Overcoating of Lead-Based Paint on Steel Structures

Cost and Performance Report

Timothy D. Race, Ashok Kumar, Robert A. Weber, and L.D. Stephenson

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Executive Summary

In the past, hazardous lead-based paint (LBP) has been used extensively on all types of Department of Defense (DoD) steel structures and steel components including road and rail bridges, transmission towers, antennae, storage tanks, metal buildings, and aircraft hangars.

The removal of LBP is generally performed by abrasive blasting or by water jetting. Containment and disposal of surface preparation debris, worker protection, and other regulatory compliance costs combine to make removal of LBP very expensive. According to a recent Federal Highway Administration report (FHWA 1995), bridge maintenance painting costs have nearly doubled over the past 5 years. The added costs for worker health, environmental monitoring, waste disposal, and containment are significant.

This Environmental Security Technology Certification Program (ESTCP) project demonstrated the overcoating process, which may be defined as the practice of painting over existing coatings as a means of extending service life. Maintenance painting of this type does not require extensive surface preparation and minimizes worker exposures and hazardous waste generation.

Demonstration of the overcoat process was performed during 2000 on a water tank at Fort Campbell, KY and a railroad bridge at Holston Army Ammunition Plant (HAAP), Kingsport, TN. The demonstrations met the performance requirements, which were to: (1) clean and overcoat the existing LBP, (2) comply with environmental standards, (3) comply with worker health and occupational safety requirements, (4) collect data and estimate installed costs, and (5) determine the performance of the overcoat process.

The installed cost of overcoating on a simple structure (Fort Campbell water tank) was estimated at $1.55/sq ft. The installed cost for overcoating on a complex structure (HAAP railroad bridge) was estimated at $2.83/sq ft. By comparison, the cost of deleading and installing a new paint system is $5 to $18/sq ft with an average cost of $8/sq ft.

The hazardous wastes generated during preparation for overcoating of the simple and complex structures were 0.18 kg per and 6.87 kg per 1,000 sq ft, respectively.
By comparison, complete coating removal by abrasive blasting with expendable coal slag abrasive would produce approximately 6,800 kg of hazardous waste per 100 sq ft.

Overcoating offers the benefit of maximizing the economic life of existing LBP coatings while minimizing present expenditures and reducing worker exposure and hazardous waste generation.
Preface

This technology demonstration was conducted for Headquarters, Department of the Army under Program Element (PE) 063728A, "Environmental Technology Demonstration"; Project 002, "Environmental Compliance Technology"; Work Unit CF-M B101, "Cost Effective Technologies to Reduce, Characterize, Dispose, or Reuse Sources of Lead Hazards." Part of this work was accomplished with funds provided by U.S. Army Forces Command under Military Interdepartmental Purchase Requests MIPR0BJECCEN04 and MIPR0DJ7CDEN35. The technical monitor was Bryan Nix (ACSIM-FSF).

The work was performed by the Materials and Structures Branch (CF-M) of the Facilities Division (CF), Construction Engineering Research Laboratory (CERL). The CERL Principal Investigator was Dr. Ashok Kumar. Part of this work was done by Tim Race, Corrosion Control Consultants and Laboratories, under contract no. DACA42-002-P-0274 and DACA42-00-D-0002. The technical editor was Linda L. Wheatley, Information Technology Laboratory – Champaign. Martin J. Savoie is Chief, CF-M, and L. Michael Golish is Chief, CF. The Technical Director of the Installation Operations Business Area is Gary W. Schanche (CV-T), and the Director of CERL is Dr. Alan W. Moore.

The authors wish to express appreciation to Karen Kopp, Utilities Branch Chief, and Audie Hardin of the Utilities Branch, both of Fort Campbell, KY, and Michael B Mills (Chief) and Scott Shelton, both of the Production Engineering Division at Holston Army Ammunition Plant, TN.

CERL is an element of the Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers. The Commander and Executive Director of ERDC is COL John W. Morris III, EN, and the Director is Dr. James R. Houston.
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1 Introduction

Background

In the past, hazardous lead-based paint (LBP) has been used extensively on all types of Department of Defense (DoD) steel structures and steel components including road and rail bridges, transmission towers, antennae, storage tanks, metal buildings, and aircraft hangars. The removal of LBP is generally performed by abrasive blasting or by water jetting. Containment and disposal of surface preparation debris, worker protection, and other regulatory compliance costs combine to make removal of LBP very expensive. According to a recent Federal Highway Administration report (FHWA 1995), bridge maintenance painting costs have nearly doubled over the past 5 years. The added costs for worker health, environmental monitoring, waste disposal, and containment are significant.

As an alternative to removing the LBP, overcoating is the practice of painting over existing coatings as a means of extending service life. Maintenance painting of this type does not require extensive surface preparation and minimizes worker exposures and hazardous waste generation. The Environmental Security Technology Certification Program (ESTCP) project reported here demonstrated the overcoating process.

Objectives

The objective of these demonstrations were to: (1) clean and overcoat the existing LBP, (2) comply with environmental standards, (3) comply with worker health and occupational safety requirements, (4) collect data and estimate installed costs, and (5) determine the performance of the overcoat process.

Approach

Demonstration of the overcoat process was performed during 2000 on a water tank at Fort Campbell, KY, and a railroad bridge at Holston Army Ammunition Plant (HAAP), Kingsport, TN.
Mode of Technology Transfer

Technology transfer is being accomplished by: (1) Technology Transfer Implementation Plan through the U.S. Army Environmental Center (AEC); (2) PWTB 420-70-2 “Installation Lead Hazard Management”; (3) participation in User Groups and Committees such as the Army Lead and Asbestos Hazard Management Team, Federal Lead-based Paint Committee Meetings at EPA or HUD, and ASTM D01.46 (Industrial and Protective Coatings) Committee; (4) websites maintained by the Army Assistant Chief of Staff for Installation Management (ACSIM) [http://www.hqda.army.mil/acsimweb/fd/policy/facengcur.html], AEC [http://aec.army.mil/usaec/], and the U.S. Army Engineer Research and Development Center/Construction Engineering Research Laboratory (ERDC/CERL) [http://www.cecer.army.mil], as well as the Hands-on-Skills-Training (HOST) website at http://www.hqda.army.mil/acsimweb/fd/policy/host/index.htm; (5) demonstration/validation of emerging technologies through Army demonstration funding (6.3) starting in Fiscal Year 2000 (FY00) and continuing through FY03, and cost/performance reports resulting from those demonstrations.

Units of Weight and Measure

U.S. standard units of measure are used throughout this report. A table of conversion factors for Standard International (SI) units is provided below.

<table>
<thead>
<tr>
<th>SI conversion factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 in. = 2.54 cm</td>
</tr>
<tr>
<td>1 ft = 0.305 m</td>
</tr>
<tr>
<td>1 sq ft = 0.093 m²</td>
</tr>
<tr>
<td>1 gal = 3.78 L</td>
</tr>
<tr>
<td>1 lb = 0.453 kg</td>
</tr>
<tr>
<td>°F = (°C x 1.8) + 32</td>
</tr>
</tbody>
</table>
2 Technology Description

Technology Application and Process Description

Overcoating does not require extensive surface preparation. Surfaces to be overcoated may be low-pressure power washed or hand washed using a mild detergent and water solution. Wash water should be collected and tested, however, to ensure that it does not meet the hazardous criteria for lead, which typically it will not. The washed surfaces are then further prepared by spot cleaning rusted areas with power or hand tools. Vacuum-assisted power tools can be used to collect the debris and reduce worker exposure. Ground tarpaulins (tarps) should also be used to collect any falling debris. The cleaned surfaces should receive a final cleaning using either solvent or water to remove any adherent dust. The clean dry surfaces are then overcoated using an appropriate coating. Overcoat materials are usually applied as systems of two to three coats.

Health and safety requirements are the same as for other industrial maintenance painting projects, including fall protection, flammable liquids, hearing conservation, eye protection, and respiratory protection. Additional requirements may be necessary depending on whether workers are exposed to lead above the action level during surface preparation activities. Half-face respirators with an Assigned Protection Factor (APF) of 10 are recommended for use during cleaning with vacuum-assisted power tools. A greater degree of respiratory protection may be required if vacuum assist is not used. Personal air monitoring (PAM) should be conducted at the outset of any project involving the removal of LBP to ensure that workers are adequately protected.

The purpose of overcoating is to maximize the economic life of the existing LBP by deferring deleading, which is very expensive. The overcoated LBP does not last as long as a new high performance coating system applied to a well-prepared blast cleaned surface. However, the installed cost of overcoating is low compared to deleading, and life cycle cost analyses generally show overcoating to be more cost effective for atmospheric exposures in mild and moderately corrosive atmospheres.

The technology is applicable to all types of DoD steel structures and steel components including pedestrian, vehicular, and rail bridges; exteriors of water tanks and
tanks storing petroleum, oils, and lubricants (POL), metal buildings, transmission towers, antennae, aircraft hangars, and maintenance facilities.

Advantages and Limitations of the Technology

The removal of hazardous coatings is generally performed by abrasive blasting or by water jetting, but containment and disposal of surface preparation debris, worker protection, and other regulatory compliance costs make removal of hazardous paints very expensive. Bridge maintenance painting costs have nearly doubled over the past 5 years (FHWA 1995). Typical bridge maintenance painting contracts involving complete coating removal and repainting averaged $5.05/sq ft for nonhazardous coatings and $10.60/sq ft for hazardous paint removal. The added costs for worker health, environmental monitoring, waste disposal, and containment are significant. The FHWA study concluded that, for mild service environments, overcoating is more cost effective than other maintenance options on a life cycle cost basis. They report an average equivalent annual cost of $1.04/sq ft for overcoating using a 3-coat alkyd system versus $1.99/sq ft for total removal and repainting with an inorganic zinc/epoxy/polyurethane system.

Overcoating is performed with a significant degree of risk, which refers to the chance that the overcoated system may either fail catastrophically or will not provide the desired period of protection. The applicability of overcoating is limited by the condition of the existing coating and underlying substrate and the severity of the exposure environment. If the existing coating is too thick, brittle, or poorly adherent, then overcoating should not be performed. If the degree of substrate corrosion is significant, then the level of effort needed to prepare the substrate may indicate that overcoating is not economically viable. Overcoating systems generally are not recommended for more severe exposure environments because deleading and paint replacement lasts significantly longer than overcoating and is more cost effective.
3 Demonstration Design

Performance Objectives

The performance objectives for these demonstrations were to:

- clean and overcoat the existing LBP,
- comply with environmental standards,
- comply with worker health and occupational safety requirements,
- collect data and estimate installed costs, and
- determine the performance of the overcoat process.

Selection of Test Sites

Two test sites were selected. The deluge water tank at Fort Campbell was chosen because it is representative of a simple structure. The tank is welded and does not have any irregular surfaces or complicated geometry. The HAAP railroad bridge was selected as a representative complex steel structure. The design contains complicated shapes such as back-to-back angles and rivet heads. Both sites were selected because of their northern climes with winter and summer temperature extremes, which can influence the performance of overcoating. Overcoat surfaces were selected to present a range of solar orientations, which may also influence the performance of the overcoat system.

Test Site Characteristics

Deluge tank number 7151 is near the corners of Blacksheep Run and C Avenue adjacent to Hangar Complex 4, Fort Campbell, KY. The tank is approximately 22 ft tall. Chicago Bridge and Iron Company constructed the tank in 1960. The existing LBP system was TT-P-86 Type I, Red Lead Linseed Oil Primer and TT-P-38 Aluminum Pigmented Tung Oil Phenolic Coating. Figure 1 shows the tank prior to cleaning and overcoating.
A visual inspection and physical tests were performed on the existing aged coating. Dry film thicknesses (DFTs) were measured at eight locations. The average thickness ranged from 2.0 to 4.1 mils. The overall average thickness is approximately 3.0 mils. Three adhesion measurements were taken, two with a south solar orientation and one with a north solar orientation. Crosscut adhesion values (ASTM D 3359 Method A) were 3A and 5A (south facing) and 3A (north facing), indicating slightly degraded intercoat adhesion.

Rusting ranged from 3 to 5 percent of the tank surface. Corrosion was primarily general spot corrosion with associated staining. The north side and lower portions of the tank were somewhat more degraded than the upper portions and south side. However, the rust distribution was fairly uniform overall.

Based on the generally low DFT and overall appearance, the tank has probably never been maintained or recoated.

