New Options for Slow-Speed Dewatering - Another Technology in the Engineer's Toolbox

New England Water Environment Association Conference

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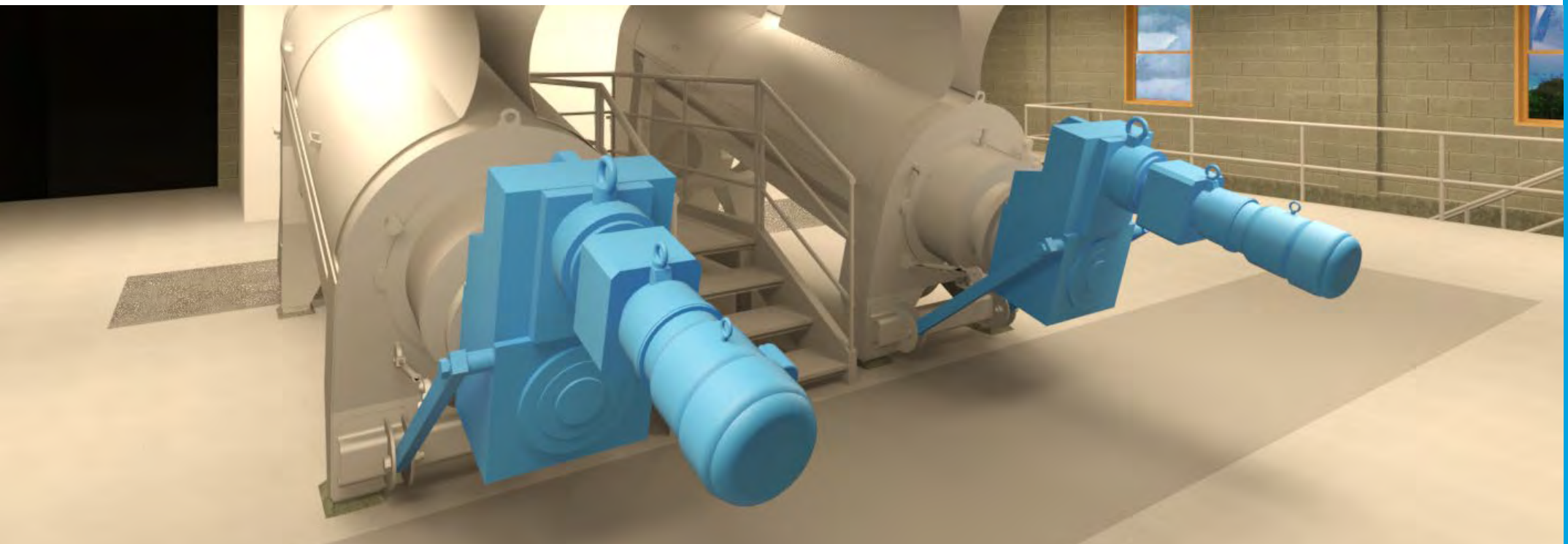

BATH MAINE CITY OF SHIPS

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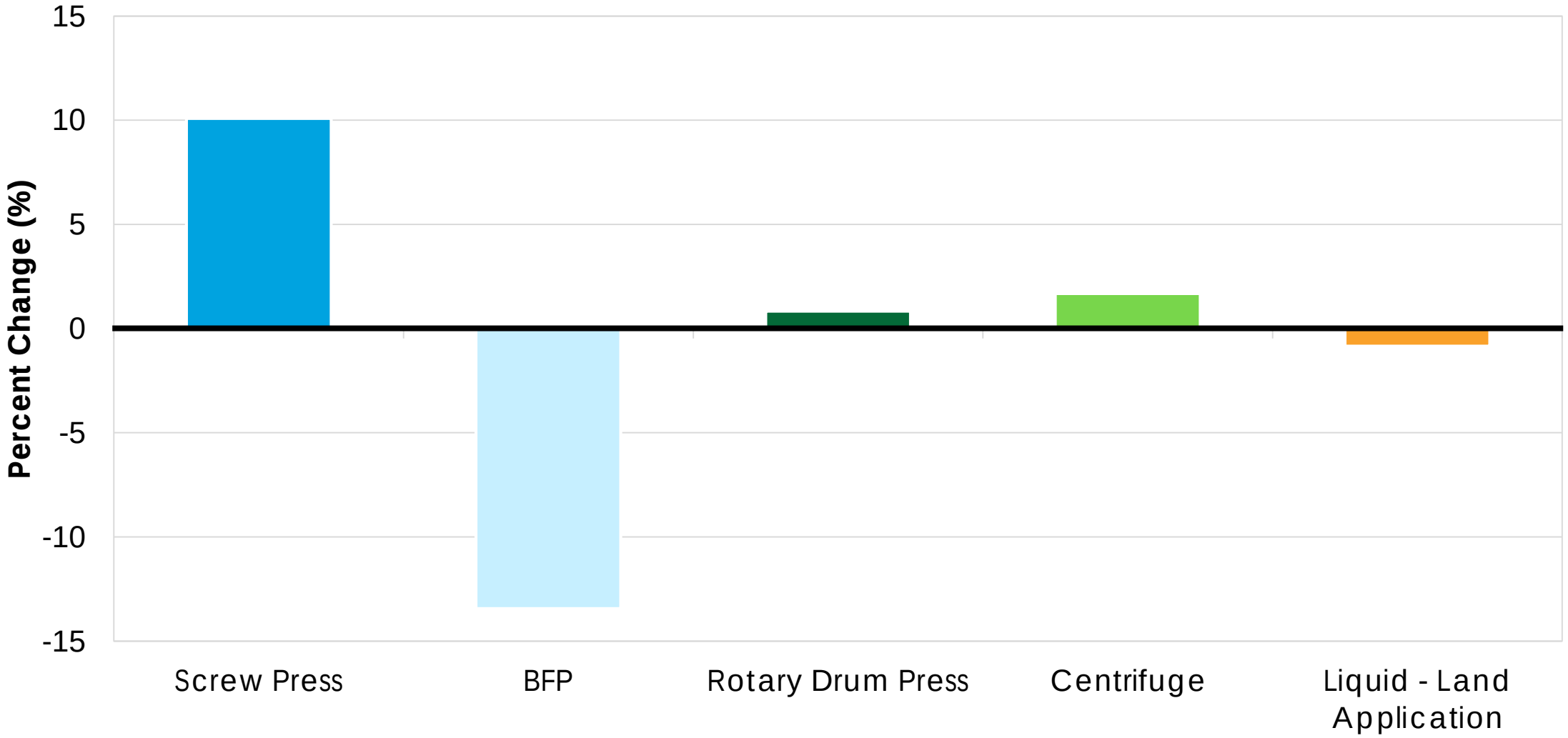
Changes in Dewatering Technologies in Maine (2011 to 2020)



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City of Bath, Maine - Solids Handling Upgrade

City requirements:

- Slow-speed technology
- Operational flexibility
- Redundancy
- Reduce odors
- Increase cake solids

Key Design Issues

- CSO Community – high volumes, low solids concentrations
- Separation of primary and waste sludges

