

Northeast Ohio Regional Sewer District

Residuals Management Validation Workgroup

Summary of Findings
and Recommendations

August 15, 2008



Welcome and Introductions



District convenes validation panel



District convenes validation panel

- **Dr. Cecil Lue-Hing** – biosolids expert and former utility director of R&D
- **Dr. Terry Logan** – agronomist and biosolids product use
- **Scott Harder** – finance and carbon footprinting
- **Perry Schafer** – biosolids technology
- **Dr. Tim Shea** – biosolids technology
- **Jim Welp** – thermal systems and energy recovery
- **Lori Stone** – biosolids planning and environmental management

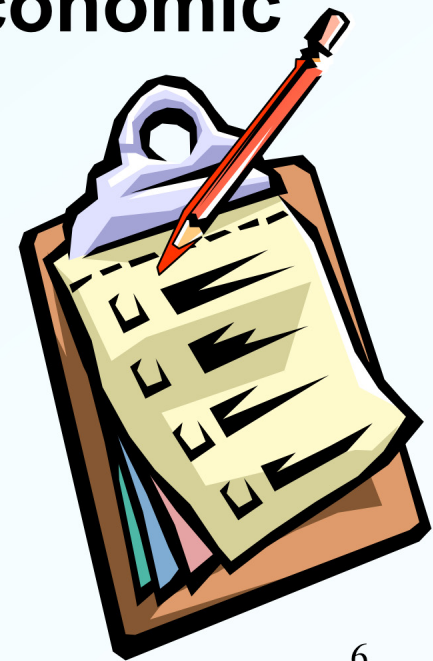
Workgroup's purpose and objectives are:

- **Review recommendations made in the District's Long-term Residuals Management Plan**
- **Investigate newer biosolids technologies**
- **Determine carbon footprinting of various biosolids management options**
- **Determine whether incineration is still the most viable and cost-effective option for the District**



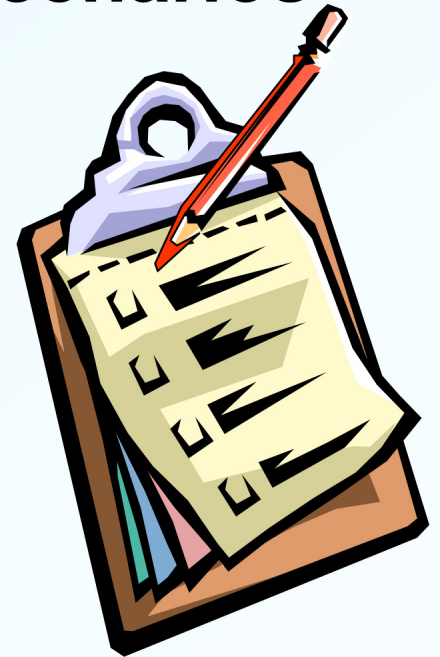
Validation team conducted a focused evaluation

- Reviewed District's comprehensive analysis of options contained in the *Residuals Management Plan* (December 2005)
- Assessed results of updated economic evaluation (2007 costs)
- Met with District staff
- Visited Southerly WWTP
- Reviewed status of Southerly incineration design project



Validation team conducted a focused evaluation

- **Identified technology options for consideration and comparison**
- **Developed carbon footprinting scenarios for options**
- **Prepared summary findings and recommendations**



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Review District's Long-term *Residuals Management Plan*

- ⇒ Reviewed the RMP screening and evaluation of 20 technologies, including innovative processes, with respect to economic, regulatory, operations, reliability, and environmental criteria
- ⇒ Verified residuals quantities & peaking factors
 - ⇒ *Confirmation of %VS content would refine FBI energy projections*

Review District's Long-term *Residuals Management Plan*

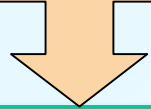
- ⇒ Reviewed RMP economic evaluation of options, and District's updated cost analysis (Dec 07 costs)
 - ⇒ *Both analyses were thorough; sensitivity analyses robust*
 - ⇒ *Relative ranking of alternatives was unaffected by cost update*
 - ⇒ *Clear separation between recommended option and other options (FBI w/ back-up landfilling)*
 - ⇒ *Comparison of non-economic factors strongly favor recommended incineration option*

