

Pollution Prevention for Metal Finishers

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<http://www.dtsc.ca.gov/PollutionPrevention/MFMS/index.cfm>

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Pollution Prevention

- Reduction or elimination of pollution at the source instead of at the end-of-the-pipe or stack
 - Consider multi-media effects
 - Good operating practices
 - spill control, training, inventory control
 - Process input substitutions- less toxic, less hazardous materials
 - Equipment and technology changes
 - Product or design reformulation
 - Energy Conservation
- Favors efficient use of resources and use of alternatives or substitutions rather than control and treatment methods

Pollution Prevention...



Where Sustainable Practices Begin!



Pollution Prevention Week September 15-21, 2008

National Pollution Prevention Roundtable 11 DuPont Circle, NW Suite 201 Washington, DC 20036 (202)299.9701 www.p2.org

Go to our website to learn more about these sustainable practices!

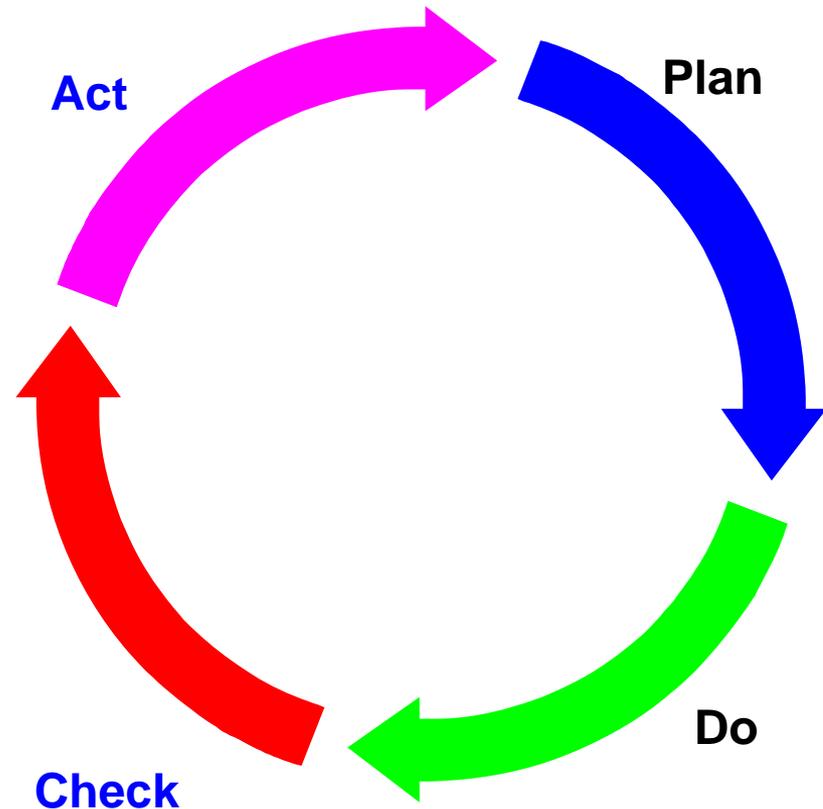
NPPR would like to acknowledge ManagEnergy, The Intelligent Energy-Europe Programme of the European Commission, and David Anderson for contributing their images.

Pollution Prevention Benefits

- Improve process efficiency
- Reduce waste and emissions
- Resources (raw materials, water, land, air, energy, people) are used more efficiently and effectively
 - Reduces operating costs
 - Improves health and safety
 - Eases regulatory burden
 - Promotes community pride
 - Reduces energy use and costs
- Move toward sustainability

Continuous Improvement

- Continuous system-review and identify problem(s) or places for improvement
- Analyze customer and production needs and evaluate alternatives
- Evaluate processes and waste streams



Plan and Review

- Use source reduction planning resources and tools
 - Model Shop Program checklist
 - SB 14 Source Reduction Plan and Reports
 - EMS- Environmental Management System
 - EPA Partnerships:
 - National Partnership for Environmental Priorities (NPEP)
 - Peak Performance Track (EMS based)
 - Green Suppliers Network
 - Lean and Environment
- Software programs to increase efficiency – operating parameter analysis



Process Change?

