CENTRISYS

LEADERS IN MUNICIPAL SLUDGE SEPARATION
FROM 20,000 FEET

- Company Overview
- Sludge dewatering overview
  - Dewatering objectives
  - Prevalent technologies
  - Centrifuges
  - The Centrisys Design
- Sludge thickening overview
  - Thickening objectives
  - Prevalent technologies
  - THK 101
- Conclusions
CENTRISYS AND CNP
DEWATERING TECHNOLOGY BACKGROUND
Goals for the typical plant operations team?

✓ Dry Cake
✓ Maximize energy efficiency / minimize energy $
✓ Minimize polymer usage / expense
✓ Streamlined daily operation, lower maintenance & repair costs
✓ ‘Less mess’ – cleaner, safer more hygienic environment for workers
✓ Flexibility – greater operator control
DEWATERING / COMPETITIVE TECHNIQUES FOR DEWATERING
## CENTRIFUGES GENERATE DRIER CAKE

<table>
<thead>
<tr>
<th>Cake Dryness</th>
<th>Belt Press</th>
<th>Screw Press</th>
<th>Dewatering Centrifuge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>25-36</td>
<td>25-40</td>
<td>25-40</td>
</tr>
<tr>
<td>WAS</td>
<td>15-16</td>
<td>16-20</td>
<td>18-22</td>
</tr>
<tr>
<td>Aerobic Digested</td>
<td>13-20</td>
<td>16-22</td>
<td>16-25</td>
</tr>
<tr>
<td>Anaerobic Digested</td>
<td>13-22</td>
<td>16-22</td>
<td>22-35</td>
</tr>
</tbody>
</table>
CENTRIFUGE DEEP DIVE
KEY COMPONENTS

CONVEYOR/SCROLL

BOWL
INSIDE THE CENTRISYS DECANTER

- Scroll
- Bowl
- Conical Section or Beach
- Feed Chamber
- Liquid Discharge, Weir Plates (diameter sets pool level)
- Solids Discharge
INSIDE THE CENTRISYS DECANTER
DEWATERING | OPERATIONS

Bowl Speed
- Increased speed = Increased %TS of cake, increased solids capture

Scroll Speed
- Increased speed = cleaner centrate, wetter cake
- Decreased speed = dirtier centrate, drier cake

Torque/Hydraulic Pressure
- Increased Pressure = Drier cake, dirtier centrate

Flow
- Increased Flow = Decreased solids capture for same %TS

Cake
THE CENTRISYS DRIVE TRAIN

Hydraulic Scroll Drive Technology

...the premier technology for maximum torque, efficiency, and longevity
HYDRAULIC SCROLL DRIVE TECHNOLOGY
HYDRAULIC SCROLL DRIVE

2080-D Rotodiff
Weight: 170kg/375lbs
Torque: 25,400Nm

Versus
Gearboxes...

P180 Gearbox
Weight: 460kg/1012lbs
Torque: 20,340Nm
NOT ALL CENTRIFUGES
ARE CREATED EQUAL
ACCEPTANCE TEST RESULTS FROM NYC WARD ISLAND

![Diagram showing power consumption over elapsed time]

- **Power Consumption (kW)**
  - Centrisys#5710
  - Centrisys#5712
  - Plant#5709

- **Elapsed Time (hour)**
  - 1 to 49

- **GPM Levels**
  - 200 GPM
  - 250 GPM

- **196 GPM**
Centrisys delivers the following:

- Highest torque, and most easily serviced scroll drive technology
- Highest quality standards of design
  - Centrifugally cast, duplex SS bowl and scroll shaft
  - Forged duplex headwalls
SCROLL – WEAR PROTECTION

Tungsten Carbide Tiles

Fused Tungsten Carbide Flame
BOWL – WEAR PROTECTION

Protected Internally by \textit{wear strips} NOT grooves

Cake Discharge
- tungsten carbide liners
WEAR PROTECTION – CUSTOMIZED FOR EACH APPLICATION
THE CENTRISYS ADVANTAGE

What customer’s really tend to care about
• Who can help me or who can I call when something isn’t working right
• How long does it take to get that part
• How long will that rebuild take

The other guys
RECENT INSTALLATION
AND BIG WINS

New York City (CS26-4s)
• Wards Island (16 Units)
• Hunts Point (16 Units)
• 26th Ward (16 Units)