Review District's Long-term *Residuals Management Plan*

- ⇒ **Verified incineration design basis**
- ⇒ **Reviewed incineration implementation schedule**
 - ⇒ *Explore risk and cost impacts of not meeting schedule*
 - ⇒ *Evaluate benefits of accelerating implementation*

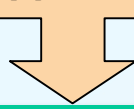
Proposed FBI Implementation

Zimpro
Process
Upgrade (10
yr. addl life)



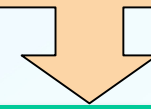
1995

Long-term
RMP
Approved



2005

Southerly
FBIs
Operational



2013



Cease
Zimpro
Operations



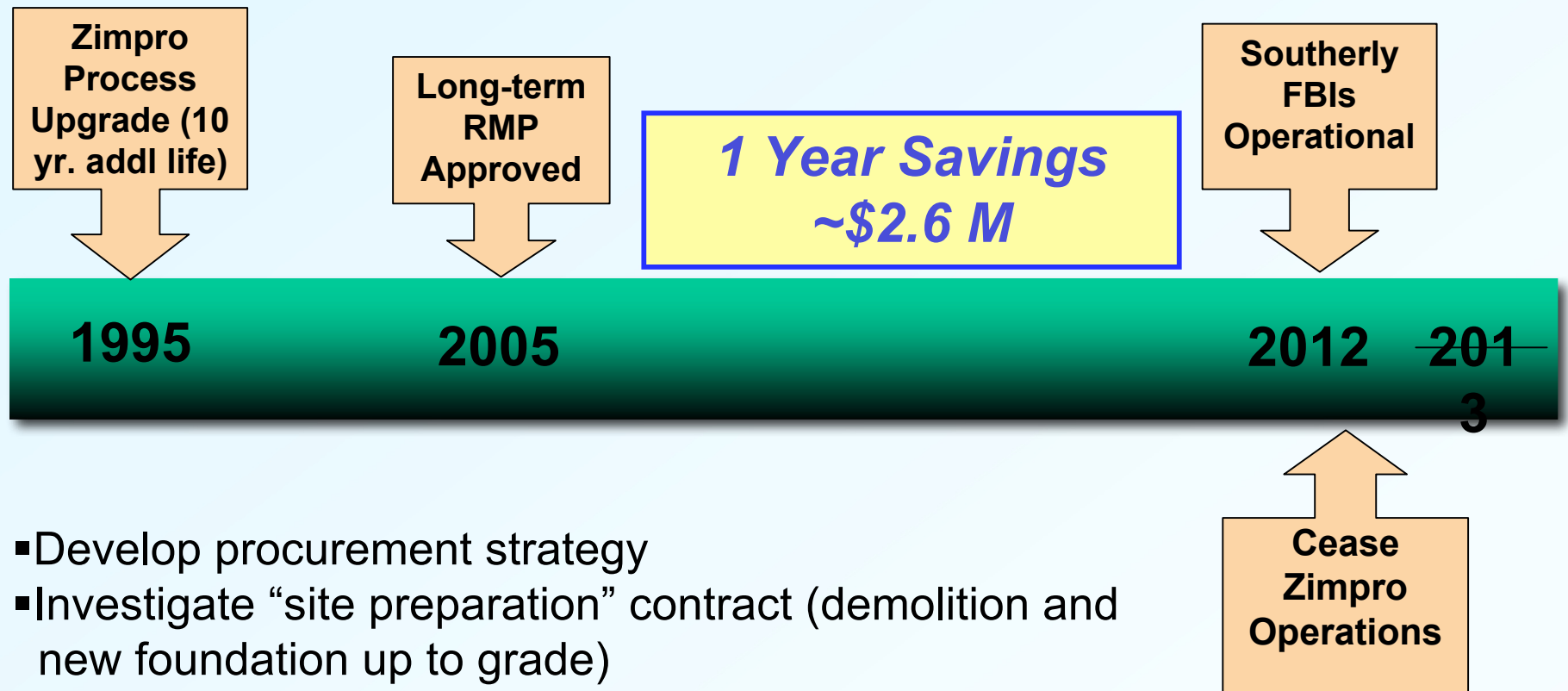
What are the known financial impacts of delay?

