

# Summary of Issues & Findings

Province of Alberta Finance and Administration Division  
Regulatory Approvals Centre's Approval of Thorhild  
Class II Municipal/Industrial Landfill

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## Detailed Discussion Submitted Concerning Deficiencies in Technical Aspects & Review of WM Application for Thorhild Landfill

- Lee, G. F., and Jones-Lee, A., *“Comments on Characteristics of Proposed Thorhild Landfill with Respect to Providing Reliable Protection of Public Health & Environmental Quality for as Long as the Wastes Remain a Threat,”* Comments prepared on behalf of Concerned Citizens of Thorhild County Society, Alberta, Canada, by G. Fred Lee & Associates, El Macero, CA, USA, 65pp, October 13 (2012). (*Comments*)  
<http://www.gfredlee.com/Landfills/ThorhildLFAppealDocuments.pdf>
- Lee, G. F., and Jones-Lee, A., *“Response to Waste Management’s November 2, 2012 Motion to Alberta Environmental Appeals Board to Disallow Portions of Dr. Lee’s Report and Possible Evidence at Hearing,”* Comments Prepared by G. Fred Lee & Associates, El Macero, CA, November 18 (2012). (*Response*)  
[http://www.gfredlee.com/Landfills/Thorhild\\_Response\\_Nov2\\_Motion.pdf](http://www.gfredlee.com/Landfills/Thorhild_Response_Nov2_Motion.pdf)

# Comments on Alberta Environment Specific Permitting Review Issues

- Summary Credentials for Rendering Conclusions (*Comments pp 63-65*)
  - Academic Undergraduate & Graduate Degrees
    - BA, MSPH, PhD
      - Public Health/Engineering
      - Water Quality Evaluation/Management
  - 30 yrs University Graduate-Level Professorships & Research
    - Issues of Landfill Siting, Design & Materials
    - Public Health/Environmental Protection Associated with MSW Management Approaches
  - 24 yrs Professional Advising/Consulting
    - Primarily with Public Agencies & Groups
    - Reviewed Characteristics & Impact Issues of > 80 Municipal Solid Wastes Landfills

## Protective Nature of Alberta Environment Landfill Standards

- AE Landfill Standards May Afford Protection of Public Health, Groundwater Resources, and Environmental Quality at Some Locations – Dependent on:
  - Design, Maintenance, Monitoring, Remediation Details
  - Siting
- WM-Proposed Thorhild Landfill Site Highly Unsuitable for Landfill
  - Site Does Not Provide Adequate Reliable Natural Protection of Groundwater Quality Goals of Environmental Protection and Enhancement Act, Water Act
  - Inadequate for Reliable Protection of Public Health, Groundwater Resources, Environmental Quality, Interests & Welfare of Those Who Own/Use Property within Sphere of Influence of Landfill for as Long as Wastes Are Threat

# Alberta Appeals Board Landfill Permit Review Issues

- Permitting Process and Review
  - Did Not Reliably Consider or Reliably Evaluate Many Issues Key to Evaluating Ability of Proposed Landfill to Provide Protection of Public Health, Groundwater Resources & Environmental Quality for as Long as Wastes in Landfill Will Be Threat
  - Review Was, Therefore, Inadequate

## Wastes in Proposed Landfill: Threat to Public Health & Environment Forever

- Must Consider Compliance with Alberta Environment Protection and Enhancement Act
  - Types of Municipal Solid Wastes (MSW) That WM Proposes to Dump in Thorhild Landfill:
    - Will Contain Variety of Chemicals Hazardous/Toxic & Otherwise Deleterious to Human Health & Environment
  - Proposed Landfill Design, Operation, Closure/Postclosure Monitoring & Maintenance Will Potentially Delay Impact on Public Health & Environment
    - Delay for Very Short Time Compared with Period over Which Wastes in This Proposed Landfill Will Be a Threat

## Comments on Alberta Environment Specific Permitting Review Issues

- *Do the terms and conditions of the EPEA Approval and Water Act Approval adequately protect the environment and human health? Environment includes land, wetlands, habitat, and wildlife*
- **My Professional Conclusion: No** (*Comments & Response*)
  - WM-Proposed Thorhild Landfill Will Be a Significant Threat to Public Health & Environmental Quality
  - WM-Proposed Landfill Location, Design, Operation, Closure/Postclosure Approaches Fall Far Short of Achieving Compliance with EPEA & Water Act Requirements