- Past practice- parts were plated
- Reviewed processes and analyzed methods to reduce costs and waste
- Final product use-
 - Location not visible
 - Powder coating would satisfy final part function



P2 Strategies

Source Reduction

- Input Substitutions
 - Material selection - least toxic, easiest to manage. For example:
 - least VOC-containing, longest lasting, most effective cleaning system(s)
 - Substitute least toxic/hazardous plating chemistries where possible, for example non-cyanide silver
- Extend the life of process baths to the maximum extent possible

P2 Strategies

Source Reduction

- Equipment Changes
 - Rinse tank sensors to minimize use of rinse water
 - Optimize tank and equipment layout
 - Minimize drag-out
- Optimize production to reduce or eliminate rejects and re-work
 - 2-3 times materials, waste, and energy to strip and reprocess

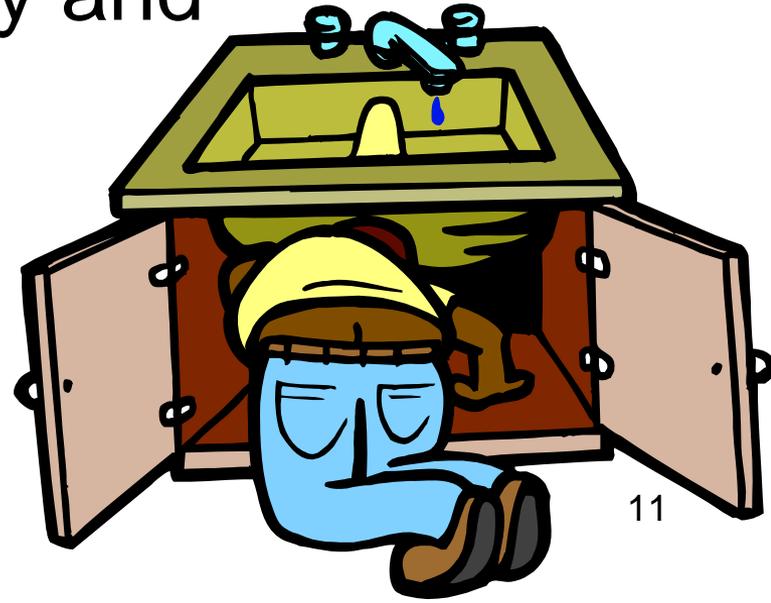
Operating Practices

- Inventory control
- Process area as well as waste treatment/recycling
- Maintain all equipment, tanks, piping, containers, including process area Use good operating practices
- Keep process solutions and rinse water inside their tanks
- Train and re-train workers

Operating Practices

Preventative Maintenance

- Identify problems before they grow significant
- Prevent operational down-time
 - Reduce costs and waste
- Improve work place safety and health
- No or low cost



Preventative Maintenance

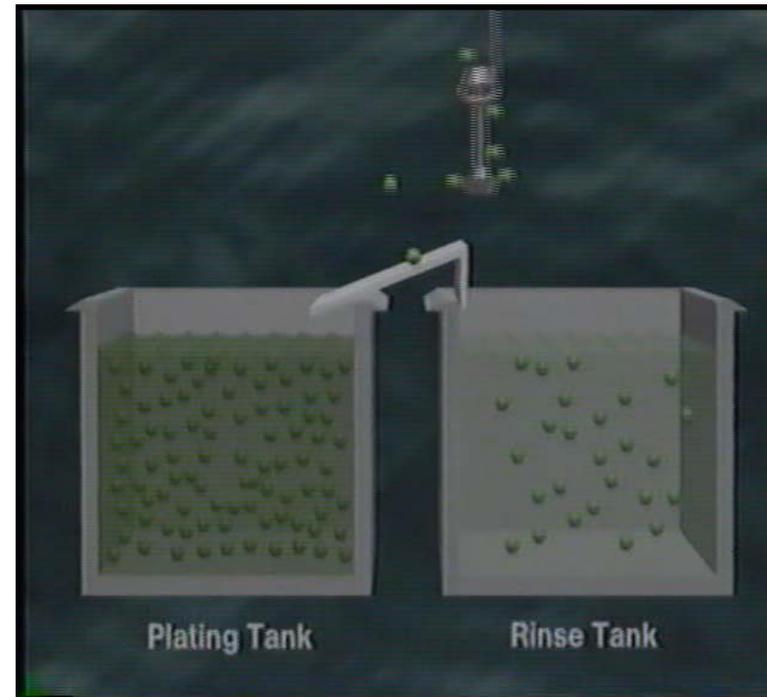
- PM on process machinery and equipment
 - Check pumps and filters
 - Schedule calibration of automated controls and monitors, for example, temperature, pH, conductivity
 - Check racks, drip guards, rinsing equipment
- Routinely inspect process and waste tanks and piping for leaks, degradation, and corrosion
- Replace, repair, and report
- Use a system so everyone knows what has been done and needs to be done
 - Post on a large board, clearly visible

