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NOTE TO USERS:

This document provides information about the Clean Air Act (CAA) and the Environmental Protection Agency's regulations under the CAA and discusses various means of complying with the requirements through the installation of ultraviolet/electron beaming (UV/EB) technology. The information provided in this document is offered in good faith and believed to be reliable, but is made WITHOUT WARRANTY, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER MATTER.

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"[Due to] EPA's regulations in the 1970s and 1980s to reduce emissions of smog-forming volatile organic compounds from coating and printing operations. . . Industry developed powder coatings and ultraviolet light cured coatings that not only reduced emissions to the EPA required levels, but essentially eliminated emissions altogether. In addition to saving industry the high cost of equipment for the collection and destruction of volatile organic compounds, these coatings provide for faster production, improved efficiency, reduction in energy costs and frequently improved performance. The coating industry has since developed new export markets. The combination of the Clean Air Act and the European goal of zero emissions of volatile organic compounds (VOC) is driving the industry to develop new techniques. Although the coating industry as a whole predicts growth of two to three percent, the powder and UV-cured coatings are growing much faster to meet the needs of customers to reduce emissions of volatile organic compounds."

Testimony of Carol M. Browner, Administrator of the U.S. Environmental Protection Agency (EPA), before U.S. Senate Committee on Environment and Public Works on February 12, 1997, portraying the use of UV-cured coatings by the coating and printing sectors as an example of an innovative and cost-effective approach taken by industry to reduce air pollution.

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Executive Summary

How can ultraviolet and electron beam curing (UV/EB) technology help your company meet Clean Air Act obligations? UV/EB technology has distinct advantages in the use of various coatings in such industries as wood furniture manufacturing, printing and publishing, adhesives, powders & inks, can coating, plastics, metals, glass, and automatizes, among others. A significant advantage of UV/EB technology is that it virtually eliminates emissions of volatile organic compounds (VOCs), that the Environmental Protection Agency (EPA) regulates as ozone precursors and as hazardous air pollutants (HAPs) under the Federal Clean Air Act. Many of these VOCs have state ambient air emission control levels associated with them. The investment in UV/EB technology will provide long term returns in the form of pollution prevention, lower environmental compliance costs, energy efficiency, and higher productivity.

By virtually eliminating emissions of VOCs, the use of UV/EB technology could mean that a company will have:

Minimal or no state and federal clean air operating permit requirements.
Low or no clean air permit fees, and increased energy efficiency and productivity.
No new compliance assurance monitoring (CAM) equipment requirements.
Marketable "emissions credits" that may be sold or used or banked for later use.

Technology that easily meets states' standards for "reasonably available control technology" (RACT) and also meets "lowest achievable emission rate" (LAER) equipment requirements in ozone "non-attainment" areas.
An equipment alternative for "best available control technology" (BACT) for facilities located in ozone "attainment" areas.
A "maximum achievable control technology" (MACT) candidate for reducing HAP emissions in selected industries.
A marketable technology for products that need to reduce their VOC emissions under EPA's "Consumer and Commercial Product VOC Rules."
As discussed in this paper, these benefits represent literally thousands of dollars per facility in permit fees, compliance costs, construction, and maintenance that a company can direct elsewhere.
Federal and state regulators are beginning to appreciate the benefits of UV/EB curing technology in meeting Clean Air Act requirements. For example, UV/EB qualifies as a "low solvent" technology and receives mention in EPA's regulations to control HAP emissions in the printing and publishing industry and wood furniture manufacturing operations.

Also, this paper identifies ways that end users of UV/EB can approach states to incorporate UV/EB in state implementation plans, in the state permitting process , and in meeting the state's ambient air limits for VOCs. RadTech International North America has achieved significant success in the State of California to ensure that the use of UV/EB technology is exempt from the state's Clean Air permit programs. The success of RadTech's efforts in California may be useful in the future to convey the merit of UV/EB coatings for Clean Air compliance to regulators in other key states, such as New Jersey, New York, North Carolina, Texas, Illinois, Ohio, Massachusetts, Florida, and Pennsylvania.

Clearly, there are great opportunities for companies to incorporate UV/EB technology now and in the future to achieve Clean Air compliance. EPA will enforce a more strict ozone standard over the next ten years, and UV/EB will be able to meet the associated emission level requirements for VOCs in geographical regions that will not meet the attainment standard of the new rule.

In addition, EPA plans to propose new MACT standards for 87 industry source categories by November 1999, many of which are potential markets for UV/EB, and finalize these standards by November 2000. Consequently, users of UV/EB technology have a valuable window of opportunity to promote its benefits as a MACT standard. The upcoming MACT of particular significance to UV/EB technology applications, among others, are paper and other webs, metal can, metal coil sources, plastics, wood paneling, and miscellaneous metal products.

RadTech hopes that your company will benefit from this guide and use it to promote UV/EB coatings to meet your Clean Air Act compliance requirements.