## Comments on Alberta Environment Specific Permitting Review Issues

- *Do the EPEA Approval and Water Act Approval adequately address the potential impacts of the landfill on the groundwater and local wells?*
- My Professional Conclusion: No (*Comments pp. 34-37*)
  - Location of WM-Proposed Landfill Does Not Provide Natural Protection of Groundwater Quality for as Long as Wastes Will Be Threat
    - The Inevitable, Eventual Failure of Landfill Liner Poses Significant Threat of leachate Pollution of Offsite Groundwater Wells & Surface Waters
    - MSW-Pollution Renders Polluted Groundwaters unsafe Unusable



# Comments on Alberta Environment Specific Permitting Review Issues

- *Did the Director adequately consider the construction and operation of the landfill? Operations include the types of waste accepted by the landfill and the proposed control of dust, noise, odours, nuisance animals, and fugitive wastes*
- **My Professional Conclusion: No** (*Comments pp. 38-42, 45-50, 53, 61-62*)
  - Inadequate WM-Owned Bufferland to Dissipate Releases from Landfill → Trespass of Odourous Chemicals onto Adjacent Properties
  - Types of MSW WM Proposes to Landfill Will Contain Wide Variety of Hazardous & Otherwise Deleterious Chemical Constituents
    - Could Be Expected in Leachate
      - Can Pollute Groundwaters → Pose Hazard to Human & Animal Health, Quality/Usability for Domestic Use
      - Can Pollute Surface Waters → Pose Hazard to Aquatic Life

# Comments on Alberta Environment Specific Permitting Review Issues

- My Professional Conclusion (cont'd):
  - WM Claims Thorhild Landfill Will Not Accept Wastes Classified as “Hazardous Waste” But Fails to Acknowledge & Address:
    - Many Components of MSW & Industrial Wastes Classified as “Non-Hazardous” Can Be Highly Hazardous to Public Health & Environmental Quality
    - Known, Unknown, Unregulated Toxic & Otherwise Hazardous/ Deleterious Chemicals Will Be Present in Wastes and Leachate
    - So-Called “Non-Hazardous” Chemicals in MSW Leachate Can Render a Groundwater Unusable as Domestic/Animal Water Supply
    - Types of Solid Wastes to Be Accepted Will Contain Chemical Constituents That Can Be Converted to Gaseous Products
      - When Present In Landfill Gas Threat to Human & Animal Health
      - Nuisance to Offsite Land Users → Decreased Property Values

## Comments on Alberta Environment Specific Permitting Review Issues

- *Are the monitoring programs adequate to protect the environment and human health?*
- **My Professional Conclusion:** No (*Comments pp. 34-35*)
- WM Proposed Monitoring Programs Significantly Deficient for Detecting Incipient Releases of Hazardous & Deleterious Chemicals
  - Will Not Enable Detection & Effective Control on WM Property
  - Inadequate to Prevent Trespass of Releases onto Adjacent Properties
    - Inadequate Number & Siting of Proposed Groundwater Monitoring Wells to Detect Leachate-Pollution of Groundwater Pollution before Offsite Groundwater Pollution
    - Inadequate Duration of Groundwater Monitoring for Detection of Pollution of Groundwater Under/Near Landfill over Entire Period That Landfilled Wastes Will Be Threat to Public Health & Groundwater Quality

# Comments on Alberta Environment Specific Permitting Review Issues

- *Are the post closure and reclamation conditions adequate?*
- **My Professional Conclusion:** No (*Comments pp. 54-60, 51-52*)
  - Greatest Deficiency in Application: Failure of WM to Acknowledge & Address Issues:
    - Proposed Landfill Will Be Threat to Public Health, Groundwater & Environmental Quality for Hundreds to Thousands of Years
      - As Long as the Wastes Can Generate Gas/Leachate When Contacted by Water
    - Hazardous/Deleterious Components of MSW Do Not “Decompose” or “Detoxify” in Dry Tomb Landfill – as Long as Wastes Kept Dry
      - Duration That Wastes Will Be Kept Dry Depends on
        - Composition & Quality of Construction
        - Maintenance of Clay/Soil Cover