Spill Prevention

- Inspect work areas and secondary containment routinely
- Control inventory- FIFO, optimum supplies available
- Product spills and leaks, unusable products become wastes
 - Written procedures and training for handling, storing and using materials
 - Use funnels, secondary containment
 - Clean up as you go
- No or low cost

Spill Prevention

- Drain work pieces over tanks
- Bridge gaps between tanks – drip guards
- Make sure spray rinse stays inside tank-splash screens
- Vents leaking on roof surface-control or use drip pans
- Change in workplace habits is hard!
 - Allow time during work time- end of shift
 - Provide incentives
 - Re-training



Dry Floor

Eliminate waste from drag-out dripping, tank spillage, and rinse overspray

- Leaks are more readily detected
- Improves overall spill prevention and release
 - Reduces potential for accidental release
 - Dry floor policy makes everyone aware that spills on the floor create waste and are not acceptable
- Prevents tracking to all areas of shop and outside areas
- Reduce air emissions
 - ARB Chrome regulation requires clean up within one hour (ATCM final 2007)

Lean 6S

- **Sort**
 - Eliminate clutter, sort out what is not needed
- **Set in Order**
 - Organize and label, set boundaries and limits
- **Shine**
 - Clean everything and solve
- **Safety**
 - Create a safe place to work
- **Standardize**
 - Keep checklists and standards to maintain the first 3 Ss
- **Sustain**
 - Maintain discipline through systems and a supportive culture



Surface Cleaning

- Planning
 - Consider the level of cleaning, type of contaminant, substrate, finishing process
- Standardize cleaning to reduce amount of cleaning products needed
- Use the best cleaning system for the type of soil and substrate

Surface Cleaning

- Work with supplier to identify and reduce contaminants
- Set up parts receiving, handling, and storage to eliminate contamination, for example consider:
 - Cover stored parts
 - Minimize handling
 - Place in clean location

Clean “Green”

- Use least hazardous/toxic options
 - Air district requirements
 - Watch out for substitutions that may increase worker exposure
- Water and Water-based Systems
 - Use deionized water
 - Hot DI water and closed loop generation
 - Detergents
 - Microbes to remove oil
 - Ultrasonic cleaning

Reduce Cleaning Waste

- On-site demonstration period to find best cleaning for work pieces
 - Time
 - Temperature
 - Solution and concentration
 - Number of work pieces or racks
 - Placement and fit into equipment- size and shape
- Maintain cleaning solutions to extend useful life and effectiveness
 - Multi-stage cleaning
 - Skim oil
 - Filter out debris and clean out sludge
 - Digest oil with microbes

Extend Life of Plating Baths

- Maintain bath purity. Frequent dumps increase product cost, increase waste generation and cost of treatment and disposal. Causes:
 - Contaminant drag-in on work pieces
 - Not enough process controls
 - Water source adds contaminants
- Drag-out affects operating costs and waste generation:
 - Amount of process chemicals used
 - Rinse water quality
 - Amount of rinse water needed

