Trends in Dewatering

WEAT Webinar 2012

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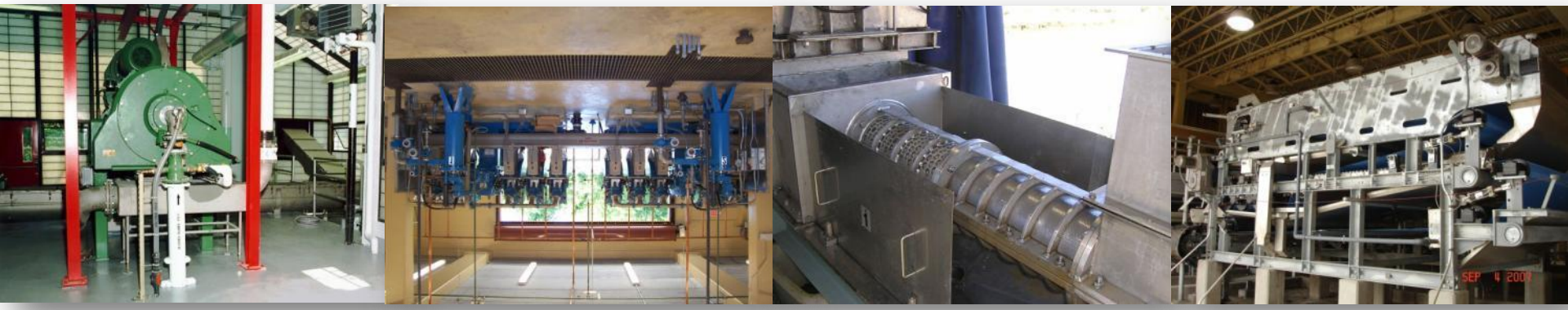
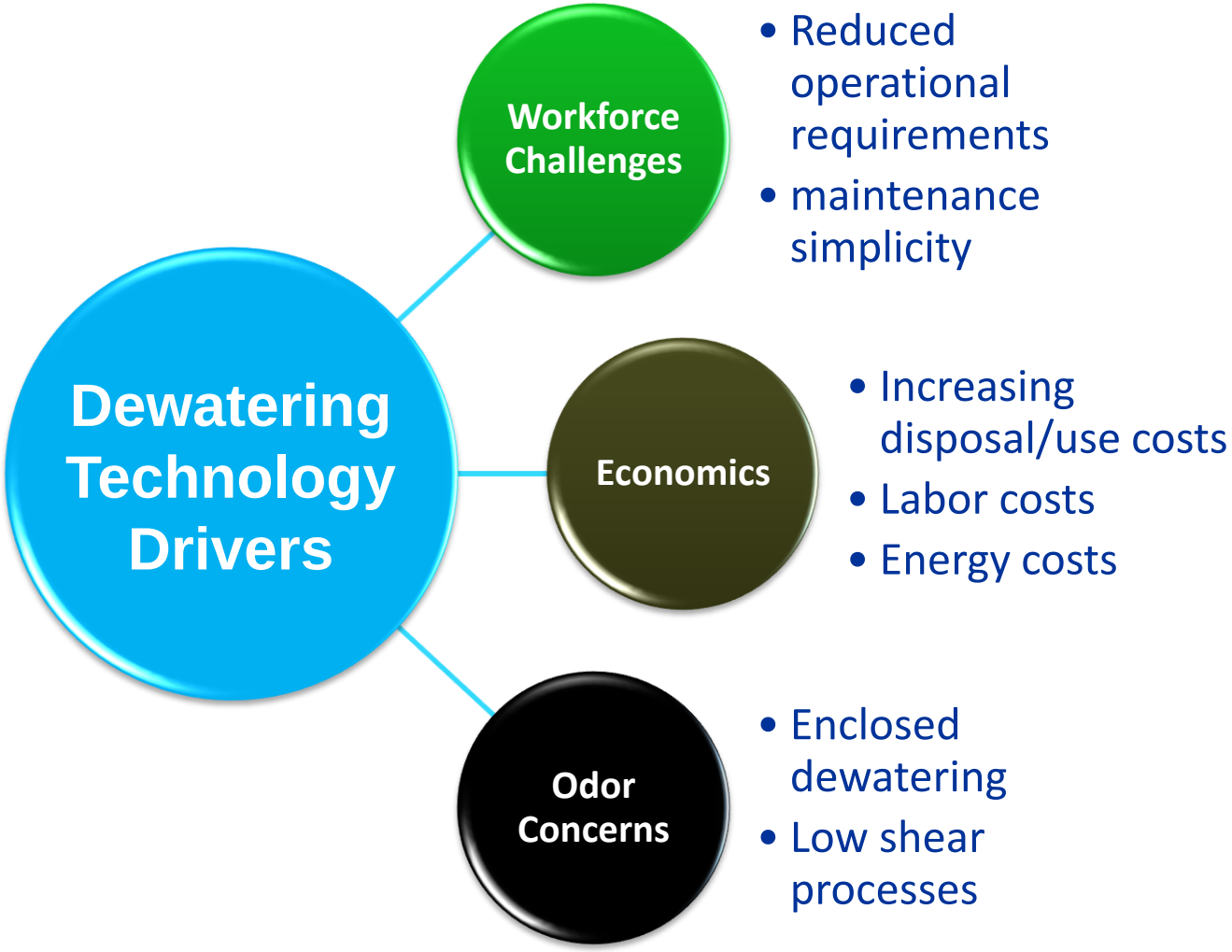
Overview

