Making a Case for WTE & Zero Wastes to Landfills
Nationally MSW is...

Recycled.................. 28 - 30%

Landfilled............... 60%

Combusted to produce energy......12%
America’s Waste Stream

1 ton MSW = c. 1 barrel oil
Recyclables

• Recycle, Dispose or Utilize?

• Glass, Paper, Metal, Plastics

• Recycle only about 15% of plastics
  • Plastics have the same energy as coal
  • Technical and economic reasons
Different management options can have different impacts...

• Landfills

• Waste to energy facilities

• Transportation
Landfills

- Adverse environmental effects of MSW landfills, including
  - toxic air emissions
  - future leaking, etc.

- Public health effects are estimated to be an order of magnitude or more greater than those of state-of-the-art WTE facilities.
Landfill Emissions

3/12/1996 the U.S. EPA issued the New Source Performance Standards

- NMOC implicated in the formation of atmospheric ozone
- NSPS required reduction of emissions of non-methane organic compounds (NMOC)
Landfill Emissions

- MSW landfills are estimated to release approx. 14,300 tons/yr of NMOC

- Landfill gases are likely to form dioxin/furan emissions when burned without proper controls
## Typical NMOC’s from Landfills

<table>
<thead>
<tr>
<th>Chemical</th>
<th>% Dry Volume</th>
<th>NMOC</th>
<th>ppmv</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>45 - 60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>40 - 55</td>
<td>Toluene</td>
<td>35</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>2 - 5</td>
<td>Dichloromethane</td>
<td>25</td>
</tr>
<tr>
<td>Ammonia</td>
<td>0.1 - 1.0</td>
<td>Ethylbenzene</td>
<td>7</td>
</tr>
<tr>
<td>Sulfur Comp</td>
<td>0.01 - 1.0</td>
<td>Acetone</td>
<td>7</td>
</tr>
<tr>
<td>Oxygen</td>
<td>0.1 - 1.0</td>
<td>Vinyl Acetate</td>
<td>6</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>0 - 0.2</td>
<td>Tetrachloroethylene</td>
<td>5</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>0 - 0.2</td>
<td>Vinyl Chloride</td>
<td>4</td>
</tr>
<tr>
<td>NMOC</td>
<td>0.01 - 1.0</td>
<td>Methyl Ethyl Ketone</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Xylenes</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dichloroethylene</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trichloroethylene</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benzene</td>
<td>2.1</td>
</tr>
</tbody>
</table>
Global Warming Potential from Landfills

Carbon Dioxide and Methane are the 2 major GHGs causing global warming

- Carbon Dioxide (CO2) 63%
- Methane (CH4) 18%
- Halocarbons 13%
- Nitrous Oxide (N2O) 6%
Global Warming Potential

**Sources of CO₂**
- Transportation: 33%
- Industrial: 28%
- Residential: 21%
- Commercial: 18%
- Agricultural: 21%
- Coal mining: 10%

**Sources of CH₄**
- Landfills: 25%
- Natural Gas Systems: 22%
- Other: 22%
- Agricultural: 21%
- Coal mining: 10%
Global Warming Potential

• Methane from landfills is 21x more potent in trapping solar heat than CO$_2$

• Even at 60% LFG collection rates, landfills are still 20x worse than WTE

• Equivalent carbon emissions of landfills (with active gas collection) is about 1.3 tons of CO2 greater than WTE combustion
Truck Emissions

- Dioxin emissions due to combustion of the fuel
- US EPA estimates 0.8ng TEQ per truck mile; Norwegian results higher & may have to do with salt & sulfur
- Polycyclic aromatic hydrocarbons (PAH)
Trucking Impact

NYC 2004 - 3 Million tons

= many 20 ton travel trailers to PA, VA & OH

= 26 million truck miles

= 32,000 lbs PAH (The average emissions of PAH was about 16kg/day/state, which is variable)
Health Risks

• As many as 15% of the general population suffer from multiple chemical sensitivity (MCS)
  – National Academy of Sciences

• Women near studied landfills have a four-fold increased chance of bladder cancer or leukemia
  – NYS Department of Health
Health Risks

• Disposing of waste via landfill can increase health risks 30-fold

• Emissions from diesel truck engines transporting waste to landfills resulted in a 10-fold increase in health risks
Waste-to-Energy Emissions

Yes, WTE has controlled emissions, but…

- Better multistage control equipment
- More consistent monitoring
Waste-to-Energy Emissions

The general public still voices the most concern about dioxins when considering a WTE plant:

- Dioxin emissions have dropped to insignificant levels in WTE facilities over the past 20 years

- 1987 – WTE is 63% of sources measured

- 2002 – WTE is 17% of sources measured
Reduction of Dioxins in U.S. Waste-to-Energy Plants

