Advancing Green Chemistry In Metal Finishing Operations

Miguel Rodas
City Of Los Angeles
December 15, 2020

Agenda

City's Source Control and Sector Champion Program

P2 Opportunities in Metal Finishing process

Data Collection and Analyses

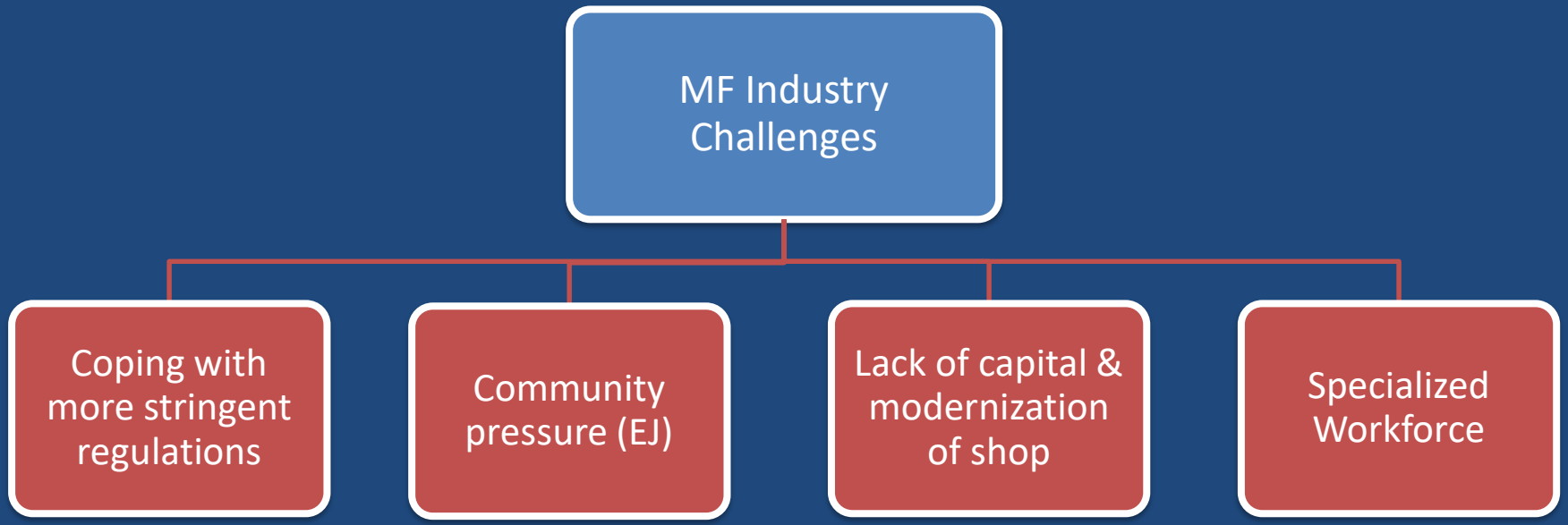
Green Chemistry (Degree of Greenness) Scorecard

City of LA Source Control Program

- Compliance Assessment & Assistance
- Sector Champions
- Business Assistance

ZERO WASTE
ZERO WASTED WATER

MF Industry Challenges



ZERO WASTE
ZERO WASTED WATER

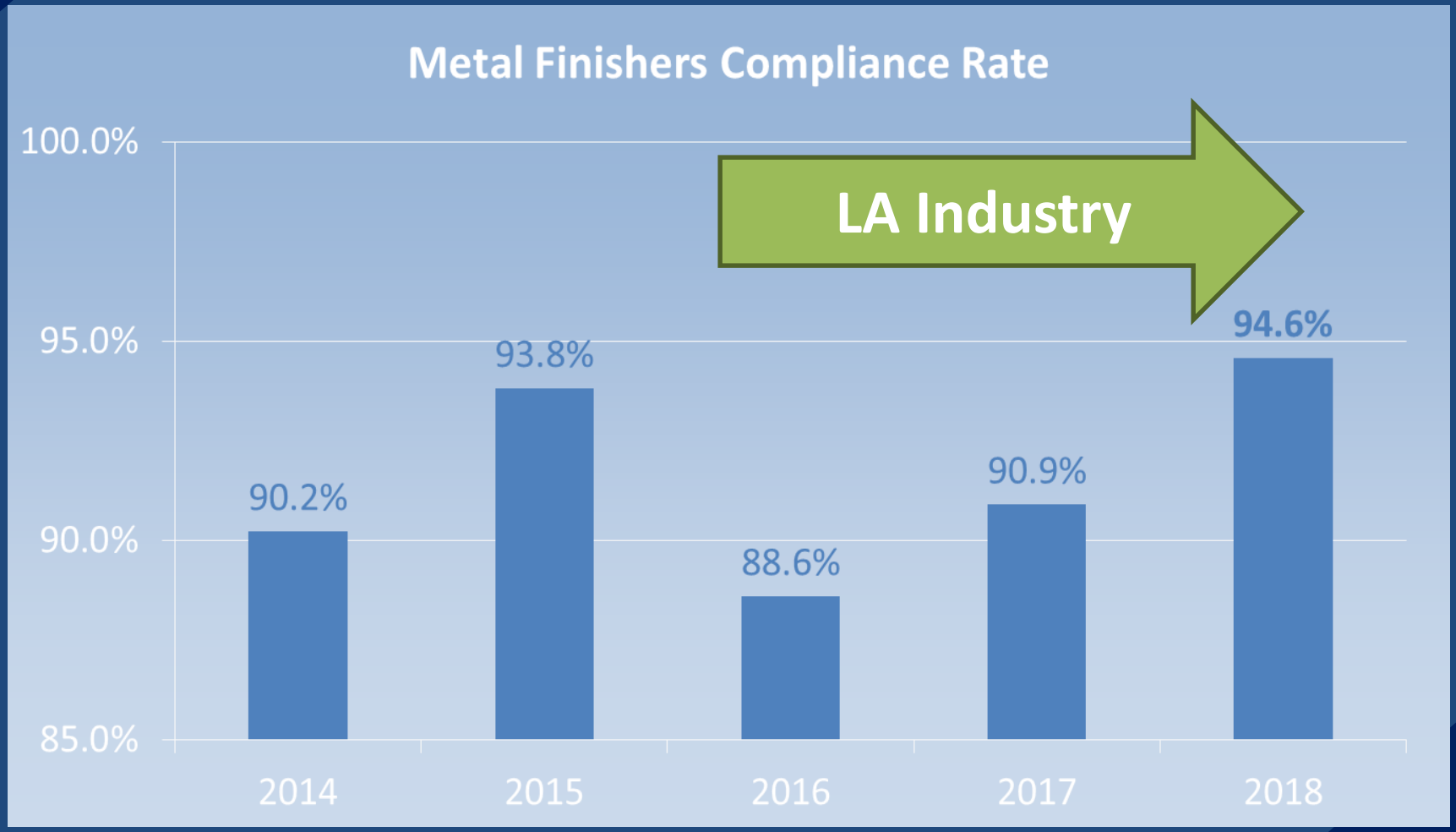
City's LA Industry Program

- √ Demystify complex regulations for MF
- √ Compliance Assistance
- √ Green Chemistry workshop
- √ CUPA training for MF
- √ Sustainable Innovations in MF

Sector Champion Goals

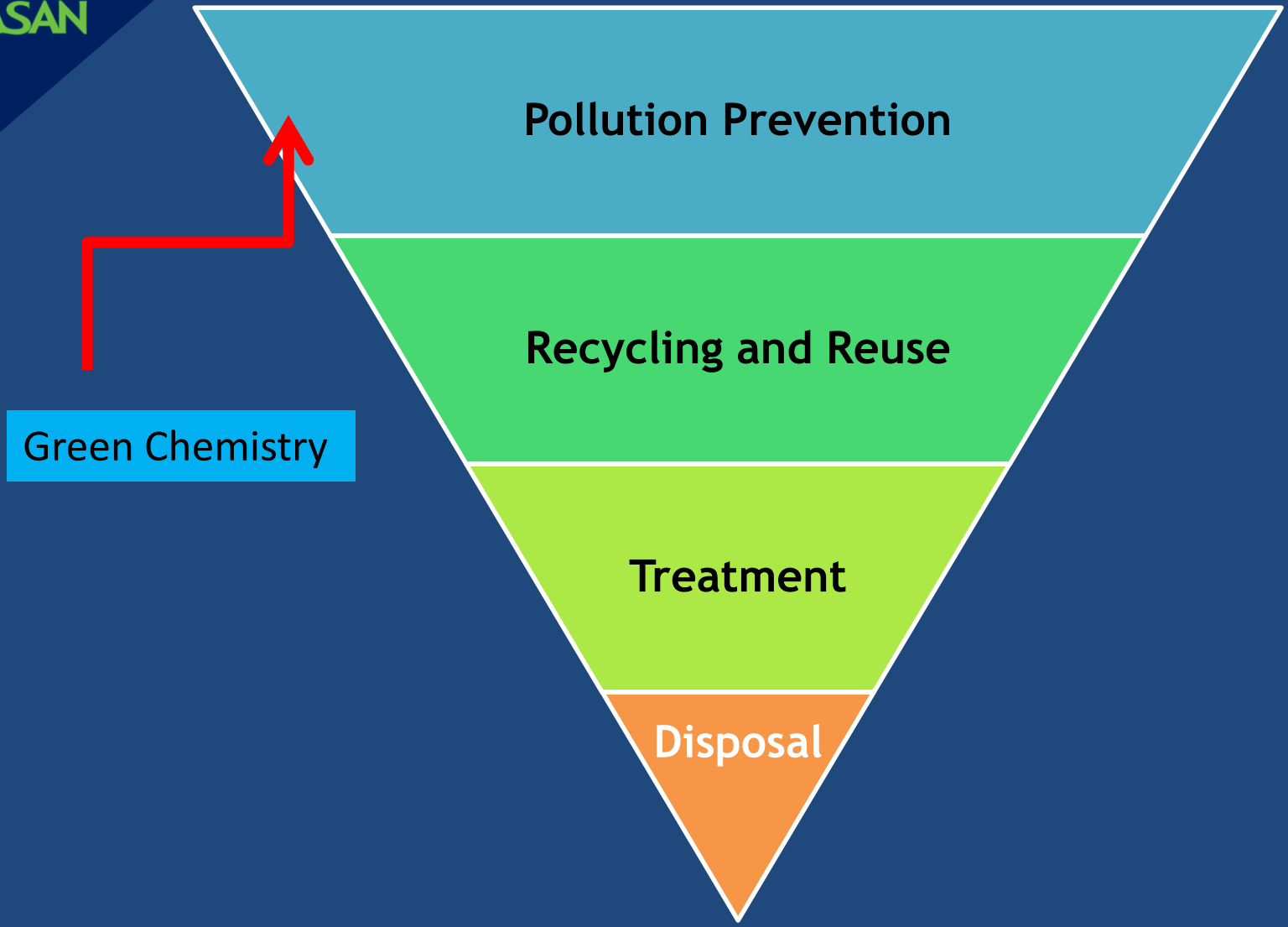
- Establish link with this industry sector
- Remove sense of adversarial relationship
- Continue Implementing industry sector cooperation
- Promote economic incentives & P2 practices
- Webinar, presentations/workshops, promote recognition by performance.

How LA Industry help Compliance



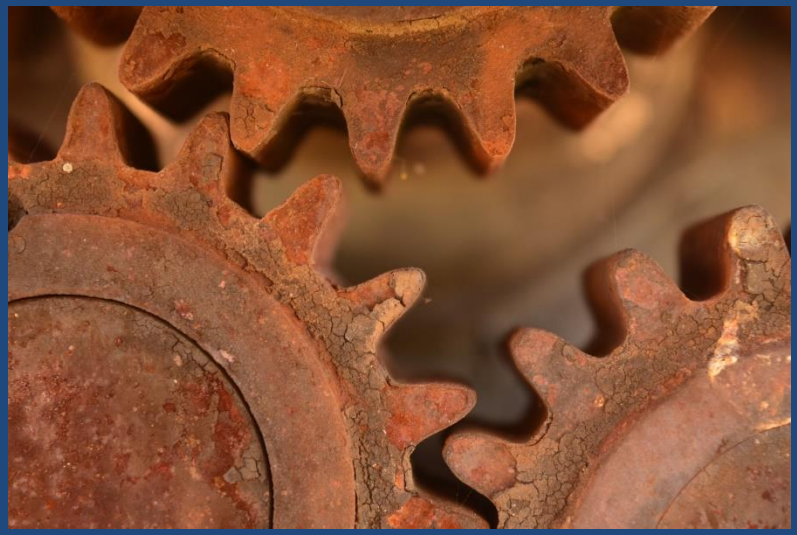
ZERO WASTE
ZERO WASTED WATER

Pollution Prevention Hierarchy



Pollution Prevention Hierarchy as established by Congress in the Pollution Prevention Act of 1990
http://cadburymarketing101.blogspot.com/2015/10/product-life-cycle-product-life-cycle.html

What is Metal Finishing?



Metal finishing is an all-encompassing term used to describe the process of placing some type of metal coating on the surface of a metallic part, typically referred to as a substrate.

Metal Finishing Processes

Electroplating

Electroless Plating

Anodizing

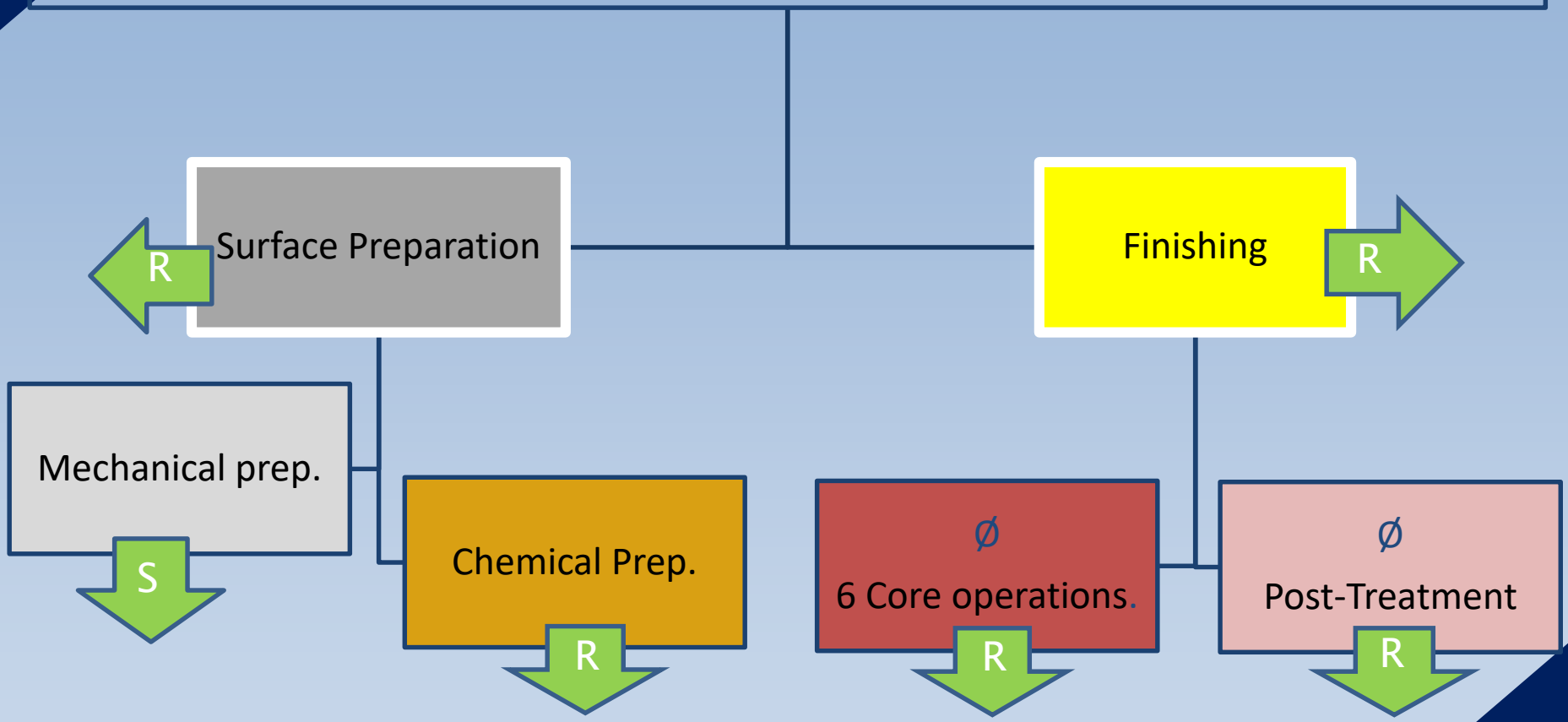
Coating

Chemical Etching

Mfg of Printed Circuit Boards

ZERO WASTE
ZERO WASTED WATER

P2 Opportunities for MF



Opportunities for P2.

Ø Pollutants load/type

ZERO WASTE
ZERO WASTED WATER

Los Angeles Metal Finishers Inventory

40 CFR Ind. Cat.	Description	Total count
413	Electroplating	22
433	Metal Finishing	58
413/433	Electroplating/Metal Finishing	6
433/464	MF/Metal Molding & Casting	2
433/471	MF/Non-Ferrous Metal Forming	1
Total		89

ZERO WASTE
ZERO WASTED WATER

P2 Source Codes

Process Substitution (P10----PS80).	8 Codes	1
Material Substitution (MS10----MS110)	11 Codes	2
Product Change (PC1----PC20)	2 Codes	3
Water Conservation (WC10---WC100)	10 Codes	4
Onsite Reuse Process (OSR10---OSR90)	9 Codes	5
Offsite Recycling (OSRR10----OSRR90)	9 Codes	6
Installation of P2 Equipment & Systems (IPES10----IPES70)	7 Codes	7
Operating Practices & Managements (OPM10----OPM80)	9 Codes	8

ZERO WASTE
ZERO WASTED WATER

Proposed Compartments

Operations & Maintenance

3a. Housekeeping & Employee training

3b. Maintenance Operations

3c. Other Recycling Programs

Water Conservation

2a. Rinsing Efficiency

2b. Water Controls

2c. Improved wastewater Treatment

CEC Reduction

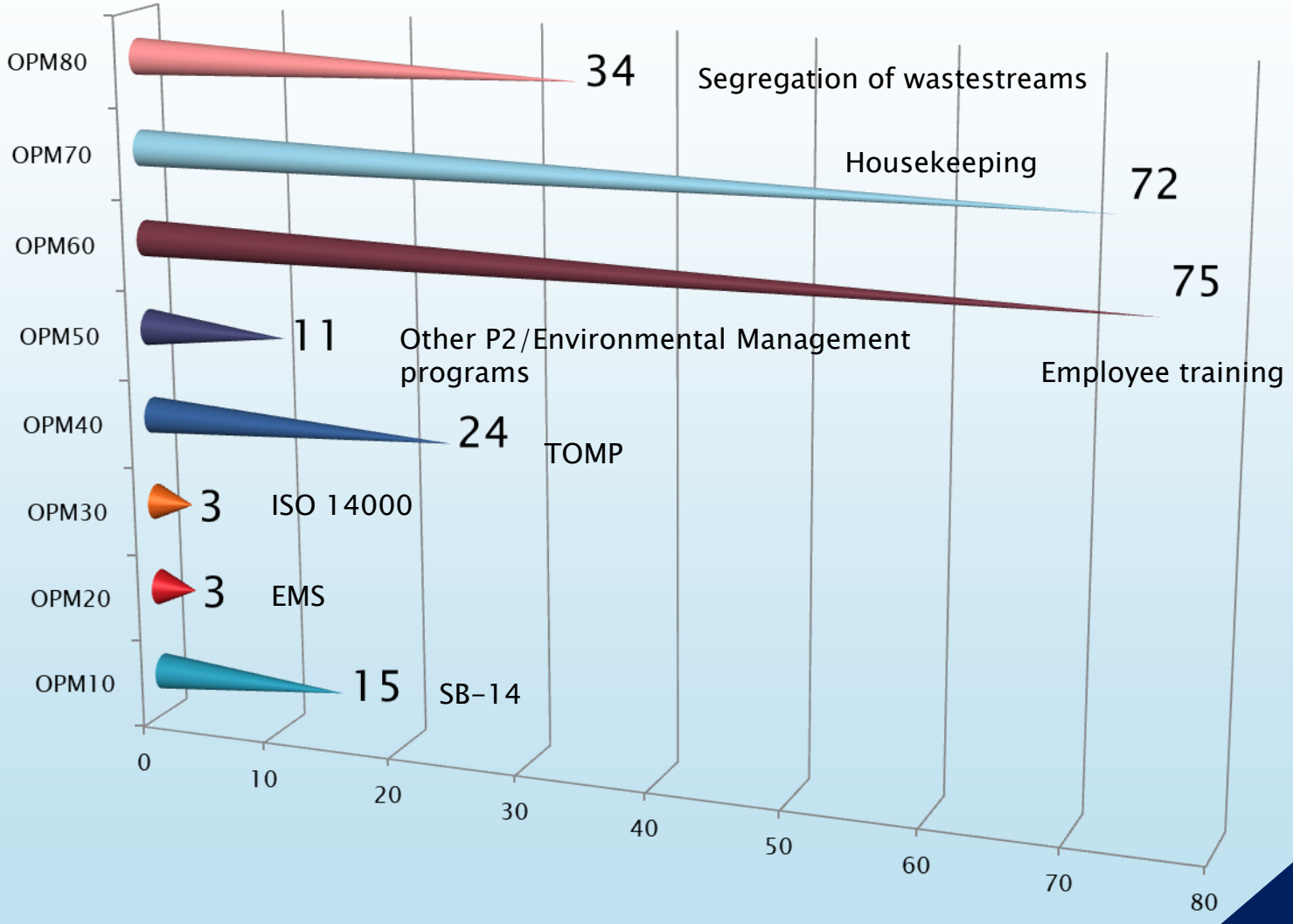
1a. Chemical Substitution

1b. Process Reformulation

1c. Reuse & Recovery Practices

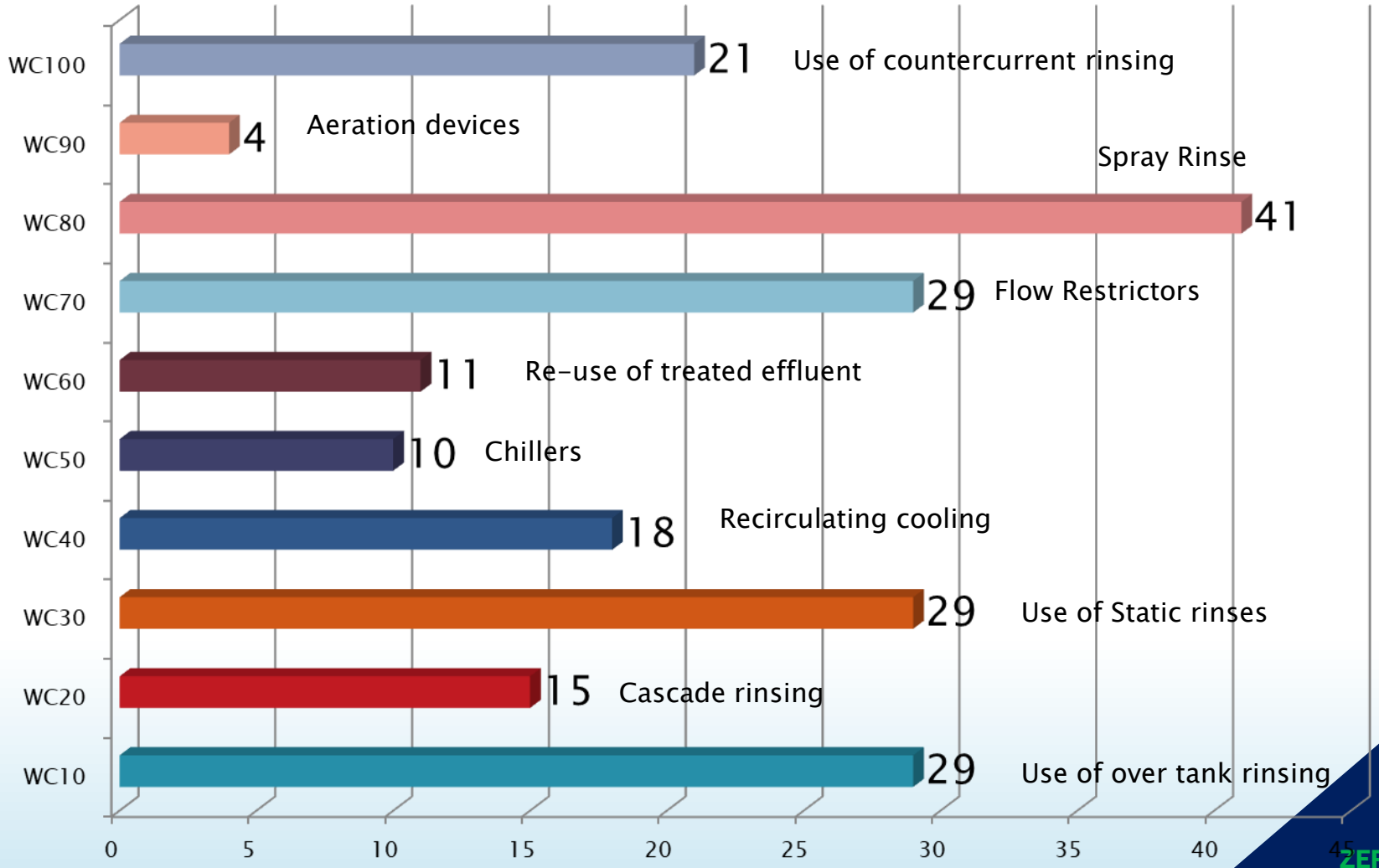
ZERO WASTE
ZERO WASTED WATER

Operating Practices & Management



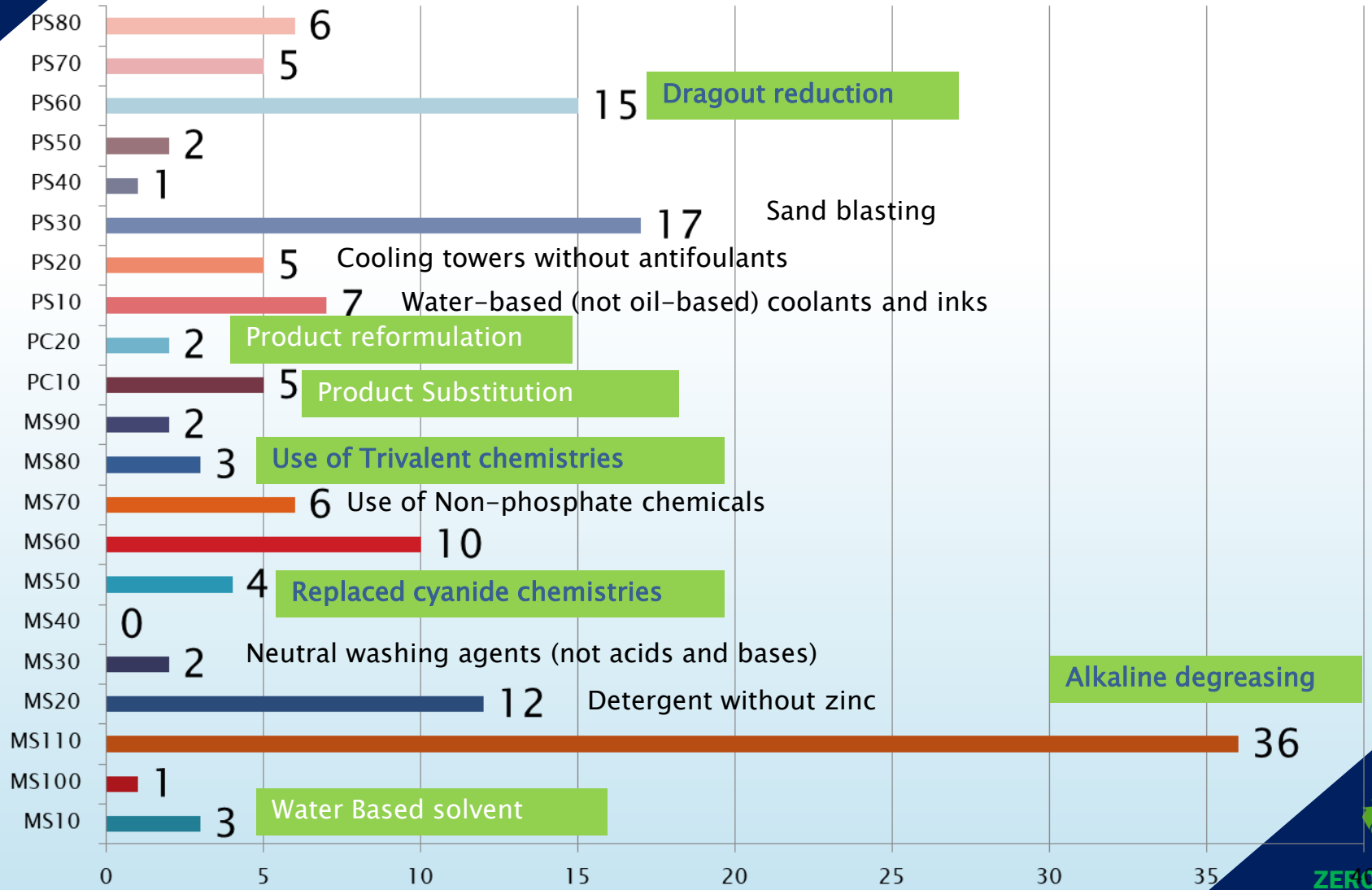
ZERO WASTE
ZERO WASTED WATER

Water Conservation practices



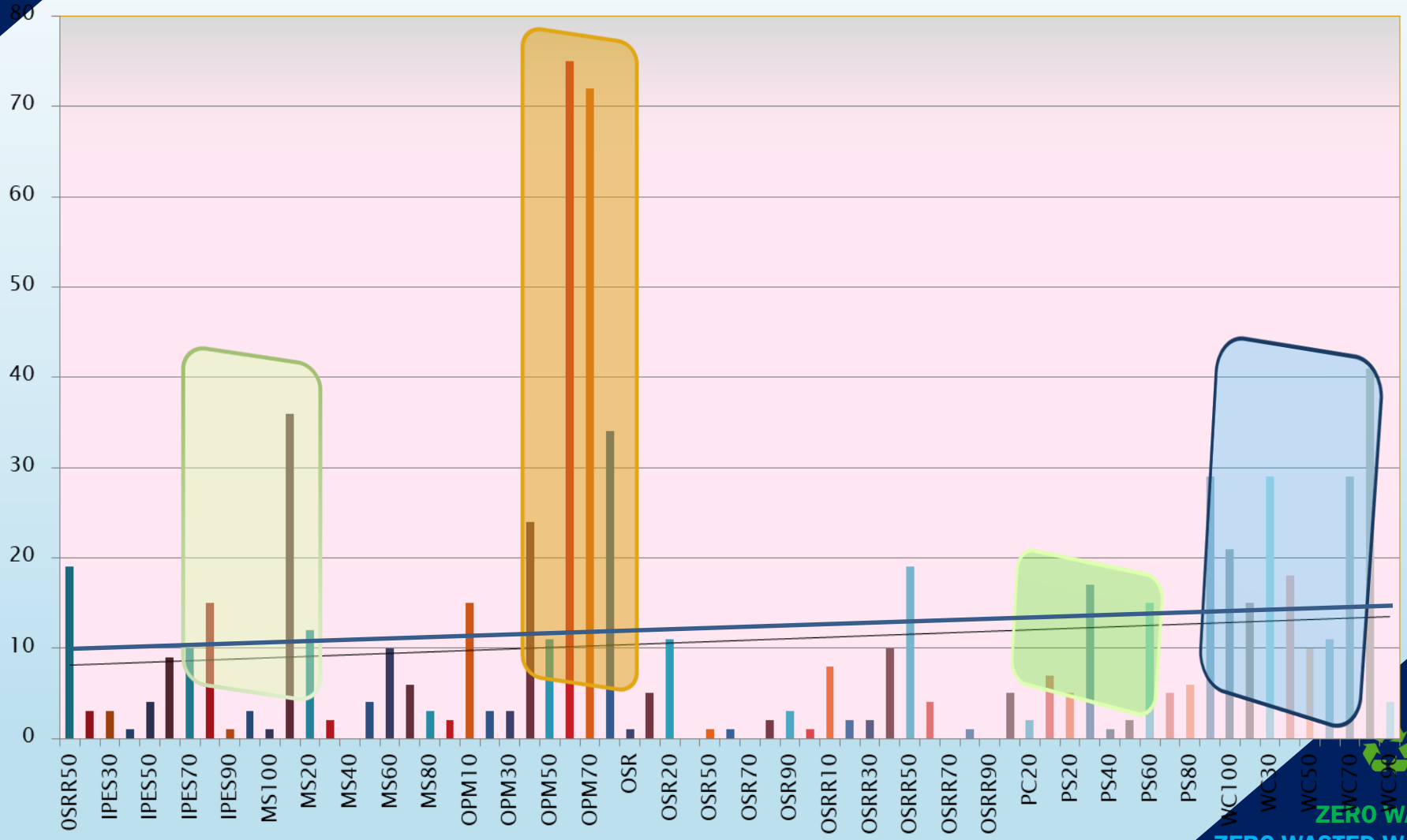
ZERO WASTE
ZERO WASTED WATER

Product Substitution/Process Modification



ZERO WASTE
ZERO WASTED WATER

General Overview



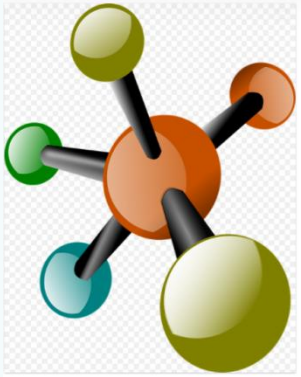
ZERO WASTE
ZERO WASTED WATER

Green chemistry is a strategic way to increase profits and move towards safer product design and creation while increasing profit margins.
