# DEWATERING EQUIPMENT & SOLIDS CAPTURE

Lower Neuse Basin Association /
Neuse River Compliance Association

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Clearwater, Inc.

# Agenda

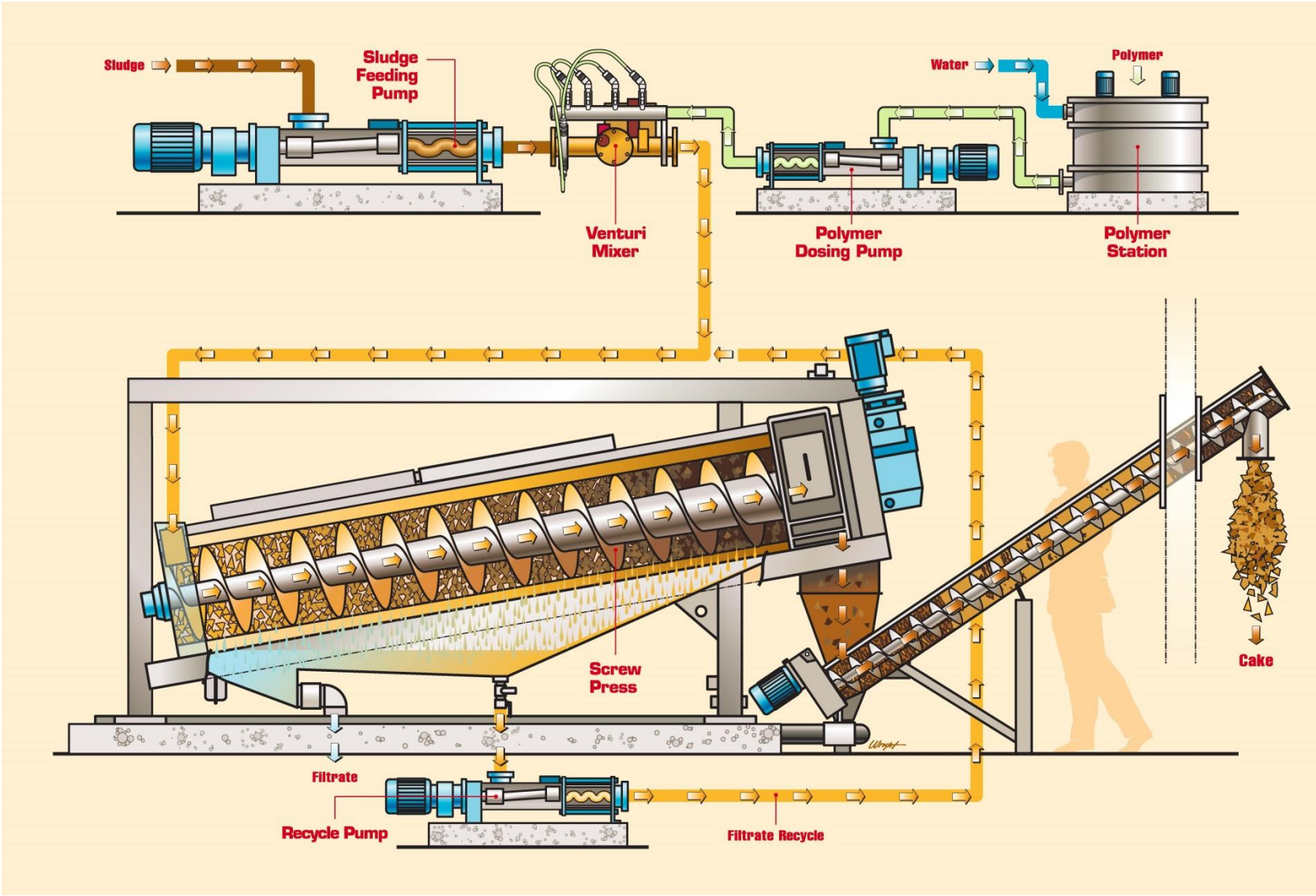
- Recent Advancements & Industry Shifts
  - Screw Press
    - Smaller WWTP's are adding mechanical dewatering
    - Pre-Thickening
  - Belt Press
    - Pre-Thickening – Throughput Capacity
    - Ability to Process Abrasive Material
    - Enclosed for Odor Control
    - Filtrate Recycle for Reduced Water Usage
- **Solids Capture**

# Screw Press

- Naturally Enclosed
- Low GPM
  - Washwater
  - Sludge
- Fiber = Good
- Grit = Bad
- Easily Monitored

18” Screw Press

# Screw Press


Sludge
Sludge Feeding Pump
Venturi Mixer
Water
Polymer
Polymer Dosing Pump
Polymer Station
Screw Press
Cake
Filtrate
Recycle Pump
Filtrate Recycle

# Screw Press


12” Screw Press

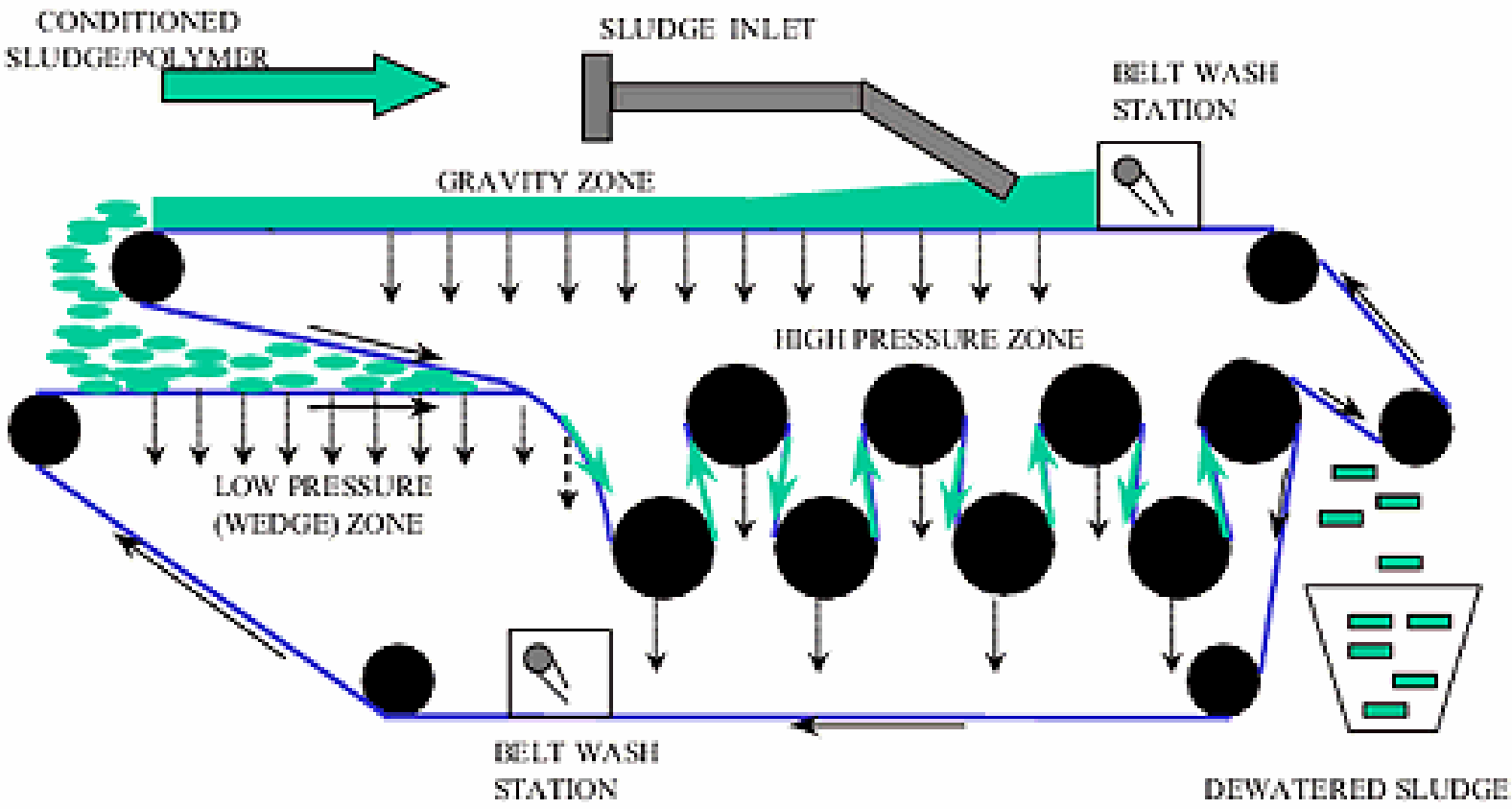
# Pre-Thickening Advantages

- Feed to Unit: 50 gpm at 1.0%
- Average discharge from pre-thickening drum is 7 – 10%

