

Mobile UV Market Review and Safety Guidelines

By Michael Kelly

Ultraviolet (UV) technology has been utilized by manufacturing for several decades, ranging from wood flooring applications to the graphic ink marketplace. Many other markets utilize UV coatings to increase their production, reduce their energy costs and floor space, and provide an overall cleaner solution.

In 2009, approximately 105,000 tons of UV coatings were shipped in the United States with many times more shipped worldwide. UV applications can run the gamut, from brake drums and conduits to tire rims and concrete floors.

For the past several years, UV lighting technology has become mobile and new field-applied markets have evolved. This is commonly referred to as “Mobile UV.” This article will provide a cursory review of the Mobile UV marketplace, specific examples and

a review of the safety guidelines when utilizing this technology.

Mobile UV applications include:

- Bathtub refinishing
- Countertop/Tile refinishing
- Flooring Concrete/VCT/Wood
- Anti-graffiti
- Touch-up applications
- Marine
- Architectural
- Autobody refinishing
- And many others

The question needs to be asked, “Why is UV technology being utilized in mobile applications?” The answers are diverse.

Economics of UV

The overall economics of Mobile UV eliminates wasted application time—mainly due to the fact that UV cures typically in less than a few seconds. This dramatically reduces the amount of spent time on-site at the customer’s location, which provides for significant manpower cost savings.

- Most UV coatings utilized in these markets are 100% solids, which is defined as a coating that contains no solvent and no water or filler material. It also provides 1,604 square feet of coverage at 1 mil.
- Typical water-based coatings are 45-50% solids that provide 721.8 to 802 square feet of coverage at 1 mil.
- Typical solvent-based coatings are 30-35% solids that provide 481.2 to 561.4 square feet of coverage at 1 mil.

FIGURE 1

Examples of UV applications



Brake Drum



Metal Containers



Color Conduit



UV Curing of Tanks

FIGURE 2

UV can be used to coat concrete floors and countertops



Based on the coverage data observations described previously, UV 100% solids coatings will typically cost more per gallon, but provide two to three times more total coverage compared to water- and solvent-based.

UV coatings provide the following additional economic benefits:

- More coverage per gallon
- Lower freight costs (paying for all

coating; no carriers like solvent and water that evaporates)

- Less waste of containers and time handling

Process Simplification

UV technology cures in seconds with a portable UV-curing light. While process and safety training is a requirement, once the operator has

been properly trained, the overall process is much simplified.

Application Equipment

UV-curing equipment has improved dramatically over the past two years, which includes the following:

- Overall equipment durability
- Continued cost-reduction efforts
- Ease-of-use improvements
- Safety enhancements (very important)
- Improved portability and packaging

Safety Enhancements

UV Equipment manufacturers have worked diligently with end-use customers on improving the safety aspects of their handheld and floor curing units.

Jelight has always shipped a complete safety package with each UV light. Each package includes UV face shield protection, UV-resistant clothing, UV-resistant gloves and a large UV “Caution” sign. In addition, Jelight’s UV bulbs are doped quartz, which reduces ozone output by a minimum of 95%.

HIDUV has supplied their handheld devices with integral range-finder sensors that will shut down the UV light if it is tilted into a non-safe position and has also included other unique safety options.

When considering the purchase of UV-curing equipment, a complete review of the functionality of the unit and its safety features is very important and should be undertaken.

Coatings Technology

While UV-coating technology has continued to improve over the years, there has been a migration of



Photo courtesy of Jelight

FIGURE 3

UV curing countertop with appropriate safety equipment



Photo courtesy of PBRA

this technology to meet the needs of these mobile type markets. The coating formulators have listened and delivered coatings to meet specific application and specification requirements.

For example, take a look at the bathtub refinishing marketplace. This market is served by a variety of different solvent and catalyzed coating solutions—all of which have positives and negatives. Specific coating and application requirements were defined by key leaders in the bathtub refinishing market and, working in partnership, they developed a unique UV solution. Based on defined requirements, a 2K-catalyzed, UV-color solution was developed, delivering the following:

- **Multiple colors**—This flexible offering meets their customers' needs.
- **One-coat application**—Using UV means no intercoat adhesion issues.
- **Fully opaque**—There are no multiple coats required.
- **Quick Cure**—The tub is operational within hours.

Sustainability (Green) Requirements

100% solids UV formulations offer the environmental benefits of no Volatile Organic Compounds (VOCs),

FIGURE 4

UV floor coating pigmented gray



Photo courtesy of Allied PhotoChemical, Inc./Aadastra floor curing unit

FIGURE 5

Overall equipment durability examples



Photo courtesy of HIDUV

Photo courtesy of Jelight

Photo courtesy of HIDUV

FIGURE 6

Portability of Equipment



Photo courtesy of Jelight

no Hazardous Air Pollutants (HAPs) and no N Vinyl Pyrollidines (NVPs). They also contain no solvents and are shipped with minimal issues. Typically, safer work conditions apply to the use of UV-cured coatings. Also, minimal reporting to local environmental entities will occur.

