Standing at a Crossroad: Biosolids Management Decisions in the Face of an Uncertain Future

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Outline for today's presentation

- A historical perspective and framework
- Case studies
- Closing thoughts and observations
- Questions (and maybe answers)

Master Planning Can Be Complicated…

A Historical Perspective and Framework

Sewage sludge regulated under 40 CFR 503 to establish minimum standards

- Major Subsections Regulate
  - Land Application
  - Surface Disposal
  - Pathogen Reduction and Vector Attraction Reduction (VAR)
  - Incineration
- Land Application Constraints
  - Non-Hazardous
  - Criteria Pollutant Levels
  - Pathogen Density
  - Vector Attraction

Subpart A—General Provisions

Sec.
503.1 Purpose and applicability.
503.2 Compliance period.
503.3 Permits and direct enforceability.
503.4 Relationship to other regulations.
503.5 Additional or more stringent requirements.
503.6 Exclusions.
503.7 Requirement for a person who prepares sewage sludge.
503.8 Sampling and analysis.
503.9 General definitions.

Subpart B—Land Application

503.10 Applicability.
503.11 Special definitions.
503.12 General requirements.
503.13 Pollutant limits.
503.14 Management practices.
503.15 Operational standards—pathogens and vector attraction reduction.
503.16 Frequency of monitoring.
503.17 Recordkeeping.
503.18 Reporting.

Subpart C—Surface Disposal

503.20 Applicability.
503.21 Special definitions.
503.22 General requirements.
503.23 Pollutant limits (other than domestic septage).
503.24 Management practices.
503.25 Operational standards—pathogens and vector attraction reduction.
503.26 Frequency of monitoring.
503.27 Recordkeeping.
503.28 Reporting.

Subpart D—Pathogens and Vector Attraction Reduction

503.30 Scope.
503.31 Special definitions.
503.32 Pathogens.
503.33 Vector attraction reduction.

Subpart E—Incineration

503.40 Applicability.
503.41 Special definitions.
503.42 General requirements.
503.43 Pollutant limits.
503.44 Operational standard—total hydrocarbons.
503.45 Management practices.
503.46 Frequency of monitoring.

Authority: Sections 405 (d) and (e) of the Clean Water Act as amended by Pub. L. 95-217, sec. 74(d), 91 Stat. 1591 (33 U.S.C. 1345 (d) and (e)), and Pub. L. 100-4, title IV, sec. 406 (b), (h), 101 Stat. 71, 72 (33 U.S.C. 1251 et seq.).

Source: 58 FR 9387, Feb. 19, 1993, unless otherwise noted.

Subpart A—General Provisions

§ 503.1 Purpose and applicability.

(a) *Purpose.* (1) This part establishes standards, which consist of general requirements, pollutant limits, management practices, and operational standards, for the final use or disposal of sewage sludge generated during the treatment of domestic sewage in a treatment works. Standards are included in this part for sewage sludge applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator. Also included in this part are pathogen and alternative vector attraction reduction requirements for sewage sludge applied to the land or placed on a surface disposal site.

(2) In addition, the standards in this part include the frequency of monitoring and recordkeeping requirements when sewage sludge is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator. Also included in this part are reporting requirements for Class I sludge management facilities, publicly owned treatment works (POTW's) with a design flow rate equal to or greater than one million gallons per day, and POTW's that serve 10,000 people or more.

(b) *Applicability.* (1) This part applies to any person who prepares sewage sludge, applies sewage sludge to the land, or fires sewage sludge in a sewage sludge incinerator and to the owner/operator of a surface disposal site.

(2) This part applies to sewage sludge applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator.

(3) This part applies to the exit gas from a sewage sludge incinerator stack.

(4) This part applies to land where sewage sludge is applied, to a surface disposal site, and to a sewage sludge incinerator.

§ 503.2 Compliance period.

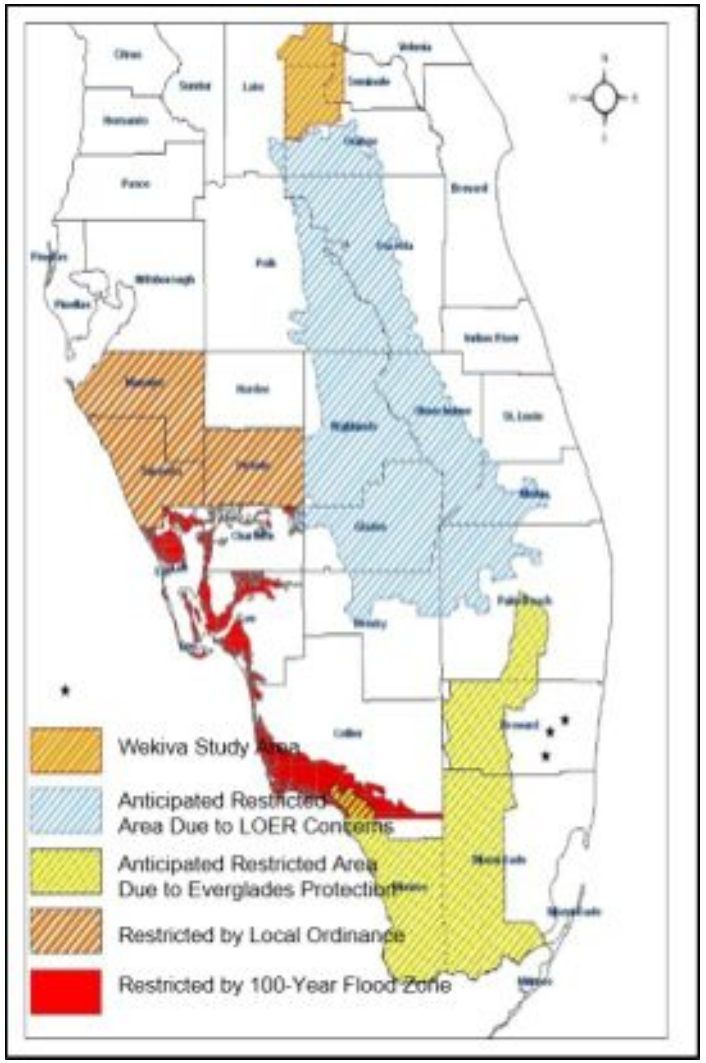
(a) Compliance with the standards in this part shall be achieved as expeditiously as practicable, but in no case later than February 19, 1994. When