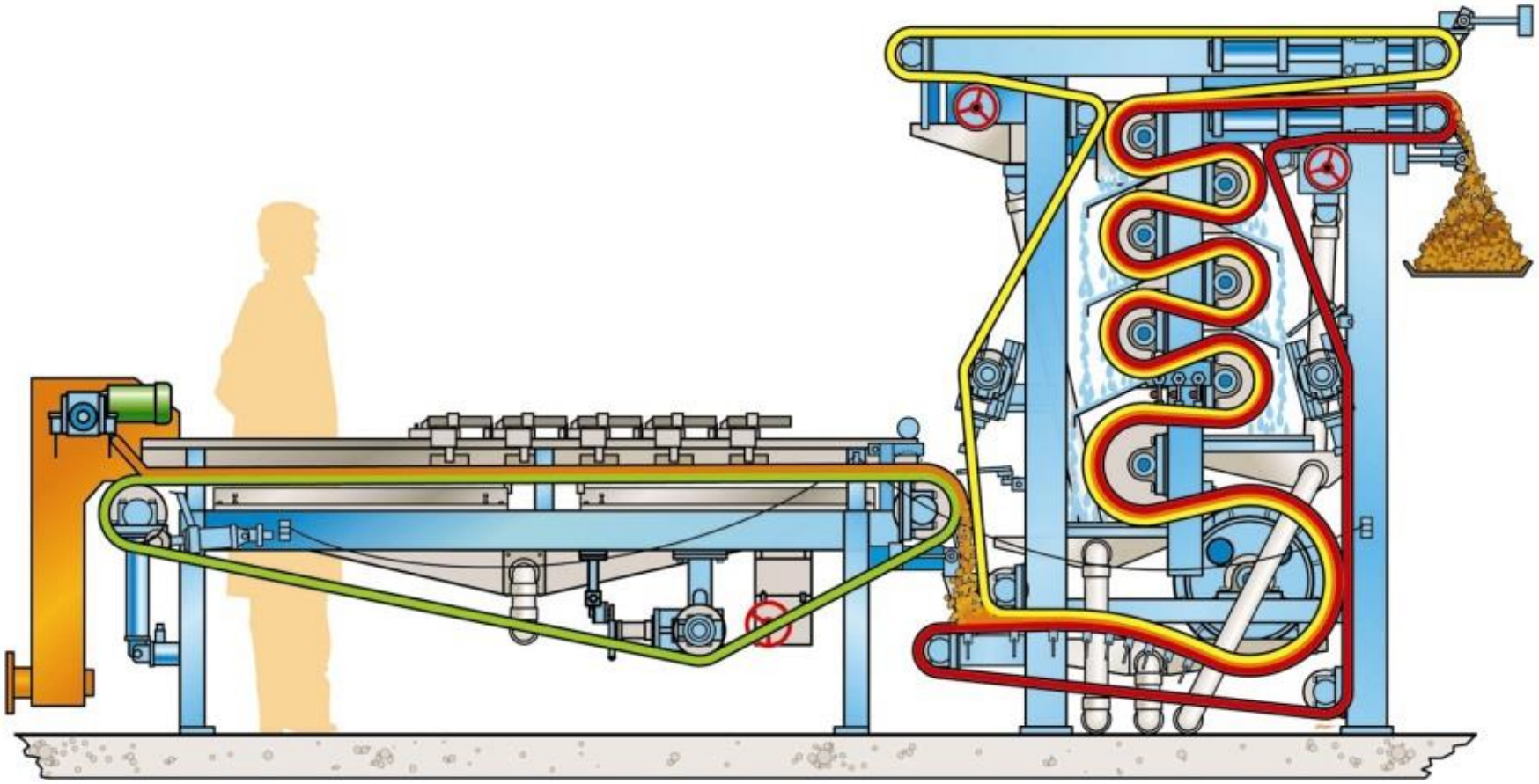
Result: 5 – 10 gpm to the Screw

# Belt Press Schematic

## Conventional 2-Belt Design

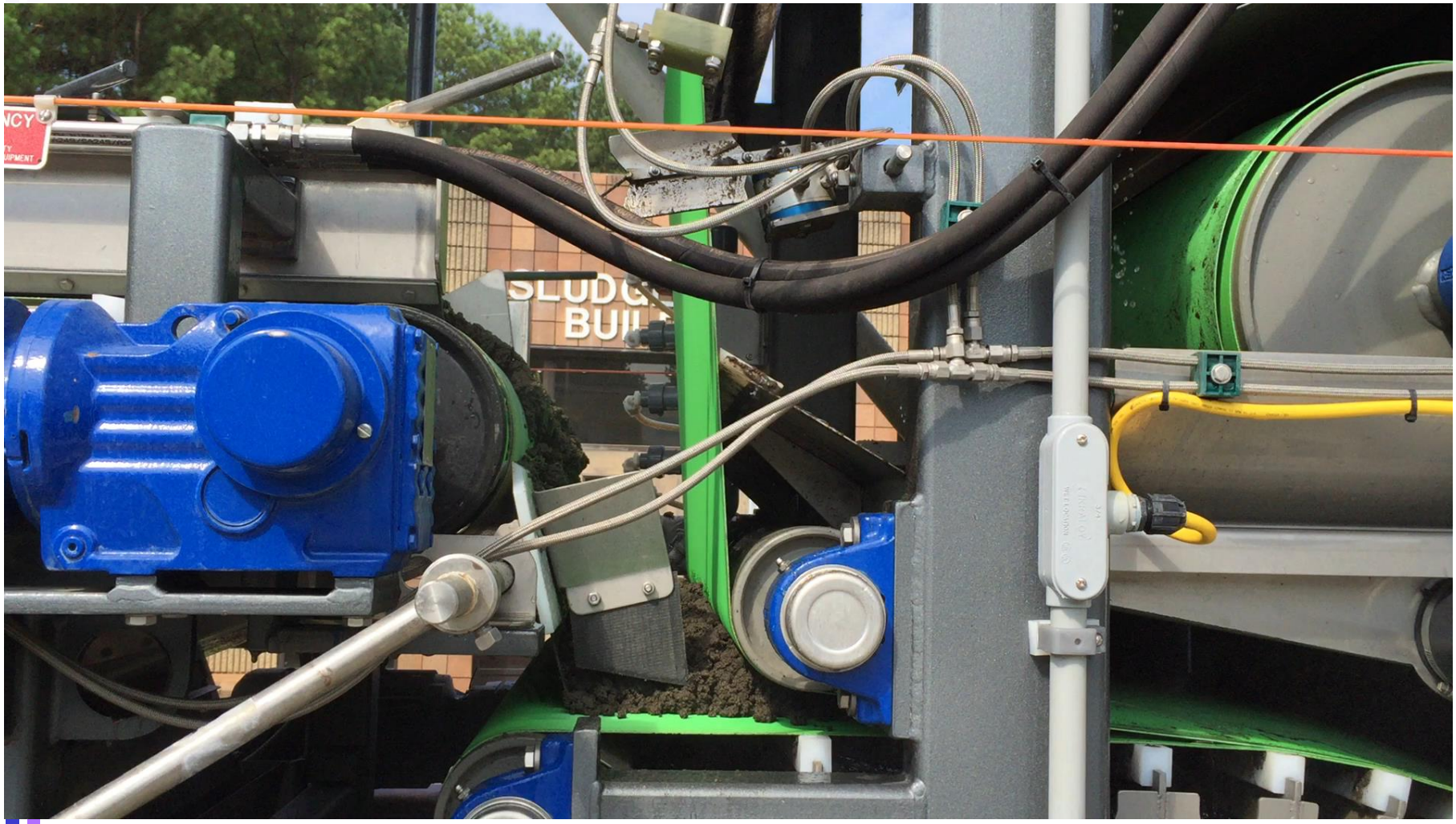


# 3-Belt Design



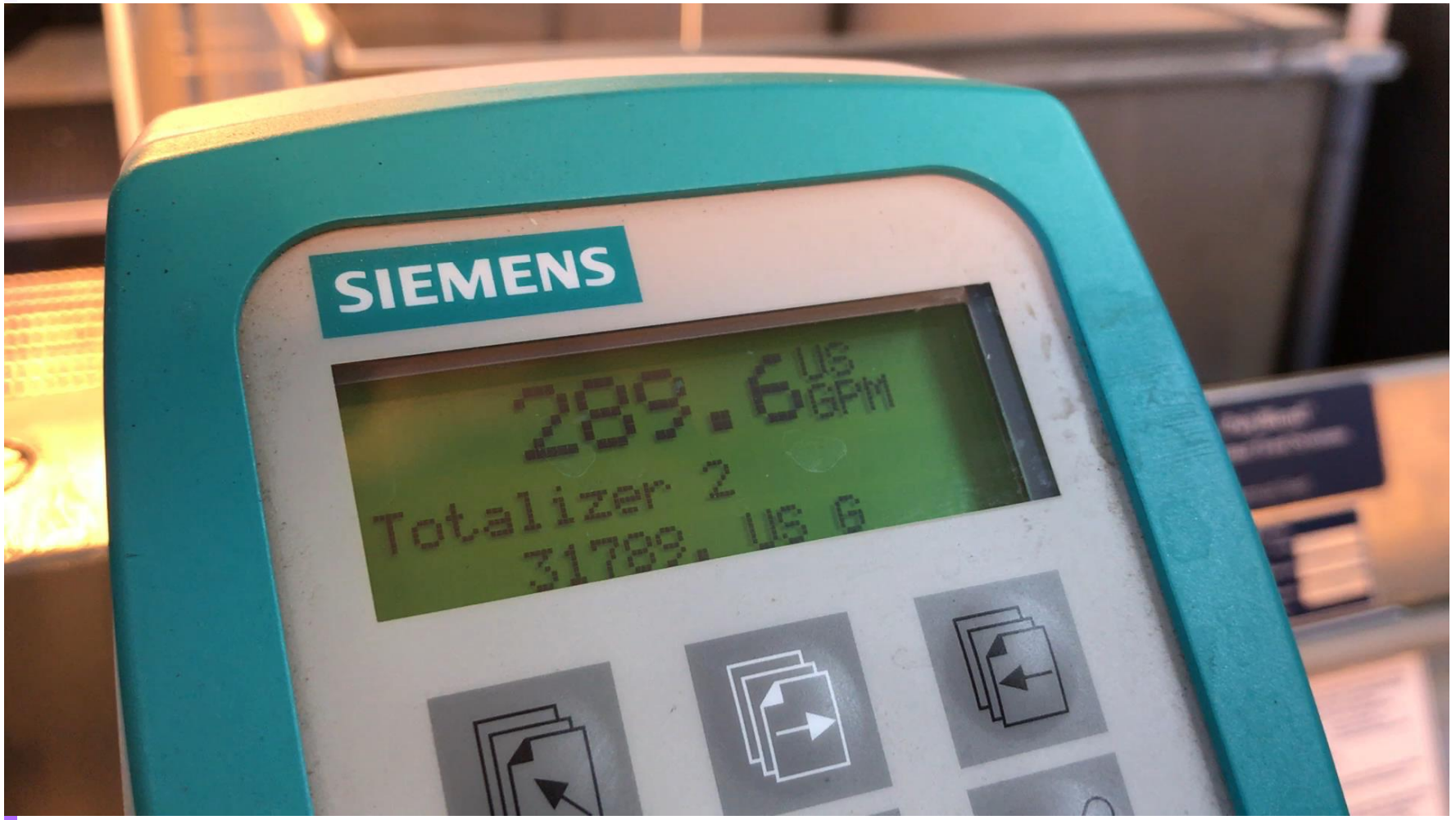
# Independent Gravity Zone - 150 gpm/meter

