

# Design, Composition and Chemistry of Demolition and Industrial Landfills in Minnesota

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Minnesota Pollution  
Control Agency

# Minnesota CDI Waste in the Year 2007

## C&D Waste LFs ←

(Permitted C&D LF's & C&D MSW LF Cells)

97 landfills      1,348,000 tons

## Merchant Industrial Waste LFs

(Accepts industrial waste for a fee from many industrial waste generators)

4 landfills      1,128,000 tons

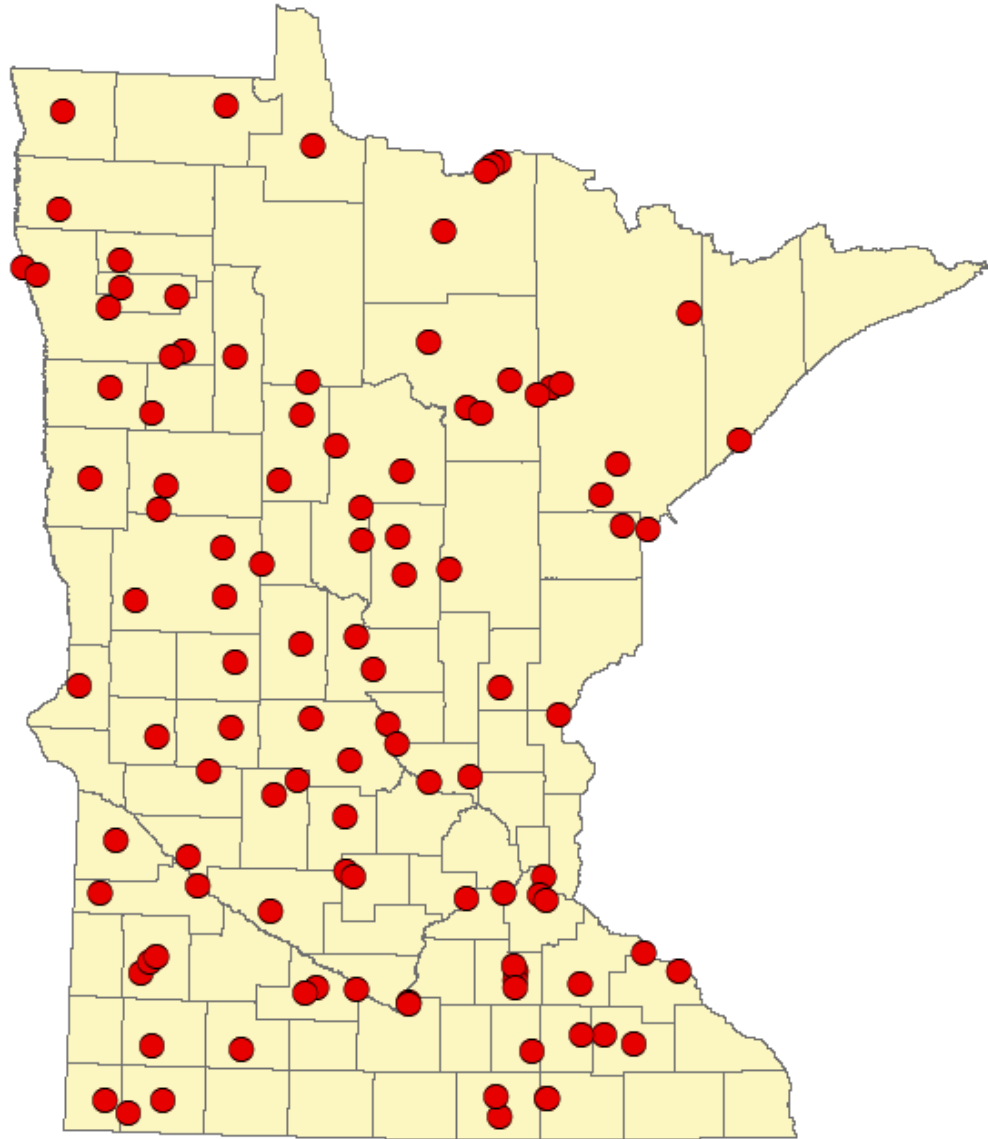
## Private Industrial Waste LFs

(Private Industrial Waste LF's receiving only company IW,  
primarily coal ash, paper mill sludge, sugar beet waste)

