



**GOVERNMENT OF PUNJAB
ENVIRONMENTAL PROTECTION AGENCY**



Environmental Assessment Checklists and Guidelines

Solid Waste Management System

Contents

No.	Contents	Page No.
1.	Introduction	1
1.1	Background	
1.2	Purpose of the Guidelines	
1.3	Scope of the Guidelines	
1.4	How to Use these Guidelines	
1.5	Applicable Environmental Legislation	
2.	Project Profile	5
2.1	Overview of the Brick Manufacturing Industry	
2.2	Types of Brick Kilns	
2.3	Brick Manufacturing Process	
2.4	Project Description	
2.5	Raw Materials and Utilities	
2.6	Plant Layout and Supporting Infrastructure	
2.7	Resource Requirements	
2.8	Pollution Sources	
2.9	Applicable Environmental Requirements	
3.	Environmental Impacts	7
3.1	Waste Collection	
3.2	Waste Transportation	
3.3	Transfer Stations	
3.4	Material Recovery Facilities (MRFs)	
3.5	Composting Facilities	
3.6	Biomethanation / Anaerobic Digestion	
3.7	Waste-to-Energy Facilities	
3.8	Sanitary Landfills	
3.9	Leachate Treatment System	
3.10	Landfill Gas Collection System	
3.11	Closure and Post-Closure Management	
4.	Environmental Mitigation Measures	8
4.1	Waste Collection	
4.2	Waste Transportation	
4.3	Transfer Stations	
4.4	Material Recovery Facilities (MRFs)	
4.5	Composting Facilities	
4.6	Biomethanation Facilities	
4.7	Waste-to-Energy Facilities	
4.8	Sanitary Landfills	
4.9	Leachate Treatment Systems	
4.10	Landfill Gas Management	
4.11	Closure and Post-Closure Management	
5	Environmental Checklists	24

List of Tables

Table 3.1:	Summary of Environmental Impacts of various components of Municipal Solid Waste Management System
Table-4.1	Summary of Environmental Mitigation Measures

1. Introduction

1.1 Background

Municipal solid waste management (MSWM) is one of the most important environmental services required to protect public health, maintain environmental quality, and support sustainable urban development. Rapid urbanization, population growth, industrialization, changing consumption patterns, and improved living standards have significantly increased both the quantity and complexity of municipal solid waste generated throughout Punjab. Effective management of municipal solid waste is therefore essential to prevent environmental pollution, conserve natural resources, and improve the quality of life.

Punjab, the most populous province of Pakistan, has a population exceeding 110 million and continues to experience rapid urban growth. Urban populations are projected to increase substantially over the coming decades, resulting in a corresponding rise in municipal solid waste generation. The average municipal solid waste generation rate ranges from approximately **0.45 kg/capita/day** in medium-sized cities to **0.65 kg/capita/day** in large metropolitan cities such as Lahore. Furthermore, per capita waste generation is increasing by an estimated **1–3 percent annually**, placing considerable pressure on existing waste management infrastructure and services.

Municipal solid waste comprises household waste, commercial and institutional waste, market waste, street sweepings, park waste, and other non-hazardous municipal refuse. An effective solid waste management system generally includes waste storage at source, segregation, collection, street sweeping, transportation, transfer stations, material recovery facilities, composting plants, waste-to-energy facilities (where applicable), sanitary landfills, leachate management systems, landfill gas management systems, and environmental monitoring.

Despite continuous efforts, municipal solid waste management in many cities of Punjab remains inadequate. Collection efficiency in many urban areas is estimated to range between **50 and 60 percent**, resulting in the accumulation of uncollected waste in streets, vacant plots, open drains, and watercourses. Improper waste handling and disposal contribute to air, soil, and water pollution, blockage of drainage systems, foul odours, vector breeding, greenhouse gas emissions, visual degradation, and increased risks of communicable diseases.

Recognizing these challenges, the Government of Punjab has launched several initiatives to improve municipal solid waste management, including the **Suthra Punjab Programme**, expansion of waste collection services through public-private partnerships, establishment of transfer stations, material recovery facilities, composting plants, sanitary landfills, and other modern waste treatment and disposal facilities. These initiatives aim to improve collection efficiency, maximize resource recovery, reduce environmental pollution, and promote sustainable waste management practices throughout the province.

Because municipal solid waste management facilities may have significant environmental and social impacts during planning, construction, operation, and closure, environmental considerations should be integrated into every stage of project development. Potential impacts include air pollution, odour, leachate generation, groundwater contamination, greenhouse gas emissions, noise, traffic, occupational health and safety risks, and impacts on nearby communities and environmentally sensitive areas.

1.2 Purpose of Guidelines

These Environmental Assessment Guidelines have therefore been prepared to assist project proponents, consultants, contractors, local governments, and regulatory authorities in identifying, assessing, and mitigating the environmental impacts associated with municipal solid waste management projects. The guidelines support environmentally sound planning, design, construction, operation, monitoring, and closure of municipal solid waste management facilities while facilitating compliance with the Punjab Environmental Protection Act, 1997 (as amended), the Punjab Environmental Quality Standards (PEQS), the Punjab Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2022, and other applicable environmental laws and standards.

1.3 Scope of Guidelines

These guidelines apply to municipal solid waste management projects in Punjab, including new developments and the expansion or upgrading of existing facilities. They cover all major components of the municipal solid waste management system, including waste collection, transportation, transfer stations, material recovery facilities, composting, bimethanation, waste-to-energy facilities (where applicable), sanitary landfills, leachate and landfill gas management systems, and landfill closure and post-closure monitoring. The guidelines provide procedures for identifying environmental impacts, implementing mitigation measures, developing environmental monitoring plans, and ensuring compliance with applicable environmental legislation and regulatory requirements to promote environmentally sound and sustainable municipal solid waste management practices.

i) Regulatory Requirement

These guidelines do not replace the statutory environmental assessment requirements prescribed under the Punjab Environmental Protection Act, 1997, and the Punjab Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2022. Establishment of Projects relating to establishment of Waste treatment and disposal facilities (sanitary landfills, waste incineration facilities, composting plants, waste-to-energy facilities, and other waste treatment or disposal installations) that fall within the Schedule-II of projects requiring an EIA shall obtain prior environmental approval from the Punjab EPA through submission of a detailed Environmental Impact Assessment.

