# Achieving Energy Self-Sufficiency Through Organic Waste Management

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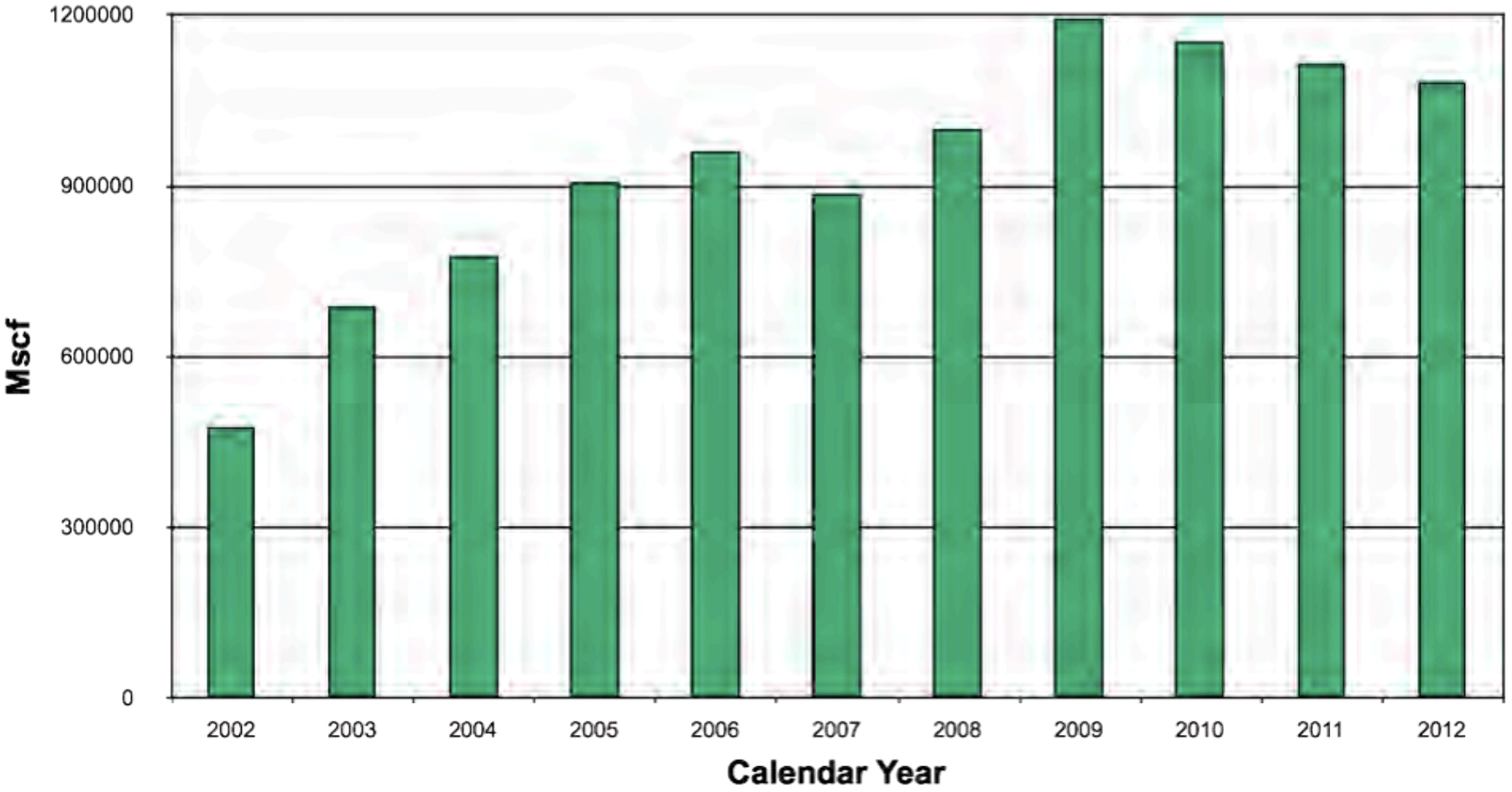
# EBMUD Wastewater Treatment

- Pure O2 activated sludge treatment capacity = 168 MGD
- Maximum design wet weather flow = 415 MGD
- ADWF ~ 65-70 MGD
- Max primary digester volume is 16 MG

# Total Digester Gas Produced

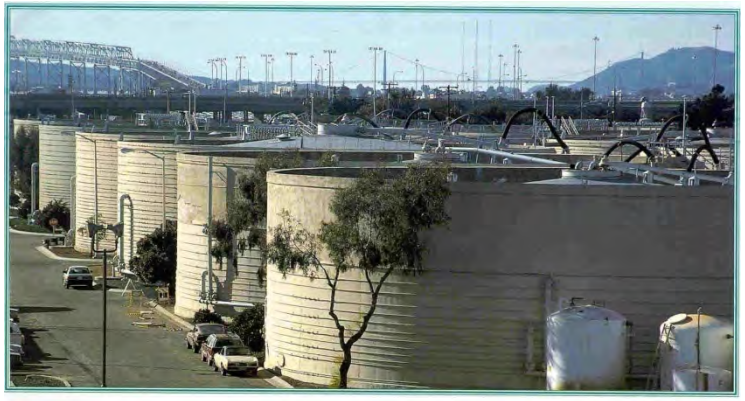


# Existing On-site Generation

- Three 2.2 MW IC engines
- Air Permitted for 3 engine operation
- Historically met ~40% of plant load
- New 4.5 MW Turbine

