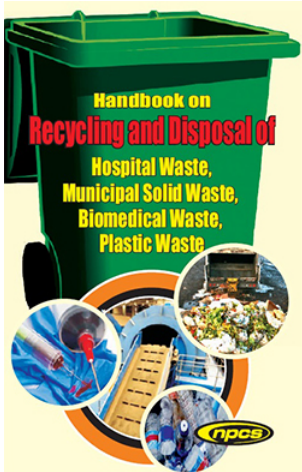


# Handbook on Recycling and Disposal of • Hospital Waste • Municipal Solid Waste • Biomedical Waste • Plastic Waste



**Author:** NIIR Board of Consultants & Engineers

**Format:** Paperback

**ISBN:** 9789381039878

**Code:** NI313

**Pages:** 544

**Price:** Rs. 1,275.00 **US\$** 125.00

**Publisher:** NIIR PROJECT CONSULTANCY SERVICES

Usually ships within **5** days

Handbook on Recycling and Disposal of

- Hospital Waste
- Municipal Solid Waste
- Biomedical Waste
- Plastic Waste

(Also Known as Medical, Municipal and Plastic Waste Management Handbook)

Waste can be almost anything, including food, leaves, newspapers, bottles, construction debris, and chemicals from a factory, candy wrappers, disposable diapers, old cars, or radioactive materials. People have always produced waste, but as industry and technology have evolved and the human population has grown, waste management has become increasingly complex. Waste recycling involves the collection of waste materials and the separation and clean-up of those materials. Recycling waste means that fewer new products and consumables need to be produced, saving raw materials and reducing energy consumption.

Waste reduction and recycling are very important elements of the local waste management framework. They help both to conserve natural resources and to reduce demand for valuable landfill space. The waste recycling services has become the one of the fastest growing industry. The growth of the waste recycling services is driven by the technology development for waste recycling.

The waste management market is expected to be worth US\$ 13.62 billion by 2025. Indian municipal solid waste (MSW) management market is expected to grow at a CAGR of 7.14% by 2025. India has planned to achieve a capacity of 2.9 million hospital beds by 2025 which will help bio medical waste management market to grow at a CAGR of 8.41%.

The concern for bio medical waste management has been felt globally with the rise in infectious diseases and indiscriminate disposal of waste. It is to be understood that management of bio medical waste is an integral part of health care. There is a clear need for the current approach of waste disposal in India that is focussed on municipalities and uses high energy/high technology, to move more towards waste processing and waste recycling (that involves public private partnerships, aiming for eventual waste minimization driven at the community level, and using low energy/low technology resources).

This book basically deals with characterization of Medical Waste, Medical Waste Data Collection Activities, Medical Waste Treatment Effectiveness, Gas Sterilization, Municipal Solid Waste, Bio-Medical Waste, Hospital Waste Incineration, Production, Use, and Disposal of Plastics and Plastic Products, Medical Waste Reuse, Recycling and Reduction, Disposal on Land, municipal and plastic waste management, Plastic Waste, incineration and number of recycling methods.

The book is highly recommended to new entrepreneurs, existing units who wants to get more information of Waste Disposal & Recycling.

## **Contents**

1. Characterization of Medical Waste
  1. INTRODUCTION AND OVERVIEW
  2. MEDICAL WASTE GENERATION
- Methodology
- Summary of Preliminary Results
3. MEDICAL WASTE DATA COLLECTION ACTIVITIES
- Transporter Notification
- Results
- Transporter Periodic Reports
- On-Site Incinerators
2. Medical Waste Treatment Effectiveness
  1. INCINERATION
- Factors Affecting Effectiveness
- Medical Waste Treatment Effectiveness
- Quality Assurance and Quality Control Procedures
- Maintenance and Operator Training
2. STEAM STERILIZATION
- Factors Affecting Effectiveness
- Quality Assurance and Quality Control Procedures
- Maintenance and Operator Training
3. GAS STERILIZATION
- Factors Affecting Effectiveness
- Quality Assurance and Quality Control Procedures
- Maintenance and Operator Training
4. CHEMICAL DISINFECTION
- Factors Affecting Effectiveness
- Quality assurance and Quality Control Procedures
- Maintenance and Operator Training
5. THERMAL INACTIVATION
- Factors Affecting Effectiveness
- Quality Assurance and Quality Control Procedures