17 landfills      1,050,000 tons



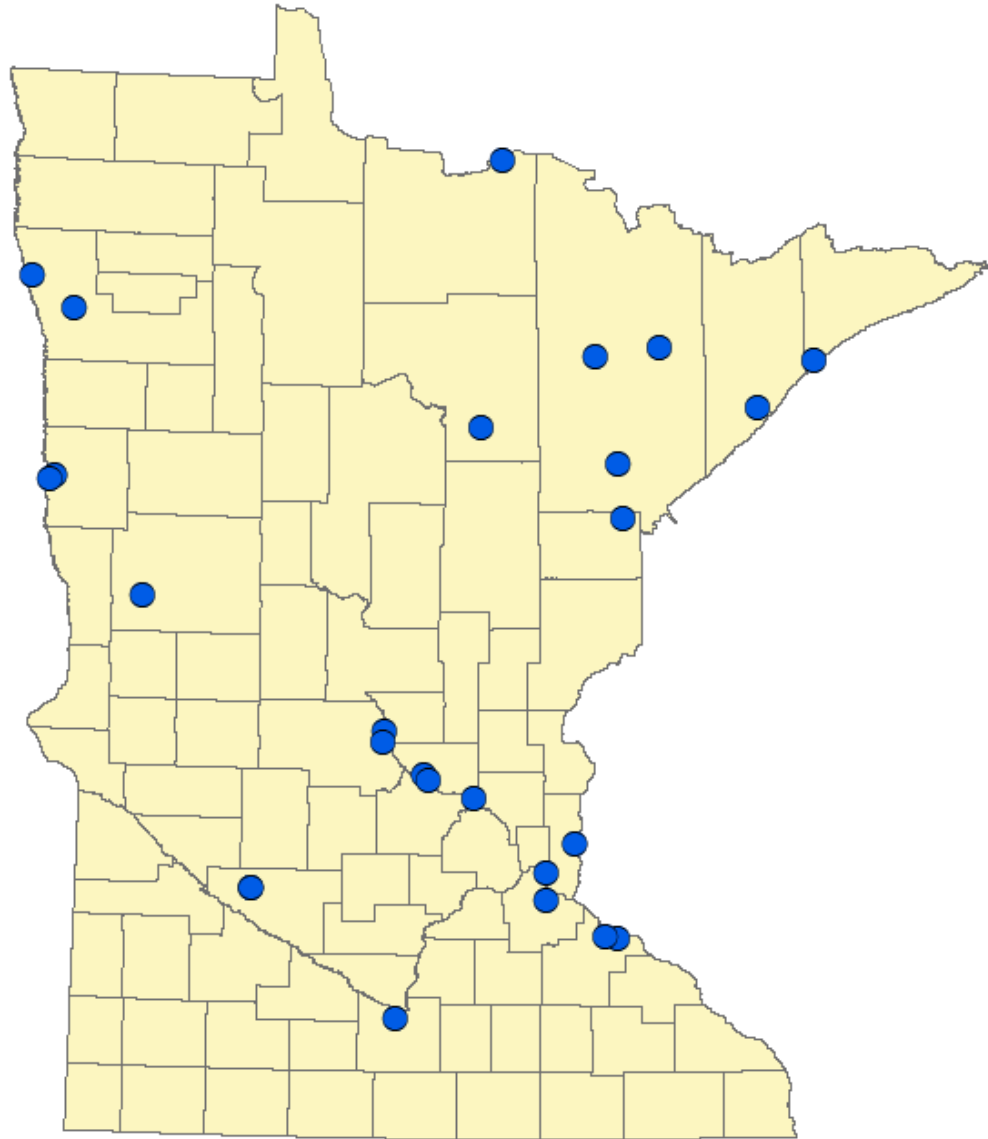
# Open Demolition Landfills



Approximate Locations

ARH 2008

# Open Industrial Landfills



Approximate Locations

ARH 2008

# Demolition Landfills Commonly Located in Mined Out Sand and Gravel Pits



# Primary Demolition Landfill Design Considerations

- The landfill is developed in phases;
- each cell built to no more than approximately a years worth of waste;
- the landfill is bermed, and stormwater is routed around, and away from the bottom of the fill usually to a stormwater basin;



# Primary Demolition Landfill Design Considerations cont.

- final cover has 2%-20% slopes, which limits the overall thickness (height) of the waste;
- 5' separation from SHWT;
- the working face kept relatively small;
- the bottom is sloped to route 25-year 24-hour storm event.

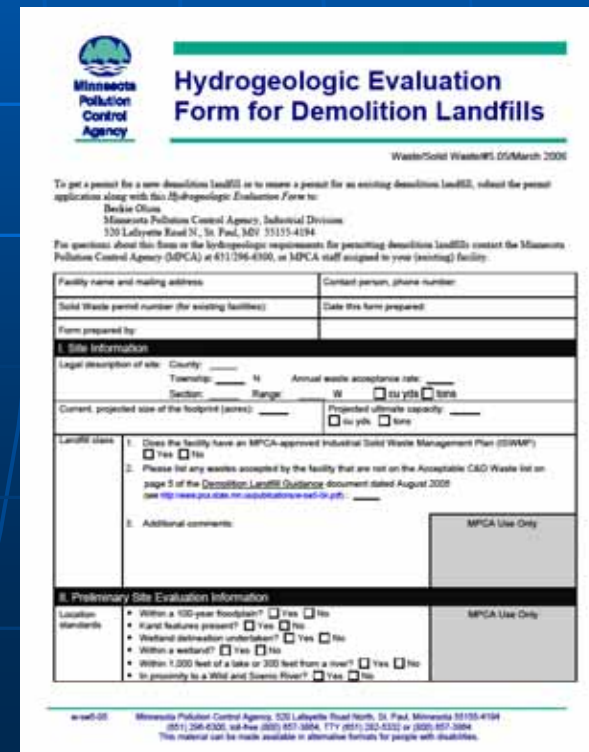


# Hydrogeologic Evaluation for Demolition Landfills

- Typically require a minimum of 8-12 borings to 5' below the water table
- Borings provide information on soil texture and depth to seasonal high water table

This information is used to determine if groundwater monitoring and/or a liner is required, not if a site is geologically "sensitive".

Derived from Guidance  
For new or existing LFs



The image shows a form titled "Hydrogeologic Evaluation Form for Demolition Landfills" from the Minnesota Pollution Control Agency. The form includes sections for site information, landfill status, and preliminary site evaluation. It contains various checkboxes and input fields for site details, waste management plans, and environmental conditions. The form is dated 05/2008 and includes contact information for the MPCA.

**Minnesota Pollution Control Agency**  
Waste/Solid Waste/MSU/05/March 2008

To get a permit for a new demolition landfill or to renew a permit for an existing demolition landfill, submit the permit application along with this Hydrogeologic Evaluation Form to:  
Bekkie Olson  
Minnesota Pollution Control Agency, Industrial Division  
520 Lafayette Road North, St. Paul, MN 55155-4194

For questions about this form or the hydrogeologic requirements for permitting demolition landfills contact the Minnesota Pollution Control Agency (MPCA) at 612-296-6300, or MPCA staff assigned to your (existing) facility.