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Chapter 1 - Purpose

The purpose of this paper is to describe how ultraviolet and electron beam (UV/EB) curing technology may assist companies in dealing with Federal and state Clean Air Act (CAA) regulations. UV/EB coatings are used in such industries as adhesives, powders & inks, wood furniture, metal cans, plastics, films, paper and paperboard, metal products, automotive, and electronics. UV/EB technology can achieve significant, long-term energy savings and productivity gains, and represents the epitome of pollution prevention for these industry sectors.

Unlike high solids and water borne coatings systems, UV/EB technology usually results in the virtual elimination of organic solvents, defined as volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions.[2]

In addition to being regulated under the Federal Clean Air Act, many VOCs and HAPs also have associated state ambient air emission control levels and are subject to the requirements of state implementation plans (sips) and state New Source Review (NSN) programs. By installing a UV/EB coating system, a plant may minimize, or even eliminate, the need to obtain a clean air permit, and thereby avoid the need to install and maintain additional pollution control devices and associated air flow control systems to assure regulatory compliance.

There has never been a problem with UV/EB technology meeting a standard that EPA has issued in regulating air pollution. Normally, UV/EB emissions are far below those standards. Nevertheless, other technologies (e.g. waterborne coatings) may also meet EPA's standards, so that the users of coatings, inks, and adhesives have not had a compelling incentive to try UV/EB technology to be in compliance -- until now.

These other technologies merely allow a company to comply with clean air requirements. UV/EB "outshines the competition" with the added advantage of freeing a company from regulatory obligations to which other technologies remain subject.

States have been given three years from the time that EPA approves their "state implementation plans" (SIPS) to review and approve company "Title V" permit applications. Roughly 33,000 plants will need permits nationwide, and the states are suppose to process an equal number of permits each year. By mid-1998, approximately 3,500 permits have been issued. With the current schedule, there is ample opportunity to incorporate UV/EB technology to largely avoid clean air permitting requirements.

What does this mean in dollar terms? States estimate that it can cost a small source $15,000 - $20,000 to obtain a Title V permit. Because of additional monitoring and procedural requirements, for a major source, the costs of initial compliance can reach $100,000 - $200,000 per facility. EPA estimates that the printing industry Maximum Achievable Control Technology (MACT) Standard will cost the 27 affected publication rotogravure facilities $92 million to comply, and $41 million for the 100 packaging rotogravure and wide-web Flexographic potentially subject to the rule. None of these estimates fully account for the on-going costs of staying in compliance, and the outside consultants and legal counsel that are often required. By comparison, the installation of UV/EB can be a breeze!

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Chapter 2 - Checklist

While each states' specific rules should be consulted, the following checklist can be used as a general guide to determine that your UV/EB application makes you qualified for regulatory relief from Clean Air permit requirements.

Develop a facility-specific emissions inventory and find out the emissions "thresholds" for regulating each of your emissions as a "major source". Consider fugitive air sources (volatilization from open vessels, spills, shipping containers, leaks from pumps, valves, and flanges, and building ventilation systems) as well as stack or point air sources (reactor and other process vents, storage tank vents, etc.).
Determine if you are in a "hazardous air pollutant" (HAP) category. If so, can your facility document that its potential-to-emit (P.E.) is below 10 tons per year (TPQ) of any HAP or below 25 TPQ of any combination of HAPs, so that it is not a "major source" that must have a Title V operating permit and install "maximum achievable control technology" (MACT) to reduce HAP emissions?
If your P.E. is above 10 TPQ of any HAP or above 25 TPQ of any combination of HAPs, consider your "federally enforceable" alternatives. Can you commit to installing UV/EB to bring emissions below these levels and be eligible for a less stringent "synthetic minor" permit which exempts you from having to install MACT?
Find out whether your facility is in an ozone "attainment" area or an ozone "non-attainment" area. If your facility is located in an "extreme" ozone non-attainment area, can you document that your P.E. any criteria pollutant (e.g, VOCs, which are ozone precursors) is below 10 TPQ so that you are not a major source that must have a Title V permit?
If your facility is located in an "severe" ozone non-attainment area, can you document that your P.E. VOCs is below 25 TPQ so that you are not a major source that must have a Title V permit?

If your facility is located in an "serious" ozone non-attainment area, can you document that your P.E. VOCs is below 50 TPQ so that you are not a major source that must have a Title V permit?

If your facility is located in an "moderate" or "marginal" ozone non-attainment area, can you document that your P.E. VOCs is below 100 TPQ so that you are not a major source that must have a Title V permit?
Can you document that your facility does not have a P.E. of 100 TPQ of any air pollutant so that you are not a major source that must have a Title V permit?
Can you document that your facility is not a major source of criteria pollutant emissions so that you are exempt from needing a compliance assurance monitoring (CAM) plan? If other parts of your facility are subject to CAM, can you at least document that your UV/EB unit is exempt from CAM by demonstrating that it does not include an emission control device?
Can you document that a modification or new construction involving UV/EB equipment will not result in any increase in emissions and be exempt from obtaining a preconstruction permit?
If you are in an ozone attainment area, UV/EB technology will typically meet or exceed the requirements to have "best available control technology" or "BACT" in place at new and modified facilities.

