

Autobody Refinishing General Best Shop Practices: Table 1
Safe Work Practices That Reduce Worker Exposures to Hazardous Chemicals

Task	Safe Work Practice	Impact on Worker Exposure
Dry sanding	Using vacuum sanders.	<i>Significant reduction in inhalation exposure to dusts.</i> Vacuum sanders efficiently collect dusts and other airborne particles generated during sanding operations, some of which contain toxic chemicals. Therefore, use of vacuum sanders minimizes potential worker exposures to dusts and particulates. By preventing dusts from entering the workspace air, vacuum sanders have the added benefit of reducing the chances of dusts settling on freshly painted cars, which can ruin paint jobs.
	Performing sanding tasks in downdraft or crossdraft prep stations.	<i>Significant reduction in inhalation exposure to dusts.</i> By performing dry sanding tasks in well ventilated areas, such as downdraft or crossdraft prep stations, painters help ensure that airborne dusts and particles are quickly removed from their breathing zones.
	Wearing respirators designed to prevent inhalation of dusts.	<i>Significant reduction in inhalation exposure to dusts.</i> Sanding operations can lead to elevated short-term exposures to airborne dusts, especially when painters use pneumatic sanders without vacuum attachments. Painters can effectively minimize their exposures to airborne dusts during dry sanding tasks by wearing properly-maintained, tight-fitting respirators that filter airborne particulates from the air that workers breathe. Use of respirators is particularly important when painters (1) do not use vacuum sanders, (2) do not perform sanding operations in downdraft or crossdraft prep stations, or (3) use compressed air to remove paint dusts from car surfaces. (Note, tight-fitting respirators offer protection far superior to that offered by loose-fitting, disposable dust masks.)
Solvent wiping	Wearing chemical-protective gloves.	<i>Significant reduction in dermal exposure to solvents.</i> When wiping cars with solvents, painters are in direct contact with cloth rags that are wet with solvent. By wearing gloves during this task, painters can easily prevent a potentially significant source of chemical exposure.
	Performing solvent wiping in downdraft or crossdraft prep stations or booths.	<i>Significant reduction in inhalation exposure to solvents.</i> By performing solvent wiping tasks in downdraft or crossdraft prep stations or spray booths, painters help ensure that solvent vapors are quickly removed from their breathing zones.

Table 1 (Continued)
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Solvent wiping (Continued)	Wearing respirators that prevent inhalation of organic vapors.	<i>Significant reduction in inhalation exposure to solvents.</i> Because many of the constituents in solvents are both volatile and toxic, potentially dangerous exposures might occur in the solvent wiping process. Painters can minimize these exposures by wearing properly-maintained respirators that control against exposure to volatile organic compounds (VOCs). As noted later in this table, painters should be trained periodically on the proper use of respirators.
	Using the least toxic solvents for wiping.	<i>Moderate reduction in dermal and inhalation exposure to solvents.</i> Auto refinish shops use a wide range of solvents of varying composition of toxic chemicals for different auto refinishing tasks. Paint distributors might offer insight into which solvents are least harmful to employees' health.
Wet sanding	Wearing gloves.	<i>Marginal reduction in dermal exposure to contaminated wash waters.</i> Because painters usually perform wet sanding after spraying primer on a car part, wash water from wet sanding may contain trace amounts of organic chemicals from the primers. Although the magnitude of dermal exposures from wet sanding is probably low, painters can reduce the potential for dermal exposure by wearing gloves while wet sanding cars.
Mixing paints	Wearing gloves, paint suits, and respirators.	<i>Significant reduction in dermal and inhalation exposure to painting materials.</i> Because paint mixing involves manual handling of volatile liquids, painters who mix paints are susceptible to significant dermal and inhalation exposures. Painters can protect themselves from these exposures by wearing gloves, paint suits, and properly maintained air-purifying respirators with organic vapor cartridges when mixing paints. As discussed below, painters should continue to wear these forms of PPE when spraying paints and when cleaning spray guns—tasks that typically are performed immediately after paint mixing. (Note: As discussed later in this table, in some cases, painters should upgrade respiratory protection to supplied-air systems during spray painting operations.)

