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Beneficial Biogas – Lakewood's Design-Build Digester Upgrades

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Presenters

Mirko Kucinic – Superintendent, Lakewood WWTP

Timothy F. McCann, PE – Design Manager, AECOM

Todd Schurig, PE DBIA – Preconstruction Manager, Kokosing Industrial, Inc.

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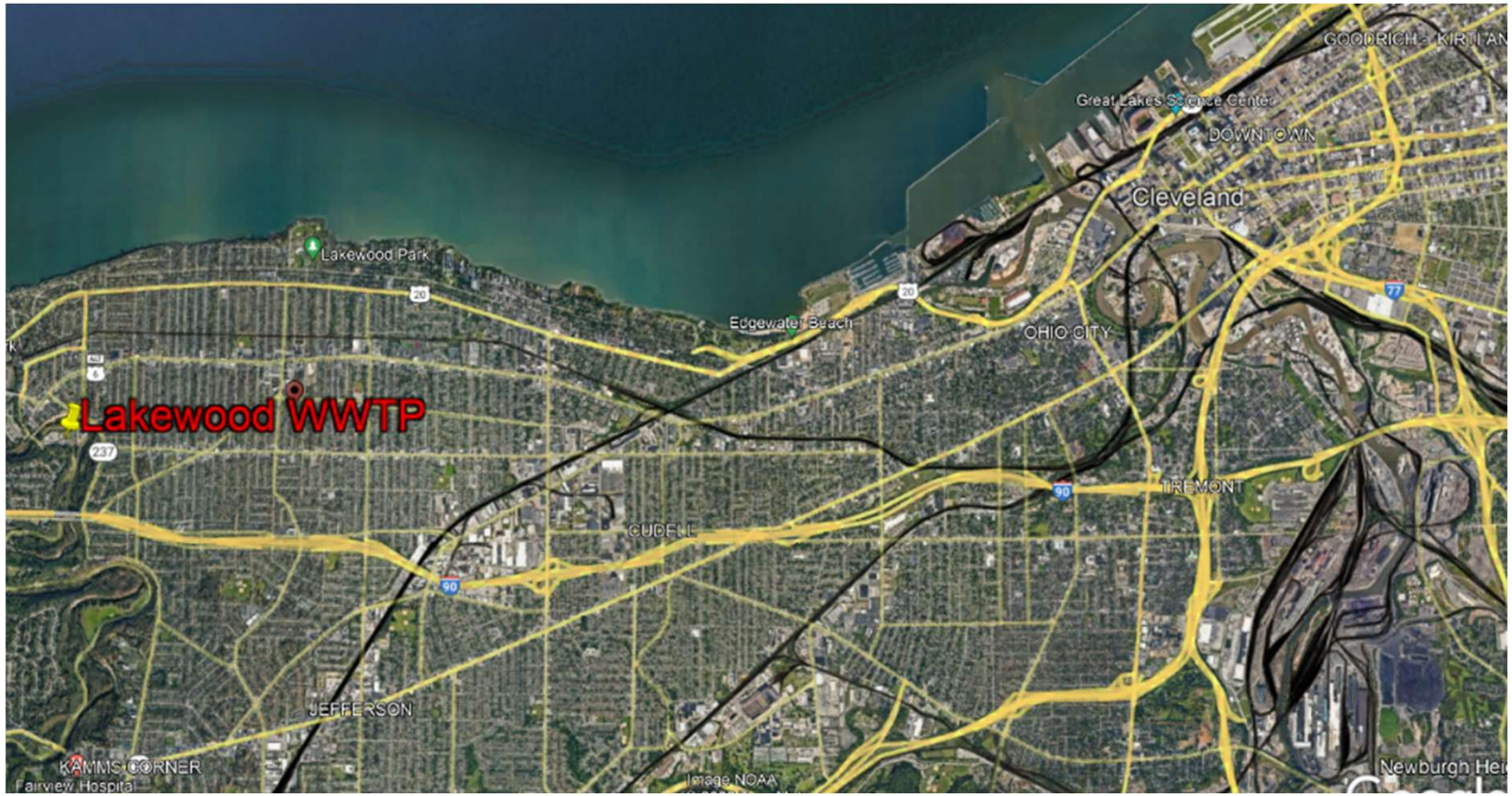
Agenda

- Introduction
- Lakewood WWTP Background
- Project Background
- Design Build Approach and Solutions
- Construction of the Improvements
- Operational Information
- General Discussion / Q&A

Mirko

Lakewood WWTP Background



Mirko

Lakewood WWTP Background

- Current Plant built in 1965
- Activated Sludge Treatment
- WWTP and CEHRT sit on 11 AC along the Rocky River
- Effluent discharge to Lake Erie
- Treats 18 MGD (Avg)
- Capacity – 30 MGD wet weather
- Capacity – 40 MGD max hydraulic