1.4 How to Use These Guidelines

These guidelines supplement all existing technical manuals and departmental instructions for forest harvesting in Punjab. The guidelines are produced for general information and compliance; however, as per current Punjab Environmental Protection Act provisions, specific approval from the Punjab EPA for routine forest harvesting may not be required unless falling under specific Schedule I or II categories.

These guidelines address potential impacts on air quality, water resources, soil, biodiversity, land use, public health, occupational health and safety, traffic, visual amenity, climate, and socio-economic conditions. They also provide guidance on environmental mitigation measures, environmental monitoring, environmental management plans, and environmental checklists to facilitate compliance with the requirements of the Punjab Environmental Protection Act, 1997 (as amended), the Punjab Environmental Quality Standards (PEQS), and other applicable environmental laws and regulations.

The guidelines are intended to support the preparation and review of environmental assessment documents, including Initial Environmental Examinations (IEEs) and Environmental Impact Assessments (EIAs), and to promote environmentally sound and sustainable municipal solid waste management practices throughout Punjab.

1.5 Glossary

Act: Means the Punjab Environmental Protection Act, 1997.

Air Emissions: The release of gases, particulate matter, odours, or other pollutants into the atmosphere from waste collection, transportation, treatment, or disposal activities.

Biodegradable Waste: Organic waste that can be decomposed naturally by microorganisms, including food waste, garden waste, paper, and other organic materials.

Buffer Zone: A designated area surrounding a waste management facility where development or sensitive land uses are restricted to minimize environmental and public health impacts.

Collection Point: A designated location where municipal solid waste is temporarily stored before collection and transportation.

Composting: A controlled biological process in which biodegradable organic waste is decomposed under aerobic conditions to produce stable organic compost.

Construction and Demolition (C&D) Waste: Waste generated from the construction, renovation, repair, or demolition of buildings, roads, and other infrastructure, including concrete, bricks, wood, metals, and rubble.

Environment: Means (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the inter-relationships between any of the factors mentioned in clauses (a) to (f).

Environmental Assessment: A process by which information on the potential environmental effects of a proposed project is identified, evaluated, and considered in decision-making before project implementation.

Environmental Management: The planning and implementation of measures to prevent, minimize, and control adverse environmental impacts associated with project activities.

Environmental Management Plan (EMP): A document describing the mitigation measures, monitoring requirements, institutional responsibilities, and reporting procedures for managing the environmental impacts of a project.

Hazardous Waste: Waste possessing toxic, corrosive, flammable, reactive, explosive, or infectious characteristics that may pose a risk to human health or the environment.

Impact on Environment: Means any effect on land, water, air, or any other component of the environment, including impacts on human health, biodiversity, socio-economic conditions, and cultural heritage.

Incineration: The controlled combustion of waste at high temperatures to reduce its volume and destroy hazardous constituents.

Integrated Solid Waste Management (ISWM): A comprehensive approach to managing solid waste through waste minimization, segregation, collection, transportation, recycling, treatment, energy recovery, and environmentally sound disposal.

Landfill Gas: A mixture of gases, primarily methane and carbon dioxide, produced by the decomposition of biodegradable waste in a landfill.

Leachate: Contaminated liquid generated when rainwater or moisture passes through waste and extracts dissolved or suspended contaminants.

Material Recovery Facility (MRF): A facility where mixed municipal solid waste or recyclable materials are sorted, separated, processed, and prepared for recycling or reuse.

Mitigation Measure: A measure adopted to avoid, reduce, control, eliminate, or compensate for an adverse environmental impact of a development project.

Municipal Solid Waste (MSW): Solid waste generated from households, commercial establishments, institutions, markets, street sweeping, parks, and other municipal activities, excluding hazardous and industrial process waste unless specifically managed within the municipal waste system.

Noise: Unwanted or excessive sound generated by vehicles, machinery, equipment, or operational activities that may adversely affect human health or the environment.

Open Dumping: The uncontrolled disposal of solid waste on land without engineered environmental protection measures.

Open Burning: The burning of waste in the open without appropriate emission control systems.

Organic Waste: Biodegradable waste derived from plants, animals, food preparation, agriculture, gardens, or similar sources.

Recycling: The collection, processing, and conversion of waste materials into new products or raw materials for further use.

Refuse-Derived Fuel (RDF): Fuel produced from combustible fractions of municipal solid waste after removal of recyclable and non-combustible materials.

Regulations: Means the Punjab Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2022.

Residual Waste: Waste remaining after recyclable and biodegradable materials have been recovered or treated, requiring final disposal.

Sanitary Landfill: An engineered waste disposal facility designed to safely contain municipal solid waste using liners, leachate collection systems, landfill gas management, and daily soil cover to minimize environmental impacts.

Segregation: The separation of waste into different categories, such as biodegradable, recyclable, hazardous, and residual waste, at the point of generation or during processing.

Solid Waste: Any discarded solid or semi-solid material generated from residential, commercial, institutional, industrial, agricultural, construction, or municipal activities, excluding liquid effluents and gaseous emissions.

Source Segregation: Separation of different waste streams at the point where waste is generated to facilitate recycling, composting, treatment, and safe disposal.

Transfer Station: A facility where municipal solid waste is temporarily received, consolidated, compacted, and transferred from smaller collection vehicles to larger transport vehicles for onward transportation.

Vector: An organism such as a fly, mosquito, rodent, or other pest capable of transmitting disease or creating public health nuisance at waste management facilities.

Waste Collection: The organized gathering of municipal solid waste from households, commercial establishments, institutions, and public areas for transportation to treatment or disposal facilities.

Waste Minimization: Measures aimed at reducing the quantity and toxicity of waste generated through improved production processes, reuse, recycling, and responsible consumption.

Waste-to-Energy (WtE): The process of generating energy in the form of electricity, heat, or fuel from the treatment of municipal solid waste through thermal or biological processes.

Wastewater: Water whose physical, chemical, or biological quality has been adversely affected by domestic, commercial, industrial, or waste management activities and requires treatment before discharge or reuse.

