MUNICIPAL WASTE INTEGRATION NETWORK
mwin
The voice and resource for municipal waste minimization and management

Recycling Council of Alberta

MSW Options Workshop: Integrating Organics and Residual Treatment/Disposal

Neil MacDonald CET, CH2M HILL

March 2, 2006

Calgary, Alberta

Workshop supported by

Natural Resources Canada / Ressources naturelles Canada

Environment Canada / Environnement Canada

Residuals Management
Sanitary Landfill & Bioreactor Landfill

- Presentation Outline
  - Technical Primer
  - Situation Update
  - Evaluation
  - Summary
  - Questions
- Facilitated Discussion

Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Technical Primer: Background

- Statistics Canada:
  - June 14, 2004 - *"Twenty-one percent of all waste materials were diverted from disposal…The remainder, about 24 million tonnes, was either placed in a landfill or incinerated." (2002 National waste data)*
  - December 2, 2005 - *"Canadian households continue to generate more solid waste, and the majority of it ends up in landfill sites."*
- Waste diversion activities significantly reduce the quantity of wastes going to landfill
- There remains substantial room for improvement
- Landfill disposal of waste remains a reality for Canadian communities in the foreseeable future

Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Technical Primer: Function

- System of biological, physical and chemical processes to break-down wastes and control potential impacts
  - By-products (leachate, gas) require management
  - Potential for effects on air, water, soil, ecology and community must be addressed
  - Renewable energy recovery potential at some facilities
- Requires careful siting, assessment, design, monitoring, controls, operation and post-closure management

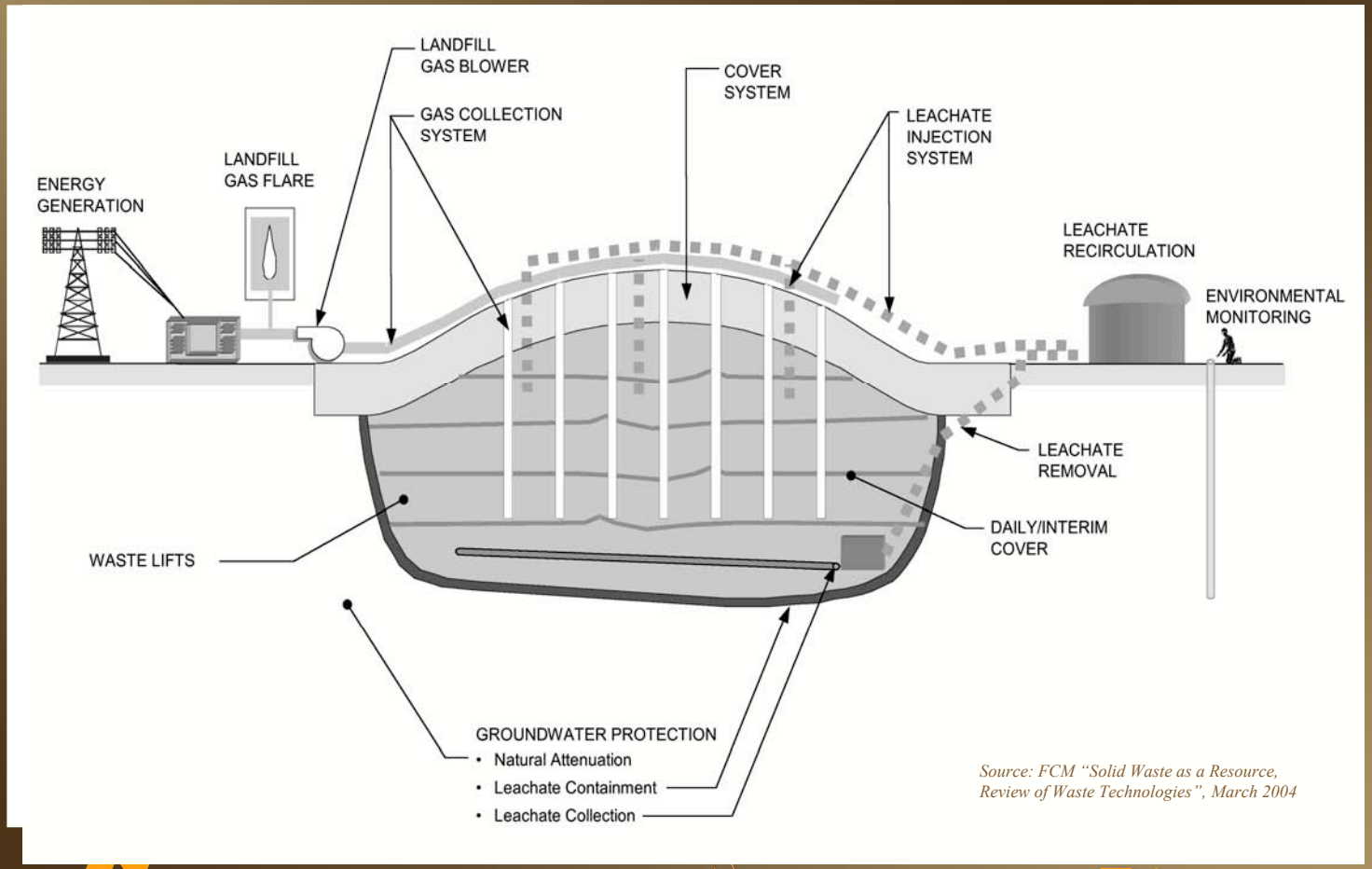
Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Technical Primer: Facility



