

**TECHNICAL SUPPORT DOCUMENT  
FOR  
CONTROLLING VOM EMISSIONS  
FROM  
LITHOGRAPHIC PRINTING, LETTERPRESS PRINTING, FLEXIBLE  
PACKAGE PRINTING, FLAT WOOD PANELING COATING, AND  
INDUSTRIAL CLEANING OPERATIONS**

**DIVISION OF AIR POLLUTION CONTROL  
BUREAU OF AIR  
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY  
SPRINGFIELD, IL 62702**

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## 1.0 INTRODUCTION

Section 172 of the Clean Air Act (CAA) requires that state implementation plans (SIPs) for nonattainment areas, such as the Chicago and Metro-East St. Louis nonattainment areas (NAAs) in Illinois, must include requirements for “reasonably available control technology” (RACT) as it applies to emissions sources.<sup>1</sup> The Chicago NAA currently includes the entire counties of Cook, DuPage, Kane, Lake, McHenry, and Will, as well as Aux Sable and Goose Lake Townships in Grundy County, and Oswego Township in Kendall county. Madison, Monroe, St. Clair, and Jersey counties are part of the ozone NAA in the St. Louis/Metro-East geographic location.

In March 2008, the United States Environmental Protection Agency (USEPA) strengthened the eight-hour ozone standard. It is likely that the same areas in Illinois that are currently designated as nonattainment for the present standards will soon be designated as nonattainment for this revised standard. Reducing VOM emissions in these areas will likely help Illinois achieve the newly revised NAAQS as well as satisfy CAA obligations.

USEPA is expected to finalize the nonattainment designations in 2010, initiating a new cycle of planning and regulatory development. Obviously, such planning has not occurred yet, so it is not possible to identify specific emission reduction measures needed to attain these standards. However, VOM emission reductions will improve ozone air quality, which will help to meet the new standards and should help to address any future requirements to implement RACT for the new standards.

Section 182(b)(2)(A) of the CAA further requires that SIPs be revised to include RACT for volatile organic material (VOM) emissions sources that are covered by a control techniques guideline (CTG) document issued by USEPA after November 15, 1990, and before the area’s date of attainment.

The USEPA defines RACT as “the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.” (44 FR 53761, September 17, 1979.) In developing the CTGs for the categories covered by this Technical Support Document (TSD), USEPA evaluated the sources of VOM emissions from the applicable industries, the available control possibilities to address the associated emissions, and the cost of such control measures.

Emissions of VOM result from various points in the processes covered by this TSD. These VOM emissions react with other pollutants in the atmosphere, such as oxides of nitrogen (NO<sub>x</sub>) and carbon monoxide (CO), to form ozone. Ozone formation is most active during the summer months because the chemical reactions involved rely on direct sunlight and high ambient temperatures. Ozone

is a powerful oxidant, and as such reacts readily with a wide range of substances. In humans, ozone irritates the respiratory system and reduces lung function. Laboratory studies suggest that it may damage lung and other tissue. There is concern that this damage can impair breathing and reduce immunity to disease for people in good health, and the effect may be more severe for people with pre-existing respiratory diseases. Ozone oxidation can also impair plant tissue and reduce the yield of some crops, as well as damage materials such as rubber products.

This TSD presents the rationale, documentation, and methodology relied upon to technically justify the Illinois EPA's proposed regulatory changes to control VOM emissions from the categories known collectively as the Consumer and Commercial Products, Group II, which includes lithographic printing, letterpress printing, flexible packaging printing, flat wood paneling coating, and industrial cleaning solvents.

To assist in evaluating the potential for implementing new emission standards for Illinois sources, the Illinois Environmental Protection Agency (Illinois EPA) reviewed and evaluated the USEPA CTGs, as well as other available information, including regulations in other states and those already existing within Illinois. In addition, Illinois EPA staff held conversations with staff from USEPA and other states, as well as with representatives from various industry groups. Based on this information, the Illinois EPA determined the applicability thresholds for application of controls and is recommending appropriate control measures. This TSD is based on the aforementioned documents and addresses the technological feasibility and economic reasonableness of implementing new standards for lithographic printing, letterpress printing, flexible package printing, flat wood paneling coating, and industrial cleaning processes.

## **2.0 PROCESS DESCRIPTION AND SOURCES OF EMISSIONS**

### **2.1 Lithographic Printing**

Offset lithographic printing has a broad range of applications, including books, magazines, periodicals, labels and wrappers, catalogs and directories, financial and legal documents, business forms, advertising materials, newspapers, newspaper inserts, charts and maps, calendars, tickets and coupons, greeting cards, and stamps.

None of the above applications are exclusive to offset printing; other modes of printing in the graphic arts industry can produce items such as those mentioned above. However, the newspaper industry uses offset lithography predominantly, with over 70 percent of all newspapers in the United States printed by this method.

Lithography is a planographic method of printing; that is, the printing and nonprinting areas are essentially in the same plane on the surface of a thin metal "lithographic" plate. The distinction between the areas is maintained chemically; when the lithographic plate is made, the image area is rendered water repellent, and the nonimage area is rendered water receptive.

In offset lithographic printing, ink is transferred from the lithographic plate to a rubber-covered "intermediate," or "blanket," cylinder and then to the substrate. Transfer of the ink from the lithographic plate to the blanket cylinder, rather than directly to the substrate, is the offset characteristic of this type of printing.