Safety, Safety, Safety

UV curing should be regarded as a technology that requires respectful caution. The main issues include the following:

- Ultraviolet radiation
- Ozone
- Lamp handling
- Poor judgment



Photo courtesy of EIT

A Note About Safety

The first and most important thing to remember about safety is *common sense*. UV technology has some level of inherent danger to it, just as users need common sense when using a chainsaw or other equipment requiring caution.

FIGURE 7

Ease of operation—Bulldog model



Photo courtesy of HIDUV

FIGURE 8

Mako-T with rangefinder, E-stop, etc.



Pay Attention and Be Careful

Safety is key with any technology—persistent and consistent awareness to safety is critical to your business success. Outlined in the following text

are the important safety considerations to be understood.

Ultraviolet Radiation

Electromagnetic radiation provides

TABLE 1

EM radiation overview

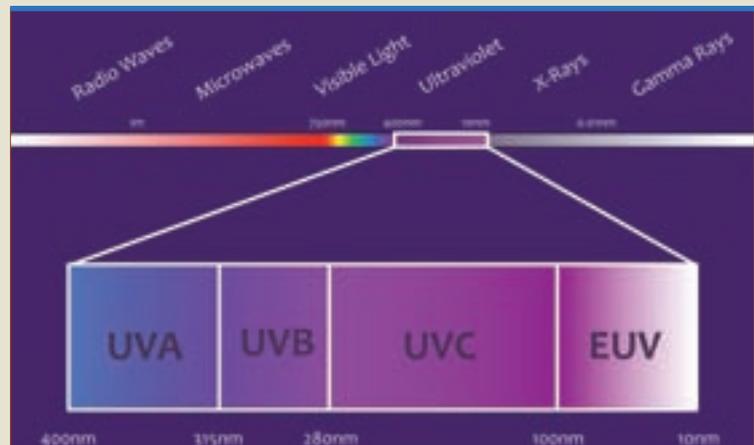


Photo courtesy of HIDUV

TABLE 2

Lamp output example

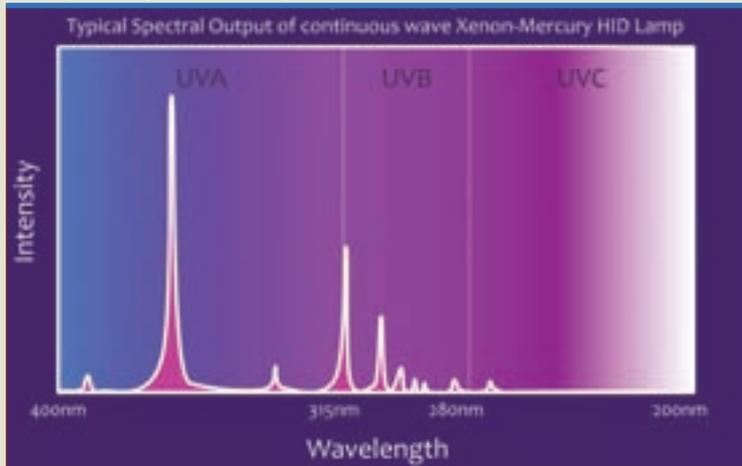


Photo courtesy of HIDUV

a graphical review of the broad span of the EM Radiation spectrum. See Table 1. Ultraviolet radiation includes the UVA, UVB, UVC and UVV spectrums.

Dangers of UV Exposure

UV coating technology has been utilized safely in fixed manufacturing for decades—in applications ranging from digital printing to wood flooring. Proper safety training programs have been implemented along with continued improvement and updates to ensure that safety is a priority. Outlined below are some additional details:

- Photokeratitis (Arc eye) and photoconjunctivitis may result from overexposure to UV radiation.
- These conditions can be very painful and lead to temporary blindness while the eye heals itself.
- Onset may be delayed by several hours after exposure.
- Long-term exposure to UVA may contribute to the formation of cataracts.
- Certain prescription drugs can render people more sensitive to UV exposure.

Each UV band penetrates the skin differently. UVA will penetrate the deepest and overexposure can lead to cosmetic damage (aging effects). UVC won't penetrate deeply past layers of dead skin, but it can still cause damage to the top layer of live cells. Without proper protection, each band can cause skin cancer.

UV Reflection

Secondary reflections off walls can result in 30 times more unwanted UV exposure when UV is used next to walls, making complete face shields a requirement. Similarly, exposure is higher when approaching walls. Remember—you can't see ultraviolet and it does reflect!