# Comments on Alberta Environment Specific Permitting Review Issues

- *Are the post closure and reclamation conditions adequate?*
- **My Professional Conclusion** (cont'd):
  - As Containment Systems Inevitably Deteriorate and Fail, Water Enters Wastes & Gas & Leachate Formed
  - Engineered System May Be Able to Keep Wastes Sufficiently Dry during Postclosure Period When WM Will Be Responsible to Inhibit Evidence of Leakage
  - Wastes Will Continue to Pose Threat after Postclosure Period
  - Gas & Leachate Will Form When Maintenance Becomes Inadequate to Prevent Entrance of Water through Cover
  - Adequate Postclosure Maintenance Must Be Achieved & Provisions for Groundwater Remediation & Replacement in Place as Long as Wastes Remain Buried
    - Problem for Private Landfill Companies: Total Cost of Reliable, Adequate Postclosure Landfill Monitoring & Maintenance Can Be Expected to Exceed Disposal Profits during Active Life of Landfill

# Comments on Alberta Environment Specific Permitting Review Issues

- *Are the post closure and reclamation conditions adequate?*
- **My Professional Conclusion** (cont'd):
  - WM Postclosure “Reclamation” of Closed Landfill Area Fails to Recognize & Address:
    - Some of Proposed Subsequent Land Uses, e.g., Farming, Could Cause Disruption of Landfill Containment System (Cover)
      - Must Be Protected *ad infinitum* to Prevent Entrance of Water into Landfilled Wastes That Would Lead to Leachate Generation That Could Lead to Groundwater Pollution

**Summary of Issues**  
**Groundwater Quality & Public Health Protection**  
**Pertinent to Thorhild Landfill**  
**Why It Is Not Possible to Predict How Long Proposed**  
**Thorhild Landfill Will Be a Threat**

- Landfill will be a threat as long as there are solid wastes in the landfill that, when contacted by water, can generate leachate that can pollute groundwater under the landfill and impairing its use for domestic and other purposes
  - Longer wastes kept dry, the longer the postponement of leachate generation
  - Storage of wastes in dry landfill does not diminish its threat to groundwater
- Liner system will deteriorate over time and fail to prevent leachate generated in the landfill from passing through the liner and entering the groundwater underlying the landfill
  - Liner system buried beneath wastes and not amenable to thorough inspection, repair, and replacement as it fails

## Summary of Issues

### Why It Is Not Possible to Predict How Long Proposed Thorhild Landfill Will Be a Threat

- Leachate collection system will not be effective in preventing leachate from passing through the liner system
- Thorhild Landfill site does not provide reliable natural protection of nearby groundwater quality
  - Range of permeability in these strata
  - Alberta allows average underlying permeability of  $10^{-6}$  cm – will not provide long-term barrier to leachate transport through the clay layer
- Mean hydraulic conductivity not reliable indicator of when off-site groundwater can be polluted by leachate
- Deterioration & eventual failure of landfill liner system will lead to groundwater pollution under landfill. Hydrogeology of landfill area is such that pollution of the area under landfill will lead to pollution of nearby & offsite groundwater – will render the groundwater unusable for domestic and many other purposes due to presence of known & presently unknown/unrecognized hazardous chemicals, & otherwise deleterious chemicals



## Summary of Issues

### Why It Is Not Possible to Predict How Long Proposed Thorhild Landfill Will Be a Threat

- Restrictions on “Hazardous wastes” that would be accepted will not prevent disposal of chemicals and materials that are, or can be expected to leach chemicals that are, hazardous or otherwise deleterious in a water supply
- Proposed landfill cover to be composed of a clay layer, which will not be an effective long-term barrier to the eventual penetration by water that falls on the surface of the landfill
  - Modes of transport through cover include
    - natural permeability
    - cracks that develop in clay layer
    - differential settling
  - Climatological characteristics of Edmonton, Alberta (cold, precipitation) do not prevent/preclude these problems

