NEW YORK STATE OF OPPORTUNITY

Department of Environmental Conservation

Hazardous Waste Reduction Planning (HWRP)

NYSP2I Hazardous Waste Reduction Case Studies and HWRP Program Updates

May 21, 2019

NYSP2I Presenters

Dr. Park provides technical assistance to the business programs and administers the R&D program.

Areas of expertise:

- Membrane Separations
- Less Toxic Parts Cleaning and Surface Treatment
- Materials Recycle

Gene Park
Assistant Director of Technical Programs

Ken provides technical assistance to businesses and administers the Direct Assistance program/

Areas of expertise:

- Manufacturing Process Assessment
- Supply Chain Optimization
- Evaluation of environmentally preferable and cost-effective alternatives

Ken Schlafer
Technical Program Manager

Agenda

Presented by NYSP2I

- **About NYSP2I**
- **Pollution Prevention (P2) Technologies**
- **Case Studies of NYSP2I Assistance Provided**

Presented by NYSDEC

- **HWRP Program Background**
- **Requirements applicable to:**
  - HWRPs, ASRs, and BUs
  - ASRs only
  - BUs only
- **Recent program changes**
- **Resources**
- **Questions?**

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

New York State Pollution Prevention Institute

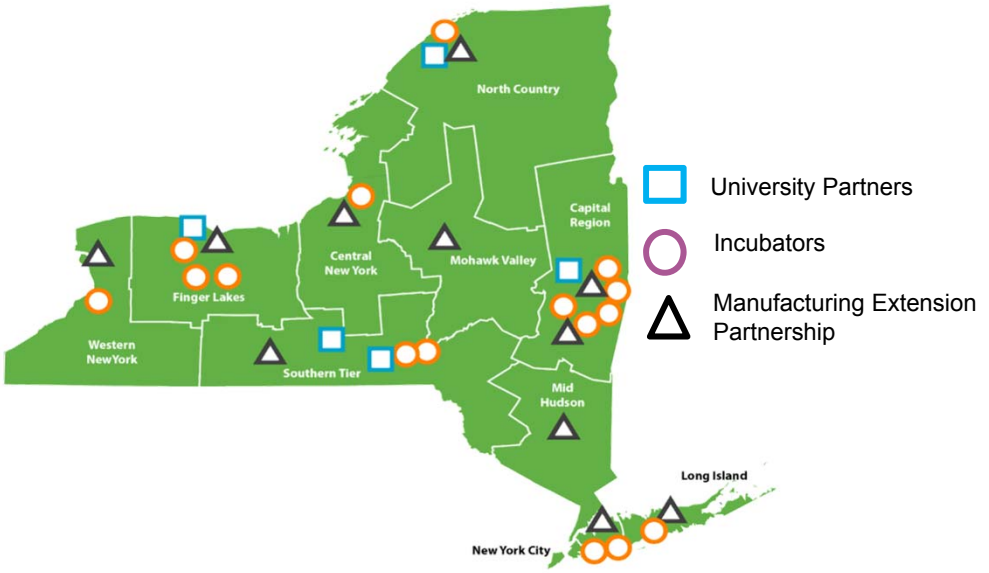
NYSP2I & Hazardous Waste Reduction Case Studies

Gene Park & Ken Schlafer

NYS Pollution Prevention Institute

5/21/2019

New York State Pollution Prevention Institute



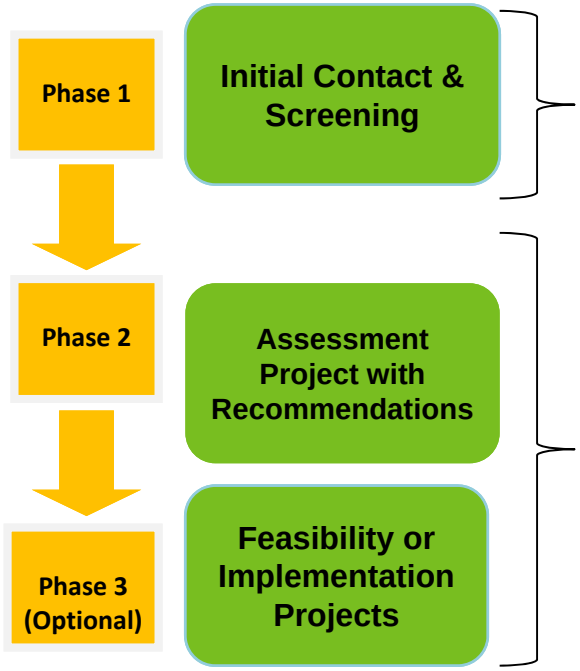
- Headquartered at **RIT** within GIS
- Established in **2008**
- **$4M** in annual NYS funding
- Focus on **reduction** of natural resource consumption (water, raw material, energy) and elimination of waste and toxics
- **P2** research, technical assistance, education and outreach
- **15+** full-time staff

NYSP2I Capabilities

- **Reduction of Environmental "Footprint"**
- **Sustainable Business Practices**
- **Food Waste Reduction & Diversion**
- **Accelerate Commercialization of Green Products or Processes**
- **Research & Development**
- **Communication and Outreach**

- P2 problem identification, reducing hazardous waste and environmental "footprint" of process or facility
- Technology assessments, validation and effectiveness studies
- Supply chain sustainability assessments, strategy, and implementation
- Green or eco-innovation products in the commercialization stages
- Food waste reduction and pathway utilization

NYSP2I Engagement



Screening Phase

- **No Cost**
- Discuss **company needs** and **opportunities,** possible Site visit.
- Use Data Intake Form (DIF) to gather baseline information

Project Phase

- **NYS funding** offsets most of the project cost to the company for non-capital expenses
- Typical project ranges from **4-6** months with cost ranging from **$15K - $50K**
- Desired project **outcomes** include job creation/retention, cost savings, sales increase, waste reduction