State and local regulations can raise the bar above that of the 40 CFR 503 regulations.

- Statewide Programs
  - Application Rates
  - Seasonal Restrictions
  - Slope & Buffer Restrictions
  - Soil pH Management
  - Phosphorus Loading Rates
  - Nutrient Management Plans

- Local Government Programs
  - Local Oversight Function
  - Monitor Application at Sites
  - Additional Residuals Testing
  - Enforce State Regulations
  - Fee Supported Program

Watershed nutrient management programs may impact land application of residuals

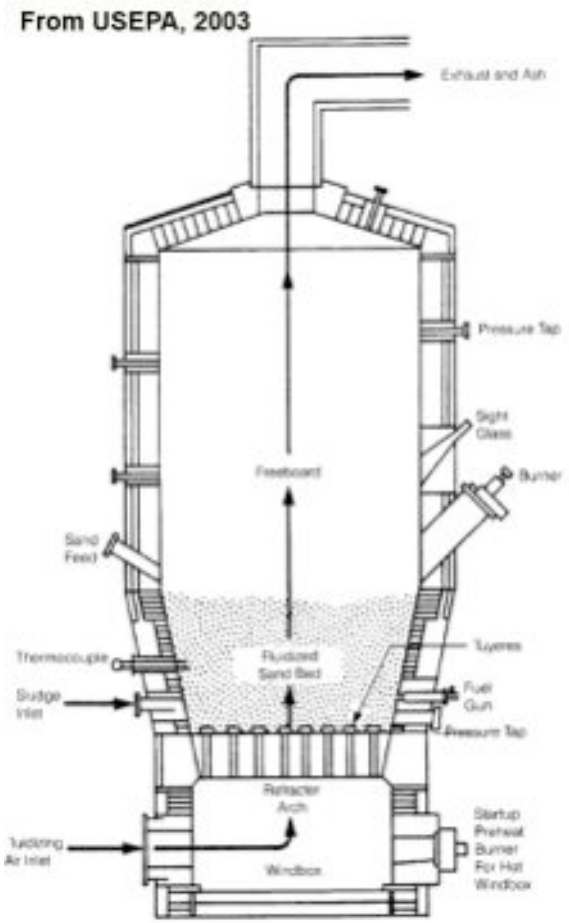


Landfill disposal is becoming less attractive (more expensive) and fails to recover resources.

- Increased focus on getting "organics" out of landfills
- Fugitive methane (GHG) emissions
- Competition for "volume" with MSW and recycling driving MSW mass rates down
- Implications of reduced MSW rates
  - Landfill compactor operation compromised with a poor MSW:CAKE ratio:
  - 15:1 = Acceptable
  - 10:1 = Problematic

Source: www.vandel.fr

Increasingly stringent air emission regulations are impacting utilities that incinerate sludge.



- Changes in MACT rules driving toward lower air emissions rates
- MHI and FBI are considered differently
- “New” and “Existing” are also considered differently.

Increasingly stringent discharge limits have resulted in higher levels of treatment and…

… increased consideration of residuals handling and sidestream recycle impacts on treatment.

Aging infrastructure can bring utilities to the crossroad when considering recapitalization.

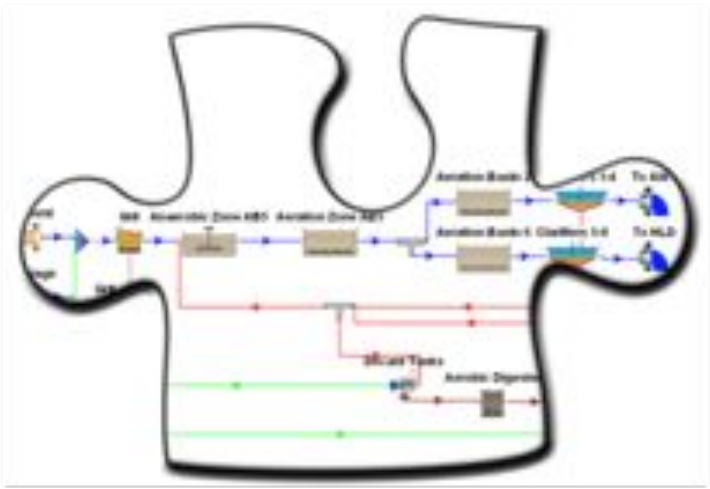
Land application may become more restrictive due to nutrient management regulatory changes

Many Elements Drive Biosolids Improvements

Water Resource Recovery Facility is becoming the new expectation from our former WWTPs.

