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Technology Demonstration of Nontoxic Chemical Stripper for Steel

Cost and Performance Report

Bernard Appleman and Patrick Nau

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Foreword

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." The Assistant Chief of Staff for Installation Management (ACSIM) technical monitor was Bryan Nix (ACSIM-FSF).

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1 Executive Summary

The environmental problem being addressed in this technology demonstration is the removal of lead-based paint (LBP) from steel structures without producing hazardous air pollutants (HAPs). The objective of this demonstration was to show the efficacy of reduced-toxicity chemical strippers, also referred to as "environmentally friendly" or "environmentally acceptable" strippers. The expected benefits were to eliminate use of caustic chemicals such as sodium hydroxide, and carcinogens such as methylene chloride; thus, the reduction of toxic waste streams. Other potential benefits include eliminating the need for containment while the LBP is being removed, and for the worker to wear respirators.

Environmentally acceptable (EA) chemical stripper technology was validated as part of a standard methodology for removing LBP on large steel structures owned by the Army, such as water tanks, aircraft hangars, bridges, antennas, ladders, poles, railings, and fuel storage tanks, leaving a surface suitable for repainting. In addition, this technology was demonstrated to meet environmental regulations and worker health and safety issues. Cost and performance data were collected and analyzed.

The results showed that the nontoxic chemical stripper RemovAll 210 (Napier Environmental Technologies, Inc., Delta, B.C., Canada), also marketed commercially as ICI DeVoe Hydrostrip 502), is capable of performing equally to conventional toxic chemical strippers and removing LBP at a cost that is competitive with other paint removal techniques. The stripper is easy to apply and is effective at removing multiple layers in one application. It eliminates the use of methylene chloride and other HAPs in toxic chemical strippers, reducing the extent of worker protection required and eliminating potential hazardous wastes. Since their components are more than 90 percent volatile, these chemical strippers add very little to the waste stream. The most significant limitation of the chemical strippers (and this nontoxic stripper is no different) is that they do not completely remove the existing paint or lead from the surface, particularly in crevices. In this demonstration, the surface was stripped free of 95 percent of the paint; all remaining paint and rust were tightly bonded. Although there is no known industry consensus standard describing this condition, it is considered superior to or equal to the condition achieved using the Society for Protective Coatings (SSPC) standard SSPC-SP 2 or SSPC-SP 3 for removing existing paint. The surface was repainted with a surface-tolerant coating.

Alternatively, spot wire brushing or pressure washing the stripped surface may be used to provide a cleaner surface prior to repainting. Also, the LBP removed will cause the waste to exceed the Toxicity Characteristic Leaching Procedure (TCLP) limit for lead and require its disposal as a hazardous waste. In addition, chemical strippers by their nature do not remove rust or mill scale. Overall, the demonstration was successful in identifying and validating a relatively new and innovative chemical stripper for improved effectiveness, worker safety, and environmental compliance.

The demonstration addressed the end-user decision-making process by providing information on the performance of candidate environmentally acceptable (EA) chemical strippers. The specific issues addressed included the reduced toxicity, based on assessment of chemicals and Material Safety Data Sheets (MSDSs), and the efficacy of the stripper. These issues were resolved by this demonstration based on evaluation of certain factors that include the application time, "dwell" time required for the stripper to act on the surface being stripped of LBP, the tools needed for removal of the paint, and the method of waste removal and disposal. End-users were provided with recommendations for coatings with which to repaint the stripped steel surfaces.

2 Technology Description

Technology Development and Application

Surface preparation is a critical requirement for maintenance painting of existing structures, and it is normally necessary to remove all or a portion of the existing paint layers. Because a large proportion of existing painted structures at government and military facilities are coated with lead-containing paint, surface preparation presents an environmental and health risk. Lead is readily absorbed into the blood from inhalation and ingestion, and chronic or acute exposure to it can result in severe debilitation to the nervous, gastrointestinal, and renal system.

Abrasive blast cleaning, considered the most effective and productive method of surface preparation, also produces the greatest amount of dust and debris. Controlling these emissions requires costly containment and disposal procedures and verifications. Alternatives to abrasive blast cleaning include: hand and power tool cleaning, pressure washing, high-pressure water jetting, cleaning with detergents, emulsifiers, and steam and chemical stripping. Each of these methods has advantages and limitations regarding surface quality (i.e., cleanliness), production rate, cost per square foot, amount of dust and debris generated, and risk to worker safety and the environment. The project reported here evaluated several chemical stripping materials to determine their relative costs and merits.

Many chemical strippers contain solvents such as xylene, toluene, or methylene chloride as their active ingredients. These chemical strippers operate by breaking chemical bonds. They have good penetrating abilities and selectively debond the coating layers. However, they tend to be flammable and toxic. In addition, they are regulated for volatile organic compounds (VOCs) and have unpleasant odors. Protective measures are required for workers and others present in the areas where they are being used.

Methylene chloride is the most commonly used active ingredient in chemical strippers; however, it tends to be toxic to humans and environmentally hazardous. It is also a recognized carcinogen.

Caustic chemical strippers are based on alkaline compounds such as sodium, calcium, potassium, or magnesium hydroxide. These strippers operate by alkali-induced hydrolysis of ester groups, and are used for removal of epoxy esters, saturated polyesters, and multilayered alkyd systems, even up to thicknesses of 20 mils. The stripped surface must be neutralized after paint removal. Caustics can burn skin and eyes; therefore, gloves, eye protection, and protective clothing should be used.

Said to be environmentally acceptable, N-methylpyrrolidone (NMP)- and dibasic ester (DBE)-based chemical strippers are nontoxic, nonflammable, and biodegradable. These chemical strippers function by penetrating coating layers and diffusing to the coating-substrate interface. The strippers tend to work well when applied to polyurethane or epoxy-coated substrates. Unfortunately, however, they work very slowly on other coating systems, such as alkyds, and they are sensitive to low temperatures.

A relatively new type of EA chemical stripper is based on so-called selective adhesion release agent (SARA) technology, developed in the mid-nineties (O'Donoghue et al. 2000). SARA formulations are water-borne macro-emulsions consisting of a nonpolar blend of solvents emulsified into a polar phase, which is usually deionized water along with other polar molecules. Generally, these chemical strippers are based on alcohol hydroxycarbolic acid peroxide systems (i.e., mixtures of hydrogen peroxide and alcohol/ester mixed with a gel). The gel provides viscosity to hold the stripper in place, and the hydrogen peroxide and alcohol/ester are the active ingredients. These constituents are 100 percent biodegradable in water and soil and are therefore not harmful to humans or to the environment. Also, they are nonflammable and have very mild and pleasant odors. Usually no breathing protection, eye protection, or even gloves are required for working with these chemical strippers.

The mechanism by which these chemical strippers operate involves penetrating through the multiple layers of paint until the hydrogen peroxide dissociates from the emulsion. The hydrogen peroxide molecule itself then dissociates, and the gas pressure of the released oxygen causes compressive stresses in the coating, which subsequently causes the coating to swell and deform. The coating layers disbond from both one another and the substrate and break into small "islands" that are easily removed by scraping. Available literature indicated that these SARA chemical strippers can remove up to 15 mils of alkyd paint within a dwell time of 16 hours.

Process Description

The design of the technology demonstration was relatively simple but was somewhat labor intensive. It involved removal of LBP from a large exterior section of a steel door on a warehouse at Fort Campbell, KY. Other than placement of the ladder, no heavy lifting was involved. No special training was required for the operation of this technology, as the directions for application of the chemical strippers, and removal of the existing paint can be understood and performed well by the average person with some practice. Also, the personnel conducting the demonstration had some experience with removal of paint with similar chemical strippers. The chemical strippers were applied by gloved hand, paintbrush, or by airless sprayer, and after adequate dwell time for the strippers to work, the paint waste was removed and disposed of in a 55-gal drum designated for LBP waste. Mobilization involved transporting to and removing from the demonstration site the following: (1) chemical strippers, (2) ladder, (3) scrapers and other paint removal tools, (4) airless sprayer, (5) paint brushes, (6) Tooke gage and other measurement instruments and tools, (7) polyethylene sheeting to catch the paint waste, (8) 55-gal waste drum, (9) a surface-tolerant coating system for repainting the steel door, (10) rags, and other materials for clean-up. No respirator was required as these operations took place outdoors on the loading deck, and the chemical strippers demonstrated contained no VOCs. Personnel conducting this demonstration used gloves, protective clothing, and eye protection.

Previous Testing of the Technology

Previous testing of EA chemical strippers in the laboratory for nonsteel substrates is documented in a 1996 Construction Engineering Research Laboratory (CERL) report (Drozdz and Engelage). All testing was conducted on 13 cm by 13 cm areas of redwood substrates. Table 1 lists the six EA chemical strippers tested.

Table 1. Chemical strippers from 1996 CERL study.

Chemical Stripper	Manufacturer	Active Ingredients
1. Peel Away 6	Dumond Chemicals	dibasic ester (DBE) and N-methyl pyrrolidone (NMP)
2. Peel Away 7	Dumond Chemicals	DBE and NMP
3. ClearAll ES/1	SAC of America	NMP
4. Wipe Away Graffiti Remover	AGP Surface Control Systems, Inc.	NMP
5. EnviroStrip #4	ProSoCo, Inc.	an ester based solvent gel
6. Safest Stripper	3M	dimethyl adipate

(Source: Drozdz and Engelage 1996.)

The efficacy of the strippers was determined for removal of exterior oil-based paint and an exterior acrylic latex paint. In each case, three layers of paint were to be removed: primer, an intermediate coat, and a topcoat. The strippers were applied to thicknesses of 0.125-0.25 in. All strippers were evaluated on the basis of how much time was required for the stripper to work and the % area of paint removed. It was found that the "Wipe Away Graffiti Remover" had the fastest removal time, removing all three layers of oil-based paint in 1.5 hours, and all three layers of latex paint in 1 hour. The other products took about 4 to 6 hours to remove all layers of oil-based and latex-based paints. The "Safest Stripper" failed to remove either oil or latex in 24 hours.

Advantages and Limitations of the Technology

The removal of LBP from steel structures and buildings is accomplished through a variety of methods, two of the most prominent being chemical stripping and abrasive blasting. The waste that is generated from these operations is often hazardous due to the toxicity and leaching characteristics of lead. In addition, many chemical strippers also introduce toxic solvents into the waste stream, such as trichloroethylene, phenol, xylene, methylene chloride, and methyl ethyl ketone, which are considered hazardous wastes under the Resource Conservation and Recovery Act (RCRA).

The general advantages of using chemical strippers are as follow:

- They do not require large equipment (compressors, blast pot) or power sources
- They produce a greatly reduced quantity of waste
- They do not generate airborne dust, which could impact adjacent operations
- Reduced noise.

The anticipated advantages of the EA technology are the elimination of:

- caustic chemicals, volatile solvents, carcinogens, and toxic waste streams resulting from the use of those chemicals
- the necessity of containment for the LBP abatement process
- the necessity of the workers to wear respirators.

The general limitations of using chemical strippers are as follow:

- Reduced quality of surface for application of paint (does not remove rust, mill scale)
- They do not produce surface profile
- Reduced productivity compared to abrasive blast cleaning or water cleaning
- They do not remove all traces of paint from the surface

- Multi-step operation (application, removal, neutralization) with dwell time needed after application
- Application generates hazardous materials (toxic solvents, caustics) requiring special protection.

The limitations of the EA technology are:

- the sensitivity to ambient temperatures
- the lengthy dwell times required for the chemicals to act
- hazardous waste residue results from the removal of LBP, which must be disposed in accordance with Federal and state EPA requirements.

3 Demonstration Design

Performance Objectives

The performance objectives listed in Table 2 are discussed below.

Table 2. Performance objectives for demonstration of nontoxic chemical strippers.

Type of Performance Objective	Primary Performance Criteria	Expected Performance (Metric)	Actual Performance Objective Met?
Quantitative	1. Lead hazard removal	95% visible paint removed; paintable surface	Met (residue of lead paint remaining)
	2. Reduced emissions	< 30 micrograms/m^3 lead dust	Met (no visible emissions)
Qualitative	1. No HAPS	Verifiable	Met (from MSDS)
	2. Reduced worker protection equipment	Verifiable	Met (respirator not required)
	3. No methylene chloride	Verifiable	Met (from MSDS)

(Source: Stephenson 2002.)

Quantitative

The most successful chemical stripper, RemovAll 210, was able to remove six layers of alkyd paint in a single operation. The stripper was not able to remove all the existing paint in two applications, however, even from relatively flat easily accessible surfaces. Consequently, the objective of producing a surface with less than 1 mg/cm^2 of lead was not achieved. The method did not produce any visible emission of dust. Although personal air samples were not collected, it is highly likely that the level of lead dust was below 30 ug/m^3 (the action level) during the removal operation. Because the application was completed in less than 30 min, the Occupational Safety and Health Administration (OSHA)-mandated 8-hr, time-weighted average was almost certainly not exceeded.

Qualitative

From the MSDS and the manufacturer's literature, it was confirmed that the product contained no methylene chloride or other HAPs. Because of the absence of HAPs or other hazardous materials (e.g., caustic, acid), the only personal protective

equipment (PPE) required for the chemical stripper was eye protection (additional protection was required because of the presence of lead on the surface [e.g., latex or rubber gloves]). This requirement represents a reduction from the type of heavy rubber gloves and boots required for application of caustic chemicals, the half-face respirator required for methylene-chloride-based strippers, and the full air-supplied respirator, hood, and full-body protection required for abrasive blast cleaning.

Selection of Test Site/Facility

Description of Test Substrate

The test site was a steel door on Building 5207, a warehouse at Fort Campbell. The door has flat surfaces of at least 100 sq ft that have tested positive for LBP. Testing of this surface is expected to have a high degree of success due to its geometry and location. This area is adequate for mobilization and staging. See Figures A1 and A2 in Appendix A.

Fort Campbell Involvement

Fort Campbell Directorate of Public Works (DPW) staff has expressed interest in in-place management or removal of LBP from various steel structures. During Fiscal Year 2000-2001 (FY00-01), the old LBP on the deluge tank at Fort Campbell Army Airfield was overcoated with moisture-cure polyurethane coating test patches. In FY01, the performance of the test patches was evaluated before the entire tank surface was painted with the best-performing polyurethane coating as in-place management of the LBP.

Test Facility History/Characteristics

These doors have had LBP on them since World War II, and similar steel doors are on the hangar facilities. Fort Campbell has about 10 such hangars. The Army has a total of 40 million sq ft of steel structures. Among them are about 400 hangars with LBP; all possible candidates for this technology.

Selection of Chemical Stripper Candidates

Based on previous testing by CERL (Drozdz and Engelage 1996), strippers based on non-HAPs solvents was sought along with a control. For these criteria, Peelaway 7 (a non-HAPs solvent-based stripper) and Peelaway 1 (a caustic stripper) were

selected. In addition, it was decided to include chemical strippers based on the new SARA technology described in Chapter 2 (O'Donoghue et al. 2000). These chemical strippers are listed in Table 3.

Table 3. Chemical strippers used in this demonstration.

Chemical Stripper	Manufacturer	Active Ingredient	Environmentally Acceptable?
Peelaway 1 (Control)	Dumond Chemicals	Caustic; sodium hydroxide	No
Peelaway 7	Dumond Chemicals	DBE and NMP	Yes
RemovAll 210*	Napier Environmental Technologies	alcohol hydroxy carboxylic acid hydrogen peroxide - alcohol	Yes
RemovAll 510*	Napier Environmental Technologies	alcohol hydroxy carboxylic acid; hydrogen peroxide - alcohol	Yes

* RemovAll 210 and RemovAll 510 chemical strippers were based on the alcohol hydroxy carboxylic acid, hydrogen peroxide system. RemovAll 210 contains less than 0.5 percent hydrogen peroxide, while RemovAll 510 contains about 7 percent hydrogen peroxide. RemovAll 510 was formulated to act faster on thinner layers of paint, while RemovAll 210 was formulated for deeper penetration (per Napier Environmental Technologies).

Physical Set-up and Operation

Pre-Demonstration Analysis

Lead content of paint

Several weeks before the demonstration, a Fort Campbell representative removed a paint chip from the test door. The KTA laboratory (KTA-Tator, Inc., Pittsburgh, PA) analyzed the chip in accordance with Association of Analytical Communities (AOAC) Method 974.02 and determined the lead content as 11 percent lead by weight.

Paint thickness and number of layers

Areas from each of the door panels were selected for measuring film thickness and the number of existing paint layers. Table 4 summarizes the results of the measurements.