2. Project Profile

2.1 Project Description

The proponent, after consulting Annexures should provide a concise description of the proposed project, including but not limited to followings:

- Name of the project
- Project location (district, tehsil, mouza, and coordinates)
- Nature of the project (new or expansion or rehabilitation)
- Government's designate nature of proposed area
- Total project area.
- Estimated water demand during construction and operation phases
- Covered and open areas
- Land ownership status
- Estimated project cost
- Detail of different categories of houses and others structures
- Number of employees during construction phase.

The proponent after deep consultation must describe the project and all related allied activities which may include but not limited to followings:

- i. General Information
- ii. Site Description
- iii. Forest Resource Characteristics
- iv. Harvesting Methodology
- v. Machinery and Equipment
- vi. Transportation and Access Roads
- vii. Workforce and Support Facilities

- viii. Construction and Operational Activities
- ix. Environmental Protection Measures
- x. Post-harvest Rehabilitation

3. Environmental Impacts

Each component of Solid Waste Management (SWM) System has its own diversified environmental to be identified and addressed according through engineering and managerial measures. **Figure-1** below describes the functional components of a typical solid waste management system.

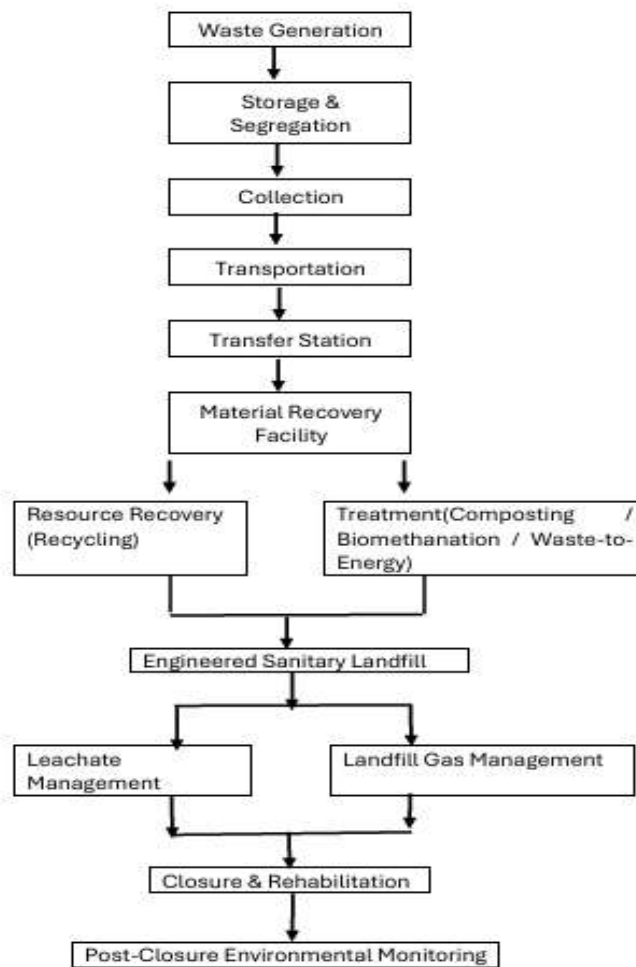


Figure-1 Functional components of a typical Solid Waste Management System.

Environmental Impacts of each component of Solid Waste Management (SWM) System are described below:

3.1 Environmental Impacts of Waste Collection

Waste collection includes door-to-door collection, communal waste collection, street sweeping, and loading of municipal solid waste into collection vehicles. Potential

Environmental Impacts related to operations of waste collection system are summarized below:

i. Air Quality

- Dust generation during handling and loading of waste.
- Odour emissions from decomposed organic waste.
- Exhaust emissions from collection vehicles.

ii. Water Quality

- Leakage of leachate from waste containers and collection vehicles.
- Contamination of nearby drains and surface water due to improper waste handling.

iii. Soil Quality

- Soil contamination from spilled waste and leachate.
- Localized littering around collection points.

iv. Noise

- Noise from collection vehicles and loading operations.
- Disturbance to nearby residents during early morning or late-night collection.

v. Public Health

- Attraction of flies, mosquitoes, rodents, and stray animals.
- Exposure of workers and the public to pathogens.
- Offensive odours affecting nearby communities.

vi. Occupational Health and Safety

- Injuries during lifting and loading of waste.
- Exposure to sharp objects, infectious waste, and hazardous materials.
- Heat stress and ergonomic injuries.

vii. Traffic and Community

- Temporary traffic congestion.
- Obstruction of roads during waste collection.
- Public inconvenience.

3.2 Environmental Impacts of Waste Transportation

Waste transportation involves hauling municipal solid waste from collection points to transfer stations, treatment facilities, or sanitary landfills. Potential Environmental Impacts related to operations of waste transportation system are summarized below:

i. Air Quality

- Exhaust emissions from transport vehicles.
- Dust emissions from uncovered waste.
- Odour nuisance along transport routes.
- ii. Water Quality**
 - Leakage of leachate from improperly covered vehicles.
 - Contamination of roadside drains.
- iii. Soil Quality**
 - Littering along transportation routes.
 - Soil contamination from accidental spills.
- iv. Noise**
 - Traffic noise generated by heavy vehicles.
- v. Public Health**
 - Spread of waste due to uncovered vehicles.
 - Attraction of scavengers and animals.
 - Increased risk of disease transmission.
- vi. Traffic**
 - Increased traffic congestion.
 - Road safety risks.
 - Accelerated road deterioration.
- vii. Occupational Health and Safety**
 - Traffic accidents.
 - Worker injuries during loading and unloading.

3.3 Environmental Impacts of Transfer Stations

Transfer stations temporarily receive municipal solid waste before transporting it to treatment or disposal facilities. Potential Environmental Impacts related to construction and operations of waste transfer stations are summarized below:

- i. Air Quality**
 - Dust emissions.
 - Foul odours.
 - Exhaust emissions from heavy equipment.
- ii. Water Quality**

- Leachate generation.
- Surface water contamination.
- Groundwater contamination if containment is inadequate.
- iii. Soil Quality**
 - Soil contamination from leachate.
 - Accumulation of spilled waste.
- iv. Noise**
 - Continuous operation of compactors.
 - Vehicle movement.
 - Heavy machinery.
- v. Biodiversity**
 - Attraction of birds.
 - Increase in rodents.
 - Proliferation of insects.
- vi. Public Health**
 - Vector breeding.
 - Disease transmission.
 - Visual nuisance.
- vii. Occupational Health and Safety**
 - Exposure to waste.
 - Mechanical injuries.
 - Slips and falls.