The new paradigm will require getting the pieces of your plant to work together seamlessly.

Liquid Treatment



Sidestream Treatment

Solids Treatment

Case Studies

Four Case Studies Demonstrate Various Approaches to Future Modifications

1. Multiple large facilities with interconnected biosolids handling

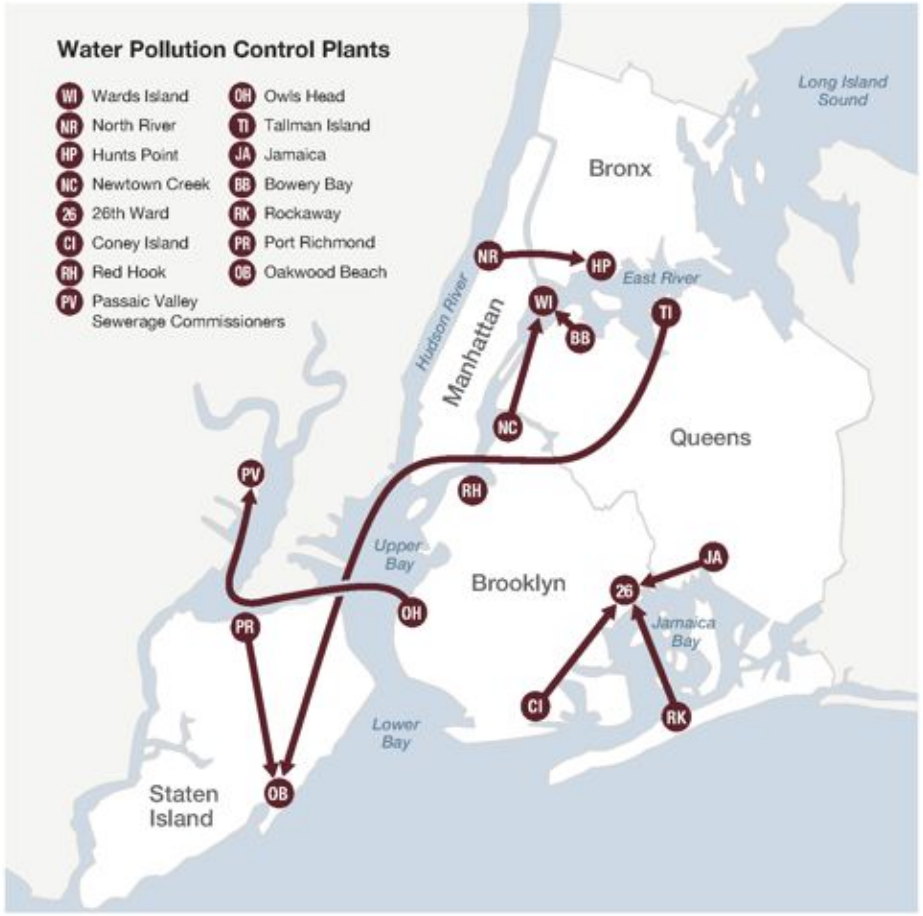
2. Increasing off-site processing costs drive on-site improvements

3. Holistic integrated approach to plant optimization

New York City DEP

Background

- The City-Wide Biosolids Management Plan (BSMP) is a comprehensive evaluation of the solids handling operations and infrastructure at all 14 WWTPs operated by the NYC DEP
- Analysis of current solids handling operations used as baseline for comparison with potential improvements and upgrades
- Future projections for both short (2020) and long-term (2040)



What is Driving the Need for a Plan?

- Infrastructure age

- Increasing solids loads – WAS increases can be significant

	Average 2020 Increase	Average 2040 Increase
Non-BNR Facilities	7.0%	20%
BNR Facilities	25%	39%

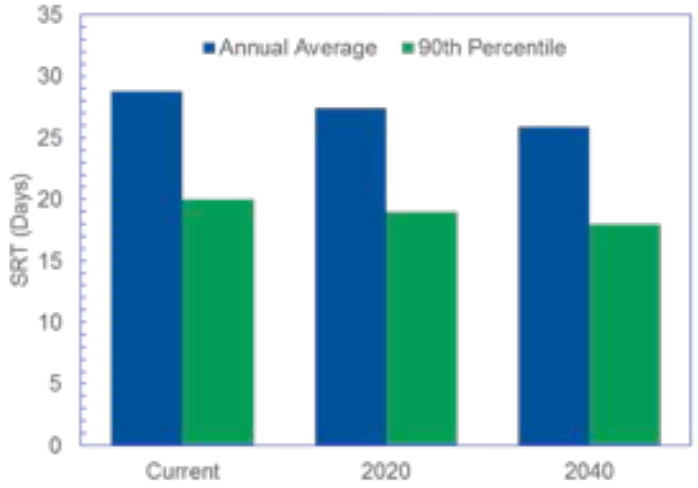
Final Biosolids Handling Contract Approach is Complex

Contract	Duration	Expires	Process	Disposal Location	Daily Amount, Wet Tons		
					Avg	Min	Max
A	3 years	4/19/13	Advanced treatment	NJ	54	54	54
B	4 years	6/23/14	Landfill	VA, PA, OH, GA	250	325	750
C	3 Years	5/31/13	Landfill	VA,PA, OH	290	250	410
D	3 years	3/17/14	Landfill	OH	360	250	410
E	5 years	4/18/18	Advanced treatment	NJ	80	80	100
F	5 years	7/1/17	Lime treatment	PA	305	200	400
G	3 years	7/1/16	Lime treatment	PA	n/d	200	400