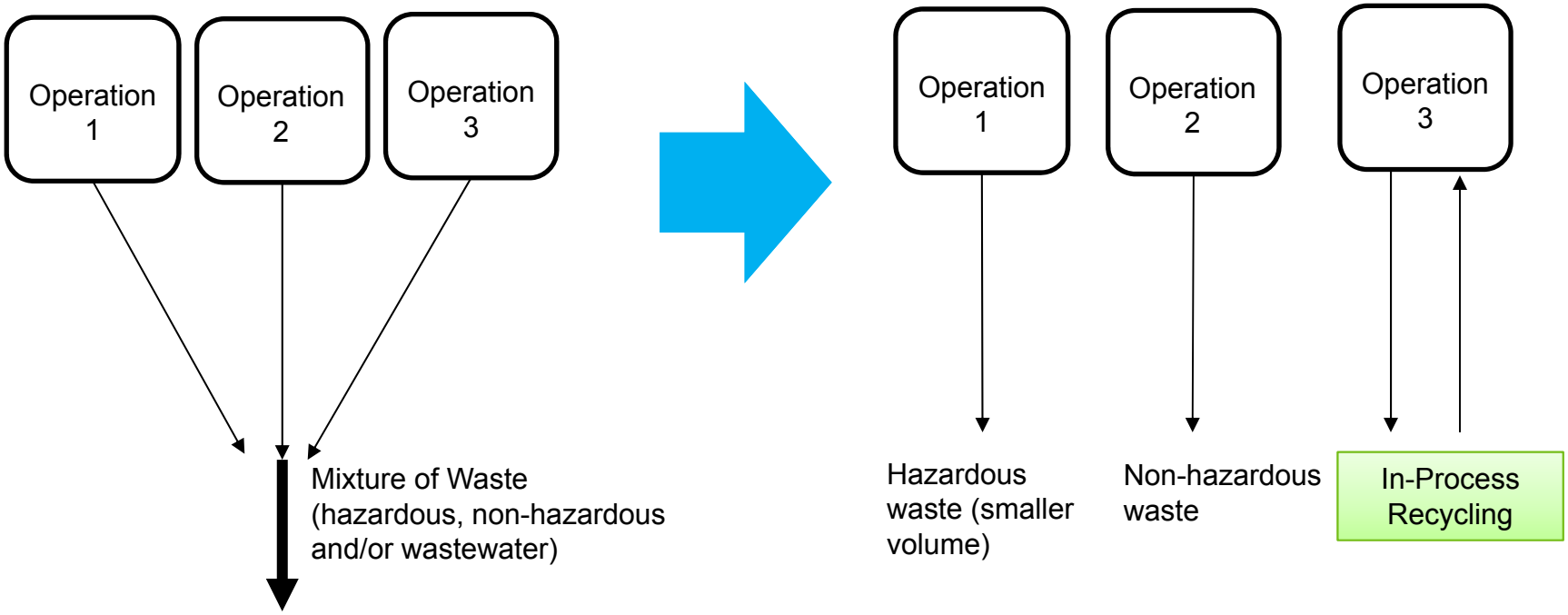
Pollution Prevention (P2) Technologies

Approaches to implement P2 vary from “Low-Tech” to “High-Tech” innovative technologies

- Low-Tech examples
  - Process stream segregation (Source Reduction)
  - Improved housekeeping (Source Reduction)
  - Screen filters (Recycling, Treatment)
  - Inventory Control (ex: expired product prevention)
- High-Tech examples
  - Membrane filtration (In-Process Recycling, Treatment)
  - Vacuum cycle nucleation (Source Reduction)
  - Ultimo non-contact densitometer (Source Reduction)

Pollution Prevention (P2) Technologies

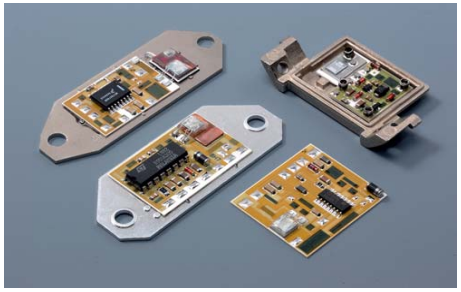
Process stream segregation



Innovative P2 Technologies

Vacuum Cycle Nucleation (VCN)

- Newer technology designed to replace or minimize use of chemicals in precision cleaning applications
- Applications where simple aqueous cleaning and ultrasonics ineffective
- Medical device, micro-electronics, any precision parts
- Lower boiling point of aqueous cleaning solution to nucleate bubbles under safe conditions

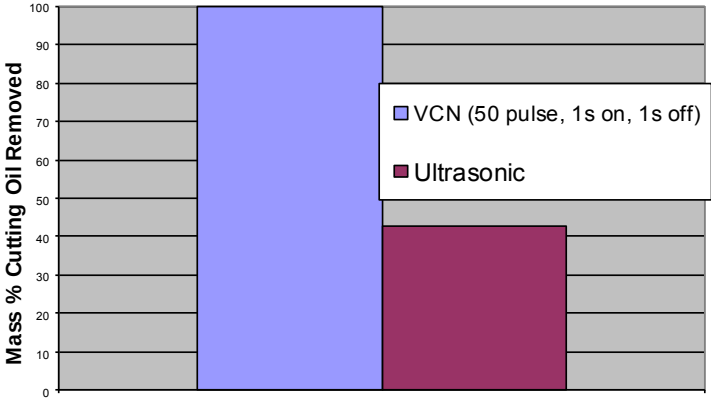


Photos courtesy of www.hason-precision.com

Innovative P2 Technologies

Vacuum Example VCN Application – Cleaning

- VCN removed all oil in porous part
- Ultrasonics cannot penetrate pores



Innovative P2 Technologies

Membrane Filtration

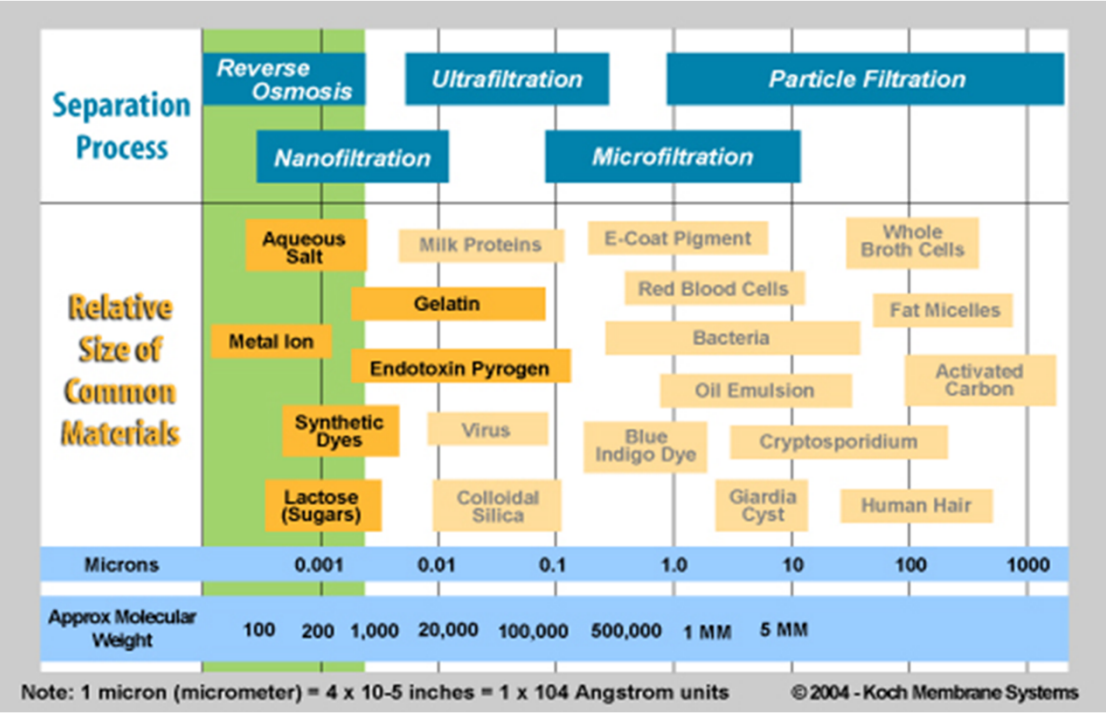


Figure and Membrane Info courtesy of Koch Membrane Systems

Low Pressure

- **Microfiltration** - Separation of large solids
- **Ultrafiltration** - Separation, concentration and purification of dissolved molecules