Old Belt Filter Press

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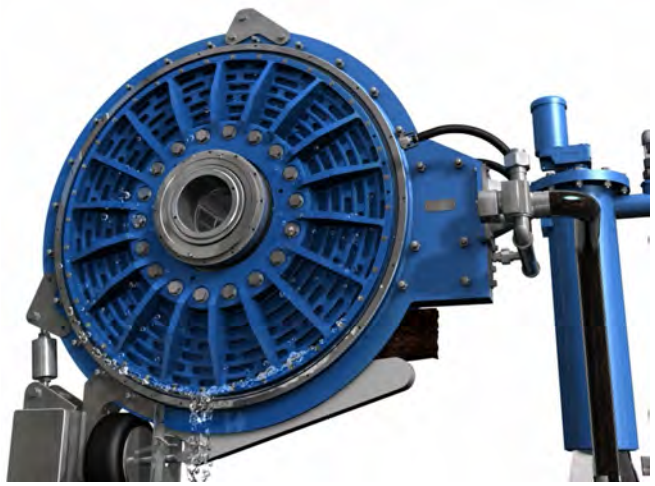
Slow-Speed Dewatering Technologies Considered

Rotary Drum Presses

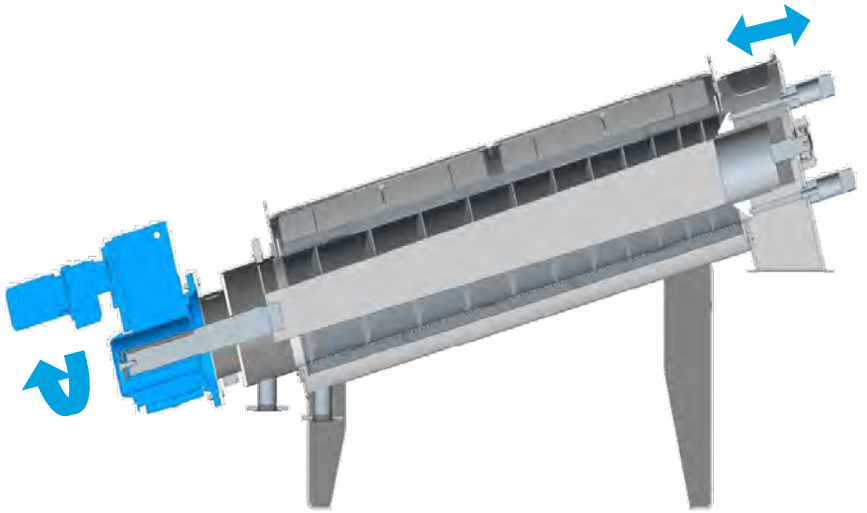
- **Fournier, Prime Solutions**

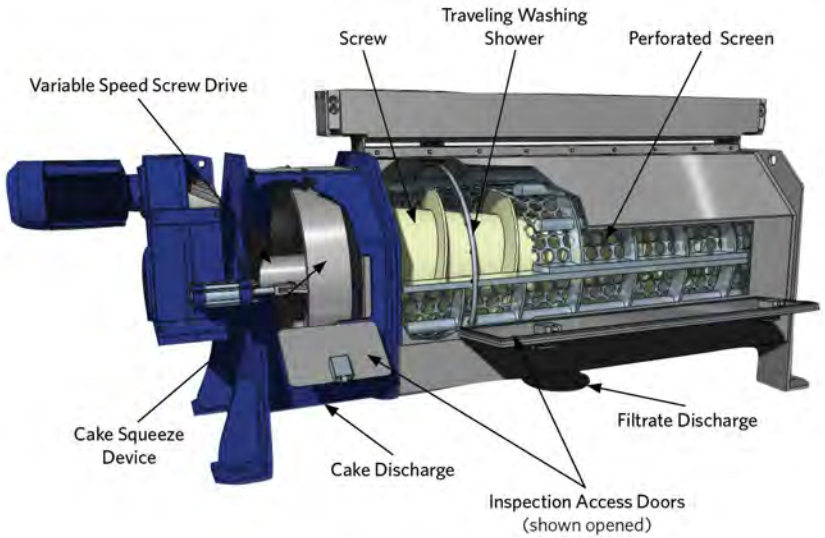


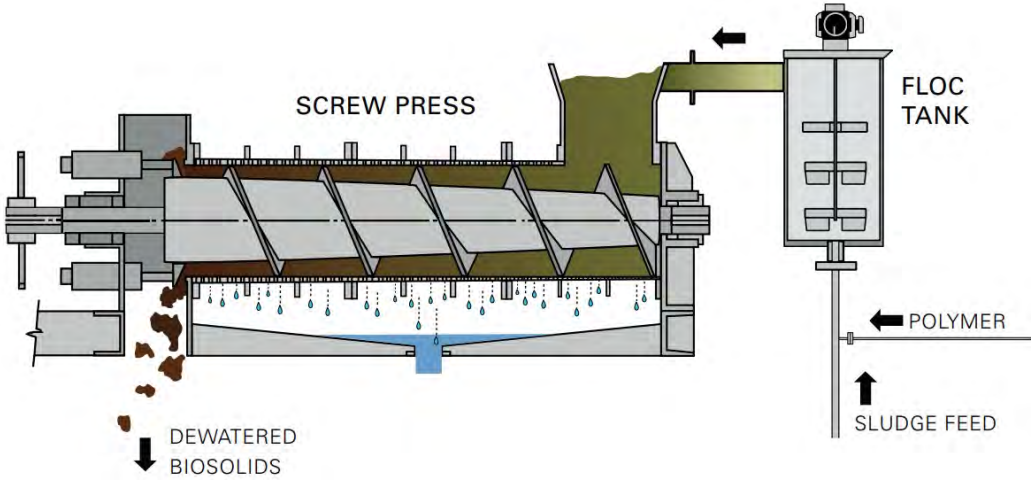
Slow-Speed Dewatering Technologies Considered

Rotary Screw Presses

- **Inclined (Huber)**
- **Horizontal (FKC)**
- **Horizontal (Ishigaki)**
- **Horizontal (Schwing Bioset)**







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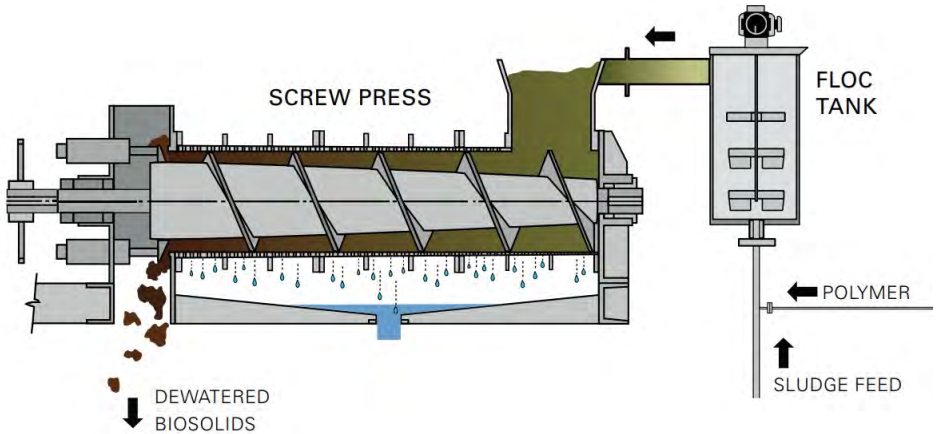
Rotary Screw Press

