ASSESSMENT, DEVELOPMENT AND DEMONSTRATION OF LOW-VOC CLEANING SYSTEMS FOR SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT RULE 1171

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I. INTRODUCTION AND BACKGROUND

Volatile Organic Compound (VOC) emissions from solvent cleaning operations contribute significantly to the South Coast Air Basin's emission inventory. The South Coast Air Quality Management District (SCAQMD or District) periodically adopts an Air Quality Management Plan (AQMP). This AQMP calls for significant reductions in VOC emissions from cleaning and degreasing operations by 2010 to achieve attainment status.

One of the District's rules that focuses on cleaning applications has future compliance limits for which technology has not yet been specified. This rule is SCAQMD Rule 1171 "Solvent Cleaning Operations." In order to help develop low- or non-VOC technologies to comply with these provisions and to satisfy the AQMP's goals, the District contracted with the Institute for Research and Technical Assistance (IRTA). Under the contract, IRTA investigated and tested low- and non-VOC alternatives in a variety of cleaning processes. The aim was to identify technologies that could be substituted for high VOC technologies used today in many types of cleaning.

TARGET APPLICATIONS

At the beginning of the two-year project, IRTA and the District staff identified the cleaning applications in Rule 1171 where more work and development and demonstration of low-VOC technologies was needed. The areas of focus were cleaning of certain electrical equipment and high technology devices, cleaning of coating and adhesives application equipment and cleaning of various types of printing application equipment. In earlier amendments to Rule 1171, the District had established target VOC content limits for these applications. The aim of this project was to assess, develop and demonstrate low-VOC cleaning systems and determine whether they could be used in these applications to comply with the target VOC limits. Another goal of the project was to evaluate the technical feasibility and cost of the low-VOC alternatives.

Table 1-1 shows the applications of interest as they are listed in Rule 1171. The table also specifies the target VOC content of the cleaning systems established in Rule 1171 for 2005. Two of the items, cleaning of spray equipment for architectural coating and cleaning of solar cells, laser hardware, scientific instruments, and high-precision optics, appear as exemptions in Rule 1171. The target VOC content for the spray equipment cleaning was 25 grams per liter and for the high technology systems, the target VOC content was 100 grams per liter.

PROJECT APPROACH

IRTA and the District decided to investigate low-VOC alternatives by working with specific companies in the Basin that conduct the operations listed in Table 1-1. IRTA is also conducting a project under EPA sponsorship that is focusing on some of the same areas that were addressed in the SCAQMD project. Specifically, IRTA is working with

companies that need to clean coating application equipment and printing application equipment. IRTA has completed the analysis with some of the companies participating in the EPA project. The results of the analysis for these companies in the EPA project are presented here.

Table 1-1
Rule 1171 Cleaning Applications and Target VOC Content

Cleaning Application	Target VOC Content (grams per liter)
Product Cleaning	
Cleaning of Electrical Apparatus Component and Electronic Component Products • Printed circuit board rework • Cleaning hybrid circuits • Cleaning general electrical components • Cleaning electric motors	100
Cleaning of Solar Cells, Lasers, Scientific Instruments & High Precision Optics	100
Repair & Maintenance Cleaning	
Electrical Apparatus Components & Electronic Components • Field cleaning of electric motors, generators, energized equipment • In-house cleaning of electric motors and other electrical equipment during rework, refurbishing, or rebuilding	100
Coating & Adhesive Application Equipment Cleaning • Cleaning of spray guns (general) • Cleaning of spray guns used for architectural coating • Cleaning of electrostatic spray guns • Cleaning of adhesive application equipment • Cleaning of application equipment for satellite/radiation effect coatings	25
Cleaning of Ink Application Equipment • Screen printing • UV printing • Specialty flexographic printing • UV lamp cleaning	100

Table 1-2 shows the companies and the electronics or high technology operation for which low-VOC cleaners were targeted. Tables 1-3 and 1-4 show the same type of information for coating application equipment and printing operations. The companies IRTA is working with in the EPA project are designated in the tables.

Table 1-2
Companies Participating in SCAQMD Project with Electronics or High Technology Operations

Cleaning Application	Company
Printed Circuit Board Rework	Hydro-Aire Teledyne Controls
Hybrid Circuit Manufacture	Teledyne Microelectronic Technologies
General Electrical Apparatus Manufacture	Corona Magnetics Cicoil
Electric Motor Manufacture	Sterling
Rebuilding/Refurbishing of Electric Motors	Walton
General and Field Electrical Equipment Maintenance	Burbank Water & Power Covanta Energy
Energized Field Electrical Equipment Maintenance	Burbank Water & Power
Solar Cells	Northrop Grumman (formerly TRW)
Optics	Northrop Grumman (formerly Litton Guidance & Control Systems)
Scientific Instruments	Astro Pak

CLEANER PERFORMANCE

Performance of the alternative cleaning agent(s) at each facility in each application was evaluated on a case-by-case basis. In each instance, the plant personnel provided information on their requirements for the cleaning process. In nearly all cases, the major criterion was if the cleaning was sufficient to go on to the next processing step. For spray gun cleaning, for example, if the spray equipment is clean, it should be able to be used successfully in applying the next coating that is required. In terms of performance, a cleaning system was judged as successful if it cleaned as well as or better than the cleaning process the company uses currently. When there were differences in the cleaning process, these were noted.

COST ANALYSIS

IRTA performed cost analysis for each of the alternatives that was successfully tested at each of the facilities participating in the project. The components included in the cost analysis were:

- capital costs where equipment needed to be purchased
- labor costs where there were differences in labor between the currently used cleaner and the alternative cleaner(s)
- cleaner costs
- electricity costs where there were differences
- regulatory fees
- disposal costs

For the capital costs, IRTA generally assumed a 10 year useful life of equipment and amortized the capital cost over this period assuming a cash purchase. For labor costs, IRTA used the labor rate at the participating facilities. For the cleaner cost, IRTA used the cost of the cleaner paid by the facility where this cost was known. In some cases, where the facility did not elect to use the cleaning alternative, IRTA used an estimate based on the cost of the product in commerce. The cost of electricity was assumed to be 12 cents per kWh. The regulatory fees for VOC and toxics emissions were taken from SCAQMD Rule 301. The disposal costs were estimated through conversations with waste haulers.

Table 1-3
Companies Participating in SCAQMD Project with Coating or Adhesives Applications

Operation	Company
Aerospace Coatings	Hydro-Aire, Gulfstream California Propeller (EPA)
Metal Coatings	American Security Products Metrex (EPA)
Wood Coatings	Oakwood Bausman & Father (EPA)
Autobody Coatings	El Dorado, Holmes (EPA) Westway (EPA)
Architectural Coatings	PCM Leisure World (EPA and SCAQMD), Murphy
Adhesives	Hickory Springs, VACCO

Table 1-4
Companies Participating in SCAQMD Project with Printing Applications

Operation	Company
Electronics Screen Printing	Teledyne Electronics
Plastic Screen Printing (UV inks)	Owens Illinois
Banner Screen Printing (UV inks)	Southern California Screen Printing
Metal Screen Printing	Nelson Nameplate
Varied Screen Printing	City of Santa Monica Paint Shop (EPA)
Textile Screen Printing	Stith Quick Draw (EPA) Melmarc Total Enterprises
Specialty Flexographic Printing	Huhtamaki

All of the assumptions that were made in the cost analysis are described in detail in the sections for each participating facility. This method makes the costs transparent so that they could be calculated based on other assumptions.

LOW-VOC, LOW TOXICITY ALTERNATIVES

Plant personnel also had other criteria that related to safety and regulations. Understandably, they did not want to use cleaning agents that were toxic and posed a risk or a potential risk to workers or that appeared on various toxics lists. In order to minimize the risks of the cleaning agents to the workers and the surrounding community, a hierarchy was used for the testing. If water-based cleaners could be used in the process, then water-based cleaners without solvent additives were tested first. If these did not work effectively, water-based cleaners with solvent additives or soy based cleaners were tested. These chemicals are low in toxicity and VOC content. If these did not work well, acetone and acetone blends with VOC cleaners were tested. Acetone is exempt from VOC regulations and is low in toxicity. In a few cases, other chemicals that are exempt from VOC regulations, like methyl acetate for example, were also tested. More detail on each of these alternatives is presented below. Material Safety Data Sheets for a number of these alternatives are presented in Appendix C.

Water-Based Cleaners

Two water-based cleaners were tested at a variety of facilities in the course of the project. One of these cleaners, Spray Clean 12, is made by Applied Cleaning Technologies in Anaheim. It is an alkaline cleaner that has been certified as a Clean Air Solvent by the SCAQMD. The District indicates that the cleaner concentrate contains zero VOC. This cleaner was successfully tested for spray gun cleaning after application of wood furniture coatings, for cleaning electrical windings on electric motors and for cleaning non-energized field electrical equipment.

The second water-based cleaner that was tested successfully is called Mirachem Pressroom Cleaner. It is a neutral cleaner that has received Clean Air Solvent Certification from the SCAQMD. The cleaner concentrate contains 75 grams per liter. This cleaner worked well for removing ink in certain of the screen printing applications and in the specialty flexographic printing application.

A third water-based cleaner was tested at one facility for cleaning hardened grease from tooling and the floor. This cleaner was the commercially available Formula 409. IRTA called the company that manufactures the cleaner but the company did not know the VOC content of the cleaner.

Soy Based Cleaners

Soy based cleaners are composed of methyl esters. IRTA asked the State of California, Department of Health Services, Hazard Evaluation System & Information Services (HESIS) group to evaluate the toxicity of the soy cleaners. Based on available data and their structure, HESIS indicated that these cleaners were likely to have low toxicity. One of the soy based cleaners tested for field generator cleaning and spray gun cleaning by IRTA, called Soy Gold 1000, is made by AG Environmental Products. This cleaner has been certified as a Clean Air Solvent by SCAQMD; the Gas Chromatograph/Mass Spectrometer (GC/MS) method (called Method 313) used in the certification program indicates that this cleaner has a VOC content of less than five grams per liter. IRTA also successfully tested another soy product called Soy Gold 2000 which is made by the same company in screen printing applications. This product has not been certified as a Clean Air Solvent but it is based on Soy Gold 1000 and contains about three percent of a surfactant that makes it water rinseable. The SCAQMD has determined the VOC content of this product is less than 20 grams per liter.

IRTA also successfully tested another soy based product, called Autowash #3 which is made by Seibert, in screen printing. It is composed of about 85 percent soy and 15 percent surfactants. SCAQMD has not yet determined the VOC content of this cleaner.

Acetone

Acetone cleaners were widely and successfully tested by IRTA during the project in electronics and high technology application cleaning, in spray gun cleaning and, in some

cases, in screen printing cleanup. Acetone is exempt from VOC regulations and it is low in toxicity when compared with most organic solvents.

One of the issues that arises with the use of acetone is its low flash point. Fire department regulations specify that no more than 15 gallons can be used in open containers at any given time. No more than 60 gallons can be stored in the facility at one time. If fire walls or other fire department approved building improvements are installed, more of the chemical can be used and stored.

Methyl Acetate

IRTA tested methyl acetate successfully in a blend with acetone for spray gun cleaning in autobody applications. Methyl acetate is exempt from VOC regulations. It has medium toxicity but forms methyl alcohol, a listed toxic, as a metabolite. IRTA tried to maximize the use of acetone which is less toxic in the blend with methyl acetate. Methyl acetate, like acetone, has a low flash point and the same fire department regulations apply to methyl acetate and acetone.

Volatile Methyl Siloxanes

IRTA tested volatile methyl siloxanes (VMSs) unsuccessfully for cleaning silicone based grease in an electronics application. The VMSs are exempt from VOC regulations. One of the project participants, an electric motor rebuilder, converted to a VMS called D5 for cleaning electric motors when they come in from the field. There is recent evidence that D5 causes tumors in rodents and the company is evaluating a conversion to a water-based cleaner.

HCFC, HFEs and HFCs

IRTA evaluated HCFC-225, a blend of two HFEs with 1,2-trans-dichloroethylene (DCE) and a blend of an HFC and DCE for cleaning energized electrical equipment. HCFC-225, the HFEs and the HFCs are exempt from VOC regulations. HCFC-225 contributes to stratospheric ozone depletion and it will eventually be banned for that reason. The HFEs and HFCs contributes to global warming. DCE is classified as a VOC and it has not been tested for chronic toxicity. Its structure indicates that it might have toxicity problems.

REPORT ORGANIZATION

This report is organized into sections that focus in more detail on each of the generic application areas. Section II describes the work that was performed on alternatives for electronics and high technology cleaning processes. Section III addresses the testing and results of the alternatives in coating and adhesive application equipment cleaning. Section IV focuses on the alternatives that were tested in printing applications. Section V summarizes the results of the project and makes recommendations for cleaning categories covered in Rule 1171. Appendix A provides Material Safety Data Sheets (MSDSs) for

some of the coatings used by the facilities in this project. Appendix B includes some stand-alone case studies for some of the companies that participated in the project and decided to make a conversion to alternatives. Appendix C provides MSDSs for some of the alternative cleaning agents that were tested during the project.

II. ALTERNATIVES IN ELECTRONICS AND HIGH TECHNOLOGY EQUIPMENT CLEANING

SCAQMD Rule 1171 regulates solvent cleaning activities and, as part of that, it establishes limits for cleaners that can be used to clean electronic devices and other high technology systems. During this project, IRTA focused on cleaners used in three of the categories. First, in the product cleaning during manufacturing category for electrical apparatus components and electronic components, the VOC content of the cleaners is currently 500 grams per liter. In July, 2005, the VOC content declines to 100 grams per liter. Second, in the repair and maintenance cleaning category for electrical apparatus components and electronic components, the VOC content of the cleaners is currently 900 grams per liter. In July, 2005, the VOC content declines to 100 grams per liter. Third, in the category of solar cells, lasers, scientific instruments and high precision optics, there is currently no VOC limit for these cleaners. The target VOC limit for this category is 100 grams per liter.

2.1 Preliminary Laboratory Testing

Table 1-2 showed the list of companies IRTA worked with during the project. Table 2-1 summarizes the companies that participated in the project and the specific applications that were addressed. In some cases, IRTA obtained contaminated parts from the companies and performed preliminary testing using different cleaning agents that might be suitable. In other cases, the cleaning of field electrical equipment for instance, it was not possible to perform preliminary laboratory testing.

Table 2-1
Electronics and High Technology Cleaning Applications

Company	Application
Teledyne Controls	Rework of printed circuit boards
Hydro-Aire	Rework of printed circuit boards
Teledyne Microelectronic Technologies	Manufacture of hybrid circuits
Corona Magnetics	Manufacture of transformers
Cicoil	Manufacture of flexible cables
Sterling	Manufacture of electric motors
Walton Motors & Controls, Inc.	Rework/rebuilding of electric motors
Burbank Water & Power	Maintenance of general field electrical equipment
	Maintenance of energized field electrical equipment
Covanta Energy	Maintenance of general field electrical equipment
Northrop Grumman (formerly TRW)	Manufacture of solar cells
Northrop Grumman (formerly Litton (Guidance & Control Systems)	Manufacture of optics
Astro Pak	Cleaning of gauges

2.2 Field Testing

For each of the companies participating in the SCAQMD project, IRTA developed a test plan for testing the alternative cleaning agent(s). In general, the test plans involved some initial testing at the site to screen potential alternatives. If the tests were successful, IRTA requested that the company perform a scaled-up longer term test of the alternatives. In one case, the company decided to convert to the alternative and, in other cases, they did not convert. In some instances, companies are continuing to test alternatives.

The description of the testing and the cost analysis of the alternatives for each of the facilities is described below. IRTA generally attempted to include all the costs a company would incur in the cost comparison of the alternatives with the cleaning system that is currently used. IRTA relied on input for the companies participation in the study for the cost estimates. For instance, some companies indicated that their acetone use would increase and others did not. In the case where the company did convert to an alternative, a stand alone case study that describes the conversion is presented in Appendix B.

2.2.1 Teledyne Controls

Teledyne Controls is located in West Los Angeles, California. The company builds data acquisition equipment and supporting ground data processing stations for airlines and airports. Teledyne also manufactures a wireless ground link system. The systems must have high reliability.

Teledyne has their circuit boards assembled on the outside. The company does a small amount of additional assembly on the boards when they arrive in-house. A few of the boards fail quality control and they are reworked and cleaned by hand. In addition, the customer repair department does a large amount of rework. The boards are assembled using a water soluble flux. The company has a water-based cleaning system with D.I. water. This system is used in a few cases for the cleaning the flux after rework. In other cases, the company used plain isopropyl alcohol (IPA) for some of the cleaning and a blend of 50 percent IPA and 50 percent D.I. water in an aerosol package for the rest of the cleaning.

IRTA and Teledyne tested a variety of low-VOC alternatives for the IPA and the IPA/D.I. water blend. These included plain D.I. water, acetone, a saponifier and different blends of acetone, D.I. water and IPA. All of the cleaners provided visually clean boards but the worker that was performing the testing did not like the high acetone content cleaners or the saponifier because the worker determined it left a residue. The remaining three cleaners, a material called Ionox, plain D.I. water and a blend of 85 percent D.I./five percent IPA and 10 percent acetone, were further tested to determine the ionic contamination left on the boards after cleaning. All three cleaners resulted in low ionic contamination levels. Teledyne decided to adopt the blend of D.I. water, acetone and IPA which has less than 100 grams per liter VOC.

Teledyne used about 12 gallons per year of IPA for rework. At a cost for electronics grade IPA of $12.25 per gallon, the annual IPA cost amounted to $147. Teledyne also used 18 aerosol cans per year of the 50 percent IPA/50 percent D.I. water blend. At a cost of $8 per can, the cost of this cleaning agent was $144 per year. The total cost of cleaning with these materials was $291 annually.

For the alternative (85 percent D.I.; five percent IPA; and 10 percent acetone), it was assumed that usage would be the same, 12 gallons plus 96 ounces or 12.75 gallons. According to Teledyne, for the new solution, the cost of acetone would be $25 per gallon and the cost of IPA would be $15 per gallon. On this basis, the total annual cost for purchasing the low-VOC blend is $41.

Table 2-2 shows the cost comparison of the IPA and the aerosol cleaner and the blend that Teledyne adopted. The values show that Teledyne Controls reduced their costs by more than seven times through the conversion.

Table 2-2
Annual Cost Comparison for Teledyne Controls for Rework Cleaning

	IPA and Aerosol	Low-VOC Blend
Cleaner Cost	$291	$41
Total Cost	$291	$41

A stand alone case study for Teledyne Controls is presented in Appendix B.

2.2.2 Hydro-Aire

Hydro-Aire, an aerospace subcontractor, is a division of Crane located in Burbank, California. The company has 572 employees. Hydro-Aire manufactures braking systems, pumps and airlocking devices. The company also does repair work on the pumps used in military and commercial aircraft like the C-130 transport and the C-17.

As part of their operations, Hydro-Aire assembles printed circuit boards. In some cases, the boards do not pass quality control and they need to be reworked. The rework process is done by hand and isopropyl alcohol (IPA) is used to clean the flux from the boards after the components have been soldered to them. Hydro-Aire uses a rosin based flux because the company has existing aerospace contracts that require it.

Two alternatives were considered for the rework operation. The reworking takes place in the same room as the main assembly operations. For assembly, the boards are cleaned in a high pressure spray system with a water-based saponifier. One option for Hydro-Aire is to clean the boards that have been reworked in this machine. The machine cycle is about 20 minutes long and the workers that clean with IPA do the cleaning in a few minutes. Although cleaning with the water-based cleaning system is an alternative, IRTA did not analyze the costs.

The second alternative tested was blends of IPA and acetone. Hydro-Aire tested a blend of 92 percent acetone and eight percent IPA, a blend IRTA devised to meet about 100 grams per liter VOC. The company used the blend for a period of time and it seemed to work well for removing the flux. Hydro-Aire is currently conducting compatibility tests to determine if the alternative cleaner is compatible with all the materials in the boards. The tests should be completed this year.

Hydro-Aire currently uses 55 gallons per month of IPA for the rework operation. The company pays $5.01 per gallon for IPA so the annual cost of purchasing the IPA amounts to about $3,307. If Hydro-Aire converted to the 92 percent acetone/eight percent IPA blend, the cost of the blend would be $4.31 per gallon, assuming a cost for acetone of $4.25 per gallon. Assuming the same amount of cleaner would be required, the annual cost of purchasing the blend would be about $2,845.

Hydro-Aire pays emission fees for the IPA. Assuming a density for IPA of seven pounds per gallon and that the cost of one ton of VOC emissions is $345, the annual emission fees amount to $797. For the new blend, which still contains some IPA, the annual emission fee would be $64.

Table 2-3 shows the cost comparison for the IPA and the IPA/acetone blend. The cost of using the IPA/acetone blend is 29 percent lower than the cost of using plain IPA.

Table 2-3
Annual Cost Comparison for Hydro-Aire for Rework

	IPA	IPA/Acetone
Cleaner Cost	$3,307	$2,845
Emission Fees	$797	$64
Total Cost	$4,104	$2,909

2.2.3 Teledyne Microelectronic Technologies

Teledyne Microelectronic Technologies is located in Marina del Rey, California. The company manufactures several different types of hybrids. In the solid state relay assembly procedure, the company employs many different cleaning processes including vapor degreasing with a cyclohexane and IPA mixture and batch loaded cold cleaning and handwiping with a range of VOC solvents.

IRTA worked with Teledyne to identify and test alternative low-VOC, low toxicity cleaners for one of the hybrid processes. The focus was to be on removing flux after soldering operations and finding alternatives for the VOC solvents used in batch loaded cold cleaning.

In one operation, the non-solid state hybrids were flushed with a spray system using IPA prior to cover sealing the assemblies. IRTA suggested that Teledyne test acetone and not

cleaning at all. The not cleaning at all option worked well and Teledyne discontinued the spray cleaning operations throughout the facility.

IRTA began work with Teledyne on the flux removal operation. The company used rosin flux and removed it with a vapor degreaser that used a VOC solvent. IRTA and Teledyne decided to pursue converting to water soluble flux and testing alternative water-based saponifiers for removing the rosin flux. Although some testing was conducted, Teledyne continued to pursue testing without the support of IRTA and is currently cleaning some solid state parts with water and a saponifier. The SCAQMD extended an exemption for VOC solvents used in small vapor degreasers and batch loaded cold cleaners so the company no longer had an imminent deadline to meet.

2.2.4 Corona Magnetics

Corona Magnetics is located in Corona, California. The company manufactures electromagnetic components used in transformers and other equipment for military and medical applications.

The magnet wire used by Corona Magnetics is generally solid copper wire coated with enamel and it is hand soldered to a terminal in a printed circuit board or a copper or nickel pin. During the soldering process, the enamel is burned off. As a result, the soldering is done at high temperature, more than 700 degrees F.

In the cleaning process, the flux from the soldering operation and various other contaminants need to be cleaned. Corona Magnetics currently uses two types of cleaning processes for removing the flux. First, most of the parts are cleaned in a vapor degreaser which contains a blend of HCFC-225 and alcohol called AK-225-AES-L. Previously, Corona Magnetics used a different blend called AK-225-AES and began using AK-225-AES-L in 2003 because of VOC restrictions in SCAQMD Rule 1122. The AK-225-AES-L has a VOC content less than 50 grams per liter because it contains less alcohol than AK-225-AES. The engineer at Corona Magnetics indicates that the company is not happy with the AK-225-AES-L because it requires more handwipe cleaning.

Second, the very small and very large parts were cleaned with isopropyl alcohol (IPA) by hand. More recently, because the regulation required cleaners to have a lower VOC content, the company converted to a blend of 60 percent acetone and 40 percent IPA. In some cases, if there is a residue left after the vapor degreaser cleaning step, the cleaning is again done by hand.

Corona Magnetics currently uses a rosin based flux on the parts. IRTA and Corona Magnetics tested a water soluble flux but it was not suitable for the high temperatures required for the soldering. Rosin flux can be cleaned with a water-based cleaner and a saponifier. The company did not want to use a water-based cleaner, however, because of the uncertainty in knowing whether the part was completely dry.

IRTA and Corona Magnetics tested three alternatives including acetone, a blend of 92 percent acetone and eight percent IPA and a blend of 92 percent acetone and eight percent d-limonene, a terpene. The terpene blend did not work at all. The plain acetone and the acetone/IPA blend worked as well as the current process.

IRTA analyzed the costs of replacing the vapor degreaser and the hand cleaning with IPA with hand cleaning with either acetone or the 92 percent acetone/eight percent IPA blend. To convert to the acetone or the acetone/IPA blend, Corona Magnetics indicates they will have to install six lab hoods at $500 each. The company would also have to spend about $3,000 on additional ventilation. The total capital cost would amount to $6,000. Assuming the system would last 10 years leads to an annual cost of $600.

Corona Magnetics used about five gallons of IPA per week for the hand cleaning. The company paid $12.25 per gallon for electronics grade IPA. The cost of the 60 percent acetone/40 percent IPA blend is higher, at $20 per gallon. The annual cost of using the IPA was $3,185. The annual cost of using the 60 percent acetone/40 percent IPA blend is $5,200. Conversion to the 92 percent acetone/eight percent IPA would require 10 percent more solvent because of the higher vapor pressure of acetone. Assuming the same cost as for the acetone/IPA blend used currently, the cost of purchasing the high acetone content blend would be $5,720. The cost of acetone is about the same as the cost of IPA. Assuming that 10 percent more acetone would be used, the cost of purchasing plain acetone would amount to $3,504 annually.

The HCFC-225 blend used in the vapor degreaser costs of $140 per gallon. Corona Magnetics uses about five gallons per month. The annual cost of purchasing the HCFC-225 blend is $8,400. If acetone in a handwipe process were substituted for the HCFC-225 vapor degreasing process, more would be required. Assuming that the usage would increase to five gallons per week, the annual cost of purchasing the acetone would be $3,185. Assuming the same usage of the 92 percent acetone/eight percent IPA blend, the annual cost would amount to $5,200.

The total annual cost of purchasing the solvents for the vapor degreaser and the IPA handwipe solvent amounts to $11,585. The annual cost of purchasing the solvents for the vapor degreaser and the 60 percent acetone/40 percent IPA (the current situation) is $13,600. The annual cost of purchasing plain acetone in handwipe as a substitute for the vapor degreaser and the IPA handwipe is $6,689. The annual cost of purchasing the 92 percent acetone/eight percent IPA blend in handwipe as a substitute for the vapor degreaser and the IPA handwipe is $10,920.

The vapor degreaser uses approximately 6 kWh of electricity. Assuming it operates half the time to maintain temperature, it will use 6,240 kWh of electricity annually. At 12 cents per kWh, the annual electricity cost amounts to $749. The ventilation hoods that need to be installed for using the acetone and acetone/IPA blends would likely have one-fourth horse power blowers and they would be operated for four hours per day. Each hood would use 0.2 kW or 208 kWh annually. The six hoods would use 1,248 kWh per

year. Again assuming a cost of 12 cents per kWh, the annual electricity cost of the ventilation hoods would be $150.

Corona Magnetics indicated that there is no disposal cost for the vapor degreaser. The handwipe solvents would evaporate so they would not require disposal.

Table 2-4 shows the cost comparison for Corona Magnetics. The lowest cost option is to convert the operation to plain acetone handwipe. This option is about half the cost of the cleaning currently (use of the vapor degreaser and the 60 percent acetone/40 percent IPA blend). The next lowest cost option is use of the 92 percent acetone/eight percent IPA blend in a handwipe operation. This option is about 22 percent less costly than the current option.

Table 2-4
Annual Cost Comparison for Corona Magnetics for Electromagnetic Assembly Cleaning

	Vapor Degreaser/ IPA	Vapor Degreaser/ 60/40 Acetone Blend	Acetone	92/8Ace-tone Blend
Capital Cost	-	$600	$600	$600
Cleaner Cost	$11,585	$13,600	$6,689	$10,920
Electricity Cost	$749	$749	$150	$150
Total Cost	$12,334	$14,949	$7,439	$11,670

2.2.5 Cicoil Corporation

Cicoil is a small company with 75 employees located in Valencia, California. The company manufactures flexible and cast cables that are used in aerospace, military and process automation. Cicoil assembles about 40 parts per day and they use solvent in various parts of the process. The primary cleaning agent used by the company historically was isopropyl alcohol (IPA).

IPA was used to clean the tools used in the assembly process. Some of the tools are aluminum and some are plexiglass. IPA was also used to clean flux from the cables after they were soldered. Finally, IPA was used to remove a silicone based mold release agent that was left on the assemblies from a potting operation. All of the cleaning is done in handwipe operations.

IRTA worked with Cicoil for several months and tested a variety of alternatives. The company cannot use water-based cleaners on the cables because the water can travel up the teflon insulation and into the wires when they are in the field and cause failure. Cicoil can use water-based cleaners, however, for cleaning their tooling. Some of the alternatives that were tested included water-based cleaners, various blends of acetone and IPA, d-limonene which is a terpene and a siloxane solvent.

For cleaning the aluminum tools, Cicoil converted from IPA to acetone and found that acetone worked better than IPA. The company converted to a commercial water-based product, Formula 409, for cleaning the plexiglass tooling and for removing the mold release agent from the floors. Cicoil then decided to convert to Formula 409 for cleaning the aluminum tooling as well. This cleaner worked as well as IPA. For the flux removal from assemblies that also contain some silicone grease, the only alternative that worked well was a blend of 50 percent acetone/50 percent IPA. Blends with lower concentrations of IPA simply could not remove the silicone grease. Although the siloxane solvent did remove the grease, it was incompatible with the materials of construction of the electronic assemblies.

Cicoil was using 55 gallons per month of IPA. Of the 55 gallons about three gallons were used for cleaning the tooling and 52 gallons were used for flux and silicone grease removal. Cicoil pays $6.23 per gallon for IPA. The annual cost for purchasing IPA for cleaning the tooling was about $224; the annual cost for purchasing IPA for flux and grease removal was $3,888. Cicoil is paying $7.07 per gallon for acetone. Assuming that Cicoil uses the same amount of the 50 percent acetone/50 percent IPA blend, the cost of purchasing the cleaner for flux and grease removal is now $4,150. Cicoil pays $12.61 per gallon for Formula 409. Assuming three gallons per month usage, the cost of purchasing the Formula 409 amounts to $454 per year.

Table 2-5 shows the cost comparison for Cicoil. Cicoil's cost increased by about 12 percent when the company converted to the acetone/IPA blend and the Formula 409.

Table 2-5
Annual Cost Comparison for Cicoil for Cleaning Electronic Assemblies

	IPA	Acetone/IPA and Formula 409
Cleaner Cost	$4,112	$4,604
Total Cost	$4,112	$4,604

2.2.6 Sterling Electric, Inc.

Sterling Electric, Inc. is an electric motor manufacturer located in Irvine, California. The company has been operating since 1927 and manufactures 50 motors per day. Many of the electric motors manufactured by Sterling are used in food processing equipment.

The electric motors are made of cast iron and aluminum. Sterling paints the electric motors after they have been assembled. In the past, prior to the coating process, the company used a brush and a mineral spirits VOC solvent to handwipe the motors to remove finger prints and other contaminants.

IRTA tested two alternatives for cleaning prior to painting. IRTA brought Sterling a parts cleaner containing a neutral water-based cleaner. Even though the cleaner contained a rust inhibitor, the company believed the parts were beginning to rust just after

cleaning. IRTA also tested acetone for handwiping the parts. Acetone seemed to clean well and the company has recently converted to this alternative.

Sterling used about one gallon per day of VOC solvent for cleaning the electric motors. The cost of the solvent was $3 per gallon and the total annual cost for purchasing the solvent was $780. IRTA estimates that the company uses 10 percent more acetone because acetone's vapor pressure is higher than the vapor pressure of the mineral spirits. Assuming a cost of acetone of $5.17 per gallon, the total annual cost of using the acetone amounts to $1,479.

Table 2-6 shows the cost comparison for Sterling. The values show that the cost of using acetone is almost double the cost of using mineral spirits.

Table 2-6
Annual Cost Comparison for Sterling for Electric Motor Manufacture

	Mineral Spirits	Acetone
Cleaner Cost	$780	$1,479
Total Cost	$780	$1,479

2.2.7 Walton Motors & Controls, Inc.

Walton Motors & Controls, Inc. is a small company with 17 employees located in South El Monte. The company rebuilds electric motors that have been in the field, sometimes for many years. Motors are received at the facility and they are disassembled. It the windings on the electric motors are still good, they clean them without removing the protective varnish. The metal parts are cleaned in a spray cabinet that uses a water-based cleaner.

Walton historically cleaned the windings in a mineral spirits parts cleaner. IRTA tested two alternatives with Walton. IRTA provided the company with a water-based parts cleaner. The water-based cleaner is an alkaline cleaner with virtually no VOC. It performed effectively on the cleaning but Walton was reluctant to use it because oven baking would be necessary for the parts cleaned in the water-based cleaner. IRTA also tested a soy based cleaner which did not perform well on the parts. A service provider brought Walton a parts cleaner with a distillation unit that relied on a volatile methyl siloxane called D5 which is exempt from VOC regulations. Walton decided to adopt the D5 system.

IRTA analyzed and compared the costs of the mineral spirits used by the company originally, the D5 used currently and the water-based cleaning alternative.

If Walton were to use the water-based cleaner, a heated parts cleaner would be required. The cost of the unit is about $1,500. Assuming a useful life for the parts cleaner of 10 years, the annual cost would be $150.

Walton leased a mineral spirits parts cleaner from a service provider who supplied the cleaning unit and the mineral spirits and provided maintenance and disposal services. The annual cost of the service was $1,300. Walton also leases the D5 unit and the service includes maintenance and disposal costs but the company purchases the D5 separately. The cost of the D5 service is $1,188 annually.

The cost of the D5 is $35 per gallon. Walton uses the distillation unit to recycle the solvent so the company purchases five gallons every six months. The total annual cost of the D5 is $350. The cost of the water-based cleaner is $10 per gallon. If a 30 percent concentration of the cleaner were required for the 30 gallon parts cleaner, then the cost of replacing the bath would amount to $90. The cleaner would require replacement every three months. The annual cost for purchasing the water-based cleaner would be $360.

The mineral spirits parts cleaner had a one-fourth horse power pump which ran four hours per day. The annual electricity cost was $42. The D5 unit has the same pump but also has a still that is run at the end of the day. The still uses 5 kW of electricity and runs for a two hour cycle. Assuming an electricity cost of 12 cents per kWh and that the still operates for 260 days per year, the electricity cost for the D5 unit is $354 annually. The water-based parts cleaner has the same pump as the other two units and it has a 2 kW heater that cycles on and off. Assuming the parts cleaner is used four hours per day, that it cycles on half the time, that it is used for 260 days per year and that the electricity cost is 12 cents per kWh, the annual electricity cost of the water-based cleaner is $167.

If Walton were to adopt a water-based cleaner, most of the parts would be air dried. The oven the company already owns would be used to dry the electrical windings. There would be no extra cost for drying the windings because they could be put through the oven with other parts that have been coated.

The disposal costs for the mineral spirits and the D5 are included in the servicing cost. For the water-based cleaner, it was assumed that the disposal cost would amount to $2 per gallon. The disposal of the 120 gallons annually would cost $240.

Table 2-7 shows the cost comparison for Walton. The cost of using the D5 is 41 percent higher than the cost of using the mineral spirits. The cost of using the water-based cleaner is lower than the cost of using either of the solvents.

Table 2-7
Annual Cost Comparison for Walton for Electric Motors

	Mineral Spirits	D5	Water-Based Cleaner
Capital Cost	-	-	$150
Servicing Cost	$1,300	$1,188	-
Cleaner Cost	-	$350	$360
Electricity Cost	$42	$354	$167
Disposal Cost	-	-	$240
Total Cost	$1,342	$1,892	$917

2.2.8 Burbank Water & Power

Burbank Water & Power, located in Burbank, provides power to the city of Burbank. The company must maintain their equipment in the field and part of that maintenance involves cleaning surfaces of generators and transformers that are not energized and various types of equipment while it is energized which means that electricity is running through it.

Burbank Water & Power cleans their non-energized field equipment with a water-based cleaner. This water-based cleaner contains less than 10 percent of a glycol ether. Assuming the glycol ether accounts for 10 percent, the cleaner would have a VOC content of about 120 grams per liter. The company uses the cleaner sometimes at full strength and sometimes at 50 percent concentration.

IRTA provided three water-based alternative cleaners that do not have any solvent additives for testing. These include Spray Clean 12, Spray Clean 14 and AX-IT. One of the cleaners, Spray Clean 12, performed as well as the current cleaner and it has zero VOC. IRTA provided five gallons of the cleaner to the facility and the personnel indicated it cleaned well.

Burbank Water & Power currently uses 85 gallons per year of their water-based cleaner to maintain their non-energized equipment. The cost of the water-based cleaner is $9.09 per gallon. The total annual cost of purchasing the cleaner is $773. The cost of the alternative cleaner is about $10 per gallon. Assuming the same level of use, the annual cost of purchasing the lower VOC water-based cleaner would be $850.

Table 2-8 shows the cost comparison for the water-based cleaners for the non-energized electrical equipment cleaning. The cost of using the lower VOC cleaner is slightly higher than the cost of using the current cleaner.

Table 2-8
Annual Cost Comparison for Burbank Water & Power for Non-Energized Electrical Equipment Cleaning

	Current Water-Based Cleaner	Alternative Water-Based Cleaner
Cleaner Cost	$773	$850
Total Cost	$773	$850

Cleaning of energized electrical equipment is generally done with a so-called contact cleaner. The cleaner cannot be water-based because most water-based materials have low dielectric strength and they conduct electricity which would be dangerous to the workers. The cleaner generally cannot have a flash point because these cleaners also generally have low dielectric strength as well. Historically, the industry used 1,1,1-trichloroethane and CFC-113 for cleaning energized electrical equipment. When production of these two chemicals was banned, the industry began using cleaners based

on HCFC-141b. HCFC-141b is a fairly significant ozone depleter and its production has now been banned. Because companies that perform energized electrical cleaning still have an inventory of the chemical, it will be used for a period of time until there is no more inventory. HCFC-141b has a dielectric strength of 53 kV while the cutoff for cleaners that can be used on energized equipment is generally 30 kV.

Burbank Water & Power, like other companies that maintain energized electrical equipment, uses an HCFC-141b aerosol cleaner. IRTA tested three alternatives with the company that could be replacements for the HCFC-141b. The first of these was based on another HCFC, HCFC-225 which is an exempt chemical. This HCFC is not as aggressive a cleaner as HCFC-141b and employees of Burbank Water & Power did not think it performed well. IRTA provided two other cleaners. One of these was a combination of hydrofluoroethers (HFEs) and 1,2-trans-dichloroethylene (DCE). The other is based on a hydrofluorocarbon, HFC-245fa, and DCE. Both of these cleaners worked well, and the employee indicated they worked as well as the HCFC-141b. The HFEs and the HFC do contribute to global warming; DCE has not been tested for chronic toxicity and it's structure indicates that it could possibly be a carcinogen. According to the MSDSs, the HFC blend has a listed VOC content of 857 grams per liter and the HFE blend has a listed VOC content of 1,104 grams per liter.

Burbank Water & Power currently uses 247 16-ounce cans of the HCFC-141b aerosol cleaner at a cost of $14 per can. The total annual cost of using this cleaner is $3,458. The cost of the HFE/DCE cleaner is $25.98 for a 12-ounce can. This translates to $34.64 for a 16-ounce can. Assuming the same usage, the annual cost of purchasing the HFE/DCE blend is $8,556. The cost of the HFC/DCE blend is $16.16 per 16-ounce can. Again, assuming the same usage, the annual cost of purchasing the HFC/DCE blend amounts to $3,992.

The employee who supervises and performs the cleaning indicated that the alternative cleaners worked well but he was concerned that the workers that do the cleaning might have to spend more time if the cleaners failed to work as well in some instances. For this scenario, IRTA assumed the cleaning labor would increase by 30 percent. Currently, six people spend two hours per week performing this type of cleaning. Assuming a labor rate of $30 per hour, the labor costs for energized electrical equipment cleaning are $18,720. If the labor cost increased by 30 percent through adoption of one of the alternatives, the labor hours would amount to 811 per year and the labor cost would total $24,336.

Table 2-9 shows the cost comparison for the energized electrical equipment cleaning. The cost of using the HFE/DCE blend if labor remains the same is 23 percent higher than the cost of cleaning with the HCFC-141b. The cost of using the HFC/DCE blend if labor remains the same is comparable to the current cost of using HCFC-141b. If the labor cost increases, the cost of using both of the alternatives is much higher than using HCFC-141b.

Table 2-9
Annual Cost Comparison for Burbank Water & Power for Energized Electrical Equipment Cleaning

	Current Cleaner	HFE/DCE (same labor)	HFC/DCE (same labor)	HFE/DCE (more labor)	HFC/DCE (more labor)
Labor Cost	$18,720	$18,720	$18,720	$24,336	$24,335
Cleaner Cost	$3,458	$8,556	$3,992	$8,556	$3,992
Total Cost	$22,178	$27,276	$22,712	$32,892	$28,327

2.2.9 Covanta Energy

Covanta has a generating facility in Sun Valley, California. The company provides electrical power to Southern California Edison. Covanta maintains their generators in the field on a regular basis. The generators are not energized when the cleaning occurs.

Covanta historically used mineral spirits to clean the generators. The company currently uses trichloroethylene (TCE) both in bulk quantities and in aerosol cans to perform the generator cleaning. Covanta provided a discarded generator so IRTA could test alternatives. A high pressure spray system that was used for spraying the mineral spirits was used for testing alternatives. IRTA and Covanta tested a soy based cleaner in various dilutions with water containing a rust inhibitor. A blend of 70 percent water, 25 percent soy and five percent rust inhibitor performed well in cleaning the generator and did not rust the parts.

Covanta uses 32 gallons of TCE at their two locations including the Sun Valley plant. About 80 percent of the TCE volume or 25.6 gallons is used in aerosol cans. Assuming there are 13 cans in a gallon, the company uses 333 cans per year. The price of the TCE is $6.94 per can. The annual cost for purchasing the aerosol cans is $2,311. The remaining 6.4 gallons of TCE is used in a blend of 80 percent TCE and another component. The price of the blend is $47. Thus the annual cost of the non-aerosol TCE blend is $376. The total annual cost of purchasing the TCE products is $2,687.

IRTA estimates that if Covanta converted to the soy material, they would have to use about 10 percent more product to obtain equivalent cleaning. Covanta uses 32 gallons of TCE based products currently so 35.2 gallons of the soy blend would be required annually. The blend is made up of about nine gallons of soy, about two gallons of rust inhibitor and the remainder is water. The cost of soy and the rust inhibitor are about $6 and $10 per gallon respectively. The annual cost of the blend would be $74.

Covanta currently pays SCAQMD toxics fees for the emissions of TCE. The cost of the emissions is 11 cents per pound. Assuming a density of 12.13 pounds per gallon for the 32 gallons of TCE used per year, the toxics fees paid by Covanta amount to $43 annually.

Table 2-10 summarizes the cost comparison for Covanta. The cost of using the soy based blend is 37 times lower than the cost of using the TCE.

Table 2-10
Annual Cost Comparison for Covanta for Generator Cleaning

	TCE	Soy Based Cleaner
Cleaner Cost	$2,687	$74
Emission Fees	$43	-
Total Cost	$2,730	$74

2.2.10 Northrop Grumman (Formerly TRW Space & Technology Division)

Northrop Grumman, located in Redondo Beach, California, manufactures solar arrays for satellites. As part of the manufacturing process, the solar cells are assembled in an array and cleaned with isopropyl alcohol (IPA) and acetone. The contaminants that are being removed are primarily particles and fingerprints.

IRTA worked with Northrop Grumman to identify and test alternative handwipe solvents for the solar cells. The company provided IRTA with a solar array with several cells to perform initial testing. In the initial testing, IRTA used IPA as the baseline. The alternatives that were tested included plain deionized (D.I.) water, plain acetone, a blend of 50 percent acetone and 50 percent D.I., a blend of 90 percent acetone and 10 percent IPA and a water-based cleaner followed by a D.I. rinse. The Northrop Grumman engineer indicated that the acetone and the acetone/IPA blend appeared to work best.

The company and IRTA performed scaled up testing on the solar cells. The technician indicated that she had used acetone in the past and it worked well. The tests indicated that acetone did perform well.

One issue that arises with the use of acetone concerns the wipe cloths used by Northrop Grumman for cleaning the solar cells. Acetone extracts certain components from the cloths. The company has a concern that the materials that are extracted from the wipe cloths will end up contaminating the solar cells if acetone is used as a final wipe. At this stage, Northrop Grumman is planning to perform tests on the wipe cloths and to determine the levels of extraction and if there could be other wipe cloths that would not result in as much extraction. IRTA also suggested that the company include blends of acetone with D.I. to see if the extraction could be minimized.

Currently, Northrop Grumman can use acetone for cleaning the solar cells but must use either IPA or ethyl alcohol for the final wipe. The results of the wipe cloth research may determine a way for the company to convert to acetone for even the final wipe.

Northrop currently pays $5.75 per gallon of semiconductor grade IPA and $5.85 per gallon for semiconductor grade acetone. The company currently uses 20 gallons of IPA and six gallons of acetone. The annual cost of purchasing the cleaners amounts to $150. If Northrop Grumman were to convert to acetone exclusively, assuming the cleaner usage would be the same, the annual cost of purchasing acetone would be $152.