# Transition and Curved Wedge

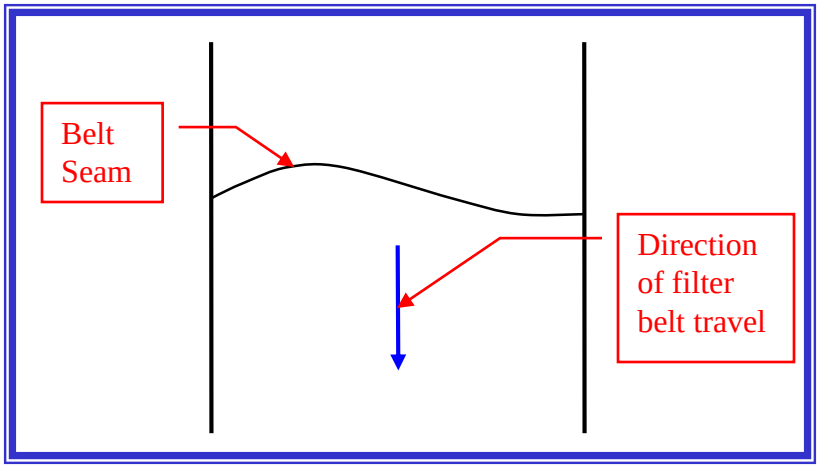


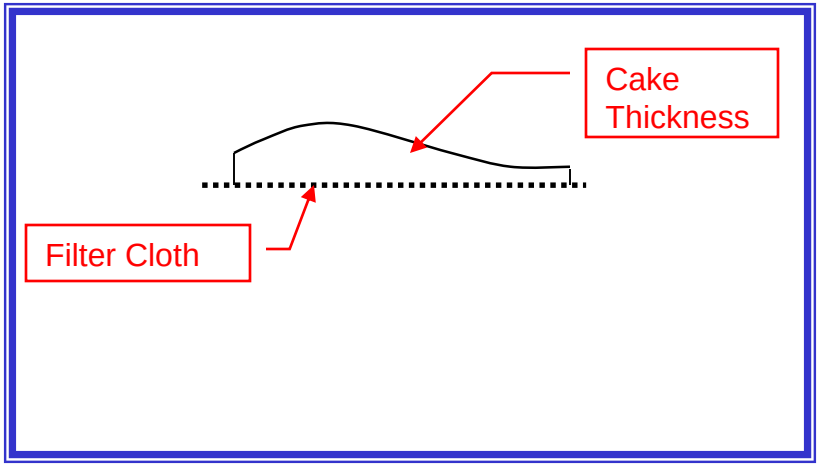
# 287 gpm 1.7% - 2,400 lb/hr

# 290 gpm 1% aerobic – 1,400 lb/hr

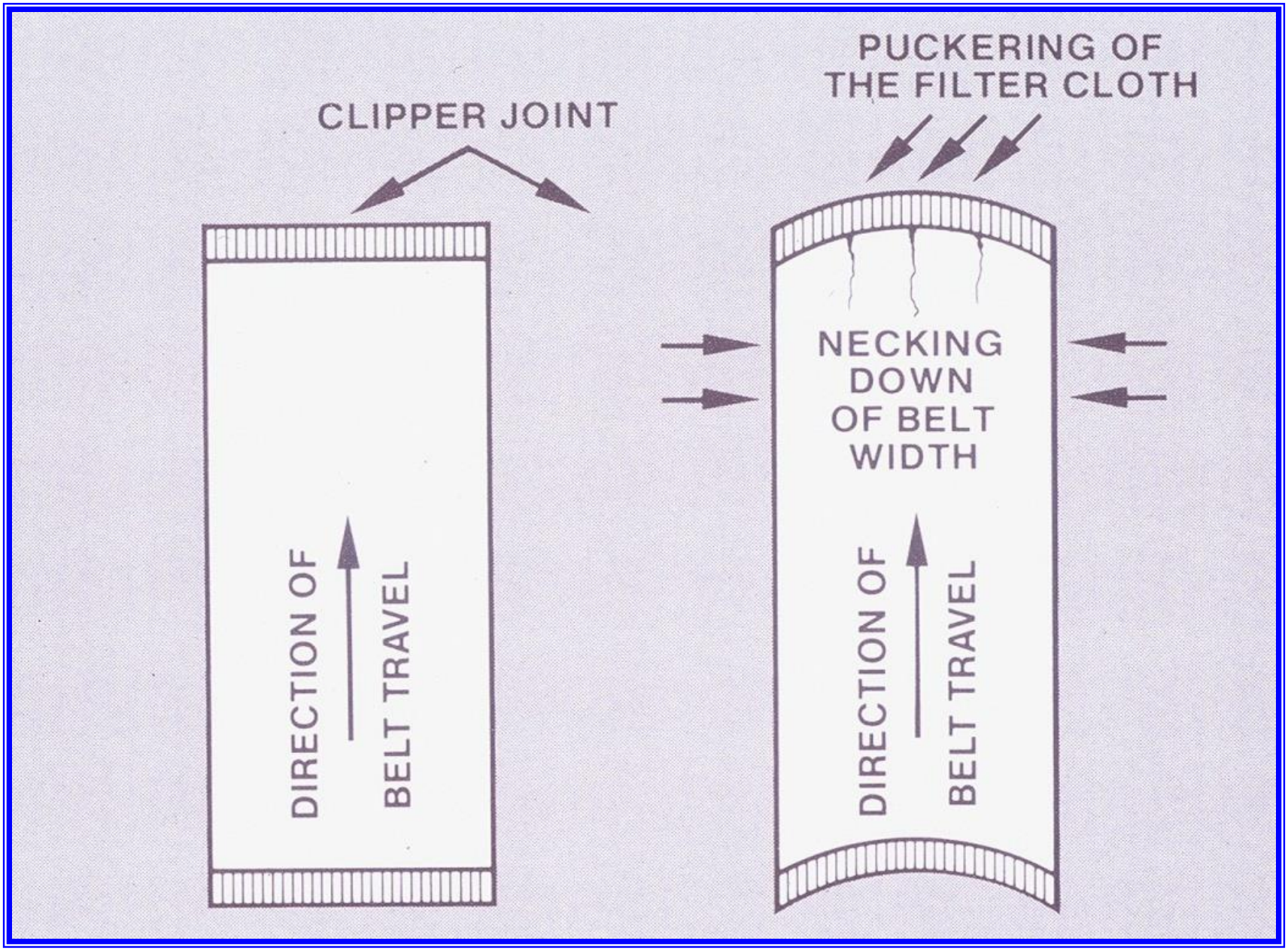


# FEED DISTRIBUTION

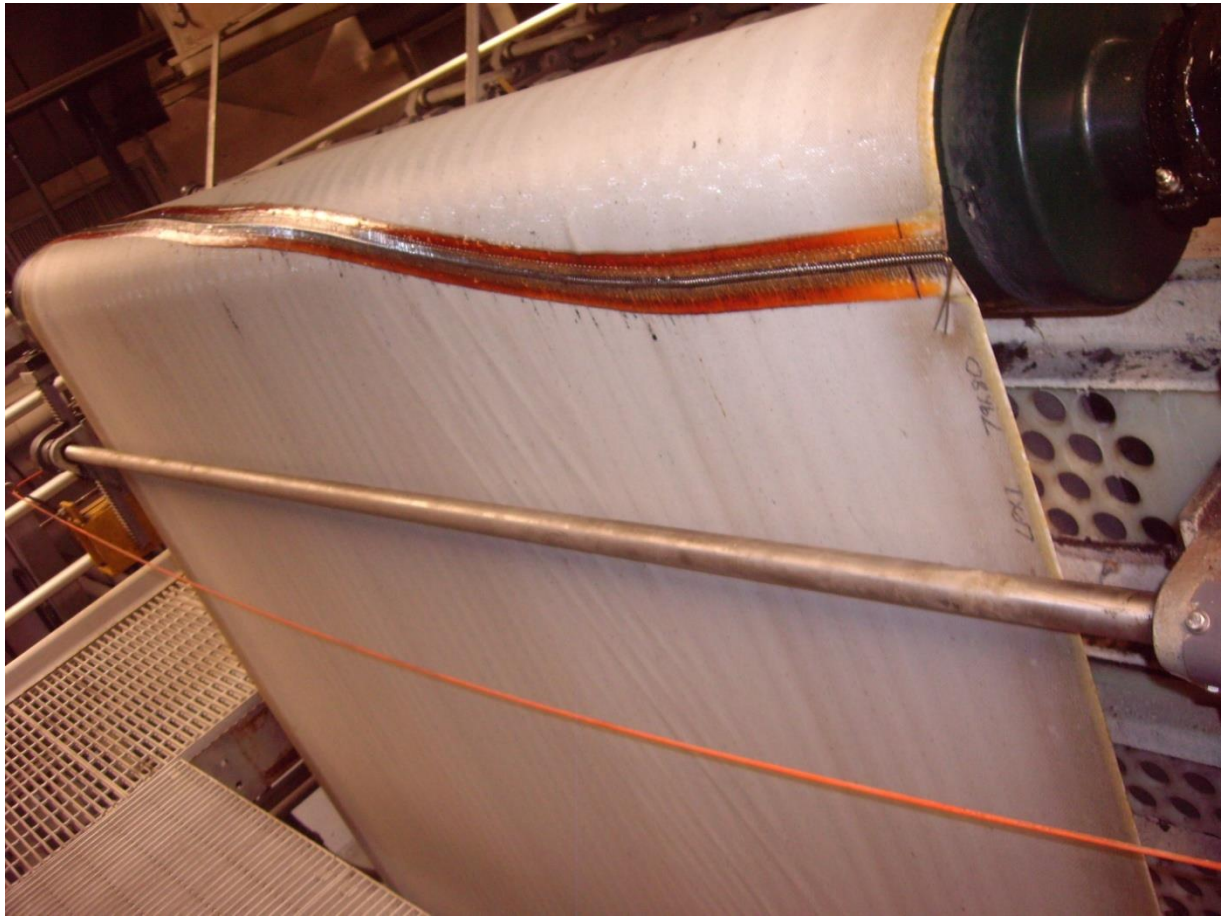


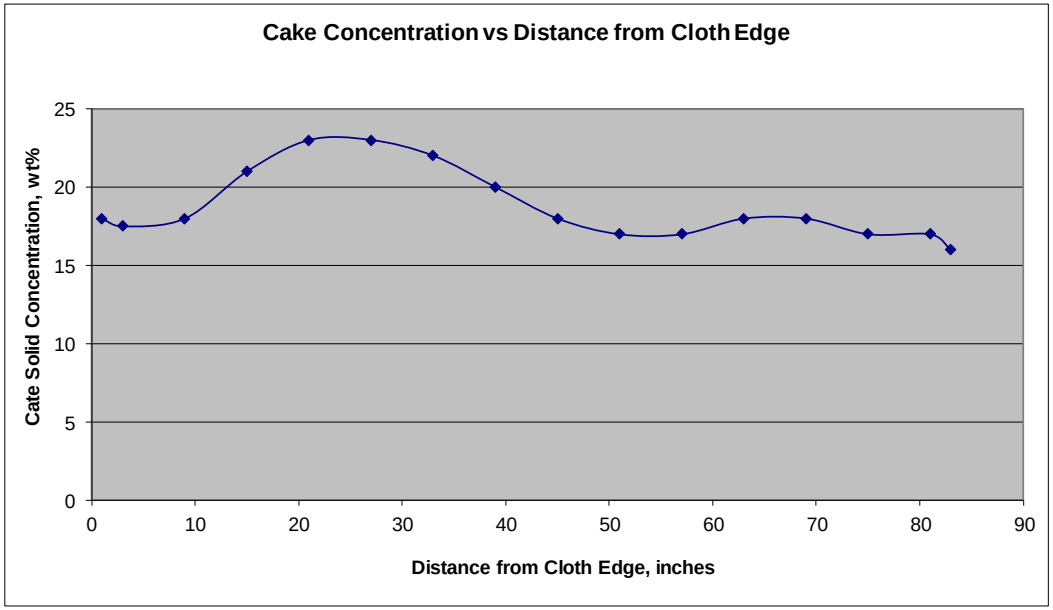

- **Uneven distribution causes:**
  - **Premature clipper wire failure**
  - **Accelerated wear on roll coating**
  - **Cake solids concentration is lowered**
  - **Belt misalignment**