Maintain Plating Bath Purity

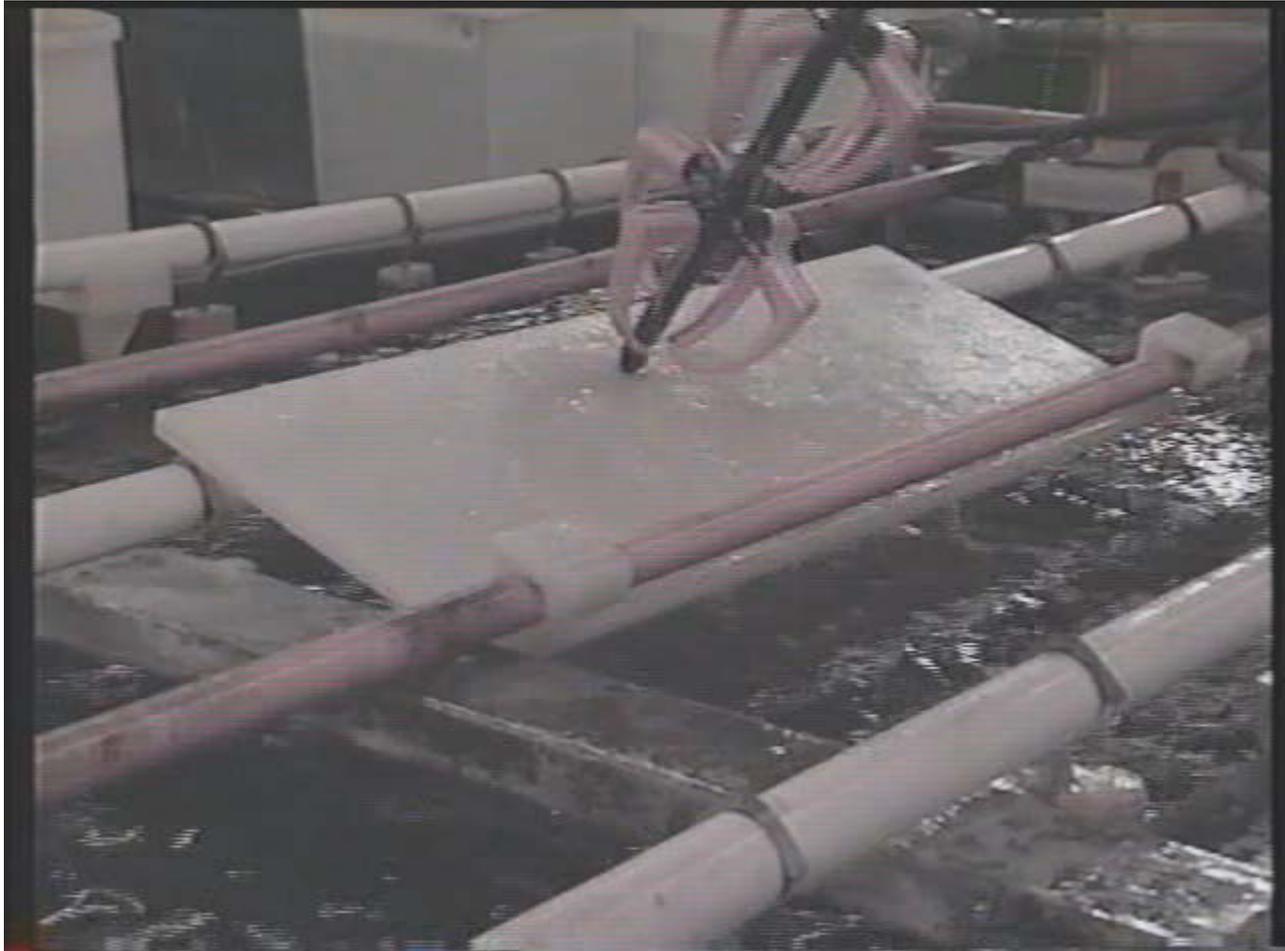
- Lab analysis of indicator parameters
 - to determine need for additives or removing contaminants
- Know your contaminants, their effects on production and monitor
- Use deionized water for rinsing
- Filter to remove solids
- Replenish