Table 2-11 shows the cost comparison for converting the operation from IPA to acetone. The cost of using IPA and acetone is about the same as the cost of using acetone alone.

Table 2-11
Annual Cost Comparison for Northrop Grumman for Solar Cell Manufacture

	IPA/Acetone	Acetone
Cleaner Cost	$150	$152
Total Cost	$150	$152

2.2.11 Northrop Grumman (formerly Litton Guidance & Control Systems)

Northrop Grumman manufactures laser guidance systems for commercial and military aerospace applications including spacecraft and aircraft missiles. The high precision parts are lapped and polished and blocking materials are used to hold the parts in place during these operations. The parts are cleaned in several steps of the process to remove the lapping, polishing and blocking compounds.

In the past, Northrop Grumman relied heavily on CFC-113 and TCA for cleaning the parts. Several years ago, Northrop Grumman initiated projects to find alternatives. They converted primarily to VOC solvents and some water-based cleaning processes. At that stage, the company's operations were classified as Batch Loaded Cold Cleaners (BLCCs) using VOC solvents and were covered by Rule 1122. Northrop Grumman did not have to make a conversion away from the VOC solvents in 1999 because they qualified for an exemption, (k)(1)(c), that extended the deadline until 2003. Even so, the company decided they wanted to convert away from the VOC solvents in 1998 and they again began working on non-VOC alternatives. By January, 1999, Northrop Grumman reduced their use and emissions of VOC solvents by 16,000 pounds or eight tons annually.

In the frame manufacturing operation, Northrop Grumman used n-methyl pyrollidone (NMP) to clean wax which was used to plug the frame bores to prevent lapping compound from intruding. The company eliminated this cleaning step by using plugs with O-rings to block the frame bores acting as a physical barrier to the lapping compound. In another step, epoxy was used to bond the frames to holding fixtures during lapping and polishing. NMP was used to remove the epoxy. Hot air at a temperature of 200 degrees F is now used to separate the frame from the fixture. The thermal expansion differences between the glass frame, metal fixture and epoxy causes the debonding.

In another operation, the substrate operation, pitch was used to hold the mirror substrates to mounting blocks during lapping and polishing. NMP, Bioact 280, a terpene-based solvent and small amounts of methanol and methylene chloride were used for deblocking and cleaning. Litton has substituted a thermoplastic for the pitch in the bonding operation. Acetone is currently used to dissolve most of the thermoplastic; this cleaning step is followed by a soak in an Armakleen detergent that is a certified Clean Air Solvent. Acetone was also used in the past for the cleaning.

In the prism operation, wax is used to bond the prisms to mounting blocks for lapping and polishing. A terpene product called Opticlear was used to dissolve the wax and clean the parts. This product has been replaced by Daraclean 121, a water-based cleaner.

Northrop Grumman used 10 drums of NMP per year in their process in the past. The cost of the NMP was $450 per drum. The total annual cost of the NMP was $4,500. Fourteen drums of Bioact 280 were used each year at a cost of $550 per drum. The total cost of using the Bioact was $7,700 per year. Fourteen drums of Opticlear were also used each year at a cost of $1,695 per drum. The total cost of using the Opticlear was $23,730 annually. The cost of the methylene chloride and the methanol amounted to $200 per year. The total yearly cost for purchasing the VOC solvents was $36,130.

The new operations involve the use of Daraclean 121 and an Armakleen cleaning agent. Northrop Grumman estimates that three drums of Daraclean 121 at a cost of $850 per drum will be required. Two drums of the Armakleen detergent at $105 per drum will also be required. The total cost of the two water-based cleaners amounts to $2,760 annually.

Northrop Grumman substituted thermoplastic for pitch in the bonding operation. The thermoplastic, at a cost of $12000 annually, is much more expensive than the pitch which carried a cost of about $2,000 annually.

Disposal costs for the Bioact 280 were $1,890 per year. Disposal costs of the Opticlear was also $1,890 per year. The disposal cost for the NMP was $1,350 per year. The total disposal cost for the solvents amounted to $5,130 annually.

The disposal cost for the Daraclean 121 is $405 per year. The Armakleen detergent does not have a disposal cost. Northrop Grumman is exploring whether the thermoplastic can be recycled.

Northrop Grumman estimates that the electrical cost and the labor cost remain the same with the old and new operations.

Table 2-12 shows the cost comparison for the VOC solvents and the water-based cleaners. By making the conversions to not cleaning and to water-based cleaning, Northrop Grumman reduced their emissions by about eight tons per year. They also reduced their costs by about 65 percent.

Table 2-12
Annual Cost Comparison for Northrop Grumman for Optics Cleaning

	VOC Solvents	Water-Based Cleaning
Cleaner Cost	$36,130	$2,760
Materials Cost (Thermoplastic and Pitch)	$2,000	$12,000
Disposal Cost	$5,130	$405
Total Cost	$43,260	$15,165

A stand alone case study of Northrop Grumman's conversion is provided in Appendix B.

2.2.12 Astro Pak

Astro Pak provides precision cleaning services to the aerospace, semiconductor and medical industries. The company is located in Downey, California. Astro Pak conducts precision cleaning and relies mainly on an ultrasonic water-based cleaning system for cleaning the parts. Some parts, however, are required to be cleaned by hand.

IRTA worked with Astro Pak to identify and test an alternative to isopropyl alcohol (IPA) for cleaning gauges for Boeing; these gauges are classified as scientific instruments. IRTA and Astro Pak conducted testing of several alternatives including a soy based cleaner, a water-based cleaner, acetone and a few blends of acetone and IPA. After the gauges are cleaned, Astro Pak uses non-volatile residue analysis (NVR) to determine whether the gauges are clean. The lower the NVR, the cleaner the parts.

During the testing, IPA was used as the control. The findings indicated that the parts had a lower NVR when acetone and acetone/IPA blends were used than they have with the IPA used currently. The soy based cleaner and the water-based cleaner left a residue so the NVR levels were higher.

IRTA performed the cost analysis for acetone because it was the alternative that gave the lowest NVR level. Astro Pak receives the gauges three or four times a year and each job requires the use of two to three gallons of IPA. Assuming an annual use of IPA of 10 gallons for the cleaning and assuming a cost for electronics grade IPA of $7.27 per gallon, the annual cost of cleaning the gauges with IPA amounts to $73. If acetone were used instead of IPA, Astro Pak would require 10 percent more because acetone has a higher vapor pressure than IPA. Astro Pak pays $7 per gallon for electronics grade acetone. On this basis, the annual cost for purchasing acetone for cleaning the gauges is $77.

Table 2-13 shows the cost comparison for IPA and acetone. The cost of using acetone is somewhat higher than the cost of using IPA. It is important to note, however, that the acetone cleaned better than the IPA.

Table 2-13
Annual Cost Comparison for Astro Pak for Scientific Instruments

	IPA	Acetone
Cleaner Cost	$73	$77
Total Cost	$73	$77

III. ALTERNATIVES IN COATING AND ADHESIVE APPLICATION EQUIPMENT CLEANING

SCAQMD Rule 1171 regulates solvent cleaning activities. It establishes VOC content limits for cleaners that can be used to clean coating and adhesive application equipment. Currently, the VOC limit for these cleaners in the rule is 550 grams per liter. Effective on July 1, 2005, the VOC limit for these cleaners declines to 25 grams per liter. The purpose of this project was to determine if the 25 gram per liter VOC limit was feasible for all cleaning categories for coating and adhesive application equipment.

3.1 Preliminary Laboratory Testing

At the beginning of this project, IRTA approached Graco, a spray gun supplier, and requested that the company build a spray gun cleaning system similar to the current Graco enclosed spray gun cleaning system. IRTA requested that the Graco system be modified to contain a heater. IRTA also asked Applied Cleaning Technologies (ACT), located in Anaheim, to build a very small table top heated ultrasonic system that could also be used for testing. IRTA conducted preliminary testing to determine which types of cleaners appeared appropriate for a number of different coatings and adhesives at the ACT test center. The heated Graco unit was used for most of the preliminary testing and it was also provided to certain facilities for testing alternatives during the project. The small heated ultrasonic system was used in the field testing. Graco also provided IRTA with a typical HVLP spray gun to use in the preliminary testing at the ACT test center.

Table 1-3 showed the list of companies IRTA worked with during the project. IRTA obtained samples of coatings from all of these companies in order to conduct the preliminary testing. In some cases, IRTA obtained a variety of different coatings from each of the facilities; in other cases, the company only used one coating or adhesive and IRTA obtained only these samples. IRTA also obtained other coatings from two coatings suppliers so that additional types of coatings possibly not used by the participating companies could be tested. Table 3-1 shows the list of companies that provided coatings and adhesives for the preliminary testing classified into different coating and adhesives categories. Some of the companies listed in the table participated in an EPA project that also involved testing alternative cleanup solvents and these are specified in the table.

The preliminary testing was designed to screen potential cleaners in a laboratory testing situation. The cleaners that worked best on the coatings in the laboratory testing could then be provided to the companies participating in the SCAQMD and EPA projects for testing in the field. IRTA used the spray gun cleaner and the spray gun provided by Graco to test the alternatives. IRTA tested several different water-based cleaners, soy and a soy blended with water and acetone on all of the coatings. If none of the options worked well, IRTA modified the alternatives to find one that did work effectively. Material Safety Data Sheets (MSDSs) for some of the products that were tested are provided in Appendix C.

Table 3-1
Companies Providing Coatings and Adhesives for Preliminary Testing

Company	Type of Coating/Adhesive
Hydro-Aire	Aerospace primers and topcoats
Gulfstream	Aerospace primers and topcoats
California Propeller (EPA)	Aerospace primer and topcoats
Sherwin Williams	Aerospace primers and topcoats
American Security Products	Waterborne and solventborne metal coatings
Metrex (EPA)	Marine solventborne coating
Oakwood	Wood furniture stain, sealer and topcoat
Bausman & Father (EPA)	Wood furniture waterborne and solventborne coatings
AMT	Wood furniture solventborne coatings
El Dorado	Automotive primer, basecoat and topcoat
Holmes Body Shop (EPA)	Automotive primer, basecoat and topcoat
Westway Industries, Inc. (EPA)	Automotive primer, basecoat and topcoat
PCM Leisure World (EPA and SCAQMD)	Latex and enamel architectural coatings
Murphy	Industrial maintenance solventborne architectural primer, intermediate coating and topcoat
Dampney Company, inc.	Industrial maintenance coatings
Hickory Springs	Solventborne foam fabrication adhesive
Vacco	Solventborne thin film laminating adhesive

The results of the preliminary testing are shown in Table 3-2 for categories of cleaning. When the scaled up field tests were performed, most of the results listed in Table 3-2 held up. In a few cases, as described below, the results in the field were different.

Table 3-2
Results of Preliminary Screening Tests

Category of Cleaning	Alternative(s) Selected
Aerospace coatings	acetone
Metal coatings	acetone
Wood furniture coatings	water-based cleaners, acetone
Autobody coatings	acetone, acetone/methyl acetate blend
Architectural coatings	water, water-based cleaners, soy, acetone, acetone/surfactant
Fabrication adhesive	acetone, soy
Thin film adhesive	water-based cleaner, acetone

3.2 Field Testing

For each of the companies participating in the SCAQMD or EPA project, IRTA developed a test plan for testing the alternative cleaning agents. In general, the test plans involved some initial testing at the site to determine if the findings from the preliminary laboratory testing would hold up in the field. If the tests were successful, IRTA asked the company to perform a scaled-up longer term test of the alternatives. In some cases, the companies decided to convert to the alternatives and in other cases, they did not convert. A few companies indicated they might convert to the alternative in the future.

The description of the testing and the cost analysis of the alternatives for each of the facilities is described below. IRTA generally attempted to include all the costs a company would incur in the cost comparison of the alternatives with the cleaning system that is currently used. In instances where companies did convert to an alternative, stand alone case studies that describe the conversion are presented in Appendix B.

3.2.1 Hydro-Aire

Hydro-Aire, an aerospace subcontractor, is a division of Crane located in Burbank, California. The company has 572 employees. Hydro-Aire manufactures braking systems, pumps and airlocking devices. The company also does repair work on the pumps used in military and commercial aircraft like the C-130 transport and the C-17.

Hydro-Aire applies aerospace coatings as part of their manufacturing process. Like other aerospace companies, the company uses a chromated epoxy primer and a polyurethane topcoat. Hydro-Aire also uses some specialized coatings like a fuel tank primer that is difficult to clean. MSDSs of a typical primer and topcoat used by the company are shown in Appendix A. For several years, Hydro-Aire used aero-MEK, a blend of MEK and various other solvents for cleaning their spray equipment.

IRTA conducted initial testing with Hydro-Aire. The first cleaner IRTA tried was acetone since that cleaner worked well during the preliminary screening tests for all of the aerospace coatings. The painter indicated that the initial testing at the facility showed that acetone seemed to work well on the typical primer and topcoat used by the company. IRTA and Hydro-Aire arranged for scaled up testing using the enclosed spray gun cleaner the company currently uses for cleaning. The next time the company changed out the solvent for disposal, acetone was used in place of aero-MEK. Hydro-Aire evaluated the new cleaner on all of their coatings, including the fuel tank primer, and found it effective. The company decided to convert to acetone and has been using it for almost a year. Figure 3-1 shows a picture of the enclosed spray gun cleaner at Hydro-Aire.

IRTA analyzed the cost of using acetone at Hydro-Aire and compared it to the cost of using the aero-MEK. Hydro-Aire purchased six drums of aero-MEK annually for cleaning their spray guns and for handwipe operations. About 60 gallons went toward spray gun cleaning each year. From the scaled up testing, the company estimates that it will use roughly the same amount of acetone. The company paid $4.94 per gallon for

Figure 3-1. Spray Gun Cleaning System at Hydro-Aire

aero-MEK and pays $4.25 per gallon for acetone. On this basis, the cost to the company for purchasing aero-MEK amounted to $296 annually; the cost of purchasing acetone instead amounts to $255 annually.

The SCAQMD emission fees are $345 per ton of VOC emitted. Assuming a density for aero-MEK of seven pounds per gallon, the fee for emitting 60 gallons is $72 per year. There are no fees for acetone since the chemical is exempt from VOC regulation.

The annualized cost comparison is shown in Table 3-3. The cost to the company for purchasing acetone is somewhat less than the cost for purchasing the aero-MEK. In addition, through the use of acetone, the company can avoid paying the VOC emission fees of $72 per year. Hydro-Aire reduced their costs by 31% through the conversion to acetone.

Table 3-3
Annual Cost Comparison for Spray Gun Cleaning for Hydro-Aire

	Aero-MEK	Acetone
Chemical Cost	$296	$255
Regulatory Fees	$72	-
Total Cost	$368	$255

A stand alone case study for the Hydro-Aire spray gun cleaning conversion is provided in Appendix B.

3.2.2 Gulfstream

Gulfstream, located in Long Beach, CA, manufactures and maintains private aircraft. The aircraft are painted with traditional and high VOC aerospace coatings. Gulfstream has an enclosed spray gun cleaner that is leased from a service provider. The company uses lacquer thinner for cleaning the spray equipment after applying the coatings.

In the preliminary tests IRTA conducted, acetone worked well on aerospace coatings. Even though some of the coatings applied by Gulfstream were higher VOC than traditional aerospace coatings, IRTA thought acetone might be suitable for the company. Acetone was tested in a spray gun cleaner provided by IRTA and Gulfstream personnel indicated that it performed well.

Gulfstream is currently leasing a spray gun cleaner. To convert to acetone, the company would have to purchase an enclosed spray gun cleaner. The capital cost of a spray gun cleaner is $5,000. Assuming a life for the equipment of 10 years, the annualized capital cost of the unit is $500.

The company's spray gun cleaner is maintained by the service provider. The cost of the maintenance which includes leasing the unit, the cost of the solvent, the cost of disposal and the cost of maintenance is $225 every two weeks. The annual cost of the service is $5,850. If Gulfstream converted to acetone, the company would have to maintain the spray gun cleaner. Assuming there would be 26 changeouts each year, that it would require 30 minutes to do the changeout and that the labor rate is $20 per hour, the annual cost of maintenance would be $260.

The cost of the lacquer thinner is included in the servicing cost. If the company converted to acetone, the cost of the new cleaner is $2.45 per gallon. Gulfstream would have to change the unit out twice per month. Assuming a five gallon capacity for the unit, the annual cost of the acetone would amount to $294 per year.

The current service provider includes disposal in the servicing cost. If Gulfstream converted to acetone, they would need to dispose of 120 gallons per year. Assuming a cost for hazardous waste disposal of $2 per gallon, the annual disposal cost would amount to $240.

Table 3-4 shows the cost comparison for Gulfstream. The figures indicate that the cost of using acetone is more than four times lower than the cost of using the lacquer thinner.

Table 3-4
Annual Cost Comparison for Spray Gun Cleaning for Gulfstream

	Lacquer Thinner	Acetone
Capital cost	-	$500
Service cost	$5,850	-
Maintenance cost	-	$260
Cleaner cost	-	$294
Disposal cost	-	$240
Total cost	$5,850	$1,294

3.2.3 California Propeller

California Propeller is a small aerospace subcontractor located in North Hollywood. The company purchases government surplus parts and different types of parts that have been used in the field for more than 50 years and refurbishes them. The parts include propellers and intricate governers that are used on aircraft.

The parts arrive at California Propeller and are disassembled, cleaned, inspected, reworked and painted. The company, like other aerospace firms, uses a chromated epoxy primer and a polyurethane topcoat. A spray gun is used to apply the coatings and, when it was cleaned, it was disassembled and cleaned with MEK in a bucket.

IRTA had obtained and tested samples of California Propeller's coatings during the preliminary testing at the ACT test center. During those tests, IRTA found that acetone worked well on the coatings. IRTA and the company performed scaled up testing of acetone at the facility and found that it worked well as an alternative to MEK. The company decided to convert to acetone.

California Propeller used five gallons of MEK every two months for spray gun cleaning. At a cost of $5.12 per gallon, the company was paying $154 per year for the cleaner. The same amount of acetone is now used for spray gun cleaning at a cost of $3.32 per gallon. The annual cost of purchasing acetone is $100.

Table 3-5 shows the cost comparison for California Propeller. The figures show that the company cut their costs by 35 percent by converting from MEK to acetone.

Table 3-5
Annual Cost Comparison for Spray Gun Cleaning for California Propeller

	MEK	Acetone
Cleaner Cost	$154	$100
Total Cost	$195	$100

A stand alone case study for California Propeller is presented in Appendix B.

3.2.4 American Security Products

American Security Products is located in Fontana, CA. The company makes burglary, fire protection and gun safes and is the largest security safe manufacturer in the country. As part of the manufacturing process, American Security Products paints the safes. The company uses a urethane topcoat, a polyester topcoat and primer. Four years, the manufacturer used an enclosed spray gun cleaner and lacquer thinner to clean the equipment used to spray the coatings.

American Security Products began testing acetone for cleaning their coatings that contained solvent. It worked well and the company made the conversion away from lacquer thinner four years ago. There was no additional capital equipment needed since the company could simply use acetone in the enclosed spray gun cleaner instead of lacquer thinner.

The cost of the lacquer thinner used by the company for spray gun cleaning was $5.50 per gallon. The company purchased 10 gallons a day. Assuming the company operates for 260 days per year, the total cost of the lacquer thinner amounted to $14,300.

SCAQMD emission fees for VOCs are $345 per ton. Assuming all of the lacquer thinner was emitted, American Security Products emitted 10 gallons of lacquer thinner per day or 2,600 gallons per year. Assuming a density for the solvent of seven pounds per gallon, this amounts to 18,200 pounds or 9.1 tons per year. The emissions fee was $3,140 per year.

The company uses the same amount of acetone for spray gun cleaning. The cost of the acetone is $4.50 per gallon. On this basis, the purchase price for the acetone cleaner is $11,700 annually. There are no emission fees for acetone because the chemical is exempt from VOC regulations.

Table 3-6 shows the cost comparison of the two solvents for American Security Products. The company reduced their costs for spray gun cleaning by about one-third through the conversion to acetone.

In the past, American Security Products used waterborne coatings for some of their production. The company currently uses waterborne coatings only for touch-up kits provided to the customers. When the company first adopted these coatings, they began cleaning their spray equipment with plain water. They used plain water for this purpose for several years.

Table 3-6
Annual Cost Comparison for Spray Gun Cleaning for American Security Products

	Lacquer Thinner	Acetone
Cleaner Cost	$14,300	$11,700
Regulatory Cost	$3,140	-
Total Cost	$17,440	$11,700

A stand alone case study for American Security Products is presented in Appendix B.

3.2.5 Metrex

Metrex is a small company located in Glendora, CA that has about 25 employees. The company manufactures, rebuilds and refurbishes various types of valves. Many of the valves processed by Metrex are used in a marine environment.

IRTA began work with Metrex on their spray gun cleaning as part of an EPA project. The coating Metrex applies to its cast iron valves must be highly resistant to attack by the harsh marine environment. The paint used by the company is a solventborne coating. An MSDS for the coating is shown in Appendix A.

For many years, Metrex used lacquer thinner for cleaning their spray gun. They flushed the solvent through the spray gun in a small bucket. The company has now converted to acetone for the spray gun cleaning operation. Metrex used about one-fourth of a gallon per month of lacquer thinner or three gallons per year. The cost of the lacquer thinner was $10.85 per gallon so the total cost amounted to about $33 annually. Metrex did not pay any regulatory fees for using the lacquer thinner because the emissions were very small. They now use the same amount of acetone but pay $9.16 per gallon. The total cost of using the acetone is $27 annually.

The cost comparison for Metrex is shown in Table 3-7. The use of acetone reduces the cost of the spray gun cleaning by about $6 per year.

Table 3-7
Annual Cost Comparison for Spray Gun Cleaning for Metrex

	Lacquer Thinner	Acetone
Cleaner Cost	$33	$27
Total Cost	$33	$27

A stand alone case study for Metrex is presented in Appendix B.

3.2.6 Oakwood Furniture

Oakwood is a high end furniture manufacturer with about 400 employees located in Ontario, CA that manufactures oak furniture. Figure 3-2 shows a picture of the type of furniture manufactured by Oakwood. The company has tested a variety of alternative low-VOC coatings for their manufacturing operation and is using coatings with a very low VOC content. The coatings used by the company include two stains, two sealers, a toner sealer, a clear sealer and one topcoat. Oakwood is using a waterborne topcoat that is very low in VOC. The spray equipment for this topcoat is cleaned with plain water. An MSDS for one of the stains used by Oakwood are shown in Appendix A.

Figure 3-2. Furniture Manufactured by Oakwood.

The company has a flat line for coating wood panels and the coatings applied on this line are solventborne but are also very low in VOC content. Oakwood uses an acetone based cleaner for cleaning the spray equipment on the flat line. The blend contains acetone, a glycol ether and a few different petroleum solvents. The VOC content of the cleaner is 96 grams per liter.

Oakwood cleans the automated spray equipment on the flat line once a week by hand. The company does a more thorough cleaning every three months. During the weekly cleaning, the employees clean the spray system, the metal on the conveyor and the rubber conveyor itself. A picture of the flat line coating application equipment during cleaning is shown in Figure 3-3.

IRTA obtained samples of Oakwood's solventborne coatings and conducted laboratory testing with the Graco spray gun cleaner to screen potential alternatives. Plain acetone worked well in the testing but IRTA also found that an alkaline water-based cleaner called Spray Clean 12 worked well in this application.

IRTA tested the water-based cleaner at Oakwood at various concentrations. The cleaner did not perform well at 25 percent concentration but it did perform well at about a 50 percent concentration. IRTA arranged for the company to do scaled up testing with 10 gallons of the water-based cleaner and it performed well on the metal part of the conveyor and the spray system and nozzles. It did not perform well, however, in cleaning

the coating residue from the rubber conveyor. IRTA tested plain acetone for cleaning the rubber conveyor and it worked well.

Figure 3-3. Spray Equipment Cleaning at Oakwood.

Oakwood currently uses 80 gallons per month of the acetone blend for cleaning the application equipment. At a cost of $5.25 per gallon, the total annual cost of the cleaning agent is $5,040. For the cost comparison, it was assumed that 75 percent of the cleaning (equipment cleaning) can be performed with the water-based cleaning alternative and that the remaining 25 percent (conveyor cleaning) can be performed with plain acetone. It was further assumed that the company would use 20 percent less cleaner if they converted to the water-based cleaner since it is obviously less volatile than the acetone blend. It was also assumed that the company would use about 10 percent more plain acetone than the acetone blend. On this basis, about 48 gallons of the water-based cleaner and 22 gallons of plain acetone would be required each month. The water-based

cleaner is diluted to 50 percent concentration with water and it costs about $9 per gallon for the concentrate. The annual cost of the water-based cleaner would be $2,592. Oakwood can purchase plain acetone for $4.24 per gallon. The annual cost of the acetone would amount to $1,119. The total cost of the alternative cleaners is $3,711.

Although it was not tested at Oakwood, plain acetone worked well for cleaning the Oakwood coatings during the screening tests at the ACT test center. For the cost analysis for this option, it was assumed that 10 percent more acetone would be used than the current cleaner. The use of acetone would be 1,056 gallons per year. At a cost of $4.24 per gallon, the annual cost of using plain acetone is $4,477.

Table 3-8 shows the cost comparison for the current cleaner, the water-based and acetone alternative and the plain acetone alternative. The figures show that Oakwood could reduce their costs for spray equipment cleaning by about 26 percent through the conversion to the water-based cleaner and plain acetone. The cost of using plain acetone is 11 percent lower than the cost of using the acetone blend.

Table 3-8
Annual Cost Comparison for Oakwood for Spray Equipment Cleaning

	Acetone/VOC Cleaner	Water-Based/Acetone Cleaner	Plain Acetone
Cleaner Cost	$5,040	$3,711	$4,477
Total Cost	$5,040	$3,711	$4,477

3.2.7 Bausman & Father

Bausman & Father is a very small company with only two employees including the owner. The company, located in Huntington Beach CA, strips and refinishes furniture and other wood items.

Bausman and Father uses two types of coatings: an acetone based coating and a water-based coating. For several years, the company cleaned their spray gun in a bucket after spraying the solventborne coating with lacquer thinner. A few years ago, they converted to acetone. Bausman cleaned their waterborne coating with plain water.

IRTA began working with the company on a project sponsored by EPA. As discussed in an earlier section, ACT contracted with a vendor to build a small table-top ultrasonic cleaning system that could be tested in spray gun cleaning. IRTA provided this cleaning system to Bausman. The preliminary laboratory cleaning tests performed by IRTA indicated that an alkaline water-based cleaner and acetone should both perform well on Bausman's coatings. Bausman began using the water-based cleaner, Spray Clean 12, in the small ultrasonic unit for cleaning the spray gun after spraying both the acetone and waterborne coatings. The water-based cleaner was more effective in cleaning the spray gun than the acetone. A picture of the ultrasonic unit at Bausman is shown in Figure 3-4.

Figure 3-4. Tabletop Ultrasonic Cleaning Unit at Bausman & Father.

Bausman used about one-half gallon of acetone each time the spray gun was cleaned. The company used a total of two gallons of acetone per year. At a cost of $7 per gallon, the total annual cost of the acetone was $14.

Bausman did not have to pay for the ultrasonic system but another company would have to purchase the unit. The cost of the system is about $300. Assuming a useful life for the equipment of 10 years, the annual capital cost is $30. The water-based cleaner is used at a concentration of 25 percent. Assuming a cost for the cleaner concentrate of $10 and that the cleaner is changed out twice a year, the annual cleaner cost amounts to $5. The ultrasonic unit is heated and it uses 1.2 kW of electricity. Assuming it operates for eight hours (a full day) for the four cleaning cycles per year and assuming an electricity charge of 12 cents per kWh, the annual electricity cost for operating the unit is $4.

The cost comparison for Bausman is shown in Table 3-9. The cost of using the water-based cleaner is much higher than the cost of using acetone because of the capital cost of the ultrasonic unit. Even so, the total cost of cleaning is very low.

This analysis did not include the labor cost for cleaning before and after implementing the ultrasonic cleaning system. It was assumed that the labor for cleaning the spray equipment at Bausman & Father is negligible. In other cases where much more cleaning is done, the labor savings for automating the cleaning process could offset some or all of the capital cost from purchasing the unit.

Table 3-9
Annual Cost Comparison for Bausman & Father for Spray Gun Cleaning

	Acetone	Water-Based Cleaner
Capital Cost	-	$30
Electricity Cost	-	$4
Cleaner Cost	$14	$5
Total Cost	$14	$39

A stand alone case study for Bausman & Father is presented in Appendix B.

3.2.8 El Dorado

El Dorado reworks and repairs four buses and airport shuttles per week at their facility in Ontario. The buses range from 20 to 40 feet in length. The company performs touch up painting for the buses. They clean and mask the surface and apply the paint. El Dorado uses HVLP spray guns to apply the coatings which consist of primers and topcoats.

The company currently uses an enclosed spray gun cleaner for cleaning their spray equipment. El Dorado uses a VOC solvent that meets the 550 gram per liter VOC level. IRTA provided the company with the spray gun cleaner designed by Graco and tested two alternative cleaning agents that worked well during the preliminary testing. The first

was acetone and the second was a blend of 80% acetone and 20% methyl acetate. As mentioned earlier, methyl acetate, like acetone, is exempt from VOC regulations. The company reported that the acetone/methyl acetate blend worked more effectively than the plain acetone on their equipment.

El Dorado currently uses a service provider and leases their cleaning equipment. In converting to an alternative, the company would need to purchase an enclosed spray gun cleaner. The cost of the spray gun cleaner is estimated at $5,000. Assuming a useful life of the equipment of 10 years, the annualized capital cost is $500.

El Dorado estimates that the new cleaning solvent requires more time for cleaning than the solvent used currently. Instead of one minute per cleaning job, the new solvent would require five minutes. The workers clean about four times per day and the labor rate is $10 per hour. Assuming a work schedule of 260 days per year, the current annual labor cost for cleaning is $173. The annual labor cost for cleaning with the new solvent would be $867.

The service provider currently performs maintenance on the unit and the total cost of the servicing, including waste disposal and supply of the cleaner, is $180 every six weeks or $1,560 annually. Assuming that the unit is cleaned and changed out every six weeks and that the changeout requires 30 minutes, the maintenance cost with the new solvent would amount to $43.

The service provider used by the company currently includes the cost of the solvent in the service cost. The cost of the new blend of acetone and methyl acetate is estimated at $6.20 per gallon. Assuming that the five gallons require changeout every six weeks, the annual cost of the new cleaner would be $269.

The service provider includes the cost of disposal of the solvent in the servicing cost. For the new cleaner, El Dorado would have to dispose of five gallons of solvent every six weeks. Assuming a disposal cost of $2 per gallon, the annual disposal cost would amount to $87.

Table 3-10 summarizes and compares the costs of using the current solvent and the new cleaner. The annual costs are slightly higher for the alternative cleaner than for El Dorado's current cleaner. Even though the company would need to make a capital investment in equipment, the cost of using the new zero VOC cleaner is only $33 more per year.

Table 3-10
Annual Cost Comparison for Spray Gun Cleaning for El Dorado

	Current Cleaner	Acetone/Methyl Acetate Blend
Capital Cost	-	$500
Labor Cost	$173	$867
Service Cost	$1,560	-
Maintenance Cost	-	$43
Cleaner Cost	-	$269
Disposal Cost	-	$87
Total Cost	$1,733	$1,766

3.2.9 Holmes Body Shop

Holmes Body Shop is located in Santa Monica, CA. It is one of a chain of 10 body shops located from Santa Monica in the west to Riverside in the east. Like other body shops, the company repairs cars and paints them as part of their process. Holmes uses HVLP spray guns and the guns are cleaned in an enclosed spray gun cleaning unit leased by Holmes. A picture of the spray gun cleaner is shown in Figure 3-5. A service provider also maintains the equipment, supplies the cleaning solvent and disposes of the waste. MSDSs for the coatings used by Holmes are shown in Appendix A.

During the laboratory testing phase, IRTA was not able to clean the spray gun contaminated with Holmes' coatings effectively with plain acetone. IRTA was able to clean the coatings with a blend of 80 percent acetone and 20 percent methyl acetate. Because plain acetone worked effectively on Westway's coatings (see below), IRTA provided five gallons of acetone and five gallons of the acetone/methyl acetate blend to Holmes for scaled up testing. The plain acetone did not work for Holmes but the acetone/methyl acetate blend did work well.

Figure 3-5. Spray Gun Cleaning System at Holmes.

If Holmes converted to the acetone/methyl acetate blend, the company would have to purchase an enclosed spray gun cleaning unit. Such units cost about $5,000. Assuming a ten year useful life for the equipment, the annual cost of the unit would be $500.

Currently, Holmes' service provider does the maintenance on the leased spray gun cleaner. The servicing cost, which includes maintenance, the cost of leasing the unit, the cost of the solvent, the changeout cost and the disposal cost, amounts to $2,290 annually. If the company converted to the new blend, the workers would have to devote about 30 minutes to changeout of the cleaner. Currently the cleaner is changed out once a month. Assuming the new blend would also have to be changed out once a month and assuming a labor cost of $10 per hour, the maintenance/changeout cost would be $60 per year.

The cost of the cleaner is currently included in the total service cost. If Holmes converted to the new blend, the cost of the cleaner would be $6.20 per gallon. The annual cleaner cost would amount to $372.

The disposal cost is currently included in the servicing cost. If Holmes converted to the new cleaner, the company would have to dispose of 60 gallons of hazardous waste each year. Assuming a disposal cost of $2 per gallon, the annual disposal cost would amount to $120 per year.

Table 3-11 shows the costs for the current and new cleaner for Holmes. The figures show that the cost of using the new cleaner are less than half the cost of using the current cleaner.

Table 3-11
Annual Cost Comparison for Spray Gun Cleaning for Holmes Body Shop

	Current Cleaner	Acetone/Methyl Acetate Blend
Capital Cost	-	$500
Service Cost	$2,290	-
Maintenance Cost	-	$60
Cleaner Cost	-	$372
Disposal Cost	-	$120
Total Cost	$2,290	$1,052

3.2.10 Westway Industries, Inc.

Westway is a small body shop located in Santa Monica, CA. The company repairs cars and, as part of that activity, they paint them. Westway uses an enclosed spray gun cleaner that belongs to the facility to clean the HVLP spray guns that are used to apply the coatings. A picture of this spray gun cleaner is shown in Figure 3-6. The cleaner used by the company is lacquer thinner.

IRTA performed preliminary testing on Westway's coatings. The results indicated that the coatings could be cleaned with acetone or an 80 percent acetone/20 percent methyl acetate blend. IRTA tested acetone at the shop because it was likely to be less costly than the acetone/methyl acetate blend. The workers at Westway used the acetone for a few months and indicated that it was effective in cleaning the spray gun.

To make the conversion to acetone, the company could use the new cleaner in their spray gun cleaner so no capital investment in equipment would be required. Westway uses about five gallons of lacquer thinner each quarter. At a cost of $5.20 per gallon, the total annual cost for purchasing the lacquer thinner is $104. The cost of acetone is $4.50 per gallon. Assuming the same amount of acetone could be used, the annual cost of the acetone would be $90. Disposal costs for the 20 gallons of spent acetone or spent lacquer thinner would amount to $40 annually.

Table 3-12 shows the cost comparison of the cleanup solvents for Westway. The cost of cleaning with acetone is about 10 percent less than the cost of cleaning with lacquer thinner.

Figure 3-6. Spray Gun Cleaning System at Westway.

Table 3-12
Annual Cost Comparison for Spray Gun Cleaning for Westway Industries, Inc.

	Lacquer Thinner	Acetone
Cleaner Cost	$104	$90
Disposal Cost	$40	$40
Total Cost	$144	$130

3.2.11. PCM Leisure World

Professional Community Management or PCM is the management company that provides the painting service to Leisure World, a retirement community where some 22,000 people live in condominiums, apartments and houses. PCM has three separate paint crews with 60 employees that repaint the buildings every seven years or so.

PCM uses latex paint for the buildings and an enamel coating for painting the front doors, windows, doorframes, railings and other metal hardware. PCM currently cleans the equipment used to apply the latex paints with a hose and plain water. The company uses lacquer thinner for cleaning the spray equipment that is used to apply the enamel coating. The spent lacquer thinner is reclaimed in a still and reused for cleaning.

During the preliminary testing, IRTA found that two low or zero VOC cleaners seemed promising for PCM. The first was a soy based cleaner called Soy Gold 1000 and the second was acetone. IRTA provided 10 gallons each of the soy based cleaner and acetone to one of the paint crews for scaled up testing. Both cleaners were capable of cleaning the application equipment but the soy cleaner took much longer.

The paint crew indicated that there was no difference in the labor required for cleaning with the lacquer thinner and the acetone. They indicated that it would take twice the amount of time to clean the equipment with soy than it would with the lacquer thinner. The painters spend about 30 minutes per day cleaning. The labor rate is $10 per hour for the 60 painters. On this basis, assuming a 260 day year, the current labor cost and the labor cost for cleaning with acetone are $78,000 per year. The labor cost for cleaning with the soy would be twice as much or $156,000.

PCM purchases one 55 gallon drum of lacquer thinner per month at $4.09 per gallon. The annual cost of the cleaner amounts to $2,699. The company would use 10 percent more acetone because it is used in the open and because less would be recovered in the still (see below). Assuming a cost of acetone of $4.24 per gallon, the annual cost of acetone would be $3,078. PCM would probably use 20 percent less soy but the company would not be able to use their still to recover the material. PCM currently recovers approximately 22 gallons of lacquer thinner from their still each month. The soy use would be 62 gallons per month. At $6 per gallon, the cost of purchasing the soy for equipment cleaning would be $4,464 per year.

The solvent still uses 5 kW per hour and is operated once a week for five hours. Assuming an electricity cost of 12 cents per kW, the annual electricity cost is $156. The cost would be lower or the same if the company used acetone and there would be no electricity cost for soy since the still cannot handle materials with high boiling points. Note that the still is used to reclaim 22 gallons of solvent. It would be less costly to purchase virgin solvent instead of using the still.

PCM currently disposes of one 55 gallon drum of hazardous waste each month at a cost of $110 per drum. The annual disposal cost amounts to $1,320. The cost for disposal of the spent acetone would be the same. More soy waste, some 62 gallons, would require disposal. Assuming the soy disposal cost is $110 per drum, the cost for disposal of the soy is $1,488 per year. The spent soy might cost less to dispose of than the other two cleaners because it might not be classified as hazardous waste. To be conservative, however, IRTA has assumed the soy would be classified as hazardous waste.

Table 3-13 shows the cost comparison for the lacquer thinner and the two alternative cleanup solvents. The total annual cost of converting to acetone is roughly the same as the current cost of using lacquer thinner. Because the labor cost increases dramatically with the use of soy, conversion to this cleaner would approximately double the cost of cleaning.

Table 3-13
Annual Cost Comparison for Spray Gun Cleaning for PCM

	Lacquer Thinner	Acetone	Soy
Labor Cost	$78,000	$78,000	$156,000
Cleaner Cost	$2,700	$3,078	$4,464
Electricity Cost	$156	$156	-
Disposal Cost	$1,320	$1,320	$1,488
Total Cost	$82,176	$82,554	$161,952

3.2.12. Murphy Industrial Coatings, Inc.

Murphy Industrial Coatings is a contractor, located in Signal Hill, that applies industrial coatings to substrates that experience harsh environments. The company provides coating services to facilities like publicly owned treatment works (POTWs) and chemical plants. The company uses industrial maintenance coatings and MSDSs for typical coatings used by Murphy are provided in Appendix A.

IRTA worked with Murphy at one of their POTW sites. The coating system is composed of three coatings including a zinc primer, an epoxy intermediate and a urethane topcoat. All of the coatings, particularly the primer, have a high solids content. For parts that are submerged, like pipes for example, the urethane topcoat is not used.

Murphy uses traditional airless architectural application equipment for applying the coatings. A picture of the equipment is shown in Figure 3-7. When the workers are finished applying the coating, they clean the spray equipment. They use a five gallon bucket containing 2.5 gallons of a cleaner which is flushed through the system. The cleaner used by the company currently is a blend of MEK, xylene and butyl alcohol.

IRTA collected samples of Murphy's coatings for preliminary testing. Acetone seemed to work well in a laboratory situation. IRTA provided acetone to Murphy for testing and, although it eventually cleaned the equipment, it took much too long. IRTA then provided a blend of 80 percent acetone and 20 percent methyl acetate to the company. This blend, like the plain acetone, took much too long to clean. IRTA worked with a formulator to develop a blend of about 95 percent acetone and five percent of a surfactant called dodecylbenzenesulfonic acid. According to the painter, this blend worked very well and was even more effective than the current cleaner on the zinc primer. The surfactant contained about 1.5 percent sulfuric acid, a material used to produce the surfactant.

Figure 3-7. Spray Gun Cleaning Equipment at Murphy.

Sulfuric acid is classified as a toxic so IRTA asked the formulator if there were a way to eliminate it. The formulator made a new blend of a salt of the surfactant and acetone that did not contain even a trace quantity of sulfuric acid. IRTA provided the new blend to Murphy and the painter and the supervisor reported that it worked well in the cleaning. IRTA then gave Murphy 10 gallons of the blend to test and the painter indicated to IRTA that it worked well but that it gelled up after use.

Murphy commonly reuses the cleaner twice before disposing of it. This generally means the cleaner is used two days for the cleaning. The fact that the cleaner gelled meant that it could not be reused the second day. IRTA does not know why the cleaner gelled. One possible explanation is that the cover was left off the container and the acetone selectively evaporated leaving solids. The painter did not report that the formulation used before this one gelled and the formulator could perform additional work on the blend to make sure it does not gel.

IRTA met with Murphy's owner and discussed the results of the testing. The owner talked to the painter and supervisor and indicated that he was told that the cleaners that were tested did not work. The owner indicated that additional testing would be required to make a final determination on the effectiveness of the cleaner.

Murphy indicated that the cost of the cleaner currently used by the company is $3.50 per gallon. This is a very low cost for the blend and other users would not be able to obtain the cleaner at that price. For purposes of analysis, IRTA assumed that the blend was 40 percent MEK, 40 percent xylene and 20 percent butyl alcohol. One formulator indicates that the cost of this blend would amount to $7 to $9 per gallon. Murphy uses five gallons of cleanup solvent per week. The cost of the cleaner to Murphy is $910 per year. The cost to other users, assuming the cleaner costs $8 per gallon, would be $2,080.

The cost of the alternative acetone/surfactant blend is $5.90 per gallon. IRTA analyzed two scenarios for the acetone/surfactant blend. Assuming that the cleaner can only be used once because it gels, 10 gallons of the cleaner would be required each week for an annual cleaner cost of $3,068. If the first acetone/surfactant blend were used and it didn't gel after use, only five gallons of the cleaner would be used each week. Under this scenario, the annual cost of the cleaner would be $1,534.

Murphy currently generates about five gallons per week of spent cleaner. Assuming a disposal cost of $2 per gallon, the annual disposal fee is $520. If Murphy converted to the acetone blend that gels, the annual disposal cost would amount to $1,040. If Murphy converted to the acetone blend that does not gel, the annual disposal cost would be $520.

Table 3-14 shows the cost comparison for Murphy. The first column gives the costs for Murphy at the below market cost of the cleaning solvent. The second column gives the costs for another user who purchases the cleaner at the market price. The third column shows the costs for the alternative cleaner assuming it gels after use. The fourth column gives the costs for the alternative cleaner assuming it does not gel and can be used twice. The figures indicate that the lowest cost option is the cleaner used by Murphy today because of the low cost of the solvent. Other users that would pay the market price would find it more cost effective to use the alternative cleaning agent if it did not gel after use.

Table 3-14
Annual Cost Comparison for Spray Equipment Cleaning for Murphy

	Current VOC Cleaner (low price)	Current VOC Cleaner (market price)	Acetone Blend (gels)	Acetone Blend (doesn't gel)
Cleaner Cost	$910	$2,080	$3,068	$1,534
Disposal Cost	$520	$520	$1,040	$520
Total Cost	$1,430	$2,600	$4,108	$2,054

3.2.13. Hickory Springs

Hickory Springs is a flexible slabstock foam producer located in Commerce, CA. The company also fabricates foam. This process involves applying adhesive to two pieces of foam and bonding them together. The foam is used to manufacture furniture.

Hickory Springs uses an acetone based adhesive to bond the foam in the fabrication operation. An MSDS for a typical acetone based adhesive is shown in Appendix A and a picture of the booth where the adhesive is applied is shown in Figure 3-8. The company uses a spray gun to apply the adhesive and the spray gun was cleaned with lacquer thinner when IRTA began work with the company.

IRTA obtained a sample of Hickory Springs' adhesive and conducted preliminary testing at the ACT test facility. The preliminary testing indicated that both acetone and a soy based product called Soy Gold 2000 worked well for cleaning the adhesive. IRTA took both acetone and soy to the facility and conducted testing on the spray gun. Plant personnel indicated that acetone worked much more effectively than the lacquer thinner for cleaning the spray gun. A blend of 20 percent soy/80 percent water also worked as well as the lacquer thinner for cleaning the spray gun.

Figure 3-8. Adhesive Spray Booth at Hickory Springs.

Hickory Springs decided to convert from lacquer thinner to WD-40 for cleaning their spray guns. The VOC content of WD-40 is probably very high but the company that makes the product was not able to provide the figure. Because IRTA believes the VOC

content is much higher than 25 grams per liter, IRTA did not consider this option to meet the 2005 target VOC limit.