A printing press is made up of a number of printing units. Printing units are available that print both sides of the substrate at the same time (a process known as perfecting), as well as only one side (known as nonperfecting).

Offset lithographic printing is also characterized by the form in which the material to be printed on – the substrate – is fed to the press. In sheet-fed printing, individual sheets of paper or other substrate are fed to the press. In web printing, continuous rolls of paper are fed to the press and the paper is cut to size after it is printed.

Lithographic inks are composed of pigments, vehicles, binders, and other additives. The pigments provide the desired color and are composed of organic and inorganic materials. Lithographic inks may be heatset, where heat is required to set the ink, or non-heatset, where the inks are set by absorption into the substrate by oxidation or other methods not requiring added heat. Heatset inks may contain up to 45 percent VOMs. Non-heatset inks have higher boiling points than heatset inks and are less pasty. They usually contain less than 35 percent VOMs. Most non-heatset inks used in sheet-fed printing are below 25 percent VOM.

A fountain solution is applied to the lithographic plate to render the nonimage areas unreceptive to ink. Since printing inks are oil-based and oil is repelled by water, the fountain solution is water-based. The fountain solution contains small quantities of gum arabic or synthetic resins, acids, and buffer salts to maintain the pH of the solution, and a wetting agent or "dampening aid" to enhance the spreadability of the fountain solution across the print plate. The role of the dampening aid is to reduce the surface tension of water as well as increase viscosity.

Isopropyl alcohol (IPA), a VOM, had been used as the primary dampening aid since the 1950s. Ethanol and normal propyl alcohol have also been used in this capacity. Before the 1980s, concentration of alcohol in the fountain solution could range from 0 to 35 percent or higher, with most presses using between 15 and 20 percent. However, in more recent years, printers have significantly reduced

fountain solution alcohol contents and often replaced alcohol completely with other dampening aids. Indeed, current Illinois rules for heatset web presses in the NAAs require that subject sources use no more than 1.6 percent alcohol, or 3 percent if the fountain solution is refrigerated; fountain solutions using only alcohol substitutes may use up to 5 percent VOM. Non-heatset web presses cannot use any alcohol and are subject to the same 5 percent VOM limit. Sheet-fed presses are limited to 5 percent VOM content or 8.5 percent if the fountain solution is refrigerated.

Cleaning solutions are used to remove excess printing inks, oils, and paper components from press equipment. The solutions are petroleum-based solvents, often mixed with detergent and/or water. The cleaning compound may be a single solvent, such as kerosene, or a combination of solvents. Cleaning solutions are used to wash the blankets, the rollers, the outside of the presses, and to remove excess ink residue between color changes. Some cleaning is done automatically, while other cleaning is done manually.

## 2.2 Letterpress Printing

Letterpress printing involves the use of a reverse-imaged raised surface that is inked and then pressed against a substrate to transfer the image. Letterpress operations make up a very small percentage of the printing industry compared to other types of printing (lithographic, flexographic, rotogravure). Indeed, according to information from the Illinois EPA's source inventory, no letterpress printing facility could be found in the Metro-East NAA, with very few of these facilities found even in the Chicago NAA.

Letterpress inks and lithographic inks are very similar, and letterpress operations also may be accomplished through sheet-fed and web presses. Thus, ink emission sources are similar to those described above for lithographic printing.

Letterpress operations do not use fountain solutions, but the cleaning solutions are once again similar to those used in lithographic printing operations.

## 2.3 Flexible Package Printing

The existing regulations found in Sections 218/219.401-404 currently cover all rotogravure and flexographic printing. The modifications being proposed in this rulemaking cover both types of printing, but only as they apply to flexible packaging. Flexible packaging means any package or part of a package, the shape of which can be readily changed. Flexible packaging includes, but is not limited to, bags, pouches, liners, and wraps utilizing paper, plastic, film, aluminum foil, metalized or coated paper or film, or any combination of these materials. Shrink-wrap labels or wrappers (but not self-adhesive labels) printed on or in-line with a flexible packaging printing press are also considered to be flexible packaging.

Flexible packaging does not include folding cartons, gift wraps, hot stamp foils, wall coverings, vinyl products, decorative laminates, floor coverings, or tissue products.

Rotogravure printing uses an image etched or engraved into a plate or cylinder. Inks, coatings, and adhesives may be applied to a substrate through the rotogravure process.

Flexographic printing has an image raised above the level of the printing plate, with the image carrier made of rubber or other flexible material. Flexographic printing is better suited to short production runs, in contrast to rotogravure printing, which is more useful for long runs.

VOM emissions for both types of printing originate from the drying of inks as well as solvents used to clean presses and other components.

According to the CTG for Flexible Package Printing, the use of waterbased inks is increasing. However, USEPA also noted, “Many facilities use hundreds of different inks to print various custom colors required by their packaging customers. Low [VOM] inks, coatings, and adhesives may not be available to meet all of the performance requirements.”<sup>3</sup>

As such, most VOM control for flexible package printing is achieved through the use of add-on control devices. In these processes, most of the solvent is captured through evaporation in a dryer, along with hoods and other collection devices for solvent that evaporates elsewhere in the printing process. Older presses frequently do not allow for the same level of capture as newer installations do, but the CTG notes, “There have been significant improvements in capture efficiency of flexographic presses and rotogravure presses” since the last time USEPA reviewed those types of operations. It continues, “Since 1990, many vendors have guaranteed capture efficiency of 85 to 90 percent without use of a permanent total enclosure.” Control devices, which destroy or recover the captured solvents, “can achieve at least 95 percent control,” according to USEPA.<sup>3</sup>