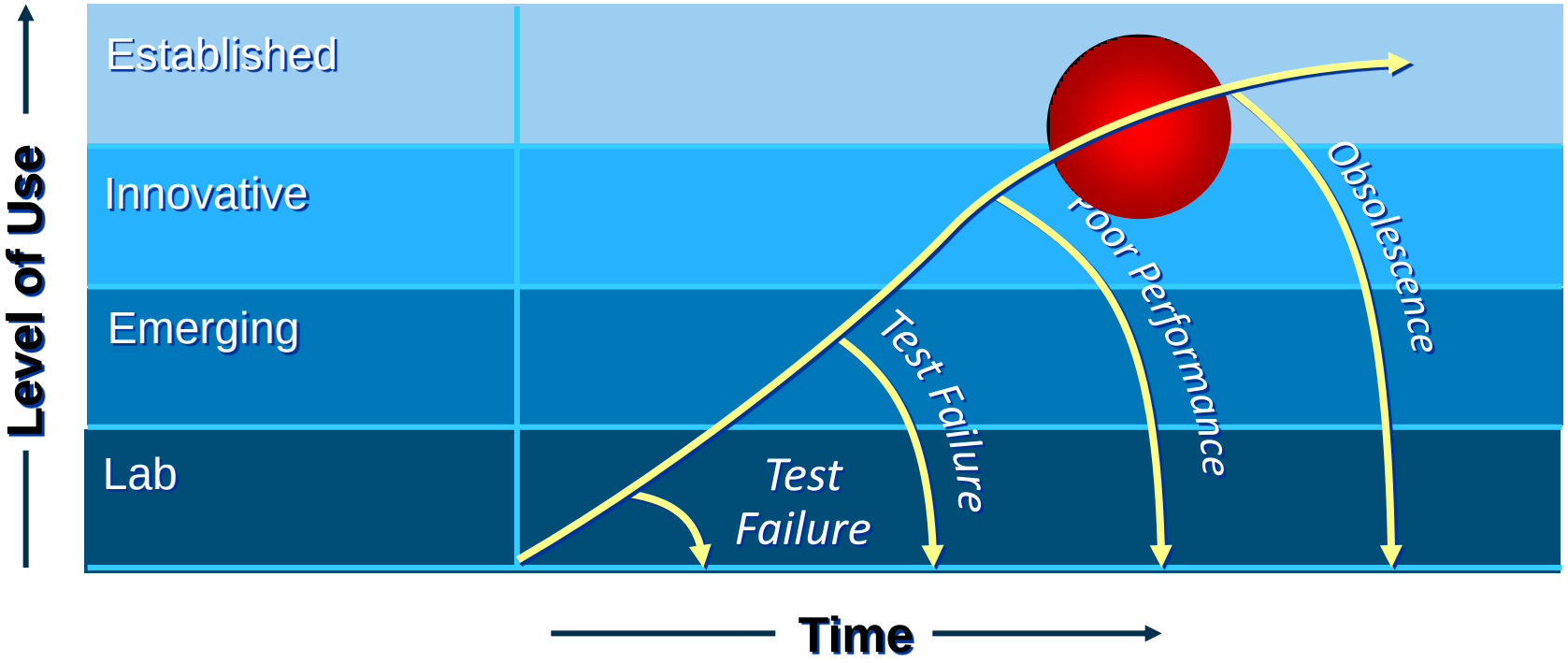
- General drivers and trends
- Technologies/case studies
- Comprehensive pilot case study



Drivers for Change



Dewatering Technology Evolution

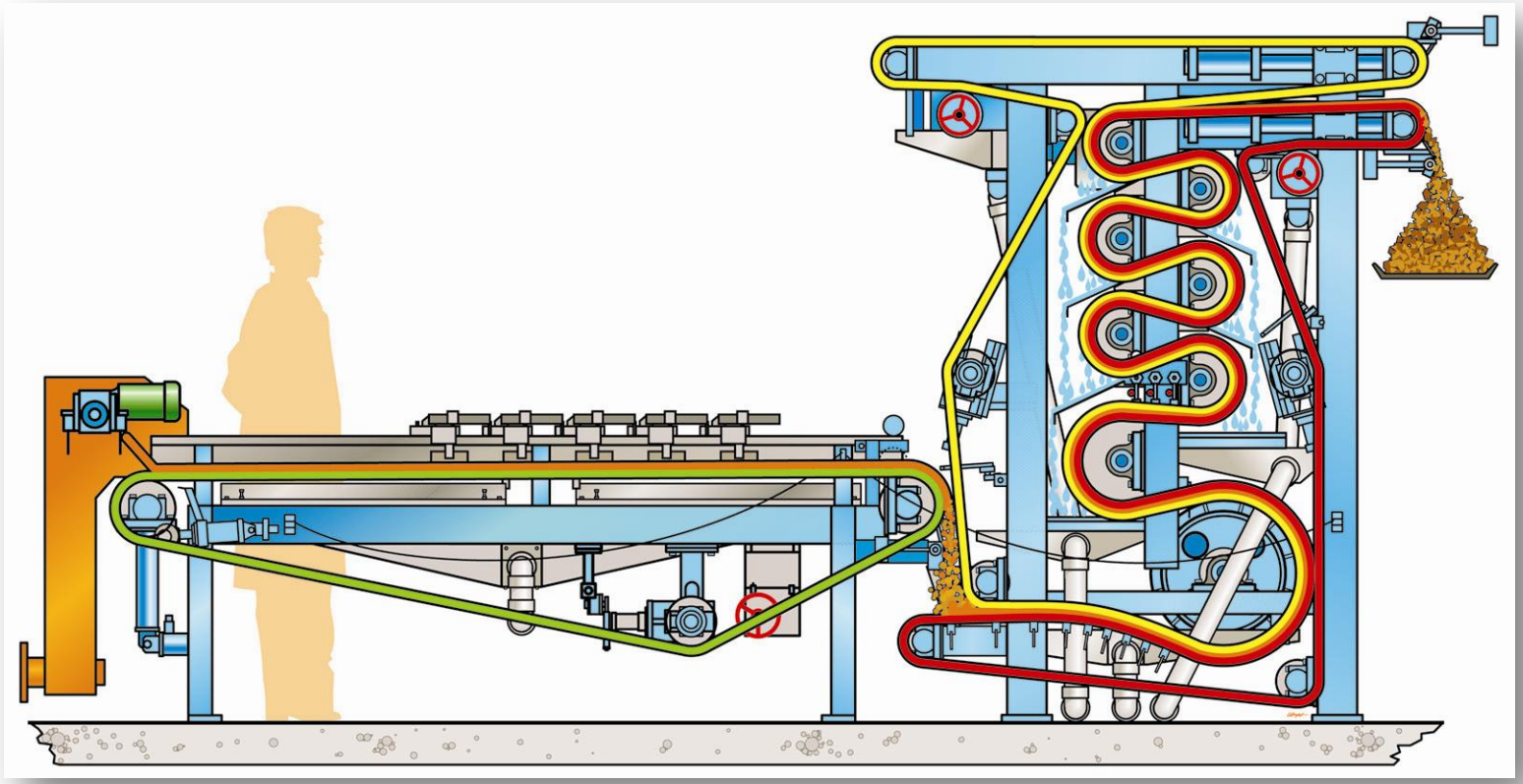


- Established: refinements, not wholesale change
- Innovative : increasing success in marketplace
- Emerging : slow movement

