as per the local PCB.

8.2.4 Ammonia (NH3)

Ammonia odour is most typically encountered at alkaline-stabilization facilities. Adding alkaline materials raises the pH, which causes the dissolved ammonia in de-watered cake to volatilize. Although the odours tend to dissipate quickly, the ammonia levels in mixing and drying areas can be high if the gas is not collected and treated.

8.2.4.1 Effects on Health

Ammonia is a colourless gas with specific irritant odour which when compressed liquefies at room temperature. Effects on the human body include irritation of the mucous membrane and breathing organs.

8.2.4.2 Locations of Sources

Ammonia typically appears in the de-watering processes and in the solids created from de-watering. This is especially true in digested solids. However, the small quantity of ammonia in sewage off gas at neutral pH contributes little to odour emissions, because the odours typically are dominated by sulphur compounds. Therefore, it is rarely necessary to provide an ammonia removal step in treating off gas from STP, unless lime or other alkaline material is used in the process to elevate the pH.

8.2.4.3 Measurement

- Proper measurements should be performed in accordance with IS 11255 Part 6.
- Short-term detector tubes, portable gas detector, etc., can be used for simplified measurement.

8.2.4.4 Preventive Measures

In the dewatering process, do not increase the pH.

8.2.4.5 Control

Generally, deodorisation equipment is effective in controlling ammonia, similar to H_2S. However, care is necessary since there is selectivity depending on the substance.

8.2.5 General Method of Prevention of Odour

Following is a short checklist of operational considerations for controlling odours of primary treatment facilities: (May also apply in other facilities)

- Remove scum routinely, with increased frequency during warm weather.
- Remove sludge before it can bubble or float.
- Wash weirs and other points where floatable and slime collect. Some facilities use submerged pipes with holes rather than effluent troughs. The submerged pipes do not splash the primary effluent, thereby reducing the release of hydrogen sulphide.

- Wash down all spills and grease coatings.
- When draining a tank, immediately flush it completely. If sludge does not drain quickly, spray lime, calcium hypochlorite, or potassium permanganate on the sludge surface to reduce odours. Because even a clean tank can produce odours, flushing the tank with a chlorine solution or keeping the tank floor covered with a low concentration of chlorine solution will reduce odours.
- If the sewage is septic, add chemicals in the collection system or at the plant, as appropriate, to reduce sulphides.
- If tanks are covered for odour control, keep plates and access hatches in place.
- Routinely check any odour scrubbers or deodorizers for plugging, adequate supply of chemicals, proper pressures for demisting, and/or effectiveness of carbon.
- The splashing of primary sewage into weir troughs and effluent channels can result in the release of hydrogen sulphide. If possible, try to minimize the splashing of primary sewage into the channel or weirs. If it cannot be accomplished operationally, then installing submerged sewer pipes may be necessary. This will require tank modifications to verify the plant hydraulics and provide proper control to avoid fluctuations in the tank levels.
- Minimize the stripping of hydrogen sulphide from the sewage when using channel air diffuser systems.

Adoption of the following regular practices will not only increase removal efficiency, but will provide better working conditions for the operator:

- Regularly remove accumulations from the inlet baffles and outlet weirs with a hose or a broom with stiff bristles. Only experience will determine the necessary frequency.
- Clean scum removal equipment regularly; otherwise obnoxious odours and an unsightly appearance will result.
- Keep cover plates in place except when operations or maintenance require their removal.
- Immediately flush and remove all sewage and sludge spills. Avoid hosing down motors and enclosed control devices.
- Establish a housekeeping schedule for the primary treatment area, including galleries, stairwells, control rooms, and related buildings, and assign responsibility for each item to a specific employee.
- Repaint surfaces as necessary for surface protection and appearance.

8.2.6 Chemical Addition

Chemical addition can control odours in STP by preventing anaerobic conditions or controlling the release of odorous substances. These chemicals fall into four basic groups based on their mechanisms for odour control, shown in Tables 8.1 to 8.4 overleaf.

Table 8.1 Chemicals used for liquid-phase odour control

Chemical	Effective against
Oxidizers	
Ozone	Atmospheric hydrogen sulphide only
Hydrogen peroxide	Hydrogen sulphide, also acts as an oxygen source
Chlorine	Hydrogen sulphide and other reduced sulphur compounds
Sodium and calcium hypochlorite	Hydrogen sulphide and other reduced sulphur compounds
Potassium permanganate	Hydrogen sulphide and other reduced sulphur compounds
Raising the oxidation–reduction potential	
Oxygen	Higher temperatures increase microbial action of anaerobic bacteria and increase the release of volatile organic compounds from the liquid to the gaseous phase.
Nitrate	
Hydrogen peroxide	
Chlorine	
Bactericides	
Chlorine	Kill or inactivate anaerobic bacteria
Hydrogen peroxide	
Potassium permanganate	
Chlorine dioxide	
Sodium hypochlorite	
Oxygen	
pH modifiers	
Lime	Prevent off gassing of hydrogen sulphide; at a very high
Sodium hydroxide	pH acts as a bactericide on sewer wall slimes