Annual Dioxins Emissions
Total for US

US EPA Data

TEQ grams per year

0 1000 2000 3000 4000 5000 6000 7000


# Average Emissions of 95 US Waste-to-Energy Plants

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Average Emission</th>
<th>EPA standard$^a$</th>
<th>Average Emission % of EPA Standard</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dioxin/Furan, TEQ basis</td>
<td>0.05</td>
<td>0.26</td>
<td>19.2%</td>
<td>ng/dscm</td>
</tr>
<tr>
<td>Particulate Matter</td>
<td>4</td>
<td>24</td>
<td>16.7%</td>
<td>mg/dscm</td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>6</td>
<td>30</td>
<td>20%</td>
<td>ppmv</td>
</tr>
<tr>
<td>Nitrogen Oxides</td>
<td>170</td>
<td>180</td>
<td>94.4%</td>
<td>ppmv</td>
</tr>
<tr>
<td>Hydrogen Chloride</td>
<td>10</td>
<td>25</td>
<td>40%</td>
<td>ppmv</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.01</td>
<td>0.08</td>
<td>12.5%</td>
<td>mg/dscm</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.001</td>
<td>0.020</td>
<td>5%</td>
<td>mg/dscm</td>
</tr>
<tr>
<td>Lead</td>
<td>0.02</td>
<td>0.20</td>
<td>10%</td>
<td>mg/dscm</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>33</td>
<td>100</td>
<td>33.3%</td>
<td>ppmv</td>
</tr>
</tbody>
</table>

$^a$EPA standard.
TCDD Emissions

nanogram/dry std cubic meter

USEPA
EU
WTE-NY
Environmental and Economic Impacts

- Reduction of fossil fuel importation and use
- Generation of electricity and heat
- Recovery of ferrous and non-ferrous metals
- Production of saleable products from ash residue
Environmental and Economic Impacts

- Reduction in number of transfer stations
- Cleaner local environment
- More jobs
- More recycling
Health Impacts

- Using multi-stage BACT air cleaning systems, the health risks of a modern WTE plant are about 1 to 2 per million;

- Those of urban diesel trucking are over 100 per million;
WTE…Part of the Global Warming Solution

- 249 Million tons of MSW is disposed of at landfills (5 Billion kwh generated), creating 20 kw hours of electricity per ton of waste.

- 29 Million tons of MSW is combusted at WTEs (15 Billion kwh generated), creating 550 kw hours of electricity per ton of waste.
Conclusions

After the 3 R’s….

WTE should be the preferred waste management practice

• Less pollution
• Less health impacts
• Lessens our dependency on fossil fuels
• Produces energy & other usable products
EU Waste-to-Energy Cycle

- 58.5 million tonnes of remaining household waste
- Thermally treated in Waste-to-Energy Plants

Generating:
- 23.4 billion kWh electricity
- 58.5 billion kWh heat

Saving:
- 6-32 million tonnes of fossil fuels
- Supplying 7 million households
- Supplying 13.4 million households
Treatment of MSW in the EU 27 in 2006
Source: EUROSTAT

[Bar chart showing the percentage of waste managed through recycling (incl. composting), waste-to-energy, and landfilling for each EU country in 2006. Each bar is divided into three sections representing the recycling, waste-to-energy, and landfilling percentages.]

- Germany: Recycling 68%, Waste-to-Energy 29%, Landfilling 0.7%
- Netherlands: Recycling 64%, Waste-to-Energy 40%, Landfilling 32%
- Belgium: Recycling 62%, Waste-to-Energy 33%, Landfilling 5%
- Denmark: Recycling 55%, Waste-to-Energy 48%, Landfilling 5%
- Sweden: Recycling 61%, Waste-to-Energy 19%, Landfilling 5%
- Austria: Recycling 43%, Waste-to-Energy 38%, Landfilling 29%
- Luxembourg: Recycling 32%, Waste-to-Energy 35%, Landfilling 10%
- France: Recycling 12%, Waste-to-Energy 7%, Landfilling 50%
- Spain: Recycling 33%, Waste-to-Energy 43%, Landfilling 7%
- Italy: Recycling 60%, Waste-to-Energy 52%, Landfilling 58%
- Finland: Recycling 9%, Waste-to-Energy 9%, Landfilling 63%
- United Kingdom: Recycling 79%, Waste-to-Energy 81%, Landfilling 0%
- Portugal: Recycling 10%, Waste-to-Energy 11%, Landfilling 87%
- Czech Republic: Recycling 11%, Waste-to-Energy 13%, Landfilling 91%
- Hungary: Recycling 15%, Waste-to-Energy 8%, Landfilling 0.37%
Contact Information

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