Belt Filter Press Trends: 3- belt BFPs

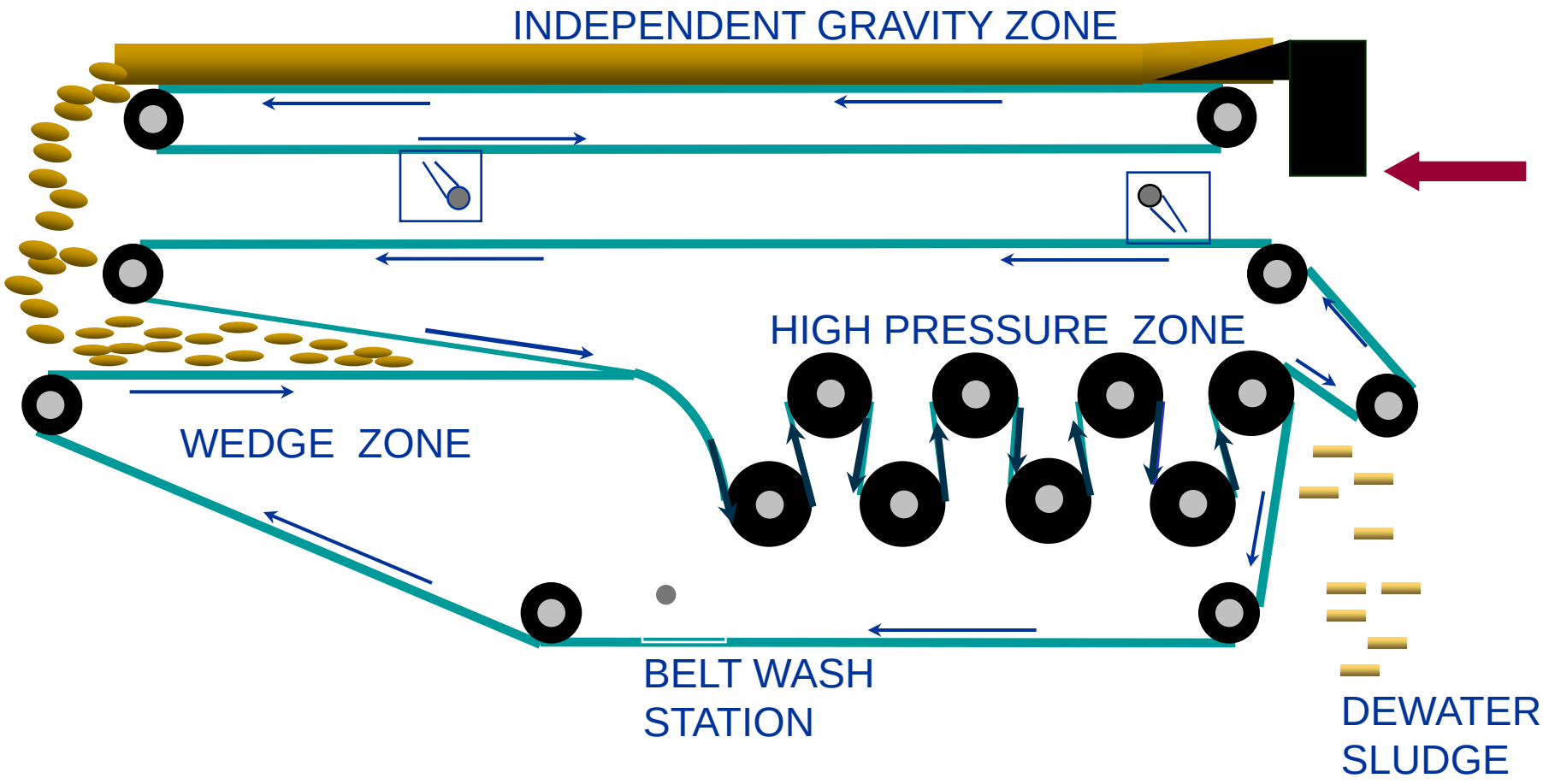
- Manufacturers:
  - Vertical: BDP, Charter Machine, Ashbrook
  - Horizonal: Ashbrook, Andritz, Komline
- Designed for thin sludges (<1.5% solids)
- Offer separate belts for drainage, pressure zones

Vertical 3-belt BFP



Schematic Courtesy BDP

Horizontal 3-belt BFP



Schematic Courtesy Ashbrook

Reasons for 3-belt BFP Applications

- Vertical units
  - Ease of access for ops/maintenance
  - Elimination of catwalks
- Eliminate need for additional BFP or thickening to accommodate hydraulic load
- Potential 2-3% increase in cake solids compared to 2-belts
  - Increase not limited to thin sludges

Case Study: Albany County Sewer District, NY

North Plant

LIQUIDS STREAM

- Conventional activated sludge
- Design/ADF flows = 35/25 mgd

SOLIDS HANDLING

- 2.0m belt filter presses
- Multiple hearth incinerators (10 hearths)
- Operating 100 hrs/wk
- Solids throughput = 1.5 DT/hr
- Cake solids = 22%

South Plant

LIQUIDS STREAM

- Conventional activated sludge
- Design/ADF flows = 29/25 mgd

SOLIDS HANDLING

- 1.5m belt filter presses
- Multiple hearth incinerators (7 hearths)
- Operating 65 hrs/wk
- Solids throughput = 1.2 DT/hr
- Cake solids = 19.8