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Task	Safe Work Practice	Impact on Worker Exposure
Mixing Paints (Continued)	Using nonhazardous cleaning agents to wash hands and arms.	<i>Significant reduction in dermal exposures to solvents.</i> Some painters use solvents to remove paints that have spilled on their hands and arms—a practice that clearly results in significant dermal exposures to toxic chemicals. Painters can avoid this source of exposure completely by using nonhazardous cleaning agents to wash their hands and arms. (Note, painters can also prevent the need for cleaning their hands and arms in the first place by wearing gloves and paint suits while handling painting materials.)
	Providing adequate ventilation.	<i>Significant reduction in inhalation exposures to solvent vapors.</i> Paint mixing rooms typically contain many sources of organic vapors, including open paint containers, paint waste drums, and gun cleaners. Shop owners can minimize the accumulation of these vapors by installing ventilation systems that are specifically designed to remove organic vapors from the paint mixing room and to prevent the vapors from entering workers' breathing zones.
	Closing all containers of painting materials immediately after their use.	<i>Significant reduction in inhalation exposures to solvent vapors.</i> Evaporative losses of volatile constituents will occur from virtually any open or partially-open container of paint materials. Painters can effectively minimize these evaporative losses, which in turn will reduce inhalation exposures to organic vapors, by closing all containers of paint materials immediately after their use.
Spraying: (1) spray guns	Using high-volume, low-pressure (HVLP) spray guns to spray primers, basecoats, and clearcoats.	<i>Significant reduction in inhalation and dermal exposure to paint overspray.</i> When operated correctly, HVLP spray guns have notably higher transfer efficiencies than conventional spray guns. The higher transfer efficiency means more paint materials end up on the car part being painted rather than in the work place air.
	Consulting with paint distributors and gun manufacturers to determine the HVLP gun settings that optimize transfer efficiencies.	<i>Moderate reduction in inhalation and dermal exposure to paint overspray.</i> The transfer efficiency of HVLP guns, and therefore the amount of paint overspray generated, is highly dependent on the gun settings that a painter selects (e.g., pressure in the air feed line) and on the painter's spraying technique. Paint distributors and spray gun manufacturers might have tips for helping painters improve their transfer efficiencies when using HVLP guns.

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Spraying: (1) spray guns (Continued)	Training painters on proper spraying techniques.	<i>Moderate reduction in inhalation and dermal exposure to paint overspray.</i> Studies have shown that, through certain training programs, painters can increase their spray transfer efficiencies by improving certain elements of their paint spraying techniques. As noted earlier, increased transfer efficiencies mean more chemicals are applied to cars and less are emitted to the work place air.
Spraying: (2) spray booths	Performing as many spraying tasks as possible, and all clearcoat spraying tasks, in ventilated spray booths.	<i>Significant reduction in inhalation and dermal exposure to paint overspray.</i> Properly maintained ventilated spray booths efficiently remove paint overspray from workers' breathing zones, thus minimizing worker exposures to potentially hazardous overspray. Downdraft spray booths typically provide the most effective ventilation and thus the best protection. Spray booths offer an added benefit of providing controlled flow of dust-free air over freshly painted car parts. For optimal protection against exposure to paints and diisocyanates, workers should always wear adequate PPE while spraying paints (see below).
	Ensuring the continued effectiveness of spray booths through regular filter changes and maintenance procedures.	<i>Moderate reduction in dermal and inhalation exposure to paint overspray.</i> By developing and strictly following a spray booth maintenance schedule, painters can ensure consistent air exchanges in spray booths and steady flow patterns of clean air through spray booths. Consistent air exchanges are needed to remove paint overspray from workers' breathing zones and steady flow patterns help provide a high quality finish on painted cars.
	Continue running spray booths after completing jobs and after curing cycles, such that the booths vent all airborne vapors before workers re-enter the booths.	<i>Moderate reduction in dermal and inhalation exposure to paint overspray.</i> Some quantities of paint overspray may linger in spray booths after painters apply primers, basecoats, and clearcoats. To ensure ventilation systems remove all overspray from spray booths, painters should run the booth for several minutes after applying primers and basecoats. For spray booths with "curing" or "baking" options, painters should vent the booth for 5–10 minute after the curing cycle is complete to remove any vapors emitted from the coating during the curing process. (Note, several booth models have cool down cycles that automatically vent the booth with fresh air at the end of the curing cycle.)