Mirko

Lakewood WWTP Treatment Processes

- Screening, De-Gritting, and CEHRT
- Primary Settling
- Gravity Sludge Thickening
- Biological Treatment (Aeration)
- Coagulation Addition for Phosphorus Removal
- Final Settling
- Disinfection (UV, May 1 to Nov 1)
- Anaerobic Digestion & Biosolids Disposal

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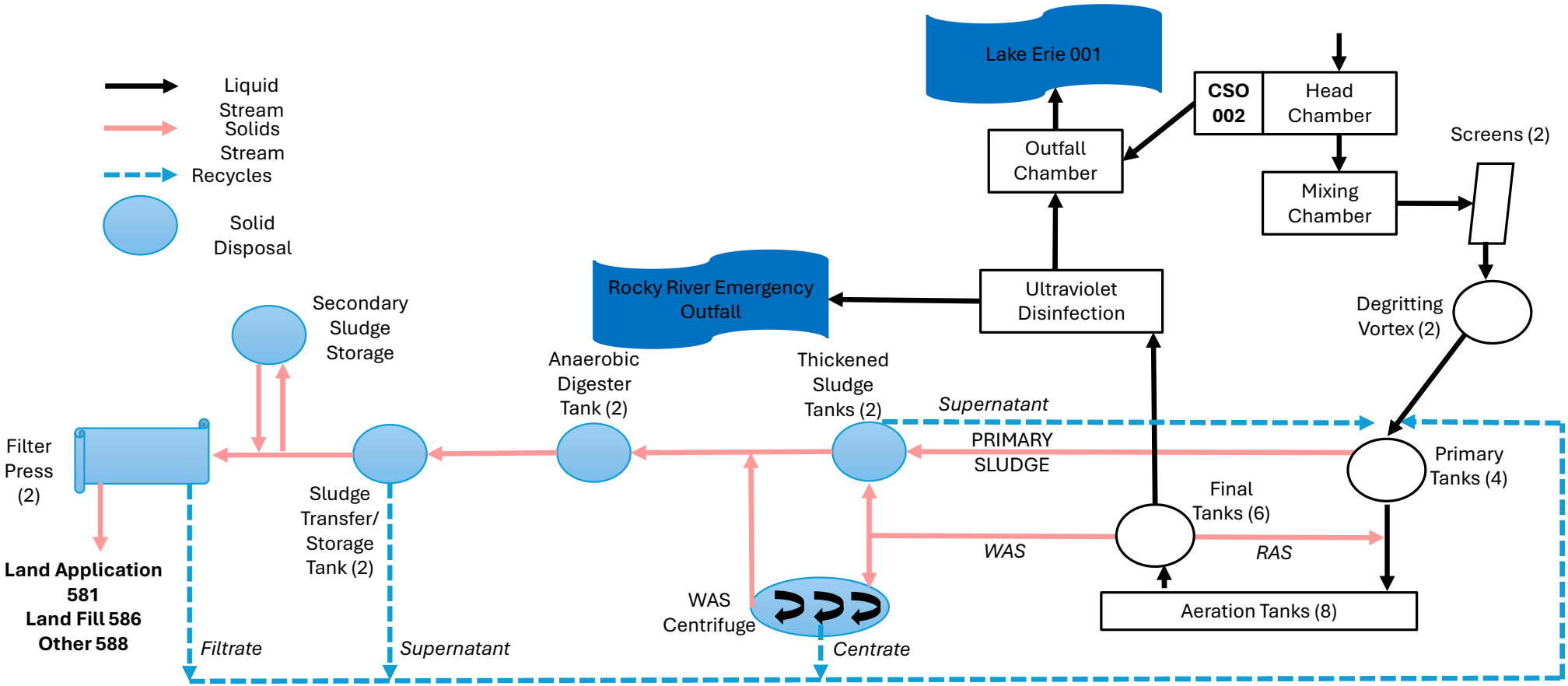
Lakewood WWTP Process Flow Diagram



