WATER-BASED PARTS WASHER SYSTEMS: A GUIDANCE PROGRAM FOR USERS

Prepared for:
Cal/EPA's Department of Toxic Substances Control
and
Santa Barbara County Air Pollution Control District

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PREFACE

This document was produced under contract with the Santa Barbara County Air Pollution Control District with funding from the California Department of Toxic Substances Control (DTSC). It presents detailed information on many of the water-based cleaning systems that will be used widely in auto repair facilities as replacements for mineral spirits parts cleaning systems. The document focuses on whether and how the DTSC Technology Certification Program or a separate "guidance program" could be used to certify these water-based cleaning systems. The purpose of such certification is to assist small firms in making good decisions on which water-based parts cleaning systems are best for them. The document also analyzes the DTSC and U.S. Environmental Protection Agency hazardous waste regulations that affect the transition from solvent to water-based cleaning systems. The information presented here should be of use to users of parts washers, vendors of water-based cleaning systems and regulatory agencies.

ACKNOWLEDGMENTS

This analysis benefited considerably from the efforts of many persons within and outside the Institute for Research and Technical Assistance (IRTA). We would particularly like to acknowledge two individuals, Robert Ludwig at the California Department of Toxic Substances Control and Gary Hoffman at the Santa Barbara County Air Pollution Control District, who offered valuable comments throughout. Tara Forton and Irene Mah y Busch of IRTA worked as hard as the authors to produce a document that was readable and well presented. Kim Wilhelm, Pat Bennett, Eric Workman, Bruce La Belle and Mike Horner of DTSC offered helpful guidance on the DTSC regulations and policies. We are particularly grateful to all the members of the advisory committee that was assembled for this project; their advice and guidance was of great use during the project.

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I. INTRODUCTION

In 1996, the South Coast Air Quality Management District (SCAQMD) amended their cleaning rule, Rule 1171, to require a conversion to solvents with 50 grams per liter Volatile Organic Compound (VOC) content or less by January 1, 1999 in repair and maintenance cleaning. The traditional solvent used for this purpose is mineral spirits and the alternative that most firms will adopt to comply with the rule is a water-based cleaner. The conversion from mineral spirits to water-based cleaning systems in repair and maintenance cleaning is underway in the four county area covered by the SCAQMD--Los Angeles, Orange, San Bernardino and Riverside counties.

The Santa Barbara County Air Pollution Control District (APCD) is not planning to amend their rule to require the conversion. The APCD does have an interest in encouraging the voluntary conversion from mineral spirits to water-based cleaners in the Santa Barbara area. In that light, the APCD requested assistance from Cal EPA's Department of Toxic Substances Control (DTSC). Several years ago, the DTSC established a Technology Certification Program to certify the performance of hazardous waste technologies. The APCD asked DTSC to collaborate on a program to analyze whether the new parts cleaning systems could be certified under DTSC's Technology Certification Program or through some other mechanism. The APCD funded the Institute for Research and Technical Assistance's (IRTA's) Pollution Prevention Center (PPC) to examine the issue.

IRTA is a nonprofit organization established to help users adopt pollution prevention methods in cleaning, dry cleaning, paint stripping, coating and adhesive applications. IRTA runs and operates the PPC. The mission of the PPC is to assist firms in implementing low and non-solvent technologies. IRTA and the PPC provide pollution prevention technical assistance to individual firms and also work with whole industries on test and demonstrations of new and emerging technologies.

Mineral spirits are used in some 600,000 parts cleaners in the U.S. for cleaning oil and grease from parts in auto repair facilities, other vehicle repair operations, machine shops and other industrial operations. More than 70,000 of these parts cleaners are located in California. In the jurisdiction of the SCAQMD, there may be more than 40,000 parts cleaning units; about 25,000 of these are in auto repair facilities and 15,000 are in industrial facilities.

The mineral spirits used today for parts cleaning contains traces of toxics like benzene, an established carcinogen, toluene which causes central nervous system problems and xylene which can cause birth defects. The low vapor pressure blend contains n-methyl pyrrolidone which is a reproductive and developmental toxin. Workers generally use the parts cleaners without gloves so they are exposed directly to the chemicals. Mineral spirits are classified by EPA as Volatile Organic Compounds (VOCs) which contribute to photochemical smog. The emissions from facilities that conduct parts cleaning also expose the surrounding community to toxics. The spent mineral spirits are hazardous waste and, if they are disposed of improperly, they can cause site contamination.

IRTA, with funding under the EPA's Environmental Justice Pollution Prevention (EJP2) Program, conducted a developmental study of water-based cleaners as alternatives to mineral spirits in auto repair facilities in 1995 and 1996. The demonstration project involved testing water-based cleaners in 18 auto repair facilities to determine their feasibility and optimizing the conditions of use for the water-based cleaners and equipment that was available at the time. Four generic types of equipment

and four water-based cleaning formulations were tested at various concentrations. The spent water-based cleaners were analyzed to determine if they were hazardous waste or if they met wastewater discharge standards. Filters were also analyzed to determine if they were hazardous waste.

The results of the study indicated that water-based cleaners were a viable alternative to the mineral spirits used today. The SCAQMD decided to require a conversion to water-based cleaners in 1996 and other air districts in California began examining their rules to determine if a conversion should be required. Because the water-based cleaning systems offer an overall advantage from the human health and environmental standpoint and because, in most cases, the water-based cleaning systems are less costly than the mineral spirits systems, it is likely that many shops will make voluntary conversions over the next several years.

In 1995 when IRTA performed the developmental study, there were very few vendors that offered formulations, equipment or systems for this sector. Over the last three years, largely because of the SCAQMD conversion requirement, numerous new vendors have begun offering new products based on water-based cleaning. Some of these products are dangerous or have dangerous features; some do not perform well; and, in some cases, the vendor literature encourages improper disposal of the spent cleaners and filters. For this reason and because many of the facilities that are making a decision to convert to the new systems are very small businesses, a program to provide them with guidance on how to select an appropriate system is useful. The small facilities do not have the resources or expertise to evaluate the range of alternative systems, to verify their performance and to determine that they do not have dangerous features. The DTSC Technology Certification Program appeared to offer a vehicle for providing the users with this kind of information.

In that light, IRTA assembled and convened a project advisory committee. Their aim was to evaluate the feasibility of using the DTSC Technology Certification Program to help small businesses to select appropriate water-based parts cleaning systems. The PPC has an advisory committee and this committee formed the core of the advisory committee that was assembled for this project. Additional individuals that are not members of the PPC advisory committee were asked to participate because they have interest and/or expertise in the arena. The committee, deemed the Water-Based Parts Cleaning Guidance Standards Advisory Committee, met three times in the course of the project and from these meetings, a set of standards for various types of parts cleaners and formulations was developed.

The hazardous waste disposal issues surrounding the use of the new water-based parts cleaning systems were determined to have great significance. Accordingly, the Committee evaluated these issues and decided it was important for DTSC to provide clarification on several of the points or seek changes in U.S. EPA and DTSC regulations to encourage the conversion. The issues in question concern handling of the spent water-based cleaning baths, the skimmed oil, the spent filters and sludges of various types.

Section II of this document provides background on the makeup of the advisory committee and DTSC's Technology Certification Program. It also presents information on the water-based cleaning formulations and the different types of parts cleaning systems that are available for repair and maintenance cleaning. In Section III, the proposed standards for formulations and equipment are presented and discussed. The disposal issues are described in Section IV. Finally, conclusions and recommendations are provided in Section V.

II. BACKGROUND

This section provides background on the advisory committee selected to work on the project, the DTSC Technology Certification Program and the water-based formulations and equipment available for repair and maintenance cleaning.

PROJECT ADVISORY COMMITTEE

IRTA runs and operates the PPC which has a large advisory committee. This committee was the core group assembled to decide on the path and guidance standards for the project. Additional committee members were added to include the viewpoint of other individuals and organizations with specific expertise and/or interest in the project. Table 1 provides a list of the committee members and their organizations and indicates whether they also serve on the PPC advisory committee.

Table 1
Water-Based Parts Cleaning Guidance Standards
Advisory Committee Members

Committee Member	Organization	PPC Advisory Committee
Pat Bennett	Cal/EPA's DTSC	No
Sheila Brice	L.A. City Bureau of Sanitation	Yes
Victor Douglas	California Air Resources Board	No
Ann Heil	L.A. County Sanitation Districts	Yes
Gary Hoffman	Santa Barbara County APCD	Yes
Russ Krinker	Southern California Edison	Yes
Tom Liebel	South Coast Air Quality Mgt. Dist.	No
Robert Ludwig	Cal/EPA's DTSC	Yes
Traci Minamide	L.A. City Bureau of Sanitation	Yes
Roberta Rigg	South Coast Air Quality Mgt. Dist.	Yes
Pradeep Sharma	Southern California Edison	Yes
Michael Stenburg	U.S. EPA Region IX	Yes
Larry Watkins	South Coast Air Quality Mgt. Dist.	Yes
Kim Wilhelm	Cal/EPA's DTSC	No
Lou Yuhas	South Coast Air Quality Mgt. Dist.	No

Committee members were selected to provide pollution prevention and cross-media interest and expertise. As discussed later, many of the issues involved in the parts cleaning conversion are cross-media in nature. In that light, representatives from air, wastewater and hazardous waste regulatory agencies were included. In addition, representatives from Southern California Edison were included because Edison is sponsoring a comprehensive conversion program and offering financial incentives to auto repair facilities that adopt the water-based cleaners.

