Proceedings from the

CANADIAN WORKSHOP ON INTEGRATED SOLID WASTE MANAGEMENT

Canada Centre
for Inland Waters

Burlington, Ontario

March 2-3, 1998

sponsored by:

Environment Canada   Environnement Canada

CSR
CORPORATIONS SUPPORTING RECYCLING

PERD

Compass Environmental Inc.

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DISCLAIMER

ACKNOWLEDGEMENT

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Environment Canada
Program on Research and Development (PERD)
Corporations Supporting Recycling
Environment and Plastics Institute of Canada
Burlington Environmental Technology Office
Canada Centre for Inland Waters
Office of the Mayor of Burlington

and a special thank you to all of the speakers and chairpersons for their time and effort.

The sponsors also gratefully acknowledge all of the in-kind contributions made towards the Workshop by the various organisations who provided travel funds for participants to attend the Workshop. Without this support, the Workshop would not have been the success it was.

PREFACE

In 1996, the International Energy Agency's Integrated Solid Waste Management (ISWM) Group held one of its international workshops in Vancouver, British Columbia. Over 40 participants from 8 different countries took part in the workshop, along with representatives from various Canadian organisations. After the workshop, several of these representatives met to discuss the issue of ISWM within the Canadian context. One of the primary concerns identified was the need to develop a more effective communication infrastructure within the country to disseminate information on ISWM from other countries. Moreover, it was suggested that there was also a need to ensure that successful Canadian experiences were touted on the national and international scene.

In response to this, Environment Canada and the Panel on Energy Research and Development (PERD), through what is now the National Office of Pollution Prevention, decided to initiate broad ranging discussions on ISWM issues with relevant parties within Canada. As a prelude to the discussion, a national survey was undertaken to compile a list of Canadian organisations involved with research/development of the concept of ISWM (Environment Canada, 1997), and to solicit their opinions on the definition of ISWM. Clearly, there are widely divergent points of view on the meaning of ISWM, which reinforced the need for pro-active discussion on the subject. Consequently, the primary objective of this workshop was to initiate a consultative process on ISWM with representatives from industry, academia and the different levels of government, with a long-term vision to establishing more effective communication channels on the issues surrounding ISWM across Canada.

Invitations were sent to organisations across the country, however, it was recognised that travel restrictions would limit participation to regions close to south-central Ontario. Despite the limitation, the response to the workshop was encouraging, with more than 45 people registering for the two-day event. These Proceedings provide a synopsis of the presentations and discussions which took place. The workshop succeeded in promoting a more unified context to the definition of ISWM, and facilitating new contacts between professionals working in the area of waste management.

EXECUTIVE SUMMARY

The major objective of the Canadian Workshop on Integrated Solid Waste Management (ISWM) was to initiate a broad discussion on the concept of ISWM with representatives of organisations involved with the management of solid waste. Specifically, the two-day workshop was used to obtain an indication of how the concept of ISWM was viewed from the private sector and different levels of government, and ultimately to provide guidance on enhancing the dissemination of information within Canada on ISWM issues. The workshop involved approximately 45 participants from three different provinces and a variety of national and regional organisations. A plenary session of keynote speakers provided the stimulus for the ensuing discussions.

The first day's presentations provided an overview of solid waste management in Canada and a more detailed look at the current role of the various management options (such as reduction, recycling, composting and energy-from-waste) within regional waste management strategies. These presentations provided background information which led to a major presentation of an LCA-based ISWM model developed here in Canada. The open forum discussion focussed on the merits and limitations of this Canadian ISWM Model, and provided the proponents of the Model with constructive feedback on further use of the model.

The "Model" was defined as a generic comparative tool which could be used by municipalities or the private sector to provide guidance or direction on potential waste management strategies. The tool was presented as a Lifecycle-based approach to waste management which incorporated ecological and economic perspectives into the assessment. It also enabled the user to examine tradeoffs between costs and environmental perspectives, and to base waste management discussions/decisions on available data.

Some concerns were voiced regarding the maturity of the databases used in the model, but it was noted that the intent was to ensure that the model was dynamic and could readily incorporate new data. Another concern was the potential abuse or distortion of the model's purpose and results. Since any LCA-based application is subject to potential misuse, essential precautionary measures, including statements clarifying the objectives, boundary definitions and assumptions, must be followed to lend credibility to the overall results. In addition, it was suggested that misuse of results could be minimised by providing ongoing user support and interpretive assistance.

The second day's presentations focussed primarily on ISWM from the perspectives of municipal officials and the private sector. These presentations were used to lead into a discussion on the perceived need to establish an entity to facilitate better communication channels within Canada and promote ISWM. It was originally proposed that a Canadian council or coalition be established which could act as a technical filter for ISWM related information, especially from a national and international perspective. This concept was supported in principle, however, there were concerns about establishing another member-based waste management organisation. It was suggested that by working with existing organisations, the concept of ISWM and the contact network could be expanded, at least at a national level. Development of a strong international ISWM network was identified as an essential key to the success of any new ISWM organisation.

BACKGROUND

Most developed countries around the world have promulgated waste management policies based on the premise of prevention, minimisation, reuse, recycling, recovery of energy and landfilling. Within that context, the application of various technologies and how they fit together in an overall system to manage a municipality's MSW is the underlying principle of Integrated Solid Waste Management (ISWM). The extent to which any one management method is used in different jurisdictions is dependent on a large number of variables including:

> geological conditions, topography, climate, overall waste composition, population density, transportation infrastructures, existing facilities, energy requirements/limitations, socio-economic forces, legislative initiatives, environmental standards, etc.

Although some of these factors are relevant to all situations, regional differences will further influence the manner in which waste is managed. Therefore, the best ISWM systems for specific regions will vary according to the collective influence of a large number of factors. However in many instances, the premise of strictly adhering to the "Waste Management Hierarchy" may not be the most effective means of dealing with the waste stream.

Many countries have implemented new policies and regulations based on a three tiered approach to waste management, designed mainly to minimise the reliance on landfill. The first tier of the approach typically promotes waste avoidance through product stewardship, reuse and waste reduction initiatives. The second tier addresses the waste handling system, and represents a refinement on the previous "Waste Management Hierarchy", which afforded material recycling and composting with preferred status within the menu of waste management options. The new initiatives emphasise the desire to recover tangible benefits from the materials, through recycling, biomass utilisation or energy recovery management options, all weighted equally in preference. Disposal is still afforded the status of the least preferable option.

Because of this new trend in policies, municipal officials are better able to select a combination of management options which are optimised to suit the site-specific considerations of a given community. Hence, ISWM could be defined as:

The protection of human health through an optimised system of practices designed to manage municipal solid waste based on the sound evaluation of site-specific environmental, energy, economic and socio-political considerations, and includes a combination of waste management options.

Objectives of the Burlington Workshop

The overall objectives of the workshop were to provide a forum for pro-active discussion on the concept of ISWM, and to facilitate enhancing the professional contact network of individuals working in the area of solid waste management. Specific objectives included:

- identifying the benefits and limitations of an LCA-based tool to assist in developing ISWM strategies;
- assessing the need to expand the existing information channels within Canada on the technical and political aspects of ISWM; and
- making recommendations on the approach required to facilitate better communication between solid waste management professionals.

Format of the Workshop
To ensure that a wide range of issues were touched on, a number of presentations were made during a plenary session to help stimulate the ensuing discussions, including:

- **Overview of Solid Waste Management in Canada**
  Alain David - National Office of Pollution Prevention - Environment Canada

- **Overview of the International Energy Agency's ISWM Group Activity**
  Steven Sawell - IEA's ISWM Group Leader/Compass Environmental Inc.

- **Status of Composting in Canada**
  Susan Antler - Composting Council of Canada

- **Recycling and Product Stewardship**
  Joe Hruska - Corporations Supporting Recycling

- **Energy-from-Waste within an ISWM Approach**
  John Chandler - A.J. Chandler & Associates Ltd.

- **Introduction to an ISWM Model**
  Fred Edgecombe - Environment & Plastics Institute of Canada

- **A Canadian Solid Waste Management Model**
  Ruksana Mirza - Proctor & Redfern Ltd.

- **Co-collection**
  Bob Christensen - Environment Canada

- **A Private Sector Perspective on ISWM Development & Operational Issues**
  George South - Muskoka Containerized Services

- **Landfill Gas Development within an ISWM Framework**
  Walt Graziani - Comcor Environmental Ltd.

- **Challenges to the Private Sector**
  - Alison Braithwaite - Walker Industries Holdings Limited

- **PEI's Approach to Solid Waste Management**
  Gerry Stewart - PEI Department of Fisheries and Environment

- **City of London's Solid Waste Management Plan**
  Jay Stanford - City of London

- **Toronto's Perspective on ISWM**
  Lawson Oates - Toronto Works Dept.

The presentation materials are provided in Appendix 1.

WORKSHOP PROGRAM

DAY 1	*- Morning Session Chair: David Hay - Environment Canada*
9:45 am	Welcome - *Mayor Robert S. MacIsaac, City of Burlington*
10:00 am	Overview of Solid Waste Management in Canada - *Alain David*
10:20 am	Overview of the International Energy Agency's ISWM Group Activity - *Steven Sawell*
10:40 am	Break
11:00 am	Status of Composting in Canada - *Susan Antler*
11:20 am	Recycling and Product Stewardship - *Joe Hruska*
11:40 am	Energy-from-Waste within an ISWM Approach - *John Chandler*
12:00 pm	Questions
1:30 pm	Introduction to an ISWM Model - *Fred Edgecombe & Ruksana Mirza*
3:30 pm	**Working Group** **Task - Discuss the Model's Merits and Outline Suggested Areas for Improvement**

DAY 2	*- Morning Session Chair: Duncan Bury - Environment Canada*
8:30 am	Co-collection - *Bob Christensen*
8:50 am	Private Sector Perspective on ISWM Development & Operational Issues - *George South*
9:10 am	Landfill Gas Development within an ISWM Framework - *Walt Graziani*
9:30	Challenges to the Private Sector - *Alison Braithwaite*
9:50 am	Questions
10:00 am	Break
10:20 am	PEI's Approach to Solid Waste Management - *Gerry Stewart*
10:40 am	City of London's Solid Waste Management Plan - *Jay Stanford*
11:00 am	Toronto's Perspective on ISWM - *Lawson Oates*
11:20 am	Proposed Canadian Council on ISWM - *Steven Sawell*
11:30 am	Questions
1:00 pm	Working Group & Open Forum Tasks **- Identify and prioritise barriers to implementing & optimising effective ISWM strategies** **- What tools are needed to address the issues? Is the concept of a Canadian Council on ISWM worthwhile pursuing?**
2:40 pm	Break
3:30 pm	Adjourn Workshop

SUMMARY OF DISCUSSION ON CANADIAN ISWM MODEL

The primary focus of the open forum discussion on Day 1 concerned the potential merits and limitations of the LCA-based tool on ISWM (prepared by Proctor & Redfern (P&R), for Environment & Plastics Institute of Canada (EPIC) and Corporations Supporting Recycling (CSR)).

The "Model" was defined as a generic comparative tool which could be used to provide guidance on potential waste management strategies based on the evaluation of comparative scenarios. The tool was presented as a Lifecycle-based approach to waste management which incorporated ecological and economic considerations into the assessment, and provided a municipal perspective rather than industry or academic perspectives. It also enabled the user to examine tradeoffs between costs and environmental concerns, and help move the waste management debate away from ideology towards the assessment of hard data.

It was stressed that the intent of the Model was to provide only guidance in decision making, rather than provide a definitive answer with respect to optimal waste management strategies. It was recognised that once a direction was selected, more detailed site-specific evaluations were required to facilitate refinement and optimisation of an ISWM strategy. It was also noted that transparency of the Model's objectives and clarity of assumptions (used to define the evaluation boundaries) were essential components to lending credibility to any results generated from the tool.

A common concern regarding the model was that it was relatively new and insufficiently tested, hence it was cautioned that it may be premature to release the tool for general use. Additional robust testing of the tool through application to actual scenarios and careful monitoring of its use was viewed as advantageous. Moreover, the quality of results were linked to the quality of the data bases used within the tool, and it was acknowledged that there is a paucity of data for certain modules. It was recognised that the Model would have to be dynamic to continuously incorporate new and better data as it becomes available. It was noted that further testing of the Model was in progress using data from other municipalities (such as Markham)

Another similar concern was how new data would be included in the model and at whose expense. The proponents indicated a preference for identifying a "home" for the Model where it could be well managed, maintained and promoted. To date, CSR and EPIC have shouldered the financial burden of development and revisions, but both sponsors indicated it may be in the best interest of the Model (to ensure integrity and raise its profile) to house it outside of industry. It was acknowledged that a significant dollar commitment was required to maintain and monitor the use of the tool. Irrespective of the financial aspects, it was also noted that the tool was only as good as the people designated to oversee its continued evolution.

Another major concern was the potential for misuse of the results. Since the tool was aimed at the municipal level and private sectors, there is a desire to provide training support and assistance with data interpretation. It was believed that this would help reduce the potential for misuse, however, it was noted that any model is subject to misapplication, and there is little control over this type of exploitation.

The continued involvement of CSR, EPIC, and the Advisory Panel was viewed as necessary components in maintaining the Model, and that there was a need for passion, vision, commitment and dedication from any involved parties to sustain the Model. However, it was strongly suggested that other organisations and individuals embrace the Model to enhance credibility and add integrity to the Model's application. The general consensus was that municipalities need to be involved in the process and suggestions pointed towards the Federation of Canadian Municipalities helping to facilitate this type of involvement.

SUMMARY OF DISCUSSION ON CANADIAN ISWM INFRASTRUCTURE

The primary purpose of the open forum on Day 2 was to discuss the need for a Canadian group (a council, coalition, alliance, etc.) dedicated specifically to promoting the concept of ISWM within Canada, and the appropriateness of using this entity as a vehicle to support the use of the ISWM tool.

It was noted that the term ISWM was still viewed in some circles as a concept which included the incineration option by definition, and that there was a challenge to ensure that ISWM is not perceived as a front for incineration by another name, or as an anti-producer responsibility forum. Most participants agreed that the concept of ISWM was not very well advanced in Canada and the paucity of information created a demand at various levels of government, especially information on innovations in waste management. There appears to be a tremendous opportunity to promote the subject since there was a great deal of interest in applying ISWM thinking to traditional waste management strategies, and that the general public was also receptive to new approaches in waste management. Therefore, it was generally agreed that there was a need for an entity that would address the topic of ISWM on a national level.

Strong opinions were expressed on the need to not only disseminate information within Canada, but to look to the rest of the world for case studies. It was acknowledged that a mechanism to promote Canadian ideas to the world and to disseminate international experiences within Canada, should be given a high priority. An emphasis was placed on identifying a group of individuals which could act as an objective technical filter on science and practical issues, and provide insight on the influence of politics on policies and regulations. It was also desirable for this group to address the subtleties which exist in different locals and differentiate between why a system may work in one given local and may not be applicable in another. However, the form the group would take was subject to debate, as there was some reticence over forming another membership fee-based organisation.

A suggestion was made to capitalise on the existing structures of similar organisations/groups (ie. SWANA, ISWA) and related magazines (Solid Waste and Recycling) to convey the information in a manner which avoided duplication of effort. The Canadian Waste Management Conference (Hamilton) and R'2000 (Metro Toronto) were identified as potential opportunities for forums to disseminate information, either through associated workshops, or as special sessions within these Conferences. Others believed that such groups are not doing an adequate job in providing access to information on ISWM, either due to lack of commitment, resources, vested interests, or their focus was too policy oriented.

Most participants agreed that a "virtual" presence (e.g., via a homepage on the Internet) was potentially valuable, especially if there was an opportunity for two way exchange of information. It was suggested that this type of baseline presence could be managed in a cost-effective manner, but funds would still be required for personnel to maintain services. This presence could then expand as needed.

It was generally agreed that something needs to be done to continue disseminating information on the concept of ISWM to avoid creating a vacuum by a lack of follow-up action in the wake of this workshop. Suggestions were made to establish a core group of individuals who are interested and committed to promoting the concept, but concerns were also raised on the mechanism of getting these people together. Other concerns included the lack of national representation at this workshop and suggestions were made to hold similar events in other major Canadian centres.

A major concern was the cost of maintaining an ISWM Coalition (especially if membership fees were not collected). Someone would have to be in charge of coordinating workshops and other events, maintaining a Web page, etc. EPIC believed it was important to have an entity or sponsors which would be viewed as neutral, to provide integrity to the message. While supporting the idea of helping to establish a group, Environment Canada reiterated that it could not be the sole sponsor.

A question of whether it would be appropriate to "house" the model at/with any newly formed Coalition on ISWM was raised. If so, it was acknowledged the envisioned mandate of a new entity would have to extend beyond simply promoting the Model. Suggested responsibilities included a comparative evaluation of the useful application and robustness of various (international) ISWM models currently available, solicit and compile comments on ISWM case studies, compile an interactive resource data base on ISWM, and publish a newsletter.

POSTSCRIPT

The sponsors of the Canadian ISWM Model (CSR & EPIC) intend to release the tool to the public domain after some further refinement. They are currently working with other communities to develop a broader data base for the model, in addition to subjecting the tool to different peer reviews to further improve upon the Model's applicability and enhance the credibility of its results. It is likely that the Model's proponents may identify several different avenues for promoting and monitoring the use of this ISWM tool.

From an international perspective, the Integrated Solid Waste Management Group is planning on pursuing sponsorship to continue their work over the next three years, although, this will be done outside of the International Energy Agency's Bioenergy Agreement. One of the primary objectives of the ISWM Group will be to enhance the communication channels within the participating countries, and thus ensure the active promotion of the concept of ISWM. If the ISWM Group is successful in reestablishing itself, it is anticipated that the Group will provide a firm foundation on which to build a Canadian entity to facilitate the two-way transfer of ISWM related information between Canada and the rest of the world. In light of the comments from the workshop, it is also recognised that it would be advantageous for any new entity to liaise closely with existing waste management organisations to provide complimentary programs and to tighten the professional networks on waste management within Canada.

In closing, it is apparent from the discussions that there is a need to promote the concept of ISWM on a broad basis within Canada. There also appears to be a nucleus of support to establish some type of formal entity to help coordinate such efforts, however, the approach to be used needs to be better defined. It is likely that if an international ISWM Group were to continue its work, it could provide a basis on which to build a complimentary Canadian infrastructure to help develop better national communication channels. The Workshop sponsors indicated that a proposal outlining the objectives, approach and budget for a Canadian ISWM Coalition will likely be forthcoming in the Summer of 1998.