NOERSD - Cleveland, OH (CS21-4.HCs)
• Westerly Plant (2 units)

Denver Metro (CS26-4s)
• Hite Creek Facility (8 units)

King County - Seattle, WA (CS26-4s)
• Westpoint Treatment Plant (4 units)

NEW Water – Green Bay, WI (CS21-4.HCs and THK600)
• Green Bay Treatment Facility (3 units and 1 unit)

Rockford, IL (CS21-4s)
• Rock River Water Reclamation District (3 units)
SUMMARY | CENTRISYS CENTRIFUGES

Top Tier Technology

- Selected best option via CDM Smith and Stantec (Formerly Arcadis) for the City of New York
  - Service
  - Scroll Drive Technology
  - Life Cycle Cost

Service is Our Priority

- Day to Day Assistance
- Repairs and Rebuilds

Parts In House

- When you Need Them, We Have

Technology Leaders

- CNP Process Technologies
THE CENTRISYS THK SERIES

Bringing Innovation to Sludge Thickening
What do plant operators want to achieve?

- 4-6% TS from the thickening process to the digester
- Maximize energy efficiency / minimize energy $\$
- Minimize polymer usage / expense
- Reduce costs of daily operation and
- Create cleaner, safer more hygienic environment for workers
- Flexibility – greater operator control
TRADITIONAL THICKENING APPROACHES

- Gravity Belt (GBT)
- Gravity Thickener
- Rotary Drum
- Dissolved Air Flotation (DAF)
Challenges with older technologies

• High polymer usage & $ for desired TS%
• Energy-intensive technologies:
  ✓ Electrical usage
  ✓ Water usage
• Labor-intensive technologies
  ✓ Operational oversight required
  ✓ High maintenance required
• Messy, odorous & space-intensive
• Reliability & maintainability of older technologies
• Fixed output:
  ✓ Little variability in operation w/out stop - restart
  ✓ Little / no versatility in process
HISTORY | EVOLUTION OF THICKENING CENTRIFUGES

Pre-1978 Rotating Assembly

Sharples Hydraulic Assist Technology

8°-10°

8°-15°

Revolution

Humboldt Type B

Centrisys THK: 2010 – Present
INNOVATION | HOW IT WORKS

Influent WAS

Weir
INNOVATION | HOW IT WORKS

Influent WAS

Weir
INNOVATION | HOW IT WORKS

Influent WAS

Weir
INNOVATION | HOW IT WORKS

Influent WAS

Weir
INNOVATION | HOW IT WORKS

- Influent WAS
- Baffle Wall
- Solids Weir
- Weir
INNOVATION | HOW IT WORKS

- Influent WAS
- Baffle Wall
- Solids Weir
- Weir
- Chain and Slats
INNOVATION | HOW IT WORKS

Influent WAS

Baffle Wall

Weir

Raise the Solids
Weir: Cake gets thicker

Chain and Slats
**INNOVATION | HOW IT WORKS**

Influent WAS

Baffle Wall

Weir

Air Diffuser: Changes density of solids – more air

Chain and Slats

**Changes**

- density of solids
- more air means cake gets thinner
INNOVATION | ENABLING TECHNOLOGIES

Hydro-Pneumatic Control of %TS

Influent Waste Activated Sludge

Internal Polymer Injection
RECENT INSTALLATIONS AND BIG WINS

The Original Installation Site
Two (2) THK 200, Kenosha, WI (1 installed in 2011, 2nd installed in 2016)

Beijing, China Projects
• Five (5) THK 600, DingFuZhaug WWTP (installed early 2016)
• Eight (8) THK 600, ZhengWangFen WWTP (installed late 2016)
• Ten (10) THK 600, GaoBeiDian WWTP (Delivery 2017-18)

Recent US Installations and Awards
• One (1) THK 600 Green Bay Wisconsin (Operational since Fall 2017)
• One (1) THK 200, Whitewater, WI (Operational since Fall 2017)
• Two (2) THK 200s, Belvidere, IL (Delivered March 2018)
• Three (3) THK 200s, Lincoln, NE (Awarded April 2018)
• Two (2) THK 600s, San Antonio, TX (Awarded April 2018)
• One (1) THK 350, Wyoming, MI (Awarded May 2018)
SUMMARY | CENTRISYS THK

- Largest Process Volume for Thickening Centrifuges
- Low to No Polymer for WAS
- Same Great Service and Support