Medium Pressure

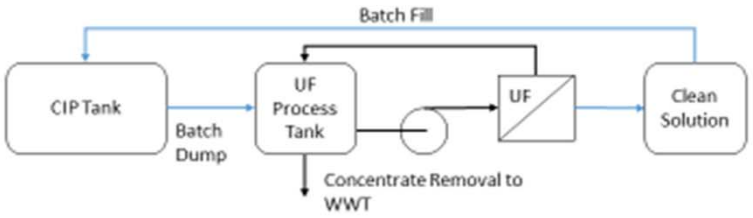
- **Nanofiltration** - Separation, concentration and demineralization of liquids

Medium to High Pressure

- **Reverse Osmosis** - Water purification and product concentration

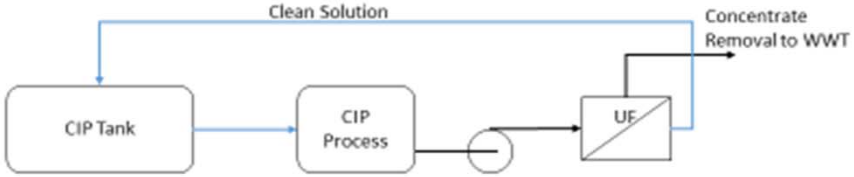
Innovative P2 Technologies

Membrane Filtration



Batch Mode

Semi-Batch Mode



Continuous Mode

New York State Pollution Prevention Institute

CASE STUDIES

DIRECT ASSISTANCE PROGRAM

CASE STUDY

NYSP2I Performs Evaluation of Cleaning Alternatives to Trichloroethylene Vapor Degreasing

Located in Rochester, New York, Rochester Steel Treating Works, Inc. (Rochester Steel) is a commercial heat treating company, established in 1932. Rochester Steel offers a range of heating services to client companies for production parts or tooling. Heat treating processes include vacuum furnaces, nitrogen & oil quenching, case hardening, and induction hardening. The company also offers cryo-tempering services, a process that is performed under cold conditions at the opposite end of the temperature spectrum.

Challenge

Rochester Steel currently relies on trichloroethylene (TCE) vapor degreasing to clean metal parts in preparation for heat-treating or post oil quenching. In order to support this process, they spend approximately $111,000 per year on purchasing, disposal, and management of TCE and TCE sludge. Rochester Steel approached NYSP2I for assistance in identifying sustainable alternative methods to vapor degreasing that eliminates the use of TCE.

Solution

The New York State Pollution Prevention Institute (NYSP2I) was tasked with evaluating TCE chemical alternatives and aqueous cleaning methods (vacuum cycle nucleation (VCN) and ultrasonics) for potential use at Rochester Steel. To accomplish these tasks, NYSP2I collected baseline data, mapped the quench/heat treat process, evaluated alternative cleaners to TCE, identified and tested alternative cleaning methods, and performed an economic analysis for alternative chemistries and cleaning methods.

Results

Testing with the VCN and ultrasonic units verified the technology capabilities for cleanliness and rust resistance on the parts. The worked performed by NYSP2I led to finding feasible alternatives to TCE. These technologies are commercially available for Rochester Steel to consider.

- Investing in ultrasonic or VCN systems can potentially reduce cleaning operating costs by 83-87% with estimated paybacks of 3 months for the ultrasonic system and less than one year for the VCN.
  - Investing in either technology eliminates hazardous waste management costs.
- Kyzen Metalnox M6314, an oil-splitting aqueous cleaner with rust inhibitors, proved to be an effective cleaner when used in either VCN or ultrasonics.

CHALLENGE

- Rochester Steel Treating Works wanted to identify sustainable alternative methods to vapor degreasing that would eliminate the use of trichloroethylene (TCE)

SOLUTION

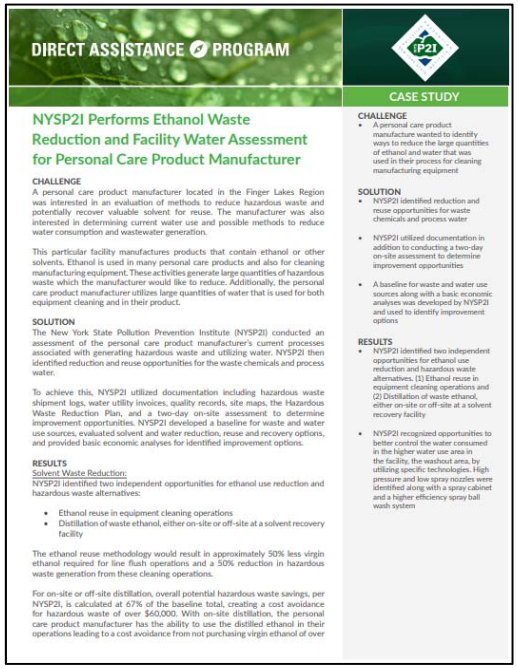
- NYSP2I evaluated TCE chemical alternatives and aqueous cleaning methods vacuum cycle nucleation (VCN) and ultrasonics for potential use at Rochester Steel Treating Works

RESULTS

- Testing with the VCN and ultrasonic units verified the technology capabilities for cleanliness and rust resistance on the parts
- The worked performed by NYSP2I led to finding feasible alternatives to TCE
- Rochester Steel Treating Works intends to implement an alternative technology to replace TCE in 2019

RSTW

Evaluation of Cleaning Alternatives to Trichloroethylene Vapor Degreasing



DIRECT ASSISTANCE PROGRAM

CASE STUDY

NYSP2I Performs Ethanol Waste Reduction and Facility Water Assessment for Personal Care Product Manufacturer

CHALLENGE

A personal care product manufacturer located in the Finger Lakes Region was interested in an evaluation of methods to reduce hazardous waste and potentially recover valuable solvent for reuse. The manufacturer was also interested in determining current water use and possible methods to reduce water consumption and wastewater generation.

This particular facility manufactures products that contain ethanol or other solvents. Ethanol is used in many personal care products and also for cleaning manufacturing equipment. These activities generate large quantities of hazardous waste which the manufacturer would like to reduce. Additionally, the personal care product manufacturer utilizes large quantities of water that is used for both equipment cleaning and in their product.

