Environmental Engineering Internship at G&K Services

Katie Venne

MnTAP Advisor: Matt Domski

G&K Services Advisor: Ben Puhl

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MnTAP

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G&K Services

- Industrial laundry facility
  - Provides workplace uniforms, towels, floor mats, linens, and many other services
- Works with a wide range of industries
- Started in Minneapolis and has been in operation over 100 years
- Headquarters are in Minnetonka and there are three other facilities in the Twin Cities

G&K SERVICES

Minneapolis Industrial

- **Processes garments, print towels, shop towels, floor mats, and mops, as well as other reusable textiles**
- **Project focused on waste reduction**
  - Opportunity #1: Solid waste
  - Opportunity #2: COD and TSS in the wastewater

Motivation for Change

- **Commitment to environmental stewardship is a G&K Services core value**
- **Solid Waste Reduction**
  - Estimated that more than 163 tons (3,000 yd^3) of solid waste generated each year
- **Wastewater Treatment**
  - High concentrations of COD and TSS measured in wastewater
  - Industrial wastewater strength charges have increased significantly between the last quarter of 2015 and the first quarter of 2016

Reasons for MnTAP Assistance

- **Assess solid waste stream – identify largest sources of waste**
- **Suggest improvements to current recycling program and uncover additional recycling opportunities**
  - Determine potential reduction in solid waste generation and associated cost savings
- **Evaluate wastewater treatment options in terms of:**
  - Efficiency
  - Costs/Savings
  - Feasibility

Approach

- **Solid waste reduction**
  - Observed and mapped out plant processes
  - Surveyed current recycling program and solid waste stream
  - Shadowed maintenance staff and conducted waste sorts

Approach

- **Wastewater treatment**
  - Learned about different types of wastewater treatment
  - Used different sets of data to predict various outcomes
  - Analyzed historical strength charge data
  - Prepared a cost and feasibility analysis

Opportunity: Solid Waste

- **Studied solid waste stream by conducting waste sorts**
  - Two at Minneapolis Industrial
  - One at St. Cloud
- **Waste sort process:**
  - Had all garbage from around the plant held on the dock
  - Sorted into eight categories
  - Kept track of weight and calculated volume

Waste Sort Results

Results of Waste Sorts at Minneapolis Industrial	Weight of Material Estimated Per Day (lbs)	Volume of Material Estimated Per Day (yd^3)	Percent of Total Waste Sorted (By Weight)	Percent of Total Waste Sorted (By Volume)
Garments and Towels	1209	6.7	64%	47%
Clean Plastic	144	2.4	8%	17%
Solvent Contaminated Plastic	86	1.69	5%	12%
Lint	160	1.05	8%	7%
Trash	122	0.90	6%	6%
Hangers	77	0.90	4%	6%
Recycling	18	0.32	1%	2%
Mats	80	0.32	4%	2%

76%

Solutions and Savings

- **Solution #1: Improve employee recycling program**
  - Add more recycling containers
  - Pair recycling containers with garbage cans - convenience
  - Provide recycling information and signs near each container
    - Spanish, Vietnamese, Hmong, English
    - Pictures of what should be recycled

Savings:

Waste Reduced per Year: **3600 lbs or 60 yd^3**

Money Saved on Solid Waste Removal Per Year: **$190**

Considerations:

Initial Costs: **$470**

Payback: **2.5 years**

Solutions and Savings

- **Solution #2: Recycle Additional Items**
  - Miller Waste Mills – Winona Minnesota
    - Currently working to set up program at G&K Services in St. Paul
    - Will take: **clean textiles, hangers, floor mats, clean plastic**
    - Recyclables picked up at no cost to G&K and will pay $0.015/lb of hangers

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Savings:

Waste Reduced: **168,000 lbs or 1300 yd^3**

Savings Per Year: **$10,700**

Considerations:

Initial Costs: **$1200**

Payback: **0.1 years**

Could be difficult to separate out clean plastic

Summary of Solid Waste Recommendations

Recommendations	Waste reduced (per year)	Implementation cost	Cost savings (per year)	Payback period	Status
Add additional recycling containers	3,600 lbs, 60 yd^3	$470	$190	2.5 years	Under review
Employee recycling education		-	-	NA	
Recycle damaged textiles, floor mats, clean plastic film, and hangers	168,000 lbs, 1,300 yd^3	$1,200	$ 10,700	0.1 years	Under review
Total:	171,600 lbs, 1,360 yd^3	$1,670	$10,890	2.6 years	