Facility name and mailing address:	Contact person, phone number:	
Solid Waste permit number (for existing facilities):	Date this form prepared:	
Form prepared by:		
<b>I. Site Information</b>		
Legal description of site: County: _____ Township: _____ N Section: _____ W Range: _____ E Projected ultimate capacity: _____ <input type="checkbox"/> cu yds. <input type="checkbox"/> tons	Annual waste acceptance rate: _____ Projected ultimate capacity: _____ <input type="checkbox"/> cu yds. <input type="checkbox"/> tons	
Current, projected size of the footprint (area): _____ <input type="checkbox"/> cu yds. <input type="checkbox"/> tons		
Landfill status: 1. Does the facility have an MPCA-approved Industrial Solid Waste Management Plan (ISWMP)? <input type="checkbox"/> Yes <input type="checkbox"/> No 2. Please list any wastes accepted by the facility that are not on the Acceptable C&D Waste list on page 5 of the Demolition Landfill Guidance document dated August 2008 (see <a href="http://www.pca.state.mn.us/industrial/waste/cd.pdf">http://www.pca.state.mn.us/industrial/waste/cd.pdf</a> ): _____ 3. Additional comments: _____		MPCA Use Only
<b>II. Preliminary Site Evaluation Information</b>		MPCA Use Only
Location: • Within a 100-year floodplain? <input type="checkbox"/> Yes <input type="checkbox"/> No • Aerial features present? <input type="checkbox"/> Yes <input type="checkbox"/> No • Wetland delineation undertaken? <input type="checkbox"/> Yes <input type="checkbox"/> No • Within a wetland? <input type="checkbox"/> Yes <input type="checkbox"/> No • Within 1,000 feet of a lake or 200 feet from a river? <input type="checkbox"/> Yes <input type="checkbox"/> No • In proximity to a Wild and Scenic River? <input type="checkbox"/> Yes <input type="checkbox"/> No	MPCA Use Only	

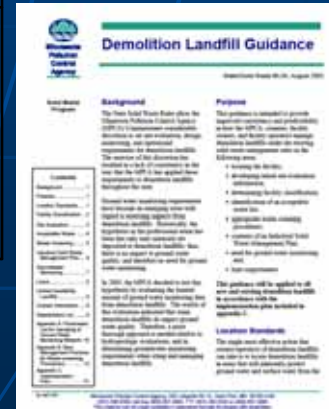
www.mn.gov Minnesota Pollution Control Agency, 520 Lafayette Road North, St. Paul, Minnesota 55155-4194  
612-296-6300, toll-free 800-657-3884, TTY 612-292-6222 or 800-657-3884  
This material can be made available in alternative formats for people with disabilities.



**Table 2: Class II Liner Decision Matrix (for demolition landfills)**

Is a liner necessary?			
Depth to Water Table	Soil Texture		
	Clay	Silt	Sand
5 feet or more	No	Run model.	Yes
At least 10 feet	No	Run model.	Run model

In terms of risk this criteria has not been fully validated



## IWEM Tier 2: Up to 20 site-specific parameters can be used

- Geographic location
- Footprint
- Depth (LF, SI)
- Distance to surface water (SI)
- Operational life (SI,WP,LAU)
- Waste Type (WP)
- Leakage rate
- User defined liner
- **Leachate concentration**
- Distance to receptor
- Unsaturated zone soil type
- Subsurface parameters
  - Depth to water table
  - Saturated thickness
  - Hydraulic conductivity
  - Regional gradient
  - Groundwater pH (metals)
- Constituent parameters
  - Sorption
  - Degradation
  - RGCs