SOLUTION

The New York State Pollution Prevention Institute (NYSP2I) conducted an assessment of the personal care product manufacturer's current processes associated with generating hazardous waste and utilizing water. NYSP2I then identified reduction and reuse opportunities for the waste chemicals and process water.

To achieve this, NYSP2I utilized documentation including hazardous waste shipment logs, water utility invoices, quality records, site maps, the Hazardous Waste Reduction Plan, and a two-day on-site assessment to determine improvement opportunities. NYSP2I developed a baseline for waste and water use sources, evaluated solvent and water reduction, reuse and recovery options, and provided basic economic analyses for identified improvement options.

RESULTS

Solvent Waste Reduction:

NYSP2I identified two independent opportunities for ethanol use reduction and hazardous waste alternatives:

- Ethanol reuse in equipment cleaning operations
- Distillation of waste ethanol, either on-site or off-site at a solvent recovery facility

The ethanol reuse methodology would result in approximately 50% less virgin ethanol required for line flush operations and a 50% reduction in hazardous waste generation from these cleaning operations.

For on-site or off-site distillation, overall potential hazardous waste savings, per NYSP2I, is calculated at 67% of the baseline total, creating a cost avoidance for hazardous waste of over $60,000. With on-site distillation, the personal care product manufacturer has the ability to use the distilled ethanol in their operations leading to a cost avoidance from not purchasing virgin ethanol of over

CHALLENGE

- A personal care product manufacture wanted to identify ways to reduce the large quantities of ethanol and water that was used in their process for cleaning manufacturing equipment

SOLUTION

- NYSP2I identified reduction and reuse opportunities for waste chemicals and process water
- NYSP2I utilized documentation in addition to conducting a two-day on-site assessment to determine improvement opportunities
- A baseline for waste and water use sources along with a basic economic analyses was developed by NYSP2I and used to identify improvement options

RESULTS

- NYSP2I identified two independent opportunities for ethanol use reduction and hazardous waste alternatives. (1) Ethanol reuse in equipment cleaning operations and (2) Distillation of waste ethanol, either on-site or off-site at a solvent recovery facility
- NYSP2I recognized opportunities to better control the water consumed in the higher water use area in the facility, the washout area, by utilizing specific technologies. High pressure and low spray nozzles were identified along with a spray cabinet and a higher efficiency spray ball wash system

Ethanol Waste Reduction and Facility Water Assessment for Personal Care Product Manufacturer

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 (saving) 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

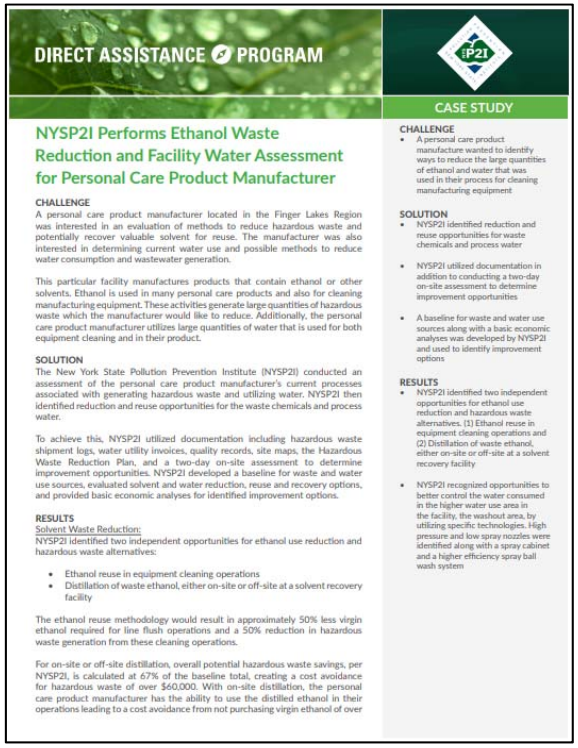
IMPLEMENTATION

- 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 30,000 pounds of liquid waste brine by processing the waste brine through the Salt Recovery Unit

Costly Hazardous Waste Reduction in Heat Treating Operation

New York State Pollution Prevention Institute

CASE STUDIES



DIRECT ASSISTANCE PROGRAM

CASE STUDY

NYSP2I Performs Ethanol Waste Reduction and Facility Water Assessment for Personal Care Product Manufacturer

CHALLENGE

A personal care product manufacturer located in the Finger Lakes Region was interested in an evaluation of methods to reduce hazardous waste and potentially recover valuable solvent for reuse. The manufacturer was also interested in determining current water use and possible methods to reduce water consumption and wastewater generation.

This particular facility manufactures products that contain ethanol or other solvents. Ethanol is used in many personal care products and also for cleaning manufacturing equipment. These activities generate large quantities of hazardous waste which the manufacturer would like to reduce. Additionally, the personal care product manufacturer utilizes large quantities of water that is used for both equipment cleaning and in their product.

SOLUTION

The New York State Pollution Prevention Institute (NYSP2I) conducted an assessment of the personal care product manufacturer's current processes associated with generating hazardous waste and utilizing water. NYSP2I then identified reduction and reuse opportunities for the waste chemicals and process water.

To achieve this, NYSP2I utilized documentation including hazardous waste shipment logs, water utility invoices, quality records, site maps, the Hazardous Waste Reduction Plan, and a two-day on-site assessment to determine improvement opportunities. NYSP2I developed a baseline for waste and water use sources, evaluated solvent and water reduction, reuse and recovery options, and provided basic economic analyses for identified improvement options.

RESULTS

Solvent Waste Reduction:

NYSP2I identified two independent opportunities for ethanol use reduction and hazardous waste alternatives:

- Ethanol reuse in equipment cleaning operations
- Distillation of waste ethanol, either on-site or off-site at a solvent recovery facility

The ethanol reuse methodology would result in approximately 50% less virgin ethanol required for line flush operations and a 50% reduction in hazardous waste generation from these cleaning operations.

