Best Practices for Sustainable Manufacturing

Case Studies from the Southern Tier of NYS

Funding provided by the New York State Department of Environmental Conservation.

Agenda

- Intro to NYS Pollution Prevention Institute
- Background Funding for S. Tier Projects
- Sustainable Manufacturing Case Studies
- Sustainable Manufacturing at Your Company using DMAIC Process
- Questions & Answers

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NYS Pollution Prevention Institute

- Established in 2008
- Headquartered at RIT
- $4M in annual funding through the NYS Department of Environmental Conservation
- Mission to reduce resource consumption (water, raw material, energy) and eliminate waste and toxics
- On-Site Technical Assistance, Research & Development, Emerging Contaminants and Green Chemistry, Food Scraps Reduction, and Outreach & Education
- 15+ full-time staff

Clarkson University defy convention
Rensselaer
R·I·T
Cornell University
Binghamton University State University of New York
New York State of Opportunity. Division of Science, Technology & Innovation
New York Manufacturing Extension Partnership
New York State of Opportunity Department of Environmental Conservation

U.S.EPA – Source Reduction Assistance Grant

Title: "Toxics Reduction and Sustainability in the S. Tier Manufacturing Industry"

Goal: Assist companies with identifying and adopting sustainable manufacturing practices and technologies

Funding: $177,506
(USEPA = $88,753; NYSDEC = $88,753)

Tasks:

1. Company Screening and Selection
2. Conduct Assessments at 4 Manufacturers
3. Identify Improvement Opportunities
4. Calculate Simple Payback / ROI
5. Technical Assistance with Implementation

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Manufacturing Case Studies

	CHT FINISHING / TCMF Triple Cities Metal Finishing Corp.	Auto Parts Mfr. 	KIK CUSTOM PRODUCTS
Challenge	Metal plating uses high volumes of water needing treatment	Equipment cleaning event generates high vol. and costly hazardous waste	Product loss and high vol. waste created during equipment cleaning
Solution	Use pH & TDS to set flow rate in rinse baths to reduce water	Use heat to increase solubility of contaminants & use less water for cleaning. Use technology to recover and reuse good material.	Maintain temperature to improve product flow. Use technology to recover product.
Results	Save >5.5 M gals water/yr & $35,000/yr	Reduce 50,000 lbs HW/event; Reclaim 32% of material; Save $50,000/event	TCO of disposal costs and lost revenue = $1.5M/yr. 60% by wt. of waste is recoverable product. 66% reduction in disposal costs.

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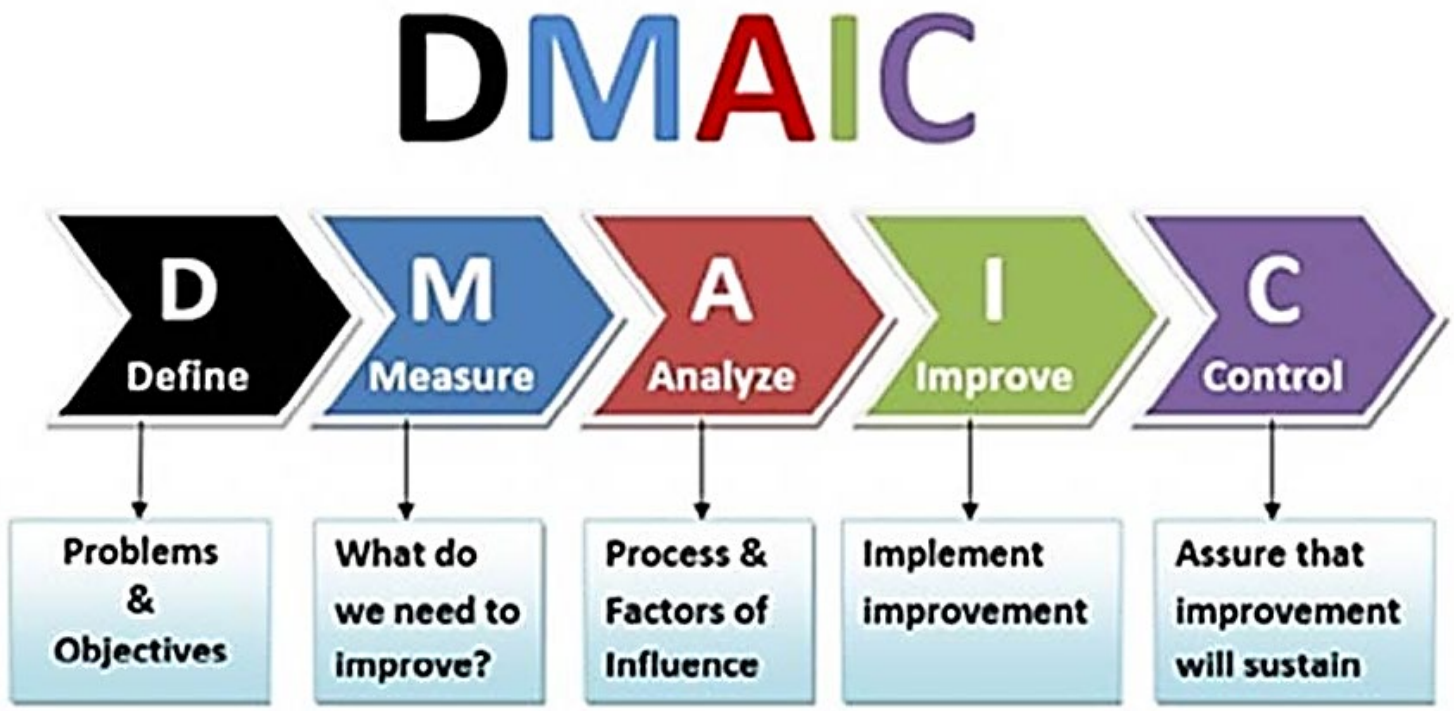
Sustainable Manufacturing