Assumes landfill is covered

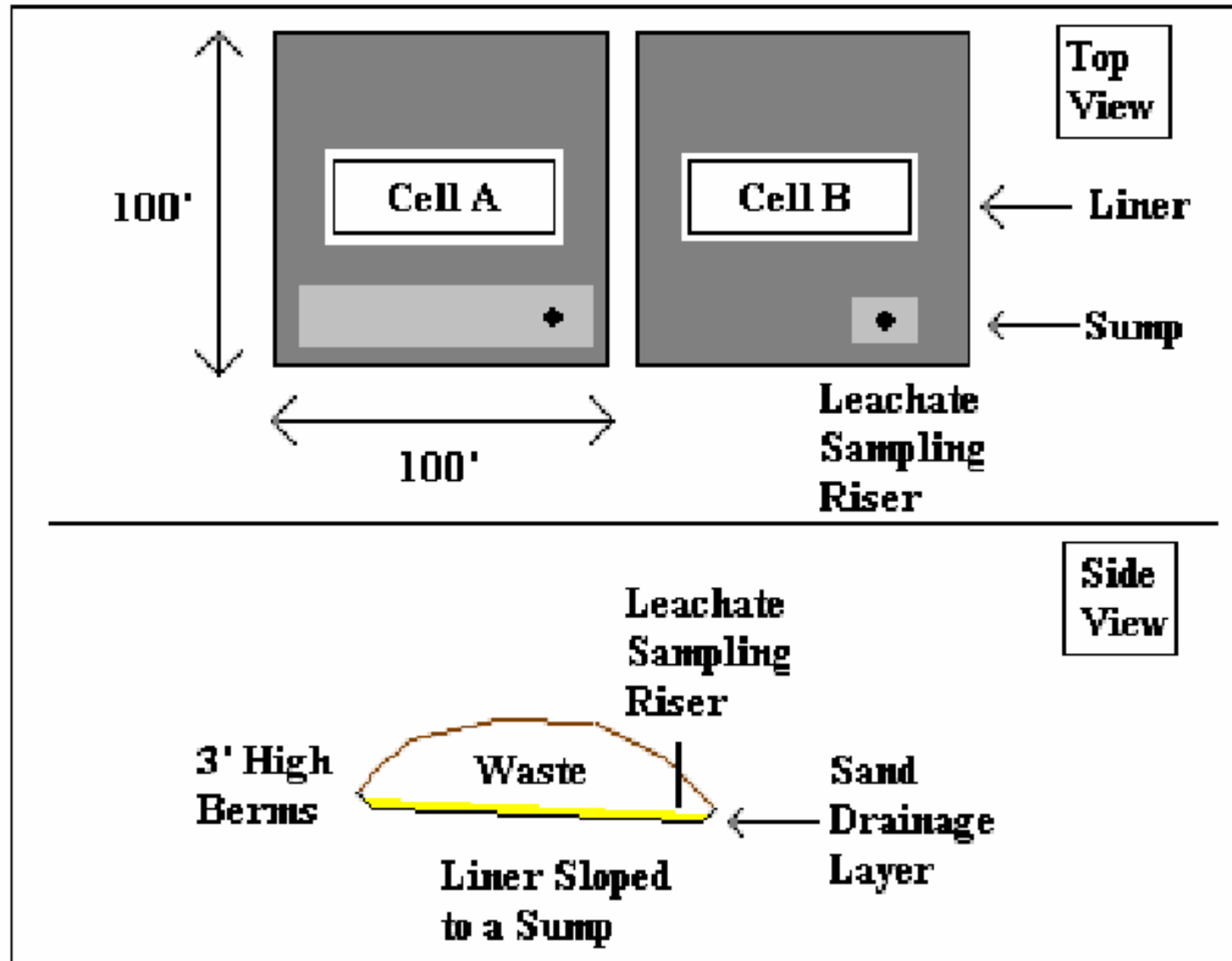
# Demolition Landfill Leachate Concentration Data for Modeling/Liner Decision

- MPCA: data from lined, Class III landfills  
(not Class I or Class II)
- EPA: surveyed multiple landfills with multiple  
waste streams
- Ohio: wastestream included CCA and other  
non-Class I or II wastes
- Townsend: wastestream included CCA and  
other non-Class I or II wastes

(No Class I or II data currently available)