CLIPPER JOINT
DIRECTION OF
BELT TRAVEL
PUCKERING OF
THE FILTER CLOTH
NECKING
DOWN
OF BELT
WIDTH
DIRECTION OF
BELT TRAVEL

# Uneven Distribution



# Distribution / Cake Solids




- **Uneven distribution "average" cake solids concentration: 18.7wt%**
- **Even distribution "average cake solids concentration: 22.0wt%**
  - **A gain of over 3 percentage points.**

# Sand Dewatering

# 3 meter - Distribution

# Other Recent Industry Shifts

- Enclosures and Odor Control
  - Totally enclosed vs. Partially enclosed
  - 6% solids and greater
- Reduced Washwater Usage
  - Washwater recycle
  - Reduces water demand
  - Also reduces filtrate as side-stream

# Enclosed GBT

# Enclosed Gravity Section

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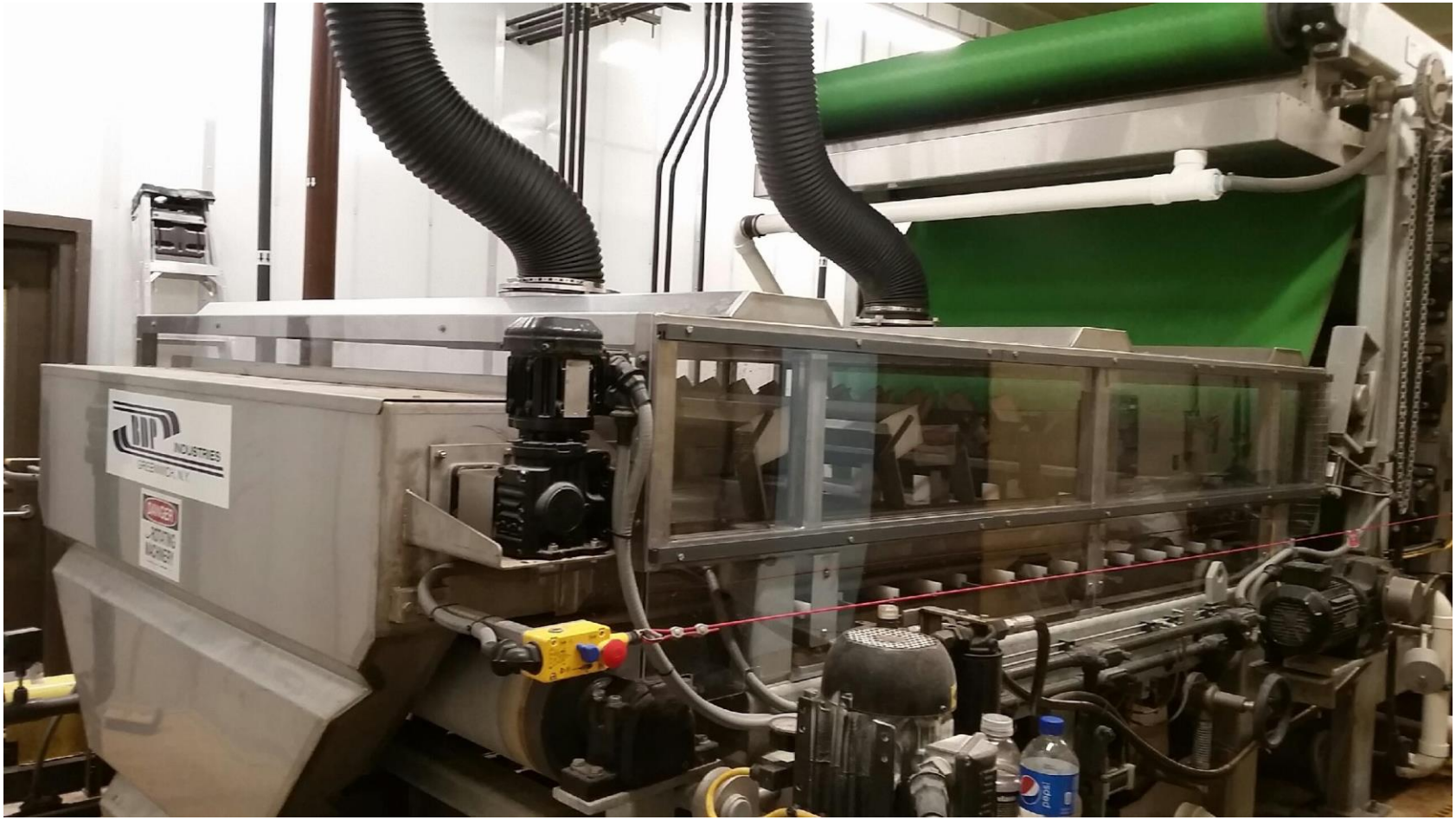


# Shift the Spotlight: Solids Capture
## "Won't Catch Me Running Dirty…"

- Optimization Parameters
- Focus on Solids Capture
- Why Does it Matter?
- A Brief Introduction to Dewatering Devices
- Ways to Improve Solids Capture
- Specifics for Existing & New Design
  - Belt Filter Press
  - Screw Press

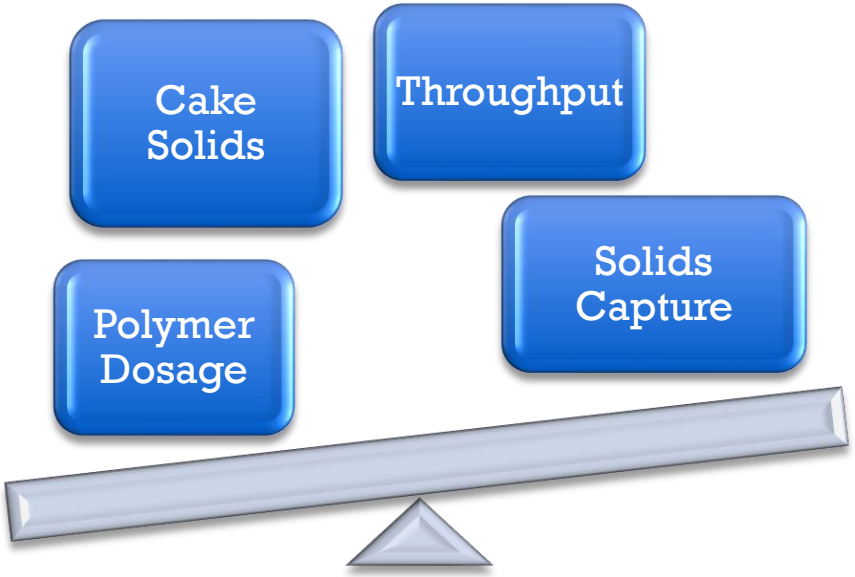
# Optimization Parameters

- Hydraulic Loading – gpm
- Solids Loading or Throughput – lb/hr
- Chemical Dosage – lb / dry ton
- Discharge Cake Solids – %wt
- Solids Capture – %

# Optimization Parameters

Balancing

Act



# Focus on Solids Capture

- Most overlooked parameter
- Run clean first, then improve other parameters
- Often leads to improvement in other parameters
- Avoid Running Dirty!
  - Lowest overall TSS for filtrate / centrate
  - Less returned to head of the plant

# Why Does it Matter?

- Poor Performance can be 80%, or as low as 60% Solids Capture
- Filtrate often returned to head of plant
- Significant load
  - Ratio to wwtp size
  - Expensive
- Running "dirty" – problems for press

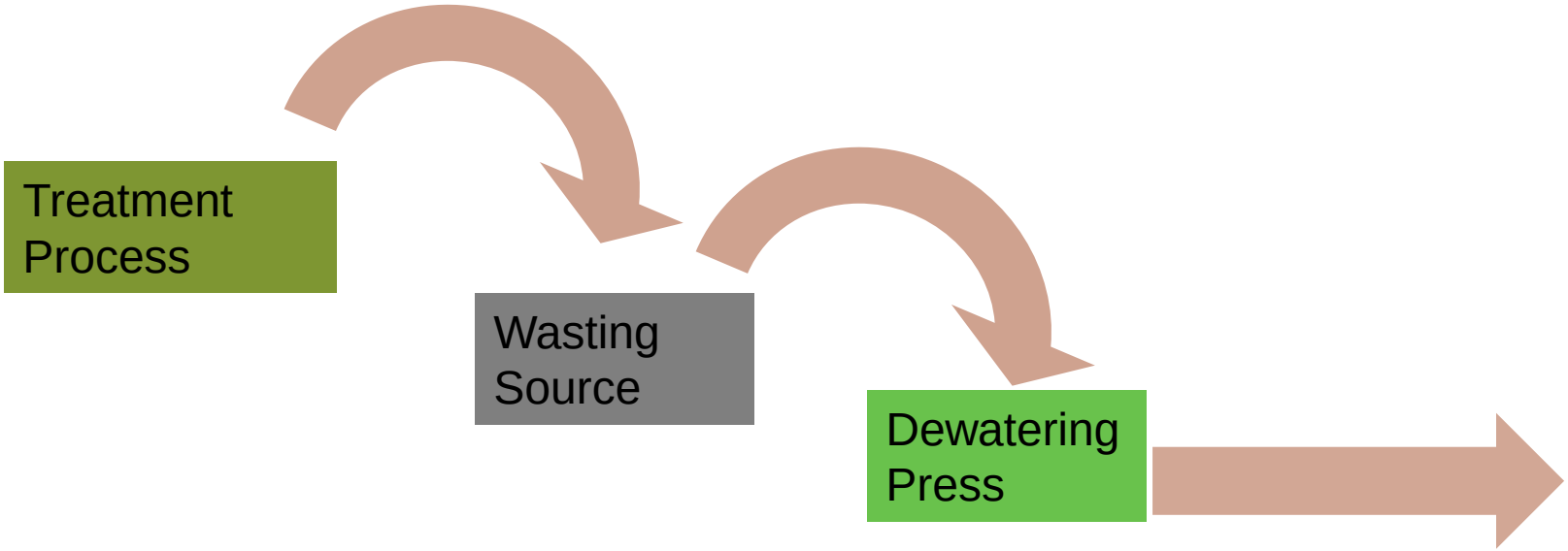
# I Want Numbers

| **Plant Information** | **VALUE** | **VALUE** | **VALUE** | **UNITS** |
|---|---|---|---|---|
| Average Plant Flow | 1 | 3 | 10 | MGD |
| Yearly Sludge | 150 | 450 | 1500 | Dry Tons per Year |
| Solids Throughput - Yearly | 300000 | 900000 | 3000000 | Dry Pounds per Year |
| Solids Throughput - Weekly | 5769 | 17308 | 57692 | Dry Pounds per Week |
| | | | | |
| **Solids Capture** | **VALUE** | **VALUE** | **VALUE** | **UNITS** |
| Recycled at 60% capture | 120,000 | 360,000 | 1,200,000 | lbs returned to head of plant (yr) |
| Recycled at 80% capture | 60,000 | 180,000 | 600,000 | lbs returned to head of plant (yr) |
| Recycled at 98% capture | 6,000 | 18,000 | 60,000 | lbs returned to head of plant (yr) |

