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# P2 Case Studies in Waste Reduction:

Cleaning,  
Acid Waste,  
Plating Wastewater,  
Offices

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## The Cleaning Problem

- Most surface treatments start with cleaning.
- Cleaning is a critical operation for many industrial processes
- Cleaning includes rinsing which typically has high water volume use and requires post-use treatment




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## *Purpose of Cleaning Steps*



- **What is being removed? Oil? Dirt? Rust?**
- **What is final state of the part surface supposed to be before the final surface treatment?**
  - **Water sheet clean? Ready for plating.**
  - **Phosphated? Ready for painting or powder coating.**


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## Purpose of Rinsing Steps

- **Extend the life of the following chemistry step (i.e. don't drag concentrated acid into alkaline tank and vice versa)**
- **Stop the reaction of the cleaning step (i.e. stop the attack of the acid etch step)**
- **Prevent water spotting (i.e. keep parts wet until they get to the next step)**


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## *Cleaning Steps Required?*

- How many steps needed to get to final surface treatment?
- What are the pollution impacts of each step?
  - Water use
  - Energy use
  - Non-hazardous waste generation
  - Hazardous waste generation
  - Chemical consumption


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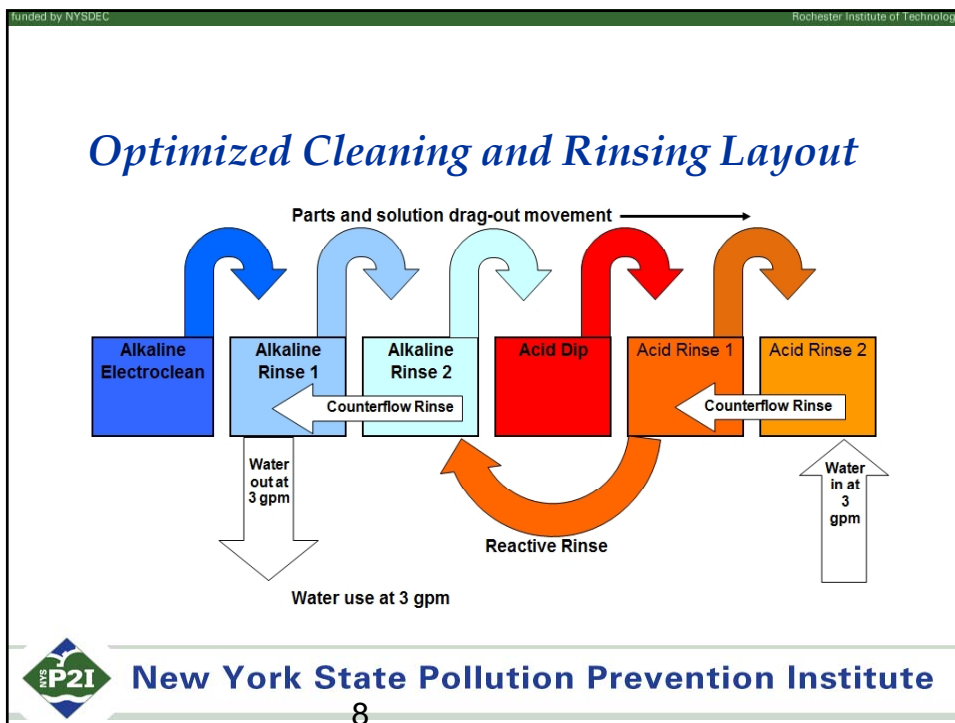
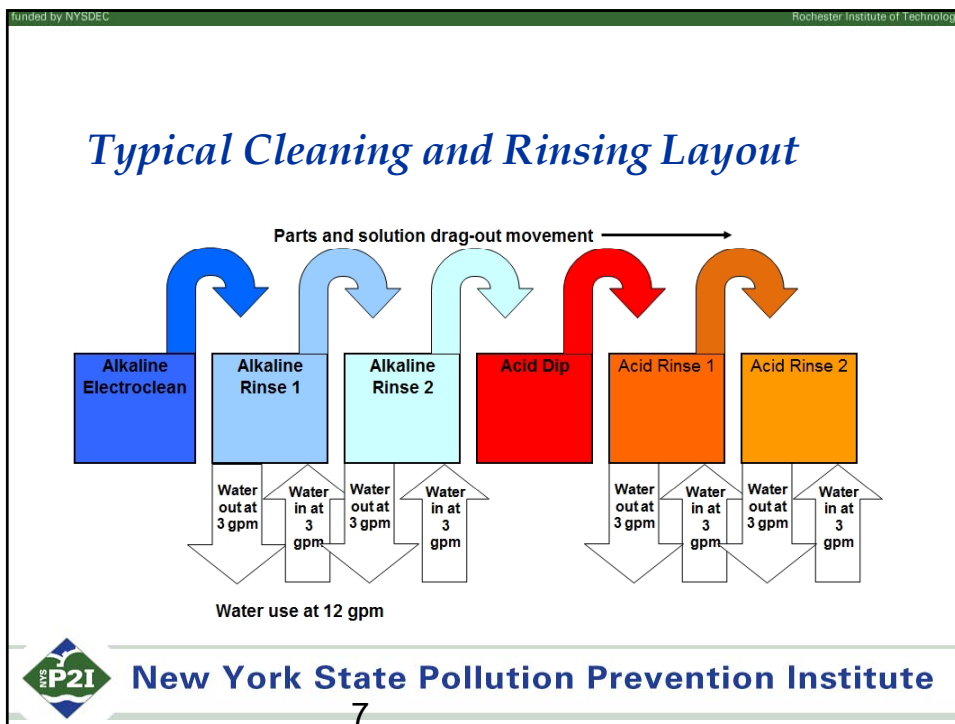
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## *Typical Cleaning Steps*

