THERMO SYSTEMS

INDUSTRIAL AUTOMATION & INFORMATION

Biogas CHP to Lower Costs and GHG through Advanced Controls

Pepco Energy Services

www.thermosystems.com

AGENDA

- Intro
- Project Overview & Benefits
- System Overview
- Project Challenges
- Conclusion
- Questions

DCWater Service Area

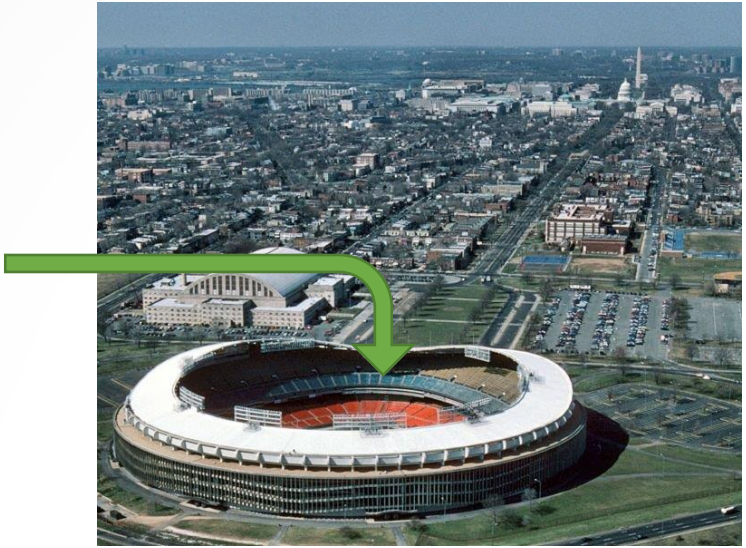
- Service area: 725 sq. miles
- Water & Wastewater to 500,000 customers in DC
- Wastewater treatment for 1.6M customers in surrounding counties

DCWater Facility Overview

- Worlds Largest AWTP
- 153 Acres
- Capacity
  - Average: 384M GPD
  - Peak: 1.076B GPD
- Largest power user in DC

Blue Plains AWTP

- Worlds Largest AWTP
- 153 Acres
- Capacity
  - Average: 370M GPD
  - Peak: 1.076B GPD
- Largest power user in DC