NYSP2I followed the DMAIC approach for "process improvement":



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Define: What is the "Challenge" / Problem

- **I have a costly waste** (disposal fees, regulatory fees, labor intensive, lost product / parts / ingredients)
- **I have high volumes of waste taking up space or need to be treated / processed before leaving site**
- **I have a corporate reduction goal** (ISO 14001, Zero Waste to Landfill, etc.)
- **I have customer demands to reduce our environmental impacts in order to do business with them**
- **I am trying to increase our product yield and be more competitive**

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Define: Goals and Objectives

Challenges tend to be broad statements. After identifying a challenge, create specific **goals** and **objectives** to define a roadmap and measure success.

Examples

Area	Goal	Objective
Waste Reduction	Become Zero waste to landfill certified	• Reduce landfill waste to less than 5% • Increase source reduction by 60%
Yield	Reduce waste across manufacturing processes	• Improve yield for filling and mixing lines by 2% each.
Waste Management Costs	Reduce waste management costs	• Increase source reduction on line to 60% • Increase line yield to 98%

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Measure

What is the current state of the process?

1. Some information may already be available (historical data).
2. Some information may need to be measured.

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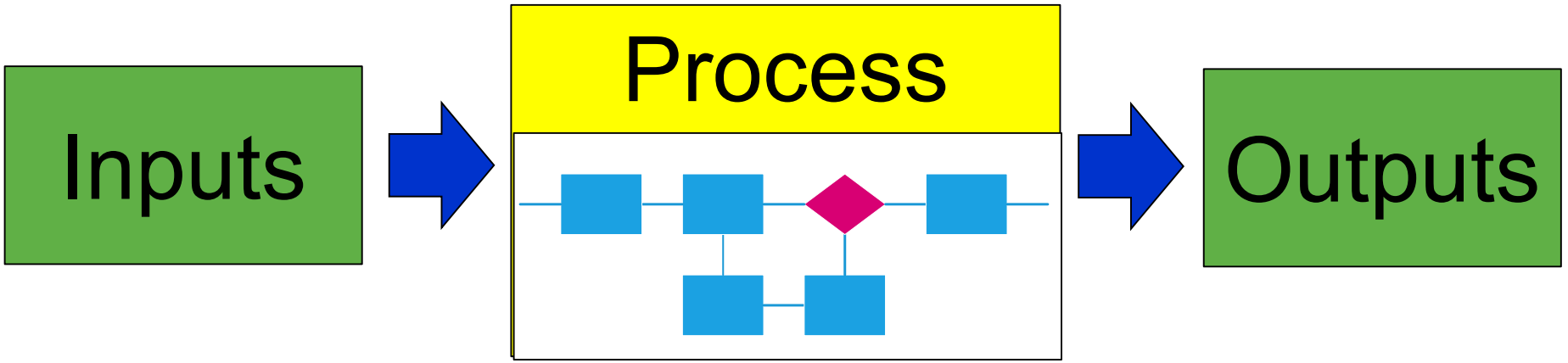
Measure: Current Process

- Choosing good measures requires a clear understanding of the actual Process steps and activities
- Inputs (ingredients, parts, chemicals, heat, pressure, labor) and Outputs (product, waste, cost) need to be identified and quantified