Hickory Springs used about one gallon per year of lacquer thinner to clean their spray gun. At a cost of $8 per gallon, the annual cost of spray gun cleaning was $8. The cost of WD-40 is $13 per gallon and, assuming that one gallon of WD-40 is also used, the annual cost of spray gun cleaning is $13. Assuming Hickory Springs would also use one gallon of acetone per year and a cost of $7 per gallon, the annual cost of acetone would be $7. The cost of soy is about $6 per gallon. Assuming a use of one gallon for the soy/water blend, the annual cost of cleaning with this cleaner would be $1.20.

Table 3-15 provides the cost comparison for the alternatives for Hickory Springs. The cost of cleaning for Hickory Springs is minimal. The lowest cost option is the soy/water blend.

Table 3-15
Annual Cost Comparison for Spray Gun Cleaning for Hickory Springs

	Lacquer Thinner	WD-40	Acetone	Soy/Water Blend
Cleaner Cost	$8	$13	$7	$1.20
Total Cost	$8	$13	$7	$1.20

3.2.14. VACCO Industries, Inc.

VACCO is a diversified manufacturer of commercial and defense products and systems sold to customers worldwide. Located in South El Monte, the company manufactures engineered fluid controls for aerospace, does precision photochemical etching for photofabrication and manufactures valves, filters and manifolds for Quiet and Non-Quiet applications for the Navy.

One of the photofabrication operations involves the manufacture of laminated bonded-core assemblies with thin metal sheets. An adhesive is used to bond the thin metal laminates and an MSDS for this adhesive is shown in Appendix A. This adhesive is used because it doesn't interfere with the magnetic nature of the thin metal foil and it also provides dampening to the thin plastic sheets when it is used for plastic lay-ups. The solventborne adhesive is based on tetrahydrofuran (THF). A spray gun is used to apply the adhesive and the cleaner that is used to clean the HVLP gun after spraying is THF, the same solvent that is used as the carrier in the adhesive.

IRTA tested two alternatives at VACCO for cleaning the spray equipment. One of these was a water-based cleaner and the other was acetone. These cleaners seemed to work well in the preliminary testing. In both cases, however, the cleaners caused the adhesive residue to form a thick gel inside the spray gun. In subsequent testing, IRTA also determined that the gel was formed even when plain water was added to the adhesive. IRTA discussed the problem with 3M, the adhesive manufacturer. 3M indicated that the

adhesive was in a delicate balance and could not offer advice on which low VOC cleaners might be able to clean up the adhesive.

Rule 1168, the District rule that regulates adhesives, provides an exemption from VOC limits for the thin metal laminating operation. In addition to VACCO, one other company in the Basin performs this type of operation using the same adhesive. The manufacturer of the adhesive, 3M, did not want to undertake an R&D effort to formulate a new adhesive with lower VOC content for only two companies in the Basin. During IRTA's current project, IRTA approached 3M again to discuss reformulating the adhesive so a low-VOC cleaning alternative could be used for the spray equipment cleaning. 3M indicated that they do not intend to reformulate the adhesive so that cleanup would be easier.

Until and unless the adhesive is reformulated without the THF, IRTA does not know of an alternative low-VOC cleaner that would effectively clean the adhesive spray equipment. Thus, IRTA did not analyze and compare the cost of any alternatives.

IV. ALTERNATIVES IN SCREEN PRINTING APPLICATION EQUIPMENT CLEANING

SCAQMD Rule 1171 regulates solvent cleaning activities and, as part of that, it establishes limits for cleaners that can be used to clean ink application equipment. The rule lists several different categories under "Cleaning of Ink Application Equipment." During this project, IRTA focused on cleaners used in two of the categories. Currently, the VOC limit for cleaners in the "Screen Printing" category is 750 grams per liter. Effective on July 1, 2005, the VOC limit for these cleaners declines to 100 grams per liter. Rule 1171 also specifies a VOC limit for the "Ultraviolet Ink/Electron Beam Ink Application Equipment (except Screen Printing)" category. The current limit is 800 grams per liter; effective July 1, 2005, this limit declines to 100 grams per liter. IRTA did not focus on this area because the District is conducting another project designed to address cleaning alternatives in lithographic printing. IRTA did test alternatives in the current study for UV screen printing. The rule also regulates the "Specialty Flexographic Printing" category. The current VOC limit for cleaners in this category is 600 grams per liter. Like the other two categories, this limit declines to 100 grams per liter in 2005. Originally, the project plan also covered UV light cleaning but there is now a consensus that cleaners for the lights will have no difficulty meeting the 100 gram per liter VOC level.

4.1. Preliminary Laboratory Testing

Table 1-4 showed the list of companies IRTA worked with during the project. IRTA obtained samples of inks from all of these companies in order to conduct preliminary screening tests. In a few cases, IRTA obtained samples for several ink types from certain companies. In other cases, where the company only used one type of ink, IRTA obtained a sample of only that ink. In addition, IRTA performed screening tests at two ink suppliers' facilities on several typical inks used in the screen printing industry so additional inks could be tested. Finally the Screen Printing and Graphic Imaging Association (SGIA) and 3M also provided a variety of inks for screening tests. Table 4-1 shows the list of companies and organizations that provided inks for the preliminary testing. Again, a few of the companies listed in the table participated in an EPA project that also involved testing alternative cleanup solvents.

The preliminary testing was designed to screen potential cleaners in a laboratory testing situation. IRTA was given two screens by one of the companies and these were used in the testing. In general, IRTA tested cleaners on the inks provided by the companies. In the screening testing, IRTA found that water-based cleaners and soy based materials worked well for cleaning the plastisol textile ink. For UV curable inks, the soy based cleaners seemed to work well in general. Acetone worked well for many inks including the difficult to remove solventborne inks.

Table 4-1
Companies Providing Inks for Preliminary Testing

Company/Organization	Type of Ink
Teledyne Electronics	Solventborne dielectric ink
Owens Illinois	UV curable ink for plastics
Southern California Screen Printing	UV curable ink for banners
Nelson Nameplate	Solventborne metal ink
	UV curable metal ink
City of Santa Monica Print Shop (EPA)	Solventborne paper/metal inks
Stith	Plastisol textile ink
Quickdraw (EPA)	Plastisol textile ink
Melmarc	Plastisol textile ink
Total Enterprises	Plastisol textile ink
Huhtamaki	Waterborne flexographic ink
Nazdar	Various
TW Graphics Group	Various
3M	UV curable inks
SGIA	Various

4.2 Field Testing

For each of the companies participating in the SCAQMD or EPA project, IRTA developed a test plan for testing the alternative cleaning agents. In general, the test plans involved some initial testing at the site to determine if the findings from the preliminary laboratory testing would hold up in the field. If the tests were successful, IRTA asked the company to perform a scaled-up longer term test of the alternatives. In some cases, the companies decided to convert to the alternatives and, in other cases, they did not convert. A few companies indicated they might convert to an alternative in the future.

The description of the testing and the cost analysis of the alternatives for each of the facilities is described below. IRTA generally attempted to include all the costs a company would incur in the cost comparison of the alternatives with the cleaning system that is currently used. In instances where companies did convert to an alternative, stand alone case studies that describe the conversion are presented in Appendix B.

4.2.1 Teledyne Microelectronic Technologies

Teledyne is an aerospace subcontractor located in Marina del Rey, California. The company manufactures hybrid circuits and uses conductive and dielectric ink to screen print the circuits on ceramic substrates. The screens used by Teledyne are stainless steel metal mesh.

Teledyne used isopropyl alcohol (IPA) for cleaning the screens when IRTA began working with the company. The workers clean the screen during a printing run and after the printing run is finished. The screens are cleaned with a sponge. After the cleaning at

the end of a run, the worker checks the screens under a microscope to determine if the screen is clean.

IRTA obtained ink samples and a typical screen from Teledyne and conducted preliminary screening testing. The results indicated that both acetone and soy based cleaners effectively cleaned the ink. Testing at the facility was needed to see if there were other effects.

IRTA tested soy based cleaners, diluted soy based cleaners and acetone at Teledyne. The soy based cleaners did not completely clean the ink from the screens even when the soy was diluted. IRTA tested a blend of soy and acetone and, although the blend cleaned the screens, it left a residue that was unacceptable. The company tested acetone and it cleaned faster and more thoroughly than the IPA. The results indicated that acetone was the best option. The company believes that it did leave a slight residue, however.

Teledyne decided not to convert to acetone until the regulation requiring 100 grams per liter VOC content cleaners becomes effective. In the meantime, the company is using a blend of 63 percent IPA and 37 percent acetone that contains less than 500 grams per liter VOC.

Teledyne used about 100 gallons per year of IPA. Teledyne staff indicate that the company uses about the same amount of the IPA/acetone blend. If the company converted to plain acetone, use might increase because of the higher vapor pressure of acetone. For purposes of analysis, it was assumed that 10 percent more acetone would be required. Teledyne pays $6 per gallon for both IPA and acetone. The cost for purchasing IPA amounts to $600 per year. The cost for purchasing acetone would amount to $660 annually.

The workers indicated that the acetone was more effective and faster in cleaning the ink than IPA but had a stronger odor. Although labor costs might be reduced to some extent if Teledyne were to adopt acetone, the analysis assumed that the labor costs were the same.

Teledyne currently pays emission fees for the IPA used in cleanup. The company emits 100 gallons of IPA annually. Assuming a density for IPA of seven pounds per gallon, the company emits about 0.35 tons of IPA per year. SCAQMD charges $345 per ton so the annual emissions fee paid by Teledyne for the IPA amounts to $121. Since acetone is exempt from VOC regulations, use of the chemical would not lead to emission fees.

Table 4-2 shows the cost comparison for the IPA and the acetone. Even though more acetone would be required, the cost of using acetone is about nine percent lower than the cost of using IPA.

Table 4-2
Annual Cost Comparison for Teledyne for Screen Printing

	IPA	Acetone
Cleaner Cost	$600	$660
Emission Fees	$121	-
Total Cost	$721	$660

4.2.2 Owens Illinois

Owens Illinois is located in La Mirada, California. The company manufactures plastic cosmetic bottles and prints on them. The screen printing process is automated and it uses a UV curable ink. A picture of the process is shown in Figure 4-1.

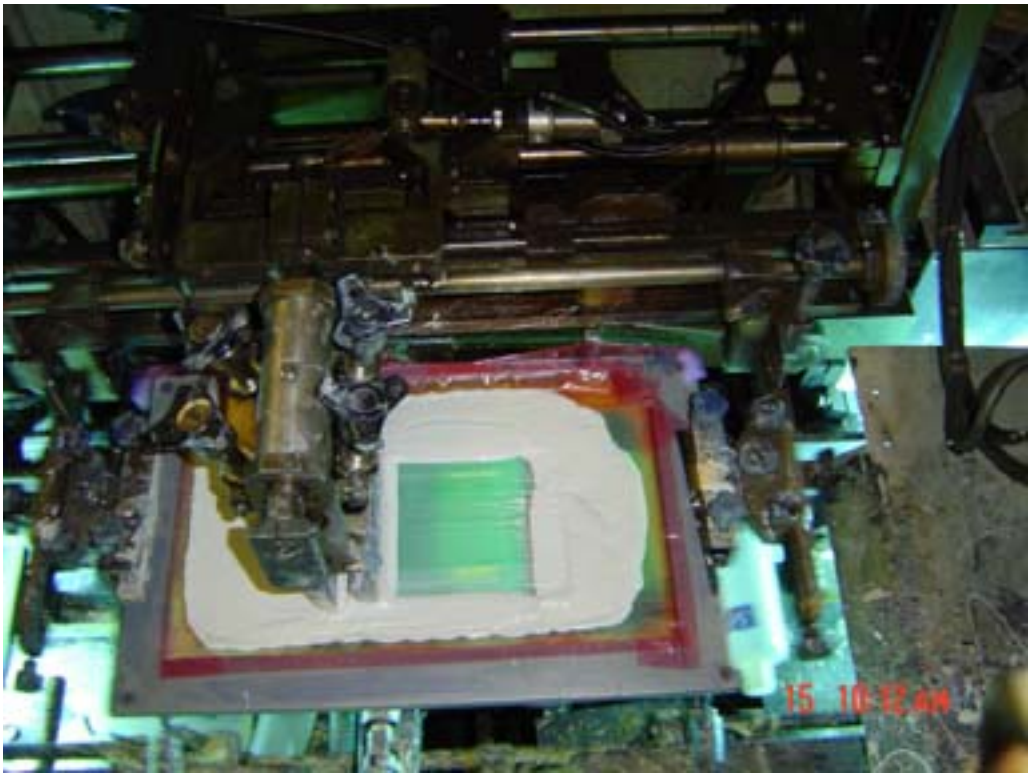

Figure 4-1. Screen Printing Operation at Owens Illinois.

Owens Illinois uses a VOC solvent for cleaning currently. Ink is cleaned from the screens with rags containing the VOC solvent at the end of a printing run. The cleaning solvent is also used to clean the bottom of the screens periodically during the printing run.

IRTA's screening testing indicated that soy based cleaners were effective in cleaning the company's ink. IRTA performed preliminary testing on some of the screens and on the in-process cleaning with soy based materials. Two of these high soy content materials, Soy Gold 2000 and Seibert Autowash #3, worked very well on the ink. IRTA selected

one of the soy products, Soy Gold 2000, which is water rinseable, for the scaled-up testing. IRTA provided five gallons of the cleaner to the facility and they used it for their cleaning. The results indicated that the cleaner performed very well for the in-process cleaning and at the end of the process. Some of the workers indicated that they liked it better than the current cleaner.

The only cost element that changed during the scaled-up testing was the cost of the cleaning agent. Owens Illinois currently uses 15 gallons per week of solvent and the cost of the current solvent is $13 per gallon. The annual cost for solvent purchases amounts to $10,140. The company would use the same amount of the soy cleaner but its cost is lower, at $6 per gallon. The annual cost for soy purchases would amount to $4,680.

Table 4-3 shows the cost comparison for Owens Illinois. The cost of using the soy based material is less than half the cost of using the current solvent.

Table 4-3
Annual Cost Comparison for Owens Illinois for Screen Printing

	Current VOC Cleaner	Soy Cleaner
Cleaner Cost	$10,140	$4,680
Total Cost	$10,140	$4,680

4.2.3 Southern California Screen Printing

Southern California Screen Printing (SCSP) is located in Fontana, California. The company performs screen printing services for the movie and advertising industries. SCSP uses UV curable ink for all of their operations. The screens used by the company are very large, perhaps 15 feet long and seven feet high. A picture of one of the screens is shown in Figure 4-2.

At the end of the screen printing process, SCSP must remove the ink from the screens. Currently the company has a bay where the ink removal occurs. The VOC cleaner is applied using a pump with a brush on the end for scrubbing the screens. The cleaner is applied to only one side of the screen except in the case of black ink. When black ink is used, both sides of the screen must be cleaned of ink. After the ink is cleaned, the stencil on the screen is removed and rinsed. The ghost image on the screen is then removed, the screen is rinsed again and, finally, is vacuum dried.

IRTA conducted screening laboratory testing on SCSP's ink and found several alternatives that might be suitable. IRTA did preliminary testing by hand cleaning screens at SCSP. The results of this testing indicated that only one cleaner, Seibert Autowash #3, was effective in cleaning the ink. This cleaner is a blend of soy methyl esters and a surfactant. An MSDS for the cleaner is provided in Appendix C.

Figure 4-2. Screen and Cleaning System at Southern California Screen Printing.

IRTA arranged for scaled-up testing at SCSP. Ten gallons were tested in the operation. The cleaner performed fairly well but more labor was required. All ink colors required the screens to be cleaned on both sides.

IRTA analyzed the costs of the alternative and compared them to the costs of the current cleaner. SCSP has one worker who spends seven hours per day cleaning screens. The worker's labor rate is $20 per hour. Assuming there are 260 working days per year, the annual labor cost for the cleaning process amounts to $36,400.

SCSP provided estimates of the labor breakdown for the cleaning process. The worker spends 20 percent of his time on ink removal, 20 percent of his time on stencil removal and rinsing, 20 percent of his time on ghost image removal, 13 percent of his time on final rinsing and seven percent of his time on the vacuum dry operation. For the cost analysis, it was assumed that the worker would spend twice the time when the alternative cleaner was used on the ink removal part of his job. On this basis, use of the alternative would add 1.4 hours of work per day to the cleaning process. The annual labor cost would amount to $43,680.

SCSP uses 110 gallons per month of solvent and the cost of the solvent is $11.53 per gallon. The annual solvent usage is 1,320 gallons and the annual cost of solvent purchases is $15,220. The cost of the alternative is estimated by the supplier at $7 per gallon. Assuming the volume of the cleaner would not change, the annual cleaner purchases for the alternative would amount to $9,240.

SCSP emits 1,320 gallons of VOC per year in the cleaning process. Assuming a density of seven pounds per gallon for the current cleaner, the company emits 4.62 tons of VOC per year. The SCAQMD fee for VOC emissions is $345 per ton. On this basis, SCSP's current annual emission fee is $1,594. The Seibert Autowash has minimal VOC content so it is assumed that emission fees will be negligible.

Table 4-4 shows the cost comparison for the current cleaner used by SCSP and the Autowash alternative. The figures show that the cost of using the alternative low-VOC cleaner and the current VOC cleaner are comparable. Although the labor cost is higher for the alternative, it is lower in overall cost than the current cleaner.

Table 4-4
Annual Cost Comparison for Southern California Screen Printing

	Current VOC Cleaner	Autowash #3
Labor Cost	$36,400	$43,680
Cleaner Cost	$15,220	$9,240
Emission Fees	$1,594	-
Total Cost	$53,214	$52,920

At the time of this writing, SCSP is investigating an alternative cleaner that they plan to adopt shortly. It is an acidic cleaner and the vendor indicates that it has a VOC content of 30 grams per liter. Because the testing is not yet complete, more information on and analysis of this alternative cleaner is not available at this time.

4.2.4 Nelson Nameplate

Nelson Nameplate is a company with about 270 employees located in Los Angeles. The company manufactures nameplates and part of the operation includes screen printing for the nameplates. Nelson uses a very durable solventborne ink which is difficult to clean. An MSDS for this ink is shown in Appendix A. Figure 4-3 shows a picture of Nelson's screen printing operation.

Nelson uses a blend of acetone and a VOC solvent for their in-process cleaning of the screens. The formulation is about half acetone. IRTA performed preliminary testing with Nelson's inks and found that acetone was an effective cleaner. At Nelson, IRTA and Nelson performed initial testing and found that acetone alone was not a suitable cleaner. The problem was that acetone, because of its high vapor pressure, evaporated very quickly "freezing" the ink on the screens. IRTA blended a new formulation containing 92 per cent acetone and eight percent of a propylene glycol ether which slowed down the evaporation of the acetone enough to prevent the "freezing." This formulation cleaned the ink effectively. An MSDS for the glycol ether in the blend is shown in Appendix C.

The high acetone content cleaner removed the emulsion from Nelson's screens. IRTA identified another emulsion that did not have this problem. Testing at Nelson verified

that the alternative emulsion could be used with the high acetone content alternative cleaner.

Both plain water and the acetone blend cleaned Nelson's UV curable ink. The company wanted one cleaner for the UV curable and solventborne inks.

Figure 4-3. Screen Printing at Nelson Nameplate.

Nelson currently uses 110 gallons per month of their press wash. The cost of the current cleaner is $10.60 per gallon. On this basis, the annual cost of purchasing the cleaning solvent is $13,992. The Nelson workers indicated they would use about twice as much of the alternative cleaner based on 92 percent acetone and eight percent glycol ether because it evaporates more quickly. The price of the alternative cleaner based on purchases of drum quantities is $4.40 per gallon. Assuming Nelson would require 220 gallons per month of the new cleaner, the annual cost of purchasing the new cleaner would amount to $11,616.

Table 4-5 shows the cost comparison for the current and new cleaner. The yearly cost of using the alternative cleaner is 17 percent lower even though more would be used.

Table 4-5
Annual Cost Comparisons for Nelson for Screen Printing

	Current Cleaner	Acetone/Glycol Ether Blend
Cleaner Cost	$13,992	$11,616
Total Cost	$13,992	$11,616

4.2.5 City of Santa Monica Paint Shop

The City of Santa Monica Paint Shop provides painting and screen printing services for the City of Santa Monica. The shop prints on paper, cardboard, plastics and metals. The City uses an enamel air dry ink on metal signs. For some of the traffic signs, the City uses several other inks including a translucent reflective traffic sign ink.

IRTA began work with the City of Santa Monica on a project sponsored by EPA. The City uses a commercial cleaning agent for removing the inks and sometimes follows with MEK. The cleaner is applied to the screens by hand. IRTA performed preliminary laboratory testing and found that one water-based cleaner called Mirachem Pressroom Cleaner, a soy based cleaner called Soy Gold 2000, acetone and a blend of 92 percent acetone and eight percent glycol ether removed the enamel ink but that only acetone based cleaners removed the other inks. IRTA performed scaled-up testing with the company and found the same results.

Over the last several months, the City has been using plain acetone for cleaning the non-enamel inks. One problem with the acetone is that it tends to remove the stencil the shop uses for these types of inks. If the acetone is removed immediately, however, the stencil is not damaged.

The City has not had any enamel ink applications over the last few months but has a choice of acetone or soy based products for removing these inks.

IRTA analyzed the costs to the City for using the current cleaner and acetone on the non-enamel ink. The City purchases eight gallons per year of cleaning solvent at a cost of $14 per gallon. The total annual cost of the cleaner amounts to $112. The use of acetone is estimated to be the same. Assuming a cost of acetone of $7 per gallon, the annual cost of using the acetone cleaner would be $56.

Table 4-6 shows the cost comparison for the City. The cost of using acetone for removing the inks is half the cost of using the current cleaner.

Table 4-6
Annual Cost Comparison for City of Santa Monica for Screen Printing

	Current Cleaner	Acetone
Cleaner Cost	$112	$56
Total Cost	$112	$56

4.2.6 Stith

Stith is a small textile screen printing company located in Santa Fe Springs. The company applies an emulsion to the screen which is exposed to form a stencil, prints primarily on T-shirts and then cleans the ink from the screens using a parts cleaner containing mineral spirits. The screens are then rinsed and the stencil is removed in some cases. In other cases, the stencil is saved for future printing for the same customer.

IRTA performed laboratory screening testing of several alternatives on Stith's ink. The company uses traditional plastisol textile printing ink. Acetone, one water-based cleaner and various soy products worked well. IRTA took these alternatives to Stith and performed preliminary testing by using rags with the alternatives to hand clean the screens. All of the alternatives worked well.

IRTA provided Stith with a parts cleaner containing a water-based cleaner called Mirachem Pressroom Cleaner at about a one-third concentration. An MSDS for this cleaner is provided in Appendix C. Stith tested the cleaner but it removed their stencil and blockout. Although there are emulsions that are both solvent and water resistant, Stith did not want to change their emulsion for the testing. At that stage, IRTA provided a parts cleaner containing a soy based cleaner called Soy Gold 2000 to Stith. An MSDS for this soy based material is provided in Appendix C.

Stith found that the soy based material cleaned the ink but, because the cleaner has a lower vapor pressure than their current cleaner, they would have to have an extra rinse step. Stith also found that use of the soy cleaner led to pinhole damage in the stencils and they had to be repaired.

Stith already has a parts cleaner and could use the soy product in that unit. Thus, no capital investment in equipment would be required to convert to the soy alternative.

Stith has one employee who spends four to six hours per day cleaning screens. The labor rate for this worker is $10 per hour. The annual labor cost for cleaning, assuming the worker spends five hours a day cleaning for 260 days per year is $13,000. If the company converted to the soy cleaner, the worker would have to spend an extra two hours per day rinsing the screens. In addition, the worker would need to spend about two minutes more to repair the damage from pinholes for each screen. Stith cleans about 30 screens per day so use of the soy would increase the cleaning time to seven to nine hours per day. The annual labor cost for cleaning the screens would amount to $20,800.

Stith currently changes out their parts cleaner, which has a fluid capacity of 25 gallons, once per year and adds five gallons of makeup solvent per month to the parts cleaner. Thus, the company purchases 85 gallons of mineral spirits per year. At a cost of $2.40 per gallon, the total annual cost is $204. The soy would require changeout once a year but less makeup solvent would be required because of the lower vapor pressure of the soy. Assuming that the makeup would be five gallons per quarter, the total soy usage

would amount to 45 gallons per year. At a cost of $6 per gallon, the cost of purchasing soy would be $270 annually.

Stith currently disposes of the mineral spirits at a cost of $375. The cost of disposing of the soy cleaner would be the same.

Table 4-7 shows the cost comparison of the current cleaner used by Stith and the alternative soy cleaner. The figures show that conversion to the soy cleaner would increase Stith's cleaning costs by about 58 percent.

Table 4-7
Annual Cost Comparison for Stith for Screen Printing

	Mineral Spirits	Soy Cleaner
Labor Cost	$13,000	$20,800
Cleaner Cost	$204	$270
Disposal Cost	$375	$375
Total Cost	$13,579	$21,445

4.2.7 Quickdraw

Quickdraw is located in West Los Angeles, California. The company is a textile printer and most of their work involves printing on T-shirts. Quickdraw removes the ink from the screens after printing. The company uses a VOC solvent for cleaning the screens currently.

IRTA tested two alternative cleaners with Quickdraw. IRTA provided the company with a heated parts cleaner containing a water-based cleaner called Mirachem Pressroom Cleaner at about a one-third concentration. An MSDS for this cleaner is shown in Appendix C. The company used the Mirachem for several months and found it satisfactory. IRTA also tested a soy based cleaner called Soy Gold 2000 in a parts cleaner with Quickdraw. The MSDS for this cleaner is shown in Appendix C. Again the company found this alternative satisfactory.

To use the Mirachem alternative, Quickdraw would need to purchase a heated water-based parts cleaner. Assuming the parts cleaner would cost $1,500 and a ten year useful life for the equipment, the annualized equipment cost would be $150. The company has a cleaning system with a pump and a brush currently. The soy could be used in this equipment. Thus for a conversion to soy, the company would not have to make a capital investment.

Quickdraw currently spends about four hours per day cleaning screens. Assuming a labor rate of $10 per hour and 260 hours per year of operation, the annual labor cost is $10,400. Quickdraw estimates that the labor cost with use of the Mirachem cleaner would increase by 10 percent because it does not remove the ink as easily as the current solvent. Thus the labor cost with the Mirachem alternative would amount to $11,440. Quickdraw

estimates that an extra hour of labor would be required each day for the soy because the screens would require rinsing. Assuming five hours per day for cleaning, the labor cost for soy would be $13,000 annually.

Quickdraw currently uses seven gallons of solvent in six months. The cost of the cleaner is $11.40 per gallon and the annual cost of the cleaner is $160. The parts cleaner used with Mirachem would require changeout every six months. Assuming a parts cleaner capacity of 30 gallons, the use of the liquid would amount to 60 gallons. The Mirachem is used at a concentration of 30 percent which means that 20 gallons of Mirachem would be used each year. Assuming a cost of Mirachem of $10 per gallon, the annual cost of purchasing Mirachem would be $200. The soy cleaner is as efficient at removing the ink as the current solvent. Quickdraw would likely use the same amount of soy as the current cleaner. Assuming a cost of $6 per gallon for the soy, the annual cost of purchasing soy is $84.

The cleaning unit with the pump at Quickdraw has a one-fourth horsepower or 0.2 kW pump. The unit operates four hours per day with the current cleaner. Thus the electricity use is 0.8 kWh per day or 208 kWh per year. Assuming an electricity cost of 12 cents per kWh, the annual electricity cost with the current solvent is $25. The soy cleaner could be used in the same unit with the same annual electricity cost. The parts washer for the Mirachem cleaner is heated and the heater uses 1.5 kW; the pump uses 0.2 kW. Assuming the parts cleaner operates 4.4 hours per day (10 percent longer than the current cleaner) and that the electricity cost is 12 cents per kWh, the annual electricity use would amount to $233 with the Mirachem.

There is no disposal required with the current solvent. Use of soy would similarly not require disposal. Use of Mirachem would require disposal of 60 gallons per year of waste. Assuming a cost for disposal of $1 per gallon, the annual cost of disposal would amount to $60.

Table 4-8 shows the cost comparison for the current solvent, the Mirachem and the soy. The figures show that the cost of using the Mirachem is 14 percent higher than the cost of using the current cleaner. The cost of using the soy is 24 percent higher than the cost of using the current cleaner.

Table 4-8
Annual Cost Comparison for Quickdraw for Screen Printing

	Current Cleaner	Mirachem	Soy Cleaner
Capital Cost	-	$150	-
Labor Cost	$10,400	$11,440	$13,000
Cleaner Cost	$160	$200	$84
Electricity Cost	$25	$233	$25
Total Cost	$10,585	$12,023	$13,109

4.2.8 Melmarc

Melmarc is a textile printing company with 180 employees located in Santa Ana. The company processes 60,000 to 80,000 garments per day and uses about 1,500 screens per day. They have 10 automated screen printing machines and four manual presses. After the screens are used for printing, they are cleaned in a conveyorized custom designed machine that uses solvent with brushes for cleaning the ink from the screens. The cleaning machine has several stages for rinsing the solvent from the screens and removing the stencils and the haze. The stencils are removed from more than 95 percent of the screens and the screens are then reused in the process.

IRTA conducted preliminary laboratory testing on the plastisol ink used by Melmarc. Several water-based cleaners and soy based products performed well. IRTA then conducted testing at the facility. IRTA staff removed the ink from the screens by hand to screen potential alternative cleaners in several different sessions. After the ink removal, the screens were put through the cleaning unit for rinsing. The manager said the screens were clean and indicated that the ink removal had been successful.

IRTA prepared for a scaled-up test. Two alternatives were to be tested. The first was one of the water-based cleaners, Daraclean 236, that performed well. The second was a soy based cleaner called Soy Gold 2000. The management of the company changed during the testing. The new screen and equipment manager refused to allow IRTA to conduct the scaled-up testing.

4.2.9 Total Enterprises

Total Enterprises is a textile printing company located in downtown Los Angeles that prints on 450,000 pieces each week. The company has eight automated machines and several additional manual machines. The company has a parts cleaner that is used to remove the ink; the parts cleaner is supplied by a service provider and it uses mineral spirits.

IRTA conducted preliminary laboratory testing with the plastisol ink used by Total Enterprises. The ink was successfully removed with Mirachem Pressroom Cleaner, a water-based cleaner, and with soy based products. In initial testing at the facility, the Mirachem removed the emulsion so facility personnel indicated that this would not be acceptable. In scaled-up testing, IRTA provided a parts cleaner containing a soy based product called Soy Gold 2000 to Total Enterprises. The soy cleaner cleaned the ink well.

Total Enterprises uses a blockout that is water soluble. After cleaning the ink with the soy cleaner, the screens require a rinse. Rinsing the screens would remove the blockout which the company did not want to do. IRTA identified a blockout that was water and solvent resistant but the company refused to try it. In addition, there was a change in management and IRTA could not continue testing at the company.

4.2.10 Huhtamaki

Huhtamaki prints ice cream cartons for a variety of customers. The company has both lithographic and flexographic printing operations. IRTA analyzed Huhtamaki's cleaning agents for the flexographic printing operation which is classified as a specialty flexographic printing operation. In this operation, Huhtamaki uses waterborne inks like many other companies that perform this type of printing.

Huhtamaki uses a water-based alkaline cleaner to clean the photopolymer printing plates and various metal parts from the press. The company has used this cleaner for many years. IRTA worked with Huhtamaki to test alternative water-based cleaners. Huhtamaki wanted a cleaner that had a lower pH than the cleaner they are currently using and they wanted an alternative cleaner that cleaned more effectively. IRTA and Huhtamaki found an alternative cleaner that met these criteria and the company is currently performing scaled-up testing. The cost of the current cleaner and the alternative are comparable. An MSDS for the alternative cleaner, called Mirachem Pressroom Cleaner, is provided in Appendix C.

V. RESULTS OF THE ANALYSIS

ELECTRONICS AND HIGH TECHNOLOGY EQUIPMENT CLEANING

Table 5-1 summarizes the applications and companies that participated in the project in testing alternatives. It also specifies the alternatives that were tested and were effective.

IRTA worked with a number of companies that have operations that require flux removal. For flux removal operations, plain D.I. water, water-based saponifiers, acetone, acetone/IPA blends and D.I. water/acetone/IPA blends are suitable.

Teledyne Controls and Hydro-Aire both conduct printed circuit board rework operations. Teledyne uses a water soluble flux and a number of alternatives including plain water worked effectively for removing the flux. The company converted to a blend of D.I. water containing small amounts of acetone and IPA. In some cases, the operators clean the reworked boards in Teledyne's water cleaning equipment with D.I. water. At Hydro-Aire, the company uses rosin flux. An acetone/IPA blend effectively removed the flux. The blend is being tested for compatibility. Hydro-Aire has water cleaning equipment that uses a saponifier with low VOC; the operators can clean the reworked boards in this equipment.

Teledyne Microelectronic Technologies was able to eliminate one of their cleaning operations in hybrid manufacture altogether. In the manufacturing process, Teledyne is primarily cleaning flux from the assemblies. Although Teledyne delayed work on the project, they did test a number of water cleaning alternatives with success.

In the case of Corona Magnetics and Cicoil Corp., flux removal is also a major cleaning task. Corona Magnetics can use acetone or an acetone/IPA blend to remove the flux in place of plain IPA and a vapor degreaser. The Cicoil flux could not be removed with a formulation with 100 grams per liter VOC or less. The company must use a blend of 50 percent IPA/50 percent acetone because the assemblies are also contaminated with silicone grease. Companies using silicone grease might be able to identify an alternative mold release agent but IRTA did not pursue this change in this case.

There are apparently two electric motor manufacturers in the SCAQMD jurisdiction. Sterling used a VOC solvent but the application was for surface preparation prior to coating, not for cleaning electronics devices. The company has now converted to acetone for this operation. This operation is not included in Table 5-1.

There are a number of electric motor rebuilders in the SCAQMD jurisdiction. IRTA worked with one electric motor rebuilder in the past, Brithinee Electric. That company uses water-based cleaners exclusively. During this project, IRTA worked with Walton, a company that performs most cleaning with water-based cleaners. The company has one operation where an exempt solvent, D5 a volatile methyl siloxane, is now used. IRTA tested a water-based cleaner for this operation that was also effective.

Table 5-1
Electronics and High Technology Applications Cleaning Alternatives

Type of Application and Companies	Alternative(s)
Printed circuit board rework	
Teledyne Controls	D.I. water, acetone/IPA/D.I. water blend, water-based cleaner
Hydro-Aire	acetone, acetone/IPA blend, water-based cleaner
Hybrid circuit manufacture	
Teledyne Microelectronic Technologies	not cleaning, water-based cleaners
Transformer component manufacture	
Corona Magnetics	acetone, acetone/IPA blend
Flexible and cast cable manufacture	
Cicoil Corp.	water-based cleaner, acetone, acetone/IPA blend, volatile methyl siloxane
Electric motor rebuilding	
Walton	D5, water-based cleaner
Field electrical equipment maintenance --energized equipment	
Burbank Water & Power	HFC and HFE aerosol cleaners
Field electrical equipment maintenance --non-energized equipment	
Burbank Water & Power	water-based cleaners
Solar cell manufacture	
Northrop Grumman (formerly TRW)	acetone
Optics manufacture	
Northrop Grumman (formerly Litton Guidance & Control Systems)	material change, physical barrier, hot water, acetone, water-based cleaners
Manufacture of gauges	
Astro Pak	acetone, acetone/IPA blend

For field electrical equipment, IRTA worked with two companies, Burbank Water & Power and Covanta Energy. For cleaning non-energized equipment, IRTA tested water-based cleaners and a soy/water blend that cleaned effectively. Burbank Water & Power

has been using a water-based cleaner for cleaning non-energized equipment for many years. For cleaning energized electrical equipment, most companies, including Burbank Water & Power, are using aerosol formulations containing HCFC-141b, an exempt chemical. IRTA tested a few alternatives that contained exempt chemicals or exempt chemical/VOC blends. Although the exempt chemical/VOC blends worked well, it is not clear whether they are recommended by the manufacturers for cleaning energized electrical equipment at this time.

Northrop Grumman (formerly TRW) uses IPA to clean solar cells. IRTA tested acetone based alternatives which worked effectively. Northrop Grumman is conducting testing to determine whether the acetone leaches components from the wipes and contaminates the solar cells in the cleaning. IRTA has suggested that the company try cleaning with an acetone/D.I. water blend during this testing. Diluting the acetone makes it much less aggressive; the removal of particles should still be adequate but the D.I. water may prevent the acetone from leaching components.

Northrop Grumman (formerly Litton Guidance & Control Systems) has been cleaning optics used in laser applications without VOC solvents for several years. IRTA worked with the company in an earlier project and has included the information in this document to demonstrate that optics companies using handwipe operations covered in Rule 1171 can find alternatives similar to those used by Northrop Grumman. For example, the company converted from pitch to thermoplastic which is easier to clean with acetone and water-based cleaners in either batch loaded cold cleaners or handwipe operations.

Astro Pak cleans a variety of scientific instruments and IRTA worked with the company on testing alternatives for cleaning aerospace gauges. Acetone was found to perform better than IPA, the currently used VOC solvent.

COATING AND ADHESIVE APPLICATION EQUIPMENT CLEANING

Table 5-2 summarizes the types of coatings and adhesives that were cleaned during the project, the companies that used these coatings and adhesives and the alternatives that were tested and were effective.

In the case of Vacco, none of the alternatives tested by IRTA were able to clean the adhesive residue. IRTA discussed the issue with 3M, the adhesive supplier and suggested that a low VOC alternative could be found if 3M would reformulate the adhesive from tetrahydrofuran (THF) to tetrahydrofurfural alcohol. 3M refused to consider reformulation. IRTA did not test blends of acetone and THF but this approach could be successful at some concentration of acetone.

For all the other categories and companies listed in Table 5-2, IRTA identified and tested alternatives that worked successfully. IRTA obviously did not test every coating or adhesive that is used and there may be coatings or adhesives that could not be cleaned with the alternatives tested here. In a few cases, water-based cleaners work effectively. For the most part, acetone based cleaners seem to be widely applicable. In some cases,

plain acetone cannot clean effectively and other components like methyl acetate or a special surfactant designed to clean high solids coatings were designed to perform the cleaning. In the case of Murphy Industrial Coatings, Inc., the architectural industrial maintenance coatings, additional testing using the acetone/surfactant blend should be conducted to refine the costs.

Table 5-2
Coating and Adhesive Application Equipment Cleaning Alternatives

Type of Coating/Adhesive and Companies	Alternative(s)
Aerospace epoxy primers and polyurethane topcoats	acetone
Hydro-Aire	
Gulfstream	
California Propeller	
Metal solventborne coatings	acetone
American Security Products	
Metrex	
Wood solventborne coatings	water-based cleaner, acetone
Oakwood	
Bausman & Father	
Autobody primers, basecoats and topcoats	acetone, acetone/methyl acetate
Holmes Body Shop	
Westway Industries, Inc.	
Architectural enamel and industrial maintenance coatings	acetone, acetone/surfactant
PCM Leisure World	
Murphy Industrial Coatings, Inc.	
Foam fabrication adhesives	acetone, soy
Hickory Springs	
High solvent adhesive	none
Vacco	
Waterborne Coatings	water
Oakwood	
Bausman & Father	
American Security Products	
PCM Leisure World	

IRTA did not work with any facilities that used electrostatic spray equipment. IRTA has held discussions with one supplier of electrostatic spray equipment. According to a Graco representative, companies can use low-VOC, low toxicity alternatives if they have

the proper electrostatic spray equipment. Specifically, the company has designed electrostatic spray equipment with the proper grounding to use waterborne coatings. This spray equipment, since it is designed to use water, can be cleaned with plain water. The company has also designed spray equipment for use with acetone coatings and this spray equipment can be cleaned with acetone. The important point is that the proper cleanup solvent must be used with the specific equipment designed for that purpose.

IRTA did not test plain water for cleaning waterborne coatings and adhesives during the project. Several of the companies that participated in the project, including American Security Products, Oakwood, Bausman & Father and PCM Leisure World, either use waterborne coatings today or used the coatings in the past; all of these companies used plain water for cleanup of the spray equipment when cleaning waterborne coatings. Many other companies have used waterborne coatings for many years and have used plain water for cleanup.

PRINTING APPLICATION EQUIPMENT CLEANING

Table 5-3 summarizes the types of inks that were the focus of the testing, the companies that used these inks and the alternatives that performed successfully.

In a few cases, the alternatives performed at least as well as the cleaner the companies were using. At Teledyne, for instance, the acetone worked more effectively in cleaning the ink than IPA.

At Owens Illinois, the soy cleaner worked very effectively and the workers liked it better than their current solvent.

IRTA tested a soy based cleaner at Southern California Screen Printing. It did not perform as well as their current cleaner and it required more labor. The company is now in the process of converting to a water-based cleaner that they identified and they believe it performs better than their current high VOC cleaner.

At Nelson Nameplate, the acetone/glycol ether blend worked well but more would be used than the current cleaner on the solventborne ink because of the high vapor pressure of acetone. The high acetone content of the cleaner removed Nelson's emulsion. IRTA identified and tested an alternative emulsion with Nelson and the new emulsion remained intact during cleaning with the acetone blend. This cleaner as well as plain water worked effectively on Nelson's UV curable ink.

The alternative cleaners that were tested at City of Santa Monica Paint Shop worked as well as the cleaner that was being used. When using the acetone cleaner, the City must remove the ink immediately so the stencil is not damaged.

Table 5-3
Printing Application Equipment Cleaning Alternatives

Type of Ink and Companies	Alternative(s)
Solventborne dielectric ink Teledyne Microelectronic Technologies	acetone
UV curable ink for plastics Owens Illinois	soy cleaner
UV curable ink for banners Southern California Screen Printing	soy cleaner
UV curable metal ink Nelson Nameplate	water cleaner, acetone/glycolether blend
Solventborne metal ink Nelson Nameplate	acetone, acetone/glycol ether blend
Solventborne metal and plastic sign ink City of Santa Monica Paint Shop	acetone, acetone/glycol ether blend, soy
Plastisol textile ink Stith Quick Draw Melmarc Total Enterprises	water-based cleaners, soy cleaner
Waterborne specialty flexographic ink Huhtamaki	water-based cleaners

In the plastisol ink category, two of the textile printers, Melmarc and Total Enterprises, dropped out of the testing program before the testing and analysis could be completed. Preliminary results at these facilities indicated that water-based cleaners and soy based cleaners were effective at cleaning the ink. At Stith, water-based cleaners could not really be tested because the company's emulsion was water soluble. The soy based cleaner that was tested was effective in cleaning the ink but it added a rinsing step to the process. According to Stith, the soy cleaner also caused pinhole damage to the stencil but this problem was not observed at any other facility that tested soy based cleaners. At Quick Draw, both a water-based cleaner and a soy based cleaner were tested for several months. This company used an emulsion and blockout that were solvent and water resistant. Both cleaned the ink effectively. Again, the soy based cleaner required an additional rinse step. Since two of the participants dropped out of the testing program, IRTA believes additional work with textile printers should be done to further refine the costs of the alternatives.

Huhtamaki has been using a water-based cleaner for several years; IRTA tested an alternative water-based cleaner that performed as well as that cleaner for removing specialty flexographic ink.

RECOMMENDATIONS

In the course of this project, IRTA focused on finding alternatives in three categories including:

- electronics and high technology cleaning applications
- coating and adhesive spray equipment cleaning
- screen and specialty flexographic ink cleanup

Table 5-4 shows the information contained in Table 1-1 in the introduction and background section.

In the first category in Table 5-4, "Product Cleaning," IRTA was able to find low-VOC alternatives that were cost effective in every case except Teledyne Microelectronic Technologies and Cicoil. Teledyne was willing to perform only limited testing. In Teledyne's application, the cleaning is primarily flux removal which can be accomplished by a wide range of low-VOC alternatives. The results of the testing in this category indicate that the 100 gram per liter VOC limit can be met. In the case of Cicoil, IRTA tested a number of alternatives and the only low-VOC formulation that worked for the application of cleaning the silicone grease was a blend of acetone and IPA with a VOC content of about 400 grams per liter. For Cicoil's other cleaning applications, the 100 gram per liter VOC limit can be met.

In the second category, "Cleaning of Solar Cells, Lasers, Scientific Instruments and High Precision Optics," IRTA also identified low-VOC alternatives that performed well and were cost effective. Northrop Grumman (formerly TRW) is conducting leaching tests on the solar cells with acetone which should be completed within the next year. The results of the testing in this category indicate that the 100 gram per liter VOC limit can be met.

In the third category, "Repair and Maintenance Cleaning of Electrical Apparatus Components and Electronic Components," IRTA identified low-VOC alternatives that were cost effective except in the case of cleaners for energized electrical equipment. Companies have traditionally used exempt solvents like TCA, CFC-113 and HCFC-141b in aerosol packages for energized electrical equipment contact cleaning. TCA and CFC-113 production have been banned and, more recently, the production of HCFC-141b has also been banned. The alternatives that will be available for this application are HFCs or HFEs which are exempt chemicals blended with DCE which is a VOC. These formulations have a much higher VOC content than 100 grams per liter.