Driving to a Class B Biosolids Product May Require Significant Investment

- Digester capacity is limited
- Solution may be a combination of approaches

Facility A



Facility B

Mechanical Thickening Alternatives

Rotary Drum Thickener (RDT)
- Enclosed process
- Slow rotation speed
- Permeable drum
- Large WWTP experience

Gravity Belt Thickener (GBT)
- Highly visible operation
- Simple adjustments to improve performance
- Odor considerations
- Large WWTP experience

NYC DEP – Lessons Learned

- Even large, complex networks can benefit from a new look at biosolids handling approaches
- Defining the goals of the plan are important
- Identifying a phased approach to capital improvements is critical to balance spending
- Balancing nutrient loading from processing activities (i.e. dewatering) is important

Haifa Association of Towns, Israel

Regulations

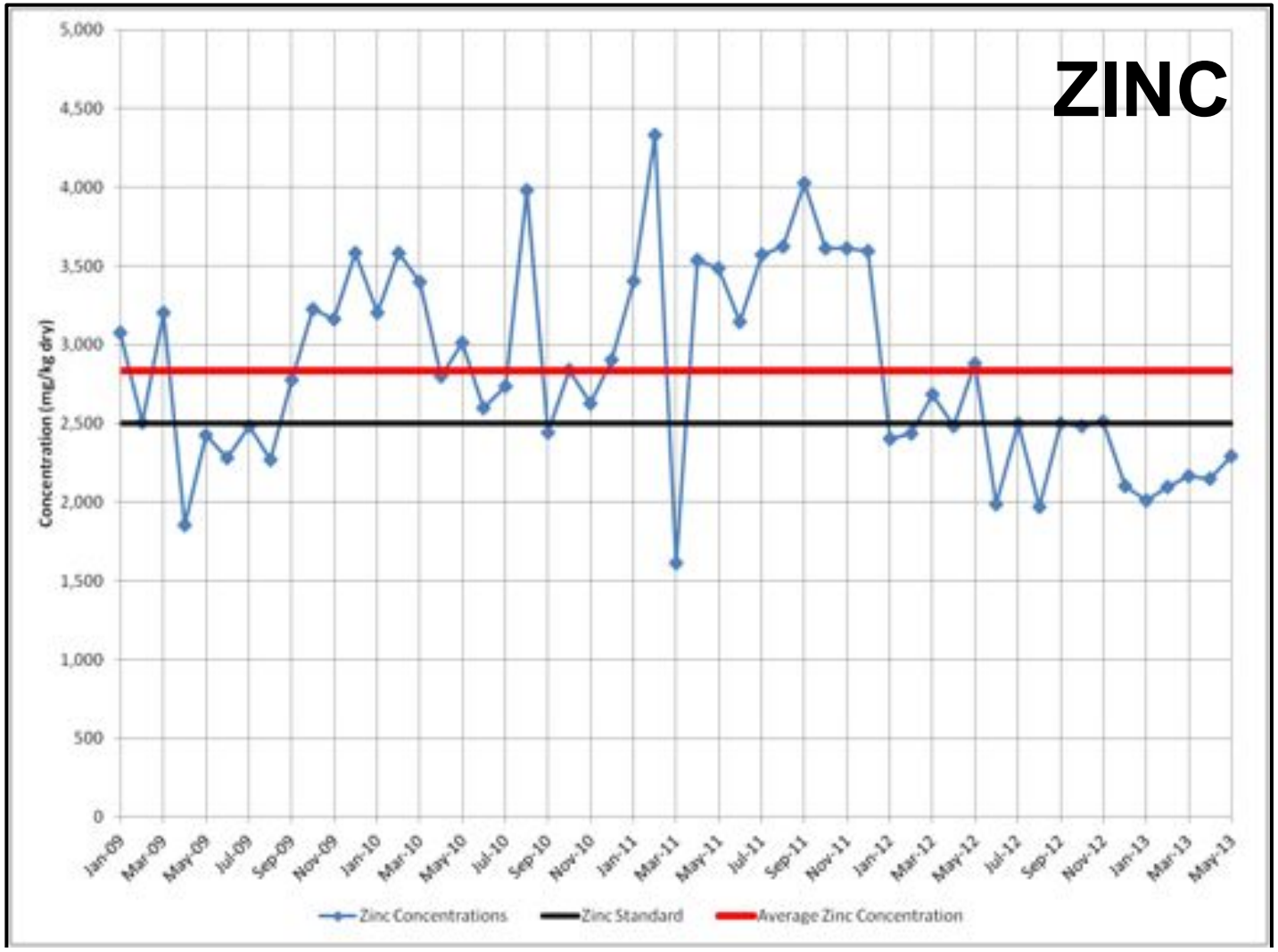
- Water Regulations (Use of Sludge and its Disposal) 2004 require that:
  - Starting in 2007, sludge must meet Class A requirements for agricultural land application

- Off-site composting was chosen for the approach to meet these requirements
  - Two concessionaries each about 150 km away from the WWTP
  - Contracts are set to expire in next 3-5 years
  - Price increasing at ~10% per year

