

Date: March 3, 2003 Project EO 55895
To: Project Team
From: Earth Tech (Canada) Inc.
Subject: Short-listing Biosolids Management Technologies

Background:

The City of Kingston currently has a stable biosolids program but is planning for the future with the recognition that the regulatory and political climate surrounding land application and biosolids management is highly volatile. By considering a wide variety of management options, Utilities Kingston will have the flexibility to move in the best direction while controlling costs to the greatest extent possible.

Objective:

To develop management strategies for both the short and long term and provide a plan that can be updated to reflect changing costs, regulations and market opportunities and restrictions.

Process:

1. Develop list of available reasonable technologies for review.
2. Develop criteria for evaluating all alternatives
3. *Shortlist technologies and strategies for detailed evaluation using weighted matrix of both quantitative and qualitative criteria.*
4. Assessment of short-listed strategies: detailed financial assessment
5. Selection of the preferred strategy
6. Develop means of implementation of preferred biosolids management strategy: phasing; maximizing existing infrastructure; siting considerations; triggers

1. List of Available Technologies for Review

Available technologies for processing biosolids were reviewed to develop a list of reasonable alternatives for managing biosolids. Technologies included in the US EPA list of acceptable technologies for producing Class A and B biosolids were considered; as well as those technologies implemented in full-scale facilities operating in Canada. Processes that are currently available only at

bench or pilot scale were not included for further evaluation. The following list of alternative strategies was considered:

Do Nothing (Maintain existing biosolids processing train)

1. Enhancements to Existing Biosolids Processing Train
- 2a. Anaerobic Digestion; Dewatering; Heat Drying/ Pelletization; Commercial Sale
- 2b. Dewatering; Heat Drying/ Pelletization; Commercial Sale
3. Enhancements to Existing Biosolids Processing Train to Achieve Class A (Pre-Pasteurization)
- 4a. Anaerobic Digestion; Dewatering; Composting; Commercial Sale
- 4b. Dewatering; Composting; Commercial Sale
5. Anaerobic Digestion; Dewatering; Landfilling
- 6a. Anaerobic Digestion; Dewatering; Lime Stabilization; Commercial Sale
- 6b. Dewatering; Lime Stabilization; Commercial Sale
- 7a. Anaerobic Digestion; Dewatering; Incineration; Ash Lagoons
- 7b. Raw Sludge Dewatering; Incineration; Ash Lagoons

2. Criteria

The following criteria are being used to complete the screening and detailed assessment of biosolids management alternatives. The screening of the long list of alternatives focuses on identifying the most environmentally, technically and financially suitable technologies for further considerations.

Natural Environmental (20%)

- Air – potential for excessive adverse impacts on the air environment; ability of the technology to control odours and air emissions
- Water - potential for excessive adverse impacts on the water environment
- Land - potential for excessive adverse impacts on the land environment

Social/ Cultural (20%)

- Public health considerations – the potential for excessive adverse impacts on public health
- Land use requirements - processing - the availability of sites for biosolids processing
- Land use requirements – disposal – the availability of sites for biosolids disposal; potential to impact existing and future land use plans adversely
- Trucking/ traffic issues – potential for adverse impacts from associated trucking and other traffic related to the biosolids management alternative

Economic/ Financial (30%)

- Relative capital and life cycle costs – a qualitative comparison of cost expectations associated with capital construction and operation/maintenance activities of the biosolids management alternative

Legal/ Jurisdictional (10%)

- Approvals – expected degree of difficulty for system approval and specific EA requirements for implementation
- Requirements for external (off-site) management/ monitoring – level of effort required for marketing, management/monitoring responsibilities.

Technical (20%)

- Sensitivity to sludge quality – the ability to tolerate a range of sludge feed conditions while meeting performance objectives and disposal/utilization guidelines.
- Compatibility with current wastewater treatment processes – biosolids system utilizes existing infrastructure: sludge processing units (digesters; dewatering); ease of implementation.
- Proven and reliable technology – potential to provide reliable biosolids processing and disposal at all times; proven history and track record of operating in North America with similarly sized installation.
- Long term viability – ability to adapt to changing regulatory criteria or public acceptance; flexible options and phased implementation to deal with changing scenarios; balance large capital expenditure against likelihood of changing markets or regulations that affect final reuse or disposal costs.

- Operational and maintenance requirements – complexity of the process, level of requirement for operator attention and specific process knowledge for both operational and maintenance activities.
- Suitability for staged development – suitable for phased approach – ability of the biosolids management alternative to be implemented and expanded in modular increments over time as the need arises; flexibility provided to the biosolids management program by the technology.
- Potential for beneficial use – the potential to recover and/or recycle at least one of the potential resources contained in biosolids (i.e. biogas, energy, nutrients).