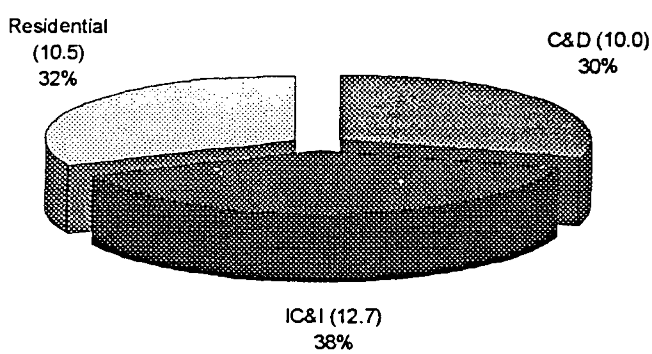
APPENDIX 1 - PLENARY SESSION PAPERS

Overview of Solid Waste Management in Canada

Canadian Workshop on Integrated Solid Waste Management
March 2-3, 1998
Burlington, Ontario

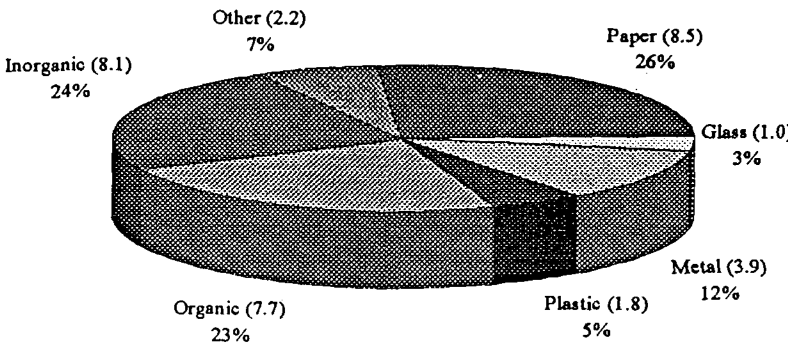
Alain David, P.Eng.
National Office of Pollution Prevention
Environment Canada

Solid Waste Generated in Canada 1992 (million tonnes)



Total 33.2 million tonnes

Composition of Solid Waste Generated in Canada 1992 (million tonnes)



Total 33.2 Million Tonnes

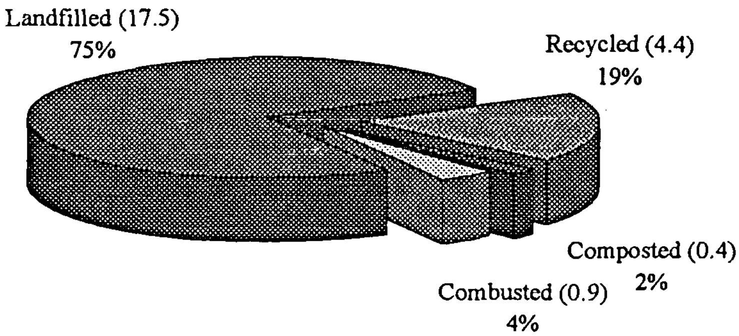
Environment Canada
Environnement Canada

Waste Diversion by Sector (1992)

- Construction & Demolition
  54% = 5.6 M tonnes
- Industial, Commercial and Institutional
  35% = 3.6 M tonnes
- Residential
  11% = 1.2 M tonnes

Environment Canada
Environnement Canada

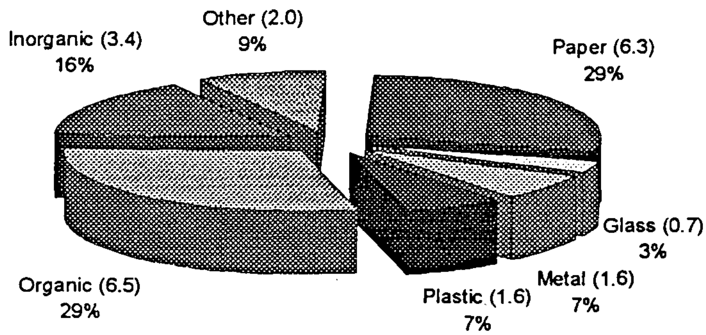
Management of Municipal Solid Waste in Canada 1992



Total 23.2 million tonnes

Environment Canada
Environnement Canada

Composition of Solid Waste Landfilled in Canada 1992 (million tonnes)



Total 22.1 million tonnes

Environment Canada
Environnement Canada

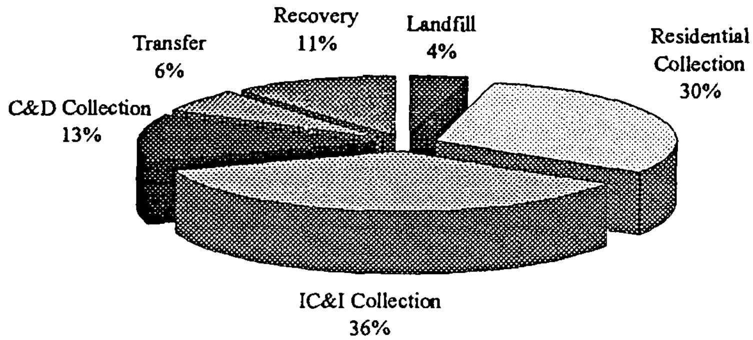
National Waste Disposal Reduction Goal

- CCME Goal: 50% solid waste disposal reduction by the year 2000 compared to 1988 (on per capita weight basis)
- 1988: Baseline (930 kg of SW disposed per person)
- 1988-1992: 13% (810 kg/person)
- 1988-1994: 23% (715 kg/person)
- 1996: Statistics Canada survey (1998)

National Packaging Reduction

- 1990: CCME endorsed National Packaging Protocol
- 3 targets for reduction of packaging weight sent for disposal from 1988 levels: 20% by 1992, 35% by 1996 and 50% by 2000.
- 1992: 21% reduction
- 1996: 51% reduction

Summary of Annual Energy Inputs for Solid Waste Management



Total Energy 6.6 Petajoules

Environment Canada
Environnement Canada

Energy (1992)

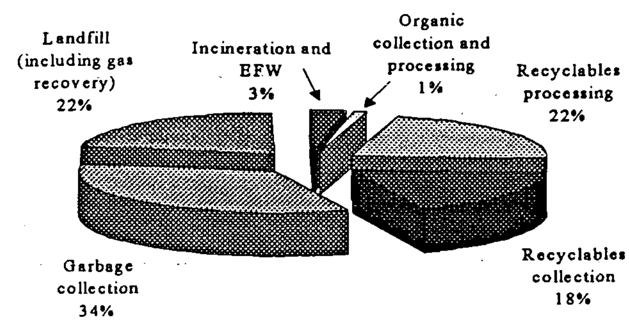
- Energy used: - 6.6 PJ
- EFW: + 6.3 PJ
- Energy from LFG: <u>+ 2.9 PJ</u>
- Net energy: + 2.6 PJ

⇒ Recycling (savings by using recycled material instead of virgin feedstock): 64 PJ

⇒ Energy in waste materials going to landfills or incinerators: 267 PJ

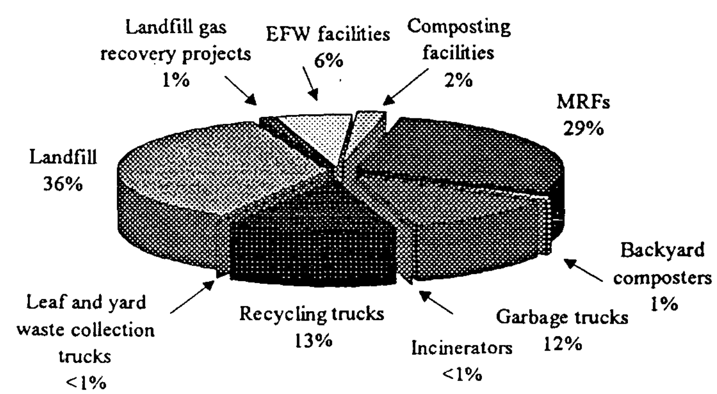
Environment Canada
Environnement Canada

Percentage Breakdown of Total Annual Capital and Operating Costs (1992)



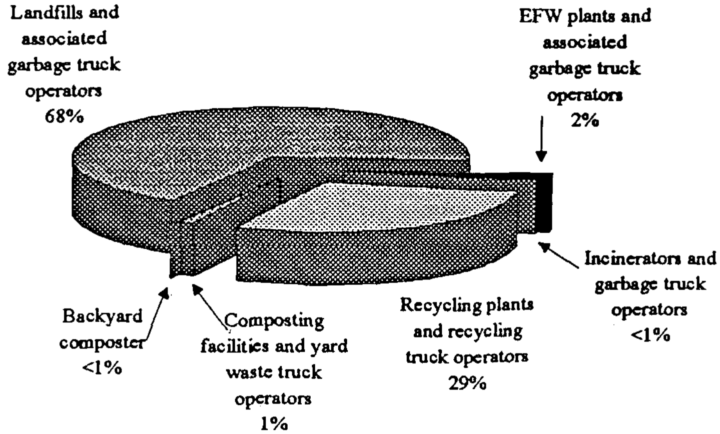
Total Annual Cost $3 Billion

Percentage Breakdown of Canadian Solid Waste Management Infrastructure Value



Total Cost $5.2 Billion

Percentage Employment in Solid Waste Activities



Total Employment 21,000

Environment Canada
Environnement Canada

Conclusions

- Majority of MSW is landfilled (75%) (1992)
  - recycled (19%), incinerated (4%), composted (2%)
  - MSW generated: about 2 kg/person/day (1992)
- National waste diversion and packaging reduction goals
  - Solid waste diversion: 23% in 1994
  - Packaging: 21% reduction in 1992
    51% reduction in 1996

Environment Canada
Environnement Canada

Conclusions (cont.)

- 66% of landfilled MSW is paper and organics
- Composting increase [86 to 252 facilities (1992-1997)]
- 21,000 related jobs
- $3 Billion/year (capital and O&M)
  - Value of infrastructure: $5.2 Billion
- Cost of waste management is significant burden on society ($110/capita/year)

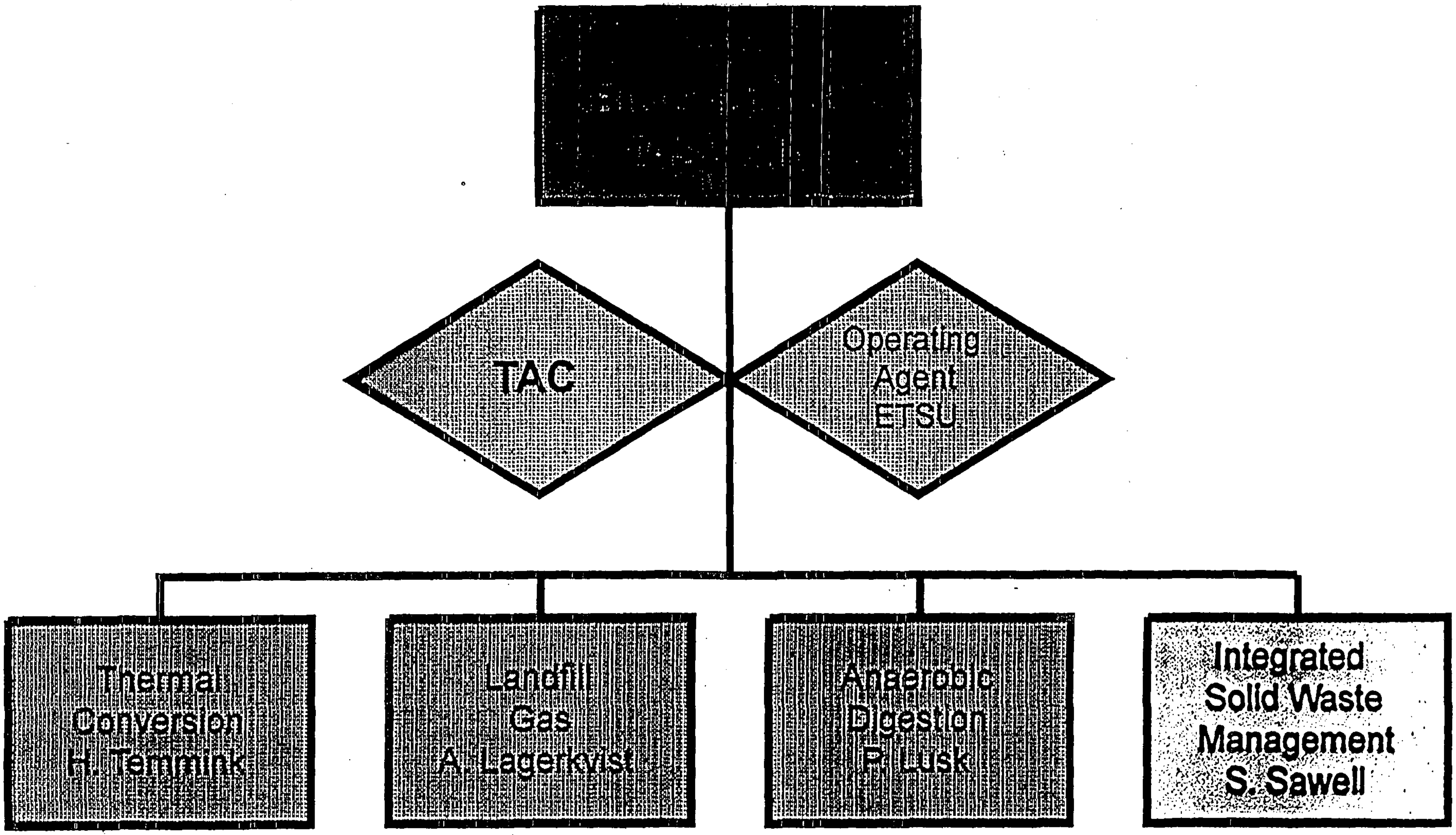
Integrated Solid Waste Management The Next Generation

- Fairly new concept in Canada
- Incorporate 4Rs into Integrated Solid Waste Management Framework
- Best thing to do with each material (paper, glass, metal, plastic, organics, inorganics) for a specific community from economic, social, energetic and environmental perspectives
- Tool to justify, qualify and quantify decisions
- Challenge: Convert a complex concept into a simple clear message

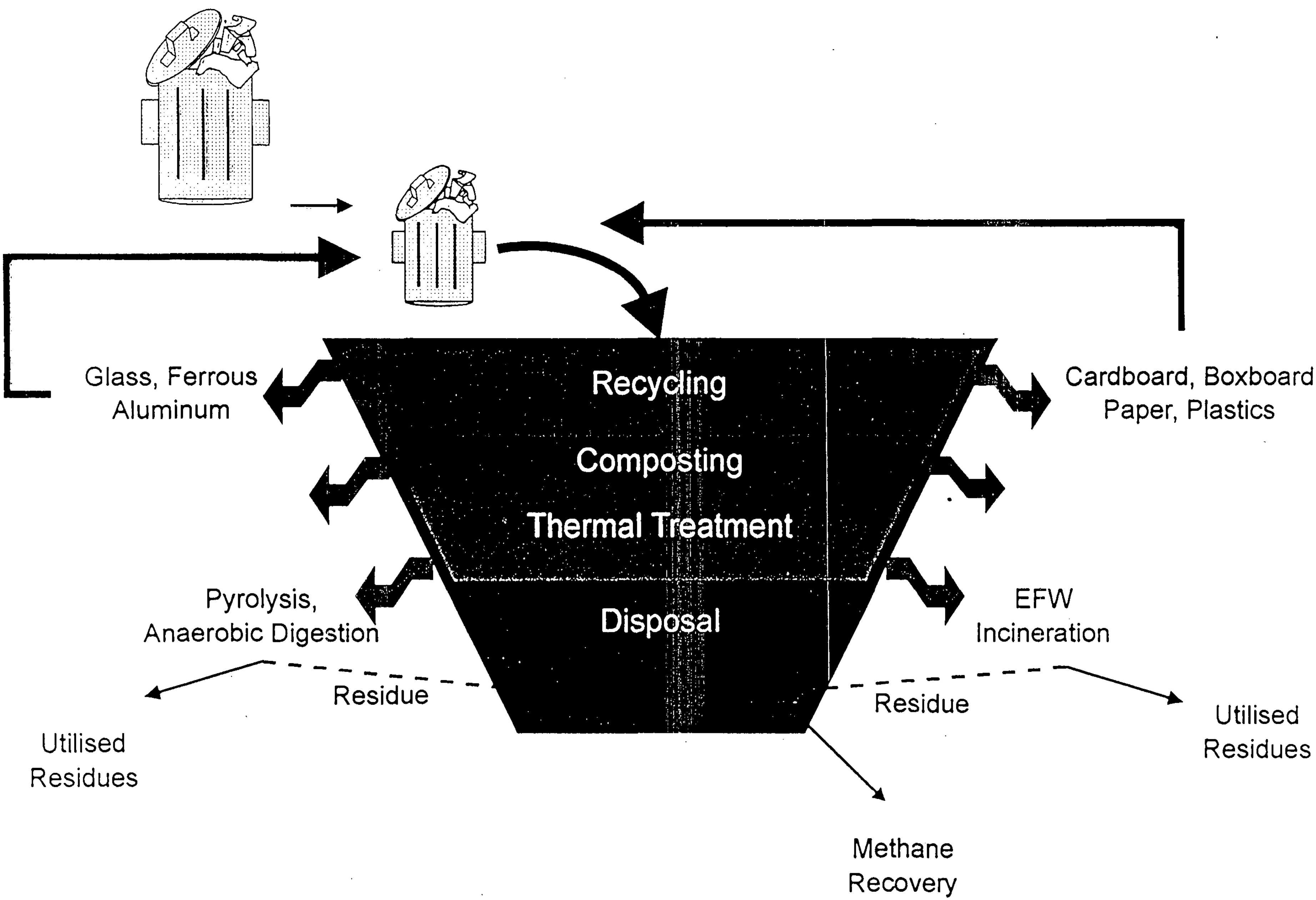
IEA TASK XIV - ENERGY RECOVERY FROM MUNICIPAL SOLID WASTE

ACTIVITY 4:

INTEGRATED SOLID WASTE MANAGEMENT


TAC
Operating Agent ETSU
Thermal Conversion H. Temmink
Landfill Gas A. Lagerkvist
Anaerobic Digestion P. Lusk
Integrated Solid Waste Management S. Sawell

WASTE MANAGEMENT



NEED

- temper ideology with realistic goals
- examine the performance of different ISWM systems and identify benefits and limitations
- develop a framework of considerations to help evaluate alternative strategies
- develop a sound/balanced approach to selecting an ISWM system based on a variety of site specific considerations

ACTIVITY OBJECTIVES

- Develop technical definitions of MSW, ISWM, prevention, minimisation, recycling, downcycling
- Identify the general factors which influence the success of ISWM systems
- Identify the benefits and limitations of each option citing technical, socio-economic and political factors

OBJECTIVES (cont'd)

- Place the various options into context within the waste management hierarchy
- Describe the concept of LCA & how it can be used to assist decision making within an overall assessment framework
- Identify the major policy/regulation differences between countries

APPROACH

- Conduct international workshops and seminars to compile information

  - Edinburgh, Scotland, Sept. 1995

  - Vancouver, Canada, Aug. 1996

  - Kyoto, Japan, Sept. 1997

EDINBURGH

- **Primary focus was on:**
  - **developing definitions for waste terms**
  - **developing lists of benefits and limitations for each WM option**
  - **placing each option in context with the WM Hierarchy**

EDINBURGH SUMMARY

- most definitions are developed to support administrative objectives
- technical, energy, environmental and economic limitations to each waste management option
- each option can potentially play a viable role within an ISWM strategy

INFLUENCING FACTORS

- MSW composition, generation rates
- climatic, geographic and geologic conditions
- energy conservation, infrastructures
- environmental and economic considerations
- legislative initiatives

"... LCA indicate that integrated waste management [through the hierarchy] is actually a large-scale pollution transfer phenomenon. The traditional hierarchy should be phased out in favour of case by case analysis. In addition, minimum recycling rates should be accompanied by an enforced maximum recycling rate."

Recommendations of the French Ministry of Environment on the European Directive on Packaging & Packaging Waste

VANCOUVER

- Primary focus was on:
  - developing a list of concerns from the perspective of the public and from waste management officials
  - examining the tools used to develop sound ISWM strategies, including LCA, LCM, risk assessment, cost benefit analysis, etc.

VANCOUVER SUMMARY

- perspectives were important factors determining responses
- public could be viewed as the customer and municipalities as the service provider
- municipalities needed to balance public pressure with consideration of costs and practicality

REQUIREMENTS

- although LCA/LCM provide a disciplined approach to accounting for input/output factors, need to include waste characterisation, risk assessments, full cost accounting, etc., in developing strategies

- essential that LCA/LCM assessments included transparency of process and third party validation of results

KYOTO

- **Primary focus was on:**
  - national WM policies and research programs
  - examining waste management issues using waste plastics as an example waste stream

KYOTO SUMMARY

- National policies are based on the premise of "sustainability" and have moved towards a three tiered approach to managing waste

- Programmes oriented towards
  - reduction & minimisation
  - recovery of materials or energy
  - ultimate disposal or useful application

ISWM

- A system of practices designed to manage MSW based on the sound evaluation of site specific environmental, energy, economic and socio-political considerations, and includes one or more of the waste management options.

