Strategies for Organic Source and Load Reduction in Industrial Effluent

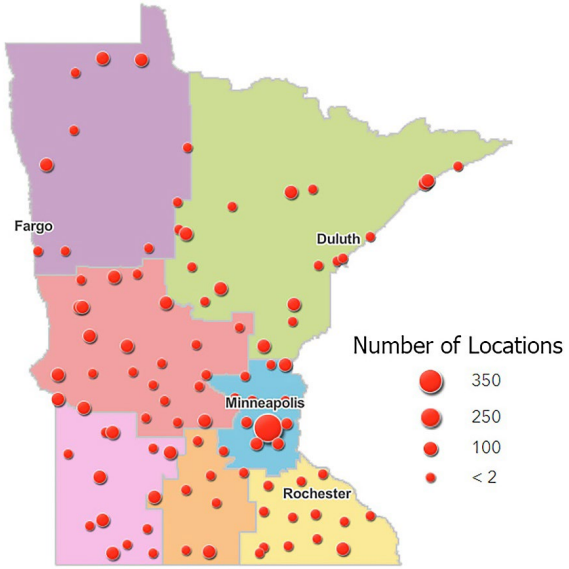
Kevin Philpy
Senior Engineer
Minnesota Technical Assistance Program

Pollution Prevention (P2)

- **Waste:**
  - no longer useful byproducts of industrial processes
- **Pollution:**
  - waste or harmful substance that is returned to the environment
- **P2 = Eliminating the source, generation, or release of toxic pollutants, hazardous substances, hazardous wastes, or industrial wastes**
  - Source reduction = pollution prevention

Minnesota Technical Assistance Program

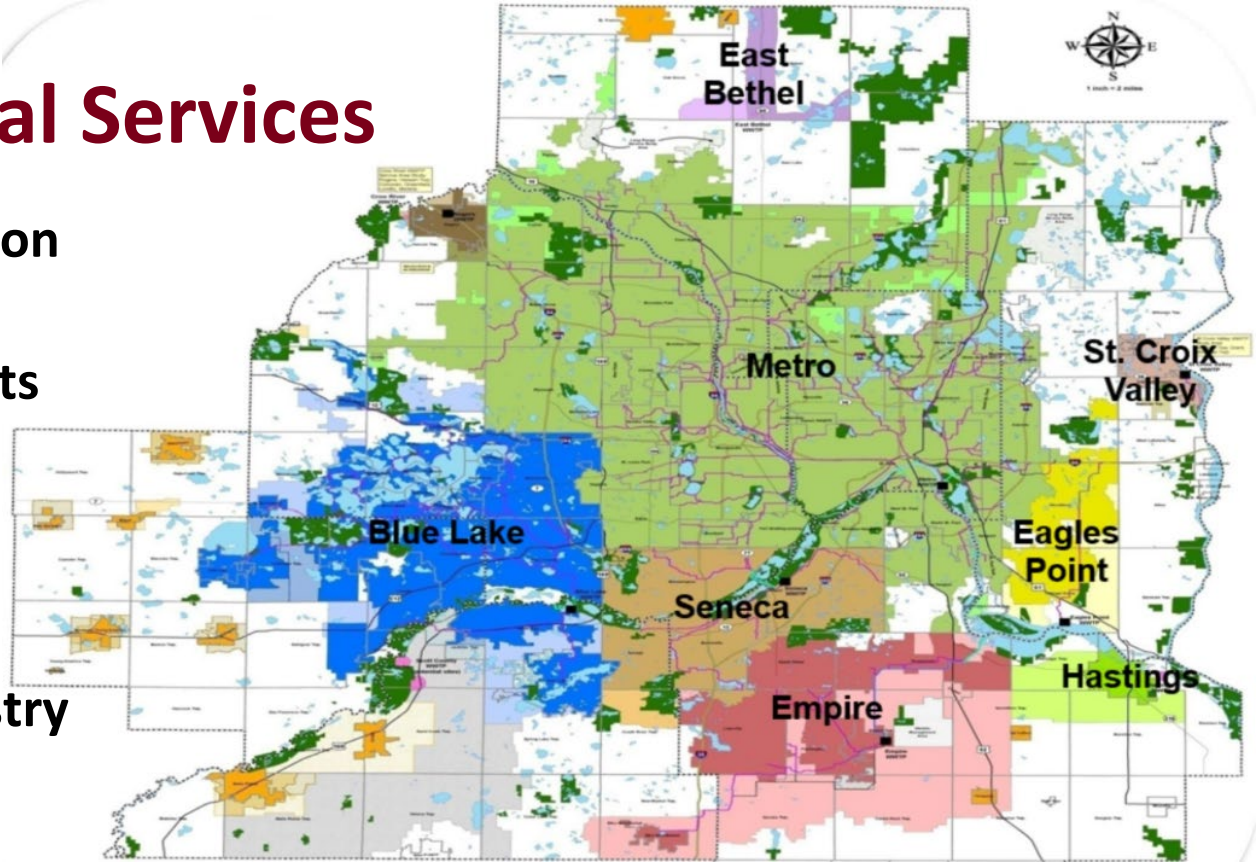
- **Confidential, grant-funded environmental support for MN businesses**
  - Prevent pollution at the source
  - Optimize resource consumption
  - Reduce waste and energy use
- **12 engineers and professionals**
- **Based in School of Public Health at University of Minnesota**