In SCAQMD Rule 1171, the District provides an exemption from VOC limits for aerosol products if 160 fluid ounces or less of the aerosol product are used per day. The data provided by Burbank Water & Power indicates that the company used far less than 160 fluid ounces of aerosol products per day. It is unlikely that other companies would use

more than 160 fluid ounces of the aerosol products in a day. This suggests that companies that are performing energized electrical cleaning with aerosol products already meet the requirements of Rule 1171. Thus, IRTA believes that setting a VOC limit of 100 grams per liter for the entire third category is reasonable.

Table 5-4
Target VOC Content for Rule 1171

Cleaning Application	Target VOC Content (grams per liter)
Product Cleaning	
Cleaning of Electrical Apparatus Component and Electronic Component Products • Printed circuit board rework • Cleaning hybrid circuits • Cleaning general electrical components • Cleaning electric motors	100
Cleaning of Solar Cells, Lasers, Scientific Instruments & High Precision Optics	100
Repair & Maintenance Cleaning	
Electrical Apparatus Components & Electronic Components • Field cleaning of electric motors, generators, energized equipment • In-house cleaning of electric motors and other electrical equipment during rework, refurbishing or rebuilding	100
Coating & Adhesive Application Equipment Cleaning • Cleaning of spray guns (general) • Cleaning of spray guns used for architectural coating • Cleaning of electrostatic spray guns • Cleaning of adhesive application equipment • Cleaning of application equipment for satellite/radiation effect coatings	25
Cleaning of Ink Application Equipment • Screen printing • UV printing • Specialty flexographic printing • UV lamp cleaning	100

In the fourth category, "Coating and Adhesive Application Equipment Cleaning," IRTA identified low-VOC alternatives that were cost effective for every company except VACCO. IRTA did not test cleaning agents for cleaning equipment used to spray every possible adhesive or coating but the results of the testing indicate that it is reasonable to expect that a limit of 25 grams per liter could be met. This is based on the wide range of

coatings and substrates successfully tested during this project. Only two companies, VACCO and one other company, use the high VOC thin metal laminating adhesive in the Basin. The District could provide an exemption for cleaning application equipment that has been used to apply this specific adhesive.

In the fifth category, "Cleaning of Ink Application Equipment," IRTA identified low-VOC cost effective cleaners for all the companies that participated in the project. In one of the subcategories, textile printing, IRTA was not able to gather implementation data. For this subcategory, IRTA suggests that more implementation information be obtained before the lower VOC limit for cleaners of 100 grams per liter goes into effect. For the other subcategories, IRTA believes the 100 gram per liter VOC limit can be achieved. IRTA worked with several companies that used UV curable screen ink and the results indicate that the 100 gram per liter limit can be achieved for UV printing operations. IRTA worked with one company that has been using a low-VOC cleaner for cleaning specialty flexographic ink. This indicates that the 100 gram per liter VOC limit can be achieved for this type of printing. IRTA did not work with any companies that clean UV lamps because input from industry prior to the project initiation indicated that the 100 gram per liter VOC limit for this application can be achieved easily.

In summary, then, IRTA tested a variety of alternatives for cleaning in electronics and high technology applications, coating and adhesive application equipment and printing application equipment. IRTA tried to cover all of the categories of cleaning in the application areas and worked with a number of companies on their processes. The project did not involve testing cleaning alternatives for all contaminants, coatings, adhesives or inks but it did focus on many different widely used types of these materials. IRTA believes it is reasonable to expect that a limit of 100 grams per liter could be met.

Appendix A
Material Safety Data Sheets (MSDSs) for Certain Coatings and Inks

MSDSs for Hydro-Aire Primer and Topcoat

MATERIAL SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : MIL-P-7962D YELLOW
IDENTIFICATION NUMBER: PT-562 DATE PRINTED: 08/02/01
PRODUCT USE/CLASS : YELLOW CHROMATE PRIMER

SUPPLIER:
PRODUCTS/TECHNIQUES, INC.
3271 S. RIVERSIDE AVE.
RIALTO, CA. 92376
P.O. BOX 760
BLOOMINGTON, CA. 92316
1-909-877-3951 8 am-4:30 pm

AFTER HOURS EMERGENCY PHONE:
1-800-424-9300 CHEMTREC

MANUFACTURER:
PRODUCTS/TECHNIQUES, INC.
3271 S. RIVERSIDE AVE.
RIALTO, CA. 92376
P.O. BOX 760
BLOOMINGTON, CA. 92316
1-909-877-3951 8 am-4:30 pm

AFTER HOURS EMERGENCY PHONE:
1-800-424-9300 CHEMTREC

PREPARER: B.BODEN, PHONE: 909 877-3951, PREPARE DATE: 03/30/99

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

ITEM	CHEMICAL NAME	CAS NUMBER	WT/WT % EQUAL TO
01	ALKYD RESIN	PROPRIETARY	18.3 %
02	MAGNESIUM SILICATE HYDRATE	14807-96-6	11.6 %
03	ZINC CHROMATE PIGMENT (SEE SEC. 3)	11103-86-9	11.4 %
04	TOLUENE	108-88-3	11.4 %
05	METHYL ISOBUTYL KETONE M.I.B.K.	108-10-1	7.0 %
06	ALIPHATIC PETROLEUM DISTILLATES	64742-89-8	6.7 %
07	XYLENE	1330-20-7	5.9 %
08	CELLULOSE NITRATE	9004-70-0	5.7 %
09	N-BUTYL ALCOHOL	71-36-3	5.6 %
10	ETHYL ACETATE	141-78-6	5.6 %
11	ISOPROPANOL I.P.A.	67-63-0	5.6 %
12	ISOBUTANOL SOLVENT	78-83-1	4.6 %
13	GRINDING ADDITIVE	PROPRIETARY	0.2 %
14	PAINT ADDITIVE	NON HAZARDOUS	0.2 %
15	METHYL ETHYL KETOXIME	96-29-7	0.2 %

	EXPOSURE LIMITS					
	ACGIH		OSHA		VAPOR PRES	MOLE
ITEM	TLV-TWA	TLV-STEL	PEL-TWA	PEL-CEILING	mmHg @ 20C	WT.
01	N/A	N/A	N/A	N/A	N.E.	N.E.
02	2 mg/m3	N/AV	2 mg/m3	N/AV	N.E.	N.E.
03	0.05 mg/m3	N/AV	0.10 mg/m3	N/A	N.E.	N.E.
04	50 PPM SKIN	150 PPM SKIN	100 PPM	150 PPM	24	92

(Continued on Page 2)

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

	EXPOSURE LIMITS					
	ACGIH		OSHA		COMPANY	
ITEM	TLV-TWA	TLV-STEL	PEL-TWA	PEL-CEILING	TLV-TWA	SKIN
05	50 PPM	75 PPM	50 PPM	N/AV	15	100
06	300 PPM	400 PPM	300 PPM	N/AV	10.2	120
07	100 PPM	150 PPM	100 PPM	200 (10 MIN)	6.6	106
08	N.E.	N.E.	N.E.	N.E.	N.E.	N.E.
09	50 PPM SKIN	N/AV	50 PPM SKIN	50 PPM	4.4	74
10	400 PPM	N/AV	400 PPM	N/AV	76	88
11	400 PPM	500 PPM	400 PPM	800 PPM	37	58
12	50 PPM	N/AV	50 PPM	N/AV	8.8	74
13	N.E.	N.E.	N.E.	N.E.	N.E.	N.E.
14	N/A	N/A	N/A	N/A	N.E.	N.E
15	N.E.	N.E.	N.E.	N.E.	N.E.	N.E.

(See Section 16 for abbreviation legend)

SECTION 3 - HAZARDS IDENTIFICATION

*** EMERGENCY OVERVIEW ***: NOTICE: REPORTS HAVE ASSOCIATED REPEATED AND PROLONGED OCCUPATIONAL OVEREXPOSURE TO SOLVENTS WITH PERMANENT BRAIN AND NERVOUS SYSTEM DAMAGE. INTENTIONAL MISUSE BY DELIBERATELY CONCENTRATING AND INHALING THE CONTENTS MAY BE HARMFUL OR FATAL.

NOTICE: THIS PRODUCT IS SOLD TO YOU AS THE SOLE USER. THIS PRODUCT IS SOLD AS AN "INDUSTRIAL PRODUCT ONLY". THIS PRODUCT IS NOT INTENDED NOR IS IT CLASSIFIED AS A CONSUMER PRODUCT. THIS PRODUCT IS NOT TO BE USED BY THE GENERAL PUBLIC.

NOTE: ALL PERCENT BY WEIGHTS AND VOC'S ARE APPROXIMATE AND MAY VARY SLIGHTLY FROM BATCH TO BATCH, AND DUE TO SOLVENT EVAPORATION, AFTER EACH USE. THE VOC'S ARE "AS PACKAGED MATERIAL".

IF THIS PRODUCT IS IN AN AEROSOL CAN, THE PERCENT OF VOC BY WEIGHT, AS DEFINED BY THE CALIF. AIR RESOURCES BOARD, IS LISTED BELOW. IF THE PRODUCT IS IN A BULK CONTAINER, THE VOC's IN GRAMS PER LITTER OR LBS PER GALLON ARE LISTED IN SECTION 16.

PERCENT VOC BY WEIGHT:_____

CATEGORIES FOR AEROSOL PAINTS ONLY:
PIGMENTED PAINTS--- EXACT MATCH FINISHES, INDUSTRIAL
UNPIGMENTED PAINTS-- CLEAR COATINGS

ZINC CHROMATE PIGMENT FROM SEC. 2:

The Zinc Chromate pigment herein is 24% Chromium (CAS# 7440-47-3).

EFFECTS OF OVEREXPOSURE - EYE CONTACT: Direct contact with the liquid or exposure to vapors or mist may cause stinging, tearing, redness, swelling and eye damage.

(Continued on Page 3)

SECTION 3 - HAZARDS IDENTIFICATION

EFFECTS OF OVEREXPOSURE - SKIN CONTACT: May cause skin sensitization, an allergic reaction, which becomes evident on reexposure to this material. Prolonged or repeated contact can result in defatting and drying of the skin which may result in skin irritation and dermatitis (rash).

EFFECTS OF OVEREXPOSURE - INHALATION: Headaches, dizziness, nausea, decreased blood pressure, changes in heart rate and cyanosis may result from over-exposure to vapor or skin exposure.

EFFECTS OF OVEREXPOSURE - INGESTION: This material may be harmful or fatal if swallowed.

EFFECTS OF OVEREXPOSURE - CHRONIC HAZARDS: No Information.

PRIMARY ROUTE(S) OF ENTRY: SKIN CONTACT SKIN ABSORPTION INHALATION INGESTION EYE CONTACT

SECTION 4 - FIRST AID MEASURES

FIRST AID - EYE CONTACT: Immediately move victim away from exposure and into fresh air. If irritation or redness develops, flush eyes with clean water and seek immediate medical attention. For direct contact, immediately hold eyelids apart and flush affected eye(s) with clean water for at least 20 minutes. Seek immediate medical attention.

FIRST AID - SKIN CONTACT: Wash with soap and water. Get medical attention if irritation develops or persists. Remove contaminated clothing. Wash skin with soap and water. Get medical attention.

FIRST AID - INHALATION: Rescuers should put on appropriate protective gear. Remove from area of exposure. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Keep victim warm. Get immediate medical attention.

FIRST AID - INGESTION: HAVE M.S.D.S. HAZARDOUS INGREDIENT SECTION (SECT. 2) READILY AVAILABLE FOR EMERGENCY PERSONNEL OR DOCTOR. Get medical attention immediately.

SECTION 5 - FIRE FIGHTING MEASURES

FLASH POINT: 24 F - ETHYL ACETATE
(TAGLIABUE CLOSED CUP)
LOWER EXPLOSIVE LIMIT: 0.9 % UPPER EXPLOSIVE LIMIT: 12.0 %

AUTOIGNITION TEMPERATURE: N/E

EXTINGUISHING MEDIA: ALCOHOL FOAM CO2 DRY CHEMICAL FOAM WATER FOG

UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors can travel to a source of ignition and flash back. Flammable Liquid. Can release vapors that form

(Continued on Page 4)

SECTION 5 - FIRE FIGHTING MEASURES

:plosive mixtures at temperatures at or above the flashpoint. "Empty" ontainers retain product residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner, or properly disposed of.

SPECIAL FIREFIGHTING PROCEDURES: Containers can build up pressure if exposed to heat (fire). As in any fire, wear self-contained breathing apparatus pressure-demand (MSHA/NIOSH approved or equivalent) and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Absorb spill with inert material (e.g. dry sand or earth), then place in a chemical waste container. Avoid runoff into storm sewers and ditches which lead to waterways.

SECTION 7 - HANDLING AND STORAGE

"ANDLING: Wash thoroughly after handling.

.ORAGE: Keep away from heat, sparks and flame. Keep container closed when not in use. Store in a cool dry area at a temperature between 50 and 95 degrees F. Do not store outside in direct sunlight.

SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Good general ventilation should be sufficient to control airborne levels. Local exhaust ventilation may be necessary to control any air contaminants to within their TLVs during the use of this product. Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

RESPIRATORY PROTECTION:
All individual company safety policies should be reviewed. If a company determines that threshold limit values and air quality contaminant levels have not been exceeded, then that company should set it's own policies regarding the use of respirators. Always follow all local, state, and federal laws and regulations regarding the use of respirators. A NIOSH/MSHA approved air purifying respirator with an organic vapor cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air purifying respirators is limited. Use a positive pressure

(Continued on Page 5)

SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

ir supplied respirator if there is any potential for an uncontrolled elease, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection. A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use. Wear a MSHA/NIOSH approved (or equivalent) full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

SKIN PROTECTION: Where contact is likely, wear chemical resistant gloves, such as neoprene or solvent resistant nitrile. To prevent repeated or prolonged skin contact, wear impervious clothing such as a chemical suit, rubber boots, and/or chemical safety goggles plus a face shield if such should be necessary. If the equipment to be worn is not available or the type of equipment for a specific job is not known, consult a reputable safety equipment supply company. Use chemical splash goggles and face shield (ANSI Z87.1 or approved equivalent).

EYE PROTECTION: Wear safety glasses with side shields (or goggles) and a face shield.

OTHER PROTECTIVE EQUIPMENT: Where splashing is possible, full chemically resistant protective clothing (e.g. acid suit) and boots are required.

HYGIENIC PRACTICES: Wash hands before eating. Remove contaminated clothing and wash before reuse. Use only in a well ventilated area. Follow all MSDS/label precautions even after container is emptied because hey may retain product residues. Ground and bond containers when ansferring material. Use spark-proof tools and explosion proof quipment. Avoid prolonged or repeated contact with skin. Avoid breathing vapors from heated material. Avoid contact with eyes, skin, and clothing.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

BOILING RANGE	: 168 - 300 F	VAPOR DENSITY	: Is heavier than air
ODOR	: SOLVENT LIKE	ODOR THRESHOLD	: N/E
APPEARANCE	: YELLOW LIQUID	EVAPORATION RATE	: Is slower than Butyl Acetate
SOLUBILITY IN H2O	: NONE		
FREEZE POINT	: N/E	SPECIFIC GRAVITY	: 1.1105
VAPOR PRESSURE	: N/E	pH @ 0.0 %	: N/E
PHYSICAL STATE	: LIQUID	VISCOSITY	:

COEFFICIENT OF WATER/OIL DISTRIBUTION: N/E

(See Section 16 for abbreviation legend)

SECTION 10 - STABILITY AND REACTIVITY

CONDITIONS TO AVOID: Avoid all possible sources of ignition.

INCOMPATIBILITY: (Materials to avoid):
strong acids and bases, oxidizers, and selected amines.

(Continued on Page 6)

SECTION 10 - STABILITY AND REACTIVITY

HAZARDOUS DECOMPOSITION PRODUCTS: CO and CO2. Other unknown hazardous products are possible.

HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.

STABILITY: This product is stable under normal storage conditions.

SECTION 11 - TOXICOLOGICAL PROPERTIES

No product or component toxicological information is available.

SECTION 12 - ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION: No Information.

SECTION 13 - DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: Dispose of in accordance with all local, state, and federal regulations.

SECTION 14 - TRANSPORTATION INFORMATION

DOT PROPER SHIPPING NAME: PAINT

DOT TECHNICAL NAME: N/A

DOT HAZARD CLASS: 3, FLAMMABLE LIQUID HAZARD SUBCLASS: N/A

DOT UN/NA NUMBER: UN 1263 PACKING GROUP: II RESP. GUIDE PAGE: 127

SECTION 15 - REGULATORY INFORMATION

THE FOLLOWING COMPONENTS ARE NOT SUBJECT TO REPORTING IN SECTION 2:

---------- CHEMICAL NAME ---------- CAS NUMBER WT/WT %
No non-hazardous components exist

U.S. FEDERAL REGULATIONS: AS FOLLOWS -

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200)

(Continued on Page 7)

SECTION 15 - REGULATORY INFORMATION

ERCLA - SARA HAZARD CATEGORY:
his product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

IMMEDIATE HEALTH HAZARD CHRONIC HEALTH HAZARD FIRE HAZARD

SARA SECTION 313:
This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

---------- CHEMICAL NAME ----------	CAS NUMBER	WT/WT %
ZINC CHROMATE PIGMENT (SEE SEC. 3)	11103-86-9	11.4 %
TOLUENE	108-88-3	11.4 %
METHYL ISOBUTYL KETONE M.I.B.K.	108-10-1	7.9 %
ALIPHATIC PETROLEUM DISTILLATES	64742-89-8	6.7 %
XYLENE	1330-20-7	5.9 %
N-BUTYL ALCOHOL	71-36-3	5.6 %
ISOPROPANOL I.P.A.	67-63-0	5.6 %

TOXIC SUBSTANCES CONTROL ACT:
The chemical substances in this product are on the TSCA Section 8 Inventory.

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(B) if exported from the United States:

---------- CHEMICAL NAME ---------- CAS NUMBER
No information is available.

U.S. STATE REGULATIONS: AS FOLLOWS -

NEW JERSEY RIGHT-TO-KNOW:
The following materials are non-hazardous, but are among the top five components in this product:

---------- CHEMICAL NAME ---------- CAS NUMBER
No non-hazardous materials are among the top five ingredients.

PENNSYLVANIA RIGHT-TO-KNOW:
The following non-hazardous ingredients are present in the product at greater than 3%:

---------- CHEMICAL NAME ---------- CAS NUMBER
No non-hazardous ingredients are present at greater than 3%.

(Continued on Page 8)

SECTION 15 - REGULATORY INFORMATION

\LIFORNIA PROPOSITION 65:
ARNING: The chemicals noted below and contained in this product, are known to the state of California to cause cancer and birth defects or other reproductive harm:

---------- CHEMICAL NAME ----------	CAS NUMBER
ZINC CHROMATE PIGMENT (SEE SEC. 3)	11103-86-9
TOLUENE	108-88-3

INTERNATIONAL REGULATIONS: AS FOLLOWS -

CANADIAN WHMIS: This MSDS has been prepared in compliance with Controlled Product Regulations except for use of the 16 headings.

CANADIAN WHMIS CLASS: No information available.

SECTION 16 - OTHER INFORMATION

HMIS RATINGS - HEALTH: 2 FLAMMABILITY: 3 REACTIVITY: 0

PREVIOUS MSDS REVISION DATE: 01/25/99

REASON FOR REVISION: NEW COMPUTER SYSTEM

VOLATILE ORGANIC COMPOUNDS (VOCS): 4.86 lbs/gal, 583 grams/ltr

:GEND: N.A. - Not Applicable, N.E. - Not Established,
N.D. - Not Determined

To comply with the requirements of the safe drinking water and toxic enforcement act of 1986 (Proposition 65) we are required to **WARN YOU** that this material is known to the State of California to cause cancer, birth defects or other reproductive harm. Safe handling is absolutely mandatory. Please review safe handling procedures with your supervisor before working with this material.

'ND OF MSDS>

MATERIAL SAFETY DATA SHEET

Printed : 09/16/01

For Coatings, Resins and Related Materials

Revised : 05/30/00

SECTION I - PRODUCT IDENTIFICATION

Manufacturer: DEFT, INC. (CAGE CODE 33461)
17451 VON KARMAN AVENUE
IRVINE CA
92614

Information Phone: (949) 474-0400
Emergency Phone: (800) 424-9300
CHEMTREC Phone: 800-424-9300

Product Class: TYPE I, POLYURETHANE
Trade Name : MIL-PRF-85285C,36231,TY I
Product Code : 03W3332;36231
C.A.S. Number: NONE

Hazard Ratings: Health - 3
none -> extreme Fire - 3
0 ---> 4 Reactivity - 1

SECTION II - HAZARDOUS INGREDIENTS

Ingredient	CAS #	Weight %	Exposure Limits ACGIH TLV	ACGIH STEL	OSHA PEL	OSHA STEL	VP mm HG
n-BUTYL ACETATE	123-86-4	5.	150 ppm	200 ppm	150 ppm	200 ppm	15 @ 68F
ETHYL 3-ETHOXYPROPIONATE	763-69-9	5.	N.E.	N.E.	N.E.	N.E.	.7 @ 68F
	Manufacturer recommends a workplace exposure limit of 50 PPM-TWA; 100 PPM-STEL.						
XYLENE	1330-20-7	< 1.	100 ppm	150 ppm	100 ppm	150 ppm	5.1 @ 68F
ETHYL BENZENE	100-41-4	< 1.	100 ppm	125 ppm	100 ppm	125 ppm	7.1 @ 68F
	IARC has determined that ethylbenzene is possibly carcinogenic to humans.						
ANTI FLOAT AGENT	1317-65-3	< 1.	10 mg/M3	N.E.	10 mg/M3	N.E.	
METHYL n-AMYL KETONE	110-43-0	20.	50 ppm	N.E.	100 ppm	N.E.	2.1 @ 68F
ANTI MAR AGENT	9038-95-3	< 0.1	N.E.	N.E.	N.E.	N.E.	
ANTI MAR AGENT	TRADE SECRET	< 0.1	N.E.	N.E.	N.E.	N.E.	
	New Jersey TSRN is 800963-3533						
FLOW AGENT	26376-86-3	< 1.	N.E.	N.E.	N.E.	N.E.	
DIBUTYLTIN DILAURATE	77-58-7	< 0.1	N.E.	N.E.	.1 mg/M3	.3 mg/M3	.2 @320F
	Causes skin and eye irritation. Harmful if swallowed or absorbed through skin. May cause liver and kidney damage.						
2-4 PENTANEDIONE	123-54-6	< 5.	N.E.	N.E.	N.E.	N.E.	6.9 @ 68F
	Union Carbide recommends a TLV of 20 ppm-TWA.						
BUTYL CARBITOL ACETATE	124-17-4	< 5.	N.E.	N.E.	N.E.	N.E.	0 @ 68F

THE ABOVE LISTED INGREDIENTS ARE ON THE TSCA INVENTORY LIST.ALSO ANY UNLISTED INGREDIENTS.

N.E. = Not Established

SECTION III - PHYSICAL DATA

Boiling Range: 260 - 475 Deg. F
Evap. Rate: 0.4 x n-Butyl Acetate
Volatiles vol % 53.6 Wgt% 37.4

Vapor Density: Heavier than Air.
Liquid Density: Heavier than Water.
Wgt per gallon: 10.28 Pounds.
Spec. Gravity: 1.23409

Appearance: GRAY LIQUID WITH SOLVENT ODOR
V.O.C.: 461.92/L
SOLUBILITY IN WATER: Insoluble PH: Not applicable
AUTOIGNITION TEMPERATURE: No information found
DECOMPOSITION TEMPERATURE: No information found
CORROSION RATE: No information found
VISCOSITY: This liquid to heavy viscous material

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flammability Class: IB Flash Point:67 F TCC LEL: 0.968 UEL: 11.80%

-EXTINGUISHING MEDIA:
FOAM, ALCOHOL FOAM, CO2, DRY CHEMICAL, WATER FOG, WATER SPRAY
-SPECIAL FIREFIGHTING PROCEDURES:
Full fire fighting equipment with self-contained breathing apparatus and full protective clothing should be worn by fire fighters. Water may be used to cool closed containers to prevent pressure build-up, auto ignition or explosion.
-UNUSUAL FIRE & EXPLOSION HAZARDS:
Keep containers tightly closed. Isolate from heat, sparks, electrical equipment and open flame. Closed containers may explode when exposed to extreme heat. Application to hot surfaces requires special precautions. During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent.

SECTION V - HEALTH HAZARD DATA

-PERMISSIBLE EXPOSURE LEVEL:
SEE SECTION II, HAZARDOUS INGREDIENTS.
-EFFECTS OF OVEREXPOSURE:
INHALATION: Irritation of the respiratory tract & acute nervous system depression characterized by the following progressive steps: headache, dizziness, staggering gait, confusion, unconsciousness or coma.

SKIN AND EYE CONTACT: SKIN: Contact with the skin can cau irri'ation. Symptoms may be swelling, redness, and rash. EYES: Liquid, aerosols, or vapors are irritating and may cause tearing, redness, and swelling accompanied by a stinging sensation.

SKIN ABSORPTION: Prolonged or repeated contact can cause moderate irritation, drying, and defatting of the skin which can cause the skin to crack.

INGESTION: Acute: Can result in irritation and possible corrosive action in the mouth, stomach tissue and digestive tract. Vomiting may cause aspiration of the solvent, resulting in chemical pneumonitis.

HEALTH HAZARDS (ACUTE AND CHRONIC)
ACUTE: Vapors are irritating to eyes, nose, and throat. Inhalation may cause headaches, difficult breathing and loss of consciousness.
CHRONIC: Prolonged contact will cause drying and cracking of the skin, due to defatting action. Skin sensitization, asthma or other allergic responses may develop.

PRIMARY ROUTE(S) OF ENTRY:
TOPICAL (SKIN CONTACT): Yes
INGESTION (GASTRO-INTESTINAL): No
INHALATION (LUNGS): Yes

CARCINOGENICITY:
NTP?: NO. IARC MONOGRAPHS?: NO. OSHA REGULATED?: NO

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:
Asthma and any other respiratory disorders. Skin allergies, eczema, and dermititis.
-FIRST AID:
INHALATION: Move to an area free from risk of further exposure Restore breathing. Asthmatic type symptoms may develop and may be immediate or delayed by several hours. Obtain medical attention.

SKIN: Remove contaminated clothing. Wash affected areas thoroughly with soap and water. Wash contaminated clothing thoroughly before reuse.

EYES: Flush with clean lukewarm water (low pressure) for at least 15 minutes, occasionally lifting eyelids. Obtain medical attention.

INGESTION: Do not induce vomiting. Do not give anything to an unconscious person. Obtain medical attention.

SECTION VI - REACTIVITY DATA

STABILITY: [ ] Unstable [x] Stable
HAZARDOUS POLYMERIZATION: [ ] May occur [x] Will not occur
-INCOMPATIBILITY
STRONG OXIDIZING AGENTS.
-CONDITIONS TO AVOID:
HIGH TEMPERATURES, SPARKS, OR OPEN FLAMES.
-HAZARDOUS DECOMPOSITION PRODUCTS:
BY HIGH HEAT/TEMPERATURE: Carbon monoxide, carbon dioxide, and oxides of nitrogen.

SECTION VII - SPILL OR LEAK PROCEDURES

-STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Evacuate all non-essential personnel. Remove all sources of ignition (flame, spark sources, hot surfaces). Ventilate area Contain and remove with inert absorbent and non-sparking tools
-WASTE DISPOSAL METHOD:
Waste must be disposed of in accordance with federal, state, and local environmental control regulations. Empty containers must be handled with care, due to product residue and flammable vapor DO NOT incinerate closed containers.
ALSO SEE SECTION IV, V, VI, FOR OTHER PRECAUTIONS.
EPA HAZARDOUS WASTE NUMBER/CODE: D001, F003, F005
HAZARDOUS WASTE CHARACTERISTICS:
IGNITABILITY YES
CORROSIVITY NO
REACTIVITY YES

SECTION VIII - SPECIAL PROTECTION INFORMATION:

-RESPIRATORY PROTECTION:
A respirator that is recommended or approved for use in an organic vapor environment (air purifying or fresh air supplied) is necessary. Observe OSHA regulations for respirator use. Ventilation should be provided to keep exposure levels below the OSHA permissible limits.
If TLV limits can be maintained and documented below the OSHA/ACGIH limits, an air supplied respirator may not be requi
(continued on next page)

MATERIAL SAFETY DATA SHEET

Printed : 08/16/01

For Coatings, Resins and Related Materials

Revised : 07/01/99

SECTION I - PRODUCT IDENTIFICATION

Manufacturer: DEFT, INC. (CAGE CODE 33461)
17451 VON KARMAN AVENUE
IRVINE CA
92614

Information Phone: (949) 474-0400
Emergency Phone: (800) 424-9300
CHEMTREC Phone: 800-424-9300

Product Class: TYPE 3, ALIPHATIC ISOCYANATE
Trade Name : CAT,MIL-PRF-85285C,36231,TY 1
Product Code : 03GY332CAT36231
C.A.S. Number: NONE

Hazard Ratings: Health - 4
none -> extreme Fire - 3
0 ---> 4 Reactivity - 1

SECTION II - HAZARDOUS INGREDIENTS

Ingredients	CAS #	Weight %	ACGIH TLV	ACGIH STEL	OSHA PEL	OSHA STEL	VP mm HG
POLYMERIC HEXAMETHYLENE DIISOCYANAT E	28182-81-2	35.	N.E.	N.E.	N.E.	N.E.	
	822-06-0	HEXAMETHYLENE DIISOCYANATE (HDI) CAS NO. 822-06-0, free monomer content averages 0.10% based on resin solids at the time of manufacture. However, after 12 months storage, the free monomer content may rise to a maximum of 0.14%. The ACGIH has a TLV of 0.005 ppm TWA.					
POLYMERIC HEXAMETHYLENE DIISOCYANAT E	28182-81-2	40.	N.E.	N.E.	N.E.	N.E.	
	822-06-0	HEXAMETHYLENE DIISOCYANATE (HDI) CAS NO. 822-06-0, free monomer content average 0.10% based on resin solids at the time of manufacture. However, after 12 months storage, the free monomer content may rise to a maximum of 0.14% The ACGIH has a TLV of 0.005ppm TWA.					
AROMATIC HYDROCARBON	64742-95-6	< 1.	N.E.	N.E.	N.E.	N.E.	3 @ 68F
XYLENE	1330-20-7	< 0.1	100 ppm	150 ppm	100 ppm	150 ppm	5.1 @ 68F
1,2,4 TRIMETHYLBENZENE	95-63-6	< 1.	100 ppm	150 ppm	100 ppm	N.E.	
CUMENE	98-82-8	< 0.1	50 ppm	N.E.	50 ppm	N.E.	
1,3,5 TRIMETHYLBENZENE	108-67-8	< 1.	N.E.	N.E.	N.E.	N.E.	
DIETHYLBENZENE	25340-17-4	< 1.	N.E.	N.E.	N.E.	N.E.	
ETHYL BENZENE	100-41-4	< 0.1	100 ppm	125 ppm	100 ppm	125 ppm	7.1 @ 68F
		IARC has determined that ethylbenzene is possibly carcinogenic to humans.					
n-BUTYL ACETATE	123-86-4	< 3.	150 ppm	200 ppm	150 ppm	200 ppm	13 @ 68F
ETHYL 3-ETHOXYPROPIONATE	763-69-9	20.	N.E.	N.E.	N.E.	N.E.	.7 @ 68F
		Manufacturer recommends a workplace exposure limit of 20 PPM-TWA; 100 PPM-STEL.					

THE ABOVE LISTED INGREDIENTS ARE ON THE TSCA INVENTORY LIST, ALSO ANY UNLISTED INGREDIENTS.

N.E. = Not Established

SECTION III - PHYSICAL DATA

Boiling Range: 260 - 428 Deg. F
Evap. Rate: 0.16 x n-Butyl Acetate
Volatiles vol % 30.1 Wgt% 26.0

Vapor Density: Heavier than Air.
Liquid Density: Heavier than Water.
Wgt per gallon: 9.01 Pounds.
Spec. Gravity: 1.08163

Appearance: AMBER LIQUID WITH SOLVENT ODOR
V.O.C.: 281 G/L
SOLUBILITY IN WATER: Insoluable PH: Not applicable
AUTOIGNITION TEMPERATURE: No information found
DECOMPOSITION TEMPERATURE: No information found
CORROSION RATE: No information found
VISCOSITY: This liquid to heavy viscous material

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flammability Class: IB Flash Point:67 F TCC LEL: 0.90% UEL: 7.60%

-EXTINGUISHING MEDIA:
FOAM, ALCOHOL FOAM, CO2, DRY CHEMICAL, WATER FOG, WATER SPRAY

-SPECIAL FIREFIGHTING PROCEDURES:
Full fire fighting equipment with self-contained breathing apparatus and full protective clothing should be worn by fire fighters. Water may be used to cool closed containers to prevent pressure build-up, auto ignition or explosion. During a fire NDI vapors and other irritating vapors may be generated by combustion or thermal decomposition.

-UNUSUAL FIRE & EXPLOSION HAZARDS:
Keep containers tightly closed. Isolate from heat, sparks, electrical equipment and open flame. Closed containers may explode when exposed to extreme heat. Application to hot surfaces requires special precautions. During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent.

SECTION V - HEALTH HAZARD DATA

-PERMISSIBLE EXPOSURE LEVEL:
SEE SECTION II. HAZARDOUS INGREDIENTS.

-EFFECTS OF OVEREXPOSURE:
INHALATION: Irritation of the respiratory tract & acute nervous system depression characterized by the following progressive steps: headache, dizziness, staggering gait, confusion, unconsciousness or coma.
SKIN AND EYE CONTACT: SKIN: Isocyanates react with skin protein and moisture and can cause irritation. Symptoms may be swelling, redness, and rash.
EYES: Liquid, aerosols, or vapors are irritating and may cause tearing, redness, and swelling accompanied by a stinging sensation.
SKIN ABSORPTION: Prolonged or repeated contact can cause moderate irritation, drying, and defatting of the skin which can cause the skin to crack.
INGESTION: Acute: Can result in irritation and possible corrosive action in the mouth, stomach tissue and digestive tract. Vomiting may cause aspiration of the solvent, resulting in chemical pneumonitis.
HEALTH HAZARDS (ACUTE AND CHRONIC)
ACUTE: Vapors are irritating to eyes, nose, and throat. Inhalation may cause headaches, difficult breathing and loss of consciousness.
CHRONIC: As a result of previous repeated overexposure or a single large dose, certain individuals will develop isocyanate sensitization which will cause them to react to a later exposure of isocyanate levels well below the TLV value of isocyanates.
PRIMARY ROUTE(S) OF ENTRY:
TOPICAL (SKIN CONTACT): Yes
INGESTION (GASTRO-INTESTINAL): No
INHALATION (LUNGS): Yes
CARCINOGENICITY:
NTP?: NO, IARC MONOGRAPHS?: NO, OSHA REGULATED?: NO
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:
Asthma and any other respiratory disorders. Skin allergies, eczema, and dermititis. Isocyanate sensitization.

-FIRST AID:
INHALATION: Move to an area free from risk of further exposure. Restore breathing. Asthmatic type symptoms may develop and may be immediate or delayed by several hours. Obtain medical attention.
SKIN: Remove contaminated clothing. Wash affected areas thoroughly with soap and water. Wash contaminated clothing thoroughly before reuse.
EYES: Flush with clean lukewarm water (low pressure) for at least 15 minutes, occasionally lifting eyelids. Obtain medical attention.
INGESTION: Do not induce vomiting. Do not give anything to an unconscious person. Obtain medical attention.

SECTION VI - REACTIVITY DATA

STABILITY: [ ] Unstable [x] Stable
HAZARDOUS POLYMERIZATION: [ ] May occur [x] Will not occur

-INCOMPATIBILITY
Water, amines, strong bases, alcohols, metal compounds and surface active materials.

-CONDITIONS TO AVOID:
Contact with moisture, material which react with isocyanates and high temperatures.

-HAZARDOUS DECOMPOSITION PRODUCTS:
BY HIGH HEAT/TEMPERATURE: Carbon monoxide, carbon dioxide, and oxides of nitrogen, traces of HCN and NOx.

SECTION VII - SPILL OR LEAK PROCEDURES

-STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Evacuate all non-essential personnel. Remove all sources of ignition (flame, spark sources, hot surfaces). Ventilate area. Contain and remove with inert absorbent and non-sparking tools.

-WASTE DISPOSAL METHOD:
Waste must be disposed of in accordance with federal, state, and local environmental control regulations. Empty containers must be handled with care, due to product residue and flammable vapor. DO NOT incinerate closed containers.
ALSO SEE SECTION IV, V, VI, FOR OTHER PRECAUTIONS.
EPA HAZARDOUS WASTE NUMBER/CODE: D001, F003, F005
HAZARDOUS WASTE CHARACTERISTICS:
IGNITABILITY: YES
CORROSIVITY: NO
REACTIVITY: YES

SECTION VIII - SPECIAL PROTECTION INFORMATION

-RESPIRATORY PROTECTION:
A respirator that is recommended or approved for use in an organic vapor environment (air purifying or fresh air supplied)

(continued on next page)

MSDS for Metrex Coating

International Paint (U S A) Inc

P.O. BOX 386, UNION, NEW JERSEY 07083

MATERIAL SAFETY DATA SHEET

May be used to comply with OSHA's Hazard Communication Standard, 29CFR 1910. 1200.
(THIS MSDS SUPERCEDES ANY PREVIOUS ISSUE)
PLEASE DIRECT TO THE APPROPRIATE DEPARTMENT IMMEDIATELY.

TELEPHONE NO. (201) 686-1300
EMERGENCY TELEPHONE NO.: (201) 686-1300
DATE OF PREPARATION: 09/22/88
REFERENCE: S5900441/K0/01 9132305000

C-WORTHY SPECIALITIES
P.O. BOX 131
SAN PEDRO, CA 90733

SECTION ONE: PRODUCT IDENTIFICATION

PROD. NO.: CLC935
PROD. NAME: I'LAC CARIBBEAN BLUE ALKYD ENAMEL
PROD. CLASS: N/A

SECTION TWO: HAZARDOUS INGREDIENTS

		% WT. (OPTIONAL)	OCCUPATIONAL EXPOSURE TLV	OCCUPATIONAL EXPOSURE PEL	VAP. PRESS. (mm Hg) (@20° C)
110-80-5	2-ETHOXYETHANOL ETHANOL, 2-ETHOXY- AROMATIC SOLVENT	0-1	5.00 PPM	200.00 PPM	4.0
64742-95-6	SOLVENT NAPHTHA,(PET.) LT.AR MINERAL SPIRITS, EXEMPT	1-5	100.00 PPM	100.00 PPM	3.0
8032-32-4	LIGROINE AROMATIC SOLVENT	45-50	100.00 PPM	500.00 PPM	7.0
64742-94-5	SOLVENT NAPHTHA,(PET.) HEAVY	1-5	N/A	N/A	0.7
---------	LEAD CPDS (AS LEAD)	0-1	0.05 MG/M3	0.05 MG/M3	N/A

N/A = NOT AVAILABLE

SECTION THREE: PHYSICAL DATA

BOILING RANGE: 308-350 DEG. F
EVAPORATION RATE: FASTER THAN ETHER [ ] SLOWER THAN ETHER [X]
VAPOR DENSITY: HEAVIER THAN AIR [X] LIGHTER THAN AIR [ ]
% VOLATILE WEIGHT (THEORETICAL): 61
LB/GAL: 7.7

SECTION FOUR: FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION: OSHA: COMBUSTIDLE, CLASS II
FLASH PT: 100 DEG. F (ASTM D3278-78)
DOT: COMBUSTIDLE
LEL: 0.8 PERCENT BY VOLUME

EXTINGUISHING MEDIA: FOAM [X] "ALCOHOL" FOAM [ ] CO_2 [X] DRY CHEMICAL [X] WATERFOG [ ] OTHER [ ]

UNUSUAL FIRE AND EXPLOSION HAZARDS
CONTAINS FLAMMABLE SOLVENT.DO NOT USE IN AREAS WHERE SPARK OR OPEN FLAME ARE PRESENT.

SPECIAL FIRE FIGHTING PROCEDURES
SMOTHER FLAMES WITH ONE OF THE ABOVE EXTINGUISHING MEDIA. WATER MAY BE USED TO COOL UNOPENED CONTAINERS,BUT MUST NOT BE USED AS AN EXTINGUISHING MEDIA.TAKE CARE TO PREVENT SPREAD OF BURNING LIQUID WITH WATER. CLOSED CONTAINERS MAY EXPLODE WHEN EXPOSED TO EXTREME HEAT.

V.O.C
400 gm / liter

(3)

SECTION FIVE: HEALTH HAZARD DATA

CLC935 S5900441/K0/01

EFFECTS OF OVEREXPOSURE

EYES - IRRITATION,REDNESS,TEARING AND BLURRED VISION.
SKIN- IRRITATING. MAY RESULT IN DERMATITIS.
HARMFUL IF ABSORBED THROUGH SKIN.
INHALATION - IRRITATION OF RESPIRATORY TRACT.HEADACHE AND
DIZZINESS AND UNCONSCIOUSNESS.
INGESTION - GASTRO-INTESTINAL IRRITATION,NAUSEA,VOMITING
DIARRHEA.

MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE

SKIN AND RESPIRATORY CONDITIONS.

INGREDIENT LISTED AS CARCINOGEN OR POTENTIAL CARCINOGEN: NTP NO IARC MONOGRAPHS NO OSHA NO

PRIMARY ROUTE(S) OF ENTRY: DERMAL [X] INHALATION [X] INGESTION [ ]

EMERGENCY AND FIRST AID PROCEDURE

EYES - FLUSH IMMEDIATELY WITH COPIOUS QUANTITIES OF WATER
FOR 15 MINUTES.GET MEDICAL ATTENTION IMMEDIATELY.
SKIN - REMOVE CONTAMINATED CLOTHING,WASH SKIN WITH PLENTY OF
SOAP AND WATER. LAUNDER CLOTHES BEFORE REUSE.
INHALATION - REMOVE TO FRESH AIR.GIVE ARTIFICIAL RESPIRATION
IF NEEDED.GET MEDICAL ATTENTION.
INGESTION -CALL A PHYSICIAN IMMEDIATELY TO DETERMINE
WHETHER OR NOT TO INDUCE VOMITING.

SECTION SIX: REACTIVITY DATA

STABILITY: UNSTABLE [ ] STABLE [X] HAZARDOUS POLYMERIZATION: MAY OCCUR [ ] WILL NOT OCCUR [X]

HAZARDOUS DECOMPOSITION PRODUCTS:

CO,CO2,VARIOUS HYDROCARBON FRAGMENTS

CONDITIONS TO AVOID

STORE AWAY FROM DIRECT HEAT,FLAME OR SPARK.

INCOMPATABILITY (MATERIALS TO AVOID)

OXIDIZING AGENTS

SECTION SEVEN: SPILL OR LEAK PROCEDURE

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: REMOVE ALL SOURCES OF IGNITION. AVOID INHALATION OF VAPORS. VENTILATE AREA. CLEAN UP WITH ABSORBANT MATERIALS.

WASTE DISPOSAL METHOD: DISPOSE IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REGULATIONS. DO NOT INCINERATE UNOPENED CONTAINERS.

SECTION EIGHT: SAFE HANDLING AND USE INFORMATION

RESPIRATORY PROTECTION: IN OUTDOOR OR OPEN AREAS, WITH UNRESTRICTED VENTILATION, USE A **NIOSH** APPROVED FILTER RESPIRATOR TO REMOVE SOLID AIR-BORNE PARTICLES OF OVERSPRAY DURING SPRAY APPLICATION. IN RESTRICTED VENTILATION AREAS, USE A NIOSH APPROVED RESPIRATOR IN ACCORDANCE WITH 29 CFR 1910. 134 TO REMOVE A COMBINATION OF PARTICULATES AND VAPORS.

VENTILATION: PROVIDE SUFFICIENT VENTILATION, IN VOLUME AND PATTERN, TO KEEP TLV AND LEL OF HAZARDOUS INGREDIENTS BELOW LIMITS SPECIFIED ON PAGE ONE, AND TO REMOVE DECOMPOSITION PRODUCTS DURING WELDING OR FLAME CUTTING ON SURFACES COATED WITH THIS PRODUCT.

PROTECTIVE GLOVES: WEAR CHEMICAL RESISTANT GLOVES.

EYE PROTECTION: SAFETY GLASSES, CHEMICAL GOGGLES AND/OR FACE SHIELD SHOULD BE WORN TO PREVENT EYE CONTACT.

HYGIENIC PRACTICES: REMOVE AND WASH SOILED CLOTHING BEFORE REUSE. WASH HANDS BEFORE EATING OR SMOKING.

OTHER PROTECTIVE EQUIPMENT WEAR APPROPRIATE IMPERVIOUS PROTECTIVE CLOTHING TO PREVENT SKIN CONTACT.

SECTION NINE: SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

STORE IN BUILDING DESIGNED AND PROTECTED FOR STORAGE OF
LIQUIDS WITH NFPA CLASS GIVEN BY OSHA CLASS IN SECTION 4.
AVOID BREATHING DUST OR CHIPS FROM SANDING OR BLASTING
SURFACES COATED WITH THIS PRODUCT.

RECOMMEND GROUNDING AND BONDING OF CONTAINERS WHEN TRANSFERRING LIQUIDS AND POWDERS TO AVOID STATIC CHARGE BUILD UP.