Source: FCM "Solid Waste as a Resource, Review of Waste Technologies", March 2004

Recycling maximized ✔ Composting maximized ✔ Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Technical Primer: Key Distinctions

Sanitary Landfill	Bioreactor Landfill
Containment & Control = 'Dry Tomb'	Enhancement of biological processes to speed and maximize waste stabilization
Lengthy waste stabilization period = contaminating lifespan 50 to 100 years(+) post closure	Shorter waste stabilization period = contaminating lifespan 20 to 50 years post closure
Natural attenuation or leachate containment, collection and treatment.	Incorporates leachate collection, recirculation & moisture addition as primary enhancement
Emissions might or might not be controlled	Gas generation rates are increased therefore active gas controls are generally incorporated
Generally includes environmental monitoring	Greatly increased emphasis on environmental monitoring and process controls
	Increased settlement → increased density, increased disposal capacity & longer lifespan
	Engineered systems require specific design considerations to meet increased performance

Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Technical Primer: Selected Key Issues

- Public perceptions = negative
  - Historic environmental legacy
  - Concerns regarding potential for long-term impacts
- Cost = comparatively low
- Land use = conflicts and priorities
- Energy recovery potential = beneficial use of a resource

Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Situation Update: Current & Future

Sanitary Landfill	Bioreactor Landfill
Wide-spread application, relied upon by many Canadian communities	Emerging technology, two operational Canadian facilities, numerous international applications
Distinct from historic legacy practices	Next step in advancement of landfill technology to a waste treatment process
Highly regulated and controlled with a focus on protection of the environment and the public	Identical regulatory regime - poses challenges to established approvals philosophies
Public concerns regarding potential impacts and long-term risk	Similar concerns based on perceptions – potential for improvement based on recognition of benefits

- Future = reduced reliance on sanitary landfill disposal:
  - On-going & expanded waste diversion efforts
  - Evolution of advanced approaches to waste management
    - Increasing adoption of bioreactor landfill
  - Reduced "wastefulness" – more efficient use of resources

Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Evaluation: Background

- Objective:
  - Evaluate effects of organic waste management activities on sanitary landfills
  - Comparative evaluation
    - Environmental, energy, social and economic indicators
    - Unit basis per tonne of waste disposed

Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Evaluation: Background

- Methodology:
  - Develop “hypothetical” community/site profiles
    - Initial service population basis 20k, 80k & 200k
  - Define waste disposal stream scenarios
    - Base-case, SSO & Mixed waste
    - Include IC&I waste (base-case) in all streams
    - Population growth at 1.5%/yr.
  - Define site profile, configurations, physical systems, operational conditions, etc.
  - Estimate indicators
    - Generic approach – not site-specific
    - Incorporates both operating lifespan and post-closure management period

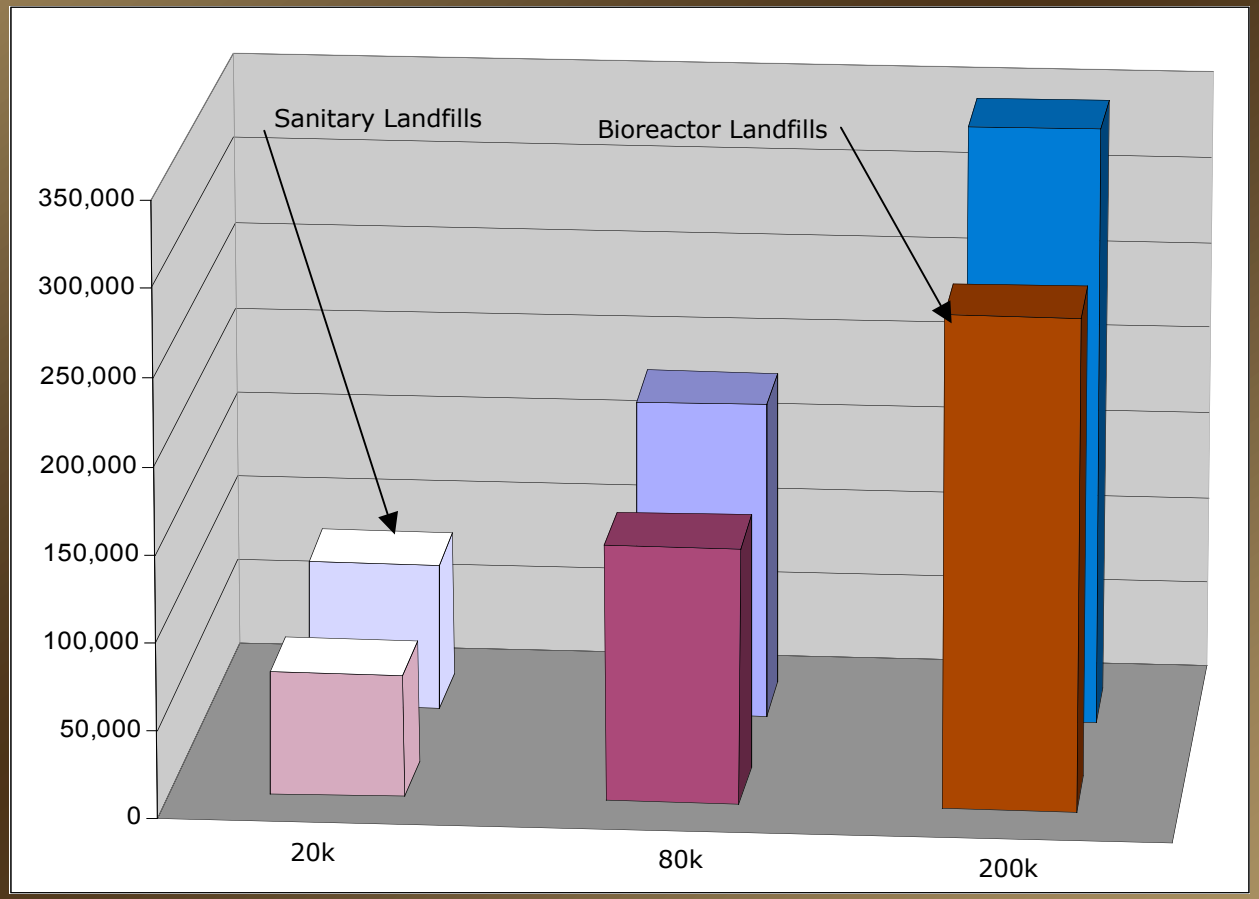
Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Evaluation: Results – Facility Footprint (m^2)