# Numbers Aren't My Thing

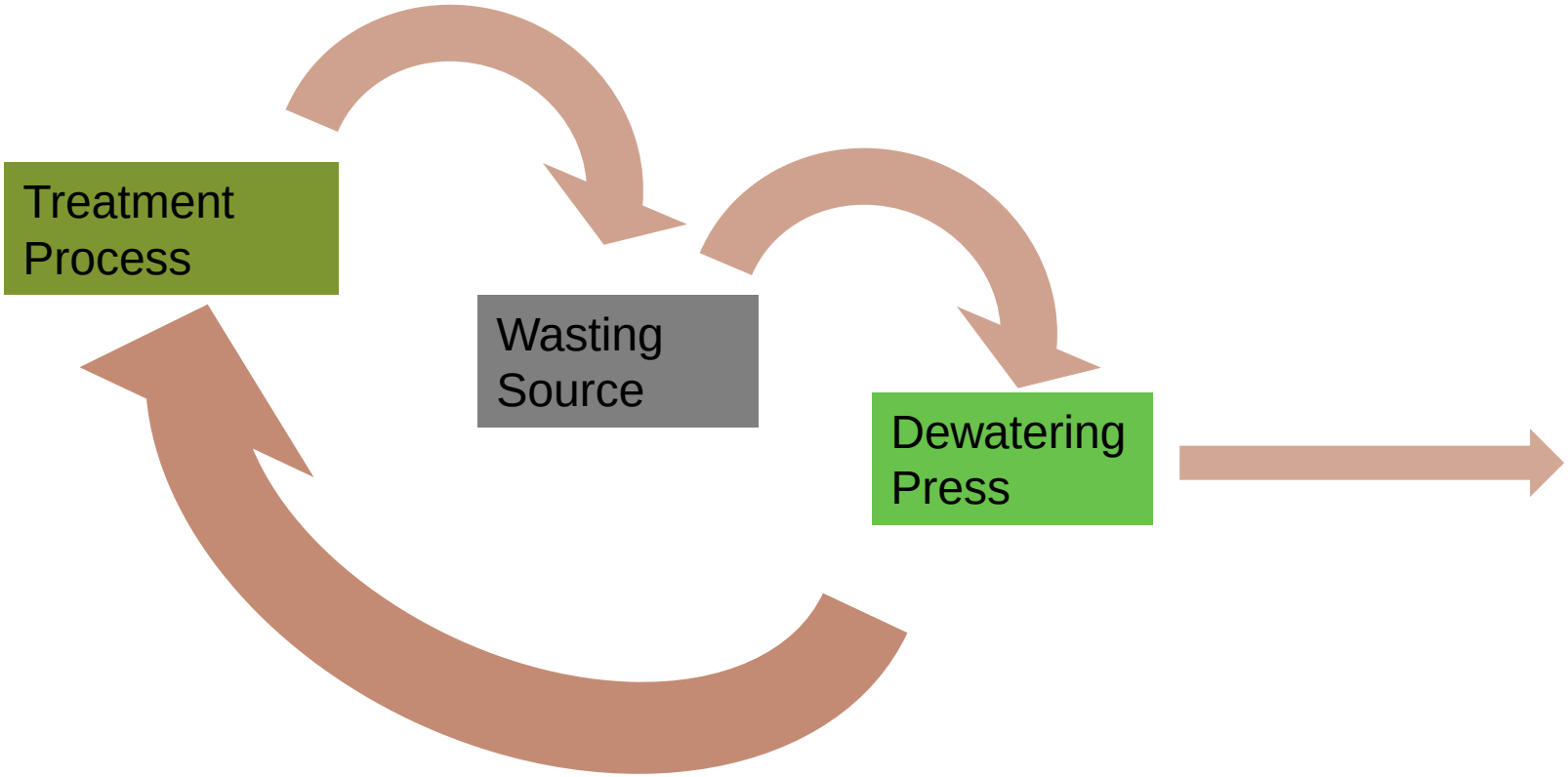
- Car Wash
- Mop The Floor
  - Imagine half of the grime decides to stay
  - Accumulation
- Toughest stuff to capture - fines

# Trace The Solids Path



# Low Solids Capture

## Hey, That's a Loop



# Why Does it Matter, Again?

- Recycled Solids hit plant multiple times
- Pumps, pipes, valves
- Treatment energy
  - Take up space in treatment zone
  - SRT reduced in tanks & digesters
- Alter the biology
- Nutrients – phosphorus (side stream)
- Carry residual polymer charge back to system
- Overall plant capacity

# Low Solids Capture

# Poor Solids Capture

# Poor Capture – Belt Press

# Poor Capture – Screw Press

# Catch Me Running Dirty

- Increased wear on flights and brushes
- Increased wear on basket or moving rings
- More frequent cleaning

# Catch Me Running Dirty

- Belt Looping
- Belt Wrinkles and Stretching
- Increased Maintenance
  - Slide Strips
  - Rollers
  - Belts
- More Frequent Cleaning

# Good Solids Capture

- Visual examples
  - Belt Press
  - Screw Press

# Running Clean – Aerobic Version

# Running Clean – Aerobic Version

# Running Clean – Aerobic Version

# Running Clean – Screw Press

# Running Clean – Anaerobic Style

# Running Clean – Anaerobic Style

# Running Clean – Anaerobic Style

# Running Clean – WTP PACl

# Ways to Improve

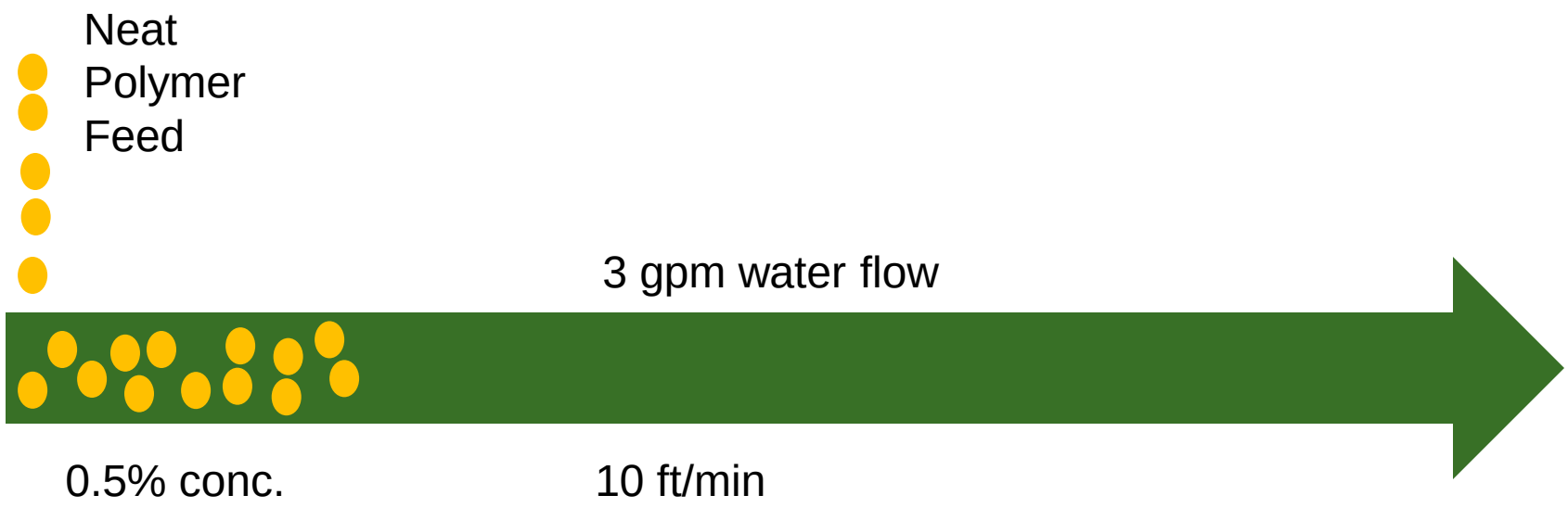
- Polymer
  - Newer polymers.  Cross-linked, highly structured
  - Proper activation & dilution
- Consistency to the Press
- Remove Variables Whenever Possible
- Take it Step by Step
- New Dewatering Equipment
  - Technology Comparisons
  - Specific Technology Notes

# Emulsion Polymer Unit

- Check Inlet Water Pressure
  - Minimum level required
- Check Mixing in Chamber
- Check Concentration
- Flooded Suction
- Length of Neat Polymer Line
- Pressure Relief Valve
- Volume of Solution Line

# Fluctuating Water Pressure

- Worse than we thought



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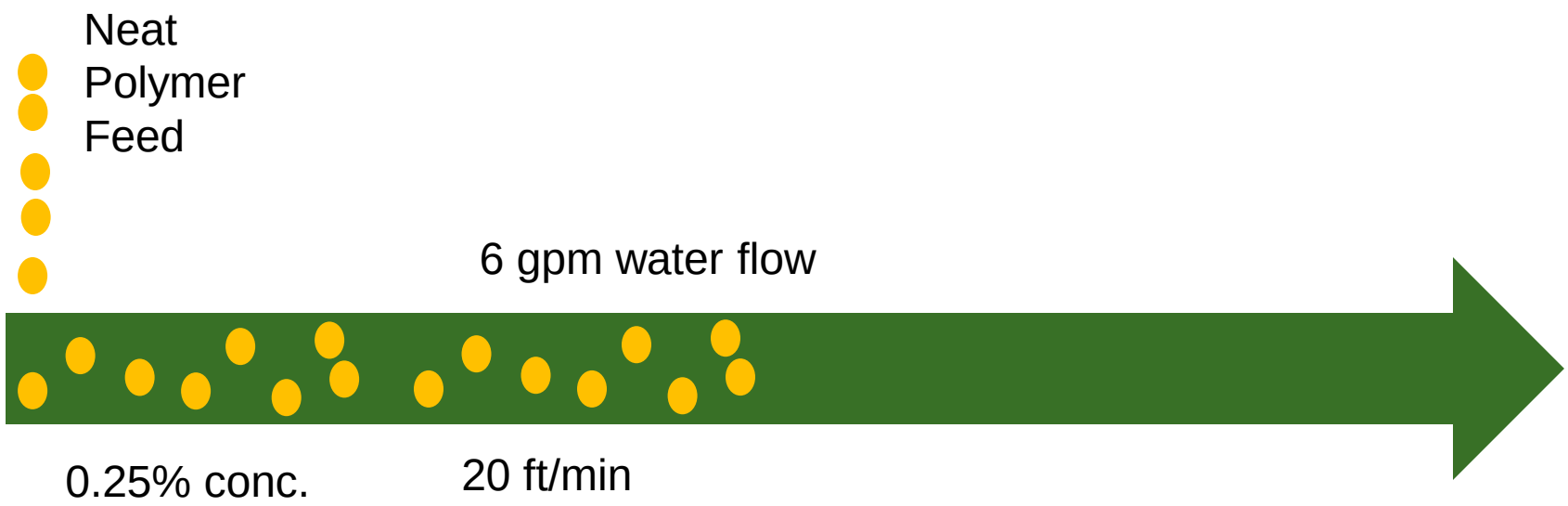