OTHER PRECAUTIONS

CHRONIC OVEREXPOSURE TO, AND MISUSE OF, SOLVENTS HAS BEEN
LINKED TO PERMANENT BRAIN AND NERVOUS SYSTEM DAMAGE.
CHRONIC OVEREXPOSURE TO ETHYLENE GLYCOL ETHERS/ACETATES
HAS CAUSED ADVERSE REPRODUCTIVE EFFECTS AND LIVER,KIDNEY
BLOOD,SPLEEN AND LUNG ABNORMALITIES IN LABORATORY ANIMALS.
THIS PRODUCT CONTAINS LEAD. REFER TO OSHA LEAD STANDARD
FOR FULL DISCUSSION OF HEALTH EFFECTS.

MSDS for Oakwood Stain

MATERIAL SAFETY DATA SHEET

7

Alternative Materials Technology, Inc.
311 Otterson Dr., Ste. 60
Chico, CA 95928

Phone (530) 894-3585
Fax (530) 896-0657

9/18/2001 **Date Prepared**

Supersedes: All prior dates

24 HOUR EMERGENCY: 1-800-255-3924

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: LOW VOC BRANDY STAIN

PRODUCT CODE: 08WS08-017 **LF#:** KB58-99B

H.M.I.S. Rating:

FLAMMABILITY	HEALTH	REACTIVITY	PROTECTION
3	1	0	G

SECTION II - HAZARDOUS INGREDIENTS

Ingredient	Cas No.	Percent	OSHA PEL	ACGIH	OTHER	mmHg
ALIPHATIC HYDROCARBONS	8052-41-3	<5				
Acetone	67-64-1	30to40	750 ppm	750 ppm		182
*Aromatic Solvents	64742-94-5	<10	100 ppm	100 ppm		5

* INDICATES CHEMICAL(S) SUBJECT TO THE REPORTING REQUIREMENTS OF SECTION 313 OF TITLE III AND OF 40 CFR 372

SECTION II-A - VOLATILE ORGANIC CONTENT (VOC)

COMPLIANCE	
VOC Grams/Liter Minus Exempt	154.97
VOC Pounds/Gallon Minus Exempt	1.29
TOTAL VOC CONTENT (EMISSIONS)	
VOC Grams/Liter	88.12
VOC Pounds/Gallon	0.74

VHAP: 0.08 Lb/gal
Solids: 4.07 Lb/gal
Density 7.64 Lb/gal
Pounds VOC/Pounds Solids
0.18

SECTION III - PHYSICAL DATA *KB58-99B*

Property	Reference Measurement
Boiling Point	116 °F
Vapor Pressure (mm Hg.)	15
Vapor Density	(Air=1) Less than 1
Solubility in Water	Not Soluble
Specific Gravity	0.917 (H2O=1)
Evaporation Rate	(Butyl Acetate =1) Less than 1
Appearance and Odor	REDDISH BROWN, SOLVENT ODOR
Density: Pounds / Gallon	7.6 lbs/Gal
Percent Non-Volatile	53.2 %
Pounds Solids / Gallon	4.07
% Wt Emissions	9.6%

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Closed Cup):	-1 °F
Lower Explosive Limit::	1.00%
Upper Explosive Limit::	
Extinguishing Media:	FOAM, DRY CHEMICAL, CARBON DIOXIDE OR ANY CLASS "B" EXTINGUISHING AGENT. WATER MAY BE UNSUITABLE AS AN EXTINGUISHING MEDIUM, BUT HELPFULL IN KEEPING ADJACENT CONTAINERS COOL.
SPECIAL FIREFIGHTING PROCEDURES	FULL PROTECTIVE EQUIPMENT INCLUDING SELF CONTAINED BREATHING APPARATUS. WATER MAY BE USED TO COOL CONTAINERS TO PREVENT PRESSURE BUILDUP, POSSIBLE AUTOIGITION OR EXPLOSION DUE TO EXTREME HEAT.
UNUSUAL FIRE AND EXPLOSION HAZARDS	Vapors may form an explosive mixture in air. Closed containers may rupture when exposed to extreme heat. Handle or discard materials such as rags in accordance with all local, state, and federal regulations. **IF ACETONE IS LISTED IN SECTION II:** **EXTREMELY! VOLATILE AND FLAMMABLE. MUST BE USED IN AN EXTREMELY WELL VENTILATED AREA. RECOMMEND THAT ALL EQUIPMENT LIGHTING, FIXTURES, AND OTHER ELECTRICAL APPARATUS BE EXPLOSION PROOF.** **AMT DOES NOT WARRANTY AND WARNS STRONGLY AGAINST USING THIS PRODUCT IF SPECIFIED CONDITIONS ARE NOT MET. THESE STATEMENTS ARE MADE BECAUSE OF THE EXTREME VOLATILITY OF THE ACETONE AND OTHER FLAMMABLE SOLVENTS CONTAINED IN THIS PRODUCT** VAPORS MAY TRAVEL ALONG GROUND OR BE MOVED BY VENTILATION TO SOURCES OF IGNITION. CLOSED CONTAINERS MAY EXPLODE WHEN EXPOSED TO EXTREME HEAT. KEEP WORK AREA FREE FROM SOURCES OF IGNITION. RESIDUE IN EMPTIED CONTAINERS CAN EXPLODE OR IGNITE EXPLOSIVELY. ALL 5-GALLON PAILS AND LARGER METAL CONTAINERS MUST BE GROUNDED AND/OR BONDED DURING LIQUID TRANSFER.

KB58-99B

SECTION V - HEALTH HAZARD DATA

Health Hazards and Effects of Overexposure:

SKIN: This material may cause defatting and irritation of skin. Prolonged or repeated contact may cause dermatitis.

INHALATION: Excess exposure to vapors or spray mists can result in headache, dizziness, incoordination, nausea and loss of consciousness. Some reports have associated repeated and prolonged occupational exposure to solvents with permanent brain and nervous system damage.

EYES: This material may be an eye irritant.

FIRST AID:

EYES: Immediately flush eyes thoroughly with water and continue washing for 15 minutes. Obtain medical attention.

SKIN: Remove contaminated clothing. Wash with soap and water immediately.

INHALATION: Remove to fresh air immediately. If coughing, difficult breathing or any other respiratory symptoms develop, seek medical attention at once.

INGESTION: If ingested DO NOT induce vomiting, keep person warm, quiet, and get medical attention immediately. Aspiration of material into lungs can cause chemical pneumonitis which can be fatal.

PRIMARY ROUTES OF ENTRY: Inhalation and skin contact.

CARCINOGENICITY: This product does not contain 0.1% or more of any substance which is listed as a carcinogen by IARC, NTP or OSHA.

SECTION VI - REACTIVITY DATA

STABILITY: Stable

INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

CONDITIONS TO AVOID: Warm storage and ignition sources.

HAZARDOUS DECOMPOSITION PRODUCTS: INCOMPLETE COMBUSTION CAN YIELD CARBON MONOXIDE AND TOXIC VAPORS.

SECTION VII- SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled: Remove all sources of ignition. Ventilate area. Absorb spill with an absorbent material such as sawdust, vermiculite or sand and place material into a closed container.

If large spill, dike to prevent this material from entering water suysstems or sewers. Wear protective equipment during cleanup.

Waste Disposal Methods: This material has been tested and found to have a flash point below 140 degrees Fahrenheit. If discarded, this material and containers should be treated as hazardous wastes based on the characteristic of ignitability as defined under federal RCRA regulations (40 CFR 261). Disposal of this material or its container requires compliance with applicable labeling, packaging, and record keeping standards.

Extreme care should be taken to ensure that it is disposed of only in a facility permitted for disposal of hazardous waste. For further information, contact your state or local waste agency or the United States Environmental Protection Agency's

RCRA hotline (1-800-424-9346 or 202-382-3000)

SECTION VIII - CONTROL MEASURES

Respiratory Protection: A canister type respirator must be worn to prevent the inhalation of vapors or spray mists when the TLV or PEL is exceeded.

Ventilation: General ventilation is required during normal use. Local ventilation may be required during certain operations to keep exposure level below the limits listed in Section II of this data sheet.

Protective Gloves: Chemical-resistant nitrile, neoprene or rubber gloves required.

Eye Protection: Wear face shield or chemical goggles.

SECTION IX- SPECIAL PRECAUTIONS AND ADDITIONAL INFORMATION

Precautions to be taken in handling and Storing: Avoid prolonged or repeated inhalation of heated vapors or spray mists. Keep away from heat or open flame. Avoid prolonged or repeated skin contact.

Other Precautions: Handle all rags and other materials and/or waste soaked with this product in accordance with the recommendations listed in Section IV of this MSDS.

SARA Title III, Section 313: This product contains chemicals subject to the reporting requirement of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and 40 CFR 372.
ANY SUCH CHEMICALS ARE SHOWN IN SECTION II OF THIS MSDS AND ARE DESIGNATED WITH AN * * *

SECTION X - DISCLAIMER

Gloss Value: All gloss values listed are approximate. Each product is drawn down on a Leneta card for gloss measurement. Gloss value as sprayed may vary +-10 gloss units.

DISCLAIMER

TO THE BEST OF OUR KNOWLEDGE, THE INFORMATION CONTAINED HEREIN IS ACCURATE, OBTAINED FROM SOURCES BELIEVED BY ALTERNATIVE MATERIALS TECHNOLOGY TO BE ACCURATE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT REPRESENTATION OR WARRANTY,

EXPRESSED OR IMPLIED REGARDING ITS ACCURACY OR CORRECTNESS.

KB58-99B

MSDSs for Holmes Coatings

AKZO NOBEL

MATERIAL SAFETY DATA SHEET
Primers

Section 1 - Product Information

Manufacturer: Akzo Nobel Coatings Inc.
5555 Spalding Drive
Norcross, GA 30092
USA

Canadian Supplier: Akzo Nobel Coatings Ltd.
110 Woodbine Downs Blvd.
Unit #4 Etobicoke, Ontario
Canada M9W 5S6

Emergency Telephone: For US transportation emergencies call Chemtrec: 800-424-9300

For Canadian transportation emergencies call - Canutec: 613-996-6666

Information: 770-246-8454 (USA 7:00am – 4:00pm Eastern Time) Product Use: primer

Item Numbers (US & Canadian):
Autosurfacer LV Sealer 002012
Basefix 790 006052/006053
Autocoat LV Epoxy 001062/001063/001064
Washprimer CR 001040/001042
Plastoflex Primer 001009
Primer PO 006003/006005
Autosurfacer LV 2.1 002081
Washprimer EM CF 001045/001046

Emergency Overview

Signs of Overexposure: Nausea, cough, dizziness, weakness, headache, chest pain, lack of coordination, shortness o. breath, dermatitis, redness and/or pain in eyes.
Emergency First Aid: Move to fresh, remove contaminated clothing, wash effected skin with soap and water, do not use solvents or thinners; if product gets into eyes, remove contact lenses, flush with water for 15 minutes.
Handling: When handling wear an organic vapor cartridge respirator (NIOSH / OSHA), solvent resistant gloves and safety eye protection designed to guard against liquid splashes. Use approved bonding and grounding procedures when transferring to another container. Close all containers tightly after use. Do not eat, drink or smoke in work areas.
Clean-up: Eliminate sources of ignition. Dike to reduce extent of spill. Remove with inert absorbent (vermiculite, clay, Oil-Dry®, Kitty Litter, etc.) using non-sparking tools. Transfer to a grounded metal container, seal container. Dispose of as hazardous waste.
Material Appearance: White, Green, Gray or Yellow
Material Physical Appearance: Liquid
Other Precautions: Vapors are heavier than air and may travel along floors. Material has an offensive odor. Prolonged exposure may reduce the user's sensitivity to the odor, thus reducing the effectiveness of odor as a warning against exposure.
Fire Fighting: Flammable liquid, refer to Guide 127 of the North American Emergency Guide Book. Forms explosive mixture with air, vapors are heavier than air and may travel to a source of ignition and flash back.
NFPA Flammability: I B and/or IC.
Akzo Nobel Coatings Inc. has no oversight with respect to the guidance practices or policies or manufacturing processes of other companies handling or using this material. The information given in this MSDS is only related to the product as shipped in its original condition as described in Section 2, "Hazardous Ingredients" and Section 9 "Physical and Chemical Properties".

These products are considered hazardous under the Federal OSHA Hazard Communication Standard

Section 2 - Hazardous Ingredients

Hazardous Ingredient	% by weight	CAS No.	Vapor Press.	ACGIH TLV	OSHA PEL	LD_{50} Oral	LD_{50} Derm	LC_{50} Inhal.	LEL

Plastoflex contains:

1,2,4 Trimethylbenzene *(SARA313)*	3.2%	95-63-6	1.7	25ppm	25ppm	5000	n. av.	18000	n.av
Aromatic Solvent	5-10%	000	n. av.	100ppm	n. av.	n. av.	n. av.	n. av.	n. av
Butanol *(SARA313)*	12.8%	71-36-3	5.5	n. av.	100ppm	790	3400	8000	1.7
Ethylbenzene *(SARA313)*	8.8%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
N-methyl-2-Pyrollidone *(SARA313)*	1-5%	872-50-4	0.29	100ppm	n. av.	4200	8000	n. av.	0.9
Xylene-mixed isomers *(SARA313)*	40.3%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Propylene Glycol Methyl Ether	10-20%	107-98-2	12.5	100ppm	n. av.	5660	13000	10000	n.av

Basefix 790 contains:

Aromatic Solvent	1-5%	000	n. av.	100ppm	n. av.	n. av.	n. av.	n. av.	n. av
Butyl Acetate	20-30%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Isopropyl Alcohol	1-5%	67-63-0	32.8	400ppm	400ppm	5045	12800	16000	2.3
Isobutyl Acetate	20-30%	110-19-0	12.5	150ppm	150ppm	13400	17400	3500	1.3
Toluene *(SARA313)(P65)*	5.6%	108-88-3	22.0	50ppm	200ppm	636	12305	8000	1.1
Xylene-mixed isomers *(SARA313)*	4.4%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Ethylbenzene *(SARA313)*	1.3%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
1,2,4 Trimethylbenzene *(SARA313)*	1.4%	95-63-6	1.7	25ppm	25ppm	5000	n. av.	18000	n.av
Nitrocellulose	1-5%	9004-70-0	n. ap.	n. av.	n. av.	n. av.	n. av.	n. av.	n.ap
V M & P Naphtha	10-20%	8032-32-4	38.0	300ppm	300ppm	n. av.	n. av.	1600	0.9

Primer PO contains:

Butyl Acetate	5-10%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Ethylbenzene *(SARA313)*	17.1%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Xylene-mixed isomers *(SARA313)*	75.7%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0

Autocoat LV Epoxy contains:

Methyl Ethyl Ketone *(SARA313)*	5.7%	78-93-3	77.5	200ppm	200ppm	2737	6480	23500	1.8
Epoxy Resin	10-20%	25036-25-3	n. ap.	10mg/m^3	15mg/m^3	30000	3000	n. av.	n.ap
Epoxy Resin	1-5%	25068-38-6	n. ap.	n. av.	n. av.	11400	2340	n. av.	n.ap
Butyl Acetate	1-5%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Butyl Glycidyl Ether	1-5%	2426-08-6	n. ap.	25ppm	50ppm	n. av.	n. av.	n. av.	n.ap
C6-C8 Branched Alcohol	1-5%	90438-79-2	22.0	n. av.	n. av.	n. av.	n. av.	n. av.	1.0
Titanium Dioxide	5-10%	13463-67-7	n. ap.	10mg/m^3	10mg/m^3	n. av.	n. av.	n. av.	n.ap
Talc	5-10%	14807-96-6	n. ap.	2mg/m^3	2mg/m^3	n. av.	n. av.	n. av.	n.ap
Ethylbenzene *(SARA313)*	0.5%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Toluene *(SARA313)(P65)*	0.002%	108-88-3	22.0	50ppm	100ppm	5000	14000	4000	1.2
Carbon Black *(P65)*	0.2%	1333-86-4	n. ap.	3.5mg/m^3	3.5mg/m^3	n. av.	n. av.	n. av.	n.ap
Xylene-mixed isomers *(SARA313)*	2.3%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Barium Sulfate	5-10%	7727-43-7	n. ap.	10mg/m^3	15mg/m^3	n. av.	n. av.	n. av.	n.ap
Amorphous Silica	10-20%	112926-00-8	n. ap.	10mg/m^3	20mg/m^3	n. av.	n. av.	n. av.	n.ap
Calcium Oxide	10-20%	1305-78-8	n. ap.	2mg/m^3	5mg/m^3	n. av.	n. av.	n. av.	n.ap
Bisphenol A Diglycidyl Ether	5-10%	1675-54-3	n. ap.	n. av.	n. av.	11000	20000	n. av.	n.ap
Methyl Isobutyl Ketone *(SARA313)*	2.6%	108-10-1	15.0	50ppm	100ppm	2080	24950	2000	1.2
Quartz Crystalline Silica *(P65)*	0.01%	14808-60-7	n. ap.	.1mg/m^3	.1mg/m^3	n. av.	n. av.	n. av.	n.ap
Zinc Phosphate *(SARA313)*	14.2%	7790-90-0	n. ap.	n. av.	n. av.	n. av.	n. av.	n. av.	n.ap

Autosurfacer LV 2.1 contains:

Talc	5-10%	14807-96-6	n.ap	2mg/m^3	2mg/m^3	n.av.	n.av.	n.av.	n.ap
Butyl Acetate	10-20%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Zinc Phosphate *(SARA 313)*	8.4%	7790-90-0	n.ap	n.av.	n.av.	n.av.	n.av.	n.av.	n.ap
Calcium Carbonate	20-40%	471-34-1	n.ap	10mg/m^3	15mg/m^3	n.av.	n.av.	n.av.	n.ap
Quartz Crystalline Silica *(P65)*	0.39%	14808-60-7	n.ap.	.1mg/m^3	.1mg/m^3	n. av.	n. av.	n. av.	n.ap
Titanium Dioxide	20-40%	13463-67-7	n.ap	10mg/m^3	10mg/m^3	n.av.	n.av.	n.av.	n.ap

Washprimer CR contains:

Butanol *(SARA313)*	10.9%	71-36-3	5.5	n. av.	100ppm	790	3400	8000	1.7
Formaldehyde *(SARA313)(P65)*	0.1%	50-00-0	9.5	0.3mg/m^3	0.75mg/m^3	800	270	590	1.1
Isopropyl Alcohol	40-70%	67-63-0	32.8	400ppm	400ppm	5045	12800	16000	2.3
Talc	1-5%	14807-96-6	n. ap.	2mg/m^3	2mg/m^3	n. av.	n. av.	n. av.	n.ap
Zinc Chromate *(SARA313)(P65)*	8.1%	13530-65-9	n. ap.	.01mg/m^3	.01mg/m^3	n. av.	n. av.	n. av.	n.ap

Autosurfacer LV Sealer contains:

Xylene-mixed isomers *(SARA 313)*	3.1%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Ethylbenzene *(SARA 313)*	0.7%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Talc	6.1%	14807-96-6	n.ap	2mg/m^3	2mg/m^3	n.av.	n.av.	n.av.	n.ap
Butyl Acetate	6.2%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Zinc Phosphate *(SARA 313)*	7.7%	7790-90-0	n.ap	n.av.	n.av.	n.av.	n.av.	n.av.	n.ap
Calcium Carbonate	14.9%	471-34-1	n.ap	10mg/m^3	15mg/m^3	n.av.	n.av.	n.av.	n.ap
Titanium Dioxide	12.3%	13463-67-7	n.ap	10mg/m^3	10mg/m^3	n.av.	n.av.	n.av.	n.ap
Kaolin	6.1%	1332-58-7	n.ap	2mg/m^3	10mg/m^3	n.av.	n.av.	n.av.	n.ap
Methyl Amyl Ketone	12.3%	110-43-0	2.1	50ppm	100ppm	1670	10286	2000	1.1
Zinc Hydroxide *(SARA313)*	1.9%	20427-58-1	n. ap.	n. av.	n. av.	n. av.	n. av.	n. av.	n.ap

Washprimer EM CF contains:

AKZO NOBEL

MATERIAL SAFETY DATA SHEET

Primers

Section 1 - Product Information

Manufacturer: Akzo Nobel Coatings Inc.
5555 Spalding Drive
Norcross, GA 30092
USA

Canadian Supplier: Akzo Nobel Coatings Ltd.
110 Woodbine Downs Blvd.
Unit #4 Etobicoke, Ontario
Canada M9W 5S6

Emergency Telephone: For US transportation emergencies call - Chemtrec: 800-424-9300

For Canadian transportation emergencies call - Canutec: 613-996-6666

Information: 770-246-8454 (USA 7:00am – 4:00pm Eastern Time) Product Use: primer

Item Numbers (US & Canadian):

Autosurfacer LV Sealer 002012
Basefix 790 006052/006053
Autocoat LV Epoxy 001062/001063/001064
Washprimer CR 001040/001042
Plastoflex Primer 001009
Primer PO 006003/006005
Autosurfacer LV 2.1 002081
Washprimer EM CF 001045/001046

Emergency Overview

Signs of Overexposure: Nausea, cough, dizziness, weakness, headache, chest pain, lack of coordination, shortness of breath, dermatitis, redness and/or pain in eyes.
Emergency First Aid: Move to fresh, remove contaminated clothing, wash effected skin with soap and water, do not use solvents or thinners; if product gets into eyes, remove contact lenses, flush with water for 15 minutes.
Handling: When handling wear an organic vapor cartridge respirator (NIOSH / OSHA), solvent resistant gloves and safety eye protection designed to guard against liquid splashes. Use approved bonding and grounding procedures when transferring to another container. Close all containers tightly after use. Do not eat, drink or smoke in work areas.
Clean-up: Eliminate sources of ignition. Dike to reduce extent of spill. Remove with inert absorbent (vermiculite, clay, Oil-Dry®, Kitty Litter, etc.) using non-sparking tools. Transfer to a grounded metal container, seal container. Dispose of as hazardous waste.
Material Appearance: White, Green, Gray or Yellow
Material Physical Appearance: Liquid
Other Precautions: Vapors are heavier than air and may travel along floors. Material has an offensive odor. Prolonged exposure may reduce the user's sensitivity to the odor, thus reducing the effectiveness of odor as a warning against exposure.
Fire Fighting: Flammable liquid, refer to Guide 127 of the North American Emergency Guide Book. Forms explosive mixture with air, vapors are heavier than air and may travel to a source of ignition and flash back.
NFPA Flammability: I B and/or IC.
Akzo Nobel Coatings Inc. has no oversight with respect to the guidance practices or policies or manufacturing processes of other companies handling or using this material. The information given in this MSDS is only related to the product as shipped in its original condition as described in Section 2, "Hazardous Ingredients" and Section 9 "Physical and Chemical Properties".

These products are considered hazardous under the Federal OSHA Hazard Communication Standard

Section 2 - Hazardous Ingredients

Hazardous Ingredient	% by weight	CAS No.	Vapor Press.	ACGIH TLV	OSHA PEL	LD_{50} Oral	LD_{50} Derm	LC_{50} Inhal.	LEL

Date of Preparation: January 7, 2002

Primers

Plastoflex contains:									
1,2,4 Trimethylbenzene *(SARA313)*	3.2%	95-63-6	1.7	25ppm	25ppm	5000	n. av.	18000	n.av
Aromatic Solvent	5-10%	000	n. av.	100ppm	n. av.	n. av	n. av.	n. av.	n. av
Butanol*(SARA313)*	12.8%	71-36-3	5.5	n. av.	100ppm	790	3400	8000	1.7
Ethylbenzene*(SARA313)*	8.8%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
N-methyl-2-Pyrollidone*(SARA313)*	1-5%	872-50-4	0.29	100ppm	n. av.	4200	8000	n. av.	0.9
Xylene-mixed isomers*(SARA313)*	40.3%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Propylene Glycol Methyl Ether	10-20%	107-98-2	12.5	100ppm	n. av.	5660	13000	10000	n.av
Basefix 790 contains:									
Aromatic Solvent	1-5%	000	n. av.	100ppm	n. av.	n. av.	n. av.	n. av.	n. av
Butyl Acetate	20-30%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Isopropyl Alcohol	1-5%	67-63-0	32.8	400ppm	400ppm	5045	12800	16000	2.3
Isobutyl Acetate	20-30%	110-19-0	12.5	150ppm	150ppm	13400	17400	3500	1.3
Toluene*(SARA313)(P65)*	5.6%	108-88-3	22.0	50ppm	200ppm	636	12305	8000	1.1
Xylene-mixed isomers*(SARA313)*	4.4%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Ethylbenzene*(SARA313)*	1.3%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
1,2,4 Trimethylbenzene *(SARA313)*	1.4%	95-63-6	1.7	25ppm	25ppm	5000	n. av.	18000	n.av
Nitrocellulose	1-5%	9004-70-0	n. ap.	n. av.	n. av.	n. av.	n. av.	n. av.	n.ap
V M & P Naphtha	10-20%	8032-32-4	38.0	300ppm	300ppm	n. av.	n. av.	1600	0.9
Primer PO contains:									
Butyl Acetate	5-10%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Ethylbenzene*(SARA313)*	17.1%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Xylene-mixed isomers*(SARA313)*	75.7%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Autocoat LV Epoxy contains:									
Methyl Ethyl Ketone*(SARA313)*	5.7%	78-93-3	77.5	200ppm	200ppm	2737	6480	23500	1.8
Epoxy Resin	10-20%	25036-25-3	n. ap.	10mg/m^3	15mg/m^3	30000	3000	n. av.	n.ap
Epoxy Resin	1-5%	25068-38-6	n. ap.	n. av.	n. av.	11400	2340	n. av.	n.ap
Butyl Acetate	1-5%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Butyl Glycidyl Ether	1-5%	2426-08-6	n. ap.	25ppm	50ppm	n. av.	n. av.	n. av.	n.ap
C6-C8 Branched Alcohol	1-5%	90438-79-2	22.0	n. av.	n. av.	n. av.	n. av.	n. av.	1.0
Titanium Dioxide	5-10%	13463-67-7	n. ap.	10mg/m^3	10mg/m^3	n. av.	n. av.	n. av.	n.ap
Talc	5-10%	14807-96-6	n. ap.	2mg/m^3	2mg/m^3	n. av.	n. av.	n. av.	n.ap
Ethylbenzene*(SARA313)*	0.5%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Toluene*(SARA313)(P65)*	0.002%	108-88-3	22.0	50ppm	100ppm	5000	14000	4000	1.2
Carbon Black *(P65)*	0.2%	1333-86-4	n. ap.	3.5mg/m^3	3.5mg/m^3	n. av.	n. av.	n. av.	n.ap
Xylene-mixed isomers*(SARA313)*	2.3%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Barium Sulfate	5-10%	7727-43-7	n. ap.	10mg/m^3	15mg/m^3	n. av.	n. av.	n. av.	n.ap
Amorphous Silica	10-20%	112926-00-8	n. ap.	10mg/m^3	20mg/m^3	n. av.	n. av.	n. av.	n.ap
Calcium Oxide	10-20%	1305-78-8	n. ap.	2mg/m^3	5mg/m^3	n. av.	n. av.	n. av.	n.ap
Bisphenol A Diglycidyl Ether	5-10%	1675-54-3	n. ap.	n. av.	n. av.	11000	20000	n. av.	n.ap
Methyl Isobutyl Ketone*(SARA313)*	2.6%	108-10-1	15.0	50ppm	100ppm	2080	24950	2000	1.2
Quartz Crystalline Silica *(P65)*	0.01%	14808-60-7	n. ap.	.1mg/m^3	.1mg/m^3	n. av.	n. av.	n. av.	n.ap
Zinc Phosphate*(SARA313)*	14.2%	7790-90-0	n. ap.	n. av.	n. av.	n. av.	n. av.	n. av.	n.ap
Autosurfacer LV 2.1 contains:									
Talc	5-10%	14807-96-6	n.ap	2mg/m^3	2mg/m^3	n.av.	n.av.	n.av.	n.ap
Butyl Acetate	10-20%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Zinc Phosphate *(SARA 313)*	8.4%	7790-90-0	n.ap	n.av.	n.av.	n.av.	n.av.	n.av.	n.ap
Calcium Carbonate	20-40%	471-34-1	n.ap	10mg/m^3	15mg/m^3	n.av.	n.av.	n.av.	n.ap
Quartz Crystalline Silica *(P65)*	0.39%	14808-60-7	n.ap.	.1mg/m^3	.1mg/m^3	n. av.	n. av.	n. av.	n.ap
Titanium Dioxide	20-40%	13463-67-7	n.ap	10mg/m^3	10mg/m^3	n.av.	n.av.	n.av.	n.ap
Washprimer CR contains:									
Butanol*(SARA313)*	10.9%	71-36-3	5.5	n. av.	100ppm	790	3400	8000	1.7
Formaldehyde*(SARA313)(P65)*	0.1%	50-00-0	9.5	0.3mg/m^3	0.75mg/m^3	800	270	590	1.1
Isopropyl Alcohol	40-70%	67-63-0	32.8	400ppm	400ppm	5045	12800	16000	2.3
Talc	1-5%	14807-96-6	n. ap.	2mg/m^3	2mg/m^3	n. av.	n. av.	n. av.	n.ap
Zinc Chromate*(SARA313)(P65)*	8.1%	13530-65-9	n. ap.	.01mg/m^3	.01mg/m^3	n. av.	n. av.	n. av.	n.ap
Autosurfacer LV Sealer contains:									
Xylene-mixed isomers *(SARA 313)*	3.1%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Ethylbenzene *(SARA 313)*	0.7%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Talc	6.1%	14807-96-6	n.ap	2mg/m^3	2mg/m^3	n.av.	n.av.	n.av.	n.ap
Butyl Acetate	6.2%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Zinc Phosphate *(SARA 313)*	7.7%	7790-90-0	n.ap	n.av.	n.av.	n.av.	n.av.	n.av.	n.ap
Calcium Carbonate	14.9%	471-34-1	n.ap	10mg/m^3	15mg/m^3	n.av.	n.av.	n.av.	n.ap
Titanium Dioxide	12.3%	13463-67-7	n.ap	10mg/m^3	10mg/m^3	n.av.	n.av.	n.av.	n.ap
Kaolin	6.1%	1332-58-7	n.ap	2mg/m^3	10mg/m^3	n.av.	n.av.	n.av.	n.ap
Methyl Amyl Ketone	12.3%	110-43-0	2.1	50ppm	100ppm	1670	10286	2000	1.1
Zinc Hydroxide*(SARA313)*	1.9%	20427-58-1	n. ap.	n. av.	n. av.	n. av.	n. av.	n. av.	n.ap
Washprimer EM CF contains:									

AKZO NOBEL

MATERIAL SAFETY DATA SHEET

Colorbuild 2.1/2.8

Section 1 - Product Information

Manufacturer: Akzo Nobel Coatings Inc.
5555 Spalding Drive
Norcross, GA 30092
USA

Canadian Supplier: Akzo Nobel Coatings Ltd.
110 Woodbine Downs Blvd.
Unit #4 Etobicoke, Ontario
Canada M9W 5S6

Emergency Telephone: For US transportation emergencies call - Chemtrec: 800-424-9300

For Canadian transportation emergencies call - Canutec: 613-996-6666

Information: 770-246-8454 (USA 7:00am – 4:00pm Eastern Time) Product Use: primer

Item Numbers (US & Canadian):

White 2.1/2.8 002502
Blue 2.1/2.8 002522
Yellow 2.1/2.8 002542
Black 2.1/2.8 002512
Green 2.1/2.8 002532
Red 2.1/2.8 002552

Emergency Overview

Signs of Overexposure: Nausea, cough, dizziness, weakness, headache, chest pain, lack of coordination, shortness of breath, dermatitis, redness and/or pain in eyes.
Emergency First Aid: Move to fresh, remove contaminated clothing, wash effected skin with soap and water, do not use solvents or thinners; if product gets into eyes, remove contact lenses, flush with water for 15 minutes.
Handling: When handling wear an organic vapor cartridge respirator (NIOSH / OSHA), solvent resistant gloves and safety eye protection designed to guard against liquid splashes. Use approved bonding and grounding procedures when transferring to another container. Close all containers tightly after use. Do not eat, drink or smoke in work areas.
Clean-up: Eliminate sources of ignition. Dike to reduce extent of spill. Remove with inert absorbent (vermiculite, clay, Oil-Dry®, Kitty Litter, etc.) using non-sparking tools. Transfer to a grounded metal container, seal container. Dispose of as hazardous waste.
Material Appearance: White, Blue, Green, Red, Black or Yellow
Material Physical Appearance: Liquid
Other Precautions: Vapors are heavier than air and may travel along floors. Material has an offensive odor. Prolonged exposure may reduce the user's sensitivity to the odor, thus reducing the effectiveness of odor as a warning against exposure.
Fire Fighting: Flammable liquid, refer to Guide 127 of the North American Emergency Guide Book. Forms explosive mixture with air, vapors are heavier than air and may travel to a source of ignition and flash back.
NFPA Flammability: I C
Akzo Nobel Coatings Inc. has no oversight with respect to the guidance practices or policies or manufacturing processes of other companies handling or using this material. The information given in this MSDS is only related to the product as shipped in its original condition as described in Section 2, "Hazardous Ingredients" and Section 9 "Physical and Chemical Properties".

These products are considered hazardous under the Federal OSHA Hazard Communication Standard

Section 2 - Hazardous Ingredients

Hazardous Ingredient	Percent weight	CAS No.	Vapor Press.	ACGIH TLV	OSHA PEL	LD_{50} Oral	LD_{50} Derm	LC_{50} Inhal.	LEL
Colorbuild 2.1/2.8 contains the following:									
Talc	5-10%	14807-96-6	n.ap	2mg/m^3	2mg/m^3	n.av.	n.av.	n.av.	n.ap
Zinc Phosphate *(SARA 313)*	7.8%	7790-90-0	n.ap	n.av.	n.av.	n.av.	n.av.	n.av.	n.ap
Calcium Carbonate	10-20%	471-34-1	n.ap	10mg/m^3	15mg/m^3	n.av.	n.av.	n.av.	n.ap
Ethylbenzene *(SARA 313)*	0.2%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Tert-butyl Alcohol*(SARA313)*	3.5%	75-65-0	40.0	100ppm	100ppm	n. av.	n. av.	n. av.	n.ap
Butanol*(SARA313)*	1.5%	71-36-3	5.5	n. av.	100ppm	790	3400	8000	1.7
p-Chlorobenzotrifluoride	30-40%	98-56-6	5.3	n. av.	n. av.	6800	2700	4479	6.2
Quartz Crystalline Silica *(P65)*	0.05%	14808-60-7	n. ap.	.1mg/m^3	.1mg/m^3	n. av.	n. av.	n. av.	n.ap
Yellow 2.1/2.8 also includes:									
Ethyl Acetate	1-5%	141-78-6	76.0	400ppm	400ppm	5620	18031	1600	2.2
Kaolin	1-5%	1332-58-7	n. ap	10mg/m^3	15mg/m^3	n. av.	n. av.	n. av.	n.ap
Red 2.1/2.8 also includes:									
Monoazo Barium Salt *(SARA313)*	3.7%	000	n. ap.	6mg/m^3	n. av.	>5000	none	none	n.ap
Black 2.1/2.8 also includes:									
Carbon Black *(P65)*	0.8%	1333-86-4	n. ap.	3.5mg/m^3	3.5mg/m^3	n. av.	n. av.	n. av.	n.ap
White 2.1/2.8 also includes:									
Titanium Dioxide	10-20%	13463-67-7	n. ap.	10mg/m^3	10mg/m^3	n. av.	n. av.	n. av.	n.ap
Kaolin	1-5%	1332-58-7	n. ap	10mg/m^3	15mg/m^3	n. av.	n. av.	n. av.	n.ap
Green 2.1/2.8 also includes:									
Copper Phthalocyanine Green	1-5%	1328-53-6	n. ap.	1mg/m^3	1mg/m^3	n. av.	n. av.	n. av.	n.ap

LD_{50} Oral - rat mg/m^3, LD_{50} Dermal - rabbit mg/m^3, LC_{50} Inhalation - rat mg/m^3 unless otherwise specified.

Chemicals marked with *(SARA313)* are subject to the requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA); see Section 15 - Regulatory Information. Chemicals marked with *(P65)* are regulated in California by Proposition 65; see Section 15 - Regulatory Information.

Section 3 – Hazards Identification

Primary Routes of Entry: Inhalation, skin contact, ingestion, eyes.
Exposure Effects Acute and Chronic:
Inhalation: Acute: Nasal and respiratory irritation, dizziness, cough, shortness of breath, dehydration, dizziness, weakness, headache, drowsiness, fatigue, nausea, headache, possible unconsciousness, chemical pneumonitis, central nervous system depression and even asphyxiation.
Skin contact: Acute: Extraction of natural oils with resulting dry skin, irritation, redness and dermatitis. Can be absorbed through the skin into the blood.
Eye contact: Acute: Irritation, redness, pain, blurred vision, sensation of seeing halos around lights and reversible damage.
Ingestion: Acute and Chronic: Gastrointestinal irritation, nausea, weakness, fatigue, vomiting and diarrhea; kidney damage, blood system damage.
Chronic: Repeated overexposure to these products may cause central nervous system damage, kidney damage, liver abnormalities, lung damage, cardiac abnormalities, reproductive organ damage, skin sensitization and dermatitis.
Other Health Effects:
Intentional misuse by deliberately concentrating and inhaling the contents may be harmful or fatal. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.

Section 4 – First Aid Measures

Emergency and First Aid Procedures: In all cases if symptoms persist, seek medical attention.
Inhalation - move to fresh air, give artificial respiration if necessary.
Skin contact - remove contaminated clothing, wash with soap and water or recognized skin cleaner. Do not use solvents or thinners.
Eye contact - contact lenses must be removed, flush with water for at least 15 minutes, consult a physician immediately.
Ingestion - drink one or two glasses of water to dilute. Do not induce vomiting. Consult a physician or poison control center immediately. Treat symptomatically.
Medical Conditions Prone to Aggravation: pulmonary conditions, liver conditions, kidney conditions, neurological disorders, pregnancy, reproductive system disorders.

AKZO NOBEL

MATERIAL SAFETY DATA SHEET

Autobase Plus Toners

Section 1 - Product Information

Manufacturer: Akzo Nobel Coatings Inc.
5555 Spalding Drive
Norcross, GA 30092
USA

Canadian Supplier: Akzo Nobel Coatings Ltd.
110 Woodbine Downs Blvd.
Unit #4 Etobicoke, Ontario
Canada M9W 5S6

Emergency Telephone: For US transportation emergencies call - Chemtrec: 800-424-9300

For Canadian transportation emergencies call - Canutec: 613-996-6666

Information: 770-246-8454 (USA 7:00am – 3:00pm Eastern Time)

Product Use: color base coat

Item and Color Numbers

Q065 049065	**Q066** 049066	**Q070** 049070	**Q110** 049110	**Q140** 049140	**Q160** 049160
Q190 049190	**Q191** 049191	**Q195** 049195	**Q198** 049198	**Q231** 049231	**Q232** 049232
Q235 049235	**Q239** 049239	**Q271** 049271	**Q279** 049279	**Q325** 046325	**Q326** 049326
Q328 049328	**Q348** 049348	**Q431** 049431	**Q436** 049436	**Q437** 049437	**Q439** 049439
Q452 049452	**Q455** 049455	**Q550** 049550	**Q564** 049564	**Q652** 049652	**Q671** 049671
Q673 049673	**Q678** 049678	**Q724** 049724	**Q725** 049725	**Q726** 049726	**Q766** 049766
Q811B 049811	**Q811E** 049812	**Q811J** 049813	**Q811M** 049814	**Q811P** 049815	**Q811R** 049816
Q811U 049817	**Q843H** 049818	**Q833G** 049819	**Q911M** 049920	**Q914C** 049921	**Q914F** 049922
Q922M 049923	**Q925M** 049924	**Q925N** 049925	**Q933F** 049926	**Q933M** 049927	**Q941F** 049928
Q941M 049929	**Q943M** 049930	**Q951F** 049931	**Q952M** 049932	**Q954H** 049933	**Q954M** 049934
Q954S 049935	**Q964F** 049936	**Q964S** 049937	**Q975S** 049938		

Emergency Overview

Signs of Overexposure: Nausea, cough, dizziness, weakness, headache, chest pain, lack of coordination, shortness of breath, dermatitis, redness and/or pain in eyes.

Emergency First Aid: Move to fresh air, remove contaminated clothing, wash effected skin with soap and water, do not use solvents or thinners; if product gets into eyes, remove contact lenses, flush with water for 15 minutes.

Handling: When handling wear an organic vapor cartridge respirator (NIOSH / OSHA), solvent resistant gloves and safety eye protection designed to guard against liquid splashes. Use approved bonding and grounding procedures when transferring to another container. Close all containers tightly after use. Do not eat, drink or smoke in work areas.

Clean-up: Eliminate sources of ignition. Dike to reduce extent of spill. Remove with inert absorbent (vermiculite, clay, Oil-Dry®, Kitty Litter, etc.) using non-sparking tools. Transfer to a grounded metal container, seal container. Dispose of as hazardous waste.

Material Appearance: Colored

Material Physical Appearance: Liquid

Other Precautions: Vapors are heavier than air and may travel along floors. Material has an offensive odor. Prolonged exposure may reduce the user's sensitivity to the odor, thus reducing the effectiveness of odor as a warning against exposure. **Fire Fighting**: Flammable liquid, refer to Guide 127 of the North American Emergency Guide Book. Forms explosive mixture with air, vapors are heavier than air and may travel to a source of ignition and flash back.