3.4 Environmental Impacts of Material Recovery Facilities (MRFs)

Material Recovery Facilities are such facilities where provisions are kept to separate recyclable materials from mixed municipal solid waste. They are usually provided with large transfer station having enough space to install associated equipment and storage facility.

Protentional impacts are Material Recovery Facilities are given below:

- i. Air Quality**
 - Dust generation.
 - Odours from mixed waste.

- Vehicle emissions.
- ii. Water Quality**
 - Wastewater from washing recyclable materials.
 - Leachate generation.
- iii. Soil Quality**
 - Leakage of contaminated water.
 - Improper storage of residual waste.
- iv. Noise**
 - Sorting machinery.
 - Conveyor belts.
 - Vehicle movement.
- v. Public Health**
 - Exposure to contaminated waste.
 - Dust inhalation.
- vii. Occupational Health and Safety**
 - Injuries from machinery.
 - Cuts from sharp objects.
 - Manual handling injuries.

3.5 Environmental Impacts of Composting Facilities

Composting converts biodegradable waste into organic compost. The construction and operation of this component of solid waste management has following potential impacts.

- i. Air Quality**
 - Odour emissions.
 - Bioaerosols.
 - Dust during compost handling.
- ii. Water Quality**
 - Leachate generation.
 - Surface water contamination.
- iii. Soil Quality**
 - Soil contamination from leachate.

iv. Biodiversity

- Attraction of flies.
- Rodents.
- Birds.

v. Public Health

- Odour nuisance.
- Vector breeding.

vi. Occupational Health and Safety

- Exposure to microorganisms.
- Respiratory irritation.

3.6 Environmental Impacts of Biomethanation / Anaerobic Digestion

Biomethanation / Anaerobic Digestion treat organic waste to produce biogas and digestate and numerous impacts which are summarized below:

i. Air Quality

- Methane leakage.
- Odour emissions.
- Biogas leakage.

ii. Water Quality

- Digestate leakage.
- Wastewater generation.

iii. Soil Quality

- Contamination from digestate spills.

iv. Occupational Health and Safety

- Fire hazards.
- Explosion risks.
- Confined space hazards.

3.7 Environmental Impacts of Waste-to-Energy Facilities (where applicable)

i. Air Quality

- Stack emissions.
- Particulate matter.
- Acid gases.

- Heavy metals.
- Dioxins and furans.
- ii. Water Quality**
 - Wastewater generation.
 - Ash handling runoff.
- iii. Soil Quality**
 - Fly ash disposal.
 - Bottom ash disposal.
- iv. Noise**
 - Turbines.
 - Boilers.
 - Heavy machinery.
- v. Occupational Health and Safety**
 - High-temperature hazards.
 - Fire.
 - Chemical exposure.
- 3.8 Sanitary Landfills**
 - i. Air Quality**
 - Landfill gas emissions.
 - Odour.
 - Dust.
 - ii. Water Quality**
 - Leachate generation.
 - Groundwater contamination.
 - Surface water pollution.
 - iii. Soil Quality**
 - Soil contamination.
 - Settlement of landfill cells.
 - iv. Biodiversity**
 - Attraction of birds.
 - Rodents.

- Insects.
- v. Climate Change**
 - Methane emissions.
 - Greenhouse gas emissions.
- vi. Public Health**
 - Vector breeding.
 - Smoke from landfill fires.
 - Odour nuisance.
- vii. Occupational Health and Safety**
 - Equipment accidents.
 - Slopes failure.
 - Fires.
- 3.9 Environmental Impacts of Leachate Treatment System**
 - Leakage from storage ponds.
 - Overflow during heavy rainfall.
 - Failure of treatment units.
 - Generation of treatment sludge.
 - Odour emissions.
 - Chemical handling risks.
- 3.10 Environmental Impacts of Landfill Gas Collection System**
 - Methane leakage.
 - Fire and explosion risks.
 - Equipment failure.
 - Greenhouse gas emissions.
 - Occupational safety hazards.
- 3.11 Environmental Impacts of Closure and Post-Closure Management**
 - Settlement of landfill surface.
 - Long-term leachate generation.
 - Continued landfill gas emissions.
 - Slope instability.
 - Vegetation failure.
 - Groundwater contamination.

- Surface water pollution.
- Unauthorized land use after closure.

Table 3.1: Summary of Environmental Impacts of Municipal Solid Waste Management Components

Component	Major Activities	Potential Environmental Impacts
Waste Collection	Door-to-door collection, communal bins, street sweeping, loading of waste	• Dust generation • Odour nuisance • Leachate leakage • Littering and spillage • Noise from collection vehicles • Vector breeding (flies, rodents, mosquitoes) • Public health risks • Occupational injuries • Traffic obstruction
Waste Transportation	Transportation of waste to transfer stations or disposal facilities	• Vehicle exhaust emissions • Dust generation • Odour emissions • Leakage of leachate • Littering along transport routes • Noise pollution • Traffic congestion and accidents • Occupational health and safety risks
Transfer Station	Temporary storage, unloading, compaction, and transfer of waste	• Dust and odour emissions • Leachate generation • Surface and groundwater contamination • Soil contamination • Noise from equipment and vehicles • Vector and pest infestation • Visual impacts • Occupational health risks
Material Recovery Facility (MRF)	Waste sorting, segregation, baling, and storage of recyclables	• Dust generation • Odour emissions • Wastewater generation • Soil contamination from spills • Noise from machinery • Residual waste generation • Occupational injuries • Exposure to hazardous materials
Composting Facility	Composting of biodegradable waste	• Odour emissions • Bioaerosols • Dust generation • Leachate generation • Surface and groundwater contamination • Attraction of flies, birds, and rodents • Fire risk due to improper compost management • Occupational health impacts
Bio-methanation / Anaerobic Digestion Plant	Anaerobic treatment of organic waste for biogas production	• Methane leakage • Odour emissions • Digestate leakage • Wastewater