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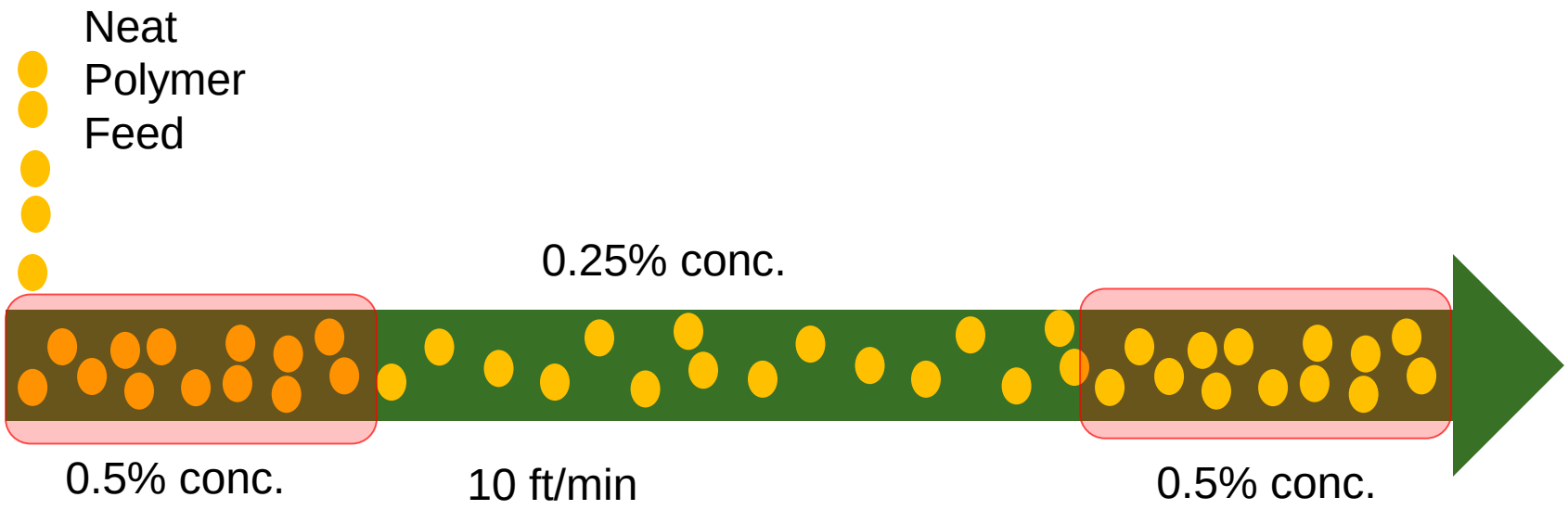


# Polymer Age Time

- Direct Feed from Polymer Blending Unit (PBU)
  - Rely on Performance of the PBU
  - Length and diameter of Solution Line
    - More Volume = More Polymer Activation
    - But… Also leads to Delayed Response and Risk of Fluctuations
- Polymer Age Tanks
  - Increase Polymer Activity ⟹ Lower Polymer Dose
  - Buffer ⟹ Consistent Concentration in Solution Line
  - Require Additional Equipment
    - Level Sensors, Mixers
    - Polymer Solution Pumps

# Polymer Solution Tanks

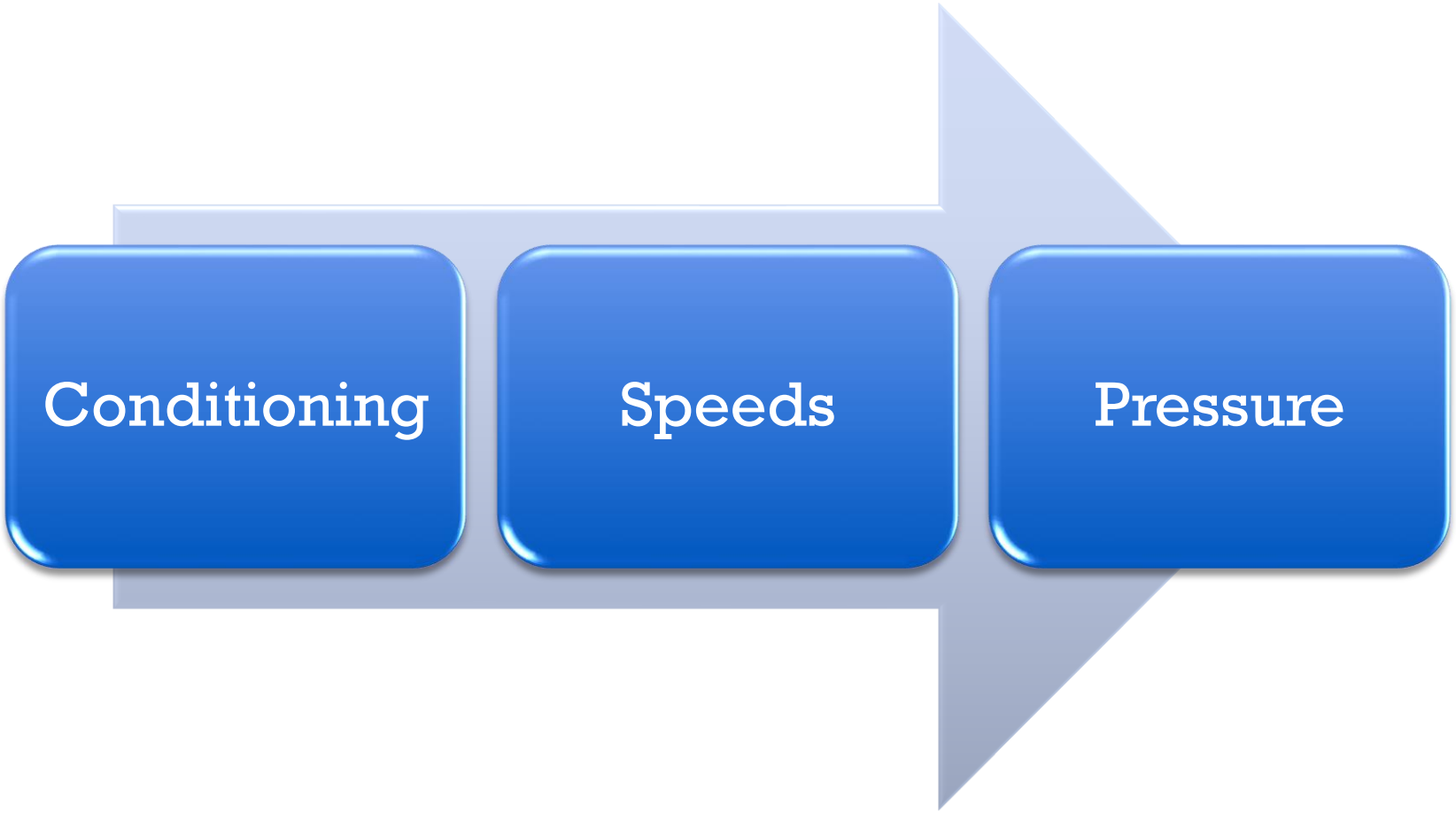
# Consistency to the Press

- Consistent Polymer Flow
  - Volume of Flow (gpm)
  - Concentration (%)
- Consistent Sludge Flow
  - Volume of Flow (gpm)
  - Consistent Make-Up
    - Percent Solids
    - Blend Ratio and/or Type of Sludge

# Remove Variables

- Consistency is Key
  - Blend Tank
  - Meter in outside sources (Septage, WTP residuals)
  - Mix settled sludges
- Easier to Find the Right Chemistry
  - A single polymer program is best
  - However, somewhat common for summer/winter polymer program