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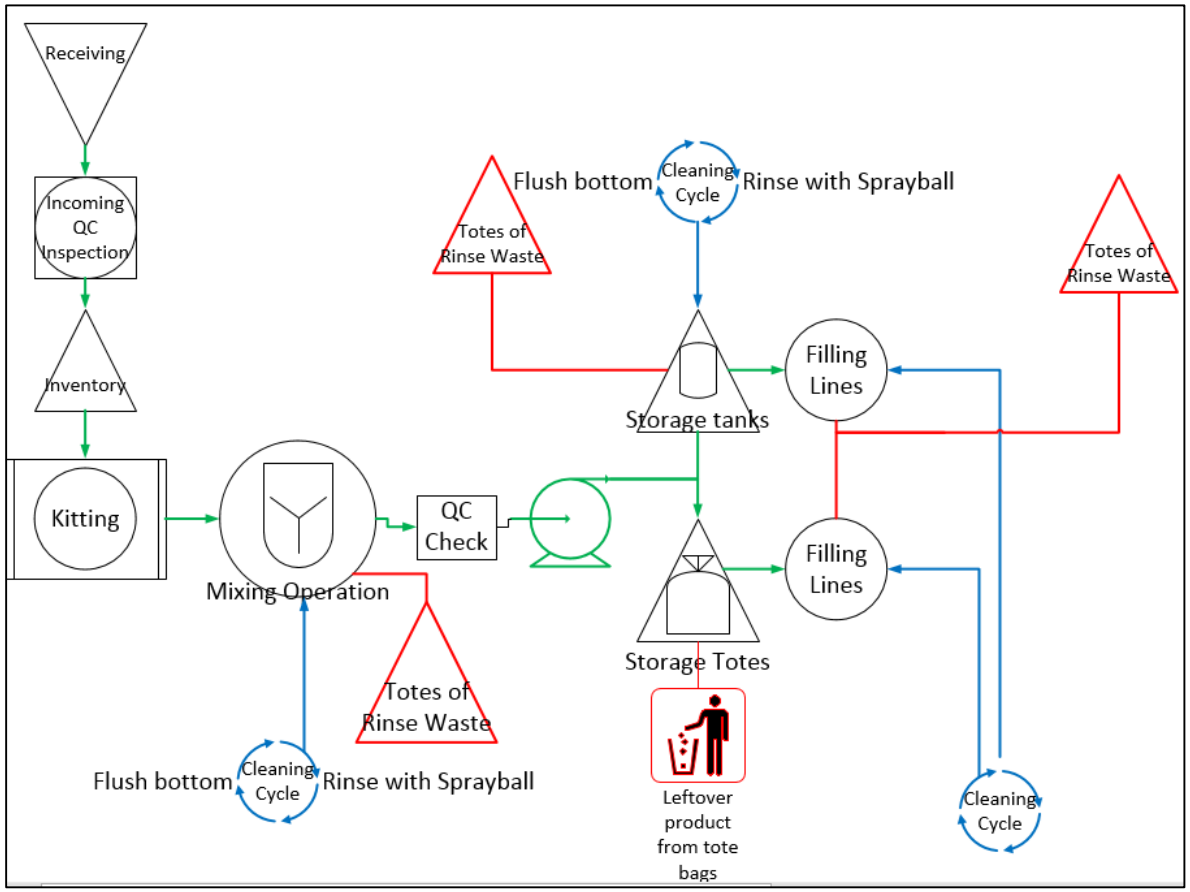
Measure: Examples

- Process Map
- Baseline data
- Pareto
- Cost

Category	One run, lbs	Percent of Total
Water	3865	42.70%
Line Waste	1465	16.20%
Transfer Lines	1200	13.20%
Drip Catchers	1040	11.50%
Filler Flushing	820	9.10%
Tank Heels	668	7.40%

Loss Line Item	Dollar
Labor Loss	$37,237
Disposal 1	$699,516
Disposal 2	$73,840
Raw Material	$548,250
Margin loss	$194,635
Total	$1,553,478



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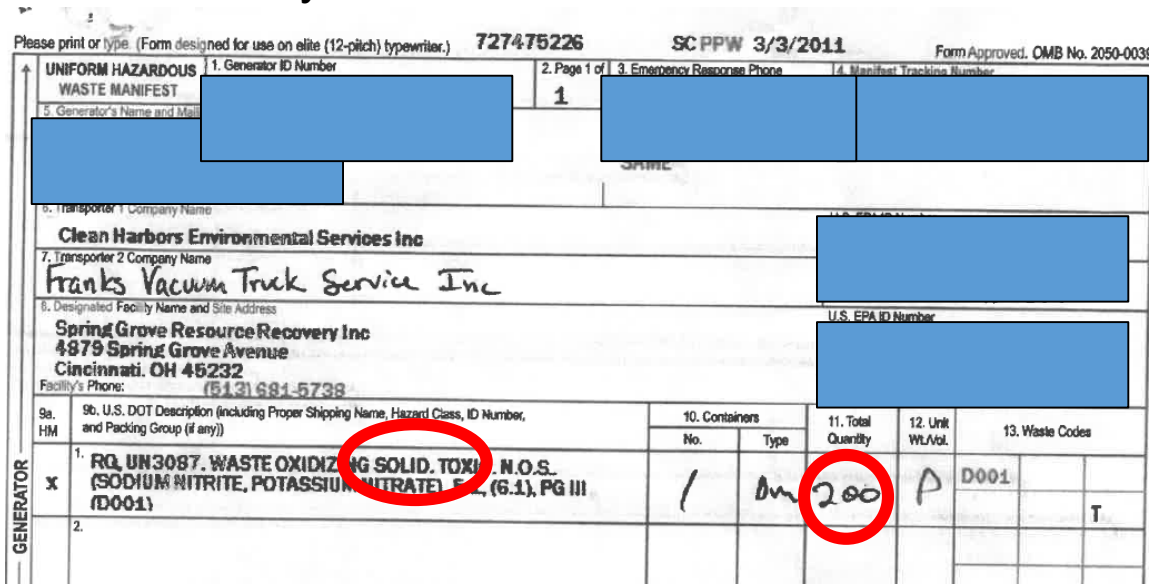
Measure: Baseline Data