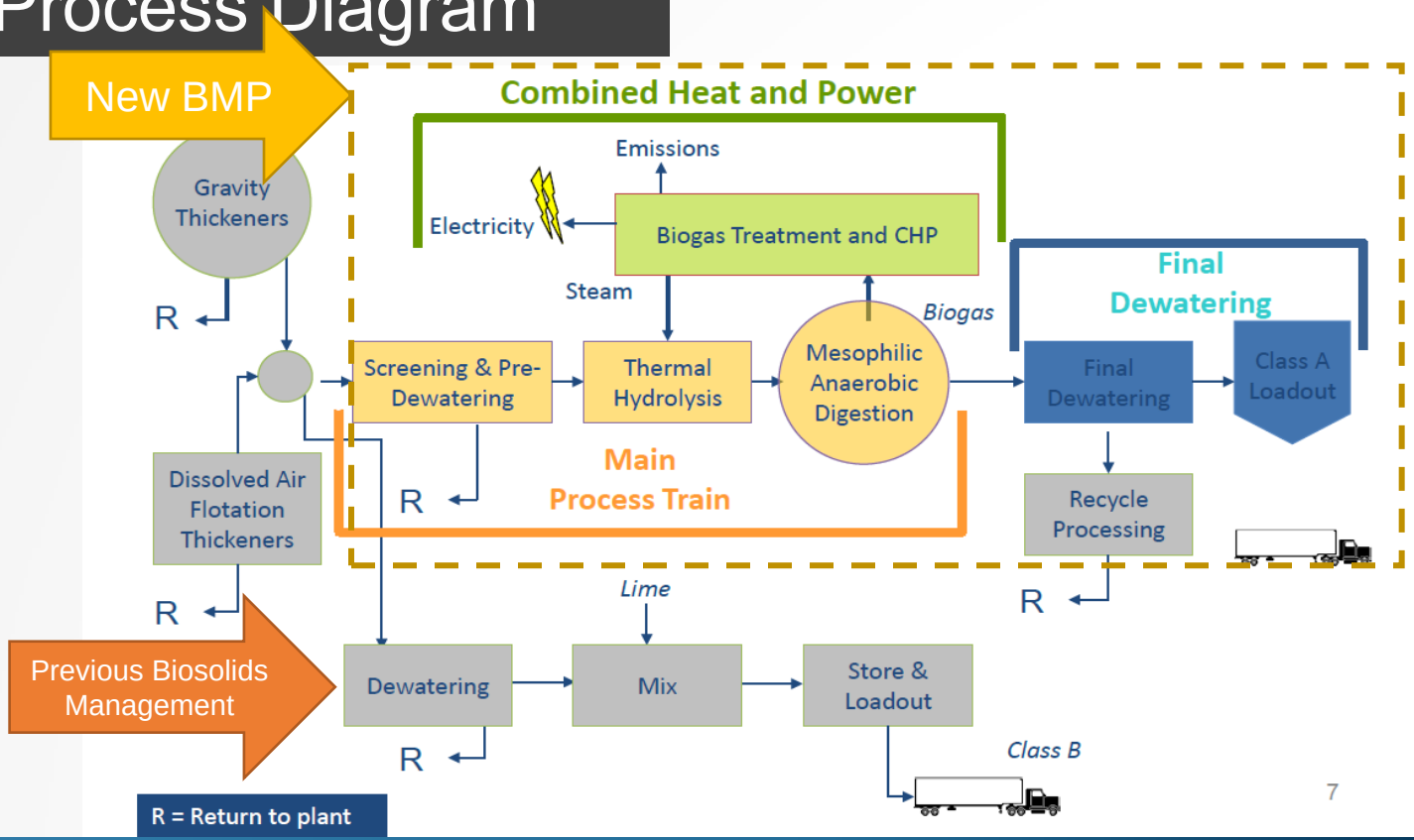
Previous Biosolids Management

- Lime Stabilization
- Class B Biosolids
- 1,200 wet tons/day
  - 65 Truckloads
- Land applied
  - Agriculture
    - 39 Counties in MD & VA
  - Silviculture
    - 40,000 acres in VA
- Annual Cost: ~$10M

New Biosolids Management Goals

- Reduce Operating Costs
  - Hauling Costs
  - Energy Costs
- “Green Benefits”
  - Reduce Energy Consumption
  - Reduce Greenhouse Gas Emissions
- Produce Class A Biosolids