OBJECTIVE: INCREASE CAKE SOLIDS CONTENT

3- belt Press Installation at North Plant

North Plant

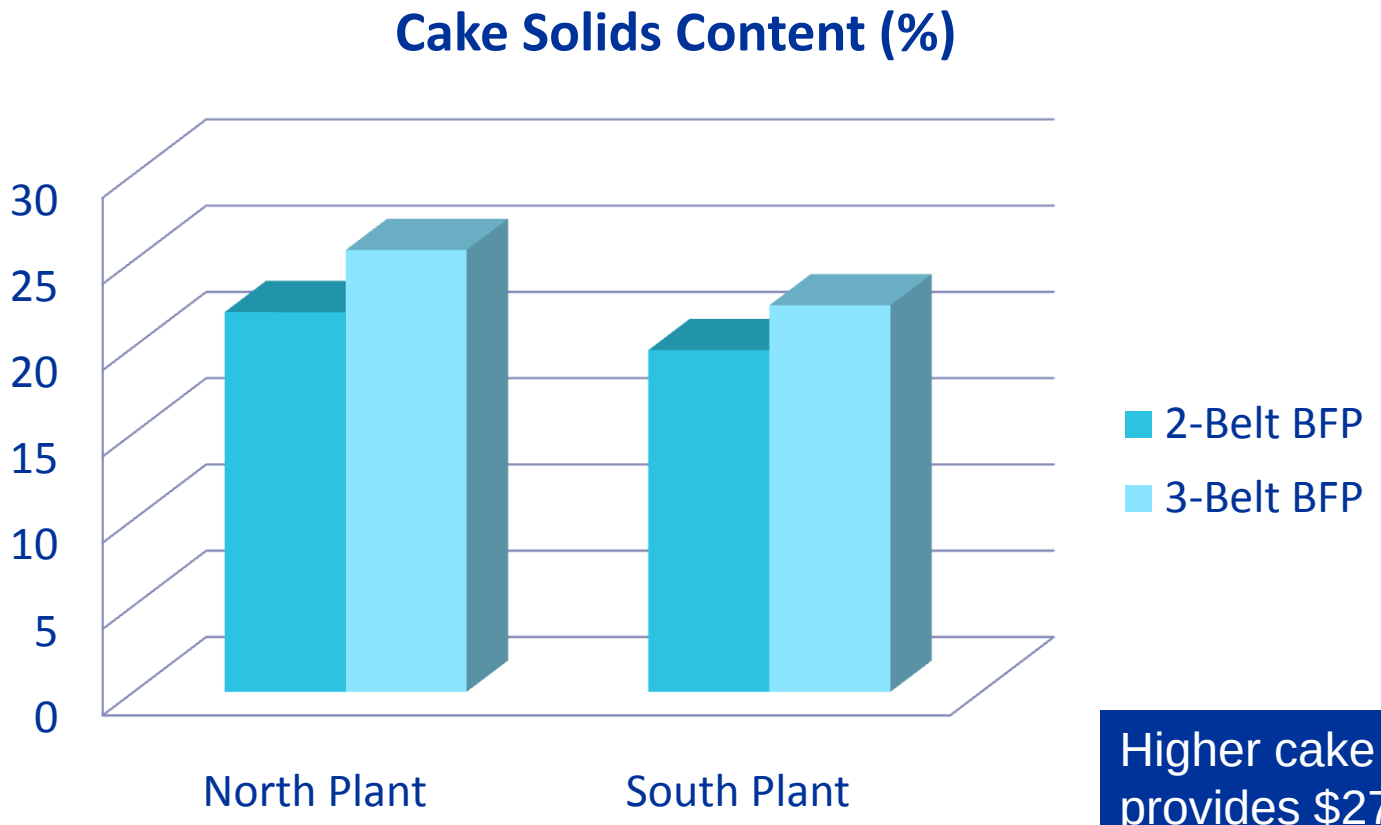
North WWTP (2-m)

South WWTP (1.5 m)

BFP Performance: Design vs Actual

Parameter	Units	North Plant		South Plant	
		Design	Actual	Design	Actual
Size	meter	2.0		1.5	
Hydraulic Throughput	gpm	100 to 200	152	75 to 150	132
Discharged Dry Solids	lbs/hr	2,500 to 3,000	2,980	1,875 to 2,250	2,300
Dewatered Cake Solids	MIN %	24	25.6	22	22.4
Solids Recovery	%	95	98.9	95	98.2
Polymer usage	lb active polymer/ DT solids	10	6.4	10	6.4

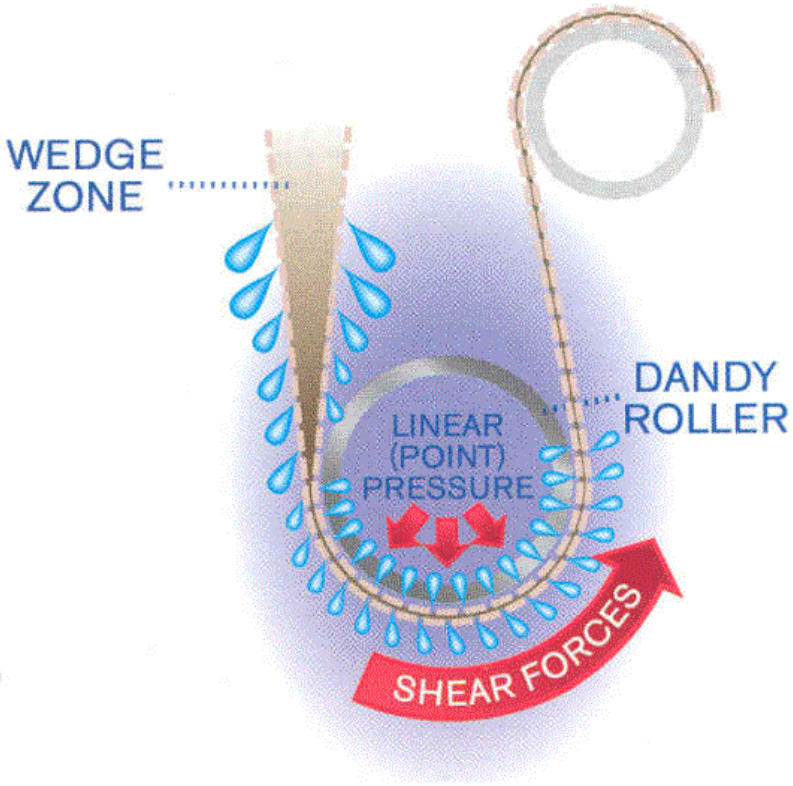
New BFPs Have Less Payback < 4 Years



Higher cake solids provides $276,000/yr savings.