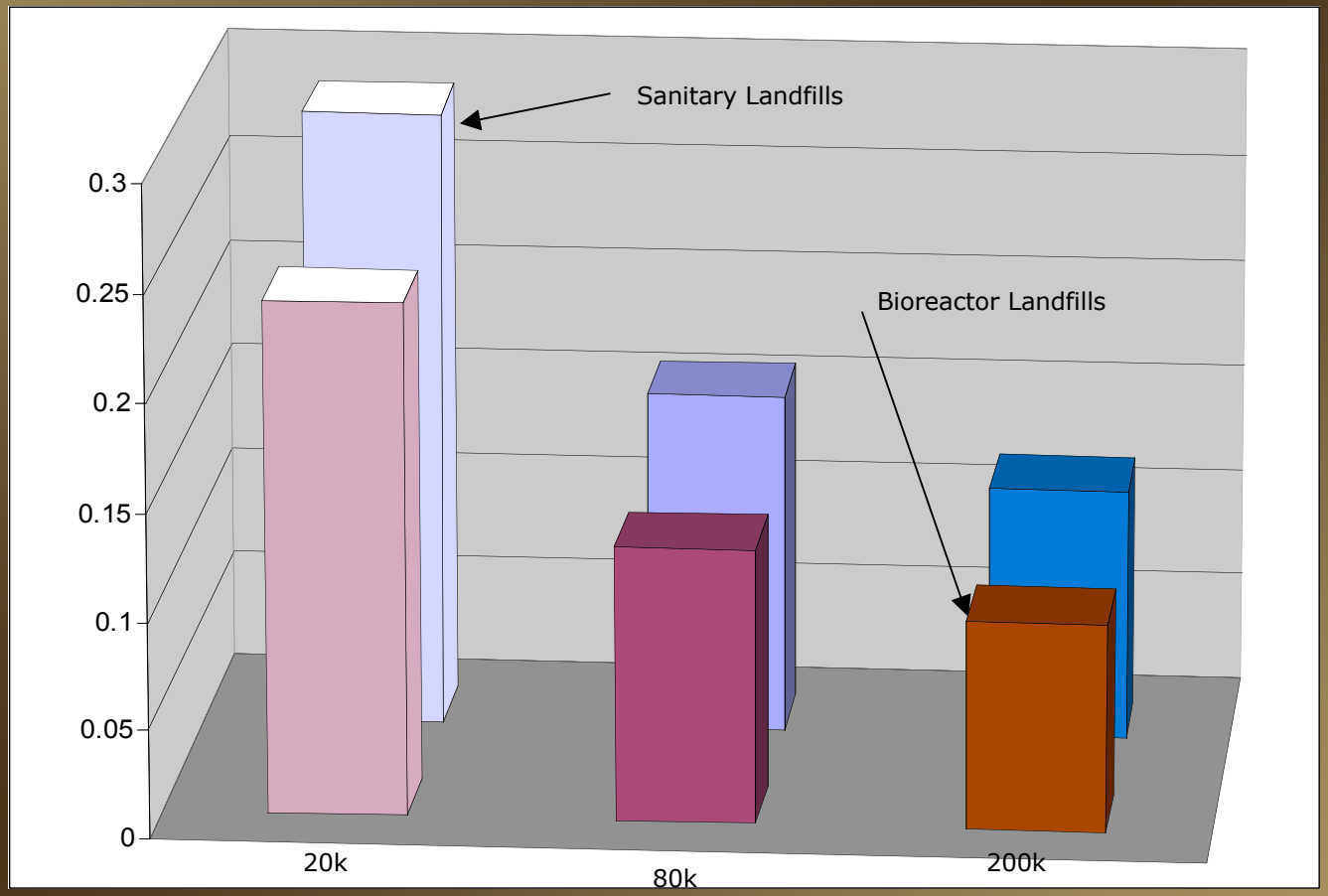
Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Evaluation: Results – Unit Land Area Consumption (m^2/tonne)