Source: WEF, 2008

Table 8.2 Liquid process operational emissions control

Process	Problems	Control measures
Preliminary treatment		
Coarse bar screens	Influent sulphide is stripped by turbulence inherent to these processes.	• Upstream chemical addition. • Recycle return activated sludge (RAS) to headworks. • Containment and ventilation to a vapour-phase control system.
Fine bar screens		
Primary treatment		
Primary clarifiers	Sulphide formed in basins during holding. Sulphide and stripped at weirs. Sulphide forms in settled solids.	• Remove unneeded basins from service. • Raise water level in flume to decrease weir drop. • Pump sludge more often. • Avoid co-settling of sludge. • Add iron salts directly or upstream. • Containment and ventilation to a vapour-phase control system.
Flow equalization basins	Odour from residual solids in flow equalization basins.	Install collection and removal equipment and flush solids with high-pressure hoses after each basin dewatering.
Secondary treatment		
Trickling filters	Influent sulphides stripped at distributors. Sulphide formed when overloaded or oxygen deficient.	• Add iron salts upstream. • Limit loading. • Provide power ventilation. • Slow down distributors or increase wetting rate to maintain a thin aerobic film.
Rotating biological contactors (RBCs)		
Aeration basins	Influent sulphide stripped at head of basin. Sulphides form when oxygen deficient.	• Decrease aeration at head of basin. • Fine-bubble diffusers cause less stripping than coarse bubble. • Pure oxygen causes lowest odour emissions.

Source: WEF, 2008

Table 8.3 Solids process operational emissions control

Process	Problems	Control measures
Thickening		
Gravity thickeners	Co-thickening biological and primary sludge causes sulphide generation. Long detention under anaerobic conditions is problematic.	• Avoid co-thickening, if multiple basins are available. • Use direct chemical treatment to reduce sulphide formed during thickening. • Provide containment and ventilation to a vapour-phase control system.
Dissolved air flotation	Aeration strips sulphide and odours from sludge.	• Use chemical pre-treatment to remove sulphide from sludge before processing. • Provide containment and ventilation to a vapour-phase control system.
Dewatering		
Belt presses	Pressing strips sulphide from feed sludge into belt press room.	• Potassium permanganate or hydrogen peroxide will treat sulphide and other odorous. • Provide containment and ventilation to a vapour-phase control system.
Stabilization		
Anaerobic digesters	The H_2S formed in the process corrodes combustion equipment. Air quality is a concern, because H_2S is converted to sulphur dioxide during combustion.	• Maintain proper temperature and pH in the process. • Add iron salts directly to the digester, at headworks, or at primary clarifiers.
Aerobic digesters	Odorous compounds form when process is overloaded or oxygen-deficient	• Provide adequate aeration and mixing to maintain aerobic conditions. • Feed at uniform organic loadings.
Lime stabilization	Ammonia is released due to high pH.	• Vent ammonia to outside unless concentrations are very high or the site is in a sensitive area.

Source: WEF, 2008

Table 8.4 Summary of odour control technology applications at sewage treatment facilities

Methods	Effects	Problems
Industrial process changes		
Lower waste temperature	Hydrogen sulphide evolution much retarded	—
Pretreat to remove odorous organics		
Collection system		
Mechanical cleaning	Hydrogen sulphide reduction	—
Aeration		
Ventilation		
Grit chamber		
Daily grit washing	General odour reduction	—
Primary clarifiers		
Increase frequency of solids and scum removal	General odour reduction	—
Aeration tanks		
Remove solids deposits	General odour reduction	—
Increase aeration to maintain dissolved oxygen at 2 mg/L		
Trickling filters (as also similar processes with synthetic media)		
Increase recirculation rate	General odour reduction	—
Keep vents clear		
Check under drains for clogging		

Table 8.4 Summary of odour control technology applications at sewage treatment facilities - continued

Methods	Effects	Problems
Anaerobic digesters		
Check waste gas burner	General odour reduction	—
Relief valves should close tightly		
Aerobic digesters		
Maintain constant loading	General odour reduction	—
Maintain adequate aeration		
Liquid-phase control alternatives—Chemical addition		
Ozone	Oxidizes water-insoluble odorants into water-soluble products	Requires onsite regeneration
Iron	Controls slime growth; precipitates sulphide; enhances settling	Increases solids
Nitrates	Inhibits production of sulphides	Costly
pH adjustment		
Alkali: NaOH	pH hinders bacterial growth in sewers and retards evolution of hydrogen sulphide.	—
Acid: HCl or H_2SO_4	Acid combines with basic ammonia and amines	—
Chlorine (gas and hypochlorite)	Inhibits growth of sulphate-reducing bacteria in sewers; oxidizes H_2S and ammonia	—
Potassium permanganate	Reacts with sulphide and other organics to reduce odour	—

Source: WEF, 2008

The effectiveness of chemical addition as an odour control technology depends on such variables as cost, dosage, presence of odour-causing compounds, effects of chemical accumulations in sludge and process waters, equipment maintenance, space limitations, and safety or toxic substance concerns. Typical odour-control applications include collection systems, headworks, primary clarifiers, process side streams, aeration tanks, solids-handling applications and storage lagoons.