Class A Complications – 2010 Metals

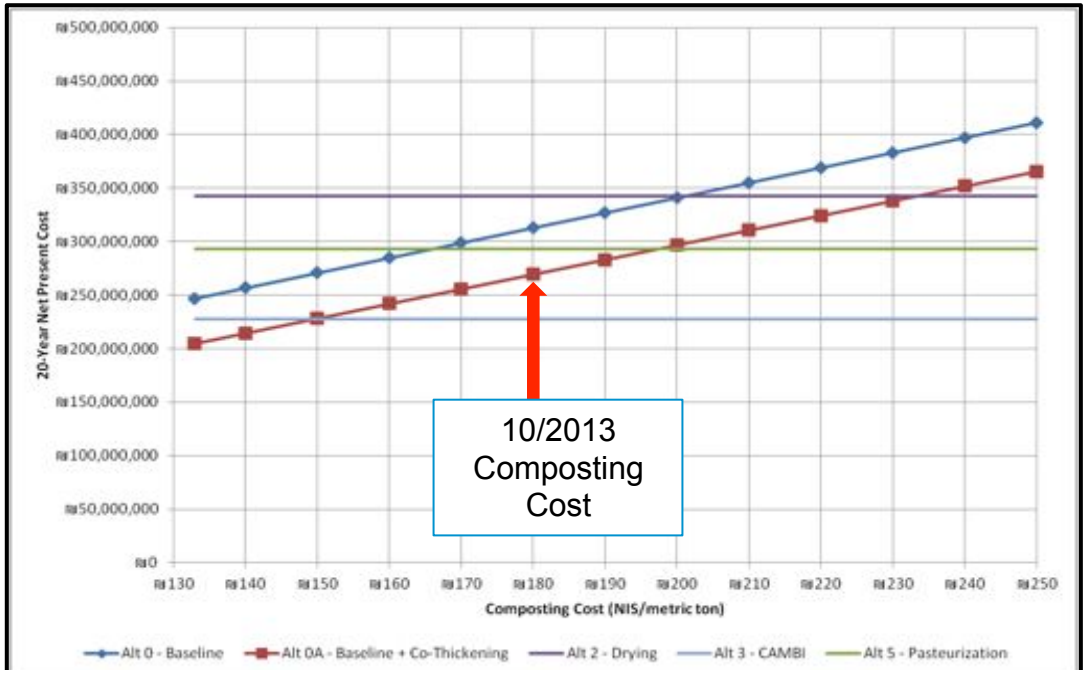
Constituent	Class A Limit (mg/kg_{dry})	Average Pollutant Content (mg/kg_{dry})	Number of Measurements (> non-detect)	Standard Deviation (mg/kg_{dry})
Cadmium	20	0.41	2	0.0
Chromium	400	121	12	62.2
Copper	***600***	***519***	***12***	***152.9***
Lead	200	32.6	12	6.1
Mercury	5	N/D	0	--
Nickel	***90***	***109***	***12***	***26.3***
Zinc	***2,500***	***2,738***	***12***	***512.6***

Variable Metals Concentrations Impact Disposal Options



Economic Sensitivity Analysis

	MASTER PLAN 20-YEAR NET PRESENT COST	UPDATED 20-YEAR NET PRESENT COST
Alt 2 – Thermal Drying	NIS 443,880,000	NIS 342,480,000
Alt 3 – Thermal Hydrolysis	NIS 239,290,000	NIS 227,680,000
Alt 5 – Pre Pasteurization	NIS 284,940,000	NIS 292,850,000