UV/EB technology will typically meet or exceed the requirements to have “reasonably available control technology” or “RACT” in place at existing plants in ozone non-attainment areas.
If you are in an ozone non-attainment area, UV/EB equipment will typically meet or exceed the requirements to have “lowest achievable emission rate” or “LAER” in new and modified facilities.

If your emissions fall below the above emission thresholds, see if your state has a program that will exempt your facility from Title V permitting altogether. If not, consider approaching your state to implement such an exemption for your UV/EB technology.

The chapters that follow are intended to identify and summarize Clean Air permit programs and explain how UV/EB technology can minimize the time and cost of complying with these programs. Beyond its purpose as a background document, it is hoped that this paper will be a springboard for discussions with state regulators about the ways that UV/EB technology can be used to meet your facility’s clean air regulations.

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Chapter 3 - General Procedures and “How to” Advice

Do you have an air permit now? If so, look at your air permit or talk to your permit writer. Try to identify the requirements that may be met or even avoided through the lower emissions associated with UV/EB technology.

Make sure someone in your organization structure has identified the right program office within the state agency that handles clean air permitting matters, and the key individuals in the program office. Does the state agency have a web site on permitting that you can visit? Is there software available from the state for the permit application process? Are there guidance documents available from the state? A list of state small business assistance programs for Clean Air permitting is included in this paper.

You will need to document your facility’s potential-to-emit to confirm that you qualify for relief from clean air requirements. Your plant engineer will need a cost-effective, reliable method for estimating air emissions. States and EPA may have specific methods they want you to use, and specific records they want you to keep. The method should be one that can be used and understood by the regulator who is responsible for developing emissions inventories and issuing operating permits.

Generally, it may not be necessary to obtain prior approval from EPA or state regulators to make a potential-to-emit calculation, make a major source determination, pay less emission tax, submit a synthetic minor permit, make a preconstruction permit determination, and avoid MACT and CAM.

You will need to communicate effectively with regulators on other clean air compliance matters such as RACT, BACT, and LAER determinations, and permit approval if you find one is required. In addition, while it is not generally required, it still may be prudent to confirm your determination that you are exempt from major source and preconstruction permit requirements with state regulators. You may want to consult legal counsel or other regulatory specialist to confirm you are on the right track with your clean air permitting plans.

If your state does not currently have an exemption from permitting which you can use, think about providing your state with information about UV/EB technology applications which promote clean air compliance, by giving them a copy of EPA Administrator Carol Browner's February 12, 1997 Congressional Testimony (quoted in the introduction to this guide), EPA's MACT standard for the printing and publishing industry, EPA's MACT standard for the wood furniture manufacturing industry, and the California South Coast Air Quality Management District (SCAQMD) Rule 219 exemption for UV/EB technology.

In the future, the regulatory advantage of UV/EB technology will be measured by more than the number of exemptions from "major source" compliance. For example, a company will be able to create "emissions credits" by reducing its VOC emissions. The facility will be able to use the offset credit immediately or bank it for later use. [or, if your facility operates under a "bubble" for counting emissions it may be able to use can use the offset to increase emissions at another plant]. EPA is also studying whether to give credit to states like Texas that actively encourage voluntary reductions by small sources [those that fall below major source permitting thresholds]. Some amount of record keeping and reporting will be associated with the former. In the latter case, the obvious partnership interest of the states should facilitate negotiations. While VOC emission credit trading programs are in their infancy, SOx credits are currently being traded on the Chicago Mercantile Exchange for approximately $122 - $140/ton.

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Chapter 4 - California Comes Onboard -- An Example of a Permit Exemption

EPA issues Clean Air Act technology-based regulations and writes "Control Technology Guidelines" (CTGs) or "Available Control Technology" (ACT) documents. These are used to guide the states in writing their own regulations which must be at least as stringent as the federal recommendations. In similar fashion, EPA sets basic standards for issuing operating permits, but the states are responsible for approving, issuing, and maintaining the permits in their jurisdiction. Thus, the states have a large role to play.

One way to keep down costs for smaller sources is to take advantage of exemptions at the state level for facilities with zero VOC emissions. States vary widely in setting levels in their regulations below which an operation is exempt from permit requirements. Also, some states actively study and approve compliant technologies. Program descriptions and contacts will be provided as an appendix to this guide for state air programs in California, New Jersey, New York, North Carolina, Texas, Illinois, Ohio, Massachusetts, Florida, and Pennsylvania. Regulators in these 10 key states will benefit from knowing more about RadTech members' presence in their states. While New York has a state-wide exemption for low-VOC technologies, not every state does at this time. In California, RadTech has convinced one of the state's air quality management districts — the South Coast Air Quality Management District (SCAQMD) — to recognize an exemption to spare any company that installs UV/EB technology from having to submit "permit to install" applications.