FUTURE

- Several countries keen to establish ISWM Group outside of IEA
- Prepare an electronic database of pertinent ISWM studies
- Conduct a comparative evaluation of MSW Management models
- monitor international progress on ISWM issues & changes in policies

Composting in Canada

The Composting Council of Canada

Le Conseil canadien du compostage

March 2, 1998

Purpose

<u>My Role</u>

- To review current status of composting in Canada

<u>Our Role</u>

- To serve as champions for the "silent majority"

The Organic Stewards

Us + Mother Nature

Waste Diversion

• 30 - 50% of waste stream

• landfill management: volume reduction; greenhouse gases; leachate

Production of a Valuable Resource

• compost "feeds" the soil ... an acknowledged depleted resource

- improves soil texture; water retention capability; aeration capacity; resistance to erosion; disease suppression

• multiple additional uses ... landfill cover --> land reclamation

The Composting Council of Canada

Le Conseil canadien du compostage

- national non-profit organization devoted to promoting organic resource recovery through composting

- multi-interests (government, industry, academics, ngos)

Two-fold message:

i. waste diversion

ii. creation of a valuable product - compost

- Products include:

- communication within industry (Annual Conference)
- market development efforts (National Agricultural Compost Trials)
- awareness building efforts (National Composting Awareness Week)

1997 Survey Results

Sponsored by PPEC (Paper and Paperboard Packaging Environment Council)

Published by Solid Waste and Recycling (Oct/Nov '97)

- previous surveys conducted in 1993 & 1995

- telephone survey to composting facilities across Canada

- 165 facilities participated

- 24% (39) in Atlantic Canada
- 51% (84) in Québec/Ontario
- 25% (42) in Western Canada

Objective: to determine current developments in centralized composting including facilities' operational practices

Current Status

Triumvirate of effort

- over 1.2 million backyard composting units
- onsite composting associated with greenhouse, nursery and farm operations as well as approx. 30 sites utilizing in-vessel technology
- over 185 centralized composting facilities

Survey Findings

Composting continuing to develop exponentially

1996: over 1,400,000 tonnes of organics composted

• up +700,000 tonnes versus 1994; up +1,100,000 tonnes versus 1992

Facilities split relatively equally between public & private operations (86 & 79 respectively)

• significantly greater amounts composted in private operations (74% or over 1,000,000 tonnes)

• average throughput at private facilities = 13,640 tonnes versus 4,366 tonnes at public

Windrow composting remains the most common practice (126 facilities)

• aerated static piles @ 27 facilities

• in-vessel units @ 22 facililities

Survey Findings (cont'd)

Tip fees for organic materials significantly lower than the area's landfill tip fees

- average $26/tonne versus $40/tonne for landfill

Leaf & Yard materials are the most common materials composted (125 facilities)

Other frequently composted organics include:
- wood (72 facilities)
- animal manure (42 facilities)
- IC&I organics (30 facilities)
- paper materials (37 facilities)
- residential food waste (20 facilities) ... total food waste (IC&I as well as residential) @ 54 facilities

Over 90,000 tonnes of paper materials composted

- paper sludge @ 59,000 tonnes
- corrugate/boxboard/newspaper/solid paper @ 31,000 tonnes
- existing pilot programs for bottle labels and other paper materials

Survey Findings (cont'd)

Various collection methods underway

- different containers (plastic & paper bags, carts, other)
- frequency of collection (seasonal, biweekly)

Estimated that over 600,000 tonnes of compost produced

- sold in either bulk or bag
- residential give-aways are limited to municipal composting operations
- price ranges from $2/tonne to over $75/tonne; average range of $20 - $40/tonne

Multiple uses for compost

- landfill cover
- park landscape programs
- private landscapers as well as the agricultural and horticultural community
- golf courses
- land reclamation projects

Survey Findings (cont'd)

Operational issues not unlike other manufacturing operations

- feedstock quality
- process management
- cost control
- sourcing raw materials
- end markets

+ COMMUNITY RELATIONS

The Future?

If

waste diversion and effective resource utilization

is **our goal** ...

then

composting and organic waste management

must attain prominence throughout

Canada

The Future

Challenge for the leaders of government & industry is to ensure both the short- and long-term viability of this process and industry.

- economics (including well-managed facilities and programs, sound business plans, landfill tip fees, garbage user fees, economies of scale and compost market demand)

- political will

- public confidence

Provinces --> continue to develop effective & efficient frameworks for organic waste diversion programs

Municipal & Private Sector --> implementation of composting operations which are cost effective, involve quality control processes, public education, good operating practices

CSR
CORPORATIONS SUPPORTING RECYCLING

Recycling and Product Stewardship

Joseph P. Hruska

Vice-President, Municipal Development

CSR

Corporations Supporting Recycling

CSR
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Recycling and Product Stewardship

Introduction

- Coalition of brandowners, packaging and material suppliers
- Mission:
  - identify environmentally sound, cost-effective waste management solutions
  - work in partnership to implement them
- Discuss recycling and industry's role in product stewardship within an ISWM System

Recycling and Product Stewardship

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Recycling and ISWM

- CSR's main focus recycling
- Within a framework of an ISWM System
- Ensure lowest possible cost to the environment and consumer
- Recycling <u>should not</u> be the only focus
- CSR and its members uphold three key principles

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Recycling and Product Stewardship

"Full Range of Treatment Options Must Be Considered"

- Municipalities select sustainable options that are assessed - ISWM Tool
- Environmental & Economic considerations
- Source Reduction, reuse, recycling, biological treatment, energy recovery and landfilling
- No preferred options - site specific

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Recycling and Product Stewardship

Waste Management Hierarchy

- Current practice - ‘not sustainable’
  - Planning has used the “hierarchy of waste treatment options- 3 R’s”
  - Results in costly sectorial and fragmented approach (e.g.. German DSD System)
- Useful as a general guideline only, with:
  - Little use in predicting overall environmental burdens for IWM systems
  - Does not address cost and economic sustainability
- IWM holistic approach can improve efficiencies

Recycling and Product Stewardship

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"Shared Responsibility"

- Responsibility to the producer of the Environmental Impact
- All participants in supply chain:
  manufacturers, retailers, consumers and municipalities
- Environmental impacts translate to costs - their specific part of the chain
- Full costs transparent - consumers make more informed purchase and disposal decisions

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Recycling and Product Stewardship

"Market Forces Part of Solution"

- All participants benefit
- Improves cost effectiveness
- Competitive bidding
- Benchmarking operating costs

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Recycling and Product Stewardship

CSR - Industry Product Stewardship In Action

- Extends responsibility/support to municipalities beyond specific responsibility in the product chain
- Technical, markets, communication, training, demonstration
- Partnership programs "leading edge"

  - public/private to build more sustainable recycling and waste systems

  - London and Markham first to launch

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Recycling and Product Stewardship

- CSR and EPIC developed a " Life Cycle Inventory for Municipal Waste Systems Tool" with City of London as test case
- Allows site specific evaluation which the 'waste management hierarchy' cannot assess
- Environmental Life Cycle Model quantify effects of waste management changes and generation of selected pollutants

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Recycling and Product Stewardship

Benefits of an IWSM Approach

- Flexibility of waste management options
- Continuous improvement possible
- Can lower cost structure of waste systems
- Create economies of scale
- Promotes Best Practices
- Promotes Transparency of costs
- Market Forces - Incentive to reduce waste

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Recycling and Product Stewardship

Next Steps

- Public Policy recognize ISWM
- Waste hierarchy only a guide - "reduction the key to resource and energy conservation"
- Public/Private Sectors depend on each other for success - Partnership
- Make LCI Assessment Tools available to municipalities and industry
- Municipalities follow principles of ISWM - "Consider overall environmental and economic impacts on local circumstances"

Energy-from-Waste within an ISWM Approach

John Chandler
A.J. Chandler & Associates Ltd.

INTRODUCTION

Waste management is a reality in any society. As populations increase so does the amount of waste. As societies improve their economic position they increase the production of waste materials. Thus a universal requirement exists to manage waste.

While it might appear that resources to address the problems of waste management would grow with the size of the population and its affluence, this is not always the case. Today's society is facing ever increasing pressure to control spending and this adds extra pressure to provide the appropriate services at the best cost.

Recognizing that without the control of waste, there is a potential to increase the spread of disease, the issue comes down to making the best choices for disposal requirements.

The previous speakers have dealt with activities that divert waste from disposal. We now discuss the position of EFW in waste management recognizing that even with incineration, a residual amount of material, of whatever nature, will require management in landfills.

The future of Energy from Waste, EFW, in Canada does not lie with the proponents who desire to build these facilities. It is intimately tied to the size of the garbage pile which society creates after taking all reasonable steps to reduce, reuse and recycle. Even the Environmental Lobby, as represented by the Environmental Defense Fund, acknowledges that incineration has a place in the overall solution of the solid waste management problem currently facing society. In a 1990 publication, Recycling & Incineration, EDF argues that a series of measures must be implemented to allow the rational development of all waste management options and thereby allow market forces to determine the balance between recycling and incineration. They advocate that all waste management options be put under the environmental microscope so that decisions can be made on the basis of what is, on balance, simultaneously best for the economy and the environment. This balance is now essential because all of the options are expensive. Gone are the days of $10/tonne tipping fees. However, we should ask whether we can afford the more costly options if substantially less costly options with nearly the same environmental impact exist.

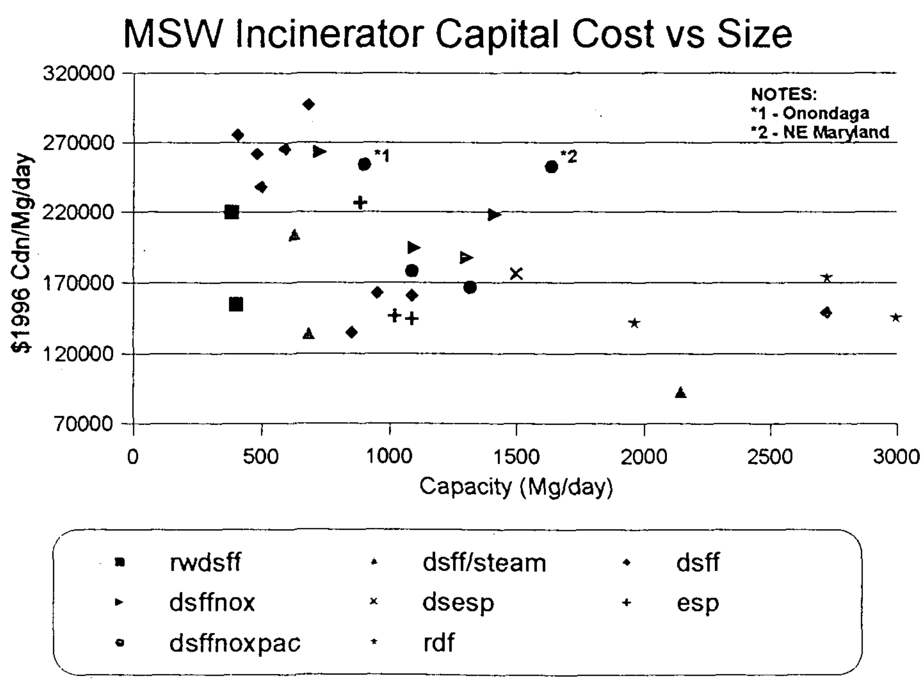
To make the right decision we need to understand how these alternatives affect society and the environment. A major factor is the cost.

THE COSTS

In a recent study completed for the International Energy Agency the focus was to determine the potential cost of using incineration as a mean of reducing anthropogenic emissions of methane. To accomplish this an attempt was made to estimate the both the capital and operating costs of incineration with two forms of energy recovery, steam and electricity. While costs were calculated for 6 different cases, I will only present the data from North America.

Based upon capital pricing information obtained from suppliers in the United States, and actual costs of two Canadian facilities, an picture of EFW costs in Canada and the United States was developed. Prices were normalized to 1996 based upon changes in the Gross Domestic Product per capita and employment cost adjustments for the particular part of the United States where the facility was built. Canadian costs were adjusted to US dollars based upon prevailing exchange rates for the year construction started and these US dollar prices were then normalized using the US GDP values. While the original study worked in US Dollars, the values were converted back to Cdn. Dollars for this presentation using a rate of $1.40Cdn/US.

It is important to recognize that incinerator systems are not common commodities. We are all familiar with buying certain commodities such as a newspaper, vegetables or gasoline. Newspapers change very little in price from week to week, or even for that matter over the course of a year. Vegetable prices can vary according the source, the time of year and success of the last harvest. We saw that last month when storms raised the price of fruits and vegetables. The price reflects the seller's costs. Gasoline prices illustrate another fundamental Gasoline price wars can drive the cost down in certain parts of a community and have little or no effect in other parts. The forces driving this pricing relate to attempting to gain a greater share of the market. A review of prices of the various EFW facilities indictates that the market may be a factor in the price charged for a given



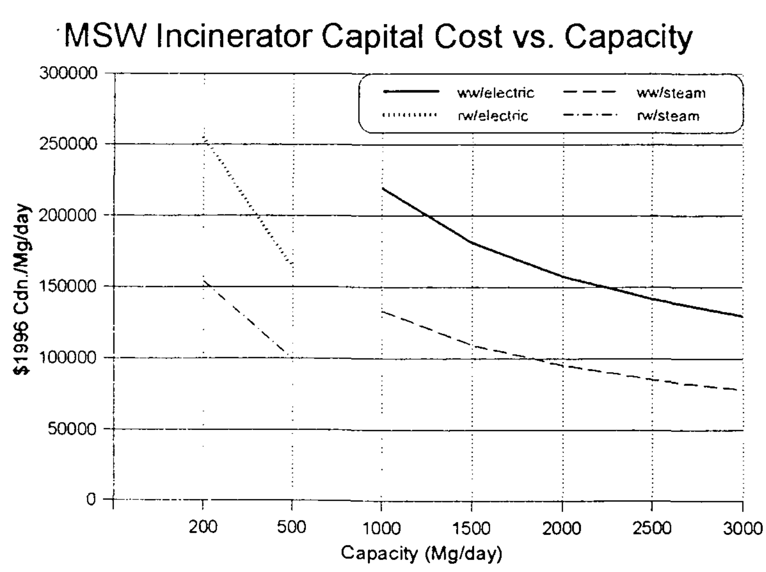
facility, but other factors must also be included.

For instance, the general trend in the graph suggests that as the facility get larger, the cost per Mg/day of capacity drops. This is the economy of scale relationship. Also apparent are different prices for different configurations of facility. For instance the facility with the DSESP is more expensive than the ESP equipped facilities of comparable size. Improving the control capabilities of the APC system by adding NO_x control or powdered activated carbon to capture PCDD/F and Hg tends to increase the price. Limited data indicates that, as we would expect, a facility equipped for just steam generation is less expensive than one equipped with a steam turbine generator set for producing electricity. Similarly, the smaller factory manufactured refractory wall systems represented by facilities such as the one in Peel appear to be less costly than the water wall facilities.

RDF facilities in the figure tend to be amongst the largest but their costs do not appear to be that sensitive to size. This may be a function of the types of facilities included in the list. One was a retrofit of an old power plant and while some components may have been available at reduced costs, demolition and working around an existing facility likely added to costs. Furthermore, the RDF facilities all have different APC systems.

The RDF systems were excluded from further study along with three anomalies in the data. These were: two facilities equipped with NO_x and PAC and a steam facility equipped with redundant steam generating equipment. The latter facility was priced with conventional fossil fuel fired combustion equipment to maintain steam production in the event of an incinerator outage. The smaller of the conventional facilities was subject to considerable litigation before it was approved and one wonders how much this affected the cost. The larger system includes the cost of a railway unloading facility used to deliver waste to the EFW and remove bottom ash from the site.

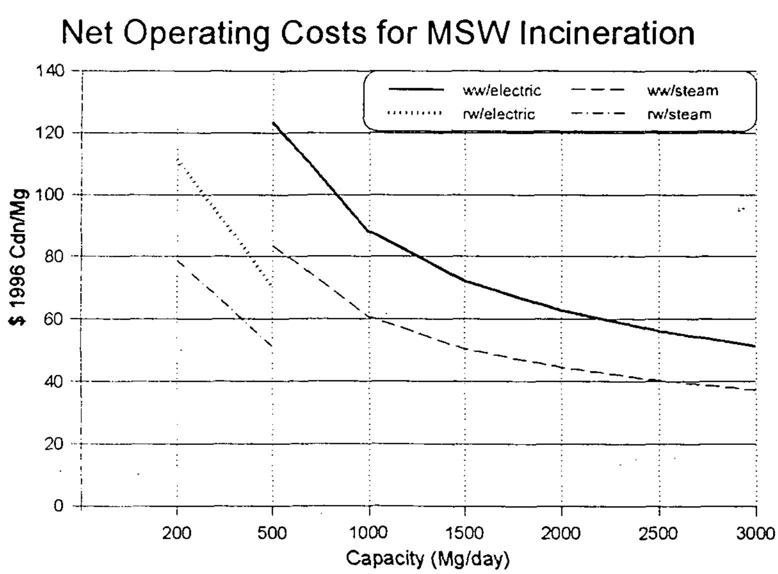
The remaining data were analysed using ANOVA techniques to determine the coefficients of various factors that could be introduced into the pricing formula. As it turned out the only significant factors accounting for differences in price were the capacity of the facility, the presence of electrical generating equipment, and the type of furnace. Surprisingly, while there were differences in the prices for the various configurations of the APC, removing the anomalies identified above reduced the significance of these coefficients below a level that warranted their inclusion in the logarithmic pricing equation that was developed. The plot of the various forms of the equation are presented in the second figure.



Note the limited range for both types of facilities. Modular or refractory systems included at the lower size ranges are unlikely to be cost effective once a certain size is reached. While it is difficult to suggest where the break point occurs in practice, the overlap between the waterwall facility pricing and that of the refractory systems is likely in the 500 Mg/day range. Similarly, manufacturers of the latter systems do not actively solicit business in the lower capacity range because their systems are difficult to design and operate effectively below a capacity of 275 Mg/day.

Estimates of operating revenue and operating costs were also developed. Factors such as labour costs for operating the facility, maintenance costs, consumables, residue management, insurance, capital replacement, and debt retirement were included in the cost side. Revenues were based upon steam sales or electricity sales with conversion from steam to electricity being based upon industry accepted factors. Electricity sales were assumed to be at a rate discounted 15% from the readily available purchase price for power and furthermore were discounted for the parasitic load of the facility assumed to be 16%.

The net cost resulting from combining the operating costs with the revenues represents the potential tipping fee for a facility. The estimate does not include an allowance for site purchase and development, a component that is too difficult to predict in a general way, nor does it contain any element of profit that might be expected to be required for any commercial service provider. While these estimates would appear to be slightly higher than the going rate for the Peel facility, it should be remembered that the Regional Municipality of Peel includes a premium of approximately 25% over the negotiated tipping fee to cover the operating expenses that are charged to their account: testing; APC residue management; and, landfill disposal of bottom ash.



Looking at the estimate in another way, the anticipated successful bidder for 500,000 Mg/year of waste disposal for Metropolitan Toronto is anticipated to bid in the range of $50 Cdn/Mg. Clearly to make this viable a large facility will be required. This might mean that an EFW proponent would build a single facility to serve the needs of not only the City of Toronto but the Greater Toronto Area where it is estimated that there will be an equal if not greater amount of waste requiring disposal.

As you can see, it is still a matter of making choices.

THE ENVIRONMENTAL EFFECTS

All the costs outlined in the previous section assume that the EFW facility will meet the latest air emission standards, and will operate in a manner that is satisfactory to the local community. The latter is possible as witnessed by the operation of the Peel facility. The application of the latest air emission standards minimize potential for health effects.

Another aspect of air emissions are greenhouse gases. While considerable emphasis has been placed on the greenhouse gas effects attributable to carbon dioxide releases to the atmosphere from anthropogenic sources, the waste management sector has the potential to produce other greenhouse gases that have a greater potential for global warming. One of these is methane [CH_4]. Methane and carbon dioxide are produced in almost equal proportions in municipal solid waste [MSW] landfill sites. The Intergovernmental Panel on Climate Change [IPCC] estimate that land disposal of wastes contributes between 5 and 20 percent of the annual anthropogenic methane emissions of 360 Tg.

At the regional and national level, governments are beginning to realize the importance of landfills in the global warming context. Measures are being implemented to reduce methane emissions by improving the capture and use of landfill gas. Another means of reducing greenhouse gas emissions from waste management activities is to minimise the amount of organic carbon entering the landfill. By implication this increases the need to incinerate the waste. Such initiatives are occurring in The Netherlands, Switzerland and Germany where the organic content of material destined for landfill has been limited to less than 5%. While this might appear logical, there are still choices to be made.

The US EPA suggests that incineration might not be the most effective way to reduce the release of carbon to the atmosphere. They say that it may be more beneficial to sequester carbon in the form of plastic in landfills where it will stay indefinitely. This conclusion is based upon the marginal energy conversion efficiency rate of older EFW facilities compared to the energy generated by the combustion of fossil fuel. This approach needs to be analysed in light of the optimized energy production performance being designed into new EFW facilities.