# Resource Recovery (R2) Program

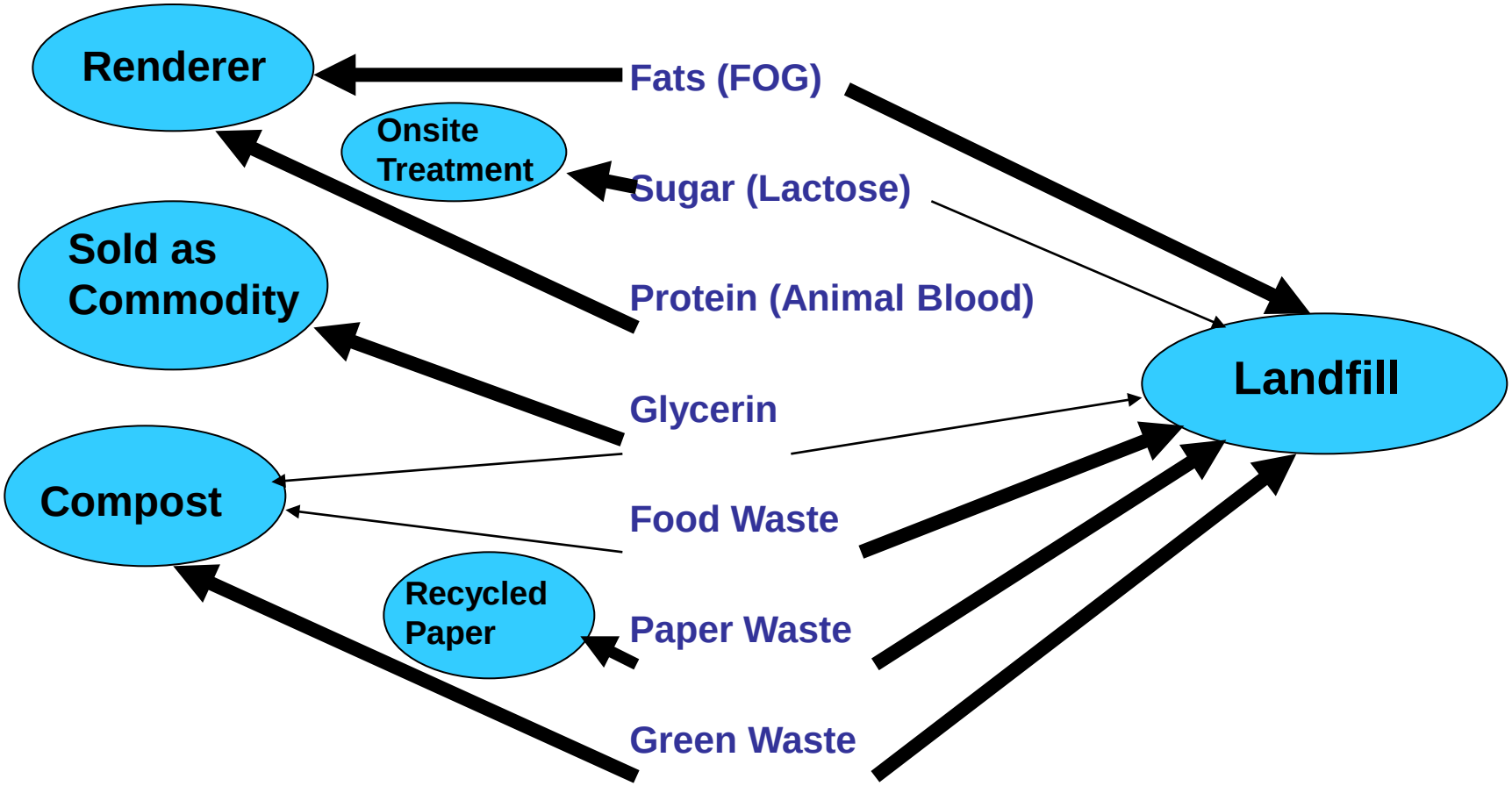
- Objective: Use excess digestion capacity
- High strength wastes added directly to digesters to increase gas production
- Digester gas fuels a 11 MW on-site Power Generation Facility



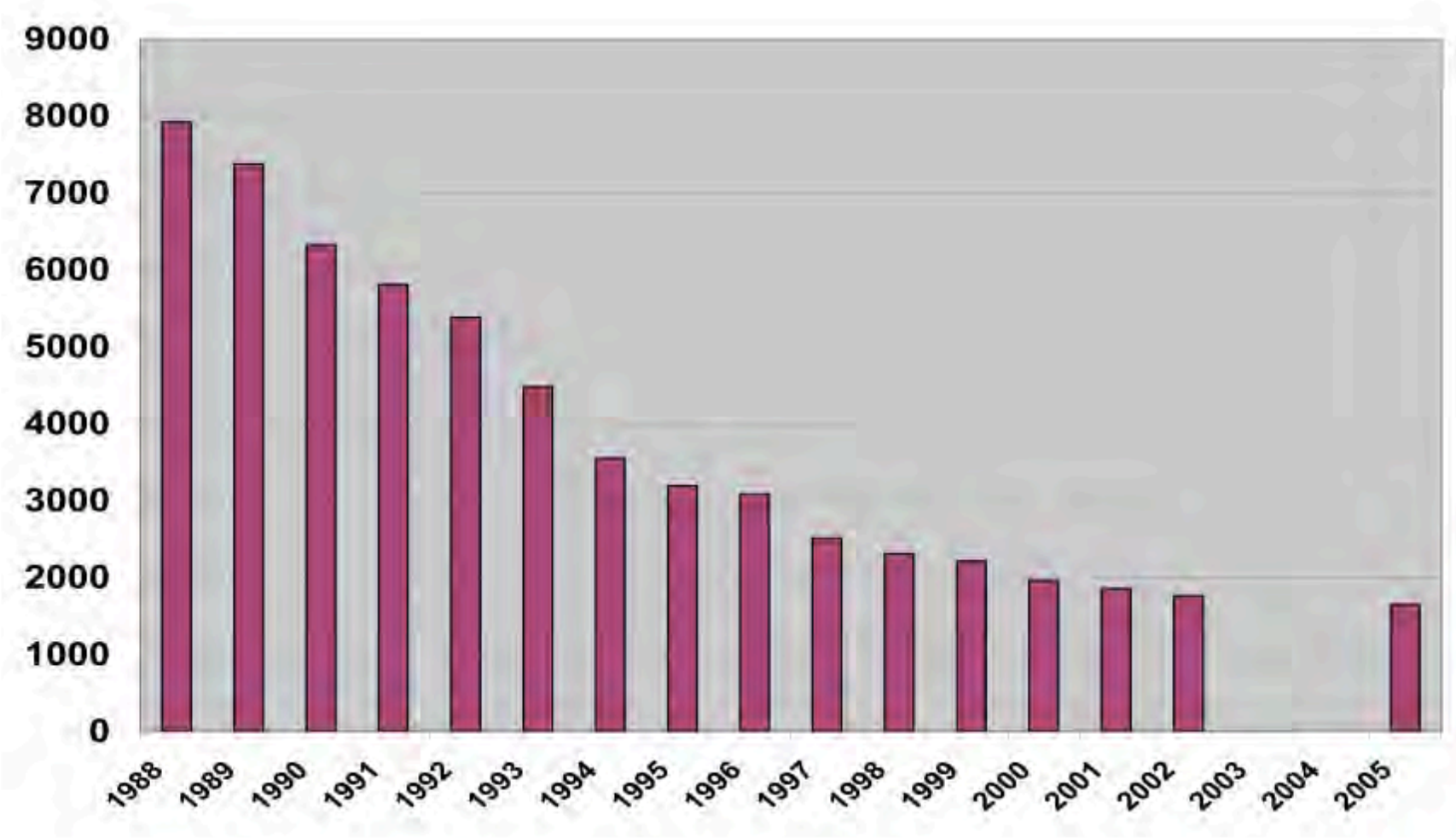
# High-Strength Waste Examples

- **Started with:**
  - Septage
- **Progressed to:**
  - Fats, oils, and greases (FOG)
- **Expanded program includes:**
  - Food processing waste
  - Winery waste
  - Industrial/commercial process waste
  - Animal processing waste
  - Municipal and agricultural lagoon wastes