SCAQMD has one of the most stringent air programs in the country. In general, prior to installation and operation, SCAQMD requires facilities to obtain a permit to install (PTI) for any equipment that emits or controls air contaminants be permitted. SCAQMD is supposed to issue a PTI within 180 days. In reality, however, permits usually take much longer.

Originally, under Rule 219 related to SCAQMD's PTI program, a permit was not required for printing and related coating and/or laminating equipment and associated dryers not emitting more than three (3) pounds of VOC emissions per day, or not using more than six (6) gallons per day of a UV type material. However, electron beam operations were not listed.

About three years ago, RadTech's West Coast Group, with the approval of the RadTech Government Affairs Committee, embarked on a program to obtain regulatory incentives for customers to convert to UV/EB technology. Given the permit processing fees, obstacles, and delays that companies encounter when applying for a permit, a broader exemption for UV/EB technology seemed like a good place to start. As a result, SCAQMD was formally approached to modify its Rule 219 (Equipment exempt from permits). The first success was achieved when SCAQMD agreed to include EB in the existing exemption. RadTech's next goal was to get SCAQMD to make an equivalency determination for UV/EB with the exemption for solvent materials of two (2) gallons per day. On an emission basis (pounds per day of VOCs) exempt solvent materials were allowed emissions twenty times higher than the UV/EB materials. When SCAQMD requested VOC testing of various UV/EB materials by an independent laboratory, RadTech asked if the rule could be modified to specify a de minimis emission limit. SCAQMD agreed and proposed a VOC limit of 50 grams per liter consistent with their rules.

Another issue that arose during this process was clean up solvents. SCAQMD includes VOCs from clean up operations in the process in determining eligibility for an exemption. Even though emissions from UV/EB technology are negligible, the high VOC content of clean up solvents drove initial emissions estimates up. The District ultimately agreed ton word the exemption to only apply to processes using low VOC clean up solvents. Thus, the exemption that is now in place applies to UV/EB technology materials containing less than 50 grams/liter VOC and using exclusively clean up solvents containing less than 50 grams/liter VOCs. The number of gallons of UV/EB type material which can be used under the exemption is unlimited. UV/EB materials containing greater than 50 grams/liter VOCs can be exempt from permitting in the SCAQMD as long as the usage is less than 6 gallons per day or less than 3 pounds per day VOCs.

This effort removes the PTI regulatory barrier, exemption eliminates permit fees (currently $756.10 per UV/EB line) and operating renewal fees (currently $171.90 per UV/EB line). SCAQMD personnel visited facilities employing UV/EB technology to observe UV/EB operations and collect information on emissions assessments, safety and handling, and comparisons of emissions from UV/EB processes to solvent-based processes.

The California SCAQMD exemption is an example of a program which could be adopted by other districts in the state and in other states with significant numbers of facilities that use or would like to install UV/EB technology. The State of Ohio has been willing to grant exemptions under its PTI program at the request of other industry sectors. By providing hard evidence of the benefits of installing UV/EB technology versus thermal solvent-based systems, these exemptions may expand at the state level in the future.

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Chapter 5 - Questions on Clean Air Compliance

Question 1: How are VOC emissions measured from UV/EB processes?

EPA's Methods 24 and 24A are the federally required methods for measuring VOC emissions. Method 24 has drawbacks for measuring VOC emissions from UV/EB-curing operations. The use of these methods has led to artificially high emissions results for UV-cured materials because these are thermal-based test methods. Method 24A modifies Method 24 to allow the test to be performed on cured material, but due to the presence of residual water and photoinitiators, Method 24A still does not present accurate results. EPA acknowledges that Methods 24 and 24A are not suitable for use with UV-cured thin film coatings. RadTech International North America is working with the American Society for Testing and Materials (ASTM) to address these issues.

As a result, EPA is allowing facilities that are subject to the MACT standard for the printing industry to use an alternative, much more flexible technique to estimate VOC emissions from UV/EB-curing operations. The "formulation method" allows a plant to rely on VOC emission estimates from suppliers based on the content of the coating formulation and the specific processing methods involved. Again, the formulation method can be used only in connection with this single EPA standard.

Regardless of the difficulties of measuring VOC emissions from UV/EB processes, the difference between UV/EB and traditional solvent-based coatings is dramatic. Coors Brewing Company estimates that VOC emissions resulting from the use of UV/EB technology sources was 1.6 tons per billion cans cured in contrast to 28.5 tons of VOCs per billion cans processed using a thermal coating.[3]

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Question 2: How UV/EB technology can help minimize HAP emission requirements?

Under the Clean Air Act, EPA regulates 189 HAPs, including many organic solvents, through technology-based regulations. Xylene, toluene, benzene, methyl ethyl ketone, methyl ethyl isobutyl ketone, and certain glycol ethers are listed HAPs, to name a few. The Agency requires any "major source" of these pollutants to meet the maximum degree of reduction in emissions that is achievable for its industry through the installation of maximum achievable control technology (MACT).[4] Major sources of HAPs are required to obtain clean air operating permits. Once all of the planned MACT standards are in place, EPA will conduct risk analyses to see if further emission reductions are warranted. EPA has proposed an industry-sponsored test program for certain HAPs, which, when finalized, would require export notification under the Toxic Substances Control Act for the tested substances and products that contain them. Also, as part of its urban air program, EPA plans to impose emission reduction requirements on certain “area” (non-major) sources of HAP emissions. One of the largest sectors that will be affected is printing facilities.