Paint adhesion

The tape adhesion of the paint to the steel door surface was measured in accordance with American Society for Testing and Materials (ASTM) D 3359 using method A (X-cut). Table 4 shows the results of these measurements. The adhesion was

extremely poor, indicating that the door was a potential candidate for repainting. Note: ASTM D 3359 rates adhesion on a scale of 0 to 5; 5 is the highest and 0 the lowest. See Figure A3.

Table 4. Number of layers, thickness, and adhesion of existing paint.

Door Panel	No. of Layers	Thickness (mils) ASTM D 1186	Tape Adhesion ASTM D 3359
1	6	15.1-20.3	0A/0B
2	6	16.5-18.2	0A/0B
3	6	14.6-18.3	0A/0B
4	6	14.1-16.1	0A/0B
5	6	~16*	0A/0B

*Measured with Tooke Gage (ASTM D 4138).

Description of Test Surface

The surface consisted of the exterior of a 12-ft wide by 10-ft tall roll-up door (No. 24) on the east side of Building 5207 at 8th Street and Desert Storm Avenue, Fort Campbell (Figure A1). The exterior of the door was made of thin-gage sheet metal and was constructed of recessed panels, rails, and stiles.

A single-hinged door, approximately 2-ft wide by 7-ft tall, was inset in the middle of the roll-up door. This door was also of a panel type design with two glass windows in the top half of the door. Two panels, approximately 4-ft wide by 3-ft tall, one above the other, were on either side of the hinged door. Six-inch-wide rails and stiles surrounded these panels.

Three panels along the top of the roll-up door were also associated with 6-in. wide rails and stiles. The two end panels were 4-ft wide by 2-ft tall. The middle panel was 2-ft wide by 2-ft tall.

For purposes of this demonstration, roll-up door panels were designated as follows:

1. Bottom 4 x 3 ft panel on the left side
2. Middle 4 x 3 ft panel on the left side
3. Middle 4 x 3 ft panel on the right side
4. Bottom 4 x 3 ft panel on the right side
5. Top 4 x 2 ft panel on the left side
6. Top 2 x 2 ft panel in the middle
7. Top 4 x 2 ft panel on the right side
8. Panel on the lower half on the hinged door.

Characterization of Existing Coating

The condition of the existing coating was assessed on 21 May 2002 before applying chemical strippers. The assessment consisted of visually observing, nondestructively measuring the total dry film thickness, determining coating adhesion, and destructively determining the number of coating layers and the thickness of each layer.

Visual observations

The coating was generally intact and providing corrosion protection with a few random spots approximately 1 to 2 in. in diameter where the coating had cracked and peeled from the surface, but a dark scale on the steel surface prevented corrosion. The color of the finish coat was dark brown, which was heavily chalked and contaminated with dust.

Coating layers and adhesion

The total coating thickness was measured with a Positector® 6000 magnetic dry film gage (DeFelsko, Ogdensburg, NY) in accordance with ASTM D 1186. The gage was calibrated using manufacturer-furnished calibration standards. The number and thickness of coating layers were determined using a Tooke gage in accordance with ASTM D 4138. Coating adhesion was determined using methods A and B of the tape adhesion test in ASTM D 3359.

Securing and Marking the Test Site

Polyethylene sheeting (6 mil) was taped onto the floor extending approximately 6 ft out from the door and 2 ft on either side. Red caution tape ("DANGER LEAD HAZARD") was placed around the perimeter of the test site, with warning signs on both sides of the door.

Application of the Four Stripper Candidates to Small Sections

Four different chemical strippers were applied to door panels on 21 May 2002 (Figures A4 through A9) as follows:

A representative of the stripper manufacturer (Napier Environmental Technologies, Inc.) applied RemovAll 210 to panel 4 (bottom right) by airless spray at 12:55 p.m. It took only a few minutes to spray the area. After allowing this first pass to set for 5 minutes, another pass of the stripper was sprayed on. Wet film thickness of the

stripper on the right half of this panel was estimated at 20-25 mils. Wet film thickness on the left half of this panel was estimated at 30-40 mils. Approximately one-half gallon of RemovAll 210 was applied to the 12-sq-ft panel. The manufacturer's recommended application rate is 40 to 90 sq ft per gallon.

During the application, several large sags occurred where the stripper slid cleanly off the surface. The Napier representative stated that the sags resulted from a slug of water in the spray line.

Lang Environmental & Engineering (an onsite Fort Campbell Lead Abatement contractor) applied Peelaway 1 to panel 1 (bottom left) by gloved hand at 1:00 p.m. The application appeared heavy but not uniform. Paper was pressed into the wet stripper to prevent evaporation of the chemicals. Approximately one-half gallon of material was applied to the 12-sq-ft panel. The application, including the paper, took about 5 minutes.

The stripper manufacturer (Napier) applied RemovAll 510 to panel 3 (middle right) by airless spray at 1:15 p.m. It took only a few minutes to spray the area. After allowing this first pass to set for 15 minutes, another pass of the stripper was sprayed on. Approximately one-half gallon of material was uniformly applied to the 12-sq-ft panel. The manufacturer's recommended application rate is 40 to 90 sq ft per gallon.

During the application, a large sag occurred where the stripper slid cleanly off of the surface. Napier stated that the sag resulted from a slug of water in the spray line.

A Lang Engineering representative applied Peelaway 7 to panel 2 (middle left) by gloved hand at 1:25 p.m. The application appeared heavy but not uniform. Paper was pressed into the wet stripper. Approximately one-half gallon of material was applied to the 12-sq-ft panel. The application, including the paper, took about 5 minutes. The manufacturer's recommended application rate is 40 sq ft per gallon.

Polyethylene sheeting was taped around the door to cover it and help retain the heat overnight.

Assessment of the Four Stripper Candidates to Small Sections

At 8:10 a.m. on 22 May 2002, removal of the chemical stripper and coating began (Figures A10 through A14) as follows:

Peelaway 1 (panel 1) – No coating came away with the paper. After scraping, the pale orange layer remained on approximately 33 percent of the surface, the light green layer remained on 33 percent of the surface, and the metal substrate was exposed at 33 percent of the surface. Scraping took 10 minutes. The surface temperature was 81 °F, as a result of the polyethylene sheeting around the door, which helped to retain the heat.

At 8:55 a.m., a second application of Peelaway 1 was applied, by gloved hand, to the left half of panel 1. At 12:45 p.m., this second application was scraped away and the coating removed down to the substrate. This result equaled the result obtained with RemovAll 210 on the left half (heavier application) of panel 4.

Peelaway 7 (panel 2) – The two top layers of coating (dark brown and tan) came away with the paper, exposing the pale orange layer. After scraping, the light green layer remained on approximately 33 percent of the surface, and the pale orange layer remained on 66 percent of the surface.

At 8:50 a.m., a second application of Peelaway 7 was applied, by gloved hand, to the right half of panel 2. At 12:45 p.m., this second application was scraped away. The coating was removed down to the light green layer.

RemovAll 510 (panel 3) – Prior to scraping, the dark brown layer was wrinkled, and some of the coating had fallen from the surface, so the pale orange layer was exposed on approximately 15 percent of the surface. Scraping removed the coating down to the orange layer.

RemovAll 210 (panel 4) – Prior to scraping, the coating was uniformly wrinkled. Scraping revealed the metal substrate on the left side of the panel where the stripper had been applied heaviest. Scraping removed coating down to the pale orange layer on the right side where the stripper had been more thinly applied.

Stripping of Paint From Entire Door

At 10:10 a.m. on 22 May 2002, RemovAll 210 (most successful chemical stripper) was sprayed over the entire door except for the portions of panels 1 and 2 where the Peelaway products were applied a second time. Application of a “mist coat” took 15

minutes. The mist coat was allowed to sit for 15 minutes, and then a full coat was applied. Application of the full coat took 15 minutes. Six gallons of material was used since it was available, but it was estimated that 4 to 5 gallons would have been enough.

A Lang Engineering representative began scraping the door at 7:15 a.m. on 23 May 2002 and had most of the paint removed by 8:30 a.m. Panel 1 was rinsed with a vinegar solution to neutralize the caustic chemical stripper, and the entire door was wiped down with water.

All coating was not removed. Visible residue of the gray and light green layers remained on much of the surface where scraping smeared the wet material rather than removing it. Paint also remained in crevices, corners, and around screwheads. The surface was stripped free of 95 percent of the paint; all remaining paint and rust were tightly bonded. This resulted in a paintable surface. Although there is no known industry consensus standard describing this condition, it is considered superior to or equal to the condition achieved using SSPC-SP 2 or SSPC-SP 3 for preparing previously painted surfaces. (Subsequent supplemental operations involving spot wire brushing or pressure washing may be used to provide a cleaner surface, if desired, prior to repainting.) Figures A15 through A17 show the results of this process.

Painting the Door

A Lang Engineering representative applied a coat of Sherwin Williams Kem Kromik alkyd universal primer by brush; the paint went on well (Figures A18 and A19). Fort Campbell expected the door to be coated brown to match the other doors. KTA tried to match the color of a paint chip from one of the doors and purchased a gallon of polyurethane modified alkyd at a Lowe's store. This polyurethane material was given to Lang Engineering, who completed the demonstration by brushing the brown finish coat over the gray-primed door the following day.

Sampling/Monitoring Procedures

The stripper application and paint removal and waste collection were monitored to determine the areas and rates and the quality of the surface produced. In addition, the operation was monitored for visible emissions, waste generation, and ambient environmental conditions.

Airborne Emissions

During the application of the strippers, there was no visible emission of dust. No strong fumes from solvents, acids, or alkalis were detected during application of the nontoxic chemical stripper. The caustic control (Peelaway 1) did produce caustic fumes.

Waste

The waste consisted of the chemical stripper residue, the old paint that had been removed, the polyethylene sheet and the water, rags, and paper towels used for removing the paint and stripper. For the full stripping of the door, the total waste generated was less than 55 gallons. The waste was assumed to be hazardous because of the high lead content of the paint. Accordingly, no sample was collected for testing of leachable lead. The facility's hazardous waste management collected the waste for ultimate disposal in a hazardous waste landfill.

Ambient Temperature and Humidity

Temperature and relative humidity can influence the reaction and dwell time of chemical strippers. These measurements were taken with a surface temperature thermometer and a sling psychrometer in accordance with ASTM E 337. Table 5 shows the ranges of these parameters for the 3 days of the stripper application and repainting. The surface temperature in all cases was at least 5 °F above the dew point, the conventional criterion for application of paint.

Table 5. Ambient conditions during demonstration.

Time Period	Surface Temperature (°F)	Air Temperature (°F)	Relative Humidity (%)	Dew point (°F)
Day 1 (5/21/02)	64-68	59-62	45-58	40-46
Day 2 (5/22/02)	61-73	52-67	37-57	29-44
Day 3 (5/23/02)	70-78	66-77	36-51	38-55

Analytical Procedures

ASTM D 1186, *Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base*.

ASTM D 3359, *Standard Test Method for Measuring Adhesion by Tape Method*.

ASTM D 4138, *Standard Test Methods for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means*.

ASTM E 337, *Standard Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)*.

AOAC Method 974.02, *Lead in Paint: Atomic Absorption Spectrophotometric Method*.

4 Performance Assessment

Performance Data

Tables 6 and 7 summarize the data and results described in Chapter 3 (p 18).

Table 6. Summary of chemical stripper applications.

Material	Area Prepared (sq ft)	Quantity of Material (gal)	Application Time (min)
RemovAll 210	12*	0.5	3-5
RemovAll 510	12	0.5	20-25**
Peelaway 1	12	0.5	~ 5***
Peelaway 1, 2nd application			~ 5***
Peelaway 7	12	0.5	~ 5***
Peelaway 7 2nd application	12		~ 5***
RemovAll 210	96	6	45

* Film was thicker on right side (30-40 mils) than on left side (20-25 mils).

** Includes 15-min interval after mist coat for full coat.

*** Includes application of paper backing.

Table 7. Summary of results of chemical stripping applications.

Material	Interval (hr)	Observations/Comments
RemovAll 210	20	All paint layers removed at heavy applications; 2 paint layers removed at light application
RemovAll 510	20	Two paint layers removed
Peelaway 1	19	1/3 surface removed to bare steel; 1/3 surface removed four paint layers; 1/3 surface removed two layers
Peelaway 1, 2nd application	4	All paint layers removed (to bare steel)
Peelaway 7	19	2/3 of surface – two layers removed; 1/3 of surface – four layers removed
Peelaway 7, 2nd application	4	four layers removed (second application only made to areas with two layers removed) (neutralized with vinegar)
RemovAll 210 (Remainder of Door)	21	~ 2-2.5 hr to scrape and wipe down, all paint layers removed on most of surface; in some areas one or two paint layers remained; paint remained in crevices, corners, and near screw heads

Performance Criteria and Assessment

Table 8 describes the primary and secondary performance criteria for the paint removal with the EA chemical stripper.

Table 8. Primary and secondary performance criteria.

Performance Criteria	Description	Primary or Secondary
Hazardous Contaminant	No hazardous air pollutants (HAPs) are to be produced by this procedure. No toxic substances or carcinogens will be used in this technology demonstration.	Primary
Process Waste	It is estimated that approximately 200 cu in. of leachable lead hazard waste will be produced and will be disposed of in a hazardous waste landfill.	Secondary
Factors Affecting Technology Performance	The reactivity of the chemical stripper will likely be affected by substrate temperature, dampness, and thickness of existing paint	Secondary
Reliability	Chemical stripping of LBP on steel substrates may be less reliable in damp or low temperature.	Primary
Ease of Use	It is anticipated that one painter can perform all operations for the chemical technology.* No specialized training will be required. Manufacturer's instructions for use of the chemical stripper will be followed. No OSHA health and safety training will be required. Guidelines in accordance with the MSDS will be followed. *For safety purposes, two workers should be present, since a scaffold is required for the case at hand.	Primary
Versatility	The technology can be used in numerous locations and may be applicable to wood or masonry.	Secondary
Maintenance	N/A	Primary
Scale-Up Constraints	Technology may not be practical for very large structures >1000 sq ft or structures of complex geometries.	Secondary

(Source: Stephenson 2000.)

Table 9 summarizes the results of how the RemovAll 210 chemical stripper performed against the performance criteria.

Table 9. Expected performance and performance confirmation methods.

Performance Criteria	Expected Performance (pre demo)	Performance Confirmation Method	Actual Performance (post demo)
PRIMARY CRITERIA (Performance Objectives) (Qualitative)			
Ease of Use	No operator training required	Experience from demonstration operations	A single operator applied and removed the chemical stripper. Little or no training was required.
Cost	< $4 /sq ft	Cost calculation	Cost for demonstration was about $9.00/sq ft; projected cost for 1,000-sq-ft project is $3.70/sq ft
Target Hazardous Contaminant - % reduction	- Reduce methylene chloride by 100% Regulator Standards No HAPS	MSDS EPA Standard Methods # and #	No methylene chloride or HAPs were used per MSDS
Process Waste - Generated	Reduce overall waste	Quantity of waste generated	55 gal of lead-contaminated waste produced (0.46 gal/sq ft); greater reductions are achievable
SECONDARY PERFORMANCE CRITERIA (Qualitative)			
Safety - Hazards - Protective clothing	Leachable lead-waste product *No respirators required*	TCLP Experience from demonstration operation	1. The process left residual lead paint assumed to exceed 1 mg/cm^2 of surface and 5 mg/L leachable 2. Minimal worker protection needed (eye protection, gloves)
Versatility other applications other locations	Yes (masonry, wood) Yes	Experience from demonstration operation	The technique is suitable for wood and masonry
Scale-Up Constraints - engineering	Other methods may be more practical for structures larger than 1,000 sq ft	Experience from demonstration operation	This technique is suitable for larger projects, but no significant reduction in unit cost is anticipated for scale-up beyond 1000 sq ft
Quality of Surface	How paintable is it	Degree of cleanliness	Under conditions of the demonstration, residues of lead paint remained; this may limit the type of coating for repaint and the lifetimes of repaint systems compared to other surface preparation methods

(Source: Stephenson 2002.)

Data Assessment

Effectiveness of Paint Removal

The existing coating consisted of six layers at 15 to 20 mils total. RemovAll 210 performed best and removed all six layers in one application when applied heavily and allowed to sit overnight. Peelaway 1 performed equally to RemovAll 210 but required a second application and a few additional hours of dwell time. One application of Peelaway 7 and RemovAll 510 removed only the top two layers after sitting overnight. Note that none of the strippers removed the old paint completely in two applications, even from relatively flat, easily accessible surfaces. Overall, the RemovAll 210 was judged to be the most effective material and was selected for the larger scale application.

Application

The RemovAll products could be readily applied by spray, which resulted in a heavier film build (required for most effective use) and higher application rate. The supplier recommended a mist coat followed by a full coat.