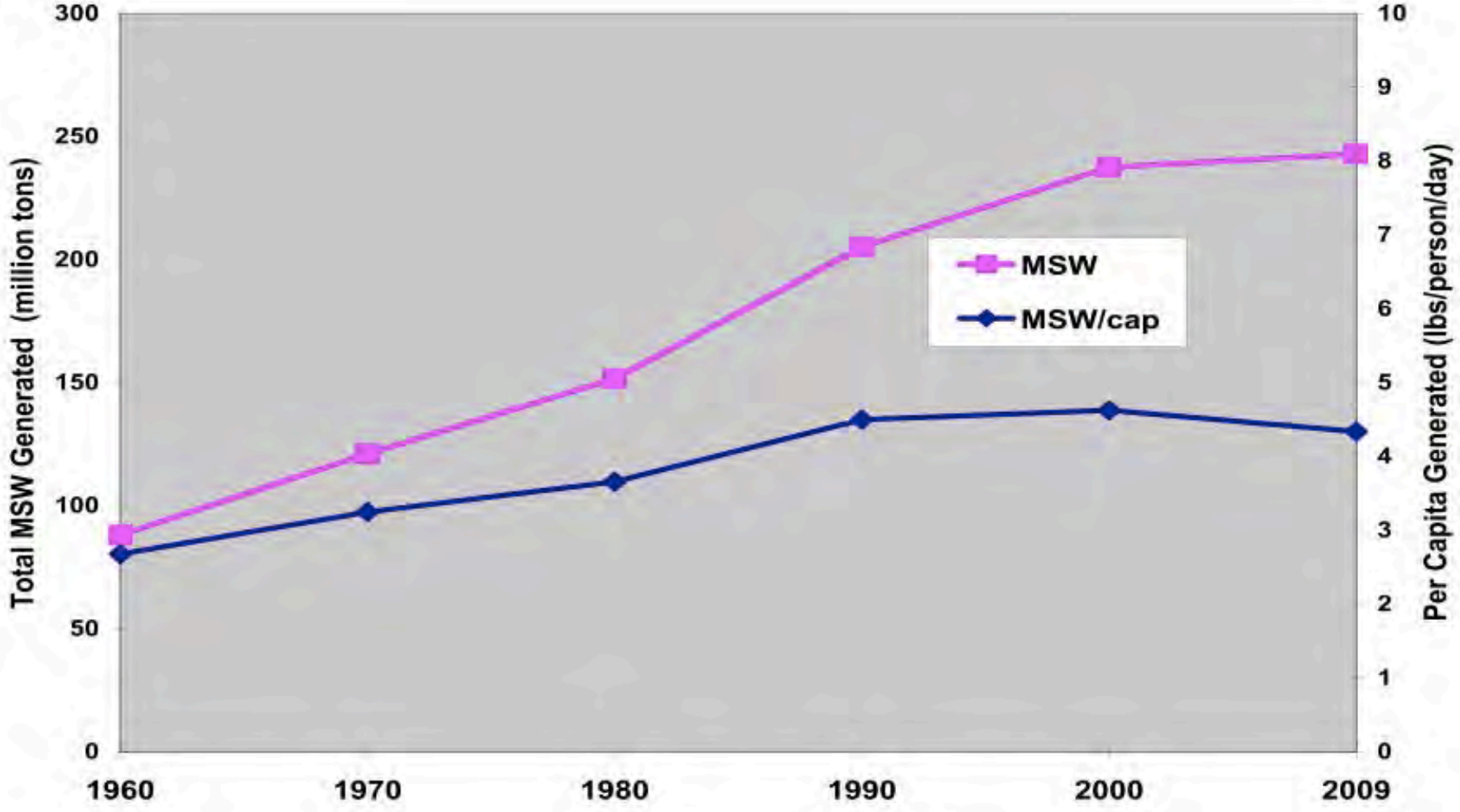
# Organic Waste Types



# Number of Landfills in the United States 1988-2005

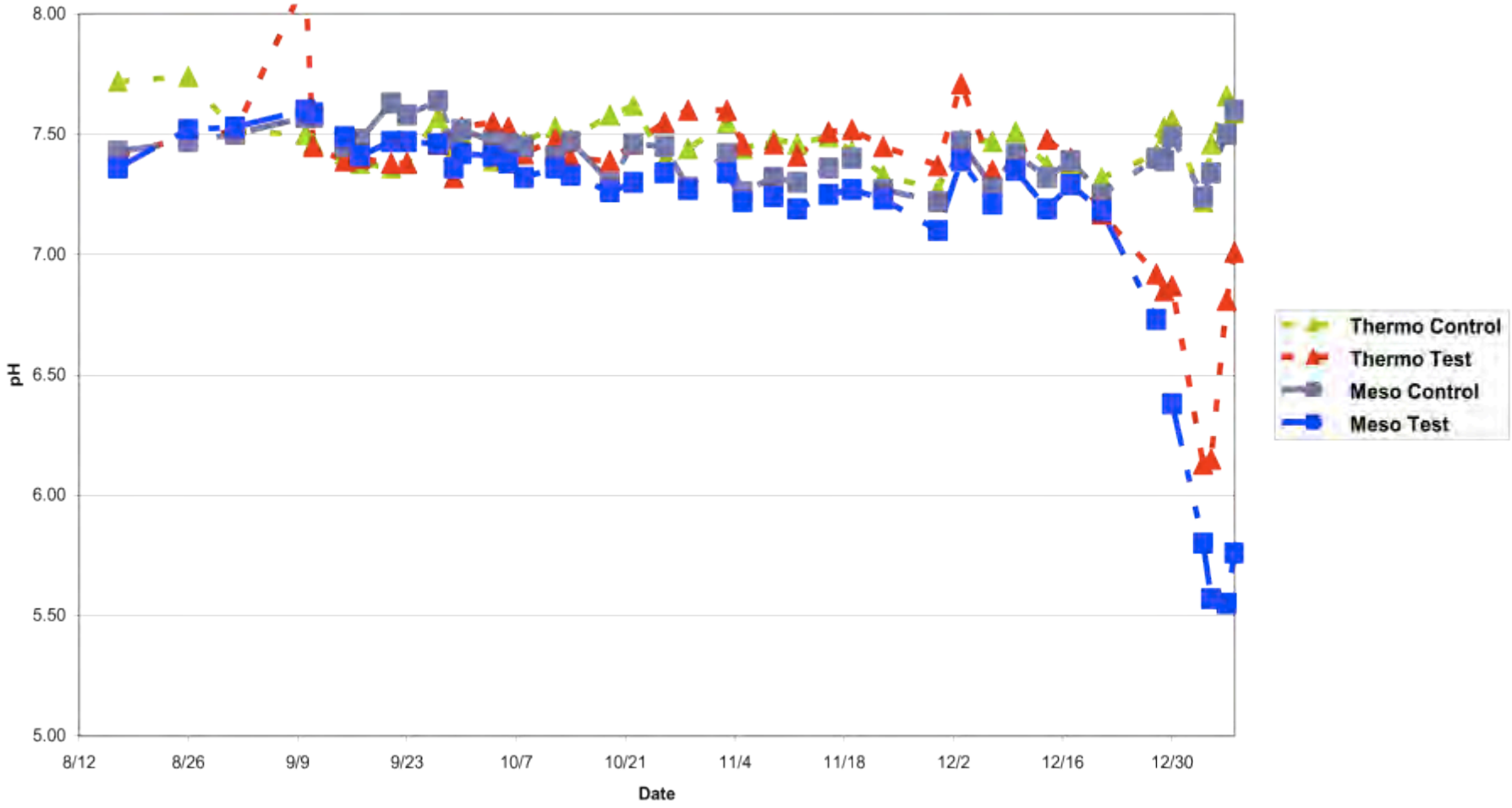