In general, it is more cost-effective to treat odours in the liquid phase than in the vapour phase.

Common chemical agents used to control odours include iron salts, hydrogen peroxide, sodium hypochlorite (chlorine), potassium permanganate, nitrates and ozone.

8.2.7 Monitoring

Regular monitoring of treatment processes can prevent odour releases as well as provide valuable information on operating procedures.

8.3 EPIDEMIOLOGICAL POLLUTION

Potentially pathogenic aerosols are generated as a result of the physical processes of aeration, trickling, spraying sewage and sludge.

The density of microorganisms in aerosols is a function of the density of a specific organism in the sewage, aeration basin, or sludge, the amount of material aerosolized, the effect of aerosol shock (impact), and finally, biological decay of the organisms with distance in the downwind direction.

In a STP, there are commonly either stagnant anaerobic conditions or an aerated mass of heated microbial material. With the use of activated sludge as a standard treatment process, the operators walk above and around a cauldron of airborne aerosols. They are often exposed to low-level aerosolized versions of microbes, some of which may be infectious.

8.3.1 Effects on Health

These aerosols may contain bacterial and viral infectious agents, and infections may result from contact with these aerosol mists. It is impossible to eliminate all sources of aerosol contamination in a STP.

The immune systems of many operators build up antibodies to a variety of bacterial and viral infectious agents. They become what are nicknamed “universal carriers” because they are often in contact with low levels of infectious agents that will not make them ill, but that they can buildup immunity like vaccination. However, if operator’s get run down they come into contact with significant infectious agents and they can easily become ill. Refer to section 9.2.1 “Diseases” of chapter 9 of this manual.

8.3.2 Locations of Sources

The aeration tanks and attached growth system are the locations of sources as shown in Figure 8.5 overleaf.

Figure 8.5 Aeration tank (left) and Attached growth system (right)

8.3.3 Measurement

Perform sampling using filter paper. Then, the samples can be collected on a Petri dish and grown in the laboratory. These samples can later be tested.

The following are the studies to be carried out in an STP:

The total microorganism content of air immediately over the aeration tank liquid surfaces:

- Decreases exponentially with height at least within the first 100 cm above the aeration tank liquid surface
- Approaches background concentrations by extrapolation of current data within 2.5 to 4 m above the aeration tank liquid surface
- Appears to be influenced by several factors, including the mixed liquor suspended solids concentration of the aeration tanks, bacterial die-off, fall-back of larger particles, and dispersion by wind currents.

In view of the above, one should bear in mind that aerosol increases closer to aeration tanks and also increases as one goes downwind.

8.3.4 Preventive Measures

- Cover the aeration tanks and attached growth systems. (To prevent diffusion of aerosols)
- Plant tall trees around tanks to prevent diffusion of aerosols.
- Stop using surface aerators and use diffused aerators.

8.3.5 Control

Controlling epidemic microbes in sewage is difficult. The above-mentioned preventive measures are desirable.

8.4 SOIL CONTAMINATION

Soil contamination has become an issue in recent years. A STP that plays an important role in conserving the environment cannot become a source of contamination itself. Sewage leaks sometimes become issues. To prevent leaks in an STP, the following are necessary:

A. Check for leaks in every facility. (High probability of leaks in pipe parts and connections between facilities.)

B. Even if there are no leaks in the facility, there may be fissures or cracks. If so, immediately repair the same on site. If this is not possible, discuss with the plant engineer and make arrangements to get the defects repaired.

C. Sometimes, sewage overflows. In such a case, check whether the flow rate to the facility is greater than the design flow rate.

D. If the flow rate is below the design flow rate, there is a possibility of clogging in the stage after the problem location. The cause of the clogging should be eliminated.

E. Since sludge is thicker than sewage, it is likely to cause clogging in the sludge treatment facilities. For this reason, care should be taken against leaks from the sludge treatment facilities. Efforts should be made to eliminate leaks.

F. If the leak is identified clearly, and soil contamination is likely to occur, discuss with the plant engineer to get accurate measurements to be made by an authorized laboratory of the local PCB.

