JSC Metal Finishing Waste Minimization Methods

Erica Sullivan
Materials Research Engineer

Materials and Processes Branch
Johnson Space Center
Johnson Space Center (JSC) has achieved VPP Star status and is ISO 9001 compliant.
The Structural Engineering Division in the Engineering Directorate is responsible for operating the metal finishing facility at JSC.
The Engineering Directorate is responsible for $71.4 million of space flight hardware design, fabrication and testing.
The JSC Metal Finishing Facility processes flight hardware to support the programs in particular schedule and mission critical flight hardware.

The JSC Metal Finishing Facility is operated by Rothe Joint Venture.

The Facility provides following processes:
- Anodizing
- Alodining
- Passivation
- Pickling
JSC Metal Finishing Facility Overview

- JSC Metal Finishing Facility completely rebuilt in 1998
  - Total cost of $366,000.
- All new tanks, electrical, plumbing, and ventilation installed
- Designed to meet modern safety, environmental, and quality requirements
- Designed to minimize contamination and provide the highest quality finishes
Quality In-House Metal Finishing

- In-house metal finishing has significant quality benefits:
  - Better process control
    - Eliminate cross-contamination that causes process variability
    - Metal buildup in process solutions can be verified by JSC laboratories
  - Better process performance
    - Process chemistry can be adjusted to specific requirements for aerospace materials
    - Performance verified through periodic salt spray testing
    - Process improvements can be overseen by engineers firsthand
  - Achieve consistent color and appearance on flight hardware
    - Hardware viewed by millions on international television
  - Immediate troubleshooting
    - Metal finishing process problems can be diagnosed in real time and quickly corrected
Metal Finishing Facility
Safety Facility Features

- Process tanks and main floor are completely non-metallic to prevent corrosion
- Sub-floor sealed and seamless polypropylene liner installed that extends 36 inches up the wall
- Open walkways and work areas
- Independent audit by Fuss and O Neil Consulting Engineers found facility met all OSHA safety requirements
Safety Facility Features

- Fumes pulled to back of tank and away from workers

- Hexavalent chromium used only in conversion coating process
  - No agitation or heating of tank
  - Short duration of any potential worker exposure
  - Workers are protected from hexavalent chromium
Safety Multiple Levels of Containment

1" polypropylene process tank
1/2" polypropylene containment tray
Fiberglass grated floor
Double-walled discharge lines

1/2" Polypropylene Liner
Chemical Resistant Plastisol Coating
3" Acid Resistant Bricks
6" of Neutralizing Membranes

primary
secondary
tertiary

S U B - F L O O R
Environmental Wastewater Minimization

- A dragout rinse tank is used to capture hexavalent chromium from treated parts after conversion coating
  - Resin bed removes chromium from dragout tank
  - Counterflow rinsing is used to minimize volume of rinse water

- Conductivity of rinses are continuous monitored
  - Will detect any contamination before pretreatment
The JSC Environmental Office oversees the disposal practices of JSC Metal Finishing Facility.

- Process chemicals are tanked and trucked to certified disposal facility.
- Rinse water is treated and released to sanitary sewer.
- Exhaust air is scrubbed and treated.
- Zero release of hazardous metals to local environment.
- JSC Metal Finishing already meets the proposed EPA Metal Products & Machinery (MP&M) Limits for metals in wastewater.

- EPA refers third parties to JSC for compliance benchmarking.
Environmental Past Initiatives

<table>
<thead>
<tr>
<th>WAS</th>
<th>CHANGED TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromic Deoxidizer</td>
<td>Non-Chromic Deoxidizer</td>
</tr>
<tr>
<td>Ferrocyanide Conversion Coatings</td>
<td>Ferrocyanide-Free Conversion Coatings</td>
</tr>
<tr>
<td>Chromated Pickles/Strippers</td>
<td>Non-Chromated Pickles</td>
</tr>
<tr>
<td>Chromic Acid Anodize</td>
<td>Sulfuric Acid Anodize</td>
</tr>
<tr>
<td>Chromated Anodize Seal</td>
<td>Non-Chromated Anodize Seal</td>
</tr>
<tr>
<td>Nitric-Chromic Acid Passivation</td>
<td>Nitric Acid Passivation</td>
</tr>
</tbody>
</table>
Memtek Facility

- A pretreatment system is used to treat the rinse waters from the Metal finishing

- The Memtek system is the chemical waste processing system used to reduce chemical waste effluent

  — After treatment, rinse water is clean enough for discharge to sanitary sewer
Memtek Facility

- Utilizes a pH adjustment followed by membrane filtration technology to remove metals prior to discharge to the sewer.
- The supernatant sludge is processed through a plate and frame filter creating a dried filter cake.
- Prior to 1998, the filter cake was considered hazardous waste due to the concentrations of metals contained in the waste.
• Environmental Initiatives in Progress

— JSC M&P Engineering is working with the Aerospace Chromium Elimination (ACE) industry team in seeking alternatives to hexavalent chromium conversion coatings
  • *Non-chromated conversion coatings do not yet match performance of current conversion coatings*

— Working towards eliminating the need for a Hazardous Waste Permit for waste collection system
Summary

• Metal Finishing Lab is a state-of-the-art facility
  — Meets all current and proposed safety, environmental and quality requirements
  — Allows JSC to develop new replacement technologies

• The Metal Finishing Facility provides fast turnaround required for Space Station and Shuttle mission critical flight hardware at JSC
Acknowledgements

- **ES Structural Engineering Division**
  - Gail Horiuchi
  - Jay Bennett
  - Leslie Schaschl

- **Rothe Joint Venture**
  - Willie Scheis
  - John Tyznik

- **JSC Environmental Office**
  - Sandra Parker
  - Rick Jones, Dyncorp