# Municipal Solid Waste Generation 1960-2009

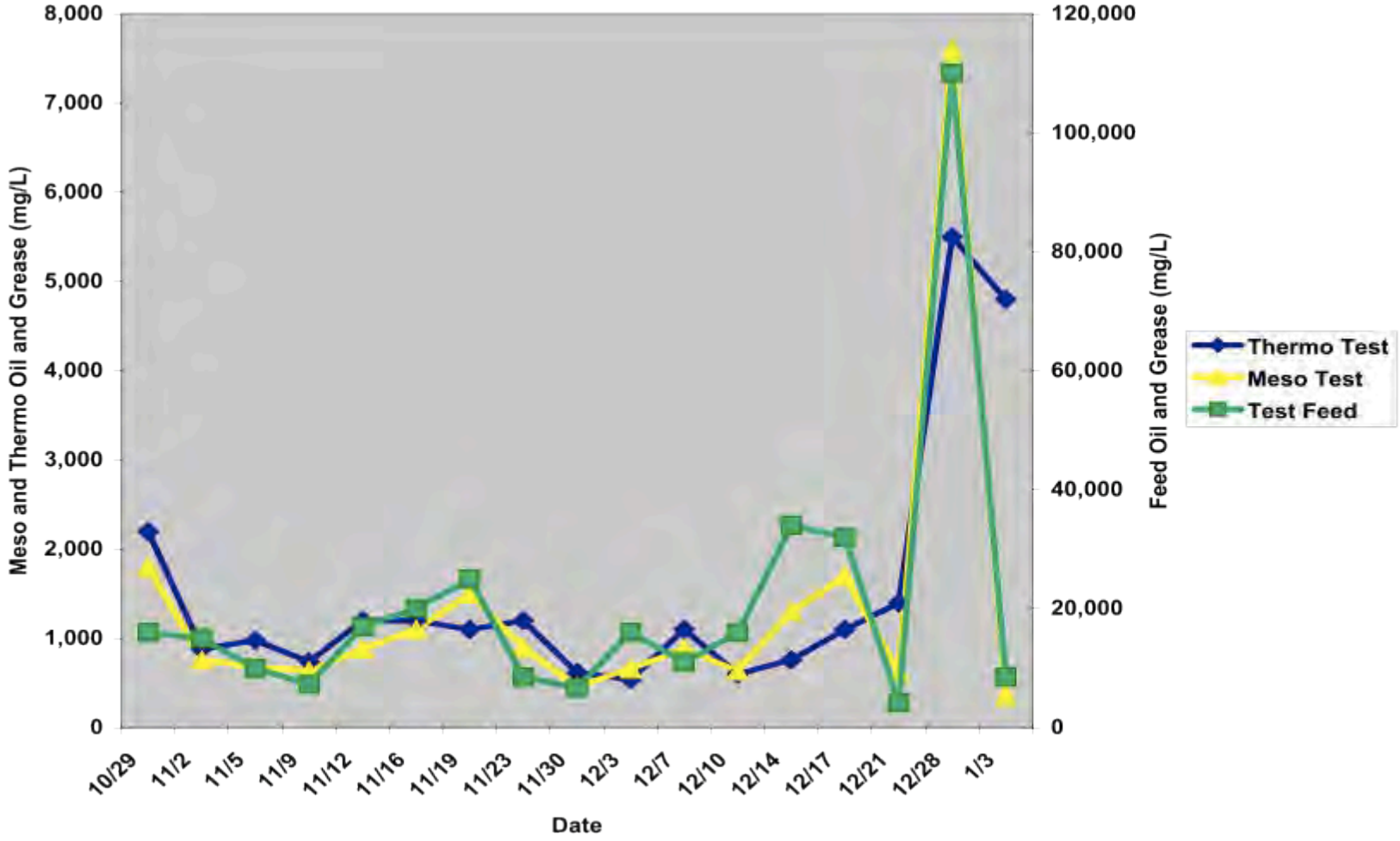


# LIQUID ORGANIC WASTES

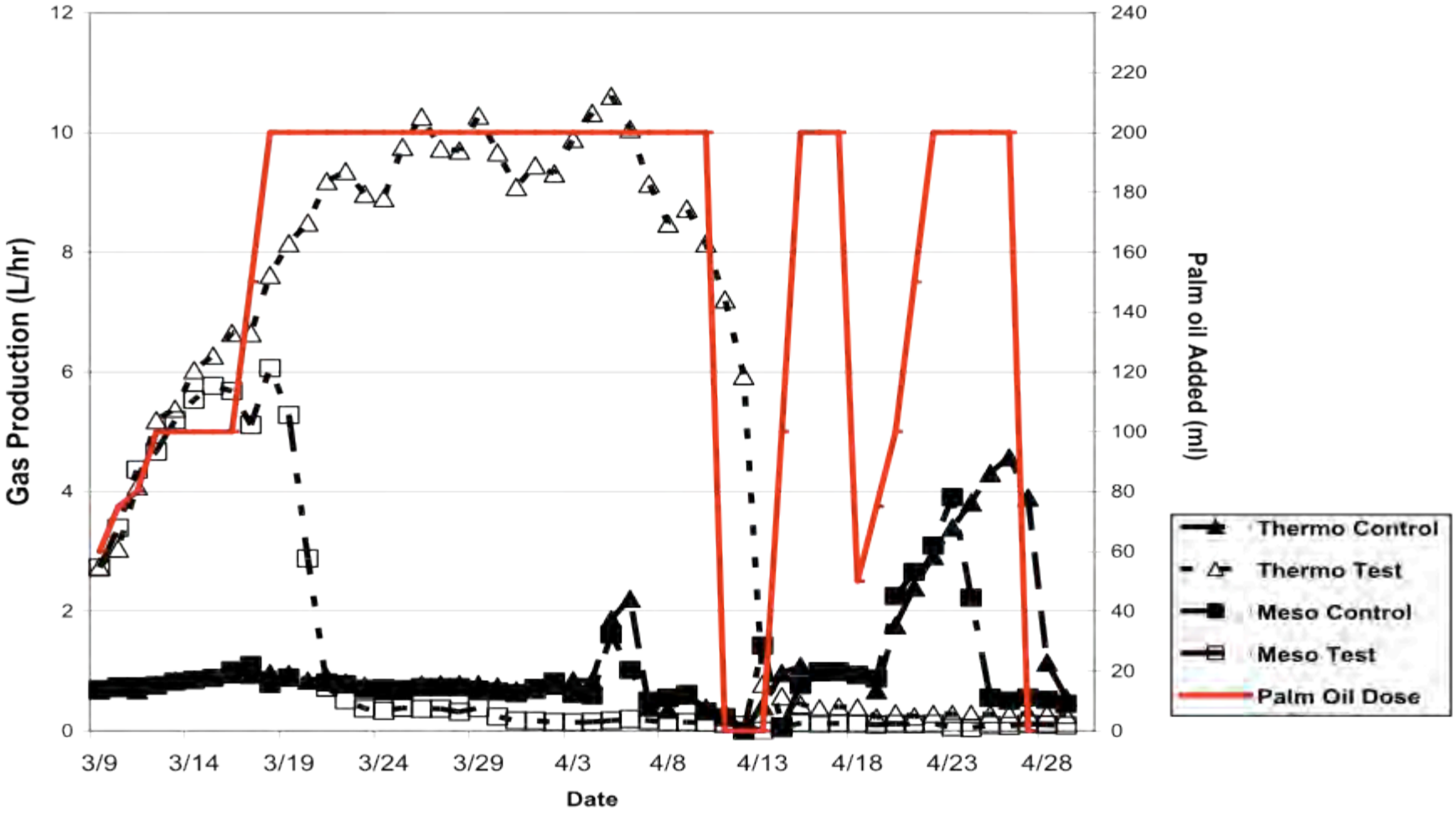