BMP – Process Diagram

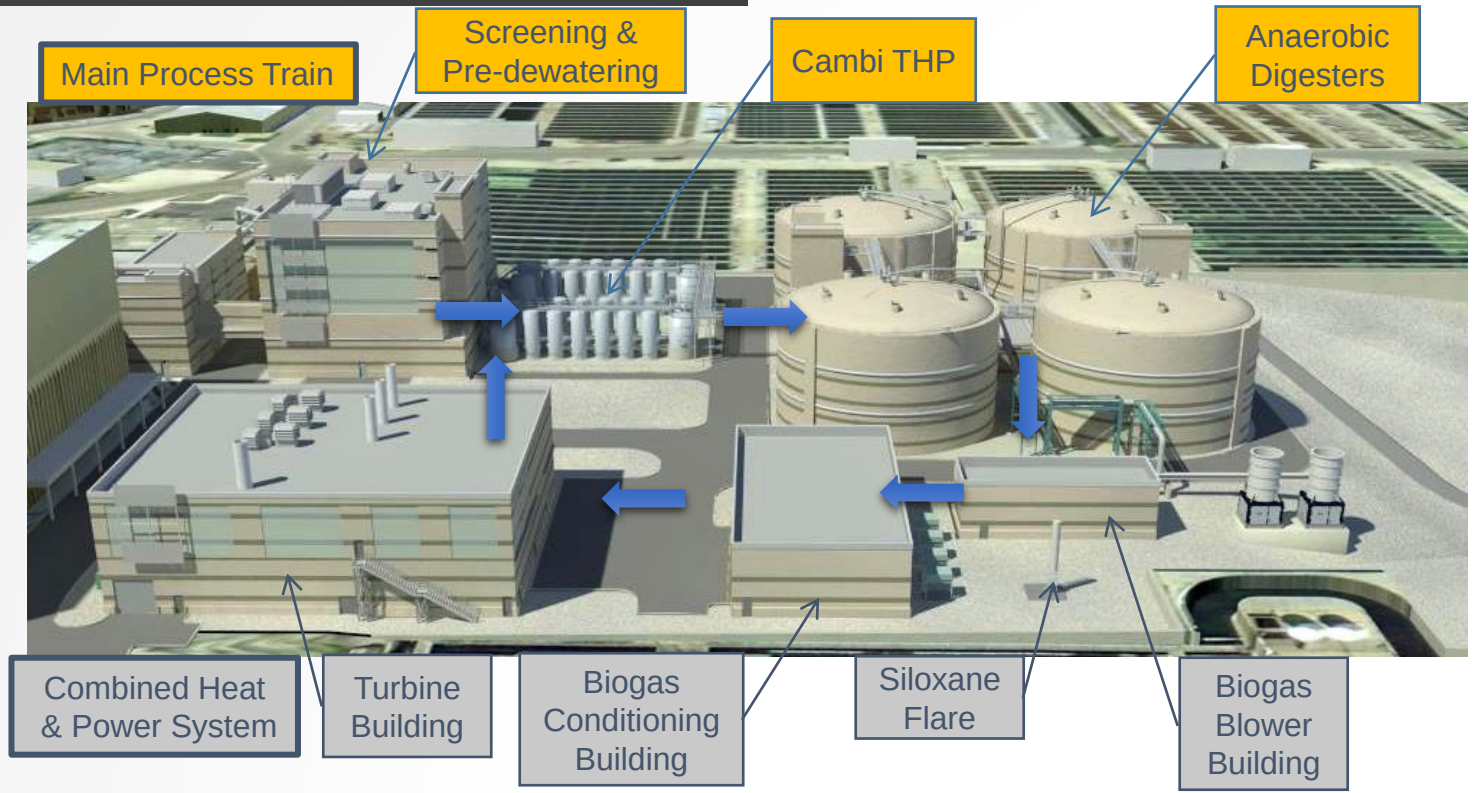


BMP - Core Components

Main Process Train (MPT)