Work Piece Movement

- Use coated racks to reduce buildup and later stripping
 - Check rack and coating routinely
- Consider automating your system to control and optimize:
 - Plating times
 - Work piece removal rate, orientation, and drag-out
 - Rinse times

Reduce Drag-out

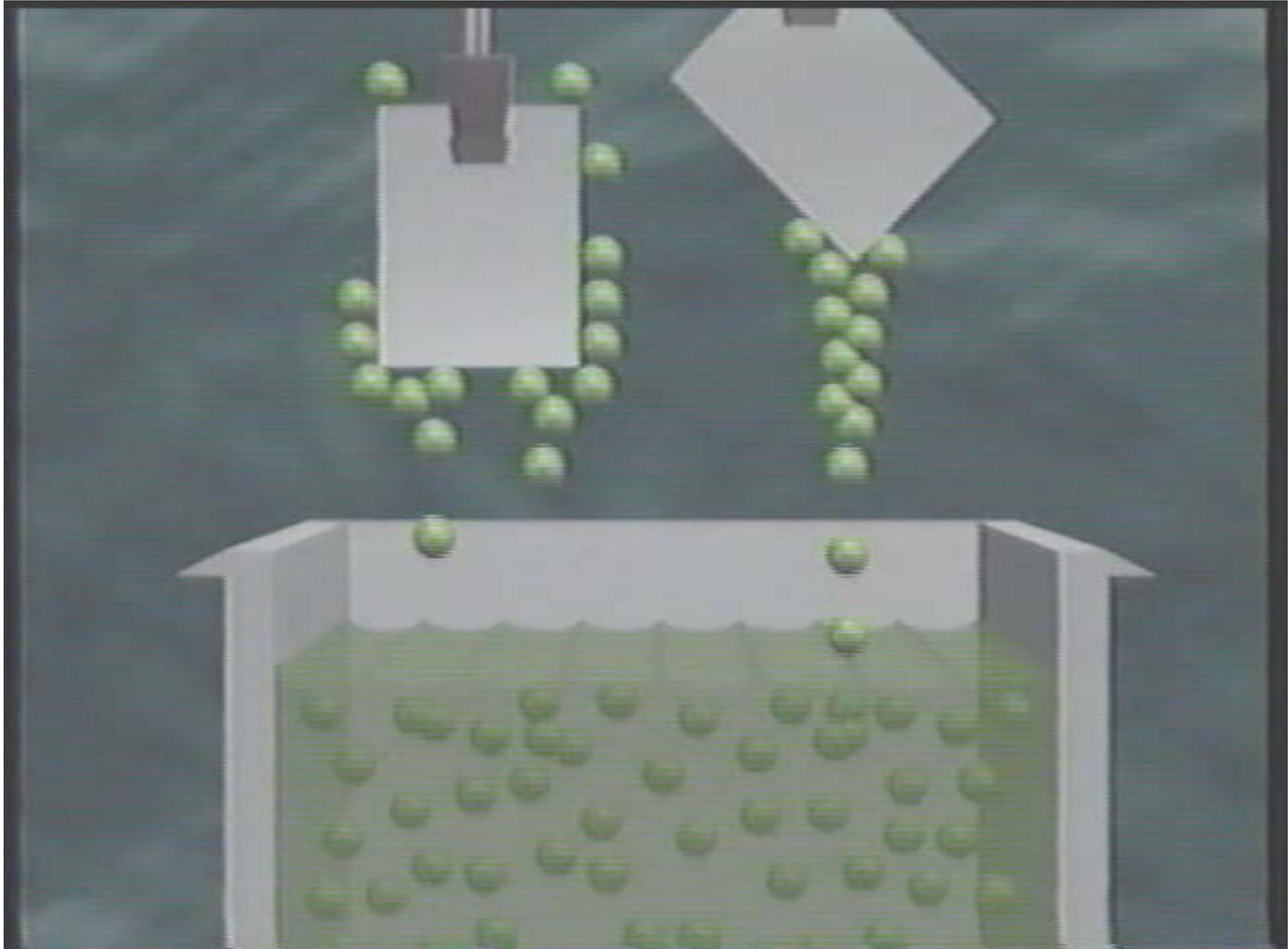
- Consider work piece
 - Shape and size
 - Orientation for drainage: largest surface near vertical, long side horizontal
 - Placement on rack
- Optimize removal rate and drainage time
- Hold work pieces over tank to drain
- Hang bars and drain boards
- Fine spray rinse (mist or fog) over tanks
- Train and re-train production line operators