Advantages

- Slow rotational speeds
- Low energy requirements
- Low noise levels
- Suitable for 24 hour per day operation
- Fully enclosed – minimal odors
- Custom-designed for specific loading rate (horizontal only)



Disadvantages

- High entry cost
- Space requirements
- Extended operation may be needed to keep size down
- Limited sizes available for inclined (but increasing)

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City of Bath, Maine - Solids Handling Upgrade

Design Approach

- **Pilot testing conducted to determine total life cycle costs and total present worth**

Item	Rotary Screw Press – Inclined	Rotary Screw Press – Horizontal	Rotary Screw Press - Horizontal
Manufacturer/ Model	Huber Q-Press 800	Ishigaki A-0706	FKC 600x3500
Polymer (lbs active/dry ton)	35	30	25
Expected Cake Solids	20%	28%	23%
# of Units Required	2	2	2
Total Present Worth	$4.57 million	$3.72 million	$4.06 million

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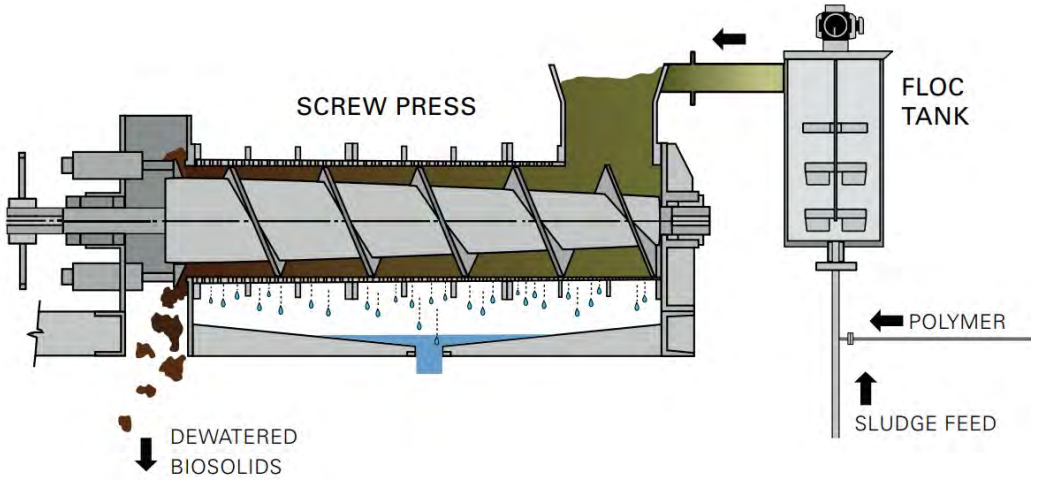
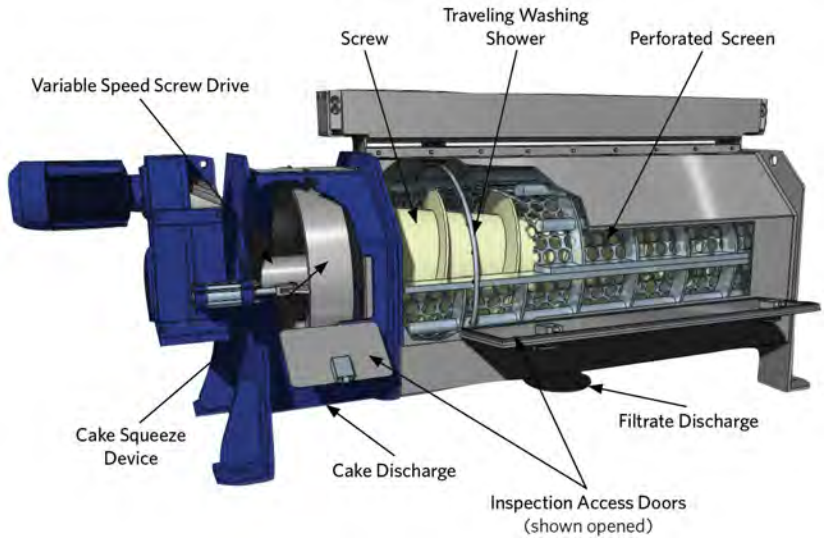
City of Bath, Maine - Solids Handling Upgrade

Basis of Design

- **Open bid - new redundant horizontal screw presses**
- **Horizontal, gravity feed system**
- **OR**
- **Horizontal, pressurized feed system**





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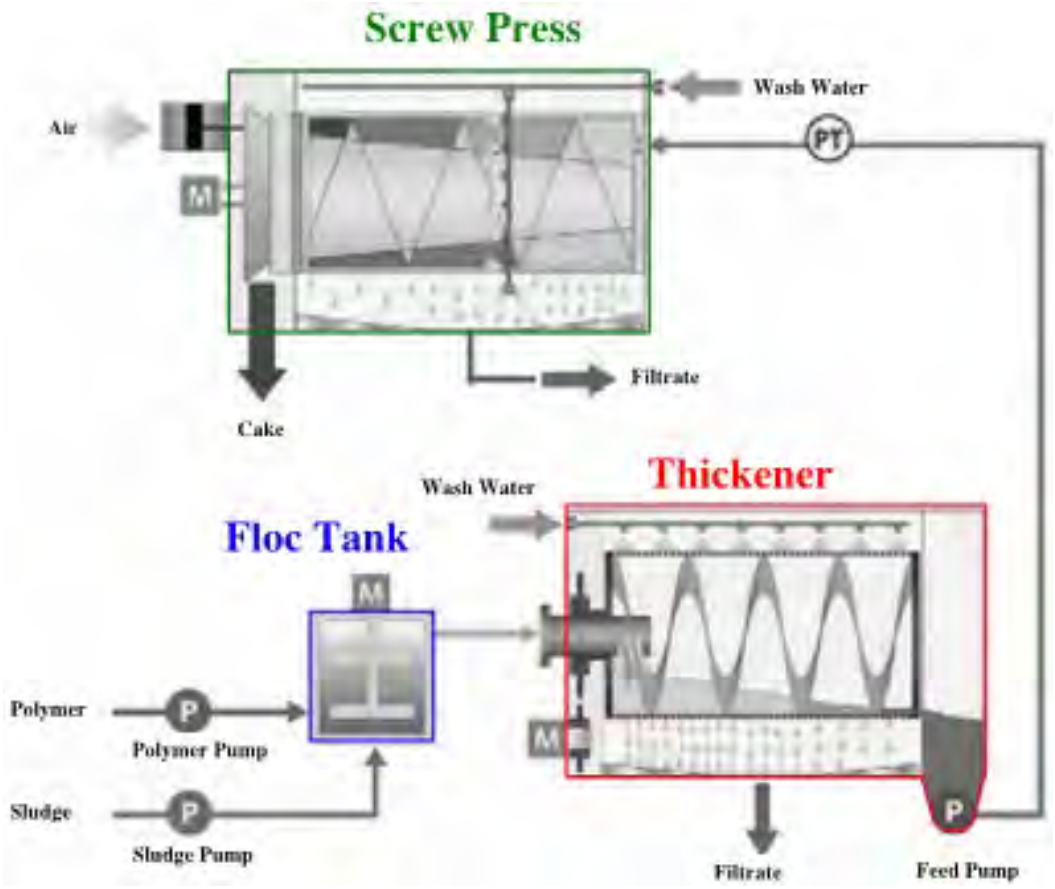
Dewatering System Process Flow Diagram