Is data already available? What can be measured?

- Water bills
- Natural gas and electricity bills
- Disposal bills – waste manifests
- Other operating costs
- Process data, product loss, yield
- Physical properties: pH, TDS, Temperature, Solubility



Please print or type. (Form designed for use on elite (12-pitch) typewriter.) 727475226 SC PPW 3/3/2011 Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST | 1. Generator ID Number | 2. Page 1 of 1 | 3. Emergency Response Phone | 4. Manifest Tracking Number

5. Generator's Name and Mail

6. Transporter 1 Company Name: Clean Harbors Environmental Services Inc

7. Transporter 2 Company Name: Franks Vacuum Truck Service Inc

8. Designated Facility Name and Site Address: Spring Grove Resource Recovery Inc, 4879 Spring Grove Avenue, Cincinnati, OH 45232

Facility's Phone: (513) 681-5738

U.S. EPA ID Number

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. RQ, UN3087, WASTE OXIDIZING SOLID, TOXIC, N.O.S. (SODIUM NITRITE, POTASSIUM NITRATE), 5.1, (6.1), PG III (D001)	1	DM	200	P	D001 T
	2.					

GENERATOR

Baseline Tank Cleaning Cost	
Hazardous Waste Costs	
Line Item:	**Rate:**
Hazardous Waste Liquid disposal cost	$0.88/lb
Hazardous Waste Solid disposal cost	$1.00/lb
DEC Fee for Liquid Waste	$16/ton
DEC Fee for Solid Waste	$27/ton
DEC Large Quantity Generator Fee	$130/ton
Tank Cleaning Costs	
Line Item	**Rate**
Total Labor Cost	$101/hr
Replacement Material	$1.10/lb

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Analyze

The baseline data is now ready for evaluation

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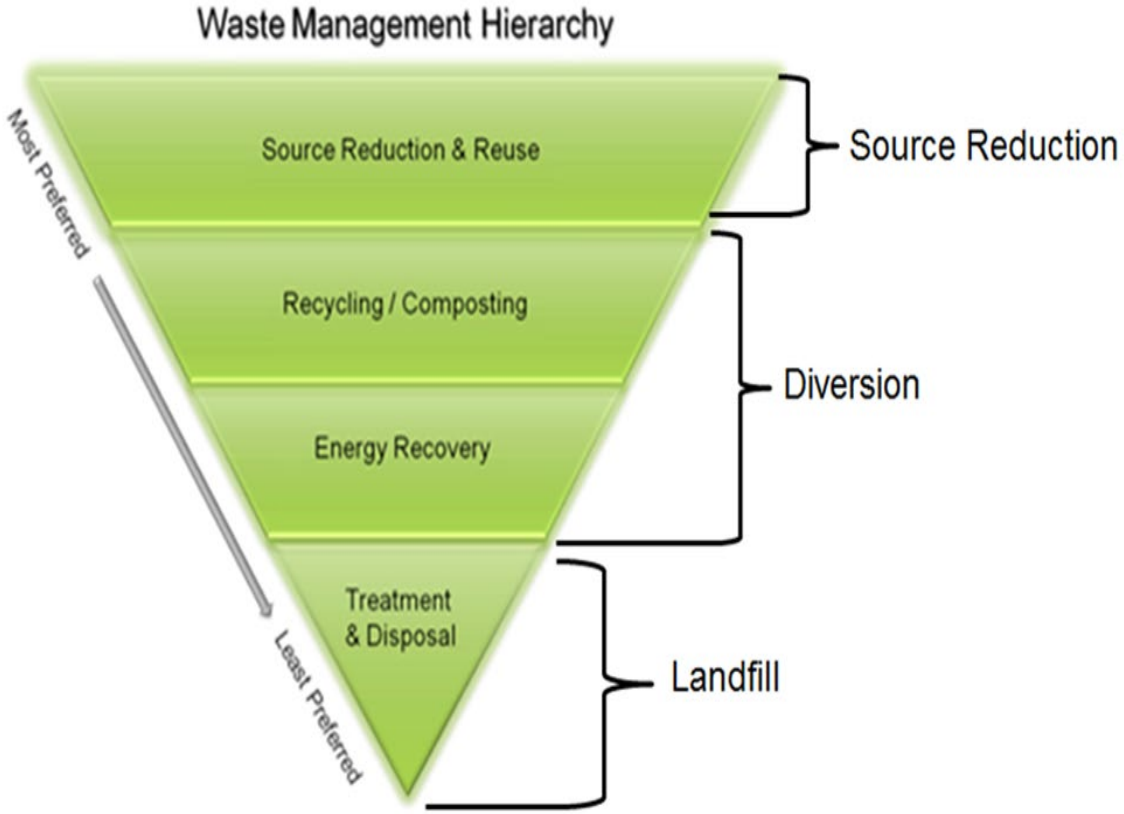
Analyze & Improve

