

# *Conducting A Cleaning Assessment*

**Presented by:**

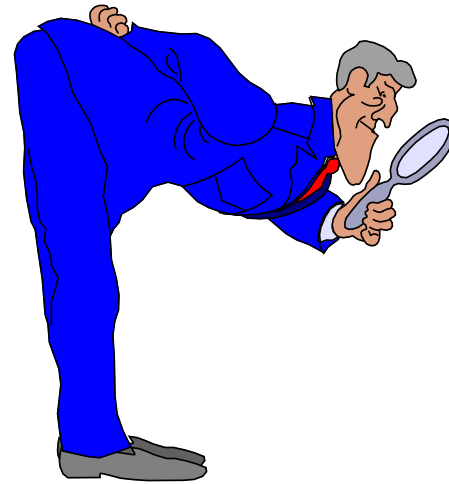
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**Business Manager**

**New York State Pollution Prevention Institute**

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# Overview



- *The Problem*
- *How clean is clean?*
- *What's new in cleaning technology for automotive rebuilders?*
- *How do I determine what's important in a cleaning process?*
- *Which cleaning technology is right for me?*

# *The Problem*

- **Cleaning is a critical, bottleneck operation for many maintenance activities**
- **Many popular cleaning chemicals have been banned or pose a risk to workers and the environment**
- **Assessing alternative methods can be challenging and time-consuming**



# *Partial MSDS for Mineral Spirits*

**Product Name:** Mineral Spirits 146 HT (Aliphatic Hydrocarbon)

**Hazards Identification:** May cause mild eye and skin irritation. Prolonged contact may dry the skin and cause burning, redness, and cracking of the skin. Repeated exposure may cause depression of the central nervous system, dizziness, nausea and unconsciousness

**Accidental Release Measures:** Eliminate all ignition sources. Notify proper authorities if a runoff has occurred.

**Handling and Storage:** Containers of this material may be hazardous when emptied. Release of hot vapors from process equipment may result in ignition without obvious ignition sources being present.

**RCRA Information:** Disposal of used or unused product subject to hazardous waste regulations due to flammability (flash point < 140 F).

# *Partial MSDS for Sodium Bicarbonate*

**Product Name:** Sodium Bicarbonate (Baking Soda)

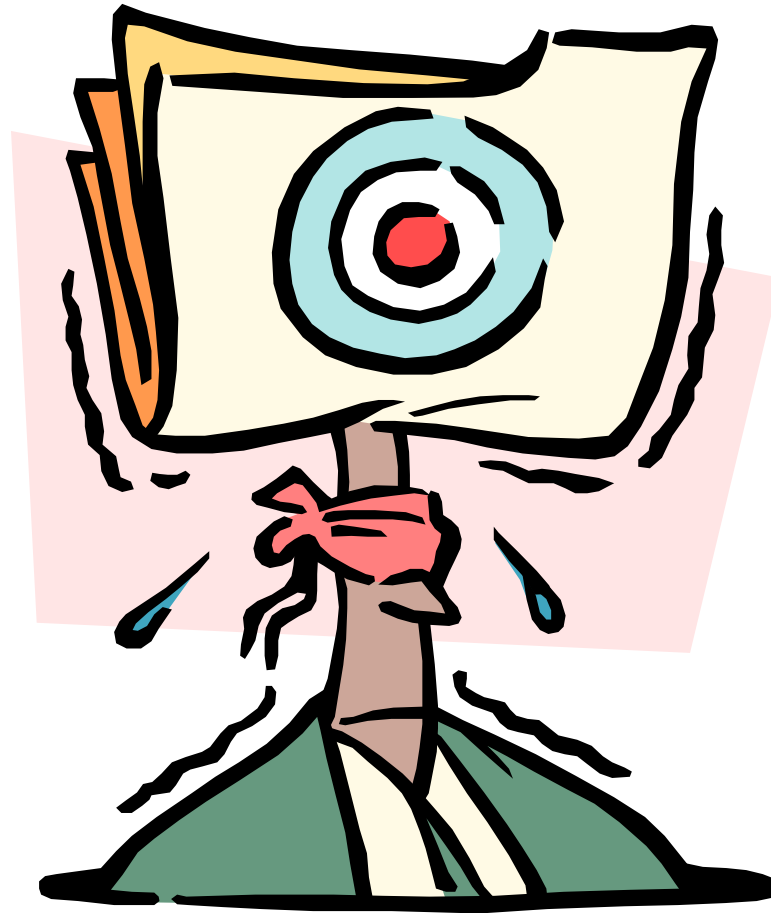
**Hazards Identification:** HMIS Rating is 0-0-0-X. Odorless white crystalline powder. May generate sparks during dry blasting with improperly grounded equipment. Nuisance dusts. No other significant health or environmental effects associated with these products.

**Subchronic Effects/Carcinogenicity:** None known. Contains no ingredients that are listed as carcinogens or potential carcinogens by IARC, NTP, OSHA, or ACGIH.

**Flammable Properties:** Non-flammable, non-combustible.

**Regulatory Information:** OSHA - Not hazardous under 29 CFR 1910.1200. CERCLA Reportable Quantity - none. RCRA - not a hazardous waste by listing or characteristic. SARA Title III - not regulated. DOT - no hazardous substance RQ.