Figure 1. Fort Campbell water tank prior to cleaning and overcoating.
Bridge 29 at HAAP is an active railroad bridge. The bridge was originally fabricated in the 1890s and moved to HAAP in about 1943 during the construction of the plant. The bridge is a multi-span through truss-type steel bridge with riveted connections and built-up beams. The piers are concrete. Welded pipe hangers support pipes conveying wastewater and chemicals. The bridge traverses a branch of the Holston River and is almost entirely over water. Figure 2 shows the railroad bridge with overcoated test areas.

A visual inspection and physical tests were performed on the aged coating. The bridge appears to have been touched up and repainted on numerous occasions. It is doubtful that the bridge has been abrasive blasted and painted in at least the last 30 years and possibly not since it was erected at HAAP in 1943. The paint system is comprised of an orange primer and aluminum topcoat, which are probably TT-P-86, Type I, red lead in linseed oil and TT-P-38, aluminum phenolic finish coat. Most of the touchup painting was done with an aluminum finish coat. Paint film thicknesses are generally 8 to 15 mils on flat vertical surfaces and 20 to 25 mils on upward facing horizontal surfaces. The amount of visible rust is less than 1 percent of the total test area. Most of the rust was on the tops of flanges. Some rusted areas on the flanges were previously coated over and were lifting and curled. Adhesion tests were performed in accordance with ASTM D 3359 Method A X-cut tape test. Adhesion ranged from 4A to 5A. In some cases, a thin layer of aluminum pigment was lifted with the tape. This nonadherent material is the equivalent of chalk in a standard pigmented coating. A good deal of dirt had also accumulated on many of the bridge components.

Figure 2. Railroad bridge at HAAP, TN, with overcoated test areas.
Physical Setup and Operation

Fort Campbell Water Tank

The structure was accessed using stepladders, painting poles, and platform scaffolds. Ground surfaces adjacent to the tank were covered with water impermeable tarpaulins. The tarp were taped to the base of the tank.

Cleaning was performed with an aqueous mixture of soap (100 to 1 dilution, Kleenz-Brite Extra, manufactured by Lad Chemicals, Inc., for James A. Lytle, Inc.). Cleaning solution was applied by sponge, and the surface was scrubbed with nonwoven abrasive pads attached to wood backup holders. Wash surfaces were rinsed with clean water using sponges and dried with clean clothes. Wash and rinse water were collected on ground tarps.

Loose paint and rust were removed in accordance with SSPC-SP 3 Power Tool Cleaning using two rotary cleaning tools equipped with 3M brand Clean and Strip pads. Waste was collected in a High Efficiency Particulate Air (HEPA) filter vacuum canister. Solvent wiping with clean rags and varnish makers and paint (VM&P) naphtha was performed to remove residual dust and contaminants.

Wasser Mio Aluminum primer, Ferromastice intermediate, and Ferrox A topcoat were applied by brush and roller to the first test area. Sherwin-Williams Corothane I Mastic primer, Corothane I Ironox A intermediate, and Corothane I Ironox A topcoat were applied by brush and roller to the second test area. Figure 3 shows the deluge tank after overcoating with test patches of moisture cure polyurethane.

All equipment, ground tarps, and debris were removed from the site. Wash and rinse water collected on the tarps was vacuumed and containerized.

HAAP Railroad Bridge

The structure was rigged using a combination of scaffolding, picks, and hanging stages. Access to the scaffold tower and staging was by ladder. Placement of the scaffold tower and staging was facilitated by use of a single-person lift bucket. The lift bucket was also used to access portions of the work surface. Ground surfaces below the bridge were covered with water-impermeable tarpaulins.
Cleaning was performed with an aqueous mixture of household bleach (100 to 1 dilution) and soap (1000 to 1 dilution, Kleenz-Brite Extra). Cleaning solution was applied by sponge and the surface was scrubbed with 3-M Scotch Brite pads. Washed surfaces were rinsed with clean water using sponges and dried with clean cloths. Wash and rinse water were collected on the ground tarps.

Loose paint and rust were removed in accordance with SSPC-SP 3 Power Tool Cleaning using a vacuum-shrouded needle gun with 2-mm diameter needles. Waste was collected in a HEPA vacuum canister. Solvent wiping with clean rags and VM&P naphtha was performed to remove residual dust and contaminants.

Power tool cleaned areas were primed with SSPC Paint 25 using a natural bristle brush followed by two coats of TT-P-38E applied by brush and roller over the entire test area. The second test area was coated with two full coats of Wasser MC-Aluminum applied by brush and roller.

All rigging was removed at the completion of painting. Ground tarps and all debris were removed from the site.
Monitoring Procedures

Ambient and surface temperatures as well as relative humidity were monitored during coating application. Dry time and degree of dryness prior to recoating were assessed. Wet and dry film thicknesses (WFTs/DFTs) were measured. The appearance of the applied coatings was noted. Total surface area that was cleaned with power tools and coated were estimated. Personal air monitoring (PAM) was conducted on the power tool operator to determine lead exposure. Total lead and Toxicity Characteristic Leaching Procedure (TCLP) lead were determined on liquid and solid wastes. Waste quantities were measured. An inspection was performed 6 months after application to assess the performance of the overcoat systems. Corrosion and adhesion were evaluated.

Analytical Procedures

The personal air samples were analyzed for lead according to National Institute for Occupational Safety and Health (NIOSH) Method 7300. The respirable dust level was measured by NIOSH Method 600. TCLP was performed in accordance with U.S. Environmental Protection Agency (EPA) Method 1311.
4 Performance Assessment

Performance Data

Fort Campbell Water Tank

Approximately 5 percent of the total test area was power-tool cleaned.

The average WFT of the Wasser Mio Aluminum primer was 3.3 mils. The average DFT was 2.0 mils. The air temperature at the time of application was 73 °F and the surface temperature was 67.5 °F. The Ferromastic intermediate coat was applied after a drying period of 19 hours. The average WFT was 4.3 mils. The average DFT was 2.6 mils. The air temperature at the time of application was 70 °F and the surface temperature was 68.5 °F. The FerroxA topcoat was applied after a drying period of 22 hours. The average WFT was 4.6 mils. The average DFT was 2.8 mils. The air temperature at the time of application was 65 °F and the surface temperature was 65 °F. The average DFT for the complete overcoat system was 7.4 mils.

The Corothane I Mastic primer for the second test area was applied to an average WFT of 3.6 mils. The average DFT was 2.2 mils. The air temperature at the time of application was 73 °F and the surface temperature was 67.5 °F. The Corothane I Ironox A intermediate coat was applied after a drying period of 19 hours. The average WFT was 3.6 mils. The average DFT was 2.0 mils. The air temperature at the time of application was 70 °F and the surface temperature was 68.5 °F. The Corothane I Ironox A topcoat was applied after a drying period of 28 hours. The average WFT was 3.6 mils. The average DFT was 2.0 mils. The air temperature at the time of application was 65 °F and the surface temperature was 65 °F. The average DFT for the complete overcoat system was 6.2 mils.

Waste minimization was accomplished by hand washing rather than power washing the existing coating. Wastewater was collected from the tarps, weighed, and tested for total lead and TCLP. The total liquid waste collected from the tarps was 20 gallons (73 kg). TCLP lead was 0.41 ppm. The wastewater was below the EPA limit for lead and was considered nonhazardous waste.
The power tool cleaning waste was weighed and tested for total and TCLP lead. The total weight of power tool cleaning debris collected was 0.22 kg. Total and TCLP lead were 83,000 ppm and 270 ppm, respectively. The power-tool cleaning debris was above the EPA limit for leachable lead (>5 ppm lead) and was disposed of as hazardous waste.

The worker operating a vacuum-shrouded rotary power tool wore a PAM device for the 120-minute duration of the power-tool cleaning. The worker exposure was 81 \( \mu g/m^3 \). Averaged over an 8-hour workday, the exposure was 20 \( \mu g/m^3 \). The action level for lead exposure is 30 \( \mu g/m^3 \) for an 8-hour workday. If the work duration had been 8 hours, then the lead action level would have been exceeded.

The two overcoat systems on the deluge tank were inspected in March 2001. DFT, corrosion, appearance, and adhesion were evaluated. Table 1 presents the inspection results for both test areas.

<table>
<thead>
<tr>
<th>Test Area</th>
<th>Appearance</th>
<th>Rust (%)</th>
<th>DFT Range (mils)</th>
<th>Avg. DFT (mils)</th>
<th>Adhesion (D 3359)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>rust stain</td>
<td>0</td>
<td>7.1 – 12.7</td>
<td>9.6</td>
<td>5A</td>
</tr>
<tr>
<td>2</td>
<td>rust stain</td>
<td>0</td>
<td>6.9 – 13.2</td>
<td>9.7</td>
<td>5A</td>
</tr>
</tbody>
</table>

**HAAP Railroad Bridge**

Approximately 3 to 4 sq ft, or less than 1 percent of the total test area was power-tool cleaned (SP 3). Approximately 25 sq ft of surface was primed with SSPC Paint 25 using a natural bristle brush. The approximate WFT of the primer was 3 to 5 mils. The air temperature at the time of application was 55 °F and the surface temperature was 56 °F. After a drying period of 21 hours, the first coat of TT-P-38E was applied by brush and roller. The approximate WFT was 2 to 2.5 mils. The air temperature at the time of application was 74 °F and the surface temperature was 55 to 62 °F. The second coat of TT-P-38E was applied after a drying period of 16 hours. The approximate WFT was 2 to 2.5 mils. The air temperature at the time of application was 59 °F.

The SSPC Paint 25 primer was just barely set-to-touch after 21 hours when the first topcoat was applied. Contrast in appearance between coats of TT-P-38 was sufficient to allow easy recoat. TT-P-38 contains leafing aluminum pigment. During application the pigment does not immediately leaf and the coating has a dull gray color. The dull gray contrasted nicely with the dried first coat of TT-P-38, which had gone through the leafing process to develop the characteristic shiny silver appearance of a leafing aluminum topcoat.
The second test area was primed with Wasser MC-Aluminum applied by brush and roller. The approximate WFT was 2.5 to 3.5 mils. The air temperature at the time of application was 54 °F and the surface temperature was 52 to 54 °F. The relative humidity was 98 percent. A second coat of MC-Aluminum was applied after a drying period of 4 to 5 hours. The approximate WFT was 2.5 to 3.5 mils. The air temperature at the time of application was 74 °F, and the surface temperature was 55 to 62 °F.

Waste minimization was accomplished by hand washing rather than power washing the existing coating. Wash and rinse water were evaporated from the tarps to further reduce the amount of waste. Debris was collected from the tarps, weighed, and tested for total lead and TCLP. The total waste collected from the tarps was 6.49 kg. Total and TCLP lead were 25,000 ppm and 6 ppm, respectively. The tarp debris exhibited the hazardous characteristic for lead (>5 ppm leachable lead).

The power-tool cleaning waste was weighed and tested for total and TCLP lead. The total weight of power tool cleaning debris collected was 0.38 kg. Total and TCLP lead were 70,000 ppm and 220 ppm, respectively. The power-tool cleaning debris was above the EPA limit for leachable lead (>5 ppm lead) and was disposed of as hazardous waste.

The worker operating the vacuum shrouded needle gun wore a PAM device for the 85-minute duration of power-tool cleaning. No airborne lead was detected. Based on the sample results, there was no lead exposure. Based on the calculated reporting limit, however, the lead exposure was 12 µg/m³. Averaged over an 8-hour workday, the exposure based on the calculated reporting limit would be 2.1 µg/m³. The Occupational Safety and Health Administration (OSHA) requires that air monitoring data and exposure levels be reported based on the operating detection limit if no lead is detected. The action level for lead exposure is 30 µg/m³ for an 8-hour workday. A half-mask respirator with an APF of 10 was worn by the power tool operator. The vacuum shroud alone provided an adequate degree of worker protection.

An evaluation of the overcoat systems was performed after 6 months of service. The period of service included the winter months with several periods of freeze-thaw. The overcoated surfaces were inspected for coating DFT, corrosion, and adhesion. The results are presented in Table 2.
Table 2. Railroad bridge overcoat performance.