G. It is good to maintain a record of the TDS of ground water in the well waters of households surrounding the STP so that questions of sewage seeping into ground water and polluting the well waters can be verified.

8.5 WATER POLLUTION

Surface-water quality considerations include compliance with treated sewage standards at the discharge point with respect to parameters like BOD, suspended and floating solids, oil & grease, nutrients, coliforms, etc.

Special consideration may be given to the presence of public bathing ghats and intake points for water supply downstream.

Another environmental consideration is the potential for ground water pollution presented by the treatment units proposed to be built.

Necessary precautions should be taken to prevent water supply contamination due to leakage from sewers. Appropriate distance between water supply pipes and sewer pipes shall be maintained. On the other hand, early detection of sewage leakage and the repair is indispensable by implementing sewer inspections described in 2.2 “Inspection and examination for sewer” of Chapter 2 in this manual.

8.6 SEWAGE TREATMENT PLANT BEAUTIFICATION AND LANDSCAPING

A STP is a facility that handles sewage. The working environment in such a plant is poor since foul odours are generated. It is therefore essential that a clean environment be maintained within the STP through daily cleaning of the plant. Within the boundaries of the premises, open areas should be planted with trees and foul odours should be dispersed.

Specific measures should preferably be adopted such as providing park-like spaces within the premises to offer residents a place for relaxation and rest. The treated sewage should be reused for watering plants and trees within the premises.

Examples of plant beautification are shown in the Figure 8.6.

Source: BWSS Board

Figure 8.6 An example of plant beautification adopted in Bangalore

8.7 REGULATION OF GREENHOUSE GAS

8.7.1 Greenhouse Gas

Greenhouse gases such as Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and Freon are released in large quantities to the atmosphere with the increasingly energetic activities of human beings, and the average temperature of the entire earth has increased. This phenomenon is known as global warming. Global warming of the earth has a serious impact on the global environment. Carbon dioxide (CO_2) emissions and methane (CH_4) generated are issues in STP operation.

A. Carbon Dioxide (CO_2)

Carbon dioxide is formed from the complete combustion of any fuel that contains carbon (e.g., methane). Any boiler, flare or power-generation technology that combusts methane, will produce a corresponding predictable amount of carbon dioxide.

B. Methane (CH_4)

Methane is the principal component of both digester gas and natural gas. It is a light gas with a specific gravity of less than 1.0. Methane is one of the critical greenhouse gases;

its global warming potential is 21 – 23 times that of carbon dioxide. From a greenhouse gas perspective, it is vital to completely flare all methane without direct atmospheric release.

8.7.2 Control

Reduction in the use of fossil fuels (fossil fuels are used even for generating electric power; so use of power is linked to the use of fossil fuels)

- Fuel for operating the sewerage facilities and reduced use of electricity are essential. (For instance, change from continuous operation to intermittent operation, if possible)
- Measures against generation of CH_4 from the treatment plant (since generation of this gas cannot be inhibited, conversion of the generated gas may be considered)

Since the generation of CH_4 is linked to global warming, checks on the CH_4 collection facility and leaks in piping are very important.

If there is damage or signs of damage, repairs should be carried out quickly.

8.7.3. Effective Use of Biogas

Biogas includes organic matter derived from of carbon, hydrogen, sulphur, and so on, and is a potential energy source of high value.

Presently, the main uses are as follows.

- Used in dual fuel engines. A part of the power requirements of a STP can be met by generating power using biogas explained in clause 5.16.1.2 and its sub clauses in Part-A manual.

8.8 CARBON CREDIT RECORD

This is a term that qualifies the holder to emit one ton of carbon dioxide into the atmosphere and is awarded to institutions or countries that have reduced their greenhouse gases below their emission quota, which literally means emission standards. These carbon credits can be traded in the international market at their current market price. For details, refer to Sec. 5.17 carbon credit of Part-A (Manual).

In STP to meet the requirements, the following are to be mainly performed:

A. An example of the Clean Development Mechanism (CDM) project in sewerage facilities is biomass power generation. This project focuses on CH_4 generated from the facilities.

B. For the project, the baseline CO_2 emissions must be studied. Based on this study, the CO_2 emissions in the base year and the reduction in CO_2 emissions thereafter are considered for approval of carbon credits.

C. Accurate data during operation is required for specifying the baseline.

D. Data collection and retention of accuracy of measuring instruments are the necessary items on site.

E. STP power and flow rate data are mainly collected through SCADA. Refer to Chapter 5 sec.5.12.12 “SCADA system” of Part-A manual.

F. Even after the project is approved, data collection and maintenance of measuring equipment will have to continue.

8.9 SUMMARY

STPs are intended primarily for improvement of water environment. They should be operated properly while preventing water pollution and odour problems. In addition to prevention of air pollution and soil contamination, planting of suitable greenery and landscaping is also required to improve the environment.