



POLLUTION PREVENTION OPPORTUNITIES FOR PAINTING & COATINGS OPERATIONS

PAINTING & COATINGS PROFILE

The painting and coatings industry uses chemical compounds to protect product workpieces and/or distinguish them from other workpiece parts and products. Historically, paints and coatings have been diluted with organic solvents that help carry the coating from the applicator to the workpiece. Organic solvents often contain volatile organic compounds (VOCs).

SOURCE REDUCTION - POLLUTION PREVENTION

Pollution prevention is the elimination or reduction of the amount or toxicity of waste produced within the manufacturing process. It allows businesses and corporations to:

- Save money, reduce operating costs and generate income from wastes.
- Reduce liability and improve public image.
- Improve product finish.
- Protect their employees, the public and the environment.
- Increase efficiency and productivity.
- Solve disposal problems created by land bans.

Within the painting and coatings industry pollution prevention is often achieved through reductions in solvent and overspray.

PAINT AND COATINGS APPLICATION

Until recently, the most common applicator has been the conventional hand-held sprayer. Applying solvent-based coatings with conventional sprayers releases VOCs that contribute ozone buildup in the lower atmosphere. More recently new applicator technologies have been developed to reduce these solvent emissions. Alternative applications are outlined in the chart at right.

Alternative Solvent Based Coating Applications

The air-atomized (AA) spray gun is used most often to apply solvent-based paint. Transfer efficiency – 30-60 percent.

The AA spray gun may be replaced with one of the following (transfer efficiency – 65-99 percent):

- Roller/curtain coating produces a curtain of spray at a 90° angle while products pass underneath on a conveyor belt. Ideal for flat or flexible surfaces. Transfer efficiency – 90-98 percent.
- Tumbling, barreling & centrifuging all use barrels to rotate products or parts in a coating. Most common when painting large number of small items. Requires higher level of operator experience/training.
- High-volume, low pressure (HVLP) spray can be applied with turbine-powered or compressed air systems. the turbine system generates large quantities of air heated to a consistent 110°F (approximate), and applies coatings as fast as AA spray guns. Compressed air is hose-fed, regulated to around 10 psi; it is not as efficient as the turbine system. Transfer efficiency – 67-70 percent.

High Solids

These coatings are similar to current solvent-based formulas, but a change in the resin systems provides a greater concentration of solids (25-60 percent) and lower concentration of VOC solvents. This results in a comparable finish with reduced VOC emissions. Special spray guns are required to apply high-solids coatings. Transfer efficiency – 65-85 percent, depending on the application method and the operator's skill.

POLLUTION PREVENTION IN THE PAINTING & COATINGS INDUSTRY

Dry Powder Coatings low or no VOCs	Fluidized Bed Coating is applied by pre-heating a workpiece and placing it in a reservoir of powder through which an air stream is passed. The powder fuses to the product and is cured in a conventional oven. Ideal for coatings 10-60 mil thick on small items. Powder Coatings are given a positive electrostatic charge and applied with a compressed-air gun to workpieces that have grounded, which causes the powder to adhere. The coating is cured in a conventional oven. The powder that doesn't adhere is collected and restored to the main supply. Powder coatings give a uniform thickness to complex surfaces, and produce almost no VOC emissions. Transfer efficiency – 90-99 percent.	Water-Based Coatings & Applications	Water-based coatings are most effective when product aesthetics are a high priority and product protection is not. Most solvent-based systems can be modified without major equipment changes, with the exception of a water-based electrostatic applicator. <i>Applications</i> – Aside from spray guns, dipping is one of the most common application methods. Products as large and complex as automobile bodies can be dipped as long as the product's run-off points are not noticeable after curing. Dipping can be used for electrocoating, where the paint is electrically charged in the dip tank and the product grounded. The paint adheres evenly, regardless of the complexity of the product surface. Efficiency – 90-99 percent.
Electrostatic & Nonelectrostatic Applications	Electrostatic charges for atomization can be obtained by air or centrifugally, through bells or spinning discs. They may be applied by conventional means or by grounding the product and charging the coating or applicator tip. Although employed most commonly for metal, the technique can be used for wood and other nonconductive materials by applying a special primer that will conduct a charge. Transfer efficiency (for centrifugal systems) – 85-95 percent. Air-atomized spray is the conventional application method. The operator controls the gun and applies the coating manually, or the gun is stationary while products are moved on an assembly line. Transfer efficiency – 65-85 percent. Airless/air-assisted sprays use lower volumes of air to produce finer sprays than air-atomized sprays. Airless spray is produced by a hydraulic pump. Air-assisted spray uses both air and hydraulic pressure to atomize the paint. Both are ideal for large workpieces or large numbers of them. Transfer efficiency – 65-70 percent.	Radiation-Curable Coatings	Radiation curings are applied as a liquid reactive monomer using high energy radiation, such as: ultraviolet, which cures with photoinitiators; infrared, which cures by a photochemical reaction; or electron beam, which polymerizes the coating instantly. <i>Applications</i> – An example of radiation curing is a three-layer technique called sputter coating. A metal is used for the middle layer. The top and bottom layers are solvent- or water-based coating. The bottom layer can be applied either electrostatically or conventionally. Both the top and bottom layers are cured by radiation.
		New Technologies	Today's innovations will increase tomorrow's business efficiency and profit while reducing wastes and environmental toxins. Only limited information is available now, but here's a preview of things to come: ● Liquid coatings contain no VOCs or water. ● Zero-Solvent Water-Borne Coatings. ● Vapor Injection Curings (VIC) apply polyurethanes. Mixing occurs outside the gun between two spray tips. ● Reactive Diluent coatings are low viscous resins mixed with polyurethanes.

