CHAPTER 1
INTRODUCTION

1.0 BACKGROUND

Rapid industrialization and urbanization has entirely changed the hazardous and municipal waste scenario in the country. The quantity of industrial, urban, municipal and agricultural wastes generated has increased appreciably and the nature of the wastes generated has become complex. Their impacts on the different ecological systems are visible now. The waste disposal activities if not managed aptly, certainly contaminate the soil, surface water and ground water, which form important resources used by the human beings in day to day activities. The impacts of the waste disposal have manifested in many forms such as health claims, total accidents, increased mortality rate and contamination of valuable natural resources. Urban and industrial activity causes huge amount of solid waste every year. Open waste disposal and land filling of these solid waste is the most common disposal alternatives in most countries. In a recycling and reuse society, landfills will still play an important role in the process of waste handling.

The increase in the population and rapid industrial growth in India has changed the lifestyle of urban residents, thus changing the composition of the garbage generated. The presence of paper, plastic and metal is on the rise, resulting in more disposal difficulty. The municipalities have not been able to collect and dispose of the enormous quantity of waste been generated. Scavengers and rag pickers have helped the corporations with the collection of the garbage generated, since they collect it from households to garbage dumps and carry out the important function of waste segregation. Waste management and disposal is a serious issue facing India today, since about 90% of waste is currently disposed of by open-dumping. Some commonly used methods by which the waste could be managed are: incineration, land filling and composting. However, these methods are inefficient and harm the environment.
1.1 Integrated Municipal Solid Waste Management Lifecycle

Integrated Municipal Solid Waste Management (IMSWM) is a comprehensive waste prevention, recycling, composting, and disposal program. An effective ISWM system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment. IMSWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions. The major ISWM activities are waste prevention, recycling and composting, combustion and disposal in properly designed, constructed, and managed landfills. Each of these activities requires careful planning, financing, collection, and transport, all of which are discussed in this chapter.
1.2 CLASSIFICATION OF SOLID WASTES

There are many terms, which relate to the types and sources of wastes and these too must be defined. Based on the source, origin and type of waste a comprehensive classification is obligatory. Because of the heterogeneous nature of solid wastes, no single method of classification is entirely satisfactory. To identify the source of waste, classifying wastes as domestic/municipal or industrial is particularly useful. For other situations, the types of waste, garbage, rubbish, ashes, street waste is of greater significance because it gives a better indication of the physical and chemical characteristics of the waste. The principal classification is given in Table 1.1. The first three types, garbage, rubbish and ashes are those which make up the bulk of municipal wastes, derived principally from households, institutions and commercial areas. Further the industrial wastes resulting from industrial processes and manufacturing operations such as food processing waste, boiler house cinders, wood, plastic and metal scraps etc. These wastes pose the most alarming/serious problems in urban areas.

Landfills and open waste disposal is a predominant method of solid waste handling and disposal as is been done in Hyderabad city. The most commonly used disposal sites are pits, abandoned quarries, or natural land surface depressions. When the solid wastes are thus disposed consequently generate landfill leachate by excess rainwater percolating through landfill waste layers. Combined physical, chemical, and microbial processes in the waste, transfer the pollutants from waste material to the percolating water. Leachate from common types of landfill that receive a mixture of municipal, commercial, and mixed industrial waste, but excluding significant amounts of concentrated specific chemical waste, may be characterized as water based solution containing four groups of pollutants (Christensen et.al., 1994).

Source: Solid Waste Management in Developing Countries by Bhide & Sunderasan, INSDOC April, 1983
# Table 1.1 Classification of Solid Wastes

