INTERSTATE WASTE TECHNOLOGIES
THERMOSELECT TECHNOLOGY
AN OVERVIEW

Presented to the

DELAWARE SOLID WASTE MANAGEMENT
TECHNICAL WORKING GROUP

January 10, 2006
INTERSTATE WASTE MANAGEMENT ALLIANCE

- Thermoselect
  - Licenses Gasification Technology to IWT
- HDR/Zachry
  - A joint venture of HDR Inc. and H. B. Zachry, Inc.
  - Design and construct the Facility and provide 100% bonding
  - Participated in 35 Waste-to-Energy Projects
  - Combined Annual Revenues of $2 billion
- Montenay/Onyx/Veolia
  - Facility operation and maintenance (30 years)
  - Will guarantee performance and Operation and Maintenance
  - Serves solid waste disposal needs of over 23 million people
  - Operates 115 thermal waste facilities - 10 in USA
  - Annual Revenues of $30 billion
- IWT
  - Project Developer
- Alliance is technically and financially qualified to privately develop waste-to-energy facilities
THERMOSELECT TECHNOLOGY

- Applied gasification technology to solid waste beginning in 1985
- Combined four well known and proven technologies - compaction, pyrolysis, gasification and gas cleaning
- 43 process patents; 300 awards worldwide
- Has operated successfully beginning in 1992
- Licensed by JFE, a $25 billion company, for Japan
- 6 plants operating in Japan - one other under construction
- Other plants under development in U.S. and Europe
THERMOSELECT PROCESS OVERVIEW

- Zinc Concentrate
- Sulfur
- Clean water
- Hydrogen
- Methanol
- Ammonia
- Power generation
- O₂
- Press
- Degassing Channel
- Homogenization reactor
- H₂, CO, CO₂, H₂O
- Quench
- Scrubber
- Process water treatment
- Synthesis gas scrubbing
- Oxygen facility
- Metals and Minerals
- Sulfur
- Clean water
- Salt
- Zinc Concentrate
- Synthesis Gas
  Production of Hydrogen
  Methanol
  Ammonia
  or
  Power generation
THERMOSELECT DESTRUCTION OF ORGANIC COMPOUNDS (DIOXINS/FURANS)

- Waste carries dioxins, furans
- Degassing channel
- Gasifier

1200 °C

- Total destruction of organic compounds (1200-2000 °C, > 2s)

2000 °C

- Shock cooling freezes stable state, no denovo synthesis

Quench

70 °C
THERMOSELECT – GASIFIER FIRING DIAGRAM (15 t/h)

Waste Throughput [Mg/h]

Gasifier Gross Load [MW]

14 MJ/kg
13 MJ/kg
12 MJ/kg
11 MJ/kg
10 MJ/kg
9 MJ/kg
8 MJ/kg
7 MJ/kg
6 MJ/kg

Excessive syngas amount
Regular Operation Range
Press Overload
External electricity required (gas engine efficiency 40.8%)
THERMOSELECT TECHNOLOGY

• The technology has been qualified by the following governments for IWT/CWT projects:

  Puerto Rico                                   City of New York (2)
  City of Los Angeles (1)                        U.S. Virgin Islands
  County of Los Angeles (1)                     Curacao
  Collier County, Florida                       Singapore

IWT and Thermoselect ranked:
1 - #1 by the City and County’s consultants, URS, in an open procurement
2 - Among the top two qualifiers by the City’s consultant, ARI, in an open procurement
Thermoselect Plant Fondotoce - Italy

Industrial scale demonstrator and pilot plant

Company: Thermoselect
Capacity: 33,000 tpy
No. of lines: 1 line 4.4 tph
Syn. gas utilization: Gas Engine
Karlsruhe - Germany

Company: TESS (Thermoselect Südwest)
Status: in service
Start-up: Feb. 1999
Capacity: 247,500 tpy
No. of lines: 3 lines 11 tph/ each
Syn. gas utilization: steam vessel & steam turbine, district heating
Projects in Japan
Kawasaki Steel Chiba Plant - Japan