To provide some idea of the significance of methane emissions, consider the IPCC method for estimating the amount of landfill methane emissions:

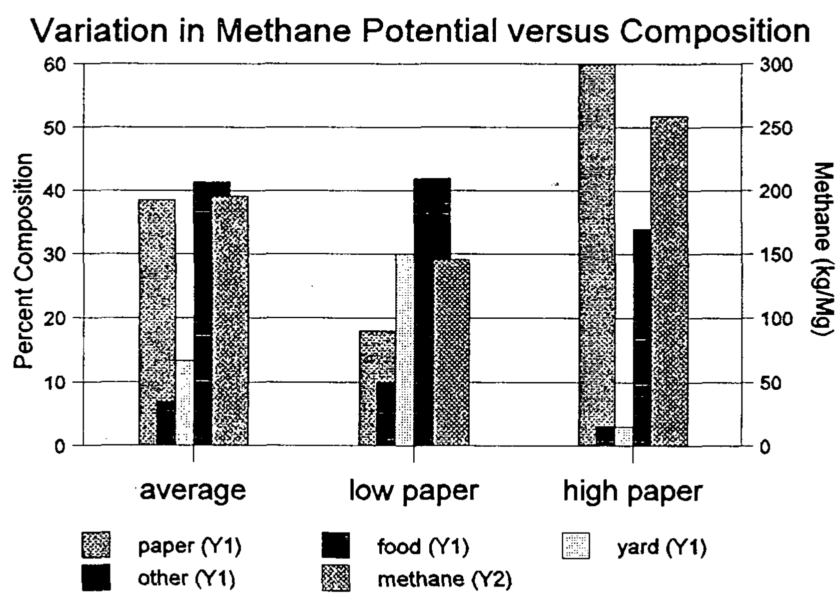
$$MR = 1330\,(MCF) \bullet (DOC) \bullet (DOC_F) \bullet (F) \qquad [4\text{-}1]$$

Where:

MR	=	Methane Reduction from incineration (kg CH_4/Mg waste)
MCF	=	Methane correction factor for landfill type. Use 1.0 for a managed landfill typical of large Canadian facilities.
DOC	=	degradable organic carbon (%)
	=	0.4 (paper) + 0.17 (yard) + 0.15 (food) +0.01 (other) where the values in parentheses represent the fraction of the component in the waste stream
DOC_F	=	fraction of DOC converted to LFG (default = 0.77)
F	=	proportion of methane in LFG (g C as CH_4/g C as biogas = 0.5)
1330	=	constant converting C in biogas as CH_4 to kg of CH_4

The formulation assumes that the emissions from incineration are negligible compared to that from landfills, regardless of the mix of waste fed to the furnace. This is based upon typical CH_4 levels in flue gas streams are less than 5 ppm_V. The reduction will change with changes in the mix of the waste. Changes in the DOC will cause the amount of CH_4 to vary and thus the equation can respond to changes in the waste stream between different locations, or indeed with changes in the waste stream over the operating life of the incinerator. The Methane Correction Factor addresses the reduction in methane generation from smaller, shallower landfills. Since incineration is likely most effective when used in large scale applications, it is safe to say that in these circumstances the landfills that would be replaced by incineration would be large managed facilities where the correction factor is not required. The equation assumes a step change in methane emissions from landfills as a function of diverting waste to the incinerator. While there is a time lag in commencement of LFG production and a long term decaying generation rate, major changes in methane emissions in Canada will not be created until 20 years after the initiation of incineration activities.

The variation in methane generation rate as a function of changes in the waste stream are illustrated in the figure. Clearly, paper has a significant effect on the methane generation rate from landfills, implying the need to increase the diversion of paper from this disposal option.



In the past it has been argued that incineration hinders recycling. EFW is not incompatible with recycling if it is considered a part of the MSW management package. While some materials like plastics and paper can be either recycled or used in the EFW process, others like glass, aluminum and ferrous metals have no value to an EFW and should be removed. In the case of combustible recyclables, the question is what is the highest and best use at the time of disposal? With an EFW in the waste management system, a decision is possible. Without one, unrecycled (due to plant capacity) and unrecyclable (due to contaminants) organic materials must be landfilled, taking up more space and emitting more greenhouse gases than if their energy content had been efficiently recovered and fossil (non-renewable) fuels not been consumed. In short, EFW will be there to help solve the solid waste management crisis, the only question is when.

As the 3-Rs are implemented, less material remains to be managed. The bottom line is that even if we can afford and induce the general public to reduce, reuse and recycle waste to the extent contemplated by advocates, we will only reduce the amount requiring ultimate disposal to 1/3 to 2/3 of the amount generated before the 3-Rs.

Last year in a paper presented at the NAWTEC conference I suggested that if we were to build enough capacity to recover the energy in half the waste collected today, that capacity will remain full into the foreseeable future. With maximum 3-R implementation, some waste will still go to the landfill without EFW processing to recover energy and unrecycled metals. With minimum expected 3-R implementation, EFW capacity equal to today's disposal requirements will be needed instead of the half indicated under the maximum 3-R scenario. Certainly reasonable amounts of EFW capacity, say equal to half of today's discards, will be needed, regardless of the success of 3-R programs.

If public policy deems energy and land conservation to be worthwhile, the rational use of energy recovery facilities (EFWs) has a place in the solid waste management hierarchy. In an EFW, the energy content of the 3-R left-overs can be recovered and the volume requiring landfilling can be minimized. Also, if the ash left after incineration is processed, any metals sneaking past a community 3-R program can be separated and recycled. The ash remaining after processing represents a relatively stable and benign material that is frequently used for construction purposes in Europe. Only a small fraction of the residue stream requires solidification or stabilization to reduce its potential environmental effects.

This means that when an EFW is part of a region's waste management strategy, instead of wasting unrecycled materials, their energy value is recovered and the inert balance--the ash--utilized to the greatest possible extent. An EFW in any integrated waste management system acts as a safety net to maximize resource recovery and minimize resource waste. Like a mechanical processing system that back-stops deposit laws and blue-box programs, the EFW catches materials that would otherwise be wasted.

EFW is more closely tied with waste disposal than with the generation of energy. EFW plants serve a useful waste management function by reducing the volume of waste that must be landfilled, while recovering the useful energy that exists in the waste. EFW results in lower greenhouse gas emissions than both landfilling and anaerobic composting. Yes, EFW does concentrate the trace metals present in our waste stream and may potentially make them more available to the environment: however, this is likely to be only a change in the time scale of release of these materials. It is not an increase in the total amount released, so proper disposal of metal bearing wastes is mandatory whether incineration is part of the process or not.

Society must decide what it is willing to spend for every function it asks government to deliver. It must recognize that the pot is not infinite and that there might need to be trade-offs between the cost of waste management and the supplying of police and educational services for instance. Regardless of the options selected for waste management, in 2010 even after intensive recycling we will need to stabilize an amount of waste similar to that we are currently disposing. We must find the best way to accomplish that be it landfilling or incineration.

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

A Life Cycle Inventory Tool for Integrated Solid Waste Management

Environment Canada
ISWM Workshop
March 2-3, 1998, Burlington, Ontario

Ruksana Mirza, B.Sc (Eng.), M.Sc.
Proctor & Redfern Limited

PROCTOR & REDFERN

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Presentation Outline

- Project Background
- Why an ISWM Tool?
- The Life Cycle Methodology
- The Tools
  - environmental
  - economic
- The Utility of the Tools
- Current Status and Next Steps

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Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Project Overview

- Initiated by EPIC/CSR and City of London
- Project Initiation - September, 1996
- Phase 1 - completed June, 1997
  - environmental and economic model development
- Phase 2 - completed September, 1997
  - user interface, user and interpretation manuals, field testing
- Peer Review - ongoing
- Next steps - testing at additional municipalities

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Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Why an ISWM Tool?

- Waste management hierarchy
  - objective to improve environmental performance and conserve resources
- Moved the focus away from disposal towards a combination of practices
- However, it does not apply to all situations

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INTEGRATED SOLID WASTE MANAGEMENT TOOL

Why an ISWM Tool?

- Environmental performance, depends on:
  - characteristics of the waste
  - efficiency of waste collection systems
  - availability of markets
  - end use of recovered materials
  - emission standards to which waste management facilities are designed and operated
  - the cost effectiveness of the environmental protection
- Need a tool for site-specific evaluation

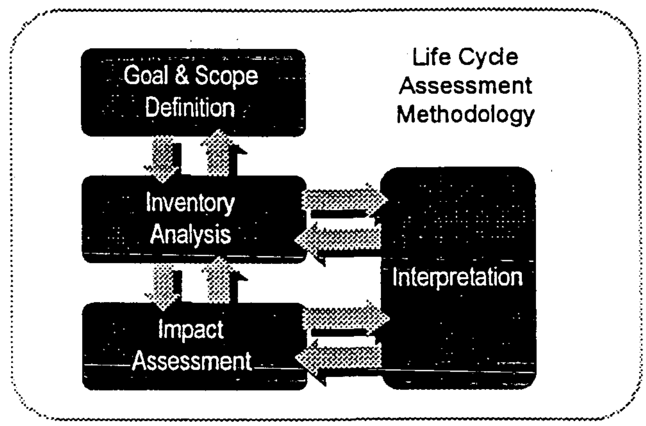
INTEGRATED SOLID WASTE MANAGEMENT TOOL

The Life Cycle Approach

- "Cradle to grave" analysis - holistic,takes into account the environmental effects of:
  - the inputs (e.g. diesel, electricity.)
  - the system (e.g. trucks, MRFs, landfills etc.)
  - the outputs (e.g. recovered materials, compost)
- Allows consideration of other indicators of environmental performance (beyond, waste diversion quantities)

INTEGRATED SOLID WASTE MANAGEMENT TOOL

What is Life Cycle Assessment?



INTEGRATED SOLID WASTE MANAGEMENT TOOL

The Use of Life Cycle Assessments

- Standardised Methodology
  - SETAC
  - CSA
  - ISO
- Reliable Data
  - Canadian National Raw Material Database
  - USEPA
  - UK DOE

INTEGRATED SOLID WASTE MANAGEMENT TOOL

LCI and Waste Management - Other Jurisdictions

- USEPA
- UK DOE
- Sweden
- Switzerland

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Goal of the Project

- To find a means for integrating environmental considerations into waste management planning
- To develop a practical tool that will enable municipalities to:
  - establish baseline environmental and economic performance of their waste management systems
  - evaluate the effects of proposed waste management system changes

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Project Approach

- Municipal Focus
  - Simple tools that can be used by municipalities
  - Test utility in several municipalities
  - Provide guidance on the interpretation of inventory results
  - Provide follow up training and support
- Based on best data currently available
  - with committment to revise as better data becomes available
- Consider selected environmental effects

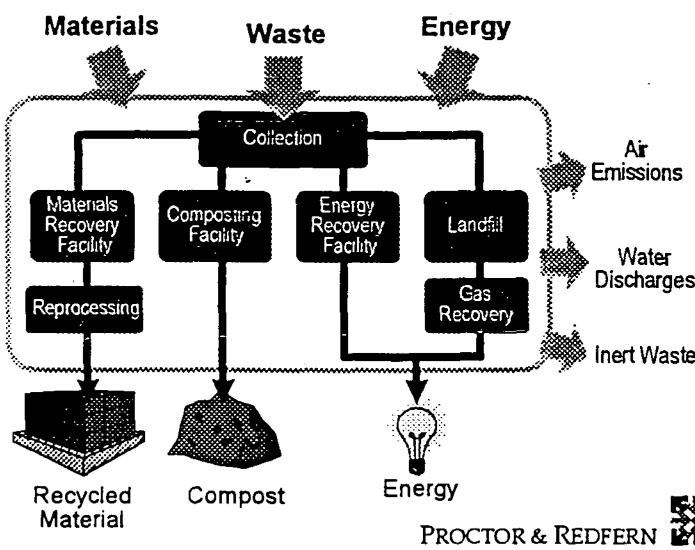
INTEGRATED SOLID WASTE MANAGEMENT TOOL

Scope Definition

Material	Recycling	Composting	Land Application	EFW	Landfilling
Paper	✓	✓		✓	✓
Glass	✓			✓	✓
Ferrous Metals	✓			✓	✓
Aluminum	✓			✓	✓
Plastics	✓			✓	✓
Food Waste		✓		✓	✓
Yard Waste		✓	✓	✓	✓
Other Waste				✓	✓

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Boundary Definition



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Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Selected Environmental Indicators

- Energy consumption
- Greenhouse gases (CO_2, CH_4)
- Acid gases (NOx, SOx and HCl)
- Smog precursors (NOx, PM and VOCs)
- Heavy metals (Pb, Cd, and Hg) and trace organic (dioxins)
- BOD
- Residual solid waste

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Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Processes Considered

- Collection and transportation
- Energy use
- Facility emissions
- Saved emissions from replaced 'new' material or conventional fuel

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Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Energy/Emissions Quantified

- Collection and transportation emissions
- Waste management facility (MRF, CCF, EFW, landfill) emissions
- Emissions associated with the production, delivery and use of the energy (fuel & electricity) consumed by trucks and facilities
- Emissions saved through the replacement of 'new' material/energy by recovered material/energy

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Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Collection & Transportation

- Direct fuel combustion energy/emissions
- Fuel production and delivery energy/emissions

- Separate collection in diesel trucks
- Truck transport (waste to facility, recovered materials to market, residues to landfill)

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Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Energy Use

- Fuel combustion energy/emissions
- Fuel production & delivery energy/emissions
- Electricity production & delivery energy/emissions
  - based on mix of fuels used to produce electricity

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Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Recycling

- Collection, transfer & transportation
- MRF operations
- Reprocessing recovered materials
- Energy/emissions saved from virgin material replacement (offset burdens)

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Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Composting

- Windrow and in-vessel
- Collection, transfer and transportation energy/emissions
- Energy consumed by composting operations and associated emissions
- Emissions from composting process (composition of organics)
- Composting residues

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INTEGRATED SOLID WASTE MANAGEMENT TOOL

Energy from Waste

- Collection, transfer & transportation emissions
- Energy consumption and associated emissions
- Emissions from combustion process
- Energy recovered (electricity or steam) and saved emissions from conventional energy replacement (offset burdens)

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Landfilling

- Energy/emissions from collection of garbage
- Energy consumed and associated emissions
- Emissions from facility operations and waste biodegradation
- Energy/emissions from landfill gas combustion (where applicable)
- Where gas is utilized, energy/emissions saved from conventional energy replacement

PROCTOR & REDFERN

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Structure of Model

- Excel 5.0 with VB interface
- 10 screens step user through each system component
  - Waste generation & composition
  - Waste flow
  - Recycling
  - Composting
  - Land Application
  - Energy from Waste
  - Landfilling
  - Collection
  - Transfer & transport

INTEGRATED SOLID WASTE MANAGEMENT TOOL

SAMPLE RESULTS
All Waste Landfilled

	Recycling	Composting	EFW	Landfill	Total Waste Management System	Virgin Material Displacement Credit	Reprocessing of Recycled Materials	Net Life Cycle Inventory
Tonnes Managed/year	0	0	0	100,000	100,000			
Energy Consumed (GJ)	0	0	0	18,693	18,693	0	0	18,693
Greenhouse Gases								
- CO_2 (tonnes)	0	0	0	388,517	388,517	0	0	388,517
Acid Gases								
- NO_x (tonnes)	0.00	0.000	0.0	7.17	7.17	0.0	0.0	7.2
- SO_x (tonnes)	0.00	0.000	0.0	3.18	3.18	0	0.0	3
- HCl (tonnes)	0.000	0.000	0.00	2.722	2.72	0.0	0.00	2.7
Smog Precursors								
- NO_x (tonnes)	0.00	0.000	0.0	7.17	7.2	0.0	0.0	7.2
- PM (tonnes)	0.00	0.000	0.00	27.8	27.8	0.0	0.0	27.8
- VOCs (tonnes)	0.00	0.000	0.00	96.1	96.1	0	0.0	96.1

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

SAMPLE RESULTS
25% Recycling, 75% Landfilling

	Recycling	Composting	EFW	Landfill	Total Waste Management System	Virgin Material Displacement Credit	Reprocessing of Recycled Materials	Net Life Cycle Inventory
Tonnes Managed/year	25,000	0	0	75,000	100,000			
Energy Consumed (GJ)	23,553	0	0	14,481	38,034	-798,187	378,379	-381,775
Greenhouse Gases								
- CO2 (tonnes)	1,505	0	0	274,521	276,026	-42,014	20,206	254,218
Acid Gases								
- NOx (tonnes)	7.69	0.000	0.0	5.52	13.21	-53.0	36.1	-3.7
- SOx (tonnes)	3.79	0.000	0.0	2.45	6.24	-88	29.9	-52
- HCl (tonnes)	0.029	0.000	0.00	1.967	2.00	-13.8	1.21	-10.6
Smog Precursors								
- NOx (tonnes)	7.69	0.000	0.0	5.52	13.2	-53.0	36.1	-3.7
- PM (tonnes)	0.96	0.000	0.00	22.3	23.3	-48.7	33.9	8.5
- VOCs (tonnes)	4.73	0.000	0.00	69.7	74.4	-45	34.1	63.4

PROCTOR & REDFERN

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Sample Run 3 - 25% Recycled, 20% Composted, 55% Landfilled

	Recycling	Composting	EFW	Landfill	Total Waste Management System	Virgin Material Displacement Credit	Reprocessing of Recycled Materials	Net Life Cycle Inventory
Tonnes Managed/year	25,000	20,000	0	55,000	100,000			
Energy Consumed (GJ)	23,553	5,618	0	10,038	39,208	-798,187	378,379	-380,600
Greenhouse Gases								
- CO2 (tonnes)	1,505	7,206	0	217,893	226,604	-42,014	20,206	204,796
Acid Gases								
- NOx (tonnes)	7.69	0.995	0.0	3.89	12.58	-53.0	36.1	-4.4
- SOx (tonnes)	3.79	0.678	0.0	1.72	6.18	-88	29.9	-52
- HCl (tonnes)	0.029	0.016	0.00	1.515	1.56	-13.8	1.21	-11.1
Smog Precursors								
- NOx (tonnes)	7.69	0.995	0.0	3.89	12.6	-53.0	36.1	-4.4
- PM (tonnes)	0.96	0.282	0.00	17.0	18.2	-48.7	33.9	3.4
- VOCs (tonnes)	4.73	0.672	0.00	53.4	58.8	-45	34.1	47.8

PROCTOR & REDFERN

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Sample Run 4 - 25% Recycled, 20% Composted, 25% EFW, 30% Landfilled

	Recycling	Composting	EFW	Landfill	Total Waste Management System	Virgin Material Displacement Credit	Reprocessing of Recycled Materials	Net Life Cycle Inventory
Tonnes Managed/year	25,000	20,000	25,000	30,000	100,000			
Energy Consumed (GJ)	23,553	5,618	-208,268	5,679	-173,418	-798,167	378,379	-593,227
Greenhouse Gases								
- CO2 (tonnes)	1,505	7,206	10,125	129,822	148,658	-42,014	20,206	126,850
Acid Gases								
- NOx (tonnes)	7.69	0.995	16.5	2.21	27.36	-53.0	36.1	10.4
- SOx (tonnes)	3.79	0.678	5.3	0.97	10.78	-88	29.9	-48
- HCl (tonnes)	0.029	0.016	3.49	0.900	4.43	-13.8	1.21	-8.2
Smog Precursors								
- NOx (tonnes)	7.69	0.995	16.5	2.21	27.4	-53.0	36.1	10.4
- PM (tonnes)	0.98	0.262	-1.47	11.6	11.3	-48.7	33.9	-3.4
- VOCs (tonnes)	4.73	0.672	1.56	31.6	38.6	-45	34.1	27.6

PROCTOR & REDFERN

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Interpretation of Results

- Description of the significance of the environmental effects evaluated and the contribution of waste management processes to those effects (say, relative to national inventory)
- Conversion to "everyday" equivalents
- Divide pollutants into two categories
  - for use in decision making
  - for information only

PROCTOR & REDFERN

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

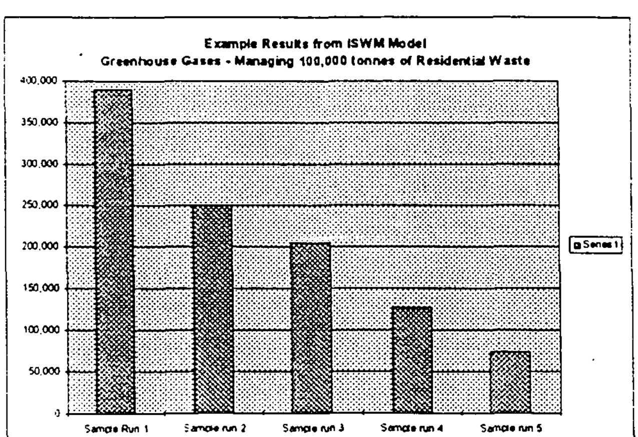
A COMPARISON OF SCENARIOS 1 and 4

	Scenario 1 - All Waste Landfilled	Scenario 4 - 30% Recycled, 20% Composted, 20% EFW	Change in Burden	Net Change (Sc. 1 - Sc. 4)	Burden Equivalents of the Net Change
Energy Consumed (GJ)	18,693	-593,227	↓	611,920	Electricity for 14,100 homes for one year
Greenhouse Gases (t)	388,517	126,860	↓	261,657	Emissions from 69,800 cars for one year
Acid Gases					
Nox (t)	7.17	10.41	↑	3.2	Emissions from 200 cars for one year
Sox (t)	3.18	-47.75	↓	51	Electricity for 6,400 homes for one year
HCl (t)	2.72	-8.19	↓	10.9	Electricity for 25,400 homes for one year
Smog Precursors					
Nox (t)	7.2	10.41	↑	3.2	Emissions from 200 cars for one year
PM-10 (t)	27.8	-3.4	↓	31.2	Electricity for 6,800 homes for one year
VOCs (t)	96.1	27.60	↓	68.5	Emissions from 2,100 cars for one year

PROCTOR & REDFERN

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL



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INTEGRATED SOLID WASTE MANAGEMENT TOOL

Economic Analysis Model

- Calculates cost and employment implications of waste management system changes
- Model based on same structure used in other EPIC models (i.e., RCCM, MRF-PCM)
- Outputs costs and employment

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Economic Analysis Model *(cont'd)*

- Outputs - Costs
  - collection and processing costs
  - system costs
  - total revenues
  - net cost per tonne
  - incremental cost per tonne
  - cost per household
  - incremental cost per household

PROCTOR & REDFERN

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Economic Analysis Model *(cont'd)*

- Outputs: Infrastructure and Equipment
  - number of collection vehicles
  - processing equipment
- Outputs: Employment
  - collection employees
  - processing employees
  - administration employees

INTEGRATED SOLID WASTE MANAGEMENT TOOL

The Utility of the Tools

- Establish a municipality's baseline environmental performance
- Determine the environmental effects of proposed changes
- Allow a municipality to undertake a cost/benefit analysis of proposed capital expenditures
- Help municipalities in 'State of the Environment' reporting
- Form a part of a municipality's overall environmental management system

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Current Status & Next Steps

- Peer Review - requirement for 'public' LCIs
- Testing at additional municipalities
- Publication
- Communication
- Training (use and interpretation)
- Maintenance (updating of defaults as 'better' numbers become available)

Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Potential Tool Refinements

- Incorporate other modes of transportation (e.g. rail haul) and other fuels (e.g. propane,CNG)
- Expand collection module to allow municipalities to explore effects of different modes of collection (e.g. co-collection)
- Expand energy grid definition - user selected, operation specific
- Expand EFW module to include co-generation (electricity & steam)

PROCTOR & REDFERN

Co-collection - Federal Perspectives

Bob Christensen, Environment Canada

In 1989, the Canadian Council of Resource and Environment Ministers (CCREM), now called the Canadian Council of Ministers of the Environment (CCME), established a national goal of reducing waste by 50% by the year 2000. This meant reducing the disposal of solid waste by 50% by the year 2000 compared to the baseline year of 1988.