# So How Do We Proceed?



# *Cleaning Assessment Objectives*

- **Assess current cleaning processes**
- **Identify potential alternative technologies**
- **Evaluate technical and economic feasibility of potential alternative technologies**
- **Develop recommendations**
- **Provide support for implementation**

# *Assess Current Cleaning Process*

- **Identify Problem**
- **Set up Site Visit**
- **Collect Data (see next slide)**
- **Evaluate Data**
- **Revise Problem Statement as Needed**
- **Prepare Baseline**

# *Collect Data (1 of 2)*

- **Current Cleaning Process (e.g. equipment, chemistries)**
- **Parts to be Cleaned (e.g. substrate, geometric complexity, sturdiness, throughput rates, size)**
- **Contaminants of Concern (e.g. grease, oil, paint, rust)**
- **Equipment Information (e.g. cycle times, temperatures, chemistries used & concentration)**

# Part Data Collection Sheet

## Turbocharger Remanufacturer Part Evaluation Sheet

By: mjo, mmb, cjs \_\_\_\_\_ Date: 7/8/98, 7/27/98 \_\_\_\_\_

Operator: \_\_\_\_\_ Time: \_\_\_\_\_

Part Name: Carrier Bearing Support  
Subassembly: \_\_\_\_\_

Item #: 149

Description:  
Material/Surface Finish: Pearlitic cast iron grade 30  
Stress relieve heat treatment  
Material/Finish Code: Cast  
C/C-M Machined surfaces



Model #	645	710	units
Part. Numl	835C8541	8491705	950T9341
Length	14	14.28	in.
Width	10	8.25	in.
Height	3.3	3.312	in.
Weight	18	32	lbs.

### Contaminants

Contaminant Description	Properties	Level
Oil	Thick film	H
Carbon	Suspended in oil	M

### Cleaning Method

	Cleaning Process and/or Agent	Effectiveness	Manual/ Time	
			Auto	Est.(mins)
1)	Proceco	Removes most oil, and some loose particles	A	20-30
2)	Zep Tanks (If necessary)	Effectively degrades and softens carbon	M	2-3
3)	Small Water Blaster	Imparts a "like new" finish	M	2-3
4)				
5)				
Total Cycle time (Range)				24-36
Total Manual Cleaning Time (Range)				4-6

### Requalification Considerations

Cleanliness:	
1)	Some rust is ok
2)	No grease, oil, carbon
3)	
4)	

Reject rate: Insignificant

Surface:	
1)	Surface will not be painted
2)	
3)	
4)	

Tolerance:	
1)	Look for cracks
2)	Check height of snap ring groove
3)	Bore Size
4)	

# Cleaning Process Data Collection Sheet

## Turbocharger Remanufacturer Cleaning Process Sheet

Process Name Aqueous Cleaning System

Bldg./Dept/Area Teardown

Equipment Proceco Typhoon  
Number \_\_\_\_\_

Features \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### Process Description

Load entire turbo onto system (Few exceptions)  
Main degreasing operation  
Two shifts 10 hr/shift (second shift is new)  
140-220 degree operating tem  
20-30 minute cycle

Soaps, Chemicals, Media

DuBois MC-726  
Sodium hydroxide solution  
\_\_\_\_\_  
\_\_\_\_\_

### Physical Data

Length (ft)	Width (ft)	Height (ft)	Footprint Area(ft <sup>2</sup> )
12	11	10	132

Operator area (ft <sup>2</sup> )	Staging area (ft <sup>2</sup> )	Number of stations	Total area req'd (ft <sup>2</sup> )
45	40	1	217

### Comments:

Palet jack used to transport large parts and a crane is used to  
lift them onto the machine  
Loading time: 11 min Loading of all part (Manual and with crane)  
Wash time: 20-30 min Timer set and allowed to run  
Unload time: 9 min Unload of all parts (Manual and with crane)  
\_\_\_\_\_  
\_\_\_\_\_

Disposal: C

4 months between cleaning  
(May go to 3 months)  
Bath is hauled away by  
disposal company  
\_\_\_\_\_  
\_\_\_\_\_



capacity 863 gallons  
turntable capacity 2000 lbs  
heating 48 kw  
largest motor 40.6 amps  
\_\_\_\_\_

### Electrical Requirements

110 A.C.	208 A.C.	230 A.C.	460 A.C.
	X		

### Other Utilities:

	Cold Water	Hot Water	Air
Ventilation	X		

### Loading Requirements:

Small parts are hand loaded. It take about 3 minutes to load  
all of the small parts. 3 minutes for the main housing,  
1 minute each for the exhaust duct, scroll, CBS

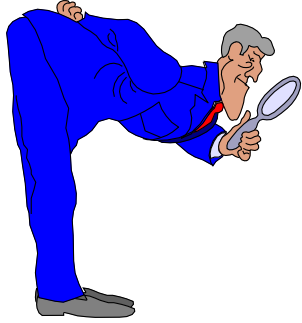
## *Collect Data (2 of 2)*

- **Financial Information (e.g. cost of power, labor, waste disposal; required payback period)**
- **Other Information (e.g. desired production rate, location of bottlenecks, rework rates, strengths and weaknesses of current cleaning processes)**
- **Cleanliness Criteria (“how clean is clean?”)**



## *How Clean is Clean?*

- Determine need for monitoring cleanliness
- Identify contaminants of concern (COCs)
- Identify cleanliness measurement method
- Determine cost of cleaning
- Determine criteria for selecting a cleanliness measurement method
- Define limits of acceptable cleanliness



# *How Clean is Clean?*

COCs for Automotive Parts Rebuilders:

- **Dirt**
- **Grease**
- **Oil**
- **Baked-on carbon**
- **Rust**
- **Gasket residue**