<i>Item</i>	<i>Cost</i>
Capital Expenditures	\$118,000,000
Less 15% Cash	17,700,000
Net Bond Financing	\$100,300,000
Annual Debt Service (4.5%/20 yr)	-\$7,700,000
Plus Construction Inflation	\$5,850,000
Change in O&M with Project	\$4,400,000
Net Annual Cost of Delay	\$2,600,000
<i>Cost per Day</i>	<i>\$7,100</i>
Incremental Rate Increase per MCF per year	\$0.55

What are other risks of delay?

- **Increasing costs to maintain Zimpro and MHI operations**
- **Unexpected costs from Zimpro and MHI interruptions**
- **Increasing natural gas prices**
- **Costs for backup landfilling due to unplanned Zimpro and MHI shutdown**
- **Increased truck traffic and noise due to backup landfilling operations**

Accelerated FBI Implementation offers cost savings



- Develop procurement strategy
- Investigate “site preparation” contract (demolition and new foundation up to grade)
- Coordinate contracts with equipment delivery
- Accelerate commissioning of dewatering to reduce risk

Workgroup's purpose and objectives are:

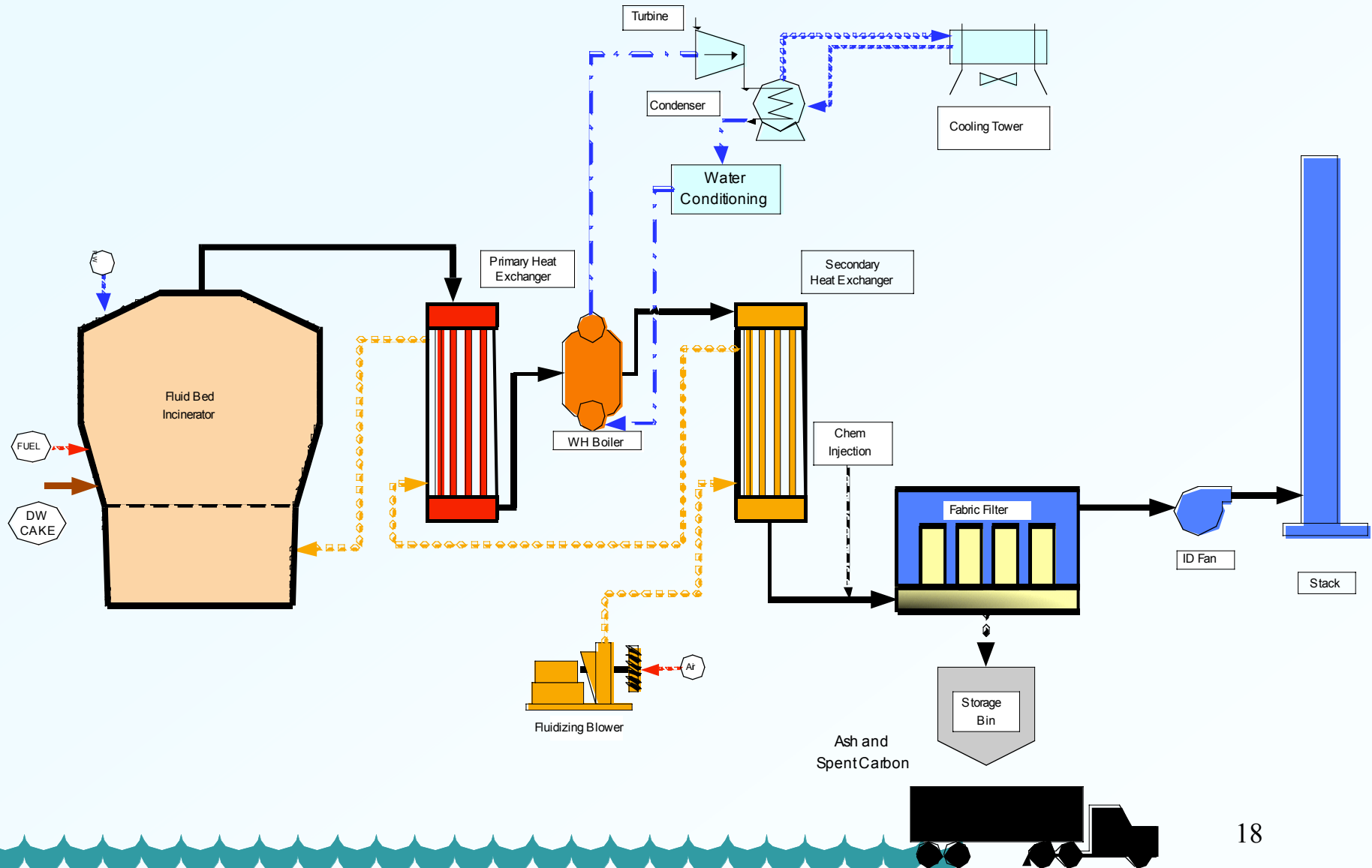
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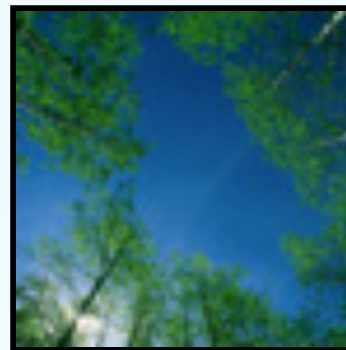
Investigate newer biosolids technologies/systems