USEPA’s recommended approach to reducing VOM emissions from flexible package printing cleaning materials focuses on work practices, “such as keeping solvent containers closed except when filling, draining or conducting cleaning operations, keeping used shop towels in closed containers, and conveying cleaning materials from one location to another in closed containers or pipes.”<sup>3</sup>

## 2.4 Industrial Cleaning Solvents

The industrial cleaning solvents category encompasses many products and cleaning styles that are used to clean dirt, soil, oil, and grease as well as remove adhesives, paints, and inks. Studies done by USEPA on six focus industries

(automotive, electrical equipment, magnetic tape, furniture, packaging, and photographic supplies) identified nine main areas where emissions of VOM occurred during cleaning processes. These nine cleaning categories are spray gun cleaning, spray booth cleaning, large manufactured components cleaning, parts cleaning, equipment cleaning, line cleaning, floor cleaning, tank cleaning, and small manufactured components cleaning. The majority of VOM emissions were released during the first four types of operations, especially the spray gun cleaning, which made up 50 percent of emissions by itself. However, it should be noted that while the CTG focused on these specific areas, it recommends coverage of a wide range of cleaning activities and the proposed industrial cleaning regulation follows that recommendation.

VOM emissions occur during the cleaning process while wiping, flushing, brushing, and from the storage and disposal of used solvents and rags. General cleaning of offices, bathrooms, and other janitorial type services are not covered by this proposed regulation.

## 2.5 Flat Wood Paneling Coating

According to the CTG for Flat Wood Paneling Coatings, “Flat wood paneling products are used in construction and can be classified as three main product types: decorative interior panels, exterior siding, and tileboard.”<sup>5</sup>

Decorative interior panels are often embossed and usually grooved, having more decorative coating requirements than many other products. Substrates include hardwood, plywood, medium density fiberboard, and particle board.

Exterior siding may be coated at the production facility or on-site (the latter is not subject to this proposed regulation). Exterior trim is also generally manufactured at the same production facility and coated with the same coatings. Substrates include solid wood, hardboard, and waferboard.

Tileboard is used in high-moisture areas such as kitchens and bathrooms, and is considered a premium interior wall paneling. Tileboard meets the specifications for Class I hardboard according to the American National Standards Institute.

Flat wood paneling products are coated to provide protection from the environment, modify the surface, and present a desired appearance.

According to the CTG for Flat Wood Paneling Coatings, “A typical flat wood coating facility applies stains and varnishes to natural plywood panels used for wall coverings. Other plants print wood grain patterns on particle board panels that were first undercoated with an opaque coating to mask the original surface. Coatings applied to flat wood paneling include fillers, sealers, ‘groove’ coats, primers, stains, basecoats, inks and topcoats. Most coatings are applied by direct

roll coating. Filler is usually applied by reverse roll coating. The offset rotogravure process is used where the coating and printing operation requires precision printing techniques. Other coating methods include spray techniques, brush coating and curtain coating. A typical flat wood paneling coating line includes a succession of coating operations. Each individual operation consists of the application of one or more coatings followed by a heated oven to cure the coatings. A typical production line begins with mechanical alterations of the substrate (filling of holes, cutting of grooves, sanding, etc.), followed by the coating operations, and packaging/stacking for shipment.”<sup>5</sup>

VOM emissions occur primarily during the coating process as the coatings dry and cure, but also as coatings are applied, and during mixing before application.

### **3.0 TECHNICAL FEASIBILITY OF CONTROLS**

CTGs for each of these categories were published by the USEPA in September 2006. Each of the CTGs contain information about add-on controls, process modifications, work practices, and material reformulation and substitution that can be used to accomplish the necessary emission reductions. The Illinois EPA depended on the CTGs, as well as discussions with other states and industry, in developing and implementing the proposed regulations.

#### **3.1 Lithographic Printing**

##### *Add-On Controls*

Add-on control devices are applicable only to heatset web offset lithographic printing, not non-heatset or sheet-fed lithographic printing, and can be grouped into two broad categories: combustion control devices (destructive) and recovery devices (nondestructive). Combustion control devices are designed to destroy VOMs in the vent stream prior to atmospheric discharge; recovery devices limit VOM emissions by recovering material for reuse.

The heatset web offset lithographic printing industry employs three basic add-on control devices: (1) thermal afterburners, (2) catalytic afterburners, and (3) condenser filter systems. The experience of the Illinois EPA indicates that the field is dominated by thermal and catalytic afterburners, which can often achieve 98 percent or greater VOM removal.

The condenser filter systems currently in use have been designed specifically for the heatset web offset printing industry. Condenser filter systems can achieve as high as 97 percent VOM removal efficiency, with 90 percent being easily achievable for older systems.

### *Fountain Solution Reformulation and Process Modifications*

A significant portion of VOM emissions from lithographic printing can be ascribed to evaporation from fountain solutions. Alcohol substitutes have been in use for over 20 years to replace or minimize the amount of alcohol used in a fountain solution. These substitutes have lower volatility than alcohol and thus reduce emissions.

Process modifications are changes in operational methods or equipment resulting in improved VOM control. Such modifications may involve retrofitting existing equipment or replacing older equipment with new technology to accommodate the process change. However, the Illinois EPA does not expect retrofitting or replacement to be an issue with this rulemaking.