Supported Facilities 2017-2021

Met Council Environmental Services

- Seven-county region around MSP
- >2 million residents
- 250 MGD



- What drives industry WW compliance?

Prohibited Wastes

2. Prohibited Waste Discharges

Prohibited wastes are specific in Waste Discharge Rule 406 and include, but are not limited to the following: (a) Flammable, explosive and corrosive wastes, gasoline, fuel oil, lubricating oil, hydraulic oil, motor oil, or grease; (b) Wastes that are likely to obstruct the flow within public sewers: grease, fat or oil of animal or vegetable origin, solid wastes, garbage, guts, bones, ash, sand, rags, lime, metal, wood, plastic, glass, or yard wastes; (c) Wastes that are likely to cause interference, pass-through, or operational problems: slug discharges, toxic chemicals, poisons, dyes, or inks; (d) Wastes that are likely to cause a public nuisance: noxious, malodorous, or foam producing substances; (e) Hazardous wastes, as defined by Minnesota Statutes; and (f) Waste generated outside of the Metropolitan Area.

Spill Control Plans and Slug Discharges

Notification is hereby provided that MCES has designated the Permittee as a Significant Industrial User (SIU). This designation is based on EPA requirements and affects the frequency of MCES inspections and monitoring as well as the permit fees for the Permittee. All SIUs are required to maintain a current Spill Control Plan on file with MCES.

This Permittee shall take all reasonable precautions to minimize all accidental discharges including prohibited slugs, spills, and bypassess. Plans for the prevention and control of accidental discharges shall be submitted to the Industrial Waste & Pollution Prevention Section for approval within a specific period of time when required by MCES. **In the event of any significant accidental discharge, spill, or bypass, the Permittee shall IMMEDIATELY notify the Minnesota State Duty Officer at (651) 649-5451 and report the facility address, and other pertinent information.**

- **What is a slug?**
- **What can we do about them?**

Strength Charges

Formula	Strength Charge=[Vx(TSS-250)x(8.34)x(TSS Rate)+Vx(COD-500)x(8.34)x(COD Rate)]
Component	Definition
Strength Charge	= Strength Charge, in dollars
V	= Volume, in million gallons per reporting period
TSS	= Total Suspended Solids in mg/L (TSS>250) If TSS is less than 250 mg/L, use 250 mg/L
COD	= Chemical Oxygen Demand in mg/L (COD>500) If COD is less than 500 mg/L, use 500 mg/L
250	= TSS threshold value, in mg/L
500	= COD threshold value, in mg/L
8.34	= Conversion factor, converts mg/L and gallons to pounds
TSS Rate - 2025	= Via onsite connection: **$0.332/lb of excess TSS** = Via permitted waste hauler: **$0.413/lb of excess TSS**
COD Rate - 2025	= Via onsite connection: **$0.166/lb of excess COD** = Via permitted waste hauler: **$0.2065/lb of excess COD**

Source Reduction is the Goal!

- Divert or limit high-strength waste from wastewater
- Minimize or reuse water
- Minimize the need for chemicals (which can be expensive!)

Source reduction benefits everyone!

https://www.epa.gov/toxics-release-inventory-tri-program/pollution-prevention-p2-and-tri

Varying P2 Needs

- **Facility-based P2**
  - Building heating/cooling – Any facility
  - Refrigeration – dairy, meat, fruit/vegetable
  - Conveyances – high-volume older facilities
- **Industry-specific P2**
  - Dairies/beverage producers – Wastewater flow
  - Shelf-stable food producers – Organic waste
  - Packaged food manufacturers – Edible oil disposal

Common Barriers to Implementation

- **Constant change**
  - Employee turnover
  - Varying corporate/leadership priorities
- **Process inconsistency**
  - 2-3 shifts = 2-3 sets of operators
  - Multiple SKUs = Multiple production schedules
- **Regulatory disagreement**
  - EPA vs. FDA vs. USDA
  - Theoretical vs. possible vs. practical