The MACT program is tied to the clean air permit program in its general prohibition of the construction or reconstruction of a major source facility without a determination by the permitting authority that compliance with the MACT standard will be achieved. A “major source” is any stationary source or group of stationary sources that has the potential to emit (PTE)10 tons or more a year of any HAP or 25 tons per year of any combination of HAPs. Generally, this assumes an around-the-clock operation. For example, if the XYZ Company emitted 50 tons of VOCs last year at an average rate of 50 pounds per hour, the company’s PTE is: 50 lbs x 24 hrs x 365 days = 219 tons per year.

UV/EB processes use relatively few, if any, HAP substances. In contrast, conventional thermal-cure systems using organic solvents, as well as many high solids and water borne systems, emit HAPs such as toluene, methyl ethyl ketone, methyl isobutyl ketone, ethylene glycol, and glycol ethers. A UV/EB operating unit is very unlikely to be classified as a “major source” of HAP emissions. In the case of a facility which remains regulated as a major source due to emissions from non-UV/EB operating units at its facility, the construction or reconstruction involving the installation of UV/EB technology is more likely to be permitted by state regulators because the facility will be able to demonstrate its compliance with the MACT standard.

UV/EB technology qualifies as a “low solvent” technology and receives mention in certain EPA’s regulations to control HAP emissions in the printing and publishing industry and wood furniture manufacturing operations.[5] Upcoming MACTs of particular significance to UV/EB technology applications are paper and other webs, metal can, and metal coil sources. Facilities in the affected industries can discuss the installation of UV/EB technology with state regulators to comply with these upcoming standards. Also, UV/EB technology may also be suggested to comply with an interim, case-by-case permitting requirements that are imposed by states in the absence of a federal MACT standard for the industry.

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Question 3: How can UV/EB technology help companies meet the ozone standard?

The Clean Air Act requires EPA to establish national ambient air quality standards (NAAQS) to protect the public health. At present, there are NAAQS for “criteria air pollutants” — carbon monoxide, particulate matter, sulfur dioxide, lead nitrogen oxide, and ozone. Emission reduction requirements for this program can be complex and strict if a facility is located in a geographic region of the country where the overall emissions exceed the NAAQS. These areas are referred to as “non-attainment areas.” Areas where emissions are below the NAAQS are known attainment areas.” Plant emissions in these areas are still regulated, but to a lesser degree.

Controlling ozone is complicated because ozone is not actually emitted by facilities. Rather, ozone precursors, such as VOCs and oxides of nitrogen (NOx) are emitted. Most VOCs originate from industrial products. They include the solvents in which coatings, inks, adhesives, and sealants, among other products, are dispersed. The solvents provide fluidity so that these products can be spread thinly and uniformly. After being applied, the solvent is evaporated into the air where it can react with NOx to form ozone. Because of this, the federal Clean Air Act, and states, focus on the regulation of VOCs and NOx to achieve the ozone NAAQS. While companies have found ways to lower their use of VOCs, and have successfully petitioned EPA to remove the VOC designation for certain organic solvents with low photochemical reactivity (acetone and methyl acetate are examples), compliance has become increasingly difficult in the face of regulations calling for further VOC reductions. Toluene and xylene are examples of solvents whose emissions are regulated as VOCs under the NAAQS program.

The states have primary responsibility for regulating pollutants that create ozone. Although EPA promulgates the NAAQS, the states are primarily responsible for determining how they will be achieved. States must develop, and submit to EPA for approval, state implementation plans (SIPs) which explain how the state will attain and maintain these standards.

Many requirements in SIPs are tied to whether a plant is a “major source” of a pollutant. For ozone, a major source is identified by the plant’s actual or potential to emit (PTE) VOC or NOx emissions. Furthermore, the thresholds for determining whether a source is “major” depends on the air quality of the area where the source is located:

Location: PTE (tons per year)
extreme ozone non-attainment area 10
severe ozone non-attainment area 25
serious ozone non-attainment area 50
moderate ozone non-attainment area 100
marginal ozone non-attainment area 100

If your have an existing facility that is located in a non-attainment area, it must comply with the SIP’s requirement to install “reasonably available control technology” (RACT). UV/EB curing technology represents near zero VOC emissions. Providing that it can be shown to be a cost-competitive technology, UV/EB technology will achieve most states’ RACT standards.

New and modified plants that are located in non-attainment areas must install equipment that achieves the lowest achievable emission rate (LAER). LAER is defined as the most stringent emission limitation contained in the SIP of any state or the most stringent emission limitation achieved in practice, whichever is more stringent. Based on the virtual elimination of VOC emissions, it is possible that UV/EB technology may be targeted and identified as LAER technology for certain regulated industries.

