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# Engineering Issues

CDIL Work Group  
Presentation  
September 18, 2008

## 2007 Annual Report Data, CDI Wastes to Landfills

- Demo waste to Demolition LF's = 1,348,000 tons
- Number of Demo Landfills receiving waste = 97
- Demo waste sent to MSW LFs = 1,000 tons
- Industrial waste to Merchant ILFs = 1,128,000 tons
- Number of of Merchant ILFs = 4
- Industrial waste to Private ILFs = 1,050,000 tons
- Number of of Private ILFs = 17
- Industrial waste sent to MSW LFs = 556,000 tons  
(381,000 tons used as ADC)

## Standing Beneficial Use Determination (SBUD) Estimated Tonnages, 2007

- Reclaimed asphalt, concrete – 4 million tons
- Wood wastes – 1.2 million tons
- Tires - 30,000 tons
- Foundry sand - 28,000 tons
- By-product lime - 400,000 tons
- Shingle scrap - 40,000 tons
- Coal ash and slag - 140,000 tons

## Can we separate industrial out of current definition of CD&I?

- Construction debris, demolition debris and industrial solid waste have separate definitions as provided in Minnesota statutes and rules.

# Statutory Definitions

- Minn. Stat. 115A.03, subd. 7: **Construction debris** means waste building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition of buildings and roads.
- Minn. Stat. 115A.03, subd. 15: **Industrial waste** means solid waste resulting from an industrial, manufacturing, service, or commercial activity that is managed as a separate waste stream.

# Rule Definitions

- Minn. R. 7035.0300, subp. 30: **Demolition debris** means solid waste resulting from the demolition of buildings, roads, and other man-made structures including concrete, brick, bituminous concrete, untreated wood, masonry, glass, tress, rock, and plastic building parts. Demolition debris does not include asbestos wastes.
- Minn. R. 7035.0300, subp. 45: **Industrial solid waste** means all solid waste generated from an industrial or manufacturing process and solid waste generated from non-manufacturing activities such as service and commercial establishments. Industrial solid waste does not include office materials, restaurant and food preparation waste, discarded machinery, demolition debris, municipal solid waste combustor ash, or household refuse.

## Are Location Standards in Conflict with Each Other?

- There are a few general locations standards that apply to all solid waste management facilities.
- Each type of solid waste management facility then has its own specific location standards.
- These standards don't necessarily conflict, but vary from one facility type to another.



# Locations Standards

- During 1988 rule revisions, general location standards were created to apply to all solid waste management facilities and specific standards were create for each type of facility
- Exception: Industrial landfills inherited old sanitary landfill rules including the prohibited locations

# Location Standards (General Requirements)

## **Minn. R. 7035.2555**

An owner or operator may not locate a new solid waste management facility in a floodplain. An owner or operator may not establish or construct a solid waste management facility in the following areas:

- A.** within a shoreland or wild and scenic river land use district governed by chapters 6105 and 6120;
- B.** within a wetland; or
- C.** within a location where emissions of air pollutants would violate the ambient air quality standards in chapters 7005, 7007, 7009, 7011, 7017, 7019, and 7028 and parts 7023.0100 to 7023.0120.

## **Location Standards**

### **(Permit-By-Rule Demo Facilities)**

#### **Minn. R. 7035.2825, subp. 2**

Demolition debris land disposal facilities permitted-by-rule must not be located:

- A.** on a site with karst features including sinkholes, disappearing streams, and caves;
- B.** within wetland areas;
- C.** within a floodplain area;
- D.** within a shoreland area; and
- E.** with a water table within five feet of the lowest fill elevation.

## Location Standards (Permitted Demo Facilities)

### **Minn. R. 7035.2825, subp. 7**

The owner or operator of a permitted demolition debris land disposal facility must not locate the facility on a site:

- A.** with active karst features including sinkholes, disappearing streams, and caves; or
- B.** where the topography, geology, or soil is inadequate for protection of ground or surface water.

# Prohibited Areas (Industrial Facilities)

## **Minn. R. 7035.1600**

The fill and trench areas of industrial solid waste land disposal facilities are prohibited within the following areas:

- A.** 1,000 feet from the normal high water mark of a lake, pond, or flowage;
- B.** 300 feet from a stream;
- C.** a regional floodplain;
- D.** wetlands;
- E.** within 1,000 feet of the nearest edge of the right-of-way of any state, federal, or interstate highway or of the boundary of a public park or of an occupied dwelling. Permission may be granted under this item, without these distance requirements, at the discretion of the commissioner, taking into consideration such factors as noise, dust, litter, and other aesthetic and environmental considerations;
- F.** locations considered hazardous because of the proximity of airports; and
- G.** an area which is unsuitable because of topography, geology, hydrology, or soils.