# *How Clean is Clean?*

## Types of Measurement Methods:

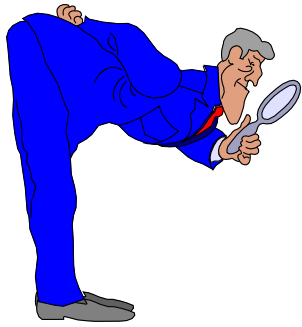
- **Direct - techniques that take a measurement from the actual surface to be cleaned, e.g. water break test**
- **Indirect - techniques that do not take measurements from the actual surface to be cleaned, e.g. gravimetric analysis**



# *How Clean is Clean?*

## Direct Measurement Methods:

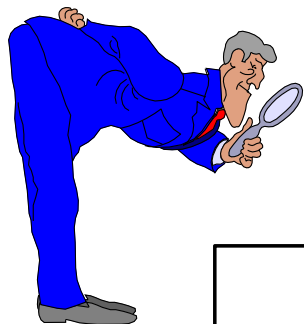
- Visual inspection (most rebuilders use this)
- Magnified visual inspection
- Touch and/or smell
- Black light
- Water break test
- Contact angle (goniometry)
- Gravimetric measurement
- Optically stimulated electron emission (OSEE)
- Direct oxidation carbon coulometry (DOCC)
- X-ray photoelectron spectroscopy (XPS)



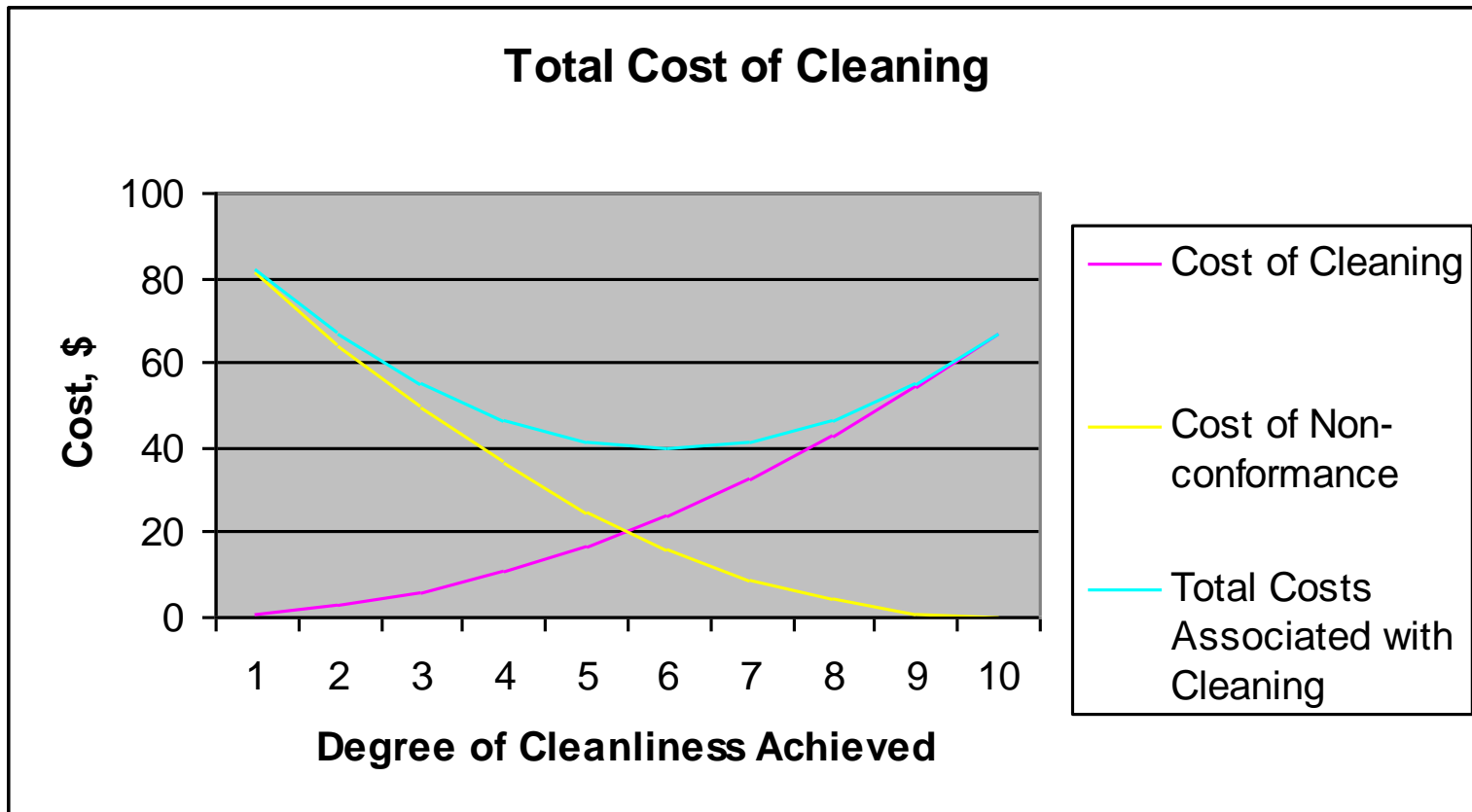
# *How Clean is Clean?*

## Indirect Methods:

- Gravimetric analysis of wipe sample
- Ultraviolet spectroscopy
- Optical particle counter
- Visual inspection of wipe sample
- Photorefectivity of wipe sample using spectrodensitometer



# How Clean is Clean?



# *Identify Potential Alternative Cleaning Technologies*

- **Expert Judgment**
- **Preliminary Testing**
- **Expert Systems and Software Tools**
- **Vendor Inquiries**
- **Industry Association Resources**
- **Trade Publications**
- **Internet Research**