New and modified sources in non-attainment areas must also satisfy certain emission “offset requirements.” The stringency of the offset requirement depends on the air quality of the area where the source is located. However, the emissions reductions achieved through the installation of UV/EB technology will almost certainly make it easier for a facility to meet state offset requirements.

In a non-attainment area, the SIP will require permits for the construction and operation of new major sources or major modifications of existing major sources. This program is referred to as major New Source Review (major NSR). In most areas of the country, a facility will not trigger major NSR unless the new capacity actually increases NOx or VOC emissions. However, in an area such as the South Coast Air Quality Management District in the State of California, any increase in emission will trigger major new source review. The installation of UV/EB technology may result in virtually zero emissions increase and may avoid major NSR permitting.

Additionally, states can regulate the modification and construction of any stationary source to assure that air standards are achieved. Under this program, states must issue permits to low-emission, non-major sources, if necessary, to achieve air quality standards. This permit program is called “minor new source review” (minor NSR). All states have some form of minor new source review, but what constitutes a modification for minor NSR purposes is a matter for each state to decide. Generally, the worse the air quality in an area, the broader the minor NSR program and the fewer and narrower the exemptions. Through the installation of UV/EB technology, the virtual elimination of VOC emissions may avoid the need to obtain a minor NSR permit.

There are also permitting requirements that apply to facilities in attainment areas. In attainment areas, the construction of a new facility classified as a major source and a major modification of an existing major source requires a permit and the installation of Best Available Control Technology (BACT). BACT is defined as the most stringent control that has been used or proven in practice to achieve the greatest amount of emissions reductions from similar equipment. Because of the near zero VOC emissions from UV/EB curing processes, UV/EB technology may qualify for BACT applications. In connection with the Rule 219 exemption effort in the California SCAQMD, the District has incorporated UV/EB technology in BACT guideline amendments. Under the new guidelines, UV/EB technology is eligible to qualify as a BACT standard if it can achieve lower emissions than the current BACT and meet criteria for new BACT.

EPA views the installation of either LAER or BACT controls as a way to protect air quality and gradually end the exemption of older sources from emission control requirements. EPA and the states are supposed to maintain database clearinghouses of technologies that meets the LAER and BACT standards. End users can ask states to list their UV/EB technologies on these databases.

Regardless of the attainment status, states cannot permit a planned new or modified source to emit any pollutant in excess of the amount allowable under applicable new source performance standards (NSPSs). Under this program, states can issue a permit only if the emissions from the new or modified plant will not increase total VOC emissions for its area. As a practical matter, total VOC emissions must decline in the geographic area before a new plant or new capacity can be built if the new facility would increase VOC emissions to any degree.

Alternatively, the installation of UV/EB technology may be allowed to proceed based on the virtual zero increase in VOC emissions associated with the technology.

Finally, even though compliance with the ozone NAAQS has been difficult and contentious, EPA recently made the ozone NAAQS much more stringent.[6] Installing UV/EB technology is a way for companies to prepare for these new standards. In the future, the strict ozone standard is likely to cause many areas of the country now in attainment with the ozone NAAQS to be reclassified as non-attainment areas, and increase the difficulty for current non-attainment areas to reach attainment. VOCs are highly regulated because of their role in the formation of ozone. Consequently, regardless of whether your plant is currently located in an attainment or non-attainment area, it can expect tighter VOC controls. Based on the VOC emissions reductions that can be achieved, installing UV/EB technology is a way to meet current and future ozone attainment standards and offers an alternative to simply adding more and more pollution control equipment.

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Question 4: How can UV/EB technology help minimize federal air permitting requirements?

Only facilities that are classified as major sources are currently required to obtain clean air operating permits. For purposes of the permitting program, major sources are those with the potential to emit:

25 to 100 tons per year or more of any one regulated pollutant (varies by degree of non-attainment);
10 tons per year or more of any one HAP; or
25 tons per year or more of any two or more HAP.
Note that the major source designation is based on a facility’s PTE. In many cases, sources can avoid major source categorization by accepting limits on their PTE. Furthermore, under EPA’s current policy, sources with actual emissions less than 50% of the major source threshold are not considered “major” regardless of their PTE.

The permitting process can be time consuming. For example, the state of Ohio has a multi-stage submission and review process typical of many states. If a timely and complete application is filed, the applicant may lawfully operate the facility using the “application shield” until Ohio EPA either determines the application is incomplete or takes a final action to issue or deny the permit. Notice of the state’s preliminary decision is published in a local newspaper and provided to affected states (neighboring states whose air quality may be affected, or states within 50 miles of the facility). A 30-day public comment period is required, and, if there is significant interest, Ohio EPA will hold a public hearing. A preliminary proposed permit is supplied to the facility which has two weeks to comment on the permit before it is submitted to U.S. EPA. EPA must decide within 45 days whether to object to the preliminary permit. If EPA approves, Ohio EPA has 10 days to issue a final permit. Rejection by EPA triggers a 90 day consultation and revision period. Once approved, third parties, including affected citizens, have the right to appeal a permit within 60 days of the agency decision.