- **Are there other viable biosolids technologies for NEORSD?**
- **Criteria for Evaluating Technologies/Systems**
 - Provide a proven and sustainable system
 - Produce Class A biosolids
 - Limit area used on-site
 - Provide renewable energy/low carbon footprint
 - Minimize trucking, odor, noise
- **Technologies/Systems Evaluated**
 1. Incineration with energy recovery
 2. Class A product via Cambi-digestion

Incineration with Energy Recovery = Green Power



Incineration with Energy Recovery = Green Power



■ Waste Heat Boiler and Steam Turbine

- Would produce 1.4 MW to 2.6 MW of 13 MW plant load
- Could separate heating system for simplicity
- All produced power could be used in dewatering/incineration substation
- Analysis assumed avoided energy is valued at \$0.069 / kWh vs. \$0.03/kWh in TM 410

■ FBI with energy recovery almost carbon neutral

■ Potential for carbon credits

■ Design and procure concurrently with FBI project

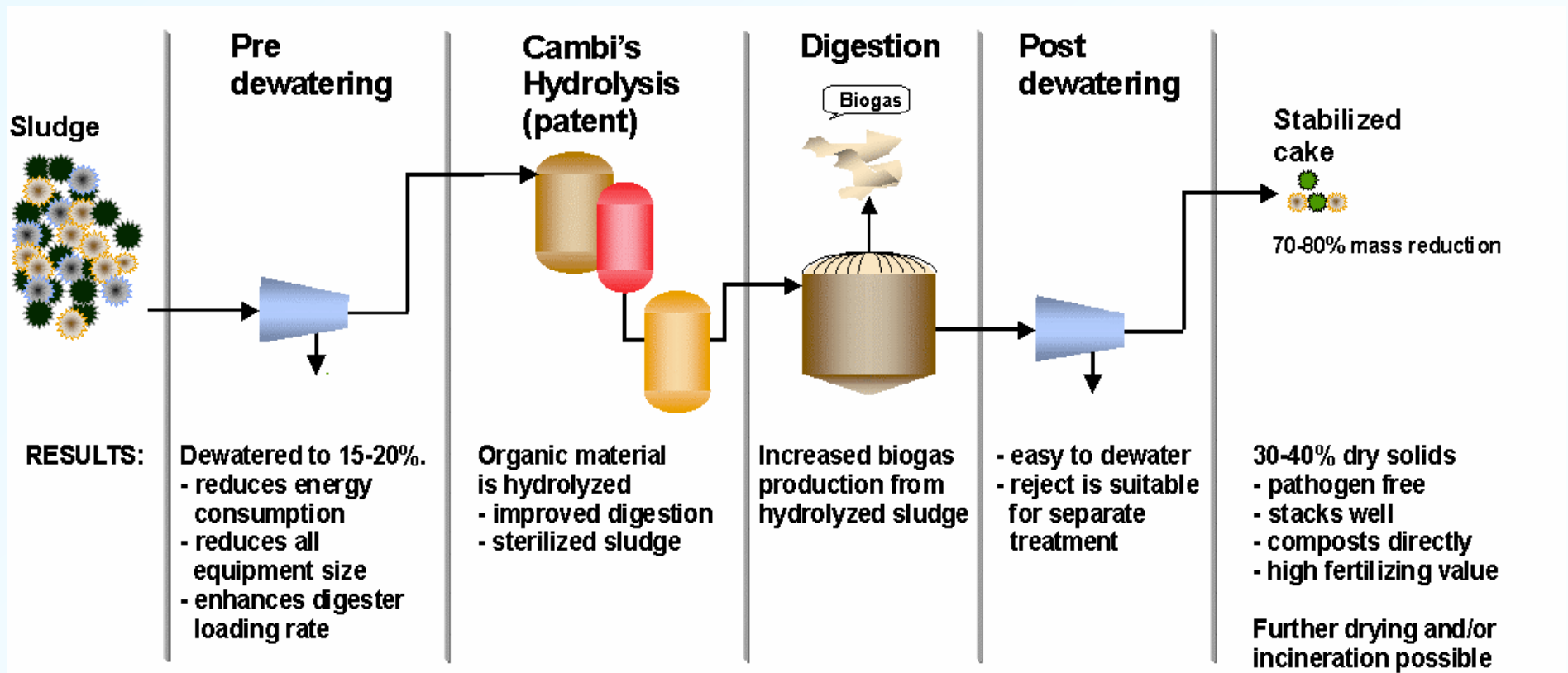
■ Opportunity to demonstrate District leadership in green sustainable solutions

Green Power Comparison

<i>Item</i>	<i>TM 410</i>	<i>Scenario 1</i>	<i>Scenario 2</i>
Feed Rate, dtpd	162.7	162.7	162.7
Total Solids, %	30	28	30
Volatile Solids, %	62	70	70
Steam Temp, F	700	750	750
Steam Pressure, psig	450	600	600
Steam Capacity, lb/h	19,940	26,000	36,000
Electricity, MW (Non-Condensing Turbine)	0.65	1.4	1.8
Electricity, MW (Condensing Turbine)	1.14	2.6	3.6
Capital Cost	\$16,500,000	\$22,000,000	\$22,000,000

Cambi-Digestion + Product

How Does Cambi Work?



Produce Class A product for beneficial use

■ What are the benefits?

- Class A biosolids without additional drying
- Can be dewatered to high solids (32-35 %)
- Low odor product
- About 25% of biogas is used for process heat
- Biogas could produce up to 3 MW of electricity from CHP-Southerly

Produce Class A product for beneficial use

■ What are the risks and uncertainties?

- Cambi is new technology to the U.S.
- Unproven U.S. service organization
- Requires larger footprint than incineration
- Reliance on distribution service providers for topsoil and agricultural land application
- Uncertainty in development of sustainable product markets

Produce Class A product for beneficial use

■ What are the estimated costs?

- Total NPV = \$370 million

■ What is the carbon footprint?

- 8,000 tons CO₂e

■ What is the timeline for implementation?