<table>
<thead>
<tr>
<th>Paint System</th>
<th>Area</th>
<th>Average Paint Thickness (mils)</th>
<th>Adhesion (D 3359)</th>
<th>Rust (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Area 1</td>
<td>South stringer, north side</td>
<td>15.2</td>
<td>5A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>South stringer, south side</td>
<td>12.5</td>
<td>4A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>North stringer, north side</td>
<td>16.0</td>
<td>5A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>South truss, north side</td>
<td>10.2</td>
<td>5A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>South truss, south side</td>
<td>14.0</td>
<td>4A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>North truss, north side</td>
<td>15.2</td>
<td>5A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>North truss, south side</td>
<td>13.2</td>
<td>5A</td>
<td>0</td>
</tr>
<tr>
<td>Test Area 2</td>
<td>South stringer, north side</td>
<td>16.3</td>
<td>5A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>South stringer, south side</td>
<td>13.8</td>
<td>4A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>North stringer, north side</td>
<td>14.9</td>
<td>5A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>South truss, north side</td>
<td>11.2</td>
<td>5A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>South truss, south side</td>
<td>15.2</td>
<td>5A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>North truss, north side</td>
<td>13.9</td>
<td>5A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>North truss, south side</td>
<td>17.6</td>
<td>3A</td>
<td>0</td>
</tr>
</tbody>
</table>

Data Assessment

*Fort Campbell Water Tank*

Areas of the dried primer, Mio Aluminum, were observed to have numerous tiny bubbles over the prepared rust spots. These areas appear slightly rough. The bubbles are characteristically formed in polyurethane films as carbon dioxide is evolved. The problem occurs when the cure reaction occurs too rapidly or the coating is applied too thickly. Wasser recommends that Mio Aluminum be applied at a WFT of 2.5 to 3.0 mils. The achieved WFT was slightly above the recommended range. High humidity also promotes rapid cure. Painting conditions were nearly ideal and humidity was not high during application. The bubbling may have been caused by a combination of relatively high WFT and moisture retained in the rust.

Both overcoat systems were performing well after 5 months of service. The winter months were relatively harsh with numerous freeze-thaw cycles. Intercoat adhesion between the overcoat systems and the original paint system was excellent. The adhesion of the original coating to the substrate was unaffected by either overcoat system. The risk that a catastrophic delamination failure will occur in the future is negligible. Both systems were devoid of any sign of early corrosion. Some rust staining of the overcoated areas had occurred as a result of wash down from corroded surfaces above the repaired areas.
After evaluation of the two coating systems, the coating system composed of Sherwin-Williams Corothane I Mastic primer, Corothane I Ironox A intermediate, and Corothane I Ironox A topcoat was chosen for completion of the tank coating job, as shown in Figure 4. The projected life of the overcoat repair on this tank is 15 to 25 years. This projection is based on the pre-overcoat condition of the original paint system, the durability of the overcoat materials, and the severity of the exposure environment. It should also be noted that the water tank can probably be overcoated two more times provided its condition is not allowed to deteriorate past that which is suitable for overcoating.

**HAAP Railroad Bridge**

Areas of dried MC-Aluminum coating were observed to have numerous tiny bubbles. These areas appeared slightly rough. The formation of these bubbles is a characteristic flaw of polyurethane coatings and occurs when carbon dioxide forms and escapes from the partially cured film. The problem is exacerbated when the cure reaction occurs too rapidly or the coating is applied at too great a thickness. The coating manufacturer recommends that MC-Aluminum not be applied at a WFT of greater than 8 mils. The recommended maximum thickness was not exceeded. High humidity also promotes rapid cure. Humidity was high during paint application but was within the manufacturer’s recommended range. The bubbling was probably caused by a combination of relatively high WFT and high humidity. Manufacturer data sheets do not necessarily address intermediate conditions or multiple effects.

![Figure 4. Deluge tank at Fort Campbell Army Airfield after overcoating completed in August 2001.](image-url)
Both overcoat systems were performing well after 6 months of service. The winter months were relatively harsh with numerous freeze-thaw cycles. Intercoat adhesion between the overcoat systems and the original paint system was excellent. The adhesion of the original coating to the substrate was unaffected by either overcoat system. Coating adhesion to the substrate was slightly less for surfaces with a south solar orientation. This is typical of alkyd-type paint systems as they tend to embrittle and lose adhesion with prolonged exposure to ultraviolet radiation. The risk that a catastrophic delamination failure will occur in the future is very small. Both systems are devoid of any sign of early corrosion.

The projected life of an overcoat repair is 12 to 18 years. This projection is based on the pre-overcoat condition of the original paint system, the durability of the overcoat materials, and the severity of the exposure environment.

**Technology Comparison**

Complete coating removal by abrasive blasting with coal slag abrasive would have produced approximately 15,000 lb (6800 kg) of hazardous waste per 1,000 sq ft. The quantity of hazardous waste generated was less than 0.1 percent of what would be produced using expendable coal slag abrasive.

Complete coating removal by abrasive blasting inside of a properly designed and ventilated containment structure would have exposed workers to a lead concentration up to 58,700 µg/m³ with a presumed exposure of over 2,500 µg/m³. Coating removal using nonvacuum-assisted power tools would have exposed workers to a lead concentration of up to 20,000 µg/m³ with a presumed exposure of up to 2,500 µg/m³. The use of vacuum-assisted power-tool cleaning greatly reduced potential lead exposures during surface preparation.

Complete coating removal by abrasive blasting with containment has high risk of environmental exposure. Power-tool cleaning has a low to moderate risk and vacuum-assisted power-tool cleaning has only a low risk of environmental exposure.

Overcoated LBP will not last as long as a new high performance coating system applied to a well-prepared blast cleaned surface. The projected overcoat life for the water tank is 15 to 25 years. The original coating system lasted 40 years with no maintenance.
5 Cost Assessment

Cost Reporting and Analysis

Cost was measured using the Bureau of Labor Statistics 1998 National Occupational Employment Wage Estimates for labor category 87402 Painters and Paperhangers, Construction and Maintenance. The 90\textsuperscript{th} percentile wage ($21.40/h) adjusted for inflation (2 percent per annum) was used. A 50-percent burden was added to cover insurance, pension, annuity, vacation, and profit. The labor cost used for the cost estimate was $33.40/h. Labor and cost details are tabulated below.

*Fort Campbell Water Tank*

The estimated unit area cost for overcoating the tank was $1.55/sq ft (see Table 3). Work was performed on portions of the tank that were generally more accessible. The estimated unit area cost range for overcoating similar tanks and other simple structures is $1.40/sq ft to $1.86/sq ft.

**Table 3. Water tank cost report.**

<table>
<thead>
<tr>
<th>Work Phase</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization</td>
<td>6.0</td>
</tr>
<tr>
<td>Washing</td>
<td>8.75</td>
</tr>
<tr>
<td>Power Tool Cleaning</td>
<td>4.0</td>
</tr>
<tr>
<td>Solvent Wipe</td>
<td>1.0</td>
</tr>
<tr>
<td>Painting System 1</td>
<td>4.5</td>
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<tr>
<td>Painting System 2</td>
<td>4.5</td>
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<tr>
<td>Demobilization</td>
<td>4.0</td>
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<tr>
<td><strong>Cost</strong></td>
<td><strong>(S/sq ft)</strong></td>
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<tr>
<td>Mobilization/Demobilization</td>
<td>0.167</td>
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<td>Surface Preparation</td>
<td>0.383</td>
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<tr>
<td>Paint Application</td>
<td>0.251</td>
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<td>Paint and Expendables (est.)</td>
<td>0.750</td>
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<tr>
<td>Waste Disposal</td>
<td>0.000</td>
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<tr>
<td><strong>Total Cost</strong></td>
<td><strong>1.551</strong></td>
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</table>
HAAP Railroad Bridge

The estimated unit area cost for overcoating the bridge is $2.83/sq ft (see Table 4). Work was performed on portions of the bridge that were generally more accessible. The estimated unit area cost for overcoating the bridge and other complex structures is $2.55/sq ft to $3.39/sq ft.

Table 4. Railroad bridge cost report.

<table>
<thead>
<tr>
<th>Work Phase</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization</td>
<td>18.0</td>
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<tr>
<td>Washing</td>
<td>12.5</td>
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<td>Power Tool Cleaning</td>
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<td>Solvent Wipe</td>
<td>5.5</td>
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<tr>
<td>Painting System 1</td>
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<td>Painting System 2</td>
<td>14.5</td>
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<tr>
<td>Demobilization</td>
<td>6.0</td>
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<td>Cost</td>
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<tr>
<td>Mobilization/Demobilization</td>
<td>0.802</td>
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<td>Surface Preparation</td>
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<td>Paint Application</td>
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<td>Paint and Expendables (est.)</td>
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<td>Waste Disposal</td>
<td>0.003</td>
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<tr>
<td>Total Cost</td>
<td>2.836</td>
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</table>

Cost Comparison

Cost-effective removal of hazardous LBP is generally performed by abrasive blasting or by water jetting. Containment and disposal of surface preparation debris, worker protection, and other regulatory compliance costs combine to make removal of LBP very expensive. The FHWA example showed that typical bridge maintenance painting contracts involving complete coating removal and repainting averaged $5.05/sq ft for nonhazardous coatings and $10.60/sq ft for hazardous paint removal. The added costs for worker health, environmental monitoring, waste disposal, and containment are significant (FHWA 1995).

The installed cost of overcoating on a simple structure (Fort Campbell water tank) was estimated at $1.55/sq ft. The installed cost for overcoating on a complex structure (HAAP railroad bridge) was estimated at $2.83/sq ft. By comparison, the cost of deleading and installing a new paint system is $5 to $18/sq ft with an average cost of $8/sq ft.
Case-specific economic analysis is recommended for measuring the life-cycle cost of repainting versus overcoating. The maintenance painting option, overcoating or repainting, with the lowest total net present value should be implemented.

Overcoating in a mild exposure environment is always cheaper than repainting, but it is not economically viable in a severe exposure environment. Overcoating may or may not be more economical in a moderate exposure environment.
6 Implementation Issues

Cost Observations

Overcoating simple structures is significantly less expensive than overcoating more complex structures. The less complex a structure is, the less expensive overcoating will be and life cycle costs will be more favorable.

Other Significant Observations

In many cases, overcoating has been used inappropriately by the industry. Because of the potentially large initial cost savings associated with overcoating, as opposed to containment and removal, the temptation to overcoat is great. The large initial cost difference between these maintenance options has meant that owners are more tolerant of the risks involved in overcoating. Owners should first properly assess the risks, and if overcoating risks are deemed acceptable, then the facility owner should take additional steps to mitigate the risk of overcoating.

The primary risk associated with overcoating is that the coating system will delaminate. If a delamination failure occurs, then the overcoating investment is lost. Delamination of a lead-containing coating may also represent an environmental hazard. In this case, the possibility for litigation is very real. The remedial cost of an unintentional introduction of lead into the environment may be significant. Delamination is difficult to predict. An understanding of the underlying principles, however, should help the coatings engineer prevent or reduce the chance of suffering a delamination failure.

Delamination is primarily the result of internal stresses in the overcoat material that cannot be supported by the underlying aged coating. Internal stress occurs as the applied overcoat contracts, either from solvent evaporation or curing. Several factors affect the degree of internal stress in the overcoat material, including type of coating, formulation, and film forming conditions. As coatings age, film stress generally increases. Aging may result in additional cross-linking and film shrinkage. A good example of age-related stress increase is the oxidative curing of alkyds. Temperature fluctuations may also affect the level of internal stress, with higher
temperatures favoring lower stress and colder temperatures causing higher stress. The higher stress associated with cold temperatures is the major cause of overcoat system failure by delamination. Plasticizer migration may lead to reduced elasticity or embrittlement of both aged coatings and overcoats. Brittle coatings are more apt to crack during temperature cycles. The application of the overcoat may also affect the internal stress of the aged coating. Solvent migration may initially reduce the stress in the existing coating, but subsequent solvent evaporation will result in an increase in the film stress. Resin in the overcoat material may penetrate the aged paint to form a stress zone within the old coating. The stress present in the overcoat is important because it is transmitted to the base coating.

The internal stress of the overcoat is counteracted by its adhesion to the aged coating. A loss of adhesion of the aged coating may result in cracking of the overcoat because the underlying coating no longer supports internal stress. This is true when the internal stress of the overcoat exceeds its tear strength. When the tensile stress in the overcoat exceeds that in the aged coating and the overcoat cracks, then peeling and delamination are likely to occur. Good overcoat/basecoat systems, like all multi-coat systems, should have higher tensile strength and rigidity in the basecoat than in the topcoat. New coating systems are specifically designed this way. Overcoat/basecoat systems should be designed this way as well. In practice, however, it is difficult to assure that the stress of the overcoat will not overwhelm the adhesion of the old existing coating.