DTSC TECHNOLOGY CERTIFICATION PROGRAM

California State Assembly Bill (AB) 2060 authorized Cal/EPA's DTSC to certify the performance of hazardous waste environmental technologies on January 1, 1994. This authorization is codified in Section 25200.15 of the Health and Safety Code.

The purpose of the program is to provide a comprehensive and independent review of hazardous waste technologies to promote and foster the growth of California's environmental technology industry and also to facilitate regulatory and technology user acceptance. Environmental technologies that are submitted for certification must meet certain criteria. These are:

ï The technology must not pose a significant hazard to public health and safety or to the environment when used under specific operating conditions

ï The technology can be used without specialized training and minimal maintenance

DTSC certification is generally expensive, ranging in cost from about $10,000 to $100,000. The high cost is related to the DTSC staff time that must be spent in verifying the validity of the claims of the technology vendor. The performance certification validates specific performance claims for specific uses of a technology under a defined range of conditions. The regulatory certification lowers the regulatory burden associated with the use of a technology and emphasizes its performance with regard to the safety and effectiveness of a particular technology.

U.S. EPA has a program that is similar to Cal/EPA's program. This U.S. EPA program is called the Environmental Technology Verification Program. U.S. EPA and Cal/EPA are conducting a pilot project for pollution prevention and waste treatment technologies. In this program, verification is the confirmation, by collection and examination of objective data and information, that specified requirements have been fulfilled. In many cases, this includes confirming specific performance claims. The pilot project focuses on certain industries. These include: electronics, metal plating and finishing, printing, petroleum refining, automobile manufacturing and iron and steel. Cleaning operations that use solvents are common to many of these areas.

DTSC plans to solicit applications from water-based cleaning formulation and equipment vendors for verification/certification of their products' performance in the electronics, metal finishing and automotive manufacture and repair industries. DTSC has developed a framework for evaluating these cleaning formulations that is based on a study by Lawrence Livermore National Laboratory (LLNL). The LLNL report and recommendations focused on developing a protocol for alternative cleaning chemistry certification. It focused on all types of cleaners, both solvent based and water-based, and was designed to target cleaners in all areas of application.

DTSC asked IRTA to assemble an advisory committee and develop criteria specifically for water-based cleaners in repair and maintenance cleaning in the automotive repair sector. This specific application area is fairly uniform and the focus is on water-based cleaners rather than solvent cleaners. One of the issues the advisory committee dealt with was the high cost of obtaining DTSC certification/verification under the Technology Certification Program. As discussed in more detail later, the vendors offering cleaners, equipment and systems in the repair and maintenance arena are often themselves small businesses without extensive resources. A certification cost of more than a few thousand dollars would be prohibitive.

WATER-BASED CLEANING SYSTEMS FOR AUTO REPAIR

When IRTA initiated the developmental water-based cleaning demonstration in auto repair facilities in 1995, there were very few vendors offering water-based cleaners, equipment or systems as alternatives to mineral spirits. In 1996, the SCAQMD modified their cleaning rule to require the conversion to water-based cleaners by January 1, 1999. This spurred the development of numerous additional cleaners, equipment and systems for the automotive repair and maintenance cleaning sector. At this stage, some vendors offer one or several water-based cleaning formulations. Some offer both a formulation and one or more types of equipment. Still others offer a complete cleaning system. The formulations and the equipment are discussed and described below.

Water-Based Cleaning Formulations

Numerous water-based cleaning formulations are being offered for use in the repair and maintenance cleaning sector. These cleaners generally contain surfactants or builders with additives like rust inhibitors as appropriate. Some of the cleaners contain solvent additives; common solvents added to water-based cleaners are terpenes, glycol ethers and alcohols. To be effective, however, water-based cleaners do not require solvent additives. In fact, some of the most effective cleaners in this sector have no solvent additives.

In some of the equipment being sold in this sector, workers' hands contact the cleaner (see below). When this is the case, the cleaner will damage the skin if it has a high pH. Thus, in many systems, cleaners that are neutral or only slightly alkaline are more suitable.

Some water-based cleaners emulsify the oil and grease and some are designed to reject it. With certain types of enzyme systems (see below), emulsifying cleaners are appropriate. In non-enzyme systems, however, cleaners that reject oil are more practical. The oil and grease float on the surface of the bath and they can be removed with physical methods like skimming or use of an absorbent. The cleaning formulation will have a much longer bath life and will be less costly if it is designed to reject oil and grease.

Parts Cleaning Equipment

Traditional parts cleaners for use with mineral spirits are generally constructed of steel or stainless steel. Two types of equipment are used in the field today with solvents. The most widely used cleaning unit is the sink-on-a-drum. The sink generally has a faucet and brush applicator. The part is cleaned in a sink work area and the solvent drains into a drum below. The drum is changed out on a regular schedule and replaced with fresh solvent. The second type of solvent equipment is an immersion system. A false sink is the work area. It can be removed to reveal the reservoir below which can be used for soaking parts that are more difficult to clean.

There are three differences between solvent and water cleaning equipment. First, water cleaning equipment does not have to be constructed of metal. Steel, stainless steel and plastic units are available. Second, water cleaning equipment must contain a heater since water-based cleaning formulations perform better if they are heated. Third, a greater range of cleaning equipment options is available for use with water cleaners. For instance, water-based cleaners can be sprayed whereas the flammable mineral spirits would pose a fire or explosion hazard if sprayed.

There are five generic types of cleaning equipment available for use with water-based cleaners. Each of these is described briefly below.

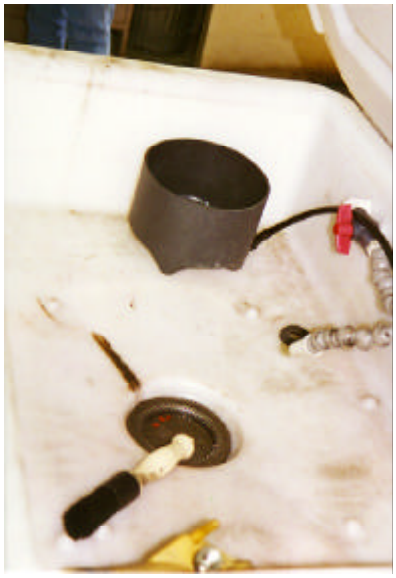
Sink-on-a-Drum Parts Washer. This unit consists of a sink mounted on a drum that has a fluid capacity ranging from about 15 to 40 gallons. It contains a heater, a pump, a faucet and brush applicator. Figures 1-1 and 1-2 show a plastic sink-on-a-drum and a view of the inside of the sink respectively. The cost of these units ranges from about $400 to $1,700 depending on the material of construction and the features. They can contain filters and/or oil skimmers which extend the bath life of the water-based cleaner.

Enzyme System. Enzyme systems are generally modified sink-on-a-drum units and are commonly made of plastic. They contain a specially formulated surfactant based emulsifying neutral enzyme cleaner. Microbes are added to the system either in an impregnated filter or directly into the cleaning formulation. The cleaner emulsifies the oil and grease and the microbes break down the contaminants into carbon dioxide and water. Like the sink-on-a-drum unit, the enzyme system has

Sink-on-a-Drum Parts Washer

Figure 1-1

Figure 1-2



a heater and a pump. Units generally have a 15 to 30 gallon liquid capacity. One type of system is shown in Figure 2-1. The cost of this type of unit ranges from about $900 to $1,500.

Immersion Parts Washer. The difference between this unit and a sink-on-a-drum is that the immersion system has a false sink that can be removed and a reservoir that is accessible for cleaning or soaking. This unit also contains a heater and a pump and has a liquid capacity of 30 to 60 gallons. Again, it can be constructed of metal or plastic. The cost of these units is somewhat higher than for

the sink-on-a-drum, ranging from about $900 to $1,700. Filters and oil skimmers can be added to these systems. Two views of a plastic unit are shown in Figure 3-1 and 3-2.