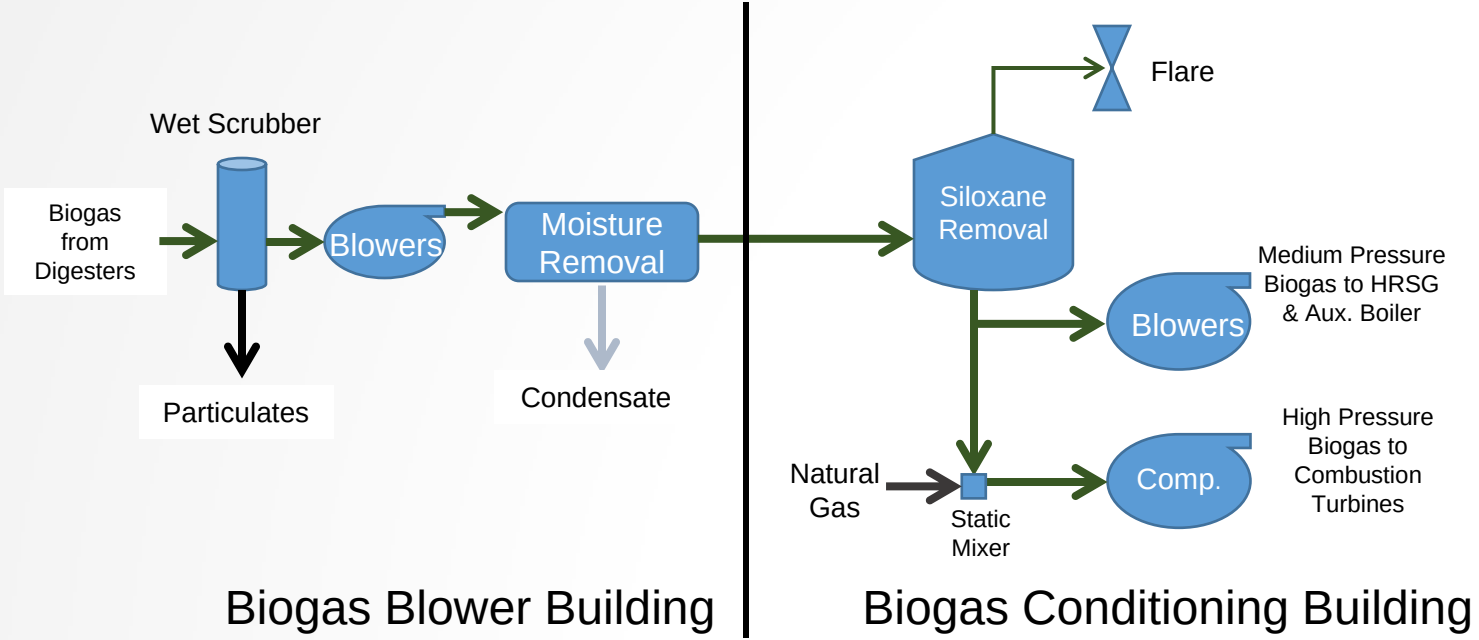
- Solids Blend Tanks
- Solids Screening & Pre-dewatering
- Cambi™ Thermal Hydrolysis Process
  - Four parallel trains, six reactors each
  - Pretreats sludge for more complete digestion
  - *Requires 47,500 pph of steam to heat and pressurize the sludge*
- Four Anaerobic Digesters
  - 80’ high, 100’ diameter, 3.8M gallons
  - *Produce 1.2M cfd of biogas, each*
- Enclosed Flares