## 6. IRRADIATION

Factors Affecting Effectiveness

Quality Assurance and Quality Control Procedures

Maintenance and Operator Training

## 7. MICROWAVE TREATMENT

Factors Impacting Effectiveness

Quality Assurance and Quality Control Procedures

Maintenance and Operator Training

## 8. GRINDING AND SHREDDING

Factors Affecting Effectiveness

Quality Assurance and Quality Control Procedures

Maintenance and Operator Training

## 9. COMPACTION

Factors Affecting Effectiveness

Quality Assurance and Quality Control Procedures

Maintenance and Operator Training

## 3. Medical Waste Handling Methods

### 1. INTRODUCTION

### 2. CURRENT PRACTICES

Handling and packaging practices

For Off-Site Incineration

Medical Waste Handling Materials

For Landfill Disposal

For On-site Treatment or Disposal

For Sewer and Ocean Disposal

### 3. STANDARDS IMPLEMENTED BY THE RULE

Segregation

Packaging

Labeling

Marking

Storage

Transport

### 4. EVOLVING HANDLING AND MANAGEMENT TECHNIQUES 19

Handling

Compaction

## 5. METHODS TO EVALUATE MEDICAL WASTE HANDLING

### 4. Medical Waste Reuse, Recycling and Reduction

#### 1. RECYCLING AND REUSE

#### 2. SOURCE REDUCTION

#### 3. GENERATION RATES

#### 4. AGENCY ACTION

#### 5. Infectious Waste Characterization

##### 1. DEFINITION OF INFECTIOUS WASTE

##### 2. TYPES OF INFECTIOUS WASTE

###### 1. Isolation Wastes

###### 2. Cultures and Stocks of Infectious Agents and Associated Biologicals

###### 3. Human Blood and Blood Products

###### 4. Pathological Wastes

###### 5. Contaminated Sharps

###### 6. Contaminated Animal Carcasses, Body Parts, and Bedding

### 3. MISCELLANEOUS CONTAMINATED WASTES - (OPTIONAL CATEGORY)

#### 6. Infectious Waste Management

##### 1. INTRODUCTION

## 2. SELECTION OF WASTE MANAGEMENT OPTIONS

### 3. INFECTIOUS WASTE MANAGEMENT PLAN

1. Designation of Infectious Waste
2. Segregation of Infectious Waste
3. Packaging of Infectious Waste
4. Storage of Infectious Waste
5. Transport of Infectious Waste (on- and off-site)
6. Treatment of Infectious Waste
7. Disposal of Treated Wastes
8. Contingency Planning
9. Staff Training
7. Treatment of Infectious Waste

### 1. INTRODUCTION

1. Monitoring
2. Steam Sterilization
3. Incineration
4. Thermal inactivation
5. Gas/Vapour Sterilization
6. Chemical Disinfection
7. Sterilization by Irradiation
8. Other Treatment Methods

### 8. Medical Waste

1. CYTOTOXIC CHEMICALS
2. HAZARDOUS CHEMICALS
3. PATHOGENS
4. TOXIC METALS
5. RADIOACTIVE MATERIALS

### 9. Hospital Incineration Systems

#### 1. INTRODUCTION

#### 2. FUNDAMENTAL CONCEPTS RELATED TO HOSPITAL WASTE INCINERATION

1. Chemical Reactions
2. Stoichiometric Combustion Air
3. Thermochemical Relations
4. Volumetric Gas Flows
5. The Combustion Process