Cooling a fountain solution is one process modification that reduces VOM emissions from the fountain solution by minimizing evaporation. Refrigerated circulators can cool the fountain solution to a temperature that usually ranges between 55 and 60°F. Refrigeration has been shown to reduce consumption of alcohol in the solution by as much as 44 percent.

### *Material Reformulation or Substitution for Cleaning Solutions*

As with fountain solutions, cleaning solutions can also be a significant source of VOM emissions from the overall lithographic printing process. To reduce these emissions, cleaning solutions may be reformulated in one of two ways. Solutions containing a smaller amount of VOM may be used. The current Illinois rule limits such solutions to no more than 30 percent VOM. While no problems with this limit have been reported to Agency personnel in Illinois, there have apparently been complaints on a national level. As such, the CTG now recommends limiting such solutions to 70 percent VOM.<sup>2</sup> The Illinois EPA's proposed regulation contains this higher limit for sources between 15 and 100 pounds per day (PPD), with the previous limit remaining in effect for larger sources.

In addition, an alternative to low-VOM cleaning materials are solutions with a low vapor pressure. The CTG notes, "Cleaning materials with [VOM] composite vapor pressure less than 10 millimeters of mercury (mm Hg) at 20°C have been used successfully by many printers for blanket washing and other cleaning activities."<sup>2</sup> It was determined by USEPA prior to Illinois' promulgation of the previous lithographic printing rule that the use of cleaning materials with a VOM composite vapor pressure less than 10 mm Hg at 20°C would result in a comparable emission reduction to using cleaning materials that contain less than 30 weight percent VOM. Once again, the Agency believes that currently-subject sources are using materials that meet this limit without problems. As such, this limit is not being changed; it will just apply to smaller sources as well.

### 3.2 Letterpress Printing

Letterpress emission sources are similar to those for lithographic printing, with the exception that letterpress operations do not use a fountain solution. In addition, letterpress printing presses are often operated at the same source as lithographic printing and many of the control options for letterpress printing are the same as the control options for lithographic printing as well. This is especially true in terms of cleaning solutions, though. Because letterpress operations have never been specifically regulated in Illinois before, the Agency is proposing to use the 70 percent VOM content limit for all subject letterpress units. It is the Agency's belief, supported by conversations with industry representatives, that Illinois does not currently contain any heatset web letterpress operations in either the Chicago or Metro-East NAA, but the regulation is necessary and technically feasible should a new such operation locate into one of the NAAs.

### 3.3 Flexible Packaging Printing

Similar to the types of printing discussed above, the two main sources of VOM emissions from flexible package printing are the evaporation of inks, coatings, and adhesives, as well as the use of cleaning materials. These VOM emissions may be controlled by material reformulation or, especially in the case of ink emissions, through the use of add-on controls.

#### *Material Reformulation*

This approach, similar to that described above, focuses on the substitution of low-VOM inks, coatings, and adhesives. According to the CTG, such reformulation "has been achieved by many facilities in the packaging rotogravure and flexographic printing industries."<sup>3</sup> Whether a particular facility is able to use such reformulated materials depends upon their specific activities, including the substrate(s) being used.

#### *Add-On Controls*

Add-on controls, however, may be used by all such printers. The most common control devices used by these sources are thermal oxidizers, catalytic oxidizers, and carbon adsorbers, with adsorbers probably being the least-used of the three. As the CTG notes, "Today, these control devices can achieve at least 95 percent control device efficiency."<sup>3</sup>

Capture systems have evolved over the years. These systems collect the VOM-containing air so it may be destroyed or reclaimed by the control device described above. While new presses may be able to obtain as high as 100 percent capture if designed properly, older presses were not necessarily constructed with emissions

capture in mind. As such, the Agency is proposing a tiered approach to capture and control in this rulemaking.

#### *Work Practices for Cleaning Materials*

The CTG recommends work practice requirements as the best means to control emissions from cleaning operations at flexible package printing sources. In particular, the document says these practices should include “keeping solvent containers closed except when filling, draining or conducting cleaning operations, keeping used shop towels in closed containers, and conveying cleaning materials from one location to another in closed containers or pipes.”<sup>3</sup>

### 3.4 Industrial Cleaning Solvents

The industrial cleaning solvents proposed regulation covers a wide range of products that remove contaminants from parts, products, tools, machinery, and other work production areas. The nine main cleaning categories mentioned in Section 2.4, above, use a multitude of different solvents with different styles of applications. VOM emission reductions can be attained by work practices, solvent substitution, and controls.

The CTG recommends that sources exceeding 15 lbs/day of VOM emissions from the cleaning category must comply with the following requirements.<sup>4</sup> The proposed regulation follows this suggestion.

#### *Work Practices*

Reductions can be obtained through solvent management practices. General work practices include keeping solvent containers and used applicators covered; properly storing and disposing of spent solvents and used cleaning rags; minimizing air circulation around all cleaning operations; and implementing equipment practices that reduce emissions, e.g., leak detection and repair practices.

#### *VOM Content Limits*

Solvent substitution to a low-VOM or no-VOM solvent can also reduce emissions. The CTG recommends a content limit of 50 grams VOM per liter (0.42 lb/gal) of cleaning material for those industries that are not already covered, or to be covered, by a CTG, as listed in Section 218.187(a)(2)(B).<sup>4</sup> However, discussions with industry, other states, and USEPA led to the addition of a number of exemptions and higher VOM content limits for certain specific cleaning activities.

Higher limits have been considered for categories that may not be able to easily meet this limit, based on recommendations from industry as well as from other states. These higher limits are outlined within the rule.

