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## Waste Containment Systems (CEMM516; 4 Credit Hours)

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**Instructor:**

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**Course Description:**

This course describes the sources and characteristics of waste and details the analysis and design of landfills, impoundments, and in-situ barriers.

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**Prerequisites:**

Basic chemistry, physics and calculus

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**Text Book:**

Sharma, H.D., and Reddy, K.R., "Geoenvironmental Engineering: Site Remediation, Waste Containment and Emerging Waste Management Technologies," John Wiley & Sons, Inc., 2004 (ISBN: 0-471-21599-6); See: <http://www.wiley.com/WileyCDA/WileyTitle/productCd-0471215996.html>

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**Syllabus:****I. Waste Characterization and Regulations**

- Sources and Characteristics of Wastes
  - Sources of Wastes
  - Classification of Wastes
  - Waste Characterization
  - Environmental Concerns with Wastes
  - Waste Management Strategies
  - Engineered Waste Disposal Facilities
- Landfill Regulations, Siting and Configurations
  - Federal Regulations
  - State and Local Regulations
  - Siting Methodology
  - Site Permit Application
  - Landfill Configurations

**II. Waste Containment Systems**

- Liner Systems
  - Low Permeability Soil Liners
  - Geomembrane Liners
  - Geotextiles
  - Geosynthetic Clay Liners (GCL)
  - Geonets and Geocomposite Drains
  - Geogrids
  - Interface Strengths Between Various Liner Components
  - Manufacturing Quality Assurance and Construction Quality Assurance

- Performance Of Liners In Waste Containment Systems
- Leachate Collection and Removal Systems and Liner Design
  - Design Criteria
  - Leachate Generation and Management
  - Containment System Liner Design
- Final Cover Systems
  - Purpose and Design Criteria
  - Regulatory Minimum Requirements
  - Layout and Grading
  - Cover Profile and Material Selection
  - Infiltration Analysis
  - Erosion Assessment
  - Drainage Layer Capacity
  - Cover Geomembrane Analysis
  - Cover Slope Stability Analysis

### III. Gas Management and Groundwater Monitoring

- Gas Generation and Management
  - Gas Generation
  - Gas Characteristics
  - Gas Production Rates
  - Gas Migration
  - Gas Collection Systems
  - Gas Flaring And Energy Recovery
- Groundwater Monitoring
  - Regulatory Requirements
  - Groundwater Monitoring Systems
  - Detection Monitoring Program
  - Assessment Monitoring Program
  - Corrective Action Program

### IV. Beneficial Uses of Closed Landfills & Bioreactors

- End Use of Closed Landfills
- Bioreactor Landfills

### V. Surface Impoundments

- Regulatory Setting
- Liner Systems
- Surface Impoundment Design
- Cover Design
- Closure and Post-Closure Care

### VI. In-Situ Barriers to Contaminant Migration

- Vertical Barriers
- Bottom Barriers
- Surface Caps or Covers
- Groundwater Pumping Systems
- Subsurface Drains