#### 3. HOSPITAL WASTE CHARACTERISTICS

#### 4. TYPES OF HOSPITAL WASTE INCINERATOR SYSTEMS

##### 1. Introduction

##### 2. Multiple-chamber incinerators

###### 1. Principle of Combustion and Air Distribution

###### 2. Mode of Operation

###### 3. Waste Feed Charging Systems

###### 4. Ash Removal Systems

###### 5. Use of Multiple-Chamber Incinerators for Incinerating Hospital Wastes

##### 3. Controlled-Air Incinerators

###### 1. Principle of Controlled Air Incineration

###### 2. Batch/Controlled-Air incinerators

###### 3. Intermittent-Duty, Controlled Air Incinerators

###### 4. Continuous-Duty, Controlled Air incinerators

##### 4. Rotary Kilns

###### 1. Principle of Operation

###### 2. Mode of Operation

###### 3. Charging System

4. Ash Removal
5. Auxilliary Equipment
  1. Waste Meat Boilers
  2. Auxiliary Waste Liquid Infection
10. Bio-Medical Waste
  1. INTRODUCTION
    1. Linkage of Bio-medical Waste Management with Municipal Waste Management
  2. ASSESSMENT OF CURRENT SITUATION
    1. Waste Generation
      - (i) Health Care Establishments
      - (ii). Whole Town/City
    2. Current Practices
    3. Allocation of Responsibilities
  3. BASIC ISSUES
    1. Management Issues of Bio-medical Waste Management
    2. Current Issues in Management of Health Care Waste
  4. LEGAL ASPECTS AND ENVIRONMENTAL CONCERN
    1. Bio-medical Waste (Management and Handling) Rules, 1998
      - Scope and application of the Rules
      - Environmental Concern
  5. WASTE IDENTIFICATION AND WASTE CONTROL PROGRAM FOR THE HEALTH CARE ESTABLISHMENTS
    1. Identification of Various Components of the Waste Generated
    2. An Exercise in Waste Control Programme
  6. WASTE STORAGE
    1. Recommended Labelling and Colour Coding
    2. Segregated Storage in Separate Containers (at the Point of Generation)
    3. Certification
  4. COMMON/INTERMEDIATE STORAGE AREA
    5. Parking Lot for Collection Vehicles
  7. HANDLING AND TRANSPORTATION
    1. Collection of Waste Inside the Hospital/Health Care Establishment
    2. Transportation of Segregated Waste Inside the Premises
    3. Collection and Transportation of Waste for Small Units
    4. Transportation of Waste Outside
  8. WASTE TREATMENT AND DISPOSAL : THE RULES AND THE AVAILABLE OPTIONS
    - Transportation of Waste Outside
      1. Incineration
      2. Autoclave Treatment
      3. Hydroclave Treatment
      4. Microwave Treatment
      5. Chemical Disinfection
      6. Sanitary and Secured Landfilling
      7. General Waste
  9. COMMON TREATMENT/DISPOSAL FACILITY
    1. Establishment of the Facility
    2. Tie Up of Health Care Set Ups
    3. Private Sector Participation
  10. OPERATION AND MAINTENANCE
  11. OCCUPATIONAL HAZARDS AND SAFETY MEASURES
    1. Occupational Hazards
    2. Safety Measures for the Medical and Para-medical Staff
    3. Safety Measures for Cleaning and Transportation Staff

## 12. FINANCIAL ASPECTS

## 13. TRAINING AND MOTIVATION

### 1. Training Modules for Different Levels of Staff

(i) Medical and laboratory personnel:

(ii) Para-medical personnel:

(iii) Sweepers, cleaning staff, guards etc.:

(iv) Administrative and management staff:

### 2. Incentives and Motivation

### 3. Awareness Generation

## 14. PLANNING ELEMENTS

### 1. Planning Inside the Health Care Establishment Premises

### 2. Planning Outside the Health Care Establishment

### 3. Relation to Overall Town Planning

### 4. Examples

## 15. MANAGEMENT ASPECTS

### 1. Organisational Set Up 104

### 2. Administration and Managerial Aspects 105

## 16. ANIMAL WASTE 105

### 11. Air Pollution Control

### 1. INTRODUCTION 108

### 2. POLLUTANT FORMATION AND GENERATION 108

### 3. CONTROL STRATEGIES 109

#### 1. Controlling Feed Material

#### 2. Combustion Control 111

#### 3. Add-On Air Pollution Control Systems

##### 1. Wet Scrubbers

##### 2. Fabric Filters

##### 3. Dry Scrubbers

### 12. Waste Minimization Options

Description of Techniques

Better Operating Practices

Chemotherapy and Antineoplastic Wastes

Formaldehyde Wastes

Instal Reverse Osmosis (RO) Water Supply Equipment

Determine Minimum Effective Cleaning Procedures

Reuse/Recycle Waste Solutions

Proper Waste Management

Photographic Chemical Waste

Store Materials Properly

Recycle Spoiled Photographic Film and Paper

Test Expired Material for Usefulness

Extend Processing Bath Life

Use Squeegees

Use Countercurrent Washing

Recover Silver and Recycle Spent Chemicals

Radionuclides

Solvents

Material Substitution

Improved Laboratory Techniques

Recycle Solvents

Mercury

Electronic Sensing Devices

Proper Spill Clean Up

- Recycle/Reuse
- Waste Anesthetic Gases
- Toxics, Corrosives, and Miscellaneous Chemicals
- Ethylene Oxide
- Use of Recyclable Drums
- Proper Material Handling
- Material Substitution
- 13. Vermiculturing
- 1. INTRODUCTION
- 2. INTRODUCTION TO VERMICOMPOSTING
- Reduction of particle size
- Vermicomposting
- Different stages and methods
- 3. THE INORA PROCESS
- The biological means
- Selection of biological methods
- Bisanitization or accelerated aerobiosis
- The biogas plants
- The earthworm
- 4. ASSESSMENT
- Environmental assessment
- Water
- Gases
- Pollutants
- Aesthetics
- Financial assessment
- 5. QUALITY AND STABILITY FACTORS IN COMPOSTING
- Introduction
- Appropriate standards
- Raw versus composted waste
- Identification
- 5. CONCLUSION
- 14. Municipal waste water treatment and energy recovery
- 1. INTRODUCTION
- 2. THE GANGA ACTION PLAN
- 3. INDO-DUTCH ENVIRONMENTAL PROJECT
- INTEGRATED APPROACH
- UASB SYSTEM -A CLEAN TECHNOLOGY
- Advantages of UASB over traditional aerobic processes
- Technical aspects
- Energy recovery from municipal sewage
- Technology options for municipal waste water treatment
- Case-studies
- 5 mld UASB treatment plant at Kanpur
- Energy savings and biogas generation
- Conclusions
- Recommendations
- 14 mld UASB treatment plant at Mirzapur
- Energy recovery
- Financial aspects
- 15. Principles of Municipal Solid Waste Management
- 1. INTRODUCTION
- Solid Waste Generation