For on-site or off-site distillation, overall potential hazardous waste savings, per NYSP2I, is calculated at 67% of the baseline total, creating a cost avoidance for hazardous waste of over $60,000. With on-site distillation, the personal care product manufacturer has the ability to use the distilled ethanol in their operations leading to a cost avoidance from not purchasing virgin ethanol of over

CHALLENGE

- A personal care product manufacture wanted to identify ways to reduce the large quantities of ethanol and water that was used in their process for cleaning manufacturing equipment

SOLUTION

- NYSP2I identified reduction and reuse opportunities for waste chemicals and process water
- NYSP2I utilized documentation in addition to conducting a two-day on-site assessment to determine improvement opportunities
- A baseline for waste and water use sources along with a basic economic analyses was developed by NYSP2I and used to identify improvement options

RESULTS

- NYSP2I identified two independent opportunities for ethanol use reduction and hazardous waste alternatives. (1) Ethanol reuse in equipment cleaning operations and (2) Distillation of waste ethanol, either on-site or off-site at a solvent recovery facility
- NYSP2I recognized opportunities to better control the water consumed in the higher water use area in the facility, the washout area, by utilizing specific technologies. High pressure and low spray nozzles were identified along with a spray cabinet and a higher efficiency spray ball wash system

Ethanol Cleaning Operations Waste Reduction

NYSP2I | New York State Pollution Prevention Institute

Ethanol Cleaning Operations Waste Reduction

Personal Care Products Manufacturer Challenge

- Ethanol used in products and for cleaning manufacturing equipment
- Desire to reduce large quantities of hazardous waste generated
- Ethanol has a potential to be reclaimed and reused in the manufacturing process

Work Performed

- NYSP2I developed a baseline for ethanol use and source activities
- Ethanol use reduction, reuse and recovery options explored

Results - NYSP2I identified two independent opportunities:

- Ethanol reuse in equipment cleaning operations
  - ~50% less virgin ethanol required for line flush cleaning and associated purchasing cost avoidance
  - ~50% reduction in hazardous waste generation
- Distillation of waste ethanol either on-site or off-site at a solvent recovery facility
  - Potential hazardous waste reduction calculated at ~67%
  - Hazardous waste cost avoidance of over $60,000
  - Cost avoidance for purchasing virgin ethanol is ~$50,000

Personal Care Products Manufacturer

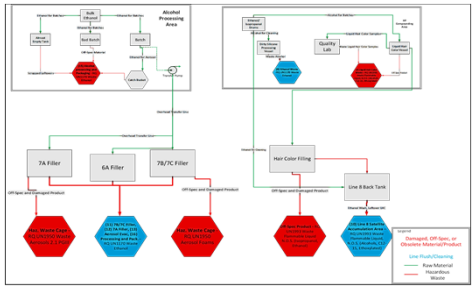
New York State Pollution Prevention Institute

Ethanol Cleaning Operations Waste Reduction

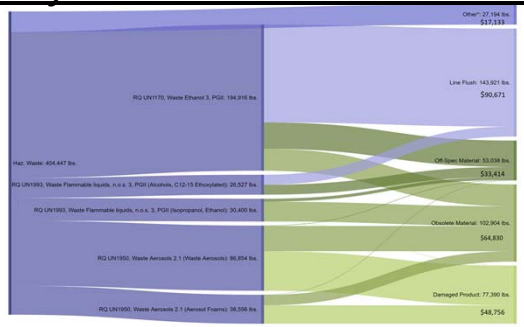
Determine Baseline

1. What are the **sources** of waste generation (what is the "activity" that is creating the waste)?
2. **How much** is generated at each source?
3. What is the "**cause**" of the *source* waste being generated?
4. Where are all of the sources **collected** (mixed) - satellite accumulation area?
5. What **opportunities** for reduction exist?
6. What is the potential **cost savings**?

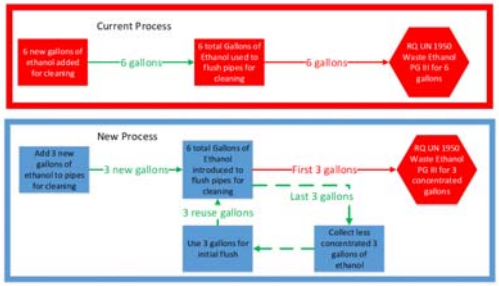
Walk the Process



Identify Causals – Waste Generation

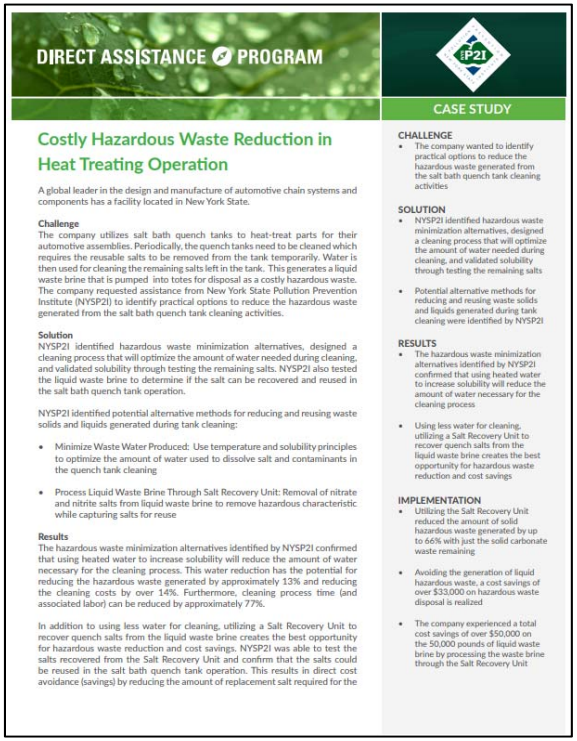


Improvement - Line Flushing



New York State Pollution Prevention Institute

CASE STUDIES



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

Costly Hazardous Waste Reduction in Heat Treating Operation

NYSP2I | New York State Pollution Prevention Institute

Costly Hazardous Waste Reduction in Heat Treating Operation

Auto Parts Manufacturer

Auto Parts Manufacturer Challenge

- Molten salt bath quench tanks used to heat treat parts
- Periodic cleaning of tanks with water creates a hazardous waste due to salt and carbonates (oxidizer)
- Liquid waste brine pumped into totes for disposal

Work Performed

- NYSP2I designed a cleaning process to optimize the amount of water used
- Used solubility principles, including heat and agitation, to remove salt build-up
- Determined salt in liquid waste brine can be recovered and reused in salt bath

Results

- Feasibility study for one cleaning event:
- 50,000 pounds of liquid waste brine resulted in recovering over 16,000 pounds of reusable salt (32% recovery rate)
- This is a cost avoidance of nearly $18,000 for new salt
- Solid hazardous waste generation was reduced by 66% to just the carbonate waste remaining
- Avoiding the generation of liquid hazardous waste resulted in a cost savings of over $33,000 for disposal

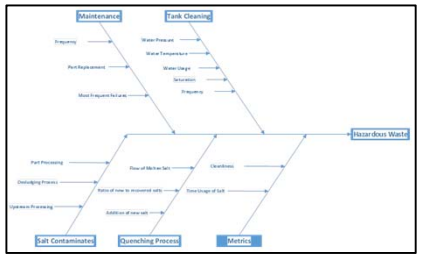
New York State Pollution Prevention Institute

