Refinish UV Safety Guide

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THE ASSOCIATION FOR UV&EB TECHNOLOGY

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Note to Users

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Safety and Handling Guidelines for UV-Curing Automotive Refinish Coatings

Introduction

UV-cure technology is a recent innovation in the automotive refinish industry. The major new element of this type of coating system is the UV-curing equipment that must be used with the UV-curing products. Additionally, there are some aspects of UV-curing products that make them different from other coatings used in autobody shops.

This RadTech publication summarizes Safety and Handling Guidelines for working with UV-curing equipment and UV-curing products in the autobody shop environment. This publication also includes a summary of General Safety and Health Considerations for autobody shops. The most important general guideline, as always, is:

Read and Heed the Product Information Provided by the Manufacturer!

Experience has shown that good shop procedures and worker training in safe handling and industrial hygiene practices enable UV-cure technology to be safely used in a wide range of industrial applications, including autobody shops.

UV-Curing Equipment

UV-curing equipment must meet all current safety standards and applicable government regulations. A detailed operating, maintenance and safety manual should be available from the manufacturer of each piece of equipment. Consider this manual the MSDS (Material Safety Data Sheets) for the equipment; follow the manufacturer's instructions to ensure your safe use of the equipment.

Observe standard electrical equipment safety precautions. Use the correct electrical outlet for the plug and cord supplied with the equipment. Do not use improper adapters or extension cords. Do not use the equipment if there is water on the workplace floor.

UV lamps and fixtures can become very hot and can cause thermal burns. Avoid inadvertent contact with the lamp housing or other "hot spots." Check to be certain that the equipment is cool before undertaking any maintenance or adjustments.

UV Energy

Ultraviolet energy refers to a portion of the electromagnetic spectrum that exists beyond the visible light spectrum, which is most familiar to us. However, we are also exposed to UV energy and its potential effects in our daily life: it is the portion of sunlight that causes tanning and sunburn, and it is also generated in arc welding (thus requiring the use of protective eyewear and clothing.)

Just as we identify certain wavelengths of visible light with names such as red, green and blue, certain wavelengths of UV energy are identified as UV-A, UV-B and UV-C.

The biological effects of UV energy result mostly from exposure to the higher energies of UV-B or UV-C

energy (wavelengths below 325 nm) and resemble typical symptoms of sunburn:

Skin: Reddening, dryness, wrinkling, darkening, burning

Eyes: Eye fatigue, inflammation, pain (feels like sand in the eyes), tears, blinking, temporary blindness, cataracts

The American Council Of Government Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) have established the following exposure limit for UV-A energy:

Near UV (315-400nm): 1 mW/cm^2 for exposures > 16 min

Adherence to this exposure limit prevents skin and eye effects in most workers. Sensitized individuals may exhibit effects even at low exposures, and they should not work in the vicinity of UV-curing equipment or be exposed to intense sunlight.

The symptoms of overexposure to UV energy are delayed, so by the time symptoms appear, the over exposure already has occurred. Basic engineering, administrative and industrial hygiene controls normally are adequate to prevent over exposure. Curing equipment is provided with shielding to minimize escape of UV energy into the workplace. With properly adjusted shielding, diffuse leakage of UV energy into the workplace normally is not a problem. Bright beams or reflections must be eliminated.

Always wear UV-rated safety glasses in the UV work area. Lens tinting is no indication that the glasses are UV-rated; always look for the manufacturers' statement of the lenses' ability to protect against UV energy. Gloves and long sleeve shirts should be worn when direct exposure to the UV energy cannot be avoided.

Exposure to UV-Curing Materials

As with all coatings, consult the suppliers' MSDS for UV-curing materials to identify potential hazards and precautions.

In general, UV-curing automotive refinish coatings are based on reactive acrylate chemistry. Acrylates have low-systemic toxicity, but they can cause skin and eye irritation, or even blister burns, upon prolonged direct contact. Since acrylates do not cause immediate irritation, exposure can go unnoticed for some time. Some individuals may develop dermal sensitization to these chemicals as a result of contact. Those who become sensitized should discontinue working in the areas where even low-level exposure might occur.