Environmental Impact of Solid Waste Disposal on Land

Objective of Solid Waste Management

## 2. PRINCIPLES OF MUNICIPAL SOLID WASTE MANAGEMENT

Waste Reduction

Effective Management of Solid Waste

Functional Elements of Municipal Solid Waste Management

## 3. HIERARCHY OF WASTE MANAGEMENT OPTIONS

### 4. WASTE MINIMISATION

### 5. RESOURCE RECOVERY THROUGH MATERIAL RECYCLING

Sorting at Source

Centralised Sorting

Sorting Prior to Waste Processing or Landfilling

### 6. RESOURCE RECOVERY THROUGH WASTE PROCESSING

Biological Processes

Thermal Processes

Other Processes

### 7. WASTE TRANSFORMATION (WITHOUT RESOURCE RECOVERY) PRIOR TO DISPOSAL

Mechanical Transformation

Thermal Transformation

Other Methods

### 8. DISPOSAL ON LAND

### 9. COMPONENTS OF MUNICIPAL SOLID WASTE MANAGEMENT SYSTEM

### 10. LINKAGES BETWEEN MUNICIPAL SOLID WASTE MANAGEMENT SYSTEM AND OTHER TYPES OF WASTES GENERATED IN AN URBAN CENTRE

### 11. MATERIALS FLOW CHART FOR MUNICIPAL SOLID WASTE MANAGEMENT SYSTEM (1000 t.p.d. WASTE GENERATION)

### 16. Composition and Quantity of Solid Waste

#### 1. INTRODUCTION

Terminology and Classification

Variations in Composition and Characteristics

#### 2. DEFINITIONS AND CLASSIFICATION OF SOLID WASTES

Definitions

(i) Domestic/Residential Waste:

(ii) Municipal Waste:

(iii) Commercial Waste:

(iv) Institutional Waste:

(v) Garbage:

(vi) Rubbish:

(vii) Ashes:

(viii) Bulky Wastes:

(ix) Street Sweeping:

(x) Dead Animals:

(xi) Construction and Demolition Wastes:

(xii) Industrial Wastes:

(xiii) Hazardous Wastes:

(xiv) Sewage Wastes:

Classification

#### 3. COMPOSITION, CHARACTERISTICS AND QUANTITIES

Need for Analysis

Field Investigations

Number of Samples to be Collected

Collection of Samples of Solid Waste

Composition and Characteristics



Characteristics of Municipal Solid Waste in Indian Urban Centres  
Per Capita Quantity of Municipal Solid Waste in Indian Urban Centres  
Estimation of Future Per Capita Waste Quantity  
Relation between Gross National Product (GNP) and Municipal Solid Waste Generation  
Rate of Increase liased on Experience in Other Cities  
Seasonal Variations  
Physical Characteristics  
Density  
Bulk Density Measurement  
1. Material and apparatus:  
2. Moisture Content  
3. Size of Waste Constituents  
4. Calorific Value  
Chemical Characteristics  
Classification  
(i) Lipids:  
(ii) Carbohydrates:  
(iii) Proteins:  
(iv) Natural Fibres:  
(v) Synthetic Organic Materials (Plastic):  
(vi) Non-combustibles:  
4. CONCLUSION  
17. Slaughter House Waste and Dead Animals  
1. INTRODUCTION  
2. MAGNITUDE OF THE PROBLEM  
3. CLASSIFICATION  
4. OPERATIONS DURING SLAUGHTERING OF ANIMALS  
Present Scenario  
Slaughtering  
Bleeding  
Dressing  
Evisceration  
5. MEASURES PROPOSED TO IMPROVE THE SLAUGHTER HOUSE WASTE MANAGEMENT  
Liquid Waste/Effluent  
Collection of Blood  
Improved Method of Dressing  
Evisceration  
Safe Disposal of Waste Products  
Odours Control  
Modernisation of Slaughter House  
Curbing Activities of Illegal Slaughtering of Animals  
Provision of Dry Rendering Plants  
6. CONCLUSION  
18. Industrial Solid Waste  
1. INTRODUCTION  
2. THE PROBLEMS  
3. INDUSTRIAL SOLID WASTE  
4. DESCRIPTION OF IMPORTANT INDUSTRIAL SOLID WASTE  
Coal Ash  
Integrated Iron & Steel Plant Slag  
Phosphogypsum  
Red Mud  
Lime Mud

Waste Sludge and Residues

Potential Reuse of Solid Wastes

## 5. WASTE MANAGEMENT APPROACH

Prevention-A Waste Minimisation Approach

Inventory Management and Improved Operations

Waste Management at Source

## 6. AREA OF APPLICATION OF SOME IMPORTANT INDUSTRIAL WASTES

## 7. CURRENT PRACTICE OF INDUSTRIAL SOLID WASTE MANAGEMENT

Collection and Transport of Wastes

Storage & Transportation

Disposal of Industrial Solid Waste

## 8. HEALTH CONSEQUENCES OF POOR INDUSTRIAL WASTE DISPOSAL

## 9. COLLECTION, STORAGE TREATMENT & DISPOSAL OF WASTES

Waste Segregation

Collection, Storage and Transport

Combined Treatment Facilities

Disposal Methods

Landfills?