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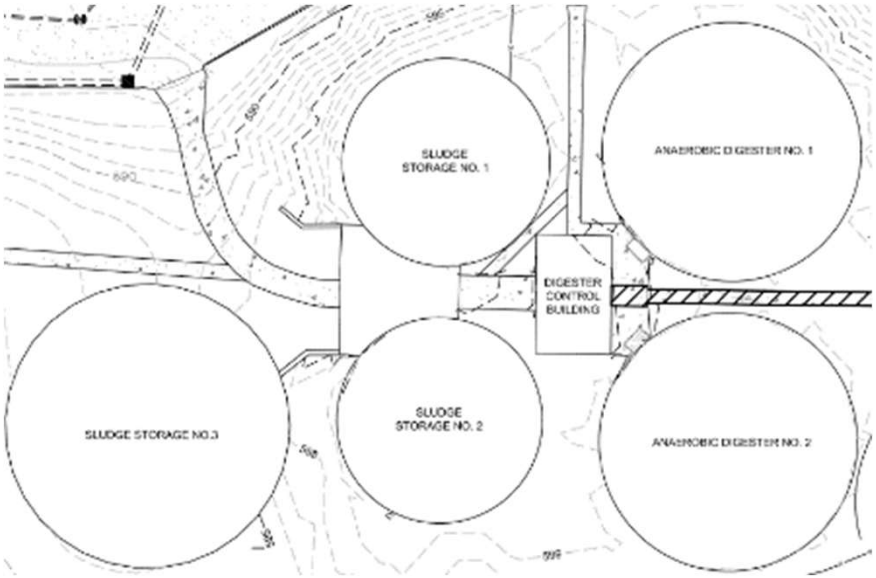
Anaerobic Digester Process Prior to Improvements

- Two (2) 75’ Dia. x 22.5’ SWD Anaerobic Digesters
- Primary, WAS and Skimmings
- Two (2) 60’ Dia. x 22.5 SWD Sludge Storage Tanks
- One (1) 77’ Dia. x 21.5 SWD Sludge Storage Tank
- Two (2) Belt Filter Press
- Land Apply Biosolids in Summer Months
- Landfill as Backup
- Sludge Storage to Maximize Land Application



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Digester Improvement Needs Background

1. Safety Improvements
   - NFPA 820 Compliance
   - Flare on Roof of Building
2. General Improvements
   - Old Equipment, Tanks and Covers
3. Maximize Utilization of Methane
   - Storage and Beneficial Use of Gas
4. Two-Phase – Thermophilic-Mesophilic Anaerobic Digestion
   - Class A Sludge

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Lakewood WWTP Digester Improvements

- Primary Digester Cleaning
- Inadequate Digester Mixing (Top Mixers)
- Electrical Equipment Code Compliance
- Primary Digester Concrete and Roof Unknown Condition
- Original Flare and Flame Arrestor Code Compliance
- Boilers and Heat Exchanger Replacement (>35 years old)
- Methane Gas Storage/Utilization
- Allen Bradley PLC5 Controls Upgrade

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NFPA and Electrical Upgrades

- Methane Piping in Building
- Electrical Code Compliance
- Adjacent to Electrical
- Corrosion in Piping
- Limited Access

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Flare Replacement

- New Flare away from Structures
- Code Compliant Equipment
- Located on Digester Building Roof

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Project Phasing

1. Design Phase - Preconstruction
   - Digester Cleaning
   - Alternative Evaluation
   - Design / Pricing
2. Build - Construction

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Digester Cleaning

1. Clean Digester
   - Temp Press
   - Sludge Hauled Away
   - Tank Cleaned
2. Assess Conditions
   - Cover Evaluated
   - Concrete (walls / slab) Reviewed
3. Determine Life Expectancy / Scope

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Alternatives Evaluation

- Number of Primary Digesters Required
- Digester Cover Types
- CHP Engine Generator vs. Microturbines
- Sludge Mixing Systems
- Heat Exchangers
- Recirculation Pumps
- Gas Conditioning
- Future Capacity
- Gas Utilization

Todd

Design Build Approach to Improvements

Why go Design-Build? ***COLLABORATION IS THE KEY!!!***

1. **<u>COLLABORATION</u>** on Scope / Design
   - Team approach to the project
     - Correctly sizing the equipment
     - Equipment selection
2. **<u>COLLABORATION</u>** on Pricing
   - Historical Cost Application
   - Up to date budgeting and vendor input with design progress

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Design Build Approach to Improvements

- ***Original Approach***
  - Class A Sludge Process was the original intent
- ***Collaborated Approach***
  - Future Proofing / Foundation
  - DB Team pitched correcting some of the safety issues in order to future proof the plan
  - The Team addressed the NFPA safety issues and took all the gas equipment outside or in a new dedicated facility

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Design Build Solutions to Improvements

Digester Mixing System – Gas Production Improvement

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Design Build Solutions to Improvements

Gas Holder Digester Cover – Gas Storage Improvement

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Design Build Solutions to Improvements

NFPA Improvements Solution – Exterior Gas Lines and Equipment

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Design Build Solutions to Improvements

NFPA Improvements Solution – New Energy Recovery Building (ERB)

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Biogas Equipment – Gas Conditioning