Minimizing the Risk of Dermatitis

Most people can work safely with UV-curing materials by using the proper protective clothing and handling procedures. It is important to remember that UV-curing materials do not evaporate or cure under usual shop conditions, so spills and incidental contamination will remain wet or sticky until cleaned up. Equipment touched with contaminated gloves can be the source of exposure if touched later by unprotected skin. Avoid getting UV-curing materials on your skin or in your eyes.

The type of protective clothing recommended depends on the type of potential exposure. Typically, fabric or non-woven long sleeved, full leg clothing or coveralls are worn.

Always wear neoprene, nitrile or butyl rubber gloves when direct contact with UV-curing materials might occur. Gloves should be selected to be resistant to prolonged contact with cleaning or coating solvents. Gloves should be replaced whenever signs of degradation are noticed (swelling, softening, cracking or discoloration).

Since UV-curing materials do not dry out or cure under usual shop conditions, they remain liquid and can be cleaned up easily with less aggressive solvents, such as soap and water, or citrus and vegetable oil cleaners. Solvents can be used for cleaning equipment, but only if the appropriate protective clothing is worn and steps are taken to prevent the possibility of fire or explosion. Solvents should not be used to wash the skin, because they may increase the possibility of penetration of chemicals into the skin, and dermatitis may occur. Hand creams should be used to prevent irritation of the skin due to frequent washing. If protective clothing becomes heavily contaminated, it should be properly discarded.

If UV-curing materials come in contact with the skin, remove any contaminated clothing and immediately wash the contacted area thoroughly with soap and cool water. Pay particular attention to washing the hair, ears, nose and other parts of the body that are not easily cleaned. Contact a physician if large areas of skin have been exposed, or if contact with UV-curing materials results in blisters. Avoid accidental transfer of UV-curing material from the hands to other parts of the body or to other people.

As with any chemical, food and beverages should not be consumed in areas where UV-curing materials are handled.

Some people may become sensitized after exposure to acrylates. Some symptoms include skin discomfort, itching or dermatitis. An allergist should be consulted if sensitization is suspected. Fully-cured UV coatings are highly crosslinked plastics that present no hazard to health.

Eye Protection

As with any coating, if eye contact with UV-curing materials occurs, flush the eyes immediately with large amounts of warm water for at least 15 minutes and immediately contact a physician.

Never look directly at the UV lamps or strong reflections, even with eye protection. Never adjust the UV shielding on UV equipment without qualified supervision.

Always wear UV-protective eyewear when working near UV-curing equipment. The lenses in safety eyewear must absorb UV light to prevent unintended exposure and eye irritation; check the manufacturer's description of the lenses to ensure that they are UV protective.

UV-Spray Coating Considerations

UV-curing materials should be spray applied in enclosed booths to prevent exposure to uncured coating aerosols, which do not evaporate and may be harmful if inhaled or allowed to contact the skin or eyes.

The overspray of UV-curing coatings remains liquid until exposed to UV energy.

Premature Polymerization, Material Storage and Transfer

UV-curing materials are designed to be reactive under controlled conditions, and care must be taken to prevent premature polymerization. Overage or improperly stored or handled materials may increase in viscosity or gel. In most cases, uncontrolled polymerization results in solidification or gelling of the material in its original container, making it unusable. Observe suppliers' shelf life recommendations. Rotate product inventory: first in, first out.

Preventing Exposure to Light

UV-curing products should be shielded from sunlight or other sources of UV energy such as fluorescent or mercury vapor lights. Exposure to light will cause an increase in product viscosity and eventually leads to

product polymerization. If plastic containers are used, the plastic should be opaque to UV light.

Storage Temperature and Localized Heating

Containers of UV-curing products should be kept at temperatures below 100°F. Temperatures above 100°F will accelerate the depletion of inhibitors, and this will lead to an increase in viscosity.

Spill Cleanup

As with any chemical, leaks and spills of UV-curing materials should be cleaned up immediately. As a general good practice, remove all sources of ignition in the cleanup area. Refer to the product MSDS for the manufacturer's recommended spill procedures.