# *Evaluate Technical and Economic Feasibility of Alternative Technologies*

- **Develop Test Plan**
- **Conduct Cleaning Test Trials**
- **Evaluate Technical Feasibility**
- **Evaluate Economic Feasibility**

# Master Schedule for Cleaning Trials

MASTER SCHEDULE - NYSDERDA Testing															
PRIMARY Processes															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Clam															
Roch Midland Excel 3%	D	X	D	X	X	X	X	X	X	X	X	X	X	X	D
Clam Cleaning Compound	X	X	D	X	X	X	D	X	X	X	D	X	X	D	
CJ's Enzyme	X	X	X	X	X	D	X	X	X	X	X	X	X	X	
Intercont															
Armakleen M100	D	D	D	D	8/25	D	D	D	D	D	D	D	D	X	D
Armakleen M400	D	D	D	D	8/10	D	D	D	D	D	D	D	D	X	D
Armakleen Multi-metal	D	D	D	D	8/9	D	D	D	D	D	D	D	D	X	D
MART Washer															
Tarksol	8/28	8/28	8/28	8/28	8/28	8/28	8/28	8/28	8/28	8/28	8/28	8/28	8/28	X	8/28
Optima 100GP	8/29	8/29	8/29	8/29	8/29	8/29	8/29	8/29	8/29	8/29	8/29	8/29	8/29	X	8/29
Bulin 224	8/30	8/30	8/30	8/30	8/30	8/30	8/30	8/30	8/30	8/30	8/30	8/30	8/30	X	8/30
Excel	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	X	8/31
Armakleen	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	X	9/1
Tabletop Ultrasonic															
CJ's Enzymatic Chemistry	D	D	D	D	X	D	D	D	D	D	D	D	D	X	D
100% Soysolv II	D	D	D	D	X	D	D	D	D	D	D	D	D	D	D

# Data Collection Sheet

Cleaning Info-Base - [Test Results Sheet - D1-FP-09-01]

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## Test Results Sheet

**Equipment:** Baking Soda Blaster  
**Test Plan:** XL baking soda, 45-55 psi, round  
**Test ID:** Bak 2-06  
**Test Date:** 6/30/00  
**Tester Initials:** JC

Parameter	Value
Cycle Time (min):	1
Pressure (psi):	50
Media:	XL Bs

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Image File: d1fp\d1fp09-1 c.jpg

**NCR3 PN:** D1-FP-09-01

**Part Name:** cap

**Overall Rating:** Very Clean

**Densitometer:** 0.113

**Partner Eval:**

**Rinsing Op:** tap

**Further Cleaning:**

**Damage:**

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**Contaminants:**

Dirt	Completely Removed	
Grease	Completely Removed	
Paint	Completely Removed	
Gasket		none


**Comment:**  
 surface has some dull areas. Small part is hard to hold

Record: 1 of 1 (Filtered)

Form View

Start Quick Inbox - Mic... Yahoo! Mai... - Message... RE: NYSE... Microsoft ... nysesda081... Microsoft P... Cleaning... 3:14 PM

# Technical Feasibility - Cleaning Test Trials for CV Joints

current first steps	alternative first steps	advantages	disadvantages
agitating aqueous washer			
high pressure spray	high pressure spray	removes heavy grease efficiently	external thread damage if parts free to move
medium pressure spray		eliminates mineral spirits (improved EH&S)	
wipe			
thermal oven	thermal oven	non-manual	potential damage to substrate(?)
		eliminates mineral spirits (improved EH&S)	does not remove rust
vibratory degreaser	vibratory degreaser (aqueous)	non-manual	does not work on bell housing (outer race)
		eliminates mineral spirits (improved EH&S)	
		removes some rust	

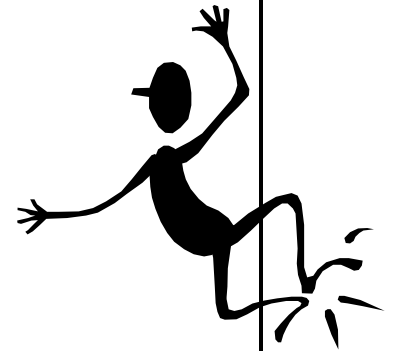
# Economic Feasibility – Cleaning Test Trials for Intake Valves

## Intake Valves: Glass Bead vs. Baking Soda

	Masking and Glass Bead Blasting <sup>1</sup> (\$/part)	Baking Soda <sup>2</sup> (\$/part)
Energy	\$0.05	\$0.03
Labor <sup>3</sup>	\$0.95	\$0.18
Media	\$0.38	\$0.44
<b>Total</b>	<b>\$1.38</b>	<b>\$0.65</b>

### Notes:

1. Based on glass bead cost of \$0.47/lb, 3 passes
2. Based on baking soda cost of \$0.50/lb
3. Based on fully-loaded labor rate of \$12/hr