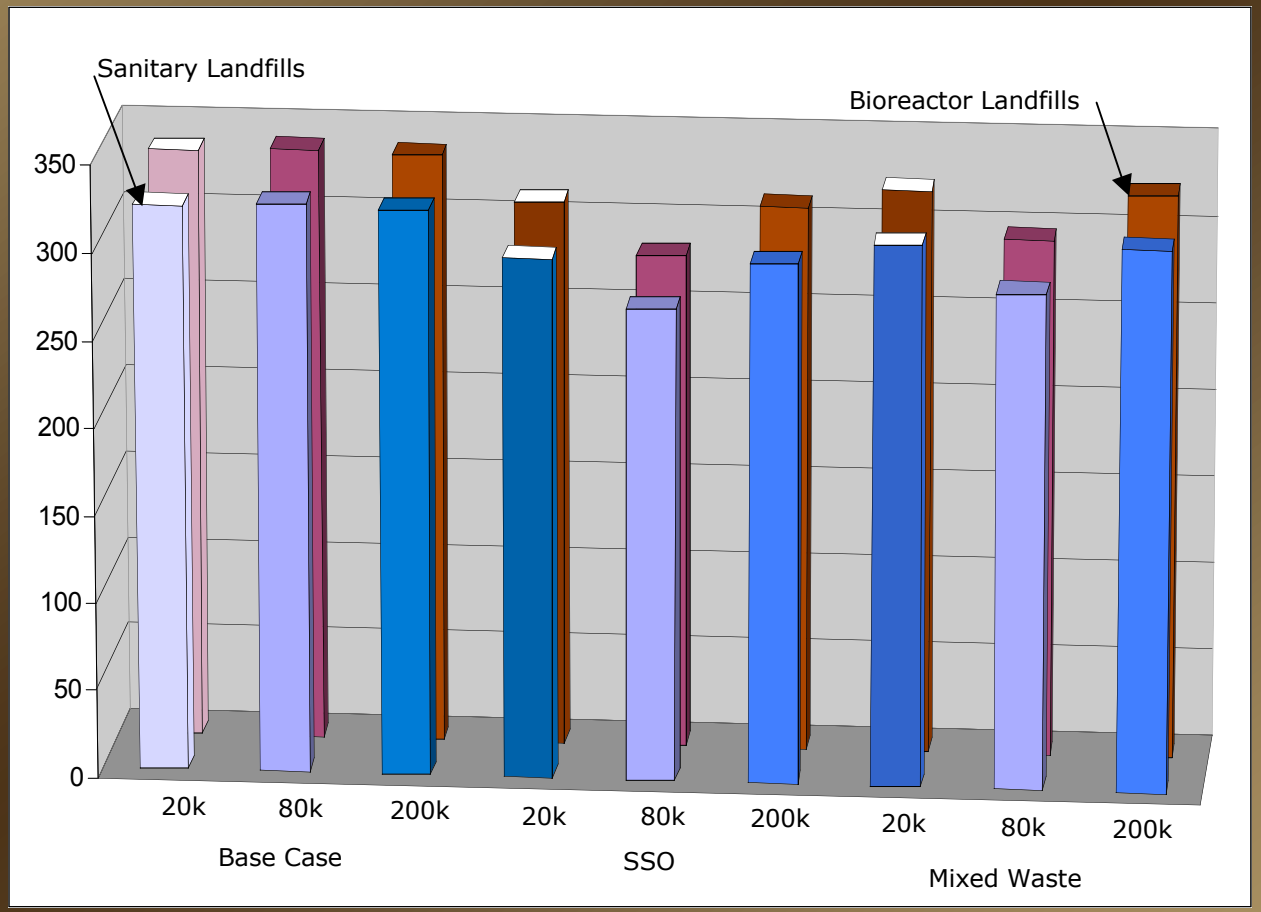
Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Evaluation: Results – Overall Gas Generation (m^3/tonne)