## Where do Permit-by-Rule (PBR) Demolition Landfills Fit?

- Initiated at the request of local government units due to concerns with tight budgets.
- The original intent of the PBR Demo Landfill was to provide an inexpensive alternative for the disposal of large publicly-owned structures (schools, hospitals) in remote areas of greater Minnesota.
- Rules allow for the disposal of up to 15,000 cubic yards of debris for a period of up to 12 months.
- Applicants submit PBR Notification to MPCA
- No formal hydrogeologic review
- No formal engineering review
- Some counties do not allow PBR demos

# PBR Demos

- PBR Demos are mini landfills
- Must follow location, design, operational and closure requirements in rules
- Must have a certified operator
- Must complete a 20 year post-closure care period

## Misuse of PBR Demos

- Have been used as “starter landfill” for fully permitted site
- Have been used by contractors to avoid disposal cost at nearby permitted site
- Are included in bid price of demolition work to low ball bid if job specifications does not identify disposal at a permitted landfill



## Other Media Affected by Landfills

- Groundwater – more to come at Oct. 9<sup>th</sup> meeting
- Surface water
- Air Emissions – Hydrogen sulfide, mercury, climate change gases\*

\*CD&I wastes once landfilled are not a significant source of climate change gases

# Governance

- MSW LFs are governed by rules which are prescriptive
- Industrial LFs are governed by policy which leans toward performance
- Demolition LFs are governed by rules and guidance which combines prescriptive and performance

# Performance Standards vs. Prescriptive Approach

## Performance

- Specify the goals you want the system to meet
- Allows for alternative design
- Facility design varies from facility to facility
- Owner is responsible for adequacy of design and proving construction meets design standards

## Prescriptive

- Specify the design you want each facility to follow
- No room for new technology
- Regulatory agency is responsible for adequacy of design
- All facilities have same design
- Owner is responsible for proving construction meets design standards

# Industrial LF Policy

- Use MSW LF rules as a guidance
- Evolution of design and performance are evaluated
- Policy is not enforceable

# Rules vs. Guidance

## Rules

- Rules outline conditions that must be followed
- Some rules state “unless otherwise approved by the commissioner” which allows approval of alternative options without seeking a variance
- Rules are enforceable

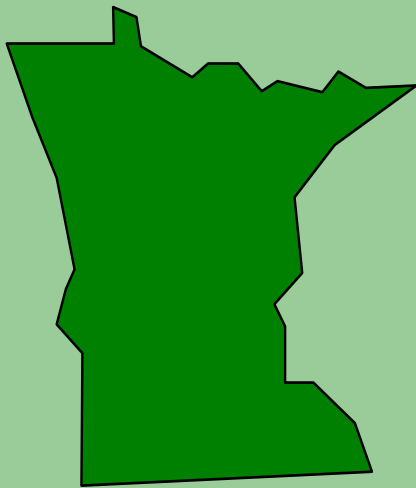
## Guidance

- Guidance provides recommendations that may be negotiated or identify the process that the agency will follow when exercising the commissioner’s discretion
- Guidance is not enforceable

# Permits

- Engineering conditions are placed in facility permit
- Permit defines specific conditions for a given facility to follow
- Permits are enforceable.

# Solid Waste Permitting Process



An 11 Step Program

# Solid waste permitting procedure

1. A permit application must be submitted. The MN solid waste rules define the information that must be submitted for each type of facility (*Minn. R. 7001.3075 through 7001.3480*).
2. The MPCA has 30 days to review the application for completeness (*Minn. Stat. § 116.07, subd. 4j(c)*). A complete application must include verification of local notification, description of site conditions, hydrogeologic study (for landfills), engineering plans, etc.



# Solid waste permitting procedure

3. The MPCA reviews the complete application to determine if it adequately defines the proposed facility to allow environmental review and public noticing. (1 – 2 months)
4. An Environmental Review is conducted, if required. This may involve the preparation of an EAW or EIS. (3 months – 2 years)

# Environmental Assessment Worksheet (EAW)

Minn. R. 4410.4300, subp. 17 identifies the mandatory solid waste categories for preparing an EAW.

- No mandatory EAW categories for Demolition or Industrial Landfills

## Environmental Impact Statement (EIS)

Minn. R. 4410.4400, subp. 13 identifies the mandatory solid waste categories for preparing an EIS.