#### *Alternate Vapor Pressure Limit*

Low vapor pressure solvents are also recommended since the slower evaporation reduces the amount of VOM released into the atmosphere. The CTG recommends that a limit of 8 mm Hg at 20 degrees Celsius be allowed in place of the 50 gram VOM per liter of cleaning material, and the proposed regulation follows this recommendation.

#### *Alternate Control*

Emissions can also be reduced by add-on controls, modifying equipment, or changing the method of cleaning. The CTG recommends an overall control efficiency of 85 percent reduction in emissions of VOM, which is reflected in the proposed rule.

#### *Exclusions*

As noted above, the CTG suggests excluding certain categories from the cleaning regulations, as these categories already have or will have their own recommended work practices and limitations. These categories include coating operations for aerospace, wood furniture, flat wood paneling, large appliance, metal furniture, plastic parts, paper film and foil, miscellaneous metal parts, auto and light-duty truck assembly, and shipbuilding and repair; flexible packaging printing materials; lithographic printing materials; letterpress printing materials; fiberglass boat manufacturing materials; and miscellaneous industrial adhesives.

Other categories with specific exemptions have also been suggested by the CTG as well as by discussions with industry groups. These include electrical and electronic components; precision optics; numismatic dies; stripping of cured inks, coatings, and adhesives; cleaning of resin, coating, ink, and adhesive mixing, molding, and application equipment; research and development laboratories; medical device or pharmaceutical manufacturing; and performance or quality assurance testing of coatings, inks, or adhesives.

Further exclusion recommendations include cleaning of paper-based gaskets and clutch assemblies; cleaning of adhesive application equipment used for thin metal laminating; touch-up cleaning on circuit boards; cleaning of coating and adhesive application processes utilized to manufacture transdermal drug delivery product using less than three gallons per day of ethyl acetate; cleaning of application equipment used to apply coatings on satellites and radiation effect coatings; cleaning of application equipment used to apply solvent-borne fluoropolymer

coatings; cleaning of ultraviolet or electron beam adhesive application; and cleaning of electrical cables.

### 3.5 Flat Wood Paneling Coatings

Flat wood paneling coating, like other forms of industrial coating, provides two options for controlling VOM emissions: reformulation or add-on controls.

#### *Material Reformulation*

Reformulation would entail sources changing from high-VOM coatings to low-VOM materials. According to the CTG, low-VOM, water-based coatings “are generally available” and “can lower [VOM] emissions greatly, and most coatings operations are capable of converting to waterborne coatings.”<sup>5</sup>

Another option for reformulation is the use of coatings that emit almost zero VOM and are cured through the use of ultraviolet light or an electron beam. The use of such systems are more limited than those for waterbased coatings, but they are available.

#### *Add-On Controls*

Add-on controls for flat wood paneling coating can be used when the source needs, or chooses, to use high-VOM coatings. The CTG notes, “Currently, an overall control and capture efficiency of 90 percent is a widely-accepted and readily available technique.”<sup>5</sup> Illinois EPA agrees, based on its experience with a variety of coating operations.

#### *Work Practices for Coatings and Cleaning Materials*

The CTG recommends specific work practice requirements for flat wood paneling coating operations: “storing all [VOM] coatings, thinners, and cleaning materials in close containers, minimizing spills of [VOM] containing coatings, thinners, cleaning up spills immediately, conveying any coatings, thinners, and cleaning materials in closed containers or pipes, closing mixing vessels which contain [VOM] coatings and other materials except when specifically in use, and minimizing emissions of [VOM] during cleaning of storage, mixing, and conveying equipment.”<sup>5</sup>

Some of these requirements are already in place within Illinois regulations for wood furniture coaters. Under the Agency’s proposal, these will apply to flat wood paneling coaters as well, and other specific requirements listed above will apply as well. These will minimize unnecessary VOM emissions from such operations.

## 4.0 ECONOMIC REASONABLENESS

### 4.1 Lithographic Printing

The largest cost factor for lithographic printing – add-on control devices – is applicable to heatset web lithographic operations only. Since the Agency’s proposal does not increase the number of sources for which this requirement is applicable, there is no foreseen additional cost due to add-on controls for existing sources. New sources will need to achieve a higher control efficiency, but since new add-on control devices would already be expected to achieve that efficiency, no additional cost is expected for this reason either.

Fountain solution and cleaning solution reformulation costs could occur for newly-regulated sources between 15 and 100 PPD of emissions under this proposal. USEPA estimated the cost for cleaning material reformulation at \$855 per ton of VOM removed (in 2005 dollars).<sup>2</sup>

For fountain solutions, USEPA actually estimated a cost savings due to a reduction in the use of alcohol. While they did not provide a specific value for the savings, the TSD for the Illinois lithographic printing rule in 1994 put this savings at \$920 per ton (while alcohol substitutes are more expensive, the cost is reduced because they are used in lower quantities).<sup>6</sup>

### 4.2 Letterpress Printing

As previously noted, letterpress printing shares a great deal in common with lithographic printing when it comes to emissions and the applicable controls. As the CTG notes, “Because of the similarities between offset lithographic printing and letterpress printing in terms of the nature of the processes at issue, the sources of [VOM] emissions and available control approaches, it is reasonable to assume that the cost-effectiveness estimates ... for control of [VOM] from heatset inks and control of [VOM] from cleaning materials apply equally to the letterpress printing industry.”<sup>2</sup>

The difference is that there is not currently a regulation for heatset web letterpress printing operations in Illinois. As such, the reasoning behind the zero cost estimate for heatset web lithographic printing cannot be used for letterpress operations. Thus, referring to the CTG, USEPA’s cost estimate is \$2,010 per ton of VOM removed (in 2005 dollars). However, as noted earlier, the Agency believes that the Illinois NAAs do not currently contain any heatset web letterpress operations.