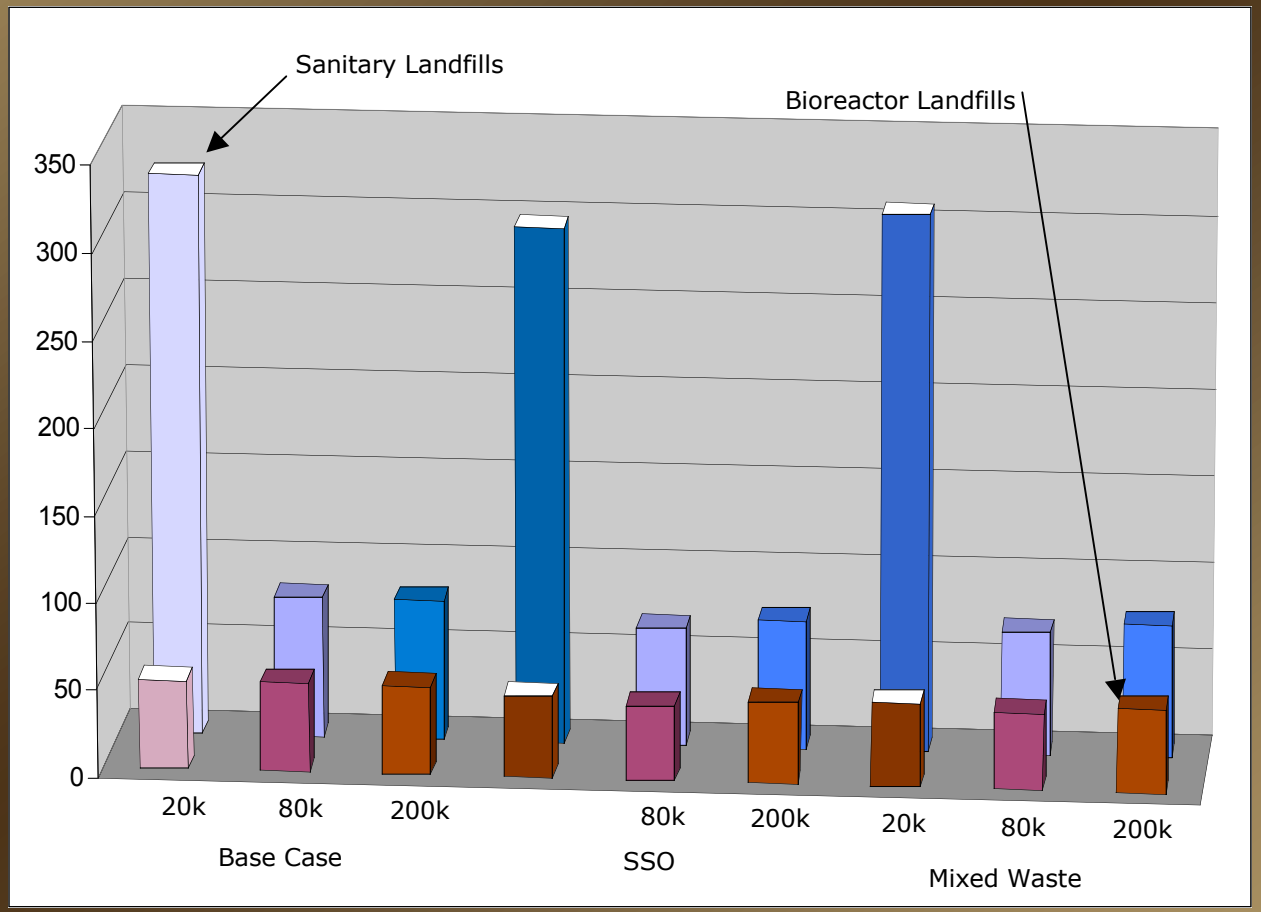
Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Evaluation: Results – Overall Gas Emissions (m^3/tonne)