Use Drain Boards to Reduce Drag-out Contaminants

Find the “Drip Point”





DRIP POINT

Measuring Impact of Racking



Horizontal



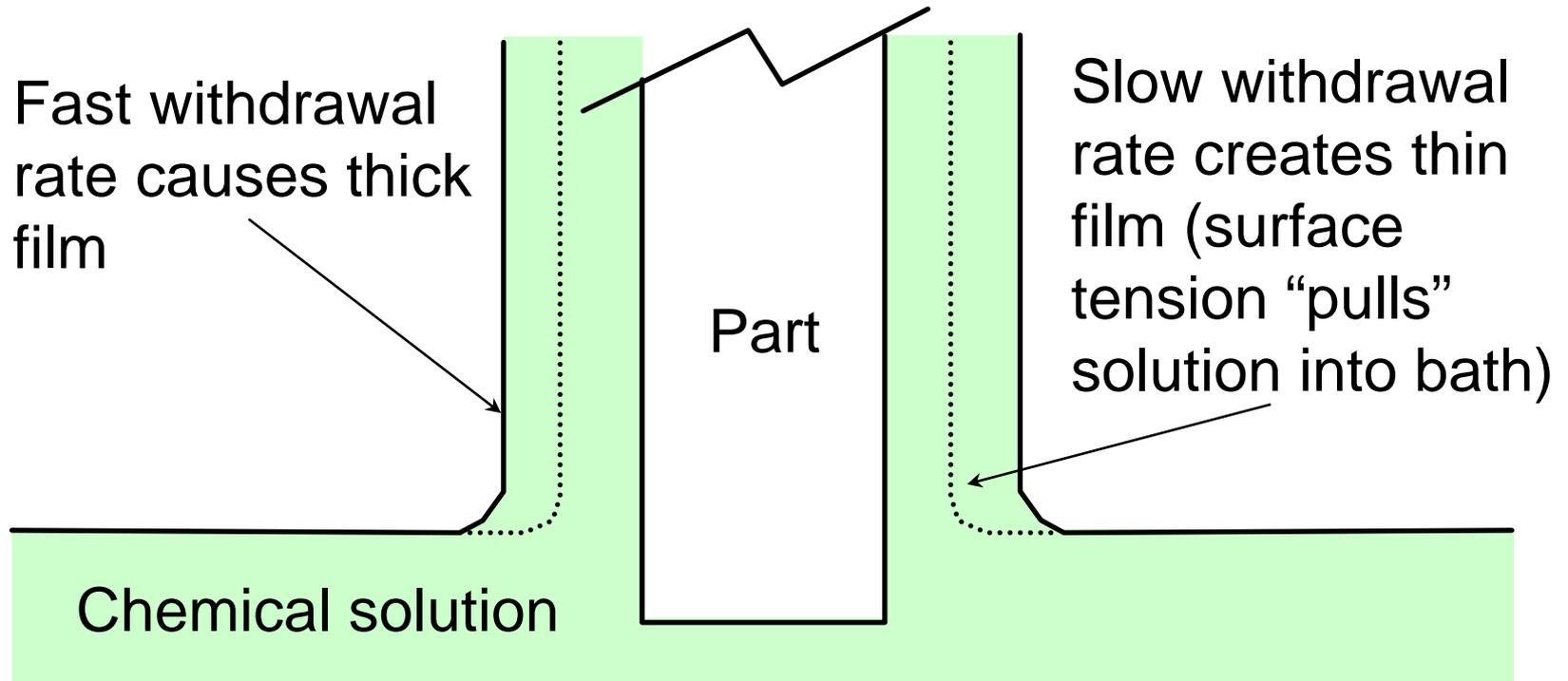
Vertical



Removing Dragout

Proper racking reduced dragout by
90% for these parts

Impacts of Withdrawal Rate on Drag-out



* Other conditions that impact thickness of solution are temperature and bath concentration.