#### 4.3 Flexible Packaging Printing

According to the CTG, “Many facilities located in ozone nonattainment areas are already meeting the control levels being recommended in this CTG.”<sup>3</sup> Indeed, this proposal does not expand the number of sources that will be subject to the ink or control device portions of the flexible packaging rotogravure and flexographic printing regulations. It is expected that those sources currently able to use compliant inks and coatings will similarly be able to make use of inks and coatings meeting the new compliance limit, while those using add-on control devices will continue to do so as well. As such, the Illinois EPA expects that there will not be any additional add-on control costs for subject facilities.

In the case of any sources not already meeting the proposed standards and needing to put on an add-on control device, the CTG says, “The costs ... will vary depending on the flow rate, hourly solvent use rate, and operating hours.” USEPA made reasonable estimates to determine the cost effectiveness, and determined that “a press exhausting approximately 5,800 cubic feet per minute, operating 2000 hours per year, and achieving 70 percent capture efficiency” would have a cost of between \$1,300 and \$2,800 per ton of VOM removed.<sup>3</sup> A source with a larger press, higher solvent use rate, more operating hours, or better capture efficiency would have an even lower cost per ton of VOM removed.

Costs associated with additional sources becoming subject to the cleaning provisions of this proposed regulation are expected to be minimal. Indeed, some sources may see an overall cost savings as less cleaning solution is necessary.

#### 4.4 Industrial Cleaning Solvents

USEPA estimated that there would be 130 sources in Illinois NAAs that would be impacted by this regulation, with a total of 2293 Mg/yr (2528 tons/yr) of baseline VOM emissions per year by using the 2002 Nation Emissions Inventory database. USEPA then determined the cost effectiveness of meeting the 50 grams of VOM per liter of cleaning material limit for a parts cleaner at \$1664/ton based on a study provided by the California Bay Area Air Quality Management District.

Costs associated with switching from high-VOM content solvents to low-VOM content or aqueous solvents may show an actual cost savings of \$1460/Mg (\$1325/ton) when taking in consideration the reduction of disposal costs, according to the CTG.

#### 4.5 Flat Wood Paneling Coatings

USEPA based their cost estimate on information obtained from the South Coast Air Quality Management District in California, arriving at a cost of between \$1,900 and \$2,600 per ton of VOM reduced (in 2005 dollars). According to the

CTG, for any sources subject to this rule in Illinois, costs “could be incurred to make changes to their coatings in order to meet” the new regulation.<sup>5</sup> Thus, the only significant cost is expected to be reformulation of coatings.

## **5.0 EXISTING AND PROPOSED STANDARDS**

### **5.1 Lithographic Printing**

Currently, Illinois has regulations covering all types of lithographic printing in the NAAs, with an applicability level of 100 PPD (calculated monthly). In addition, there is a secondary applicability level of 100 tons per year of maximum theoretical emissions for heatset web lithographic printing, which was carried over from the previous rule. The Agency is proposing removing the 100-ton limit, as it is no longer necessary and USEPA has agreed that removing it will not cause a backsliding concern.

This new proposal does not reduce the applicability threshold for add-on control devices used by heatset presses. Thus, no new lithographic printing units will need to add controls. However, new control devices on heatset web lithographic presses will need to meet a 95 percent control efficiency instead of the current 90 percent limit. The Agency believes that control devices in existence today can meet the 95 percent limit, but at the request of printing industry representatives, the Agency has agreed to not ask existing sources to meet the higher control efficiency.

The proposal does provide a new applicability threshold of 15 PPD for fountain solution and cleaning solution requirements for all lithographic printing operations. The requirements are the same as are already present in the Illinois regulations, other than a correction to the fountain solution limits that changes their measurement from “by volume” to “by weight.” USEPA has informed Illinois EPA that the limit should be weight-based, and the change will slightly loosen the standard for sources, if anything. The Illinois EPA has not encountered any sources with problems complying with the fountain solution, cleaning solution, recordkeeping, reporting, or material handling portions of the existing rule, and no such issues are expected when lowering the applicability threshold.

Sources between 15 and 100 PPD will be able to take advantage of several new exclusions pertaining to fountain and cleaning solutions. Sheet-fed presses that print substrates no larger than 11 inches by 17 inches and any lithographic press with a fountain solution reservoir of no larger than one gallon are not required to comply with the fountain solution requirements. As described above, all sources in this group will also need to meet only a 70 percent VOM content limit in cleaning solutions rather than the 30 percent limit that is applicable to sources over 100 PPD. All such sources will also be able to use up to 110 gallons of cleaning solution per year that do not meet either the VOM content or vapor

pressure requirements. These exclusions will ease any potential burden on the smallest sources affected by this rule.

Sources which fall below one of the applicability limits, and are thus exempt from one or more control requirements, must certify this exemption to Illinois EPA through calculations showing that their emissions will not exceed the applicable VOM threshold. These calculations must include all VOM emissions, including inks, fountain solution, and cleaning solvents, and are determined on a monthly basis.