		generation• Fire and explosion hazards• Occupational safety risks
Waste-to-Energy Facility (where applicable)	Thermal treatment of municipal solid waste and electricity generation	• Air emissions (PM, SO ₂ , NO _x , CO, dioxins, furans, heavy metals)• Fly ash and bottom ash generation• Wastewater generation• Noise pollution• Greenhouse gas emissions• Occupational hazards
Sanitary Landfill	Placement, compaction, and daily covering of residual waste	• Landfill gas generation (methane, carbon dioxide)• Leachate generation• Groundwater contamination• Surface water pollution• Soil contamination• Dust and odour emissions• Noise from heavy machinery• Vector breeding• Landfill fires• Visual impacts
Leachate Collection and Treatment System	Collection, storage, treatment, and disposal of landfill leachate	• Leakage from collection systems• Surface water contamination• Groundwater contamination• Sludge generation• Chemical handling risks• Odour emissions
Landfill Gas Collection and Management System	Collection, flaring, or utilization of landfill gas	• Methane leakage• Fire and explosion hazards• Air pollution due to incomplete combustion• Equipment failure• Occupational safety risks
Closure and Rehabilitation of Landfill	Final capping, landscaping, revegetation, and site stabilization	• Land settlement• Slope instability• Continued leachate generation• Continued landfill gas emissions• Soil erosion• Failure of vegetation establishment
Post-Closure Monitoring	Monitoring of environmental performance after landfill closure	• Long-term groundwater contamination• Surface water pollution• Landfill gas migration• Settlement of landfill cover• Damage to monitoring systems• Public safety concerns

4. Environmental Mitigation Measures

4.1 Waste Collection

Proponents are required to implement measures including but not limited to followings to mitigate impacts of waste collection system,

i. Air Quality

- Waste shall be collected at regular intervals to prevent decomposition and odour generation.
- Collection vehicles shall be covered during transportation.
- Dust shall be minimized by avoiding unnecessary handling and by cleaning collection areas regularly.
- Collection vehicles shall be properly maintained to minimize exhaust emissions.

ii. Water Quality

- Leachate leakage from collection containers and vehicles shall be prevented.
- Waste shall not be allowed to enter drains, canals, or watercourses.
- Collection containers shall be cleaned periodically.

iii. Soil Quality

- Waste spillage shall be cleaned immediately.
- Collection points shall be paved wherever practicable.

iv. Noise

- Collection shall preferably be undertaken during designated hours.
- Vehicles shall be properly maintained to minimize noise.

v. Public Health

- Collection frequency shall prevent waste accumulation.
- Waste bins shall remain covered.
- Vector control measures shall be implemented.

Vi Occupational Health and Safety

- Workers shall be provided with PPE.
- Workers shall receive training on safe waste handling.
- Hepatitis and tetanus vaccination shall be encouraged.

4.2 Waste Transportation

Proponents are required to implement measures including but not limited to followings to mitigate impacts associate with transportation system,

i. Air Quality

- Waste transport vehicles shall be fully covered.
- Vehicles shall be maintained to comply with emission standards.

- Waste shall not be overloaded.
- ii. Water Quality**
 - Vehicles shall be leak-proof.
 - Leachate shall not be discharged onto roads or drains.
- iii. Soil Quality**
 - Waste spilled during transportation shall be removed immediately.
- iv. Noise**
 - Vehicle maintenance shall minimize excessive noise.
 - Drivers shall avoid unnecessary horn use.
- v. Traffic Management**
 - Transportation routes shall be planned to minimize congestion.
 - Waste shall preferably be transported during off-peak traffic hours.
- vii. Occupational Health and Safety**
 - Drivers shall receive defensive driving training.
 - Emergency spill kits shall be available.

4.3 Transfer Stations

Proponents are required to implement measures including but not limited to followings to mitigate impacts of transfer stations,

- i. Air Quality**
 - Waste unloading areas shall be enclosed where practicable.
 - Water shall be sprayed to suppress dust.
 - Waste shall not remain at transfer stations beyond the designated storage period.
- ii. Water Quality**
 - Floors shall be paved and graded.
 - Leachate collection systems shall be installed.
 - Collected leachate shall be treated before discharge.
- iii. Soil Protection**
 - Impermeable flooring shall be provided.
 - Spillages shall be cleaned immediately.
- iv. Noise**

- Equipment shall be regularly maintained.
- Noise barriers shall be installed where required.

v. Public Health

- Routine pest control shall be implemented.
- Adequate sanitation facilities shall be provided.

vi. Occupational Health and Safety

- Workers shall wear appropriate PPE.
- Fire-fighting equipment shall be available.

4.4 Material Recovery Facilities (MRFs)

Proponents are required to implement measures including but not limited to followings to mitigate impacts of Material Recovery Facilities (MRFs),

i. Air Quality

- Sorting areas shall be adequately ventilated.
- Dust suppression systems shall be installed where necessary.

ii. Water Quality

- Wastewater shall be collected and treated.
- Drainage shall prevent runoff contamination.

iii. Waste Management

- Residual waste shall be transported to approved disposal facilities.
- Recyclables shall be stored separately.

iv. Occupational Health and Safety

- Machinery shall be fitted with safety guards.
- Workers shall receive regular safety training.

4.5 Composting Facilities

Proponents are required to implement measures including but not limited to followings to mitigate impacts of waste treatment facility through composting,

i. Air Quality

- Compost piles shall be turned regularly.
- Moisture content shall be maintained.
- Odour-generating waste shall not remain exposed.

ii. Water Quality

- Composting pads shall be paved.
- Leachate shall be collected and treated.

iii. Soil Protection

- Composting shall be carried out on impermeable surfaces.

iv. Public Health

- Vector control programmes shall be implemented.

v. Occupational Health and Safety

- Workers shall wear masks, gloves, and boots.

4.6 Biomethanation Facilities

Proponents are required to implement measures including but not limited to followings to mitigate impacts of development of Bioethanation facilities.,

i. Air Quality

- Biogas leakage shall be prevented through routine inspection.
- Gas detection systems shall be installed.

ii. Water Quality

- Digestate shall be stored in lined facilities.
- Wastewater shall be treated before discharge.

iii. Occupational Health and Safety

- Fire detection and suppression systems shall be installed.
- Explosion-proof electrical equipment shall be used.