In response to this national goal, Environment Canada established the Office of Waste Management to consolidate existing waste-related activities and undertook a number of new waste initiatives. Although the Department's organizational landscape changed considerably over the next few years (and, by the way, that landscape is still changing), Environment Canada continued to develop and pursue significant activities in waste prevention, handling, treatment and disposal involving both hazardous and non-hazardous (i.e. solid) waste.

One of the more major activities was an RIS study on solid waste management in Canada which was published by Environment Canada in March 1996. Natural Resources Canada (NRCan) was a partner in the study and provided PERD funding support. PERD (the federal Program of Energy Research and Development) supports R&D activities in a wide range of areas relating to energy production and use. Among the issues addressed by PERD is the energy dimensions of solid waste management.

The study was published as a set of three reports tilted *Perspectives on Solid Waste Management in Canada*. Volume 1 was *An Assessment of the Physical, Economic and Energy Dimensions of Solid Waste Management in Canada*. Volume 2 was *Options for Integrated Municipal Solid Waste Diversion*. Volume 3 was *Case Studies of Leading-Edge Solid Waste Diversion Projects*. Target audiences were municipalities across the country, the waste management industry in Canada, provincial governments, federal agencies, foreign governments, and members of the general public interested in waste management issues.

Volume 1, *An Assessment of the Physical, Economic and Energy Dimensions of Solid Waste Management in Canada*, presented data on solid waste quantity and composition estimates, cost and employment estimates of waste management activities, and estimates of energy used in and recovered from waste management activities. One of the key findings was that solid waste and recyclables collection consumed 79% of the 6.6 petajoules required annually in Canada for solid waste management.

The report presented additional details of the energy consumed; one chart shows the energy input on a per tonne basis as a function of the type of waste management activity. This chart, as you can see, shows that the energy input per tonne for the collection of residential recyclables is quite a bit higher than for the other activities. In working towards the 50% waste reduction goal, municipalities are of course seeking to increase the amount of recycling. Therefore it becomes important to make the collection of recyclables and garbage as energy-efficient and cost-effective as possible.

This report was used to provide input to an October 1995 PERD workshop to discuss R&D needs in the field of energy and waste, and to provide a focus for future PERD work in this area. The focus of the workshop was on R&D activities that would contribute to one or more of the following goals:

- 50% reduction in solid waste going to landfill by the year 2000;
- 20% reduction in energy expended to collect and handle solid waste by the year 2005; and
- 100% increase in the energy recovered from solid waste by the year 2005.

The workshop was attended by a small group of stakeholders from the public and private sectors who provided their views on the question of PERD priorities in the energy and waste field. The results of the workshop were used by PERD to develop an R&D needs document.

The needs document dealt only with R&D activities. Commercialization of technologies, public education programs, and policy matters, while important in their own right, are all outside the scope of the PERD program. In addition, solid waste R&D needs must have an energy component in order to be addressed under the PERD program.

Among the solid waste R&D needs identified for future action in the PERD needs document, was the need to optimize waste collection to maximize energy efficiency.

Following up on the R&D action items identified in the PERD needs document, Environment Canada, using funding from the PERD program, embarked on an initial study of energy-efficient waste collection. The result was a March 1997 Proctor and Redfern report titled *Waste Collection Energy Use Optimization*, which identified strategies and technologies for saving energy during the collection of solid waste and recyclables and recommended options that have the greatest potential to reduce energy consumption and costs. The report outlined a series of energy conservation and fuel cost saving measures that have been implemented by municipalities across Canada, assessed the applicability of these to other municipalities, and estimated the energy and emission reduction potential of these measures.

The study found that energy-saving measures implemented by municipalities or haulers in their waste management programs, were generally motivated more by the prospect of reducing overall program costs rather than simply the desire to reduce energy consumption.

The report noted that the energy efficiency of waste and recyclables collection systems have been heavily impacted by the use of special trucks for the collection of recyclables. One of the critical aspects affecting the collection costs and fuel consumption is the time per stop. This is critical to the length of time required to complete a route and to the quantity of fuel used. Extensive curbside sorting of recyclables can increase the stop time dramatically. Any opportunity to reduce this time (in some cases the time per stop is up to 60 seconds or more) will result in lower fuel consumption and lower cost per tonne collected.

Initially, MRFs were not designed to sort a wide variety of materials, but rather to clean materials before sending them to market. Consequently, as the number of materials collected started increasing, a lot of the separation was done at the curb. With the advent of better designed MRFs capable of managing a mixed material stream, the retooling of recyclables collection to a faster system (e.g. two streams - fibers and containers) will tend to decrease fuel consumption and improve overall waste management system costs. However, this will, in most cases, require a capital expenditure at the MRF to allow improved sorting efficiency.

The Proctor and Redfern report identified the co-collection of waste and recyclables as a collection technology that appears to be promising in terms of saving energy and costs. The study found that co-collection has the potential to significantly reduce fuel consumption and greenhouse gas emissions. It recommended that these findings be confirmed by undertaking a pilot study jointly with a municipality that is examining ways of making waste and recyclable collection more efficient.

The report also noted that the application of GIS (geographical information systems) computerized map-based route design optimization software appears to offer significant promise in not only reducing fuel consumption and emission levels but in reducing overall waste and recycling collection costs.

Several examples of how co-collection has been used in Canada were described in the report.

One example cited was a pilot study of the co-collection of organics, garbage and recyclables in Muskoka, Ontario. A SHU-PAC horizontally-split 2-compartment truck was used to collect garbage and organics the first week and garbage and recyclables the second week. Separate carts were used for garbage and organics at the curb. Recyclables continued to be collected in the blue box, as before.

As a result of this co-collection approach, the total number of collection vehicles for all three streams was decreased from three to two. However, as the capital cost for the specialty 2-compartment truck is approximately $60,000 greater than for a typical side-packer truck, municipal collection cost savings were only in the order of 25%. Fuel costs are reported to have decreased from a total of $29,277 per year for waste and recyclables to $17,474, a reduction of over 40%.

Here's another example, not just a pilot, but a full-scale operation. The City of Guelph, Ontario services 35,000 households (25,000 SFDs and 10,000 MFDs) with weekly co-collection of wet and dry waste. Wet waste consists of food, sanitary products and compostable fibers, while dry waste is all of the remainder. Yard waste, bulky waste, HHW and Christmas trees are not part of the collection system.

At the curb, the wet fraction is put out in clear green bags and the dry is in clear blue bags. Both streams are collected each week in 2-compartment side-loading collection vehicles. As a result of this co-collection approach, seven fewer trucks are used compared to the old system where garbage was collected separately from recyclables. Total collection cost savings were estimated at $80,000 annually. Information on the quantity of fuel or cost of fuel saved was not available in time to be included in the report.

A third example from the report, describes a co-collection pilot in Markham involving a population of 5,500 (2,200 SFDs and no MFDs).The truck used was a Fiba-Canning-designed hybrid vehicle with a natural gas engine and brake-energy recovery system. The truck capacity was 56 cubic yards (larger than average) with a 2-compartment aluminum body. Each compartment had variable compaction to accommodate weekly collection of organics and alternating collection of recyclables and garbage.

The truck used about one-half the energy consumed by a conventional truck, produced less than 1% of the particulate emissions of three conventional vehicles, and cost 60% less to operate than a diesel-powered truck of the same weight and size. However, the vehicle is relatively expensive, having a capital cost of about $165,000 (US).

This co-collection vehicle was part of a collaborative effort led by Fiba-Canning and included Natural Resources Canada (CANMET), Transport Canada, the Ontario Ministry of Environment and Energy, the Canadian Gas Association and Volvo Sweden.

Following up on the recommendations of the Proctor and Redfern report, Environment Canada, with the assistance of the PERD program, participated with the Regional Municipality of Ottawa Carlton (RMOC) and CSR: Corporations Supporting Recycling, to test 2 types of co-collection trucks in two 2-week pilot programs in the fall of 1997. KANN (a US truck manufacturer), provided one of its three-compartment co-collection trucks and a driver for the first two-week trial. Bluewater Recycling Association provided a SHU-PAC three-compartment truck and a driver for the second two-week trial. Both trucks had variable compaction in all compartments. The three streams collected were garbage, fibres and containers.

Although the report has not yet been finalized, interim results from these two-week trials suggest that co-collection appears to be better suited to rural applications than to urban or suburban applications. Optimized results from the RMOC trials are currently being used to develop energy and emission scenarios using the CSR/EPIC Integrated Solid Waste Management tool. These will then be extrapolated on a national basis. This will be completed by the end of March. Future federal initiatives in this area are still being developed, but possibilities include additional municipal trials or studies of existing full-scale programs and workshops for technology and information transfer.

Co-Collection

Federal Perspectives

CCME National Goal

- Reduce the disposal of solid waste by 50% by the year 2000, compared to 1988.

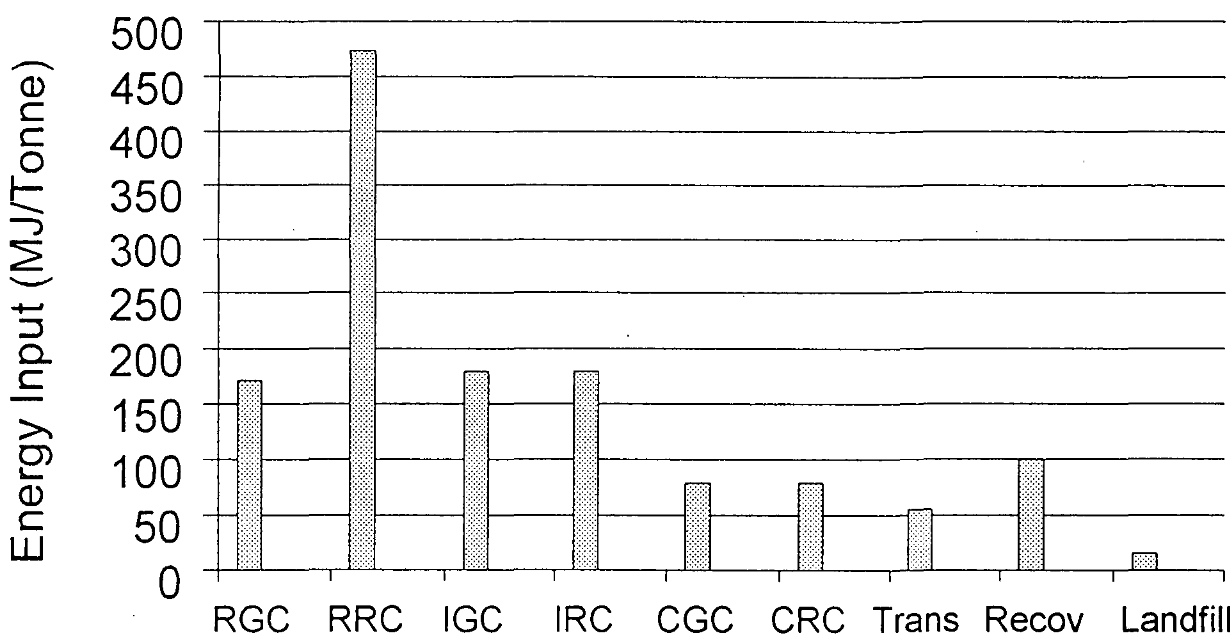
Perspectives on Solid Waste Management in Canada (RIS)

- Volume 1: Physical, economic and energy dimensions
- Volume 2: Options for ISWM
- Volume 3: Case Studies

Selected Key Findings

- Solid waste management consumes a total of 6.6 PJ annually.
- Collection (garbage & recyclables) consumes 79% of the total.

Energy Input for Solid Waste Management Activities



PERD Workshop, 1995

- Identify solid waste R&D needs that have an energy-saving component.
- Need to optimize waste collection to maximize energy efficiency.

Waste Collection Energy Use Optimization (P&R)

- Municipalities and haulers focus on reducing overall program cost.
- Time per stop is critical.
- Sorting: curbside versus MRF.
- Co-collection has potential.

Muskoka, Ont.

- Co-collection pilot for organics, garbage and recyclables (2-week cycle).
- SHU-PAC horiz.-split 2-compartment truck.
- Number of trucks decreased from 3 to 2.
- 25% savings on collection cost.
- 40% decrease in fuel costs.

Guelph, Ont.

- Full-scale (35,000 hhlds) weekly 2-stream (wet and dry) co-collection.
- Yard waste, bulky waste, Christmas trees, HHW are excluded.
- 7 fewer trucks reqiured.
- $80,000 collection cost savings.

Markham, Ont.

- Co-collection pilot (2,200 hhlds) for organics, recyclables, garbage (2-week cycle)
- 2-compartment, variable compaction Fiba-Canning truck with natural gas engine and brake-energy
- 50% energy savings, 60% operating cost savings. Capital cost is $165,000 (US).

RMOC Co-collection Pilot

- Supported by EC, PERD, CSR, KANN, Bluewater Recycling.
- KANN and SHU-PAC trucks with 3 compartments and variable compaction to co-collect garbage, fibr
- Best results in rural areas.
- National energy and emission scenarios are being developed.

MUSKOKA CONTAINERIZED SERVICES LTD.

Box 1779, 580 Ecclestone Dr.,
Bracebridge, Ontario
P1L 1V7

Phone (705) 645-4453 or 1-800-461-4448
Fax (705) 645-9485
email mcs@muskoka.net

Intermediate Processing Facility
500 Ecclestone Drive
Bracebridge, Ontario

HIGHLIGHTS

Type	Commingled Hand Sorted Source Separated Market preparation includes final sort to remove contamination, accumulation of full–load quantities and shipment.
History	Established in 1994.
Size	20,000 square feet + covered storage
Material Receiving	Construction & Demolition Industrial, Commercial & Institutional Bulk sorted From Contractors, M C S and the General Public.

Materials Accepted

Clean Wood (Dimensional Lumber)
Skids/Pallets
Mixed Wood (Painted, Stained etc.)
Wooden Reels
Old Corrugated Cardboard
Industrial, Commercial & Institutional Waste

Asphalt Shingles
Roofing Material (Tar & Gravel)
Styrofoam (Polystyrene)
Scrap Metal
Concrete/Brick

Muskoka Containerized Services Ltd.

GEORGE SOUTH, H.B.Sc., M.A.
Manager - Waste Diversion
Environmental Planner

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WORKING TO IMPROVE OUR ENVIRONMENT

recycled paper

Average Annual Throughput	10,000 tonnes and increasing
Employees	2 material handlers 1 loader operator
Processing Equipment	Arasmith Salvager Hog 50 x 54 T. S. Vibrating Conveyor Muma Magnetic Discharge Conveyor T. S. Disc Screen John Deere 544 G
Areas served	Primarily Muskoka, Parry Sound Haliburton **Licensed for Ontario.**
Operating Authority	M.O.E.E. Provisional Certificate of Approval for a Waste Disposal Site (Processing and Transfer) **No. A740014**
Primary Product	Wood Fibre Ground to Specifications Suitable for the Manufacture of Chip Board or for Landscaping and Composting Purposes.

Philosophy

Muskoka Containerized Services Ltd. is dedicated to maximizing the diversion of waste from disposal sites and will continue to expand the types of materials to be recycled as markets become available.

March 1995.

MAXIMUM DIVERSION RECYCLING CENTRE

MUSKOKA RECYCLING

500 EcclestoneDrive
Bracebridge, Ontario

	HIGHLIGHTS
Type	Commingled sorting lines Hand sorted – conveyor feed Market preparation includes final sort to remove contamination, densification/packaging of recyclables, accumulation of full–load quantities and shipment.
Ownership	Muskoka Containerized Services Ltd.
Manager/Operator	Muskoka Containerized Services Ltd.
History	Established in 1988 Redesigned & moved to new facility 1993
Size	28,000 square feet + outside storage
Material Receiving	Blue Box curbside Mobile Depots I. C. & I. Bulk sorted

Materials Accepted

Newspaper & all flyers	Glass Bottles & Jars
Magazines/Catalogues/Telephone Books	Steel Cans
Fibre Egg Cartons	Aluminum Cans
Old Corrugated Cardboard	P.E.T. Bottles
Kraft (brown) Paper & Bags	Rigid Plastic Bottles (ie: Juice, Shampoo etc.)
Old BoxBoard	Mixed Plastics
Mixed Household Paper	Aluminum Trays & Foil
Office Paper	Polystyrene/Styrofoam (ie: trays, cups etc.)
Polycoat (wax) Milk & Juice Cartons	Textiles

Average Annual Throughput	9,000 tonnes and increasing
Employees	13 material handlers 1 loader operator 1 baler operator 1 supervisor
Processing Equipment	Ambaco 8043 horizontal baler Kernic/Vibrotech Fibre & Container Processing System MSS Elpac 48 Aluminum Separator Vibrating Feed Screeder Fibre sorter 1845 Case skidsteer loader Hyster Lift Truck
Areas served	Muskoka, Haliburton, Parry Sound, Nipissing M.O.E.E. Provisional Certificate of Approval foe a Waste Disposal Site (Processing and Transfer) No. A740013

Philosophy

Muskoka Containerized Services Ltd. is dedicated to maximizing the diversion of wastes from disposal sites and will continue to expand the types of materials to be recycled as markets become available.

The Maximum Diversion Recycling Centre will continue to upgrade it's processing systems and capabilities to provide cost effective handling of recyclable materials.

January 1997.

March 2, 1998

What I have been asked to speak on this morning is ISWM within the private sector, particularly in terms of development and operational issues.

I wish to do this,, by using the evolution of the waste management system in Central Ontario as a case study, and in particular Muskoka Containerized Services.

What you will observe is an incremental approach towards the development of what is presently the most fully integrated and comprehensive waste management system for both the Residential and Commercial sectors in the Province.

By way of introduction, Muskoka Containerized Services or MCS for short, is a 27 year old company involved in all aspects of waste management and in particular resource recovery.

If we flip back to the early 70's this is where it all began. Open burning dumps - not even what we would try to call a landfill.

These sites were scattered throughout the area. Our first initiative was to convince municipalities that these sites could be better managed as transfer operations hauling to a central disposal area.

We also put in smaller transfer sites for our seasonal cottage residents to enable them easy access and eliminate the numerous small holes which were serving as disposal points.

We then carried on from the 70's to the mid eighties enlarging our waste collection system, serving both the residential and commercial sectors, but not really evolving our waste management options away from the single haul and dump focus.

Then 1987 and 88 came along and we began our shift from a waste disposal company to our present resource recovery focus.

This first step began with the development of Muskoka Recycling.

This began as a very small operation using roughly 6000 sq feet, to now a present 28,000 square foot operation with two shifts in the summer months accepting some 25 different recyclable materials.

It is now a two stream MRF accepting Fibres and Containers, which are collected curbside using both one and five ton trucks, as well as a series of depot drop off stations serviced through roll-off and roll-off pup combinations.

This facility uses both manual and mechanical separation to recover products and then compacts the clean material for shipment using an Ambacco 8043.