It should be noted that the current regulation recognizes that the substrate retains some of the VOM present in the ink, and thus a retention factor of 0.95 is used when calculating emissions from non-heatset inks, and a factor of 0.20 is used when calculating emissions from heatset inks. In addition, it contains a factor recognizing that VOM remains on solvent-laden rags that are stored and disposed of properly. These factors continue to be allowed for determination of applicability. In addition, this proposal adds emission adjustment factors to be used in other situations when not determining applicability (such as Annual Emissions Reports and permit limits). These factors take into account carryover of VOM from automatic blanket wash and fountain solutions into the dryer and control device. All of these factors may be found in the CTG.<sup>2</sup>

Because of the new exclusions that apply only between 15 and 100 PPD, even subject sources in this group must continue to calculate emissions to ensure they do not exceed the 100 PPD threshold and lose the exclusions. Sources may opt out of the exclusions if they do not wish to make use of them, and thus would not need to calculate emissions in this fashion.

## 5.2 Letterpress Printing

There are currently no specific Illinois regulations covering letterpress printing operations; any such operations would therefore be covered by Subpart TT, Section 218/219.301, or paper coating regulations. The new proposal addresses both heatset and non-heatset letterpress operations.

This proposal would require that heatset letterpress printers use an add-on control device if they meet the applicability requirement of 25 TPY PTE plantwide. However, as noted earlier, the Agency believes there are no such operations in Illinois NAAs.

All letterpress printing operations of 15 PPD or more will be also required to abide by cleaning material limitations equivalent to those described above for lithographic sources between 15 and 100 PPD. That is, cleaning solutions will be required to contain no more than 70 percent VOM or have a maximum composite partial vapor pressure of less than 10 mm Hg.

### 5.3 Flexible Packaging Printing

Currently, Illinois rules cover all flexographic, packaging rotogravure, and publication rotogravure printing. All ink limits for these different types of printing are identical, with the only difference found in the add-on control requirements – flexographic printers are required to get 60 percent overall VOM reduction, packaging rotogravure are required to get 65 percent overall reduction, and publication rotogravure must achieve 75 percent overall reduction.

The new proposal separates out flexible package printing from the existing flexographic and rotogravure regulations. Thus, any flexographic or rotogravure operation that is not printing on flexible packaging will not see a change to the applicable regulations.

Sources that print on flexible packaging will need to meet either a tightened ink VOM content or add-on control requirement. The required control efficiency will depend on both the date of construction, at the source, of the press and the control device. This recognizes that presses and control devices already installed at the source might not have been designed to obtain capture and control efficiencies as high as are currently obtainable.

### 5.4 Industrial Cleaning Solvents

Illinois has current regulations for cold cleaning degreasing, open top vapor degreasing, and conveyORIZED degreasing operations as well as some limitations and work practices on cleaning solvent uses in existing rules, e.g., regulations regarding autobody refinishing, wood furniture coating, and lithographic printing. This new rule sets limitations based on an applicability of 15 lbs/day of actual VOM emissions from cleaning operations. Once applicable, the source will need to follow the work practice standards discussed in Section 3.4, above, and either comply with a VOM content limitation of the cleaning solutions, use a low vapor pressure cleaning solution, or utilize an emissions control system that provides 85 percent overall control of VOM emissions from cleaning activities.

### 5.5 Flat Wood Paneling Coatings

There are currently no specific Illinois regulations covering flat wood paneling coating operations; any such operations would therefore be covered by Subpart TT, Section 218/219.301, or potentially wood furniture coating, depending on whether the operations fell into the definition related to that process.

The new proposal will add coating VOM requirements and work practice requirements for both coatings and associated cleaning operations. As with other coating categories, there is also an option available to use add-on control instead

of compliant coatings; however, the flat wood paneling coating category will require an overall control of 90 percent rather than the 81 percent overall control required for existing coating categories.

The work practice requirements include several that are already required for wood furniture coaters, which have been accomplished without any problems known to the Agency. In addition, other common sense requirements are being added, including minimizing spills of VOM-containing materials, minimizing VOM emissions during cleaning, and closing mixing vessels except when they are in use.

## **6.0 AFFECTED SOURCES AND EMISSION REDUCTIONS**

### **6.1 Lithographic Printing**

The Agency does not expect any additional reductions from increasing the required control efficiency for heatset web lithographic printers from 90 to 95 percent, because that change will not affect existing control devices.

However, there will be some small VOM reductions related to the addition of fountain and cleaning solution requirements for sources with 15 PPD or more of emissions. It is difficult to estimate such reductions because the Illinois source inventory does not track information such as the number of gallons of cleaning solution used, the size of sheet-fed presses, or the fountain solution reservoir volume – as such, sources that may be excluded from requirements are not identifiable.

The Agency found a total of 98 lithographic printing sources in the Chicago NAA and three in the Metro-East NAA that have lithographic printing emissions over 15 PPD, according to the Bureau of Air's 2005 source inventory (modified for sources that have shut down since that time).

In the Chicago NAA, 66 of the sources are below 100 PPD, and thus are potentially impacted by this rulemaking (two more are over 99 PPD and are assumed to be already complying with the existing lithographic printing regulations). In the Metro-East NAA, all three sources are below 100 PPD. The Agency is conservatively judging that all of the sources listed may be impacted, but it is likely that some of them are already considered subject, as the daily emission rate in the inventory is an average estimate, while sources may have exceeded 100 PPD at some previous point. The Agency has tried to account for sources that are already controlled, as the 100 PPD applicability limit applies to uncontrolled emissions. (See Appendix B for the list of these potentially affected sources.)