# Technical and Economic Feasibility – Baking Soda Blasting

Part Information					Cleaning Data				Cost (\$/part)			
Part	Component	Materials of Construction	Contaminants	Level of Contaminant	Pre-cleaning	psi/cfm	Cycle Time	Results	Media <sup>1</sup>	Energy <sup>2</sup>	Labor <sup>3</sup>	Total
Intake Valve	Engine, Cylinder Head	Steel	Carbon	High	none	75/80	45 sec - 1 min.	very clean	\$0.44	\$0.03	\$0.18	<b>\$0.65</b>
			Grease	Medium								
			Dirt	Medium								
Housing	Heavy Duty Fuel Injector (12"x10"x5")	Aluminum, Brass	Oil	High	Enzymatic Cleaning	75/80	4 min.	excellent	\$2.00	\$0.14	\$0.80	<b>\$2.94</b>
			Carbon Grease	Medium								
			Dirt	Low								
Pump Housing	Fuel Pump, Heavy Duty (5"x3"x1.6")	Aluminum, Copper	Grease	Medium	none	50/57	3 min.	adequately clean	\$1.50	\$0.09	\$0.60	<b>\$2.19</b>
			Dirt	Medium								
			Paint	Medium								
			Gasket	Medium								
Throttle Body	Carburetor	Aluminum, Zinc	Grease	Medium	none	75/80	1-2 min.	very clean	\$0.75	\$0.06	\$0.30	<b>\$1.11</b>
			Gasket	Medium								
			Oxidation	Medium								
Notes:												
1. Based on media consumption rate of 1lb/min and cost of \$0.5/lb												
2. Assume 90% efficiency of compressor and average electricity cost of \$0.10/kwh												
3. Based on fully loaded wage rate of \$12/hr.												
4. Total cost represents baking soda only-does not include pre-cleaning cost of enzymatic cleaning.												

# *Develop Recommendations*

- **Select Optimal Process**
- **Formulate Recommendations**
- **Prepare Future State Analysis**
- **Present Findings to Client**

# *Criteria for Selection of Technologies – Optical Tool Manufacturing Company*

- **Musts**
  - No severe degradation of the tool surface
  - Removal of contaminants to permit effective transfer of impressions
- **Wants**
  - Superior removal of contaminants from tool surface
  - Low capital cost of cleaning equipment
  - In situ cleaning process (i.e. no disassembly of machine)
  - Short cleaning cycle time
  - Environmentally friendly cleaning process
  - Minimal health and safety risks

# *Criteria for Selection of Technologies*

## *Scoring System for Cleaning Effectiveness*

<b>Score</b>	<b>Criteria for Scoring</b>
5	% Contrast >20
4	15 < % Contrast <= 20
3	10 < % Contrast <= 15
2	5 < % Contrast <= 10
1	% Contrast <= 5

# *Criteria for Selection of Technologies*

## *Scoring System for Capital Costs*

<b>Score</b>	<b>Criteria for Scoring</b>
5	Capital Cost $\leq$ \$10,000
4	$\$10,000 <$ Capital Cost $\leq$ \$25,000
3	$\$25,000 <$ Capital Cost $\leq$ \$50,000
2	$\$50,000 <$ Capital Cost $\leq$ \$100,000
1	Capital Cost $>$ \$100,000

# *Criteria for Selection of Technologies*

## *Scoring System for In Situ Process*

<b>Score</b>	<b>Criteria for Scoring</b>
5	In situ
4	[not assigned]
3	[not assigned]
2	[not assigned]
1	Machine disassembly required

# *Criteria for Selection of Technologies*

## *Scoring System for Cleaning Cycle Time*

<b>Score</b>	<b>Criteria for Scoring</b>
5	Cycle Time $\leq$ 30 minutes
4	30 minutes $<$ Cycle Time $\leq$ 1 hour
3	1 hour $<$ Cycle Time $\leq$ 2 hours
2	2 hours $<$ Cycle Time $\leq$ 4 hours
1	Cycle Time $>$ 4 hours

# *Criteria for Selection of Technologies*

## *Scoring System for Environmental Impacts*

<b>Score</b>	<b>Criteria for Scoring</b>
5	Generates no solid waste, wastewater, or air emissions
4	Generates solid waste, wastewater, or air emissions
3	Generates solid waste and (wastewater emissions or air emissions)
2	Generates hazardous waste only
1	Generates hazardous waste and (wastewater or air emissions)

# *Criteria for Selection of Technologies*

## *Scoring System for Health & Safety*

<b>Score</b>	<b>Criteria for Scoring</b>
5	No special personal protective equipment (PPE) required
4	Special PPE required and/or potential asphyxiation hazard
3	Toxic chemicals used in process
2	Suspected carcinogens, teratogens, and/or mutagens used in process
1	Confirmed carcinogens, teratogens, and/or mutagens used in process

# Results of Technology Evaluation

Technology	Weight								←--FINAL SCORE (100 Max.)
	4	5	3	3	2.5	2.5 *	*	*	
	Capital Cost	Cleaning Effectiveness	In Situ	Cycle Time	Environmental Impact	Health & Safety	Removes Contaminant	No Degradation of Tool Surface	
Ideal System	5	5	5	5	5	5	1	1	<b>100</b>
CO <sub>2</sub> granule blasting	3	3	5	5	5	4	1	1	<b>80</b>
CO <sub>2</sub> Snow blasting	5	1	5	5	5	4	1	1	<b>78</b>
Baking Soda blasting	5	3	5	3	3	4	1	1	<b>77</b>
Laser ablation	1	4	5	5	4	4	1	1	<b>74</b>
Biosoy-60	4	4	1	1	1	3	1	1	<b>52</b>
Iso Paraffinic/Naphthenic Hydrocarbon blend	4	NA	1	1	1	3	1	1	<b>43</b> (adjusted value)
Armakleen	4	2	1	1	1	3	1	1	<b>42</b>
D-Limonene	4	2	1	1	1	3	1	1	<b>42</b>
HTF-85B	4	1	1	1	1	3	1	1	<b>37</b>
Super Electrosafe	4	1	1	1	1	3	1	1	<b>37</b>
Infrared (or thermal)	5	4	5	4	4	4	1	0	<b>0</b>
Steam	5	1	5	5	4	4	0	1	<b>0</b>
Supersonic Gas/Liquid	3	1	5	5	4	4	0	1	<b>0</b>