Potential Future BFP Trends

- Continue to see 3-belts
- Enclosed units for odor control
- Evolution to address “smooth sludges”
  - Larger roller(s) for gentle pressure



Courtesy: Ashbrook

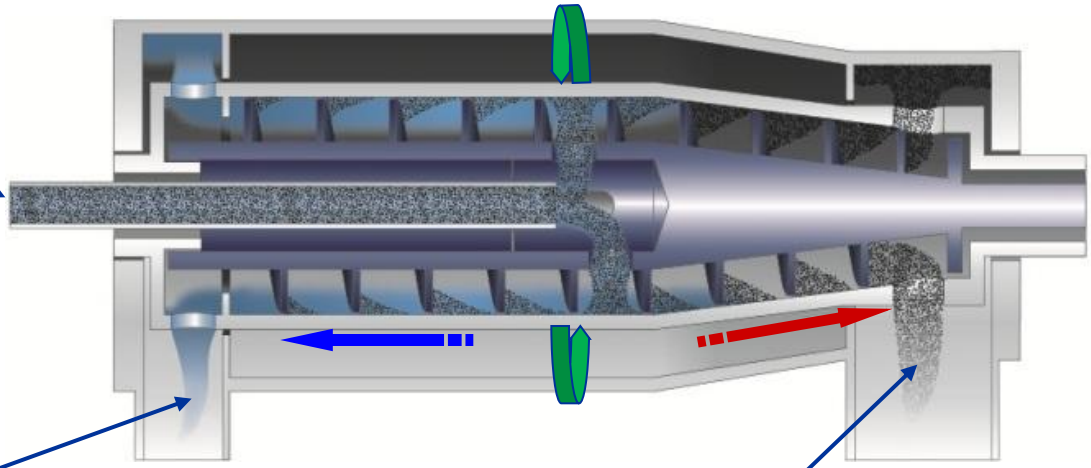
Centrifuge Dewatering

- Commonly used technology, especially at larger facilities
  - High throughput machine
  - Typically highest cake solids other than pressure filter
- Uses centrifugal force to separate solids from liquids
- Manufacturers: Alfa Laval, Andritz, Centrisys, Flotweg, Westfalia

Centrifuge Operating Principals

Bowl and scroll drive system creates differential speed

Sludge Feed



Continuous recovery of the clarified liquid (centrate) by overflow

Continuous gravity discharge of the dewatered solids

A scroll scrapes continuously the centrifuged sediments.

The clear effluent is evacuated on the opposite side.

Courtesy: Andritz

Centrifuge Advantages and Disadvantages

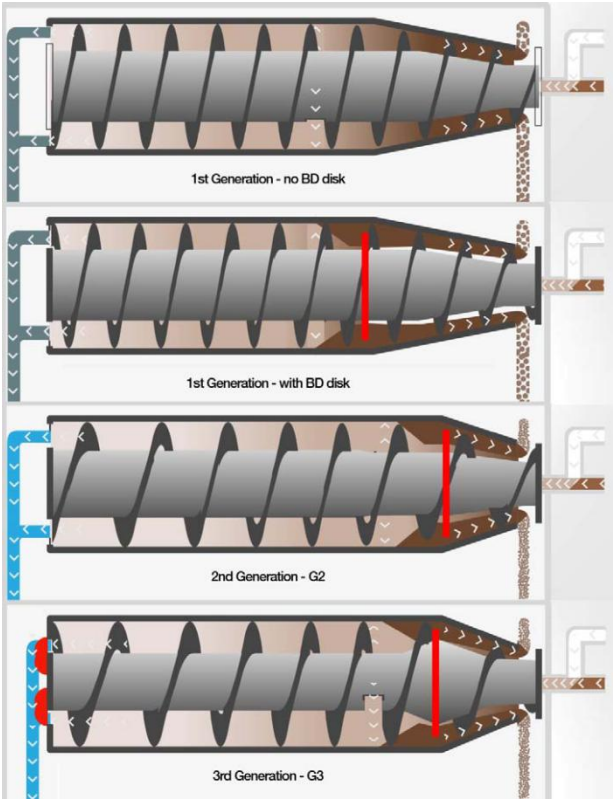
- Advantages
  - Small footprint, low staffing requirements
  - Small, contained odor source, facilitating odor control
  - Major maintenance items easily removed/replaced
- Disadvantages
  - High power consumption and polymer use
  - Relatively noisy, higher vibration
    - Vibration is a structural concern
  - High shear operation, resulting in higher odor potential and possible indicator regrowth
  - Expensive spare parts
  - Repair work performed by manufacturer

Centrifuges in Texas

- Historically not dominant choice
  - Low disposal/use costs
  - Historic preference for BFPs
  - Historic maintenance requirements
- Drivers moving in favorable direction
  - Disposal/use costs increasing
  - O&M somewhat simplified
    - Easy start up/shut down
  - Enclosed process (odors)
- Concerns
  - Product odor
  - Regrowth/reactivation (AnD biosolids)

Centrifuge Trends

- Focus on energy reduction (varies by manufacturer)
- Other
  - Controls – focus on “set it and forget it”
  - Interchangeable parts for major maintenance (scrolls)
    - 4 hr vs multi-week effort