Waste Disposal

Fully cured UV materials ordinarily present no safety—or health—related disposal hazards, and normally may be disposed of as non-hazardous waste. Always check local regulations to determine the appropriate requirements for accumulation and disposal of waste (uncured) coatings, spent solvents, used spray booth filters, and wastewater from cleanup and water-wash spray booths.

General Health & Safety Considerations in Automotive Refinish Surface Coating Operations

Introduction

The general hazards associated with automotive refinish surface preparation, paint mixing, application, and clean up are well known:

- Exposure to dust, solvents, and other toxic chemicals
- Flammable or explosive aerosols and vapors
- Spray coating hazards: pressurized equipment, compressed air and pressurized liquids
- Spill cleanup
- Waste disposal

Worker training is the key component of a health and safety plan in any workplace. Always consult the supplier's product Technical Data Sheet and MSDS before working with any chemicals, and review the manufacturer's instructions for tools and equipment. Ensure that workers are trained to understand the identified hazards and recommended handling and work practices. Always consult MSDS for first aid information and emergency instructions; know what's needed **before it becomes needed!**

Basic safety practices include:

- Effective design, installation, inspection and maintenance of production and engineering control equipment to prevent physical injury and chemical exposure in the workplace
- Proper use and maintenance of personal protective equipment
- Good personal hygiene and workplace cleanliness, including provisions for clean up, clothing storage, and laundering or disposal of contaminated clothing
- Applying barrier cream on the hands before putting on gloves
- Mixing and using the products in well-ventilated areas
- Washing thoroughly before smoking, eating and using the toilet
- Never wash the skin with solvents, which can penetrate and carry chemicals through the skin
- Providing separate eating, drinking and smoking facilities outside of the work area

Engineering controls reduce the amount of potentially hazardous material to which an employee may be exposed. They are primary workplace safety systems. Vapors, aerosols and dusts must be drawn away from and not into the workers' breathing zone, and a constant supply of fresh make-up air is required for ventilation efficiency. Check that the ventilation system is on and operating before starting any work that may produce airborne contaminants. Ventilation systems should be routinely checked and maintained to ensure adequate exhaust airflow.

Personal protective equipment is required to prevent incidental contact with chemicals, or when engineering controls cannot assure a safe working environment. Recommended protective clothing depends on the chemical and potential mode of exposure. Always use gloves when skin contact is possible. Select gloves resistant to the specific solvents or chemicals used. Information on glove resistance characteristics can be obtained from the glove manufacturer. Use a rubber apron or impervious suit when working with solvents or other toxic or corrosive materials. Shoes must provide full-foot covering. Use rubber boots when exposure to solvent or liquid chemicals could occur.

Wear eye protection (safety glasses with side shields, chemical goggles, full-face respirators, or face shields with glasses or goggles) when handling any chemical. The type of eye protection required depends on the hazard and the specific applications. When there is a possibility of vapor, aerosol or dust exposure, such as when mixing spraying or pumping material under pressure, the eyes should be protected by chemical goggles at a minimum. Use a full-face shield for eye protection if working with toxic or corrosive chemicals, or if splashing is likely.

Exposure to Dust, Solvents and Other Chemicals

Dust Exposure

Safety and Handling Measures

Engineering controls to prevent dust exposure include central exhaust ventilation, process or operator enclosures, local exhaust ventilation and dust collectors. Follow good housekeeping procedures. Avoid using compressed air for cleaning dust off equipment and work surfaces, and use vacuum as an alternative to sweeping and for removing dust from clothing. Wear protective clothing to keep dust off of skin, and use a dust mask or respirator when engineering and administrative controls are inadequate to prevent overexposure to dust.

Chemical Exposure

Potential Exposure Concerns

Skin contact with solvents can "de-fat" and dry the skin, promoting skin irritation. Some solvents are absorbed directly through the skin and may transport dissolved chemicals through the skin.