(i) Definitions

Why landfills?

Design:

## 10. CASE STUDIES

Construction:

Closure & Post Closure:

Incineration

Manifest System

Post Treatment

Back-transport

Monitoring

Record Keeping

## 11. LEGISLATION FOR MANAGEMENT OF HAZARDOUS WASTE AND CATEGORISATION OF HAZARDOUS WASTE

### 11. HANDLING OF HAZARDOUS CHEMICALS

### 12. INDUSTRIAL LOCATION

### 13. MANAGEMENT OF INDUSTRIAL SOLID WASTES CO-ORDINATION (SPCBs & LOCAL BODIES)

### 19. Emerging Processing Technologies

#### 1. INTRODUCTION

#### 2. VERMICOMPOSTING

#### 3. BIOGAS FROM MUNICIPAL SOLID WASTES

#### 4. CONVERSION OF SOLID WASTES TO PROTEIN

#### 5. ALCOHOL FERMENTATION 259

#### 6. PYROLYSIS

Plasma Arc Technology/Plasma Pyrolysis Vitrification (PPV)

#### 7. REFUSE DERIVED FUEL

#### 8. HYDROPULPING

#### 9. SLURRY CARB PROCESS

#### 10. TREATMENT FOR RECOVERY OF USEFUL PRODUCTS

#### 11. SUMMARY

#### 20. Wastewater and Its Collection

#### 1. ECOSYSTEM APPROACH TO POLLUTION CONTROL

Food Chains and Webs

Accumulation of Substances in Food Chains and Webs

Accumulation of Pollutants in Waterbodies

Species Diversity and Ecosystem Stability

Nature of Pollutants

Effects of Pollutants

Control of Pollutants

## 2. WASTE WATER CHARACTERISTICS

Municipal Wastewater

Industrial Wastewater

Fluctuations In Flow and Composition

## 3. TYPES OF WASTES AND APPLICABLE RULES

## 4. PLANNING FOR WASTEWATER COLLECTION

Introduction

Data Requirements and Surveys

On-Site and Off-Site Disposal Systems

Sewer Discharge Standards

Proportion of Industrial and Domestic Wastes

Potential Health Benefits

New Approaches in Sewerage System Design

## 21. Principles of Reactor Design

### 1. REACTION ORDER

### 2. FLOW PATTERNS OF REACTORS

Batch Reactors

Ideal Plug Flow

Ideal Completely Mixed Flow

### 3. ESTIMATION OF DISPERSION NUMBER, D/UL

Use of Tracer Tests

Use of Empirical Equations

Cells in Series Parallel Arrangements

### 4. EFFECT OF SHOCK LOADS

### 5. ESTIMATION OF WASTEWATER TEMPERATURE IN LARGE REACTORS

### 6. FACTORS AFFECTING CHOICE OF REACTORS

Nature of the Waste

Process Optimization

Other Factors

## 22. Principles of Biological Treatment

### 1. MICROBIAL GROWTH RATES

### 2. TREATMENT KINETICS

### 3. HANDLING OF SOLIDS

### 4. SLUDGE AGE AND HYDRAULIC RETENTION TIME

### 5. FOOD/MICROORGANISMS RATIO

### 6. BUILD UP OF SOLIDS IN SYSTEM

### 7. SUBSTRATE REMOVAL EFFICIENCY

### 8. TEMPERATURE EFFECTS

### 9. ESTIMATION OF FINAL EFFLUENT BOD

### 10. OXYGEN REQUIREMENTS

For Facultative and Flow-through Units

For Flow-through Systems with Recycling

### 11. NUTRIENT REQUIREMENTS

### 12. PHOSPHORUS REMOVAL

### 13. NITROGEN REMOVAL

### 14. CHOICE OF SLUDGE AGE

## 23. Mechanically Aerated Lagoons

### 1. TYPES OF AERATED LAGOONS

Facultative Aerated Lagoons

Aerobic Flow-through Lagoons  
 Aerobic Lagoons with Recycling of Solids  
 2. DESIGN OF FACULTATIVE AERATED LAGOONS  