## Summary of Issues

### Why It Is Not Possible to Predict How Long Proposed Thorhild Landfill Will Be a Threat

- Even after inevitable large-scale failure & leaching of wastes, deposition of garbage in plastic bags that are only crushed will result in the “hiding” of some of the wastes until the plastic bags decompose/deteriorate
  - Can be expected to be many decades to hundreds of years
  - Can represent a very long-term threat to groundwater pollution
- Appearance of “cessation of leachate generation” as evidenced by no leachate in leachate collection system
  - Does not mean that wastes in landfill are no longer threat to generate leachate
  - Can be periods of no leachate generation, followed by periods of leachate generation
- Wastes in the Thorhild landfill will be threat to generate leachate for very long period of time – likely hundreds of years
  - Will require active, effective maintenance & periodic replacement of landfill cover for as long as the wastes in the landfill, when contacted by water, can generate leachate that can lead to groundwater pollution

## Summary of Issues

### Why It Is Not Possible to Predict How Long Proposed Thorhild Landfill Will Be a Threat

- Cannot rely on proposed groundwater monitoring program with the conventional, currently proposed monitoring well array to detect incipient groundwater pollution by landfill leachate
  - Heterogeneity of the geological strata under the landfill makes relying on groundwater pollution assessment by monitoring wells as proposed, unreliable
  - Each monitoring well will only sample groundwater within about one foot of the well
  - Well spacing grossly inadequate to reliably detect early, much less incipient, groundwater pollution
  - Higher permeability pathways present in the strata under & near the landfill

## Summary of Issues

### Why It Is Not Possible to Predict How Long Proposed Thorhild Landfill Will Be a Threat

- The 50-m buffer between the waste deposition area & adjacent property line inadequate to prevent trespass of waste-derived chemicals in landfill gas and leachate onto adjacent properties
  - Presents public health and environmental quality threat
  - Typically need a mile or more of buffer land between waste deposition area and adjacent properties to reduce likelihood of trespass of waste-derived chemicals at potentially significant concentrations
- Alberta's proposed approach of determining the end of the Postclosure period by comparing the composition of the leachate to area groundwater not reliable
  - Composition of leachate variable over time due to variability of leaching of solid wastes in the landfill

## Summary of Issues

### Why It Is Not Possible to Predict How Long Proposed Thorhild Landfill Will Be a Threat

- Alberta Landfill Standards are stated to be the **minimum**
  - Not represented as being protective at all locations or at proposed Thorhild landfill site
- ESRD/Centre review of the proposed Thorhild landfill location, design, closure, postclosure funding/maintenance has not adequately considered the professional literature that is pertinent to assessing potential public health & environmental quality problems and concerns of Thorhild landfill as proposed
- Disconnect between Alberta ESRD statements about the protective nature of the proposed landfill & WM application claims of the proposed landfill's design, operation, closure, and postclosure care
- ESRD review has ignored key professional literature references in approving the proposed landfill

## Summary of Issues

### Why It Is Not Possible to Predict How Long Proposed Thorhild Landfill Will Be a Threat

- This assessment based on professional background, university research on liner integrity issues, & more than 4 decades of experience reviewing about 80 landfills.
- Additional information on these issues & related issues available in our “Flawed Technology” review (that contains 170 references to professional literature with 85 peer-reviewed papers & reports) on Lee/Jones-Lee website, [www.gfredlee.com](http://www.gfredlee.com).

## Overall Assessment

- WM-Proposed Thorhild Landfill Application Fails to Meet Requirements of Province of Alberta Environmental Protection Act and Ground Water Protection Act
- Review of WM Application by Alberta Finance & Administration Division Regulatory Approvals Centre Fails to Adequately Review Potential Compliance of Proposed Landfill to Afford Protection of Public Health & Groundwater Quality
- Any Future Application for a Landfill in Area Proposed for Thorhild Landfill Should Fully Comply with Requirement to Provide Full Protection of Public Health, Groundwater Quality & Interests of Those in Sphere of Influence for as Long as Wastes in Proposed Landfill Will Be a Threat

**Further Information**  
Consult Website of  
**Drs. G. Fred Lee and Anne Jones-Lee**



<http://www.gfredlee.com>