<table>
<thead>
<tr>
<th>TYPES OF SOLID WASTE</th>
<th>DESCRIPTION</th>
<th>SOURCES</th>
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<tbody>
<tr>
<td>Food waste (garbage)</td>
<td>Wastes from the preparation, cooking, and serving of food. Market refuse, waste from the handling, storage, and sale of produce and meats and vegetable. Combustible (primary organic) paper, cardboard, cartons wood, boxes, plastics, rags, cloth, bedding, leather, rubber, grass, leaves, yard trimmings. Noncombustible (primary inorganic) metals, tin cans, metal foils dirt, stones, bricks, ceramics, crockery, glass bottles, other mineral refuse.</td>
<td>Households, institutions and commercial such as hotels, stores, restaurants, markets, etc.</td>
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<tr>
<td>Rubbish</td>
<td>Residue from fires used for cooking and for heating buildings, cinders, clinkers, thermal power plants.</td>
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<tr>
<td>Ashes and Residues</td>
<td>Large auto parts, tyres, stoves refrigerators, others large appliances, furniture, large crates, trees, branches, palm fronts, stumps, flotage.</td>
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</tr>
<tr>
<td>Bulky waste</td>
<td>Street sweepings, Dirt, leaves, catch basin dirt, animal droppings, contents of litter receptacles dead animals.</td>
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<tr>
<td>Street waste</td>
<td>Small animals: cats, dogs, poultry etc. Large animals: horses, cows etc.</td>
<td>Streets, sidewalks, alleys, vacant lots, etc.</td>
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<tr>
<td>Dead animals</td>
<td>Lumber, roofing, and sheathing scraps, crop residues, rubble, broken concrete, plaster, conduit pipe, wire, insulation etc.</td>
<td>Construction and demolition sites, remodeling, repairing sites</td>
</tr>
<tr>
<td>Construction &amp; demolition waste</td>
<td>Solid wastes resulting from industry processes and manufacturing operations, such as food processing wastes, boiler house cinders, wood, plastic and metal scraps and shaving, etc. Effluent treatment plant sludge of industries and sewage treatment plant sludges, coarse screening, grit &amp; septic tank</td>
<td>Factories, power plants, treatment plants, etc.</td>
</tr>
<tr>
<td>Industrial waste &amp; sludges</td>
<td>Hazardous wastes: pathological waste, explosives, radioactive material, toxic waste etc.</td>
<td></td>
</tr>
<tr>
<td>Hazardous wastes</td>
<td>Tree-trimmings, leaves, waste from parks and gardens, etc.</td>
<td>Households, hospitals, institution, stores, industry, etc.</td>
</tr>
<tr>
<td>Horticulture Wastes</td>
<td></td>
<td>Parks, gardens, roadside trees, etc.</td>
</tr>
</tbody>
</table>
1. Dissolved organic matter, expressed as chemical oxygen demand (COD) or total organic carbon (TOC), including methane, volatile fatty acids.

2. Inorganic macro components: Calcium (Ca\(^{2+}\)), Magnesium (Mg\(^{2+}\)), Sodium (Na\(^+\)), Potassium (K\(^+\)), Ammonium (NH\(_4^+\)), Iron (Fe\(^{2+}\)), Manganese (Mn\(^{2+}\)), Chloride (Cl\(^-\)), Sulfate (SO\(_4^{2-}\)) and bicarbonate (HCO\(_3^-\)).

3. Heavy Metals: Cadmium (Cd\(^{2+}\)), Chromium (Cr\(^{3+}\)), Copper (Cu\(^{2+}\)), Lead (Pb\(^{2+}\)), Nickel (Ni\(^{2+}\)), and Zinc (Zn\(^{2+}\)).

4. Xenobiotic organic compounds (XOCs) originating from household or industrial chemicals and present in relatively low concentrations in the leachate (usually less than 1mgL\(^{-1}\) of individual compounds). These compounds include, among others, a variety of aromatic hydrocarbons, phenols, chlorinated aliphatic hydrocarbons, and pesticides.

All compounds in leachate entering an aquifer will be subject to dilution as the leachate mixes with groundwater (Freeze and Cherry, 1979). Dilution is the interaction of the leachate flow in the aquifer with the flow of groundwater. Leachate migration should be seen in terms of a three-dimensional plume developing in a three-dimensional geological structure where gradients, permeability, and physical boundaries (geological strata, infiltration, rivers, abstraction wells etc.) determine the position and migration velocity of the plume. Dilution is governed by macroscopic dispersion and molecular diffusion, but can also be affected by local vertical gradients, leachate density, and to some extent viscosity.

**1.3 Transport of pollutants in waste disposal site**

The transport and fate of pollutants emanated from the waste in a landfill and open waste dumpsites depends on various mechanisms like biotic and abiotic degradation,
advection and diffusion, sorption to particles and desorption. A simplified physical view of leakage from a landfill into a stratified formation is shown in Fig 1.1.