# BENCH-SCALE FOG DIGESTION
## pH



# BENCH-SCALE FOG DIGESTION
## Oil and Grease



# BENCH-SCALE DIGESTION
## Palm Oil Enhanced Feed



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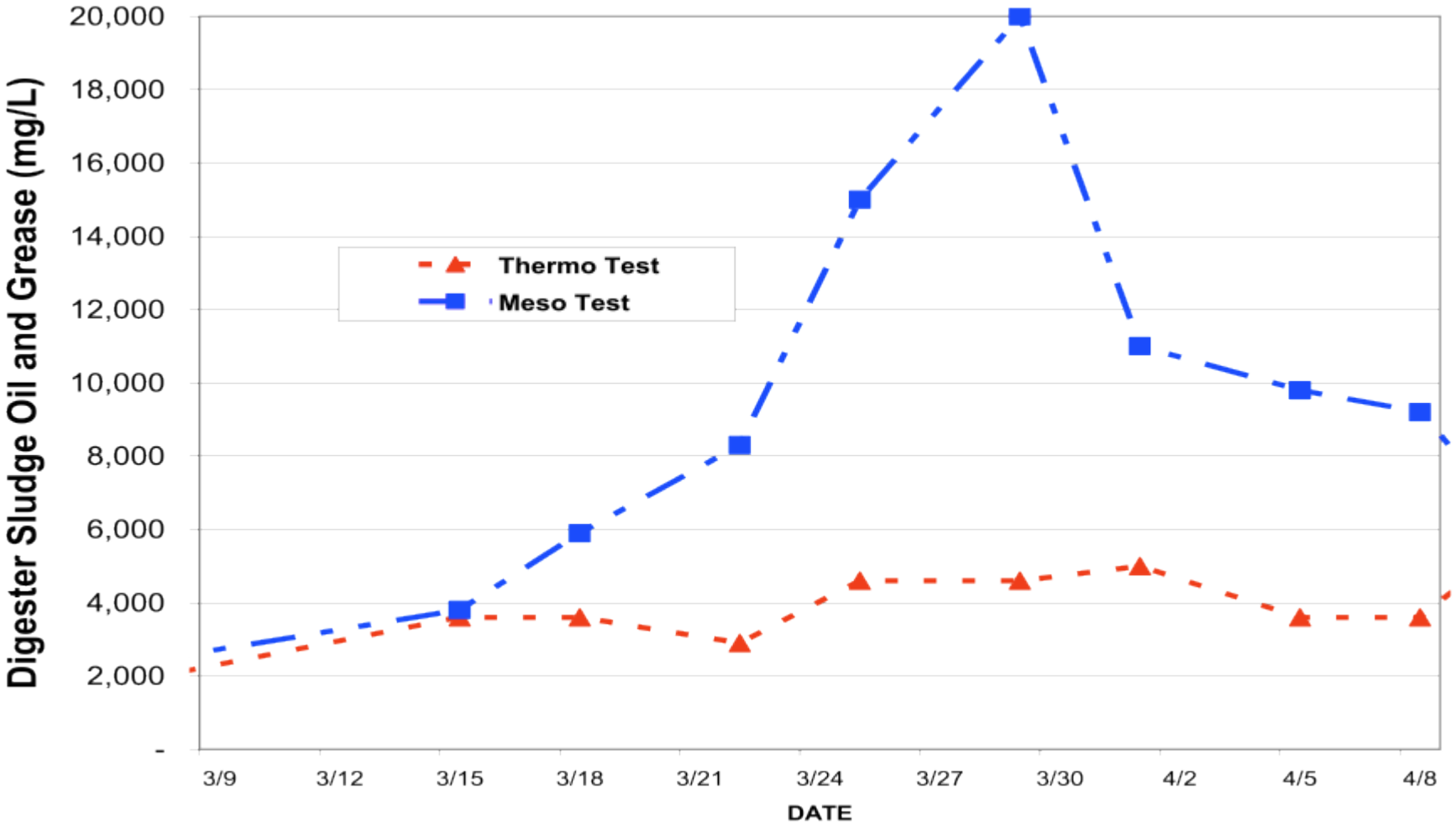
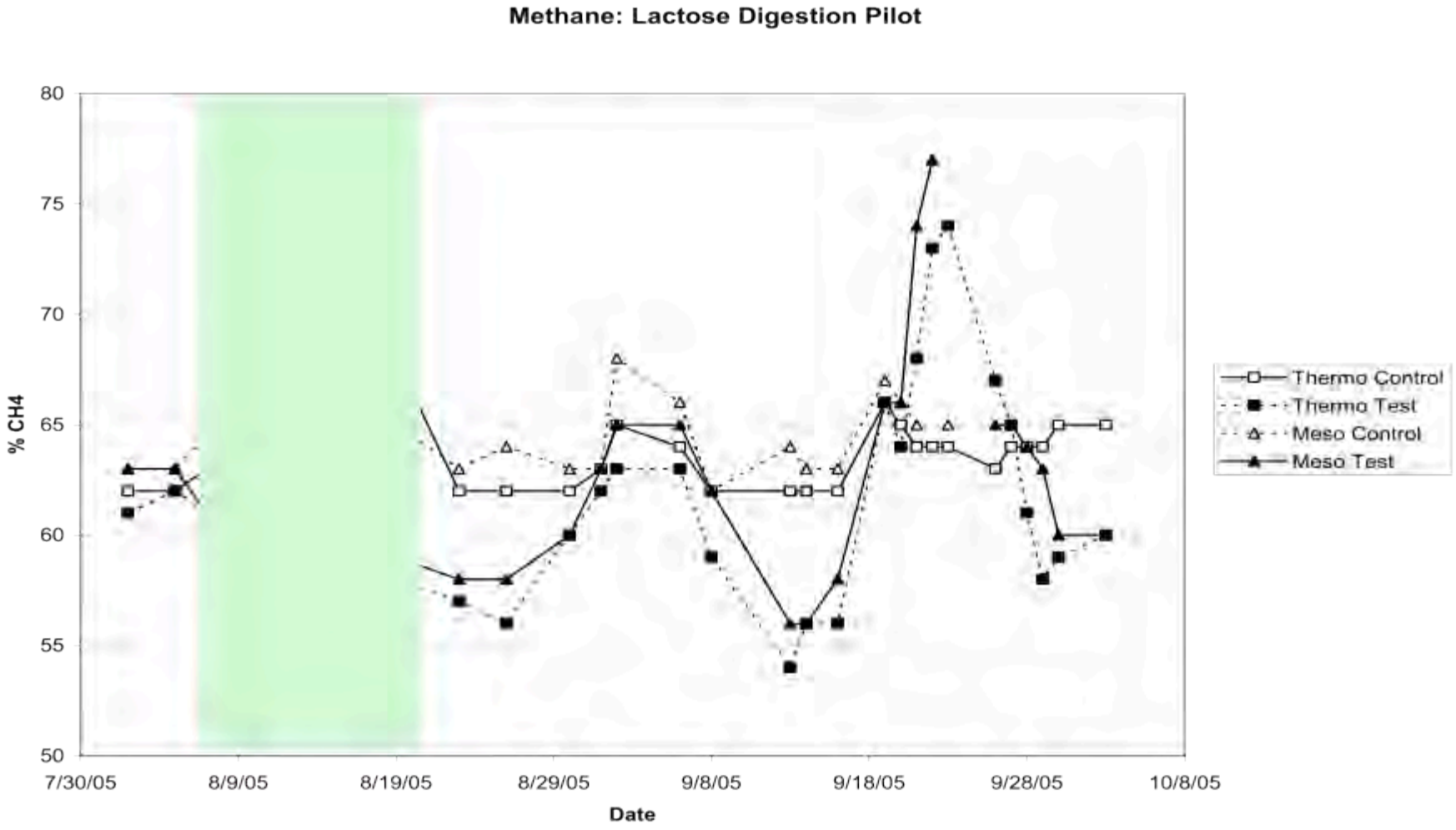
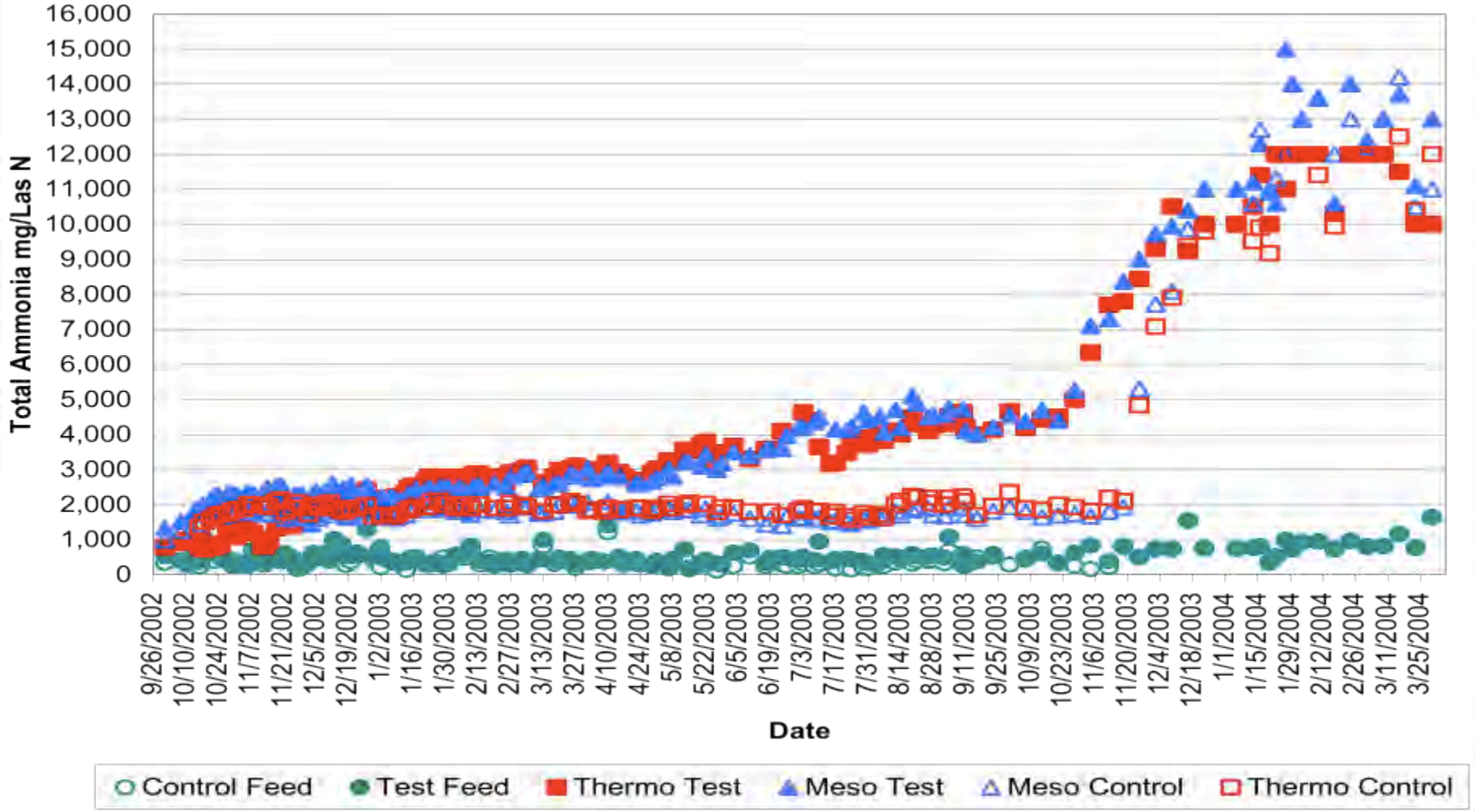