Flocculation Tank

- Two 600-gallon steel flocculation tanks
- Variable speed blended sludge fed into tank
- Variable speed paddle mixer
- Various polymer injection points
  - 2 in the bottom and 1 into the sludge feed line
- Viewing window
- Gravity flow to thickener

Thickener

- Tumbling Thickener
- 1 polymer injection point
- 20 gpm of stationary, overlapping wash water
- Spiral flights, cylinder and screens all rotate together
- Sludge is dropped in the hopper
- Hopper is equipped with a level sensor
- Thickened sludge is transferred to the screw press via progressive cavity pump
- Pump is variable speed and controls the level of the hopper and the pressure of the screw press

Screw Press

- Screw flights are a constant diameter and are equipped with lip seals to clean the inner diameter and help maintain pressure
- Screw shaft increases in diameter to create more pressure towards the cake end
- Openings in filter screen gradually decrease in size towards cake end to aid in dewatering
- Cake end is equipped with a cone shaped plate controlled by adjustable pneumatic cylinders to optimize cake solids

Wash Bar

- **A chain driven, traveling wash system cleans deposits on the outer screen**
- **Washwater is approximately 80 gpm and can be manually run or put on a schedule**

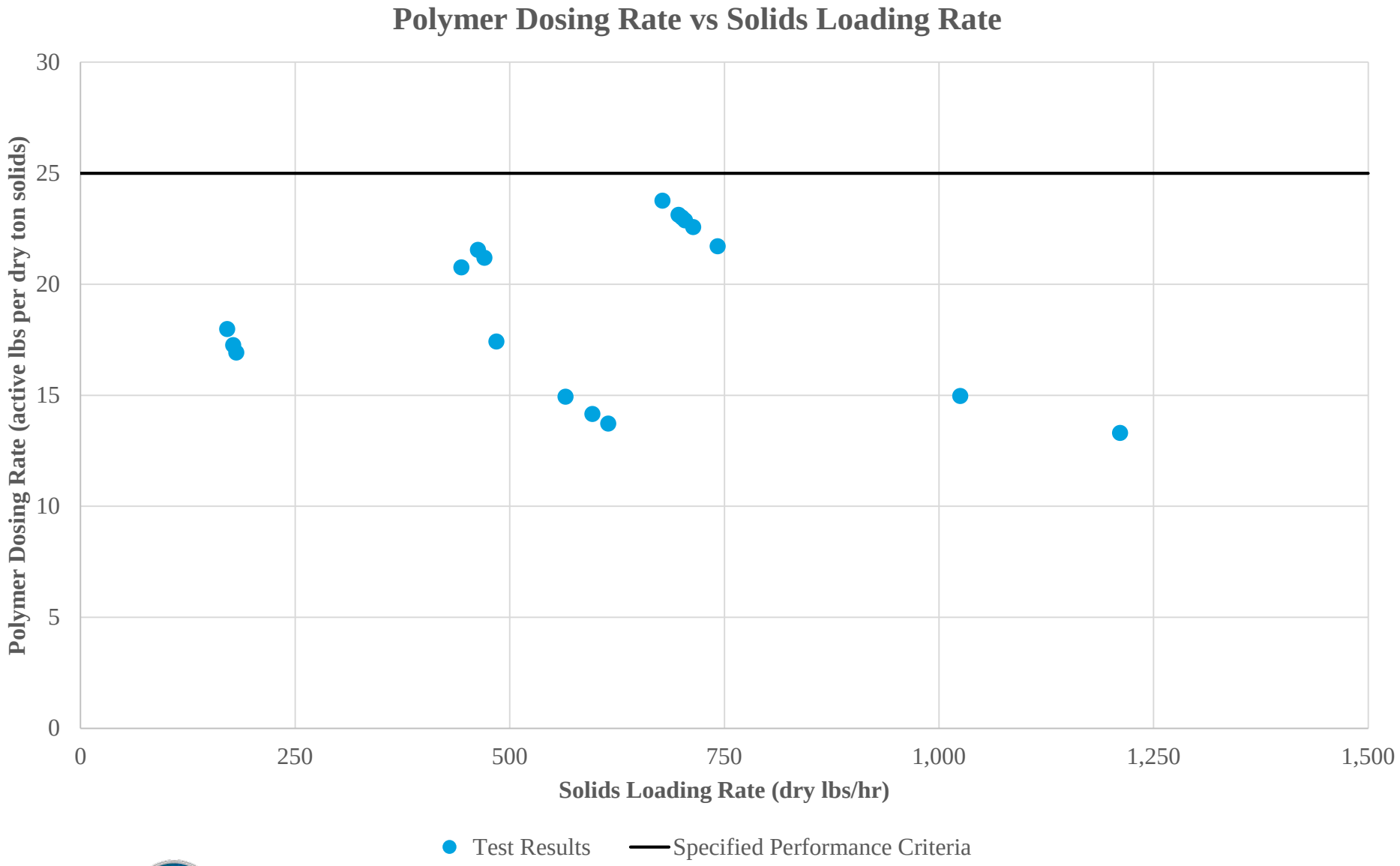
Automatic Controls

- Polymer injection based on sludge pump flow rate
- Sludge flow rate based on thickener hopper level
- Thickener speed based on hopper level
- Progressive cavity pump speed based on hopper level and screw press pressure
- Screw press speed based on pressure

Old Vs. New

- Better working environment
- Better odor control
- Reliability?
- Less time spent overseeing the equipment
- Performance