The permit itself includes emission limits and standards, as well as monitoring, recordkeeping and reporting requirements. Facilities must certify compliance with the terms of their permits at least annually. In some cases, planned physical or operational changes are not allowed unless the permit is revised, which could result in costly delays. Changes that trigger major NSR (discussed in Question No. 1) also trigger the permit revision procedures for operating permits, which could result in additional delay. Similarly, changes that trigger minor NSR most likely trigger the minor permit modification procedures for sources with operating permits. These procedures generally allow sources to make such changes quickly, but not without some risk.

In sum, it is certainly possible that the installation of UV/EB technology would allow a facility to entirely avoid the clean air operating permit program and the delays that can result if the operating permit ever needs to be revised. At a minimum, a facility could use UV/EB technology to reduce its “potential to emit.” Avoiding the major source classification and operating permit program requirements can result in substantial savings in terms of both time and money. Avoiding this program may also have the additional benefit of allowing a facility to avoid the cost and delays that could result if the source makes physical or operational changes that would require a change in the permit.

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Question 5: Can UV/EB technology can help reduce operating permit fees?

Yes. Clean air operating permit fees are assessed on the actual amount of emissions of regulated air pollutants. Fees are calculated using a base fee of $25/ton in 1989 dollars, and is subject to annual increases as measured against the 1989 Consumer Price Index. As of September 1997, the “presumptive minimum” amount was $32.65/ton of pollutant per year. UV/EB technology can greatly reduce any fees paid for emissions. For example, based on the Coors’ Study, typical annual emissions for a facility using UV/EB technology in a can manufacturing plant was 6.4 tons of VOC, 0.2 tons of HAPs and 4,200 tons of CO_2,. In contrast, a thermal curing plant typically emits 114 tons of VOC, 57.2 tons of HAPs, and 8,416 tons of CO_2,. The total difference is 4,380.6 tons which would mean the facility would save over $240,000 by using UV/EB technology.

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Question 6: Can UV/EB technology reduce the burden of complying with CAM rule?

Yes. On October 22, 1997, EPA published the final CAM rule. This rule requires “major sources” of so-called “criteria pollutants” to design and implement monitoring plans for large emission units, which in some cases could result in the need for the source to install expensive continuous emissions/opacity monitoring equipment. The CAM rule only applies to sources that need Title V operating permits, and then only to specific emissions units that use control devices to achieve compliance that also exceed major source thresholds based on pre-control potential to emit.
UV/EB technology may achieve significant cost savings by effectively exempting a facility from the CAM rule. First, by lowering the source’s PTE, the facility may not be categorized as a major

source. If this is the case, CAM does not apply. Second, even if a facility needs an operating permit, at emissions units where UV/EB is installed, CAM most likely would not apply because UV/EB technology would reduce the emissions unit's potential to emit to below major source thresholds. Furthermore, CAM only applies to emissions units that employ "control devices" and UV/EB technology may not be considered a "control device" because it is an inherent part of the process and EPA has specifically excluded inherent plant equipment from the control device definition in the final rule.

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Question 7: Can UV/EB technology help companies meet state level permitting?

Yes. Several states, including California, New York, Massachusetts, Texas, Florida, Ohio, and Illinois, have their own ambient air emission limits for certain air pollutants. In contrast to EPA's technology-based standards, the state limits often are based on a health assessment of the chemical. For example, Massachusetts, defines Threshold Effects Exposure Limits and Allowable Ambient Limits for Ambient Air for covered chemicals. Commonly included in the list of covered chemicals is the list of federally identified HAPs. Due to the nominal emissions of HAPs from UV/EB processes (in fact, HAP emissions may be virtually zero), companies will reduce the burden of complying with state emission levels.

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Question 8: Can UV/EB technology help companies faced with VOC enforcement actions?

Yes. If a facility is involved in a VOC enforcement case, the consent decree may afford the source the option to comply by means of low solvent technology (+LST) (e.g., UV/EB technology) rather than add-on controls.[7] If the violating facility wants such an "alternative means" clause, the facility must agree to escrow stipulated penalties which accrue for violations of interim milestones in the schedule for add-on controls; however, the consent decree may provide for the forgiveness of such penalties if compliance occurs by the schedule end date. In the alternative, the defendant may agree to post a performance bond.

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Question 9: Getting credit down the road -- how can UV/EB technology generate beneficial emission credits?

Suppose the owner of a furniture manufacturing facility wants to construct a new coatings line. If the facility is located in an ozone non-attainment area, the owner may create offset credits by installing UV/EB technology to reduce its current VOC emissions. If the owner of the furniture manufacturing facility does not need to use the UV/EB offsets immediately, e.g., to install another piece of equipment that will increase VOC emissions at the plant, the credits achieved by installing UV/EB technology remain valuable. The Clean Air Act has created a private market in emission credits, and EPA allows for the "banking" of unused credits for offset against future new sources. The future new emissions source may be within the facility that generated the credit or transferred or sold to other sources within the same air region. As long as net emissions are reduced, it is immaterial who reduces them.