The Peelaway products were applied by gloved hand along with required paper backing to prevent evaporation of the chemicals in the stripper. For this demonstration, a second application was needed to give best results.

Personnel Training/Ease of Operation

Each of the products was relatively easy to apply. Although individuals with previous experience did the applications in this demonstration, a novice would likely become proficient in a relatively short time. No special equipment is required to apply the products.

Health and Safety

The RemovAll chemical strippers contained no HAPs or other ingredients requiring special health and safety precautions. The applicator should be provided with eye protection, gloves (e.g., latex or rubber), and waterproof footwear. Peelaway 7 contains the solvents NMP and DBA, both of which are not HAPs. The PPE is similar to that for RemovAll with the additional requirement that gloves and footwear should also be resistant to the solvents. A half-face respirator may also be required if the work is done in an area of limited ventilation. Peelaway 1 is a control containing caustics and would require additional safety precautions, including a half- or

full-face respirator and chemically resistant clothing and footwear. National Institute for Occupational Safety and Health (NIOSH) researchers reported that use of caustic chemical strippers generated air-borne lead dust levels of less than 5 micrograms per cubic meter, which is less than 10 percent of the Permissible Exposure Limit (PEL) (Mickelsen and Haag 1997). The operation also generated alkaline dust levels of less than or equal to 50 percent of the PEL. These data indicate that additional respiratory protection measures, beyond the half- or full-face respirator, are not required.

Environmental

All the chemical strippers result in great reduction in waste compared to abrasive blast cleaning or water jetting. The waste stream consists of the removed paint and surface debris, the chemical stripper material (less the volatiles), and water used for rinsing. If removing LBP, the waste will often be classified as hazardous because of its leaching potential. The dilution factor in the waste generation is relatively low. Accordingly, the planning of a chemical stripping project for LBP should anticipate handling and disposal in accordance with RCRA regulations.

Limitations

Chemical stripping does not remove existing rust and mill scale, nor does it produce a surface profile. The method does not remove all the existing paint, particularly in crevices and around connections where the penetration of the stripper is less likely. Chemical stripping normally requires a dwell time of several hours for the active ingredients to penetrate the paint layers, and react with and disbond the old paint.

Technology Comparison

As noted, chemical stripping is one of several alternatives for removing LBP from metallic and other structures. Table 10 compares chemical stripping with other methods based on selected criteria, on a scale of 1 to 5, with 5 being the best.

These data show that no single technique excels in each of the criteria. The method selected requires an analysis of the particular project, which would include consideration of the size, complexity of configuration, sensitivity to dust and debris, accessibility of equipment, severity of exposure environment, risk of early paint failure and lead contamination, and budget.

Table 10. Comparison of alternate methods for lead paint removal.[a]

Method	Equipment Costs[b]	Paint Removal[e]	Rust and Mill Scale Removal[e]	Production Rate (m^2/hr)	Level of Dust Generated	Quantity of Waste Generated
Chemical stripping	5	3-4	1	1-2	5	2-3
Abrasive blast cleaning	2	5	5	5	1	1
Vacuum blasting	1	5	5	2	4-5	4
Wet abrasive blast cleaning	2	5	5	3-4	4-5	1
Pressure washing[c]	3-5	2-3	1	5	4-5	4-5
High or ultra-high pressure waterjetting[d]	1-2	4	2	3-4	5	2-4
Hand and power tool cleaning	4-5	2	1-2	2	4	4
Power tool cleaning to bare metal	4	4-5	4-5	1-2	3	4
Power tool cleaning: vacuum recovery	3	2-4	2	2	4-5	4
Abrasive blasting with proprietary additive for lead stabilization[g]	2	5	5	4-5	1	1[f]
Thermal spray vitrification[g]	1	3-4	1	2	4-5	4
Laser paint removal	1	3-4	1	1	4-5	5
Urethane sponge cleaning	2-3	5	4-5	2-3	4	3-4
Sodium bicarbonate cleaning	2-3	2-3	1-2	2-3	4-5	2-4

[a] Information derived from (except for methods with footnote g): *Industrial Lead Paint Removal Handbook* (Trimber 1993). Rating scale of 1 to 5, with 5 being the best.

[b] Including containment costs and operator training.

[c] Pressures up to 5,000 psi.

[d] High pressure waterjetting: 10,000-30,000 psi, ultra-high pressure waterjetting: > 30,000 psi.

[e] These numbers are for flat surfaces; they will be reduced for nonuniform surfaces.

[f] Leachable level for lead in solid waste is usually less than 5 mg/L (nonhazardous).

[g] The ratings for these specific methods were developed based on general experience (they are not included in the reference given in footnote a).

Chemical stripping is favored under the following circumstances:

- Relatively small areas to be repainted (1,000 sq ft or less)
- Noncritical service environment (e.g., exterior of storage tank, steel doors)
- Limited budget for outside contractors
- Sensitive machinery or equipment nearby
- Limited availability of waste disposal facilities
- Steel structures where abrasive blasting or other LBP removal processes are impractical.

Thus, the advantages that the EA chemical strippers demonstrated is that they contain no toxic or carcinogenic chemicals harmful to humans or to the environment that can add to the waste stream; they are nonflammable; and the chemically stripped surface requires no neutralization prior to repainting. The EA chemical strippers also have no unpleasant odors and they require no gloves or breathing protection to use them. Workers must bear in mind, however, that lead hazards are still present in the LBP being removed, and they must take proper precautions. Gloves and protective clothing are suggested. The waste will contain lead and must be disposed of as a lead hazard in accordance with local, state, and Federal regulations.

Because the EA chemical stripper leaves a residue and does not remove mill scale or rust or create a surface profile, the replacement paint should be a surface-tolerant coating that has good wetting, penetrating, and film building capabilities.

5 Cost Performance Assessment

A cost analysis was completed for the chemical stripper demonstration project at Fort Campbell. This analysis includes the following information:

- A summary of the fieldwork and all costs associated with the project.
- An evaluation of the total cost associated with the actual work.
- A breakdown of the costs associated with individual tasks of the project. This includes a further breakdown into individual items (labor, materials, equipment, mobilization, staging, and waste disposal).
- Analysis using the Environmental Cost Analysis Methodology.
- A comparison of the costs of the chemical stripper demonstration project with other coating removal methods.
- Comments on the project related to this cost analysis.

Cost Reporting: Summary of Field Demonstration

The demonstration project involved the application of four chemical strippers to various sections of an overhead garage door. Approximately 100 sq ft of surface area was cleaned with the strippers. Additionally, the cleaned sections of the door were then repainted. The painting work is not part of this analysis.

Several factors affect the cost calculations. These factors make a true cost analysis difficult, but for comparative purposes, the calculations appear accurate. These factors include:

- Lack of complete removal of all existing coatings
- Labor provided by vendors
- Relatively small surface area prepared
- Use of subcontract labor
- Down time.

Evaluation of Total Cost for the Removal

This estimate was based upon the actual field time to perform the stripping of the full door (approximately 100 sq ft). An allowance was included for mobilization and de-mobilization, as these items were not specifically monitored. Also, an allowance

was included for some equipment items that would normally be incidental or included with a "small tool" allowance.

Labor

A one-person crew was used with an estimated wage rate of $30 per hour. This rate includes overhead and profit. Note: This was the rate charged by the onsite contractor.

The chemical stripping of the 100 sq ft area was performed over a 2-day period. An 8-hour day was used for the estimation.

Based upon this: (2 days x 8 hr/day) x $30 per hour = $480

Materials

- Approximately 4 gal of RemovAll 210 were estimated to be needed at a cost of $42/gal = $168

- Additional material costs were incurred for the polyethylene sheeting, signs, tape, wipes, and PPE (gloves, eye shield). This cost is estimated at $90.

Total Material Cost = $258

Equipment and Miscellaneous Cost

Allowance = $200 (brushes, maintenance of application equipment)

Waste Disposal

The waste was contained in one 55-gal barrel, with an estimated disposal cost of $400. As shown in Table 11, the overall cost incurred for the chemical stripping of the 100-sq-ft section of door was $1,338. The estimated unit cost is $13.38/sq ft.

Table 11. Actual cost for removing 100 sq ft of door surface.

Cost Item	Cost ($)
Labor	480
Materials	258
Equipment and Miscellaneous	200
Waste Disposal	400
Total	1,338

Projected Costs Based on Estimated Labor and Material Costs

This evaluation was made to further analyze the costs of actually performing the removal work based upon the effort required to strip approximately 100 sq ft. The project was divided into several stages including mobilization/set-up, initial stripper application, scraping and rinsing, and clean-up/demobilization. Table 12 shows the estimated time to perform each of these tasks.

Table 12. Labor required for individual chemical stripping tasks.

Work Item	Labor (hr)
Mobilization/Set-up	2.0
Initial Stripper Application (including mist coat)	1.0
Scraping and Rinsing	2.5
Clean-up/Demobilization	2.0
Total	7.5

The unit labor cost is computed as follows:

(7.5 hr x $30.00/hr) ÷ 100 sq ft = $2.25 sq ft

The estimate is 4 gal of material for 100 sq ft. For equipment and other materials, the estimate is $200 for 100 sq ft. For waste disposal, it is estimated that approximately 80 percent of the waste volume in the 55-gal drum was from the full door application; the overall cost for disposing of the waste was (0.80 x $400) or $320.

The best estimate for the unit cost for chemical stripping of the 100 sq ft section is $9.13, as shown in Table 13.

Table 13. Estimated unit cost for paint removal from 100-sq-ft door surface.

Cost Item	Cost/Sq Ft	Comment
Labor	$2.25	7.5 hr at $30/hr
Materials	$1.68	4 gal at $42/gal
Equipment and Other Materials	$2.00	Rental of spray equipment, ground cover, tape, signs, water
Waste Disposal	$3.20	80% of $400 cost for 55-gal barrel
Total	$9.13	

Environmental Cost Analysis Methodology

Estimated operational costs are provided in Table 14 based on using the chemical stripper from Napier (RemovAll 210) to remove LBP from 1,000 sq ft of flat steel surface. For comparison, Table 15 shows an analysis for thermal spray vitrification.

Table 14. Estimated costs by category for LBP removal from 1,000-sq-ft steel structures with chemical strippers.

Direct Environmental Activity Process Costs				Indirect Environmental Activity Costs		Other Costs	
Start-Up		Operation & Maintenance					
Activity	***$***	***Activity***	***$***	***Activity***	***$***	***Activity***	***$***
Equipment Purchase		Labor to Operate Process	960	Compliance Audits		Overhead Assoc. with Process	
Equipment Design		Labor to Manage Hazardous Waste		Document Maintenance		Productivity/ Cycle Time	
Mobilization*	180	Utilities		Envr. Mgmt. Plan Development & Maintenance		Worker Injury Claims & Health Costs	
Site Preparation	60	Mgmt./ Treatment of By-products		Reporting Requirements		Demobilization	60
Permitting		Hazardous Waste Disposal Fees	800	Laboratory Test/Analyze Waste Streams	60	Profit (10%)	335
Installation		Raw Materials		Medical Exams (including loss of productive labor)			
Training of Operators		Process Chemicals, Nutrients		Waste Transportation (on and off-site)	80		
Waste Containers	30	Consumables and Supplies	1125	OSHA/EHS** Training			
		Equipment Maintenance		Worker Protection			
		Training of Operators					
Category Total	270		2885		140		395
Total							3690
Cost/sq ft							$3.69

* Summarizes the costs associated with setting up the technology including, but not limited to, planning, contracting, mobilization of personnel, and transportation.

** Environmental, health, and safety.

An explanation of the estimates is as follows:

1. Labor cost $30/hr (this is the rate charged by Lang Engineering)

- Mobilization: 2 laborers x 3 hr x $30/hr = $180
- Demobilization: 2 laborers x 1 hr x $30/hr = $60
- Site preparation: 2 laborers x 1 hr x $30/hr = $60
- Operation: 2 laborers x 16 hr x $30/hr = $960

2. Material cost:

- $42/gal: information from manufacturer
- 40 sq ft/gal: practical estimate (manufacturer recommends 30 mils for thick films and estimates coverage at 40-90 sq ft/gal)
- $42/gal x 1,000 sq ft/40 sq ft per gal = $1,050
- $75 for polyethylene ground cover, signs, tape, pails, brushes, gloves
- Total material cost: $1,125

3. Disposal cost: estimate 2 barrels at $400 each

4. Laboratory testing:

- Presence of lead: $30/test x 2 tests = $60
- Leachable lead test: not required, as waste is assumed to be hazardous.

5. Labor production rate: The Painting and Decorating Contractors of America (PDCA) prepare labor productivity charts for estimating purposes (PDCA 1998). There are a variety of chemical stripper categories with an average production rate of 50 sq ft/person-hour. This rate is production time only. Considering the effort required for protecting, scraping, clean up, etc., a one-person crew could expect approximately 250 sq ft of production per day. This rate is supported by data from the NIOSH study of caustic stripping on a bridge (Michelsen and Haag 1997). The crew chemically stripped 6,000 sq ft with 1,917 labor hours. This is equivalent to 250 sq ft per 8-hr day or 1,000 sq ft in 32 hours.

Table 15. Demonstrated costs by category for LBP removal via thermal spray vitrification.

Direct Environmental Activity Process Costs				Indirect Environmental Activity Costs		Other Costs	
Start-Up		**Operation & Maintenance**					
Activity	***$***	***Activity***	***$***	***Activity***	***$***	***Activity***	***$***
Equipment Purchase		Labor to Operate Equipment	801-1143	Compliance Audits		Overhead Assoc. with Process	
Equipment Design		Labor to Manage Hazardous Waste		Document Maintenance		Productivity/Cycl e Time	
Mobilization*	368	Utilities		Envr. Mgmt. Plan Development and Maint.		Worker Injury Claims & Health Costs	
Site Preparation		Mgmt./Treatment of By-products		Reporting Requirements		Demobilization	368
Permitting		Hazardous Waste Disposal Fees	200	Test/Analyze Waste Streams		Profit (10%)	319-384
Installation		Raw Materials	800	Medical Exams (including loss of productive labor)			
Training of Operators		Process Chemicals, Nutrients		Waste Transportation (on and off-site)	125		
Equipment Depreciation	10	Consumables and Supplies	175	OSHA/EHS Training			
Materials for Containment of Glass	100	Equipment Maintenance		Worker Protection	250		
		Training of Operators					
Category Total	478		1,976 - 2,318		375		687 - 722
Total							3,516-3,893
Cost/per sq ft							3.52-3.89

(Source: Weber et al. 1999.)

Comparison to Costs of Other Removal Methods

It is difficult to directly compare the costs of other removal methods. The main obstacle is that each project location varies a great deal and access, staging, and local environmental factors have a great impact on the total costs. Other subjective items (such as geographic location, labor markets, etc.) also influence costs.

Published Costs for Other Removal Methods

For further comparison, the costs for several alternative LBP removal processes are presented in Tables 16 and 17. Table 16 presents data from a CERL project on thermal spray vitrification.

Table 16. Costs for alternative LBP removal processes.

Technology	Cost Range ($/Sq Ft)	Average ($/Sq Ft)
Thermal Spray Vitrification	3.50-9.50	5.00
Abrasive Blasting	5.00-18.00	8.00
Wet Abrasive Blasting	5.00-20.00	12.00
Vacuum Blasting	4.00-20.00	10.00
Water Blasting	4.00-20.00	13.00
Water Blasting with Abrasive Injection	4.00-19.00	9.00
Power Tool Cleaning to Bare Metal	5.00-15.00	7.00

(Source: Weber et al. 1999.)

A second cost comparison is derived from a fairly comprehensive series of costs that are from an assessment prepared for the New York City Department of Transportation (NYC DOT) (Final Environmental Impact Statement [FEIS] 1998).

The costs represent labor, materials, and equipment for the surface preparation only. Associated costs of necessary containment (in the case of chemical stripping, these costs are minimal) are also included. Other items such as engineering, scaffolding, and worker protection are also not included.

Table 17. Cost comparison with various removal methods.

Removal Method	Estimated Cost ($/Sq Ft)	Estimate Range (+/- 30%)
Dry Abrasive Blasting	$5.50	$3.85 to $7.15
Dry Abrasive Blasting (w/stabilizers)	$6.50	$4.55 to $8.45
Hydroblasting (e.g., waterjetting)	$5.10	$3.60 to $6.60
Power Tool Cleaning (vacuum shrouded)	$1.75	$1.25 to $2.30
Chemical Strippers (from NYC study)	$7.10	$5.00 to $9.25
Vitrification	$5.00	$3.50 to $6.50
Laser Blasting		No Information Available

(Source: FEIS 1998.)