**Fig 1.1 Schematic view of leakage from a landfill site**

Contaminant leakage with constant concentration is released at $x=0$ in all layers. The stratigraphy is horizontal such that the hydraulic conductivity does not change along the $x$ axis but does change along the vertical direction ($z$ axis). Uniform groundwater flow is from left to right, parallel with the stratigraphic layers. It is generally accepted that, for nonreactive solute transport in a region without sinks/sources, the concentration distribution is governed by the Advective-Dispersion Equation (ADE) in a local scale:

$$\nabla \cdot (D \nabla C - qC) = \frac{\partial nC}{\partial t}$$

where $D$ is the local-scale dispersion coefficient tensor, which is determined by local-scale pore space geometry (grain size, shape, orientation, etc.) and groundwater flow velocity; $q$ is groundwater discharge which is related to groundwater velocity
\[ V = \frac{q}{n}, \text{ where } n \text{ is porosity, } C \text{ is concentration, } t \text{ is time.} \]

Considering the limited information about hydraulic conductivity, a stochastic approach is used to treat the local-scale ADE as a stochastic partial differential equation. In a strongly heterogeneous aquifer containing different layers with different hydraulic conductivities, the dispersive effect caused by velocity distribution will be the leading cause of dispersion. Local-scale dispersion will cause some transverse mixing between different layers. Leachate from active and closed solid waste landfills can be a major source of contamination to groundwater and surface waters (Hancock et al., 1995; Flyhammar, 1997; Ding et al., 2001). The impact of the leachate on the plants micro flora and micro fauna is very high and governed by several factors, such as high load of organic matter, heavy metals, high content of nitrogen and mass flux of transported contaminants (Loizidou and Kapetanios, 1993; Kjeldsen and Grundtvig, 1995). Water is the most important environmental medium which is principally susceptible to pollution. Groundwater contamination can originate on the surface of the ground and in the subsurface above and below the water table. Contaminant through the waste dumped on the ground ultimately reaches the groundwater with time. These pollutants migrate horizontally and vertically under favorable geochemical conditions thus contaminating soil and groundwater in the area. Contamination of soil and groundwater due to solid waste disposal is a matter of immense apprehension that affects the food chain and deteriorates human and animal health.

In recent years an enormous concern has been articulated over problems of contamination of soil, and groundwater with heavy/toxic metals due to unavoidable waste generation and disposal in urban areas which often cause damage to the environmental systems (Thuy et al., 2000). This can be severe in cities lacking efficient waste disposal systems or treatment plants. Environmental geochemical studies need to be carried out to evaluate the extent of pollution of soil and groundwater due to waste disposal. Keeping these facts a pedo geochemical and hydro geochemical study is being taken up at JawaharNagar, Dundigal and Autonagar waste disposal sites in Hyderabad.
1.4 DESCRIPTION OF THE AREA

The study area Jawahar Nagar lies between the Longitude 78°59′ N and Latitude 17°51′ E falling in Survey of India Toposheet No. 56 K/10/SW; Dundigal lies between Longitude 78°38′ N and Latitude 17°59′ E falling in Survey of India Toposheet No. 56 K/6 and Autonagar lies between Longitude 78°58′ N and Latitude 17°38′ E falling in Survey of India Toposheet No. 56 K/11, Fig 1.2.

1.5 DESCRIPTION OF THE DUMPSITES

There are around 40 sites in the neighborhood of Hyderabad, where hazardous wastes generated predominantly by the municipal and industrial units are being dumped haphazardly. As per the survey of the Environmental Protection and Training Research Institute (EPTRI), Hyderabad, the main reasons for the location of these un mindfull dumpsites around the city are due to improper handling and non-implementation of the Hazardous Waste Management Rules and non-availability of common waste management practices.