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Design Build Solutions to Improvements

Biogas Equipment – Gas Utilization

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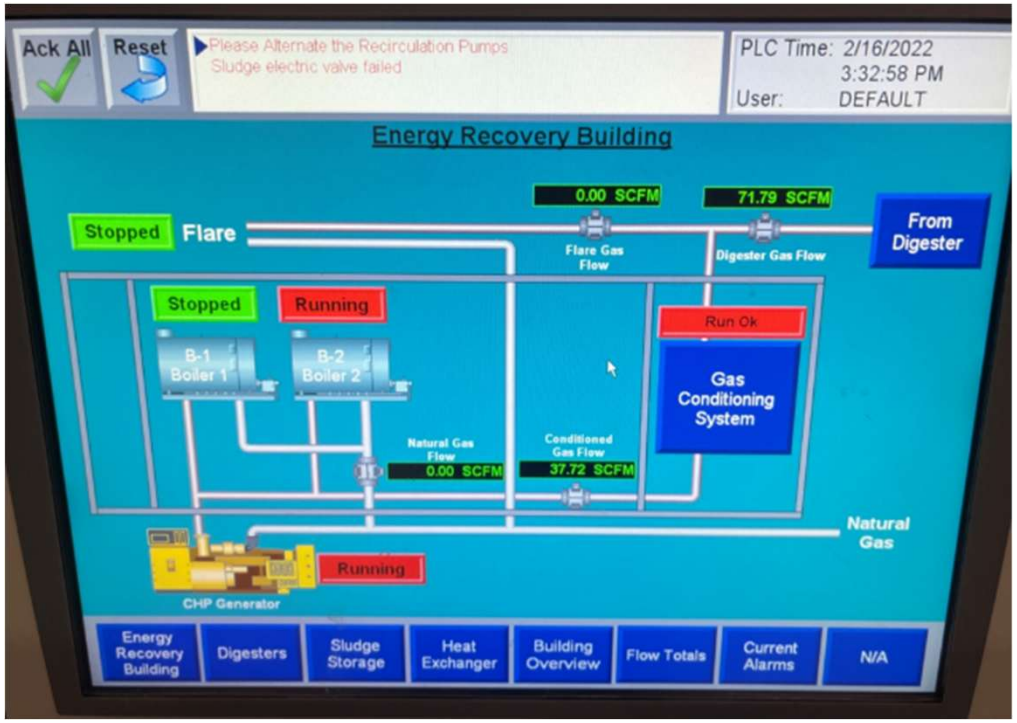
Design Build Solutions to Improvements

System Controls and Gas Monitoring



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Digester Operational Information

- Initial Startup Phase for all Equipment
- Utilizing Boilers and CHP
- Running on One Anaerobic Digester

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Digester Methane Production/Usage – 2024 Data

	Gas Production	Boiler Usage	Flare Usage	CHP Usage	Boiler NG Use
Average	710	317	92	301	4
Total	260,030	116,141	33,580	110,309	1,384
Minimum	437	74	2	14	-
Maximum	1,179	641	561	827	114

Values in 100 ft^3/day

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Mirko

Digester Methane Production Comparison

	May 2016	July 2016	Oct 2016	Dec 2017	Jan 2017	2024 Avg.
Average	597	587	493	486	448	710
Maximum	709	816	583	595	508	1,179

Values in 100 ft^3/day

2016-17 Average: 522

2024 Average: 710

36% INCREASE IN METHANE

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Digester Operational Summary Information

- Old system (two digester) gas production – 522 cCF / day
- New system (one digester) gas production – 710 cCF / day
- Increased Methane Production – Approx. 36%
- Methane Utilized in CHP
- Produces Approx. 30% of Plant Electricity
- 13,852 Run Hours
- Total KW/H: 1,162,109

CHP Maintenance

- Oil Changed – Approx. 8 times
- Spark plugs changed – around 8 times
- Engine heads replaced – once (at 10,000 hours)
- CHP runs between 80% - 90% of power
- Main water recirculating pump replaced – 1 time
- Radiator cooling fan motor replaced – 1 time
- Iron sponge and Siloxane media replaced – 1 time
- Methane gas H2S concentration must be below 100 mg/L

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Project Challenges

- High Hydrogen Sulfide Content in Gas
- Foaming During Digester Startup
- Dialing in Methane Gas Parameters
- More Gas to Optimize Boiler and CHP Run Times
- Gas Metering

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General Discussion / Questions?

THANK YOU!!

Digester Cover and Mixing Pump

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New Sludge Heat Exchangers and Recirc. Pumps

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New Energy Recovery Building

New Flare and Boilers

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New Combined Heat & Power Unit

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