NFPA Flammability: 1B or 1C

Akzo Nobel Coatings Inc. has no oversight with respect to the guidance practices or policies or manufacturing processes of other companies handling or using this material. The information given in this MSDS is only related to the product as shipped in its original condition as described in Section 2, "Hazardous Ingredients" and Section 9 "Physical and Chemical Properties"

These products are considered hazardous under the Federal OSHA Hazard Communication Standard

Section 2 - Hazardous Ingredients

Hazardous Ingredient	Percent weight	CAS No.	Vapor Press.	ACGIH TLV	OSHA PEL	LD_{50} Oral	LD_{50} Derm	LC_{50} Inhal	LEL
Q065 Connector contains:									
Xylene-mixed isomers *(SARA313)*	13.8%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Ethylbenzene *(SARA313)*	3.9%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Propylene Glycol Methyl Ether Acetate	1-5%	108-65-6	3.4	100ppm	n. av.	8532	5000	n. av.	1.5
Butanol *(SARA313)*	3.2%	71-36-3	5.5	n. av.	100ppm	790	3400	8000	1.7
Aromatic Solvent	1-5%	000	n. av.	100ppm	n. av.	n. av	n. av.	n. av.	n. av
Isopropanol	1-5%	67-63-0	32.8	400ppm	400ppm	5045	12800	16000	2.3
Cellulose Acetate Butyrate	5-10%	9004-36-8	n. ap.	n. av.	n. av.	n. av.	n. av.	n. av.	n.ap
Propylene Glycol Methyl Ether	1-5%	107-98-2	12.5	100ppm	n. av.	5660	13000	10000	n.av
Butyl Acetate	45-50%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Toluene*(SARA313)(P65)*	0.04%	108-88-3	22.0	50ppm	200ppm	636	12305	8000	1.1
All toners contain the following:									
Butyl Acetate	20-45%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Propylene Glycol Methyl Ether Acetate	1-20%	108-65-6	3.4	100ppm	n. av.	8532	5000	n. av.	1.5
Acrylic Resin	1-15%	000	n. ap.	n. av.	n. av.	n. av.	n. av.	n. av.	n.ap
Propylene Glycol Methyl Ether	1-15%	107-98-2	12.5	100ppm	n. av.	5660	13000	10000	n.av
Xylene-mixed isomers *(SARA313)*	5-15%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Butanol *(SARA313)*	1-20%	71-36-3	5.5	n. av.	100ppm	790	3400	8000	1.7
Cellulose Acetate Butyrate	1-10%	9004-36-8	n. ap.	n. av.	n. av.	n. av.	n. av.	n. av.	n.ap
Ethylbenzene *(SARA313)*	1-5%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Diacetone Alcohol	1-5%	123-42-2	0.9	50ppm	50ppm	4000	13500	n.av.	1.8
Toluene*(SARA313)(P65)*	<0.75%	108-88-3	22.0	50ppm	200ppm	636	12305	8000	1.1
Q070 also contains:									
Isopropanol	10-15%	67-63-0	32.8	400 ppm	400 ppm	5045	12800	12000	2.3
Q110 and Q195 also contain:									
Aromatic Solvent	1-5%	000	n. av.	100ppm	n. av.	n. av.	n. av.	n. av.	n. av
Amorphous Silica	1-5%	112926-00-8	n.ap	10mg/m^3	20mg/m^3	n. av.	n. av.	n. av.	n.ap
Alumina Trihydrozide	1-5%	21645-51-2	n.ap	2mg/m^3	n. av.	n. av.	n. av.	n. av.	n.ap
Titanium Dioxide	5-25%	13463-67-7	n.ap	10mg/m^3	10mg/m^3	n.av.	n.av.	n.av.	n.ap
Q140 also contains:									
Isopropanol	1-5%	67-63-0	32.8	400 ppm	400 ppm	5045	12800	12000	2.3
2-butoxyethanol *(SARA313)*	2.53%	111-76-2	0.4	20S	50S	470	220	450	1.1
Carbon Black*(P65)*	1-5%	1333-86-4	n.ap	3.5mg/m^3	3.5mg/m^3	n.av.	n.av.	n.av.	n.ap
Q160 also contains:									
Carbon Black*(P65)*	1-5%	1333-86-4	n.ap	3.5mg/m^3	3.5mg/m^3	n.av.	n.av.	n.av.	n.ap
Q190 and Q191 also contain:									
Amorphous Silica	1-10%	112926-00-8	n.ap	10mg/m^3	20mg/m^3	n. av.	n. av.	n. av.	n.ap
Q198 also contains:									
Graphite	5-10%	7782-42-5	n.ap	2mg/m^3	5mg/m^3	>2000	n.av.	n.av.	n.ap
Q231, Q271, Q452 and Q726 also contain:									
2-butoxyethanol *(SARA313)*	1-5%	111-76-2	0.4	20S	50S	470	220	450	1.1
Q239 also contains:									
Iron Oxide	1-5%	1317-61-9	n.ap	10mg/m^3	10mg/m^3	n.av.	n.av.	n.av.	n.ap
Q326 also contains:									
2-butoxyethanol *(SARA313)*	1.26%	111-76-2	0.4	20S	50S	470	220	450	1.1
Azo Pigment	10-15%	000	n.ap	n.av.	n.av.	>2000	n.av.	n.av.	n.ap
Q328, Q833G, Q922M, Q933F, Q933M, Q943M Q952M also contain:									
Iron Oxide	1-15%	1309-37-1	n.ap	5mg/m^3	10mg/m^3	n.av.	n.av.	n.av.	n.ap
Q431 also contains:									
2-butoxyethanol *(SARA313)*	1.15%	111-76-2	0.4	20S	50S	470	220	450	1.1
Melamine	1-5%	108-78-1	n.ap	n.av.	n.av.	3161	>1000	3248	n.ap
Q439 also contains:									
2-butoxyethanol *(SARA313)*	2.30%	111-76-2	0.4	20S	50S	470	220	450	1.1
Q455 also contains:									
Bismuth Vanadate	15-20%	14059-33-7	n.ap	05mg/m^3	5mg/m^3	n.av.	n.av.	n.av.	n.ap
Q550, Q564, Q652, Q671 also contains:									
Cu Phthalocyanine	5-15%	000	n.ap	1mg/m^3	1mg/m^3	n.av.	n.av.	n.av.	n.ap
Q673 also contains:									
2-butoxyethanol *(SARA313)*	1.20%	111-76-2	0.4	20S	50S	470	220	450	1.1

AKZO NOBEL

MATERIAL SAFETY DATA SHEET

Clear Coatings

Section 1 - Product Information

Manufacturer: Akzo Nobel Coatings Inc.
5555 Spalding Drive
Norcross, GA 30092
USA

Canadian Supplier: Akzo Nobel Coatings Ltd.
110 Woodbine Downs Blvd.
Unit #4 Etobicoke, Ontario
Canada M9W 5S6

Emergency Telephone: For US transportation emergencies call - Chemtrec: 800-424-9300

For Canadian transportation emergencies call - Canutec: 613-996-6666

Information: 770-246-8454 (USA 7:00am – 4:00pm Eastern Time)

Product Use: clear coat

Item Numbers (US & Canadian):
Autoclear II LV 001158
Autoclear LV Mat 001356

Autocoat LV Clear High Solids 001192 - NA

Emergency Overview

Signs of Overexposure: Nausea, cough, dizziness, weakness, headache, chest pain, lack of coordination, shortness of breath, dermatitis, redness and/or pain in eyes.
Emergency First Aid: Move to fresh, remove contaminated clothing, wash effected skin with soap and water, do not use solvents or thinners; if product gets into eyes, remove contact lenses, flush with water for 15 minutes.
Handling: When handling wear an organic vapor cartridge respirator (NIOSH / OSHA), solvent resistant gloves and safety eye protection designed to guard against liquid splashes. Use approved bonding and grounding procedures when transferring to another container. Close all containers tightly after use. Do not eat, drink or smoke in work areas.
Clean-up: Eliminate sources of ignition. Dike to reduce extent of spill. Remove with inert absorbent (vermiculite, clay, Oil-Dry®, Kitty Litter, etc.) using non-sparking tools. Transfer to a grounded metal container, seal container. Dispose of as hazardous waste.
Material Appearance: Clear
Material Physical Appearance: Liquid
Other Precautions: Vapors are heavier than air and may travel along floors. Material has an offensive odor. Prolonged exposure may reduce the user's sensitivity to the odor, thus reducing the effectiveness of odor as a warning against exposure.
Fire Fighting: Flammable liquid, refer to Guide 127 of the North American Emergency Guide Book.
NFPA Flammability: IC
Akzo Nobel Coatings Inc. has no oversight with respect to the guidance practices or policies or manufacturing processes of other companies handling or using this material. The information given in this MSDS is only related to the product as shipped in its original condition as described in Section 2, "Hazardous Ingredients" and Section 9 "Physical and Chemical Properties".

These products are considered hazardous under the Federal OSHA Hazard Communication Standard

Section 2 - Hazardous Ingredients

Hazardous Ingredient	% by weight	CAS No.	Vapor Press.	ACGIH TLV	OSHA PEL	LD_{50} Oral	LD_{50} Derm	LC_{50} Inhal.	LEL
Autocoat LV Clear High Solids contains:									
Aromatic Solvent	1-5%	000	n. av.	100ppm	n. av.	n. av.	n. av.	n. av.	n. av
1,2,4 Trimethylbenzene *(SARA313)*	1.0%	95-63-6	1.7	25ppm	25ppm	5000	n. av.	18000	n.av
Benzotriazole Complex	1-5%	25973-55-1	n. ap.	n. av.	n. av.	7750	1100	0.4mg/l	n.ap
Butyl Acetate	20-40%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Ethyl Amyl Ketone	1-5%	541-85-5	2.0	25ppm	25ppm	3500	16000	n. av.	n. av
Methyl Amyl Ketone	5-10%	110-43-0	2.1	50ppm	100ppm	1670	10286	2000	1.1
Propylene Glycol Methyl Ether Acetate	1-5%	108-65-6	3.4	100ppm	n. av.	8532	5000	n. av.	n.av
Toluene*(SARA313)(P65)*	0.3%	108-88-3	22.0	50ppm	200ppm	636	12305	8000	1.1
Ethylbenzene*(SARA313)*	0.5%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Xylene-mixed isomers*(SARA313)*	2.1%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Autoclear LV Mat contains:									
Aromatic Solvent	5-10%	000	n. av.	100ppm	n. av.	n. av.	n. av.	n. av.	n. av
Amorphous Silica	1-5%	112926-00-8	n. ap.	10mg/m^3	6mg/m^3	3160	n. av.	n. av.	n.ap
Benzotriazole Complex	1-5%	25973-55-1	n. ap.	n. av.	n. av.	7750	1100	0.4mg/l	n.ap
Butyl Acetate	10-20%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
Ethyl Amyl Ketone	1-5%	541-85-5	2.0	25ppm	25ppm	3500	16000	n. av.	n. av
Methyl Amyl Ketone	10-20%	110-43-0	2.1	50ppm	100ppm	1670	10286	2000	1.1
Propylene Glycol Methyl Ether Acetate	1-5%	108-65-6	3.4	100ppm	n. av.	8532	5000	n. av.	n.av
Ethylbenzene*(SARA313)*	0.5%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0
Xylene-mixed isomers*(SARA313)*	2.1%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Synthetic Amorphous Silica	10-20%	63231-67-4	n. ap.	10mg/m^3	6mg/m^3	31600	2000	n. av.	n.ap
Toluene*(SARA313)(P65)*	1.3%	108-88-3	22.0	50ppm	100ppm	5000	14000	4000	1.2
Autoclear II LV contains:									
Benzotriazole Complex	1-5%	25973-55-1	n. ap.	n. av.	n. av.	7750	1100	0.4mg/l	n.ap
Aromatic Solvent	1-5%	000	n. av.	100ppm	n. av.	n. av.	n. av.	n. av.	n. av
Butyl Acetate	5-10%	123-86-4	8.0	150ppm	150ppm	10768	17600	2000	1.7
1,2,4 Trimethylbenzene *(SARA313)*	1.5%	95-63-6	1.7	25ppm	25ppm	5000	n. av.	18000	n.av
Propylene Glycol Methyl Ether Acetate	1-5%	108-65-6	3.4	100ppm	n. av.	8532	5000	n. av.	n.av
p-Chlorobenzotrifluoride	40-50%	98-56-6	5.3	n. av.	n. av.	n. av.	n. av.	n. av.	n. av.
Xylene-mixed isomers*(SARA313)*	1.7%	1330-20-7	5.1	100ppm	100ppm	4300	>1700	5000	1.0
Ethylbenzene*(SARA313)*	0.4%	100-41-4	7.1	100ppm	100ppm	3500	15486	n. av.	1.0

LD_{50} Oral - rat mg/m^3, LD_{50} Dermal - rabbit mg/m^3, LC_{50} Inhalation - rat mg/m^3 unless otherwise specified.

Chemicals marked with *(SARA313)* are subject to the requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA); see Section 15 - Regulatory Information. Chemicals marked with *(P65)* are regulated in California by Proposition 65; see Section 15 - Regulatory Information.

Section 3 – Hazards Identification

Primary Routes of Entry: Inhalation, skin contact, ingestion, eyes.
Exposure Effects Acute and Chronic:
Inhalation: Acute: Nasal and respiratory irritation, nausea, cough, shortness of breath, dehydration, dizziness, weakness, headache, drowsiness, fatigue, chest pain, vomiting, central nervous system effects, asphyxiation.
Skin contact: Acute: Extraction of natural oils with resulting dry skin, irritation, redness and dermatitis. Can be absorbed through the skin into the blood causing drowsiness.
Eye contact: Acute: Irritation, redness, pain, blurred vision, sensation of seeing halos around lights and reversible damage.
Ingestion: Acute: Gastrointestinal irritation, nausea, vomiting, diarrhea, weakness, drowsiness, fatigue, lack of coordination, central nervous system effects, depression.
Chronic: Repeated overexposure to this product may cause central nervous system damage, kidney damage, liver abnormalities, lung damage, cardiac abnormalities, reproductive organ damage, eye damage.
Other Health Effects:
Intentional misuse by deliberately concentrating and inhaling the contents may be harmful or fatal. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.

Section 4 – First Aid Measures

Emergency and First Aid Procedures: In all cases if symptoms persist, seek medical attention.

MSDSs for Murphy Coatings

SECTION I - PRODUCT: CARBOZINC 11 HS BASE (0249A1NL)
Date: 11/08/99 Replaces 09/14/99
(aka CARBO ZINC 11 HS BASE)
CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
ALKYL SILICATE	P89-882	40%	NE	NE	NE
ETHYL ALCOHOL	64-17-5	25%	1000 PPM	NE	NE
PM SOLVENT	107-98-2	10%	100 PPM	150 PPM	NE
MICA	12001-26-2	5%	3MG/M3	NE	NE
COLOR PIGMENT	MIXTURE	5%	3.5MG/M3	NE	NE
METHYL SILICATE	681-84-5	1%	1PPM	NE	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
ALKYL SILICATE	NOT AVAILABLE	NO/NO
ETHYL ALCOHOL	7060MG/KG RAT,ORAL 20000PPM/10HRS RAT,INHALATION	NO/NO/1,2,3
PM SOLVENT	>5180 MG/KG, ORAL, RAT 10000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3
MICA	NOT AVAILABLE	NO/NO
COLOR PIGMENT	NOT AVAILABLE	NO/YES
METHYL SILICATE	NOT AVAILABLE	NO/NO

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 3, FLAMMABILITY 3, REACTIVITY 1, PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 173F(78C)-248F(120C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 40 %. VOLATILE BY VOLUME: 66 %. PRODUCT WT/GAL: 10.6 LBS/U.S.GAL. 1.27 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 55 F(12C) (Setaflash) LEL 1.8 % UEL 19.0 %.
OSHA-FLAMMABLE LIQUID/OSHA/CLASS/1B, DOT-FLAMMABLE LIQUID NOS*,3,UN1993,PGII,
CANADIAN TDGA: FLAMMABLE LIQUID NOS* 3,UN1993,PGII
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate.

PRODUCT: CARBOZINC 11 HS BASE (0249A1NL)
Date: 11/08/99 Replaces 09/14/99

Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL). Eliminate all ignition sources. Keep away from sparks, open flames and heat sources. All electric equipment and installations should be made and grounded in accordance with the National Electrical Code. In areas where explosion hazards exist, workers should be required to use nonferrous tools and to wear conductive and non-sparking shoes.
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. May cause nose and throat irritation.
CONTACT: May be harmful if absorbed through the skin. May cause eye irritation. May cause skin irritation.
NOTICE: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If you have a condition that could be aggravated by exposure to dust or organic vapors see a physician prior to use.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe any fumes or smoke from these operations.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and

equipment. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use MSHA/NIOSH approved supplied air respirator. Follow all current OSHA requirements for respirator use.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing. Hypersensitive persons should wear gloves or use protective cream.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.
APPLICATION: Use only in accordance with Carboline application instructions, container label and Product Data Sheet.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

CARBOLINE CO. MATERIAL SAFETY DATA SHEET
PRODUCT: CARBOZINC 11 HS BASE (0249A1NL)
Date: 11/08/99 Replaces 09/14/99

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct
SILICA AMORPHOUS	NE	25%

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

SECTION I - PRODUCT: ZINC FILLER (0231B1NL)
Date: 07/09/99 Replaces 02/24/99

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
ZINC DUST	7440-66-6	100%	10MG/M3	15MG/M3	NE
LEAD	7439-92-1	0.20%	.05MG/M3	.05MG/M3	NE

CHEMICAL NAME	HAZARDOUS INGREDIENTS (F)	ADDITIONAL DATA (G)
ZINC DUST	NOT AVAILABLE	NO/YES/2,5/ 1000#
LEAD	NOT AVAILABLE	NO/YES/2

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: D2A -- D2B -- F
HMIS/NFPA CLASSIFICATION: HEALTH 3, FLAMMABILITY 0, REACTIVITY 0, PERSONAL PROTECTION CODE E, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: N/A. VAPOR DENSITY: N/A EVAPORATION RATE: N/A VOLATILE BY WEIGHT 0 %. VOLATILE BY VOLUME: 0 %. PRODUCT WT/GAL: 58.5 LBS/U.S.GAL. 7.03 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: No Flash Point. LEL: N/A UEL: N/A
OSHA-, DOT-ZINC FILLER, NOT REGULATED, CANADIAN TDGA: ZINC DUST UN1436 4.3 PGII (DANGEROUS WHEN WET)(DECLASSIFICATION REQUESTED)
NON REGULATED POWDER: The product has been tested and shown to fall well below the level of gas emission when exposed to water (49CFR PART 173 E,4) and is therefore not a regulated product and is not defined as dangerous when wet. Product is packed in steel or plastic water tight containers.
EXTINGUISHING MEDIA: Dry Chemical, Carbon Dioxide, Since material is packed in water tight containers water may be used to cool containers.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Recent testing has shown that this type of zinc powder evolves only a small amount of hydrogen gas when in contact with moisture or water. Also with the material packed in small containers that are water proof only broken or opened containers will have exposed powder. Contact with alkalis, or acids should be avoided because the

reaction will liberate sufficent quanitites of hydrogen gas and may explode on contact with oxidizing agents such as sulfur and oxygen or strong oxidizers.
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area. Wear protective clothing. Use a NIOSH approved self-contained breathing unit. Cover all open zinc dust containers. Do not spread out material. Water can react with hot zinc dust to form hydrogen gas.

SECTION V - HEALTH HAZARD DATA:

INHALATION: Overexposure will be irritating to mucous membranes.
CONTACT: May cause eye irritation. May cause skin irritation.
NOTICE: Contains LEAD which may cause blood disorders and lead poisoning.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If you have a condition that could be aggravated by exposure to dust or organic vapors see a physician prior to use.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCT: Under fire conditions hot zinc dust that is exposed to water could generate Hydrogen gas. When welding, heating or torch cutting surfaces coated with a zinc coating Zinc Oxide Fume can be produced and could cause "metal fume fever". Use exhaust systems and proper breathing protection to avoid breathing the fumes resulting from these conditions.
CONDITIONS TO AVOID: Avoid water contact with opened zinc powder containers.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents either acids or bases.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Use dry cleanup methods that do not disperse dust into the air. Avoid breathing the dust. take up the material and seal tightly for proper disposal.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not

able to monitor use MSHA/NIOSH approved supplied air respirator.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct
No materials meet this criteria		

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

SECTION I - PRODUCT: CARBOZINC HS ACTIVATOR (0249C1NL)
Date: 07/17/95 Replaces 03/22/94

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
PM SOLVENT	107-98-2	90%	100 PPM	150 PPM	NE
N-BUTANOL	71-36-3	10%	NE	50PPM/SKIN	NE
ZINC CHLORIDE	7646-85-7	5%	NE	NE	NE
TITANATE	5593-70-4	5%	NE	NE	NE

HAZARDOUS INGREDIENTS CHEMICAL NAME	ADDITIONAL DATA (F)	(G)
PM SOLVENT	15000 PPM/4HRS RAT,INHALATION	NO/NO/1,2,3
N-BUTANOL	2500MG/KG RAT,ORAL	NO/YES/1,2,3/
	>800PPM/4HRS RAT,INHALATION	5000#/U140
ZINC CHLORIDE	NOT AVAILABLE	NO/NO
TITANATE	NOT AVAILABLE	NO/NO

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 3, FLAMMABILITY 3, REACTIVITY 1, PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 243F(117C)-248F(120C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 95 %. VOLATILE BY VOLUME: 99 %. PRODUCT WT/GAL: 7.8 LBS/U.S.GAL. 0.94 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 91 F(32C) (Setaflash) LEL 1.4 % UEL 13.8 %.
OSHA-PAINT/FLAMMABLE/LIQUID/UN1263/PGIII, DOT-PAINT,3,UN1263,PGIII, CANADIAN TDGA: PAINT,3,UN1263,PGIII
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL).
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete

body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. May cause nose and throat irritation. May cause lung injury.
CONTACT: May be harmful if absorbed through the skin. May cause eye burns. May cause skin irritation.
NOTICE: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If you have a condition that could be aggravated by exposure to dust or organic vapors see a physician prior to use.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and equipment. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below

PRODUCT: CARBOZINC HS ACTIVATOR (0249C1NL)
Date: 07/17/95 Replaces 03/22/94

exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use MSHA/NIOSH approved air-purifying respirator.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct

No materials meet this criteria

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

SECTION I - PRODUCT: CARBOGUARD 890 PART A (0986A1NL)
Date: 11/08/99 Replaces 07/06/99
(aka CARBOLINE 890 PART A)
CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
COLOR PIGMENT	MIXTURE	30%	3.5MG/M3	NE	NE
EPOXY RESIN	25068-38-6	15%	NE	NE	NE
SILICA	14808-60-7	10%	0.1MG/M3	NE	NE
XYLENE	1330-20-7	10%	100 PPM	150 PPM	NE
ETHYL BENZENE	100-41-4	5%	100 PPM	125 PPM	NE
AROMATIC SOLVENT	64742-95-6	5%	25PPM	NE	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
COLOR PIGMENT	NOT AVAILABLE	NO/YES
EPOXY RESIN	11.4G/KG RAT,ORAL >20ML/KG SKIN,SENSITIZER	NO/NO/1,2
SILICA	NOT AVAILABLE	NO/NO/NR/NO
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3/ 1000#/U239
ETHYL BENZENE	NOT AVAILABLE	NO/YES/1,2,3/ 1000#
AROMATIC SOLVENT	4700MG/KG RAT,ORAL 3670PPM/8HRS RAT,INHALATION	NO/YES/1/2/3

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D2A -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 2, FLAMMABILITY 3, REACTIVITY 0,
PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 277F(136C)-355F(179C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 10 %. VOLATILE BY VOLUME: 17 %. PRODUCT WT/GAL: 11.7 LBS/U.S.GAL. 1.41 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 89 F(31C) (Setaflash) LEL 1.0 % UEL 7.0 %.
OSHA-FLAMMABLE LIQUID/OSHA/CLASS/1C, DOT-PAINT,3,UN1263,PGIII, CANADIAN TDGA: PAINT,3,UN1263,PGIII

PRODUCT: CARBOGUARD 890 PART A (0986A1NL)
Date: 11/08/99 Replaces 07/06/99

EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL).
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. May cause nose and throat irritation.
CONTACT: May cause eye irritation. May cause skin irritation. May cause allergic skin reaction.
NOTICE: Contains SILICA which can cause cancer. Risk of cancer depends on duration and level of exposure. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If sensitized to amines, epoxies or other chemicals do not use. See a physician if a medical condition exists.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and equipment. Follow safe handling and use guidelines in Section VIII. Contain

and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use MSHA/NIOSH approved supplied air respirator.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct
EPOXY RESIN	25036-25-3	20%
ALKYL PHTHALATE	68515-42-4	15%
EPOXY RESIN	25036-25-3	15%

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

SECTION I - PRODUCT: CARBOGUARD 890 PART B (0986B1NL)
Date: 11/08/99 Replaces 01/05/99
(aka CARBOLINE 890 PART B)
CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
SILICA	14808-60-7	65%	0.1MG/M3	NE	NE
XYLENE	1330-20-7	10%	100 PPM	150 PPM	NE
ETHYL BENZENE	100-41-4	5%	100 PPM	125 PPM	NE
ISOPHORONE DIAMINE	2855-13-2	5%	NE	NE	NE
DIAMINOCYCLOHEXANE	694-83-7	5%	NE	NE	NE
CYCLOALIPHATIC AMINE	TRADE SECRET	5%	NE	NE	NE
CYCLOALIPHATIC AMINE	BLEND	5%	NE	NE	NE
AROMATIC SOLVENT	64742-95-6	5%	25PPM	NE	NE
ISOPROPANOL	67-63-0	5%	400 PPM	500 PPM	NE

HAZARDOUS INGREDIENTS CHEMICAL NAME	ADDITIONAL DATA (F)	(G)
SILICA	NOT AVAILABLE	NO/NO/NR/NO
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3/ 1000#/U239
ETHYL BENZENE	NOT AVAILABLE	NO/YES/1,2,3/ 1000#
ISOPHORONE DIAMINE	>0.5 G/KG ORAL >2 G/KG DERMAL	NO\NO
DIAMINOCYCLOHEXANE	750 MG/KG ORAL 160 MG/KG DERMAL	NO/NO
CYCLOALIPHATIC AMINE	1230 MG/KG ORAL RAT;2000 MG/KG DERMAL	NO/NO/1,2
CYCLOALIPHATIC AMINE	NOT AVAILABLE	NO/NO/1,2
AROMATIC SOLVENT	4700MG/KG RAT,ORAL 3670PPM/8HRS RAT,INHALATION	NO/YES/1/2/3
ISOPROPANOL	4720MG/KG RAT,ORAL 16000PPM/8HRS RAT,INHALATION	NO/NO/3

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D2A -- D2B -- E
HMIS/NFPA CLASSIFICATION: HEALTH 3, FLAMMABILITY 3, REACTIVITY 0,
PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 180F(82C)-355F(179C). VAPOR DENSITY: Heavier than air.
EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 17 %. VOLATILE BY

PRODUCT: CARBOGUARD 890 PART B (0986B1NL)
Date: 11/08/99 Replaces 01/05/99

VOLUME: 33 %. PRODUCT WT/GAL: 13.4 LBS/U.S.GAL. 1.61 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 71 F(21C) (Setaflash) LEL 1.0 % UEL 12.7 %.
OSHA-FLAMMABLE LIQUID/OSHA/CLASS/1B, DOT-PAINT,3,UN1263,PGII, CANADIAN TDGA: PAINT,3,UN1263,PGII
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL).
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: May cause allergic respiratory reaction, effects may be permanent. Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. May cause nose and throat irritation. May cause lung irritation.
CONTACT: May be harmful if absorbed through the skin. Can cause eye burns. Can cause skin burns. Can cause allergic skin reaction.
NOTICE: Contains SILICA which can cause cancer. Risk of cancer depends on duration and level of exposure. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If you have a condition that could be aggravated by exposure to dust or organic vapors see a physician prior to use.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create

smoke and fumes. Do not breathe.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and equipment. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use MSHA/NIOSH approved supplied air respirator.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

PRODUCT: CARBOGUARD 890 PART B (0986B1NL)
Date: 11/08/99 Replaces 01/05/99

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct
BENZYL ALCOHOL	100-51-6	10%
POLYMER SOLUTION	MIXTURE	5%

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

SECTION I - PRODUCT: CARBOGUARD 890 LT PART B (0983B1NL)
Date: 11/17/99 Replaces 01/11/99
(aka CARBOLINE 890 LT PART B)
CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
SILICA	14808-60-7	60%	0.1MG/M3	NE	NE
XYLENE	1330-20-7	10%	100 PPM	150 PPM	NE
ETHYL BENZENE	100-41-4	5%	100 PPM	125 PPM	NE
TDMAM PHENOL	90-72-2	5%	NE	NE	NE
NONYL PHENOL	25154-52-3	5%	NE	NE	NE
AROMATIC SOLVENT	64742-95-6	5%	25PPM	NE	NE
ISOPROPANOL	67-63-0	5%	400 PPM	500 PPM	NE

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
SILICA	NOT AVAILABLE	NO/NO/NR/NO
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3/ 1000#/U239
ETHYL BENZENE	NOT AVAILABLE	NO/YES/1,2,3/ 1000#
TDMAM PHENOL	2169 MG/KG ORAL	NO/NO
NONYL PHENOL	1620MG/KG ORAL 2140 MG/KG SKIN	NO/NO
AROMATIC SOLVENT	4700MG/KG RAT,ORAL 3670PPM/8HRS RAT,INHALATION	NO/YES/1/2/3
ISOPROPANOL	4720MG/KG RAT,ORAL 16000PPM/8HRS RAT,INHALATION	NO/NO/3

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D2A -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 3, FLAMMABILITY 3, REACTIVITY 0, PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 180F(82C)-355F(179C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 14 %. VOLATILE BY VOLUME: 25 %. PRODUCT WT/GAL: 12.7 LBS/U.S.GAL. 1.53 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 71 F(21C) (Setaflash) LEL 1.0 % UEL 12.7 %.

PRODUCT: CARBOGUARD 890 LT PART B (0983B1NL)
Date: 11/17/99 Replaces 01/11/99

OSHA-FLAMMABLE LIQUID/OSHA/CLASS/1B, DOT-PAINT,3,UN1263,PGII, CANADIAN TDGA: PAINT,3,UN1263,PGII
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
FIRE AND EXPLOSION HAZARDS: Product contains less than 1% volatile components. The amount of vapors that could accumulate are minimal. However vapors are heavier than air and could travel long distances ignite and flashback. Eliminate all ignition sources. Keep away from sparks, open flames, and heat sources. All electrical equipment and installations should be made and grounded in accordance with the National Electrical Code. In areas where explosion hazards exist, workers should be required to use nonferrous tools and to wear conductive and non-sparking shoes.
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: May cause allergic respiratory reaction, effects may be permanent. Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. May cause nose and throat irritation. May cause lung irritation.
CONTACT: May be harmful if absorbed through the skin. May cause eye burns. May cause skin burns.
NOTICE: Contains SILICA which can cause cancer. Risk of cancer depends on duration and level of exposure. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If you have a condition that could be aggravated by exposure to dust or organic vapors see a physician prior to use.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe any fumes or smoke from these operations.
CONDITIONS TO AVOID: Heat, sparks, and open flames.

PRODUCT: CARBOGUARD 890 LT PART B (0983B1NL)
Date: 11/17/99 Replaces 01/11/99

INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and equipment. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor use MSHA/NIOSH approved supplied air respirator. Follow all current OSHA requirements for respirator use.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing. Hypersensitive persons should wear gloves or use protective cream.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.
APPLICATION: Use only in accordance with Carboline application instructions, container label and Product Data Sheet.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

PRODUCT: CARBOGUARD 890 LT PART B (0983B1NL)
Date: 11/17/99 Replaces 01/11/99

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

CARBOLINE CO. MATERIAL SAFETY DATA SHEET
PRODUCT: CARBOGUARD 890 LT PART B (0983B1NL)
Date: 11/17/99 Replaces 01/11/99

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct
POLYAMIDE	MIXTURE	15%
BENZYL ALCOHOL	100-51-6	5%
BENZYL ALCOHOL	100-51-6	5%
POLYMER SOLUTION	MIXTURE	5%

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

SECTION I - PRODUCT: CARBOTHANE 134HG PART A (0859A1NL)
Date: 08/24/00 Replaces 03/31/00

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
SILICA	14808-60-7	25%	0.1MG/M3	NE	NE
COLOR PIGMENT	MIXTURE	15%	3.5MG/M3	NE	NE
TOLUENE	108-88-3	10%	50 PPM	150 PPM	NE
BUTYL ACETATE	123-86-4	10%	150 PPM	200 PPM	NE
ETHYL BENZENE	100-41-4	5%	100 PPM	125 PPM	NE
DISPERSING AGENT	MIXTURE	5%	NE	NE	NE
XYLENE	1330-20-7	5%	100 PPM	150 PPM	NE
ALIPHATIC DIOL	TS	5%	25 PPM	25 PPM	25 PPM

HAZARDOUS INGREDIENTS ADDITIONAL DATA

CHEMICAL NAME	(F)	(G)
SILICA	NOT AVAILABLE	NO/NO/NR/NO
COLOR PIGMENT	NOT AVAILABLE	NO/YES
TOLUENE	5.0 G/KG RAT ORAL, 14G/KG RABBIT DERMAL 8000 PPM/4HRS, RAT, INHALATION	NO/YES/1,2,3/ 1000#/U220
BUTYL ACETATE	7.4 G/KG RABBIT ORAL >1800 PPM/6H INHALATION	NO/NO/1,2,3
ETHYL BENZENE	NOT AVAILABLE	NO/YES/1,2,3/ 1000#
DISPERSING AGENT	NE NE	NO/NO
XYLENE	4300MG/KG RAT,ORAL 15000 PPM/4HRS RAT,INHALATION	NO/YES/1,2,3/ 1000#/U239
ALIPHATIC DIOL	NE NE	NO/NO/1/4/

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B2 -- D2A -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 3, FLAMMABILITY 3, REACTIVITY 1, PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 232F(111C)-284F(140C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 23 %. VOLATILE BY VOLUME: 34 %. PRODUCT WT/GAL: 10.6 LBS/U.S.GAL. 1.28 sp gr.

PRODUCT: CARBOTHANE 134HG PART A (0859A1NL)
Date: 08/24/00 Replaces 03/31/00

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 50 F(10C) (Setaflash) LEL 1.0 % UEL 7.6 %.
OSHA-FLAMMABLE LIQUID/OSHA/CLASS/1B, DOT-PAINT,3,UN1263,PGII, CANADIAN TDGA: PAINT,3,UN1263,PGII
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to keep percent vapor below the "Lower Explosion Level" (LEL). Eliminate all ignition sources. Keep away from sparks, open flames and heat sources. All electric equipment and installations should be made and grounded in accordance with the National Electrical Code. In areas where explosion hazards exist, workers should be required to use nonferrous tools and to wear conductive and non-sparking shoes.
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. May cause nose and throat irritation.
CONTACT: Can cause eye irritation. May cause skin irritation. May cause allergic skin reaction.
NOTICE: Contains SILICA which can cause cancer. Risk of cancer depends on duration and level of exposure. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If you have a condition that could be aggravated by exposure to dust or organic vapors see a physician prior to use.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and

unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe any fumes or smoke from these operations.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and equipment. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to ensure all personnel are below guidelines. If not sure, or not able to monitor, use MSHA/NIOSH approved supplied air respirator. Follow all current OSHA requirements for respirator use.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL).
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates to skin, change gloves and clothing. Hypersensitive persons should wear gloves or use protective cream.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.
APPLICATION: Use only in accordance with Carboline application instructions, container label and Product Data Sheet.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

PRODUCT: CARBOTHANE 134HG PART A (0859A1NL)
Date: 08/24/00 Replaces 03/31/00

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

CARBOLINE CO. MATERIAL SAFETY DATA SHEET
PRODUCT: CARBOTHANE 134HG PART A (0859A1NL)
Date: 08/24/00 Replaces 03/31/00

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct
ACRYLIC COPOLYMER		35%
ACRYLIC COPOLYMER	MIXTURE	10%

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

SECTION I - PRODUCT: URETHANE CONVERTER 811 (0856B1NL)
Date: 04/10/00 Replaces 11/13/97

CHEMTREC TRANSPORTATION EMERGENCY PHONE NO.: 800-424-9300
PITTSBURGH POISON CONTROL CENTER HEALTH EMERGENCY NO.: 412-681-6669

SECTION II - HAZARDOUS INGREDIENTS EXPOSURE LIMITS

CHEMICAL NAME	(A)	(B)	(C)	(D)	(E)
POLYMERIC HDI	MIXTURE	90%	0.005PPM	0.02PPM	NE
AROMATIC SOLVENT	64742-95-6	5%	25PPM	NE	NE
BUTYL ACETATE	123-86-4	5%	150 PPM	200 PPM	NE
HDI ISOCYANATE	822-06-0	2%	0.005PPM	0.02PPM	NE

CHEMICAL NAME	HAZARDOUS INGREDIENTS ADDITIONAL DATA (F)	(G)
POLYMERIC HDI	>10000 MG/KG RAT ORAL 137-1150 MG/M3 4 HOURS; RAT	NO/NO/1,2,3,5
AROMATIC SOLVENT	4700MG/KG RAT,ORAL 3670PPM/8HRS RAT,INHALATION	NO/YES/1/2/3
BUTYL ACETATE	7.4 G/KG RABBIT ORAL >1800 PPM/6H INHALATION	NO/NO/1,2,3
HDI ISOCYANATE	710MG/KG ORAL 570MG/KG DERMAL 23PPM 4 HRS	NO/NO

TABLE (A) CAS NUMBER (B) LESS THAN WT (C) TLV-TWA (D) STEL (E) CEILING (F) TOXICITY DATA (LD50/Route,LC50/Route) (G) SARA 302/SARA 313/ SARA 311-312 CATEGORIES/CERCLA. NE = not established, NR = not required, NO = no. Color Pigment Mixture may contain Iron Oxides, Titanium Dioxide, Carbon Black, and other particulates not otherwise regulated in varying amounts depending on color of product.

WHMIS CLASSIFICATION: B3 -- D2A -- D2B
HMIS/NFPA CLASSIFICATION: HEALTH 3, FLAMMABILITY 2, REACTIVITY 1,
PERSONAL PROTECTION CODE G, NFPA FIRE FIGHTING PHASE 4

SECTION III - PHYSICAL DATA:

BOILING RANGE: 259F(126C)-355F(179C). VAPOR DENSITY: Heavier than air. EVAPORATION RATE: Slower than ether. VOLATILE BY WEIGHT 10 %. VOLATILE BY VOLUME: 13 %. PRODUCT WT/GAL: 9.3 LBS/U.S.GAL. 1.12 sp gr.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

FLAMMABILITY CLASSIFICATION: FLASH POINT: 106 F(41C) (Setaflash) LEL 1.0 % UEL 7.6 %.
OSHA-COMBUSTIBLE/LIQUID/OSHA/CLASS/II, DOT-PAINT,3,UN1263,PGIII, CANADIAN TDGA: PAINT,3,UN1263,PGIII
EXTINGUISHING MEDIA: Dry Chemical, Foam, Carbon Dioxide, Water Fog.
FIRE AND EXPLOSION HAZARDS: Vapors are heavier than air and will accumulate. Vapors will form explosive concentrations with air. Vapors travel long distances and will flashback. Use mechanical ventilation when necessary to

keep percent vapor below the "Lower Explosion Level" (LEL). Eliminate all ignition sources. Keep away from sparks, open flames and heat sources. All electric equipment and installations should be made and grounded in accordance with the National Electrical Code. In areas where explosion hazards exist, workers should be required to use nonferrous tools and to wear conductive and non-sparking shoes.
SPECIAL FIRE FIGHTING PROCEDURES: Evacuate hazard area of unprotected personnel. Use a NIOSH approved self-contained breathing unit and complete body protection. Cool surrounding containers with water in case of fire exposure.

SECTION V - HEALTH HAZARD DATA:

INHALATION: Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. May cause nose and throat irritation. May cause lung irritation. Contains HEXAMETHYLENE DIISOCYANATE which may cause allergic respiratory reaction, effects may be permanent.
CONTACT: May cause eye irritation. May cause skin irritation. May cause allergic skin reaction.
NOTICE: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.
MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: If sensitized to isocyanates or other chemicals do not use. See a physician if a medical condition exists.
PRIMARY ROUTE(S) OF ENTRY: Inhalation, Dermal, Ingestion.
EMERGENCY FIRST AID PROCEDURES: When exposed always get medical attention.
EYE CONTACT: Flush with water for 15 minutes.
SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and clean before reuse.
INHALATION: Remove to fresh air. Provide oxygen if breathing is difficult. Use artificial respiration if not breathing. Get medical attention.
IF SWALLOWED: DO NOT INDUCE VOMITING!! Always get medical attention.

SECTION VI - REACTIVITY DATA:

STABILITY: This product is stable under normal storage conditions.
HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, and unidentified organic compounds. Consider all smoke and fumes from burning material as very hazardous. Welding, cutting or abrasive grinding can create smoke and fumes. Do not breathe any fumes or smoke from these operations.
CONDITIONS TO AVOID: Heat, sparks, and open flames.
INCOMPATIBILITY: Avoid contact with strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES:

STEPS TO BE TAKEN IN CASE OF SPILL: Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking. Evacuate the area of unprotected personnel. Wear appropriate personal protection clothing and

equipment. Follow safe handling and use guidelines in Section VIII. Contain and soak up residual with an absorbent (clay or sand). Take up absorbent material and seal tightly for proper disposal. Dispose of in accordance with local, state and federal regulations. Refer to Section II for Sara Title III and CERCLA information.

SECTION VIII - SAFE HANDLING AND USE INFORMATION:

RESPIRATORY PROTECTION: Use only with ventilation to keep levels below exposure guidelines. (Section II). User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor, use MSHA/NIOSH approved supplied air respirator. Follow all current OSHA requirements for respirator use.
VENTILATION: Use explosion-proof ventilation when required to keep below health exposure guidelines and Lower Explosion Limit (LEL) .
SKIN AND EYE PROTECTION: Recommend impervious gloves, clothing and safety glasses with side shields or chemical goggles to avoid skin and eye contact. If material penetrates the skin, change gloves and clothing. Hypersensitive persons should wear gloves or use protective cream.
HYGIENIC PRACTICES: Wash with soap and water before eating, drinking, applying cosmetics, or using toilet facilities. Use of a hand cleaner is recommended. Launder contaminated clothing before reuse. Leather shoes can absorb and pass through hazardous materials. Check shoes carefully after soaking before reuse.
APPLICATION: Use only in accordance with Carboline application instructions, container label and Product Data Sheet.

SECTION IX - SPECIAL PRECAUTIONS:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep away from heat, sparks, open flame, and strong oxidizing agents. Keep containers closed. Store in cool, dry place with adequate ventilation. If pouring or transferring materials, ground all containers and tools.
OTHER PRECAUTIONS: Do not weld, heat, cut or drill on full or empty containers.

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Carboline Company 350 Hanley Ind. Ct. St. Louis, MO 63144
PHONE NO. 314-644-1000 FOR INDUSTRIAL USE ONLY

SPECIFIC STATE REGULATORY INFORMATION

NEW JERSEY
PENNSYLVANIA
Non-Hazardous Materials above 1 Percent:

Name	CAS	Pct
No materials meet this criteria		

CALIFORNIA

WARNING: This product contains a chemical(s) known to the State of California to cause cancer, and birth defects or other reproductive harm.

MSDS for Nelson Nameplate Ink

Unleaded 11-22-99 SJ

MATERIAL SAFETY DATA SHEET

DATE OF LAST CHANGE: 07/01/98

DATE PRINTED.....: 11/04/99

MANUFACTURER'S NAME:

VR CHICAGO
1100 N. NORTH BRANCH ST.
CHICAGO
IL 60622 4292 USA

EMERGENCY TELEPHONE #: (800)424-9300
(U.S. and Canada)
EMERGENCY TELEPHONE #: (703)527-3887
(Outside U.S. and Canada, collect calls are accepted)
INFORMATION TELEPHONE #: (800)736-7636

SECTION 1 -- CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

CODE: GVNL

TRADE NAME...: GV SERIES GLOSS VINYL SCREEN INK

MSDS# 261-069

PRODUCT CLASS: SCREEN INK unleaded

INK SERIES...: GV

- HMIS CODES -
HEALTH - 2*
FLAMMABILITY - 2
REACTIVITY - 0
PPE - X

-------Item Description-------	WT lb/gal	VOC g/L	VOC lb/gal	‡ VOC volume
GV107 PERMANENT MAROON	8.6	646	5.4	70
GV111 BLACK	8.6	672	5.6	73
GV122 OPAQUE WHITE	11.2	577	4.8	63
GV149 PERMANENT GREEN	8.7	676	5.6	74
GV157 ROYAL BLUE	8.7	667	5.6	73
GV162 PURPLE	8.8	672	5.6	73
GV170 CLEAR GLOSS	8.4	694	5.8	76
GV185 BRILLIANT PALE GOLD	10.1	674	5.6	73

-------Item Description- ------	WT lb/gal	VOC g/L	VOC lb/gal	‡ VOC volume
GV110 TRANSPARENT RED	8.6	665	5.5	72
GV112 WHITE	10.2	640	5.3	70
GV139 MAJESTIC YELLOW	8.4	686	5.7	75
GV152 LIGHT BLUE	8.9	662	5.5	72
GV159 PERMANENT BLUE	8.6	671	5.6	73
GV164 CERISE	9.1	649	5.4	71
GV173 CLEAR GLOSS EXTERIOR	8.4	698	5.8	76
GV187 SILVER	8.9	671	5.6	73

SECTION 2 -- COMPOSITION, INFORMATION ON INGREDIENTS

CHEMICAL NAME; COMMON NAME; CAS NUMBER	PERCENT BY WEIGHT	OCCUPATIONAL EXPOSURE LIMITS -------ACGIH------- TLV	-------OSHA-------- PEL	VAPOR PRESSURE IN mmHg	NOTES
ISOPHORONE; CAS #: 78-59-1	28-46	NOT ESTABLISHED Ceiling 5 ppm	4 PPM	< 1.0 @ 20C	(1)
RESIN MIXTURES; CAS #: Not Available	21-28	NOT ESTABLISHED	NOT ESTABLISHED	< 1 @ 20C	
ETHYL 3-ETHOXYPROPIONATE; ESTER SOLVENT EEP; CAS #: 763-69-9	5-22	NOT ESTABLISHED	NOT ESTABLISHED	1.11 @ 25C	(2)
PETROLEUM DISTILLATE; AROMATIC HYDROCARBON; CAS #: 64742-94-5	7-14	NOT ESTABLISHED	NOT ESTABLISHED	<1 @ 20C	(3)
* NAPHTHALENE; PETROLEUM DISTILLATE; CAS #: 91-20-3	2	10 ppm STEL: 15 ppm	10 ppm STEL: 15 ppm	<1 @ 20C	(4)
PETROLEUM DISTILLATE; AROMATIC HYDROCARBON; CAS #: 64742-95-6	2	NOT ESTABLISHED	NOT ESTABLISHED	3.0 @ 20C	
TITANIUM DIOXIDE; CAS #: 13463-67-7	0-33	10 mg/m3	10 mg/m3	N/A	
* COPPER COMPOUNDS; CAS #: 7440-50-8;	0-18	1 mg/m3	1 mg/m3	N/A	(5)
DIACETONE ALCOHOL; 4-HYDROXY-4-METHYL-2-PENTANONE CAS #: 123-42-2	0-11	50 ppm	50 ppm	1.0 @ 20C	
PIGMENTS; MIXTURE; ‡: NOT AVAILABLE	0-9	10 mg/m3 Total dust	15 mg/m3 Total dust	N/A	(6)
* ALUMINUM COMPOUNDS; CAS #: 7429-90-5;	0-9	10 mg/m3	15 mg/m3 Total Dusts	N/A	(7)

CARBON BLACK; PIGMENT BLACK; #: 1333-86-4	0-5	3.500 mg/m3	35.00 mg/m3	N/A	
* ZINC COMPOUNDS; CAS #: 7440-66-6;	0-2	10 mg/m3 Total dust	15 mg/m3 Total dust	N/A	(8)

* SUBJECT TO REPORTING REQUIREMENT OF SECTION 313 OF TITLE III OF SARA (40 CFR PART 372).

1) This chemical is included on the list of Hazardous Air Pollutants (HAPs) from Title III of the Clean Air Act Amendments of 1990.
2) Supplier recommended exposure limit of 50 ppm.
3) Industry recommended exposure limit of 100 ppm.
4) This chemical is included on the list of Hazardous Air Pollutants (HAPs) from Title III of the Clean Air Act Amendments of 1990.
5) CAS # and exposure limits are for copper dusts and mists.
6) See Section 8 Exposure Controls, Personal Protection- Exposure Guidelines for more information on exposure limits.
7) CAS # and TLV are for metal dusts.
8) See Section 8 Exposure Controls, Personal Protection for more information on above exposure limits.