Improve the current state to reach goals

1. Materials and properties
2. Process changes
3. Assess Alternative Technologies
4. Payback



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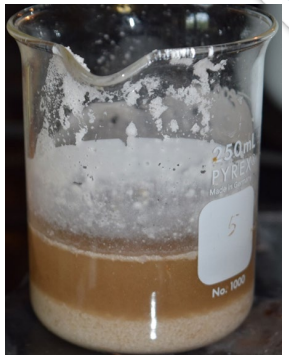
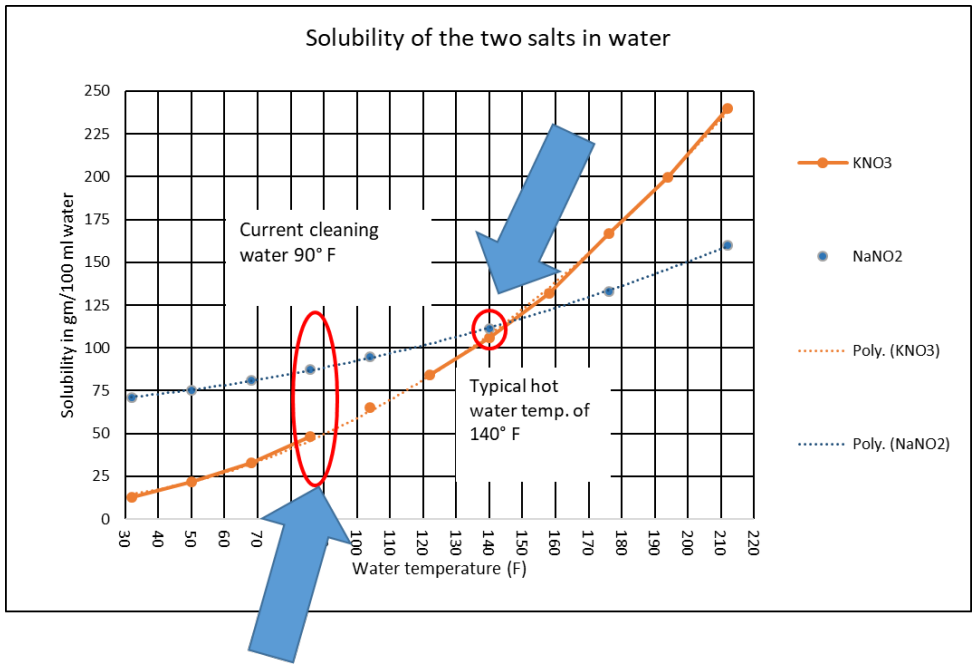
Analyze: Example

- Material testing (heating, solubility)
- Assess process improvements and technology options
- Payback calculation





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Improve and Control

Once improvements or changes are found to improve the process, the changes need to be implemented. To make the changes "stick", controls need to be put in place during implementation