TABLE 3

UV exposure issues

	UVA	UVB	UVC
Eye – Cornea	-	Photokeratitis (Arc Eye)	Photokeratitis (Arc Eye)
Eye – Aqueous	Absorption	Absorption	-
Eye – Lens	Cataracts	Cataracts	-
Skin	Skin Cancer, Aging Effects	Sunburn, Skin Cancer	Skin Cancer

Photo courtesy of HIDUV

FIGURE 9

Graphical representation of reflected UV energy



Photo courtesy of HIDUV

Skin Protection

Outlined below are requirements when curing with mobile UV devices:

- Full-skin protection is recommended around portable UV-curing equipment.
- Full-face shields will protect both the eyes and the skin of the face.
- Plain cotton clothing will typically reduce the UVB and UVC exposure by more than 80 percent, but won't block UVA very well.
- Dyed fabrics will usually block UV better, but the only way to be certain about protection is dedicated UV safety gear.
- Many companies sell UV stabilized Tyvek suits for use in UV curing. They block 98% of UV.

FIGURE 10

Protective clothing



Photo courtesy of HIDUV

Eye Protection

Any eyewear must protect from the sides—even indirect UV exposure is hazardous. Anyone in the area being cured must be wearing protection. A user standing alongside the machine may receive more exposure than the operator! Eye protection must have a full-face shield to insure adequate

FIGURE 11

Recommended safety gear for mobile UV applications



Photo courtesy of HIDUV

protection from UV. To be certain of the effectiveness of your protective wear and safety equipment, it should meet ANSI Z87.1 or EN 166:2002 standards.

FIGURE 12

Example of full-face shield



Glasses— not recommended



Photos courtesy of HIDUV

What is Ozone?

Ozone is a colorless gas in normal concentrations, a very strong oxidizer, and a pollutant at ground level. After a thunderstorm, the sharp 'fresh' smell produced by the lightning is ozone. Ozone is found in the upper atmosphere to block out UV (the ozone layer). Ozone is detectable by most people in concentrations as low as 10ppb.

Ozone and People

Some people can be adversely affected (respiratory problems) by ozone in concentrations as low as 40ppb. Exposure to concentrations above 105ppb for eight hours is considered "unhealthy" by the EPA. Above 125ppb is considered "very unhealthy." Occupational Safety and Health Administration (OSHA) regulations limit exposure to 100ppb averaged over eight hours. The National Institute for Occupational Safety and Health has established concentrations of 500ppb as "Immediately Dangerous to Life and Health."

Health Effects of Ozone

Ozone exposure has been linked to many cardiopulmonary problems, including asthma, bronchitis, heart attacks and premature death. Ozone can cause eye irritation. Ozone can convert cholesterol in the blood into plaque, thus hardening arteries and causing heart disease.

UV sources will typically produce some quantity of ozone, as UV light interacts with oxygen in the air. Some manufacturers such as Jelight utilize doped mercury lamps, which can reduce ozone emissions up to 95 percent. Stationary hot lamps will generate the least ozone due to thermal decomposition. Immediately after the ozone is created by the UV radiation, it is destroyed by the extremely high temperature of the lamp. Shielding around the lamp may help to contain some ozone, so that the hot lamp can destroy it.

Safety Equipment for Ozone

There are various companies that sell portable ozone detectors. There are versions that can tell you the level of ozone, and other less expensive versions that light up to tell you when you're over the safe limit. Cards or badges which change color depending on the ozone concentration also exist, but are typically only good for a single use.

Safety Regulations

Ozone and mercury are regulated—but, as of today in the U.S., UV radiation exposure is not regulated by OSHA. Given the sudden rise in site-applied UV coatings, this may change in the near future. UV-curing equipment is typically classified IEC12198-1 Category 2 due to the high amount of UV emitted, which indicates that special measures must be taken during use and protective equipment must be worn.

FIGURE 13



UV Lamps

Proper handling of UV lamps is critical. Never allow your skin to touch a lamp as oil from hands will damage a lamp, eventually causing it to burst.

FIGURE 14



If accidentally handled by bare skin, wipe the lamp off with high-percentage isopropyl alcohol. If the lamp requires cleaning, please utilize denatured alcohol and lint-free cloths. Lamps must be disposed of properly. Please review your local regulations as they can vary from state to state. Check before throwing out a lamp. If no proper disposal site is available, the EPA recommends double bagging the lamp before disposal.

Safety Review

The first and most important thing to remember about safety is *common sense*. UV technology has some level of inherent danger.

Pay Attention and Be Careful

Conclusion

UV-coating technology has been utilized for decades in fixed manufacturing and has recently been expanding into the mobile

FIGURE 14

UV-curable paints



UV marketplace. The combination of UV coatings, mobile UV-curing equipment and proper safety training have opened many new opportunities in the marketplace. This mobile UV technology offers greater economic savings, reduced overall manpower and a true green solution.

Mobile UV offers:

- Innovative UV-curing equipment
 - Built-in safety features
 - Durability
 - Portability
 - Maximum coverage
 - No VOCs, HAPs or NVPs
 - Non-flammability
 - All colors
 - Rollable, brushable, sprayable
- ...and more. ▶

—Michael Kelly is CEO/president of Allied PhotoChemical, Kimball, Mich.

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