1. Alkaline cleaner, could include ultrasonics, agitation, or electrocleaning to assist the cleaning chemistry in contaminant removal
2. Rinses (parts drag in alkali to rinse water)
3. Acid etch, to remove light rust or oxides
4. Rinses (parts drag in acid to rinse water)
5. Sometimes a repeat of the alkaline and acid steps

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## Acid Waste Problem

- Acid is consumed in the process of etching metal
- The dissolved metal builds up in the acid solution as parts are processed through it
- Spent acid must be treated to remove the metal and acid before disposal


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## Possible Solutions

- In some acid systems PRO-pHx<sup>®</sup> precipitates the dissolved metal allowing it to be filtered out
- In other acid systems the chemical reactions can be analyzed and the acid life can be extended by proper acid measurement and management

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## Results from Coating Technology

**Business:** Nickel plater and aluminum anodizer

**Action:** Implemented PRO-pHx in their HCl acid etch tanks


- Virtually eliminated acid waste treatment which included savings on NaOH to neutralize the residual acid and associated sludge disposal
- Saved on acid purchases
- More consistent steel etching and cleaner acid baths
- Equipment costs minimal; a pump and filter for each tank
- Annual savings of \$21,000 and 6,800 gallons of acid waste

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## Results from TECT Power



**Business:** Manufacturer of steel and titanium turbine blades and components

**Action:** Develop better methods of monitoring and controlling a nitric acid-hydrofluoric acid bath chemistry to maximize bath life.

- Savings in acid disposal (including transportation), \$29,500
- Reduction in purchased acid, \$28,000/yr.


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## Cleaning Chemistry Problem


- Most aqueous cleaners for metals are alkaline and therefore need to be treated before disposal or have a significant waste hauler cost
- The cleaners lose their effectiveness as oil and dirt builds up during use
- Purchasing the cleaner chemistry can add up to significant \$ on an annual basis

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## Cleaning the Cleaner

- Oil removal
  - Superator® to remove both the surface oil and most of the emulsified oil
  - Ultrafiltration to break the oil emulsions to separate out the oil
- Solids removal
  - Centrifugal separation to separate the liquid phase from the solids
  - Ultrafiltration to allow the cleaning chemistry through but hold back the suspended solids

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## Potential Results from D&W Diesel,

project still in-process

Business: Remanufacturer of Heavy-duty Turbochargers, Starters, Alternators, and Fuel Systems Components

**Action: Extension of washwater to reduce waste disposal and cleaning chemistry costs using continuous ultrafiltration**

- Higher product quality from more consistent cleaning results
- Annual savings of \$8,700 for the cost of cleaning chemicals
- Annual savings of \$6,300 associated with reduced disposal cost
- Cost of equipment, \$14,700 with a 1 year payback




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## Problem: Treated Wastewater from Cleaning and Plating Lines