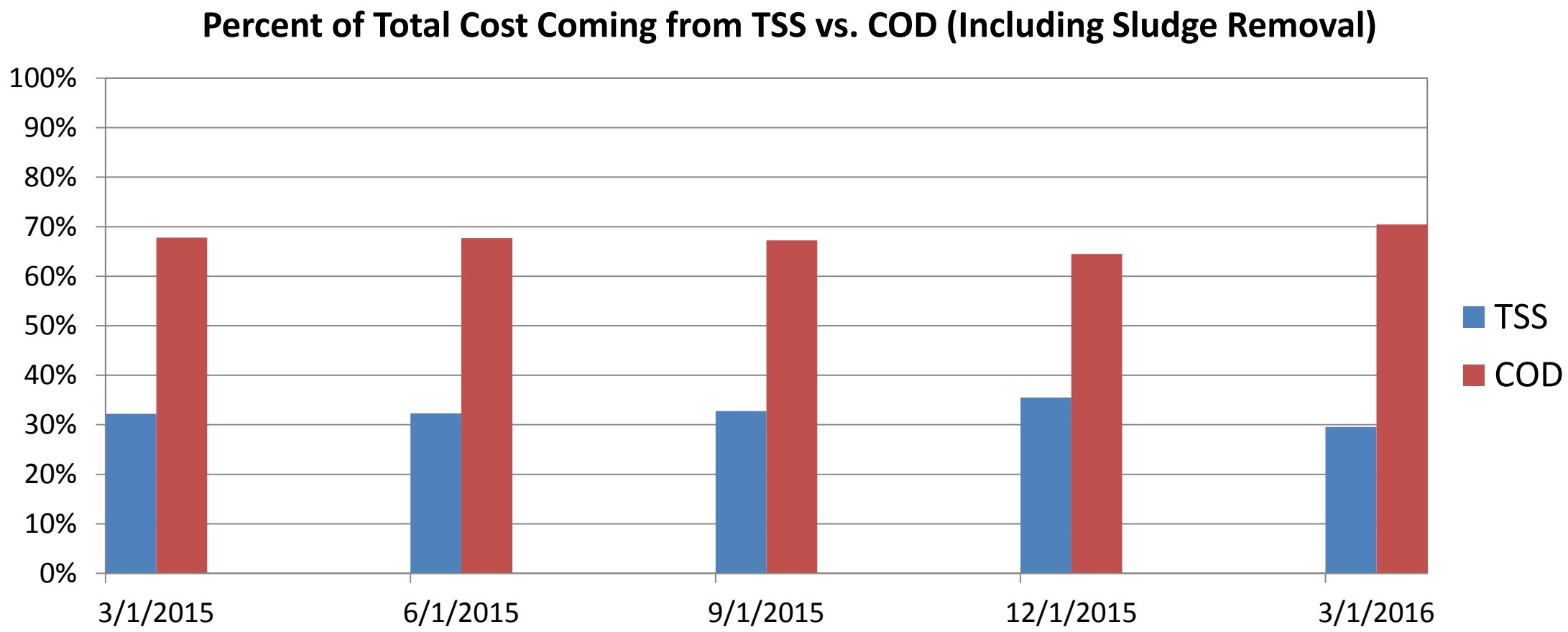
Opportunity: COD and TSS in the Wastewater

- **Metropolitan Council calculates wastewater strength charges quarterly based off:**
  - Volume of water used
  - Excess chemical oxygen demand (COD)
  - Excess total suspended solids (TSS)
- **Assessed effectiveness, feasibility, and cost of implementing different types of treatment**

Possible Sources of COD and TSS

- **Analysis of historical strength charge data shows that most of the quarterly cost comes from COD concentrations**
  - Testing has shown that a significant portion of COD in the wastewater is soluble
- **Sources of COD:**
  - Shop towels
  - Print towels
  - Varnish towels
- **Sources of TSS:**
  - Shop towels
  - Print towels
  - Floor mats

Historical Strength Charge Data



Background: Solvent Contaminated Wipes

- **Solvent contaminated wipes - towels containing regulated solvent**
  - Not usually considered hazardous waste when handled according to MPCA rules:
    - All free liquid must be removed before the towels leave the customer site
    - Customers must count any removed liquid as part of their own hazardous waste
    - Containers or bags of soiled towels must be labeled as "**Excluded Solvent Contaminated Wipes**"
    - All containers must be closed and sealed during transport
- **If all of these rules are followed the towels may be transported without a hazardous waste manifest, or hazardous waste license**

Wastewater Solution #1: Install a DAF

- **Dissolved air flotation (DAF) wastewater treatment system**
  - Uses chemicals and air to suspend solids at the surface of the water
    - Solids are skimmed off of water, pumped into filter press, and disposed of
  - Will require an additional operator
  - An efficiency study using data from multiple plants showed estimated removal to be:
    - 65% of COD
    - 85% of TSS