Screw Press – Certified Testing Results



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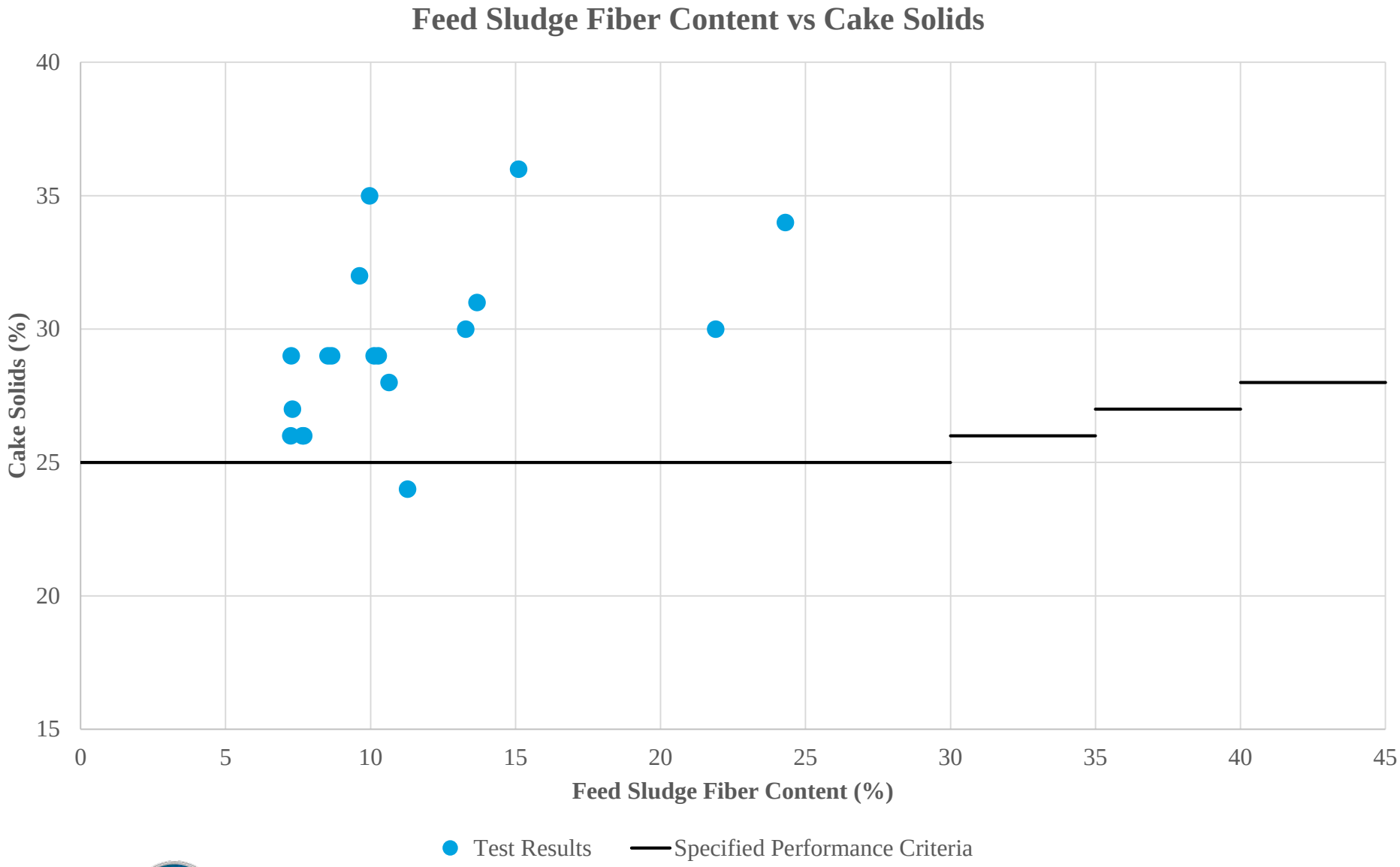
Screw Press – Certified Testing Results



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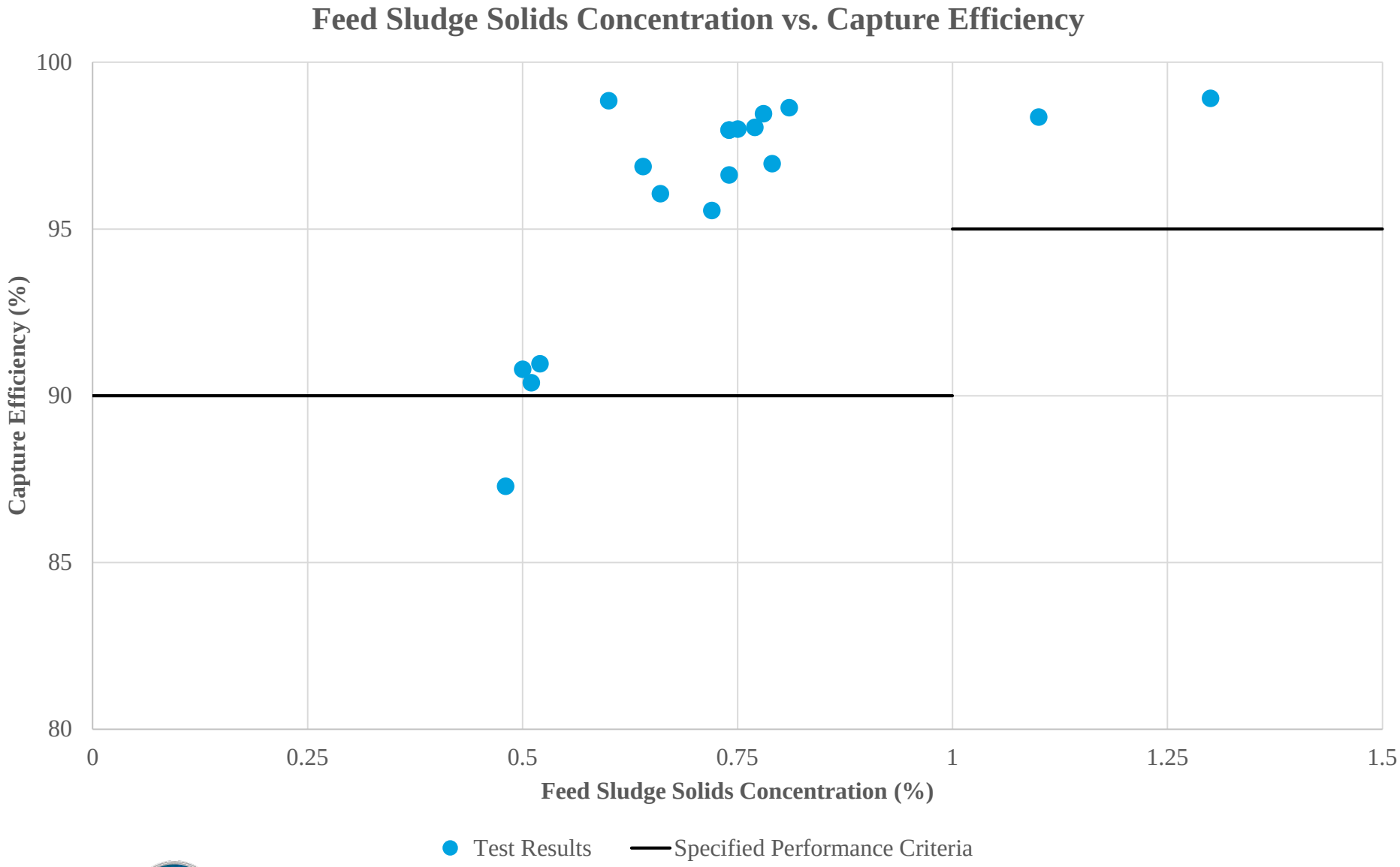
Screw Press – Certified Testing Results



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Rotary Screw Press (Horizontal) – City of Bath

Results – How does the equipment stack up?