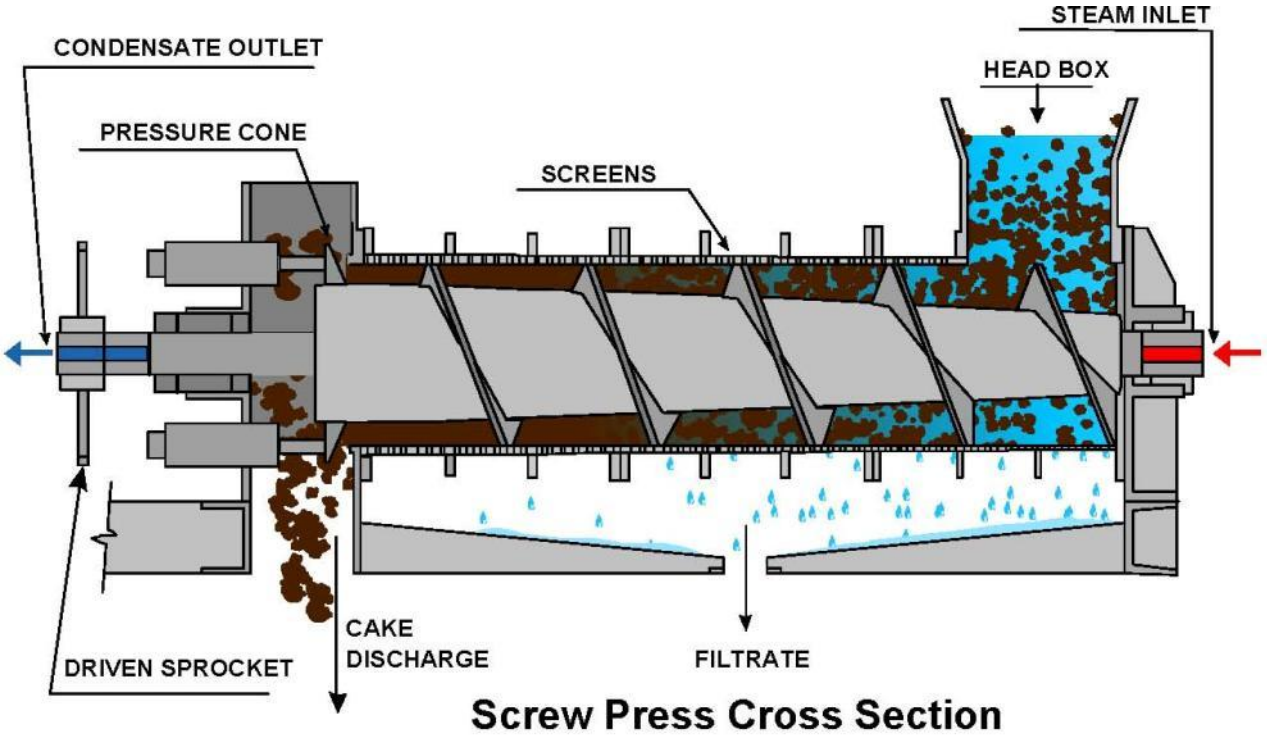


Source: Alfa Laval (Islander), 2012

Screw Press Dewatering

- Relatively new technology with growing interest
  - From pulp/paper industry
  - Strong focus on west coast
- Simple, low maintenance system
- Free draining dewatering device
- Screw applies pressure against basket
- Potential cake solids expected slightly less than centrifuge
- Manufacturers: FKC (horizontal), Huber (inclined), PWTech (inclined), BDP (inclined)