Company: Kawasaki Steel Corporation
Status: In service
Start-up: Sept. 1999
No. of lines: 2 lines 6.88 tph/each
Capacity: 110,000 tpy
Syn. gas utilization: One Jenbacher Gas Engine and in Chiba Works
Kurashiki, Japan

Company: Mizushima Eco Works
Status: In Service
Startup: April 2005
Capacity: 222,832 tpy
No. of lines: 3 lines
Northeast Waste Processing Facility

Capacity: 1,056,000 tpy

No. of processing modules: 9 lines

Throughput: 16.5 tph per line

Synthesis gas utilization: Gas Engine Generators
U. S. Virgin Islands Waste Recycling Facility
THERMOSELECT TECHNOLOGY PROCESSES ALL WASTES

• Household Waste
• Commercial Waste
• Industrial Waste
• Municipal Sewage Sludge
• Tires
• Medical Waste
• Used Computer Equipment
**PRODUCES 100% RECYCLED MATERIAL**

<table>
<thead>
<tr>
<th>Input</th>
<th>Pounds</th>
<th>Products</th>
<th>Pounds</th>
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<tr>
<td>Waste</td>
<td>2,000</td>
<td>Synthesis Gas</td>
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<td>Oxygen</td>
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<td>Water</td>
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<td>Aggregate</td>
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<td></td>
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<td>Metal Pellets</td>
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<td></td>
<td>Sulfur</td>
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<tr>
<td></td>
<td></td>
<td>Salt</td>
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<tr>
<td></td>
<td></td>
<td>Zinc Concentrate</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>3,122</td>
<td>Total</td>
<td>3,122</td>
</tr>
</tbody>
</table>
DIVERSION FROM LANDFILL

Vitreous Mineral Granulate
approx. 20-25 % of Input

Iron-Copper Alloy
approx. 1-3 % of Input

Salt
approx. 1 % of Input

Sulfur
approx. 0.2 - 0.3 % of Input

Zinc-Concentrate
approx. 0.2 - 0.3 % of Input

Concrete
Sand-Blasting
Road Construction

Metallurgy

Chemical Industry, Additive for
Metallurgy

Chemical Industry, i.e. Sulfuric Acid Production

Zinc-Recovery
Air Emissions

% of USEPA Limits

- Dust
- HCl
- SO2
- NO2
- CO
- Hg
- Cd
- Pb
- PCDD, DF

Measured
Permit
USEPA Limits
GASIFICATION IS NOT AN INCINERATION TECHNOLOGY

- **Gasification** is an industrial chemical process that uses high temperature to break down and transform waste (including its toxic elements) into clean synthesis gas and other commercially useful products.

- **Incineration** burns waste producing heat, ash and harmful air emissions.

- Industry professionals have consistently differentiated these two technologies.
U.S. EPA
DEFINITION OF
GASIFICATION SYSTEM

• An enclosed thermal device and associated gas cleaning system that does not meet the definition of an incinerator. And that: (1) limits oxygen...to prevent full oxidation, (2) utilizes gas cleanup systems, (3) slags inorganic feed materials above 2,000 degrees F, (4) produces a synthesis gas, and (5) is equipped with monitoring devices to ensure quality of synthesis gas.

• This definition exactly describes the Thermoselect technology and differentiates gasification from incineration.
THERMOSELECT TECHNOLOGY
SUMMARY OF ENVIRONMENTAL BENEFITS

• Is not an incineration technology
• 100% of the waste becomes useful recycled products
• No ash is generated - No landfills required
• Comprehensive solution - Processes all forms of waste
• Has no process water discharges
• Air emissions are 90% lower than permitted by the U.S. EPA
• Requires only 10 acres of land to process up to 500,000 tons of waste per year for 30 years