- Several years required for concept and project development
- Must evaluate facility siting and details (“Contractor Parking Lot”)

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Sources of GHG Emissions

	SCOPE 1 - Direct	SCOPE 2 - Indirect	SCOPE 3 - Other Indirect	BIOMASS COMBUSTION
Alternative	CO ₂ ,CH ₄ , N ₂ O	CO ₂ ,CH ₄ , N ₂ O	CO ₂ ,CH ₄ , N ₂ O	CO ₂
Baseline MHIs	Natural gas Biosolids transport fuel Ash transport fuel Fugitive emissions	Electric power	Polymer supply chain	Biosolids incineration
FBI	Natural gas use Ash transport fuel	Electric power	Polymer supply chain	Biosolids Incineration
FBI + Cogen	Natural gas use Ash transport fuel	Electric power	Polymer supply chain	Biosolids Incineration
Cambi	Topsoil transport Land app transport Disposal transport	Electric power	Polymer supply chain	
Landfill Disposal	Biosolids transport fuel Decay emissions	Electric power	Polymer supply chain	

Sources of GHG Emissions¹

	SCOPE 1 - Direct	SCOPE 2 - Indirect	TOTAL SCOPES 1+2	SCOPE 3 - Other	BIOMASS COMBUSTION
Alternative	CO ₂ ,CH ₄ , N ₂ O	CO ₂ ,CH ₄ , N ₂ O	metric tons CO ₂ equivalents	CO ₂ ,CH ₄ , N ₂ O	CO ₂
Baseline MHIs	13,780	5,500	19,280	6,000	1,570
FBI	500	5,200	5,700	6,000	1,570
FBI + Cogen ²	500	-11,000	-10,500	6,000	1,570
Cambi	570	-8,800	-8,230	8,000	n/a
Landfill Disposal	24,525	750	25,275	6,000	n/a

1 - Methodology and emissions factors based on IPCC, Climate Registry, WRI/WBCSD and other sources.

2 - Possibly meets additionality and other Gold Standard criteria.

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Compare options to proposed FBI project

Option	GHG (mtCO ₂ e)	NPV (\$)
Proposed FBI Project	5,700	250 M
Green Power	-10,500	230 M
Cambi-digestion	-8,230	370 M

District requested panel listen to Schmack process presentation

- **Experience in Germany with animal manures, food and agricultural wastes**
- **Very limited biosolids processing experience in the U.S. or elsewhere**
- ***Not ready for District implementation***

Findings

■ Cost-effectiveness

- Decision to phase out and decommission Zimpro is correct
- Existing facilities are at end of useful life; increasing risk of operational failure
- Significant costs associated with delays
- Proposed FBIs will minimize uncontrollable costs

⇒ ***Proposed FBI project w/ green power is the most cost-effective solution***

Findings (continued)

■ Energy efficient

- Proposed FBI project will reduce natural gas consumption by ~98% (approx. \$1 M per year)
- Opportunities exist to produce green energy (approx. \$0.4 – 1.6 M per year)

Findings (continued)

■ Environmentally friendly

- Significant reduction in regulated air emissions relative to existing incineration
- Proposed FBI project will reduce greenhouse gas emissions by 13,580 tons/yr compared to existing incineration
- Proposed FBI project **with green power** will **further** reduce greenhouse gas emissions by 16,200 tons/yr
- Proposed FBI project poses the least lowest odor, noise, traffic impacts