A similar process happens for fibre products, which are sorted along the same line, using reversible conveyors belts, and sorted into three primary grades.

The next addition to our integrated system was what we call the IPF, in 1994.

This facility grew out of a trial we did, where we took in 20 loads of construction and demolition waste and found that we could successfully divert 90 to 95 % of the material.

So what we did was we went out and purchased a wood hog for wood fibre recovery, where we hog the material to a three inch minus particle size and sell it to particle board manufacturers.

Off spec. wood and used pallets are ground and shipped via containers or 120 cubic yard walking floor trailers.

Mixed loads of c&d also come in, and we sort off the drywall, compostable fibres, brick, concrete, scrap metal, shingles etc., all for recycling.

we also operate a waste transfer site at this location, sending nonrecyclable waste for disposal in Michigan.

The next step towards integration was Hazardous waste service for residents and businesses, which we added in 1995, along with reuse buildings at all landfills which we operate.

There are six of these residential sites in the Muskoka area, which are serviced by a mobile collection truck. The material is then taken back to this central facility for bulking and shipment to final proper disposal or reuse.

Now that we have gone to this point, we have addressed the dry side of materials from both the residential and commercial sectors, the only thing that is left is the organic side of materials. Now in order to make any big waste diversion impact any integrated program must address organics.

we began with this in 1995 using an outdoor windrow site which we designed and permitted. we then expanded in 1996 to our indoor composting facility "COMPOSTIT"

Materials processed, cured and then sold in bags or as bulk material. This material consists of manure's, sewage sludge's, restaurant and fast food outlet food wastes, grocery store food wastes and waxed cardboard etc.

We continue to operate the outdoor facility, as you see here, for a variety of materials, using a SCAT turner.

So after all is said and done, we have developed a comprehensive system to both collect and process what was waste material and maintain the value within those resources. We have encountered numerous barriers along the way, which typically involved not the public at large, as there is a real desire on their part to continue to divert waste materials, but from the politician and even the MOE itself.

Developing the political will to implement, expand and maintain these programs is a challenge unto itself.

The whole process from a commercial end is driven by economics. Realistic tip fees within central Ontario have provided us with the ability to creatively develop these waste diversion programs. To be honest, without 80 and 90 dollar per tonne tip fees, none of this would exist, or could be maintained.

Other driving factors have to deal with our geography and the nature of the area. People have a desire to conserve and maintain recreational areas such as central Ontario, and are possibly more inclined to undertake the development of these types of programs.

The final driving factor has been success is addictive. When you are successful, the political will changes from one of difficulty, to one of wanting to take credit and cautiously do more if the success can be assured. Developing partnership contracts has been an area which we have excelled, as it has made the political people happy, and allowed waste diversion to take place under the umbrella of efficiency.

We take pride in what we have accomplished and we hope to continue to do more of the same in the future.

MUSKOKA RECYCLING

MAXIMUM DIVERSION RECYCLING CENTRE (MDRC)

COMPARISON of YEARLY TONNAGE

Month	1991	1992	1993	1994		1995		1996		1997		1998	
				Incoming	Shipped	Incoming	Shipped	Incoming	Shipped	Incoming	Shipped	Incoming	Shipped
JAN.	432	575	435	360	368	494	431	588	530	692	628		
FEB.	323	482	330	402	349	415	425	518	578	628	701		
MAR.	395	539	404	436	464	548	524	528	479	691	683		
APR.	548	533	477	399	377	486	435	560	494	680	688		
MAY	636	495	560	547	494	653	638	790	664	830	498		
JUN.	531	717	654	671	603	688	644	733	820	856	767		
JUL.	827	854	675	891	804	848	776	1,132	710	1,323	1,103		
AUG.	795	940	845	1,039	920	1,045	867	1,296	1,201	1,285	1,112		
SEPT.	645	684	557	680	717	705	824	855	856	985	928		
OCT.	653	785	478	619	513	695	629	850	831	985	818		
NOV.	409	660	720	555	531	642	587	656	456	738	721		
DEC.	373	535	500	517	552	552	479	639	668	723	599		
TOTAL	6,567	7,799	6,635	7,116	6,692	7,771	7,259	9,145	8,287	10,416	9,246	0	0
				15,683,664	Pounds	17,127,284	Pounds	20,155,580	Pounds	22,956,864	Pounds	0	Pounds

Muskoka Recycling
Materials Recycled

OLD BOXBOARD
Examples of boxboard packaging are: **detergent/laundry cartons, cereal boxes, cracker and biscuit boxes, shoe boxes, tissue boxes, and over the counter drug boxes (toothpaste, toiletries, cough syrup and cosmetics).**

FIBRE EGG CARTONS & EGG FLATS
Made from recycled paper.

RESIDENTIAL HOUSEHOLD PAPER
Examples of mixed household papers: **junk mail, cash register receipts, writing paper, envelopes, computer paper, and clean paper packaging.**

BROWN PAPER & BAGS
Examples are: **paper grocery bags, liquor store bags and brown packaging paper.**

POLYCOAT (WAX) MILK & JUICE CARTONS
Examples are: **milk cartons, juice cartons, whipping cream cartons, and Tetra Pak drinking boxes.**

ALUMINUM TRAYS & FOIL
Examples are: **pie plates, take out containers, T.V. dinner trays, oven roasters and clean household foil**. **DO NOT** include: aerosol cans, butter and candy wrap, "take out" lids, metallic potato chip and snack food bags, and blister foil for tablets/pills.

POLYSTYRENE (STYROFOAM)
Examples are: **foam meat and bakery trays, egg cartons, plastic or foam cups, foam fast food containers, and protective foam packaging.**

NEWSPAPERS, MAGAZINES & CATALOGUES
Please include **all newspapers, flyers, magazines, catalogues and telephone books**.
DO NOT include hard cover books.

. . . 2

CORRUGATED CARDBOARD
Examples are: **boxes used for shipping stereos, furniture, large appliances or groceries** (it has wavy corrugations in the middle). The boxes must be flattened and cut to a size of 30" x 30". **DO NOT** include waxed boxes.

CLEAR & COLOURED BOTTLES & JARS
Only container glass is acceptable. **PLEASE RINSE** the containers. Lids and labels can remain on. **DO NOT** include any other types of glass, ceramics, dishes, window glass, pyrex, drinking glasses etc.

METAL FOOD & BEVERAGE CANS
PLEASE rinse the cans. Labels can remain on. Place metal lids from the cans in the bottom of the can and pinch the top to trap the lids inside. **DO NOT** include aerosol cans, paint cans, metal pots & pans, sheet metal etc.

PLASTIC LIQUOR & SOFT DRINK BOTTLES (P.E.T.)
PLEASE rinse and labels can remain on.

RIGID PLASTIC CONTAINERS
Examples are: **bottles for detergents, water, juice, bleach, shampoo, anti-freeze and others with a small top.**

MIXED PLASTICS
Examples are: **plastic grocery bags, large mouth containers such as yogurt, ice cream, margarine and sour cream etc.** **DO NOT** include vinyl siding or commercial & industrial quantities.


CONTAINERS ONLY

WHERE DO THE RECYCLABLE MATERIALS GO ?

MATERIAL	MARKET	USE
Newspaper, Magazines and Catalogues	Newspaper Mill– Ontario Linerboard Mill – Ontario	Newspaper Box Board
Corrugated Cardboard	Cardboard Mill – Ontario Linerboard Mill – Ontario	Cardboard Box Board
Telephone Books	Newspaper Mill – Ontario Tissue Mill – Quebec	Newspaper Paper Toweling
Office Paper	Tissue Mill – Quebec Paper Mill – U.S.A.	Toilet & Facial Tissue High Grade Paper
Clear Container Glass	Consumers Glass – Ontario	Container Glass
Coloured Container Glass	Consumers Glass – Ontario	Container Glass
Steel Cans	De–tinning Mill – Ontario	Manufacture of Steel
Aluminum Cans	Alcan Mill – Ontario	Manufacture of Aluminum
Plastic Soft Drink Bottles (P.E.T.)	Plastic Mill – Quebec Wellman – S. Carolina	Soft Drink Bottles, Carpet, Snow Fencing, Bubble Mattress etc.
Rigid Plastic Bottles	Regrind Plant – Ontario	Rigid Plastic Bottles
Mixed Plastic	Plastic Manufacturer – Ontario	Lumber Substitute
Old Boxboard	Linerboard Mill – Ontario	New Boxboard
Mixed Household Paper & Egg Cartons	Newspaper Mill – Ontario Linerboard Mill – Ontario	Newspaper New Boxboard
Brown Paper & Bags	Cardboard Mill – Ontario Linerboard Mill – Ontario	Cardboard New Boxboard
Milk & Juice Cartons	Paper Mill – U.S.A.	Tissue & High Grade Paper
Aluminum Trays & Foil	Metals Broker – Ontario	Manufacture of Aluminum
Polystyrene/Styrofoam	C.P.R.A. – Ontario	New Foam Products

RECYCLE. RECYCLE. RECYCLE. RECYCLE. RECYCLE. RECYCLE. RECYCLE. RECYCLE. RECYCLE.

MUSKOKA's TWO STREAM RECYCLING SYSTEM

We suggest using two Blue Boxes

BLUE BOX for FIBRES

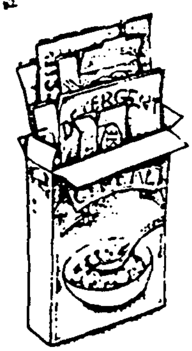
NEWSPAPER
* including advertising inserts and glossy flyers

MAGAZINES

CATALOGUES

TELEPHONE BOOKS

CORRUGATED CARDBOARD
* layered cardboard boxes with a ripple between the layers



BOXBOARD
* cereal, detergent, shoe boxes, kleenex and cardboard tubes

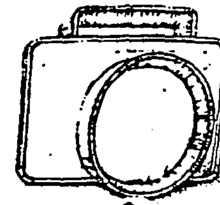
EGG CARTONS

MIXED & OFFICE PAPERS
* junk mail, writing paper, envelopes, brochures and coupons

BROWN PAPER & BAGS

TEXTILES
* place clean clothing and household linens into a plastic bag, tie with some textile and set into the Blue Box.

BLUE BOX for CONTAINERS



GLASS BOTTLES & JARS
* clear and coloured beverage and food containers

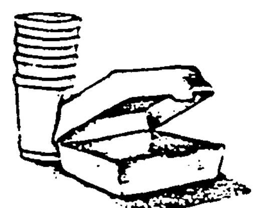
METAL BEVERAGE & FOOD CANS

ALUMINUM TRAYS & FOIL

PLASTIC SOFT DRINK BOTTLES (P.E.T.)

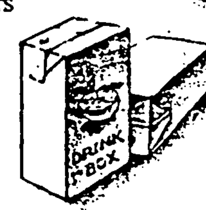
RIGID PLASTIC BOTTLES
* antifreeze, windshield washer, milk, fabric softener and bleach bottles, etc.

MIXED PLASTIC
* margarine, ice cream, yogurt, ketchup, peanut butter and shampoo bottles, etc.



PLASTIC FILM
* store plastic bags in another plastic bag, tie and place in Blue Box

POLYSTYRENE (styrofoam)
* meat trays, bakery trays, plastic and foam cups and fast food containers



WAX COATED MILK and
JUICE CARTONS
JUICE DRINK BOXES

REMEMBER **keeping the materials separated into these two streams will help to keep the cost of operating the recycling program under control.**

We thank you in advance for your participation in this waste diversion program.

NEED TO KNOW MORE ABOUT THE PROGRAM?

CALL: 645-6080 or 1-800-461-5544

MUSKOKA RECYCLING
DISTRICT MUNICIPALITY OF MUSKOKA
"Making Recycling Work"

RECYCLE. RECYCLE. RECYCLE. RECYCLE. RECYCLE. RECYCLE. RECYCLE. RECYCLE. RECYCLE.

LANDFILL GAS DEVELOPMENT
Within an ISWM Framework

WALTER GRAZIANI, P. ENG.

Gas Recovery Systems, Inc.
Comcor Environmental

GRS
Gas Recovery Systems

COMCOR

WHY COLLECT AND UTILIZE LANDFILL GAS?

- Reduce liability
- Environmental benefits
- Current and pending Regulation/Legislation

REDUCE LIABILTY

- Migration of landfill gas in subsoils off site can create explosion hazards
- Nuisance effects from uncontrolled landfill gas venting can create odour problems
- Vegetation damage

ENVIRONMENTAL BENEFITS

- Control of LFG can reduce greenhouse gas (GHG) emissions
- 26% of uncontrolled methane emissions by source in Canada are attributed to landfills
- Methane is 21 times by weight more potent than carbon dioxide as a GHG contributor
- National Goal - Stabilize net emissions of GHG at 1990 levels by the year 2000
- Collection and flaring of LFG is good public policy but utilizing the energy is the highest and best use of the LFG

ENERGY PRODUCTION / PROFIT

- LFG can be used to produce electricity or as an industrial fuel
- LFG in Canada has potential to heat more than 500,000 homes
- LFG utilization can produce a profit to the landfill owner and/or reduce operating costs

REGULATION / LEGISLATION

- CURRENT OR PENDING LEGISLATION IN MANY JURISDICTIONS
- UNITED STATES
  - Clean Air Act - new source performance standards and emissions guidelines (NSPS)
  - 2.5 million tonnes in place must undergo testing and control
- UNITED KINGDOM
  - LFG collection required
- SPAIN
  - LFG collection required
- ITALY
  - LFG collection required
- CANADA
  - Federal regulation for GHG reduction ?

DEVELOPING A LANDFILLL GAS UTILIZATION PROJECT

TWO SPECIFIC ASPECTS OF A LANDFILL GAS UTILIZATION PROJECT

- Technical aspect
- Financial aspect

TECHNICAL ASPECTS

- GAS CHARACTERIZATION
  - Gas quality
  - Gas quantity
  - Gas collection
- TECHNOLOGY SELECTION
  - ELECTRICAL PRODUCTION
    - Reciprocating Engines
    - Gas Turbines
    - Boiler Steam Turbines
  - MEDIUM BTU GAS - GAS FOR INDUSTRIAL USE
    - Compression
    - Drying
  - HIGH BTU GAS
    - Chemical Solvent
    - Membrane
  - NEW TECHNOLOGIES
    - Compressed natural gas for vehicle use

TECHNICAL HURDLES

- Gas characterization/supply is by far the most problematic issue
- Over 30% of the existing projects were overdesigned for capacity (i.e. gas limited)
- Majority of premature project closures are due to LFG gas supply problems
- Important to have experienced firms involved with gas projections/collection/field operation
- If project fails it will likely fail due to a gas shortage

FINANCIAL ASPECTS

- CAPITAL COSTS
  - Excess capacity
  - Technology selection
  - Pretreatment
  - New vs. Like new equipment
- CONTRACT NEGOTIATION WITH MONOPOLIES
- FINANCING
  - Security of developer
  - Security of end user
  - Credibility of developer / operator
  - Technolgy selection
  - Closing costs and due dilligence
  - Validity of contract

FINANCIAL HURDLES

- Relatively easy to determine if project economically viable
- Largest financial hurdle is securing a contract and securing a contract acceptable to financier
- Contract and end user are most contentious issues with financier
- Weak end user will generally kill project or financier premium on loan rate to compensate for risk will kill project
- Landfill owner has to be aware of financial hurdles developers face to bring a utilization project on line
- At present it is not realistic for landfill owner to expect a significant royalty
- Landfill owner benefit is that the LFG issue is being managed for the site

Integrate Solid Waste Management
CHALLENGES TO THE PRIVATE SECTOR
Presentation to:
The Canadian Integrated Solid Waste Management Workshop
March 3, 1998

By: Alison Braithwaite
Environmental Regulatory Coordinator
Walker Industries Holding Limited

In order to understand the challenges to the private sector it is important to put them into perspective of society as a whole. Figure 1 is a model of the interactions within society that influence the decisions that are made. This model of society can be used to explain the breakdown of public policy development including the development of integrated solid waste management systems.

There are at least six major forces that influence decision making:

1. GOVERNMENT - the role of government is the Guardian of Society. Its survival depends on:
    - money from business
    - votes from the general public
    - their image in the media

   They have a short term of about 4 years to make a difference.
   The structure of government (departmentalizing issues) creates a system of examining problems to closely. It discourages resolving society's problems on a macro level (looking at the big picture). It encourages the micro-management of issues which leads to a web of ineffective policies.
2. BUSINESS - the survival of business depends on growth and profit. This means making money, keeping our customers happy, being innovative and influencing government so they do not do anything that could compromise our potential for growth and profit.
3. GENERAL PUBLIC - the survival of each individual depends on having money to meet our needs. The general public is the electorate, the tax payer, the consumer (of media and of products and services). The general public votes most effectively with their wallet.
4. MEDIA - the survival of the media depends on selling products. They make money by being sensational.
5. UNIONS - the purpose of a union is to influence government and business in order to protect their members. The survival of unions depends on having members or making money through union dues.
6. NON-GOVERNMENTAL ORGANIZATIONS (NGO supported by business have similar motives to business) - the purpose of an NGO (that are not business associations) is to influence government to be better guardians of society.

The common motive for these groups is survival. The common need is money. The common thread is the marketplace. The common flaw is a lack of leadership, and a lack of long term planning. The economic system is the key to developing self-sustaining public policy. (The Ecology of Commerce, by Paul Hawkin outlines a way to use the economic system to ensure the guardianship of the planet.)

In order to survive Business must:

- react quickly to change
- be innovative
- get a jump start on the competition
- offer something that nobody else has (good service, good product, low prices)

Timing is crucial to stay profitable and continue to grow, to survive.

The barriers to innovation include:

- lack of a level playing field
- onerous and time consuming approvals
- inability to deal with innovation
- government desire to control business
- regulating by exemption
- regulating as a reaction to outrage

Lack of a level playing field:
In order to compete fairly it is necessary for each competitors to follow the same rules. The level competition is affected by:

- unclear legislation which results in different interpretations of the law
- different laws between municipalities
- different laws between provinces
- different laws between countries
- global agreements
- different rules for the public and private sector

Approvals:
Timing is crucial to make sound business decisions. If time lines are not met the window of opportunity in the market place may disappear. With approvals there is a loss of control over the timing of a business concept. This loss of control over timing makes planning more of a challenge to business. It makes the decision as to whether an investment makes good business sense more difficult. Timing is also affected by the number of approvals that are required by different agencies for the same project. It is also difficult for business to determine all the approvals that are required for a given investment.

Approvals also have an effect on the level playing field. Requirements for approval and conditions of approval evolve over time. This means two company (one old and one just entering the market) in the same business will have completely different requirements. This creates an uneven field for competition.

Inability to Deal with Innovation:
Legislation is a good kick start for change. Legislation however does not easily evolve. Given the forces at work in society (see figure 1) it is not easy to make changes to legislation. Legislation is written at a specific point in time to address the specific problem of the day. It tends to be rigid and therefore unable to address the innovations of the future. It is not written to promote or address innovation.

Control of Business:
Business does not like to be told what to do. Legislation is an attempt by government to balance control and guardianship. Government has a tendency to be afraid to lose control so the adopt inclusive legislative language and only exempt what clearly needs no control. An example of this is the definition of waste that was just introduced by the Ontario Ministry of the Environment.

Government also tends to regulate for the bad actor. This leads to government being very directive instead of setting goals. It is with the directive approach that we can find ourselves entangled in a web of legislation that was written for different times.

Government also has a tendency to want to create unnatural and therefore non-sustainable systems. (eg. landfill bans and Ontario's proposed tire management program). Behaviour will not be maintained by implementing an artificial and non-sustaining system.

Reacting to Outrage:
Outrage is created in part from the inability of technical people to communicate. Outrage is the mainstay of media. It is sometimes created by the media and is always exploited by the media. It is not however a good reason for changing or creating public policy.

The politician wants to use the development of public policy as a means to pacify the public (and more importantly the media). By reacting to outrage the politician can be seen to be reacting, be seen to be the guardian of society.

Developing public policy from outrage leads to poor decisions. It leads to decisions that neither protect the environment nor the marketplace.

Appropriate Public Policy
Public policy should focus on the purpose of the government which is as the guardian of society.

It should be written in a manner that encourages innovation. This is done by thinking to the future when it is being developed.