Costly Hazardous Waste Reduction in Heat Treating Operation

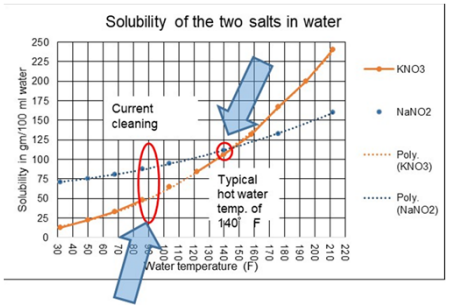
DEFINE / MEASURE

Molten salt

Carbonate



ANALYZE



Investigate solubility to optimize the amount of water used to dissolve salt

IMPROVE

Hot Water

$9K Water + Waste Savings

Room Temp water to clean tanks

$67K per year

Hot water (104 degF) to clean tanks

$59K per year

Evaporator

Additional $30K Savings

Using a multistage evaporator to recover salt & carbonates

NYSP2I determined that the multi-stage evaporator will give the greatest opportunity for hazardous waste and cost reduction due to 1) brine being evaporated (no liquid hazardous waste) and 2) Some quench salts can be recovered and re-used (salt savings)

These improvements impacted the two highest cost items in the quench tank cleaning process

- amount of hazardous waste produced
- cost of replacement quench salt

CASE STUDIES

DIRECT ASSISTANCE PROGRAM

CASE STUDY

NYSP2I Performs Evaluation of Cleaning Alternatives to Trichloroethylene Vapor Degreasing

Located in Rochester, New York, Rochester Steel Treating Works, Inc. (Rochester Steel) is a commercial heat treating company, established in 1932. Rochester Steel offers a range of heating services to client companies for production parts or tooling. Heat treating processes include vacuum furnaces, nitrogen & oil quenching, case hardening, and induction hardening. The company also offers cryo-tempering services, a process that is performed under cold conditions at the opposite end of the temperature spectrum.

Challenge

Rochester Steel currently relies on trichloroethylene (TCE) vapor degreasing to clean metal parts in preparation for heat-treating or post oil quenching. In order to support this process, they spend approximately $111,000 per year on purchasing, disposal, and management of TCE and TCE sludge. Rochester Steel approached NYSP2I for assistance in identifying sustainable alternative methods to vapor degreasing that eliminates the use of TCE.

Solution

The New York State Pollution Prevention Institute (NYSP2I) was tasked with evaluating TCE chemical alternatives and aqueous cleaning methods (vacuum cycle nucleation (VCN) and ultrasonics) for potential use at Rochester Steel. To accomplish these tasks, NYSP2I collected baseline data, mapped the quench/heat treat process, evaluated alternative cleaners to TCE, identified and tested alternative cleaning methods, and performed an economic analysis for alternative chemistries and cleaning methods.

Results

Testing with the VCN and ultrasonic units verified the technology capabilities for cleanliness and rust resistance on the parts. The worked performed by NYSP2I led to finding feasible alternatives to TCE. These technologies are commercially available for Rochester Steel to consider.

- Investing in ultrasonic or VCN systems can potentially reduce cleaning operating costs by 83-87% with estimated paybacks of 3 months for the ultrasonic system and less than one year for the VCN.
  - Investing in either technology eliminates hazardous waste management costs.
- Kyzen Metalnox M6314, an oil-splitting aqueous cleaner with rust inhibitors, proved to be an effective cleaner when used in either VCN or ultrasonics.

CHALLENGE

- Rochester Steel Treating Works wanted to identify sustainable alternative methods to vapor degreasing that would eliminate the use of trichloroethylene (TCE)

SOLUTION

- NYSP2I evaluated TCE chemical alternatives and aqueous cleaning methods vacuum cycle nucleation (VCN) and ultrasonics for potential use at Rochester Steel Treating Works

RESULTS

- Testing with the VCN and ultrasonic units verified the technology capabilities for cleanliness and rust resistance on the parts
- The worked performed by NYSP2I led to finding feasible alternatives to TCE
- Rochester Steel Treating Works intends to implement an alternative technology to replace TCE in 2019

RSTW

Evaluation of Cleaning Alternatives to Trichloroethylene Vapor Degreasing

NYSP2I | New York State Pollution Prevention Institute

Evaluation of Cleaning Alternatives to Trichloroethylene Vapor Degreasing

Rochester Steel Treating Works

- Commercial heat treating company located in Rochester, NY established in 1932.
- RSTW offers a range of services to client companies for production parts or tooling.
- RSTW heat treating processes include vacuum furnaces, nitrogen & oil quenching, case hardening, and induction hardening.

Work Performed

- NYSP2I evaluated TCE chemical alternatives and aqueous cleaning methods including vacuum cycle nucleation (VCN) and ultrasonics for potential use at Rochester Steel Treating Works

Results

- Testing with the VCN and ultrasonic units verified the technology capabilities for cleanliness and rust resistance on the parts
- The worked performed by NYSP2I led to finding feasible alternatives to TCE
- Rochester Steel Treating Works intends to implement an alternative technology to replace TCE in 2019
- Expected payback less than 1 year (TCE costs and disposal, regulatory fees)

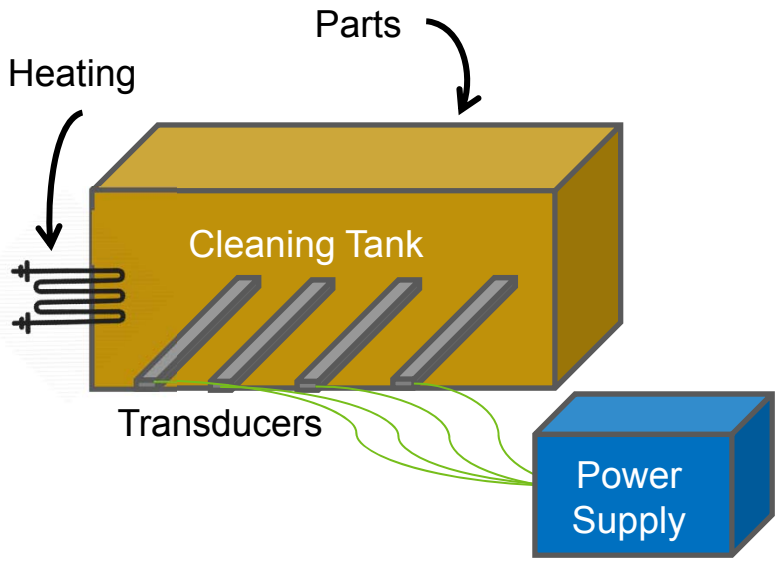
RSTW
Rochester Steel Treating Works, Inc.

"The New York State Pollution Prevention Institute (NYSP2I) was instrumental in identifying more environmentally friendly solutions to our cleaning process. As an independent source, the NYSP2I evaluates all options and seeks what is best for your company. The members of the team were a pleasure to work with and we would highly recommend their services."

