HISTORIC
FRANKLIN
TENNESSEE

ITEM #12
WRKS
11/26/13

MEMORANDUM

November 22, 2013

TO: Board of Mayor and Aldermen

FROM: Eric Stuckey, City Administrator
David Parker, City Engineer/CIP Executive
Mark Hilty, Water Management Director

SUBJECT: **Discussion and Consideration of Biosolids Handling Processes for the Water Reclamation Facility Modifications and Expansion Project (COF Contract No. 2013-0001)**

The purpose of this memorandum is to provide the Board of Mayor and Aldermen (BOMA) with information regarding biosolids treatment alternatives for the Water Reclamation Facility Modifications and Expansion Project. Based on staff's understanding of BOMA's requests, this memorandum provides information on the following:

- Thermal hydrolysis vendors and installations – Attachment A
- Examples of other class A biosolids technologies – Attachment B
- Biosolids alternatives cost breakdowns – Attachment C
- Solids alternatives projected output – Attachment D

Consultants and staff are continuing to work through two pieces of information requested by the BOMA. This includes:

- Estimates for capital costs and operations and maintenance costs for the additional examples of other class A biosolids technologies and
- Estimates for the sanitary sewer rate impacts related to the alternatives

Staff expects to have this information available early next week and recognizes BOMA may not have adequate time to review the materials for a detailed discussion. That being said, the materials will be made available to BOMA as soon possible for discussion at the November 26, 2013 Work Session and/or future meetings as necessary. In order to keep the design process moving forward, we plan to discuss these option at both the November 26th and December 10th work session. Having a consensus around the design approach (especially as it relates to drying and producing a class A solid) will allow the design process to continue.

ATTACHMENT A
THERMAL HYDROLYSIS PROCESS (THP) VENDORS

Thermal Hydrolysis Process (THP) Vendors

- CAMBI
  - Based in Asker, Norway
  - U.S. headquarters in Jasper, Alabama

- I. Krüger (Subsidiary of Veolia Water Solutions & Technologies)
  - Based in Copenhagen, Denmark
  - U.S. headquarters in Cary, North Carolina
  - Two types of THP:
    - EXELYS™: continuous process
    - BioTHELYS®: batch process

CAMBI Plants in Operation

- Hamar, Norway
- Chertsey, UK
- Sarspborg, Norway
- Aberdeen, UK
- Lillehammer, Norway
- Dublin, Ireland
- Fredericia, Denmark
- Niigata, Japan
- Bydgoszcz, Poland
- Brisbane, Australia
- Brussels, Belgium
- Milton Keynes, UK
- Verdal, Norway
- Norwich, UK
- Abo/Turku, Finland
- Tees Valley, UK
- Geiselbullach, Germany
- Wales, UK
- London, UK
- Vilnius, Lithuania
- Santiago, Chile
- Drammen, Norway
- Manchester, UK
- Newcastle, UK
- Oslo, Norway

- Capacities ranging from 1,300 to 100,000 DT/year

CAMBI Plants in Design or Construction

- Washington, DC
- Tilburg, Holland
- London, UK
  (3 Thames Water plants)
- Vaxjo, Sweden
- Vigo, Spain
- West Sussex, UK
- Stavanger, Norway
- Edinburgh, Scotland

- **Washington, DC, installation will be world's largest (143,000 DT/year)**
- Approximately 75% complete

Krüger THP Installations

- BioTHELYS® (batch process)
  - Saumur, France
  - Chateau Gontier, France
  - Le Pertuiset, France
  - Tergnier, France
  - Monza, San Recco, Italy
  - Esholt, UK
  - Oxford, UK
- EXELYS™ (continuous process)
  - Versailles, France
  - Lille, France
  - Grinstead, Denmark
  - Bonneuil en France, France (Demonstration)
  - Hillerod, Denmark (Demonstration)
- Capacities ranging from 1,100 to 36,000 DT/year