BMP Site Layout

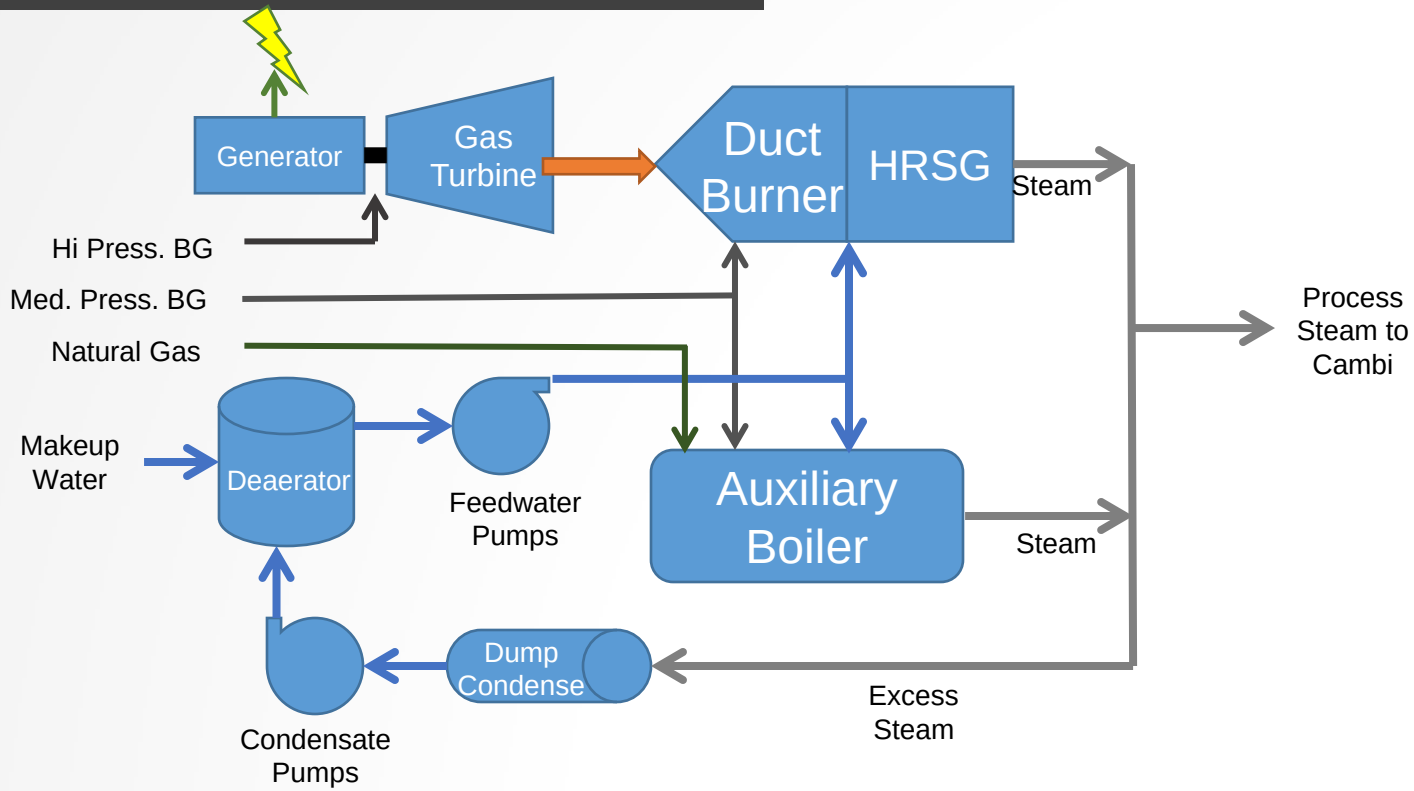


Biogas Conditioning Process Flow Diagram

- Biogas must be cleaned, dried, and pressurized for use in the combustion turbines



CHP Process Flow Diagram



Turbines & Steam System

- Solar® Mercury™ 50
  - 4.6MW @ 13.8kV
- Rentech HRSG
  - Produce 14,000 pph @175 psig
  - Duct burner
    - Up to 35,000 pph
- Auxiliary Boiler
  - 47,500 pph
  - Dual fuel
- Standby Diesel Generator
  - 2MW