The other primary risk associated with overcoating is that the overcoat system will not provide a long enough period of service to be considered cost effective. In this case, the overcoat system may not experience a catastrophic failure such as delamination, but may fail prematurely because of the severity of the service environment and/or the degree of protection afforded by the overcoat material. Such failures are typified by early onset or excessive rust-through.

Thicker aged coatings tend to be more highly stressed. Large peeling forces can be generated during curing and aging of the overcoat. When overcoated, thicker more highly stressed coatings are more likely to delaminate than thinner coatings with lower internal stress. Delamination may also be caused by thermal cycling, which may disrupt the integrity of thick aged coatings that have been overcoated. Thicker, more highly stressed coatings are also more likely to sustain blast media or other mechanically induced damage with a subsequent loss of adhesion that may affect the performance of the overcoat system.

The mechanical properties of coatings may change as they age. Age-related changes are due primarily to changes within the coating that increase the glass transition
temperature. As a coating's glass transition temperature increases, its internal stress increases, adhesion decreases, and brittleness increases. The glass transition temperature increase is generally the result of thermal and photo radiation effects. For acrylic latex coatings, it has been shown that the temperature increase is due entirely to photo radiation. For oil paint the effect is mainly due to photo radiation; for alkyd, it is due to both thermal and photo radiation, with thermal effects playing a greater role. Long oil coatings generally take longer to embrittles than short oil coatings.

Epoxy and alkyd coatings may chalk and erode with prolonged exposure. Generally, this does not present a problem for overcoating as long as the loose chalk is removed before overcoating. Even severely eroded coatings with exposed primer may be good candidates for overcoating, provided the remaining coating has good adhesion and total rusting is nominal.

The degree of adhesion of the aged coating to the substrates is one of the most critical factors affecting the overcoating process. Poorly adherent coatings are more likely to delaminate when overcoated than are aged coatings with good adhesion. Poor intercoat adhesion in aged multi-coat systems may also result in overcoat delamination failures. Generally the aged coating system will fail at its weakest point. Coating type, age, thickness, and surface preparation may all affect the adhesion of the aged coating system.

The condition of the substrate may also affect the performance of the overcoat system. In general, if more corrosion is present, more surface preparation will be needed. Mechanical cleaning, especially abrasive blasting, may disrupt the adhesion of the aged coating adjacent to the removal areas. Additionally, overcoating may not be cost effective if extensive surface preparation is required. The original surface preparation may also play a role in the performance of the overcoat to the extent that it affects coating adhesion on mill scale and other poorly cleaned surfaces. This effect may cause localized problems on structures that were not cleaned uniformly before receiving the original coating.

The problems associated with surface contaminants are not necessarily specific to overcoating; however, contaminants are less likely to be removed during overcoating because much less surface preparation is typically done. Less surface preparation is performed to lower costs and to reduce environmental and worker exposures to hazardous dusts. Rigorous surface preparation is also more likely to cause mechanical damage to an old marginally adherent embrittled coating that may later manifest itself as a delamination failure.
As noted above, thermal- and photo radiation-induced increases to the glass transition temperature may lead to embrittlement and reduced adhesion of the aged coating. Oil and oil-modified alkyds on structural components exposed to thermal and photo radiation, will be more prone to these age-related effects. Similar coatings in protected areas not directly exposed to the sun may be more suitable for overcoating. Thermal cycling is another weather-related effect. Internal coating stresses may increase to unsupportable levels at low temperatures, explaining why many overcoat delamination failures occur during or after cold spells. Structures in mild climates are less likely to be exposed to low temperatures that may precipitate delamination failures. Conversely, oil and alkyd coatings exposed in sunny climates may age faster than in other locales.

Severe exposure environments, including fresh and saltwater immersion and chemical and marine atmospheres, are usually not suitable for overcoating. FHWA and Army research has shown that, for severe service environments, total removal and replacement of the aged coating with a high performance coating system is more cost effective than overcoating.
References

Cited


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NIOSH Method 1311, *Toxicity Characteristic Leaching Procedure.*

NIOSH Method 7300, *Elements (ICP)*

Society for Protective Coatings (SSPC) SP 3, *Power Tool Cleaning.*

U.S. Environmental Protection Agency Method 1311, *Toxicity Characteristic Leaching Procedure.*

Uncited


ASTM D 5064, *Practice for Conducting a Patch Test to Assess Coating Compatibility.*

ASTM D 5065, *Practice for Assessing the Condition of Aged Coatings on Steel Surfaces.*


SSPC-VIS 2, *Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces.*


Race, Timothy D., *Decision Tree for Lead-Based Paint Hazard Control and Abatement for Steel Structures*, prepared by Corrosion Control Consultants and Labs for CERL, April 2002.


Points of Contact

<table>
<thead>
<tr>
<th>Organization</th>
<th>Phone/Fax/email</th>
<th>Role in Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERDC-CERL</td>
<td>Tel: 217-373-7235</td>
<td>Principal Investigator Assistant</td>
</tr>
<tr>
<td>PO Box 9005</td>
<td>Fax: 217-373-7222</td>
<td>Investigator Contract Monitor</td>
</tr>
<tr>
<td>Champaign, IL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61826-9005</td>
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<tr>
<td>AFZB-PW-M-U</td>
<td>Phone: 270-798-5082</td>
<td>Ft. Campbell PWBC</td>
</tr>
<tr>
<td>Bldg. 868</td>
<td>Fax: 270-798-6075</td>
<td>Utilities Br. Chief</td>
</tr>
<tr>
<td>Fort Campbell, KY</td>
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</tr>
<tr>
<td>42223-5130</td>
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<tr>
<td>AFZB-PW-E-C</td>
<td>Phone: 270-798-9597</td>
<td>Fort Campbell</td>
</tr>
<tr>
<td>865 13th St</td>
<td>Fax: 270-798-9606</td>
<td>TSCA* Manager</td>
</tr>
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<tr>
<td>Corrosion Control Consultants</td>
<td>Phone: 630-834-3811</td>
<td>Principal Contractor</td>
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<td>&amp; Labs.</td>
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<tr>
<td>Corrosion Control Consultants</td>
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<td>Principal Contractor</td>
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* Toxic Substances Control Act
List of Acronyms

APF    Assigned Protection Factor
ASTM  American Society for Testing and Materials
DFT    dry film thickness
DoD    Department of Defense
EPA    Environmental Protection Agency
ESTCP  Environmental Security Technology Certification Program
FHWA   Federal Highway Administration
HAAP   Holston Army Ammunition Plant
HEPA   High Efficiency Particulate Air
LBP    lead-based paint
NIOSH  National Institute for Occupational Safety and Health
OSHA   Occupational Safety and Health Administration
PAM    personal air monitoring
POL    petroleum, oils, and lubricants
PPM    part per million
SSPC   The Society for Protective Coatings
TCLP   Toxic Characteristic Leaching Procedure
WFT    wet film thickness
Appendix: Overcoat System Material Safety Data Sheets
## PRODUCT INFORMATION

### COROTHANE® I MASTIC

**Product**: COROTHANE® I - Mastic is a single component, moisture curable urethane with micaceous iron oxide, designed as a primer or intermediate coat for previously painted steel surfaces, excluding lead overcoating. It is high solids and VOC compliant. Product is designed to be topcoated.

- Outperforms epoxy mastics when overcoating old red lead coatings.
- Low temperature application - down to 20°F.
- Can be applied in humidities up to 90%.
- Excellent recoatability.
- Superior to epoxy mastics for flexibility, corrosion resistance, blister resistance, and impact resistance.

### PRODUCT CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
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<tbody>
<tr>
<td>Finish</td>
<td>Matte</td>
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<tr>
<td>Color</td>
<td>Reddish Gray</td>
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<tr>
<td>Volume Solids</td>
<td>60% ± 2%</td>
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<td>VOC (calculated)</td>
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<td>Spreading Rate</td>
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<td>Dry Mils</td>
<td>2.5 - 3.5</td>
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<tr>
<td>Coverage</td>
<td>275 - 385 sq ft/gal approximate</td>
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<td>Recommended Spreading Rate per coat:</td>
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<tr>
<td>Wet Mils</td>
<td>4.0 - 5.5 lbs/gal</td>
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<tr>
<td>Coverage</td>
<td>275 - 385 sq ft/gal approximate</td>
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<tr>
<td>Drying Schedule</td>
<td>5.0 mils wet @ 60% RH:</td>
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<tr>
<td>To touch</td>
<td>40 minutes</td>
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<tr>
<td>To recoat</td>
<td>15 minutes</td>
</tr>
<tr>
<td>To handle</td>
<td>24 hours</td>
</tr>
<tr>
<td>To cure</td>
<td>7 days</td>
</tr>
<tr>
<td>Shelf Life</td>
<td>12 months, unopened, at 77°F</td>
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<tr>
<td>Flash Point</td>
<td>&gt;93°F, PMCC</td>
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<td>Reducer/Clean Up</td>
<td>Reducer #15, R/K15</td>
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**Performance Characteristics**

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<tr>
<th>Test Description</th>
<th>Substrate</th>
<th>Steel Plates:</th>
<th>Surface Preparation:</th>
<th>SSPC-Sp6</th>
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<tr>
<td>1st Coat:</td>
<td>1st Coat:</td>
<td>3.0 mils dry</td>
<td>3.0 mils dry</td>
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<tr>
<td>Corrosion Resistance</td>
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<td>ASTM D4800, C917 wheel, 1000 cycles, 1 lb load</td>
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<td>Adhesion</td>
<td>Method:</td>
<td>ASTM D4541</td>
<td>Result:</td>
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<td>Direct Impact Resistance</td>
<td>Method:</td>
<td>ASTM D2794</td>
<td>Result:</td>
<td>60 in. lbs</td>
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<tr>
<td>Dry Heat Resistance</td>
<td>Method:</td>
<td>ASTM D2795</td>
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<td>300°F</td>
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<td>Moisture Condensation Resistance</td>
<td>Method:</td>
<td>ASTM D4582, 100°F, 300 hours</td>
<td>Result:</td>
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<td>Pencil Hardness</td>
<td>Method:</td>
<td>ASTM D3363</td>
<td>Result:</td>
<td>2B</td>
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<td>Salt Fog Resistance</td>
<td>Method:</td>
<td>ASTM B117, 3600 hours</td>
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<td>Rating 9 per ASTM D610 for rusting</td>
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<tr>
<td>Wet Heat Resistance</td>
<td>Method:</td>
<td>Non-immersion</td>
<td>Result:</td>
<td>180°F</td>
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The system is designed for use in dry environments with a relative humidity of 90% or less.
## PRODUCT INFORMATION

### RECOMMENDED SYSTEMS

<table>
<thead>
<tr>
<th>Steel:</th>
<th>Corothane I - GalvaPac Zinc Primer @ 3.0 - 4.0 mils dft</th>
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</thead>
<tbody>
<tr>
<td>1 ct.</td>
<td>Corothane I - Mastic @ 2.5 - 3.5 mils dft</td>
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<tr>
<td>1 ct.</td>
<td>Corothane I - Alphatic @ 2.0 - 3.0 mils dft</td>
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<tr>
<td>or</td>
<td>Corothane IHS @ 2.0 - 3.0 mils dft</td>
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### SURFACE PREPARATION

- Surface must be clean, dry, and in sound condition. Remove oil, dust, grime, dirt, loose rust, and other foreign material to ensure adequate adhesion.
- Refer to product Application Bulletin for detailed surface preparation information.

**Minimum recommended surface preparation:**

- Iron & Steel: SSPC-SP2, SP3
- Previously Painted: SSPC-SP2, SP3

### TINTING

- Do not tint.

### APPLICATION CONDITIONS

- **Temperature:**
  - air and surface: 20°F minimum, 100°F maximum
  - material: 45°F minimum
  - do not apply over surface ice
- **Relative Humidity:**
  - Can be applied at relative humidities up to 98%
- Refer to product Application Bulletin for detailed application information.