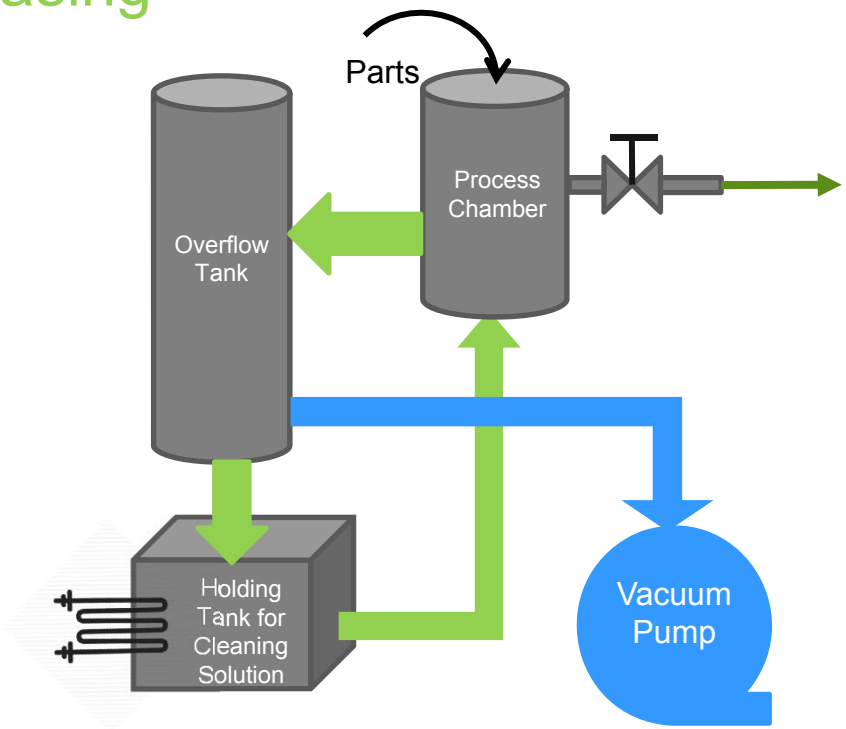
Brian Miller
Chief Operating Officer
Rochester Steel Treating Works, Inc.

Evaluation of Cleaning Alternatives to Trichloroethylene Vapor Degreasing

ULTRASONICS



VCN



Thank You

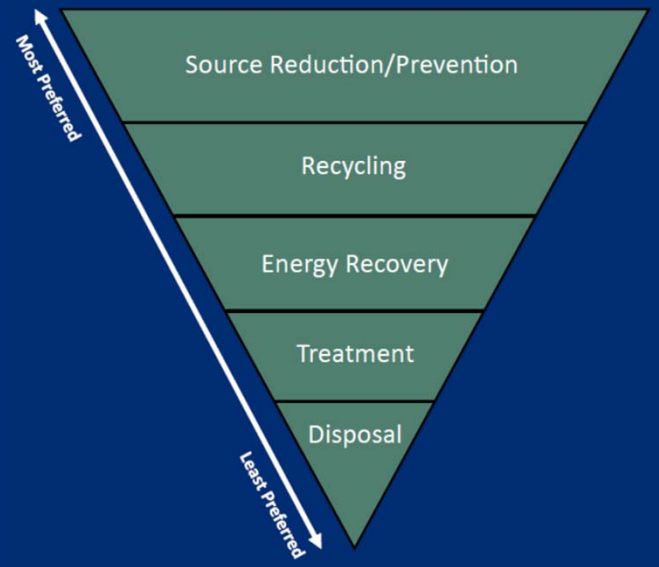
Rochester Institute of Technology
111 Lomb Memorial Drive, Bldg. 78-2000
Rochester, NY 14623

Phone: (585) 475-2512
Email: nysp2i@rit.edu
Web: www.rit.edu/affiliate/nysp2i

Funding provided by the State of New York.

Hazardous Waste Reduction Planning

- Established under Article 27, Section 0908 of the Environmental Conservation Law (ECL 27-0908)
- Applicable to generators ≥25 TPY or TSDFs
- Intent of program:
  - To reduce volume and toxicity of HW through reduction planning
  - Promote waste management hierarchy



NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Program Requirements

- Develop, implement and submit a written HWRP by July 1
- Submit Annual Status Report (ASR) one year following submittal of HWRP, by July 1
- Submit Biennial Update (BU) one year after ASR, by July 1

For HWRP, ASR, and BU

Which waste streams to include (throughout report/tables):

- At least 90% of HW **generated***

generated* *this includes hazardous wastewaters*

OR

- Waste streams ≥5 TPY

(*Whichever represents greater amount*)

AND

- All acute hazardous waste streams

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

For HWRP, ASR, and BU – Table 1

COMPANY NAME	EPA I.D. NUMBER
Chemical Corp.	NYD008675309

TABLE 1

WASTE STREAM ID NUMBER	NAME OF WASTE	EPA HAZARDOUS WASTE CODE(S)*	SOURCE OF GENERATION	DISPOSAL MANAGEMENT METHOD CODE**	QUANTITY OF WASTE GENERATED (TONS)				PRODUCTIVITY INDEX BASE INDEX = 1 (YEAR HWRP FIRST SUBMITTED)			
					2012	2013	2014	2015	2012	2013	2014	2015
WS-1	Spent Solvent	D001, D004	Equipment Cleaning	H040			100	105			1.0	0.9

- Name of Waste, Waste ID Codes
- Source of Waste, Management Method
- Qty. of HW Generated (Tons)
- Productivity Index

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

For HWRP, ASR, and BU

Tips for Table 1

- Be sure to include EPA Waste Codes and Disposal Management Method Codes for each waste stream
- Waste generation quantities need to be in tons
- In initial HWRP submittal, Productivity Index = 1
  - Following years should be based on "production" in current year compared to base year:

$$PI_{2018} = \frac{Prod._{2018}}{Prod._{Base\ Year}}$$

Please include a sample calculation in your submittal

Example: $PI_{2018} = \frac{50{,}000\ hover\ boards\ in\ 2018}{48{,}000\ hover\ boards\ in\ 2016} = 1.04$

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

For HWRP, ASR, and BU – Table 2

COMPANY NAME	EPA I.D. NUMBER
Chemical Corp.	NYD008675309

TABLE 2

WASTE STREAM ID NUMBER	NAME OF WASTE	WASTE STREAM AFFECTED	REDUCTION PLANS/PROJECTS	ESTIMATED WASTE REDUCTION (TONS)	METHOD USED TO CALCULATE *ROI	*ROI (EST)	GOAL DATE	REMARKS
WS-1	Spent Solvent	Cleaning Wastes	Switch to steam cleaning	50	PP	6 mo.	Q1 2020	Reduce solvent use

- Name of Waste, Reduction Plans/Projects
- Estimated Waste Reduction (tons)
- Return on Investment
- Goal Date for Implementation