Parameter	Design Criteria	Test Results (Avg)
Max Hydraulic Loading Rate (gpm)	245	300
Solids Loading Rate (lbs/hr)	659	750
Min Solids Capture Rate (%)	90/95	95.4
Max Polymer Consumption (active lbs/dry ton)	25	19
Min Cake Solids (%)	25-28	30.1

General Improvements

- Co-settling to separating
- Filtrate quality
- Polymer optimization
- Running at night

Additional Points

- Pay attention to the sprayers
- Pilot Test
- Redundancy
- Break the old habits
  - Patience with parameter changes
- Highly adjustable
  - Future transition
  - Adjustability to tailor your needs at the time

CONTACT INFORMATION

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THANK YOU

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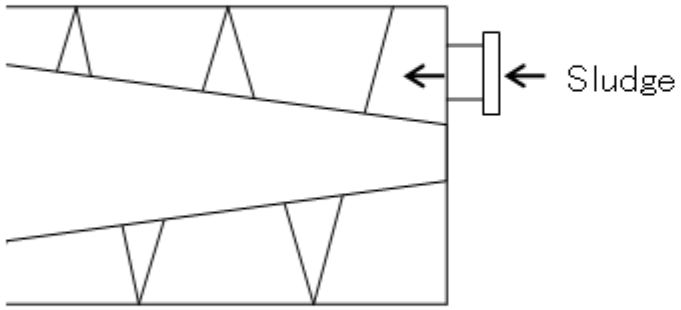
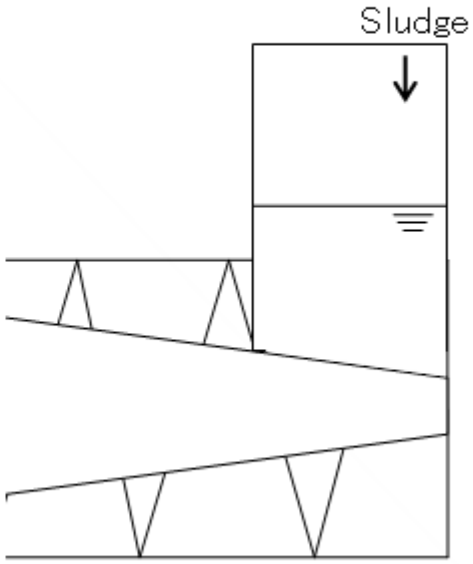
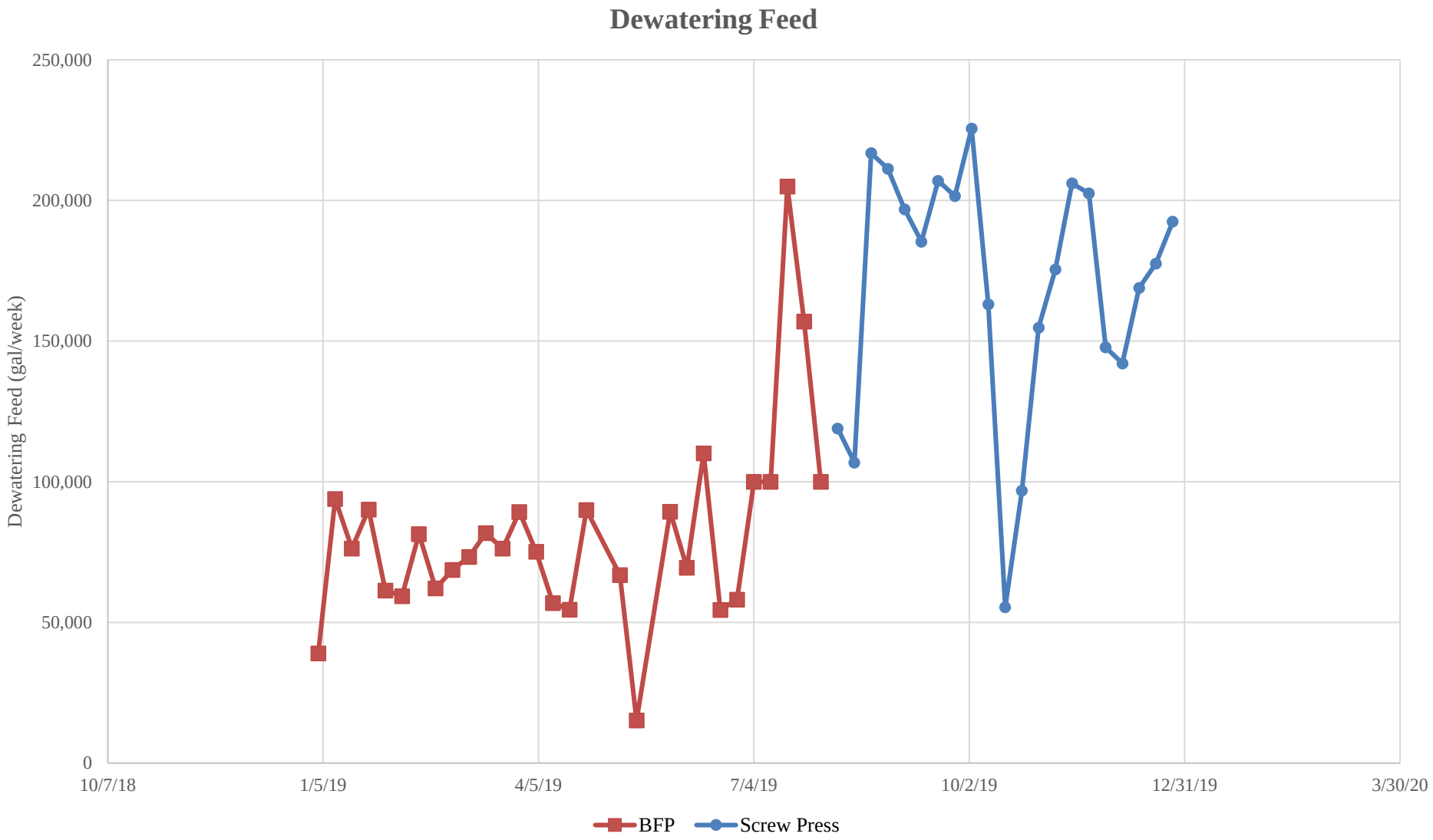
Feed Systems