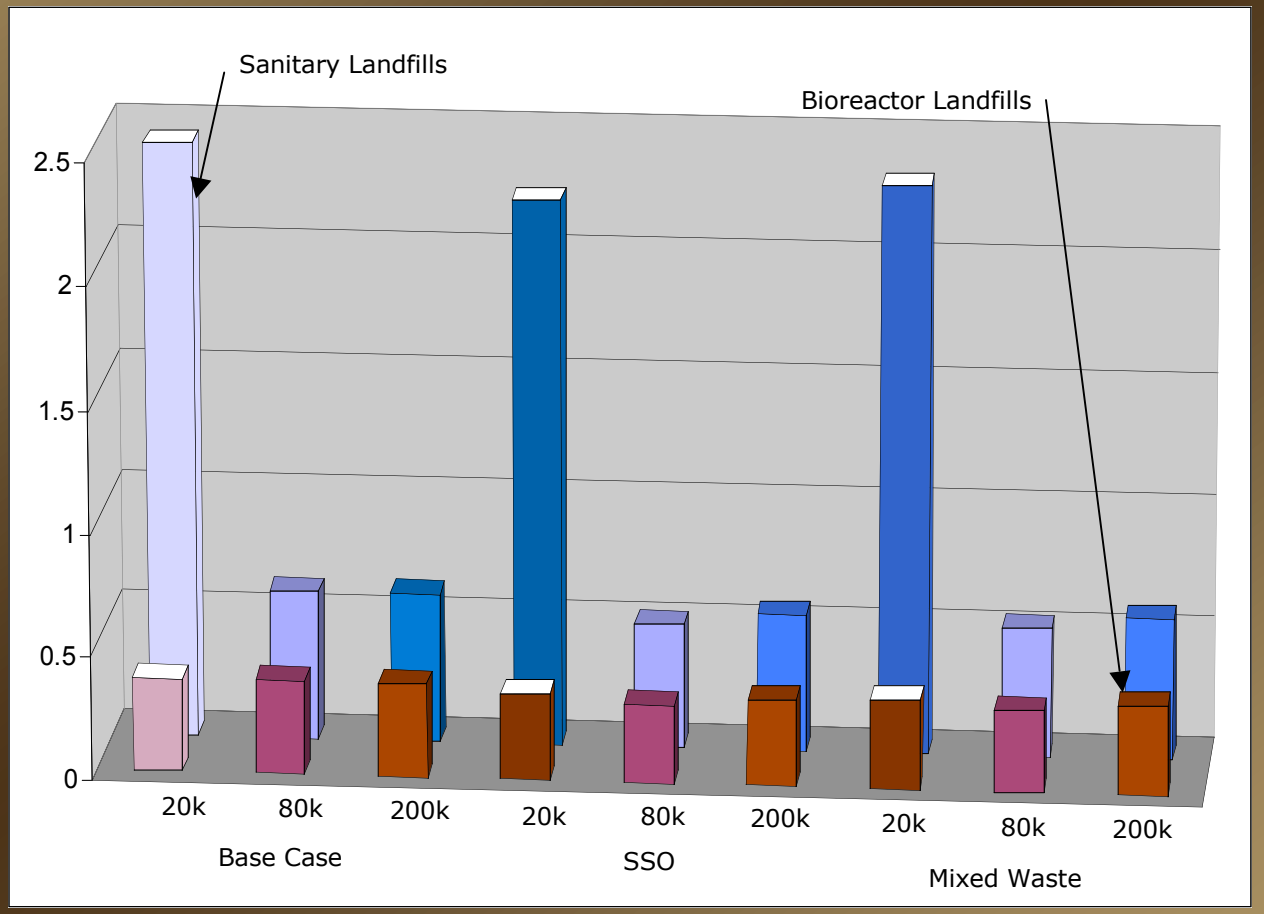
Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Evaluation: Results – Greenhouse Gas Emissions (tonnes eCO_2/tonne)



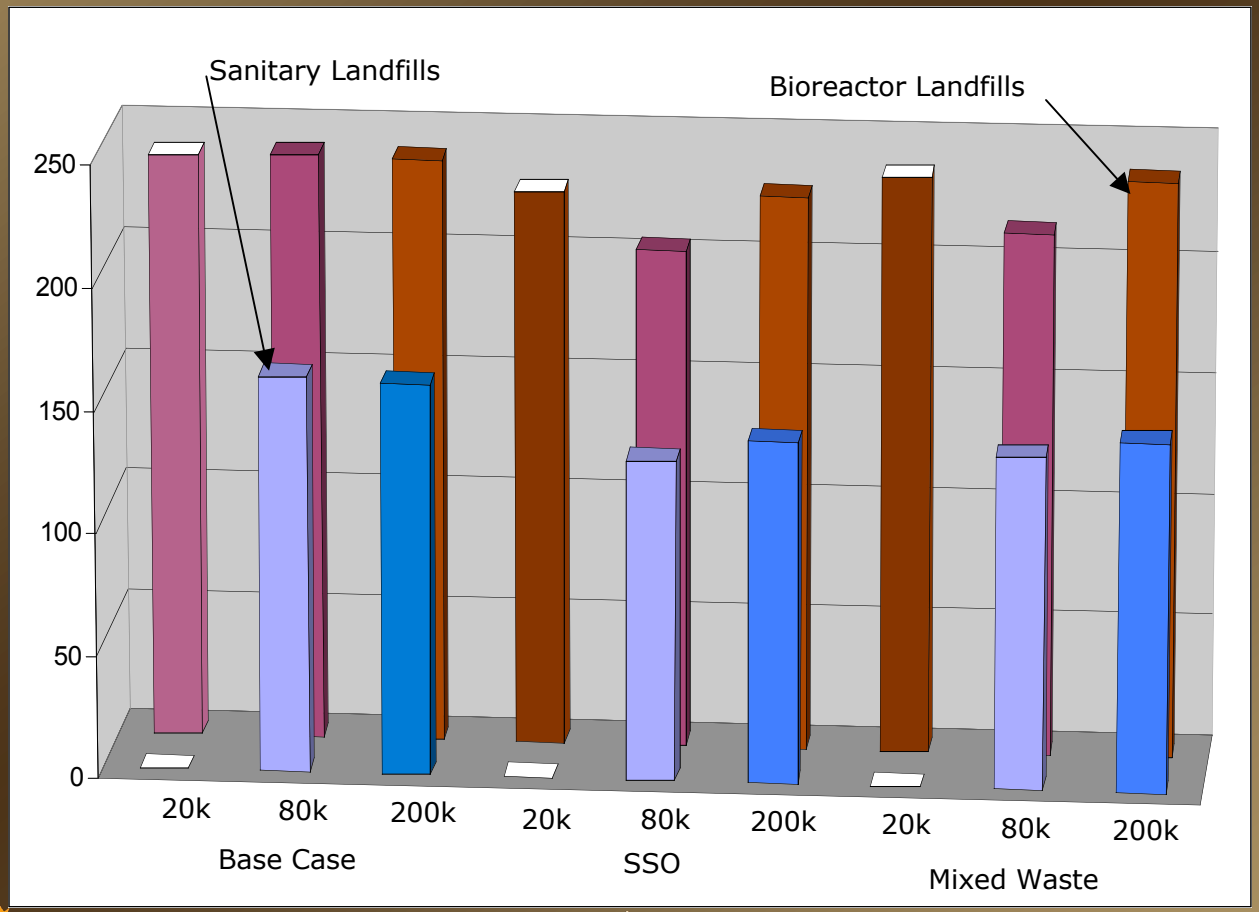
Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Evaluation: Results – Renewable Energy Recovery Potential (kW-hr/tonne)