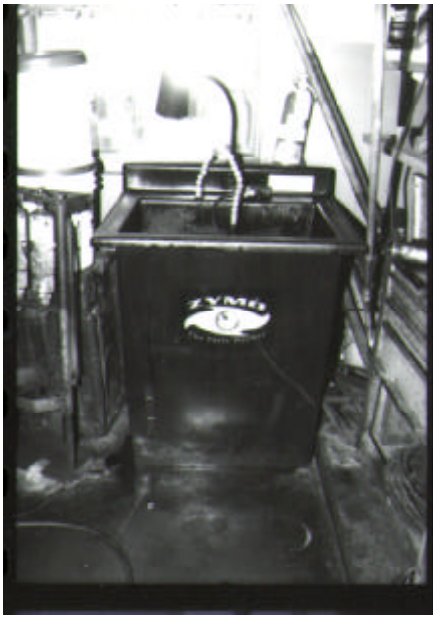
Spray Cabinet. This type of unit operates by spraying and/or flushing high pressure cleaning formulation in an enclosed cabinet. The parts are placed inside the cabinet, generally on a platform, and the door is closed. The spray nozzles are positioned to target specific areas of the parts. The mechanical action provided by the worker for the other units is automated in the case of the spray cabinet.

Spray cabinets are made of metal and some have plastic tops. They can be classified as top of front loaders. The liquid capacity of the smaller units for use in this sector ranges from 20 to 60 gallons. These units are generally heated to a higher temperature than the other types of units because workers' hands do not come in contact with the fluid. The units can include filters and oil skimmers. The cost of a spray cabinet ranges from $2,000 to $6,000. A front loader spray cabinet is shown in Figure 4-1.

Ultrasonic Systems. These systems must be made of metal. They rely on cavitation energy generated by ultrasound to clean the parts. Basically, tiny bubbles are formed which provide the mechanical action to "scrub" the parts. This type of system is most effective for cleaning parts with complex geometries and passages like carburetors, valve bodies and fuel injectors. The systems consist of a generator and a set of transducers. Several types of systems are being offered in this sector and they are expensive, ranging in cost from about $3,000 for a small unit to more than $12,000 for a larger system. An ultrasonic system is shown in Figure 5-1.

Enzyme System

Figure 2-1



Immersion Parts Washer

Figure 3-1

Figure 3-2

Spray Cabinet

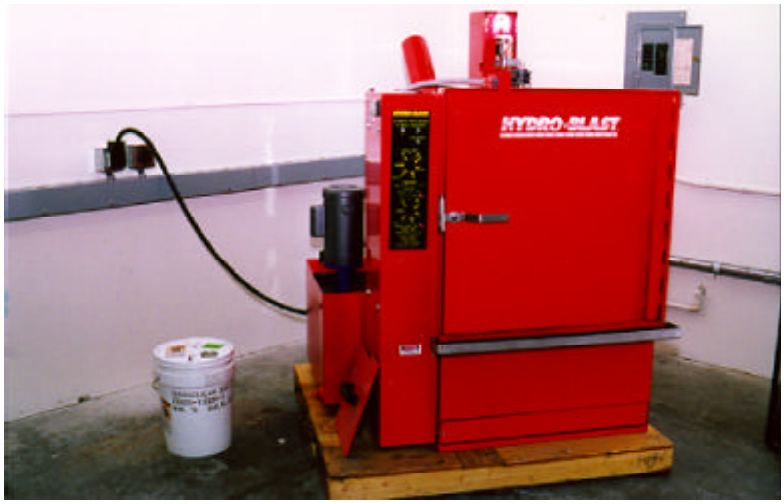


Figure 4-1

Ultrasonic Systems

Figure 5-1

III. PROPOSED STANDARDS

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This project involved developing guidance standards for water-based cleaning formulations and four different types of equipment that are available in the auto repair parts cleaning sector. The standards for the cleaning formulations and equipment translate into information on formulations and equipment that must be provided by vendors. One of the aims of the project was to provide a framework that would minimize the cost of certification and make the program accessible to smaller vendors. The standards that were developed in the course of the project are presented and discussed below. A shorter set of requirements to be given to users was also developed. The intent was to provide users with a list of criteria for formulations and cleaning systems so they could ask vendors whether their products met these criteria. The DTSC role in implementing a program for providing guidance to users is discussed later.

DTSC GUIDANCE STANDARDS FOR WATER-BASED CLEANING SYSTEMS

Table 2 presents the data that vendors would have to provide to DTSC for evaluation and potential certification. The table lists the general information that all vendors would have to submit. It also lists the specific standards and information that would be required for water-based cleaning formulations and for four types of equipment. No standards for ultrasonic equipment are included because that type of equipment is very new to the arena. Standards for this equipment could be added at a later date.

General Information Requirements

For this category, vendors must submit the obvious information like name, address and other identification. They are also required to submit all of the vendor literature for the product. In addition, the literature must contain various types of information including cautions regarding use of the formulations or equipment and disposal recommendations.

In IRTA's earlier EJP2 developmental study, the spent water-based cleaners were analyzed. About three-fourths of the spent cleaning agents were hazardous waste and none of the spent cleaners met the discharge standards of Publicly Owned Treatment Works (POTW) or sanitary districts. Accordingly, users must not discharge the spent cleaner directly into the sewer or the storm drain. In some instances where users have appropriate wastewater treatment systems, they might solicit and obtain written permission from the discharge agency to discharge the spent cleaner to the treatment system. If the spent cleaner is a hazardous waste, a DTSC tiered permit is required to treat it. Spent cleaner can also be shipped off-site for disposal. If it is a hazardous waste, it must be stored properly and picked up by a licensed hazardous waste hauler. Vendor literature should contain this type of information.

Many vendors claim that their cleaners are non-toxic and biodegradable and this may be the case for cleaners that are unused. After the cleaners are used, however, they are contaminated with metals and, in some cases, organic brake cleaner components. The implication in the vendors' claims is that the spent cleaner can be poured in the sewer. To prevent this from happening, in order to obtain certification, the vendor literature must contain the cautions listed in Table 2.

One of the other cautions that is included in the general information category involves use conditions. Vendors must specify all use conditions. If the pH of the formulation is high, for example, the vendor must specify that the formulation cannot be used in equipment where workers' hands come in contact with the formulation. Since very few if any workers wear gloves during cleaning, this can prevent damage to their hands. Other types of restrictions may be that the cleaners can cause damage to certain metals or that the temperature in a particular cleaning unit should not exceed a certain level.

Table 2
VENDOR DATA REQUIREMENTS

General

This information is required at the time of application. Processing of the application will not begin until the information is provided.

Name, address, phone and fax number of vendor, e-mail address if available. Specify contact person

Name of product.

Complete vendor literature for the product. Should include all information available to users.

Literature must contain:

- the statement that the spent cleaners must not be poured directly in the sewer.
- the statement that, although the virgin cleaning formulation may not be hazardous, the spent cleaner may be hazardous waste due to metals and contaminants cleaned from the parts and should be handled properly.
- the statement that if the user plans to discharge the spent cleaner through a wastewater treatment system, they should contact their POTW first and obtain written permission.
- the statement that a tiered permit from DTSC or the local CUPA may be necessary if the spent cleaner is hazardous waste and is treated in a clarifier or evaporator.
- the DTSC program telephone number and the statement that users can contact DTSC if the statements made by the vendor have been misrepresented. DTSC could withdraw certification.
- all conditions and restrictions (i.e. pH, equipment restrictions). As an example, the literature must include a statement that a cleaner with pH of 11.5 in the working concentration cannot be used in a sink-on-a-drum or an immersion system.

Cleaning Formulation Information

Certification is limited to water-based cleaners.

Formulation data sheet specifying ingredients at 1.0 percent concentration or greater by weight.

Recommended working concentration or concentration range for parts cleaning applications.

Material Safety Data Sheet (MSDS) for product.

Cleaners must be certified as a Clean Air Solvent by the SCAQMD. Include certification. This certification has certain requirements:

- the cleaner cannot contain stratospheric ozone depleting compounds.
- the cleaner cannot contain chemicals that are on the SCAQMD global warming chemical list or otherwise designated by EPA as global warming compounds.
- the cleaner cannot contain Hazardous Air Pollutants (HAPs) as listed in Section 112(b)(1) of the Clean Air Act Amendments of 1990.
- the cleaner cannot contain a chemical with a Maximum Incremental Reactivity (MIR) higher than that of toluene.
- the cleaner must have a VOC composite partial pressure not exceeding 5 mm Hg at 20 degrees C.
- the cleaner must have a VOC content not exceeding 50 grams per liter.

Cleaning formulations may not contain any solvent additives. Solvent additives are chemicals listed as exempt in SCAQMD Rule 102 and any chemical which would be detected using SCAQMD Test Method 304. Vendor should supply laboratory data demonstrating that Test Method 304 has been conducted on the concentrate.

Cleaning formulation must reject or consume oils cleaned from the parts. This is to facilitate oil removal by skimming or other separation techniques. Enzyme units have the capability to consume the oil. Cleaning formulations which emulsify oil will not be approved because of the difficulty of extending the bath life. Use MIL-C-87937B as test for Type II cleaners.

Vendors must provide the names, addresses, phone numbers and points of contact for at least three shops using the cleaning chemistry in a parts washing application. The shops must be willing to confirm they are using the cleaner at the recommended working concentration, that they have been using the cleaner for more than six months and are satisfied with it. The reference shops must also be willing to describe how the cleaner is used and the method of disposal. They must be willing to allow DTSC to conduct on-site observation/verification of the cleaning performance.