In a related concept, various emissions points of an industrial complex can be treated as a single emissions point to meet some clean air requirements. “Bubbles” refers to multi-plant facilities under common ownership; “netting” refers to stacks at a single plant. Bubbling and netting are complex concepts, but simply stated, the plant operator can to reduce total pollution abatement costs by changing the mix of controls so as to maximize emission reduction for the processes which are least expensive to control. In some instances, a facility may choose to use UV/EB technology in one portion of its operation and use that reduction to offset potential emission increases elsewhere in its operation.

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Question 10: Can UV/EB technology help companies meet future product VOC requirements?

Yes. EPA has already implemented a standard to reduce emissions of VOCs from certain household cleaners and related consumer products, architectural coatings, and automobile refinish coatings. These standards do not really affect the potential end use markets for UV/EB technology. However, through a series of rulemakings expected to be issued into the year 2003, EPA will limit the VOC content of more than just consumer products. These rulemakings will be particularly targeted to printing and coatings materials. Rules to regulate flexible packaging print materials, lithographic print materials, and flat wood paneling coatings are slated for 1999. In 2001, rules are expected for metal coatings, large appliance coatings, and miscellaneous industrial adhesives. Rules for plastic parts coatings, paper, film, and foil coatings, letterpress printing materials, and metal furniture coatings are scheduled for 2003.

VOC emissions from consumer products occur due to the evaporation of the organic compounds contained in the products during their use. In fact, all of the VOCs contained in a product might be expected to be emitted to the atmosphere. Control of emissions from consumer products can only be achieved through the reformulation of the products to contain less VOCs, or through measures to promote the use of lower content VOC products. As a result, UV/EB technology may assist companies meet VOC-content limitations for their products.

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Chapter 6 - Conclusion

Clean Air Act compliance is complex, and UV/EB offers a simple way for end users to steer clear of the maze. To summarize, there are essentially two components involved with Clean Air Act compliance. The control of HAPs, and VOC contribution to ozone in the lower atmosphere. Both components affect solvents used in conventional and water-bourne coatings, inks, and adhesives. Many high solids and water borne systems may be able to achieve interim compliance, but over the long run, because these products are not VOC-free, coatings may have to be reformulated again and again in the face of shifting and increasingly stringent standards.

At a minimum, UV/EB technology can provide end-users with valuable opportunities to meet the myriad of Clean Air Act requirements and achieve significant long term savings. Many Clean Air Act requirements may be entirely avoided through installation of UV/EB technology. Because federal regulations are directed to “major sources” and UV/EB users are far below the cut-off levels for such sources, they should be outside the regulated group and not subject to some of the more onerous requirements, such as installing pollution control equipment, keeping detailed records of compliance, frequent monitoring, periodic reporting, and applying for, maintaining, and revising Title V permits. There are also many other advantages to UV/EB technology. These include state-of-the-art product appearance, performance characteristics such as durability, lower energy consumption, less space, higher productivity, and appreciable value-added content to its users.

With continued efforts by RadTech International North America and the commitment of the end-users of UV/EB, federal and state regulators can become better informed about the environmental and economic advantages of UV/EB curing technology. In the increasingly stringent clean air climate, state and federal regulators should allow the industry to expand the range of options for meeting clean air regulations. UV/EB technology offers a long term, flexible solution to meeting these obligations.

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[1] Sponsored by RadTech International North America, a nonprofit trade association for the UV/EB industry. RadTech was established in 1986 for the purpose of promoting the use and development of UV/EB processing, to serve as international forum and source for UV/EB processors, suppliers, and users, and to develop and disseminate information on the proper operation and handling of materials and equipment.

[2] In a study by Coors Brewing Company, thermal coatings curing emitted 28.5 tons/billion cans of VOCs, while VOC releases for the UV/EB processes were conservatively estimated at 1.6 tons/billion cans.

[3] Erik T. Dunhua, "UV Pollution Prevention Technology in Can Manufacturing," Sponsored by the Coors Brewing Company.

[4] These standards are also known as National Emissions Standards for Hazardous Air Pollutants (NESHAPS).

[5] See 61 Fed. Reg. 27132, 27133 (May 30, 1996) (“[Printing and publishing} sources may reduce HAP usage and emissions through conversion to . . . ultraviolet/electron beam cure materials.”); and 60 Fed. Reg. 62930 (December 7, 1995) (“UV/EB technology can assist [wood

furniture] plants meet the requirement that a compliant coating contain no more than 4.5 Mg of any one HAP").

[6] Under the new ozone NAAQS, areas will not be designated as attainment or non-attainment until the year 2000, and states will have 3 years thereafter to develop implementation plans. The regulations provide that attainment will not be required until 2010 with the chance of up to two 1-year extensions. Areas will not be required to meet the new standard until they are in attainment with the current standard for 3 consecutive years.

[7]"Revised Guidance Concerning Compliance by Use of Low Solvent Technology in VOC Enforcement Cases," U.S. EPA (February 8, 1989).