The recommended permissible exposure limits (PEL) indicated above reflect the levels adopted by OSHA in 1989. Although, some of the 1989 levels have since been vacated, the Nazdar Company recommends that the lower exposure levels be observed as reasonable worker protection.
NOTE: Due to the broad spectrum of colors each MSDS may represent, ranges of some ingredients listed in Section 2 may exceed those specified in the Canadian Controlled Product Regulations. If specific concentration information is needed to comply with this regulation contact Nazdar.

SECTION 3 -- HAZARDS IDENTIFICATION

GENERAL HEALTH EFFECTS
THE FOLLOWING INFORMATION HAS BEEN DEVELOPED BASED UPON USING THE PRODUCT AS INTENDED BY THE MANUFACTURER. The potential health effects of this product are based on the hazards of its components. The use of this product in combination with other products may produce synergistic (additive) health effects. Cautionary labeling and material safety data sheets of all materials used with this product should be reviewed before use.

EYES
Eye contact with liquid, vapors or mists may cause moderate to severe irritation, including burning, tearing, redness or swelling and reversible eye damage.

SKIN
Repeated or prolonged overexposure may cause skin irritation or dermatitis. Symptoms may include dryness, chapping and redness. Toxic and may be harmful if absorbed through the skin.

INHALATION
Inhalation may cause respiratory tract irritation. Symptoms may include headaches, nausea, dizziness and intoxication.

INGESTION
Ingestion may cause gastrointestinal tract irritation. Symptoms may include abdominal pain, nausea, vomiting and diarrhea.

CHRONIC EFFECTS/TARGET ORGANS
Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents may be harmful or fatal.

ANIMAL STUDIES
Isophorone is a suspect carcinogen in lab animals. Ethyl 3-ethoxypropionate (EEP) has been suggested, after overexposure, as a cause of the following effects in laboratory animals, and may aggravate pre-existing disorders of these organs in humans: mild, reversible liver effects. EEP has been shown to cause harm to the fetus in laboratory animal studies. Harm to the fetus occurs only at exposure levels that harm the pregnant animal. The relevance of these findings to humans is uncertain. Diacetone alcohol has been found to cause kidney and liver injury and blood disorders in lab animals. For animal studies, reference TSCA Section 4 Test Rule Results or contact the manufacturer for further details.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Pregnant women and persons with pre-existing health disorders should consult their physician before using this product. Repeated and prolonged overexposure and/or individual sensitivity may increase the potential for and degree of adverse health effects. See Section 3 "Hazards Identification" for effects of certain hazardous ingredients.

ROUTES OF EXPOSURE
Primary exposure routes: Inhalation-Dermal (Contact/Absorption)-Ingestion

SECTION 4 -- FIRST AID MEASURES

EYES
After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. If irritation persists have eyes examined and tested by medical personnel.

SKIN
In case of contact, immediately wash skin with soap and plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention if irritation persists. Thoroughly wash (or discard) clothing and shoes before reuse.

INHALATION
Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention if breathing difficulty is experienced.

INGESTION
If swallowed, do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.

OTHER COMMENTS
Not Applicable

SECTION 5 -- FIRE FIGHTING MEASURES

FLASH POINT
150 Degrees - 160 Degrees Fahrenheit (SETA Flash)

OSHA FLAMMABILITY CLASSIFICATION (NFPA)
Class IIIA Combustible Liquid

FLAMMABLE LIMITS (LEL-LOWER EXPLOSIVE LIMIT)
0.8% volume in air

EXTINGUISHING MEDIA
Foam-CO2-Dry Chemical-Water Spray

FIRE AND EXPLOSION HAZARDS
Isolate from heat, electrical equipment, sparks, and open flame. Keep containers tightly closed. Vapors may be heavier than air and can travel to a source of ignition then flash back. Closed containers may explode when exposed to extreme heat.

FIRE FIGHTING EQUIPMENT
Full protective equipment including self-contained breathing apparatus (SCBA) is recommended to protect firefighters.

SPECIAL FIRE FIGHTING PROCEDURES
Water may be ineffective but may be used to cool containers. Fumes released on burning may be toxic and dangerous.

SECTION 6 -- ACCIDENTAL RELEASE MEASURES

RELEASE MANAGEMENT MEASURES
Remove all sources of ignition (flames, hot surfaces and electrical, static or frictional sparks). Avoid contact or breathing vapors. Ventilate area. Contain release and remove with inert absorbent. Use non-sparking tools to place material in appropriate container for disposal. The National Response Center (800-424-8802) and local authorities should be contacted for any reportable spill/release.

SECTION 7 -- HANDLING AND STORAGE

HANDLING AND STORAGE METHODS
Use in a well ventilated area. Follow all MSDS/label precautions even after container is emptied; container may retain product residues. Store in closed containers in cool, dry, well ventilated area away from sources of ignition. Keep containers closed when not in use. Smoke in designated areas only. Avoid prolonged or repeated overexposure to this product. Keep out of reach of children. Follow label directions carefully. Do not take internally. Harmful or fatal if swallowed.

SECTION 8 -- EXPOSURE CONTROLS, PERSONAL PROTECTION

RESPIRATORY PROTECTION
If concentrations of hazardous ingredients exceed exposure limits listed in Section 2 an appropriate NIOSH (National Institute for Occupational Safety and Health) approved respirator with an organic vapor cartridge should be used. If material is handled under mist, spray or dust forming conditions, a P100 (99.97% efficiency) filter should be used in addition to the organic vapor cartridge. If no exposure limits are listed in Section 2, follow general safety guidelines in 29 CFR 1910.134 Respiratory Protection or other applicable respiratory standard.

SKIN PROTECTION
Use neoprene, nitrile or other gloves resistant to chemicals listed in Section 2. Contact a reputable safety supply company

for appropriate gloves. Solvent resistant aprons are recommended. Prevent prolonged skin contact with contaminated clothing.

EYE PROTECTION
Use ANSI (American National Standards Institute) approved safety glasses, faceshield or splash proof goggles to prevent eye contact. Contact a reputable safety supply company for appropriate eye protection. The availability of an eye wash is highly recommended.

EXPOSURE GUIDELINES
See Section 2 "Composition, Information on Ingredients" for occupational exposure limits. Excessive concentrations of nuisance dusts or particulates not otherwise classified (PNOC) or regulated (PNOR) may reduce visibility and cause unpleasant deposits in the eyes, ears, and nasal passages. The TLV and PEL has been established for all non-toxic "nuisance dusts" that are not otherwise classified and refers to both organic and inorganic dusts. Exposure or generation of these dusts is not anticipated during normal printing operations. The use of dry pigments and powders, grinding or sanding of printed products may generate quantities of these particulates. Refer to Section 2 Composition, Information on Ingredients for exposure limits.

HYGIENIC PRACTICES
Wash with soap and water before eating, smoking or using toilet facilities. Separately wash or discard clothing and footwear before reuse. NEVER try to remove ink from the skin by using solvent or thinner. Such action is likely to increase the possibility of undesirable effects. Remove contaminated clothing to prevent prolonged skin contact.

ENGINEERING CONTROLS
Use applicable engineering controls, work practices and personal protective equipment to ensure all concentrations are kept below the exposure limits listed in Section 2.

OTHER PROTECTION
Not Applicable

SECTION 9 -- PHYSICAL AND CHEMICAL PROPERTIES

**

APPEARANCE:
Viscous liquid

ODOR:
Characteristic

PHYSICAL STATE:
Liquid

pH
Not applicable

VAPOR PRESSURE
See Section 2 for individual ingredients.

VAPOR DENSITY
Heavier than air

BOILING POINT
Greater than 300 degrees Fahrenheit

FREEZING POINT
Not available

SOLUBILITY IN WATER
Not tested

EVAPORATION RATE
Slower than ether

VISCOSITY
Greater than water

PERCENT VOLATILE BY VOLUME: SEE SECTION ONE

WEIGHT PER GALLON: SEE SECTION ONE

VOC: SEE SECTION ONE

PHOTOCHEMICALLY REACTIVE
Yes

Percent volatile = Percent VOC

SECTION 10 -- STABILITY AND REACTIVITY

CHEMICAL STABILITY
Stable

CONDITIONS TO AVOID
Avoid excessive heat, ignition sources, sparks and open flame.

INCOMPATIBILITY WITH OTHER MATERIALS
Strong acids/bases, oxidizing/reducing agents and reactive chemicals.

HAZARDOUS DECOMPOSITION PRODUCTS
May produce hazardous fumes when heated to decomposition e.g. carbon monoxide, carbon dioxide and other noxious gases.

HAZARDOUS POLYMERIZATION
Not anticipated during normal printing and storage conditions.

SECTION 11 -- TOXICOLOGICAL INFORMATION

EXPERIMENTAL TOXICITY DATA
Experimental toxicity data on diacetone alcohol has given the following results: Intraperitoneal LD50 Mouse: 933 mg/kg. Oral LD50 Rat: 4 g/kg: Dermal LD50 Rabbit: 13.6 g/kg.

SECTION 12 -- ECOLOGICAL INFORMATION

ECOTOXICITY
No Data Available

ENVIRONMENTAL FATE
No Data Available

SECTION 13 -- DISPOSAL CONSIDERATIONS

DISPOSAL METHODS
Dispose of in accordance with applicable local, county, state, provincial and federal regulations. Emptied containers may retain hazardous properties. Empty containers should be disposed of in an environmentally safe manner in accordance with applicable regulations.

SECTION 14 -- TRANSPORT INFORMATION

TRANSPORT INFORMATION
Not regulated. The product(s) described by this Material Safety Data Sheet do not meet the definition of nor are they classified as a hazardous material/dangerous good as defined by the United States Department of Transportation (DOT), the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO) or the Canadian Transportation of Dangerous Goods Act (TDG).

SECTION 15 -- REGULATORY INFORMATION

SARA TITLE III 313 INFORMATION
See Section 2 "Composition, Information on Ingredients" for applicable chemicals.

TOXIC SUBSTANCES CONTROL ACT STATUS
All ingredients in Section 2 are listed on the U.S. Environmental Protection Agency's Toxic Substances Control Act (TSCA) Inventory and the Canadian Domestic Substance List.

OTHER REGULATORY INFORMATION
Not Applicable

SECTION 16 -- OTHER INFORMATION

DISCLOSURE
The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind express or implied is made with respect to the information contained herein. The data in this MSDS relates only to the specific material designated herein and does not apply to use in combination with any other material or process.

DEFINITIONS

ACGIH: American Conference of Governmental Industrial Hygienists

AIHA: American Industrial Hygiene Association

CEILING: (TLV-Ceiling and PEL Ceiling Limit) The ceiling exposure limit or concentration not to be exceeded for even brief times.

DOT: Department of Transportation

HMIS: The Hazardous Materials Identification System (HMIS) developed by the National Paint and Coatings Association (NPCA) to provide information on the acute health hazards, reactivity and flammability encountered in the workplace at room temperatures.

IARC: International Agency for Research on Cancer

NFPA: National Fire Protection Association

NTP: National Toxicology Program

STEL: Short-Term Exposure Limit: ACGIH terminology for the short-term exposure limit or maximum concentration for a continuous exposure period of 15 minutes.

TLV: Threshold Limit Value. A term ACGIH uses to express the airborne concentration of a material to which most workers can be exposed during a normal daily and weekly work schedule without adverse effects.

TWA: Time-Weighted Average

VOC: Volatile Organic Compound

Appendix B
Stand Alone Case Studies for Selected Facilities

TELEDYNE CONTROLS CONVERTS TO LOW-VOC REWORK CLEANER

Teledyne Controls, located in West Los Angeles, has been providing data acquisition equipment and supporting ground data processing stations to operating airlines for over 20 years. The systems are used in aircraft and engine monitoring activities including the flight data recorder. Teledyne Controls also manufactures a wireless groundlink system that transfers data to and from civil transport aircraft and the operator's data processing center. The data transfer starts after the aircraft has landed and is parked at the gate.

The systems built by Teledyne must have high reliability. As part of the manufacturing process, Teledyne assembles printed circuit boards (PC Boards) that are a critical part of the systems. Historically, Teledyne, like many other aerospace companies, used 1,1,1-trichloroethane (TCA) and CFC-113 to remove the flux from PC boards after the components were soldered to them. When the ozone depleting substance ban was announced, Ray Cole, the Teledyne Controls Environmental, Health and Safety Engineer, decided the best option was to conduct testing and convert to a water soluble flux. As a result of the conversion, the company was able to remove flux from the PC boards with plain deionized water.

Teledyne, like other companies that assemble PC boards, must rework some of the boards that fail quality control. During rework, the components are removed from the board, flux is added, the components are again soldered and the boards are cleaned. Generally, these are hand operations and the cleaning agent most commonly used for rework cleaning is isopropyl alcohol (IPA). Teledyne was using a blend of half IPA and half deionized water for the rework cleaning when IRTA approached the company to participate in a project sponsored by the South Coast Air Quality Management District (SCAQMD). The SCAQMD project involves working with companies to find suitable alternatives to IPA for rework of PC boards.

IRTA and Teledyne agreed to test several low-VOC formulations to try to identify an acceptable alternative. The alternatives that were tested at Teledyne included plain deionized water, acetone, various blends of acetone, deionized water and IPA and a saponifier containing no VOC. Although all the potential alternatives appeared to provide visually clean boards, the worker did not like the saponifier or the high acetone content formulations. The other formulations were tested to determine the ionic contamination levels and all of the formulations resulted in low levels.

According to Ray Cole, "we decided to switch to an 80% deionized water/5% acetone/10% IPA cleaner throughout our facility. The workers like it and it allows us to lower the VOC content of the cleaner to about 100 grams per liter." The cost of the alternative is much lower because the company was purchasing the 50% IPA/50% deionized water product in aerosol packages. Says Ray Cole, "we've made a successful conversion. The cleaner is lower VOC and it's also less costly."

Annual Cost Comparison for Printed Circuit Board Rework Cleaning for Teledyne Controls

	Aerosol IPA/ D.I. Water Blend	D.I. Water/Acetone/ IPA Blend
Chemical Cost	$291	$41
Total Cost	$291	$41

LITTON CONVERTS AWAY FROM VOC SOLVENTS

Litton Guidance & Control Systems is located in Woodland Hills, California. The company makes laser-based guidance systems for space applications. The optical components must meet stringent performance specifications and cleaning is a major part of the operation.

The company historically used ozone depleting solvents, CFC-113 and 1,1,1 – trichloroethane (TCA), for their cleaning. Litton began work several years ago on alternatives when the production bans were announced. All of their operations were converted away from CFC-113 and TCA, primarily to VOC solvents and water-based cleaners with high concentrations of high VOC solvents.

The South Coast Air Quality Management District (SCAQMD) amended Rule 1122 "Solvent Degreasers" in July of 1997. The amendments affected VOC solvents that are used in batch loaded cold cleaning operations. The rule requires companies to use solvents with a VOC content of 50 grams per liter or less or to use the higher VOC solvents in an airless airtight degreaser beginning in January 1999. Since Litton had many operations using VOC solvents, they were strongly affected by this rule.

IRTA began work with Litton in 1998 to assist the company in evaluating their processes and in adopting low and non-VOC solvents so they could comply with the January 1999 deadline. Says Gary Augeri, Member of the Technical Staff at Litton, "our operations might have been covered by one of the exemptions in Rule 1122 so we could have continued to use the VOC solvents. Litton Manufacturing Management wanted to set an example and we decided to make a commitment to switch away from these solvents."

At this stage Litton Optics Manufacturing has converted virtually all of their cleaning processes away from VOC cleaners in the frame, substrate and prism operations in the optics shop. For frame manufacture, wax was used to plug the frame bores to prevent lapping compound from entering the internal bores. Litton eliminated a cleaning step that employed n-methyl pyrrolidone (NMP) by using plugs with O-rings to block the frame bores as a physical barrier to the lapping compound. The lips of the plugs are now sealed with adhesives which are removed with a Liquinox detergent. Epoxy is used to bond the frames to holding fixtures during lapping and polishing. In the past, NMP was used to remove this epoxy. Very hot detergent is now used to separate the frame from the fixture. The thermal expansion difference between the glass part and the metal fixture causes the debonding.

In the substrate operation, pitch was used to hold the mirror substrates to mounting blocks during lapping operations. NMP, methanol and methylene chloride were used in the past for cleaning. Litton now uses thermoplastic; this is followed by a soak in an Armakleen detergent made by Church & Dwight.

In the prism operation, wax is used to bond the prisms to mounting blocks for lapping

and polishing. A terpene-based cleaning process was used to dissolve the wax and clean the parts. Litton has converted to Daraclean 121, a water-based cleaner made by W.R. Grace for this cleaning process.

All of the parts are put through a final clean either with hot water alone or with hot water and detergent. In some cases, ultrasonics are necessary to achieve the required cleanliness.

“The new process works very well,” says Mr. Augeri. “In some cases, we were able to use different materials in our processes and could avoid cleaning all together. In other cases, we could substitute water-based cleaners. We found we don’t have to rely on solvents for getting the cleanliness we need. The new water-based cleaners are better for the environment and for our workers.”

BURBANK AEROSPACE COMPANY ADOPTS ALTERNATIVE SPRAY GUN CLEANER

Hydro-Aire is a division of Crane located in Burbank, California. The aerospace company has 572 employees. Hydro-Aire manufactures braking systems, pumps and air locking devices and is a Boeing subcontractor. Hydro-Aire also repairs the pumps used in military and commercial aircraft like the C-17 and the C-130 transport.

IRTA began work with Hydro-Aire in 1997 on alternatives to the company's vapor degreasers. The company made a complete conversion away from 1,1,1-trichloroethane (TCA) to water-based cleaners in their manufacturing operations. Hydro-Aire used VOC solvents for repair and maintenance cleaning when they rebuilt units from the field and during manufacture of new components. The company also converted these operations to water-based cleaners. At this stage, Hydro-Aire is using VOC solvents only in handwipe operations and in spray gun cleaning.

More recently, as part of a project sponsored by the South Coast Air Quality Management District (SCAQMD), IRTA worked with Hydro-Aire to test alternatives to the VOC solvent used in spray gun cleaning. The coatings used by the company are typical aerospace coatings that generally consist of an epoxy-based primer and a polyurethane topcoat. A number of the coatings are specialty coatings that meet high performance parameters. Hydro-Aire, like other aerospace companies, historically used an MEK blend for cleaning their paint spray equipment.

IRTA performed testing using a variety of alternatives in laboratory tests using Hydro-Aire's coatings. The aim was to identify one or more alternatives that would prove a suitable alternative to the MEK blend. The cleaner that performed best on the coatings was acetone. Acetone is exempt from VOC regulations and is relatively low in toxicity and is therefore better from an overall human health and environmental standpoint than the MEK blend.

IRTA tested acetone at Hydro-Aire and the preliminary testing indicated that it performed as well as or better than the MEK blend. In scaled up testing for several months, the same conclusion was reached. According to Tommy Jennings, Environmental Manager at Hydro-Aire, "acetone performs every bit as well as our MEK blend. We made the decision to convert to acetone because it reduces our VOC emissions and it is better for the workers."

IRTA compared the costs to Hydro-Aire of using the acetone for spray gun cleaning and compared them to the costs of using the MEK blend. Hydro-Aire has an enclosed spray gun cleaner and the same unit was appropriate for use with acetone. The unit is changed out with the same frequency with acetone as it was with the MEK blend. Says Tommy Jennings, "Acetone is a great solution. It reduces the health and environmental concerns and it's also less costly than the MEK blend."

Annual Cost Comparison for Spray Gun Cleaning for Hydro-Aire

	MEK Blend	Acetone
Chemical Cost	$296	$255
Regulatory Fees	$72	-
Total Cost	$368	$255

SMALL AEROSPACE COMPANY MAKES SPRAY GUN CLEANING CONVERSION

California Propeller, a small 30-employee firm in North Hollywood, was established in 1950 by Cyrus Bearson. The company buys government surplus parts and various other parts that have been used in the field for 10 to 40 years and refurbishes them. The parts are mainly used for control and governing and they include propellers and intricate governors. They are made of many different substrates including aluminum, stainless steel, nickel and brass plating, various ferrous metals and some are anodized.

The parts arrive at California Propeller heavily contaminated with oil, grease, rust, various preservatives, black oxide and carbon from long years of field use. They are disassembled, cleaned, inspected, reworked by filing, sanding or blasting and painted. Several years ago, IRTA assisted the company in converting away from a 1,1,1-trichloroethane vapor degreaser to a water-based cleaning process. Like other aerospace companies, California Propeller uses an epoxy based primer and a polyurethane topcoat to paint the parts after they are reworked. When the spray gun is cleaned, it is disassembled and cleaned with a brush with MEK.

As part of a project with U.S. EPA, IRTA began work with California Propeller to try to identify a suitable alternative for spray gun cleaning. The South Coast Air Quality Management District (SCAQMD) regulates the cleaners that can be used for application equipment cleaning in Rule 1171 "Solvent Cleaning Operations." Historically, the VOC content of spray gun cleaners in Rule 1171 was set at 950 grams per liter and 35 mm Hg vapor pressure. On December 1, 2001, the VOC content of these cleaners declined to 550 grams per liter. In July of 2005, the VOC content of the cleaners is reduced even further, to 25 grams per liter. IRTA and California Propeller wanted to find a technically suitable cleaning alternative that would meet the 2005 VOC content level.

IRTA obtained samples of coatings from California Propeller and various other companies in the Basin to test alternative low-VOC low toxicity cleaning agents in a laboratory setting using a spray gun cleaner provided by Graco. For California Propeller's coatings, it appeared that acetone was the best cleaner in the preliminary testing. Acetone is not considered a VOC and it is relatively low in toxicity. Based on IRTA's initial results, California Propeller conducted scaled up testing of acetone. It worked as well as or better than the MEK cleaner that had been used previously and the company decided to convert to the alternative.

Barrett Bearson, the owner of California Propeller, is very satisfied with the acetone spray gun cleaning alternative. "We are at the cutting edge in aerospace propellers. We would like to be at the cutting edge of environmentally preferable alternatives as well." Says Bearson, "the workers are very satisfied with acetone. It cleans well, it doesn't cause smog, it isn't toxic and it costs less than the MEK. It's a win-win for everyone."

Annual Cost Comparison for Spray Gun Cleaning for California Propeller

	MEK Cleaner	Acetone Cleaner
Chemical Cost	$154	$66
Total Cost	$195	$66

FONTANA COMPANY ADOPTS LOW-VOC COATING EQUIPMENT CLEANERS

American Security Products is located in Fontana, California. As the name indicates, the company makes burglary, fire protection and gun safes and is the largest security safe manufacturer in the country.

In the safe manufacturing process, American Security Products uses adhesives to bond the velour to shelves in the safe and to the safe walls. The safes are also painted. The company began using waterborne adhesives for their bonding operation several years ago. American Security Products uses a urethane topcoat, a polyester primer and topcoat on the different lines of the safes.

Until four years ago, American Security Products used lacquer thinner for cleaning their coating application equipment. The company performed the cleaning in an enclosed spray gun cleaning unit that they owned. American Security Products did not have to clean their spray equipment for their adhesives at all because the latex residue left in the spray gun can simply be peeled off. For cleaning the solventborne coatings from the spray equipment, the company decided to convert to acetone. This decision was based on the fact that acetone is not classified as a VOC and American Security Products wanted to reduce their overall facility VOC emissions.

American Security Products has been using the non-VOC alternatives for four years and they are very happy with their performance. "We want to do the right thing for the workers and the environment," says Mike Hassel, Production Manager at American Security Products. "Using water and acetone for cleaning our spray guns has accomplished this and it has saved us money. We paid fees for emitting the lacquer thinner and that cost has been eliminated."

Annual Cost Comparison for Spray Gun Cleaning for American Security Products

	Lacquer Thinner	Acetone
Cleaner Cost	$14,300	$11,700
Regulatory Cost	$3,140	-
Total Cost	$17,440	$11,700

SMALL GLENDORA COMPANY CONVERTS TO LOW-VOC SPRAY GUN CLEANER

Metrex Valve Corp. is a small manufacturer located in Glendora, California with about 25 full time employees. Metrex is on Original Equipment Manufacturer (OEM) that manufactures and rebuilds water regulating valves for the commercial, military and nuclear industries. Some of the valves manufactured by Metrex for the military are made of cast iron; they are used in the marine environment and must be highly resistant to corrosive attack. The coating used by Metrex on its cast iron parts is an extreme high gloss coating that provides the proper protection.

IRTA began working with Metrex as part of an EPA sponsored project. The aim of the project was to work with companies to identify, test and implement alternative low-VOC, low toxicity spray gun cleaners. Metrex agreed to participate in the project.

Metrex uses a High Volume Low Pressure (HVLP) spray gun to apply the coatings to its cast iron valves and paints about one to two days each month. The company cleans the spray gun immediately after spraying so the paint being cleaned does not cure. The gun is disassembled and cleaned in a can. When IRTA began working with Metrex, the company used lacquer thinner as the cleaning agent.

IRTA conducted preliminary testing with the Metrex coating and found that acetone might be a potential alternative. Acetone is not classified as a VOC and is low in toxicity. The chemical has a low flash point and the fire regulations allow storage of 60 gallons and 15 gallons of acetone for open use. The small quantities of cleanup solvent used by Metrex are well below the limit.

Metrex and IRTA conducted testing of the acetone for cleaning the spray gun. The painter indicated that the acetone worked well on the cup and gun; it cut the coating residue very effectively. Metrex performed scaled up testing of acetone over the following weeks and found it to be as effective as their current solvent. The company decided to convert to acetone.

According to Bill Carter, Environmental, Health and Safety Manager at Metrex, “acetone has performed well. We decided to use it instead of the lacquer thinner. Acetone is not a VOC, it is better for the workers and they like it much better than the previous solvent we used. Acetone has also proved to be less expensive. Metrex Valve wants to do its part for the environment.”

Annual Cost Comparison for Spray Gun Cleaning for Metrex

	Lacquer Thinner	Acetone
Cleaner Cost	$33	$27
Total Cost	$33	$27

SMALL HUNTINGTON BEACH FURNITURE STRIPPER CONVERTS TO BETTER SPRAY GUN CLEANING METHOD

Bausman & Father is a small furniture stripping and refinishing company located in Huntington Beach, California. The owner and one employee provide commercial furniture stripping services. After the furniture and other wood items are stripped, they are refinished. Some of the pieces are antiques that are restored to their original elegance.

IRTA began working with Bausman & Father as part of a project sponsored by EPA. The aim of the project was to assist small companies in identifying, testing and implementing alternative spray gun cleaning solvents. The South Coast Air Quality Management District (SCAQMD) modified one of their cleaning rules, Rule 1171 "Solvent Cleaning Operations" to require lower VOC content spray gun cleaners. The current limit is 550 grams per liter VOC and, in 2005, the limit declines to 25 grams per liter VOC.

Bausman & Father uses a High Volume Low Pressure (HVLP) spray gun to apply acetone and waterborne coatings to the furniture after it is stripped. For many years, like other companies that coat wood, the company used lacquer thinner for cleaning the spray gun. A few years ago, Bausman & Father converted to acetone.

As part of the EPA project, IRTA arranged for a small tabletop ultrasonic cleaning system to be designed and built for testing. IRTA provided this system to Bausman & Father and the company has been using it for spray gun cleaning for more than a year. The spray gun is dismantled and placed in the ultrasonic system. The cleaner used in the system is an alkaline water-based solution. It is diluted to about 25 percent for the spray gun cleaning. The system has a heater which heats the cleaning solution to about 140 degrees F.

Mark Bausman, owner of Bausman & Father likes the water-based cleaner and system. "It cleans the waterborne coatings very well, better than solvents," he says. "Using the water-based cleaner allows the waterborne coating to release from the spray gun so you can avoid scrubbing. The system also cleans the acetone coatings well. The ultrasonics are very effective." The ultrasonics allow the water cleaner to penetrate the complex passages of the spray gun.

Bausman & Father did not have to pay for the ultrasonic system but other companies would have to purchase it at a cost of about $300. The cost analysis presented below reflects this cost.

Annual Cost Comparison for Bausman & Father

	Acetone	Water-Based Cleaner
Capital Cost	-	$30
Electricity Cost	-	$4
Cleaner Cost	$14	$5
Total Cost	$14	$3

Appendix C
Selected Cleaning Alternatives

Alternative Cleaners Examined During Preliminary Screening Tests for Coating and Adhesive Application Equipment Cleaning

Material Safety Data Sheet

EMERGENCY PHONE NUMBERS	HAZARD RATING
714-701-9500	4 - EXTREME 3 - HIGH 2 - MODERATE 1 - SLIGHT 0 - INSIGNIFICANT **SEE SECTION V HMIS: TOXICITY 1, REACTIVITY 0, SPECIAL

I. General Information

Manufacturer	Trade Name & Synonyms
UNIVERSAL CHEMICAL TECHNOLOGIES 1517 N. Harmony Circle Anaheim, CA 92807	Power Kleen: Spray Clean 12
DOT Hazard Classification: Alkaline Liquid	Chemical Family: Mixture
Proper DOT Shipping Name: Spray Clean 12	
Prepared By: D.C. ATKINS & SONS, INC. Date: 7/4/99	LEGEND: N/E = Not Established N/A = Not Applicable

II. Ingredients

Hazardous Components	CAS NUMBER	Percent	ACGTH TLV
Does not contain materials considered hazardous per 29 CFR 1910: 1200			

III. Physical Data

Boiling Point (F)	Approx. 215 F	Specific Gravity (H2O = 1)	1.1
Vapor Pressure (mm Hg)	Approx. 18	Percent Volatile	Approx. 82 VOC=0
Vapor Density (Air=1)	<1	Evaporation Rate (BuOAc=1)	Approx. 0.4
Solubility in Water	Complete	Reactivity in Water	None
Appearance & Odor	Clear Liquid, No Ordor	pH	10-13

IV. Fire & Explosion Hazard Data

Flash Point (Test Method): SetaFlash Closed Tester No Flash	Flammable Limits	NA	LEL	NA	LEL
	Auto Ignition Temperature	NE			

Extinguishing Media

☒ Foam ☐ Alcohol Foam ☐ CO2 ☒ Dry Chemical ☐ Water Spray ☒ Water ☐ Not Applicable ☐ Other

Special Fire Fighting Procedures

None

Unusual Fire & Explosion Hazards

None

Spray Clean 12

V. HEALTH HAZARD DATA

Threshold Limit Value of Product	OSHA TEV	ACGTH TLV	Carcinogen
		SEE SECTION II	NONE KNOWN

SYMPTOMS OF EXPOSURE AND ROUTES OF ENTRY SEE SECTION II

EYES:	Severe irriation
SKIN:	Irritation on prolonged contact
INHALATION:	Not a normal route of entry
INGESTION:	Not a normal route of entry

FIRST AID

EYES:	Flush with water for 15 minutes. Consult a physician if irritation persist.
SKIN:	Wash with water. Remove contaminated clothing and footwear.
INGESTION:	Do not induce vomiting. Give plenty of water. Consult a physician immediately.

VI. REACTIVITY DATA

Stability	[ ] Unstable [X] Stable	Conditions to Avoid	Strong acids
Incomparability		Material to Avoid	Strong acids
Hazardous Polymerization	[ ] May Occur [X] Will Not Occur	Conditions to Avoid	N/A

Hazardous Decomposition Products

Oxides of carbon on incineration

VII. ENVIRONMENTAL PROTECTION PROCEDURES

Spill Response: Small Spill: Adsorb with suitable absorben; discard as alkaline waste.
Large Spill: Dike area, pump into suitable tank for recovery of disposal.

Waste Disposal Method
Neutralize to pH of approximately 7 using dilute acid. Check with sewer district before running down drain check all applicable regulatory ordinances.

VIII. SPECIAL PROTECTION INFORMATION

Eye Protection: Safety Glasses Recommended	Skin Protection: Rubber Gloves and Apron suggested
Respiratory Protection (Specific Type): Not normally needed	Ventilation Recommended: General

Other Protection
Eye wash in area

IX. SPECIAL PRECAUTIONS

Hygenic Practices in Handling & Storage
Do not store with acidic materials

Other Precautions
Keep closures on containers when not in use.

DISPOSAL OF EMPTY CONTAINERS
Flush thoroughly with water before disposing

SOYGOLD 1000 SOLVENT

MATERIAL SAFETY DATA SHEET

EMERGENCY PHONE: 913-599-6911 CHEMTREC: 800-424-9300

SECTION I-IDENTIFICATION

PRODUCT: SOYGOLD® 1000
CAS No.: 67784-80-9
CHEMICAL: Fatty acid methyl esters
SYNONYMS: Methyl esters of soybean oil

SECTION II-INGREDIENTS AND HAZARD CLASSIFICATION

TYPICAL COMPOSITION

Alkyl C_{16}-C_{18}-Methyl Esters
This product contains no hazardous material.
SARA HAZARD: TITLE III SECTION 313-Not listed FIRE (Section 311/312): None noted

SECTION III-HEALTH INFORMATION

EFFECTS OF OVEREXPOSURE
INHALATION: No known problems
INGESTION: LD_{50}:>50ml/kg (albino rats)(similar products)
EYE CONTACT: Not classified as eye irritants
SKIN CONTACT: Not classified as a skin irritant or corrosive material

SECTION IV-OCCUPATIONAL EXPOSURE LIMITS

PEL: NO OSHA PEL TLV: NO ACGIH TLV

SECTION V-EMERGENCY FIRST AID PROCEDURE

FOLLOW STANDARD FIRST AID PROCEDURES
SWALLOWING: Call physician or poison control center.
SKIN CONTACT: Wash affected area.
EYE CONTACT: Flush eyes with cool water for at least 15 minutes. Do not let victim rub eyes.
INHALATION: Immediately remove victim to fresh air. Get medical attention immediately.

SECTION VI-PHYSICAL DATA

BOILING POINT: Over 600° F (315° C) at 760 mm Hg pressure
MELTING POINT: -1° C
VAPOR PRESSURE: 1.8 mm Hg at 68° F
SPECIFIC GRAVITY: 0.882 g/ml at 25° C
DIELECTRIC STRENGTH: 42.4
SOLUBILITY IN WATER: Negligible at room temperature
APPEARANCE AND COLOR: Light yellow and liquid at room temperature
ODOR: Light vegetable oil odor

SECTION VII-FIRE AND EXPLOSION HAZARDS

FLASH POINT & METHOD USED: 425° F (218° C)(PMCC)
FLAMMABLE LIMITS: Not applicable
NFPA RATING: No NFPA rating

HMIS RATING: HEALTH: 0 FIRE: 1 REACTIVITY: 0

SPECIAL FIRE FIGHTING PROCEDURES & PRECAUTIONS
Treat as oil fire. Use water spray, dry chemical, foam or carbon dioxide.

UNUSUAL FIRE & EXPLOSION HAZARDS
Rags soaked with any solvent present a fire hazard and should always be stored in UL listed or Factory Mutual approved, covered containers. Improperly stored rags can create conditions that lead to oxidation. Oxidation, under certain conditions can lead to spontaneous combustion. This product contains antioxidants to retard oxidation.

SECTION VIII-REACTIVITY

STABILITY:	Stable
HAZARDOUS POLYMERIZATION:	None likely
MATERIALS TO AVOID:	Strong oxidizing agents
HAZARDOUS DECOMPOSITION PRODUCTS:	CO_2, CO
CONDITIONS TO AVOID:	None known

SECTION IX-EMPLOYEE PROTECTION

CONTROL MEASURES:	Adequate ventilation
RESPIRATORY PROTECTION:	None required
PROTECTIVE CLOTHING:	No need anticipated
EYE PROTECTION:	None required

SECTION X-ENVIRONMENTAL PROTECTION

ENVIRONMENTAL PRECAUTIONS:	Avoid uncontrolled releases of this material into environment.
SPILL OR LEAK PRECAUTIONS:	Contain spilled material. Transfer to secure containers. Where necessary, collect using absorbent media.
WASTE DISPOSAL:	Dispose of according to federal, state and/or local requirements.

SECTION XI-REGULATORY CONTROLS

DOT CLASSIFICATION:	Class 55
DOT PROPER SHIPPING NAME:	Cleaning Compound, N.O.S.
OTHER REGULATORY REQUIREMENTS:	Listed in TSCA inventory

SECTION XII-PRECAUTIONS: HANDLING, STORAGE AND USAGE

No special precautions necessary.

SECTION XIII-DATE AND SIGNATURE

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any other process. The stated MSDS is reliable to the best of the company's knowledge and believed accurate as of the date indicated. However, no representation, warranty or guarantee of any kind, expressed or implied, is made as to its accuracy, reliability or completeness and we assume no responsibility for any loss, damage or expense, direct or consequential, arising out of use. It is the user's responsibility to satisfy himself as to the suitableness and completeness of such information for his own particular use.

AG ENVIRONMENTAL PRODUCTS, L.L.C.
9804 PFLUMM
LENEXA, KS 66215

SIGNATURE: William A. Ayres

PREPARED BY: WILLIAM A. AYRES REVISION DATE: 5-01-01

UNUSUAL FIRE & EXPLOSION HAZARDS
Rags soaked with any solvent present a fire hazard and should always be stored in UL listed or Factory Mutual approved, covered containers. Improperly stored rags can create conditions that lead to oxidation. Oxidation, under certain conditions can lead to spontaneous combustion. This product contains antioxidants to retard oxidation.

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CONDITIONS TO AVOID:	None known

SECTION IX-EMPLOYEE PROTECTION

CONTROL MEASURES:	Adequate ventilation
RESPIRATORY PROTECTION:	None required
PROTECTIVE CLOTHING:	No need anticipated
EYE PROTECTION:	None required

SECTION X-ENVIRONMENTAL PROTECTION

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SECTION XII-PRECAUTIONS: HANDLING, STORAGE AND USAGE

No special precautions necessary.

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9804 PFLUMM
LENEXA, KS 66215

SIGNATURE: William A. Ayres

PREPARED BY: WILLIAM A. AYRES REVISION DATE: 5-01-01

SOYGOLD 2000 SOLVENT

MATERIAL SAFETY DATA SHEET

EMERGENCY PHONE: 913-599-6911 CHEMTREC: 800-424-9300

SECTION I-IDENTIFICATION

PRODUCT: SOYGOLD® 2000
CAS No.: 67784-80-9
CHEMICAL: Fatty acid methyl esters
SYNONYMS: Methyl esters of soybean oil

SECTION II-INGREDIENTS AND HAZARD CLASSIFICATION

TYPICAL COMPOSITION	CAS	%
Alkyl C_{16}-C_{18}-Methyl Esters	67784-80-9	97-99
Surfactant	9016-45-9	1-3

SARA HAZARD: TITLE III SECTION 313: Not listed FIRE (Section 311/312): None noted

SECTION III-HEALTH INFORMATION

EFFECTS OF OVEREXPOSURE
INHALATION: No known problems
INGESTION: LD_{50}:>50ml/kg (albino rats)(similar products)
EYE CONTACT: Not classified as eye irritants
SKIN CONTACT: Not classified as a skin irritant or corrosive material

SECTION IV-OCCUPATIONAL EXPOSURE LIMITS

PEL: NO OSHA PEL TLV: NO ACGIH TLV

SECTION V-EMERGENCY FIRST AID PROCEDURE

FOLLOW STANDARD FIRST AID PROCEDURES
SWALLOWING: Call physician or poison control center.
SKIN CONTACT: Wash affected area.
EYE CONTACT: Flush eyes with cool water for at least 15 minutes. Do not let victim rub eyes.
INHALATION: Immediately remove victim to fresh air. Get medical attention immediately.

SECTION VI-PHYSICAL DATA

BOILING POINT: Over 600° F (315° C) at 760 mm Hg pressure
MELTING POINT: -1° C
VAPOR PRESSURE: 0.882 mm Hg at 25° C
SPECIFIC GRAVITY: 0.882 g/ml at 25° C
DIELECTRIC STRENGTH: >56.9
SOLUBILITY IN WATER: Negligible at room temperature
APPEARANCE AND COLOR: Light yellow to clear and liquid at room temperature
ODOR: Light vegetable oil odor

SECTION VII-FIRE AND EXPLOSION HAZARDS

FLASH POINT & METHOD USED: 425° F (218° C)(PMCC)
FLAMMABLE LIMITS: Not applicable
NFPA RATING: No NFPA rating

HMIS RATING: HEALTH: 0 FIRE: 1 REACTIVITY: 0

SPECIAL FIRE FIGHTING PROCEDURES & PRECAUTIONS
Treat as oil fire. Use water spray, dry chemical, foam or carbon dioxide.

UNUSUAL FIRE & EXPLOSION HAZARDS
Rags soaked with any solvent present a fire hazard and should always be stored in UL listed or Factory Mutual approved, covered containers. Improperly stored rags can create conditions that lead to oxidation. Oxidation, under certain conditions can lead to spontaneous combustion. This product contains antioxidants to retard oxidation.

SECTION VIII-REACTIVITY

STABILITY:	Stable
HAZARDOUS POLYMERIZATION:	None likely
MATERIALS TO AVOID:	Strong oxidizing agents
HAZARDOUS DECOMPOSITION PRODUCTS:	CO_2, CO
CONDITIONS TO AVOID:	None known

SECTION IX-EMPLOYEE PROTECTION

CONTROL MEASURES:	Adequate ventilation
RESPIRATORY PROTECTION:	None required
PROTECTIVE CLOTHING:	No need anticipated
EYE PROTECTION:	None required

SECTION X-ENVIRONMENTAL PROTECTION

ENVIRONMENTAL PRECAUTIONS:	Avoid uncontrolled releases of this material into environment.
SPILL OR LEAK PRECAUTIONS:	Contain spilled material. Transfer to secure containers. Where necessary, collect using absorbent media.
WASTE DISPOSAL:	Dispose of according to federal, state and/or local requirements.

SECTION XI-REGULATORY CONTROLS

DOT CLASSIFICATION:	Class 55
DOT PROPER SHIPPING NAME:	Cleaning Compound, N.O.S.
OTHER REGULATORY REQUIREMENTS:	Listed in TSCA inventory

SECTION XII-PRECAUTIONS: HANDLING, STORAGE AND USAGE

No special precautions necessary.

SECTION XIII-DATE AND SIGNATURE

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any other process. The stated MSDS is reliable to the best of the company's knowledge and believed accurate as of the date indicated. However, no representation, warranty or guarantee of any kind, expressed or implied, is made as to its accuracy, reliability or completeness and we assume no responsibility for any loss, damage or expense, direct or consequential, arising out of use. It is the user's responsibility to satisfy himself as to the suitableness and completeness of such information for his own particular use.

AG ENVIRONMENTAL PRODUCTS, L.L.C.
9804 PFLUMM
LENEXA, KS 66215

SIGNATURE: William A. Ayres

PREPARED BY: WILLIAM A. AYRES REVISION DATE: 5-01-01

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS | J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ACETONE

MSDS Number: A0446 --- *Effective Date: 04/10/01*

1. Product Identification

Synonyms: Dimethylketone; 2-propanone; dimethylketal
CAS No.: 67-64-1
Molecular Weight: 58.08
Chemical Formula: (CH3)2CO
Product Codes:
J.T. Baker: 5356, 5580, 5805, 9001, 9002, 9003, 9004, 9005, 9006, 9007, 9008, 9009, 9010, 9015, 9036, 9125, 9254, 9271, A134, V655
Mallinckrodt: 0018, 2432, 2435, 2437, 2438, 2440, 2443, 2445, 2850, H451, H580, H981

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Acetone	67-64-1	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight

Flammability Rating: 4 - Extreme (Flammable)
Reactivity Rating: 2 - Moderate
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. Higher concentrations can produce central nervous system depression, narcosis, and unconsciousness.
Ingestion:
Swallowing small amounts is not likely to produce harmful effects. Ingestion of larger amounts may produce abdominal pain, nausea and vomiting. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms are expected to parallel inhalation.
Skin Contact:
Irritating due to defatting action on skin. Causes redness, pain, drying and cracking of the skin.
Eye Contact:
Vapors are irritating to the eyes. Splashes may cause severe irritation, with stinging, tearing, redness and pain.
Chronic Exposure:
Prolonged or repeated skin contact may produce severe irritation or dermatitis.
Aggravation of Pre-existing Conditions:
Use of alcoholic beverages enhances toxic effects. Exposure may increase the toxic potential of chlorinated hydrocarbons, such as chloroform, trichloroethane.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

5. Fire Fighting Measures

Fire:
Flash point: -20C (-4F) CC
Autoignition temperature: 465C (869F)
Flammable limits in air % by volume:
lel: 2.5; uel: 12.8
Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Contact with strong oxidizers may cause fire. Sealed containers may rupture when heated. This material may produce a floating fire hazard. Sensitive to static discharge.