Sink-on-a-Drum/Enzyme System Requirements

- Cleaning formulations must have a pH $\geq$ 6.5 and $\leq$ 10
- High temperature emergency cutoff switch
- Temperature preset between 100 and 120 degrees F
- Drum diameter 50 percent or greater than largest sink dimension
- Sink depth between 4 and 16 inches
- Recirculating fluid
- Equipped with cleaning brush
- Pump size greater than 1/10 horse power
- Oil removal or consumption capability (filter, enzyme unit)
- Fluid capacity between 10 and 30 gallons
- Drain and pre-pump strainer
- Corrosion protected (plastic, stainless steel, mild steel with a protective coating)
- Weight capacity for parts greater than 100 pounds
- Vendors must provide the names, addresses, phone numbers and points of contact for at least three shops using the cleaning unit in a parts washing application. The shops must be willing to confirm they have been using the unit for six months and are satisfied with it. The reference shops must also be willing to describe their method of disposal. They must be willing to allow DTSC to conduct on-site observation/verification of cleaning performance.

Immersion System Requirements

- Cleaning formulations must have a pH $\geq$ 6.5 and $\leq$ 10
- High temperature emergency cutoff switch
- Temperature preset between 100 and 120 degrees F
- Base area 50 percent or greater than sink area
- Heating element barrier to prevent direct contact
- Recirculating fluid
- Equipped with cleaning brush
- Pump size greater than 1/10 horse power
- Oil removal or consumption capability (filter, skimmer, enzyme, weir)
- Fluid capacity between 10 and 50 gallons
- Drain and pre-pump strainer
- Corrosion protected (plastic, stainless steel, mild steel with a protective coating)
- Weight capacity for parts greater than 100 pounds
- Equipped with platform to hold parts while hand cleaning
- Vendors must provide the names, addresses, phone numbers and points of contact for at least three shops using the cleaning unit in a parts washing application. The shops must be willing to confirm they have been using the unit for six months and are satisfied with it. The reference shops must also be willing to describe their method of disposal. They must be willing to allow DTSC to conduct on-site observation/verification of cleaning performance.

Spray Cabinet Requirements

- Cleaning formulations must have a pH > 6.5 and < 12.4 and be non-foaming
- Not equipped with hand cleaning mechanism
- High temperature emergency cutoff switch
- Low water safety cut-off
- Lid interlock switch
- Recirculating fluid
- Spray pressure greater than 30 psi
- Oil removal or consumption capability (filter, skimmer, enzyme, weir)
- Pre-pump strainer and parts screen
- Corrosion protected (plastic, stainless steel, mild steel with protective coating)
- Weight capacity for parts greater than 500 pounds
- Vendors must provide the names, addresses, phone numbers and points of contact for at least three shops using the cleaning unit in a parts washing application. The shops must be willing to confirm they have been using the unit for six months and are satisfied with it. The reference shops must also be willing to describe their method of disposal. They must be willing to allow DTSC to conduct on-site observation/verification of cleaning performance.

Cleaning Formulation Information

To qualify for potential certification, a cleaner must be a water-based cleaner that has passed SCAQMD Clean Air Solvent Certification, contains no solvent additives and rejects or destroys oil. Other requirements depend on the type of equipment in which the cleaner is used.

The vendors must supply a Material Safety Data Sheet (MSDS) on the cleaner and must specify all ingredients at one percent concentration or greater. This is adequate information since the cleaner will be diluted even further upon use. They must also provide the recommended working concentration. Typical working concentrations in sink-on-a-drum and immersion units are 25 to 30 percent. Concentrations in a spray cabinet are normally in the three to 15 percent range.

Cleaning agents must be certified by the SCAQMD as Clean Air Solvents (CASs) Certification under this program requires that the cleaner contain no ozone depleting substances, global warming compounds or hazardous air pollutants (HAPs). Vendors can examine the lists provided by SCAQMD to determine whether or not they would potentially qualify. The cleaner also cannot have a reactivity greater than a certain level, it cannot have a VOC composite vapor pressure greater than 5 mm Hg and it cannot have a VOC content that exceeds 50 grams per liter at the working concentration.

The SCAQMD performs gas chromatography/mass spectrometry (GS/MS) on the cleaner concentrate submitted by the vendor to determine whether it meets the criteria. The concentrate may not meet the 50 grams per liter VOC content requirement and the SCAQMD will specify that the cleaner is certified only if used at 50 percent concentration or less for instance. As an example, if the cleaner concentrate showed a VOC content of 100 grams per liter, the SCAQMD would specify that the cleaner must be used at 50 percent concentration or less.

The SCAQMD Clean Air Solvent certification guarantees that the formulation contains no more than 50 grams per liter VOC. This still allows the certification of unlimited amounts of chemicals that are exempt from VOC regulations or cleaners containing 50 grams per liter VOC solvent. The DTSC certification would go further and not allow the use of cleaners that contain any solvent additives whatsoever; solvent cleaners cannot qualify for certification in this sector. Water-based cleaners with no solvent additives are widely available and they perform as well as or better than cleaners with VOC or exempt solvent additives.

The criteria in Table 2 also specify that the formulations may not contain chemicals listed in SCAQMD Rule 102 (chemicals exempt from VOC regulations) or any chemicals that would be detected using SCAQMD Test Method 304 except for amines. The intent of this provision is that the cleaner contain no solvent additives. Amines are commonly present in water-based cleaning formulations as part of the surfactant, as alkaline builders and as rust inhibitors. They are volatile enough to vaporize off during Test Method 304. Since the amines are technically not solvent additives, their presence is acceptable. It may be that other substances that are not considered solvents would be encountered when Test Method 304 was performed. These would have to be dealt with on a case-by-case basis. One of the tasks of DTSC in implementing this program would be to develop a list of "solvents."

Some cleaning formulations reject oil and some emulsify oil. Rejecting chemistries are preferred in all units except enzyme systems. The oil floats on rejecting cleaners and can be physically removed with oil skimmers or absorbents and, to some extent, with filters. Oil removal capability will allow a much longer bath life and a longer period before disposal and changeout of the bath is required. Under the equipment provisions (see below), the criteria require a filter or an oil skimmer or both in non-enzyme systems. Enzyme units, because they contain microbes which consume the oil, have inherent oil removal capability. Enzyme units rely on emulsifying cleaners but that is acceptable in this case because of the presence of the microbes.

Cleaners in non-enzyme units must meet MIL-C-87937B for Type II cleaners. This military specification is included in Appendix A. It involves testing with a particular oil to determine a minimum level of rejection capability.

The last requirement for formulations is that vendors must provide information on three facilities that have used the cleaner in a parts washing application for at least six months. The reference shops must be satisfied with the cleaner, must describe what it is used for and how they are handling disposal. DTSC staff could call or visit the shops to confirm the performance of the cleaner. As discussed later, IRTA recommends this type of performance verification rather than laboratory testing because performance is case specific.

Sink-on-a-Drum/Enzyme System Information

The cleaning formulation used in the sink-on-a-drum must have a pH in the range of 6.5 to 10 at the working concentration. Neutral chemistries are the best cleaners for these applications because the workers' hands contact the cleaner and workers rarely wear gloves.

The units must have a high temperature cutoff switch in case the temperature begins to climb. Again because workers do not wear gloves, high temperatures will damage their hands. In this light, the temperature in these units should be set between 100 and 120 degrees F. Generally the temperatures in these units range between 105 and 110 degrees F. Some workers can tolerate slightly higher temperatures. At temperatures lower than about 105 degrees F, the cleaners are less effective.

The drum diameter on these units must be 50 percent or greater than the largest sink dimension. This is because the unit could be very unstable if the drum diameter were much smaller than the surface area of the sink. The sink should be four to 16 inches deep to provide sufficient area to clean parts.

The fluid must be circulated through the brush and applicator. Some units do not have brushes as standard features. The criteria require the cleaning unit to be equipped with a brush. The pump size must be at least 1/10 horse power so the fluid movement will be adequate for cleaning the parts.

The units must contain a filter, an oil skimmer or both or must be an enzyme system containing microbes. As discussed earlier, this provision will ensure a long bath life before changeout is required. This will, in turn, minimize the disposal problem. The fluid capacity of the equipment should be between 10 and 30 gallons. The upper limit of 30 gallons will allow the accumulation of roughly two spent baths in a drum for shipment off-site as hazardous or non-hazardous waste.

The units must contain a drain so the fluid drains from the sink area to the drum. A pre-pump strainer is necessary so the pump will not become clogged.

The equipment must have some corrosion protection. It can be made of stainless steel or plastic which will not corrode. If it is made of mild steel, it must have a protective coating.

The equipment must be capable of holding at least 100 pounds of parts. Some assemblies that require cleaning could weigh this much.
Again, as was the case with cleaning formulations, the equipment vendors must provide information on three facilities that have used the equipment for six months or more. The users must be satisfied with the performance of the units and must be willing to discuss their disposal method.