Solvent vapor and paint aerosols may form during spray applications. Volatile organic solvents can cause respiratory irritation and acute nervous system effects, such as dizziness, sleepiness, lack of coordination, loss of equilibrium, headache or confusion. Exposure to high concentrations of solvent vapor may lead to acute nervous system depression, including unconsciousness, coma or even death. Even at lower concentrations, prolonged and repeated occupational exposure to solvents may lead to permanent damage to the liver, reproductive system and nervous system, blood damage and fetotoxicity.

Safety and Handling Measures

Spray booths and hoods provide isolated environments that prevent airborne contaminants from entering the workplace. Local exhaust systems ("elephant trunk" exhaust tubes, slot hoods, dust extraction systems) capture contaminants and remove them from the work area.

Appropriate approved respirators must be used when engineering controls are not adequate to prevent exposure to airborne chemicals. Use only NIOSH-approved respiratory protection equipment.

Air-purifying respirators filter and absorb contaminants present in the air before they reach your respiratory tract. A dust mask or face piece fitted with particulate filters will remove airborne dust and particles, but they do not protect against vapors of paint solvents and toxic chemicals. For this, you need the appropriate chemical cartridges.

An air-purifying respirator fitted with particulate filters and chemical cartridges will protect against breathing both particulates (such as paint aerosols) and vapors (from solvents and other chemicals). Be sure the chemical cartridges being used are suited for the chemicals with which you are working. Filters and cartridges must be changed (replaced) regularly, according to manufacturer and OSHA recommendations, and your workplace respiratory protection plan.

Air-supplied respirators deliver fresh air directly to the worker and should be used when air quality is unknown, when applying coatings that contain isocyanates or highly reactive catalysts, and when applying solvent-based paints in confined areas. Consult the MSDS and labels for recommendations on the appropriate respiratory protection to be used when components are mixed together and applied in multiple-component coatings systems.

Emergency Conditions

Airborne hazardous combustion products can form under the conditions of fire or uncontrolled polymerization, and emergency responders should be prepared to wear an appropriate air-supplied or air-purifying respirator.

Flammable or Explosive Aerosols and Vapors

Fire or explosion requires three contributing factors: fuel, air and a source of ignition.

Flammable solvents, thinners, cleaners or even finely divided particles (dust or aerosols) provide the fuel, so prevention of fire or explosion requires preventing all three essential factors from coming together. The basic precautions include:

- Operate only in designated, adequately ventilated painting areas, constructed of fire-resistant materials and designed for use and storage of flammable liquids

- All construction, equipment and electrical fixtures must meet all applicable National Fire Protection Association, federal, state and local fire codes and standards
- Install explosion-proof equipment in areas where flammable liquids are handled
- Eliminate sources of ignition and post appropriate warning signs
- Maintain good housekeeping
- Limit quantities of flammable materials in work areas
- Dispose of all solvent- or paint-soiled rags in approved, self-closing, marked metal containers
- Empty waste rag containers at the end of each day to avoid spontaneous combustion
- Provide fire extinguishers or fire extinguishing systems designed to handle the most flammable materials being used

Spray Coating Hazards

Spray coatings are atomized directly into the air, so both general room ventilation and local exhaust ventilation are required to control and contain aerosols and vapors, thus minimizing overexposure to these airborne contaminants. Engineering controls, such as spray booths and local exhaust ventilation (i.e., elephant trunk, slot hood, etc.), are preferred for minimizing employee exposure to any aerosols or vapors that may be generated from the spraying process. Explosion-proof construction is required for flammable formulations. All ventilation equipment should be electrically bonded and grounded.

Spray coating must be performed in a properly designed and approved spray booth that complies with local codes and OSHA standards for electrical equipment and air handling. The volume of exhaust air, make-up air, and overall ventilation must be designed to control hazards inside and outside the spray booth. These design parameters must be monitored and maintained regularly to assure that the spray booth performance continues to work properly.

To ensure worker overexposure is further minimized or prevented, NIOSH-approved respiratory protection must be worn when spraying coatings. See *respiratory protection* in the **Exposure to Dust, Slovents and Other Cheimcals** section.

Spraying coatings presents a number of physical hazards in addition to potential exposure to solvent and chemical vapors and aerosols. These hazards are outlined below.