- No mandatory EIS categories for Demolition or Industrial Landfills

# Solid waste permitting procedure

5. If the facility is located in the 7 county metropolitan area, review for compliance with the Metropolitan Solid Waste Policy Plan is conducted (*Minn. Stat. § 473.823, subd. 3*). (1 – 2 months concurrent with step 3)

# Solid waste permitting procedure

6. All local approvals are obtained.
  - Some counties may require Environmental Review
7. The MPCA develops a draft permit. (1 month)
8. The draft permit is public noticed for 30 days and then issued if there are no requests for public meetings, contested case hearings, or unresolved issues.
  - A public meeting may be held during or after the 30 day notice period. If after, the comment period is extended to allow time for additional comments.

## Solid waste permitting procedure

9. Contested permits are taken to the MPCA Citizens' Board to determine if the permit can be issued. (1 – 2 months)
10. Contested permits may require a contested case hearing to resolve issues. (up to 12 months)
11. The MPCA's decision to issue a permit may be appealed.

## Other permits or approvals

- Conditional Use Permit (county and/or local)
- Zoning permit
- County License
- Certified Operator (MPCA)
- NPDES General Industrial Stormwater Permit (MPCA)
- NPDES General Construction Stormwater Permit (MPCA)
- Watershed District Permit
- NPDES/SDS Discharge Permit (MPCA) or Leachate Treatment Agreement (WWTF)
- Air Quality Permit (MPCA)

# End of Permitting Process

Questions?



# Demolition Landfill Guidance Overview

Standardizing a statewide process for reviewing demolition debris landfill permit applications



# What is this guidance?

- Baseline for MPCA site specific decisions on:
  - *Facility classification*
  - *Location standards*
  - *Site evaluation*
  - *Acceptable Waste*
  - *Waste Screening*
  - *ISWMP*
  - *GW monitoring*
  - *Liner requirement*

## How is it being used?

- New and existing facilities
- Staff forums
- Leadership oversight
- Consistency is the goal

# Facility Classification

- **Class I Landfills**: Can only take wastes on the acceptable waste list (or a smaller list)
- **Class II demolition landfills**: Class I wastes, incidental packaging, and demo-like industrial wastes as defined in ISWMP
- **Class III demolition landfills**: Any C&D and most industrial wastes, as defined in ISWMP

# Classification Matrix

Demolition Landfills	Class I	Class II	Class III
Acceptable Wastes	Acceptable C&D Waste List (See list in Acceptable Waste section.)	Acceptable C&D Waste List + Incidental non-recyclable packaging + Demo-like industrial wastes comprised of wood, concrete, porcelain fixtures, shingles, or window glass	All C&D wastes + Most industrial wastes
Waste Screening	Stringent screening is required.	Screening is required.	Screening is required.
Industrial Solid Waste Management Plan (ISWMP) Contents	Describe screening procedures, address asbestos-containing materials (ACM) if applicable.	Describe screening procedures and identify additional C&D wastes and specific demo-like industrial wastes to be accepted; address ACM if applicable. Develop waste acceptance criteria.	Describe screening procedures and identify additional C&D wastes and specific industrial wastes to be accepted; address ACM if applicable. Develop waste acceptance criteria.
Groundwater Monitoring	See Ground Water Matrix.	Yes	Yes
Liner	No	See Liner Matrix.	Yes
Reclassification	NA	If the facility takes more than 50% industrial waste based on annual gate receipts, it should be reclassified as an industrial landfill.	

# Location Standards

- May not be located in:
  - Floodplain
  - Shoreland
  - Wetland
  - Active karst
  - Where the topography, geology, or soil is inadequate for protection of ground or surface water.
  - May not be located closer than 1,000 feet from a lake or pond, or 300 feet from a river, stream, or creek.

# Site Evaluation

- **Required With permit applications**
- Verify site meets location standards
- Sufficient documentation to establish the separation distance between the lowest fill elevation and the water table;
- Sufficient information to establish groundwater flow direction; and
- A description of the on-site soils.
- *Hydrogeologic Evaluation Form for Demolition Landfills* on web page.

# Acceptable Waste

- Acceptable waste is select **construction and demolition (C&D) debris** resulting from the alteration, construction, destruction, rehabilitation, or repair of physical structures, such as houses, buildings, industrial or commercial facilities, and roadways. This definition also includes wastes generated from land-clearing activities.
- Refer to *Demolition Landfill Guidance* for list of materials



# Pre-Demo Inspections

- Inspect buildings prior to being demolished
- Identifies items/materials that need to be removed prior to demolishing building
- Directs unacceptable materials to proper management facility

# Waste Screening



- All owners/operators need to establish a Waste Screening Area (WSA) where incoming loads would first be dumped and sorted, to remove unacceptable materials prior to pushing the waste into the working face.
- Guidance identifies minimum WSA requirements.