Reduce Water Use

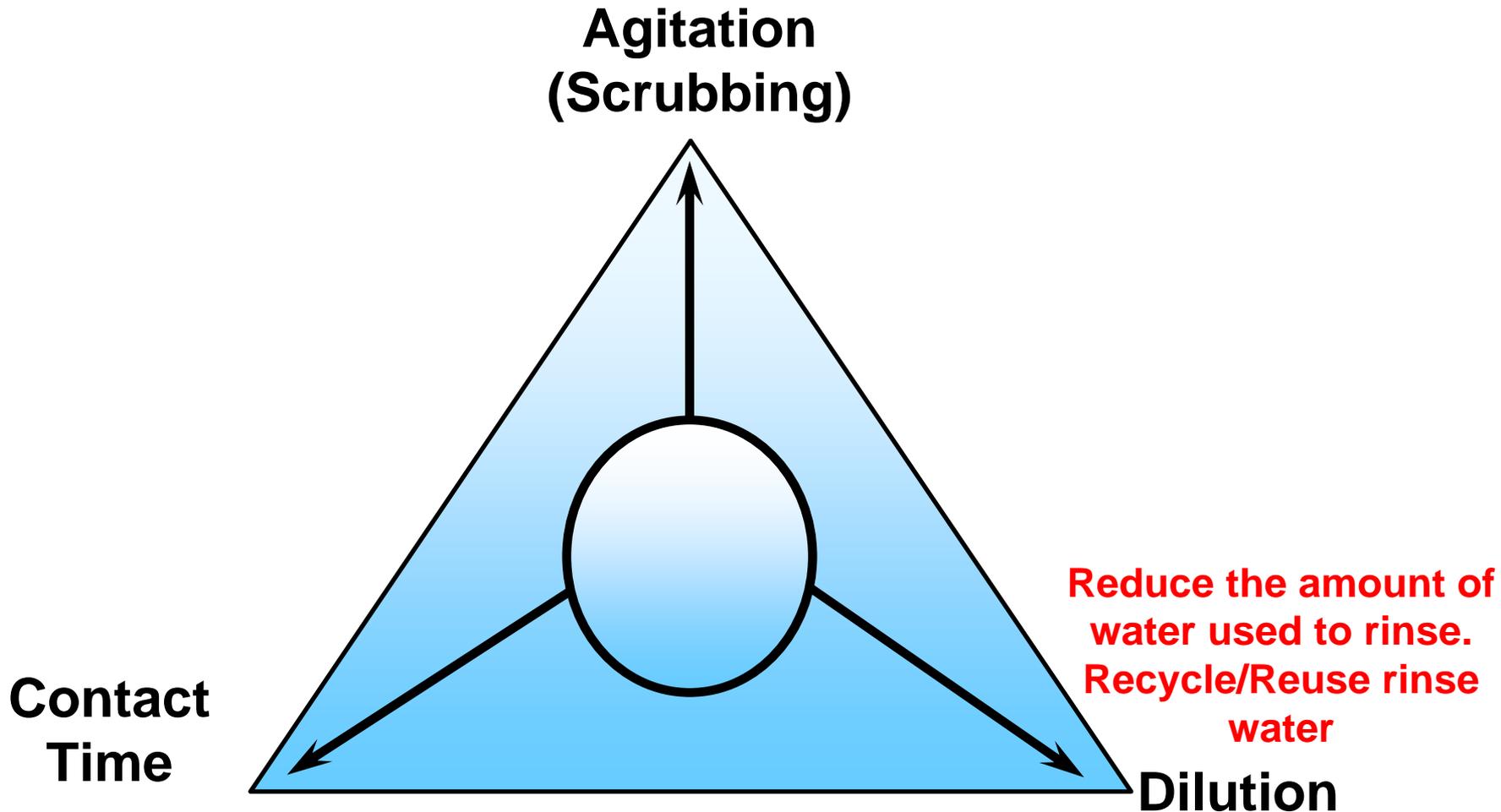
- Reduce waste water generation - benefits:
 - Eliminate or reduce WWTS
 - Reduce HW treatment burden, chemical costs
 - Reduce labor
 - Reduce make up water
 - Reduce amount of sludge
 - Reduce water and sewer costs
- Rebates and incentives from local water agencies may pay back partial cost of equipment or technology
- Capture storm water run-off and treat for process water use