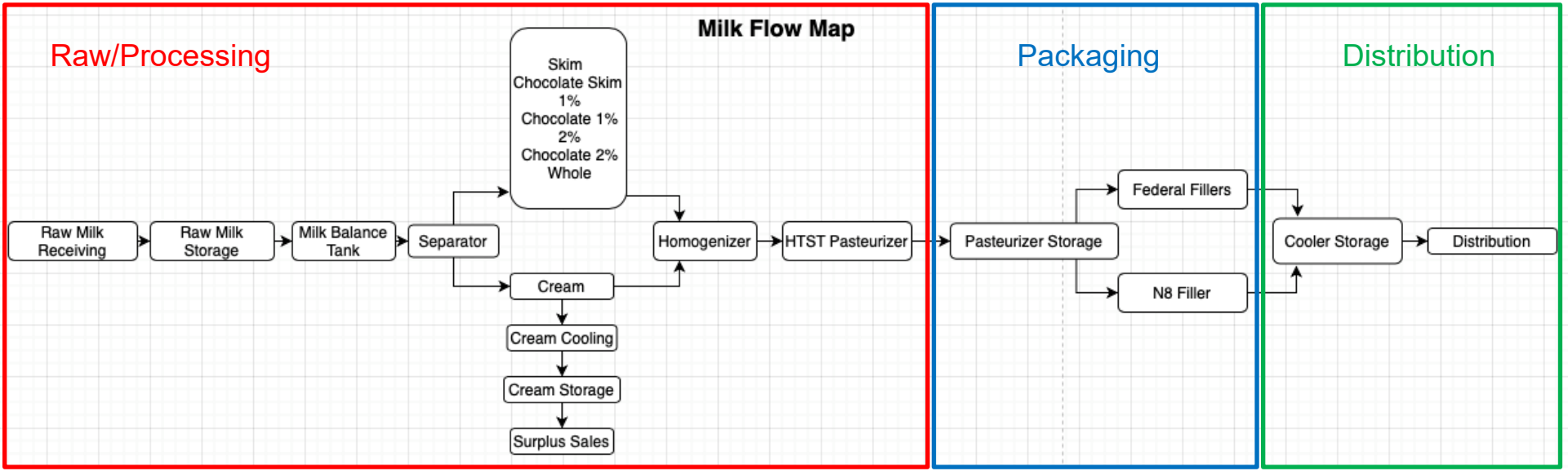
MnTAP Summer Intern Program

- 17 projects for 2025
- Develop real solutions for a company/organization focusing on:
  - Pollution prevention
  - Process efficiency/lean manufacturing
  - Waste minimization
  - Water & energy conservation
- Full time, 500 hrs (13 weeks)
- $19/hr + $1,500 stipend ($22/hr)
- Intern: project lead
- 1 MnTAP and 1 Company advisor

The 2023 MnTAP Intern Cohort

2023-24 Internships

Dairy Processing



Dairy Product Conservation

- **Reduce product lost to wastewater**
  - Average Shrink of 2%
  - Shrink: 100 jugs made, 98 jugs make it to distribution
- **Evaluate key processes for milk loss**
- **Decrease strength charges resulting from milk loss to drain**

Federal Fillers

Rotary filler for half and full gallon jugs

- **Start Up:**
  - Milk is run through to rinse out sanitizer
  - Milk flow is shut off manually once sanitizer is removed
- **Shut Down:**
  - At end of run, remaining milk is discharged to floor drain
  - Bowl and lines are rinsed before cleaning

Recommendations for Federal Fillers

Proposed Solution for Start Up

- Implement an inline conductivity sensor before bowl of filler
- Eliminates operator variability in shutoff time
- Cost: TBD

Potential Annual Savings

- 94,000 gallons of milk
- $114,000 in revenue
- $38,000 in strength charges

Recommendations for Federal Fillers

Proposed Solution for Shut Down

- Best practice sharing between operators
- Reduce milk left in bowl before filler is shut down
- Cost: $1,000

Potential Annual Savings

- 29,000 gallons of milk
- $35,000 in revenue
- $11,700 in strength charges

CIP (Clean-in-Place) Systems

- CIP systems clean tanks/product lines
- May include:
  - Pre-rinse
  - Intermediate-rinse
  - Post-rinse
  - Caustic/acid wash
  - Sanitize
- Remove product, scale and biofouling
- Each system is responsible for multiple tanks/lines called circuits
- Trended system data

A Reuse CIP system

Decrease Pre-Rinse Time

Water Savings

- Trended data was utilized
- There was no turbidity sensor present
- Used post/intermediate-rinse time for new pre-rinse time
- Safety net of 20 seconds utilized