4.7 Waste-to-Energy Facilities

Proponents are required to implement measures including but not limited to followings to mitigate impacts of treatment of solid waste through waste to energy facilities,

iii. Air Quality

- Air pollution control devices shall be installed.
- Stack emissions shall comply with PEQS.

iv. Water Quality

- Wastewater shall be treated before discharge.

v. Waste Management

- Fly ash and bottom ash shall be disposed of safely.

vi. Occupational Health and Safety

- High-temperature safety procedures shall be implemented.
- Continuous emission monitoring shall be undertaken where applicable.

4.8 Sanitary Landfills

Proponents are required to implement measures including but not limited to followings to mitigate impacts of sanitary landfills,

i. Air Quality

- Daily cover shall be applied.
- Landfill gas shall be collected and flared or utilized.
- Dust suppression measures shall be implemented.

ii. Water Quality

- Composite liners shall be installed.
- Leachate collection and treatment systems shall be provided.
- Groundwater monitoring wells shall be installed.

iii. Soil Protection

- Waste shall be disposed only within designated cells.
- Landfill liners shall be inspected regularly.

iv. Biodiversity

- Buffer zones shall be maintained.
- Access of animals shall be controlled.

v. Public Health

- Vector control programmes shall be implemented.
- Open burning shall be prohibited.

vii Occupational Health and Safety

- Heavy equipment operators shall be trained.
- Emergency response plans shall be implemented.

4.9 Leachate Treatment Systems

i. Water Quality

- Treatment units shall be inspected regularly.
- Leachate ponds shall be lined.
- Overflow shall be prevented.

ii. Occupational Health and Safety

- Workers handling chemicals shall use PPE.
- Chemical storage shall comply with safety requirements.

4.10 Landfill Gas Management

Measure to implement to mitigate the impacts of landfill gas management system include but not limited to following:

i. Air Quality

- Gas wells shall be inspected regularly.
- Gas leakage shall be monitored and controlled.
- Methane shall be flared or utilized for energy recovery.

ii. Occupational Health and Safety

- Gas monitoring equipment shall be installed.
- Fire and explosion prevention measures shall be implemented.

4.11 Closure and Post-Closure Management

Proponents are required to implement following measure to mitigate the impacts of activities associated with management of closure and post closure of landfills.

i. Soil Protection

- Final cover shall be installed.
- Slopes shall be stabilized.
- Native vegetation shall be established.

ii. Water Quality

- Leachate monitoring well shall be constructed and monitoring will be continued after closure.
- Surface drainage systems shall be maintained.

iii. Air Quality

- Landfill gas collection and flaring system shall be established.
- Monitoring of landfill gas shall continue until emissions become insignificant.

iv. Public Safety

- Site access shall be controlled.
- Long-term environmental monitoring shall be maintained.

Table - 4.1 describes the environmental mitigation measures that can likely be adopted to mitigate the environmental, social and health impacts of each component of solid waste management system.

Table-4.1 Summary of Environmental Mitigation Measures

Component	Major Environmental Mitigation Measures
Waste Collection	• Ensure regular waste collection to prevent waste accumulation and decomposition. • Use covered waste bins and collection vehicles. • Prevent waste spillage during collection and loading. • Clean collection points regularly. • Provide appropriate PPE to waste collection workers. • Implement vector and pest control measures. • Conduct public awareness programmes on proper waste disposal and segregation.
Waste Transportation	• Use covered and leak-proof transport vehicles. • Follow designated transportation routes. • Maintain vehicles regularly to minimize emissions and leakage. • Clean up waste spills immediately. • Train drivers in safe driving and emergency response procedures. • Avoid overloading transport vehicles.
Transfer Station	• Provide paved and impermeable floors. • Install leachate collection and treatment systems. • Enclose waste unloading areas where practicable. • Implement dust suppression and odour control measures. • Carry out routine pest and vector control. • Provide fire-fighting equipment and emergency response facilities. • Maintain proper housekeeping throughout the facility.
Material Recovery Facility (MRF)	• Provide adequate ventilation in sorting areas. • Install dust suppression systems where necessary. • Collect and treat wastewater before discharge. • Segregate and safely store recyclable materials. • Install safety guards on machinery. • Provide PPE and regular safety training to workers. • Dispose of residual waste at approved facilities.
Composting Facility	• Maintain optimum moisture and aeration of compost piles. • Turn compost regularly to minimize odour generation. • Construct composting pads on impermeable surfaces. • Collect and treat leachate appropriately. • Implement vector and pest control measures. • Provide PPE to workers. • Maintain good housekeeping practices.
Biomethanation Facility	• Inspect digesters regularly to prevent gas leakage. • Install methane detection systems. • Store digestate in lined containment facilities. • Treat wastewater before discharge. • Install fire detection and suppression systems. • Use explosion-proof electrical equipment. • Prepare and implement emergency response procedures.

Waste-to-Energy Facility	• Install appropriate air pollution control equipment. • Monitor stack emissions regularly. • Treat wastewater before discharge. • Dispose of fly ash and bottom ash safely. • Maintain combustion efficiency. • Provide PPE and specialized safety training to workers. • Conduct routine maintenance of plant equipment.
Sanitary Landfill	• Construct engineered landfill cells with composite liners. • Install leachate collection and treatment systems. • Collect and utilize or flare landfill gas. • Apply daily soil cover over disposed waste. • Install groundwater monitoring wells. • Implement dust, odour, and vector control measures. • Prohibit open burning of waste. • Restrict unauthorized access to the landfill site.
Leachate Treatment System	• Construct lined leachate collection ponds. • Inspect collection pipes and pumps regularly. • Treat leachate before discharge in accordance with applicable standards. • Properly manage treatment sludge. • Store treatment chemicals safely. • Provide PPE to operators.
Landfill Gas Management System	• Landfill gas collection and flaring system shall be established. • Monitoring of landfill gas shall continue until emissions become insignificant. • Inspect gas collection wells and pipelines routinely. • Flare or utilize methane for energy recovery. • Maintain gas extraction equipment. • Implement fire and explosion prevention measures. • Train workers in gas safety procedures.
Closure and Post-Closure Management	• Install final cover and cap the landfill properly. • Stabilize landfill slopes against erosion. • Establish native vegetation on closed landfill surfaces. • Continue monitoring groundwater, leachate, landfill gas, and settlement. • Maintain surface drainage systems. • Restrict unauthorized site access. • Implement long-term environmental monitoring and maintenance programmes.

