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
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
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
Manufacturing Case Studies

**Auto Parts Mfr.**

**Challenge:** Metal plating uses high volumes of water needing treatment

**Solution:** Use pH & TDS to set flow rate in rinse baths to reduce water

**Results:** Save >5.5 M gals water/yr & $35,000/yr

**Challenge:** Equipment cleaning event generates high vol. and costly hazardous waste

**Solution:** Use heat to increase solubility of contaminants & use less water for cleaning. Use technology to recover and reuse good material.

**Results:** Reduce 50,000 lbs HW/event; Reclaim 32% of material; Save $50,000/event

**Challenge:** Product loss and high vol. waste created during equipment cleaning

**Solution:** Maintain temperature to improve product flow. Use technology to recover product.

**Results:** 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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NYSP2I followed the DMAIC approach for “process improvement”:

[Diagram showing the DMAIC process: Define, Measure, Analyze, Improve, Control]

https://nearyou.imeche.org/eventdetail?id=13840
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
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**

<table>
<thead>
<tr>
<th>Area</th>
<th>Goal</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Reduction</td>
<td>Become Zero waste to landfill certified</td>
<td>• Reduce landfill waste to less than 5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase source reduction by 60%</td>
</tr>
<tr>
<td>Yield</td>
<td>Reduce waste across manufacturing processes</td>
<td>• Improve yield for filling and mixing lines by 2% each.</td>
</tr>
<tr>
<td>Waste Management Costs</td>
<td>Reduce waste management costs</td>
<td>• Increase source reduction on line to 60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase line yield to 98%</td>
</tr>
</tbody>
</table>
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.
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.
Measure: Examples

- Process Map
- Baseline data
- Pareto
- Cost

### Category and Percent of Total

<table>
<thead>
<tr>
<th>Category</th>
<th>One run, lbs</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>3865</td>
<td>42.70%</td>
</tr>
<tr>
<td>Line Waste</td>
<td>1465</td>
<td>16.20%</td>
</tr>
<tr>
<td>Transfer Lines</td>
<td>1200</td>
<td>13.20%</td>
</tr>
<tr>
<td>Drip Catchers</td>
<td>1040</td>
<td>11.50%</td>
</tr>
<tr>
<td>Filler Flushing</td>
<td>820</td>
<td>9.10%</td>
</tr>
<tr>
<td>Tank Heels</td>
<td>668</td>
<td>7.40%</td>
</tr>
</tbody>
</table>

### Loss Line Item and Dollar

<table>
<thead>
<tr>
<th>Loss Line Item</th>
<th>Dollar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor Loss</td>
<td>$37,237</td>
</tr>
<tr>
<td>Disposal 1</td>
<td>$699,516</td>
</tr>
<tr>
<td>Disposal 2</td>
<td>$73,840</td>
</tr>
<tr>
<td>Raw Material</td>
<td>$548,250</td>
</tr>
<tr>
<td>Margin loss</td>
<td>$194,635</td>
</tr>
<tr>
<td>Total</td>
<td>$1,553,478</td>
</tr>
</tbody>
</table>
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

### Baseline Tank Cleaning Cost

<table>
<thead>
<tr>
<th>Line Item</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Labor Cost</td>
<td>$101/hr</td>
</tr>
<tr>
<td>Replacement Material</td>
<td>$1.10/lb</td>
</tr>
</tbody>
</table>

### Hazardous Waste Costs

<table>
<thead>
<tr>
<th>Line Item</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous Waste Liquid disposal cost</td>
<td>$0.88/lb</td>
</tr>
<tr>
<td>Hazardous Waste Solid disposal cost</td>
<td>$1.00/lb</td>
</tr>
<tr>
<td>DEC Fee for Liquid Waste</td>
<td>$16/ton</td>
</tr>
<tr>
<td>DEC Fee for Solid Waste</td>
<td>$27/ton</td>
</tr>
<tr>
<td>DEC Large Quantity Generator Fee</td>
<td>$130/ton</td>
</tr>
</tbody>
</table>
Analyze

The baseline data is now ready for evaluation
Analyze & Improve

Improve the current state to reach goals

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

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

```
3233: Single Rinse
225
3201B: Nitric Predis. after Zn
225
3232: Cascade Rinse
490
```

<table>
<thead>
<tr>
<th>pH</th>
<th>conductivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.78</td>
<td>955</td>
</tr>
<tr>
<td>4.09</td>
<td>2099</td>
</tr>
</tbody>
</table>

**flow**

*After* / *Improvement*:

```
3233: Single Rinse
225
3201B: Nitric Predis. after Zn
225
3232: Cascade Rinse
490
```

2 gpm

```
0 gpm
pH and conductivity TBD after implementation
```

```
2 gpm
pH and conductivity TBD after implementation
```

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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
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
More Information Available:

- **Visit P2I at**: [www.rit.edu/affiliate/nysp2i/](http://www.rit.edu/affiliate/nysp2i/)
- **Case studies available at**: [www.rit.edu/affiliate/nysp2i/business-assistance/case-studies](http://www.rit.edu/affiliate/nysp2i/business-assistance/case-studies)
Question & Answer

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Thank You