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Spraying: (3) PPE	Installing and using supplied-air respirator systems in spray booths.	<i>Significant reduction in inhalation exposures to paint overspray.</i> Based on the results of several exposure monitoring studies conducted in the auto refinish industry, the National Institute for Occupational Safety and Health (NIOSH) has recommended that painters use supplied-air respirators during all spraying operations, even those performed in downdraft spray booths. Supplied-air systems typically provide far superior respiratory protection to workers than air-purifying respirators, and these systems also eliminate concerns regarding cartridge change-out procedures and, depending on the type of facemask used, concerns that employees may not achieve proper face to facepiece seals.
	Wearing gloves, paint suits, and head socks while spraying cars.	<i>Significant reduction in dermal exposures to paint overspray.</i> Paint spraying operations generate a visible cloud of overspray that clearly has the potential to contact any parts of painters' bodies that are exposed. Painters can prevent such exposures by covering as much exposed skin as possible while spraying car parts. Excellent protection can be achieved by consistent use of gloves, paint suits, and head socks. Using this dermal protection also prevents employees from inadvertently exposing family members to painting materials, which might have otherwise settled on painters' clothes.
	Ensuring that painters consistently wear the required PPE.	<i>Significant reduction in dermal and inhalation exposures to all substances.</i> Clearly, purchasing PPE for painters is of little benefit if painters do not consistently wear and maintain the required PPE. Because one-time exposures to diisocyanates have been linked to adverse health effects, it is especially important for painters to wear PPE every time they work with paint mixtures containing diisocyanates. Therefore, shop owners should play an active role in ensuring (1) that painters understand why they should wear PPE and (2) that painters consistently wear PPE.
	Implementing change-out procedures for air-purifying respirator (APR) cartridges.	<i>Moderate reduction in inhalation exposures to paint overspray.</i> Most APRs have recommended "change-out" cycles, which indicate the duration of time that the respirator cartridges can be safely used before they become saturated and no longer protect the user. To avoid unnecessary inhalation exposures as a result of painters using respirator cartridges longer than their recommended service lives, auto refinish shops should have formal change out procedures. (Note, such schedules are now required under OSHA's Respiratory Protection Standard.)

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Task	Safe Work Practice	Impact on Worker Exposure
Spraying: (3) PPE (Continued)	Consulting with painters when selecting PPE.	<i>Moderate reduction in dermal and inhalation exposures to all substances.</i> Because painters (and not shop owners) ultimately wear PPE, it is important that shop owners select PPE that painters will be comfortable wearing. To reach this end, shop owners should work closely with painters whenever selecting and purchasing PPE.
Gun cleaning	Performing gun cleaning tasks in a well ventilated area.	<i>Significant reduction in inhalation exposures to solvent vapors.</i> Gun cleaning, whether automated or manual, typically involves the use of volatile solvents to remove residual paint materials from spray guns. By placing gun cleaners and by performing manual gun cleaning in well ventilated areas, such as in a ventilated mixing room or immediately adjacent to a downdraft prep area, painters can help ensure that solvent vapors generated by cleaning operations are quickly removed from workers' breathing zones.
	Wearing gloves, paint suits, and respirators when cleaning guns.	<i>Significant reduction in dermal and inhalation exposures to solvent vapors.</i> Because gun cleaning involves use of volatile liquids, painters are susceptible to significant dermal and inhalation exposures while cleaning guns. Painters can protect themselves from these exposures by wearing gloves, paint suits, and properly maintained respirators with organic vapor cartridges when cleaning guns. Use of PPE during gun cleaning should not be particularly burdensome, especially since painters should already be wearing PPE when spraying paints—the task that usually immediately precedes gun cleaning.
	Purchasing gun cleaning equipment that painters will use.	<i>Moderate reduction in inhalation exposures to solvent vapors.</i> Many auto refinish shops have automated gun cleaners that painters do not use, generally because some painters do not believe automated units can effectively remove trace amounts of impurities from the spray guns. Because gun cleaning tasks are potentially significant sources of inhalation exposures to solvents, shop owners and painters should work together to identify gun cleaning technologies that painters will actually use. Shops should consider using gun cleaners on a free "trial basis" (an option provided by some distributors) before purchasing any units.

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Task	Safe Work Practice	Impact on Worker Exposure
Gun cleaning (Continued)	Getting conventional gun cleaning systems to work.	<i>Moderate reduction in inhalation exposures to solvent vapors.</i> Some painters choose not to use automated gun cleaners because the cleaning solvents get contaminated with residual paint too quickly. Shops should investigate alternative approaches for using automated gun cleaners in a manner that optimizes the use of cleaning solvents (e.g., using two gun cleaners, one with “dirtier” solvents dedicated to initial cleaning and rinsing and one with “cleaner” solvents dedicated to final removal of trace impurities; instructing painters to rinse spray gun cups with a small amount of solvent and to dump the solvent and excess paint into a waste barrel prior to putting the spray gun and cup in the cleaner).
	Maintaining automated gun cleaners.	<i>Moderate reduction in inhalation exposures to solvent vapors.</i> Air quality measurements taken in auto refinish shops have shown that automated gun cleaners can be the greatest source of solvent vapors in the work place. Because loose fittings, leaking hoses, and other poorly maintained parts can increase solvent vapor emissions from cleaning units, painters should frequently inspect gun cleaners and promptly perform necessary maintenance tasks.
	Not allowing unsafe manual cleaning procedures.	<i>Moderate reduction in inhalation exposures to solvent vapors.</i> Some painters use gun cleaning approaches that can contribute to significant exposures, such as spraying “clean” solvents under pressure as a final cleaning stage or dipping spray guns in open containers of solvent. Shop owners and painters should work together to decide which gun cleaning approaches are clearly unsafe. Under no circumstance should painters clean guns by spraying solvents under pressure in the open shop air.
	Shops should implement gun cleaning procedures that require reuse of cleaning solvents.	<i>No reduction in inhalation exposures to solvent vapors.</i> Re-use of cleaning solvents, to the greatest extent possible, helps auto refinish shops optimize their use of raw materials. Although re-use of solvents does not necessarily result in a reduction in the amount of evaporative losses (and worker exposures), the practice of re-using solvents is encouraged from an environmental and economic perspective.