The area around Hyderabad districts has nearly 230 hazardous waste-generating industries. The belt also has the largest concentration of chemical and bulk drug manufacturing units, earning the State the nickname 'bulk drug capital' of the country. These units generate up to 0.71-lakh cu.m of organic, 0.26-lakh cu.m of inorganic, 0.37-lakh cu.m of miscellaneous and 0.04-lakh cu.m of inert wastes. According to the Comptroller and Auditor-General of India, hazardous wastes were being dumped by more than 230 industries in these districts in vacant lands and along roadsides close to industrial premises and other open areas. At Patancheru Industrial Development area, waste from paint and dye industries sealed in polythene bags and gunny bags were buried in pits followed by soil covering. In Jeedimetla industrial area, wastes were deposited on both sides of roads leading to the industries.
In the study area, indiscriminate dumping of domestic wastes in JawaharNagar and Autonagar area without following the method of waste segregation has become a routine practice with which the levels of toxic elements in soil and water may drastically exceed the permissible limits. The degree of contamination has been so intense that some parts of the environment have become unsuitable for human livelihood.
The contaminants from these dumpsites percolate and find its way to groundwater regime, contaminating it and resulting in considerable degradation of the groundwater quality. The continuous disposal of wastes will have a widespread impact on soil and groundwater in the proximity of dumpsites.

1.6 CLIMATIC CONDITIONS IN HYDERABAD

Tropical is the right term to define the climate of Hyderabad. Located at an elevation of 544 meters, the city observes three main seasons - summers, monsoons and winters. The summer season extends from March to May, whereas monsoons prevail from June to October and winter season lingers from November to February.

![Fig 1.3 Monthly Average Temperature and Rainfall in Hyderabad](image)

These are average maximum and average minimum temperature for Hyderabad. The highest temperature in Hyderabad for the month is usually higher than the average maximum temperature. Similarly, the lowest temperature in Hyderabad for the month is usually lower than the average minimum temperature Fig 1.3.
Hyderabad is fairly warm all throughout the year except for the winter season which is pleasant. Summer (March to May) is severely hot with temperature is always above 30°C and soaring as high as 45°C. Winter from November to February is pleasant with temperature running between 14°C to 22°C. Monsoon season (June to September) offers medium rains and may be associated with heavy winds.

1.6.1 Temperature

The mean daily temperature varies from 30°C to 36°C from April to June and from 20°C to 24°C in the months of December and January. The mean maximum temperature ranges between 40°C and 43°C in May. On individual days, the maximum temperature had touched 47°C in most parts of the region. After the withdrawal of the monsoon, the maximum temperature rises slightly due to increased insulation.

The mean minimum temperature is 13°C to 17°C in December and January, but it rises to 26°C to 29°C in May. The minimum temperature falls rapidly after October, as low as 10°C. The mean diurnal variation is 12°C for the year as a whole. It is 13°C to 15°C in February and March, and 8°C in the monsoon months of July and August. The climate is pleasant from November to February. The summer months of April and May are uncomfortable due to oppressive heat. The period from July to September is warm and humid.

1.6.2 Rainfall

Hyderabad receives an average rainfall of 900 mm from the southwest and northeast monsoon. More than 75% of the rainfall is received during the south-west monsoon season, i.e., from June to September, July being the month when it rains. September is the month, when there are rains. Its advent is sudden and the rainfall increases from less than 5% (of the annual) in May to 15% in June.
1.6.3 Humidity

Humidity in the morning is very high exceeding 80 per cent from July to September. In the dry months of March, April and May, humidity is generally low with an average of 25% to 30% and decreases to 20 % at individual stations.

1.6.4 Cloudiness

June to October is the period when more than half of the sky is covered with clouds, while only about 2/8 of the sky is clouded from January to March. Half of the days in July and August have overcast skies. About 10 to 13 days in the months of January, February and March, the skies are free from clouds in clear weather.

1.7 LITERATURE REVIEW

Several researchers world over are functioning on geochemical approach to identify the soil and water contamination around waste disposal sites. Dimitra Rapti-Caputo et al (2006, Engineering Geology, 85, 111–121) has discussed about the geochemical evidences of landfill leachate in groundwater. He carried out this study to evaluate the environmental risks associated with leachate flowing into groundwater resources, in the present research, a hydrogeological and geochemical monitoring of the two principal aquifer systems developed below the landfill of Sant'Agostino (Ferrara Province, Northern Italy) was performed.