Summary of Solids Upgrades

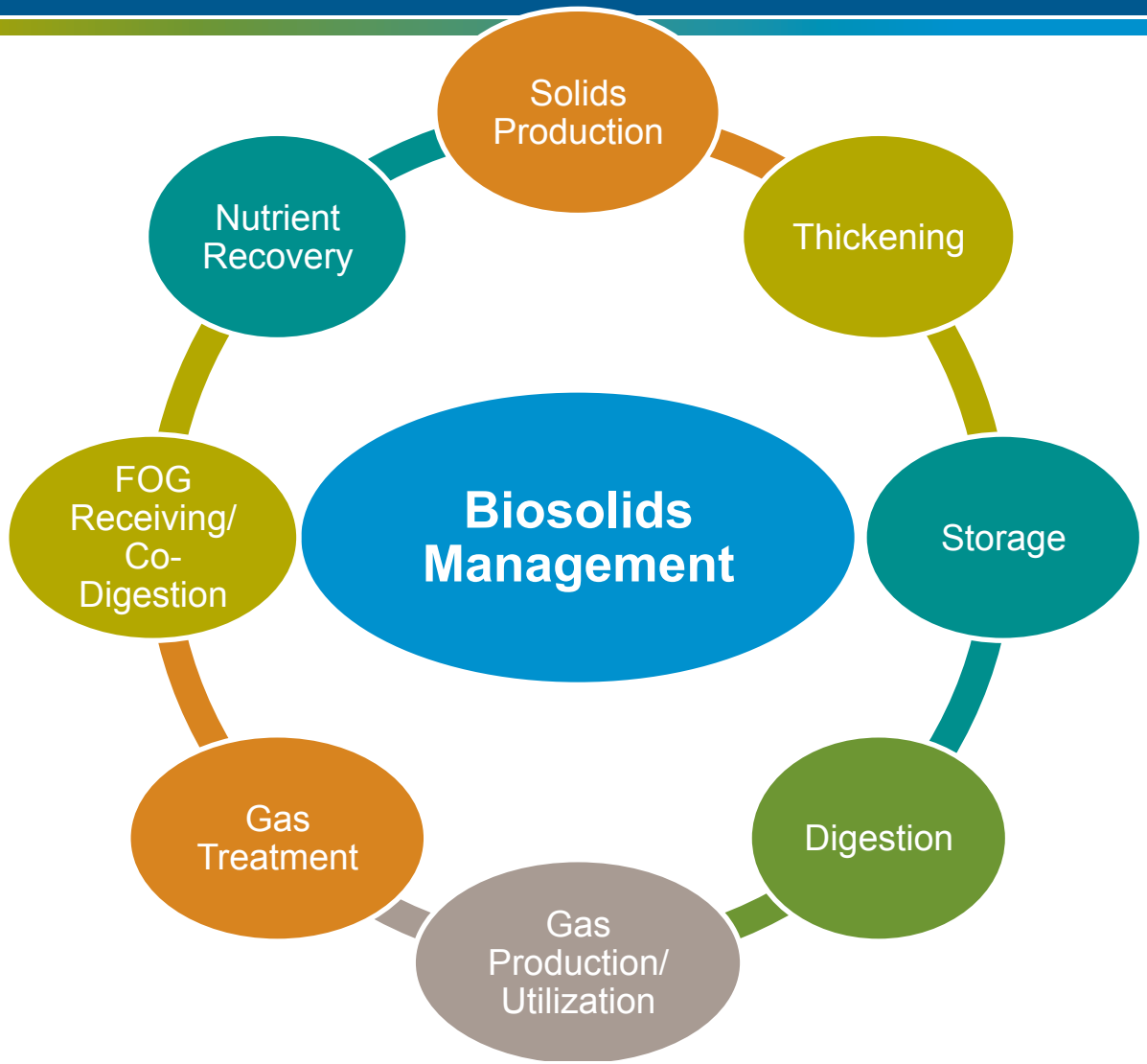
Process	Upgrade(s)	Phasing/Timing
Thickening	Replace 2 GBTs Replace 1 GBT	Phase 1C Phase 3
Co-Thickening	Replace 3 GBTs Replace 1 GBT	Phase 1C Phase 3
Digestion	To be determined – no sooner than Phase 3	Dependent on decision: Class A vs Class B, desired gas production
Dewatering	Class A: discontinue use of BFPs Class B: None required	Class A: in conjunction with dryer implementation Class B: Not applicable
Thermal Drying (Class A)	Installation of belt or drum drying technology potentially followed by gasification in the future	Unknown at this time, may be required in the next several years, pending composting facility availability and regulations

Haifa – Lessons Learned

- Economic analysis can’t be the only factor
- Conditions change and solutions need to be flexible
- There is inherent value in retaining control
- Cannot ignore needs for addressing existing infrastructure