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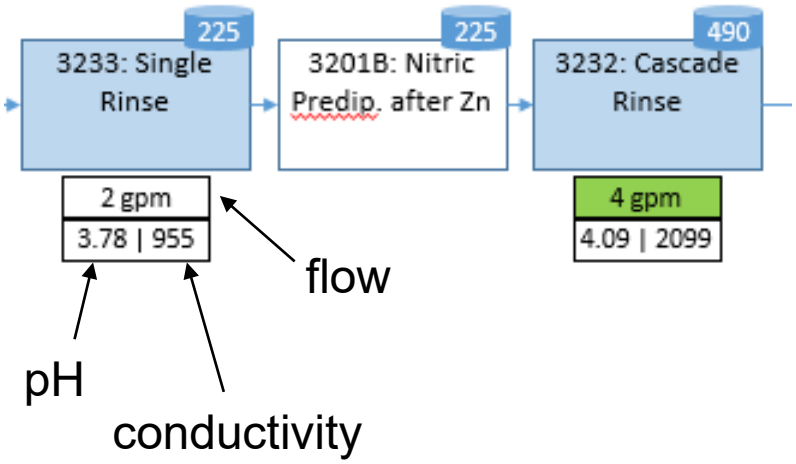
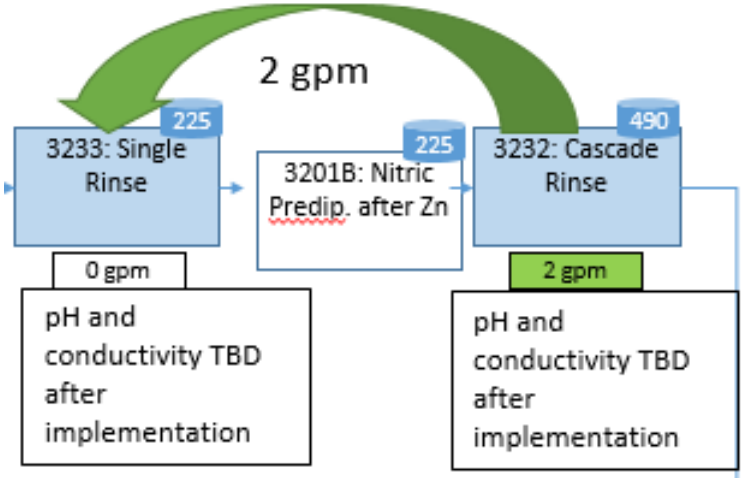
Improve: Example

- Baseline water use: 6 gpm (example below)
- Potential water savings: 2 gpm-- 66% reduction
- Techniques: Counterflow, reactive rinsing, decrease flow rates
- Annual savings = $20,500 (water savings) across this whole plating line

Before / Baseline:



After / Improvement:



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Control: Example

Plating line water use reductions

Control

- Rinse flow is manually set using flow meter
- Add signage at each rinse control
- Create a procedure and train employees for consistency
- Daily line checks for pH, TDS, flow
- Take corrective action / to maintain improvement

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Conclusions

1. Define your project sustainability goals and objectives
2. Baseline data is more readily available than perceived
3. Analyze with source reduction as the number one goal for reducing waste
4. Continue to monitor and control

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More Information Available

- Visit P2I at www.rit.edu/affiliate/nysp2i/
- Case studies available at: www.rit.edu/affiliate/nysp2i/business-assistance/case-studies

DIRECT ASSISTANCE PROGRAM

CASE STUDY

NYSP2I Works with Triple Cities Metal Finishing Corp and C.H. Thompson Company, Inc. on Implementation of Water Reduction Recommendations for Plating Operations

Two companies in Binghamton, NY, Triple Cities Metal Finishing Corp (TCMF) and C.H. Thompson Company, Inc. (CHT), manufacture a variety of products across several industries including defense / aerospace, automotive, electronics, and others. Metal finishing operations at these facilities include metal plating, anodizing, phosphating, wet painting, and powder coating.

Challenge

Metal plating is a water-intensive manufacturing activity that requires a large quantity of solution and many rinse baths to achieve the conduction that attracts and binds finishing materials to the base metal substrate. For high volume and large metal parts, this process creates an enormous demand for water. TCMF and CHT sought to reduce water consumption in these operations.

Solution

The New York State Pollution Prevention Institute (NYSP2I) conducted assessments at TCMF and CHT which identified opportunities to reduce water use and the associated costs at these facilities. Following these assessments, NYSP2I focused on three key areas to assist TCMF and CHT with implementing the improvement opportunities identified during the assessment.

1. Plumbing modifications and water flow rate improvements
2. A Failure Modes and Effects Analysis (FMEA), control plans & check sheets
3. Standard Operating Procedures and corrective action plans

NYSP2I engineers advised TCMF and CHT on plumbing modifications and recommended how to make water flow rate improvements on the plating lines at the respective facilities. Recommendations were based on water quality from pH and total dissolved solids (TDS) measurements.

NYSP2I created a control plan for in-process checks for operators and procedural changes of rinse water quality and flow rates. A Failure Modes and Effect Analysis (FMEA) was developed as a risk management tool to help examine implications of any process improvement or redesign. The FMEA allows the company to identify activities that could fail and provides recommended actions.

Standard operating procedures (SOP) and training were developed to provide step-by-step instruction on corrective actions regarding water quality. The procedures will create more structure to the process, simplify and standardize operator tasks, and help reduce errors or variation that may occur. Having a documented SOP creates organizational knowledge, standardizes performance, and increases consistent product quality and performance.