Immersion System Information

Many of the criteria for the immersion system are the same as those for the sink-on-a-drum and enzyme system. The reasons for these criteria are also the same.

The fluid capacity, in the case of the immersion system, is allowed to be higher. The upper end of the capacity, however, is 50 gallons. This volume would fit in a 55 gallon drum that might be used for disposal of the spent cleaner.

The immersion system should have a false sink or a platform for detailing the parts. The immersion bath is suitable for soaking parts but there should be provision for hand cleaning as well.

Spray Cabinet Information

In this case, because the cleaning is automated and the workers' hands do not come in contact with the cleaning formulation, the pH of the cleaner can be higher. The upper bound of the pH is set just below the limit of 12.5 which would make the spent cleaner hazardous waste by reason of the pH alone. The cleaner should be non-foaming or it could pour out of the machine.

Some spray cabinets are equipped with a hand cleaning mechanism, a brush for detailing parts. The criteria do not allow this feature because it could be dangerous. The pH of the cleaners used in spray cabinets is most often too high and workers' hands will be damaged if they use this feature.

A high temperature emergency cutoff switch, low water safety cutoff and lid interlock switch are required. The lid interlock switch prevents the worker from opening the door of the cabinet while it is running.

Spray cabinets must have a recirculation mechanism and a spray pressure greater than 30 psi. In general, spray cabinets with lower spray pressure do not clean well.

These units must have oil removal or consumption capability. Although there are currently no spray cabinets that employ enzyme formulations, such a unit could be offered in the future. The oil removal mechanisms include filters and oil skimmers.

These machines, like the other units, must include a pre-pump strainer and parts screen and they must be protected in some way from corrosion.

Spray cabinets must be designed with a weight capacity of 500 pounds for cleaning larger or more parts.

As before, the vendors must provide information on three facilities that have used the unit for six months or longer and are satisfied with the performance.

GUIDANCE STANDARDS FOR USERS OF PARTS CLEANING SYSTEMS

Table 3 shows a one-page handout that was designed for users. It is a summary of the information in the more detailed guidance standards of Table 2. It is not necessary that users read and fully understand this handout. Rather, its purpose is to allow the user, when approached by a vendor, to ask if the system being offered complies with the requirements on the handout. The users might ask system manufacturers to include the information in the handout as part of the purchase contract. It should protect users to some extent from vendors offering systems without essential features.

One item that appears on the user guidance standard sheet that does not appear on the vendor sheet concerns test systems. Users should request test systems from the vendors before they decide to purchase a system. Most vendors are willing to provide a test system to users for a period of a week to a month. Users can familiarize themselves with the system during this time period and decide if it is suitable for their needs. No user should purchase a system before they have tested it.

ISSUES IN IMPLEMENTATION

Several issues arose during the development of the formulation and parts cleaning equipment standards. The most important of these issues are addressed and discussed below.

Separate Certification

The first issue is whether equipment and formulations could be certified separately or whether the vendors would have to collaborate with one another and submit a full system for certification. As an example of the full system concept, a water-based cleaning formulation vendor would have to submit an application in collaboration with a specific equipment manufacturer.

There are advantages and disadvantages to both approaches. Formulation vendors may want their formulation certified for use in all equipment and they may not want to incur the cost of certification over and over with numerous equipment manufacturers. Equipment manufacturers, similarly, may want their equipment certified for use with any cleaner. The danger in this approach is that all formulations could not be safely used in all equipment. For instance, a foaming cleaner could not be used in a spray cabinet effectively. A high pH cleaner could not be used safely in a sink-on-a-drum or immersion system. DTSC would have no control over the use of improper cleaners in equipment.

IRTA's recommendation, in this case, is to require certification of systems. In other words, formulation and equipment vendors should collaborate in submitting certification applications. In some cases, like enzyme systems, for example, the cleaner and equipment are already paired. In many

other cases, equipment and formulation vendors are already working together to supply the market with systems.

Collaboration of the cleaning system vendors with a waste transporter was not made a part of the system requirements. Some users may actually have wastewater treatment systems and authorization to discharge the spent cleaner through the treatment system. Others, as discussed later, may use evaporators or evaporator/condensers for the spent material. Cleaning system vendors are required to include information about the waste disposition in their literature but there is no explicit requirement for collaboration with a waste transporter.

Changes in Design

The second issue is whether changes in the formulation or equipment would trigger the need for re-certification. Vendors commonly modify the equipment and formulations they offer. In some cases, the modifications may be substantial enough to require re-certification. In other cases, when they are minor and do not affect any of the parameters of Table 2, re-certification may not be necessary. In IRTA's view, this issue would have to be handled on a case-by-case basis, depending on what the modification involved. DTSC could develop a list of critical parameters. If one of these changed, then re-certification would be required.

Certification Cost

The third issue involves the high cost of certification. Discussion of this issue dominated the advisory committee meetings from the outset. Costs for DTSC staff to certify technologies under the Technology Certification Program are very high, often in the range of $30,000 to $100,000. DTSC staff must certify every piece of information provided by the vendor firsthand. Often extensive testing is involved.

One of the aims of this project was to examine if the DTSC Technology Certification Program could be used to assist users, in this case small auto repair facilities, in selecting water-based cleaning systems that would prove suitable and of low cost. Most formulation and cleaning equipment manufacturers in the repair and maintenance sector are themselves very small businesses. Many likely have no more than 10 employees. These firms do not have the resources to pay the high cost of certification.

IRTA conducted informal discussions with some of the vendors in this arena. The consensus was that a one-time certification fee of more than about $2,000 would be prohibitive. Vendors are required to obtain SCAQMD Clean Air Solvent Certification at a cost of $400. They would also be required to conduct SCAQMD Test Method 304 which would have a similar cost. In addition, they would have to determine the cleaner's oil rejecting capability which would also involve laboratory work.

As discussed in more detail later, IRTA recommends that DTSC require the vendors to certify to all the requirements on the list shown in Table 2. DTSC staff would only be required to investigate the claims that three firms had used the formulation/equipment for six months and could attest to its satisfactory performance. This would reduce the costs of certification greatly.

Table 3
DTSC GUIDANCE TO USERS OF PARTS WASHERS

General

- Spent cleaners must not be poured directly in the sewer.
- Although the virgin cleaning formulation or "as sold" product may not be hazardous, the spent cleaner may be hazardous waste and should be handled properly.
- If you plan to discharge the spent cleaner through a wastewater treatment system, you should contact your local POTW first. You cannot dispose of a hazardous waste directly to the sewer.
- If you treat your spent cleaner in a clarifier or evaporator, you are required to obtain a tiered permit from DTSC or the local CUPA if the spent cleaner is hazardous waste.
- Vendor literature should specifically include all conditions and restrictions (i.e. pH, equipment restrictions). As an example, the literature must include a statement that a cleaner with pH of 11.5 in the working concentration cannot be used in a sink-on-a-drum or an immersion system.
- Vendors must provide the names, addresses, phone numbers and points of contact for at least three shops using the cleaning chemistry and/or equipment. The shops must be using the cleaner in a parts washing application. The shops must be willing to confirm they are using the cleaner at the recommended working concentration, that they have been using the cleaner for more than six months and are satisfied with it. The reference shops must also be willing to describe how the cleaner is used and the method of disposal.
- Vendors should provide users with a "test" system for a period of one week to one month.

Cleaning Formulation Information

- Limited to water-based cleaners with no solvent additives.
- Formulation data sheet should specify ingredients at 1.0 percent concentration or greater by weight.
- Recommended working concentration or concentration range for parts cleaning applications.
- Material Safety Data Sheet (MSDS) for product.
- Cleaners must be certified as a Clean Air Solvent by the SCAQMD.
- Cleaning formulation must reject or consume oils cleaned from the parts. This is to facilitate oil removal by skimming or other separation techniques. Enzyme units have the capability to consume the oil.

General Equipment Requirements

- High temperature emergency cutoff switch
- Recirculating fluid
- Oil removal or consumption capability (filter, skimmer, weir, or enzyme unit)
- Drain and pre-pump strainer
- Corrosion protected (plastic, stainless steel, mild steel with a protective coating)

Sink-on-a-Drum/Enzyme and Immersion System Requirements

- Cleaning formulation pH > 6.5 and < 10
- Temperature preset between 100 and 120 degrees F
- Drum diameter 50 percent or greater than largest sink dimension
- Sink depth between 4 and 16 inches
- Fluid capacity between 10 and 30 gallons
- Pump size greater than 1/10 horse power
- Weight capacity for parts greater than 100 pounds
- Equipped with cleaning brush

Sink-on-a-Drum/Enzyme System Requirements

- Drum diameter 50 percent or greater than largest sink dimension
- Fluid capacity between 10 and 30 gallons

Immersion System Requirements

- Base area 50 percent or greater than sink area
- Heating element barrier to prevent direct contact cleaning
- Fluid capacity between 10 and 50 gallons
- Equipped with platform to hold parts while hand

Spray Cabinet Requirements

- Cleaning formulation pH > 6.5 and < 12.4
- Not equipped with hand cleaning mechanism
- Low water safety cut-off
- Weight capacity for parts greater than 500 pounds
- Lid interlock switch
- Spray pressure greater than 30 psi
- Pre-pump strainer and parts screen

IV. DISPOSAL AND OTHER CROSS-MEDIA ISSUES

When SCAQMD Rule 1171 passed, SCAQMD established a working group to examine the implications of the rule on other media. Members of the group included representatives from wastewater discharge agencies, the regional water quality control boards, DTSC and IRTA. The aim of the working group, in part, was to examine the implications of Rule 1171 on other media and to work on methods of minimizing the environmental burden that could potentially result from the transition to water-based cleaners.