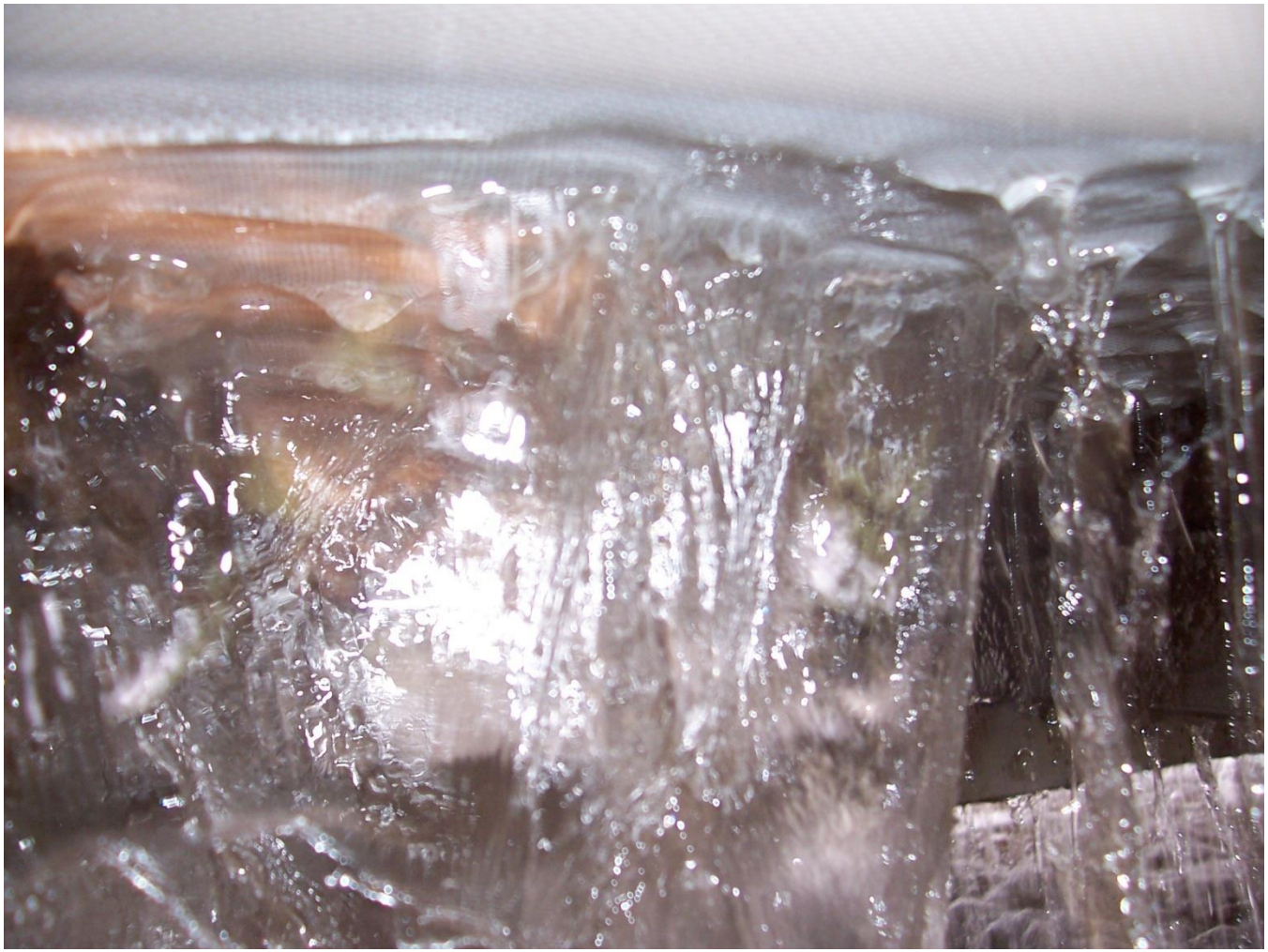
# Step by Step



# Conditioning

# Strong Floc with Clear Separation

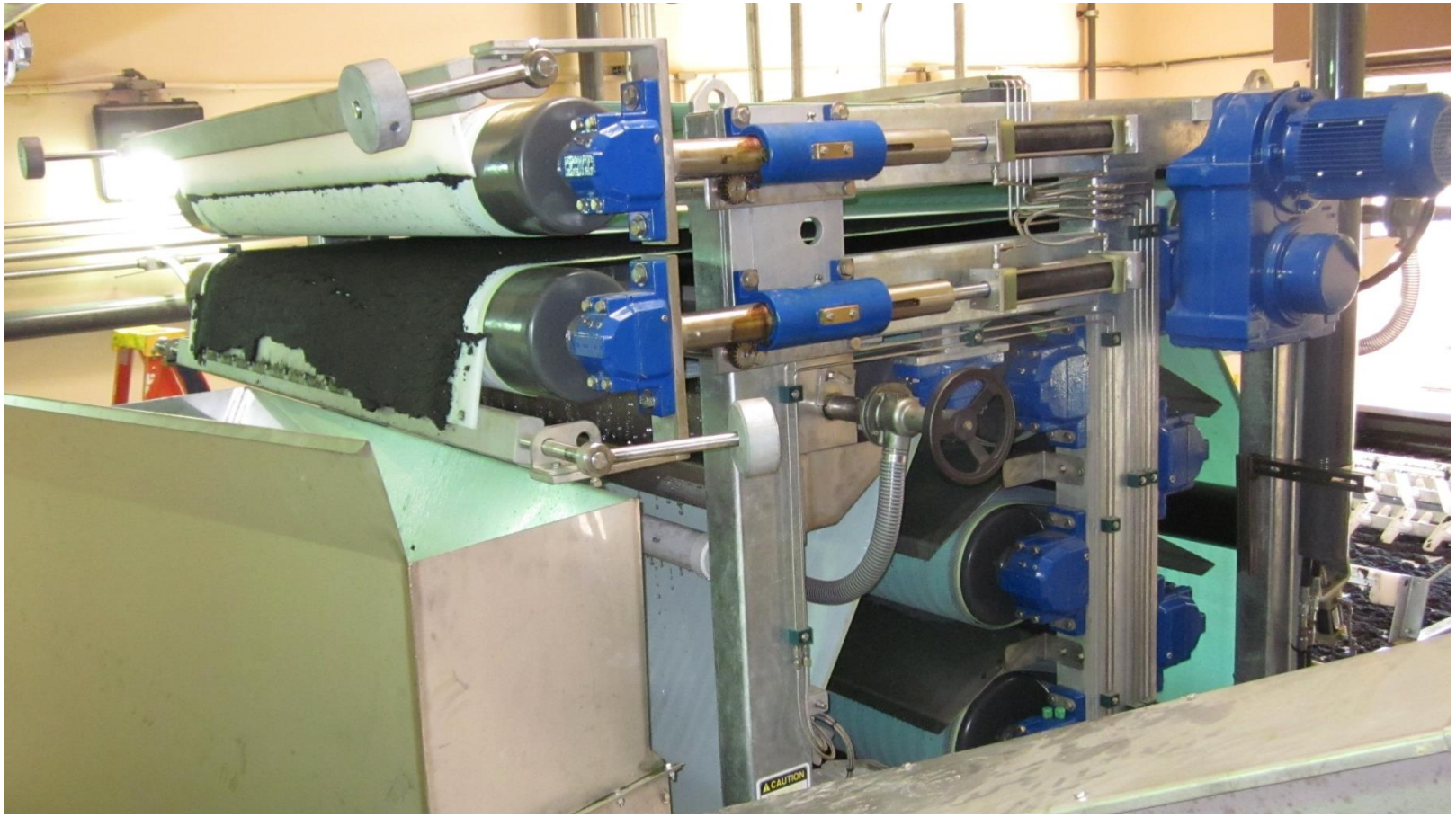
# Clean Initial Filtrate



# Pressure Section Speed

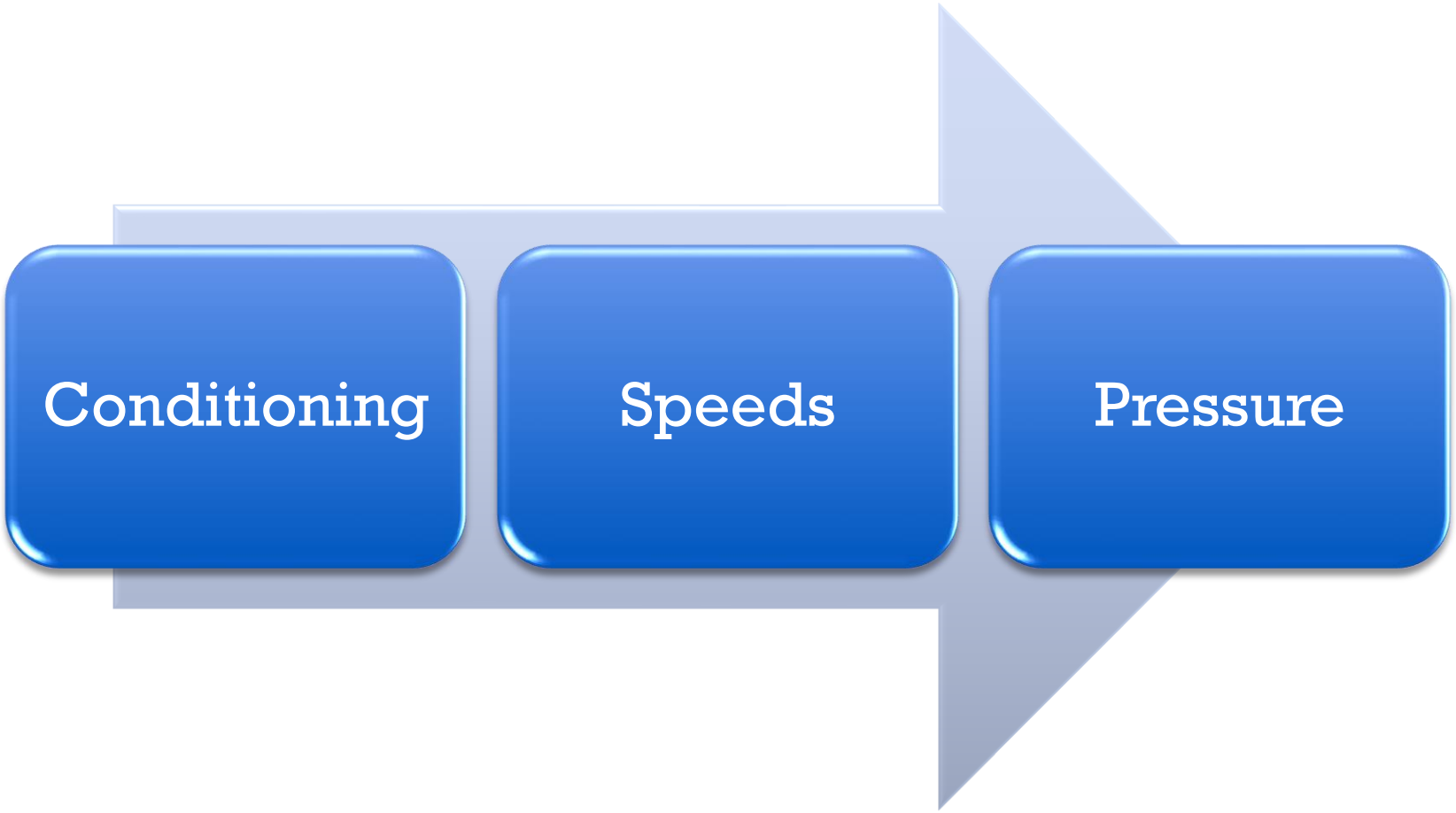
- Belt Press
  - Slow belts until cake is roughly 3/8” to 5/8”
  - Time under pressure is important
- Screw Press
  - Monitor inlet pressure