CHALLENGE

- Metal plating is a water-intensive manufacturing activity that requires a large quantity of solution and many rinse baths to achieve the conduction that attracts and binds finishing materials to the base metal substrate

SOLUTION

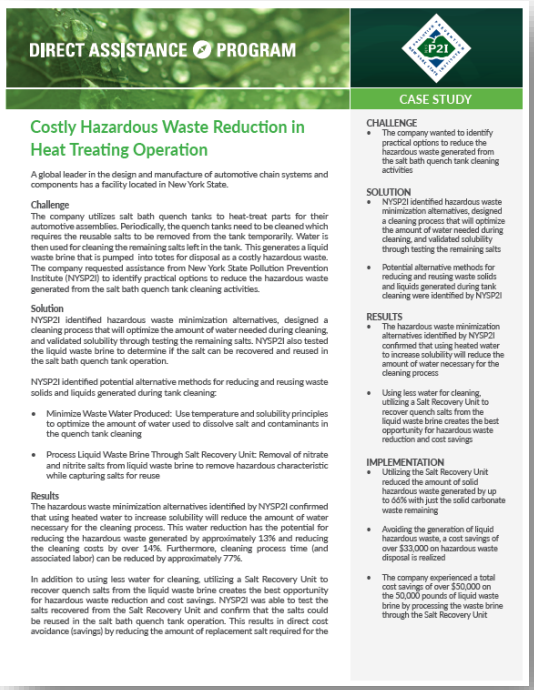
- NYSP2I suggested plumbing modifications and water flow rate changes to TCMF and CHT's processes
- A Failure Modes and Effect Analysis (FMEA), control plan, and check sheets were developed
- Standard operating procedure(s) (SOP) and corrective action plan were developed to provide step-by-step instruction on corrective actions around water quality

RESULTS

- Recently implemented reductions by TCMF will potentially save up to 5.2M gallons per year of water at a cost of $29,000 per year
- Implemented reductions at CHT will potentially save 600K gallons per year of water and $6,500 per year

CHT FINISHING

TCMF Triple Cities Metal Finishing Corp



DIRECT ASSISTANCE PROGRAM

CASE STUDY

Costly Hazardous Waste Reduction in Heat Treating Operation

A global leader in the design and manufacture of automotive chain systems and components has a facility located in New York State.

Challenge

The company utilizes salt bath quench tanks to heat-treat parts for their automotive assemblies. Periodically, the quench tanks need to be cleaned which requires the reusable salts to be removed from the tank temporarily. Water is then used for cleaning the remaining salts left in the tank. This generates a liquid waste brine that is pumped into totes for disposal as a costly hazardous waste. The company requested assistance from New York State Pollution Prevention Institute (NYSP2I) to identify practical options to reduce the hazardous waste generated from the salt bath quench tank cleaning activities.

Solution

NYSP2I identified hazardous waste minimization alternatives, designed a cleaning process that will optimize the amount of water needed during cleaning, and validated solubility through testing the remaining salts. NYSP2I also tested the liquid waste brine to determine if the salt can be recovered and reused in the salt bath quench tank operation.

NYSP2I identified potential alternative methods for reducing and reusing waste solids and liquids generated during tank cleaning:

- Minimize Waste Water Produced: Use temperature and solubility principles to optimize the amount of water used to dissolve salt and contaminants in the quench tank cleaning
- Process Liquid Waste Brine Through Salt Recovery Unit: Removal of nitrate and nitrite salts from liquid waste brine to remove hazardous characteristic while capturing salts for reuse

Results

The hazardous waste minimization alternatives identified by NYSP2I confirmed that using heated water to increase solubility will reduce the amount of water necessary for the cleaning process. This water reduction has the potential for reducing the hazardous waste generated by approximately 13% and reducing the cleaning costs by over 14%. Furthermore, cleaning process time (and associated labor) can be reduced by approximately 77%.

In addition to using less water for cleaning, utilizing a Salt Recovery Unit to recover quench salts from the liquid waste brine creates the best opportunity for hazardous waste reduction and cost savings. NYSP2I was able to test the salts recovered from the Salt Recovery Unit and confirm that the salts could be reused in the salt bath quench tank operation. This results in direct cost avoidance (savings) by reducing the amount of replacement salt required for the

CHALLENGE

- The company wanted to identify practical options to reduce the hazardous waste generated from the salt bath quench tank cleaning activities