In the course of this work, it became apparent that the DTSC regulations and their interpretation by DTSC staff would be important. It also became apparent that U.S. EPA hazardous waste regulations would also be a factor. All the working group members, including DTSC, were committed to facilitating the transition away from solvents to water-based cleaners in repair and maintenance cleaning. Even though there are cross-media effects, the work group members believed that, from an overall pollution prevention standpoint, the use of water-based cleaners was preferred. Even so, the transition would affect many small businesses and the work group wanted to explore regulatory changes that would facilitate and reduce the cost of the transition.

Part of IRTA's charge in this project was to examine the DTSC and U.S. EPA hazardous waste regulations, to determine if they had an impact on the conversion and to work with DTSC staff to identify changes that might be necessary to provide an incentive to firms to make a conversion to water-based cleaners. This section describes the water-based cleaning process and the hazardous waste that is generated. It also focuses on the DTSC and U.S. EPA regulations that come in to play as part of the process.

SPENT WATER-BASED CLEANING BATHS

Many of the water-based cleaning systems include oil skimmers and filters. These features extend the bath life of the cleaner. Eventually, however, the spent cleaning bath will have to be changed out. The frequency of the changeout depends on contaminant loading, the oil rejection capability of the cleaner and the methods of oil removal that are employed. The microbes in the enzyme units "eat" the oil and the baths in these systems may last indefinitely. Some have been operating in the field for more than two years without the need for changeout.

The spent water-based cleaning baths, when they require changeout, may or may not be hazardous waste. In IRTA's earlier developmental study, about three-fourths of the spent cleaning baths were classified as hazardous waste. In virtually all cases, this was because the cleaners contained metals at levels that exceed the Soluble Threshold Limit Concentration (STLC) as specified in Title 22 of the California Health and Safety Code of Regulations. Metals that commonly exceed the STLC in these baths are cadmium, copper, lead and zinc. At the federal level, the Toxicity Characteristic Leaching Procedure (TCLP) levels determine whether a sample is classified as hazardous waste. Since the TCLP and STLC levels for cadmium and lead are the same, most of the spent baths would also be considered hazardous waste in the rest of the country.

There are several methods of dealing with the spent cleaning baths. First, if the facility has an appropriate wastewater treatment system, the spent bath can be treated, but only if written permission is obtained from the POTW or sanitary district. It is unlikely that most automotive shops would be able to exercise this option. Some of the larger shops might have appropriate wastewater treatment systems and might be able to obtain written permission to discharge the spent baths. If the spent bath is not a hazardous waste, then it could be sent to the wastewater treatment system. If the bath is a hazardous waste, then the firm must obtain a tiered permit from DTSC or the local Certified

Unified Program Agency (CUPA) to use the treatment system. For generators treating less than 55 gallons of waste per month, the fee for this permit is at least $100 the first year and $50 or more per year thereafter.

Second, the facility could use an evaporator to treat the spent cleaning bath. If the spent bath is not a hazardous waste, this can be done without a DTSC tiered permit. A SCAQMD permit for the evaporator may be required, however, if the spent bath contains any VOCs or toxics. It is likely that a permit would be required in other air districts in the state as well. If the spent bath is hazardous waste, a DTSC tiered permit will be required. Again, the fee for the permit is at least $100 the first year and $50 a year or more thereafter if the amount of waste treated is less than 55 gallons per month. The SCAQMD permit fee is much more costly; it ranges from about $800 to $2,000, depending on whether VOCs or toxics are present in the spent bath. If the process that is used is actually an evaporation with recondensation and the recovered water is reused on-site, then a tiered permit is not required even if the spent bath is hazardous waste. At least one manufacturer offers a system that contains a distillation unit. Distillation is equivalent to evaporation and recondensation so no tiered permit is required to perform the distillation if the recovered water is reused on-site.

Third, the facility can ship the spent cleaning bath off-site. If the spent bath is non-hazardous waste, it can be taken away by any firm. If the spent bath is hazardous waste, it must be taken away by a licensed hazardous waste transporter, typically at a higher cost. If the spent bath is hazardous waste, it must be stored in an appropriately labeled hazardous waste container. In most cases, the accumulation time allowed for the hazardous waste would be 180 days. This accumulation time applies after the generator has accumulated 100 kilograms of hazardous waste.

The management options for the spent water-based cleaning baths are summarized in Table 4.

Table 4
Spent Water-Based Cleaning Bath Disposal Options

Option	Classification	DTSC Regulations	Other Regulations	Other Factors
Discharge to wastewater treatment system	Non-Haz	----	Written permission from discharge agency	----
	Haz	Tiered permit required	Written permission from discharge agency	----
Evaporator	Non-Haz	----	Air permit likely required	Residue will likely be hazardous waste
	Haz	Tiered permit required	Air permit likely required	Residue will likely be hazardous waste
Evaporator/ Recondenser or Distillation Unit	Non-Haz	----	Air permit likely required	Residue will likely be hazardous waste
	Haz	----	Air permit likely required	Residue will likely be hazardous waste
Shipment off-site	Non-Haz	----	----	----
	Haz	must be stored and labeled properly	----	----

OIL PRODUCTS, FILTERS AND SLUDGE

Some of the water-based cleaning units are equipped with oil skimmers. The skimmed oil that is removed from the cleaning baths is considered used oil by DTSC as specified under section 25250.1 (b) in the Health and Safety Code. It can be stored in containers with other used oil and it can be picked up by a used oil recycler.

Filters are commonly used in many of the different types of water-based cleaning units. Enzyme units either have a filter impregnated with microbes or the microbes are added directly into the cleaning fluid. These latter units often have a strainer in the drain where sludge builds up. In all of these cases, the filters or the sludge periodically requires disposal. In IRTA's developmental study, two spent enzyme filters were analyzed and one was found to be hazardous waste and one was not.

If the filters or sludge are hazardous waste, DTSC has ruled that they cannot be put in with used oil filters for pickup by a used oil recycler. The reason that the automotive oil filters are allowed to be picked up by oil recyclers is because these filters contain steel which is melted down and recycled. Filters made of steel are considered "scrap metal" under federal rules. Parts cleaner filters and sludges do not generally contain metal so, according to DTSC, they cannot be managed in the same manner as used oil automotive filters. The parts cleaner filters must be stored as hazardous waste and picked up by a licensed hazardous waste transporter. DTSC has determined that used oil generated by the facility does not need to be counted in the amount of hazardous waste generated by the facility. Thus the accumulation time for the filters does not begin until the total amount of hazardous waste on-site amounts to 100 kilograms. After that, the same accumulation time applies as for spent baths.

If an evaporator is used to treat a spent water-based cleaning bath, a sludge will remain. It is probable that this sludge will be classified as a hazardous waste even if the spent cleaning bath was not. The evaporation process tends to concentrate the metals in a smaller volume and the metals content is likely to exceed the STLC and TCLP. The same holds true for the system containing a distillation unit which generates a still bottom. DTSC has ruled that the evaporator sludge and the still bottom cannot be managed as used oil if they are classified as hazardous waste. It must be stored, accumulated and shipped in the same manner as parts cleaner filters that are hazardous waste.

Table 5 summarizes the options and the regulations that affect the disposition of the oil, filters and sludge.

Table 5
Oil, Filter and Sludge Management

Material	Classification	DTSC Regulations	Other Factors
Oil from skimmers	----	Can be added in with other used oil	----
Spent water cleaning system filters	Non-Haz	----	----
	Haz	Hazardous waste storage and transport regulations apply	Can't dispose with used oil filters
Filter sludge/ evaporator sludge/ distillation sludge	Non-Haz	----	----
	Haz	Hazardous waste storage and transport regulations apply	Can't dispose with used oil; can wipe with shop towels and send off-site to laundry

OFF-SITE SHIPMENT

The spent products from the water-based cleaning process, including spent water-based cleaning baths, filters, sludge and still bottoms from distillation or evaporation, can be classified as non-hazardous or hazardous waste. If these materials are non-hazardous, they can be disposed of in any appropriate manner. If they are hazardous wastes, they must be taken away by a licensed hazardous waste transporter.

In the parts cleaning arena, "automotive parts cleaning solvents" generated in auto repair facilities can be managed by the transporter under a milkrun variance as defined under Section 66263.42 of Title 22. This variance can be obtained under two conditions. First, the variance provision applies to hazardous wastes that are picked up from generators of non-RCRA hazardous waste totaling less than 100 kilograms per calendar month. Second, the variance provision applies to wastes that are subject to reclamation agreements with generators of between 100 and 1,000 kilograms per month.