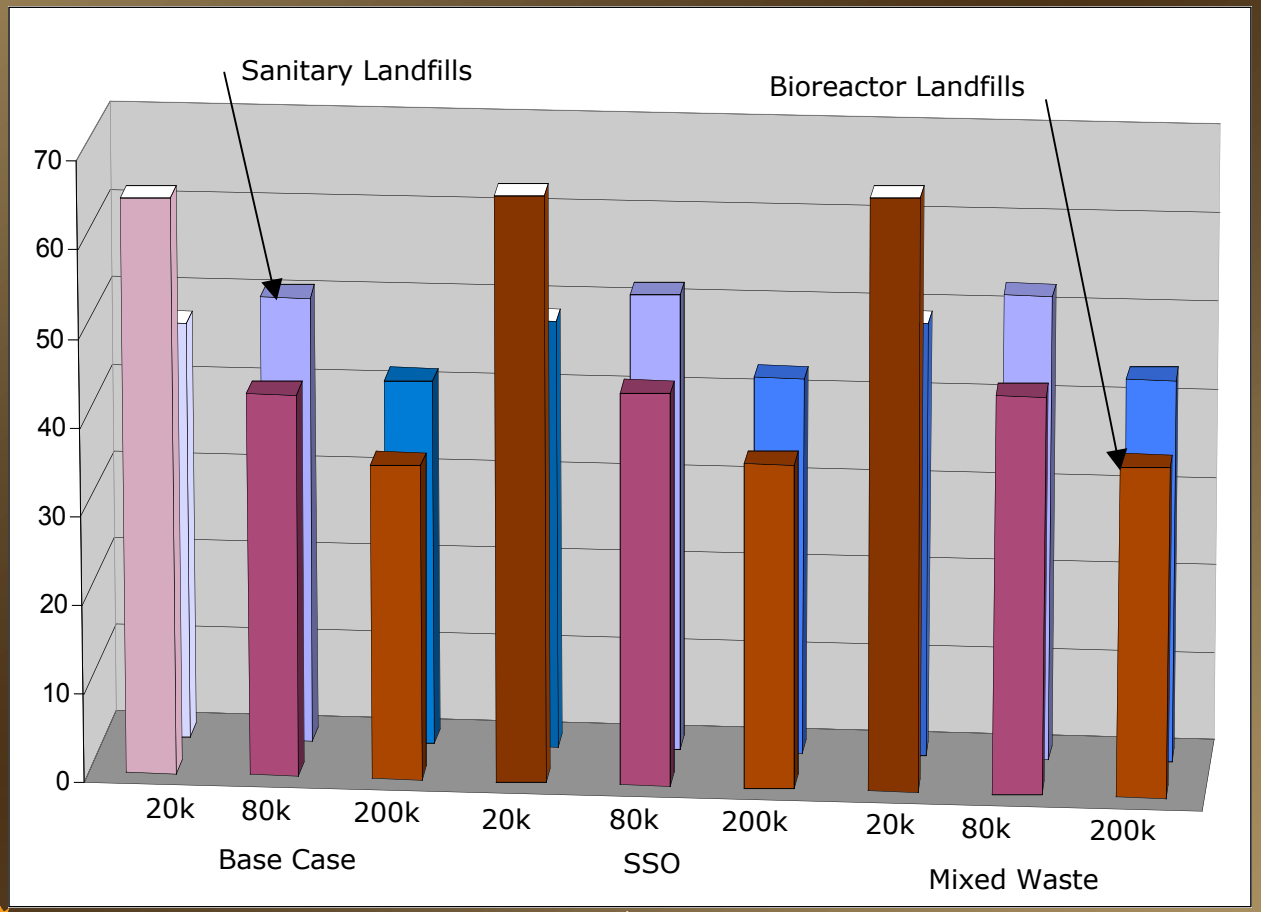
Recycling maximized ✔

Composting maximized ✔

Residuals ?

Residuals Management
Sanitary Landfill & Bioreactor Landfill

Evaluation: Results – Disposal Costs ($/tonne)



Recycling maximized ✔

Composting maximized ✔

Residuals ?