# Sugar Wastes Provide Lower Methane Content



# Poultry Blood Feed to Bench-Scale Anaerobic Digester



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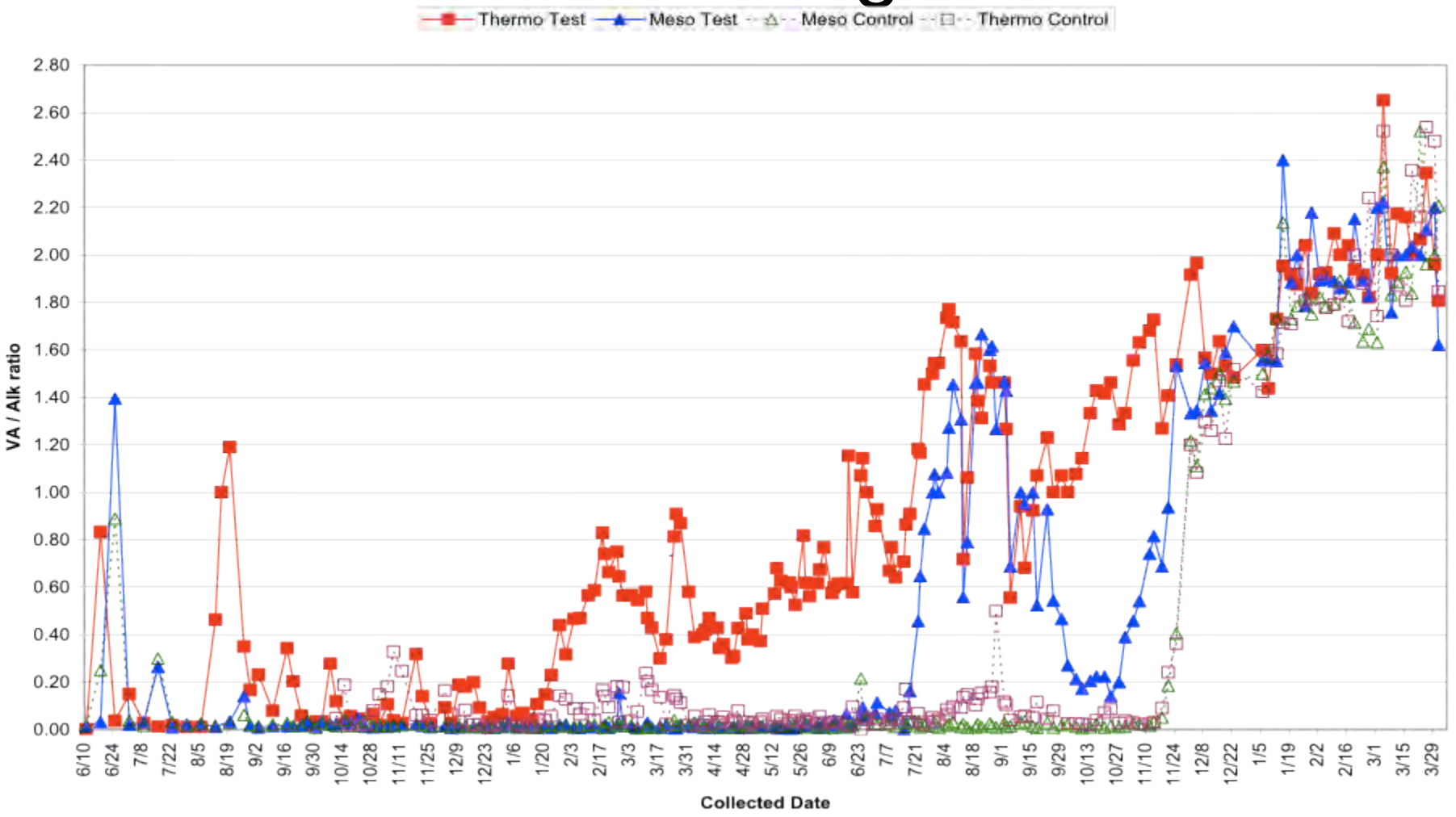
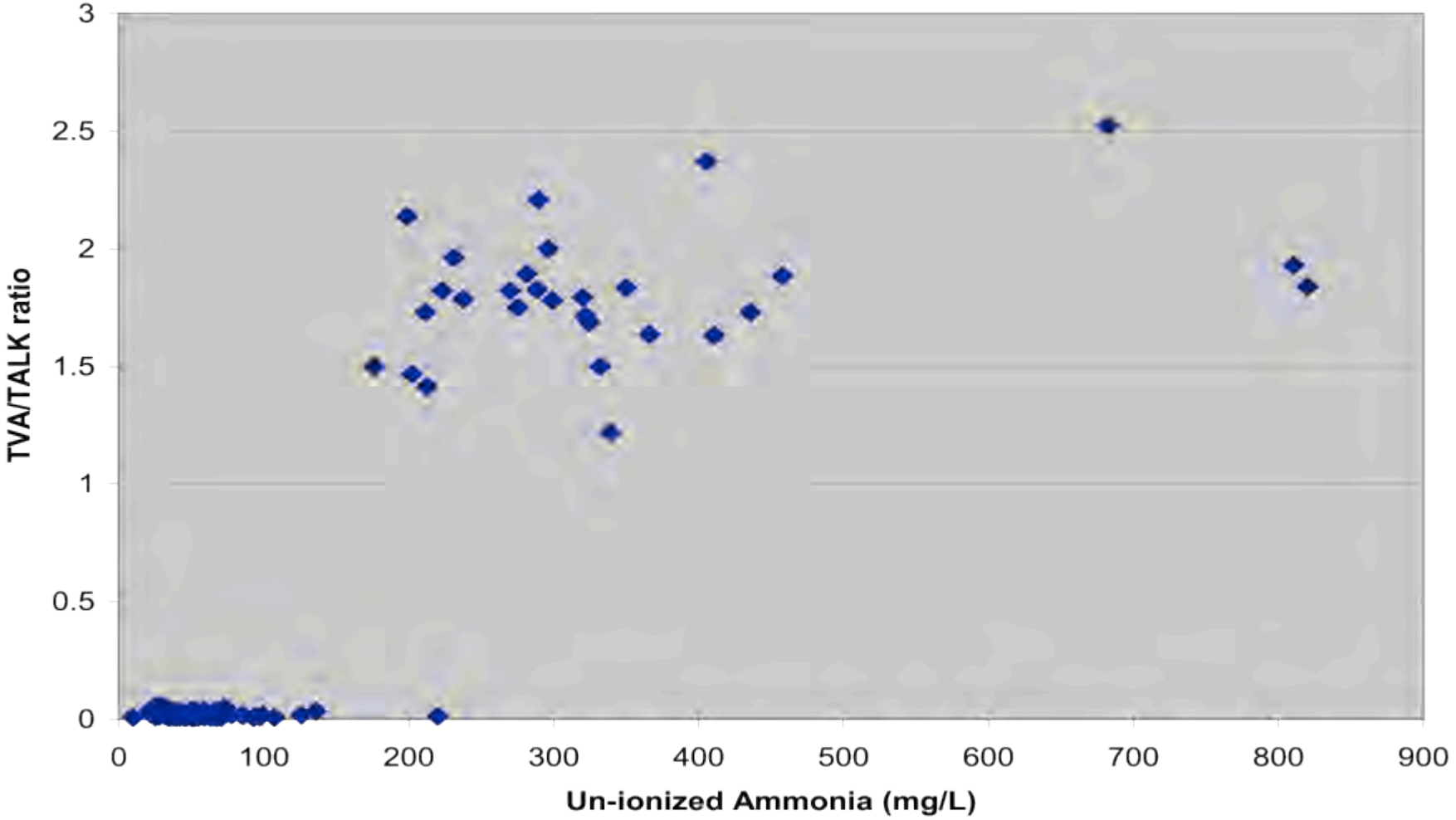
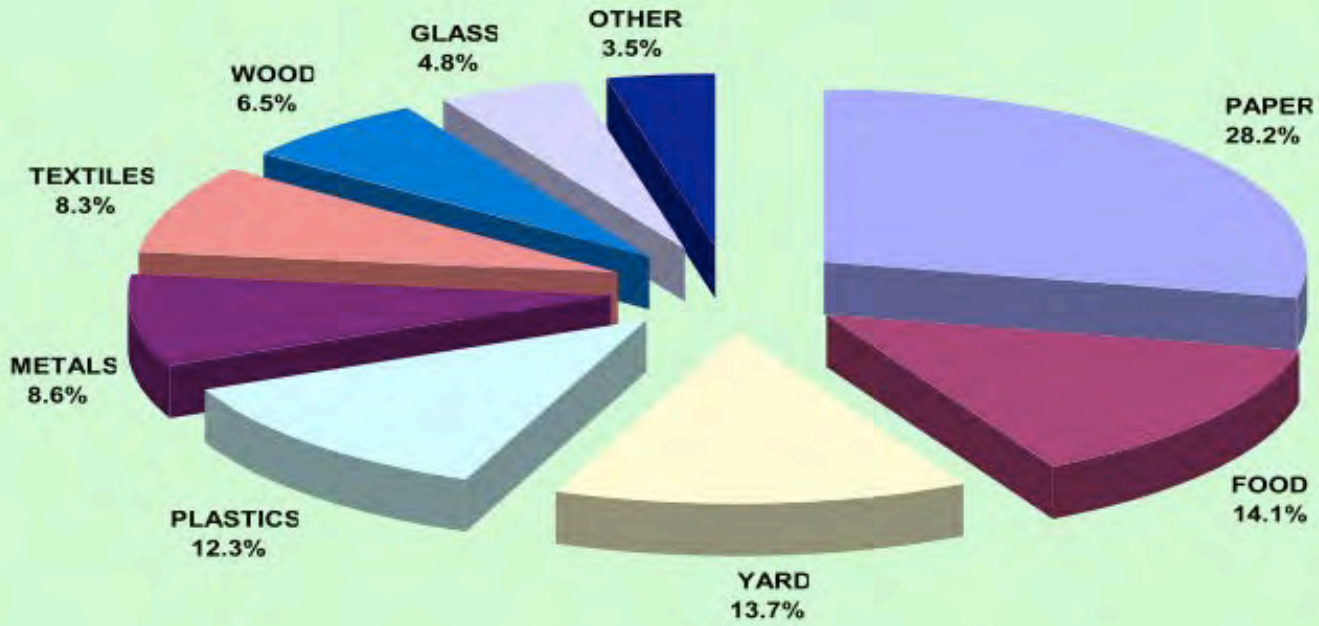