Paint Stripping Methods	<i>Noncaustic Paint Removers</i> (e.g., alkaline, non-phenolic) are now on the market to replace phenolic strippers, which release acid, acid fumes and vocs into the environment. the noncaustic stripper remove paint without the harmful side effects.	<i>Cryogenic Coating Removal (CCR)</i> treats a product with liquid nitrogen (NO ₂) to make the coating brittle, then propels plastic beads at it. The stripped paint is collected with the beads and disposed of properly.
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GOOD OPERATING PRACTICES

Many painting and coatings companies have significantly reduced VOC contamination and land-problems with simple procedures based on common sense. Examples are outlined in the chart below.

GOOD OPERATING PRACTICES	
Improved Managerial Practices	Train employees, operate equipment properly and develop management initiatives. Install high-efficiency applicators. label and record use and disposal of paints, coatings and waste. Use proper handling, storage, tracking and inventory control methods. Schedule well and practice time management.
Prevention Practices	Prevent spills, prepare for emergencies. Practice regular preventive maintenance. Use low-volume water cleaning systems. Use tanks with nonstick surfaces such as Teflon™. Scrape sides of tank manually or with automated system. Install tanks with a length-to-diameter ratio of 1:1.
Waste Prevention Practices	Purchase only the amount of paint needed. Clean bags and drums used to ship paints. Avoid using bags for shipping. Replace lids on opened paint containers. Don't open a new container if one is open. Use computers to access accurate data on paint mixing, chemical ingredients, etc. Replace lids on batch tanks to prevent dust loss and evaporation of solvents. Assign specific equipment to handle specific paint types and colors. Schedule paint color changes from light to dark to reduce cleaning frequency. Lower air pressure on conventional spray guns. Recycle paint overspray. Scrape dry paint before using thinner. Use less toxic cleaning solutions. Eliminate caustic solutions if tanks are wet. Let cleaning solvent soak in tank, then mix it into the next batch of paint. Segregate cleanup solvents and recover/reuse them. Blend wastes with fuel. Sell or use waste as primer or industrial coating, or donate it to nonprofit organizations.

SUCSESSES FROM PENNSYLVANIA COMPANIES

Company Name and Location	Application Alternative	Cost Savings
True Temper Hardware Company Camp Hill, Pa.	Vacuum Coating System/Ultraviolet Curing 100 percent transfer efficiency*	About \$253,700 per year
Moore Products Company Spring House, Pa.	Automated Powder Coating 95-98 percent transfer efficiency*	About \$25,000 per year
Pennsylvania House Lewisburg, Pa.	Water Based Flat Line Roller Coater 100 percent transfer efficiency*	About \$80,000 per year
Dresser Manufacturing Division Bradford, Pa.	Water Borne Acrylic - low VOC ?? transfer efficiency*	About \$27,700 per year
Spriax Sarco Allentown, Pa.	Automated Powder Coating 95-98 percent transfer efficiency*	About \$257,500 per year
Chamberlain Manufacturing Corporation Scranton, Pa.	Low VOC High Solid Paint ?? transfer efficiency*	Not broken down for painting operation
Dana Corporation Lancaster, Pa.	Reduced amount of painting performed - details incomplete in Governor's Environmental Excellence Awards write-up*	Reduced cost per product item about 28 percent

For more information about pollution prevention approaches contact:

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This fact sheet and related environmental information are available electronically via Internet. Access the DEP website at <http://www.dep.state.pa.us> (choose Information by Subject/Pollution Prevention and Compliance Assistance).