- Problem:
  - Treated wastewater is typically low in metals and high in dissolved solids such as NaCl (neutralization of HCl with NaOH in the treatment process) or some other salt from neutralization.
  - Rinse water is the primary source of wastewater in cleaning and plating systems
  - If the dissolved solids were removed the water could be reused as rinse water



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## Reusing Treated Water

- Reverse Osmosis (RO) is the best candidate for recovering treated water for reuse


**Figure 1.**

**Figure 2.**

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## Potential Results from Steel Plater XYZ,

project still in-process

**Business:** Job shop zinc plater

**Action:** Reduce rinse water use on the high volume plating line

- Reactive rinsing
- Counterflow rinsing
- PRO-pHx in HCl etch tanks
- Reverse Osmosis to reuse treated wastewater


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## Potential Savings


- Reactive Rinses
  - Save approx. 1.1 million gpy, ~\$3,000/yr.
- Counterflow Rinses
  - Save approx. 1.6 million gpy, ~\$4,300/yr.
- PRO-pHx
  - Save approx. 34,000 gallons of acid waste, ~\$123,000/yr.
- RO water treatment
  - Reuse approx. 1.75 million gpy, ~\$4,600/year

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## Problem:

## Greening the Office

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## Greening Offices: First Niagara

- Furniture audit
- Cleaning supplies
- Office supplies
- Waste audit
- Carpooling

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## Furniture and Cleaning Supplies


- For future wooden furniture purchases First Niagara will be looking for FSC certified wood furniture (sustainable wood products)
- They are already using Green Seal Certified cleaners