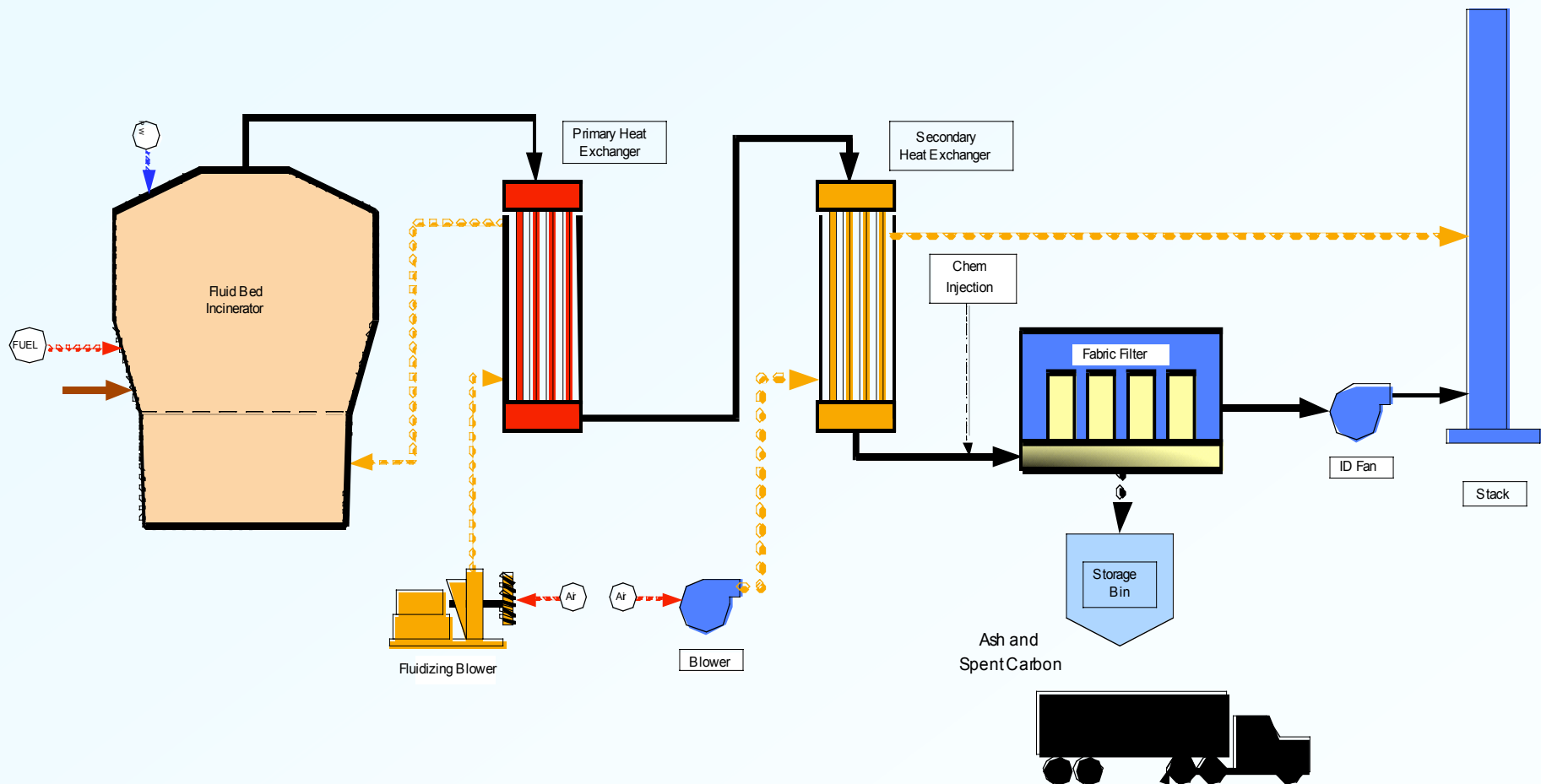
Recommendations

- **Proceed with proposed FBI design and construction**
- **Reconsider green power option**
- **Accelerate FBI project implementation**
- **Develop a contingency plan for unplanned process shut-downs**
- **Review staffing plan for future FBI operating conditions**
- **Develop comprehensive sampling plan for liquids and solids streams**
 - More accurately quantify % VS
- **Update/develop stakeholder communications plan in light of expanded capital commitments**

Questions?



Proposed FBI (w/ Process Energy Recovery)



District requested panel listen to Schmack process presentation

■ Several projects in planning phase

- *Columbus*
- *Canton*

■ Several biosolids processing unknowns and concerns

- *Site limitations at Southerly; new site required*
- *0.5% TS can only be provided; additional thickening facilities required for proposed facilities (cost add-on)*
- *“PFRP” unit process undefined*

■ Promising technology with more biosolids processing experience