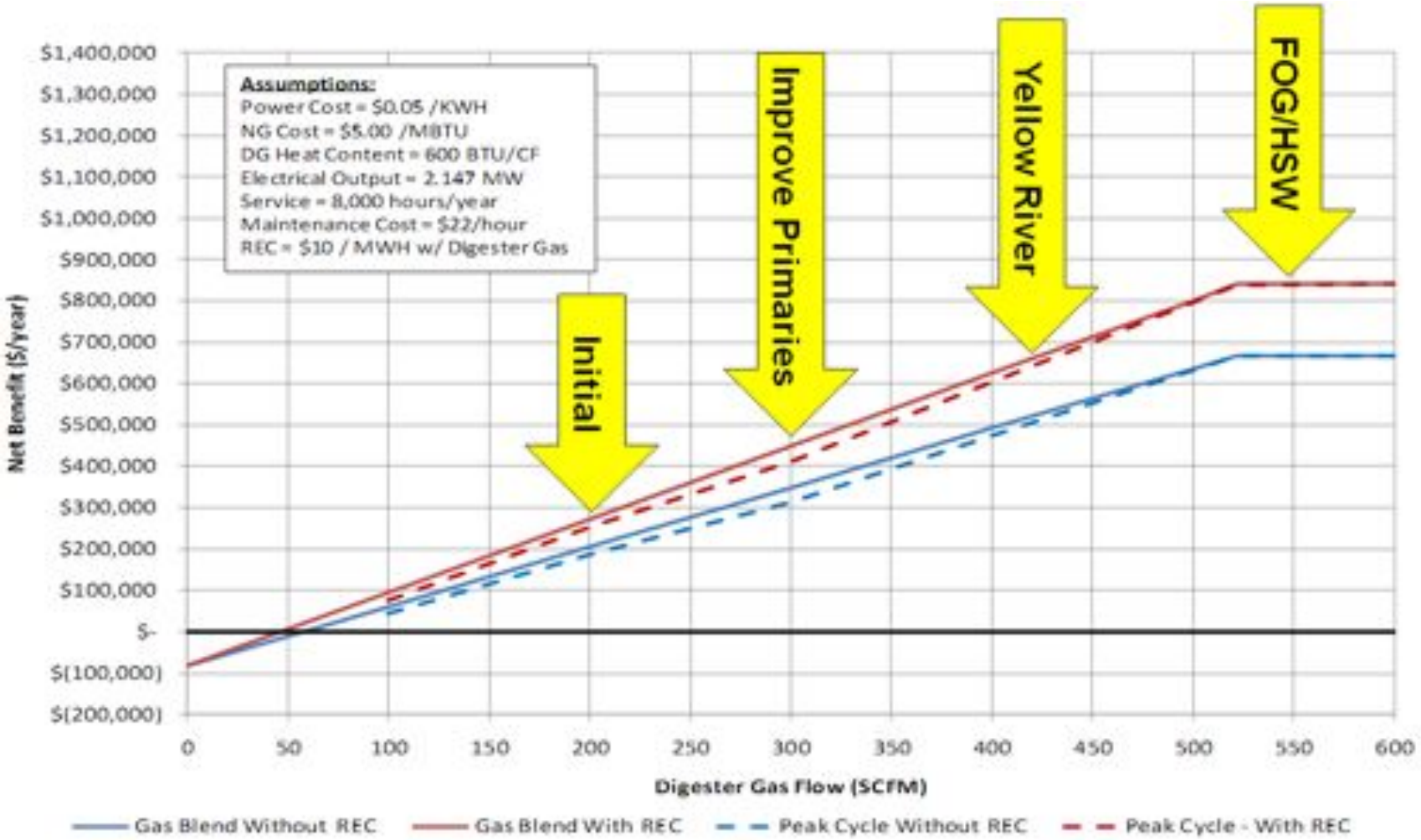
F. Wayne Hill WRF, Gwinnett County, GA

This involved a comprehensive look into their whole process for a synergistic solution.

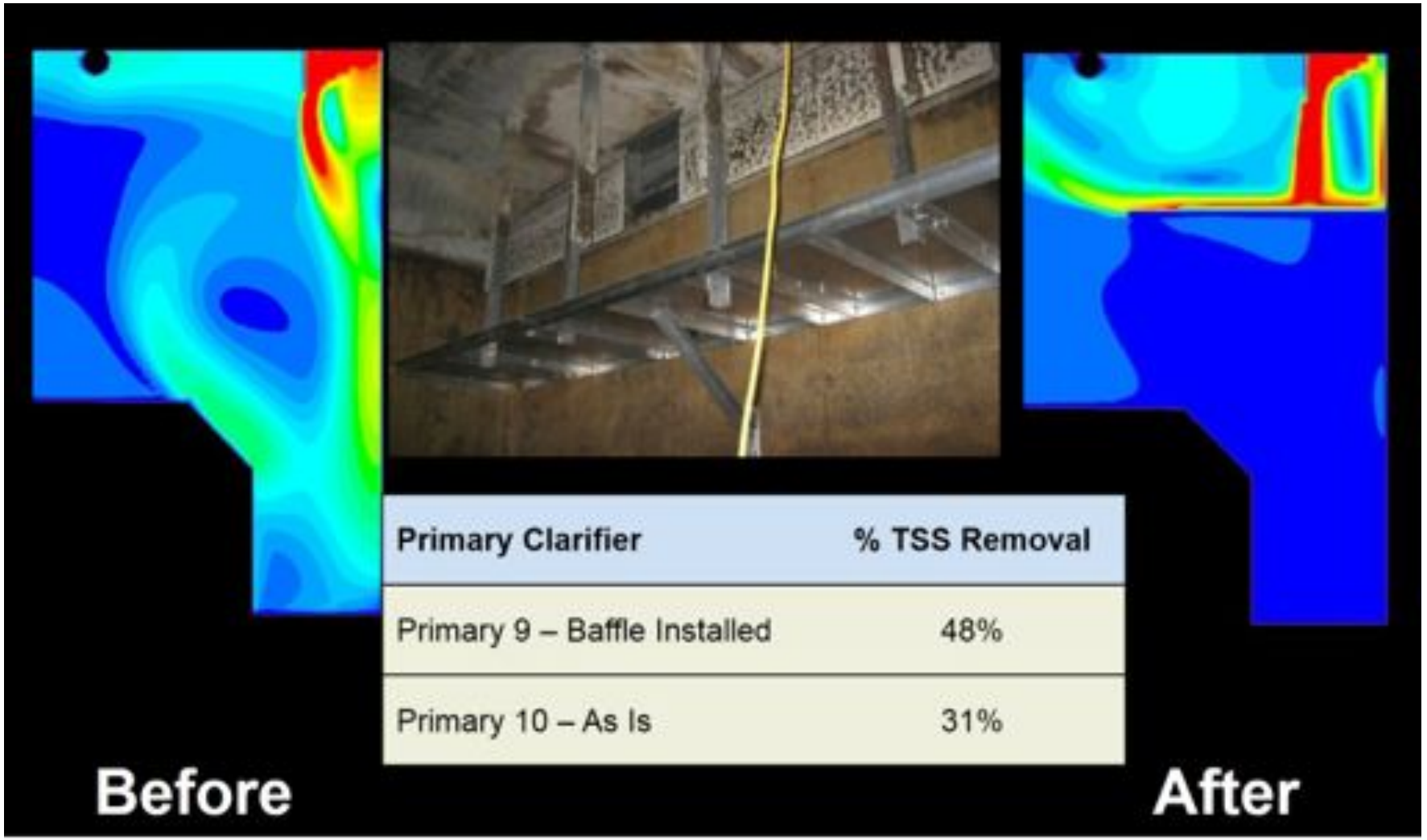


Pending new CHP system was to be added for beneficial use of digester gas.

… but the plant was “short” on digester gas production to meet maximum value solution.