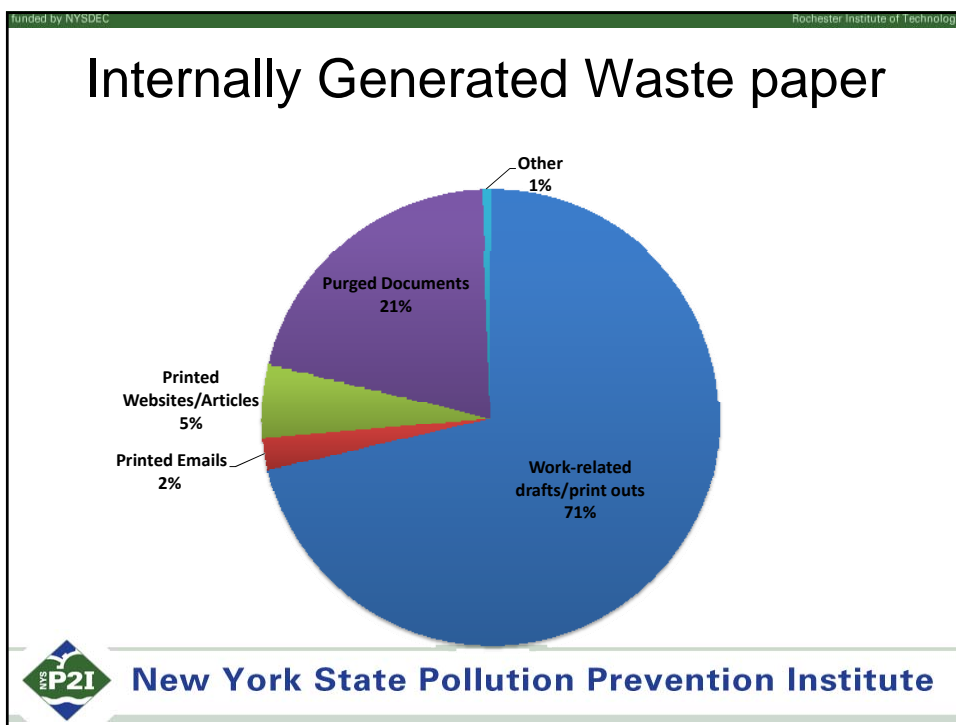
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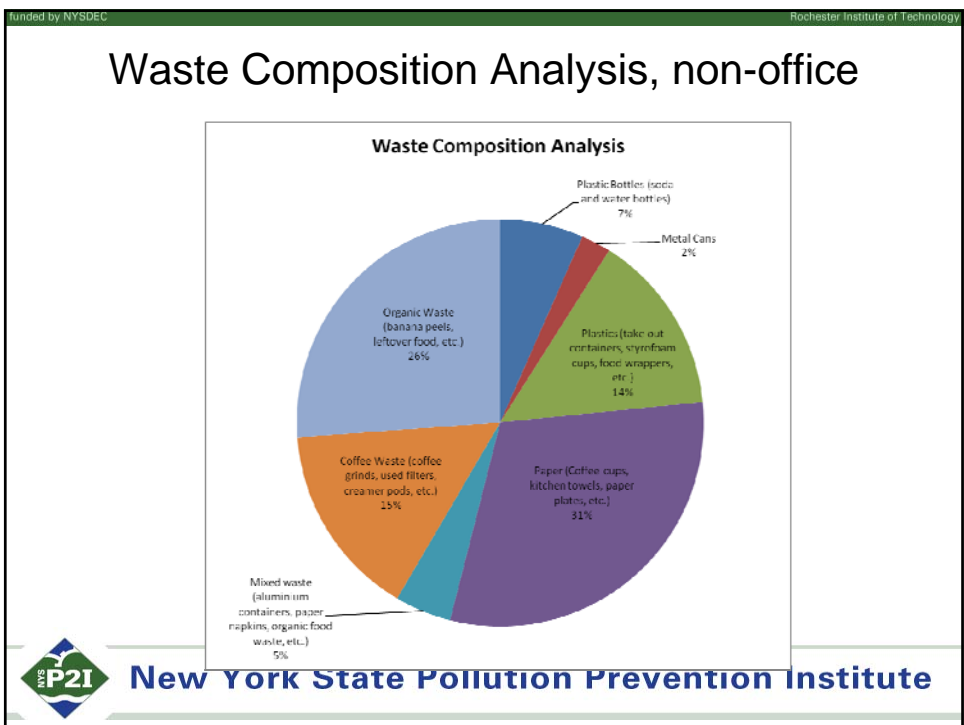
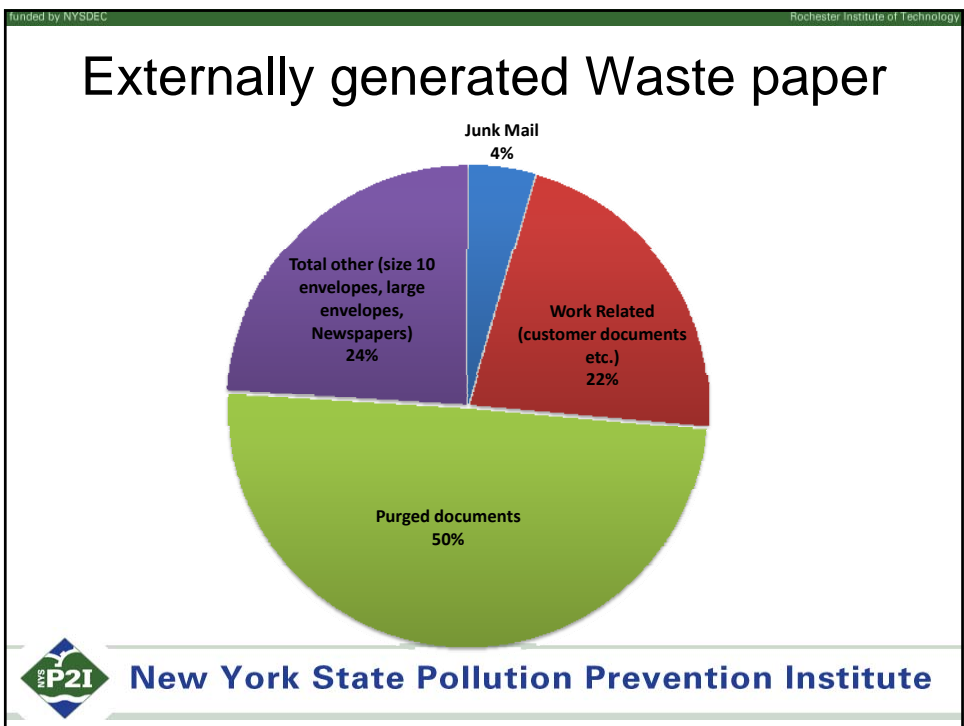
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## Solid Waste from the Office

- Printer paper was the largest category
- At the time of the survey, the printer paper had no recycled paper content
- At the time of the survey 38% of the employees did not print double sided copies
- Annual amounts of internally generated copies would drop from 6600# to 4300# if all copies were printed double sided (170 employees)

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# Carpooling


## Benefits


- Reduction in gas consumption
- Reduction in road congestion
- Get to start working before you get to the office (only kidding 😊)

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# Questions?



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