Pressurized Method	Hopper Method
	

Screw Press Performance Results



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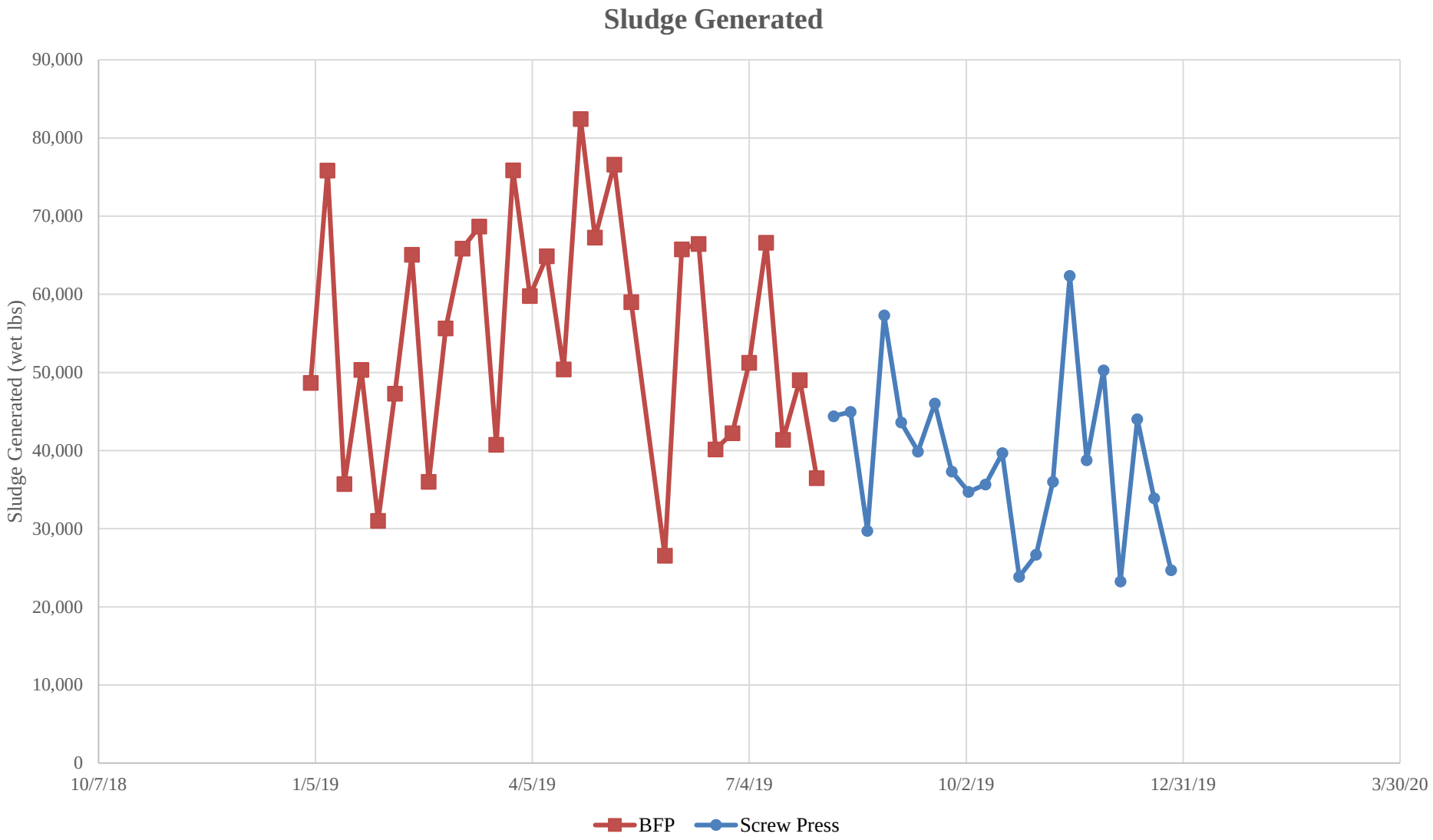
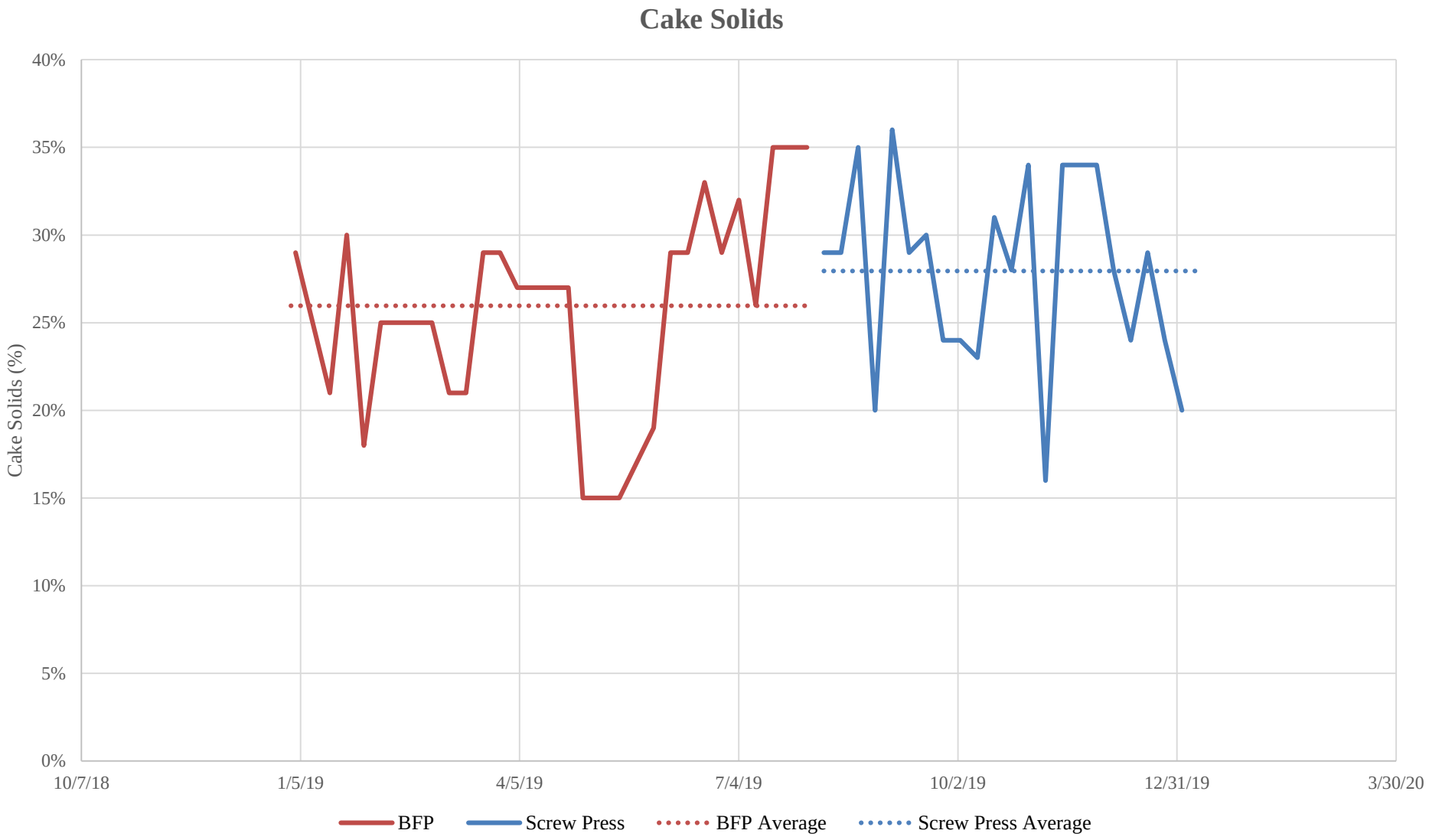