Several stratigraphic columns and penetrometric tests have been analyzed in order to reconstruct in detail a lithological and hydrogeological model of the underground. The integrated elaboration of the data allowed to obtain information and to make inferences on i) the influence of the landfill on the contamination of the underground resources (high concentration in the same elements, like Cl, Al, Zn, Pb, Cr, Ni); ii) the contribution of the frequency in lithological variability (sand–peat–clay) on the propagation process of the contaminant elements on the aquifer system;
iii) the importance of the position of the monitoring network on the identification of the pollution process and the protection of the water resources.

Dimitra Rapti-Caputo et al (2006, Engineering Geology, 85, 122–131) in his next paper has brought out the focus on Pollution risk assessment based on hydrogeological data and management of solid waste landfills, in which he presented the preliminary results obtained by applying an integrated methodology that considers the way the refusal is treated, the management procedure of the landfill and the impact of the leachate on the underground water resources. He also verified the whole method for some landfills located in different geological conditions.

In another study A. Kasassi et al (2008, Bio resource Technology, 99, 8578–8584), measurements from a closed unlined landfill in carried out a research on Soil contamination by heavy metals with the aim of characterization of soil samples of a closed unlined landfill located northwest of Thessaloniki, North Greece, in relation to heavy metals values.

Peter Kjeldsen et al (1993, Journal of Hydrology, 142, 349-371), discussed about groundwater pollution source characterization of an old landfill, to demonstrate a quantitative evaluation of the leachate recharge by combining various relatively well-known methods and techniques. The quantitative evaluation includes information on leachate quantity and quality (covering variations in time and space) for Vejen Landfill, Denmark. The investigation of Vejen Landfill showed that only a minor part (8%) of the landfill area constituted a significant source of groundwater pollution.

The soil composition underlying the landfill and the presence of a small drainage ditch were both very important factors for the behavior of the landfill as a source of groundwater pollution.

Ernest K. et al (1988, Applied Geochemistry, Vol. 3, pp, 523-533), focused on Heavy metal migration at a landfill site, Sarnia, Ontario, Canada, by means of thermodynamic assessment and chemical interpretations. He brought out the significant findings that heavy metals leached from the landfill have migrated into the subsoil ~ 10 cm in the case of Pb, Cu and Zn, and up to 20 cm in the case of Fe. At one location in the landfill Cu, Zn, Pb and Fe at the clay/waste interface were found to be above their natural background concentrations by values. Thermodynamic calculations and Eh-pH diagrams suggest that Fe(OH)2, Zn(OH)2 and Pb(OH)2 are not stable phases in the solids of the subsoil.

Pradeep Jain et al (2005, Journal of Waste Management, 25, 25–35), discussed about heavy metal content in soil reclaimed from a municipal solid waste landfill in located in north central Florida. The objectives of this study were to characterize soil and fine organic matter recovered from a MSW landfill with respect to the metal content and to assess limitations associated with the reuse of these materials outside the landfill environment.

Perre E. et al (2006, Chemosphere, 63, 1879–1891), conferred about the Characterizing As (III, V) adsorption by soils surrounding ash disposal facilities in United States in which he explained that leachate derived from unlined coal ash disposal facilities is a potential anthropogenic source of arsenic to the environment. He also showed that the impact of leachate-induced changes in soil pH over time may not be significant for As(V) adsorption at pH < 7; However, As(III) adsorption may be impacted over the entire pH range especially if phyllosilicate clays contribute significantly to adsorption. He concluded that site-specific linearized adsorption coefficients estimated using the soil property relationships generated in this study will aid in predicting arrival of arsenic in a leachate plume.
G. Merrington et al (1994, Applied Geochemistry, Vol. 9. pp. 677-687), brought out a significant result about the transfer and fate of Cd, Cu, Pb and Zn from two historic metalliferous mine sites in the U.K. This study has attempted to show how a straightforward compartmental approach to the complex problem of pollutant metal transfer from historic metalliferous mine sites provides an indication of the form, magnitude and individual metal partitioning within the environment. These findings have wide general validity and applicability in mine sites redevelopment and reclamation programmes, where data on contaminant form and long-term release is required.