Environmental Assessment Checklist

Section I: Project Description

File No _____ (To be filled by EPA)

Date _____

General Information

1. Project Name or Title _____
2. Project Proponent (Department, organization, or owner) _____
3. Address _____
4. Telephone _____
5. Fax _____
6. E-mail _____
7. Representative of the Proponent _____
8. Designation _____
9. Name of the person who conducted this assessment _____
10. Designation _____
11. Qualification _____

Project Information

12. Project Location _____
13. Cost of the Project _____
14. Period of construction (start and end dates) _____
15. Total land area _____ m²
16. Brief Project Description _____

Please attach a sketch showing the layout of the proposed facilities

17. Will any new land be acquired? _____
If yes, please specify
The total area: _____

Present ownership of land _____

What is the present use of the land? _____

How the land will be acquired (Through Land Acquisition Act or Direct Purchase)? _____

When the compensation will be paid? _____

18. In case of state land, are there any squatter settlements on the land? _____

If yes, please specify

Number of settlements _____

Will any compensation be paid? _____

When the compensation will be paid? _____

19. How many trees will be removed for the construction of the road? _____

Section II: Screening

Is the proposed facility or part of the facility inside an ecologically sensitive area:

☐ Yes ☐ No

If yes, then the project would require an initial environmental examination or an environment impact assessment. Refer to the Punjab Environmental Protection Agency Review of Initial Environmental Examination and Environment Impact Assessment Regulations, 2022 for appropriate category.

Section III: Environmental Profile

1. Describe the terrain of the project area:

☐ Flat or Level (Slope < 3%)

☐ Level to moderately steep (Slope 3%-30%)

☐ Moderately steep to mountainous (Slope > 30%)

2. Are there signs of soil erosion or landslide anywhere within 500 m of the proposed site?

☐ Yes ☐ No

If yes, please describe (where, nature) _____

3. Is there any surface water body (river, canal, stream, lake, wetland) within 500 m of the proposed site?

☐ Yes ☐ No

If yes, describe each water body:

Name (including type, ie, river, canal or stream)	Dimensions	Status and Uses (Is it polluted? Is domestic or other wastewater discharged to it? What are its uses, eg, agriculture, domestic, industrial, washing, fishery)

4. Is there any groundwater well on the proposed site or within 500 m of the proposed site?

☐ Yes ☐ No

If yes, describe each well:

Type (Dug well, tube well, hand pump)	Location (Village, road, mohalla, etc. and distance from the site)	Depth and Yield	Uses (Drinking, agriculture, domestic, industrial, washing, livestock)

5. Is any critical wildlife habitat found on, or within 1 km of the proposed site of the facility?

☐ Yes ☐ No

If yes, please describe _____

It is recommended that the opinion of the Punjab Wildlife Department should be obtained regarding the wildlife sensitivity of the proposed site.

Please attach the relevant opinion or no objection certificate of the Punjab Wildlife Depart if the opinion of the Department has been sought.

6. How many trees are there on the proposed site? _____

7. Please provide the traffic count for all main roads adjacent to the proposed site or roads that will provide access to the site. The count should be based on data collected, for both directions, on at least three typical working days. Use the following format:

Road _____ Count Location _____

	6:00 am- 9:00 am	9:00 am- 12:00 noon	12:00 noon- 3:00 pm	3:00 pm- 6:00 pm	6:00 pm- 9:00 pm
Large vehicles (trucks, buses, tractor trolleys, Minibuses)					
Medium sized vehicles (Suzuki pickups, cars, jeeps, taxis)					
Small vehicles (Rickshaws, motorcycles, scooters)					
Slow vehicles (animal- driven carts, tongas)					
Others					

(Please add additional sheets, if needed)

8. What is the present land use in the vicinity (roughly a radius of 500 m) of the proposed site?

	Residential (Thick, Moderate, Sparse)	Commercial (Office, Shops, Fuel Stations)	Open Land (Parks, Farmlands, unutilized plots, barren land)	Industrial	Other
Description					

(Please attach a map of the proposed project site and indicate roughly the area that you have considered for this evaluation)

9. How are the general hygienic conditions of the project area?

- ☐ Generally clean
☐ Fair
☐ Poor

10. Is there any bad odor in the project area?

- ☐ Yes ☐ No

What is the source of the odor? _____

11. Is there any site of cultural importance (graveyard, shrine, mosque, archaeological site) within 1,000 m of the proposed scheme?

☐ Yes ☐ No

If yes, please describe? _____

12. What main sources of pollution exist within a radius of 1000 m of the proposed site:

Name of the Source	Type of Pollution (Noise, air water)	Location (Village, road, mohalla, etc.)	Distance from Site

Section IV: Impact Assessment and Mitigation Measures

Potential Negative Environmental Impacts	Tick, if relevant	Mitigation Measures	Tick, if proposed	Monitoring Plan
Site Selection	☐	Waste management facilities have been located away from residential areas, schools, hospitals, and other sensitive receptors.	☐	Verify approved site plans before construction.
		Environmentally sensitive areas such as wetlands, forests, floodplains, and wildlife habitats have been avoided.	☐	Site inspection and review of layout plans.
		Adequate buffer distances have been maintained from surface water bodies and groundwater sources.	☐	Verify buffer distances during site inspection.
		The site is accessible through suitable road networks without causing unnecessary traffic congestion.	☐	Review site layout and access roads.
		The site is located outside flood-prone and unstable areas.	☐	Verify topographic and flood hazard maps.
Waste Collection	☐	Waste will be collected at regular intervals to prevent accumulation and decomposition.	☐	Review collection schedules and conduct field inspections.
		Covered waste bins and collection vehicles will be provided.	☐	Visual inspection.
		Waste spillage during collection will be cleaned immediately.	☐	Routine site inspection.
		Collection points will be cleaned and disinfected regularly.	☐	Inspection of collection points.
		Workers will be provided with appropriate PPE.	☐	PPE inspection records.
Waste Transportation	☐	Covered and leak-proof vehicles will be used for waste transportation.	☐	Vehicle inspection.
		Vehicles will be maintained regularly to reduce emissions and leakage.	☐	Maintenance records.
		Waste transportation routes will minimize impacts on residential areas.	☐	Route inspection.