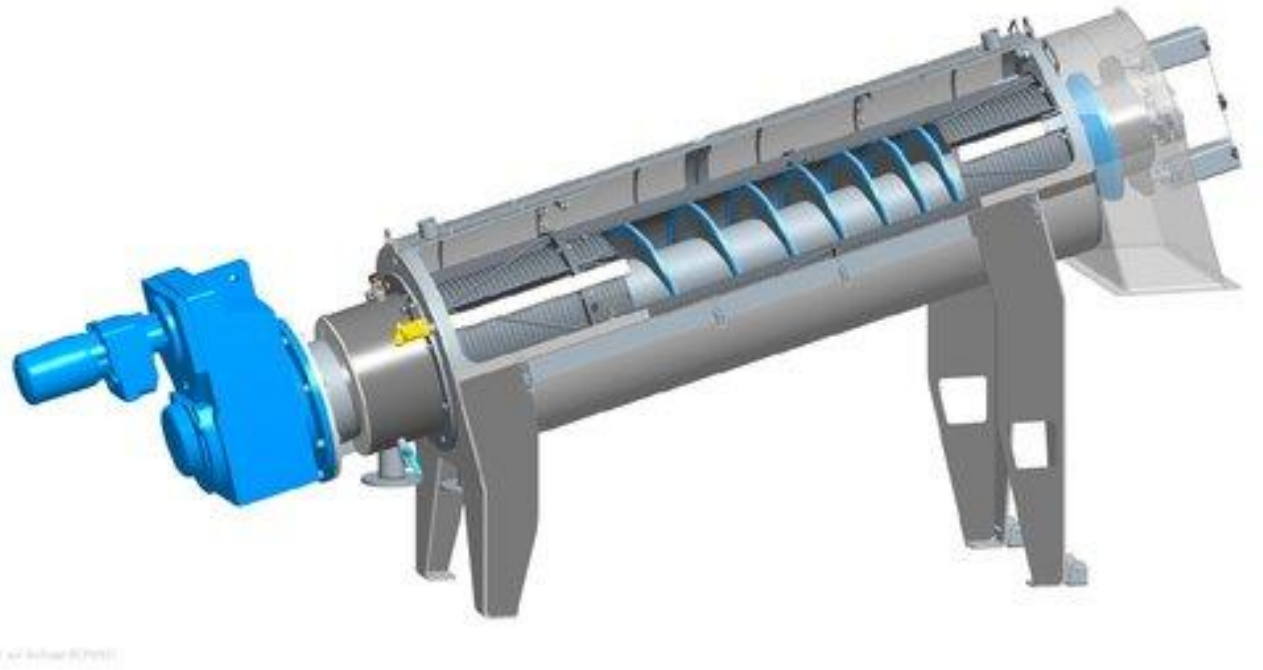
Horizontal Screw Press



Screw Press Cross Section

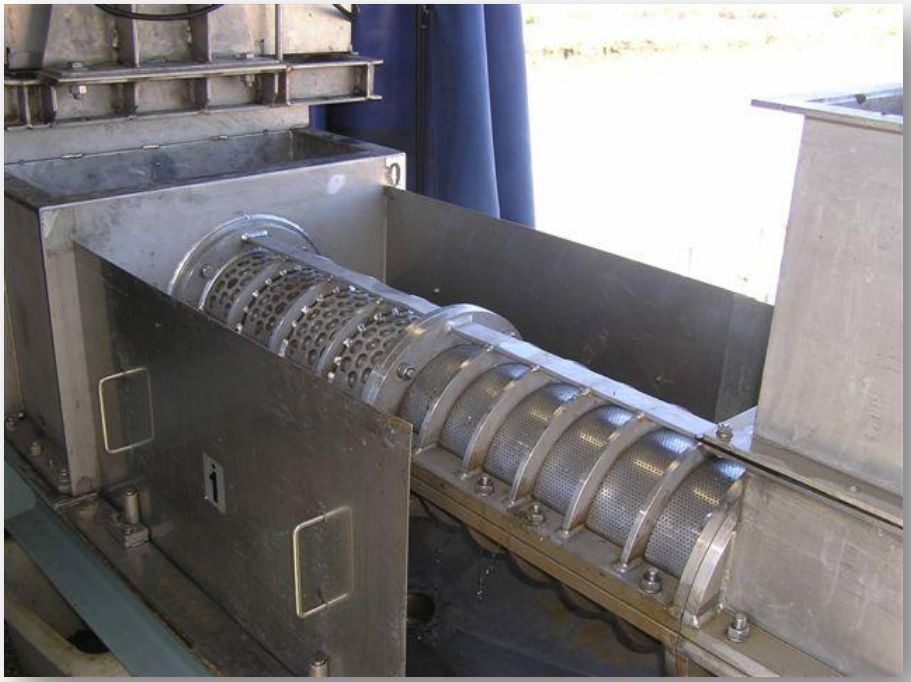
Courtesy: FKC

Inclined Screw Press



Courtesy: Huber

Screw Press Basket and Cake



Screw Press Advantages and Disadvantages

Advantages

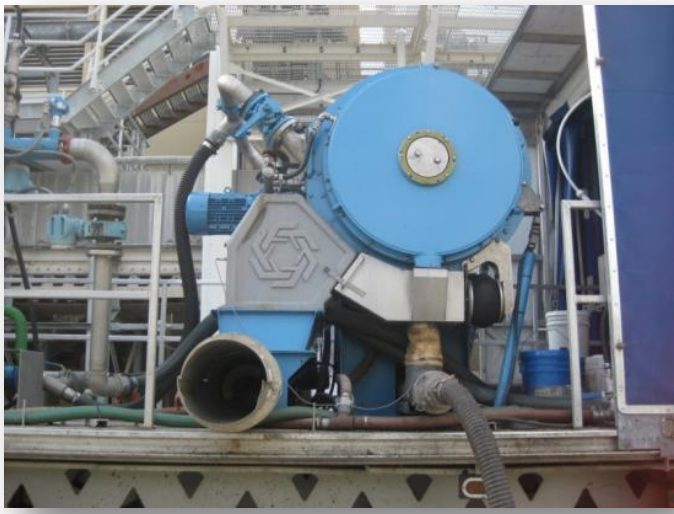
- Enclosed system provides good odor containment
- Easy start up and shut down, can run automated
- Low power consumption
- Low maintenance requirements

Disadvantages

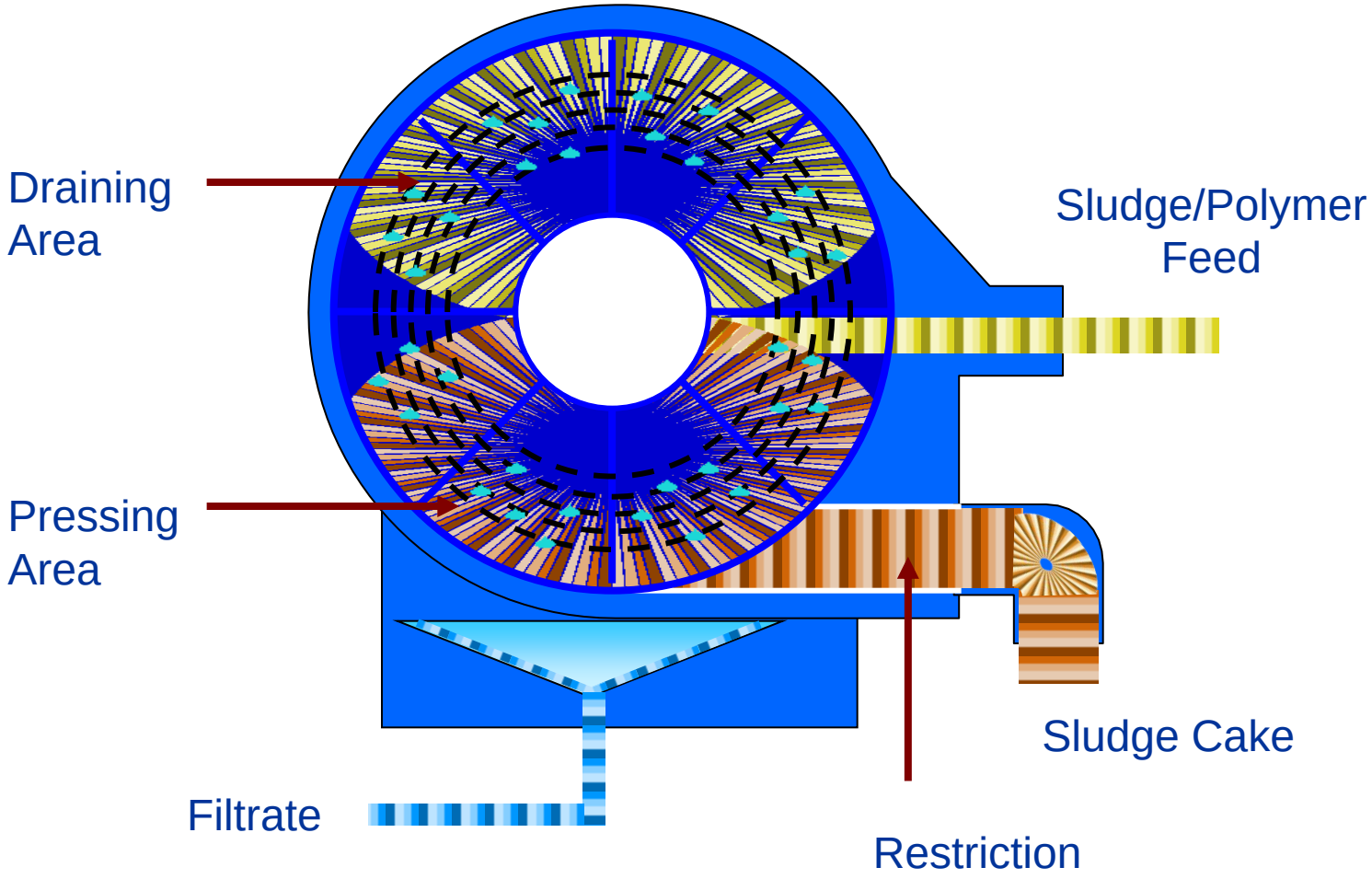
- Low thoughput = more units and larger footprint
- Typically, cake solids expected to be lower than centrifuge
- Typically, polymer dose expected to be slightly higher
- Testing recommended