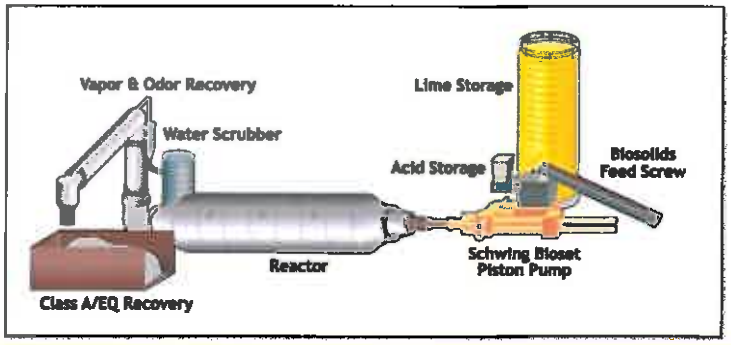
ATTACHMENT B
EXAMPLES OF OTHER CLASS A BIOSOLIDS TECHNOLOGIES

Other Class A Biosolids Technologies

- Alkaline Stabilization
- Pre-Pasteurization
- Advanced Anaerobic Digestion
- Composting
- Thermal Drying

Alkaline Stabilization – Proprietary Systems

- RDP
- N-Viro: Cement kiln dust with subsequent drying
- Bioset Process
  - Uses quicklime & sulfamic acid to raise pH & temperature
  - No external heat source – heat generated by chemical addition



Alkaline Stabilization
Advantages & Disadvantages

Advantages

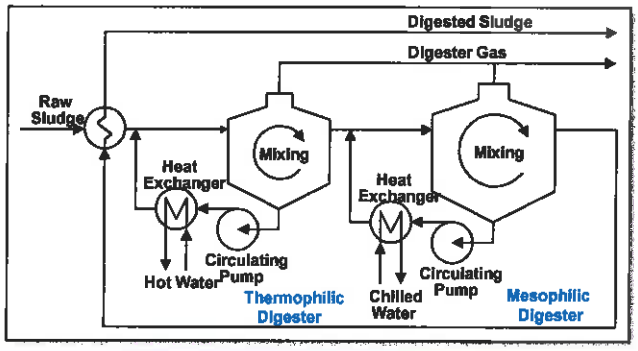
- Low capital cost
- Simple & flexible
- Small footprint
- Established demand for stabilized product

Disadvantages

- Odor potential (ammonia release)
- Produces dust
- High O&M costs
- Increased mass/volume due to lime addition

Advanced Anaerobic Digestion

- Thermophilic Anaerobic Digestion
- Temperature Phased Anaerobic Digestion (TPAD)
- Numerous installations in the U.S., mostly in the Midwest (DuPage County, IL)



Advanced Anaerobic Digestion Advantages & Disadvantages

Advantages

- Increased pathogen reduction
- Increased volatile solids reduction & biogas production
- Can reduce foaming

Disadvantages

- Higher capital costs
- Greater operational complexity
- Increased heat demand due to higher operating temperature
- Increased dewatering polymer consumption
- Increased nutrients (N and P) in recycle streams

Pre-Pasteurization

- Heat treatment of sludge before conventional anaerobic digestion
- Reliable Class A pathogen reduction
- Not shown to enhance digestibility of the sludge
- Proven, but not widely used

Pre-Pasteurization
Advantages & Disadvantages

Advantages

- Reliable "add-on" to conventional digestion produces Class A biosolids

Disadvantages

- System must be designed to handle thicker sludges
- Added operational complexity
- Safety risks associated with hot equipment
- High energy consumption (heat recovery can minimize)

Composting

- Three types:
  - Aerated static pile
  - Windrow
  - In-vessel process
- Requires bulking agent/amendment
  - Wood wastes
  - Typically requires additional grinding, screening
- Raleigh, NC markets as "Raleigh Plus"

Composting
Advantages & Disadvantages

Advantages

- Simple process
- Product is easily stored
- Low initial cost (excluding in-vessel systems)

Disadvantages

- Requires large land area
- Requires bulking agent & carbon source
- Odor control is difficult
- High O&M cost
- In-vessel systems have high capital cost