Continues...

Environmental Assessment Checklist and Guidelines- Solid Waste Management

Potential Negative Environmental Impacts	Tick, if relevant	Mitigation Measures	Tick, if proposed	Monitoring Plan
		Waste spilled during transportation will be cleaned immediately.	☐	Field inspection.
		Drivers will receive training on safe waste transportation.	☐	Review training records.
Transfer Station	☐	Transfer station floors will be paved and impermeable.	☐	Site inspection.
		Leachate collection and drainage systems will be provided.	☐	Inspection of drainage system.
		Dust suppression measures will be implemented.	☐	Visual inspection during operation.
		Odour control measures will be implemented.	☐	Community complaints and site inspection.
		Pest and vector control programme will be implemented.	☐	Inspection records.
Material Recovery Facility (MRF)	☐	Waste will be segregated efficiently to maximize resource recovery.	☐	Operational records.
		Recyclables will be stored separately in designated areas.	☐	Site inspection.
		Residual waste will be transported to an approved disposal facility.	☐	Waste transfer records.
		Dust suppression and adequate ventilation will be provided.	☐	Routine inspection.
		Machinery will be fitted with appropriate safety guards.	☐	Equipment inspection.
Composting Facility	☐	Composting will be carried out on paved or lined surfaces.	☐	Site inspection.
		Compost piles will be turned regularly to minimize odour.	☐	Operational records.
		Leachate will be collected and treated appropriately.	☐	Inspection of leachate system.
		Vector and pest control measures will be implemented.	☐	Routine inspection.
		Compost quality will be monitored periodically.	☐	Compost quality analysis.

Continues...

Environmental Assessment Checklist and Guidelines- Solid Waste Management

Potential Negative Environmental Impacts	Tick, if relevant	Mitigation Measures	Tick, if proposed	Monitoring Plan
Biomethanation Facility	☐	Digesters and gas pipelines will be inspected regularly for leakage.	☐	Routine inspection.
		Biogas detection and fire protection systems will be installed.	☐	Safety inspection.
		Digestate will be stored in lined containment facilities.	☐	Site inspection.
		Wastewater generated will be treated before discharge.	☐	Effluent quality monitoring.
Waste-to-Energy Facility	☐	Air pollution control equipment will be installed and maintained.	☐	Stack emission monitoring.
		Stack emissions will comply with applicable PEQS.	☐	Stack monitoring reports.
		Fly ash and bottom ash will be managed safely.	☐	Waste disposal records.
		Workers will be provided with specialized PPE.	☐	PPE inspection.
Sanitary Landfill	☐	Waste will be disposed only within engineered landfill cells.	☐	Site inspection.
		Composite liners will be installed beneath landfill cells.	☐	Construction quality inspection.
		Daily soil cover will be applied over waste.	☐	Daily operational records.
		Leachate collection and treatment systems will be installed.	☐	Leachate monitoring.
		Landfill gas collection and utilization/flaring systems will be provided.	☐	Gas monitoring records.
		Groundwater monitoring wells will be installed around the landfill.	☐	Groundwater quality monitoring.
		Open burning of waste will be strictly prohibited.	☐	Routine site inspection.
		Access of unauthorized persons and animals will be restricted.	☐	Security inspection.

Continues...

Environmental Assessment Checklist and Guidelines- Solid Waste Management

Potential Negative Environmental Impacts	Tick, if relevant	Mitigation Measures	Tick, if proposed	Monitoring Plan
Leachate Management	☐	Leachate collection pipelines will be inspected regularly.	☐	Inspection records.
		Leachate treatment facilities will be maintained in operational condition.	☐	Effluent monitoring reports.
		Treated leachate will comply with PEQS before discharge.	☐	Laboratory analysis.
Landfill Gas Management	☐	Landfill gas wells will be monitored regularly.	☐	Gas monitoring records.
		Methane will be flared or utilized for energy recovery where feasible.	☐	Operational records.
		Fire and explosion prevention measures will be implemented.	☐	Safety inspection.
Wastewater Management	☐	Wastewater generated from washing and operational activities will be collected and treated before discharge.	☐	Effluent quality monitoring.
		Stormwater drainage will be separated from contaminated wastewater.	☐	Drainage inspection.
Air Quality	☐	Dust suppression measures will be implemented throughout the facility.	☐	Visual inspection.
		Vehicles and machinery will be maintained to minimize exhaust emissions.	☐	Maintenance records.
		Odour control measures will be implemented where necessary.	☐	Site inspection and complaint records.
Noise	☐	Machinery and vehicles will be maintained to reduce noise levels.	☐	Noise monitoring.
		High-noise activities will be limited to daytime hours where practicable.	☐	Operational records.
Occupational Health and Safety	☐	Workers will wear appropriate PPE at all times.	☐	Daily inspections.
		First aid kits and emergency response equipment will be available.	☐	Safety inspection.
		Workers will receive training on waste handling and emergency procedures.	☐	Training records.

Continues...

Environmental Assessment Checklist and Guidelines- Solid Waste Management

Potential Negative Environmental Impacts	Tick, if relevant	Mitigation Measures	Tick, if proposed	Monitoring Plan
		Firefighting equipment will be maintained in operational condition.	☐	Inspection records.
Community Health and Safety	☐	Warning signs and restricted access will be provided.	☐	Site inspection.
		Public complaints regarding dust, odour, and noise will be addressed promptly.	☐	Complaint register review.
		Traffic management measures will be implemented to minimize risks to the public.	☐	Traffic observations.
Closure and Post-Closure Management	☐	Temporary facilities and unused materials will be removed after project completion.	☐	Final site inspection.
		Final capping and slope stabilization will be completed.	☐	Post-closure inspection.
		Native vegetation will be established over closed landfill areas.	☐	Vegetation survival monitoring.
		Long-term monitoring of groundwater, leachate, landfill gas, and settlement will be continued.	☐	Annual environmental monitoring reports.