So green chemistry is creating products and processes that reduce or eliminate the generation of hazardous substances.

What is Green Chemistry

Green chemistry is an innovative way to create products and processes that reduces the generation of hazardous substances

Green Chemistry



The 12 principles

1. Prevention
2. Atom Economy
3. Less Hazardous Synthesis
4. Design Benign Chemicals
5. Benign Solvents & Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis (vs. Stoichiometric)
10. Design for Degradation
11. Real-Time Analysis for Pollution Prevention
12. Inherently Benign Chemistry for accident prevention

"Green Chemistry is the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products."

-Paul Anastas

Not all P2 is Green Chemistry (GC), however GC is Pollution Prevention at the Molecular level.

ZERO WASTE
ZERO WASTED WATER

Degree of Greenness

*"Green chemistry has been practiced primarily at the chemical discovery, development and formulation levels, there are, however, several ways to assess the **degree of greenness** of a company"*
– Ann Blake, GC3

- Change the source materials
- Incorporate green chemistry practices in products
- Change manufacturing practices to substitute or reduce the use of hazardous chemicals
- Develop and implement policies that restrict chemicals of concern in the products they source, make, and/or sell

GC3 GREEN CHEMISTRY & COMMERCE COUNCIL
Business Mainstreaming Green Chemistry

Reference:
1. Ann Blake, *Measuring Progress Toward Green Chemistry.*
www.greenchemistryandcommerce.org

ZERO WASTE
ZERO WASTED WATER

Metrics of Greenness

GC3 Metrics

1. Molecular/Process
2. Product and Material
3. Firm and Sector Level
4. Societal Level

Proposed Metrics

- ✓ Raw Materials
- ✓ Chemicals of concern
- ✓ Process changes
- ✓ Manufacturing Practices
- ✓ Operations & Maintenance

ZERO WASTE
ZERO WASTED WATER

Sample MF Scorecard

	Product Change (PC)	Product Substitution (PS)	Material Substitution (MS)	Water Conservation (WC)	O & M	Total P2s
Facility A	0	1	1	2	4	8
Facility B	0	1	1	5	5	12
Facility C	1	1	2	5	6	15

Greenness = f (GC) + P2.

ZERO WASTE
ZERO WASTED WATER

Degree of Greenness

Process Substitution or Reformulation/Modification

- H2SO4 Anodizing instead of Chromic acid
- Tin Plating instead of lead
- Dragout Reduction
- Wastestream segregation*
- Sand Blasting instead of acid cleaning
- Automated systems (in-line product quality/changes in operating settings)
- Energy Conservation

Degree of Greenness Cont.

Material or Chemical Substitution

- Alkaline degreasing
- Water based (non-halogenated) solvents
- Zin/Nickel alloys instead of Cadmium Plating

Degree of Greenness Cont.

Convert to Less Toxic Products

- Hex Chrome free
- Trivalent chemistries
- Cyanide free
- Delisting RCR waste

ZERO WASTE
ZERO WASTED WATER

Questions?

Miguel Rodas

Miguel.Rodas@lacity.org

www.lacitysan.org

ZERO WASTE
ZERO WASTED WATER