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

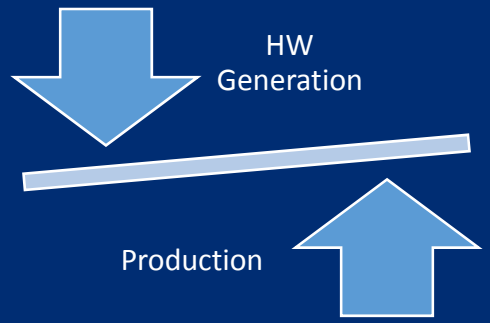
For HWRP, ASR, and BU

Tips for Table 2

- Reduction Plan/Project – Provide brief description of each plan/project
- Estimated Waste Reduction – Estimate based on knowledge of waste stream, or can be based on formal calculation
- Return on Investment (ROI) – Several different methods available
- Goal Date – Date by which reduction plan will be implemented
- Remarks – Provide additional details on any of the previous columns

For ASRs

- Update Table 1 and Table 2 (→ *More discussion after BU slides*)
- Describe progress in achieving time schedule for implementation laid out in HWRP (or BU)
- If not implemented as planned, provide reason
- If reduction alternative is not achieving reductions, another alternative may be selected (briefly describe action in ASR, more detailed account in BU)



For ASRs

Common Omissions

- Waste generation quantity discrepancies – make sure the numbers in Table 1 match the numbers in the Annual Hazardous Waste Report;
- If implementation schedule changed, provide reason, update Table 2; and
- Need estimated waste reductions or goal dates in Table 2

For BUs

- Describe changes in waste generation and reduction plans since HWRP or previous BU;
- Updated Table 1 – be sure to include new acute waste streams, streams over 5 TPY or streams newly included in 90%
  - If new streams, plan should also include:
    - Narrative description of source of generation, method of disposal;
    - Productivity index;
    - Evaluation of feasibility and practicability of implementing reductions (incorporate this into Table 2)
- Updated waste management cost estimates;
- Updated Table 2 – be sure to note any completed plans, re-evaluate existing plans, and provide updated schedules as necessary;
- Updates to training program, corporate goals, resources (if any)

For BUs

Re-evaluate Waste Reduction Alternatives

- Substitution of non-toxic/less toxic inputs
- Reformulation or re-design of end products (i.e., product re-design)
- Modification or re-design of production processes or equipment (e.g., increased efficiency)
- Changes in usage, storage, and handling (e.g., inventory control)
- Closed-loop reclamation, re-use, and recycling (i.e., recycle waste back into process)
- On-site/off-site recycling to reduce amount to be treated/disposed (e.g., off-site reclaim)

Waste Stream	Material Substitution	Product Re-design	Process Modification	Storage and Handling	Closed-loop reclaim	On-site/Off-site Recycle
WS-1	**Feasible**	Won't meet spec	**Feasible**	**Feasible**	Attempted (Ineffective)	Not Available
WS-2	ROI > 5 years	Won't meet spec	**Feasible**	ROI > 5 Years	**Feasible**	**Feasible**

For BUs

Re-evaluation of Alternatives (Cont.)

Any waste reduction alternatives that are selected (feasible/practicable) need to be put into Table 2, along with:

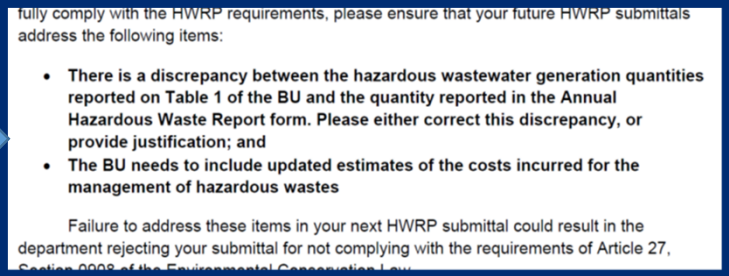
- Estimated waste reduction (in tons);
- Schedule for implementation;
  - If multi-step implementation – give schedule for next step
- Return on Investment (ROI);
  - Various methods – Payback period, annualized costs, increased rate of return

For BUs

Common Omissions

- Waste generation quantity discrepancies – make sure the numbers in Table 1 match the numbers in the Annual Hazardous Waste Report;
- If new waste streams – need full details similar to HWRP write-up;
- Updated costs for waste management needed;
- Estimated waste reductions and goal dates needed in Table 2; and
- If no evidence of re-evaluation of waste reduction alternatives in past submittals, this needs to be done in the BU

Text from a DEC comment letter:



fully comply with the HWRP requirements, please ensure that your future HWRP submittals address the following items:

- **There is a discrepancy between the hazardous wastewater generation quantities reported on Table 1 of the BU and the quantity reported in the Annual Hazardous Waste Report form. Please either correct this discrepancy, or provide justification; and**
- **The BU needs to include updated estimates of the costs incurred for the management of hazardous wastes**

Failure to address these items in your next HWRP submittal could result in the department rejecting your submittal for not complying with the requirements of Article 27,

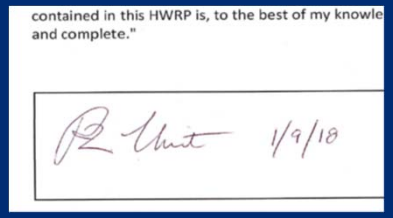
NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Recent Changes (HWRPs, ASRs, and BUs)

- Fillable PDF forms available on our website (with built-in Excel Tables 1 and 2);
- Separate Excel Tables 1 and 2 available for sites that can't use PDF option;
- We have included a certification statement in our fillable PDFs;
  - Signed by senior level staff member who:
    - Is familiar with contents of plan and knowledgeable of program requirements and
    - Can commit resources to implementing reduction plans
    - For fillable PDF, digital signatures are acceptable; hand-signed, scanned also accepted if fillable PDF is not used.

Digital Signature:

Signed and Scanned:



NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Resources

On NYSDEC Website:

- Guidance Document for Hazardous Waste Reduction Plans, Annual Status Reports & Biennial Updates (link)
- HWRP fillable form (link); ASR fillable form (link); and BU fillable form (link)
- * NEW - Previous Webinars and P2I Case Studies (link)
- * NEW - Fact Sheet on Solvent Reduction (link)

Other Resources:

- NEWMOA Pollution Prevention Website (link) – Has links to P2Rx and P2 Infohouse
- EPA Pollution Prevention Website (link) – Links to P2 for Business page

Support From NYSP2I

- **NYSP2I** can assist with finding easy-to-implement waste reduction solutions **(but not writing HWRP submittals).**
- **NYSDEC** staff can assist with any questions on the development of the HWRP.

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Questions?

Thank You

Pollution Prevention Unit
Division of Materials Management
(518) 402-9469
HW.ReductionPlanning@dec.ny.gov

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation