Reduce Hazardous Waste and Save Money

New York State Pollution Prevention Institute (NYSP2I)

Eugene Park & Trish Donohue

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Agenda

• About NYSP2I

• What is Sustainability & Pollution Prevention (P2)?

• Pollution Prevention Assessments for Hazardous Waste & other Environmental Impacts
  • Screening
  • Assessment
  • Implementation

• Examples of NYSP2I Assistance Provided

• Q&A Session
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

Ms. Donohue provides technical assistance to businesses including:
- Manufacturing Process Assessment
- Supply Chain Optimization
- Material and Energy Balances
- Evaluation of environmentally preferable and cost-effective alternatives

Trish Donohue
Senior Pollution Prevention Engineer
Rochester Institute of Technology

- Founded in 1829
- Privately endowed, co-ed university
- 9 colleges emphasizing career education and experiential learning
- 18,600 undergraduate and graduate students in Rochester, NY
- International locations in Eastern Europe, Dubai, and China
Golisano Institute for Sustainability

- Technical problem-solving and applied R&D for manufacturers
  - Product design innovation
  - Process efficiency
  - Pollution prevention
  - Resource efficiency
  - Technology validation
  - Advanced manufacturing technology deployment

- Professional staff working exclusively on industrial engagements

- Customized executive and workforce training & workshops

- Confidential or collaborative engagements

- Expertise across variety of industry sectors and technology domains
NYS 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 Business Assistance

- Must be **NY-based** company
- Technical assistance draws from a multi-disciplinary team of 100+ industry-experienced engineers, technicians and environmental scientists
- Typical project ranges from 3-6 months with cost ranging from $15K - $50K
- **NYS funding** offsets most of the project cost to the company for non-capital expenses
- Post-project reporting ranging from 3-5 years
- Desired project **outcomes** include job creation/retention, cost savings, sales increase, waste reduction
Technical Expertise

- 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 Results

As of January 2017,

- Over 225 companies assisted to date
- Nearly $3M in R&D projects funded to solve industry problems
- Over $1M invested across nearly 80 communities in NYS
- Impact
  - Almost 10M pounds of waste & emissions reduced
  - 90M+ gallons in avoided water use and 62M+ gallons of avoided discharges
  - Nearly 13M kWh in reduced electricity use
What is Sustainability?

Many terms for addressing social, environmental and economic initiatives:

- “3Ps” – People, Planet, Profit
- “Triple Bottom Line”
- “Corporate Social Responsibility”
- “Corporate Citizenship”
- “Sustainable Growth”

Each company or organization should define how they address “sustainability”

Sustainability is actualized
In evaluating P2 opportunities, organizations should start at the top of the pyramid (i.e., source reduction) and work their way down as needed to define the most appropriate methods for preventing pollution.

Source: U.S. EPA
Pollution Prevention Hierarchy

Source Reduction
• Product / process change
• Green chemistry / toxics reduction

In-Process Recycling
• Direct reuse of materials or by-products in process

Other Recycling
• Reuse / repurpose of waste in other applications
• Anaerobic digestion

Treatment and Disposal
• Safe conversion of waste to environmentally-friendly form
• Proper disposal
• LAST RESORT

Source: U.S. EPA
Direct Assistance with NYSP2I: How it works

**Phase 1**
- Initial Contact
- Company Screening
- Develop Scope of Work

**Phase 2**
- Assessment
- Recommendations
- Feasibility Study (Optional)

**Phase 3**
- Implementation
- Case Study
- Follow-up
Pollution Prevention 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 Technologies

Process stream segregation

Operation 1

Operation 2

Operation 3

Mixture of Waste
(hazardous, non-hazardous and/or wastewater)
Pollution Prevention Technologies

Process stream segregation, cont.

Operation 1

Hazardous waste (smaller volume)

Operation 2

Non-hazardous waste

Operation 3

In-Process Recycling
Innovative P2 Technologies

Vacuum Cycle Nucleation

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

![Image of a cleaning application with VCN and Ultrasonic results]

![Bar chart comparing mass % cutting oil removed between VCN (50 pulse, 1s on, 1s off) and Ultrasonic]
Membrane Filtration

Batch Mode

Semi-Batch Mode

Continuous Mode
Case Studies
Evaluation of Vacuum Cycle Nucleation (VCN) as an Environmentally Preferable Cleaning Process

Precision Parts Manufacturer
- Main product line: Small parts with tiny openings
- Current precision cleaning process relies on multi-stage ultrasonics that utilizes over 1500 gal/year of caustic cleaning chemicals at a cost of over $60,000/year
- Other issues include higher than acceptable reject rates

Work Performed
- NYSP2I performed a series of VCN tests under different operating conditions (chemical type, chemical concentration [<1%], temperature, pulse pattern, total cleaning time)
- Preliminary economic analysis

Results
- Optimum VCN process was determined which increased cleaning effectiveness significantly (lower rejection rates)
- Chemical costs savings calculated to be over $60,000/year
- Implementation is economically justified, 1-2 year payback
Recovery of Cerium Oxide and Solvent Substitution

Sydor Optics
- Main product line: Optical lenses for industrial application
- Almost 50% of expensive polishing compound (cerium oxide, CeO2) lost to sewer as TSS (9-10 kg/day, $15,000-20,000/year); 3-400 gallons xylene used to remove wax from lenses
- Looking to recover more CeO2 and reduce or eliminate use of xylene in lens cleaning

Work Performed
- NYSP2I evaluated 1) solids separation and recovery technologies (centrifugation and membrane filtration) to capture more CeO2 and 2) different alternative chemistries and processes to clean prepared samples

Results
- Bigger centrifuge and microfiltration can increase CeO2 recovery to 100%; TSS loadings to sewer would also be eliminated
- Hot water, ultrasonics, and small amounts of acetone possible replacement for xylene
- Implementation is economically justified, 1-2 year payback
- Follow-up implementation project has commenced
Halogenated Solvent Use Reduction in Corian® Production

DuPont
- Main product line: Corian® solid surface material
- 8,400 lbs/year methylene chloride (MeCl2) and 1,750 lbs/year of trichloroethylene-perchloroethylene spray (TCE-PCE) used as cleaning chemicals
- Looking to reduce or eliminate use of halogenated solvents

Work Performed
- NYSP2I evaluated different alternative chemistries and processes to clean prepared samples

Preliminary Results
- Potential to eliminate 100% MeCl2 and TCE-PCE use at the facility using more benign chemistries and processes
- For MeCl2 replacement, positive results were observed with Acrastrip 950, VCN, and ultrasonics
- For TCE-PCE replacement: CRC Chlor-Free Non-Chlorinated Degreaser, Sakrete Concrete Mortar Dissolver, Bio-Solv & Acrastrip 950 were also positive
- Further feasibility studies & economic analysis needed
Optimization of Dewatering/Drying Process in Manufacturing of Dog Treats

Full Circle Feed
- Start-up company located in Syracuse that produces dog treats from leftover buffet food destined for landfill
- Requested assistance to optimize energy use and evaluate management of wastewater to enable company expansion

Work Performed
- NYSP2I performed a baseline energy analysis, wastewater analysis, and a drying analysis which examined how drying time is affected by an alternative drying technology (convection)

Results
- Forced-air convection oven would reduce drying time by 64%, resulting in a corresponding reduction in energy usage and an estimated $1344 savings in annual energy costs based on current production rates
- Wastewater contains high levels of organics and solids. Simple settling would reduce organic content by over 50% and reduce potential surcharges
PeroxyChem LLC manufactures hydrogen peroxide, peracetic acid, persulfates and adjacent technologies in Tonawanda, NY.

Work Performed
- Evaluated new metal cathodes to find the root cause of corrosion and shorter life-span using Scanning Electron Microscope (SEM) analysis and SEM Energy Dispersive X-ray (EDX).
- Identified potential coatings and conducted accelerated corrosion and delamination tests.

Results
- Determined original coating had poor performance and the new metal had a manufacturing defect.
- Identified an alternative coating material that can potentially withstand the process environment, prevent corrosion, and provide improved longevity for the new cathode metal.
- Should the new coating material be implemented, it would enable the replacement of the previous cathode metal thereby eliminating toxic materials and the generation of over 1,000 pounds of toxic hazardous waste.
Title: Tread-End Cement Reduction

Project Mission:
Reduce the amount of Volatile Organic Compounds (VOC) exhausted at the Goodyear Dunlop Tire North America (GDTNA) Plant located in Tonawanda, New York. Reduce the amount of Cement applied to the end of treads on the 224 and 227 Extruding lines and reduce the amount of dollars spent on Tread-End Cement.

Improvement Goals

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<thead>
<tr>
<th>Improvement Goals</th>
<th>Current State</th>
<th>Future Goal</th>
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<tbody>
<tr>
<td>1. Reduce VOC at Buffalo Plant</td>
<td>Not Optimal</td>
<td>Better</td>
</tr>
<tr>
<td>2. Reduce Tread-End Cement</td>
<td>6.8 grams/Tread</td>
<td>3.5 grams/Tread</td>
</tr>
<tr>
<td>3. Reduce Tread-End Cement Cost</td>
<td>$54,000 / Year</td>
<td>$24,000 / Year</td>
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Improvement Category:

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<th>Safety</th>
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<td>Quality</td>
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<tr>
<td>Cost</td>
<td>X</td>
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<tr>
<td>Engagement</td>
<td>Communications</td>
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Grams of Cement Per Treads By Week
Monthly Average of Grams VOC per Tread End Cemented 2014

Average monthly regulatory limit = 10 grams / tread.

Baseline = 6.8 grams / tread

No cementing in D228

New Average = 3.3 grams / tread

- Improved gun height above the tread
- Changed photo eyes from AC to DC
- Shortened air lines between solenoid valves and spray guns
Thank You

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