 Substrate Removal Rate  
 Lagoon Mixing Conditions and Efficiency  
 Lagoon Depth  
 Solids in Suspension and Power Level  
 Oxygenation and Power Level  
 Anaerobic Activity In Facultative Lagoons  
 Performance  
 Sludge Accumulation  
 3. DESIGN OF AEROBIC FLOW-THROUGH TYPE LAGOONS  
 Substrate Removal and Solids Concentration  
 Detention Time  
 Solids Concentration  
 Final Effluent BOD  
 Oxygen Requirements  
 Aeration Power and Power Level  
 4. DESIGN OF DUAL-POWERED AERATED LAGOONS  
 Design Basis  
 Retention Time  
 Performance Power Requirement  
 Sludge Accumulation  
 5. DESIGN OF AEROBIC LAGOONS WITH RECYCLING OF SOLIDS (EXTENDED AERATION LAGOONS)  
 6. CHOICE OF COMBINATIONS AND LAYOUTS OF UASBs, AERATED LAGOONS AND ALGAL PONDS  
 7. OPTIMIZATION TRIALS  
 8. CONSTRUCTION FEATURES  
 24. Power Generation Based on Distillery Spentwash  
 INTRODUCTION  
 THE BIOPAQ TECHNOLOGY  
 Pre-acidification/buffer tank  
 Sludge disposal  
 Biogas handling  
 CASE-STUDY  
 NEW DEVELOPMENT  
 Power generation scheme  
 CONCLUSION  
 25. Production, Use, and Disposal of Plastics and Plastic Products  
 1. SUMMARY OF KEY FINDINGS  
 2. TECHNOLOGICAL OVERVIEW  
 Manufacturing Resins  
 Incorporating Additives  
 3. PRODUCTION AND CONSUMPTION STATISTICS  
 Historical Overview  
 Domestic Production of Plastics  
 Import/Export and Domestic Consumption  
 Economic Profile of the Plastics Industry  
 Sector Characteristics  
 Market Conditions and Prices for Commodity Resins  
 Characteristics of Major Resin Types  
 Characteristics of Major Additive Types  
 4. MAJOR END USE MARKETS FOR PLASTICS

Packaging  
Building and Construction  
Consumer and Institutional Products  
Electrical and Electronics  
Furniture and Furnishings  
Transportation  
Adhesives, Inks, and Coatings  
5. DISPOSITION OF PLASTICS INTO THE SOLID WASTE STREAM

Plastics in Municipal Solid Waste  
Plastics in Building and Construction Wastes  
Plastics in Automobile Salvage Residue  
Plastics in Litter  
5 Plastics in Marine Debris.  
26. Impacts of Post-consumer Plastics Waste on the Management of Municipal Solid waste

#### SUMMARY OF KEY FINDINGS

Landfilling  
Management Issues  
Incineration  
Management Issues  
Environmental Releases  
Litter

#### LANDFILLING

Management Issues  
Landfill Capacity  
Landfill Integrity  
Other Management Issues  
Environmental Releases  
Leaching of Plastic Polymers  
Leaching of Plastics Additives

#### INCINERATION

Introduction  
Number, Capacity, and Types of Incinerators  
Combustion Properties of Plastics  
Plastics Combustion and Pollution Control  
Incinerator Management Issues  
Excessive Flame Temperature  
Products of Incomplete Combustion (PICs)  
Formation of Slag  
Formation of Corrosive Gases  
3 Environment Release  
Emissions from MSW Incinerators  
Plastics Contribution to Incinerator Ash