# Belt Tensions

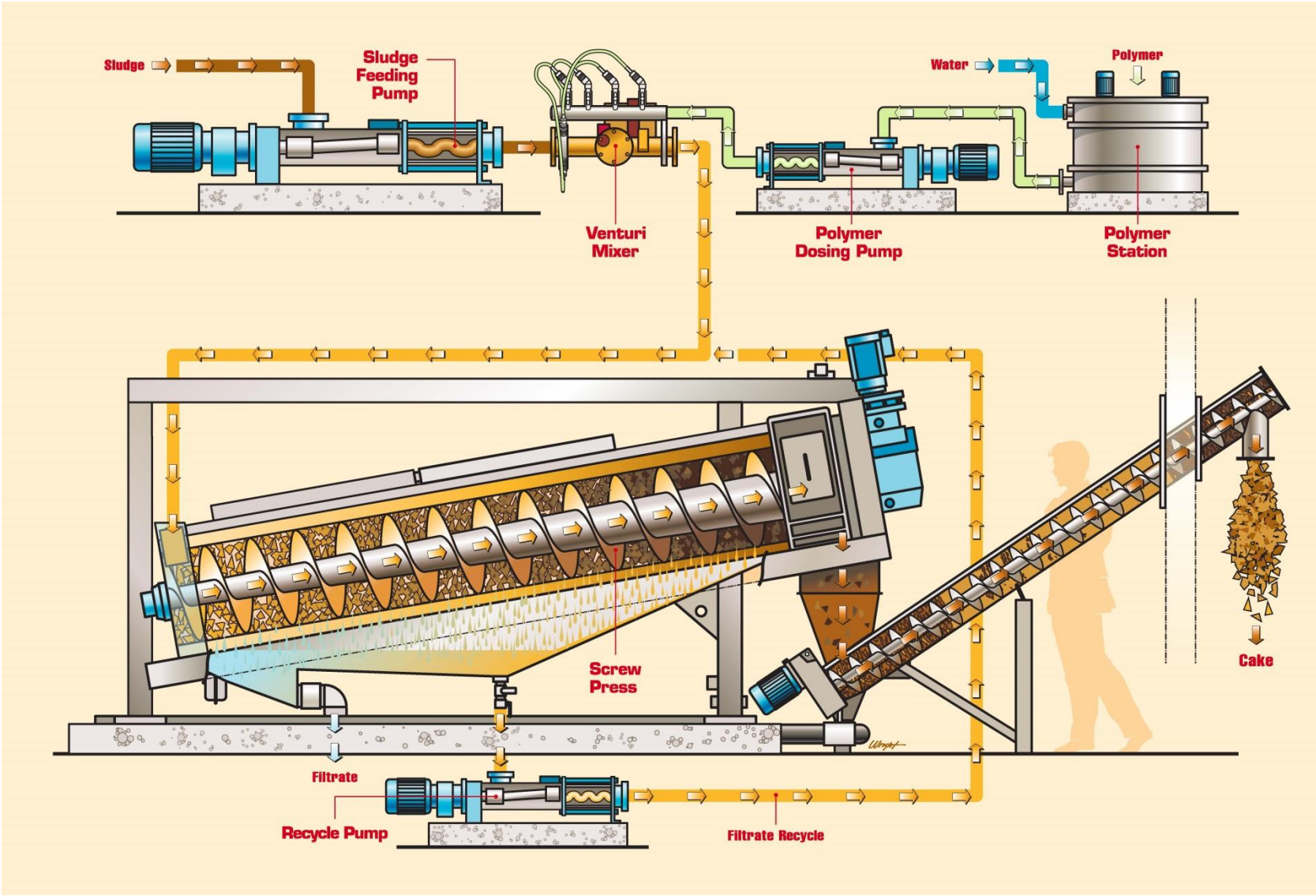


# Step by Step

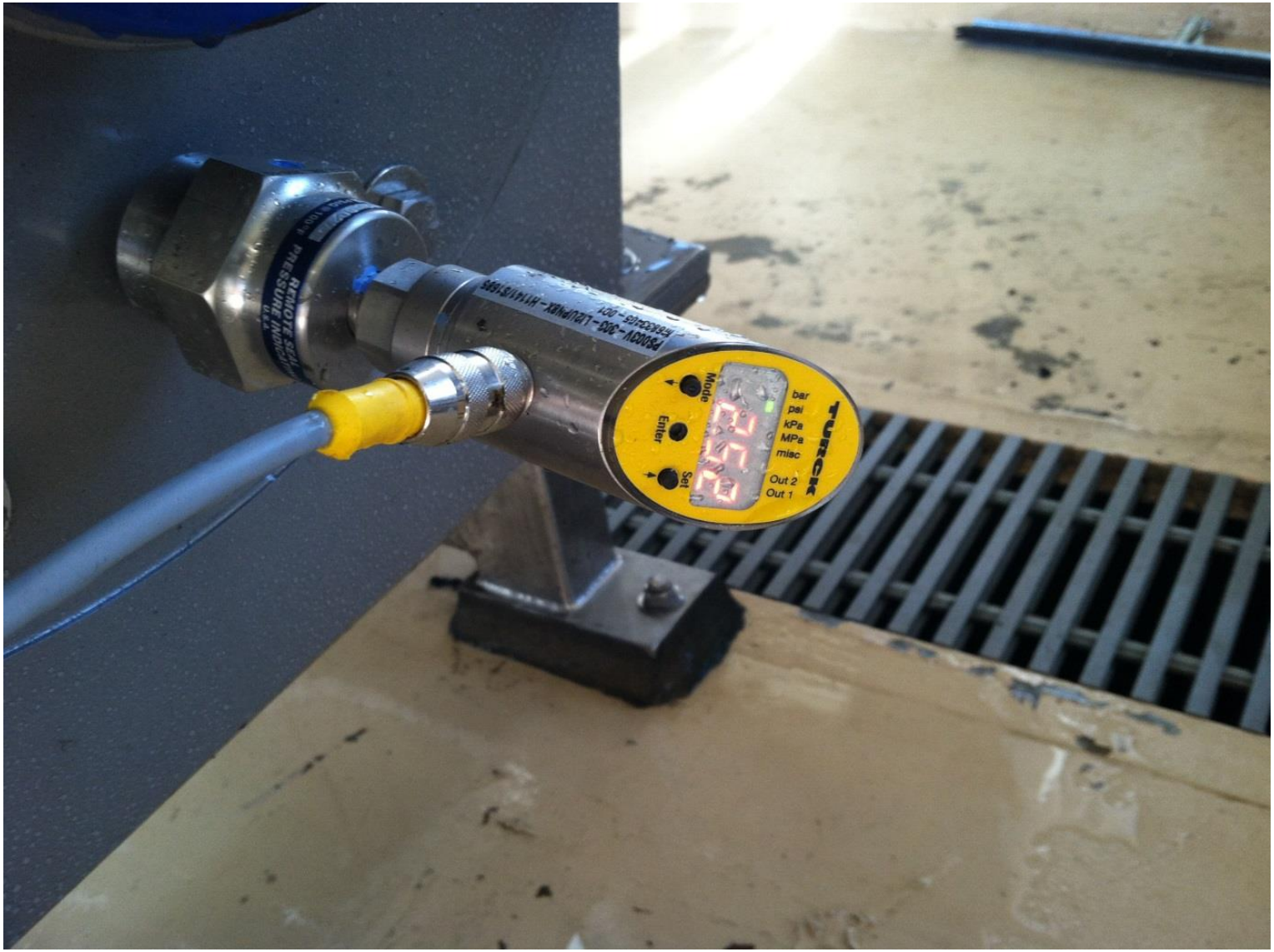
## Same for Screw Press / Rotary Press



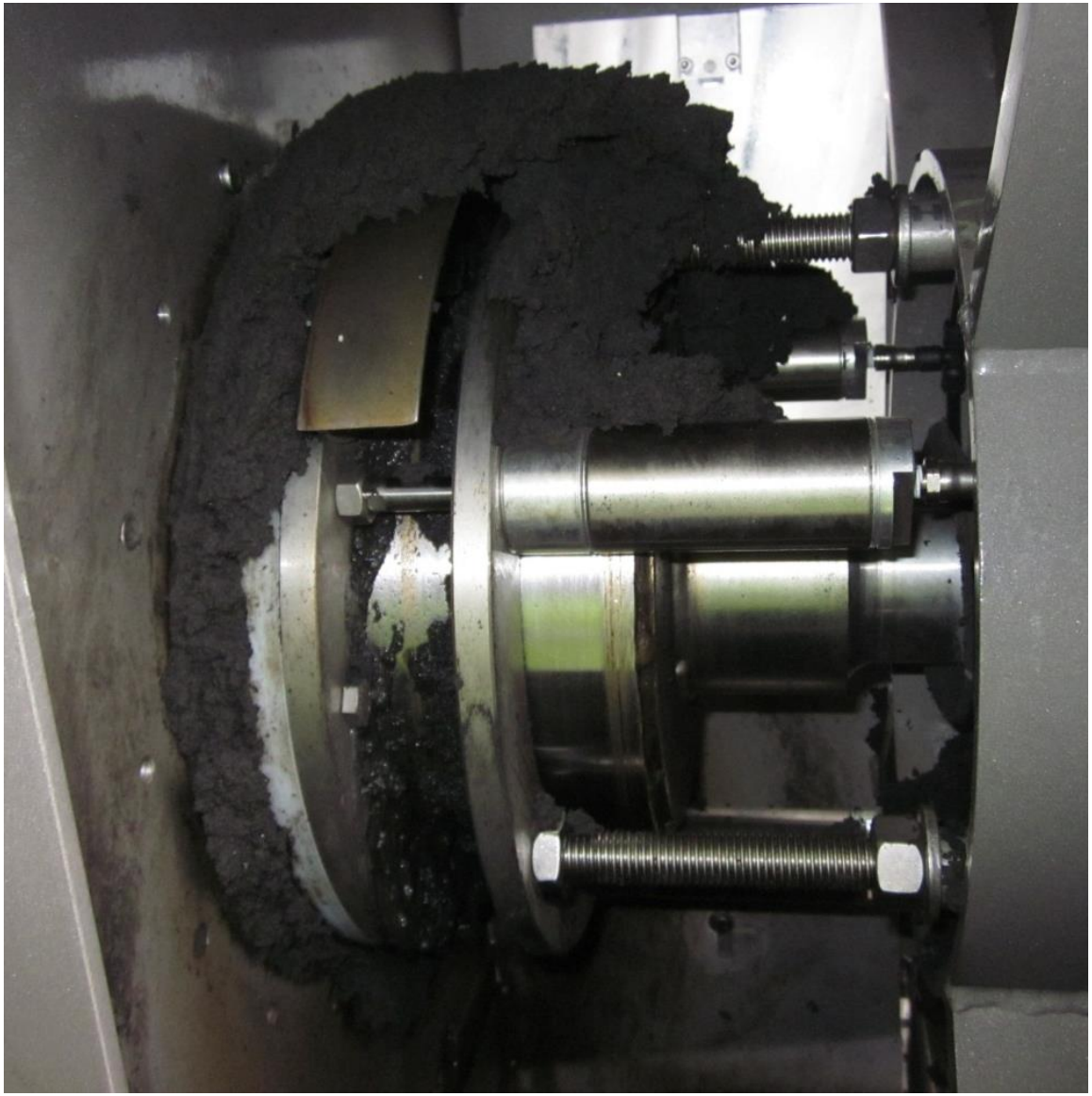
# Screw Press


Sludge
Sludge Feeding Pump
Venturi Mixer
Water
Polymer
Polymer Dosing Pump
Polymer Station
Screw Press
Cake
Filtrate
Recycle Pump
Filtrate Recycle

# Increased Automation



# Discharge Cone



# New Dewatering Equipment
## Design Considerations for Solids Capture

- Belt Press
  - Distribution
  - Pressure Profile – Curved Wedge & Roll Diameter
  - Belt Tracking – Continuously Centered
- Screw Press / Rotary Press
  - Inlet pressure monitoring
  - Screen design
  - Filtrate recycle
  - Automatic Cone Pressure
- Centrifuge
  - Torque monitoring
  - Pond depth adjustments
  - Inlet location
  - Specific to the application

# Thank You

questions?

# Residuals – At Work and at Home