### ORDERING INFORMATION

- Packaging: 1 and 5 gallon containers
- Weight per gallon: 18.0 ± 0.2 lb

### SAFETY PRECAUTIONS

- Refer to the MSDS sheet before use.
- Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

The systems listed above are representative of the product's use. Other systems may be appropriate.
## APPLICATION BULLETIN

### SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

**Iron & Steel**

Minimum surface preparation is Hand Tool Clean per SSPC-SP2. Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. For better performance, use Commercial Blast Cleaning per SSPC-SP6. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils). Prime any bare steel within 8 hours or before flash rusting occurs.

**Previously Painted Surfaces**

If in sound condition, clean the surface of all foreign material. Smooth, hard, glossy coatings and surfaces should be dulled by abrading the surface. Apply a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, or if this product attacks the previous finish, removal of the previous coating may be necessary. If paint is peeling or badly weathered, clean surface to sound substrate and treat as a new surface as above.

### APPLICATION CONDITIONS

<table>
<thead>
<tr>
<th>Temperature:</th>
<th>20°F minimum, 100°F maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative humidity:</td>
<td>Can be applied at relative humidities up to 99%</td>
</tr>
</tbody>
</table>

### APPLICATION EQUIPMENT

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

**Reducer/Clean Up**

Reducer #15, R7K15

**Airless Spray**

<table>
<thead>
<tr>
<th>Pump</th>
<th>30:1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>1800 - 2000 psi</td>
</tr>
<tr>
<td>Hose</td>
<td>1/4&quot; ID</td>
</tr>
<tr>
<td>Tip</td>
<td>.015&quot; - .019&quot;</td>
</tr>
<tr>
<td>Filter</td>
<td>60 mesh</td>
</tr>
<tr>
<td>Reduction</td>
<td>as needed up to 10% by volume</td>
</tr>
</tbody>
</table>

**Conventional Spray**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Groco</th>
<th>Links</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gun</td>
<td>900</td>
<td>95</td>
</tr>
<tr>
<td>Fluid Nozzle</td>
<td>070</td>
<td>88/95</td>
</tr>
<tr>
<td>Air Nozzle</td>
<td>947</td>
<td>88PR</td>
</tr>
<tr>
<td>Atomization Pressure</td>
<td>60-70 psi</td>
<td>60-70 psi</td>
</tr>
<tr>
<td>Fluid Pressure</td>
<td>15-20 psi</td>
<td>15-20 psi</td>
</tr>
<tr>
<td>Reduction</td>
<td>as needed up to 10% by volume</td>
<td></td>
</tr>
</tbody>
</table>

**Brush**

<table>
<thead>
<tr>
<th>Brush</th>
<th>Natural Bristle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction</td>
<td>as needed up to 10% by volume</td>
</tr>
</tbody>
</table>

**Roller**

<table>
<thead>
<tr>
<th>Cover</th>
<th>3/8&quot; natural or synthetic with phenolic core</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction</td>
<td>as needed up to 10% by volume</td>
</tr>
</tbody>
</table>

If specific application equipment is listed above, equivalent equipment may be substituted.

---

Polyurethane 5.03A 2004744A

continued on back
**APPLICATION BULLETIN**

<table>
<thead>
<tr>
<th>APPLICATION PROCEDURES</th>
<th>PERFORMANCE TIPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface preparation must be completed as indicated.</td>
<td>Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.</td>
</tr>
<tr>
<td>Stir paint thoroughly prior to use with a power agitator. Filter slowly through a 55 mesh screen.</td>
<td>When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.</td>
</tr>
<tr>
<td>Apply paint at the recommended film thickness and spreading rate as indicated below.</td>
<td>Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface treatments, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.</td>
</tr>
<tr>
<td><strong>Recommended Spreading Rate per coat:</strong></td>
<td>Excessive reduction of material can affect film build, appearance, and adhesion.</td>
</tr>
<tr>
<td>Wet mils: 4.0 - 5.5</td>
<td>In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Reducer #15, R7K15.</td>
</tr>
<tr>
<td>Dry mils: 2.5 - 3.5</td>
<td>Pour a small amount of Reducer #15, R7K15 over the top of the paint in the can to prevent skinning or gelling.</td>
</tr>
<tr>
<td>Coverage: 275 - 365 sq ft/gal approximate</td>
<td>Place a temporary cover over the pail to keep excessive moisture, condensation, fog, or rain from contaminating the coating.</td>
</tr>
<tr>
<td><strong>Drying Schedule @ 5.0 mils wet @ 50% RH:</strong></td>
<td>Corothane KA Accelerator is acceptable for use. See data page 5.98 for details.</td>
</tr>
<tr>
<td>At 77°F</td>
<td>It is recommended that partially used cans be sealed/closed for use at a later date.</td>
</tr>
<tr>
<td>@50°F</td>
<td>Product is designed to be topcoated.</td>
</tr>
<tr>
<td>To touch: 40 minutes 30 minutes 15 minutes</td>
<td>Refer to Product Information sheet for additional performance characteristics and properties.</td>
</tr>
<tr>
<td>To recoat minimum:</td>
<td></td>
</tr>
<tr>
<td>maximum: 60 days 60 days 60 days</td>
<td>Clean spills and spatters immediately with Reducer #15, R7K15. Clean tools immediately after use with Reducer #15, R7K15. Follow manufacturer's safety recommendations when using any solvent.</td>
</tr>
<tr>
<td>To handle: 24 hours 18 hours 5 hours</td>
<td>Refer to the MSDS sheet before use. Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.</td>
</tr>
<tr>
<td>Drying time is temperature, humidity, and film thickness dependent.</td>
<td></td>
</tr>
</tbody>
</table>

**CLEAN UP INSTRUCTIONS**

Clean spills and spatters immediately with Reducer #15, R7K15. Clean tools immediately after use with Reducer #15, R7K15. Follow manufacturer's safety recommendations when using any solvent.
## Product Information

### Product Description

COROTHANE® IRONOX A is a single component, VOC compliant, moisture curing urethane finish coat with micaceous iron oxide, designed for low temperature or high humidity applications, providing UV resistance and chemical resistance equivalent to two part urethane coatings:
- Low temperature application - down to 20°F
- Provides resistance to yellowing, chalking, or degradation by sunlight
- Excellent adhesion to most surfaces
- Superior abrasion resistance
- Outstanding chemical resistance
- Suitable for use in USDA inspected facilities

### Recommended Uses

- Color topcoat for previously painted surfaces where maximum color retention and chemical resistance is required
- Chemical resistant coating for metalized surfaces, containment ponds, and tanks
- Superior coverage on edges and bridging over hairline cracks due to micaceous iron oxide
- Recommended topcoat for lead overcoat system

### Performance Characteristics

<table>
<thead>
<tr>
<th>Product Characteristics</th>
<th>Performance Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Characteristics</strong></td>
<td><strong>System Tested:</strong> (unless otherwise indicated)</td>
</tr>
<tr>
<td>Finish: Low Gloss</td>
<td>Substrate Steel</td>
</tr>
<tr>
<td>Color: Gray</td>
<td>Surface Preparation: SGPC-SP6</td>
</tr>
<tr>
<td>Volume Solids: 55% ± 2%</td>
<td>1st Corothane I-GalvaPac Zinc Primer @ 3.0 lbs/ft²</td>
</tr>
<tr>
<td>Weight Solids: 74.7% ± 2%</td>
<td>1st Corothane I-Mastic @ 2.5 lbs/ft²</td>
</tr>
<tr>
<td>VOC (calculated): &lt;420 g/l; 3.5 lb/gal</td>
<td>1st Corothane I-Ironox A @ 3.0 lbs/ft²</td>
</tr>
<tr>
<td><strong>Recommended Spreading Rate per coat:</strong></td>
<td><strong>Abrasion Resistance</strong></td>
</tr>
<tr>
<td>Wet min: 4.0 - 7.0</td>
<td>Method: ASTM D4063, 5.00 mils, 1,000 cycles, 1-lb load</td>
</tr>
<tr>
<td>Dry min: 2.5 - 3.5</td>
<td>Result: 30 mg loss</td>
</tr>
<tr>
<td>Coverage: 220 - 290 sq ft/gal approximate</td>
<td><strong>Adhesion</strong></td>
</tr>
<tr>
<td><strong>Drying Schedule @ 60° F, 60% RH:</strong></td>
<td>Method: ASTM D4541</td>
</tr>
<tr>
<td>@55°F</td>
<td>Result: 1041 psi</td>
</tr>
<tr>
<td>@77°F</td>
<td><strong>Corrosion Weathering</strong></td>
</tr>
<tr>
<td>@100°F</td>
<td>Method: ASTM D334, 15 cycles, 5000 hours</td>
</tr>
<tr>
<td><strong>To touch:</strong> 1-1/2 hours</td>
<td>Result: Rating 10 per ASTM D714 for Blistering</td>
</tr>
<tr>
<td>1 hour</td>
<td>Result: Rating 10 per ASTM D610 for Rusting (dry)</td>
</tr>
<tr>
<td>20 minutes</td>
<td><strong>Direct Impact Resistance:</strong></td>
</tr>
<tr>
<td><strong>To recoat:</strong> 24 hours</td>
<td>Method: ASTM D2794</td>
</tr>
<tr>
<td>4 hours</td>
<td>Result: 90 in. lbs.</td>
</tr>
<tr>
<td>1 hour</td>
<td><strong>Dry Heat Resistance:</strong></td>
</tr>
<tr>
<td><strong>To cure:</strong> 4 days</td>
<td>Method: ASTM D2485</td>
</tr>
<tr>
<td>3 days</td>
<td>Result: 260°F</td>
</tr>
<tr>
<td>3 days</td>
<td><strong>Flexibility:</strong></td>
</tr>
<tr>
<td><strong>Drying time is temperature, humidity, and film thickness dependent:</strong></td>
<td>Method: ASTM D222, 180° bend, 1/8&quot; mandrel</td>
</tr>
<tr>
<td><strong>Shelf Life:</strong> 12 months, unopened, at 77°F</td>
<td>Result: Passes</td>
</tr>
<tr>
<td><strong>Flash Point:</strong> &gt;93°F, FMCC</td>
<td><strong>Moisture Condensation Resistance:</strong></td>
</tr>
<tr>
<td><strong>Reducer/Clean Up:</strong> Reducer #15, R7K15</td>
<td>Method: ASTM D4555, 100°F, 4000 hours</td>
</tr>
<tr>
<td></td>
<td>Result: Non-visible, delamination or crazing at substrate</td>
</tr>
<tr>
<td></td>
<td><strong>Penetrometer Hardness:</strong></td>
</tr>
<tr>
<td></td>
<td>Method: ASTM D3353</td>
</tr>
<tr>
<td></td>
<td>Result: 2H</td>
</tr>
<tr>
<td></td>
<td><strong>Salt Fog Resistance:</strong></td>
</tr>
<tr>
<td></td>
<td>Method: ASTM B117, 500 hours</td>
</tr>
<tr>
<td></td>
<td>Result: Per ASTM D610 for Rusting (dry)</td>
</tr>
<tr>
<td></td>
<td>Rating 10 per ASTM D714 for Blistering</td>
</tr>
<tr>
<td></td>
<td><strong>Water Resistance:</strong></td>
</tr>
<tr>
<td></td>
<td>Method: Non-dimension</td>
</tr>
<tr>
<td></td>
<td>Result: 180°F</td>
</tr>
</tbody>
</table>
**PRODUCT INFORMATION**

<table>
<thead>
<tr>
<th>Steel:</th>
<th>Surface Preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ct. Corothane I - Galvapac Zinc Primer @ 3.0 - 4.0 mils dft</td>
<td>Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion. Refer to product Application Bulletin for detailed surface preparation information.</td>
</tr>
<tr>
<td>1 ct. Corothane I - IronOx A @ 2.5 - 3.5 mils dft</td>
<td></td>
</tr>
<tr>
<td>Steel:</td>
<td>Minimum recommended surface preparation:</td>
</tr>
<tr>
<td>1 ct. Corothane I - Galvapac Zinc Primer @ 3.0 - 4.0 mils dft</td>
<td>* Iron &amp; Steel: SSPC-SP6</td>
</tr>
<tr>
<td>1 ct. Corothane I - Mastic @ 2.5-3.5 mils dft</td>
<td>Concrete &amp; Masonry: SSPC-SP13/NACE 6</td>
</tr>
<tr>
<td>1 ct. Corothane I - IronOx A @ 2.5 - 3.5 mils dft</td>
<td>Previously Painted: Clean, dry, sound</td>
</tr>
<tr>
<td>Steel:</td>
<td>* Primer required</td>
</tr>
<tr>
<td>1 ct. Corothane I - PrePrime @ 1.5 - 2.0 mils dft</td>
<td></td>
</tr>
<tr>
<td>1 ct. Corothane I - Mastic @ 2.5-3.5 mils dft</td>
<td></td>
</tr>
<tr>
<td>1 ct. Corothane I - IronOx A @ 2.5 - 3.5 mils dft</td>
<td></td>
</tr>
</tbody>
</table>

Concrete, smooth:

1 ct. Corothane I - PrePrime @ 1.5 - 2.0 mils dft
1 ct. Corothane I - IronOx A @ 2.5 - 3.5 mils dft

Previously Painted Surfaces:
Spot prime bare steel with 1 coat of Corothane I - Galvapac Zinc Primer
2 coats: Corothane I - IronOx A @ 2.5 - 3.5 mils dft or
1 ct. Corothane I - Mastic @ 2.5 - 3.5 mils dft (Check compatibility)
1 ct. Corothane I - IronOx A @ 2.5 - 3.5 mils dft

**COLOR AVAILABILITY/TINTING**

Color: Gray
Do not tint.