Comparing the chemical stripping costs in this study to those reported above indicates that the cost estimates provided in Tables 14 and 15 are within the range of the numbers derived in the NYC DOT study.

Comparing Costs of Alternate Chemical Strippers

In this study, the nontoxic chemical stripper (SARA-based RemovAll 210) gave slightly better overall cleaning than the other types of chemical strippers evaluated (non-HAPS solvent-based Peelaway 7 and caustic-based Peelaway 1). As none of these methods was optimized, however, it is assumed that, for cost comparison, they all provide approximately similar cleaning rates. The only differences expected are in the cost of materials, the extent of worker protection, and the environmental disposal costs. These items are compared in Table 18.

Table 18. Comparative costs of various chemical strippers.

Stripper Type	Material Cost* ($/Sq Ft)	Worker Protection Cost	Waste Disposal Cost
Adhesion Release Agent-Based (RemovAll 210)	$42/gal 40 sq ft/gal $1.05/sq ft	Lowest (gloves and eye protection)	Lowest: lead paint waste likely hazardous; unused stripper nonhazardous
Non-HAPs Solvent-Based (Peelaway 7)	$42/gal 40 sq ft/gal $1.05/sq ft	Moderate (half-face respirator)	Lead paint waste likely hazardous; unused stripper nonhazardous
Caustic-Based (Peelaway 1)	$17/gal 20 sq ft/gal $0.85/sq ft	Highest (full-face respirator, possibly ventilation)	Lead-paint waste likely hazardous, but may be stabilized by lime; Unused stripper is hazardous waste

* Data from manufacturers.

The caustic-based stripper has the lowest material cost, with the other two strippers costing the same. However, the nontoxic SARA stripper provides other benefits (e.g., to nearby trades, in shipping and handling, and reduced risk of releases into the environment). The overall cost will depend on the specific project.

6 Implementation Issues

Cost Observations

The key cost factors are the material, labor, and disposal costs. The waste from the chemical stripper will likely require disposal as a hazardous waste. Because most of the stripper material is volatilized or consumed, however, the total waste consists primarily of the paint and surface debris residue and any rags or ground covering that may have become contaminated. With careful housekeeping, the total waste can be kept to a minimum.

The reductions in unit cost for surface areas greater than the 500 – 1,000-sq-ft range are expected to be minimal. The method is simple and does not lend itself to large-scale equipment or automation. Another factor limiting production is the need to wait several hours for the chemical stripper to react with the paint, particularly for thicker coating films.

Performance Observations

The chemical stripper could not render the surface essentially lead-free in the two applications used in the demonstration. Residual paint remained in crevices and around connections. As a result, unless the applicator is extremely fastidious in applying the chemical stripper, the technique may not eliminate the lead hazard (based on the 1-mg/cm^2 criterion). The residual paint could affect the performance of subsequently applied coatings. The stripped surface met the requirements of SSPC-SP2 to SSPC-SP3 for repainting.

A proper coating system was chosen for repainting. Coatings requiring a bare steel substrate (e.g., some epoxies and zinc-rich coatings) could not be used as overcoats. In addition, the chemical stripper does not remove rust or mill scale and does not produce a surface profile. Selection of overcoats is limited to surface-tolerant coatings (i.e., those with good wetting, penetrating, and film build capabilities.)

The EA chemical stripper eliminated the use of methylene chloride or other HAPs and of caustic chemicals. Also because the stripper is water-borne, there is essen-

tially no odor or emission of any volatile organic solvents. This feature reduces the extent of PPE required for the applicator, as well as the hazards of shipping and storing the material, and in disposing of unused material.

Scale-Up

As noted, the scale up from a 100-sq-ft project to one of approximately 1,000 sq ft is expected to present little operational or technical challenge. On the other hand, it seems unlikely that any significant reductions in unit cost or increases in production would result from further scale-up.

Other Significant Observations

Chemical stripping is an easy technique to use in the field, requiring little or no training. When the method is used to remove lead paint, the worker must be aware of the presence of lead, although relatively easily implemented protective measures (gloves, protective suits and footwear, and eye and face protection) are available. The release agent technology used in RemovAll 210 is relatively new. Additional products are being developed that may improve the efficacy or reduce the cost of this technology. Presently there are two known commercial sources of this product, which is available nationally. There are several variations of the release agent technology; different products are recommended for different substrates, thicknesses, and conditions. In the initial stages of implementation, it is prudent to follow the manufacturer's recommendations. At a later stage, additional evaluations are encouraged along with support of industry consensus standards on the new technology.

The ambient conditions during the demonstration were favorable for application and removal. The performance of these materials in hot, cold, or very humid conditions still needs to be evaluated. The manufacturer recommends an application temperature of 65 to 95 °F (20 to 32 °C), and states that the paint will generally take between 1 and 6 hours to work, depending on the number of layers of paint; however, best results are obtained when the stripper is allowed to remain on the paint for 24 hours. It is also suggested that the temperature of the surface be kept between 70 to 90 °F (21 to 33 °C) using a thick polyethylene sheet taped around the work area, but not touching the coating and applied stripper, so that heat is held in, as was the case in this demonstration.

The demonstration evaluated the EA chemical stripper on one type of coating, alkyd, under one set of conditions. The selection of an alkyd is appropriate as it is the most widely used generic type of LBP on existing structures. Additional evaluations are recommended on alkyds of different chemical composition, thickness, and condition, as well as other generic types of paint to determine the full potential and utility of this type of chemical stripper.

Lessons Learned

- Napier Environmental Technologies RemovAll 210 (also marketed commercially as ICI DeVoe Hydrostrip 502) was the best performing EA chemical stripper, as it removed all six layers (14-16 mils) within a dwell time of 21 hours except for a thin residue a few microns thick, and it performed slightly better than the caustic chemical stripper (control). The application time of this chemical stripper was 45 minutes.
- The RemovAll 210 must be applied at thicknesses of 1.5 times the thickness of the coating that is to be removed.
- It is also suggested that the temperature of the surface be kept between 70 and 90 °F (21 and 33°C) using a thick polyethylene sheet taped around the work area, but not touching the coating and applied stripper, so that heat is held in, as was the case in this demonstration.
- Because of variations in paint type, age, thickness, and substrate, small patch tests are recommended.
- Spray application is preferred as it allows one to achieve greater film thicknesses needed for multi-layer coatings. In some cases, a mist coat is advisable before applying the full coat.
- Because the stripper removes only paint and not rust or mill scale, surfaces with extensive rusting are not good candidates for this technology.
- Dumond Chemical Peelaway 1 (which is a caustic stripper) removed all paint (six layers, 14 to 16 mils) to bare steel in a 23-hr dwell time.
- Napier Environmental Technologies RemovAll 510 removed two layers (5-6 mils) in a 20-hr dwell time.
- The results appear to indicate that the hydrogen peroxide in the RemovAll 510 dissociated before it penetrated all the way down through the six layers.
- Dumond Chemical PeelAway 7 removed up to four layers (10 mils) in a 21-hr dwell time.
- No chemical stripper completely removed all paint. Although there is no known industry consensus standard describing this condition, it is considered superior to or equal to the condition achieved using SSPC-SP 2 or SSPC-SP 3. A surface-tolerant coating (with good wetting, penetrating, and film build-

ing capabilities) should be used for repainting. Alternatively, wire brushing or pressure washing may be used to provide a cleaner surface before repainting.

End-User Issues

The end users should consult CERL representatives before using this technology. A competent manufacturer's representative may not be available locally to advise and assist with the application. Also end users may wish to stock this material for use in small areas by agency personnel. It is important, however, to be aware of the chemical stripper's shelf life as some of the active ingredients may decompose after 6 months or so. (Napier Environmental Technologies has stated that the RemovAll 210 EA stripper has a 2-yr shelf life.) At present, there is no generic description of these materials, so depots and other facilities will need to specify the products by name. Note that specific products are recommended for specific substrates and conditions.

Approach to Regulatory Compliance and Acceptance

The chemical stripper materials themselves are nontoxic and nonpolluting. The main concern is that they leave residual lead paint on the surface. Future activities disturbing those surfaces would require consideration of a potential lead exposure risk. A second concern is the fact that the waste materials from removing lead paint are hazardous based on the TCLP. At some future date, the manufacturers may elect to include an additive that would render the waste nonhazardous.

References

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ASTM E 337, *Standard Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)*.

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Points of Contact

Name	Organization	Phone/Fax/E-mail	Role in Project
Dr. Ashok Kumar	ERDC-CERL P. O. Box 9005 Champaign, IL 61826-9005	Tel: 217-373-7235 Fax: 217-373-7222 E-mail: a-kumar@cecer.army.mil	Principal Investigator
Dr. L.D. Stephenson	ERDC-CERL P. O. Box 9005 Champaign, IL 61826-9005	Tel: 217-373-6758 Fax: 217-373-7222 E-mail: l-stephenson@cecer.army.mil	Asst. Investigator /Contract Monitor
Dr. Bernard Appleman	KTA-Tator, Inc 115 Technology Dr. Pittsburgh, PA 15275	Phone: (412) 788-1300, x306 Fax: 412-788-1306 E-mail: bappleman@kta.com	Principal Contractor
Patrick Nau	KTA-Tator, Inc 694 E. New Circle Road, Suite #4 Lexington, KY 40505	Phone: 859-252-1454 Fax: 859-252-1889 E-mail: pnau@kta.com	Contractor Field Manager
Karen Kopp	AFZB-PW-M-U Bldg. 868 Fort Campbell, KY 42223-5130	Phone: 270-798-5082 Fax: 270-798-6075 E-mail: koppk@campbell.army.mil	Fort Campbell PWBC Utilities Br. Chief
Jerry Knickerbocker	AFZB-PW-E-C 865 13th St Fort Campbell, KY 42223-5130	Phone: 270-798-9597 Fax: 270-956-2484 E-mail: knickerboj@campbell.army.mil	Fort Campbell TSCA* Manager
Jeremy Rains	AFZB-PW-E-C 865 13th St Fort Campbell, KY 42223-5130	Phone: 270-956-2484 Fax: E-mail: rainsj@cempbell.army.mil	Fort Campbell TSCA Program
Billy Holland	Lang Environmental & Engineering 9029 3rd St Fort Campbell, KY 42223	Phone: 931-431-4771 888-340-7664-pager E-mail: BillyH@lang-eng.com	Contractor to assist w/demo
Bill Baggett	Environmental Div Fort Campbell, KY	Phone: 270-798-9786 E-mail: baggettb@ campbell.army.mil	Waste removal
David Hunter	Napier Environmental Technologies, Inc.	Phone: 404-943-1796 678-575-4423 cell E-mail: davidh@napiere.com	Rep. for chemical stripper mfr

* Toxic Substances Control Act.

Appendix A: Photographic Record of Technology Demonstration

Figure A1. Original condition of the door showing the brown finish coat.

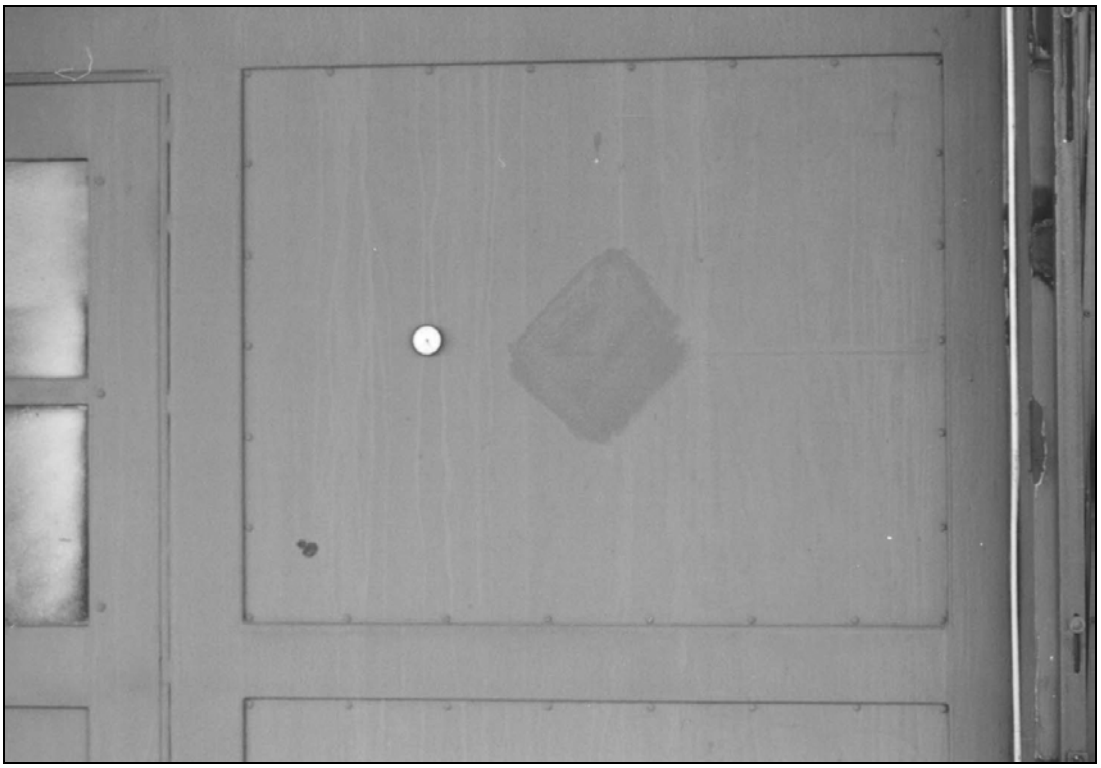


Figure A2. The darker square area had been wiped off.

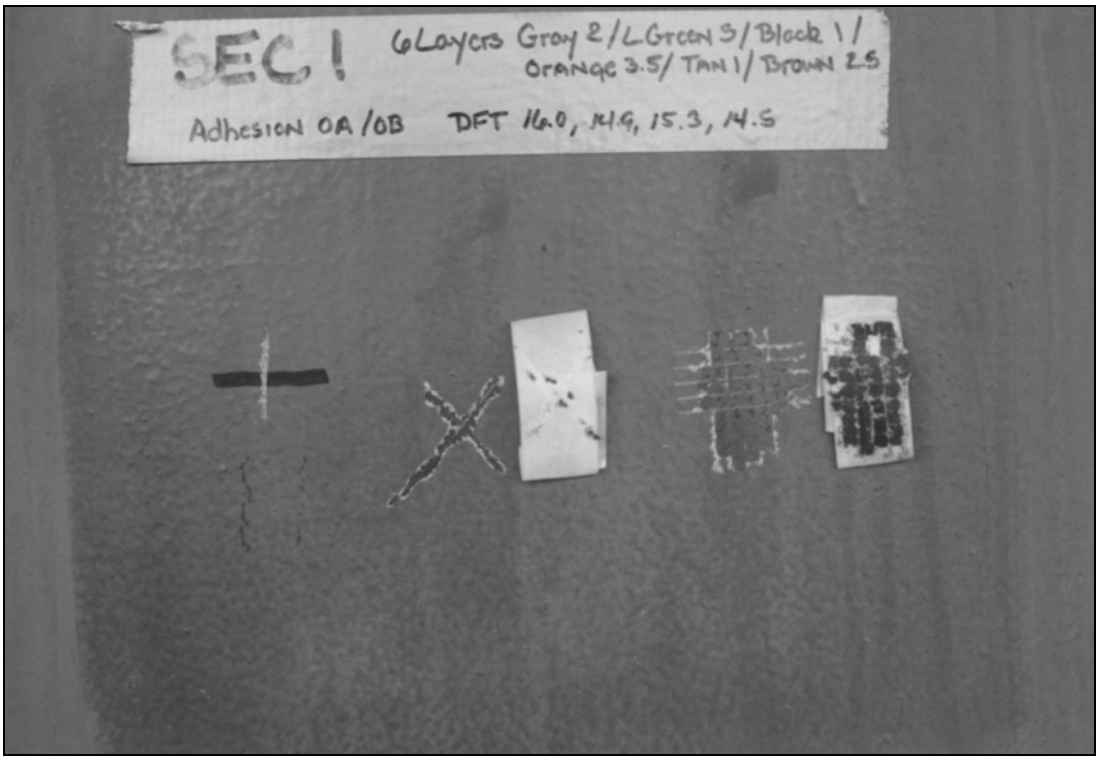


Figure A3. Test patch on door section 1 (bottom left panel used for Peelaway 1).

Figure A4. Hand application of Peelaway 7 to section 2 (middle left panel).