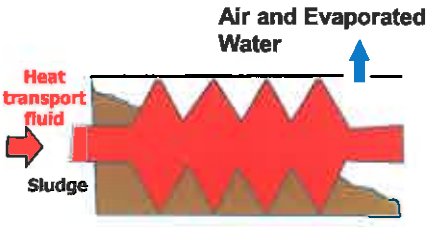
Thermal Drying

- Dries product to >90% TS
- Dried product can be used as fertilizer or fuel for kilns/boilers
- Direct (convection) & indirect (conduction) systems available
- Better suited to digested biosolids
  - Higher quality product
  - Energy synergy with biogas
  - Fewer safety concerns

Thermal Drying

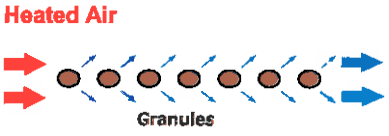
Direct (Convection)

- Heat is transferred directly to sludge particles
- Examples:
  - Paddle dryer (Paragould, AR; Rahway, NJ)



Indirect (Conduction)

- Heat is conducted through metal surface to sludge
- Examples:
  - Belt dryer (Buffalo, MN)
  - Rotary drum dryer (Cary, NC; Nashville, TN)



Thermal Drying
Advantages & Disadvantages

Advantages

- Small footprint
- High quality product
- Good mass reduction

Disadvantages

- High capital cost
- High O&M cost (energy intensive)
- Dust control is required to reduce safety risk

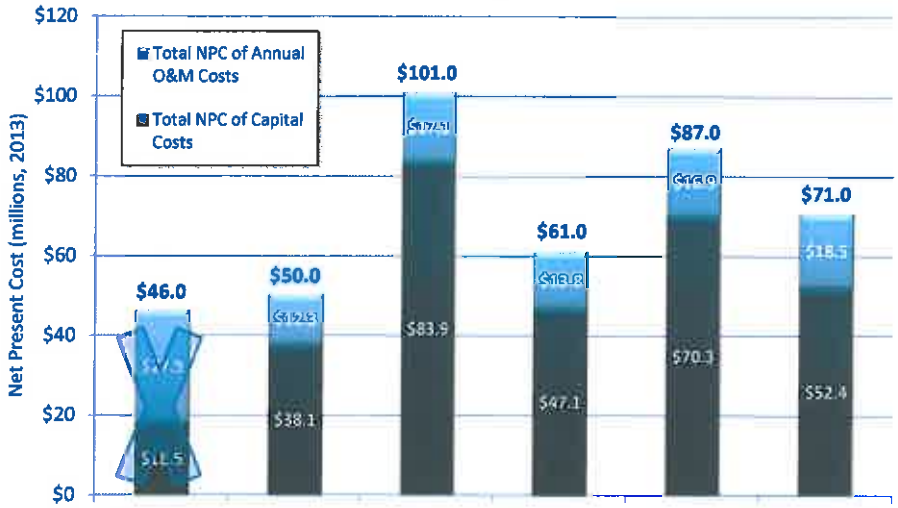
ATTACHMENT C
BIOSOLIDS ALTERNATIVES
COST BREAKDOWNS

Economic Analysis – Capital Cost

Process Train	Estimated Capital Cost at Each Phase (millions)			Net Present Capital Cost of Three Phases[1] (millions)
	Phase I (2018-2023)	Phase II (2024-2031)	Phase III (2032-2040)	
~~Alternative 1: Continue Current Treatment Process~~	~~$17.6~~	~~–~~	$0.0	$19.0
Alternative 2: Replace Thickening, Add Digestion	$33.0	$11.6	$1.6	$38.0
Alternative 3: Alternative 2 Plus Solar Drying	$67.0	$21.0	$22.0	$84.0
Alternative 3A: Alternative 3 with Partial Solar Drying	$41.0	$12.0[2]	$5.0[2]	$47.0[2]
Alternative 4: Alternative 3 Plus Thermal Hydrolysis	$64.0	$15.0	$6.0	$70.0
Alternative 4A: Alternative 4 with Partial Solar Drying	$52.0	$6.0[2]	$3.0[2]	$52.0[2]

[1] 2013 dollars. [2] Does not include Phase II or III solar dryer expansion.