# ISWMP

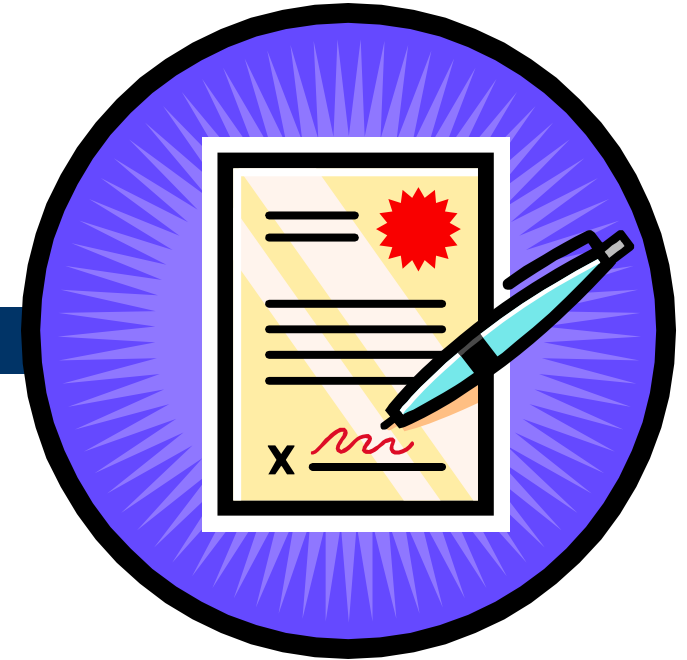
- All facilities must have an approved ISWMP
- Only wastes included in your approved ISWMP may be accepted
- Template available on MPCA web page



# ISWMP

## Class I ISWMP

- Must include:
  - Acceptable waste list  
(or smaller list)
  - Specific waste screening procedures
  - How you will manage unacceptable waste
  - Special waste management (e.g. asbestos)



# ISWMP

## Class II and Class III ISWMP

- Evaluation and Analysis:
  - Frequency and number of samples required will vary
  - New facility -- complete testing of waste prior to completion of facility
  - Existing facilities -- evaluated waste prior to acceptance
  - Evaluate waste at regular intervals but at least during each re-permitting event.

# ISWMP

## Acceptance Criteria Procedures

- Each class III facility is responsible for determining its own waste acceptance criteria
- The proposed criteria should be justified by use of the Industrial Waste Evaluation Model (IWEM) or equivalent model.
- IWEM or equivalent model may help to design, locate and monitor the landfill and identify acceptable wastes proposed for disposal.
- IWEM Guidance is available on MPCA web page.

# Liners

- **Class I – Not required**
- **Class II – See Matrix**

Liner Decision Matrix		Soil Type		
		Clay	Silt	Sand
Depth to Water Table	5 feet or more	No	Run model	Yes
	At least 10 feet	No	Run model	Run model

- **Class III – Generally Required**
- **Liner Guidance on MPCA web page**

# Ground Water Monitoring

- **Determined by type of waste accepted**
  - Defined by ISWMP
- **Required at Class II and Class III facilities**
- **Some flexibility at Class I facilities dependent on:**
  - Hydrogeology
  - Location of human and environmental receptors
  - Risk associated with potential impacts



# Ground Water Monitoring

- For new monitoring systems – three times per year for three years.
- Parameter list in Appendix A
- After three years permittee may request modification to sampling program.

# Ground Water Monitoring

- MPCA Hydros meet regularly to evaluate new proposals.
- Hydrogeologic evaluation form developed to promote consistent approach to evaluation and decision making.

## **“Limited Availability” Landfills**

- The MPCA anticipates this consideration applying to a small number of Class I operations.

# End of Demolition Guidance

Questions?

# Landfill Design

Liners



# Guidance

- Guidance for Liner Design for Demolition Debris or Industrial Solid Waste Landfills  
(Waste/Solid Waste #5.02, October 2005)
- [www.pca.state.mn.us/publications/w-sw5-02.pdf](http://www.pca.state.mn.us/publications/w-sw5-02.pdf)

# Design Variables

- Incoming waste types
- Site geology
- Groundwater flow
- Receptor locations
- Future land use plans
- Surface water locations
- Local shoreland requirements
- Cost
- Alternative waste management options
- Changes in technology
- Changes in waste stream
- Local industry
- Air emission issues

# Design Recommendations

- Compatible with waste types
- Collect water movement through waste
- Prevent water movement from landfill
- Minimum 90% collection efficiency
  - HELP Model (Hydrologic Evaluation of Landfill Performance)
- 3 components: Stable subgrade, barrier liner, drainage layer