# Ammonia vs. TVA/TALK Ratio



# SOLID ORGANIC WASTES

# Total 2009 MSW Generation Before Recycling



# Generation and Recovery of Materials in MSW 2006

| Material | Weight Generated (million tons) | Recovery as a Percent of Generation |
|---|---|---|
| Paper and Paperboard | 85.2 | 51.6% |
| Yard Trimmings | 32.4 | 62.0% |
| Food Scraps | 31.1 | 2.4% |

# Food Waste Delivery

# Food Waste Anaerobic Digestion Benefits Observed

- Food Waste *vs.* Wastewater Solids Digestion
  - Requires about half the digester volume
  - Produces about half the biosolids/lbs fed
  - Produces about 3.5 X methane/digester volume
- Provides New Renewable Energy Source
- Diverts Food Wastes From Landfills
- Reduces Green House Gases
- Wastewater Treatment Plant Permit compliance should not be impacted

# Other Organic Solid Wastes Literature Review

- Green Waste
  - Methane Yield Half That of Food Waste
  - Lower Methane Content—Like Sugar Wastes
  - Similar VS Destruction to Food Waste
- Paper Waste
  - Biodegradability vs. Lignin Content
  - Office Paper: 82% Biodegradable
  - Newspaper: 22% Biodegradable

# Conclusions

- Opportunity for recycling organic wastes in anaerobic digesters
- Organic wastes have challenges to anaerobic digestion
- FOG can be toxic at higher digester sludge levels
- Operating digesters at thermophilic vs. mesophilic temperatures best for FOG
- Sugar wastes can lower methane content in digester gas
- Animal blood can cause ammonia toxicity in anaerobic digesters