# Final Weighted Score Equation

$$S_i = \{\prod M_{ij}\} \sum [B_k W_{ik}]$$

# *Results of Technology Evaluation (cont'd)*

- **Best Cleaning Alternatives**
  - **CO<sub>2</sub> Granules Abrasive Blasting**
  - **CO<sub>2</sub> Snow Abrasive Blasting**
  - **Sodium Bicarbonate Abrasive Blasting**
  - **Laser Ablation**

# *Results of Technology Evaluation (cont'd)*

- **Cleaning Alternatives Creating Surface Damage**
  - **Laser Ablation (experimental phase)**
  - **Infrared (or Thermal) Treatment**

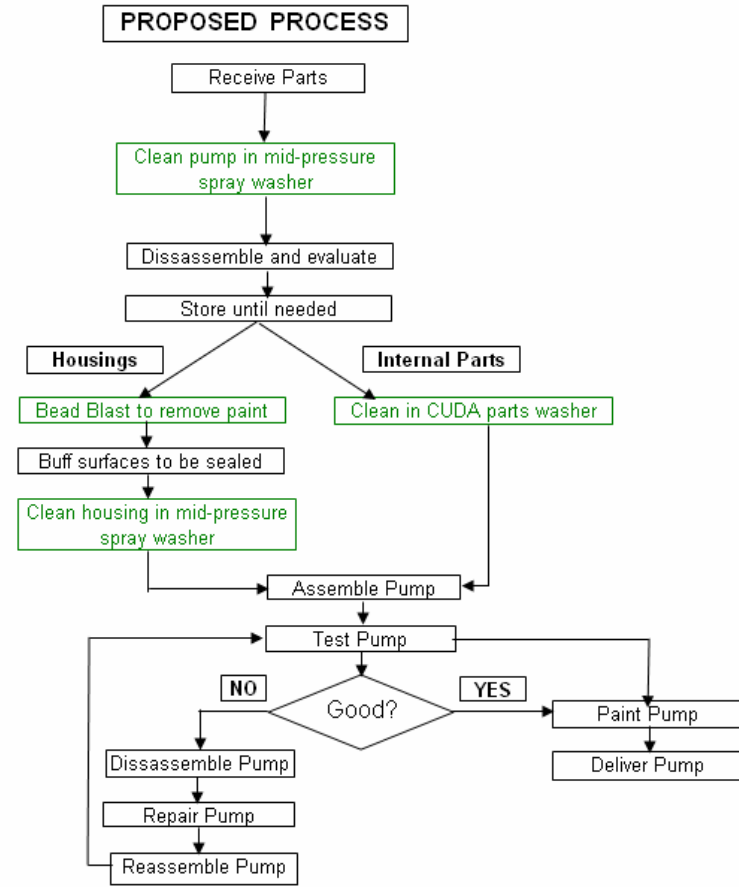
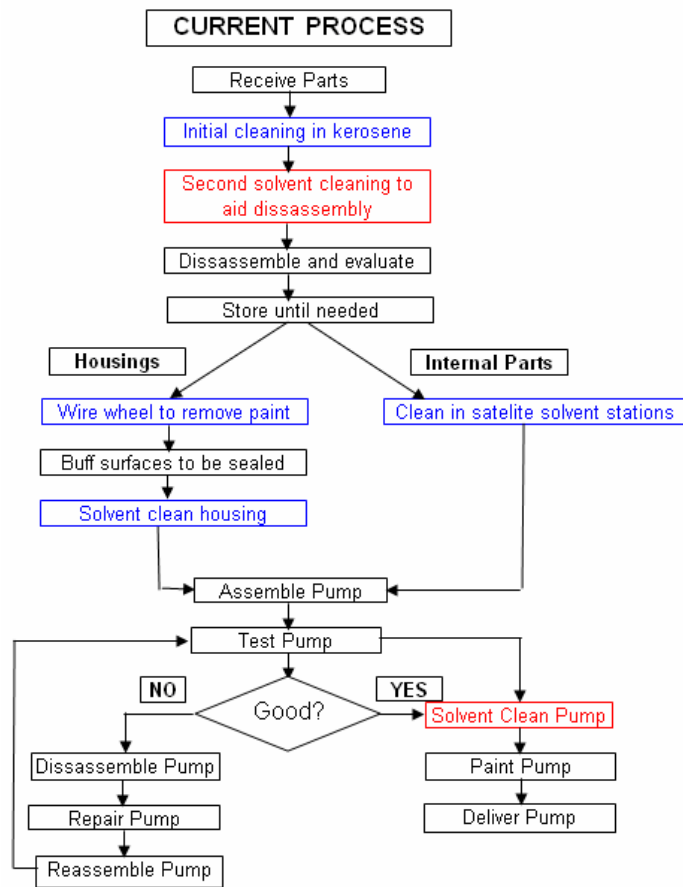
# *Results of Technology Evaluation (cont'd)*

- **Ineffective Cleaning Alternatives**
  - Superheated Steam Cleaning
  - Supersonic Gas/Liquid

# *Recommendations*

- **Verify findings using vision system test**
- **Conduct additional experimental testing**
  - CO2 granule abrasive blasting
  - CO2 snow abrasive blasting
  - sodium bicarbonate abrasive blasting
  - laser ablation
- **Consider additional alternative technologies**
  - thermal oven
  - combinations of alternative cleaning methods
- **Conduct long-term studies**
  - posterior/anterior tool cleaning cycle differences
  - refinement of % contrast method for polypropylene molds