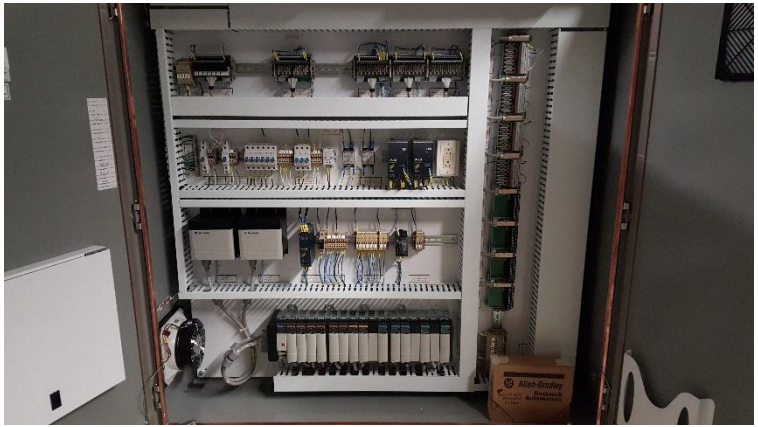
Solar Turbine

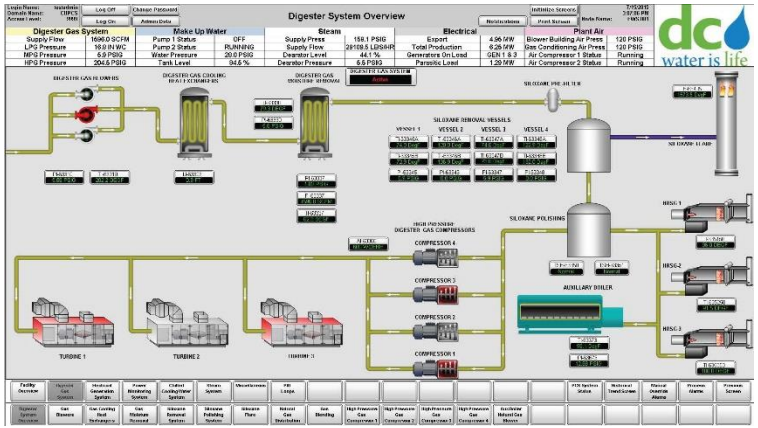
HRSG

Aux. Boiler

BOP Control System

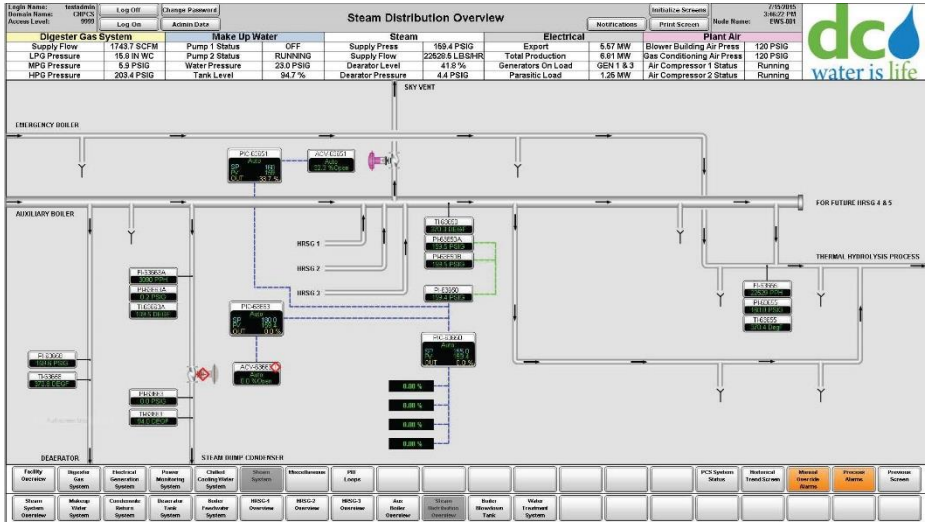
- Redundant Allen Bradley ControlLogix PLC
- Two (2) RIO Panels
- Wonderware SCADA





Project Requirements

- First Requirement – Burn all available biogas
- Second Requirement – Produce steam to satisfy current process load
- Third Requirement – Maximize electrical production