Screw Press Performance Results



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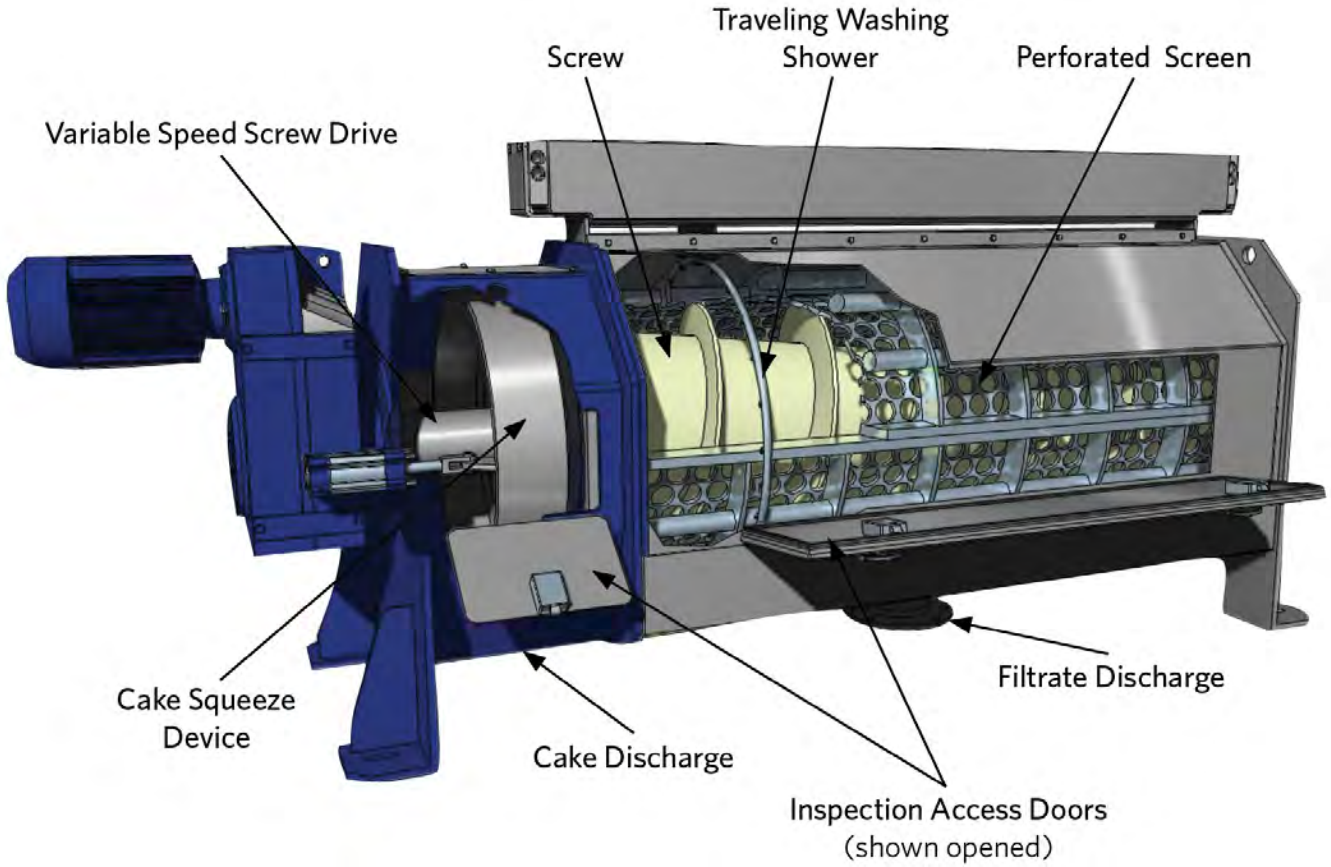
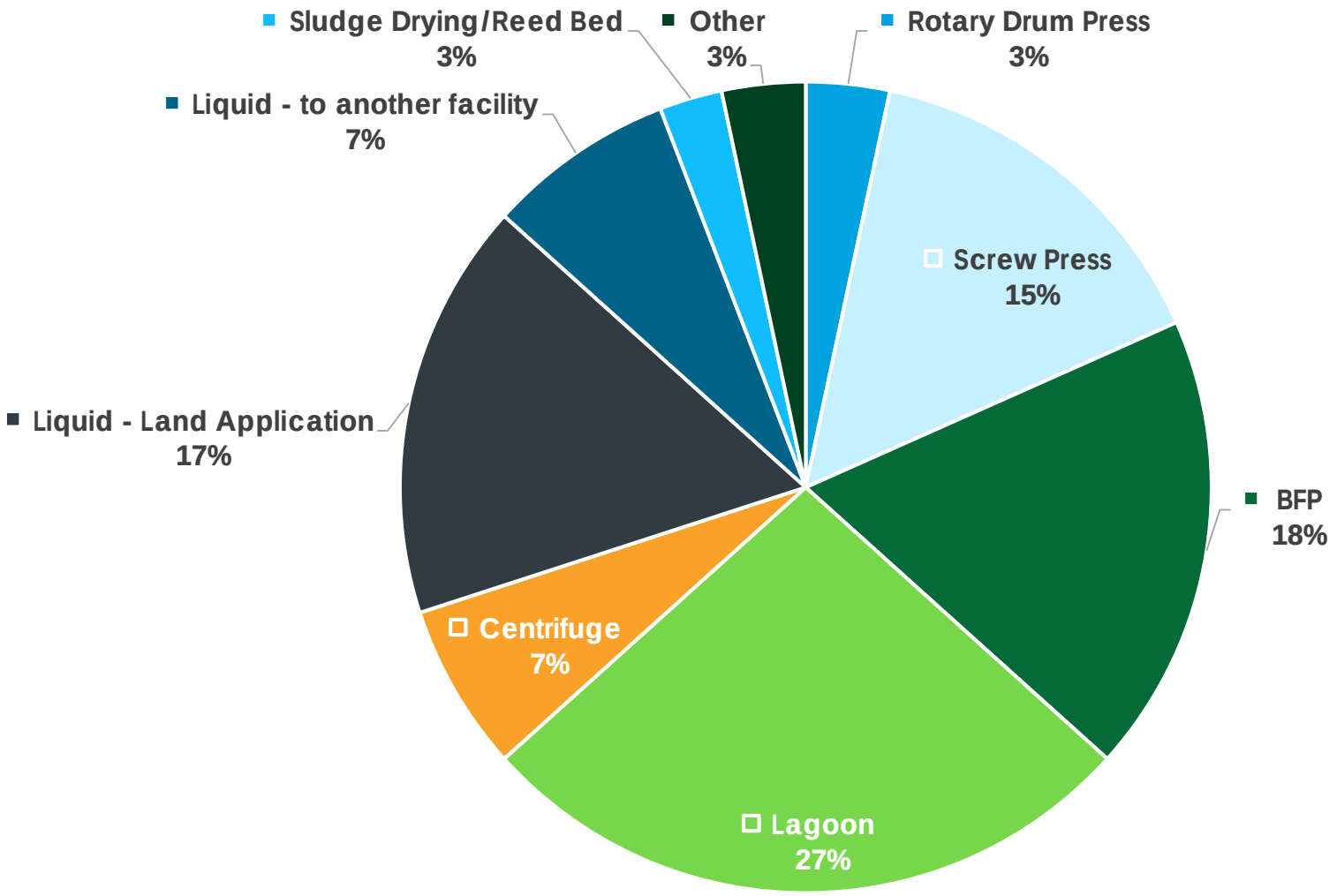
Rotary Screw Press

- **Principal of Operation**



Sludge Dewatering in Maine (2020)



What Technology Is Best for My Plant?

- **Comparison of different evaluation criteria**

Parameter	Belt Press	Centrifuge	Fan/Screw Press
Low Feed Solids	⚠	👍	👍
Solids Throughput	🧍 🧍	🧍 🧍 🧍	🧍
Continuous Operation	⚠	👍	👍
Footprint	👣 👣 👣	👣 👣	👣 👣
Energy Demand	💡	💡 💡 💡	💡
Noise	👂 👂	👂 👂 👂	👂
Polymer Consumption	🧪	🧪 🧪 🧪	🧪 🧪
Sludge Disposal Costs	$ $ $	$	$ $
Equipment Costs	$	$ $ $	$ $
Maintenance Costs	$ $	$ $ $	$

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