# Flow Charts for Current and Future States – Automotive Reman Project



Steps Eliminated by Proposed Process

Steps Changed by Proposed Process

Proposed Cleaning Process Steps

**FLOW CHART OF CURRENT AND PROPOSED CLEANING PROCESSES**

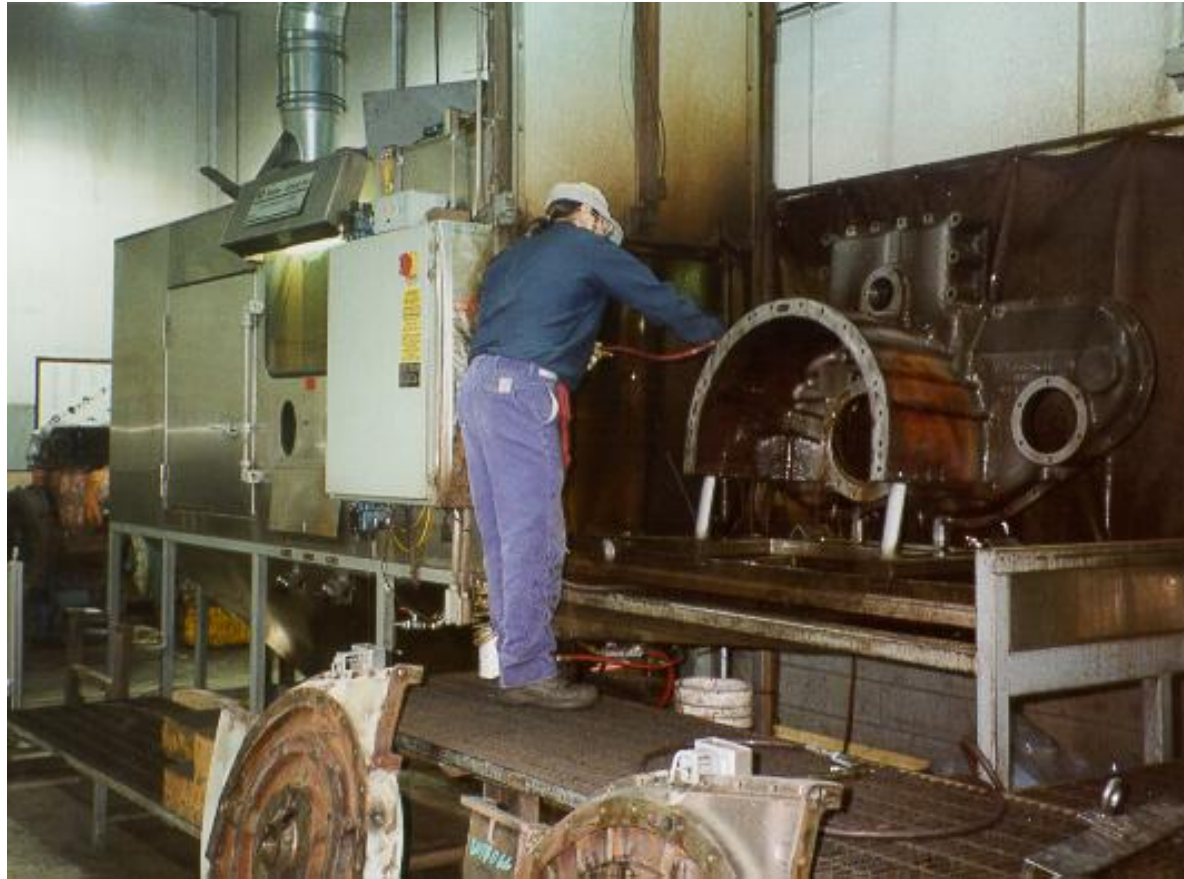
# Economics of Future State – Aerospace Parts Manufacturer

PROCESS	DESCRIPTION	Annual Cost \$/year	Annual Savings \$/year	Capital Investment \$	Payback Period years	10-year IRR %/year
<b><u>Cold Cleaning in Cans</u></b>						
Base Case	Methylene Chloride at Workstations (net of labor)	\$2,190	---	---	---	---
Option 1	Premium Gold at Workstations (net of labor)	\$230	\$1,960	\$0	0.00	INFINITE
Option 2	NZD-Ultra at Workstations (net of labor)	\$1,400	\$790	\$0	0.00	INFINITE
<b><u>Complex Degreaser</u></b>						
Base Case	Methylene Chloride in Degreaser	\$38,700	---	---	---	---
Option 1	Aqueous Cleaning with Vertrel XDA/XF	\$22,000	\$16,700	\$29,000	1.74	56.95%
Option 2	Aqueous Cleaning with IPA Dip Tank	\$26,400	\$12,300	\$6,500	0.53	189.23%
Option 3	Replace Methylene Chloride with Vertrel CMS	\$82,100	(\$43,400)	\$0	INFEASIBLE	INFEASIBLE
<b><u>Simple Degreaser #1</u></b>						
Base Case	Methylene Chloride in Degreaser	\$62,500	---	---	---	---
Option 1	Aqueous Cleaning with Vertrel XDA	\$16,000	\$46,500	\$50,000	1.08	92.87%
Option 2a	Aqueous Cleaning with Segregated IPA Dip Tank	\$22,600	\$39,900	\$27,500	0.69	145.07%
Option 2b	Aqueous Cleaning with Integrated IPA Dip Tank	\$22,600	\$39,900	\$50,000	1.25	79.57%
Option 3	Replace Methylene Chloride with Premium Gold	\$58,100	\$4,400	\$0	0.00	INFINITE
Option 4	Replace Methylene Chloride with NZD-Ultra	\$59,900	\$2,600	\$0	0.00	INFINITE
Option 5	Replace Methylene Chloride with Vertrel CMS	\$105,900	(\$43,400)	\$0	INFEASIBLE	INFEASIBLE
<b><u>Simple Degreaser #2</u></b>						
Base Case	Methylene Chloride in Degreaser	\$62,500	---	---	---	---
Option 1	Replace Methylene Chloride with Premium Gold	\$29,100	\$33,400	\$0	0.00	INFINITE
Option 2	Replace Methylene Chloride with NZD-Ultra	\$30,800	\$31,700	\$0	0.00	INFINITE
<b><u>Total for Option 1, All Cases</u></b>						
Base Case	Methylene Chloride	\$165,890	---	---	---	---
Option 1	Various	\$67,330	\$98,560	\$79,000	0.80	124.72%