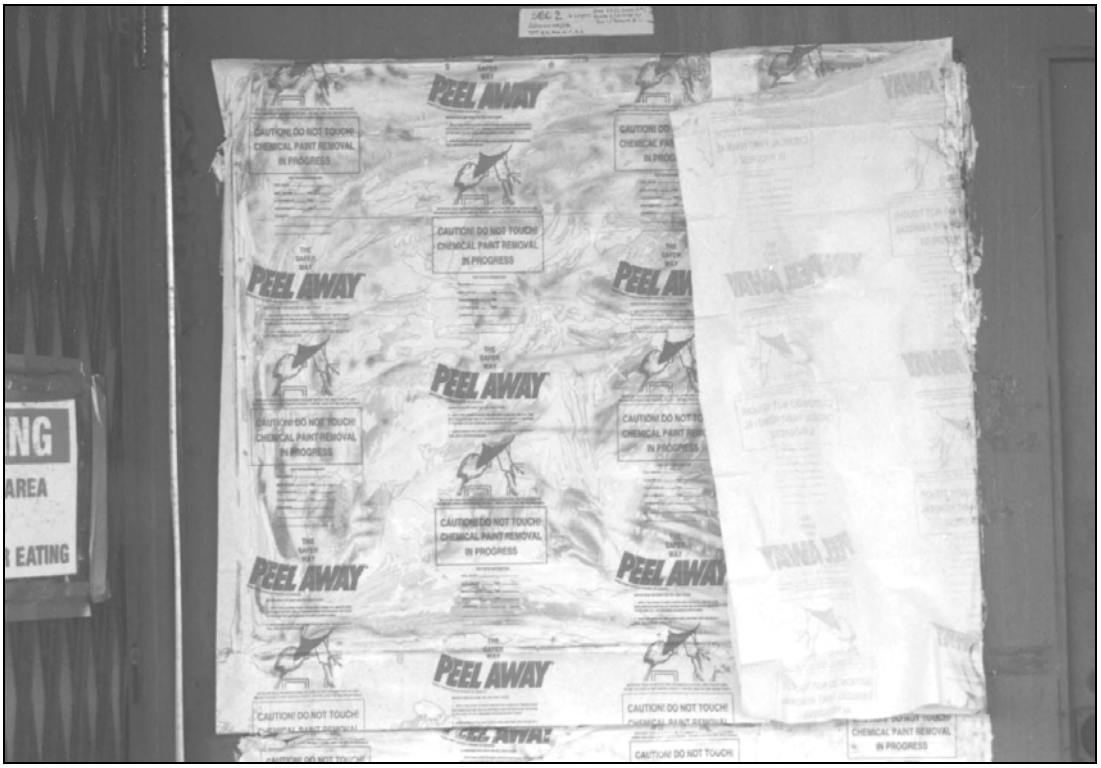


Figure A5. Section 2 (middle left panel) with completed Peelaway 7 application.

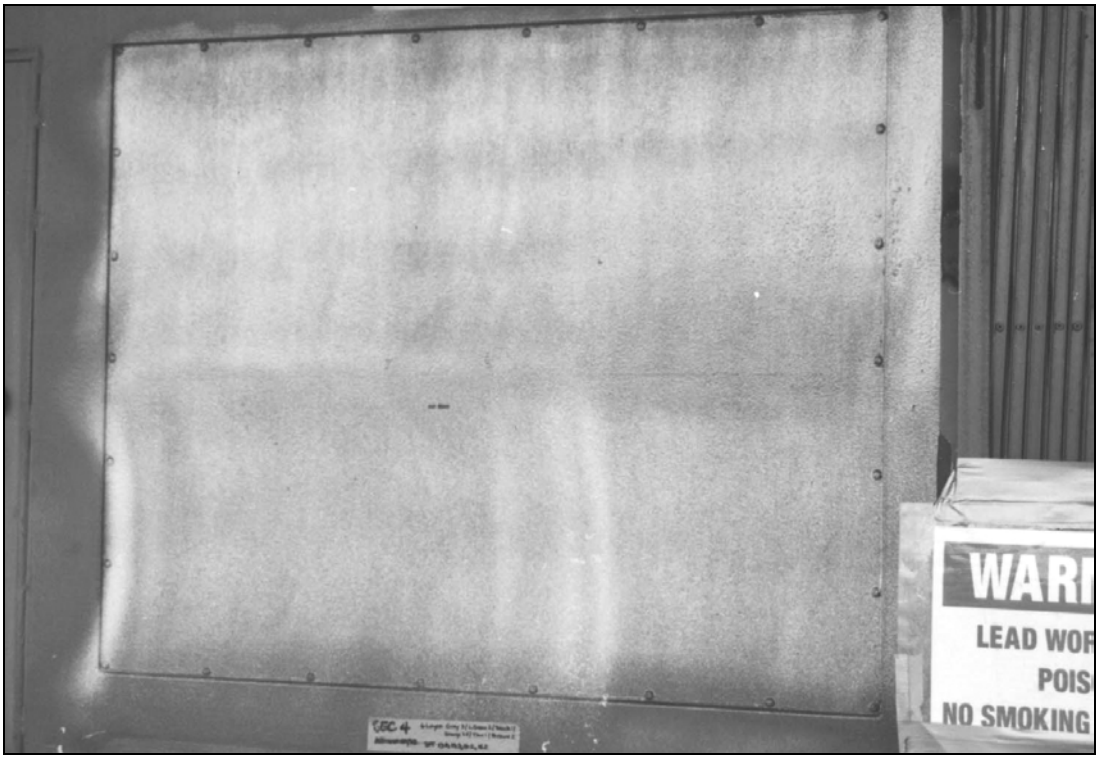


Figure A6. Section 3 (middle right panel) with a "mist" coat of RemovAll 510.

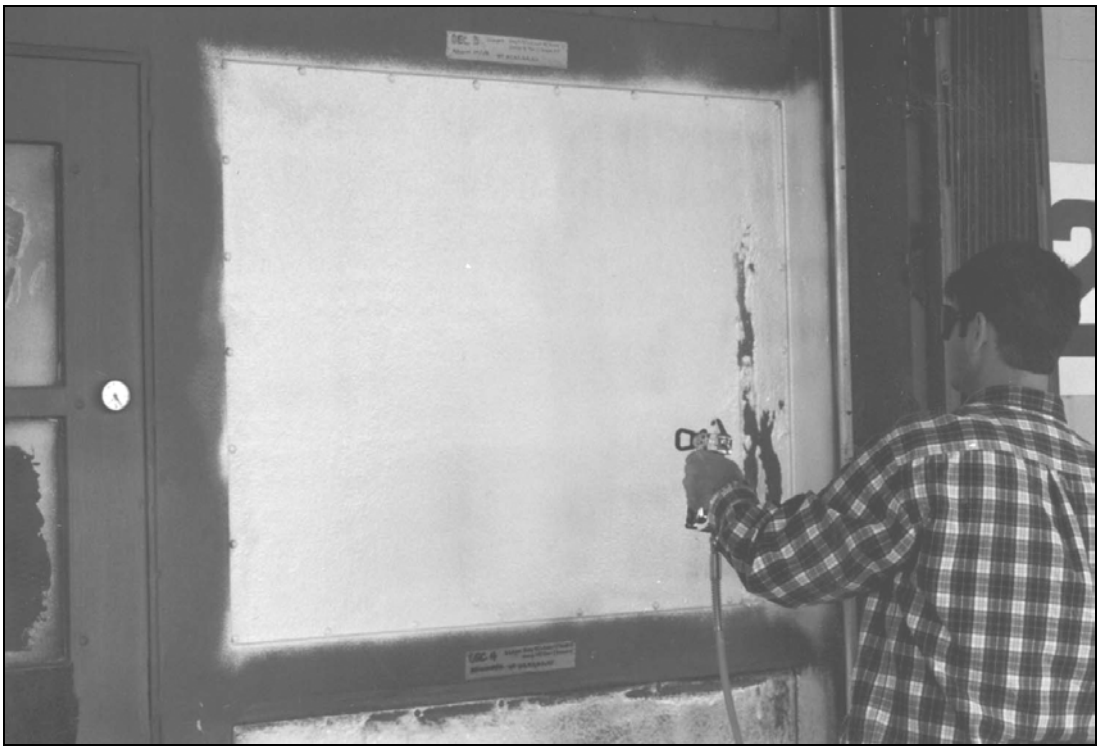


Figure A7. Complete spray application of Removall 510 to section 3 (middle right panel) showing a large sag.

Figure A8. Brush application of RemovAll 510.

Figure A9. Completed application of chemical strippers to the door panels showing the plastic cover applied to keep the door warm overnight.

Figure A10. Removal of the chemical strippers.

Figure A11. Section 1 (bottom left panel) after the second application of Peelaway 1 had been scraped off the left side of the panel.

Figure A12. Section 2 (middle left panel) after the first application of Peelaway 7 had been scraped off.

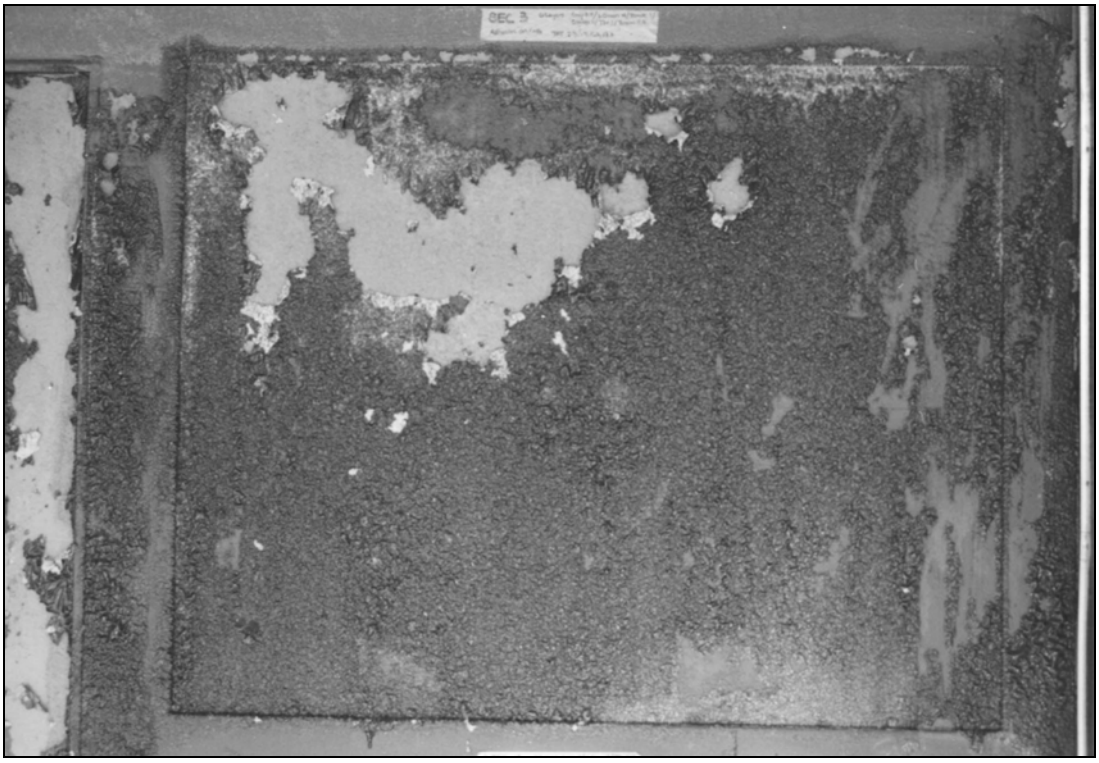


Figure A13. RemovAll 510 on section 3 (middle right panel) after setting overnight.

Figure A14. Section 4 (bottom right panel) after the RemovAll 210 had been scraped off.

Figure A15. Door after coating removal was completed.

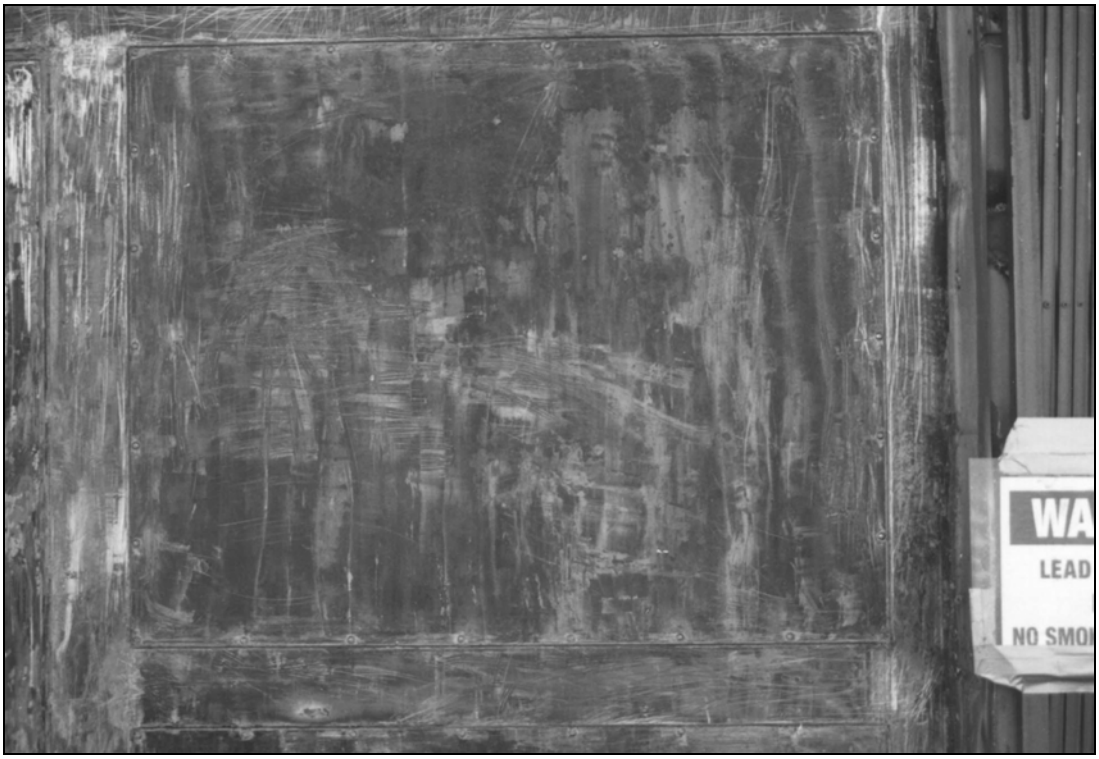


Figure A16. Section 3 (middle right panel) after coating removal was completed.

Figure A17. Coating that remained in crevices, corners and around screwheads.

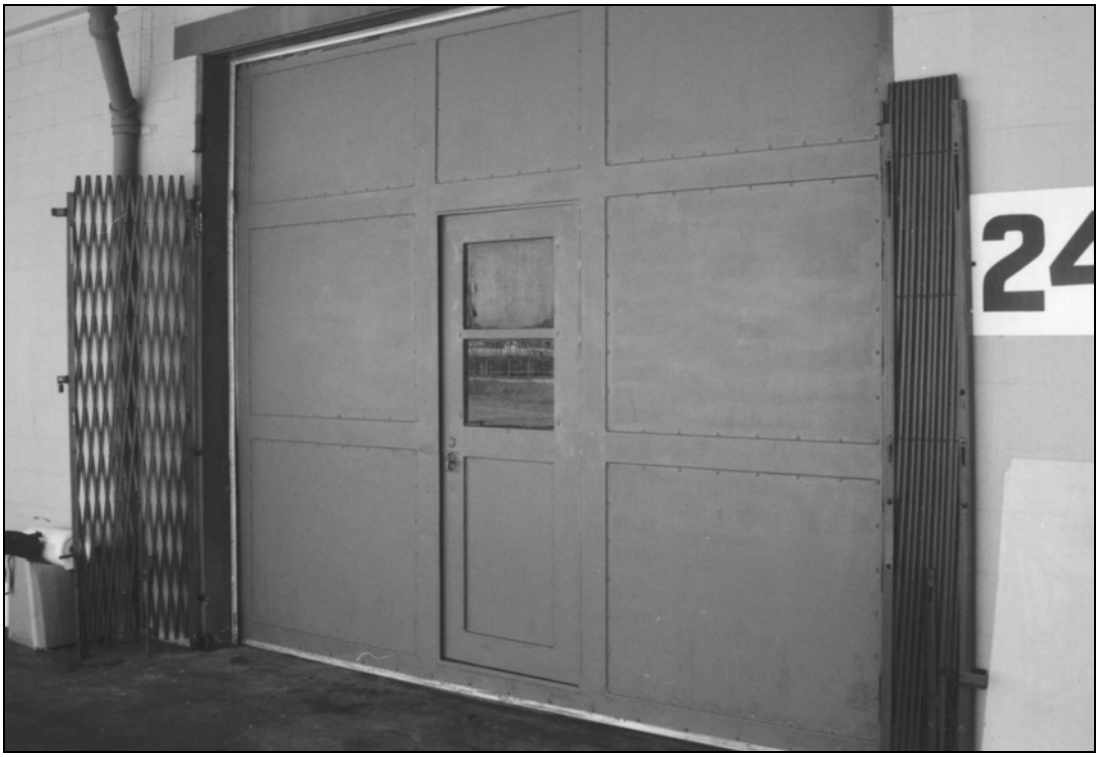


Figure A18. Door after primer application.