**APPLICATION CONDITIONS**

Temperature:
air and surface: 20°F minimum, 100°F maximum
material: 45°F minimum
Do not apply over surface ice

Relative humidity:
Can be applied at relative humidities up to 99%

Refer to product Application Bulletin for detailed application information.

**ORDERING INFORMATION**

Packaging: 1 and 5 gallon containers
Weight per gallon: 13.4 ± 0.2 lb depending on color

**SAFETY PRECAUTIONS**

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.
# APPLICATION BULLETIN

## SURFACE PREPARATION

<table>
<thead>
<tr>
<th>Surface Preparation</th>
<th>APPLICATION CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface must be clean, dry, and in sound condition. Remove oil, dust, grease, dirt, loose rust, and other foreign materials to ensure adequate adhesion.</td>
<td>Temperature: air and surface: 20°F minimum, 100°F maximum. Material: 40°F minimum. Do not apply over surface ice.</td>
</tr>
<tr>
<td>Iron &amp; Steel</td>
<td>Relative humidity: Can be applied at relative humidities up to 95%.</td>
</tr>
<tr>
<td>Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Commercial Blast Cleaning per SSPC-SP6. For better performance, use Near White Metal Blast Cleaning per SSPC-SP10. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 min). Prime any bare steel the same day as it is cleaned.</td>
<td></td>
</tr>
<tr>
<td>Poured Concrete</td>
<td></td>
</tr>
<tr>
<td>New</td>
<td></td>
</tr>
<tr>
<td>For surface preparation, refer to SSPC-SP13/NAECE 6. Surface must be clean, dry, sound, and offer sufficient profile to achieve adequate adhesion. Minimum substrate cure is 28 days at 70°F. Remove all form release agents, curing compounds, salts, efflorescence, laitance, and other foreign materials by sandblasting, shotblasting, mechanical scarification, or suitable chemical means. Refer to ASTM D4260. Rinse thoroughly to achieve a final pH between 6.0 and 10.0. Allow to dry thoroughly prior to coating.</td>
<td></td>
</tr>
<tr>
<td>Old</td>
<td></td>
</tr>
<tr>
<td>Surface preparation is done in much the same manner as new concrete, however, if the concrete is contaminated with oils, grease, or chemicals, etc., they must be removed by cleaning with a strong detergent. Refer to ASTM D4258. Form release agents, hardeners, etc. must be removed by sandblasting, shotblasting, mechanical scarification, or suitable chemical means. If surface deterioration presents an unacceptably rough surface, Kern Cat-Cat Epoxy Filler/Sealer is recommended to patch and resurface damaged concrete. Fill all cracks, voids, and spall holes with Armor/Seal Crack Filler.</td>
<td></td>
</tr>
<tr>
<td>Previously Painted Surfaces</td>
<td></td>
</tr>
<tr>
<td>If in sound condition, clean the surface of all foreign material. Smooth, flat or glossy coatings and surfaces should be dulled by abrading the surface. Apply a fast dry, allowing paint to dry one week before testing adhesion. If adhesion is poor, or if the product attacking the previous finish, removal of the previous coating may be necessary. If paint is peeling or badly weathered, clean surface to sound substrate and treat as a new surface.</td>
<td></td>
</tr>
</tbody>
</table>

## APPLICATION EQUIPMENT

- The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

<table>
<thead>
<tr>
<th>Help</th>
<th>Reducer/Clean Up</th>
<th>Reducer #15, R7K15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airless Spray</td>
<td>Pump</td>
<td>30:1</td>
</tr>
<tr>
<td>Pressure</td>
<td>1800 - 2000 psi</td>
<td></td>
</tr>
<tr>
<td>Hose</td>
<td>1/4” ID</td>
<td></td>
</tr>
<tr>
<td>Tip</td>
<td>011” - 015”</td>
<td></td>
</tr>
<tr>
<td>Filter</td>
<td>60 mesh</td>
<td></td>
</tr>
<tr>
<td>Reduction</td>
<td>as needed up to 10% by volume</td>
<td></td>
</tr>
</tbody>
</table>

- Conventional Spray

<table>
<thead>
<tr>
<th>帮助</th>
<th>Unit</th>
<th>Grain</th>
<th>Binks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid Nozzle</td>
<td>100</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Air Nozzle</td>
<td>947</td>
<td>88PR</td>
<td></td>
</tr>
<tr>
<td>Atomization Pressure</td>
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</tr>
<tr>
<td>Fluid Pressure</td>
<td>15-20 psi</td>
<td>15-20 psi</td>
<td></td>
</tr>
<tr>
<td>Reduction</td>
<td>as needed up to 10% by volume</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Brush

| Brush | Natural Bristle |
| Reduction | as needed up to 10% by volume |

- Roller

| Roller | Cover | 1/4” natural or synthetic with phromatic core |
| Reduction | as needed up to 10% by volume |

If specific application equipment is listed above, equivalent equipment may be substituted.
# APPLICATION BULLETIN

## APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Stir paint thoroughly prior to use with a power agitator. Filter slowly through a 55 mesh screen.

Apply paint at the recommended film thickness and spreading rate as indicated below:

**Recommended Spreading Rate per coat:**
- Wet mils: 4.0 - 7.0
- Dry mils: 2.5 - 3.5
- Coverage: 225 - 290 sq ft/gal approximate

**Drying Schedule @ 50 mils wet @ 50% RH:**
- @ 55°F @ 77°F @ 100°F
- To touch: 1.5 hours 1 hour 20 minutes
- To recoat: 24 hours 4 hours 1 hour
- To cure: 4 days 3 days 3 days

Drying time is temperature, humidity, and film thickness dependent.

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

## PERFORMANCE TIPS

- Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.
- When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and particles. If necessary, cross spray at a right angle.
- Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.
- Excessive reduction of material can affect film build, appearance, and adhesion.

In order to avoid blockage of spray equipment, clean equipment before use and before periods of extended downtime with Reducer #15, R7K15.

- Pour a small amount of Reducer #15, R7K15 over the top of the paint in the can to prevent skinning or grilling.
- Place a temporary cover over the paint to keep excessive moisture, condensation, fog, or rain from contaminating the coating.
- Corothane KA Accelerator is acceptable for use. See data page 5.98 for details.
- When applying white or light colors of Corothane 1 - Aliphatic over dark colors or porous surfaces, a minimum of 2 coats is required for adequate hide.
- It is recommended that partially used cans not be sealed/dosed for use at a later date.
- Refer to Product Information sheet for additional performance characteristics and properties.

## CLEAN UP INSTRUCTIONS

Clean spills and splatters immediately with Reducer #15, R7K15. Clean tools immediately after use with Reducer #15, R7K15. Follow manufacturer's safety recommendations when using any solvent.

## SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.
MATERIAL SAFETY DATA SHEET

DATE OF PREPARATION: 09/07/01
DATE OF LAST REVISION: 09/07/01
MANUFACTURER'S CODE: MC-ALUMINUM 2.8

SECTION I. GENERAL

MANUFACTURER'S NAME AND ADDRESS: WASSER HIGH-TECH COATING, INC.
1904 WEST JAMES STREET, SUITE 100, KENT, WA 98032
253-850-9207

INFORMATION PHONE NUMBER: 100W 604-424-9300
EMERGENCY PHONE NUMBER: 604-424-9300

CHEMICAL FAMILY: POLYURETHANE, POLYURETHANE FOAM

TRADE NAME: WASSER MC-ALUMINUM

SHIPS RATING: 12, 13, 1

SECTION II. HAZARDOUS INGREDIENTS

STORAGE: WAREHOUSE

CAS NUMBER: 102-70-6

EXPOSURE LIMITS: TLV

POLYURETHANE FOAM POLYMER 45-55 Pneumonia 0.05ppm ceiling OSHA TEL 50ppm-500ppm Manufacturer's 500ppm-2000ppm TWA/OSHA

HEALTH HAZARDS: 1200ppm OSHA STEL 1500ppm TWA/ACGIH 35ppm STEL 12ppm TWA/ACGIH

ETHYLENIZENES 01-03 100-41-4

ACRYLIC FIBER 29-13 1330-70-7 100ppm TWA/OSHA 100ppm STEL OSHA 100ppm TWA/ACGIH 30ppm STEL 12ppm TWA/ACGIH

ALUMINUM POWDER 125-2 7429-90-5

SECTION III. PHYSICAL DATA

BOILING POINT: 200°C, 117°F

APPROX. WEIGHT PER GALLON: 8.5 LBS/1.1 g/cm³

EVAPORATION RATE: SLOWER THAN ETHYL

VAPOR DENSITY: HEAVIER THAN AIR

% VOLUME: 48 (APPEX)

BOILING POINT: LESS THAN 2.8 BTLS/9G

SOLUBILITY IN WATER: 0.001%

SECTION IV. FIRE AND EXPLOSION INFORMATION

FLASH POINT: 20°F, 6°C, CLOSED CUP

EXTINGUISHING MEDIA: DRY CHEMICAL, FOAM, CARBON DIOXIDE, WATER SPRAY

SPECIAL FIREFIGHTING PROCEDURES: Wear self-contained breathing apparatus (SCBA), with a full-face piece, operated in the positive-pressure mode. Full protective clothing such as rubber gloves, boots, etc. should be worn by firefighters. Do not use water or other materials unless the fire is small and well-ventilated areas. Closed containers may explode when exposed to extreme heat or when contaminated with water (CO2 evolved). A fire, incorporate vapors and other irritating, highly toxic gases may be generated by thermal decomposition or combustion.

SECTION V. FIRST AID AND HEALTH HAZARD INFORMATION

EMERGENCY FIRST AID:

INGESTION: Gastro-intestinal illness. In the unlikely event of ingestion, call a physician immediately with a list of the ingredients.

SKIN: Remove all contaminated clothing. Wash affected skin thoroughly with soap and water.

EYES: Flush with water for at least 15 minutes and consult a physician. If irritation continues, consult a physician.

INHALATION: This is an industrial paint. The primary hazard is organic solvent. Inhalation of reactive polyurethane is unlikely unless spray spraying, then the hazard is spray dust. An inhalation above TLV can occur when spraying or painting in a confined, unventilated area. Remove exposed person to fresh air. Treat for exposure to organic solvent. Give mouth to mouth then oxygen if breathing has stopped. Contact a physician. Ataxia and tremors may develop and persist for 12-24 hours if exposed to excessive spray dust or fumes without respiratory protection. Treatment is symptomatic with other symptoms.

HEALTH HAZARD INFORMATION: SYMPTOMS OF OVER EXPOSURE:

INHALED: Nasal and respiratory tract irritation. Breathing solvent vapors at concentrations in air that exceed 100ppm can cause nausea and central nervous system effects including dizziness, loss of coordination, drowsiness, headache, confusion, fatigue, nausea, loss of appetite and/or loss of consciousness. Sensitized individuals may experience chest tightness, wheezing, coughing and/or shortness of breath. These symptoms may not appear for hours and may persist for 4-24 hours.

CONTACT WITH SKIN: Overexposure may cause severe irritation. Skin irritation to inorganic and organic solvents may occur. Allergic contact may occur in some individuals. Nausea in high concentrations. Headache, nausea, confusion, reversible eye damage, abdominal pain, fatigue and loss of consciousness may occur.