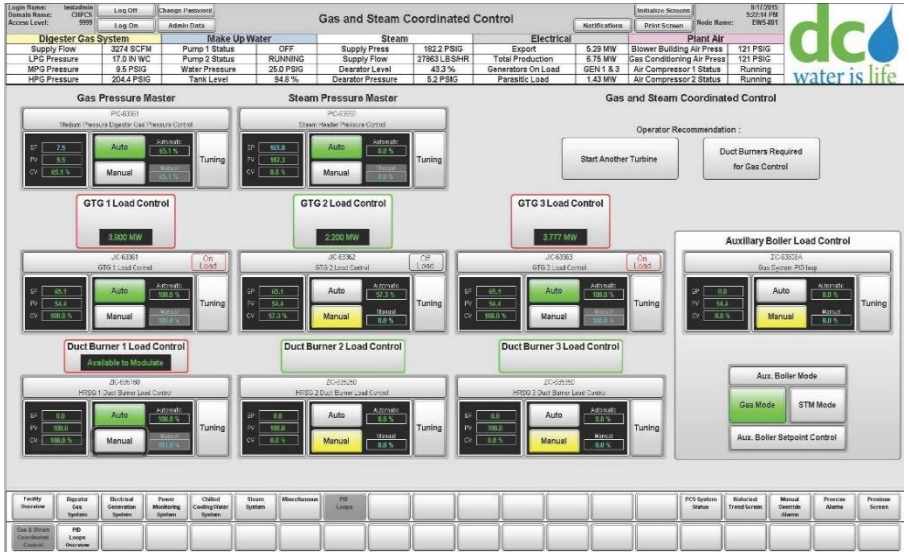


Project Challenges

- Varying supply volume of biogas
  - Ambient conditions
  - Volume of material being processed
- Varying energy content of biogas
  - Quality of Anaerobic Digestion Process (Digester Tanks)
- Varying steam load of process
  - BMP Thermal Hydrolysis

Coordinated Gas & Steam

- Gas Pressure Master Control
  - Modulate gas consumers' (DB & GTG) to control biogas header pressure
- Steam Pressure Master Control
  - Modulate steam producers' (DB) firing rates to control steam header pressure
- Special Circumstances
  - NG Blending
  - Duct burners for Gas Pres. Control



BMP Benefits

Biosolids Disposal

- Reduce biosolids volume by 50%
- Reduced Hauling costs by $10M
- Reduce risk of future disposal cost increases
- Class A biosolids available for beneficial reuse
- Reduce O&M of Lime Stabilization

Energy

- Produce clean-burning digester gas for heat and power
- Generate 30% of daily power demand for Blue Plains AWTP
- Reduce Electricity Costs by $10M
- Hedge against future electric price increases

Sustainability

- Reduces DC Water's greenhouse gas (GHG) emissions by ~ 40%
- Reduce truck traffic and truck emissions by an estimated 1.2 Million miles

Thank You

References

http://lystek.com/what-are-class-a-class-b-biosolids/
https://www.dcwater.com/
Pepco Energy Services – “SCEC - DCW CHP Presentation” dated March 15, 2015

Class A vs B - Reference

- What Are Class A Biosolids? - In Class A biosolids, pathogens must be reduced to virtually non-detectable levels and the material must also comply with strict standards regarding metals, odors and vector attraction reduction (VAR) as specified in the US EPA, Part 503 Rule. VAR refers to processing which makes the biosolids less attractive to vectors, which have the potential for transmitting diseases directly to humans or can play a role in the life cycle of a pathogen, as a host.
- Examples of vectors are flies, mosquitoes, rodents, birds, etc. Various processes can be utilized to achieve Class A designation such as anaerobic digestion, lime stabilization, composting and thermal hydrolysis. This designation means the material meets U.S. EPA guidelines for land application with no restrictions. Thus, Class A biosolids can be legally used as fertilizer on farms, vegetable gardens, and can be sold to home owners as compost or fertilizer.
- The term Class A EQ (Exceptional Quality) is used to describe a biosolids product that not only meet, but exceed, all Class A pathogen reduction metals and VAR requirements.
- What Are Class B Biosolids - Class B biosolids are treated but contain higher levels of detectable pathogens than Class A biosolids. The use of Class B biosolids and may require a permit from the EPA with conditions on land application, crop harvesting and public access. In terms of nutritional value, however, Class B and Class A biosolids are similar as they both contain important nutrients and organic matter.
- Due to pathogens, odors and the ability to achieve higher VAR standards with advanced technology, there is a distinct shift away from Class B use and toward Class A and Class A EQ treatment solutions.