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Waste management	Ensuring that recycling operations do not emit significant quantities of solvent vapors into areas in which painters work.	<i>Significant reduction in inhalation exposures to solvent vapors.</i> Evaporative losses of solvents from solvent recycling units are known to occur, especially through loose fittings or leaking connections. Shop owners can minimize worker exposures to these evaporative losses either by moving solvent recycling units away from where painters work or by placing solvent recycling units in well-ventilated areas and by immediately fixing loose or leaking fittings.
	Ensuring that paint and waste containers are closed throughout the work day.	<i>Moderate reduction in inhalation exposures to solvent vapors.</i> As noted earlier, most paint materials contain significant quantities of volatile constituents that can readily evaporate into the workplace unless stored in closed containers. Therefore, painters should ensure that containers of waste paint are always closed, possibly by using specially designed funnels equipped with lids to prevent escape of vapors from drums into which workers frequently pour wastes.
	Placing waste paint drums atop spill containment pallets.	<i>Marginal reduction in dermal and inhalation exposures to waste paints.</i> Most auto refinish shops store waste paints in 55-gallon drums. Storing these (and other) drums atop containment pallets can help mitigate the potential consequences of leaks and spills.
Health and safety training and management	Providing initial training to new employees and periodic refresher training to all other employees on important health and safety topics.	<i>Significant reduction in worker exposures.</i> Because painters' working habits have a strong impact on how safely painters refinish cars, shop owners should develop and implement training programs to ensure that painters understand and consistently follow safe working practices. More specifically, shop owners should (1) administer initial training to all new hires to ensure that new employees do not develop unsafe working habits and (2) administer refresher training to all employees to ensure that they continue to appreciate, and protect themselves from, the hazards of the workplace.

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Task	Safe Work Practice	Impact on Worker Exposure
Health and safety training and management (Continued)	Taking advantage of free training courses that paint distributors, insurance carriers, and equipment manufacturers are known to offer.	<i>Significant reduction in worker exposures.</i> Paint distributors and PPE distributors often offer training on safe work practices for auto refinishing, sometimes at no cost to the shop. Shop owners should take advantage of these training resources, which can educate painters on important health and safety concepts that may have been overlooked in training offered by the shops.
	Developing and implementing effective hazard communication programs and respiratory protection programs.	<i>Significant reduction in worker exposures.</i> A hazard communication program documents a facility's plan for informing employees of the specific hazards posed by working with hazardous chemicals. By knowing the specific hazards posed by primers, basecoats, clearcoats, and solvents, painters may be more likely to protect themselves from the hazards. A respiratory protection program documents a facility's plan for ensuring that all employees adequately protect themselves from unhealthy inhalation exposures. These programs generally indicate when respiratory protection is necessary, what kind of respiratory protection should be used, and how the shop can assess the effectiveness of the program (e.g., by periodic medical evaluations). Both programs are regulatory requirements of the Occupational Safety and Health Administration (OSHA).
	Assigning an employee or hiring a consultant to oversee and implement the safe work practices listed throughout this table.	<i>Significant reduction in worker exposures.</i> Shop owners generally do not have enough time to both manage business items and ensure that painters perform auto refinishing tasks safely. To effectively implement safe work practices, shop owners should consider designating an employee, or possibly hiring a consultant, as the shop's "safety manager." This employee (or consultant) should work closely with the shop owner, the painters, paint distributors, PPE distributors, and equipment manufacturers to ensure a safe working environment for the auto refinishing process.
	Conducting periodic inspections of auto refinishing operations.	<i>Moderate reduction in worker exposures.</i> Although auto refinish shops might have health and safety policies and standard operating procedures, painters may not always follow them, especially guidelines for wearing PPE. By requiring periodic safety inspections of the auto refinishing process, shop owners can identify and promptly correct unsafe work practices.