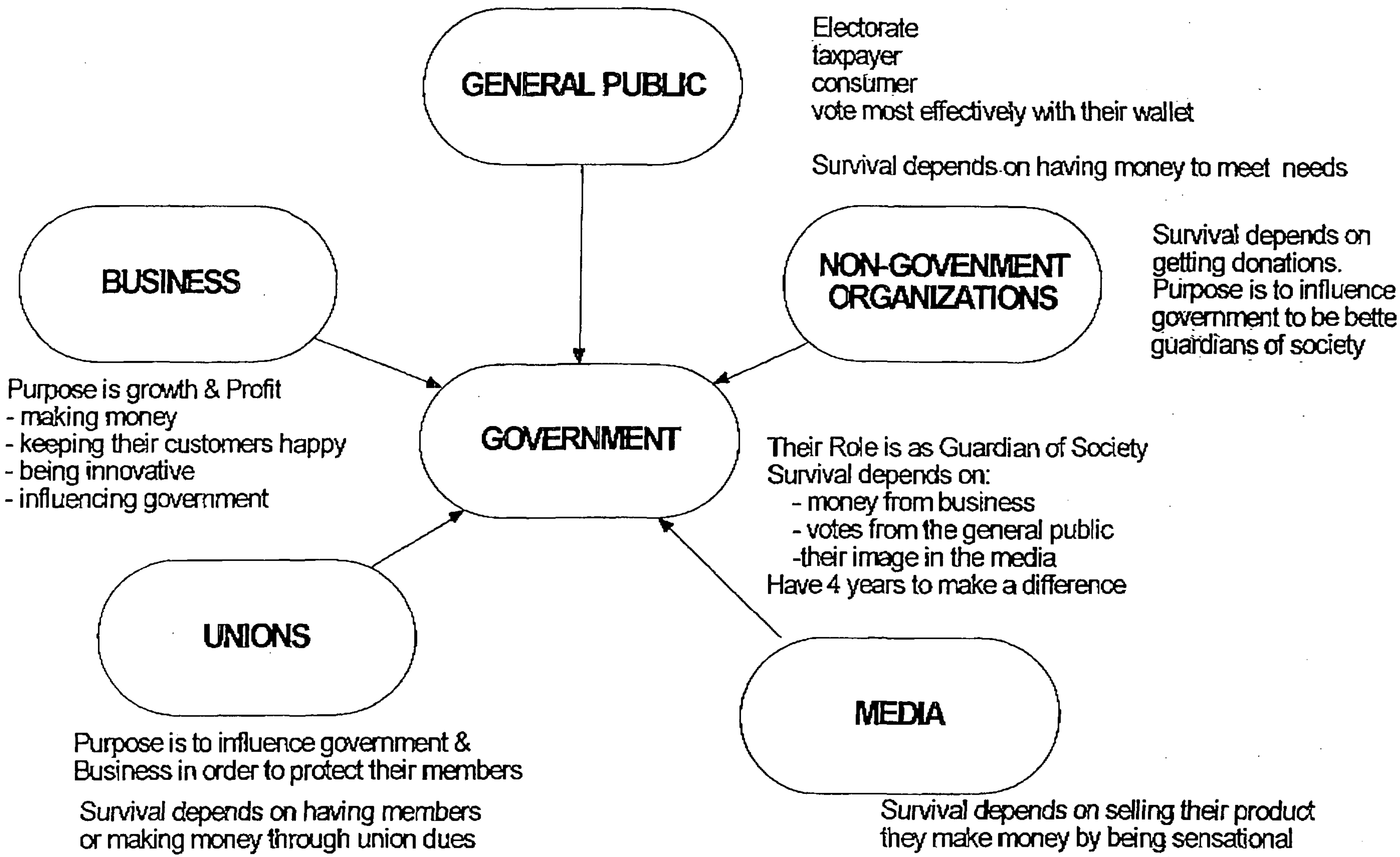
Public policy should set goals and not provide a recipe for how they should be reached.

Public policy should look at the big picture. It should not treat a symptom but address the disease.

Public policy should use the most powerful tool we have today... the marketplace.

Questions that Should be Asked when Developing Public Policy:
1. Have we properly defined the problem?
2. Are we focusing on the symptom and not the disease?
3. Does this promote innovation?
4. Are we drawing on the right expertise? (ie. not too departmentalized).
5. Are we looking far enough into the future?
6. Are we providing a timeframe industry can adapt to (and survive)?
7. Is there a way of influencing the economic system to reach our goals? (this does not mean creating an unnatural marketplace that is not sustainable).

Figure1: SURVIVAL



Today I will present to you the foundation of P.E.I.'s Waste Management System for the mid 90's and beyond. The system is called "Waste Watch".

Waste Watch is a system based on source separation which promotes waste reduction and waste management education. But first let me give you a brief overview of waste management in P.E.I. to lay the groundwork for where we are today.

P.E.I. - THE GARDEN OF THE GULF

A place of rolling hills, farm after farm, miles of beautiful rivers and estuaries, beautiful beaches and only 130,000 people.

My colleagues have said: You can't have waste management problems there.

Well, P.E.I. is only 1.3 million acres in size. 750,000 acres are in agricultural production. Some 200,000 acres are wetlands and estuaries and some 40,000 acres are in urban developments. Throw in the facts that P.E.I. is the most densely populated Province in Canada and we're 100% dependent on groundwater, you begin to get an understanding that locating a landfill and /or compost site that's not in someones backyard is difficult to say the least. Also were no different than most residents in North America. We generate too much waste and therefore we do have waste management problems.

In the 1970's we had two Tee-Pee burners or smokers and approximately 450 dump sites.

In 1973 the Provincial Government stepped in and took over the waste management system. The municipalities, "surprisingly enough", said **IF YOU WANT IT, YOU CAN HAVE IT**.

Within a few years three sanitary landfills were opened along with 6 roll-off container sites or mini transfer stations. All but 40 of the community dumps were closed. Add in an Energy From Waste Plant in 1983 and you have the system which became my responsibility to manage in 1988.

Today we have :
- 1 Energy From Waste Plant,(owned by Trigen Energy Systems) 3-33tpd Consumat incinerators, 2 Wood Chip Burners c/w APC, a 1.25 mgw generator & District Heating System
- 1 Composite lined landfill c/w leachate collection
- 1 Compost facility (9000 t per year)
- 1 Regional Sanitary Landfills
- 9 Roll-off Container Sites
- 17 Community Disposal Sites

The disposal fee is set by the Province and is currently at $36.00 per metric tonne.

Now we come to the waste management problems or as I prefer to call them challenges.

The Energy From Waste Plant is at or over capacity 7 to 9 months of the year, the Queens County Regional Landfill's operational agreement expires in July of 2000 and the Kings County Regional Landfill will close to all but inert materials in September of 1997.

Waste Watch was "adopted" in the East Prince Region in December of 1994 and the East Prince Waste Management Commission was formed.

A valuable asset in developing the windrow composting expertise was gained through the PVYn potato crisis. This gave us confidence that composting could be a major component of the waste management system. Approximately 18,000 tons of mostly rotten potatoes, by the time we got them to the compost pile, were successfully composted. At the peak of the program we had some 22 miles of windows.

The decision was also made that only dry waste/bulk inert materials would be landfilled. This meant all recyclables that could be economically recovered and marketed had to be removed. Thus the concept of Waste Watch. This idea seemed new, even radical! Would people accept it? Could people be taught how to separate?

Remember when I said we "adopted" Waste Watch.

Picture if you will a major North American City. The waste management system is in critical condition. Along comes a man with a vision. This vision became reality and a fully integrated waste management resource recovery facility was developed which boasted **a 60% recovery rate**.

Metals and glass were sorted using an 80 foot conveyor belt/sorting system.

All the City's food waste was collected and processed for utilization as fertilizer and other products. The remaining waste was incinerated and the energy recovered used in the facility and the community. The City was New York. The year was 1896.

The idea of "Waste Watch" was not new or radical. People did what was needed then and in some areas of North America and many areas in Germany and other European countries waste separation is a way of life. But, could we do it in P.E.I.? Well after almost to two years of operation we have shown a municipal waste diversion of over 60% and a total reduction of all waste being landfilled by 45%.

Something unique about how the original demonstration began in 1992. Municipal councillors went door to door to solicit participants in designated areas of their respective municipalities. Signing up people that were keen and some not so keen. In fact in several homes there was a resounding **NO**. But with some persistence and encouragement people agreed to give it a try.

After the success of the demonstration program it was rolled out to the entire East Prince Region in December of 1994.

Each home is given: - A Sorting Guide which includes

- A Recyclables List
- A Compostables List
- A Waste List
- A Collection Schedule/ Calendar
- One Compostainer cart 240 l
- One Refuse cart 240 l
- One 7 l mini bin

Another unique feature of the program is the Collection Schedule. It is based on a 2 week cycle throughout the year: Compost, Garbage, Compost, Garbage. Also Recyclables are only picked up once a month using a two stream Blue Bag system. (Fibres Bag #1 & Mixed Recyclables Bag #2)

The backbone of the system is the carts. The program does not allow the use of bags for Compost and actively discourages the use of bags for Garbage.

- The most important cart is the Compostainer - CRITICAL to keep organic waste in an "aerobic" condition to allow for the bi-weekly collection and also to enhance the composting process.
- A waste cart with no bags allows inspection every time the cart is dumped.
- A Mini Bin for the kitchen helps to make it convenient in the kitchen. Also many people, over 5000 have purchased the household murf by Recycle Action
- Blue Bags are purchased at local grocery and hardware stores.

Residents place kitchen waste, garden and yard waste in the compostainer. The container is then placed at curbside. This material is composted using windrow technology with the first 30 to 40 days under roof (1 acre).

Normally temperatures in the piles will reach 65°C in 10 to 12 days.

Compost records are kept on every windrow and a summary of the amount and types of material used in each windrow is maintained.

Compost quality is of utmost importance and we believe that **quality material in** gives **quality material out**.

NOTE: All mature compost produced to date has been sold.

The ability to inspect at the curbside is vital to and has greatly enhanced our quality control.

The entire East Prince Region is on Waste Watch. This includes approximately 10,400 households and some 1000+ businesses.

The chart attached depicts just what people can do when given the OPPORTUNITY and GOOD tools to do it conveniently and cost effectively.

What about institutions and businesses. Prince County Hospital - 100 beds. They had a recycling program which the Department assisted in setting up 2 years before Waste Watch, so they were very keen about the program from the beginning. The separation figures obtained by this group of committed employees has been tremendous. 75% Compostables, 25% Waste. Note: Biomedical waste is handled separately.

In closing I would like to stress that the system was set up so that the total costs would change very little in most communities. In fact, in the long term the home owner saves on the cost of bags and also on disposal fees.

NOTE : 1.Reduction as a result of drying out of organic material.

2.The tip fees for waste are expected to rise in coming years and remain steady for compost.

Prince Edward Island has many other Waste Reduction Initiatives including:

- 1.Complete Refillable requirements and deposit/return system for all flavoured carbonated beverages and beers.
- 2.Deposit/Return system on all wine and Liquor bottles.
- 3.Tire Tax of $2.00 with Free Island wide collection and no disposal fee if placed in proper container.
- 4.Core charge for new Lead acid batteries Refundable with old battery.
- Other programs are listed on the attached sheet.

SO GOD WILLING WE WILL ALL TAKE RESPONSIBILITY FOR OUR WASTE BY MANAGING OUR WASTES AS RESOURCES AND OUR CHILDREN CAN LOOK FORWARD TO A LONG LIFE ON A BEAUTIFUL ISLAND AND BE PROUD OF THEIR HERITAGE.

THANK YOU.

Respectively Submitted

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P.E.I. Dept. Of Environmental Res.
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INTEGRATED WASTE MANAGEMENT IN LONDON
Concepts & Practices

PRESENTATION OUTLINE

1. Background - London

2. Waste Management Planning Versus Implementation

3. Continuous Improvement System
   - Framework - IWM
   - Public and Political Reaction
   - Unique Features

4. Next Steps

LONDON & IWM - PUSHING FORWARD

LONDON

- Cost has always been the single most important factor
- INTEGRATION and OPTIMIZATION thinking:
  - staff (60% Landfill Manager)
  - garbage trucks - day, night, some Saturdays
  - 15-18% ONP for sewage sludge bulking
- Began a Waste Management Plan?????

1. BACKGROUND

FACTS & FIGURES - 1997

LONDON

Major Program	Tonnes	$/te
Recycling	16,025	$40
Yard Collection & Composting	4,800	$60
Yard Materials Depots	5,200	$35
Leaf Collection & Management/composting	4,200	$60
Garbage Collection	92,800	$40
EFW	46,500	$29
Disposal	120,000	$14 ($14)
Operating & Partial Capital	**$9.1 M**	**$65**

1. BACKGROUND

FACTS & FIGURES - 1997

LONDON

"London garbage hits a new low
Amount drops 35% in 10 years"

- **420 kg per capita residential waste sent to disposal facilities - 1987**
- **273 kg per capita - 1997**

Actual numbers	**31,100**
Evidence based numbers	**3,000**
Calculated numbers	**8,900**
"Disappeared"	**7,000**
TOTAL	**50,000**

3. WASTE MANAGEMENT IMPLEMENTATION

LONDON

- London is a single tier government
- Planning and implementation must go "hand-in-hand"
- Budget challenges pushed IWM thinking even further
- REDUCING MUNICIPAL COST
- PARTNERING
- COMMUNICATIONS

REDUCING MUNICIPAL COST

LONDON

- user pay for white goods
- ban on collection of grass
- cancelled "clean-up" weeks
- user pay for grass at the Depots
- reduced garbage collection frequency
- yard materials and leaf collection weeks (not days)
- demonstrations & modelling

DIFFERENT DAY

Garbage & Recycling Calendar

The Corporation of the City of London

SEPTEMBER '97

SUN	MON	TUES	WED	THURS	FRI	SAT
	1 STAT	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

OCTOBER '97

SUN	MON	TUES	WED	THURS	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13 STAT	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

NOVEMBER '97

SUN	MON	TUES	WED	THURS	FRI	SAT
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24	25	26	27	28	29

DECEMBER '97

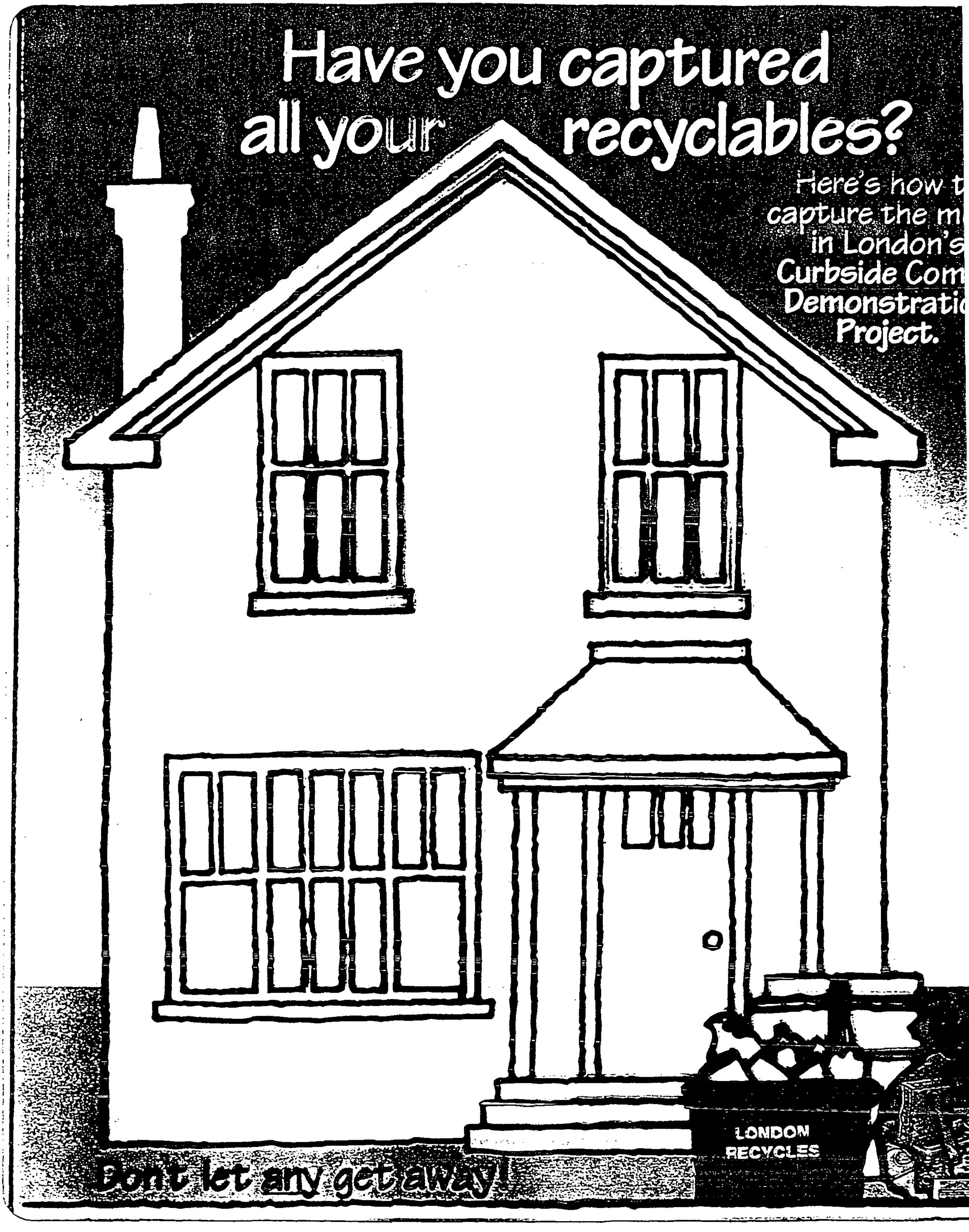
SUN	MON	TUES	WED	THURS	FRI	SAT
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25 STAT	26 STAT	27
28	29	30	31			

JANUARY '98

SUN	MON	TUES	WED	THURS	FRI	SAT
				1 STAT	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

FEBRUARY '98

SUN	MON	TUES	WED	THURS	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28


Have you captured all your recyclables?
Here's how t
capture the m
in London's
Curbside Com
Demonstratio
Project.
LONDON RECYCLES
Don't let any get away!


LONDON
CARES
BLUE BOX
FOOD
DRI♥E

CSR
CORPORATIONS
SUPPORTING
RECYCLING

LONDON

Working in partnership to help London meet the objectives of *Recycle 2000: Our Vision Includes You*

COMMUNICATIONS IN WASTE MANAGEMENT

LONDON

Our assessment with residents and the media indicated:

- **more feedback**
- **constant reminders**
- **simple messages**
- **“Event” oriented**
- **multi-media**
- **slogans**

LONDON'S IWM INVOLVEMENT WITH CSR & EPIC

London's input:

- **data input requirements & critique**
- **practical applications & user friendly tools**
- **data interpretations *(and misinterpretations)***

London's needs - data output & interpretations FOR ANY current & future changes:

- **cost**
- **environmental impacts**
- **labour**

4. CONTINUOUS IMPROVEMENT SYSTEM

LONDON

DEFINITION:

- continuous improvement - a dynamic framework that strives to make annual improvements to protect human health & the environment by effectively allocating dollars & resources

- Key items include:
  - increased access to data
  - improved data analysis
  - community input

LONDON

4. *CONTINUOUS IMPROVEMENT SYSTEM*

KEY ELEMENTS

Annual System Goals:

- ✔ minimize the production of garbage
- ✔ minimize environmental burden
- ✔ minimize cost to taxpayers
- ✔ maximize opportunities for new business

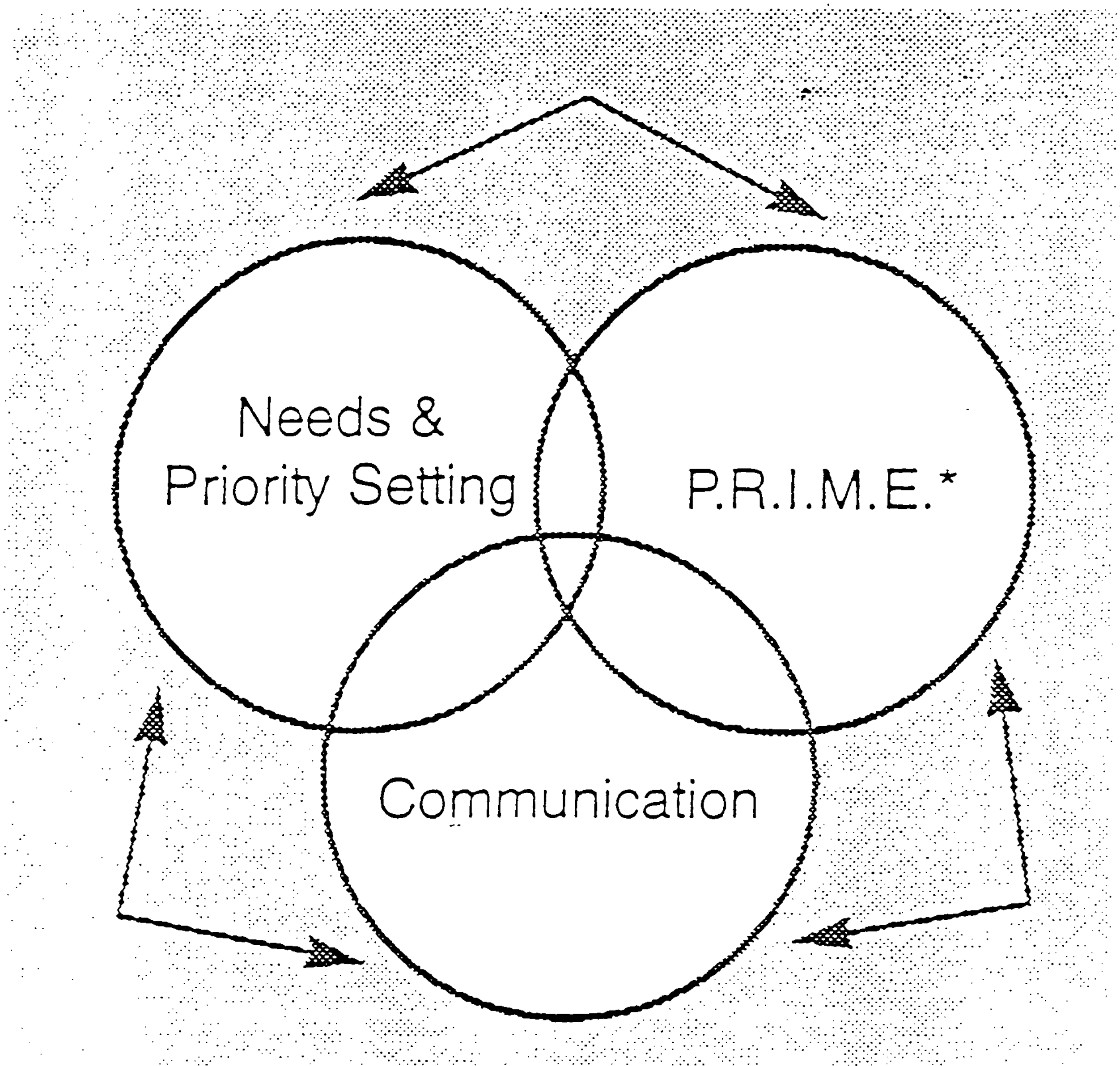
Systematic Framework that annually:

- monitors existing system
- monitors other jurisdictions
- obtains input and feedback from users
- evaluates potential new components
- implements approved components

4. CONTINUOUS IMPROVEMENT SYSTEM

LONDON

HOW DOES IT WORK?