Most auto repair facilities using water-based cleaners will not fall under the first case. The spent water-based cleaning baths, filters, sludge and still bottoms generated by auto repair shops will often be classified as RCRA hazardous wastes. Commonly, because the state STLC and federal TCLP levels are the same for some of the metals commonly found in these wastes, the waste that is hazardous under state regulations will also be classified as RCRA hazardous waste. The spent water-based cleaning baths must be changed out periodically and when they are, the generator will end up exceeding the 100 kilogram (220 pound) per month cutoff level specified for the milkrun variance in the first case above. A bath containing 30 gallons of water-based cleaning solution, for example, would amount to about 250 pounds or 114 kilograms of waste and would cause the facility to exceed the 100 kilogram threshold level in the month it was changed out. Other facilities might have smaller baths or might use enzyme systems where only filters or sludge requires disposal. Even so, it would not be convenient for transporters to distinguish between the different types of facilities and pick up waste from some under the milkrun variance procedure and others under conventional manifesting procedures.

Most auto repair facilities will fall under the second case because they generate between 100 and 1,000 kilograms of hazardous waste per month. Under the milkrun variance provision, these wastes must be subject to reclamation agreements with the generators. In the case of mineral spirits, the spent solvent is reclaimed and the still bottom is incinerated. In the case of the spent water-based cleaner, the spent cleaner is more likely to be treated and discharged, a process that is not defined as reclamation. As a consequence, the milkrun provisions do not apply to water-based parts cleaning.

HAZARDOUS WASTE ISSUES REQUIRING RESOLUTION

The hazardous waste regulations that govern the disposition of the wastes generated from water-based cleaning in this sector are much more onerous than the regulations governing the disposition of the wastes generated from the use of mineral spirits. DTSC is committed to facilitating the transition from mineral spirits to water-based cleaners for auto repair facilities in repair and maintenance cleaning because it is a good pollution prevention measure. In this light, there are four major issues concerning DTSC's and U.S. EPA's regulations and interpretations of regulations that need to be addressed.

The first issue concerns the disposal of spent filters and sludge from the water-based cleaning systems. Oil recyclers, in many instances, have told vendors and users that they are willing to take the parts cleaner filters or sludge along with the used automotive oil filters that they routinely pick up from auto repair facilities. DTSC, however, has ruled that if the material is classified as hazardous wastes, then the filters cannot be managed in the same manner as used automotive oil filters. The reason they interpret the regulations in this manner stems from the fact that the steel used in automotive oil filters could be recycled; this means it falls under the federal definition of "scrap metal" which is exempt from hazardous waste requirements. The filters in parts cleaners are most often made of plastic and fibrous materials. Because the filters in parts cleaners contain no metal, DTSC staff reason that they cannot be managed as "scrap metal" used oil filters which are made of steel.

Manufacturers of parts cleaning filters could begin using steel-containing casings to allow the filters to be managed with the used oil filters. In order to do this, however, they need to know the percentage of steel a filter must contain in order for it to be managed with the used oil filters. There is currently no guidance on how much steel must be contained in the filter to qualify it for this type of management. Another alternative would be for parts cleaning equipment manufacturers to design their units to make use of automotive oil filters. This may be the most cost effective alternative because automotive filters are mass produced and likely inexpensive. Filter sludge must be dealt with differently since it has no casing at all. One method of handling it, whether it is hazardous or non-hazardous waste, is to collect it on shop towels. These shop towels can then be sent off-site for management by a laundry. Although this practice is legal, it may not be good public policy because it involves a cross-media transfer. The sludge components simply become a problem for the laundry rather than for the automotive shop.

The second issue concerns the sludge from strainers, evaporation sludge and the distillation sludge. It is not clear why the filter, evaporation and distillation sludge cannot be handled as used oil. Automotive oil filters in vehicles contain oil which is contaminated with metals from worn, old components that have been subjected to high temperatures. The filters also probably contain dirt and particulates. When these filters are drained, the used oil that results also contains these contaminants. Other types of fluids like brake fluid and transmission fluid are commonly also added to the "used oil." The oil skimmed from the bath with an oil filter is also considered used oil.

Water-based parts cleaners are used to clean the same type of oil and fluids from parts that are then put back in the vehicle. The water-based cleaner contains the oil, the other fluids, the dirt and metals removed from the parts. The filters in water-based cleaners are used to remove all of these contaminants from the water-based cleaners. Parts cleaner filters and sludges likely include the same contaminants as the used oil that is drained from the used automotive oil filters. If the spent water-based cleaner is processed further by evaporation or distillation, the water is driven off and the contaminants are concentrated in the sludge. This material and the sludge from strainer filters may not differ significantly from used oil in its characteristics. DTSC staff, however, have ruled that this material is not used oil and cannot be managed as such.

The third issue involves the DTSC requirement for a tiered permit when using an evaporator to treat hazardous waste. If the spent water-based cleaner is classified as a hazardous waste, then a DTSC tiered permit is required to treat that waste with an evaporator. As mentioned above, no tiered permit is required if the water is recondensed and reused on-site. In that event, the process is deemed recycling rather than treatment.

The dry cleaning industry sought clarification from U.S. EPA several years ago on whether evaporation of separator water containing perchloroethylene, a listed RCRA waste, required a RCRA treatment permit. EPA indicated that no RCRA permit was required. In contrast, DTSC regulations did require a tiered permit for evaporator treatment of dry cleaning separator water. In order to allow evaporation by the dry cleaning industry, DTSC exempted evaporation of separator water from tiered permitting provided that less than 180 gallons per month was treated. There is no reason that DTSC could not provide a similar exemption from tiered permitting for water-based cleaning formulations.

The fourth issue concerns the milkrun variance. This issue may be more difficult to resolve because it is governed by RCRA rather than by DTSC. The spent water-based cleaning baths that are hazardous wastes are generally RCRA hazardous waste. Most auto repair shops will generate between 100 and 1,000 kilograms of hazardous waste each month. In order to manage these wastes under a milkrun variance, the condition that applies to the wastes is that they be subject to reclamation agreements with generators of between 100 and 1,000 kilograms of waste per month.

Because the infrastructure and management procedures are still evolving in this sector, the management practices are not yet obvious. Most of the spent water-based cleaning baths are likely to be handled the same way, however. The transporter will probably have an agreement with a facility that has a RCRA Part B permit for wastewater treatment. There are several such facilities in the Los Angeles area. The transporter will deliver the spent water-based cleaning formulation to the facility. The facility will treat the water in various ways including neutralization, metals precipitation and oil separation. The clean water that remains will be discharged under a POTW permit. Because the water is treated rather than reclaimed, there is no reclamation agreement with the generators as required by the regulation. Thus spent water-based cleaners cannot be managed under a milkrun variance because of the current RCRA requirement that the waste be reclaimed.

In order to facilitate and encourage the conversion to water-based parts cleaning, DTSC could approach U.S. EPA with this issue. Other interested parties, like the California air districts, the California Air Resources Board, the water-based cleaning system vendors and automotive shops, could also assist with this effort. EPA could modify the regulation and incorporate an exemption from the reclamation agreement requirement for firms using water-based cleaning formulations.

V. CONCLUSIONS AND RECOMMENDATIONS

SCAQMD Rule 1171 requires a conversion from mineral spirits to cleaners with a VOC content of 50 grams per liter or less in repair and maintenance cleaning by January 1, 1999. Auto repair shops in the South Coast Basin have 25,000 cleaning units that will be affected by the regulation. Virtually all the shops will convert to water-based cleaning systems.

Because the auto repair shops that must make the conversion are small businesses, they do not have the time or the expertise to evaluate and compare the systems that are available. Many vendors make claims about their water-based cleaners and their equipment that may not prove out in the field. IRTA was asked to establish an advisory committee to evaluate whether DTSC's Technology Certification Program would be a suitable means for certifying the water-based cleaning systems used for repair and maintenance cleaning. IRTA was also asked to examine the DTSC regulations that would affect the transition from solvents to water-based cleaners and analyze the implications. The results of the project in these two areas are described below.

TECHNOLOGY CERTIFICATION PROGRAM

There appeared to be a consensus of the project advisory committee that DTSC's Technology Certification Program, as it is today, is not a good vehicle for assisting small businesses in selecting the appropriate cleaning systems in the water-based parts cleaning arena. The cost of the program to a vendor to obtain certification is very high and many of the vendors offering water-based cleaners and equipment are small businesses without the resources to pay high fees for certification.

The Technology Certification Program in its present form does not appear to be a good vehicle for evaluating water-based cleaning systems in the automotive repair sector. Cleaning applications are extremely diverse and alternatives must be selected on a case-by-case basis. The auto repair water-based parts cleaning category is about as uniform a category that can be found. Even so, there are strong variations in the cleanliness requirements even within this uniform category. For instance, a shop rebuilding transmissions would require a very different set of cleaning tools than a shop that wants to remove gross oil from parts after repairs.