Figure A19. Floor after the work area was cleaned up.

Appendix B: Product Data Sheets and Material Safety Data Sheets

RemovAll~ 210

Industrial Paint Stripper
Powered by the patented *SARA*® Technology

Product Description

RemovAll 210 is a water-based coating and paint remover that is completely biodegradable and non-toxic. It is worker friendly and environmentally safe, yet it is completely effective in removing the toughest paints and coatings, which makes it the ideal choice for all industrial, architectural and marine applications.

Substrates and Coatings

RemovAll 210 has proven it will effectively lift urethanes, latex, alkyd paints, lead based paints and varnish as well as most two component epoxy coatings and fusion bonded epoxies from all types of substrates, including steel, aluminum, metal alloys, concrete, and masonry.

Typical Applications

- Water storage tanks
- Above the water line on ships
- Painted concrete floors
- Pulp and paper mills
- Automobile parts
- Bridges
- Food Processing plants
- Exteriors & interiors of buildings
- Petrochemical facilities
- Water treatment facilities
- Any area where abrasive blasting is not an option for environmental, or economic reasons
- Any area where worker safety or damage to delicate equipment may be a concern.

Product Features

- Contains no toxic air pollutants (TAP's) or hazardous air pollutants (HAP's)
- Non carcinogenic, non toxic and fully biodegradable
- Non flammable
- Low VOC's (Volatile Organic Compounds) and non ozone depleting
- Not regulated for transportation or storage
- Low and inoffensive odour
- Will not burn skin
- Performs effectively on most coatings including two component and fusion bond epoxies
- Cost effective because:
  - * Requires much less chemical to achieve desired results
  - * Reduces man-hours and effort required to complete a project
  - * Reduces cost of cleanup and waste disposal
  - * Reduces down time since other work at site can continue while stripper does its job
- Lowers insurance costs for worker safety and storage hazards

Physical and Chemical Properties

Appearance: Orange foamed emulsion
Boiling Point: 100° C (212° F)
pH: 2.0 – 3.0 (Direct Reading)
Flash point: in excess of 100° C (212° F)
Specific Gravity: 1.01
Freezing Point: 0° C (32° F)
VOC content: 121 g/L (1.01 lbs/gal)
Viscosity (cPs): 5,000 – 12,000
Transportation / Storage: Not regulated in USA or Canada (DOT, TDG, HMIS, WHMIS)

Directions for Use

Preparation: Cover / protect areas where the paint is to be left on. Remove masking tape immediately after application as the remover may soak through the tape, damaging the paint beneath it. Thoroughly mix the stripper, prior to use, with a high speed drill mixer. Remove all filters from sprayer & gun.
Tools required: Suitable spray equipment (airless or HVLP) or brushes, rollers etc, scraper, masking tape / polyethylene sheet, pressure washer. Even the smallest airless sprayer is capable of pumping
Application: Apply a thick, even layer onto the coating being removed. An airless spray machine is the most effective means for application. Use a tip size of 0.019 inches or larger. (Example: a 519 or 425 tip) Brushing and rolling should be avoided because these methods produce a lower film build and inconsistent thickness of stripper. Once applied, leave it alone, as agitation slows down penetration.
Coverage: The desirable thickness of stripper is approximately one and a half times the dry film thickness of the paint. Minimum wet film thickness should be 15 mils (300 microns). Yield is approximately 40 to 90 sq. ft. per US gallon (1 to 2.2 sq. metre per Litre).
Re-Application: When removing multiple layers of paint, the remover may lift the coating layer by layer. If this happens, remove the lifted layers and re-apply. Do not allow the stripper to dry out. The stripper is designed to remain wet and effective over extended periods of time (upto 48 hours), but excessive sunshine or windy conditions can cause early drying. If the stripper starts to dry, reapply a light coating and allow additional time for project completion.
Dwell Time: The time required for penetration varies according to the types of paint, the number of layers to be removed, and the temperature. Most paint systems will take between 1 and 6 hours. Leaving the stripper overnight will provide the best results.
Removal: Removal of residue can be completed by scraper, squeegee, wet/dry vacuum suction system or by high pressure (2,500 - 3,500 psi) water wash. Dispose of solid paint waste in accordance with local government regulations. **Do not collect and/or store removed paint and stripper waste residue in metal containers.**
Optimum temperature: Surface temperatures should be 65° to 95° F (20° to 32° C). The product does perform effectively at lower temperatures (even at 32° F, 0° C), but the dwell time increases.
Test Patch: Always prepare a test patch prior to full application. This will indicate the time required for project completion and suitability of product.

Safety Precautions

Proper safety procedures should be followed at all times while handling the product. Please refer to the Material Safety Data Sheet for important health and safety information prior to use.

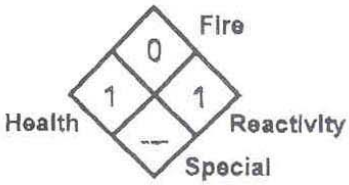
Ordering Information:

This information applies to US markets. Metric sizes and packaging are supplied to European and Asian markets.

Packing Available	Volume	Shipping Weight
Pails (4 per case)	1 U.S. Gallon (3.79 Litres) each pail	36 lbs (16 Kg) per case
Pails	5 U.S. Gallons (18.9 Litres)	45 lbs (20 Kg)
Drums	55 U.S. Gallons (205 Litres)	500 lbs (240 Kg)

Napier Environmental Technologies Inc.
720, Eaton Way, Delta, B.C. V3M 6J9 Canada
Phone: (604) 526-0802 Fax: (604) 526-7772 www.napierenvironmental.com

MATERIAL SAFETY DATA SHEET



UTILIZING PATENTED TECHNOLOGY DEVELOPED BY Napier Environmental Technologies Inc.

NFPA 704 DESIGNATION HAZARD RATING
4 = Extreme 3 = High 2 = Moderate
1 = Slight 0 = Insignificant

WHMIS CLASSIFICATION: D-2B

Issue Date: 10/10/2001	Supersedes: 08/10/2000

PATENTED PROTECTED TECHNOLOGY

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT IDENTIFIER:	**RemovAll 210 (Spray grade)**
PRODUCT USE:	Epoxy and Polyurethane Paint Remover
MANUFACTURED BY:	NAPIER ENVIRONMENTAL TECHNOLOGIES INC. 720 Eaton Way Delta, BC V3M 6J9 PHONE: 604-526-0802 FAX: 604-526-7772 EMERGENCY PHONE NUMBER 1-800-663-9274

2. COMPOSITION & INFORMATION ON INGREDIENTS

Component	% weight	CAS #	SARA Title III Section 313	RCRA	CARCINOGENICITY (As per 29CFR 1910-1200)
Aromatic Alcohol	<40	100-51-6	Not Listed	No	No
Aromatic Solvent, Naphthalene Depleted	<10	68477-31-6	No	No	No
Hydrogen Peroxide	<5	7722-84-1	No	No	No
Water, Deionized	<50	7732-18-5	No	No	No

NO *HAP's* OR *TAP's* ARE IN THIS PRODUCT.

The above information is based on manufacturer's Material Safety Data Sheets.

3. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Foamed Emulsion	**Bulk Density**	N/D
Odor	Specific	**Vapor Pressure**	13mm Hg@25°C
Odor Threshold	N/A	**Vapor Density**	Heavier than Air
Molecular Formula	Mixture	**Evaporation Rate (n-Butyl Acetate=1)**	< 1
Molecular Weight	N/A	**VOC content**	121g/l (1.01lbs/gal)
Boiling Point	~100°C(212F)	**% Volatiles**	96.10
Freezing Point	~0°C (32F)	**Solubility in Water**	Considerable
Specific Gravity	1.01	**Viscosity (cPs)**	5,000 – 12,000
Density (lbs/gal)	8.41	**pH (direct reading)**	2.0 - 3.0

4. STABILITY & REACTIVITY

GENERAL:	This product is stable and hazardous polymerization will not occur.
CONDITIONS TO AVOID:	Hot or cold storage.
INCOMPATIBLE MATERIAL:	Strong oxidizers, acids and alkalies.
HAZARDOUS DECOMPOSITION PRODUCTS:	Thermal decomposition (combustion) will produce carbon monoxide and dioxide.
SENSITIVITY TO MECHANICAL IMPACT:	This product is not sensitive to mechanical impact.
SENSITIVITY TO STATIC DISCHARGE:	This product is not sensitive to static discharge.

5. HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS:

EYE CONTACT: Exposure to vapor and mists, or direct contact with product may cause slight to moderate eye irritation. Symptoms of exposure may include: a stinging sensation, excess blinking and tear production, redness and swelling of the conjunctiva.

SKIN CONTACT: Repeated or prolonged exposure to vapors, mists, or foam may cause slight irritation. Symptoms of exposure may include: redness and a burning sensation. Prolonged or widespread contact may result in the absorption of potentially harmful amounts of material, with identical symptoms as ingestion.

INGESTION: Ingestion may cause moderate to severe irritation of the gastrointestinal tract. Symptoms of exposure may include: nausea, headache, dizziness, and abdominal pain.

INHALATION: Exposure to vapor or mists may cause moderate to severe irritation of respiratory tract. Symptoms may include: headache, nausea, coughing, chest pain and vomiting.

TERATOGENICITY:	None	MUTAGENICITY:	None
REPRODUCTIVE TOXICITY:	None	CARCINOGENICITY:	None

6. FIRST AID MEASURES

EYE CONTACT: Immediately flush eyes with plenty of clean running water for at least 15 minutes

SKIN CONTACT: Immediately flush skin with plenty of clean running water while removing contaminated clothing. Continue for at least 15 minutes. If irritation is evident or discoloration persists, seek medical attention.

INHALATION: Immediately move to fresh air. Seek medical attention if irritation persists.

INGESTION: DO NOT induce vomiting unless directed by medical personnel. Drink large quantities of milk or water. Seek medical attention.

7. FIRE FIGHTING MEASURES

GENERAL: **THIS PRODUCT IS NON-FLAMMABLE.**

FLASHPOINT AND METHOD: >176 Degrees F (PMCC)*

*Note: Interference from the high levels of water in the product prevent testing the product at temperatures above 176 Degrees F. The water vapour from the product smothers the test flame at high temperatures by displacing oxygen in the test cup.

FLAMMABLE LIMITS (in air, % by volume): **Lower:** N/A **Upper:** N/A

AUTOIGNITION TEMPERATURE: N/A

HAZARDOUS COMBUSTION PRODUCTS: Thermal decomposition of this product will produce carbon monoxide, carbon dioxide and other toxic volatiles.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

CONTROL MEASURES: Where product is heavily sprayed, local exhaust ventilation should be implemented.

RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT:

RESPIRATOR:	MSHA/NIOSH approved mist organic vapor cartridge (ie. OVD/DM #8741 or #8751A).
EYES:	Chemical splash goggles.
GLOVES:	Rubber or Neoprene.
CLOTHING:	Tyvec coveralls or rubber or neoprene apron.
FOOTWEAR:	Impervious boots.
OTHER :	Eye wash station and safety shower should be available in the work area.

9. HANDLING AND STORAGE

STORAGE TEMPERATURE: 0 - 45° C (32 - 113 F) **STORAGE PRESSURE:** Ambient

GENERAL: Prior to each use, mix well. Store in a well ventilated area. Avoid contamination of any kind. Potential immersion elements such as drum pumps and hoses should be removed after each use. Empty containers should be thoroughly rinsed with water and disposed of according to local regulations.

Cautionary Note: Care should be exercised when moving in or around product application areas (particularly oversprayed areas) as contacted surfaces become very slippery.

10. ACCIDENTAL RELEASE MEASURES

LAND SPILL: Wearing recommended protective clothing, dike spill using soil, sand or compatible commercial absorbent. Pick up bulk of product using pumps or vacuum truck or absorb product in sand or commercial absorbent. Place in approved containers for recovery or disposal. Flush spill area with water, collect rinsates and containerize for disposal. Prevent runoff from contaminating storm sewers, streams or other bodies of fresh water. Rinsates may be disposed of in sewers leading to a municipal or city treatment facility or an internal treatment facility.

WATER SPILL: This material is considerably soluble in water. Stop or divert water flow. Dike contaminated water and remove from disposal and/or treatment. Notify all downstream users of possible contamination.

11. DISPOSAL CONSIDERATIONS

RCRA 40 CFR 261 CLASSIFICATION: Not Classified

U.S. EPA WASTE NUMBER/DESCRIPTION: None

If this product is disposed of as shipped, it does not meet the criteria of a hazardous waste under 40 CFR 261, in that it does not exhibit the characteristics of hazardous waste of Subpart C, nor is it listed as a hazardous waste under Subpart D. As a non-hazardous liquid waste, it should be disposed of in accordance with all local, state or provincial, and federal regulations. Consult state or provincial or local officials for proper disposal method.

12. TRANSPORTATION INFORMATION

RemovAll 210 (Spray Grade) is NOT regulated as a hazardous material under the regulations of the U.S. DOT, IMDG or in Canada TDG.

This Material Safety Data Sheet is provided as an information resource only. It should not be taken as a warranty or representation for which Napier Environmental Technologies Inc. assumes legal responsibility. While Napier Environmental Technologies Inc. believes the information contained herein is accurate and compiled from sources believed to be reliable, it is the responsibility of the user to investigate and verify its validity. The buyer assumes all responsibility of using and handling the product in accordance with applicable federal, state, provincial and local regulations.

Removall~510

Automotive & Heavy Industrial Paint Stripper
Powered by the patented *SARA*® Technology

Product Description

RemovAll 510 is a water-based coating and paint remover that is completely biodegradable and non-toxic. It is worker friendly and environmentally safe, yet it is completely effective in removing the toughest paints and coatings, which makes it the ideal choice for all automotive and heavy industrial applications.

Substrates, Coatings and Product Grades

RemovAll 510 has proven it will effectively lift highly cross-linked urethane and epoxy top coats and primers, alkyds, lead based paints, non-skid coatings (100% solid content) and the toughest of industrial coatings and linings from metallic and plastic substrates. It is also capable of lifting fuel resistant primers, inorganic zinc primers and coal tar epoxies. RemovAll 510 is available in a paste that could be sprayed or brushed onto the surface.

Typical Applications

- Petrochemical plants
- Chemical tank farms
- Refineries
- Pulp and paper mills
- Ballast tanks on ships
- Bridges
- Nuclear plants
- Shipyards and other marine applications
- Painted plastic (eg. automobile bumpers)
- Automobiles and rail cars.
- Any area where abrasive blasting is not an option for environmental, or economic reasons
- Any area where worker safety or damage to delicate equipment may be a concern.