CHRONIC: Long-term unprotected exposure may lead to muscular weakness, confusion, impaired coordination, liver damage, kidney damage, dermatitis, mucous membrane damage, pulmonary edema, anemia and/or blood disorders. Large decreases in lung function may occur with chronic overexposure to inorganic solvents. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.

01-MC-Aluminum 2.8 2001-06-17 Page 1 of 2
SECTION V, cont.

As a result of previous unexpected overexposures, certain individuals may develop incapacitate sensitization (chemical reactions) which will cause them to react to a later exposure to incapacitate well below the TLV. Sensitized individuals may show symptoms similar to individuals who show sensitization to specific dusts, animal fur, and other irritants if re-exposed to the product. This long latency can remain in a sensitized individual if re-exposed. Skin sensitization can also result from overexposure. Laboratory studies with rats have shown that petroleum distillates cause kidney damage and liver tumors. Several studies evaluating petroleum workers have not shown significant increases of kidney damage or liver tumors. Although acute and repeated acute exposure of specific irritants to health over a period of years may cause lung disease. This product contains no cancer agent found on any list.

SECTION VI. REACTIVITY DATA

CONDITIONS TO AVOID: Avoid heat, sparks, open flame and other sources of ignition.

INCOMPATIBILITY (MATERIALS TO AVOID): Mixing with water, alcohol, amines, strong acids and bases, oxidizing agents and surface active materials may cause reaction or spalling.

HAZARDOUS DECOMPOSITION PRODUCTS: Toxic gases and vapors including carbon monoxide, carbon dioxide, oxides of nitrogen, traces of HCN, hydrocarbons and other unidentified organic compounds.

CONDITIONS TO AVOID: Combining or mixing with water or other materials that reach with incompatibles may cause ignition or premature reaction in the container.

SECTION VII. ELIMINATION AND DISPOSAL INFORMATION.

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: This material is paint. Minor spills or leaks in well-ventilated area cause no hazard. Major spills in confined areas should be treated with care. Avoid all sources of ignition if solvent vapors are excessive or the spill is confined to a closed area or confined space. Peroxides not used for protective equipment should avoid the area until solvent vapors have vented. Avoid allowing spilled material to leak into any flammable water source. Material spilled on the ground can be contained and collected with absorbent. There is no danger of material entering into ground water if it is contained. Solvent evaporation will occur in spilled material if it is in open ventilation leaving a small stable non-hazardous residue. Dried material can be disposed of in landfill. Sem-dry and liquid should be collected and placed in sealed salvage container or allowed to dry by evaporation in a well-ventilated area.

WASTE DISPOSAL PROCEDURES: Spilled product that is not a thin film dried paint must be disposed of as a hazardous solid waste according to Resource Conservation and Recovery Act regulations. Preferred method of disposal is incineration.

SECTION VIII. EMPLOYEE PROTECTION INFORMATION

PRECAUTIONS must be taken so those persons handling this material do not breathe the vapors above the TLV, or have it contact the skin or eyes. In spray operations, protective clothing must be afforded against exposure to both vapor and spray mist.

EYE PROTECTION: Liquid chemical goggles. Vapor resistant goggles should be worn when contact lenses are in use. In a splash hazard environment, goggles or a full face shield should be used.

SKIN PROTECTION: Percutaneou mast cells (latex rubber, nitrile rubber, polyvinyl alcohol). Cover as much of the exposed skin area as possible with appropriate clothing. If skin creams are used, keep the areas covered by the cream to a minimum.

RESPIRATOR: This product contains polymeric reactive monomers. Due to the high molecular weight and low vapor pressure it is extremely unlikely that monomer reactive monomer can get into the vapor phase during normal aging, storage, mixing, rolling, or rolling applications; however, during spraying in confined spaces the spray mist particles may reach a hazardous level, even if the vapor phase does not contain hazardous levels. Since this product contains organic solvent it is required to use an NIOSH approved spray paint respirator. Use of a spray paint respirator will ensure a safe environment. The respirator should not be used in the event of an electrical hazard. The respirator should be used to prevent inhalation of hazardous materials. The respirator should be able to prevent inhalation of hazardous materials.

OTHERS: Protective clothing and equipment: Appropriate protective clothing necessary to prevent repeated or prolonged skin contact should be worn. Cotton or synthetic clothing should be worn when contact is expected. The clothing should be changed frequently. The clothing should be changed frequently. The clothing should be changed frequently.

SKIN STORAGE AND HANDLING REQUIREMENTS: Observe local regulations. Store in a cool, well-ventilated liquid storage area. Keep away from moisture, heat, sparks, and open flames. Use non-sparking tools. Use only with adequate ventilation. Avoid contact with eyes, skin and clothes. Avoid breathing vapor. At storage temperatures above 100 degrees F, this product may slowly polymerize.

PROTECTIVE MEASURES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Do not wash, acetone or water, to clean or wash. Wear appropriate personal protective equipment when working on contaminated equipment if the ingredients exceed the TLV. Do not use, flame out, brake or weld dry cleaning without a NIOSH/MSHA approved respirator, as welding fumes may be harmful.

The information contained herein is to be accurate and reliable, the best information currently available to the user. However, we make no warranty of merchantability or any other warranty, expressed or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.
MATERIAL SAFETY DATA SHEET

MC-FERROMASTIC 2.8

SECTION I. GENERAL

MANUFACTURER'S NAME AND ADDRESS:
WASSER HIGH-TECH COATINGS, INC.
1004 W. JAMESTOWN STREET, SUITE 100, KENT, WA 98032

EMERGENCY PHONE NUMBER:
233-810-2967

CHEMTEC 800-424-3900

TRADE NAME:
MOISTURE-CURE POLYURETHANE PAINT

DISPOSAL RATING:
WASSER MC-FERROMASTIC
1-2-3-3-1-1

SECTION II. HAZARDOUS INGREDIENTS

COMPOUND
POLYURETHANE FIREPOLYMER
POLYPHENOL NAPHTHALENE
METHYL-HEXYL KETONE
METHYLISOBUTYL KETONE
XYLENE

CAS NUMBER
50-10-0
6622-80-5
108-42-2
108-10-1
107-03-3

EXPOSURE LIMITS TLV
60ppm ceiling OSHA PEL
50ppm PEL
50ppm-TWA ACGIH
50ppm-TWA OSHA
75ppm OSHA STEL
50ppm-TWA ACGIH
100ppm-TWA OSHA
50ppm OSHA STEL
50ppm-TWA ACGIH

SECTION III. PHYSICAL DATA

BOILING POINT
20°F, 127°F

APPROX. WEIGHT PER GALLON
12 LBS., 1.14 gal

OCCUPATION RATE
SLOWER THAN AIR

VAPOR DENSITY
HEAVIER THAN AIR

W VOLATILE (VOLUME)
35 (APPROX)

VOC
LESS THAN 2.8 LBS.

APPEARANCE AND ODOR
BROWN COLORED LIQUID WITH AROMATIC SOLVENT ODOR

SECTION IV. FIRE AND EXPLOSION INFORMATION

FLASH POINT CLOSED CUP
37°F, 1°C

EXTINGUISHING MEDIA:
DRY CHEMICAL, FOAM, CARBON DIOXIDE, WATER SPRAY

SPECIAL FIREFIGHTING PROCEEDURES: Wear self-contained breathing apparatus (SCBA), with a full-face piece, operated in the positive-pressure mode. Full protective clothing such as rubber gloves, boots, etc. should be worn by firefighters. No skin should be exposed. Clear fire area of unprotected personnel. Water from fog nozzles may be useful to cool closed containers to prevent pressure build-up.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapor is heavier than air. Under conditions of stagnant air, vapors can build up and travel a considerable distance along the ground to an ignition source, which may result in a flashback to the source of the vapor, or an explosion. Do not use or store near open flame, heat, sparks, electrical equipment or hot surfaces. Use only in well-ventilated areas. Closed containers may explode when exposed to extreme heat or burn when contaminated with water (CO2 evolved). During a fire, incorporate vapors and other irritants, highly toxic gases may be generated by thermal decomposition or combustion.

SECTION V. FIRST AID AND HEALTH HAZARD INFORMATION

EMERGENCY FIRST AID:

INGESTION: Gastric-intestinal distress. In the unlikely event of ingestion, call a physician immediately with a list of the ingredients.

SKIN: Remove heavily contaminated clothing. Wash affected skin thoroughly with soap and water.

EYES: Flush with water for at least 15 minutes and consult a physician. If irritation continues, consult a physician.

INHALATION: This is an industrial paint. The primary hazard is organic solvent. Inhalation of reactive polyurethane is unlikely when spraying. If the hazard is spray dust. An inhalation above TLV can occur when spraying or painting in a confined space without respiratory protection. Remove exposed persons to fresh air. Treat for exposure to organic solvent. Give resuscitation if necessary but only after breathing has stopped. Consult a physician. Asthmatic type symptoms may develop and persist for at least 1-24 hours if exposed to excessive spray dust or fumes without respiratory protection. Treatment is symptomatic.

HEALTH HAZARD INFORMATION: SYMPTOMS OF OVER EXPOSURE:

INHALATION: Neonatal and respiratory tract irritation. Breathing solvent vapors at concentrations in air that exceed 800 ppm can cause narcosis and central nervous system effects including dizziness, loss of coordination, drowsiness, headache, confusion, fatigue, nausea, loss of appetite and loss of consciousness. Sensitized individuals may experience chest tightness, wheezing, coughing and/or shortness of breath. These symptoms may not appear for hours and may persist for 4-24 hours.

CONTACT WITH SKIN: Overexposure may cause severe irritation. Skin irritation to inorganic and organic solvents may cause allergic dermatitis in individuals with prior sensitization. Exposure to fixed paint or dust is not hazardous.

CONTACT WITH EYES: May cause severe irritation.

SWALLOWED: Any ingestion is harmful resulting in burning sensation in the mouth and stomach accompanied by abdominal distress.

HEALTH EFFECTS OR RISKS FROM UNPROTECTED EXPOSURE:

ACUTE: Prolonged unprotected breathing of solvent vapor or spray may cause eye, nose, respiratory tract and skin irritation. Allergic skin or respiratory reaction may occur in some individuals. Nausea in high concentrations. Headache, nausea, confusion, reversible eye damage, abdominal pain, fatigue and loss of consciousness may occur.

CHRONIC: Long term unprotected exposure may lead to muscular weakness, confusion, impaired coordination, liver damage, kidney damage, dermatitis, severe membrane damage, pulmonary edema, anemia and/or blood disorders. Large decrease in lung function may occur with chronic overexposure to solvents.

Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
SECTION V. CONT.

As a result of previous unprotected exposures, certain individuals may develop incapacitating sensitization (chemical asthma) which will cause them to react to a later exposure to incinerator well below the TLV. Sensitized individuals may show symptoms similar to individuals who show sensitization to specific dust, animal fur, and other irritants if re-exposed to this product. This long sensitivity can reappear in a sensitized individual if re-exposed. Silica sensitization can also result from exposure. Laboratory studies with rats have shown that silica dust causes kidney damage and kidney or liver tumors. Several studies evaluating silica exposure have not shown significant increase of kidney damage nor kidney or liver tumors. Properly designed and equipped booths for spray work and dust control in the plant and in the event of silica exposure are essential.

This product contains no cancer agent found on any list.

SECTION VI. REACTIVITY DATA

CONDITIONS TO AVOID: Avoid dust, fumes, mists, or smoke and the use of open flames or other sources of ignition.

INCOMPATIBILITY (MATERIALS TO AVOID): Mixing with water, alcohol, amines, strong acids and bases, oxidizing agents, and metal ores of Fe, Zn, Cu, and other unidentified organic compounds.

CONDITIONS TO AVOID: Combining with water or other materials that reach with inorganic acids may cause gellation or premature reaction in the container.

SECTION VII. SPILL, LEAK, AND DISPOSAL INFORMATION

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: This material is paint. Minor spills or leaks in well-ventilated areas are not hazardous. Major spills in confined areas should be treated with care. Avoid all sources of ignition. If solvent vapors are excessive or the spill is confined in a closed room or enclosed space. Permeate not venting protective equipment should avoid the area until solvent vapors have dissipated. Avoid allowing spilled materials to leach into any flowing water sources. Material spilled on the ground can be contained and collected with a squeegee. If the spill extends into ground water it must be contained. Solvent evaporation will occur in spilled material if left in open ventilation leaving a solid residue. Contaminated soil must be disposed of at a landfill. Solid and liquid should be collected and placed in sealed barrel containers or allowed to dry by evaporation in a well-ventilated area.