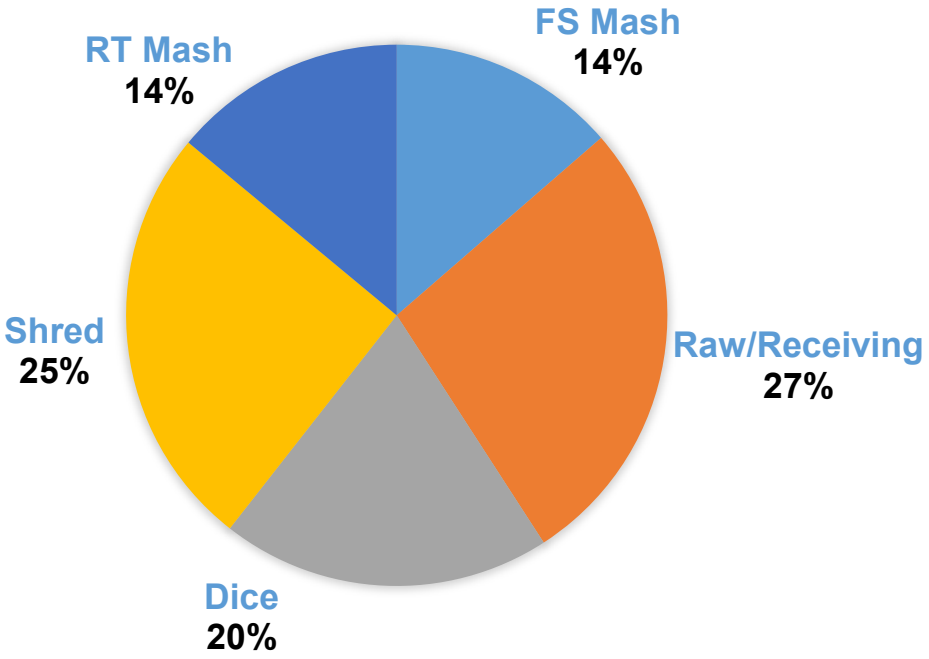
Fuel Savings

- Same as post/intermediate-rinse

Total Annual Savings

- $39,000
- 3,000,000 gallons of water
- 4,200 therms of NG

PROCESS WATER USE



*Excludes water from Utility Room, Waste Room, CIP

Potato Processing

- Flow Mapping
- Understanding Equipment
- Researching Options
- Recommending

Raw Receiving

- **80,000 gallons daily**
  - 25 million gallons annually
  - 27% of annual water use
- **Washer**
  - Uses majority of water in Raw/Receiving
  - Washer fill + sprayers
  - Conveyor system to move potatoes

Washer Recommendations

- **Install sprayer flow restrictor**
  - Implementation Cost:
    - <$100
  - Annual Savings:
    - 3.6 million gallons
    - $38,000
- **Automate sprayer shut off**
  - Implementation Cost:
    - $1,000
  - Annual Savings:
    - 520,000 gallons
    - $5,000

Peel Starch Separators

Background

- **Large rotating drum**
  - Require 5 GPM
  - Removes peel
- **Lines 2, 3, and 4**
  - Running almost 24/7
  - Using over 10 GPM

Recommendations

- **Install flow restrictors**
  - Implementation cost:
    - <$500
  - Annual Savings
    - 4.7 million gallons
    - $49,000

Solutions

Recommendation	Annual reduction	Total cost	Annual savings	Payback period	Status
Install Flow Restrictors on Peel Starch Separators	4.7 million gallons	<$500	$49,000	4 days	Recommended
Install Flow Restrictor on Washer Sprayers	3.6 million gallons	<$100	$38,000	1 day	Recommended
Automate Raw/Receiving Sprayer Shut Off	520,000 gallons	$1,000	$5,000	2 months	Recommended
Automate FS Mash Water Shut-Off	180,000 gallons	$5,000	$2,000	2.5 years	Tentatively Recommended
Install Nozzle on USDA Hose	75,000 gallons	<$100	$800	2 months	Recommended

5.7% water reduction if all recommendations are implemented

Source Reduction is the Goal!

- Divert or limit high-strength waste from wastewater
- Minimize or reuse water
- Minimize the need for chemicals (which can be expensive!)

Source reduction benefits everyone!

https://www.epa.gov/toxics-release-inventory-tri-program/pollution-prevention-p2-and-tri

Thank You!

Strengthening Minnesota businesses by improving efficiency while saving money through energy, water, and waste prevention

www.mntap.umn.edu

Kevin Philpy

philp029@umn.edu

410-707-4027

MnTAP

UNIVERSITY OF MINNESOTA