Concept: Definitive Demolition Landfill Leachate Study Design



# Impacts of Un-lined Demolition Landfills in Minnesota

- Trojan study (used existing data)
- On-going MR 7035.2815 monitoring

## Typical Groundwater Parameters for Demolition Landfills

### 1x/year

arsenic, barium, boron, cadmium, chloride, chromium, copper, iron, lead, manganese, mercury, nitrate-N, sodium, sulfate

### 3x's/year

VOC sampling and field parameters  
(DO, pH, SC, turbidity, temp. alkalinity)

Leachate currently not sampled for Class I facilities



# Summary of Groundwater Impact Analysis at Unlined Solid Waste Disposal Facilities in Minnesota

(Trojan, 2003)

- Data was analyzed at 43 landfills in Minnesota, but only 8 of them were exclusively demolition landfills.
- One had insufficient data, 5 had down-gradient concentrations greater than up-gradient, and 2 had no differences between up-gradient and down-gradient wells

\*: At present not all demolition landfills have groundwater monitoring



# VOC groups for which concentrations of one or more VOC were greater in down-gradient versus up-gradient well(s)

(Trojan, 2003)

Number of Sites	CFCs	Chlorinated hydrocarbons	Other hydrocarbons
13	13	7	10

VOCs detected: 1,1,1-trichlorethane, 1,1,2-trichloroethene, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichlorethene, and vinyl chloride being detected most frequently. Other inorganics frequently detected included tetrahydrofuran, benzene, and to a lesser extent, acetone, ethyl ether, ethylbenzene, toluene, and xylene.





Metal groups for concentration of one or more chemical was greater in down-gradient well(s) compared to up-gradient well(s).

(Trojan, 2003)

Number of Sites	Ca, Mg, Na, or K	Fe or Mn	Other metals and metalloids
20	15	9	7

- Typically, calcium, magnesium, or sodium concentrations were higher in the down-gradient wells compared to up-gradient wells.
- Other metals that were found at higher concentration in down-gradient wells included barium, cadmium, copper, chromium, and lead.
- Barium was the metal for which down-gradient concentrations most frequently exceeded up-gradient concentrations.

- Currently groundwater monitoring data is submitted electronically to the MPCA (DELTA system)
- Automated analysis of the data (“flagging”) using DELTA is currently limited, so reviews are usually done in annual reports
- Some demolition landfills now undertaking (limited) corrective actions because of exceedances of performance standards (boron and VOCs)



# Industrial Landfill Design Considerations



- Design depends on waste type and volumes, but industrial landfills cannot accept hazardous waste as defined by the TCLP test
- Typically need a liner and leachate collection system, stormwater controls
- Industrial landfill design is based on waste types and volumes (E.G. spent lime vs. “promiscuous” manufacturing wastes)
- Industrial landfill design may be the same or greater than MSW landfill design (2’ clay and 60 mil HDPE)

# Industrial Landfill Leachate

- Composition, volume, strength depends on waste types;
- may have (very) elevated concentrations of BOD, salts, VOCs, metals;
- if leachate is collected it needs adequate treatment.

# Class 1 Demolition LF Summary

- Stake-holder derived Demolition Guidance developed to reduce permitting subjectivity
- More standardized hydrogeologic information in the Hydrogeologic Evaluation Form is now required for permitting demolition landfills.
- The decision if GW monitoring is required based on soil properties and SHWT- but criteria is not solely risk based.

# Class 1 Demolition LF Summary

cont.

- Organic and inorganic parameters have been detected above performance standards in monitoring wells downgradient of un-lined demolition landfills, resulting in implementing corrective actions.
- More demolition landfills will require GW monitoring as they re-enter the 5-year permitting cycle

# Class II Demolition LF Summary

- Liner decision based on soils and SHWT, and may involve modeling.
- Modeling data sets are currently not based on Class I demolition materials.

# Industrial Landfill Summary

- Design based on waste type and quantity (may use MSW design rules)
- Leachate composition and strength depends on waste types and quantity.

More information on industrial landfill design, composition and chemistry may be provided in future presentations.



# Questions?