Economic Analysis – Net Present Cost (2013 Dollars)



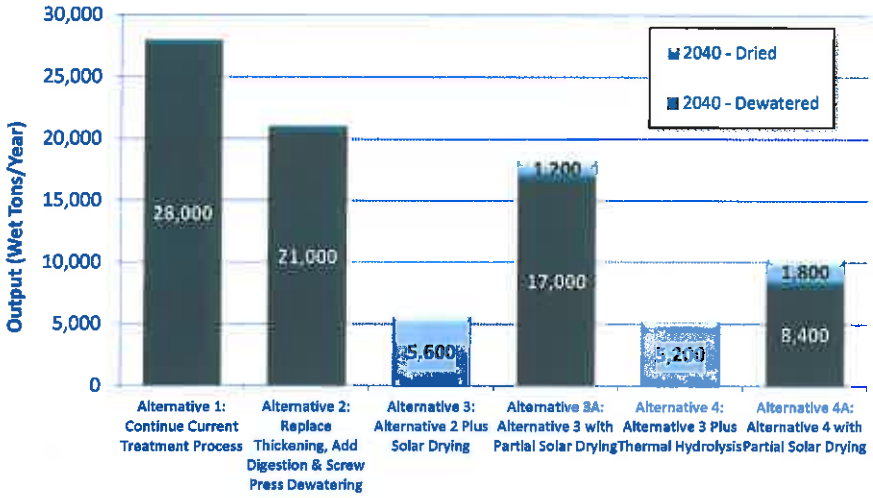
ATTACHMENT D
SOLIDS ALTERNATIVES PROJECTED OUTPUT

Solids Alternatives Projected Output

Alternative	Product(s)	Biosolids Class
Alternative 1: Continue Current Treatment Process	Dewatered Sludge for Landfill Disposal	N/A
Alternative 2: Replace Thickening, Add Digestion & Screw Press Dewatering	Dewatered Biosolids for Agriculture	B
Alternative 3: Alternative 2 Plus Solar Drying	Dried Biosolids for Agriculture/Public Use	A[1]
Alternative 3A: Alternative 3 with Partial Solar Drying	Dried Biosolids for Ag./Public, Dewatered Biosolids for Ag.	A[1] (dried), B (dewatered)
Alternative 4: Alternative 3 Plus Thermal Hydrolysis	Dried Biosolids for Agriculture/Public Use	A
Alternative 4A: Alternative 4 with Partial Solar Drying	Dried Biosolids for Ag./Public, Dewatered Biosolids for Ag.	A

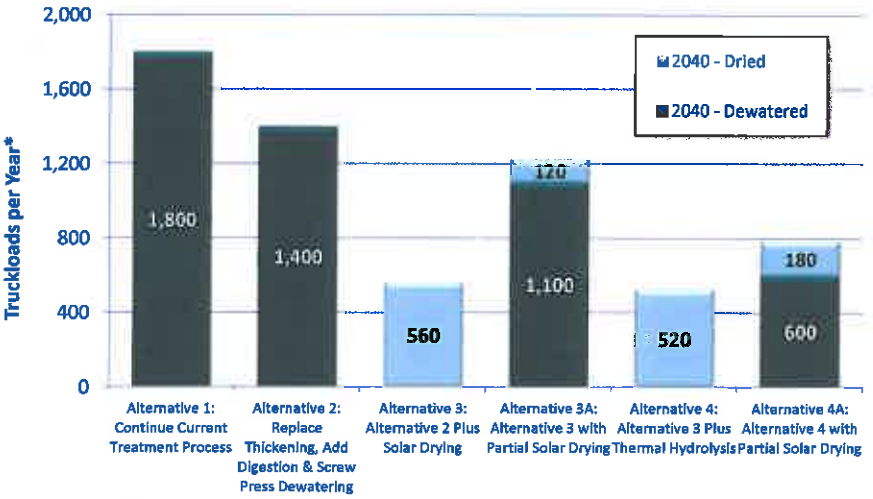
[1] Subject to approval by TDEC.

Solids Alternatives Projected Output



Current hauling: approximately 11,000 WT/year.

Solids Alternatives Projected Output



* Based on 20-CY truckload.

Current hauling: approximately 550 truckloads/year.