Pressurized Equipment, Compressed Air, Pressurized Liquids

Inspect all hoses, connections, gaskets and fittings before use and immediately remove defective equipment from service. Hoses and gaskets must be compatible with coatings and cleaning solvents. Provide strain relief devices on the connecting ends of high-pressure hoses. Hoses must not contact machinery, sharp edges, or other objects that could cause damage. Do not pull on hoses to move equipment. Do not exceed maximum recommended operating pressures or temperatures.

Always wear eye protection when operating spray equipment. When not spraying, hold the gun by the grip and remove fingers from the trigger. Spray guns must have a trigger guard and safety lock.

Airless spray pressures can exceed 1,000 psi. Never point an airless spray gun at any part of the body, and never pass a finger over the gun orifice to clean it, since paint can be injected into the skin.

Before servicing any spray equipment, shut off the pump power supply or air and coating supply, and carefully relieve the pressure in the system. Follow lockout-tagout procedures when appropriate.

Electrostatic Discharge

Static electricity can be generated during the pouring and spraying of liquids, and in some paint systems, an electrostatic potential is induced intentionally between the spray gun and the work piece to optimize paint transfer efficiency. If not properly considered, these factors can introduce severe electrical shock and electrical spark ignition hazards.

Assure that the spray booth and waste containers are grounded. Perform periodic continuity checks to ensure that the grounding is intact. Be especially careful when liquids are in containers made of

non-metallic (non-conductive) materials, such as glass or plastic.

Spill Cleanup

Leaks and spills of automotive refinish cleaners, coatings and reducers should be cleaned up immediately. As a general good practice, remove all sources of ignition in the cleanup area.

Refer to the MSDS for the recommended procedures for the spilled material.

Only personnel wearing the proper protective clothing and adequately trained in cleanup and disposal procedures should be permitted in the spill area. An air-supplied or air-purifying respirator, chemical safety goggles or full-face shield, impervious gloves, protective clothing, and rubber boots are recommended when exposure to hazardous chemicals is possible. Use an over-pack for leaking containers.

Small spills can be cleaned up using disposable towels, rags or an absorbent material, which then should be collected and disposed of as hazardous waste. Towels and cloths used to clean up spills should never be reused, but disposed of immediately.

Large spill areas should be isolated immediately to contain the material and prevent chemicals from entering waterways. Appropriate means to recover or collect the spilled material may vary, depending on specific quantities and conditions. After the main cleanup, residual material can be cleaned up in the same manner as for a small spill. Good ventilation should be provided until the area has been thoroughly cleaned.

Contaminated areas should be thoroughly washed with a strong alkaline detergent. Washings should be collected for appropriate disposal, and care should be taken to prevent worker exposure and inadvertent contamination of underground water. The use of solvents for cleanup of large contaminated areas is not recommended, since the solvent would introduce significant new fire, toxicity and environmental hazards.

Waste Disposal

For partially cured or uncured coating waste that may be classified as a hazardous waste, special disposal requirements may exist. These requirements may include special packaging, storage, transportation and documentation as well as specific disposition of the waste. Cleanup solvents, cleanup absorbents and contaminated filters and clothing are almost always classified as hazardous wastes and must be handled in strict compliance with federal and local regulations. Empty containers should be disposed of in accordance with applicable regulations.

Always check local regulations to determine appropriate requirements for accumulation and disposal of waste coatings, spent solvents and wastewater from cleaning operations, used masking paper and tape, replaced filters from dry spray booths, and wastewater from water-wash spray booths.

Worker Training

Clearly defined work procedures and effective worker training are essential for safe application of any industrial technology. The safe use and handling of application equipment, paints, coatings and workplace chemicals requires that all employees who work with these systems must be trained in safe handling procedures. Training should address at a minimum:

* Identification of health and safety hazards
* Hazard communication (labels, MSDS and product information bulletins)
* Workplace engineering controls
* Personal protective equipment (including respiratory protection)
* Safe handling procedures
* Emergency procedures

This guide to safe handling of UV-curing materials is also available on the RadTech International North America Web site at *www.radtech.org.*

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