WASTE DISPOSAL PROCEDURES: Spilled product that is left in a thin film on the floor must be disposed of in a hazardous waste disposal area according to Resource Conservation and Recovery Act regulations. Preferred method of disposal is incineration.

SECTION VIII. EMPLOYEE PROTECTION INFORMATION

PRECAUTIONS MUST BE TAKEN; those persons handling this material do not breathe the vapors above the TLV, or have it contact the skin or eyes. In emergency operating, protective glasses must be afforded against exposure to both vapor and spray mist.

EYE PROTECTION: Liquid chemical goggle: Vapor resistant goggle should be worn when contact lenses are in use. In a workplace environment: goggle or a full face shield should be used.

SKIN PROTECTION: Permeation resistant gloves (glove rubber, nitrile rubber, polyvinyl alcohol). Cover as much of the exposed skin area as possible with appropriate clothing. If skin creams are used, keep hands covered with the cream by a minimum.

RESPIRATOR: This product contains polystyrene reactive polystyrene prepolymer. Due to the high molecular weight and low vapor pressure it is extremely unlikely that measurable reactive polymer can get into the vapor phase during normal mixing, stirring, or rolling operations; however, during spray application in confined spaces the spray mist particles may reach a hazardous level, even if the vapor phase does not contain hazardous levels. Since this product contains organic solvents it is required to use a properly rated air. Air supply filter operating at 10,000 psi or higher. The respirator is required to wear a full face, supplied air respirator. This product will generally not show reactive isocyanate at levels above the TLV in the vapor phase, even during spray operations where the isocyanate is present at a high concentration. The particles may penetrate a gas mask or respirator if improperly fitted or if no equipped with a HEPA filter. Therefore always wear a full face, supplied air respirator during spray operations where airborne spray dust is present in hazardous levels.

GLOVES: Skin contact should be minimized by wearing rubber impermeable gloves made of nitrile or natural rubber.

OTHER PROTECTIVE CLOTHING AND EQUIPMENT: Appropriate protective clothing necessary to prevent extended or prolonged skin contact should be worn. Solvent resistant boots should be worn where splashing can occur. If barrier creams are used, keep the area that is protected only by the cream, to a minimum.

HYGIENIC WORK PRACTICES: Wash hands thoroughly with soap and water after handling this product, and before eating or smoking. Wash contaminated clothes thoroughly before reuse. Safety showers and eye stations should be available to employees.

OTHER STORAGE AND HANDLING REQUIREMENTS: Keep away from heat, sparks, and other igniters. Do not smoke. Use only with adequate ventilation. Avoid breathing vapor. Avoid breathing vapor. The storage temperature range for this product is 30 degrees F to 35 degrees C. This product may slowly polymerize.

PROTECTIVE MEASURES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Do not wash, heat or roll on or near container. Wear appropriate personal protective equipment when working on contaminated equipment if the ingredients exceed the TLV. Do not wash, flame out, burn or use dry cleaning without a NOX/CH4 Mess approved respirator, as welding fumes may be harmful.

The information contained herein is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.
MATERIAL SAFETY DATA SHEET

MC-FERROX A 2.8

DATE OF PREPARATION: 05/07/97
DATE OF LAST REVISION: 09/17/01
MANUFACTURER'S CODE: MC-FERROX A 2.8

MANUFACTURER'S NAME AND ADDRESS:
WASSER HIGH-TECH COATINGS, INC.
1004 WEST JAMES STREET, SUITE 100, KENT, WA 98032
253-852-2607

EMERGENCY PHONE NUMBER:
CHEMTREC 1-800-424-9300

CHEMICAL FAMILY:
MOISTURE-CURE POLYURETHANE FOAM

TRADE NAME:
WASSER MC-FERROX A

EMS RATINGS:
HEP, LP, I

SECTION II. HAZARDOUS INGREDIENTS

NAME
POLYURETHANE FOAM POLYMER
HIGH PLASH ACRYLIC
METHYL N-AMYL KETONE
METHYLISOBUTYLKETONE
XYLENE

WAT
25-30
02-15
02-12
0-10
0-10

CAS NUMBER
6474-95-5
6474-95-5
110-43-0
110-43-0
1330-20-7

EXPOSURE LIMITS TLV
500 ppm TWA OSHA
50 ppm Manufacturer
50 ppm TWA ACGIH
100 ppm TWA OSHA
75 ppm OSHA STEL
50 ppm TWA ACGIH
150 ppm OSHA STEL
150 ppm OSHA STEL

SECTION III. PHYSICAL DATA

BOILING POINT
200°F (110°C)

APPROX. WEIGHT PER GALLON
11.3 LBS.

APPROX. DENSITY
SLOWER THAN ETHER

Vapor Density HEAVIER THAN AIR

VOC
36 (APPROX)

APPEARANCE AND ODOR
COLORED LIQUID WITH AROMATIC SOLVENT ODOR

SECTION IV. FIRE AND EXPLOSION INFORMATION

FLASH POINT
110°F

EXTINGUISHING MEDIA DRY CHEMICAL, FOAM, CARBON DIOXIDE, WATER SPRAY

SECTION V. FIRST AID AND HEALTH HAZARD INFORMATION

EMERGENCY FIRST AID:

INGESTION: In the unlikely event of ingestion, call a physician immediately with a list of the ingredients.

SKIN: Remove heavily contaminated clothing. Wash affected skin thoroughly with soap and water.

EYES: Flush with water for at least 15 minutes and consult a physician. If irritation continues, consult a physician.

INHALATION: This is an industrial paint. The primary hazard is organic solvent. Inhaling reactive polyurethane is unlikely unless spraying, then the hazard is in spray dust. An inhalation above TLV can occur when spray painting or in a confined space without respiratory protection. Exposed exposed person to fresh air. Treat for exposure to organic solvent. Give oxygen to patient immediately if exposure is suspected or if breathing has stopped. Contact a physician. Treatment is symptomatic.

HEALTH HAZARD INFORMATION: SYMPTOMS OF OVEREXPOSURE:

INHALED: Nasal and respiratory tract irritation. Breathing solvent vapors at concentrations in air that exceed 800 ppm can cause nervous and central nervous system effects including dizziness, loss of coordination, drowsiness, headache, confusion, fatigue, nausea, loss of appetite and loss of consciousness. Sensitized individuals may experience chest tightness, wheezing, coughing and shortness of breath. These symptoms may not appear for hours and may persist for 4-24 hours.

CONTACT WITH SKIN: Overexposure may cause severe irritation. Skin irritation to inorganic and organic solvents may occur among dermatitis in individuals with prior sensitization. Exposure to dried paint or dust is not hazardous.

CONTACT WITH EYES: May cause severe irritation.

SWALLOWED: Any ingestion is harmful resulting in burning sensation in the mouth and stomach accompanied by abdominal distension.

HEALTH EFFECTS OR RISKS FROM UNPROTECTED EXPOSURE:

ACUTE: Prolonged unprotected breathing of solvent vapor or spray may cause eye, nose, respiratory tract and/or skin irritation. Allergic skin or respiratory reaction may occur in some individuals. Nadicor in high concentrations. Headache, nausea, confusion, reversible eye damage, abdominal pain, fatigue and loss of consciousness may occur.

CHRONIC: Long-term unprotected exposure may lead to muscular weakness, confusion, impaired coordination, liver damage, kidney damage, dermatitis, mucous membrane damage, pulmonary edema, anemia and/or blood disorders. Large decreases in lung function may occur with chronic overexposure to inorganics.

Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.

SECTION IV, cont.
01-MC-Ferrox A 2.8 2001-09-17
As a result of previous unprotected overexposure, certain individuals may develop incapacitating sensitization (chemical synesthesia) which will cause them to react to a later exposure to inorganic well below the TLV. Reactivated individuals may also show symptoms similar to individuals who show sensitization to specific dusts, animal fur, and other irritants if re-exposed to this product. This type of reaction can reappear if re-exposed. Skin examination can also result from overexposure. Laboratory studies with rare have shown that petroleum distillates cause kidney damage and kidney removal. Several studies evaluating potential workers have shown significant increases of kidney damage. This article reviews the presence of pesticides. Repeated and prolonged unprotected breathing of spray mist and/or dust over a period of seven may cause lung damage.

This product contains no cancer agents found on any list.

**Section VIII: Health, Lead, and Disposal Information.**

**Steps to be taken in Case Material Released or Spilled:** This material is paint. Minor spills or leaks in well-ventilated areas cause no hazard. Major spills in confined areas may be treated with care. Avoid all sources of ignition if solvent vapor is excessive or the spill is confined to a closed can or confined space. Flammable or explosive protective equipment should be used. Contain spills with absorbent to minimize fire hazard. NO material spilled on the ground can be contained and collected with absorbent. There is no danger of material penetrating into ground water if it is contained. Solvent evaporation will occur in spilt material if left in open ventilation leaving a solid stable non-hazardous residue. Dented material can be disposed of in landfill. Semi-liquid and liquid should be collected and placed in sealed salvage containers or allowed to dry by evaporation in a well-ventilated area.

**Waste Disposal Procedures:** Spilled product that is not in film or liquid must be disposed of as hazardous solid waste according to Resource Conservation and Recovery Act regulations. Preferred method of disposal is incineration.

**Section VIII: Storage and Handling Information.**

**Precautions to be taken:** Do not breathe the vapors above the TLV, or have it contact the skin or eyes. In spray operations, protection must be afforded against exposure to both vapor and spray mist.

**Eye Protection:** Liquid chemical goggles. Vapor contact goggles should be worn when contact lenses are in use. In a friction hazard environment goggles or a full face shield should be used.

**Skin Protection:** Desensitize resistant gloves (butyl rubber, nitrile rubber, polystyrene coated). Cover as much of the exposed skin as possible with appropriate clothing. If skin comes in contact, use water with soap and water after handling this product, and before eating or smoking.

**Respirator:** Use a respirator having a particle size of .3 microns or less. The respirator should be fitted with a particle size of .3 microns or less. The respirator should be fitted with a particle size of .3 microns or less. The respirator should be fitted with a particle size of .3 microns or less. The respirator should be fitted with a particle size of .3 microns or less.

**Personal Protective Clothing and Equipment:** Appropriate protective clothing should be worn to prevent or limit contact with the skin or eyes.

**Hygienic Work Practices:** Wash hands thoroughly with soap and water after handling this product, and before eating or smoking. Wash contaminated clothing thoroughly before reuse. Safety showers and eye showers should be available to employees.

**Other Storage and Handling Requirements:** Secure label precautions. Store in a cool, well-ventilated liquid storage area. Keep away from moisture, heat, sparks, and open flames. Use non-sparking tools. Use only with adequate ventilation. Avoid contact with eyes, skin, and clothes. Avoid breathing vapor. At storage temperatures above 100 degrees F, this product may slowly spew.

**Protective Measures During Maintenance of Contaminated Equipment:** Do not weld, heat or drill on or near containers. Wear appropriate personal protective equipment when working on contaminated equipment if the intermediate exceed the TLV. Do not run, flame cut, braze or weld dry coating without a NIOSH-listed approved respirator, as welding fumes may be harmful.

The information contained herein is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to each information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

01-MC-Ferrox A 2.8 2001-09-17 Page 2 of 2
Hazardous lead-based paint (LBP) has been used extensively on all types of Department of Defense steel structures and steel components. The removal of LBP is generally performed by abrasive blasting or by water jetting. Containment and disposal of surface preparation debris, worker protection, and other regulatory compliance costs combine to make removal of LBP very expensive.

The Environmental Security Technology Certification Program (ESTCP) project reported here demonstrated the overcoating process, which may be defined as the practice of painting over existing coatings as a means of extending service life. Overcoating offers the benefit of maximizing the economic life of existing LBP coatings while minimizing present expenditures and reducing worker exposure and hazardous waste generation.

Demonstration of the overcoat process was performed on a water tank at Fort Campbell, KY and a railroad bridge at Holston Army Ammunition Plant (HAAP), Kingsport, TN. The installed cost of overcoating on the simple structure (water tank) was estimated at $1.55/sq ft. The installed cost for overcoating on the complex structure (railroad bridge) was estimated at $2.83/sq ft. By comparison, the cost of deleading and installing a new paint system is $5 to $18/sq ft with an average cost of $8/sq ft.