SOLUTION

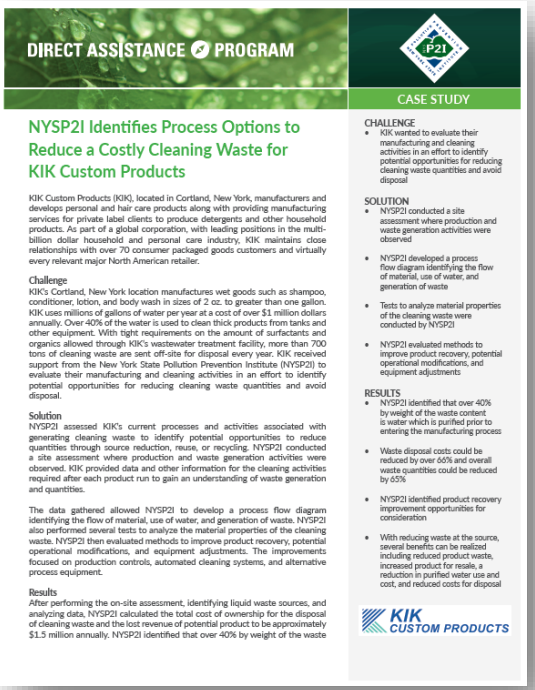
- NYSP2I identified hazardous waste minimization alternatives, designed a cleaning process that will optimize the amount of water needed during cleaning, and validated solubility through testing the remaining salts
- Potential alternative methods for reducing and reusing waste solids and liquids generated during tank cleaning were identified by NYSP2I

RESULTS

- The hazardous waste minimization alternatives identified by NYSP2I confirmed that using heated water to increase solubility will reduce the amount of water necessary for the cleaning process
- Using less water for cleaning, utilizing a Salt Recovery Unit to recover quench salts from the liquid waste brine creates the best opportunity for hazardous waste reduction and cost savings

IMPLEMENTATION

- Utilizing the Salt Recovery Unit reduced the amount of solid hazardous waste generated by up to 66% with just the solid carbonate waste remaining
- Avoiding the generation of liquid hazardous waste, a cost savings of over $33,000 on hazardous waste disposal is realized
- The company experienced a total cost savings of over $50,000 on the 50,000 pounds of liquid waste brine by processing the waste brine through the Salt Recovery Unit



DIRECT ASSISTANCE PROGRAM

CASE STUDY

NYSP2I Identifies Process Options to Reduce a Costly Cleaning Waste for KIK Custom Products

KIK Custom Products (KIK), located in Cortland, New York, manufacturers and develops personal and hair care products along with providing manufacturing services for private label clients to produce detergents and other household products. As part of a global corporation, with leading positions in the multi-billion dollar household and personal care industry, KIK maintains close relationships with over 70 consumer packaged goods customers and virtually every relevant major North American retailer.

Challenge

KIK's Cortland, New York location manufactures wet goods such as shampoo, conditioner, lotion, and body wash in sizes of 2 oz. to greater than one gallon. KIK uses millions of gallons of water per year at a cost of over $1 million dollars annually. Over 40% of the water is used to clean thick products from tanks and other equipment. With tight requirements on the amount of surfactants and organics allowed through KIK's wastewater treatment facility, more than 700 tons of cleaning waste are sent off-site for disposal every year. KIK received support from the New York State Pollution Prevention Institute (NYSP2I) to evaluate their manufacturing and cleaning activities in an effort to identify potential opportunities for reducing cleaning waste quantities and avoid disposal.

Solution

NYSP2I assessed KIK's current processes and activities associated with generating cleaning waste to identify potential opportunities to reduce quantities through source reduction, reuse, or recycling. NYSP2I conducted a site assessment where production and waste generation activities were observed. KIK provided data and other information for the cleaning activities required after each product run to gain an understanding of waste generation and quantities.

The data gathered allowed NYSP2I to develop a process flow diagram identifying the flow of material, use of water, and generation of waste. NYSP2I also performed several tests to analyze the material properties of the cleaning waste. NYSP2I then evaluated methods to improve product recovery, potential operational modifications, and equipment adjustments. The improvements focused on production controls, automated cleaning systems, and alternative process equipment.

Results

After performing the on-site assessment, identifying liquid waste sources, and analyzing data, NYSP2I calculated the total cost of ownership for the disposal of cleaning waste and the lost revenue of potential product to be approximately $1.5 million annually. NYSP2I identified that over 40% by weight of the waste

CHALLENGE

- KIK wanted to evaluate their manufacturing and cleaning activities in an effort to identify potential opportunities for reducing cleaning waste quantities and avoid disposal

SOLUTION

- NYSP2I conducted a site assessment where production and waste generation activities were observed
- NYSP2I developed a process flow diagram identifying the flow of material, use of water, and generation of waste
- Tests to analyze material properties of the cleaning waste were conducted by NYSP2I
- NYSP2I evaluated methods to improve product recovery, potential operational modifications, and equipment adjustments

RESULTS

- NYSP2I identified that over 40% by weight of the waste content is water which is purified prior to entering the manufacturing process
- Waste disposal costs could be reduced by over 66% and overall waste quantities could be reduced by 65%
- NYSP2I identified product recovery improvement opportunities for consideration
- With reducing waste at the source, several benefits can be realized including reduced product waste, increased product for resale, a reduction in purified water use and cost, and reduced costs for disposal

KIK CUSTOM PRODUCTS

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Question & Answer

Thank You

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