Source Reduction in Rinse Systems

- Drag-out reduction results in better rinsing
- Effective rinsing:
 - Removes process solution
 - Limits contamination to next process
- Efficient rinsing-minimize water use depends on:
 - Type of rinse
 - Controls
 - Tank design

Maximizing Rinse Efficiency



Source Reduction - Rinse Systems

- Improve rinse effectiveness and efficiency in tanks
 - Agitate work pieces
 - Multiple rinse tanks where possible
 - Countercurrent rinsing
 - Cascading
 - Good rinse water circulation
 - Spray rinsing
 - Forced air
- Rinse tank controls
 - Conductivity or pH controls
 - Flow meters or timers
 - Flow restrictors
 - Manually shut off water



Conductivity Control Systems

- Requires proper placement in tank and circulating rinse
- Conventional type
 - Fouls or becomes coated easily
 - Needs maintenance and cleaning
- Toroidal (electrodeless) meters
 - Resist fouling and coating
 - Easier to operate and maintain than conventional
 - Monthly calibration checks



Rinse Water Reuse and Recycling

- Ion exchange
 - metal cations removed from rinse water
 - anions removed
 - single process line vs batch
 - keep organics (oil, solvents, grease) out of waste stream; use carbon adsorption to remove
- Reverse osmosis
 - water passes through microporous membrane;
 - larger metal molecules cannot pass through and are recovered
 - single process tank use:
 - concentrated metals solution returned to plating bath,
 - water returned to rinse tank

Rinse Water Reuse and Recycling Equipment Purchase

- Check it out- in-shop demonstration, make sure it works for your needs
- Rebates and incentives from supplier may cover part of installation cost
- Consider Metal Finishing Loan Program to finance equipment purchases

Energy Efficiency & Conservation

- Energy audit from your electric utility
- Lighting – about 20% of electrical use in California
 - Change out T-12 to more efficient T-8 or T-5 (for high bay areas)
 - Take advantage of natural lighting



Energy Efficiency & Conservation

- Replace conventional motors with high efficiency motors at end of life
- Check compressor hoses and pumps
- Consider solar
- Rebates and incentives from utility may cover part of installation cost

Tools & Resources

- US EPA Region 9 Metal Finishing P2
 - <http://www.epa.gov/region09/waste/p2/projects/metal.html>
- [Green Suppliers Network](https://www.greensuppliers.gov/gsn/home.gsn)
 - <https://www.greensuppliers.gov/gsn/home.gsn>
- [Lean Manufacturing and the Environment](http://www.epa.gov/lean/leanenvironment.htm)
 - <http://www.epa.gov/lean/leanenvironment.htm>
- CoolCalifornia.org
 - Small business toolkit; carbon calculator; one-stop

- National Partnership for Environmental Priorities (NPEP) Cd, Pb, Hg
 - <http://www.epa.gov/npep/>
- EMS – industry template
 - <http://www.epa.gov/sectors/metalfinishing/ems.html#ems>
 - <http://www.epa.gov/sectors/metalfinishing/index.html>
- National Environmental Performance Track
 - <http://www.epa.gov/performancectrack/>