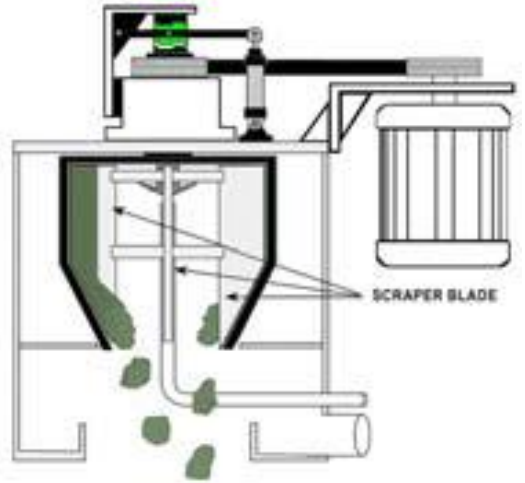
Wastewater Solution #2: Install a Norchem System

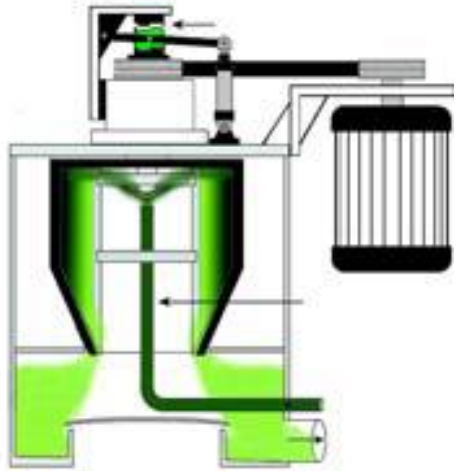
- **Norchem Ultrapure wastewater treatment system**
  - Uses a centrifuge and ceramic membrane filters to treat wastewater
  - Treated water can be reused without any additional equipment
  - Would not require an additional operator
  - An efficiency study using data from multiple plants showed estimated removal to be:
    - 90% of COD
    - 90% of TSS

Picture Source: http://norchemcorp.com/solutions/ultrapure/

Wastewater Solution #3: Install a Wastewater Centrifuge

- **Wastewater centrifuge**
  - Would not require an additional operator
  - Studies done by G&K show that a centrifuge alone is not as efficient as other treatment systems at removing TSS or COD
  - An efficiency study done using data from the centrifuge attached to the Norchem system in a G&K plant showed estimated removal to be:
    - 15% of COD
    - 50% of TSS





Summary of Wastewater Treatment Recommendations

Recommendation	Cost Savings ($/year)	COD Reduced (lb/yr)	TSS Reduced (lb/yr)	Payback Period (Equipment and Install Costs Only)	Payback Period (Including Operating Costs)	Status
Wastewater Centrifuge	$76,600	282,600	129,400	7.3 years	> 10 years	Under review
DAF	$201,700	1,225,000	220,000	5.3 years	> 10 years	Under review
Norchem	$251,800	1,700,000	233,000	5.0 years	> 10 years	Under review

- **All calculations were done using an average of the data collected by G&K Services and the Metropolitan Council in the first quarter of 2016, these values were projected out for one year**
- **Cost savings include reduction in strength charge and reduction in sludge removal costs**

Wastewater Treatment Recommendations

- **Consider treating wastewater at Minneapolis Industrial via other technology**
  - Research other types of wastewater treatment
    - **Examples currently under consideration:**
      - Shaker screen
      - Turbo-Disc Automatic Filtration
- **Continue efficiency studies and gather more data points for the Norchem system and wastewater centrifuge**
- **Continue tracking and comparing future industrial strength charges**
- **Investigate further into the cause of increased COD and TSS concentrations in the wastewater**

Summary of Recommendations

Recommendations	Waste reduced (per year)	Implementation cost	Cost savings (per year)	Payback period	Status
Add additional recycling containers	3,600 lbs	$470	$190	2.5 years	Under review
Employee recycling education		-	-	NA	
Recycle damaged textiles, floor mats, clean plastic film, and hangers	168,000 lbs	$1,200	$ 10,700	0.1 years	Under review
Install a Norchem Ultrapure wastewater treatment system	1,700,000 lbs COD, 233,000 lbs TSS	$712,500 (install and equipment), $274,000 (operating/year)	$251,800	> 10 years	Under review
Total:	171,600 lbs solid waste, 1,700,000 lbs COD, 233,000 lbs TSS	$988,170	$262,690		

Personal Benefits

- Work experience in an industrial setting
- Learned about an industry and area of engineering I previously knew little about
- Learned about environmental rules and regulations
- Applied skills gained in school to real world situations
- Experience doing cost/benefit analyses

Thank you!

Questions?

This project was sponsored in part by the Minnesota Pollution Control Agency