The Technology Certification Program has been designed around parameters that can be measured. The cleaning alternatives area is strongly empirical. There are virtually no measured parameters that are meaningful. For instance, if a plating shop is cleaning buffing compound and oil from parts that will subsequently be plated, their parts will not require the same standard of cleanliness as a shop that is cleaning steel for subsequent coating. There is simply no way to subcategorize all cleaning applications in a way that would make cleanliness standards meaningful.

The advisory committee devoted a substantial amount of time to discussing how a lower cost program might better serve the interests of the auto repair shops. A separate program, a guidance program sponsored by DTSC, appeared to be a feasible alternative. This guidance program would not have the stringent QA/QC requirements of the Technology Certification Program and it would be possible to structure it specifically for the auto repair water-based cleaning sector. The requirements for approval under the guidance program could be less stringent than for the Technology Certification Program. For example, the vendors offering systems would all apply to DTSC for certification. The burden for DTSC staff of evaluating every claim could be minimized if the vendors were required to self-certify to the requirements of Table 2. DTSC's role in the approval process would be to contact at least three users and determine if the system was operating and performing in a satisfactory manner and if the shops were satisfied with it. DTSC could issue a certificate that verified the certification.

The input from users of the water-based systems is the most valuable parameter; it is the best measure of a technology's effectiveness and efficiency. As mentioned above, the cleaning operations are empirical. One shop may be perfectly satisfied with an enzyme system whereas another shop may be pleased with the performance of a spray cabinet. The most meaningful standard in cleaning applications is that they are effective if the shop using the process is satisfied.

IRTA's recommendation, given the input from the advisory committee, is that auto repair water-based parts cleaning should not be a part of the Technology Certification Program. A separate more appropriate program should be established by DTSC to focus on this application area. A less rigorous guidance program should be implemented that relies more on the users' judgment of the technology performance and less on the measurement of parameters. This sort of program could be less costly to the vendors and more vendors could avail themselves of the guidance approval process.

DTSC AND U.S. EPA REGULATIONS

The results of the project suggest that DTSC and U.S. EPA regulations do not encourage the use of water-based cleaners as alternatives to mineral spirits in auto repair parts cleaning. The high cost of managing the hazardous waste streams will provide a disincentive to firms to make the conversion. The conversion to water-based cleaners makes sense in terms of pollution prevention and it will provide an overall health and environmental benefit. The costs of using the water-based cleaners are also likely to be lower than the costs of using mineral spirits. The hazardous waste regulations that apply when water-based cleaners are used are more complex, however, and this is not good public policy. Changes in two areas of DTSC regulations and two areas of EPA regulations could facilitate the switch to water-based cleaners and make it less costly.

The first area involves the spent water-based cleaning system filters. Currently U.S. EPA and DTSC regulations do not allow the disposal of these filters with used automotive oil filters. The reason they cannot be handled in this manner is because they contain no steel. U.S. EPA should examine a change that would allow the disposal of parts cleaner filters with used automotive oil filters.

The second area concerns strainer, evaporation and distillation sludge. Currently DTSC regulations do not allow the disposal of this material with used oil. DTSC could investigate whether it would be feasible to modify the regulations to allow the material to be disposed with used oil.

The third area involves the DTSC requirement for a tiered permit for evaporators that are used to treat spent water-based cleaners if they are classified as hazardous waste. Dry cleaning water-based wastes are exempt from RCRA treatment permit requirements and DTSC regulations allow evaporation of 180 gallons per month of these wastes without the need for a tiered permit. DTSC could set a similar limit on the amount of spent water-based cleaner that could be treated in an evaporator and exempt it from the tiered permit requirement.

The fourth area involves an EPA regulation that affects the milkrun variance. Currently, under U.S. EPA regulations, transporters cannot obtain a milkrun variance for water-based cleaners without a reclamation agreement with the generator. The spent water-based cleaners are treated and the water is released to the POTW. DTSC, with the help of other interested parties, could work with EPA to change the reclamation agreement requirement to allow transporters to obtain a milkrun variance for transporting water-based cleaners.

APPENDIX A

MIL-C-87937B: Emulsion Characteristics of Type II Cleaners

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INCH-POUND

MIL-C-87937B

MILITARY SPECIFICATION

27 Jan 94

Superseding

CLEANING COMPOUND, AEROSPACE EQUIPMENT

MIL-C-87937A

16 Oct 1991

This specification is approved for use by all
Departments and Agencies of the Department of Defense

1. SCOPE

1.1 Scope. This specification establishes the requirements for biodegradable, water dilutable, environmentally safe cleaning compounds for use on aerospace equipment to include aircraft, aerospace ground equipment (AGE) and AGE engines.

1.2 Classification. The cleaning compounds covered by this specification shall be a following types.

Type 1 - Terpene Based, Solvent Emulsion, Water Dilutable Cleaning Compound

Type II - Water Dilutable Cleaning Compound

Type III - Gel-Type Cleaning Compound

Type IV - Heavy Duty, Water Dilutable Cleaning Compound

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, noted in the solicitation.

SPECIFICATIONS

Federal

O-S-642	Sodium Phosphate, Tribasic, Anhydrous. Dodecahydrate, & Monohydrate, Technical
P-D-680	Dry Cleaning and Degreasing Solvent
QQ-A-250/4	Aluminum Alloy 2024, Plate and Sheet
QQ-A-250/5	Aluminum Alloy Alclad 2024, Plate and Sheet
QQ-A-250/12	Aluminum Alloy 7075, Plate and Sheet

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be in improving this document should be addressed to: Code (63) SA-ALC/SFSP, 1014 Andrews Rd STE Kelly AFB TX 78241-5603, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

4.6.7 Flash point. The flash point of the concentrated cleaning compound (Type I, II, III and IV) shall be determined in accordance with ASTM D 56 (Tag Closed Cup) and for materials that have a tendency to form a surface film under the test conditions use ASTM D 93. The flash point of the 10% solution in distilled water (Type I only) shall be be determined in accordance with ASTM D 92.

4.6.8 Emulsion characteristics. Twenty ml of a 25% by volume solution (Types I and II) of the cleaning compound (12.5% by volume solution for Types III and IV) shall be placed in a 50 ml glass stoppered graduated cylinder. Twenty ml of lubricating oil conforming to MIL-L-2104, grade 10W, shall be added. An emulsion shall be formed by 10 inversions of the graduated cylinder followed by a vigorous 15 second shake. After the emulsion has stood for 5 minutes the 15 second shake shall be repeated. At 5 minutes and 8 hours for the Type I and at 5 minutes and 24 hours for the Types II, III and IV cleaner the amount of free water and cleaner which separates from the lubricating oil shall conform to the requirements of Table I.

4.6.9 Hydrogen embrittlement. The hydrogen embrittlement properties of the cleaning compound shall be determined in accordance with ASTM F 519 using either Type 1a, 1b, or 1c, Treatment B AISI 4340 steel specimens.

4.6.10 Total immersion corrosion. The total immersion corrosion effects of the cleaning compound on the new, unused metals and metal alloys listed in Table II shall be determined in accordance with ASTM F 483. Conformance to the requirements in Table II shall be for weight loss after 168 hours. In order to obtain the best results on test panels in this very low weight category, the panels must be handled with gloves, cleaned in a very careful manner and dried in an oven. They are cooled and dried in a desiccator both before and after which weighing.

4.6.11 Low embrittling cadmium plate corrosion. The cleaning compound shall be evaluated for corrosion on low-embrittling cadmium plate in accordance with ASTM F 1111.

4.6.12 Effects on unpainted metal surfaces. The cleaning compound shall be evaluated for effects on un-painted metal surfaces in accordance with ASTM F 485.

4.6.13 Effect on painted surfaces. The concentrated cleaning compound (Type III only) and a 25% solution (Type I, II, and IV only) with distilled water shall be tested in accordance with ASTM F502 except that the panels used for testing shall be coated with the paint systems listed in Table VI. For all paint systems tested, a separate panel will be required for both 25% solution and concentrate. For Type II, Type III, and Type IV compound, conduct the test on all paint systems listed in Table VI. For Type I compound, conduct the test only on the enamel semigloss (F) and polyurethane (P) paint systems.

4.6.14 Stress crazing of MIL-P-5425 and MIL-P-25690 (type A and C) acrylic plastics. The cleaning compound shall be evaluated for stress crazing of stretch (Type A and C) acrylic plastics in accordance with ASTM F 484.

4.6.15 Stress crazing of polycarbonate plastic. The cleaning compound shall be evaluated for stress crazing of polycarbonate plastics using the test procedure outlined in ASTM F 484 with the exception that the acrylic plastics called for in the procedure be replaced with polycarbonate plastic conforming to MIL-P-83310 of the same dimensions and the polycarbonate specimens shall be stressed for 30 = 2 minutes to an outer fiber stress of 2000 psi.