Fire Extinguishing Media:
Dry chemical, alcohol foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB(R) solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Acetone:
-OSHA Permissible Exposure Limit (PEL):
1000 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):
500 ppm (TWA), 750 ppm (STEL) A4 - not classifiable as a human carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin

contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless, volatile liquid.
Odor:
Fragrant, mint-like
Solubility:
Miscible in all proportions in water.
Specific Gravity:
0.79 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
56.5C (133F) @ 760 mm Hg
Melting Point:
-95C (-139F)
Vapor Density (Air=1):
2.0
Vapor Pressure (mm Hg):
400 @ 39.5C (104F)
Evaporation Rate (BuAc=1):
ca. 7.7

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Concentrated nitric and sulfuric acid mixtures, oxidizing materials, chloroform, alkalis, chlorine compounds, acids, potassium t-butoxide.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 5800 mg/kg; Inhalation rat LC50: 50,100mg/m3; Irritation eye rabbit, Standard Draize, 20 mg severe; investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Acetone (67-64-1)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.
Environmental Toxicity:
This material is not expected to be toxic to aquatic life. The LC50/96-hour values for fish are over 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 350LB

International (Water, I.M.O.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 350LB

15. Regulatory Information

Ingredient	TSCA	EC	Japan	Australia

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Acetone (67-64-1)	No	No	None

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Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 350LB

International (Water, I.M.O.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 350LB

15. Regulatory Information

Ingredient	TSCA	EC	Japan	Australia

Ingredient	Korea	DSL	NDSL	Phil.
Acetone (67-64-1)	Yes	Yes	Yes	Yes

Ingredient	-SARA 302- RQ	TPQ	List	------SARA 313------ Chemical Catg.
Acetone (67-64-1)	No	No	Yes	No

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Acetone (67-64-1)	5000	U002	No

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: Yes
SARA 311/312: Acute: Yes Chronic: No Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 2[Y]E
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: 1 Flammability: 3 Reactivity: 0
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.
Label First Aid:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
No changes.
Disclaimer:

****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

SIGMA-ALDRICH

Material Safety Data Sheet

Date Printed: 08/05/2002
Date Updated: 11/14/2000
Version: 1.20

Section 1 - Product and Company Information

Product Name	METHYL ACETATE, ANHYDROUS, 99.5%		
Product Number	296996		
Brand	Aldrich Chemical		
Company	Sigma-Aldrich		
Street Address	3050 Spruce Street		
City, State, Zip, Country	SAINT LOUIS, MO 63103 US		
Technical Phone:	314 771 5765	**Emergency Phone:**	414 273 3850 Ext. 5996
Fax:	800 325 5052		

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
METHYL ACETATE	79-20-9	No

Formula C3H6O2
Synonyms Acetate de methyle (French), Devoton, Ethyl ester of microacetic acid, Methylacetaat (Dutch), Methylacetat (German), Methyl acetate (ACGIH:OSHA), Methyle (acetate de) (French), Methylester kiseliny octove (Czech), Methyl ethanoate, Metile (acetato di) (Italian), Octan metylu (Polish), Tereton

Section 3 - Hazards Identification

Emergency Overview
Flammable (USA) Highly Flammable (EU), Irritant.
Highly flammable. Irritating to eyes and skin. Repeated exposure may cause skin dryness or cracking. Vapors may cause drowsiness and dizziness.
Target organs): Eyes, Kidneys.

HMIS Rating
Health: 1* Flammability: 3 Reactivity: 1

NFPA Rating
Health: 1 Flammability: 3 Reactivity: 1

*additional chronic hazards present. For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

Oral Exposure
If swallowed, wash out mouth with water provided person is conscious. Call a physician.

Inhalation Exposure
If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

Dermal Exposure
In case of contact, immediately wash skin with soap and copious amounts of water.

Eye Exposure
In case of contact immediately flush eyes with copious amounts of water for at least 15 minutes.

Section 5 - Fire Fighting Measures

Flammable Hazards: Yes

Explosion Hazards
Vapor may travel considerable distance to source of ignition and flash back.
Container explosion may occur under fire conditions.

Flash Point: -60.8 °F -16 °C

Explosion Limits: **Lower:** 3.1 % **Upper:** 16 %

Autoignition Temp: 502 °C **Flammability:** Yes

Extinguishing Media
Suitable
Water spray. Carbon dioxide, dry chemical, powder, or appropriate foam.

Firefighting
Protective Equipment
Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s)
Flammable liquid. Emits toxic fumes under fire conditions.
Specific Method(s) of Fire Fighting
Use water spray to cool fire-exposed containers.

Section 6 - Accidental Release Measures

Procedure to be Followed in Case of Leak or Spill
Evacuate area. Shut off all sources of ignition.

Procedure(s) of Personal Precaution(s)
Wear respirator, chemical safety goggles, rubber boots, and heavy rubber gloves.

Methods for Cleaning Up
Cover with dry-lime, sand, or soda ash. Place in covered containers using non-sparking tools and transport outdoors. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

Handling
User Exposure
Avoid breathing vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

Storage
Suitable
Keep container closed. Keep away from heat, sparks, and open flame. Handle and store under nitrogen.

Special Requirements
Protect from moisture.

Section 8 - Exposure Controls / PPE

Engineering Controls
Safety shower and eye bath. Use nonsparking tools. Mechanical exhaust required.

Personal Protective Equipment

Respiratory
NIOSH/MSHA-approved respirator
Hand
Compatible chemical-resistant gloves
Eye
Chemical safety goggles.

General Hygiene Measures
Wash thoroughly after handling. Wash contaminated clothing before reuse.

Exposure Limits, RTECS

Country	Source	Type	Value	Remarks
USA	ACGIH	STEL	757 MG/M3 (250 PPM)	
USA	ACGIH	TWA	606 MG/M3 (200 PPM)	
USA	MSHA Standards	TWA	200 PPM (610 MG/M3)	
USA	OSHA	PEL	SH TWA 200 PPM (610 MG/M3)	
New Zealand	OEL			check ACGIH TLV
USA	NIOSH	TWA STEL	200 PPM 250 PPM	

Section 9 - Physical/Chemical Properties

Appearance

Physical State	Color
Clear liquid	Colorless

Molecular Weight: 74.08 AMU

Property	Value	At Temperature or Pressure
pH	N/A	
BP/BP Range	56 - 58 °C	
MP/MP Range	-98 °C	
Freezing Point	N/A	
Vapor Pressure	165 mm-g	20 °C
Vapor Density	2.55 g/l	
Saturated Vapor Conc.	N/A	
SG/Density	0.934 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Partition Coefficient	N/A	
Decomposition Temp.	N/A	
Flash Point °F	-60.8 °F	
Flash Point °C	-16 °C	
Explosion Limits	Lower: 3.1 % Upper: 16 %	
Autoignition Temp	502 °C	
Refractive Index	1.362	
Solubility	N/A	

Section 10 - Stability and Reactivity

Stability
Stable
Stable
Conditions to Avoid
Protect from moisture.

Materials to Avoid
Strong oxidizing agents

Hazardous Decomposition Products
Hazardous Decomposition Products
Carbon monoxide, Carbon dioxide

Hazardous Polymerization
Hazardous Polymerization
Will not occur

Section 11 - Toxicological Information

Route of Exposure
Skin Contact
Causes skin irritation.
Skin Absorption
May be harmful if absorbed through the skin
Eye Contact
Causes eye irritation.
Inhalation
May be harmful if inhaled. Material is irritating to mucous membranes and upper respiratory tract.
Ingestion
May be harmful if swallowed.

Target Organ(s) or System(s)
Eyes. Kidneys. Central nervous system.

Signs and Symptoms of Exposure
Exposure can cause: Narcotic effect. This product is metabolized into formic acid. Humans and other primates metabolize formic acid more slowly than do rodents. Formic acid can build up in the body producing toxic effects possibly leading to death; therefore, data from studies in rodents may have limited relevance for human risk assessment.

RTECS Number: AI9100000

Toxicity Data

Oral - Rat: > 5,000 mg/kg (LD50)

Oral - Rabbit: 3,705 mg/kg (LD50)

Skin - Rabbit: > 5,000 mg/kg (LD50)

Intraduodenal - Rabbit: 3700 MG/KG (LD50)

Irritation Data

Skin - Rabbit: 500 mg 24H
Remarks: Mild irritation effect

Skin - Rabbit: 20 mg 24H
Remarks: Moderate irritation effect

Eyes - Rabbit: 100 mg 24H
Remarks: Moderate irritation effect

Section 12 - Ecological Information

Section 13 - Disposal Considerations

Appropriate Method of Disposal of Substance or Preparation
Contact a licensed professional waste disposal service to dispose of this material.
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable.

Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Methyl acetate
UN#: 1231
Class: 3
Packing Group: Packing Group II
PIH: Not PIH

IATA
Proper Shipping Name: Methyl acetate
IATA Number: 1231
Hazard Class: 3
Packing Group: II

Section 15 - Regulatory Information

EU Directives Classification
Symbol of Danger: F Xi
Indication of Danger
Highly Flammable. Irritant.
Risk Statements R: 11 36 66 67
Highly flammable. Irritating to eyes. Repeated exposure may cause skin dryness or cracking. Vapors may cause drowsiness and dizziness.
Safety Statements S: 16 26 29 33
Keep away from sources of ignition - no smoking. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Do not empty into drains. Take precautionary measures against static discharges.

US Classification and Label Text
Indication of Danger
Flammable (USA) Highly Flammable (EU) Irritant.
Risk Statements
Highly flammable. Irritating to eyes and skin. Repeated exposure may cause skin dryness or cracking. Vapors may cause drowsiness and dizziness.
Safety Statements
Keep away from sources of ignition - no smoking. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Do not empty into drains. Take precautionary measures against static discharges. Wear suitable protective clothing, gloves, and eye/face protection.
US Statements
Target organ(s): Eyes. Kidneys.

United States Regulatory Information
Listed: No

TSCA Inventory Item: Yes

Section 16 - Other Information

Warranty
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. Sigma-Aldrich Inc. shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

Alternative Tested at Southern California Screen Printing

MATERIAL SAFETY DATA SHEET

I. PRODUCT IDENTIFICATION

Trade Name: SIEBERT AUTOWASH #3
Generic Name: Blanket Wash

CAS #: Proprietary Blend

Manufacturer: Siebert, Inc.
Address: 8134 West 47th Street
City: Lyons State: IL Zip: 60534

Emergency phone#: (800) 535-5053
Technical phone#: (708) 442-2010

DOT Hazard Classification: Not Regu
NFPA Codes: Health - 0 Flammability - 0 Reactivity - 0
HMIS Codes: Health - 1 Flammability - 0 Reactivity - 0 Personal Protection - B

II. HAZARDOUS INGREDIENTS

If present, IARC, NTP, and OSHA carcinogens and chemicals subject to the reporting requirements of SARA Title III Section 313 are identified in this section.

Ingredient Name	CAS Number	%wt	TLV	STEL	SARA TITLE III
Fatty esters	Various	70 to 90	None established	None established	No
Surfactants	Various	15 to 30	None established	None established	No

References: 29CFR 1910.1000, ACGIH "Threshold Limit Values for Chemicals in the Workplace", National Toxicology Program Annual Report, International Agency for Research on Cancer Monographs, and 40CFR Part 372. All components of this product are in compliance with TSCA.

III. PHYSICAL DATA

Boiling Point @ 760 mm Hg:	**308 - 335°F**
Vapor Pressure @ 80°F:	**<0.1 mm Hg**
Specific Gravity @ 68°F:	**0.92**
Water Solubility (%):	**Insoluble**
Specific Vapor Density (air=1):	<1.0
% Volatile by Volume:	<1.0
% Volatile Organic Compound(s):	<1.0
Appearance:	Clear golden liquid
Odor:	Typical organic odor

IV. FIRE AND EXPLOSION DATA

Flash Point (Method): >300°F (TCC)
Explosive Limit: LEL - N/E UEL - N/E
Extinguishing Media: Water fog, carbon dioxide, or dry chemical.
Special Fire Fighting Procedures: Wear self-contained breathing apparatus when fighting chemical fires.
Unusual Fire and Explosion Hazards: Fine sprays/mists may be combustible at temperatures below normal flash point. Rags soaked with material, stored for a long period while mixed with strong alkali or acidic materials, may smolder, then smoke, and may even ignite.

V. HEALTH HAZARD DATA

Eyes - May cause temporary irritation, redness, tearing, blurred vision. Contact lenses must not be worn when possibility exists for eye contact due to spraying liquid or airborne particles.
Skin - Prolonged or repeated contact may cause irritation.

Breathing - Excessive inhalation of vapors may cause nasal and respiratory irritation, central nervous system effects including dizziness, weakness, fatigue, nausea, headache and possible unconsciousness.
Swallowing - Can cause gastrointestinal irritation, nausea, vomiting, and diarrhea.

First Aid/Emergency Procedures

Inhalation: Remove to fresh air. If breathing is difficult, administer oxygen. If breathing has stopped, give artificial respiration. Keep person warm, quiet and get medical attention.
Skin Contact: Wash thoroughly with soap and water. Remove contaminated clothing. Launder contaminated clothing before re-use.
Eyes: Flush with copious amounts of water. Get medical attention.
Ingestion: Do not induce vomiting. If large quantity is swallowed, give lukewarm water (pint). NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. Get medical attention immediately. Risk of damage to lungs exceeds poisoning risk.
Primary Entry Route(s): Inhalation, skin contact.
Chronic Health Effects: Chronic overexposure may aggravate existing skin, eye and lung conditions.

VI. REACTIVITY DATA

Stability: Stable. Hazardous Polymerization: Cannot occur.
Incompatibilities: Avoid contact with strong oxidizing materials, strong alkalies, strong mineral acids.
Hazardous Decomposition Products: Carbon mono/di oxides.
Conditions to Avoid: None

VII. SPILL OR LEAK PROCEDURES

Procedures for Spill/Leak:

Eliminate all ignition sources (flares, flames including pilot lights, electrical sparks, etc.).

Small Spill - Absorb liquid on paper, vermiculite, floor absorbent, or other absorbent material and transfer to a recovery drum.

Large Spill - Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Stop spill at source, dike area of spill to prevent spreading, pump liquid to salvage tank. Remaining liquid may be taken up on sand, clay, earth, floor absorbent, or other absorbent material and shoveled into recovery drums. Prevent run-off to sewers, streams or others bodies of water. Notify proper authorities, as required, that a spill has occurred.

Waste Management:

Landfill solids at permitted sites. Use registrated transporters. Burn concentrated liquids at permitted sites. Avoid flameouts. Assure emissions comply with applicable regulations. Dilute aqueous waste may biodegrade. Avoid overloading/poisoning plant biomass. Assure effluent complies with applicable regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection:

If workplace exposure limit(s) of product is exceeded, a NIOSH/MSHA approved air supplied respirator is advised in the absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions. Engineering or administrative controls should be implemented to reduce exposure.

Ventilation: Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain minimum exposure.
Eye Protection: Chemical Splash Proof Goggles and full face shield are advised for operations where eye or face contact can occur.
Gloves: Wear impervious gloves.
Other Protective Equipment: To prevent repeated or prolonged skin contact, wear impervious clothing and boots.

IX. SPECIAL PRECAUTIONS

Special Handling/Storage:

To avoid skin contact and ingestion, wash hands and face well before eating or smoking. Do not permit food in work area. Avoid breathing mists if generated. Store at room temperature. Reseal container when not in use. Do not store near acids, bases or flammable liquids. Containers of this material should be rinsed when emptied, since emptied containers retain product residues (vapor, liquid, and/or solid). All hazard precautions given in this data sheet must be observed.

As of the date of preparation of this document, the foregoing information is believed to be accurate and is provided in good faith to comply with applicable federal and state law(s). However, no warranty or representation with respect to such information is intended or given.

Date revised: 04/01/2001
jpm

Alternatives Tested at Nelson Nameplate

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS | J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ACETONE

MSDS Number: A0446 --- *Effective Date: 04/10/01*

1. Product Identification

Synonyms: Dimethylketone; 2-propanone; dimethylketal
CAS No.: 67-64-1
Molecular Weight: 58.08
Chemical Formula: (CH3)2CO
Product Codes:
J.T. Baker: 5356, 5580, 5805, 9001, 9002, 9003, 9004, 9005, 9006, 9007, 9008, 9009, 9010, 9015, 9036, 9125, 9254, 9271, A134, V655
Mallinckrodt: 0018, 2432, 2435, 2437, 2438, 2440, 2443, 2445, 2850, H451, H580, H981

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Acetone	67-64-1	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight

Flammability Rating: 4 - Extreme (Flammable)
Reactivity Rating: 2 - Moderate
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. Higher concentrations can produce central nervous system depression, narcosis, and unconsciousness.
Ingestion:
Swallowing small amounts is not likely to produce harmful effects. Ingestion of larger amounts may produce abdominal pain, nausea and vomiting. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms are expected to parallel inhalation.
Skin Contact:
Irritating due to defatting action on skin. Causes redness, pain, drying and cracking of the skin.
Eye Contact:
Vapors are irritating to the eyes. Splashes may cause severe irritation, with stinging, tearing, redness and pain.
Chronic Exposure:
Prolonged or repeated skin contact may produce severe irritation or dermatitis.
Aggravation of Pre-existing Conditions:
Use of alcoholic beverages enhances toxic effects. Exposure may increase the toxic potential of chlorinated hydrocarbons, such as chloroform, trichloroethane.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

5. Fire Fighting Measures

Fire:
Flash point: -20C (-4F) CC
Autoignition temperature: 465C (869F)
Flammable limits in air % by volume:
lel: 2.5; uel: 12.8
Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Contact with strong oxidizers may cause fire. Sealed containers may rupture when heated. This material may produce a floating fire hazard. Sensitive to static discharge.

Fire Extinguishing Media:
Dry chemical, alcohol foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB(R) solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Acetone:
-OSHA Permissible Exposure Limit (PEL):
1000 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):
500 ppm (TWA), 750 ppm (STEL) A4 - not classifiable as a human carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin

contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless, volatile liquid.
Odor:
Fragrant, mint-like
Solubility:
Miscible in all proportions in water.
Specific Gravity:
0.79 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
56.5C (133F) @ 760 mm Hg
Melting Point:
-95C (-139F)
Vapor Density (Air=1):
2.0
Vapor Pressure (mm Hg):
400 @ 39.5C (104F)
Evaporation Rate (BuAc=1):
ca. 7.7

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Concentrated nitric and sulfuric acid mixtures, oxidizing materials, chloroform, alkalis, chlorine compounds, acids, potassium t-butoxide.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 5800 mg/kg; Inhalation rat LC50: 50,100mg/m3; Irritation eye rabbit, Standard Draize, 20 mg severe; investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Acetone (67-64-1)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.
Environmental Toxicity:
This material is not expected to be toxic to aquatic life. The LC50/96-hour values for fish are over 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 350LB

International (Water, I.M.O.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 350LB

15. Regulatory Information

Ingredient	TSCA	EC	Japan	Australia

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Acetone (67-64-1)	Yes	Yes	No	Yes

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Acetone (67-64-1)	No	No	Yes	No

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Acetone (67-64-1)	5000	U002	No

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: Yes
SARA 311/312: Acute: Yes Chronic: No Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 2[Y]E
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: 1 Flammability: 3 Reactivity: 0
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.
Label First Aid:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
No changes.
Disclaimer:
****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

72-62-7820-01

008669

GLYCOL ETHER DPM

THIS MSDS COMPLIES WITH 29 CFR 1910.1200 (THE HAZARD COMMUNICATION STANDARD)

****

Product Name: GLYCOL ETHER DPM
CAS NUMBER: 34590-94-8

05 50 088 0936060-

Data Sheet No: 0003866-005
Prepared: 10/05/89
Supersedes: 03/04/86

BENCO SALES INC
P O BOX 1415
CROSSVILLE TN 38557

PRODUCT: 3989160
INVOICE: 650542
INVOICE DATE: 10/23/89
TO: BENCO SALES INC
STOUT DRIVE
CROSSVILLE TN 38555

ATTN: PLANT MGR./SAFETY DIR.

SECTION I-PRODUCT IDENTIFICATION

General or Generic ID: GLYCOL ETHER

DOT Hazard Classification: COMBUSTIBLE (173.115)

SECTION II-COMPONENTS

IF PRESENT, IARC, NTP AND OSHA CARCINOGENS AND CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SARA TITLE III SECTION 313 ARE IDENTIFIED IN THIS SECTION.
SEE DEFINITION PAGE FOR CLARIFICATION

INGREDIENT	% (by WT)	PEL	TLV	Note
DIPROPYLENE GLYCOL MONOMETHYL ETHER CAS #: 34590-94-8	>95	100 PPM - SKIN	100 PPM - SKIN	(1)

Notes:

(1) SKIN ABSORPTION MAY POTENTIALLY CONTRIBUTE TO THE OVERALL EXPOSURE TO THIS MATERIAL. APPROPRIATE MEASURES SHOULD BE TAKEN TO PREVENT ABSORPTION SO THAT THE TLV IS NOT INVALIDATED.

OSHA/ACGIH SHORT TERM EXPOSURE LIMIT (STEL) FOR DIPROPYLENE GLYCOL MONOMETHYL ETHER IS 150 PPM.

SECTION III-PHYSICAL DATA

Boiling Point	for PRODUCT	356.00 - 378.00 Deg F (180.00 - 192.22 Deg C) @ 760.00 mm Hg
Vapor Pressure	for PRODUCT	< 0.10 mm Hg @ 68.00 Deg F (20.00 Deg C)
Specific Vapor Density	AIR = 1	5.1
Specific Gravity		.953 - .959 @ 68.00 Deg F (20.00 Deg C)
Percent Volatiles		100.00%
Evaporation Rate	(BU AC = 1)	.80

SECTION IV-FIRE AND EXPLOSION INFORMATION

FLASH POINT(TCC) 167.0 Deg F (75.0 Deg C)

EXPLOSIVE LIMIT (PRODUCT) LOWER - 1.1%

EXTINGUISHING MEDIA: ALCOHOL FOAM OR CARBON DIOXIDE OR DRY CHEMICAL

HAZARDOUS DECOMPOSITION PRODUCTS: MAY FORM TOXIC MATERIALS:, CARBON DIOXIDE AND CARBON MONOXIDE, VARIOUS HYDROCARBONS, ETC.

FIREFIGHTING PROCEDURES: WEAR SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN THE POSITIVE PRESSURE DEMAND MODE WHEN FIGHTING FIRES.

SPECIAL FIRE & EXPLOSION HAZARDS: VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL ALONG THE GROUND OR BE MOVED BY VENTILATION AND IGNITED BY HEAT, PILOT LIGHTS, OTHER FLAMES AND IGNITION SOURCES AT LOCATIONS DISTANT FROM MATERIAL HANDLING POINT.

NEVER USE WELDING OR CUTTING TORCH ON OR NEAR DRUM (EVEN EMPTY) BECAUSE PRODUCT (EVEN JUST RESIDUE) CAN IGNITE EXPLOSIVELY.

ALL FIVE GALLON PAILS AND LARGER METAL CONTAINERS INCLUDING TANK CARS AND TANK TRUCKS SHOULD BE GROUNDED AND/OR BONDED WHEN MATERIAL IS TRANSFERRED.

NFPA CODES: HEALTH- 0 FLAMMABILITY- 2 REACTIVITY- 0

SECTION V-HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE LEVEL	100	PPM - SKIN
THRESHOLD LIMIT VALUE (SKIN)	100	PPM - SKIN

CONTINUED ON PAGE: 2

SECTION V-HEALTH HAZARD DATA (Continued)

EFFECTS OF ACUTE OVEREXPOSURE: FOR PRODUCT

EYES - CAN CAUSE IRRITATION.
SKIN - CAN CAUSE SLIGHT IRRITATION.
BREATHING - EXCESSIVE INHALATION OF VAPORS CAN CAUSE NASAL AND RESPIRATORY IRRITATION AND CENTRAL NERVOUS SYSTEM EFFECTS INCLUDING DIZZINESS, WEAKNESS, FATIGUE, NAUSEA, HEADACHE AND POSSIBLE UNCONSCIOUSNESS.
SWALLOWING - SLIGHTLY TOXIC. MAY PRODUCE SIGNS OF INTOXICATION CHARACTERIZED BY INCOORDINATION, DIZZINESS, DROWSINESS, HEADACHE, NAUSEA, MENTAL CONFUSION, POSSIBLY SLURRED SPEECH, AND STUPOR, DEPENDING ON THE QUANTITY OF MATERIAL INGESTED.

FIRST AID:

IF ON SKIN: THOROUGHLY WASH EXPOSED AREA WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING. LAUNDER CONTAMINATED CLOTHING BEFORE RE-USE.

IF IN EYES: FLUSH WITH LARGE AMOUNTS OF WATER, LIFTING UPPER AND LOWER LIDS OCCASIONALLY.

IF SWALLOWED: IMMEDIATELY DRINK TWO GLASSES OF WATER AND INDUCE VOMITING BY EITHER GIVING IPECAC SYRUP OR BY PLACING FINGER AT BACK OF THROAT. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. GET MEDICAL ATTENTION IMMEDIATELY.

IF BREATHED: IF AFFECTED, REMOVE INDIVIDUAL TO FRESH AIR. IF BREATHING IS DIFFICULT, ADMINISTER OXYGEN. IF BREATHING HAS STOPPED GIVE ARTIFICIAL RESPIRATION. KEEP PERSON WARM, QUIET AND GET MEDICAL ATTENTION.

PRIMARY ROUTE(S) OF ENTRY:

INHALATION, SKIN ABSORPTION, SKIN CONTACT

EFFECTS OF CHRONIC OVEREXPOSURE: FOR PRODUCT

OVEREXPOSURE TO THIS MATERIAL (OR ITS COMPONENTS) HAS APPARENTLY BEEN FOUND TO CAUSE THE FOLLOWING EFFECTS IN LABORATORY ANIMALS:, LIVER ABNORMALITIES, KIDNEY DAMAGE

SECTION VI-REACTIVITY DATA

HAZARDOUS POLYMERIZATION: CANNOT OCCUR

STABILITY: STABLE

INCOMPATIBILITY: AVOID CONTACT WITH:, STRONG OXIDIZING AGENTS.

SECTION VII-SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

SMALL SPILL: ABSORB LIQUID ON PAPER, VERMICULITE, FLOOR ABSORBENT, OR OTHER ABSORBENT MATERIAL AND TRANSFER TO HOOD.

VENTILATE AREA.

LARGE SPILL: ELIMINATE ALL IGNITION SOURCES (FLARES, FLAMES INCLUDING PILOT LIGHTS, ELECTRICAL SPARKS). PERSONS NOT WEARING PROTECTIVE EQUIPMENT SHOULD BE EXCLUDED FROM AREA OF SPILL UNTIL CLEAN-UP HAS BEEN COMPLETED. STOP SPILL AT SOURCE, DIKE AREA OF SPILL TO PREVENT SPREADING, PUMP LIQUID TO SALVAGE TANK. REMAINING LIQUID MAY BE TAKEN UP ON SAND, CLAY, EARTH, FLOOR ABSORBENT, OR OTHER ABSORBENT MATERIAL AND SHOVELED INTO CONTAINERS.

PREVENT RUN-OFF TO SEWERS, STREAMS OR OTHER BODIES OF WATER. IF RUN-OFF OCCURS, NOTIFY PROPER AUTHORITIES AS REQUIRED, THAT A SPILL HAS OCCURED.

WASTE DISPOSAL METHOD:

SMALL SPILL: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

LARGE SPILL: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

SECTION VIII-PROTECTIVE EQUIPMENT TO BE USED

RESPIRATORY PROTECTION: IF WORKPLACE EXPOSURE LIMIT(S) OF PRODUCT OR ANY COMPONENT IS EXCEEDED (SEE SECTION II), A NIOSH/MSHA APPROVED AIR SUPPLIED RESPIRATOR IS ADVISED IN ABSENCE OF PROPER ENVIRONMENTAL CONTROL. OSHA REGULATIONS ALSO PERMIT OTHER NIOSH/MSHA RESPIRATORS (NEGATIVE PRESSURE TYPE) UNDER SPECIFIED CONDITIONS (SEE YOUR SAFETY EQUIPMENT SUPPLIER). ENGINEERING OR ADMINISTRATIVE CONTROLS SHOULD BE IMPLEMENTED TO REDUCE EXPOSURE.

VENTILATION: PROVIDE SUFFICIENT MECHANICAL (GENERAL AND/OR LOCAL EXHAUST) VENTILATION TO MAINTAIN EXPOSURE BELOW TLV(S).

PROTECTIVE GLOVES: WEAR RESISTANT GLOVES SUCH AS:, NITRILE RUBBER, NATURAL RUBBER

EYE PROTECTION: CHEMICAL SPLASH GOGGLES IN COMPLIANCE WITH OSHA REGULATIONS ARE ADVISED; HOWEVER, OSHA REGULATIONS ALSO PERMIT OTHER TYPE SAFETY GLASSES. (CONSULT YOUR SAFETY EQUIPMENT SUPPLIER)

OTHER PROTECTIVE EQUIPMENT: TO PREVENT REPEATED OR PROLONGED SKIN CONTACT, WEAR IMPERVIOUS CLOTHING AND BOOTS.

SECTION IX-SPECIAL PRECAUTIONS OR OTHER COMMENTS

CONTAINERS OF THIS MATERIAL MAY BE HAZARDOUS WHEN EMPTIED.SINCE EMPTIED CONTAINERS RETAIN PRODUCT RESIDUES (VAPOR, LIQUID, AND/OR SOLID), ALL HAZARD PRECAUTIONS GIVEN IN THE DATA SHEET MUST BE OBSERVED.

THE INFORMATION ACCUMULATED HEREIN IS BELIEVED TO BE ACCURATE BUT IS NOT WARRANTED TO BE WHETHER ORIGINATING WITH THE COMPANY OR NOT. RECIPIENTS ARE ADVISED TO CONFIRM IN ADVANCE OF NEED THAT THE INFORMATION IS CURRENT, APPLICABLE, AND SUITABLE TO THEIR CIRCUMSTANCES.

 LAST PAGE--SIE ATTACHMENT PAGE ENCLOSED--LAST PAGE

DEFINITIONS

This definition page is intended for use with Material Safety Data Sheets supplied by the Ashland Chemical Company. Recipients of these data sheets should consult the OSHA Safety and Health Standards (29 CFR 1910), particularly subpart G - Occupational Health and Environmental Control, and subpart I - Personal Protective Equipment, for general guidance on control of potential Occupational Health and Safety Hazards.

SECTION I
PRODUCT IDENTIFICATION

GENERAL OR GENERIC ID: Chemical family or product description.

DOT HAZARD CLASSIFICATION: Product meets DOT criteria for hazards listed.

SECTION II
COMPONENTS

Components are listed in this section if they present a physical or health hazard and are present at or above 1% in the mixture. If a component is identified as a CARCINOGEN by NTP, IARC or OSHA as of the date on the MSDS, it will be listed and footnoted in this section when present at or above 0.1% in the product. Negative conclusions concerning carcinogenicity are not reported. Additional health information may be found in Section V. Components subject to the reporting requirements of Section 313 of SARA Title III are identified in the footnotes in this section, along with typical percentages. Other components may be listed if deemed appropriate.

Exposure recommendations are for components. OSHA Permissible Exposure Limits (PELs) and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) appear on the line with the component identification. Other recommendations appear as footnotes.

SECTION III
PHYSICAL DATA

BOILING POINT: Of product if known. The lowest value of the components is listed for mixtures.

VAPOR PRESSURE: Of product if known. The highest value of the components is listed for mixtures.

SPECIFIC VAPOR DENSITY: Compared to AIR = 1. If Specific Vapor Density of product is not known, the value is expressed as lighter or heavier than air.

SPECIFIC GRAVITY: Compared to WATER = 1. If Specific Gravity of product is not known, the value is expressed as less than or greater than water.

pH: If applicable.

PERCENT VOLATILES: Percentage of material with initial boiling point below 425 degrees Fahrenheit.

EVAPORATION RATE: Indicated as faster or slower than ETHYL ETHER, unless otherwise stated.

SECTION IV
FIRE AND EXPLOSION DATA

FLASH POINT: Method identified.

EXPLOSION LIMITS: For product if known. The lowest value of the components is listed for mixtures.

HAZARDOUS DECOMPOSITION PRODUCTS: Known or expected hazardous products resulting from heating, burning or other reactions.

SECTION IV (cont.)

EXTINGUISHING MEDIA: Following National Fire Protection Association criteria.

FIREFIGHTING PROCEDURES: Minimum equipment to protect firefighters from toxic products of vaporization, combustion or decomposition in fire situations. Other firefighting hazards may also be indicated.

SPECIAL FIRE AND EXPLOSION HAZARDS: States hazards not covered by other sections.

NFPA CODES: Hazard ratings assigned by the National Fire Protection Association.

SECTION V
HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE LIMIT: For product.

THRESHOLD LIMIT VALUE: For product.

EFFECTS OF ACUTE OVEREXPOSURE: Potential local and systemic effects due to single or short term overexposure to the eyes and skin or through inhalation or ingestion.

EFFECTS OF CHRONIC OVEREXPOSURE: Potential local and systemic effects due to repeated or long term overexposure to the eyes and skin or through inhalation or ingestion.

FIRST AID: Procedures to be followed when dealing with accidental overexposure.

PRIMARY ROUTE OF ENTRY: Based on properties and expected use.

SECTION VI
REACTIVITY DATA

HAZARDOUS POLYMERIZATION: Conditions to avoid to prevent hazardous polymerization resulting in a large release of energy.

STABILITY: Conditions to avoid to prevent hazardous or violent decomposition.

INCOMPATIBILITY: Materials and conditions to avoid to prevent hazardous reactions.

SECTION VII
SPILL OR LEAK PROCEDURES

Reasonable precautions to be taken and methods of containment, clean-up and disposal. Consult federal, state and local regulations for accepted procedures and any reporting or notification requirements.

SECTION VIII
PROTECTIVE EQUIPMENT TO BE USED

Protective equipment which may be needed when handling the product.

SECTION IX
SPECIAL PRECAUTIONS OR OTHER COMMENTS

Covers any relevant points not previously mentioned.

ADDITIONAL COMMENTS

Containers should be either reconditioned by CERTIFIED firms or properly disposed of by APPROVED firms. Disposal of containers should be in accordance with applicable laws and regulations. "EMPTY" drums should not be given to individuals. Serious accidents have resulted from the misuse of "EMPTIED" containers (drums, pails, etc.). Refer to Sections IV and IX.

Alternatives Tested at Stith and Quickdraw

HIGH PERFORMANCE MIRACHEM®

A division of INNOVATIVE ENVIRONMENTAL PRODUCTS, INC.

Material Safety Data Sheet

MIRACHEM. Pressroom Cleaner (Formulation No. 2501)

Section I - General

Manufacturer Name:	The Mirachem Corporation P.O. Box 27608 Tempe, Arizona 85285-7608	Date Prepared: Revision Date:	7/3/96
Emergency Phone:	1-(800) 847-3527		

Section II - Hazardous Ingredients/Identity Information

Hazardous Component (CAS #)	OSHA PEL	ACGIH TLV	Other Limits	% (Optional)
None				

N.E. = None Established

Section III - Physical/Chemical Characteristics

Boiling Point:	>210°F	Specific Gravity (H_2O = 1):	0.9957
Vapor Pressure (mm Hg.): @ 20°C	Composite 0.006	pH:	8.7-9.5
Vapor Density (AIR =1):	> 1	Evaporation Rate (Butyl Acetate=1):	> 1
Solubility in Water:	Complete	Melting Point:	N/A

Appearance and Odor: Clear liquid with a mild citrus odor

N/A = Not Applicable N.E. = Not Established

Section IV - Fire and Explosion Hazard

Flash Point (Method Used):	>212°F (PMCC ASTM D93)	Explosive Limits:	N/A
Extinguishing Media:	N/A		
Special Fire Fighting Procedures:	N/A	Unusual Fire Fighting and Explosion Hazards:	N/A

Section V - Reactivity

Stability:	Unstable Stable X	Incompatibility (Materials to Avoid):	Strong Acids and Alkalies. demulsify product.
Hazardous Decomposition or By-products:	Thermal decomposition may produce CO_2		
Hazardous Polymerization:	May Occur	Will Not Occur	X

Section VI - Health Hazard Data

Eye Contact:	May cause mild temporary irritation.
Skin Contact:	Prolonged or repeated exposure may cause mild irritation.
Inhalation:	No adverse effects expected.
Ingestion:	No adverse health effects are anticipated to occur as a result of acute ingestion. Chronic effects are not known.
Carcinogenicity:	None of the components in this material are listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.
Signs/Symptoms of Overexposure:	Prolonged contact may cause mild irritation or dryness to sensitive skin.
Medical Conditions Generally Aggravated by Exposure:	None known.

Section VII - Emergency and First Aid Procedures

Eyes:	Immediately flush with clean water. Consult physician if necessary.
Skin:	Rinse with water.
Ingestion:	If swallowed, treat symptomatically and supportively. Do not induce vomiting. If victim conscious and alert, give two glasses of water or milk to drink. If vomiting occurs, keep head below hips to prevent aspiration. Contact Physician.
Inhalation:	No adverse effects anticipated.

Section VIII - Precautions for Safe Handling and Use

In Case of Spill:	Flush with water into containing area.
Waste Disposal:	Flush to sewer where applicable within Federal, State or Local disposal requirements.
Handling & Storage Precautions:	Wear protective goggles or face shield if splashing or spraying liquid. Protect from freezing.
Other Precautions:	Keep container tightly closed. Keep out of reach of children.

Section IX - Control Measures

Respiratory Protection:	No respiratory protection is necessary.
Ventilation:	Good general ventilation is sufficient.
Protective Clothing:	When prolongec skin contact is expected, wear protective gloves.
Eye Protection:	Wear safety glasses.
Work/Hygienic Practices:	Use good personal hygiene practices, wash hands before eating, drinking, smoking, or using toilet facilities.

SOYGOLD 2000 SOLVENT

MATERIAL SAFETY DATA SHEET

EMERGENCY PHONE: 913-599-6911 CHEMTREC: 800-424-9300

SECTION I-IDENTIFICATION

PRODUCT: SOYGOLD® 2000
CAS No.: 67784-80-9
CHEMICAL: Fatty acid methyl esters
SYNONYMS: Methyl esters of soybean oil

SECTION II-INGREDIENTS AND HAZARD CLASSIFICATION

TYPICAL COMPOSITION	CAS	%
Alkyl C_{16}-C_{18}-Methyl Esters	67784-80-9	97-99
Surfactant	9016-45-9	1-3

SARA HAZARD: TITLE III SECTION 313: Not listed FIRE-(Section 311/312) None noted

SECTION III-HEALTH INFORMATION

EFFECTS OF OVEREXPOSURE:

INHALATION: No known problems
INGESTION: LD50:>50ml/kg (albino rats)(similar products)
EYE CONTACT: Not classified as eye irritants
SKIN CONTACT: Not classified as a skin irritant or corrosive material

SECTION IV-OCCUPATIONAL EXPOSURE LIMITS

PEL: NO OSHA PEL TLV: NO ACGIH TLV

SECTION V-EMERGENCY FIRST AID PROCEDURE

FOLLOW STANDARD FIRST AID PROCEDURES:

SWALLOWING: Call physician or poison control center.
SKIN CONTACT: Wash affected area.
EYE CONTACT: Flush eyes with cool water for at least 15 minutes. Do not let victim rub eyes.
INHALATION: Immediately remove victim to fresh air. Get medical attention immediately.

SECTION VI-PHYSICAL DATA

BOILING POINT:	Over 600° F (315° C) at 760 mm Hg pressure
MELTING POINT:	-1° C
VAPOR PRESSURE:	Less than 5 mm Hg at 72° F
SPECIFIC GRAVITY:	0.87 at 25° C
SOLUBILITY IN WATER:	Negligible at room temperature
APPEARANCE AND COLOR:	Light yellow and liquid at room temperature
ODOR:	Light vegetable oil odor

SECTION VII-FIRE AND EXPLOSION HAZARDS

FLASH POINT & METHOD USED:	425° F (218° C)(PMCC)
FLAMMABLE LIMITS:	Not applicable
NFPA RATING:	No NFPA rating

HMIS RATING: HEALTH: 0 FIRE: 1 REACTIVITY: 0

SPECIAL FIRE FIGHTING PROCEDURES & PRECAUTIONS: Treat as oil fire.
Use water spray, dry chemical, foam or carbon dioxide.

UNUSUAL FIRE & EXPLOSION HAZARDS:
Rags soaked with any solvent present a fire hazard and should always be stored in UL listed or Factory Mutual approved, covered containers. Improperly stored rags can create conditions that lead to oxidation. Oxidation, under certain conditions can lead to spontaneous combustion. This product contains antioxidants to retard oxidation.

SECTION VIII-REACTIVITY

STABILITY:	Stable
HAZARDOUS POLYMERIZATION:	None likely
MATERIALS TO AVOID:	Strong oxidizing agents
HAZARDOUS DECOMPOSITION PRODUCTS:	CO_2, CO
CONDITIONS TO AVOID:	None known

SECTION IX-EMPLOYEE PROTECTION

CONTROL MEASURES:	Adequate ventilation
RESPIRATORY PROTECTION:	None required
PROTECTIVE CLOTHING:	No need anticipated
EYE PROTECTION:	None required

SECTION X-ENVIRONMENTAL PROTECTION

ENVIRONMENTAL PRECAUTIONS: Avoid uncontrolled releases of this material to environment.

SPILL OR LEAK PRECAUTIONS: Contain spilled material. Transfer to secure containers. Where necessary, collect using absorbent media.

WASTE DISPOSAL: Dispose of according to federal, state and/or local requirements.

SECTION XI-REGULATORY CONTROLS

DOT CLASSIFICATION:	Class 55
DOT PROPER SHIPPING NAME:	Cleaning Compound, N.O.S.
OTHER REGULATORY REQUIREMENTS:	Listed in TSCA inventory

SECTION XII-PRECAUTIONS: HANDLING, STORAGE AND USAGE

No special precautions necessary.

SECTION XIII-DATE AND SIGNATURE

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any other process. The stated MSDS is reliable to the best of the company's knowledge and believed accurate as of the date indicated. However, no representation, warranty or guarantee of any kind, expressed or implied, is made as to its accuracy, reliability or completeness and we assume no responsibility for any loss, damage or expense, direct or consequential, arising out of use. It is the user's responsibility to satisfy himself as to the suitableness and completeness of such information for his own particular use.

AG ENVIRONMENTAL PRODUCTS, L.L.C.
9804 PFLUMM
LENEXA, KS 66215

SIGNATURE: William A. Ayres

PREPARED BY: WILLIAM A. AYRES REVISION DATE: 7-1-98

Alternative Tested at Huhtamaki

HIGH PERFORMANCE MIRACHEM®

A division of PROACTIVE ENVIRONMENTAL PRODUCTS, INC.

Material Safety Data Sheet

MIRACHEM. Pressroom Cleaner (Formulation No. 2501)

Section I - General

Manufacturer Name:	The Mirachem Corporation P.O. Box 27608 Tempe, Arizona 85285-7608	Date Prepared: Revision Date:	7/3/96
Emergency Phone:	1-(800) 847-3527		

Section II - Hazardous Ingredients/Identity Information

Hazardous Component (CAS #)	OSHA PEL	ACGIH TLV	Other Limits	% (Optional)
None				

N.E. = None Established

Section III - Physical/Chemical Characteristics

Boiling Point:	>210°F	Specific Gravity (H_2O = 1):	0.9957
Vapor Pressure (mm Hg.): @ 20°C	Composite 0.006	pH:	8.7-9.5
Vapor Density (AIR =1):	> 1	Evaporation Rate (Butyl Acetate=1):	> 1
Solubility in Water:	Complete	Melting Point:	N/A

Appearance and Odor: Clear liquid with a mild citrus odor

N/A = Not Applicable N.E. = Not Established

Section IV - Fire and Explosion Hazard

Flash Point (Method Used):	>212°F .PMCC ASTM D93)	Explosive Limits:	N/A
Extinguishing Media:	N/A		
Special Fire Fighting Procedures:	N/A	Unusual Fire Fighting and Explosion Hazards:	N/A

Section V - Reactivity

Stability:	Unstable		Incompatibility (Materials to Avoid):	Strong Acids and Alkalies demulsify product.
	Stable	X		
Hazardous Decomposition or By-products:		Thermal decomposition may produce CO_2		
Hazardous Polymerization:		May Occur		Will Not Occur X

Section VI - Health Hazard Data

Eye Contact:	May cause mild temporary irritation.
Skin Contact:	Prolonged or repeated exposure may cause mild irritation.
Inhalation:	No adverse effects expected.
Ingestion:	No adverse health effects are anticipated to occur as a result of acute ingestion. Chronic effects are not known.
Carcinogenicity:	None of the components in this material are listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.
Signs/Symptoms of Overexposure:	Prolonged contact may cause mild irritation or dryness to sensitive skin.
Medical Conditions Generally Aggravated by Exposure:	None known.

Section VII - Emergency and First Aid Procedures

Eyes:	Immediately flush with clean water. Consult physician if necessary.
Skin:	Rinse with water.
Ingestion:	If swallowed, treat symptomatically and supportively. Do not induce vomiting. If victim conscious and alert, give two glasses of water or milk to drink. If vomiting occurs, keep head below hips to prevent aspiration. Contact Physician.
Inhalation:	No adverse effects anticipated.

Section VIII - Precautions for Safe Handling and Use

In Case of Spill:	Flush with water into containing area.
Waste Disposal:	Flush to sewer where applicable within Federal, State or Local disposal requirements.
Handling & Storage Precautions:	Wear protective goggles or face shield if splashing or spraying liquid. Protect from freezing.
Other Precautions:	Keep container tightly closed. Keep out of reach of children.

Section IX - Control Measures

Respiratory Protection:	No respiratory protection is necessary.
Ventilation:	Good general ventilation is sufficient.
Protective Clothing:	When prolongec skin contact is expected, wear protective gloves.
Eye Protection:	Wear safety glasses.
Work/Hygienic Practices:	Use good personal hygiene practices, wash hands before eating, drinking, smoking, or using toilet facilities.