# Design Process

- Permittee selects liner design
- Permittee evaluates liner design and provides justification for design to MPCA in permit application
- MPCA reviews design and justification to verify adequacy of protection
- Occasionally MPCA technical staff hold forum to review and discuss design

# Industrial Waste Evaluation Model (IWEM)

A Potential Tool



# Guidance

- **Guidance for Industrial Waste Management Evaluation Model (IWEM)** (Waste/Solid Waste #5.03, October 2005)
- [www.pca.state.mn.us/publications/w-sw5-03.pdf](http://www.pca.state.mn.us/publications/w-sw5-03.pdf)

## What is the IWEM Model?

- Computer modeling tool produced by the federal EPA (February of 2003)
- Part of the *Guide for Industrial Waste Management (2/03)*
  - *Guide* developed by EPA & 12 states, others
  - *Guide* recommends BMPs to protect water and air
  - *Guide* offers risk-based approach to liners
  - IWEM supports the *Guide*

# Purpose of the IWEM Model

- Intended for facility managers, regulators, and citizens as a simple-to-use tool to evaluate appropriate liner systems
- Liner evaluations for:
  - Landfills
  - Surface impoundments
  - Waste piles
  - Land application

## What is it doing?

- Provides the results of fate and transport modeling of constituents (chemicals) in a waste through subsurface soils to ground water and beyond (to prescribed wells).
- Utilizes EPA's EPACMTP model (EPA Composite Model for Leachate Migration with Transportation Products)

## Model Details

- Model contains 2 evaluation tiers
  - Tier 1 - screening analysis, national data
  - Tier 2 - location-adjusted, limited site specific
  - Tier “3” - not in model but see *Guide*
- IWEM model compares expected leachate concentrations entered to leachate concentration threshold values chosen (MCLs, HB, “HRLs”, etc.)

# Model Results

- The model provides 4 types of recommendations
  - Minimum protective liner based on leachate only
  - Alt. protective liner based on leachate & location
  - Maximum conc. levels protectively managed
  - Wastes that can be protectively land applied



# Liner Recommendations

- One of three liner scenarios recommended
  - No liner needed to be protective
  - Single liner needed
    - (3 feet of clay w/ hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec)
  - Composite liner needed
    - (60 mil HDPE and a GCL ( $5 \times 10^{-9}$ ) or 3 feet of clay)

## Technical Details

- EPACMTP models attenuation and biochemical transformation based on constituent-specific organic carbon partition coefficients (Tier 2)
- Uses Monte Carlo simulation (repeated random sampling) to determine probability distribution of predicted ground-water concentrations

# Liner Designs

Typical Proposals



# Liner Materials

- Clay liners
  - Must be placed in layers (lifts)
  - Must be compacted and bonded together
  - Needs to meet design permeability
- Synthetic membrane liners
  - Must be placed by certified installers
- Geosynthetic clay liners (GCL)
- Composite liners
  - A combination of any of the above components

## Demo Landfill Liner Design Examples

- Elk River Landfill: 6 inches low permeability ( $2 \times 10^{-6}$  cm/sec) soil overlain by 60-mil HDPE membrane
- Vonco II Landfill: 1 foot compacted clay overlain by 60-mil HDPE
- SKB Rich Valley Landfill: 2 foot compacted clay
- Dem-Con Landfill: GCL overlain by 40-mil HDPE

# Industrial Landfill Liner Designs

- American Crystal Sugar Landfill: former wastewater pond design - 1 foot of compacted clay @ 3,500 gal/acre/day (old wastewater standard)
- Excel Energy Sherco 3 Landfill: 1 foot compacted clay overlain by a GCL and topped with a 60-mil HDPE membrane
- Grand Rapids Sludge Landfill: GCL overlain by 60-mil HDPE
- Hoot Lake Landfill: 1 foot compacted clay topped by 60-mil HDPE

# Clay Barrier Layer Construction



# Synthetic Membrane Installation





# Placing Gravel in Leachate Collection Trench



# Placing Sand Drainage Layer



# Liner Leak Detection



# Addressing Liner Issues

Minnesota's Experience



# Fixing Liner Problems

- Ponderosa Landfill: bio-fouling of the drainage layer
- SKB Rosemount: Liner slipped out of key trench and slid down slope
- Rice County Landfill: Leakage of primary liner in leachate holding pond due to improper boot around pipe penetration

## Liner Longevity (EPA, 2002)

- Antioxidant Depletion.....200 years
- Induction Time.....20 years
- Half Life of Engineering Property...750 years
- Total Lifetime Estimate.....970 years

# Engineering Wrap-Up

Questions?