# *Provide Support for Implementation*

- **Assist Client in Equipment Selection and Installation**
- **Modify Operating Parameters as Needed**
- **Collect Metrics**

# *Implementation*



# *Results from Engine Systems*

From work on a cleaning assessment for a major rebuilder of turbochargers where cleaning of parts was a major bottleneck in production.

- Identified applicable technology
- Company purchased new equipment
- Doubled capacity



## **Results:**

**Economic Growth:**

**\$3 million/year**

**Job Retention:**

**12 employees**

**Worker Safety:**

**Ergonomic improvements**

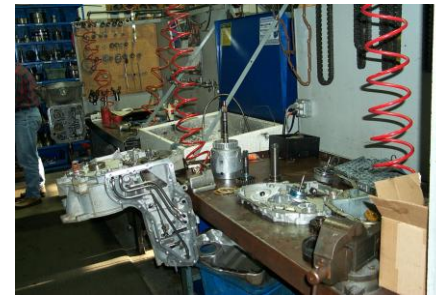
**Waste Reduction:**

**1,700 gallons of cleaning solution**

**Energy Conservation:**

**Lower electricity consumption  
by optimizing cleaning process**

# *Results from Dial Transmission*



- **Action - replace solvents parts washer with ultrasonic cleaning systems**
  - \$44,000 of annual savings obtained from capital investment of \$10,240 - payback period is 12 weeks!
  - 67% reduction in use of compressed air
  - 80% reduction in use of solvents
  - 80% reduction in generation of solvent waste
  - Elimination of solvent droplets in shop air, improving indoor air quality and worker safety
  - Improvements in ergonomics of cleaning processes
  - Reduced energy costs and higher product quality

# *Results from Arc Remanufacturing*



- **Action - mid-pressure spray washer with high-pressure spray washer and washwater filtration system**
  - Eliminate precleaning operations in vibratory degreaser and rework in primary cleaning process
  - Longer bath lives save on soap costs, water costs, and waste disposal expenses
  - Shorter cycle times result in decreased operating expenses and reduced energy consumption
  - Annual savings of \$105,000 are obtained from installed equipment cost of \$67,000, or a payback of less than 8 months!
  - Washwater contaminants are separated and encapsulated, and can be disposed of as non-hazardous waste, eliminating a hazardous waste stream



# *Results from D&W Diesel*

- **Action – replace two-step cleaning process with one-step ultrasonic cleaning operation and washwater filtration system**
  - Eliminate solvent tank cleaning operations at facility
  - Reduced energy costs from elimination of energy-intensive cleaning process; rework eliminated in secondary cleaning process
  - Higher product quality from superior cleaning results
  - Annual savings of \$10,000 are obtained from installed equipment cost of \$21,300, or a payback of about two years!
  - Washwater contaminants are separated and encapsulated, and can be disposed of as non-hazardous waste, eliminating a hazardous waste stream
  - Longer bath lives save on soap costs, water costs, and waste disposal expenses

# Implementation of High-Performance Cleaning Technologies in NY State

**Conducted under a grant from the New York State Energy Research and Development Authority (NYSERDA).**

## **Problem:**

- Many automotive remanufacturing companies use inefficient or antiquated cleaning systems.
- Old systems are expensive, inefficient, and environmentally costly.
- Small companies often do not have resources to improve systems.

## **Objective:**

- Implement improved cleaning systems in selected NY companies and conduct technology transfer events.

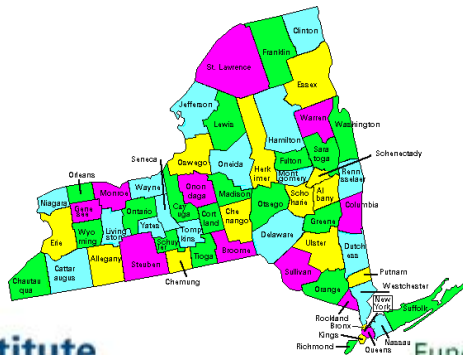
## **Results:**

- Installed alternative systems in 5 NY companies, resulting in \$250K of annual savings from a \$159K investment.
- Reductions in hazardous and non-hazardous waste of 99% and 61%, respectively; substantial energy savings as well.
- Conducted numerous technology transfer events (demonstrations, published articles, seminars); created 4 new jobs for NY State!



# Potential Results in New York State (1)

- Action - replace solvents parts washers with ultrasonic systems, and upgrade aqueous spray washers at 150 transmission rebuilding firms in New York State:
  - Annual savings in cleaning costs are \$9,750,000
  - Annual savings in natural gas/propane are 1.64 million cubic feet
  - Reduction in disposal of mineral spirits by over 50,000 gallons per year
  - Elimination of over 150,000 pounds of brakewash per year, and its toxic constituents, including methanol, toluene, and ethylbenzene
  - Significant improvements in indoor air quality and worker safety





# Questions?