Thomas Baumann et al (2006, Water Research, 40, 2776 – 2786), figured out about colloid and heavy metal transport at landfill sites in direct contact with groundwater in Munich, Germany. He pointed out that Colloids are ubiquitous in aquatic systems and are suspected of facilitating contaminant transport. He also pointed out that at sites where the disposed waste is in direct contact with ground water, two main prerequisites for colloidal transport are fulfilled: these two prerequisites are a high concentration of colloids and many different contaminants, some that are very unlikely to be transported in an aqueous solution. The results suggest that the change of hydro chemical conditions at the interface, from a reducing, high ionic strength environment inside of the disposal sites to an oxidizing, low ionic strength environment in the groundwater together with physical filtration effects for the larger particles, is an effective chemical barrier for colloids. Field observations suggest that the colloids form a rather persistent coating around the aquifer matrix that reduces the hydraulic conductivity and enhances the sorption capacity of the aquifer close to the waste disposal sites.

M. O. Looser et al (1999, Journal of Water Research, Vol. 33, No. 17, pp. 3609 – 3616), discussed about the landfill underground pollution detection and characterization using inorganic traces in various contaminated areas located in Switzerland. He inferred that the use of the inorganic trace elements is helpful for the detection and/ or the survey of contaminated sites.
In this study he pointed out that the usual measured inorganic substances are insufficient for advanced pollution detection. These parameters are generated mainly by geogenic or diffuse anthropogenic sources and the normative limits, fixed for sanitary reasons, are too high to be considered as alarm levels. He suggested that the inorganic trace elements are a good tool to complete the usual investigations or monitoring methods but they must be used with a specific approach that takes into account the geologic and hydrogeologic environment.

M.A. Goncalves et al (2004, Applied Geochemistry, 19, 137–151), discussed about the base-metals and organic content in stream sediments in the vicinity of a landfill in Northern Portugal. In this paper, the environmental impact of such a landfill is studied, whose operation has been running for many years. According to author, a stronger correlation exists if the total concentration of organic compounds is considered, which suggests that base metals can be easily partitioned into the sediments by the rapid adsorption onto their surfaces by organic compounds near the pollution source. The organic content identified decreases downstream as do base metal concentrations. This can be explained by the formation of complexes with organic acids as is extensively reported in natural and laboratory systems. The overall results point to the limited capacity for pollutant retention in this system, and suggest that in case of serious failure the contaminated plumes are likely to disperse rapidly into the environment.

L. Giusti et al (2009, Journal of Waste Management, 29, 2227–2239), dealt about a review of waste management practices and their impact on human health. His work reviews (i) the most recent information on waste arising and waste disposal options in the world, in the European Union (EU), in Organization for Economic Co-operation and Development (OEDC) countries, and in some developing countries (notably China) and (ii) the potential direct and indirect impact of waste management activities on health. Though the main focus is primarily on municipal solid waste (MSW), exposure to bio aerosols from composting facilities and to pathogens from sewage treatment plants are considered.
The main conclusion of the overall assessment of the literature is that the evidence of adverse health outcomes for the general population living near landfill sites, incinerators, composting facilities and nuclear installations is usually insufficient and inconclusive. According to author there is convincing evidence of a high risk of gastrointestinal problems associated with pathogens originating at waste disposal sites and sewage treatment plants.

Subhasish Chattopadhyay et al (2009, Journal of Waste Management, 29, 1449–1458), discussed about A review on Municipal solid waste management in Kolkata, India in which he figured out that in Kolkata, the major disposal site of Dhapa is at the eastern fringe of the city at an average distance of 10 km from the collection points. The total area of the Dhapa landfill site is $21.47 \times 10^4$ m$^2$. Bulldozers at the disposal area are used to spread and level the garbage. Due to an increase in population, the total waste generation/disposal has increased over the years. The life of this disposal site is almost exhausted; however, another landfill site exists, and is located in the Garden Reach area of $3.52 \times 10^4$ m$^2$ where approximately 100 t of wastes are disposed of daily by open dumping. Author in his paper also highlighted about the groundwater pollution due to heavy metals such as lead and arsenic which are found to be above desired limit.