Product Features

- Contains no toxic air pollutants (TAP's) or hazardous air pollutants (HAP's)
- Non carcinogenic, non toxic and fully biodegradable
- Non flammable
- Low VOC's (Volatile Organic Compounds) and non ozone depleting
- Not regulated for transportation or storage
- Low and inoffensive odour
- Will not burn skin
- Performs effectively on most coatings including two component and fusion bond epoxies
- Cost effective because:
  - Requires much less chemical to achieve desired results
  - Reduces man-hours and effort required to complete a project
  - Reduces cost of cleanup and waste disposal
  - Reduces down time since other work at site can continue while stripper does its job

Physical and Chemical Properties

Appearance: Blue foamed emulsion
Boiling Point: 100° C (212° F)
pH: 3 – 4 (Direct Reading)
Flash point: in excess of 100° C (212° F)
Specific Gravity: 1.03
Freezing Point: 0° C (32° F)
VOC content: 76 g/L (0.632 lbs/gal)
Viscosity (cPs): 4,000 – 11,000
Transportation / Storage: Not regulated in USA or Canada (DOT, TDG, HMIS, WHMIS)

Directions for Use

Preparation: Cover / protect areas where the paint is to be left on. Remove masking tape immediately after application as the remover may soak through the tape, damaging the paint beneath it. Thoroughly mix the stripper, prior to use, with a high speed drill mixer.
Tools required: Suitable spray equipment (airless or HVLP) or brushes, rollers etc, scraper, masking tape / polyethylene sheet, pressure washer. Even the smallest airless sprayer is capable of pumping
Application: Apply a thick, even layer onto the coating being removed. An airless spray machine is the most effective means for application. Use a tip size of 0.019 inches or larger. (Example: a 519 or 425 tip) Brushing and rolling should be avoided because these methods produce a lower film build and inconsistent thickness of stripper. Once applied, leave it alone, as agitation slows down penetration.
Coverage: The desirable thickness of stripper is approximately one and a half times the dry film thickness of the paint. Minimum wet film thickness should be 15 mils (300 microns). Yield is approximately 40 to 90 sq. ft. per US gallon (1 to 2.2 sq. metre per Litre).
Re-Application: When removing multiple layers of paint, the remover may lift the coating layer by layer. If this happens, remove the lifted layers and re-apply. Do not allow the stripper to dry out. The stripper is designed to remain wet and effective over extended periods of time (upto 48 hours), but excessive sunshine or windy conditions can cause early drying. If the stripper starts to dry, reapply a light coating and allow additional time for project completion.
Dwell Time: The time required for penetration varies according to the types of paint, the number of layers to be removed, and the temperature. Most paint systems will take between 1 and 6 hours. Leaving the stripper overnight will provide the best results.
Removal: Removal of residue can be completed by scraper, squeegee, wet/dry vacuum suction system or by high pressure (2,510 - 3,510 psi) water wash. Dispose of solid paint waste in accordance with local government regulations. **Do not collect and/or store removed paint and stripper waste residue in metal containers.**
Optimum temperature: Surface temperatures should be 65° to 95° F (20° to 32° C). The product does perform effectively at lower temperatures (even at 32° F, 0° C), but the dwell time increases.
Test Patch: Always prepare a test patch prior to full application. This will indicate the time required for project completion and suitability of product.

Safety Precautions

Proper safety procedures should be followed at all times while handling the product. Please refer to the Material Safety Data Sheet for important health and safety information prior to use.

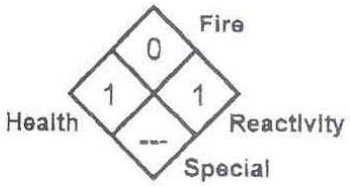
Ordering Information

This information applies to US markets. Metric sizes and packaging are supplied to European and Asian markets.

Packing Available	Volume	Shipping Weight
Pails (4 per case)	1 U.S. Gallon (3.79 Litres) each pail	36 lbs (16 Kg) per case
Pails	5 U.S. Gallons (18.9 Litres)	45 lbs (20 Kg)
Drums	55 U.S. Gallons (205 Litres)	510 lbs (240 Kg)

Napier Environmental Technologies Inc.
Napier Environmental Technologies Inc.
720, Eaton Way, Delta, B.C. V3M 6J9 Canada
Phone: (604) 526-0802 Fax: (604) 526-7772 www.napierenvironmental.com

MATERIAL SAFETY DATA SHEET



UTILIZING PATENTED TECHNOLOGY DEVELOPED BY Napier Environmental Technologies Inc.

NFPA 704 DESIGNATION HAZARD RATING
4 = Extreme 3 = High 2 = Moderate
1 = Slight 0 = Insignificant

Issue Date: 10/10/2001	Supersedes: 08/10/2000

WHMIS CLASSIFICATION: D-2B

PATENTED PROTECTED TECHNOLOGY

1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT IDENTIFIER:	**RemovAll 510 (Spray Grade)**
PRODUCT USE:	Epoxy and Polyurethane Paint Remover
MANUFACTURED BY:	NAPIER ENVIRONMENTAL TECHNOLOGIES INC. 720 Eaton Way Delta, BC V3M 6J9 PHONE: 604-526-0802 FAX: 604-526-7772
	EMERGENCY PHONE NUMBER 1-800-663-9274

2 COMPOSITION & INFORMATION ON INGREDIENTS

Component	% weight	CAS #	SARA Title III Section 313	RCRA	CARCINOGENICITY (As per 29CFR 1910-1200)
Aromatic Alcohol	<40	100-51-6	Not Listed	No	No
Hydroxycarboxylic Acids	<10	Proprietary Mixture	No	No	No
Hydrogen Peroxide	<5	7722-84-1	No	No	No

All components are listed in the TSCA Inventory (U.S.) and on the DSL (Canada).

NO *HAP's* OR *TAP's* ARE IN THIS PRODUCT.

The above information is based on manufacturer's Material Safety Data Sheets.

3 PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Foamed Emulsion	Bulk Density	N/D
Odor	Specific	Vapor Pressure	13mm Hg@25°C
Odor Threshold	N/A	Vapor Density	Heavier than Air
Molecular Formula	Mixture	Evaporation Rate (n-Butyl Acetate=1)	< 1
Molecular Weight	N/A	VOC content	76 g/L (0.632 lbs/gal)
Boiling Point	~100°C(212F)	% Volatiles	95.20
Freezing Point	~0°C (32F)	Solubility in Water	Considerable
Specific Gravity	1.03	Viscosity (cPs)	4,000 – 12,000
Density (lbs/gal)	8.60	pH	approx. 3 - 4

4 STABILITY & REACTIVITY

GENERAL:	This product is stable and hazardous polymerization will not occur.
CONDITIONS TO AVOID:	Hot or cold storage.
INCOMPATIBLE MATERIAL:	Strong oxidizers, acids and alkalies.
HAZARDOUS DECOMPOSITION PRODUCTS:	Thermal decomposition (combustion) will produce carbon monoxide and dioxide.
SENSITIVITY TO MECHANICAL IMPACT:	This product is not sensitive to mechanical impact.
SENSITIVITY TO STATIC DISCHARGE:	This product is not sensitive to static discharge.

5. HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS:

EYE CONTACT:	Exposure to vapor and mists, or direct contact with product may cause slight to moderate eye irritation. Symptoms of exposure may include: a stinging sensation, excess blinking and tear production, redness and swelling of the conjunctiva.
SKIN CONTACT:	Repeated or prolonged exposure to vapors, mists, or foam may cause slight irritation and temporary skin whitening. Symptoms of exposure may include: redness and a burning sensation. Prolonged or widespread contact may result in the absorption of potentially harmful amounts of material, with identical symptoms as ingestion.
INGESTION:	Ingestion may cause moderate to severe irritation of the gastrointestinal tract. Symptoms of exposure may include: nausea, headache, dizziness, and abdominal pain.
INHALATION:	Exposure to vapor or mists may cause moderate to severe irritation of respiratory tract. Symptoms may include: headache, nausea, coughing, chest pain and vomiting.

TERATOGENICITY:	None	MUTAGENICITY:	None
REPRODUCTIVE TOXICITY:	None	CARCINOGENICITY:	None

6. FIRST AID MEASURES

EYE CONTACT:	Immediately flush eyes with plenty of clean running water for at least 15 minutes
SKIN CONTACT:	Immediately flush skin with plenty of clean running water while removing contaminated clothing. Continue for at least 15 minutes. If irritation or discoloration persists, seek medical attention.
INHALATION:	Immediately move to fresh air. Seek medical attention if irritation persists.
INGESTION:	DO NOT induce vomiting unless directed by medical personnel. Drink large quantities of milk or water. Seek medical attention.

7. FIRE FIGHTING MEASURES

GENERAL: THIS PRODUCT IS NON-FLAMMABLE.

FLASHPOINT AND METHOD: > 176° F (PMCC)*

*Note: Interference from the high levels of water in the product prevent testing the product at temperatures above 176° F. The water vapour from the product smothers the test flame at high temperatures by displacing oxygen in the test cup.

FLAMMABLE LIMITS (in air, % by volume): Lower: N/A Upper: N/A

AUTOIGNITION TEMPERATURE: N/A

HAZARDOUS COMBUSTION PRODUCTS: Thermal decomposition of this product will produce carbon monoxide, carbon dioxide and other toxic volatiles.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

CONTROL MEASURES: Where product is heavily sprayed, local exhaust ventilation should be implemented.

RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT:

RESPIRATOR:	MSHA / NIOSH approved mist organic vapor cartridge (ie. OVD/DM #8741 or #8751A).
EYES:	Chemical splash goggles.
GLOVES:	Rubber or Neoprene.
CLOTHING:	Tyvec coveralls or rubber or neoprene apron.
FOOTWEAR:	Impervious boots.
OTHER:	Eye wash station and safety shower should be available in the work area.

9. HANDLING AND STORAGE

STORAGE TEMPERATURE: 0 - 45° C (32 - 113° F) STORAGE PRESSURE: Ambient

GENERAL: Prior to each use, mix well. Store in a well-ventilated area. Avoid contamination of any kind. Potential immersion elements such as drum pumps and hoses should be removed after each use. Empty containers should be thoroughly rinsed with water and disposed of according to local regulations. Do not completely fill containers with the resulted paint waste. Until mostly dry, wet paint waste can have the tendency to slightly expand, therefore do not seal containers airtight to allow a breathing period.

Cautionary Note Care should be exercised when moving in or around product application areas (particularly oversprayed areas) as contacted surfaces become very slippery.

10. ACCIDENTAL RELEASE MEASURES

LAND SPILL: Wearing recommended protective clothing, dike spill using soil, sand or compatible commercial absorbent. Pick up bulk of product using pumps or vacuum truck or absorb product in sand or commercial absorbent. Place in approved containers for recovery or disposal. Flush spill area with water, collect rinsates and containerize for disposal. Prevent runoff from contaminating storm sewers, streams or other bodies of fresh water. Rinsates may be disposed of in sewers leading to a municipal or city treatment facility or an internal treatment facility.

WATER SPILL: This material is considerably soluble in water. Stop or divert water flow. Dike contaminated water and remove from disposal and/or treatment. Notify all downstream users of possible contamination.

11. DISPOSAL CONSIDERATIONS

RCRA 40 CFR 261 CLASSIFICATION: Not Classified

U.S. EPA WASTE NUMBER/DESCRIPTION: None

If this product is disposed of as shipped, it does not meet the criteria of a hazardous waste under 40 CFR 261, in that it does not exhibit the characteristics of hazardous waste of Subpart C, nor is it listed as a hazardous waste under Subpart D. As a non-hazardous liquid waste, it should be disposed of in accordance with all local, state or provincial, and federal regulations. Consult state or provincial or local officials for proper disposal method.

PAINT WASTE STORAGE AND DISPOSAL:
Empty containers should be thoroughly rinsed with water and disposed of according to local regulations. Do not completely fill containers with the resulted paint waste. Until mostly dry, wet paint waste can have the tendency to slightly expand, therefore do not seal containers airtight to allow a breathing period. Dispose of the solid paint waste according to local regulations.

12. TRANSPORTATION INFORMATION

RemovAll 510 (Spray Grade) is NOT regulated for transportation (DOT/TDG).

This Material Safety Data Sheet is provided as an information resource only. It should not be taken as a warranty or representation for which Napier Environmental Technologies Inc. assumes legal responsibility. While Napier Environmental Technologies Inc. believes the information contained herein is accurate and compiled from sources believed to be reliable, it is the responsibility of the user to investigate and verify its validity. The buyer assumes all responsibility of using and handling the product in accordance with applicable federal, state, provincial and local regulations.

DUMOND CHEMICALS, INC.

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SPECIFICATION AND DATA

PEEL AWAY 1®

SPECIFICATIONS AND DATA

1. PRODUCT NAME
   PEEL-AWAY I

2. MANUFACTURER
   National Office:
   Dumond Chemicals
   1501 Broadway
   New York, NY 10036
   Phone: (212) 869-6350
   FAX: (212) 764-5762

3. PRODUCT DESCRIPTION

Basic Use: PEEL-AWAY I - The PEEL-AWAY I System is an environmentally safe method of removing up to thirty-two (32) coats of paint with a single application from most surfaces, and there are NO FUMES AND NO FLAMMABLE SOLVENTS. The system includes a paste that is spread or sprayed over the surface to be stripped. This paste is then covered with a fibrous laminated cloth which controls evaporation, and is left on until all of the paint is dissolved. The laminated cloth is then removed with the bulk of the paste and paint adhering to it and the stripped surface is washed clean and neutralized. The fibrous laminated cloth also protects the passerby while the stripping process is taking place. The PEEL-AWAY I System is excellent for turned, carved, or molded surfaces where a cast of the stripped surface is often seen on the cloth as it is removed. It is also especially suitable for plain or ornate plaster walls or ceilings, brick, concrete, stucco, softwoods, cast iron, steelwork, marble or fiberglass.

Lead Paint Abatement: The PEEL-AWAY 1 System is especially suited for removing lead paint and has two major advantages:(1) The paste is applied to the surface and then is covered by the PEEL-AWAY fibrous laminated cloth, keeping the paint in a wet or damp state and preventing lead particles from getting into the air or onto the surrounding area and (2) When the stripping job is finished and the cloth is removed the bulk of the paste and lead paint comes off intact on the cloth for proper disposal. Refer to federal and local regulations for disposal of lead-based material.

Limitations: PEEL-AWAY I - Product efficiency is reduced below a temperature of 32°F. It will not work on two part epoxy paints, chlorinated rubber, cementitious paints, baked finishes, or other exotic coatings. Do not use on hardwoods except where the surface will be repainted. Do not use on aluminum. Test patches should be made on unknown surface coatings.

4. TECHNICAL DATA

PEEL-AWAY I - Interior/Exterior
Paint Stripper
Form: Paste
Viscosity: 26.5
Specific Gravity: 1.44
Wt./Gal.: 12.0 lbs.
Flash Point: None
Solid Content: 58.0
VOC: 0
PH: 13.0

5. INSTALLATION

PREPARATORY WORK: It is often impossible to know the type or condition of the surface before paint is removed. Before a project is started it is important that a small test area be done typical of the surface to be stripped to ensure that the results will be satisfactory. This will also teach the first time user how to handle the PEEL-AWAY System and how to gauge the important thickness at which the product is applied to the surface and the time values for removing the PEEL-AWAY Cloth. Applying PEEL-AWAY too thinly or unevenly or removing too quickly may result in more than one application, thereby increasing your material and labor costs. Precautions: Protect areas not being stripped with polyethylene and masking tape. Note: PEEL-AWAY I will not attack glass or plastic surfaces but will etch aluminum. Workmen should wear rubber gloves taped to their sleeves, wear face shield or goggles, and a hat, especially where working at head height and above. When spraying or "hosing down" wear rubber or polyethylene rain suit so as to avoid splash to skin and eyes and follow spraying instructions that are supplied with machinery.

Application: Apply paste 1/8" to 1/4", according to age and thickness of paint, with either trowel or spray equipment. If using a trowel to apply, on irregular surfaces use a nylon brush to force paste into crevices. Then use the trowel to apply further coating. If using spray equipment this is not necessary since the product is applied evenly into all irregular surfaces. This will eliminate air pockets and additional touch up work.

Cover paste with PEEL-AWAY fibrous laminated cloth printed polyethylene side facing out. Rub gently to remove air and pierce remaining air bubbles with knife. The cloth comes in one square meter size and can be applied easily to the

DUMOND CHEMICALS, INC.

APPLICATIONS & SOLUTIONS

GUIDE FOR USING PEEL AWAY I FOR THE REMOVAL OF LEAD BASED PAINT

The following are some recommended guidelines to follow in removing lead based paint with the PEEL-AWAY I product. Specific instructions that are contained with our product should be followed. The Peel-AWAY I product has NO TOXIC FUMES AND NO FLAMMABLE SOLVENTS so minimum ventilation is required. Airborne lead sampling was done during a PEEL-AWAY abatement project by an outside environmental Company and the conclusion was "No detectable exposure of workers to airborne lead was found while using PEEL-AWAY for removal of lead based paint."

I. PREPARATORY WORK

It is often impossible to know the type or condition of the surface before paint is removed. Before a project is started it is important that a small test area be done typical of the surface to be stripped to ensure that the results will be satisfactory. This will also inform you of the thickness to apply the product and the time values for removing the product. Applying the product too thinly or unevenly or removing too quickly may result in more than one application thereby increasing your material cost.

HAZARDOUS MATERIAL

The fact that you are removing lead based paint does not necessarily mean that you are dealing with hazardous material. The test patches that are done should be collected and sent to a local laboratory for a TCLP test to determine the lead level of the residue of the paint/paste. The PEEL-AWAY product contains lime, which starts to stabilize the lead, and there is a good chance that the test results will indicate less than 5ppm lead which means you are not dealing with hazardous material in terms of disposal.

