Building a Case for Cooperation in Residual Management
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Solid Waste
Liquid Waste
Gases

“Residual Management”
Project Organization

I thought you were making the door!
Technology Evolution

- Dumps
- Simple Lagoons
- Engineered Sanitary Landfills
- Complex Mechanical Treatment Plants

Higher Level of Environmental Protection
Cooperative Approach

Environmental Benefits

Economic Benefits

Risk Management Benefits

Result: Improved Operation and Reduced Costs
Residuals (Liquids, Gases & Bio-solids)

- Leachate from landfills that have a collection system
- Landfill gas generated from the decomposition of wastes
- Sludge from septic treatment systems
- Screenings from primary sewage and septage facilities
- Sludge from sewage treatment plants
Leachate

- Leachate is the product of free water in landfills leaching contaminants from the waste it has been in contact with.

- The formation of leachate occurs after it has reached its field capacity moisture content.

*Leachate collection manhole*
Leachate Generation

Estimated Quantity of Leachate Generated

Estimated Quantity of Leachate Requiring Treatment and Disposal
Landfill Gas

![Graph showing generation rate over time for different cells with CO and NH₄ labels.]
Septage

- Cell 1 Anaerobic
- Cell 2 Anaerobic
- Cell 3 Aerobic
- Grit, Rags, Sludge (<5% solids)
- Effluent for Disposal
Screenings

- Product of the preliminary fine screening of domestic sewage
- Organic and inorganic
- 40 to 60% solids
- Disposal to cells
Sewage Sludges

- Residual from either a primary or secondary sewage treatment process
- Very coarse
- High organic and inorganic solids
- 3 to 5% solids
Other Residuals

- Grease from food preparation
- Used motor oil
- Sludges from car washes
- Blood and by-products from abattoirs
- Manure
- Petroleum contaminated soils
Disposal Options for Residuals

Leachate

1. Anaerobic / Aerobic lagoons with mechanical aeration
   ➢ *Effective treatment*

2. Recycle leachate by re-circulating it through the landfill
   ➢ *Increased waste decomposition of solid waste in landfill*
   ➢ *Reduced strength of leachate*
Disposal Options for Residuals

Landfill Gas

- Collected and flared or used to produce energy
- Passive venting
- Re-circulation of leachate can affect rate of gas generation
- Approximately 40 to 80 tonne per day landfill site could generate 1 MW of energy
Disposal Options for Residuals

Septage

- Series of lagoons: settling pond, anaerobic and aerobic
- Sludge disposal
Disposal Options for Residuals

Sewage Sludge

Primary Treatment Sludge:
- Direct disposal to dedicated cells on site
- Primary digestors at treatment plant

Secondary Treatment Sludge:
- Co-composting
- Landfarming
- Lagoons
Disposal Options for Residuals

Screenings:

- Dedicated cells
- Landfilled
- Co-composting
Co-Disposal Options

- Numerous Options:
  - Bioreactor Landfill
  - Co-composting

- Environmental and Economic Benefits

- Challenge: Different Operating Agencies

Cooperation?
Bioreactor Landfill

- Designed to rapidly change and biodegrade organic component of solid waste stream
- Adding sufficient liquids and air
- Aerobic, Hybrid and Anaerobic

Waste Age, Phil O’Leary & Patrick Walsh, June 2002, p.64
Bioreactor Landfill

Most Easily Adapted to Caribbean: Anaerobic

- Moisture content most important aspect
- Upwards of 65%
- Leachate, storm-water, screenings, sewage sludge, septage and waste treatment effluents
- Accelerated decomposition, reduced leachate treatment and disposal costs, reduced need for leachate treatment facilities, reduced post closure costs and increased landfill gas generation
Co-Composting

- Organic waste supplemented with a range of materials
- Carbon to Nitrogen Ratio (C:N) key
- Simple windrow facility to enclosed reactor
- Successful co-composting mixtures:
  - MSW organics / secondary sewage sludge
  - Septage solids / wood chips
  - Abattoir wastes / yard wastes
  - Chicken manure / yard wastes
  - MSW organics / septic tank pump out waste
  - MSW organics / fishery wastes
Typical Small Island State Operations

- Leachate: left in the landfill, treated, recycled or released
- Landfill Gas: ignored, passively vented
- Septage: lagoon treatment, effluent discharged
- Screenings: landfilled, dedicated disposal cells
- Sewage Sludge: stored, land spread
- Other Residuals: uncontrolled
Caribbean Case Study

New Providence

New Providence Sanitary Landfill
- Operated by DEHS
- 60 mil HDPE Liner
- Leachate Collection
- Gas Collection Piping Installed

Septage & Sludge Facility
- Operated by W&SC
- HDPE Liner
- Treats waste from septic tank pumpouts
Present Situation

- Landfill Leachate
- Treatment (Lagoons - Future)
- Liquid Disposal (Deep Well)

- Septage & Sludge
- Lagoons (Anaerobic/Aerobic)
- Liquid Disposal (Deep Well)

- Drying Beds (Future)
Cooperative Approach

- Septage & Sludge
  - Landfill
  - Landfill Leachate
  - Lagoons (Anaerobic/Aerobic)
  - Recirculate
  - Liquid Disposal (Deep Well)
  - Solids Disposal (Landfill)

Or
Conclusion: Real World?

- Solutions can appear very simple on paper yet a little more complicated to implement in the real world.
- On a daily basis, landfills, sewage treatment plants and septage and sludge facilities throughout the Caribbean continue to operate and generate residuals.
- The responsibility for cost effective business practices rests on the shoulders of the General Managers and the Directors of these operating entities.
Conclusion

- It can be concluded that there is merit in investigating cooperative solutions that could result in cost savings, a higher level of environmental protection and reduced risk.

- The benefits are numerous:
  - Residuals from one stream could benefit another system resulting in a useable end product.
  - Capital and operating costs could be reduced.
  - Risk of damage to the environment from the mismanagement of these residuals could be prevented.
Thank you