H. Lakshmikantha et al (2006, Journal of Waste Management, 26, 640–650), highlighted about the report on waste dump sites around Bangalore. The work aims at identifying, locating and quantifying the industrial and domestic waste dump sites located in and around Bangalore urban and rural districts of Karnataka state, India. It was reported that about 1500 tons of municipal waste per day is being generated from Bangalore city. Studies reveal that there is no scientific treatment and disposal facility for scientific management of the waste generated. The waste from industries and community areas is disposed in an unscientific manner at several open dump sites across the city.

There are more than 60 dump sites consisting of both municipal and industrial waste existing in and around Bangalore city; the locations are totally unhygienic.
Based on the experience gained from field visits, physical observation of the waste disposed, quantity and nature of the waste disposed, each site was given with a grading based on polluting potential of the site. Author reported that the disposal sites have got tremendous potential of spreading the epidemics/diseases to the people living in their immediate vicinity and at nearby places.

K. Jeevan Rao et al (2003), discussed about the soil and water Pollution due to open Landfills. The studies were conducted to evaluate the impact of land disposal of urban solid wastes as open landfill in Hyderabad city. He highlighted that indiscriminate dumping of urban solid wastes in low laying areas as open landfills can result in environmental pollution; predominantly contamination of water and soil. Author recommended facilitating the guidelines prescribed by the Ministry of Environment and Forest MOEF, New Delhi, to prevent soil and water pollution due to disposal of urban solid waste.

1.8 SCOPE OF THE PRESENT STUDY

Hyderabad is a major Indian city with a population of more than seven million and the extent of solid waste generated from the city is 3000 to 4000 tons per day. The solid waste generated in Hyderabad metropolitan area is disposed-off as open waste disposal and landfills in low-lying areas, creating a serious concern about the possible contamination of the ground water and soils. Therefore, a detailed study needs to be carried out to identify the type of toxic pollutants that are contaminating the groundwater and soils in and around the dumpsites. Improper and unscientific disposal of urban solid wastes can pollute the air, water and soil in several ways. The impact of solid waste dump on ground water and soil is vast and has adverse effect on human as well as on ecosystem. Entry of pollutants into the shallow aquifers by percolation from ground surface, through wells, from surface water and by saline water intrusion degrades the quality of sub surface water and soils.
The solid wastes can be a major source of groundwater pollution unless precautions are taken to treat leachate emanating through these waste disposal sites. Inorganic and organic constituents emanating from these dumpsites are toxic when their background value exceeds prescribed level. The movement of contaminated groundwater is controlled by physical and geochemical properties of (1) the contaminant (2) the groundwater and (3) the geologic system through which the contaminated groundwater is flowing.

Three waste disposal sites are selected for the present study located in the Hyderabad city, out of which two are municipal solid waste disposal sites at Jawahar Nagar and Autonagar, whereas one is hazardous waste disposal facility at Dundigal.

### 1.9 IMPORTANCE OF THE STUDY

The detail study of solid waste disposal, its impact on groundwater and soil, the geologic features affecting the migration of contaminants to the groundwater etc. is important to identify the extent of pollution in both the medias (groundwater and soil), to suggest appropriate remediation to the problem of water and soil contamination due to municipal and industrial solid wastes.

Since groundwater and soil are the important part of our environment. Virtually all aspects of the earth’s environment interact at one level or another with soil and water. To ascertain the extent of pollution due to these dumpsites and its impact on groundwater and soil in the study area, the following objectives are proposed for study:

### 1.10 AIMS AND OBJECTIVE

The Aims and Objectives of MSWM are

- To protect the health of the urban population, particularly that of low-income groups who suffer most from poor waste management.
- To promote environmental conditions by controlling pollution and ensuring the sustainability of ecosystems in the urban region.
To supports urban economic development by providing demanded waste management services and ensuring the efficient use and conservation of valuable materials and resources.

To protect environmental health

To promote the quality of the urban environment

To generate employment and incomes in the sector itself.

Study the nature of wastes dumped in and around the study area.

Determine the source of pollutants.

Understand the geochemistry of the groundwater and soil of the study area.

Prepare the distribution maps of heavy/toxic metals in soil and groundwater.

Suggesting the suitable measures to minimize the wastes from various sources and other remedial measures to overcome the problem associated with the contamination of soil and groundwater.