II. APPLICATION

The PEEL-AWAY product is usually applied between 1/8" to 1/4" thick, according to age and thickness of paint being removed (this is predetermined by tests) with either a trowel or specialized spray equipment. The paste is then covered with fibrous laminated cloth printed polyethylene side facing out. Leave on for up to 24 hours or more according to test patch findings. Remove by sliding PEEL-AWAY tool or taping knife into dried up paste around the edges of the cloth, easing paint, paste and cloth away from the surface in one piece. Remove as much as possible with tool before clean-up procedure.

BE SURE TO FOLLOW SPECIFIC INSTRUCTIONS THAT ACCOMPANY PRODUCT WITH REGARD TO CLEAN-UP PROCEDURE FOR INTERIOR AND EXTERIOR WORK.

NEUTRALIZATION

Failure to properly clean and neutralize the surface will result in alkaline residue that may cause an unsightly white haze. Alkaline residue may also interfere with performance of clear sealers or future paint coatings. It is most important that all pertinent neutralization instructions that accompany the product be followed.

III. HEALTH AND SAFETY PRECAUTIONS

Nitrile or latex gloves, taped to the sleeves shall be worn when applying the PEEL-AWAY product. Goggles should be worn. When using spray equipment particle dust masks and face shields along with a cotton/poly jumpsuit should be worn. Rubber suits for heavy duty wash down and cleanup. All other requirements that are in the specifications should be complied with.

MaterialSafetyDataSheet

Datelastreviewed:June30,1997

I.GeneralInformation

ChemicalName&Synonyms ProprietaryBlend	TradeName&Synonyms PeelAway1
ChemicalFamily Alkaline	Formula Mixture
ProperDOTShippingName SodiumHydroxideSolidMixture,UN1823	DOTHazardClassification Containerssmallerthan25lbs(11kg) -ORM -D. Containersgreaterthan25lbs(11kg)- CorrosiveMaterial
Manufacturer DumondChemicals,Inc.	Manufacturer'sPhoneNumber (212)869- 6350
Manufacturer'sAddress 1501Broadway,NewYork,NY10036	EmergencyNumber: (800)457- 4280

II.Ingredients

PrincipalHazardousComponents	CAS#	Percent	PEL	TLV
CalciumHydroxide	1305-62-0	21	5mg/m ^{3}TWA (respirablefraction)	5mg/m ^{3}TWA
MagnesiumHydroxide	1309-42-8	16	NoneEstablished	NoneEstablished
SodiumHydroxide	1310-73-2	9	2mg/m ^{3}TWA	2mg/m ^{3}Ceiling
Non-hazardousIngredients	N/A	Balance	NoneEstablished	NoneEstablished

SARA313:ThisproductcontainsnochemicalsthatareregulatedunderSARATitleIII,section313.

III.PhysicalData

BoilingPoint(°F) Greaterthan212	SpecificGravity(H_2O=1) 1.33
VaporPressure(mmHg) @20°Csameaswater	PercentVolatilebyVolume(%) 51.5
VaporDensity(Air=1) sameas water	EvaporationRate(ButylAcetate=1) sameaswater
SolubilityinWater Complete	pH 13
Appearance&Odor Whitepaste,noodor.	

IV.Fire&ExplosionHazardData

FlashPoint(TestMethod None	AutoignitionTemperature None	
FlammableLimits None	LEL N/A	UEL N/A

ExtinguishingMedia
Thismaterialisnotcombustible.Usemediaappropriateforthesurroundingfire.

SpecialFireFightingProcedures
WearfullemergencyequipmentandNIOSHapprovedpositivepressureSCBA.Cool containerswithwater.

UnusualFire&ExplosionHazards
Atelevatedtemperaturescontainersmayrupture.Contentsarecorrosive.Allpersonalcontactshould beavoided.

HMISRatings	Health:3	Flammability:0	Reactivity:0

V.HealthHazardData

OSHAPermissibleExposureLimit	ACGIHThresholdLimitValue
SeeSectionII	SeeSectionII
Carcinogen -NTPProgram	Carcinogen -IARC
No	No

SymptomsofExposure
AcuteEffects :Eyes:Maycauseseverebumswithpossiblepermanentdamage.Skin:Maycausechemicalburnswith reddeningandpain.Inhalation:May causeeyeandrespiratoryirritation.Ingestion:Maycauseburnstomouthand gastrointestinalcorrosion.
ChronicEffects:Repeatedskincontactwithdilutesolutionsormistsmaycausedermatitis.

MedicalConditionsAggravatedByExposure:
Individualswithchronicrespiratoryorskindiseasesmaybeatriskfromexposure.

PrimaryRoute(s)ofEntry
Eye,skin,ingestion

EmergencyFirstAid
Eye:Flushwithwaterfor30minutes.Getimmediatemedicalattention.Skin:Flushthoroughlyw/waterfor 15minutes. Removecontaminatedclothing.Getmedicalattentionforirritation.Inhalation:Removetofreshair.Getimmediatemedical attention.Ingestion:Ifconscious,givewaterormilk.Donotinducevomiting.Getimmediatemedicalattention.

IV.ReactivityData

Stability		Unstable	ConditionstoAvoid
	X	Stable	N/A

Incompatibility
Acids,flammableliquids,organichalogens,nitromethaneandmetalssuchasaluminum,tinorzinc.

Hazardous Polymerization		MayOccur	ConditionstoAvoid
	X	WillN otOccur	N/A

HazardousDecomposition
Noneknown.

VII.EnvironmentalProtectionProcedures

SpillResponse
Wearappropriateprotectiveclothing.Collectintoclosablecontainers.Washspillareawithwater.Prevent runofffromenteringsewersorwaterways.Reportspillsasrequired.

WasteDisposalMethod
Disposeofinaccordancewithallstate,localandfederalregulations.

VIII.SpecialProtectionInformation

EyeProtection	SkinProtection
Chemicalsafetygoggles/Faceshield	Rubberorneoprene gloves
RespiratoryProtection(SpecificType)	VentilationRecommended
Forsprayapplication,wearaNIOSHapproved dust/mistrespirator&eyeprotection.	Nonenormallyrequired.Ifexposurelimitsareexceeded, localexhaustmayberequired.

OtherProtection
Imperviousapron,boots,safetyshower,eyewashasneeded.

IX.SpecialPrecautions

HygienicPracticesinHandling&Storage
Storeinacool,wellventilatedareaawayfromacidsandotherincompatiblesubstances.

WorkPractices
Preventeyeandskincontact.Donotbreathemistsoraerosols.

OtherPrecautions
Useonlywithappropriateprotectiveequipment.Washthoroughlyafteruse.

DUMOND CHEMICALS, INC.

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SPECIFICATION AND DATA

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PEEL AWAY 7®

SPECIFICATIONS AND DATA

1. **PRODUCT NAME:**
PEEL-AWAY 7

2. **MANUFACTURER:**
Dumond Chemicals Inc.
1501 Broadway
New York, N.Y. 10036
Phone: 212-869-6350
FAX: 212-764-5762

3. **PRODUCTION DESCRIPTION:**
The PEEL-AWAY 7 System is an environmentally safe, user friendly paint remover that has been specially formulated to remove multiple layers of paint from wood, brick, stone, metal, plaster, marble and fiberglass surfaces. The chemicals contained in PEEL-AWAY 7 have been selected for their very low evaporation rate which means in some cases you will have to give the product more time to work than with some of the more aggressive chemical products, but the end results will be the same. PEEL-AWAY 7 contains no water and will remove multiple layers of paint with one application instead of several that are often needed with other "safe" removers. This product can be used on both interior and exterior surfaces. In addition to removing multiple layers of alkyds and latex paints, in most instances in a single application, it also has the capability of removing almost all industrial coatings i.e. epoxies, urethanes, aluminum paints, etc. The PEEL-AWAY 7 is a paste that is brushed or sprayed over the surface to be stripped. The paste is then covered with a fibrous laminated cloth which controls evaporation and is left on until the paint is dissolved. The laminated cloth is then removed with the bulk of the paste/paint adhering to the cloth and the stripped surface is then washed clean. In some cases where only a few coats of paint/coatings are being removed the product will work without using the laminated cloth. Usually within a twenty to thirty minute time frame you see the bubbling action of the product. PEEL-AWAY 7 is excellent for carved and molded surfaces where a cast of the stripped surface is often seen on the cloth as it is removed. PEEL-AWAY 7 also has the ability to emulsify VAT tile for simple removal and will not allow any fibers in the air. It also can be used to remove asbestos based paint coatings.

Advantages: DOES NOT CONTAIN METHYLENE CHLORIDE OR CAUSTIC. Normal ventilation is required and product will easily cling to a vertical or ceiling surface. Stays effective longer and can be left on the surface if required for 96 hours depending on the paint/coatings being removed. Will work on most epoxy and urethanes plus other industrial coatings. Classified as non-hazardous material.

Limitations: Product efficiency is reduced below a temperature of 40°. It may not work on some epoxy or other industrial coatings and will not work on most cementitious coatings. Test patches should be made on unknown surface coatings.

Composition & Material:
PEEL-AWAY 7 is formulated and blended with "user" friendly chemicals with excellent penetration and adhesive properties. It does not contain any water. It utilizes a fibrous laminated cloth which allows the paste to work in a sealed and safe environment with little or no evaporation taking place.

4. **TECHNICAL DATA:**

FORM: Tan paste
WT/GAL: 11 lb.
FLASH POINT: 266 F
pH: Neutral

5. **PREPARATORY WORK:**
It is often impossible to know the type or condition of the surface before paint is removed. Before a project is started it is important that a small test area be done typical of the surface to be stripped to ensure that the results will be satisfactory.

GENERAL APPLICATION: Apply PEEL-AWAY 7 with a brush, roller or spray equipment about 1/16" to 1/8" thick working well into crevices and detailed areas. (Test patches will make this determination). Cover paste with fibrous laminated cloth printed polyethylene side facing out. Rub gently to create the adhesion between the cloth and the paste. Dwell time can be between 2 and 24/48 hours depending on the thickness and type of coating being removed. Remove by sliding putty knife under paste and easing paste, paint and cloth away from the surface in one piece.

IV. SUMMARY

The PEEL-AWAY System has two major advantages for removing lead based paint:

(1)The paste is always keeping the paint in a wet or damp state preventing any lead particles getting into the air or on the surrounding area.

(2) When the stripping job is finished and the cloth is removed the bulk of the paste and paint come off intact on the cloth for easy collection and proper disposal.

V. TECHNICAL SERVICES

Dumond Chemical Inc. employs a direct personal assistance staff on hand to answer technical questions. Also available are trained sales representatives and technical people for on site

If you have questions or comments, please contact us Copyright © 1999 Dumond Chemicals, Inc.

MaterialSafetyDataSheet

Datelastreviewed:June30,1997

I.GeneralInformation

ChemicalName&Synonyms ProprietaryMixture	TradeName&Synonyms PeelAway7
ChemicalFamily OrganicSolventMixture	Formula Mixture
ProperDOTShippingName NotRegulated	DOTHaz ardClassification Not Regulated
Manufacturer DumondChemicals,Inc.	Manufacturer'sPhoneNumber (212)869- 6350
Manufacturer'sAddress 1501Broadway,NewYork,NY10036	EmergencyNumber: (800)457- 4280

II.Ingredients

PrincipalHazardousComponents	CAS#	Percent	PEL	TLV	Other
DibasicEster	119-40-0 627-93-0	10-25	NoneEstablished	NoneEstablished	10mg/m ^{3} (manufacturer)
*n-Methyl-2-Pyrrolidone	872-50-4	20-50	NoneEstablished	NoneEstablished	100ppm (manufacturer)
AluminumSilic ate	1332-58-7	20-40	15mg/m ^{3} (totaldust)	10mg/m ^{3}	
NonylphenolEthoxylate	68412-54-4	<1	NoneEstablished	NoneEstablished	
Non-hazardousIngredients	N/A	10-30	NoneEstablished	NoneEstablished	

*SARA313:n -Methyl-2-PyrrolidoneisaregulatedchemicalunderSARATitleIII,Section313.

III.PhysicalData

BoilingPoint(°F) Notavailable	SpecificGravity(H $_2$0=1) Greaterthan1
VaporPressure(mmHg@20°C) 0.29	PercentVolatilebyVolume(%) 85%
VaporDensity(Air=1) 3.4(n -methyl-2-pyrrolidone)	EvaporationRate(ButylA cetate=1) Lessthan1
SolubilityinWater Partial	pH 3.2

Appearance&Odor
Lightbrownpastewithaslight,sweetodor.

IV.Fire&ExplosionHazardData

FlashPoint(TestMethod) 266 ^{0}F(Setaflash)	AutoignitionTemperature Notavailable	
FlammableLimits	LEL 0.99%	UEL 7.9%

ExtinguishingMedia
Watersprayorfog,foam,carbondioxideordrychemical.

SpecialFireFightingProcedures
WearfullemergencyequipmentandNIOSHapprovedpositivepressureSCBA.Coolfi reexposed containerswithwater.

UnusualFire&ExplosionHazards
Atelevatedtemperaturescontainersmayrupture.Vaporsformexplosivemixtureswithair.Decomposition productsmaybehazardous.

HMISRatings	Health:2	Flammability:1	Reactivity:0

V.HealthHazardData

OSHAPermissibleExposureLimit	ACGIHThresholdLimitValue
SeeSectionII	SeeSectionII
Carcinogen -NTPProgram	Carcinogen -IARC
No	No

SymptomsofExposure
AcuteEffects :Eyes:Vaporsmaycauseirritation,blurredvision ,corneaopacityoredema.Skin:Maycauseirritation. Inhalation:Mistsandvaporsmaycauseblurredvisionandirritationoftheeyes,mucousmembranesandupperrespiratory tract.Ingestion:Maycausegastrointestinalirritation,vomiting,diarrhea,headacheandabdominalpain.
ChronicEffects:Prolongedskincontactmaycausedermatitis.Widespread/prolongedcontactmaycauseabsorptionwith symptomssimilartoingestion.

MedicalConditionsAggravatedByExposure:
Individualswithchronicresp iratoryorskindiseasesmaybeatriskfromexposure.

PrimaryRoute(s)ofEntry
Eye,skin,inhalation,ingestion

EmergencyFirstAid
Eye:Immediatelyflusheyeswithwaterfor15minutes.Getimmediatemedicalattention.Skin:Washthoroughlyw/soap& water.Removecontaminatedclothing.Getmedicalattentionforirritation.Inhalation:Removetofreshair.Getimmediate medicalattention.Ingestion:Ifconscious,give2glassesofwater.Donotinducevomiting.Getimmediatemedicalattention.

IV.ReactivityData

Stability		Unstable	ConditionstoAvoid
	X	Stable	N/A

Incompatibility
Strongacids,bases,oxidizersorreducingagents.

Hazardous		MayOccur	ConditionstoAvoid
Polymerization	X	WillNotOccur	N/A

HazardousDecomposition
Carbondioxide,carbonmonoxideandoxidesofnitrogen.

VII.EnvironmentalProtectionProcedures

SpillResponse
Wearappropriateprotectiveclothing.Removeignitionsources.Collectwithaninertabsorbent.Washspill areawithwater.Preventrunofffromenteringsewersorwaterways.Reportspillsasrequired.

WasteDisposalMethod
Disposeofinaccordancewithallstate,localandfederalregulations.

VIII.SpecialProtectionInformation

EyeProtection	SkinProtection
Chemicalsafetygoggles/faceshield	Butylrubberglovesrequired.
RespiratoryProtection(SpecificType)	VentilationRecommended
Forsprayapplication,aNIOSHapprovedorganic vaporrespiratormaybeused.	Goodgeneralventilationisusuallyadequate.Ifexposure limitsaree xceeded,localexhaustmayberequired.

OtherProtection
Imperviousapron,boots,safetyshower,eyewashasneeded.

IX.SpecialPrecautions

HygienicPracticesinHandling&Storage
Storeinacool,wellventilatedareaawayfromoxidizersandotherincompatiblesubstances.

WorkPractices
Avoideyeandskincontact.Avoidbreathingvapors.Washthoroughlyafterhandling.

OtherPrecautions
Useonlywithappropriateprotectiveequipment.Emptycontainersretainresidueandmaybehazardous.

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14. ABSTRACT

The environmental problem being addressed in this technology demonstration is the removal of lead-based paint (LBP) from steel structures without producing hazardous air pollutants. Environmentally acceptable chemical stripper technology was validated as part of a standard methodology for removing LBP on large steel structures owned by the Army, such as water tanks, aircraft hangars, bridges, antennas, ladders, poles, railings, and fuel storage tanks, leaving a surface suitable for repainting. In addition, this technology was demonstrated to meet environmental regulations and worker health and safety issues. Cost and performance data were collected and analyzed.

15. SUBJECT TERMS
Lead-based paint, paint removal, paint stripper, steel structures, hazardous air pollutants (HAPs), environmental compliance

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