#### LITTER

Background  
Analysis of Relative impacts of Plastic and other Litter  
27. The Potential for Divertable Plastic Waste

#### 1. SCENARIO DEVELOPMENT

1 Scenario 1  
2 Scenario 2  
3 Scenario 3  
4 Scenario 4  
5 Scenario 5

#### 2. ESTIMATED QUANTITIES OF DPW

1. Scenario 1
2. Scenario 2
3. Scenario 3
4. Scenario 4
5. Scenario 5
3. SUMMARY

28. Objectives and Action Items

OBJECTIVES FOR IMPROVING MUNICIPAL SOLID WASTE MANAGEMENT

Source Reduction

ACTION ITEMS:

ACTION ITEMS:

OBJECTIVE 1: EVALUATE POTENTIAL FOR MINIMIZING PACKAGING

ACTION ITEMS:

OBJECTIVE 2: EDUCATION AND OUTREACH ON SOURCE REDUCTION

ACTION ITEMS:

RECYCLING

ACTION ITEMS:

Improving Recyclability of the Waste Stream

Collection/Separation

Processing

Marketing

Public Education

Landfilling and Incineration

OBJECTIVE 1: FURTHER EVALUATE ADDITIVES

ACTION ITEM:

OBJECTIVE 2: MONITOR PVC USE

ACTION ITEMS:

OBJECTIVE 3: IMPROVE DISPOSAL OPTIONS

ACTION ITEMS:

OBJECTIVES FOR HANDLING PROBLEMS OUTSIDE THE MSW MANAGEMENT SYSTEM

Wastewater Treatment Systems/Combined Sewer overflows/Stormwater Drainage Systems

Wastewater Treatment Systems

ACTION ITEM:

Combined Sewer Overflows

ACTION ITEMS:

Storm water Discharges

ACTION ITEMS:

Other Sources of Marine Debris

Vessels

OBJECTIVE 1: IMPLEMENT ANNEX V OF MARPOL

ACTION ITEMS:

OBJECTIVE 2: REDUCE IMPACT OF FISHING GEAR

ACTION ITEM:

Plastic Manufacturers, Processors, and Transporters

ACTION ITEMS:

Garbage Barges

ACTION ITEM:

Land- and Sea-Originated Litter

OBJECTIVE 1: SUPPORT LITTER RETRIEVAL AND CHARACTERIZATION

ACTION ITEMS:

OBJECTIVE 2: SUPPORT LITTER PREVENTION

ACTION ITEMS:

Degradable Plastics

## ACTION ITEMS:

29. Recent Legislative and Regulatory Actions

LOCAL AND STATE ACTIONS

FEDERAL ACTIONS

IMPLICATIONS FOR PLASTICS RECYCLING

## About NIIR

**NIIR PROJECT CONSULTANCY SERVICES (NPCS)** is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.

Our various services are: Detailed Project Report, Business Plan for Manufacturing Plant, Start-up Ideas, Business Ideas for Entrepreneurs, Start up Business Opportunities, entrepreneurship projects, Successful Business Plan, Industry Trends, Market Research, Manufacturing Process, Machinery, Raw Materials, project report, Cost and Revenue, Pre-feasibility study for Profitable Manufacturing Business, Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Business Opportunities, Investment Opportunities for Most Profitable Business in India, Manufacturing Business Ideas, Preparation of Project Profile, Pre-Investment and Pre-Feasibility Study, Market Research Study, Preparation of Techno-Economic Feasibility Report, Identification and Section of Plant, Process, Equipment, General Guidance, Startup Help, Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

NPCS also publishes various process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

---

**NIIR PROJECT CONSULTANCY SERVICES** , 106-E, Kamla Nagar, New Delhi-110007, India. **Email:** [npcs.india@gmail.com](mailto:npcs.india@gmail.com) **Website:** [NIIR.org](http://NIIR.org)

Wed, 16 Jun 2021 22:40:39 +0530