# Regulations Drive New Advancements in Rust Preventives

## Aqueous Low VOC Rust Preventive Solutions

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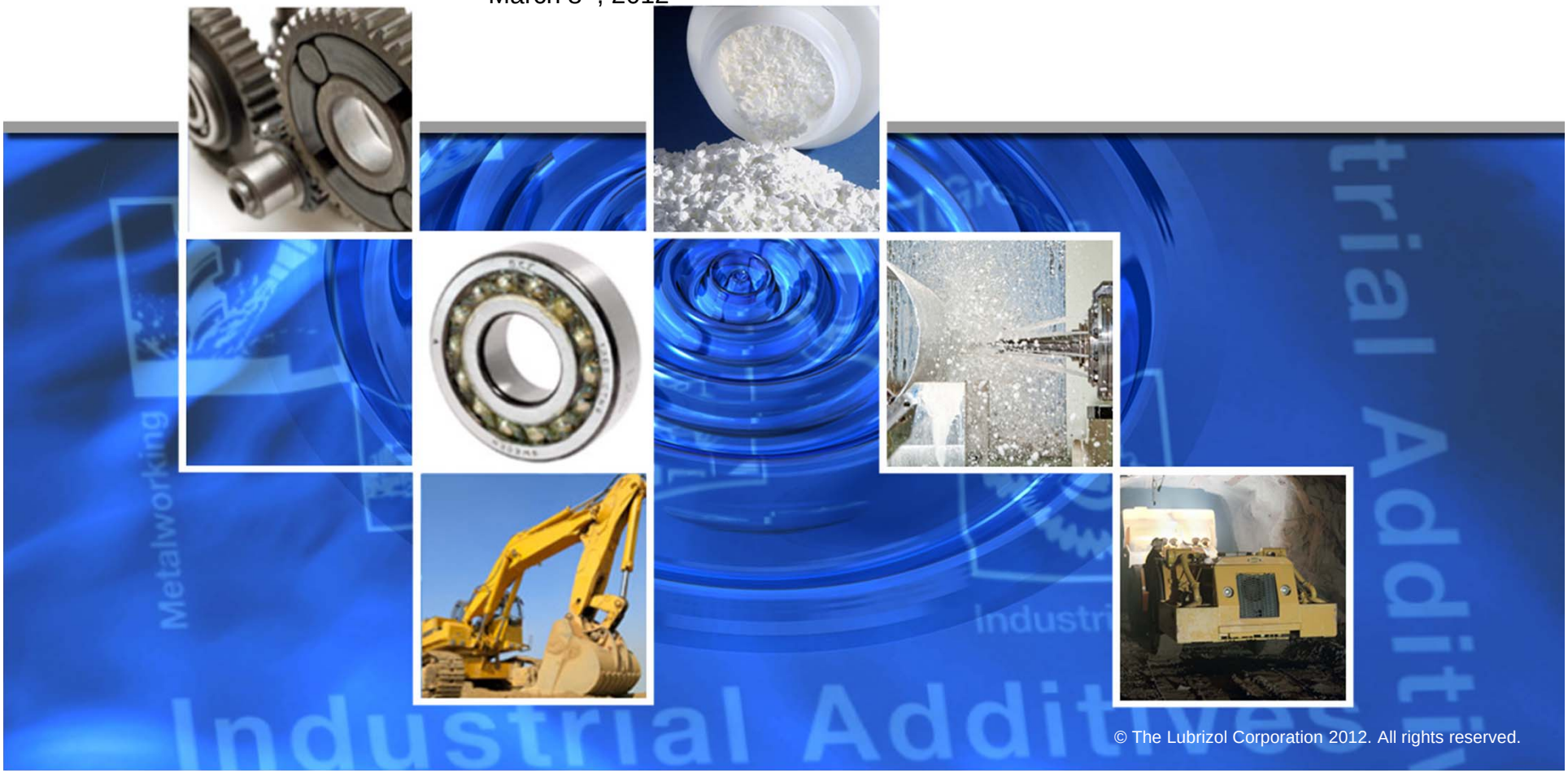
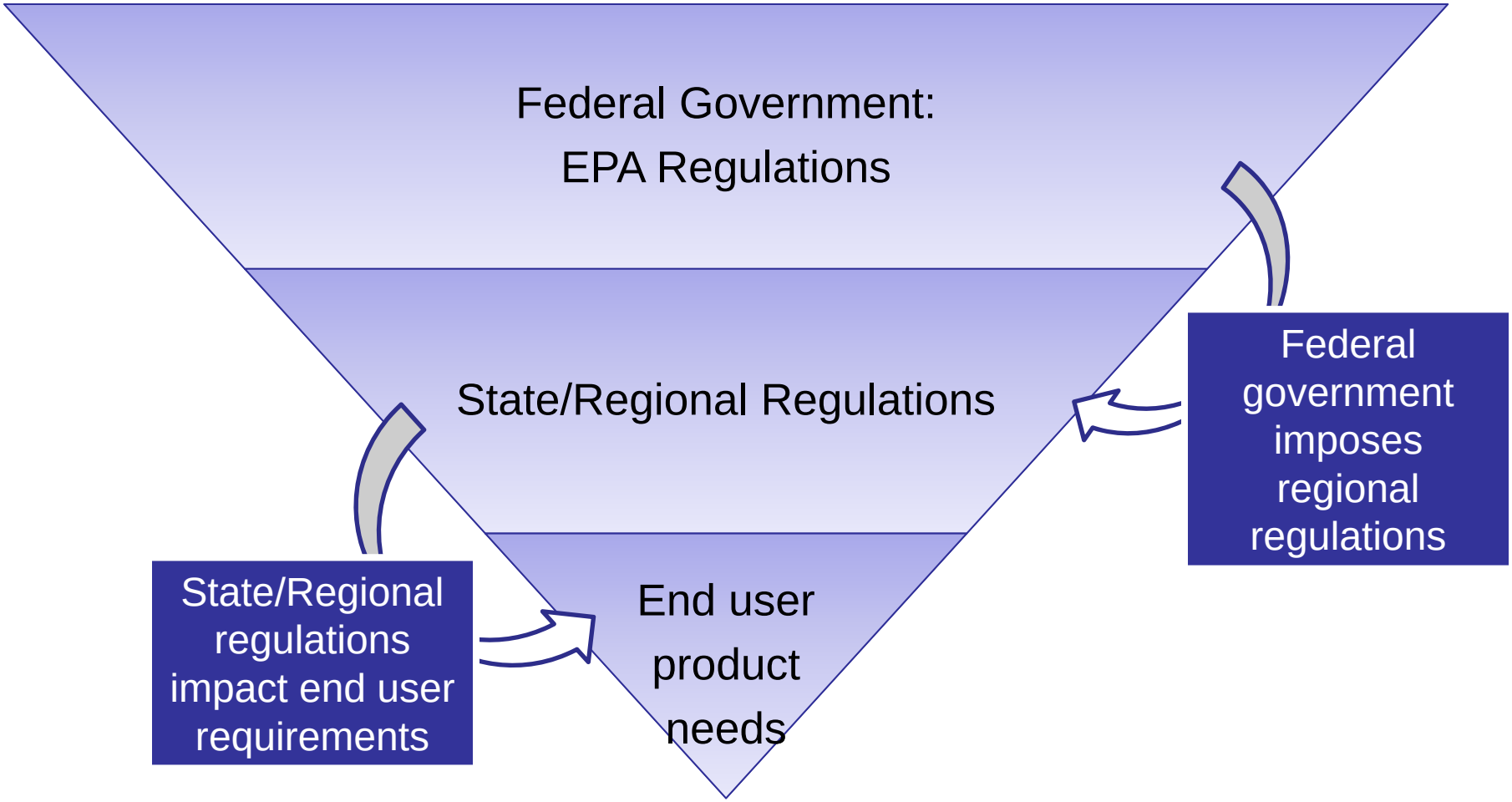


# Agenda

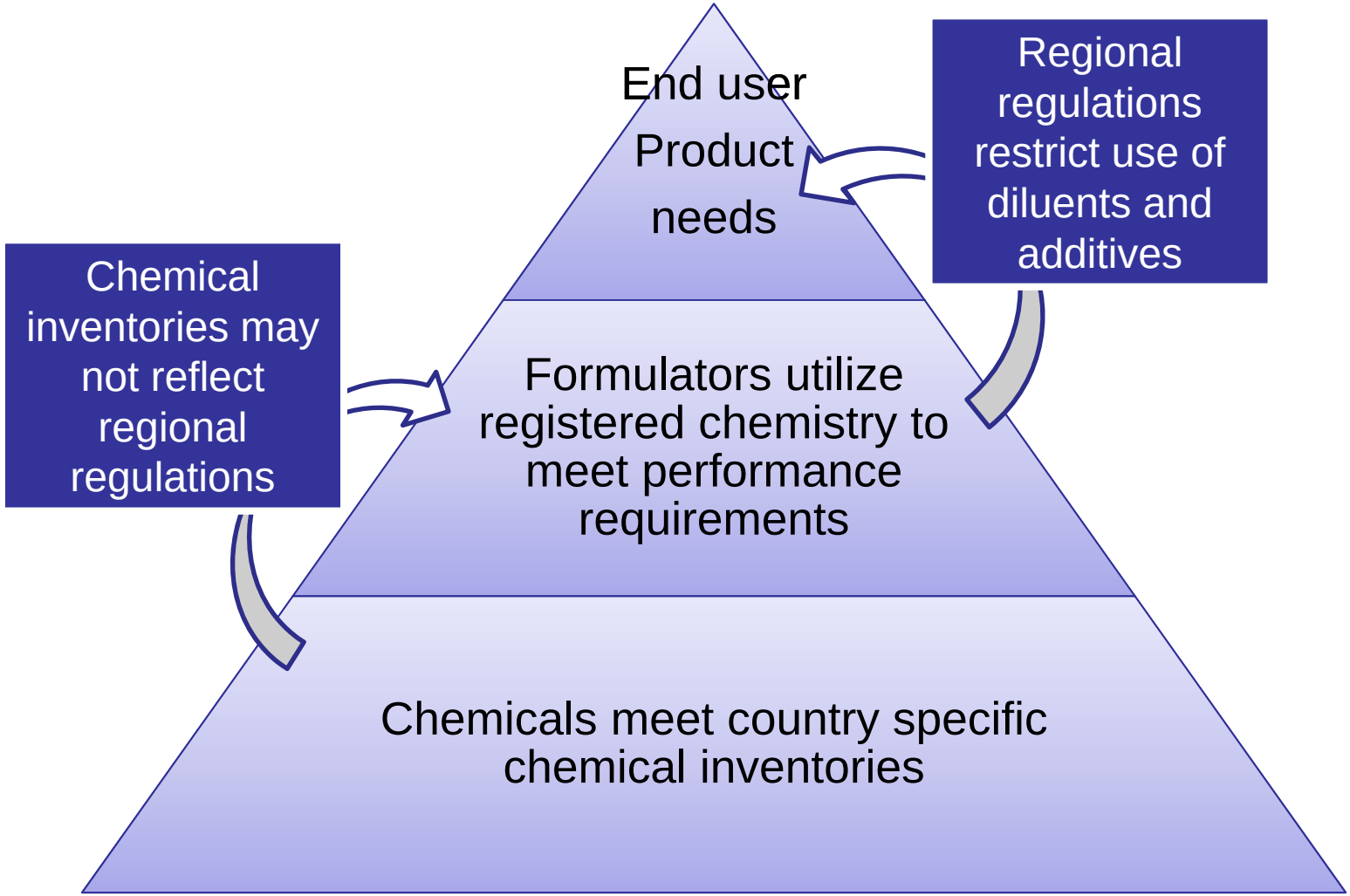
- New regulations require innovative solutions
- Aqueous low Volatile Organic Compounds (VOC) rust preventive
  - Market drivers
  - Project scope
  - Rust preventive performance
    - Aqueous vs. solvent
    - Heavy duty
    - Moderate duty
  - Applications
  - Benefits

# NEW VOLATILE ORGANIC COMPOUND (VOC) REGULATIONS

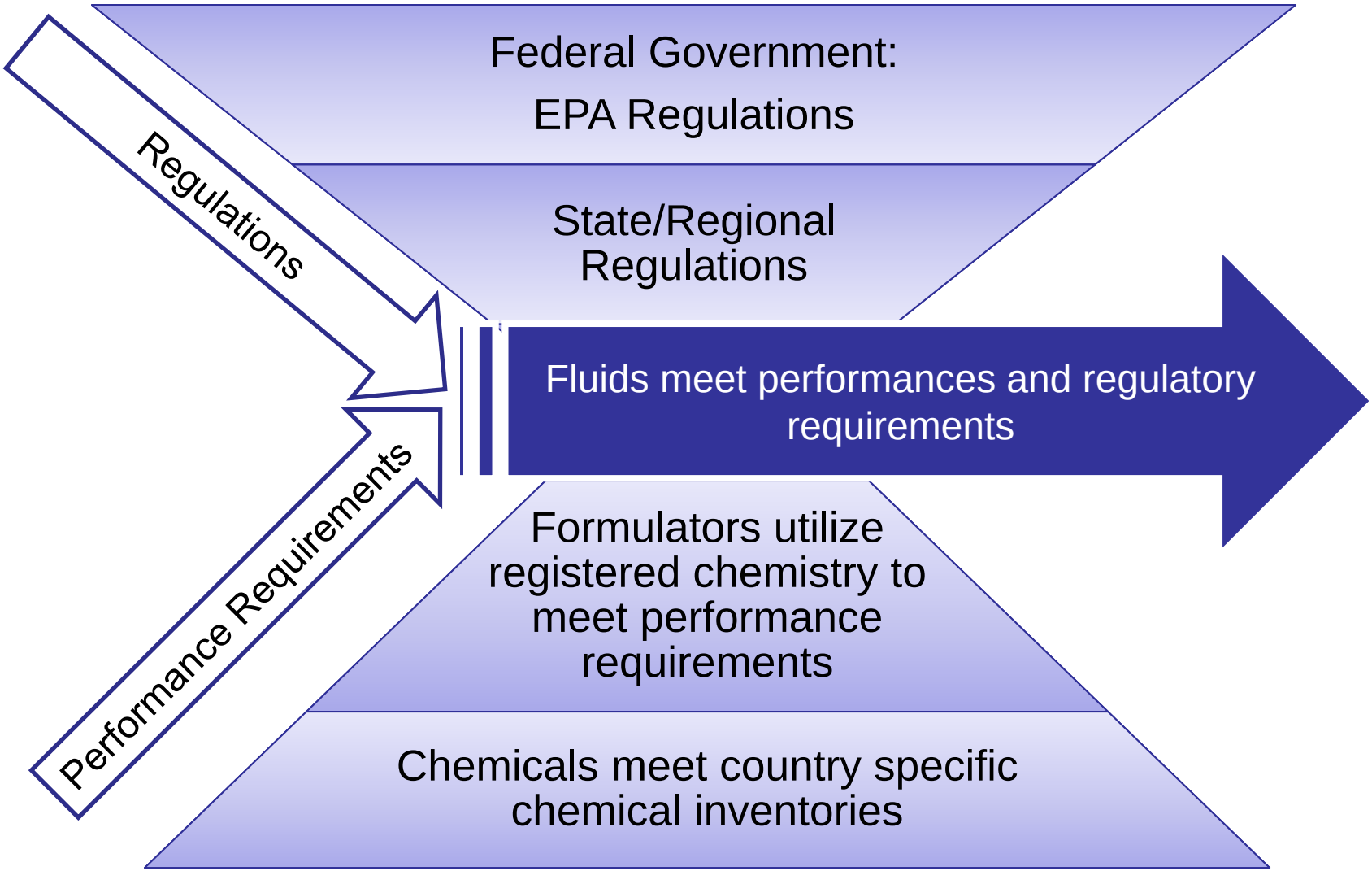
# Regulation of VOC Content



# Formulating VOC Compliant Products



# Combining Regulations and Formulating



# Regulation of VOC Content

- Rule 1144 is a regional regulations to “reduce VOC emissions from the use of metalworking fluids”*
  - “South Coast AQMD is the air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside and San Bernardino counties, the smoggiest region in the U.S.”*
- Compliance will require fluid suppliers provide VOC data for products marketed in this region
  - Products are sold regionally and nationally
  - Regional requirements can have a national impact

**Innovative solutions are required to meet new regulations**

*http://www.aqmd.gov/Default.htm

# AQUEOUS LOW VOC RUST PREVENTIVE

# Rust Preventive Market Drivers

## Regulation of VOC content

- Eliminate flashpoint concerns
- Minimize adverse health and environmental effects
- Sales restrictions in regulatory rich geographies

## Removal and cleaning

- Heavy duty rust preventives are difficult to remove for further processing
  - May require solvent and/or abrasive methods
  - Desire to use water-based alkaline cleaners

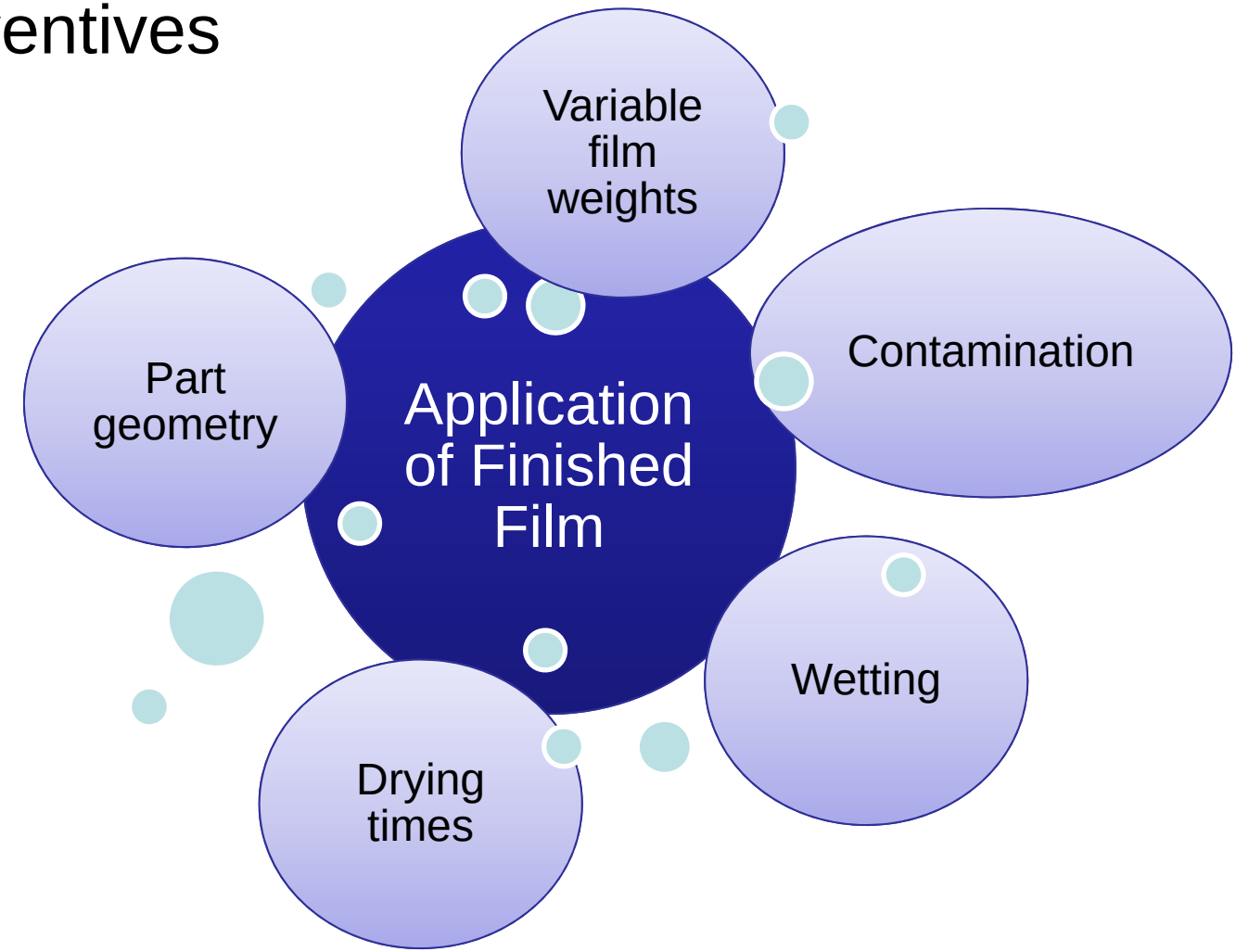
## Multi-functional

- Provides a range of product performance utilizing the same raw materials

# Project Scope: Aqueous Low VOC Rust Preventive

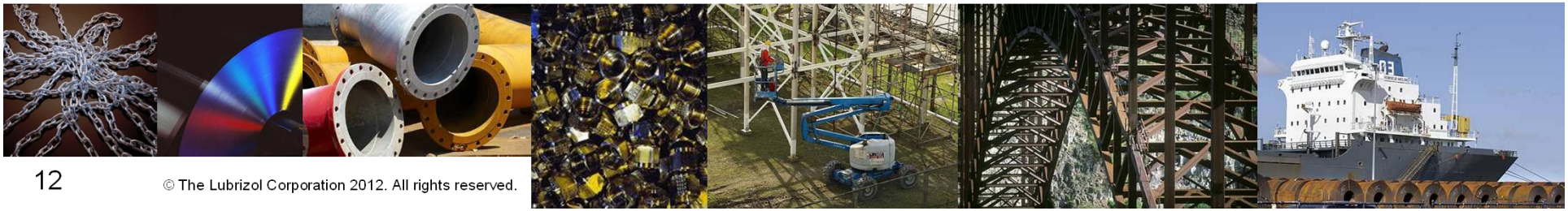
| Flexibility | Market Solutions | End User Demands |
|---|---|---|
| • Range of surfaces to be protected<br>– Metals<br>– Pre-treatments<br>• Multiple application methods<br>• Diverse performance requirements | • Hazards and costs associated with heavy metal exposure/disposal<br>• Cleaning time and cost<br>• Number of additives<br>– To respond to global demands<br>– To deliver multiple performance levels | • Easier cleaning<br>• Cold temperature storage<br>• Long lasting film in extreme atmospheres<br>• Spray control<br>• Uniform film formation |

# New Challenges to Aqueous Based Rust Preventives



# Aqueous Based Rust Preventive

| Desired Features |
| --- |
| • Exceptional salt spray protection<br>• Excellent acid fume protection<br>• Non-staining |
| • Removable by alkaline cleaning methods (>50$^{o}$C)<br>• Low VOC content<br>• Does not contain heavy metals |
| • Formulation flexibility<br>• Cold temperature film flexibility<br>• Lubricity properties |



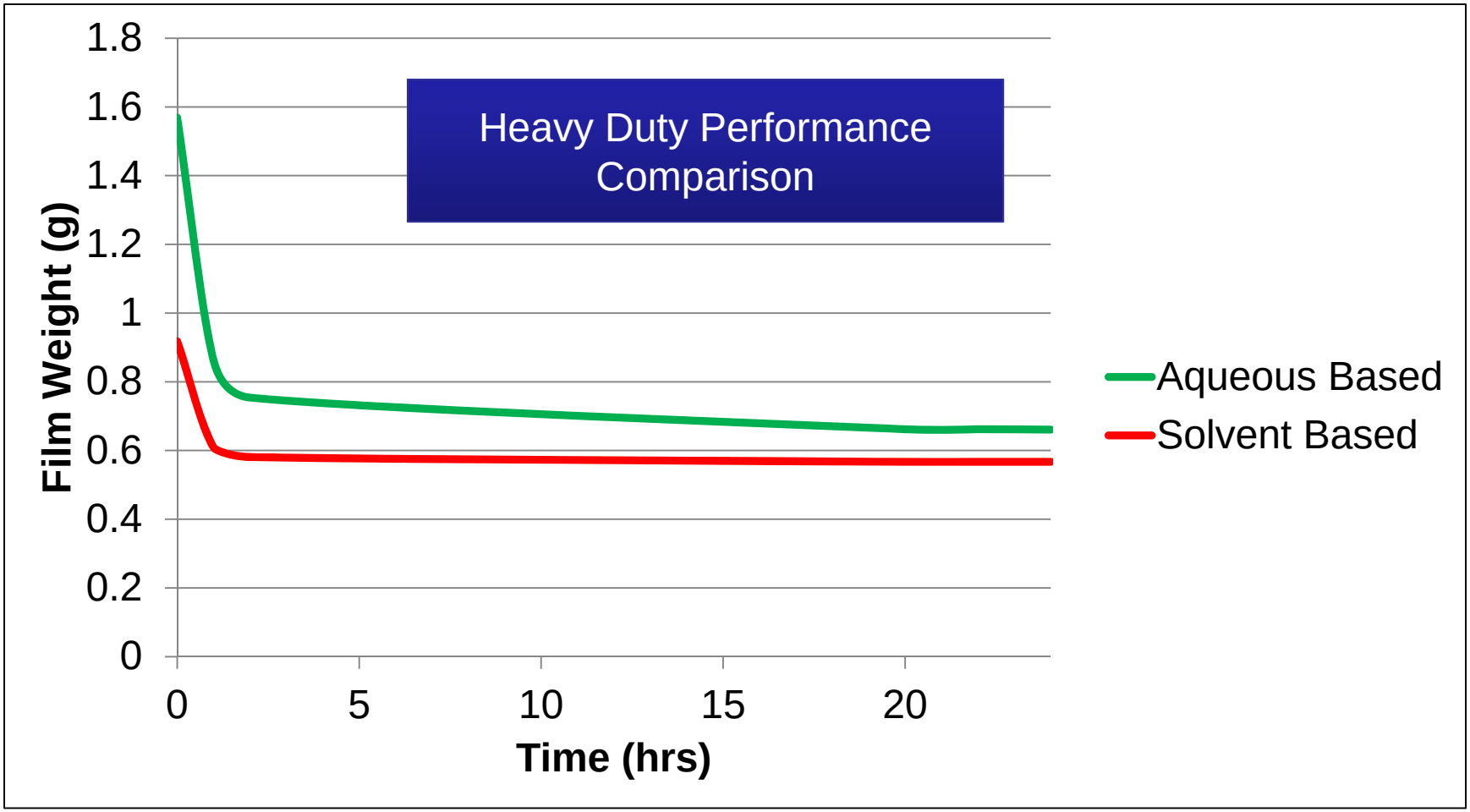
# Heavy Duty Comparison

| | Aqueous Based | Solvent Based |
|---|---|---|
| Product | 100% | 100% |
| Total solids content, % | 35% | 55% |
| VOC content (lbs/gal) | <0.3 | 3.34 |
| Dry film thickness<br>24 hours drying time | 2.3 mils | 2.3 mils |
| Flash point | N/A | 40$^{o}$C |

# Heavy Duty Performance Comparison

| | Aqueous Based | Solvent Based |
|---|---|---|
| Salt spray ASTM B117 | | |
| Cold rolled steel | 1000+ hrs | 1000+ hrs |
| Electrogalvanized | 800 hrs | 600 hrs |
| Iron phosphate | 800 hrs | 800 hrs |
| Acid fume<br>4N HCl | 250 hrs | 100 hrs |
| Cold temperature Flexibility<br>-20°C | Excellent | Excellent |
| Humidity cabinet<br>ASTM D1748 | 60+ days | 60+ days |

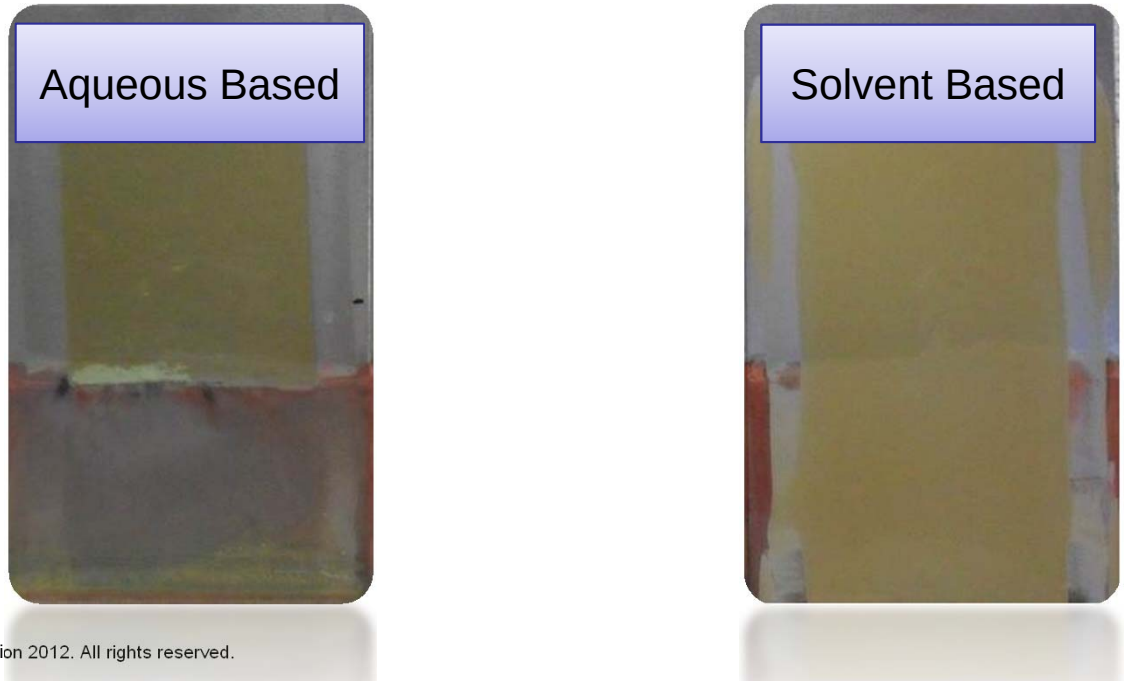
# Film Weight vs. Drying Times




Drying = ambient temperature, relative humidity

# Cleanability

- 15 minute static soak in 5% industrial cleaner at 50°C
- Follow with rinse and 30 second soak in 5% $CuSO_4$ solution for plating
- Copper plating indicates clean surface
- 2.3 mL dry film thickness



# Moderate Duty Comparison

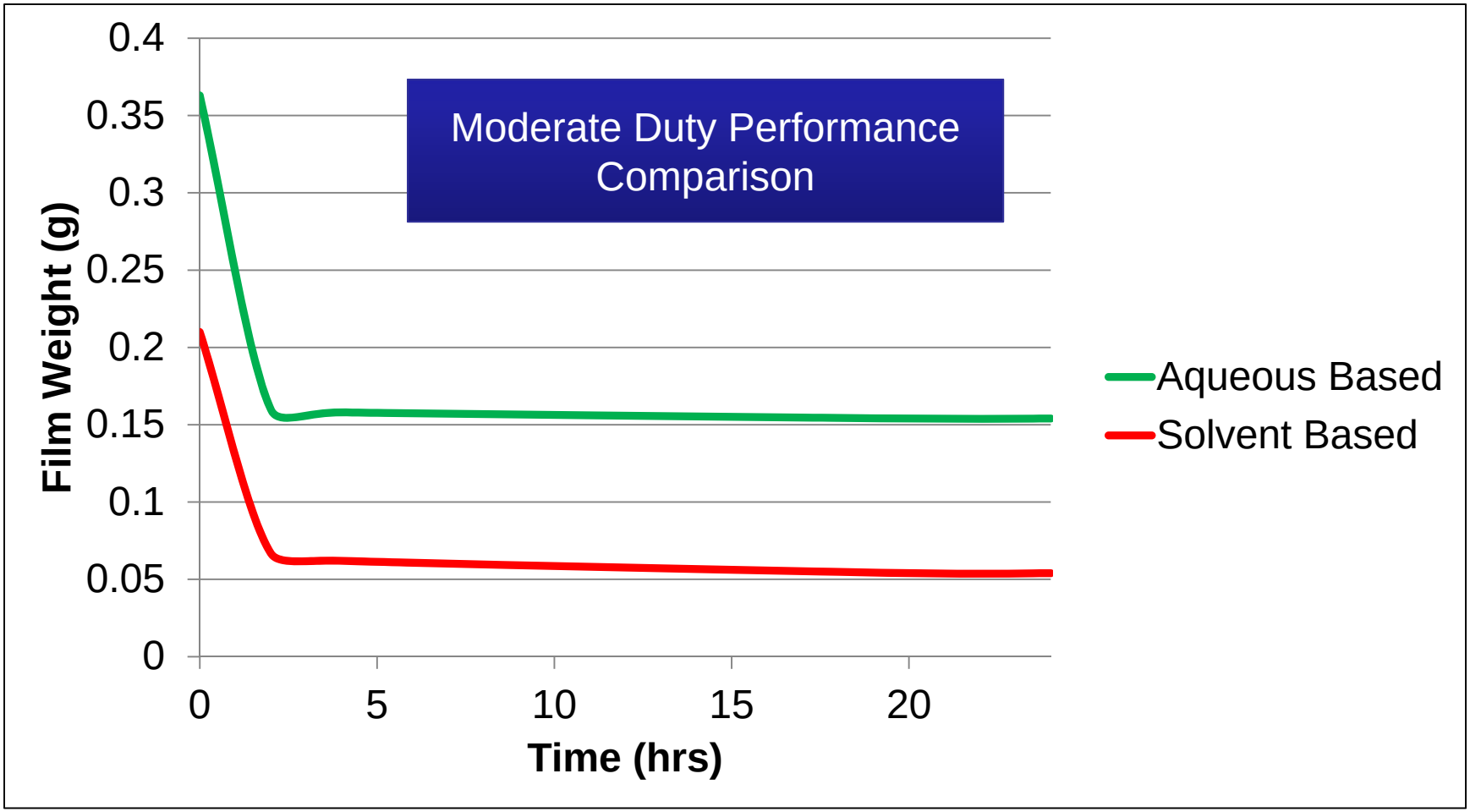
| | Aqueous Based | High Performance Solvent Based |
|---|---|---|
| Product | 49% | 20% |
| Total solids content, % | 18* | 20 |
| VOC content, lbs/gal | <0.15 | 5.21 |
| Dry film thickness<br>24 hours drying time<br>Dipping application | 0.5 mils | 0.12 mils |
| Flash point | N/A | 40°C |

*1% wetting agent added

# Moderate Duty Performance Comparison

| | Aqueous Based | High Performance Solvent Based |
|---|---|---|
| Salt spray ASTM B117<br>Cold rolled steel | 500 hrs | 175 hrs |
| Acid Fume<br>4N HCl | 200 hrs | 100 hrs |
| Humidity cabinet<br>ASTM D1748<br>Cold rolled steel | 60+ days | 60+ days |
| Cold temperature Flexibility<br>-20$^{o}$C | Excellent | Excellent |
| Stack stain,<br>1008 carbon steel<br>MIL-C-22235A | Pass | Pass |

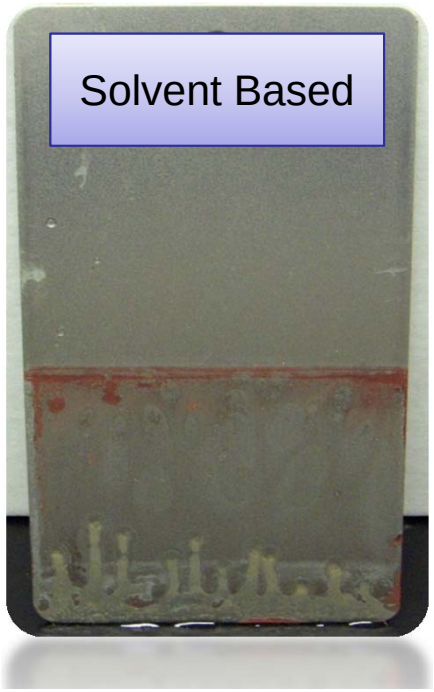
# Film Weight vs. Drying Times




Drying = ambient temperature, relative humidity

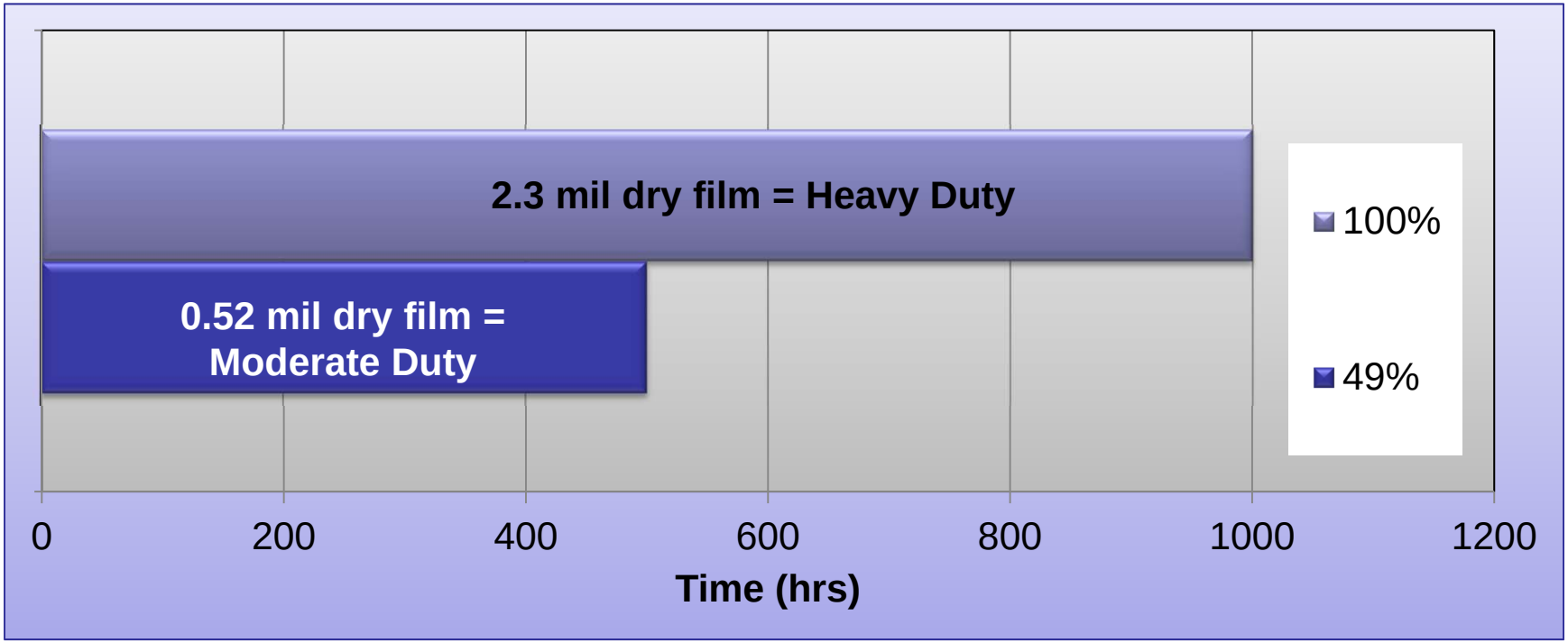
# Cleanability

- 15 minute static soak in 5% industrial cleaner at 50°C
- Follow with rinse and 30 second soak in 5% $CuSO_4$ solution for plating
- Copper plating indicates clean surface
- Dry film after dip application

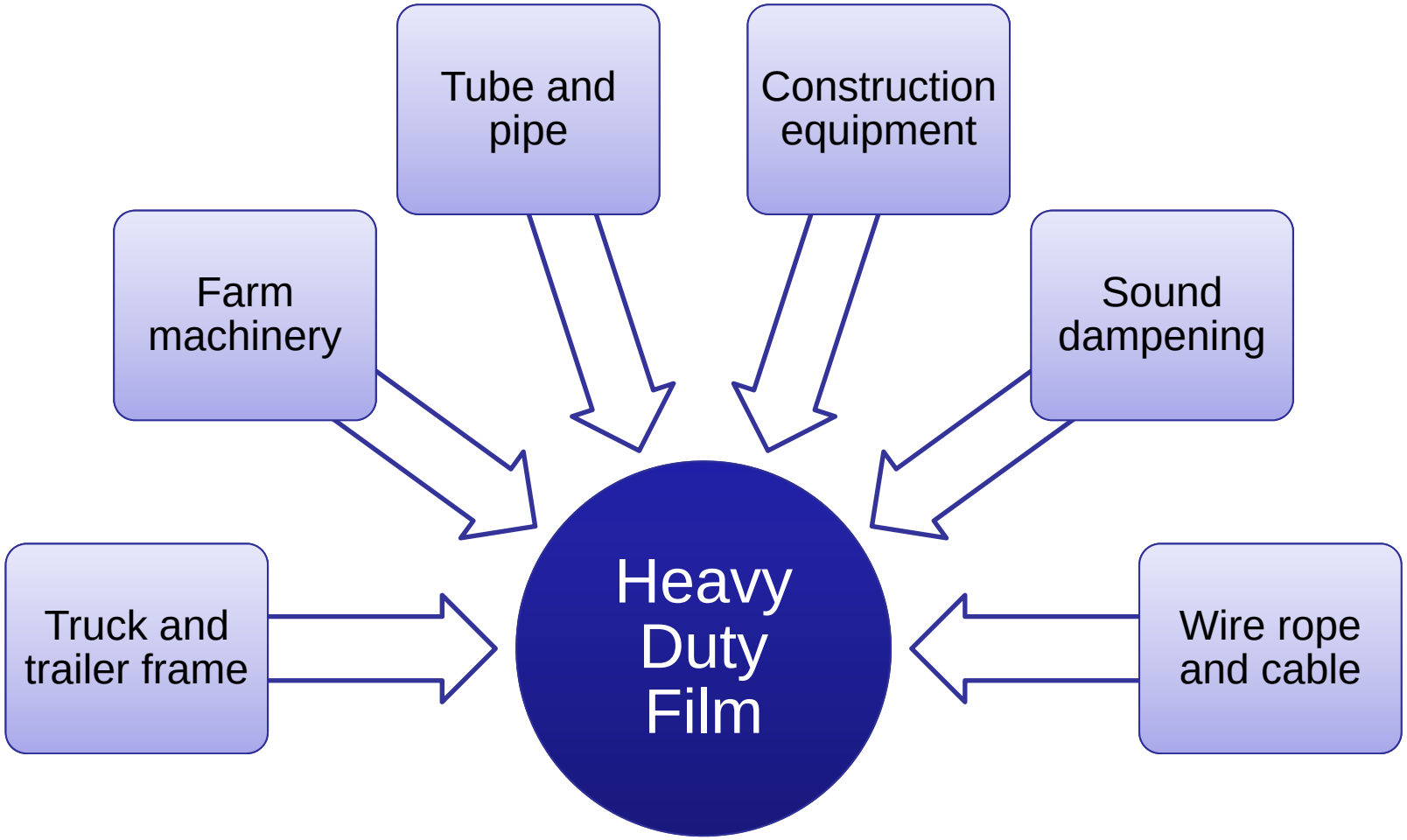



# Aqueous Based Rust Preventive

- Salt spray results
- Comparison: neat and diluted in water



# Aqueous Rust Preventive: Applications



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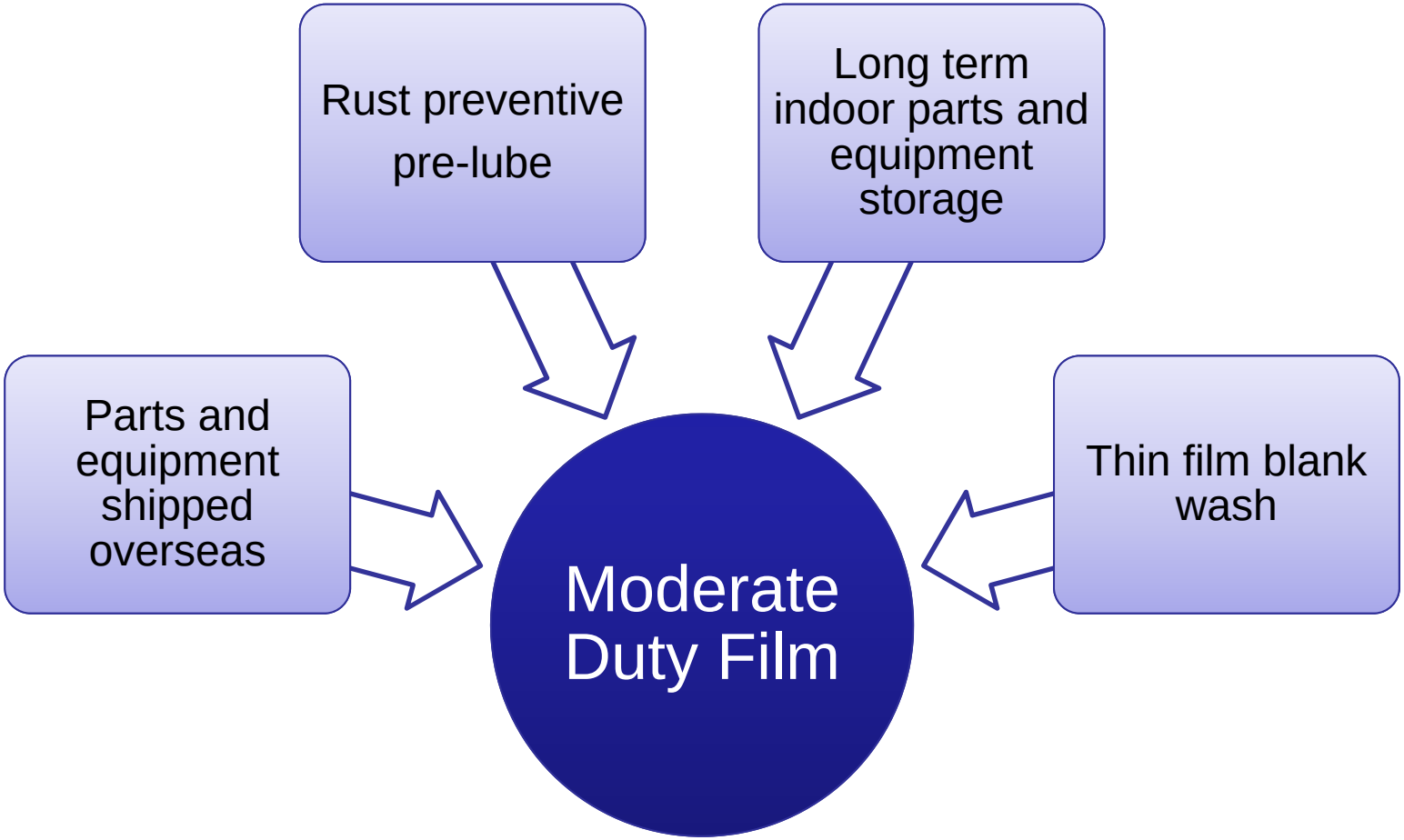

# Aqueous Low VOC Rust Preventive: Summary

| Desired features lead to… | Desired benefits |
|---|---|
| • Exceptional salt spray protection<br>• Excellent acid fume protection<br>• Non-staining | Added assurance that parts will not rust or stain when shipped or stored |
| • Removable by alkaline cleaning methods (>50°C) | Reduce work-place hazards by utilizing water based cleaners |
| • Low volatile organic compound content (VOC)<br>• Calcium based | Responsive to low VOC and heavy metal regulations |
| • Hard water stability<br>• Cold temperature film flexibility<br>• Lubricity properties | Formulation flexibility that enables multiple performance levels while reducing complexity |

# Aqueous Based Rust Preventive: It can be done!

## Responsive to regulatory issues

- Low VOC content
- No heavy metals

## Performance = Protection

- Extreme atmosphere
- Non-staining

## Formulation flexibility

- Multiple performance levels
- Reduced complexity

# Acknowledgements

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