Rotary Press Features

- Relatively “new” technology (to Texas)
- Simple, best suited for raw sludges
- Solids rotated between two parallel revolving filter elements; filtrate flows through these elements
  - Friction of plates and backpressure at outlet produces cake
- Cake solids:
  - 25-28% P+WAS
  - 14-27% WAS
- Manufacturers: Fournier, Prime Solutions



Rotary Press Operation



Rotary Press- 6 Channel Unit

Rotary Press Advantages/Disadvantages

- Advantages
  - Enclosed, low odor, noise levels
  - Easily expanded
  - Small footprint
  - Easy start up, shut down
  - Ease of operation/maintenance
  - Low power consumption

- Disadvantages
  - Works better with sludges that are more fibrous
  - Relatively small throughput; capital costs can be high

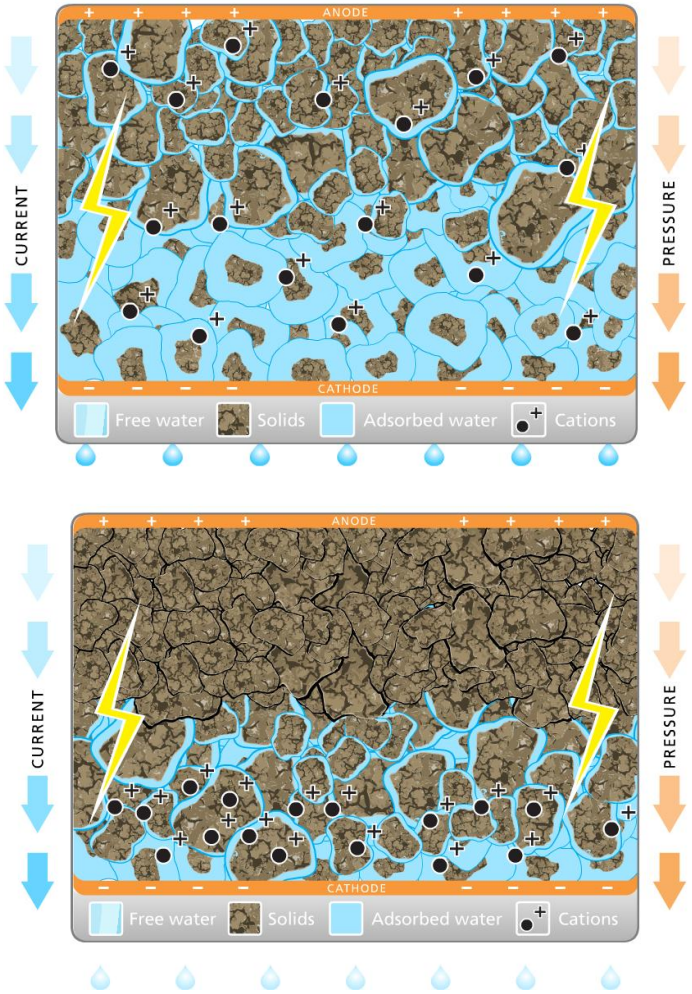
Case Study: Gloucester, MA (5 mgd Primary Plant)

- Drivers
  - Labor requirements
  - Dewatering room odors
  - Washwater requirements
- 2, 6-channel presses

Parameter	Performance
Throughput	2,000 dry lb/hr (per 6-channel press)
Cake solids	35-42%
Dewatering time	6-12 hrs/week
Washwater use	5 minutes per day

Electrodewatering

- Suppliers : Ovivio Cinetek, Siemens?
- Add cathodes, anodes to pressure zone
- Combination of electro-osmosis and application of controlled mechanical pressure to sludge
  - 500 to 1500 kwh/DT
- Cake solids of 25-50%
- Reported pathogen reduction
- Canadian installations
  - Victoriaville: from ~15-18% to 35%
  - Valleyfield: from 14% to 25%



Electrodewatering Advantages/Disadvantages

Advantages

- 40 to 50% reduction in sludge volume, increased solids
- Small footprint
- Reported pathogen and odor reduction
- Self-contained

Disadvantages

- Few US vendors
- Emerging technology
- Relatively high power consumption
- Needs high feed solids (10-20%)
- Low throughput/high capital ($1M+/meter)

Technology Comparison Case Study: Orange County Utilities, FL

- Three facilities
  - Northwest WRF: 7.5 mgd
  - South WRF: 43 mgd, AnD
  - Eastern WRF: 24 mgd
- General
  - No primary clarifiers
  - Different biological processes
  - Different biosolids processing
  - Belt Filter Press Dewatering

Feed Sludge Characteristics

OCU Facility	Solids Content	Volatile Solids	pH
Northwest WRF	1.0-1.5%	82-84%	7.0
South WRF	3.0%	70-74%	7.5
Eastern WRF	0.9-1.0%	88-90%	6.8

Pilot Test Results: Cake Solids Content

	Belt Filter Press	Centrifuge	Screw Press	Rotary Fan Press	Electro-Dewatering
Northwest WRF	14%	23%	21%	----	39%
South WRF	13%	20%	17%	14%	37%
Eastern WRF	15%	21%	20%	17%	43%

Polymer Consumption

Pounds Active Polymer per Ton	Centrifuge	Screw Press	Rotary Fan Press
Northwest WRF	20-24	18-20	----
South WRF	33-37	30-35	12-16
Eastern WRF	19-23	18-24	12-16

Solids Capture

Percent Capture	Centrifuge	Screw Press	Electro-Dewatering
Northwest WRF	97%	94%	92%
South WRF	96%	95%	95%
Eastern WRF	92%	97%	93%

Energy Consumption

kWh per Ton	Centrifuge	Screw Press	Electro-Dewatering
Northwest WRF	98	14	225
South WRF	53	6	265
Eastern WRF	92	14	163

Implications for Orange County Utilities

	Dry Tons per Day	Belt Filter Press (WTPD)	Centrifuge (WTPD)	Screw Press (WTPD)
Northwest WRF	4.7	34	21	22
South WRF	16.4	126	81	96
Eastern WRF	19.7	131	96	97
Total	40.8	291	198	215

Conclusions

- Dewatering alternatives outperformed OCU's BFPs
- Screw press offers cake solids content comparable to centrifuge
- Linear electro-dewatering, rotary press throughput too small for this application (multiple units needed)
- Centrifuge selected due to high throughput and dewatered cake solids
  - Screw press preferred at one facility, but standardization was a concern

Word of warning….

Your results may vary….

When in doubt, pilot!!

Questions?