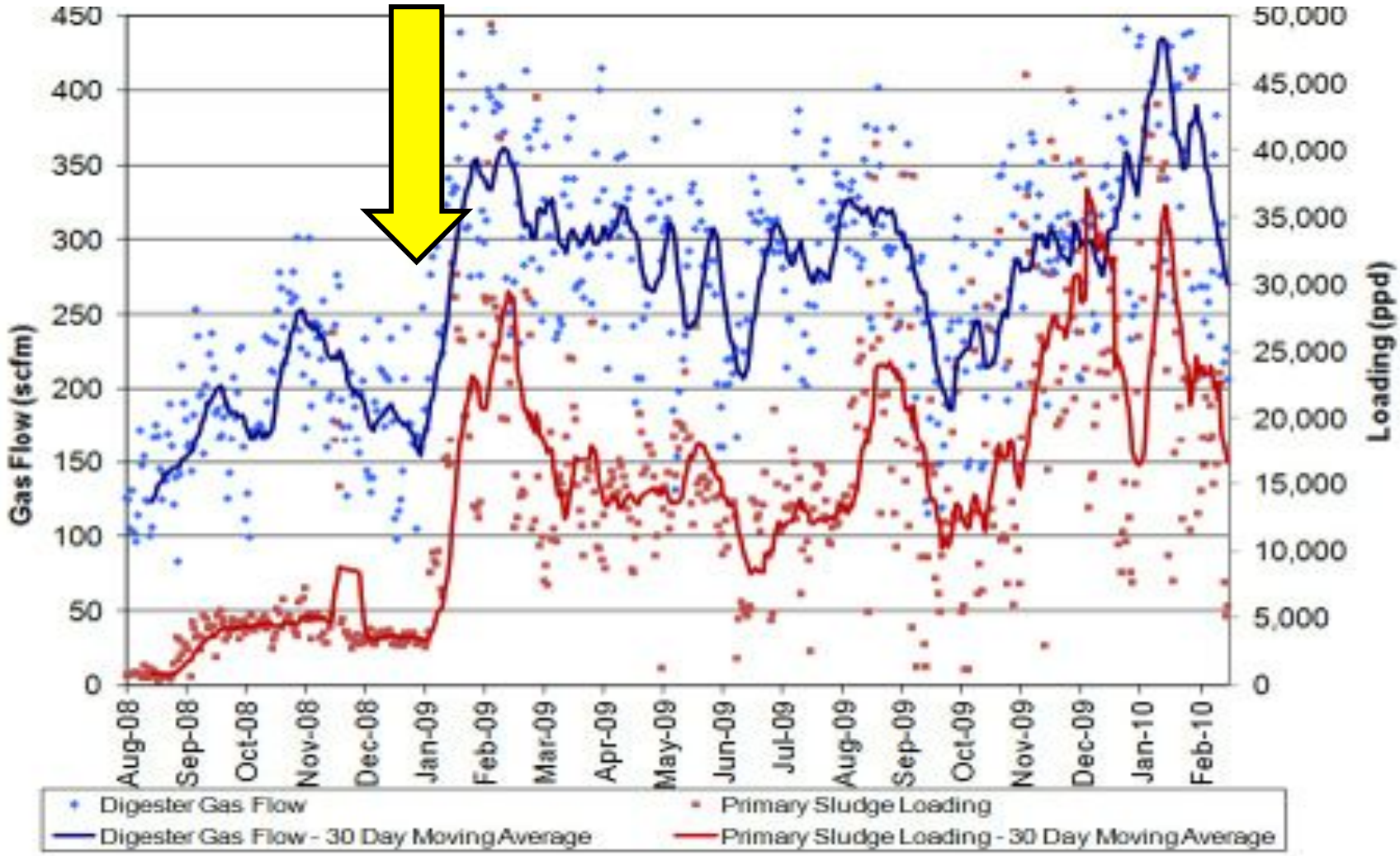


Field testing confirmed a 50% increase in clarifier TSS removal from 31% to 48% after baffle installed



Primary Clarifier	% TSS Removal
Primary 9 – Baffle Installed	48%
Primary 10 – As Is	31%

Digester gas production rates increased with increased primary sludge to digestion.



Other opportunities were also identified during the primary clarifier optimization study.

- BioWin calibration and special sampling verified “true” loadings much lower helping “capacity crisis”
- Improved primary clarifier performance reduced loads to secondary process
- Digesters were still short on capacity
- Recommended co-thickening to 5.5% on RDTs replacing high energy WAS thickening centrifuges

DG2E facility generates 2.1MW output power and saves over $1MM per year in purchased power.

FOG/HSW receiving added for co-digestion of select streams to boost gas production.

Construction underway for installation of on-site struvite recovery system using WASSTRIP

Lessons Learned from F. Wayne Hill

- A “digester problem” likely does not end at the digesters
- Strict discharge requirements can drive improvements throughout the facility
- Sometimes simple is best
- Innovative solutions also have their place

What Can Your Utility do to Plan for the Future?

There are lots of factors to consider in making plans for the future and each utility is unique.

There are no “cookie cutter” solutions that will “fit” each and every situation… except maybe…

- Generally, moving to higher levels of biosolids stabilization will cost you more…
- Some technologies can recover marginal capital costs (e.g., co-generation, struvite harvesting, Co-Digestion of FOG/HSW, etc.)
- Holistic solutions can be cheaper than silo solutions.

Questions?

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WERF Research
Operational Impacts of Co-Digestion

- Survey nearly ready for distribution
- Looking for utilities in any stage of co-digestion planning or implementation
- Report expected in late 2015 or early 2016

Send an email to
mvanhorne@hazenandsawyer.com
to get early notification of the survey!