SUMMARY OF EVALUATION CRITERIA FOR SANITARY LANDFILL TECHNOLOGY			
Criteria	**Population**		
	20,000	**80,000**	**200,000**
Facility Throughput (Tonnes)	293,580	1,150,424	2,935,802
Major Design Features	Natural Attenuation	Engineered Containment	Engineered Containment
Commercial Status in Canada and elsewhere	Widely applied	Widely applied	Widely applied
Total Capital Cost ($1,000s) (Including finance & inflation allowances)	9,800	36,235	68,090
Total Operating Cost ($1,000s) (Including finance & inflation allowances)	4,125 to 4,686	21,970 to 24,295	53,547 to 59,520
Cost/Tonne Annualized ($) (Including finance & inflation allowances)	$47.43 to $49.34	$50.59 to $52.62	$41.43 to$43. 47
Footprint Size (ha)	8.4	18.2	34.4
Zoning Requirements	Typically i ndustrial, agricultu ral, rural	Typically industrial, agricultural, rural	Typically industrial, agricultural, rural
Approvals Required	Provincial environmental assessment and permit requirements, municipal bylaws	Provincial environmental assessment and permit requirements, municipal bylaws	Provincial environmental assessment and permit requirements, municipal bylaws
GHG Emissions (tonnes eCO_2/tonne waste disposed)	2.23 to 2.43	0.51 to 0.61	0.56 to 0.61
Energy Recovery Potential (kW-hr/tonne waste disposed)	--	131 to 162	140 to 160
Potential Environmental Impacts	Site-specific potential for occurrence of leachate and odour impacts	Engineered control of potential impacts. Source of renewable energy	Engineered control of potential impacts. Source of renewable energy
Quality of Processed Organics (if applicable)	NA	NA	NA
Public Acceptability	Generally poor	Generally poor	Generally poor
Potential Social Impacts	Potential for land use conflicts. Minimal employment. Potential nuisance impacts include traffic (similar to other was te management methods).	Potential for land use conflicts increased due to land area requirements. Modest employment . Potential nuisance impacts include traffic (similar to other was te management methods). Renewable energy recovery seen as positive.	Potential for land use conflicts increased due to land area requirements. Significant e mployment. Potential nuisance impacts include traffic (similar to other was te management methods). Renewable energy recovery seen as positive.

Recycling maximized ✔

Composting maximized ✔

Residuals ?

SUMMARY OF EVALUATION CRITERIA FOR BIOREACTOR LANDFILL TECHNOLOGY

Criteria	Population		
	20,000	80,000	200,000
Facility Throughput (Tonnes)	293,580	1,150,424	2,935,802
Major Design Features	Engineered containment & process controls	Engineered containment & process controls	Engineered containment & process controls
Commercial Status in Canada and elsewhere	Emerging technology	Emerging technology	Emerging technology, 2 Canadian Sites and numerous international
Total Capital Cost ($1,000s) (Including finance & inflation allowances)	13,571	32,236	60,579
Total Operating Cost ($1,000s) (Including finance & inflation allowances)	5,510 to 5,843	17, 520 to 19,522	43,847 to 49,103
Cost/Tonne Annualized ($) (Including finance & inflation allowances)	$64.99 to $ 66. 13	$43.25 to $ 44.99	$35.57 to$ 37.36
Footprint Size (ha)	7.0	14.6	28.1
Zoning Requirements	Typically industrial, agricultural, rural	Typically industrial, agricultural, rural	Typically industrial, agricultural, rural
Approvals Required	Provincial environmental assessment and permit requirements, municipal bylaws	Provincial environmental assessment and permit requirements, municipal bylaws	Provincial environmental assessment and permit requirements, municipal bylaws
GHG Emissions (tonnes CO_2/tonne waste disposed)	0.35 to 0.38	0.32 to 0.38	0.35 to 0.38
Energy Recovery Potential (kW-hr/tonne waste disposed)	--	204 to 240	236 to 239
Potential Environmental Impacts	Engineered control of potential impacts. Energy recovery not considered feasible.	Engineered control of potential impacts. Source of renewable energy	Engineered control of potential impacts. Source of renewable energy
Quality of Processed Organics (if applicable)	NA	NA	NA
Public Acceptability	Similar to landfill with potential improvement	Similar to landfill with potential improvement	Similar to landfill with potential improvement
Potential Social Impacts	Potential for land use conflicts. Modest employment. Potential nuisance impacts include traffic (similar to other waste management methods). Rapid waste stabilization, reduction of long-term environmental risk, reduced emissions, and renewable energy recovery are seen as positive.	Potential for land use conflicts increase due to land area requirements. Modest to significant employment. Potential nuisance impacts include traffic (similar to other waste management methods). Rapid waste stabilization, reduction of long-term environmental risk, reduced emissions, and renewable energy recovery are seen as positive.	Potential for land use conflicts increase due to land area requirements. Significant employment. Potential nuisance impacts include traffic (similar to other waste management methods). Rapid waste stabilization, reduction of long-term environmental risk, reduced emissions, and renewable energy recovery are seen as positive.

Recycling maximized ✔

Composting maximized ✔

Residuals ?