3. Evaluation and Recommend Short List

Project Team members (10) each completed the evaluation process for the long list of alternatives considered. For each criterion, other than economic, the alternative strategies were rated from -2 to +2, with the status quo at zero; therefore, each alternative was evaluated and graded on how it fared relative to the “do nothing” option for each criterion: from much worse (-2), worse (-1) to better (+1) or much better (+2). The scores from each member of the project team were averaged, and the weighting factor applied for each criteria category.

For the economic analysis, a cost per tonne was developed for each alternative. This cost is based on a life cycle cost incorporating estimated capital costs amortized over 25 years and operating costs reported from existing facilities utilizing the various technologies at a similar scale. Technologies that produce a marketable end market were assigned revenue based on that typically received at other facilities in Canada; a market analysis was not evaluated for the Kingston area. Reported revenues for biosolids were: heat-dried pellets at \$28/tonne; and lime stabilized solids at \$30/tonne. At the compost facilities surveyed (Guelph, Edmonton, Calgary), the compost is used as landfill cover or roadside mulch and does not generate revenue; therefore none was assigned. In order to compare options, the costs were compared to the existing cost per tonne for disposal; the cost was then converted to a score out of 30%, where the do nothing alternative rated the highest possible score.

The total score out of 1.00 was developed for each alternative by summing the score for each category. The resulting ranking of the alternatives is as follows:

Ranking	Alternative
1	1. Enhancements to Existing Biosolids Processing Train
2	Do Nothing (Maintain existing biosolids processing train)
3	5. Anaerobic Digestion; Dewatering; Landfilling

4	3. Enhancements to Existing Biosolids Processing Train to Achieve Class A (Pre-Pasteurization)
5	6a. Anaerobic Digestion; Dewatering; Lime Stabilization; Commercial Sale
6	2a. Anaerobic Digestion; Dewatering; Heat Drying/ Pelletization; Commercial Sale
7	4a. Anaerobic Digestion; Dewatering; Composting; Commercial Sale
8	2b. Dewatering; Heat Drying/ Pelletization; Commercial Sale
9	6b. Dewatering; Lime Stabilization; Commercial Sale
10	4b. Dewatering; Composting; Commercial Sale
11	7a. Anaerobic Digestion; Dewatering; Incineration; Ash Lagoons
12	7b. Raw Sludge Dewatering; Incineration; Ash Lagoons

From this evaluation, we note the following observations:

- For each technology, we considered implementation with and without the anaerobic digestion phase (noted as “a” and “b” alternatives); it is clear through this evaluation process that there is a preference for maintaining anaerobic digestion as part of the management strategy. This can be attributed to a number of reasons including:
 - decreased risk of odours at downstream processes
 - potential beneficial use of biogas for heating; co-generation
 - capital investment in existing infrastructure
- Clear preference for maintaining the existing management strategy (noted by difference in final scores); this is likely due to the fact that there is presently no incentive (i.e. regulatory; public pressure; lack of willing landowners for application; other available markets) to change existing system.

- Incineration was clearly not favoured, due primarily to poor economics at this scale of operation, but also the considerable approvals required for a new incineration facility.
- It is noted that Alternative 3 offers little actual disposal advantage over the base case under the draft provisions of the Nutrient Management Act but will be carried forward to the next level of analysis.

As a result of the above ranking process, the following shortlist has been developed for further consideration:

Ranking	Alternative
1	1. Enhancements to Existing Biosolids Processing Train
2	Do Nothing (Maintain existing biosolids processing train)
3	5. Anaerobic Digestion; Dewatering; Landfilling
4	3. Enhancements to Existing Biosolids Processing Train to Achieve Class A (Pre-Pasteurization)
5	6a. Anaerobic Digestion; Dewatering; Lime Stabilization; Commercial Sale
6	2a. Anaerobic Digestion; Dewatering; Heat Drying/ Pelletization; Commercial Sale
7	4a. Anaerobic Digestion; Dewatering; Composting; Commercial Sale

The Next Steps:

A detailed financial assessment will be completed for the above short-listed alternatives to include site-specific implementation considerations (e.g. one facility vs. two; will it fit on the existing WPCP site, etc.).

The evaluation of these alternatives will also be considered in development of a long-term strategy. For example, enhancements to the existing processing train will be reviewed with a view to providing facilities for possible future technologies should they be required.

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