LONDON

POLITICAL AND PUBLIC REACTION

Public:

- generally supportive - the environmental application
- some skepticism about our ability to undertake
- management tool only (no action)

Political:

- positive
- consistent with current City direction
- wise
- "business-like"

SOME NEXT STEPS FOR IWM IN LONDON

- Compare 1997 to 1996 AND Refine Reporting Framework
- Alternative recycling systems?? Co-collection vehicles in the City??
- Benchmarking/Best Practices
- Upcoming recycling Tender/RFP - what materials?
- Is there a role for city's landfill in upcoming Tender/RFP?
- Is there a role for front-end recovery at the EFW facility?

LONDON

4. UNIQUE FEATURES OF THE STRATEGY

- **no long term "traditional diversion" targets**
- **no mention of the "hierarchy"**
- **a Council commitment to:**
  - **partnerships**
  - **Continuous Improvement Framework (e.g., IWM Tool)**
- **establishment of a multi-sector waste management advisory committee (needs & priorities)**

INTEGRATED WASTE MAN.

THE EPIC/CSR/LONDON MODEL

INTEGRATED WASTE MAN.

- EPIC HAS ALWAYS PROMOTED ISWM.
- STRICT RELIANCE ON 3R'S CAN LEAD TO ENVIRONMENTAL MISTAKES AS WELL AS ECONOMIC DIFFICULTIES.
- HOW CAN YOU PLAN FOR WASTE MAN. SYSTEMS WHICH PROVIDE LOWEST ECOLOGICAL IMPACT FOR THE FINANCIAL RESOURCES AVAILABLE..
- EPIC HAS BEEN INVOLVED IN DEVELOPMENT OF LIFE CYCLE INVENTORY AS PART OF THE CDN. RAW MATERIAL DATA BASE AND A NORTH AMERICAN INVENTORY FOR PLASTICS.

INTEGRATED WASTE MAN.

- ATTENDED MEETING OF A WORKING GROUP OF THE INTERNATIONAL ENERGY AGENCY (IEA) IN 1996.
- LISTENED TO REPORTS OF THE WORK OF EPA (US) AND DOE (UK).
- MULTI MILLION $ LONG TERM PROJECTS TO ASSESS ECO IMPACT OF SOLID WASTE SYSTEMS.
- BOUNDARY CONDITIONS WENT FROM BIRTH OF A SUBSTANCE TO ITS DEATH AND BURIAL.
- WONDERED IF WE COULDN'T HAVE A SIMPLER *FRAMEWORK* WHICH WOULD BE USEFUL AS A GUIDE FOR DECISION MAKING.
- RESULT IS WHAT YOU WILL SEE TODAY.

INTEGRATED WASTE MAN.

- THE *FRAMEWORK* HAS BECOME A MODEL WHICH IS USEFULL FOR ITS INTENDED PURPOSE..
- THE DATA INCORPORATED IN THE MODEL IS THE BEST AVAILABLE IN THE PUBLISHED LITERATURE. THE SOURCES ARE ALL ACKNOWLEDGED.
- NEW DATA BECOMES AVAILABLE ALL THE TIME.
- NO MATERIAL SECTOR eg.PLASTICS HAS SLANTED THE DATA TO ITS ADVANTAGE .
- THE PROCESS AS WILL BE SEEN IS TRANSPARENT.
- **SO LET THE SHOW BEGIN.**

INTEGRATED SOLID WASTE MANAGEMENT TOOL

The ISWM Tool

- Establishes environmental and economic baseline data
  - environmental life cycle effects
  - economic system costs
- Evaluates the effects of proposed waste management system changes
- Allows site specific analysis
- Considers a range of environmental effects (greenhouse gases, smog precursors, acid gases, etc.)

EPIC ENVIRONMENT AND PLASTICS INDUSTRY COUNCIL

CSR CORPORATIONS SUPPORTING RECYCLING

PROCTOR & REDFERN

INTEGRATED SOLID WASTE MANAGEMENT TOOL

Life Cycle Model - Input Screen D

MATERIALS RECOVERY FACILITY

Annual energy consumption:

Electricity	25	kwh/tonne
Natural gas	10	MJ/tonne

Residue: 5 %

Residue management:

(•) landfilled ( ) incinerated

Distance to markets:

Paper		km
Glass		km
Ferrous		km
Aluminum		km
Plastics		km

Distance from MRF to landfill/incinerator: km

< Back Next >

EPIC ENVIRONMENT AND PLASTICS INDUSTRY COUNCIL

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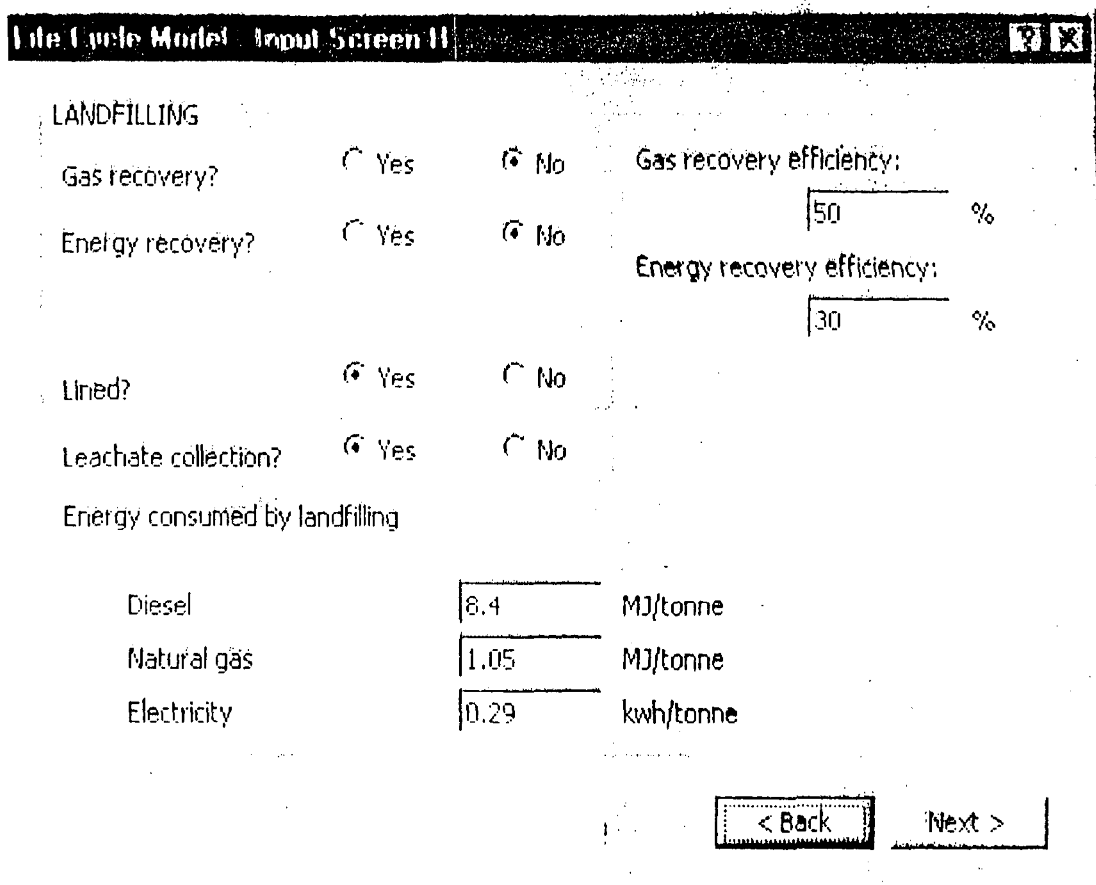
Life Cycle Inventory of Waste Management Systems

INTEGRATED SOLID WASTE MANAGEMENT TOOL



EPIC ENVIRONMENT AND PLASTICS INDUSTRY COUNCIL

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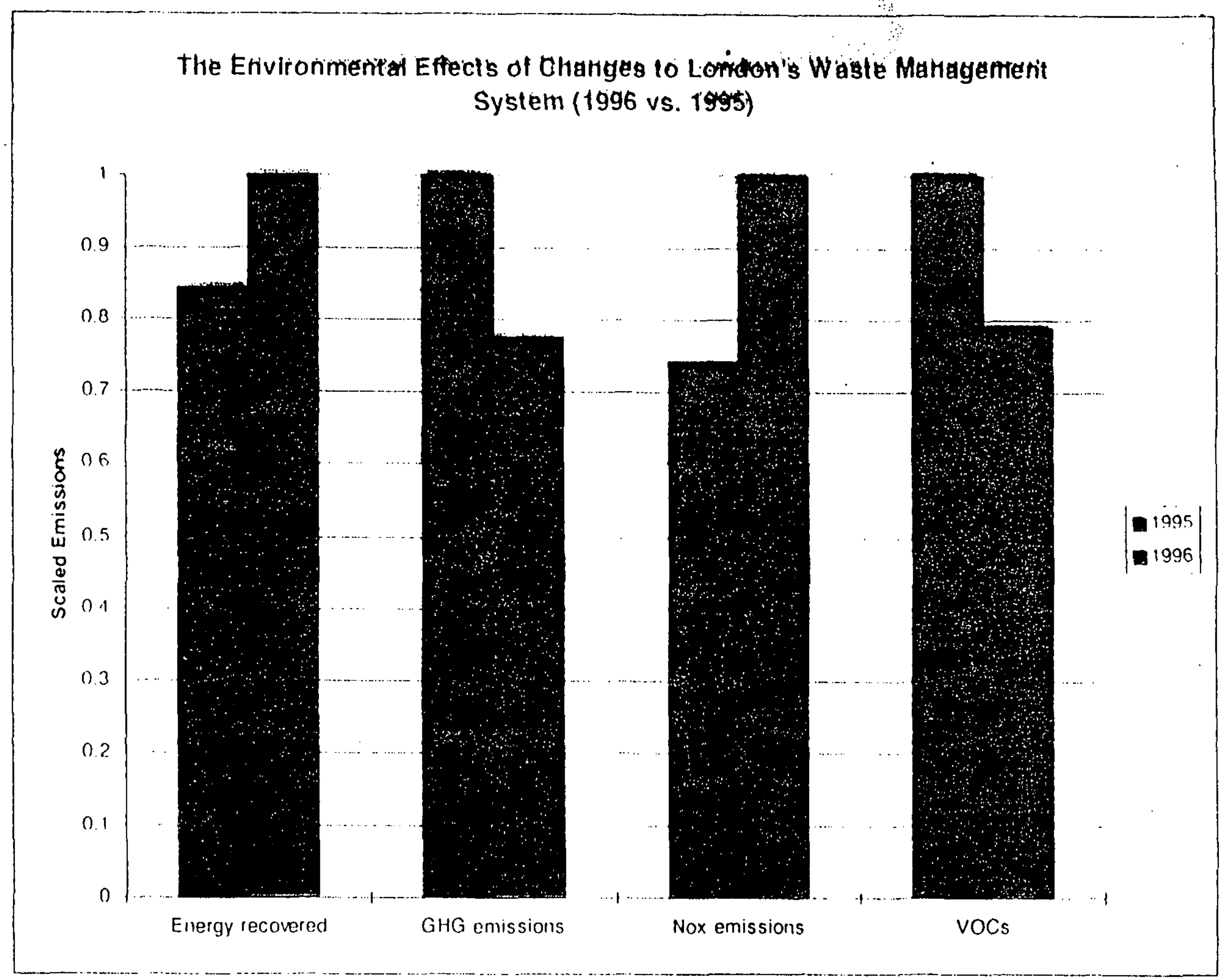
PROCTOR & REDFERN

INTEGRATED SOLID WASTE MANAGEMENT TOOL



EPIC — CSR — PROCTOR & REDFERN

SAMPLE RUN: CITY OF LONDON - A COMPARISON OF 1995 and 1996

INTEGRATED SOLID WASTE MANAGEMENT TOOL

	Scenario 1 - 1995	Scenario 2 - 1996	Change in Burden	Net Change (Sc. 1 - Sc. 2)	Burden Equivalents of the Net Change
Energy Consumed (GJ)	-733,664	-874,358	↓	140,694	Electricity for 3,200 homes for one year
Greenhouse Gases (t)	265,631	206,883	↓	58,749	Emissions from 15,700 cars for one year
Acid Gases					
NOx (t)	10.56	14.06	↑	3.5	Emissions from 200 cars for one year
SOx (t)	-57.41	-63.37	↓	6.0	Electricity for 800 homes for one year
HCl (t)	-1.45	-4.54	↓	3.1	Electricity for 7,200 homes for one year
Smog Precursors					
NOx (t)	10.6	14.06	↑	3.5	Emissions from 200 cars for one year
PM-10 (t)	3.9	-2.5	↓	6.4	Electricity for 1,400 homes for one year
VOCs (t)	40.0	20.94	↓	19.1	Emissions from 600 cars for one year

EPIC ENVIRONMENT AND PLASTICS INDUSTRY COUNCIL

CSR CORPORATIONS SUPPORTING RECYCLING

PROCTOR & REDFERN

Canadian Workshop on ISWM

Lawson Oates
City of Toronto
Works and Emergency Services
March 3, 1998

EA For Long-term Disposal

- new disposal capacity will be needed in 2002
- currently designing an EA Terms of Reference
- 4 Planning Principles: turn to marketplace; no generic comparison of technologies; 3Rs Strategy will identify residual; consultation is Toronto-based

Developing Evaluation Criteria

- Will engage three categories of evaluation criteria
- (1) Traffic safety effects and impact on the natural environment (from a macro-environmental perspective)
- (2) Ontario Benefits (including job creation and purchase of goods and services)
- (3) System Costs to Toronto

Integration:

- An approach where transportation and disposal options are combined using criteria judged against the understanding of environmental, economic and social impacts
- look at transfer point(s), haulage method (truck, rail), and disposal technology (EFW, landfill)

Life Cycle Inventory:

- The quantification of environmental impacts within a given set of boundaries (I.e. start and stop points) for individual options
- "Boundaries" defined as macro-environmental impact (not addressed by site specific approvals process)
- Direct energy consumption quantified -- not indirect

Cost-Benefit Analysis

- The quantification of economic and social impacts (jobs) for the delivery of services within individual options
- System costs to Toronto

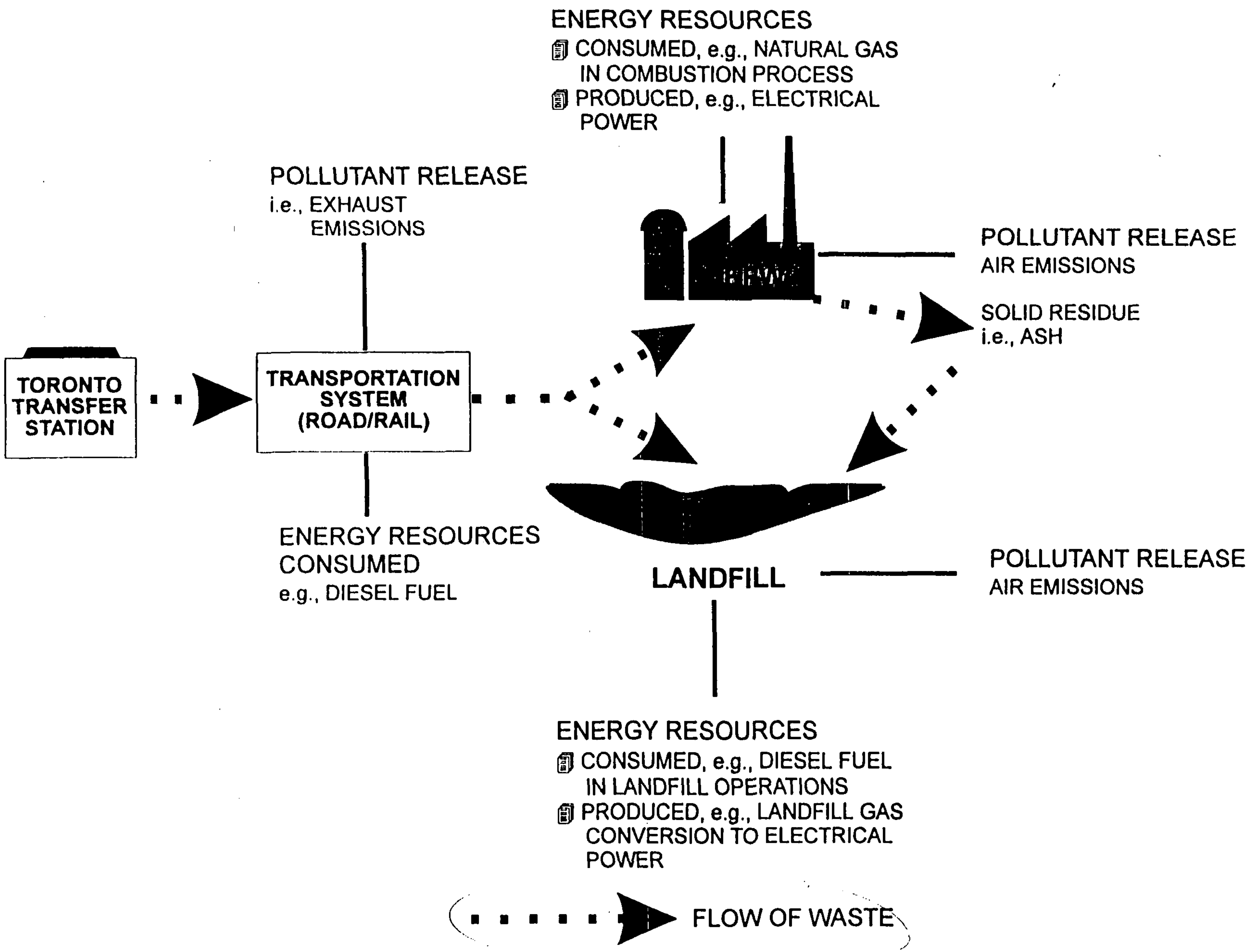
3RS

- to date use of ISWM has proved to be complex
- new approach must lend itself to “reasonable” application and understanding at public level
- can be used as a tool to determine: what materials will be in the recycling program

Operations

- good potential for ISWM to examine and justify movement of material from one stream to another -- for example diverting paper out of the disposal stream on basis that less methane will be produced
- opportunities for application of ISWM for collection services

FIGURE 1
ENVIRONMENTAL EFFECTS INVENTORY MODEL



APPENDIX 2 - WORKSHOP COMMUNICATIONS LIST

Canadian Workshop on Integrated Solid Waste Management - Communication List

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