For the sources that apparently would be affected by this proposed regulation, the Illinois EPA reviewed its inventory in an attempt to estimate potential emission reductions from fountain solution reformulation. The recent lithographic printing CTG does not contain enough specific information to usefully estimate such reductions, but refers back to the 1993 draft CTG on this source category.<sup>7</sup> Using the information and model plants therein, Illinois EPA determined that fountain solution emission reductions would be estimated at between 25% and 90% for smaller sources. As this draft CTG is 16 years old and the new CTG indicates that steps have been taken to reduce VOM content in fountain solutions, the Illinois EPA used the 25% figure in calculating reductions.

Cleaning solutions can be calculated as a straight 30% reduction, since the regulation requires reformulation such that they cannot contain more than 70% VOM.

As noted above, the Illinois EPA inventory does not necessarily specify, for each source, which emissions result from cleaning and which are from fountain solutions. However, using the model plants from the 1993 draft CTG as a guide, it appears that cleaning solution emissions at smaller plants make up a lower percentage of emissions compared to fountain solutions, ranging up to approximately 50% at certain facilities. Assuming that almost 50% of non-ink emissions come from cleaning solutions, which have 30% reduction, it is safe to use a 25% overall emission reduction to cover all VOM originating from the source.

The total VOM emissions from the 66 Chicago NAA sources are 1.455 tons per day. Thus, a 25% overall reduction equates to 0.36 tons per day of VOM. The total VOM emissions from the three Metro-East NAA sources is 0.0295 tons per day. A 25% overall reduction would provide 0.007 tons per day.

## 6.2 Letterpress Printing

As noted earlier, the Agency does not believe there are currently any heatset web letterpress printing operations in the NAAs. As such, no emissions reductions are expected from add-on controls for this category.

According to a search of the Bureau of Air's 2005 source inventory, there are two sources in the Chicago NAA, and none in the Metro-East NAA, making use of letterpress printing (see Appendix B). Only one of these sources appears to emit more than 15 PPD from such operations, with less than 0.02 TPD of VOM, including emissions from the letterpress as well as other printing operations. Even if all of the emissions originated from letterpress cleaning solutions, which are to be reduced by 30 percent, the resulting reduction would be 0.005 TPD. As such, the Illinois EPA expects negligible emission reductions overall from the implementation of this regulation.

### 6.3 Flexible Packaging Printing

It is difficult to estimate emission reductions for the flexible packaging printing category, as the Illinois source database does not generally specify the type of substrate being used by a flexographic or rotogravure printing operation, nor does it specify the date of original installation of the printing press or the associated control device. As such, all existing flexographic and rotogravure printing facilities identified as such in the Illinois inventory and exceeding the proposed applicability threshold are listed in Appendix B as potentially affected sources.

However, the Illinois inventory indicates that all sources but one using flexographic or rotogravure printing of any type are already achieving greater control efficiency than required by the proposed regulation. The remaining source (identified with an asterisk in Appendix B) is required by its permit to achieve 60 percent control efficiency, but will now need to achieve 65 percent. This change would equate to a 0.03 TPD reduction according to its permitted emissions, but a 0.01 TPD reduction according to emissions information in the inventory.

While the inventory does not provide information regarding the use of compliant inks, it has been the Agency's experience that sources printing on flexible packaging have had difficulty with the use of compliant VOM inks on such substrates. Sources either relied on add-on controls or switched to waterbased inks that should meet the newly proposed requirements as well as the existing ones. As such, negligible emission reductions are expected from the new ink limits.

The cleaning materials work practice standards being proposed do not lend themselves to a calculation of emission reductions. The Agency believes that the environment will see actual VOM emission reductions due to the storing of cleaning materials and used shop towels in closed containers, as well as conveying cleaning materials in closed containers or pipes, but calculation of such emission reductions cannot be accomplished without detailed information from every affected source – both before and after such changes are made.

### 6.4 Industrial Cleaning Solvents

USEPA estimated that there are 130 sources in the impacted areas that have emissions over 15 PPD in Illinois. These sources are estimated to have baseline emissions of 2293 Mg/yr (2528 TPY) of VOM as mentioned previously and include degreasing operations that are already impacted by existing state regulations that will not gain any further reductions.

It is not reasonably practicable to estimate emission reductions for the other impacted sources under the industrial clean-up solvent rule, as any source in either

NAA that uses cleaning solvents is potentially affected, depending upon the source's usage level. Further, many different types of sources throughout the NAAs may use different types of cleaning solutions and may already be using compliant solutions. For these reasons, Appendix B does not list specific sources that are potentially impacted by this rulemaking.

As discussed above, the Agency believes that the environment will see actual VOM emission reductions due to these proposed regulations, but calculation of such emission reductions cannot be accomplished without detailed information from every affected source.

#### 6.5 Flat Wood Paneling Coatings

A search of the Bureau of Air's 2005 source inventory indicated four sources that will likely be subject to the proposed flat wood paneling coating regulation in the Chicago NAA, and none in the Metro-East NAA. One of these four sources would appear to fall below the proposed applicability threshold. The other three total 0.09 TPD of VOM emissions. According to the CTG, VOM emissions were reduced an average of 60 percent for interior paneling and tileboard manufacturing. This description seems to fit the Illinois NAA sources best. As such, Illinois EPA estimates a VOM reduction of 0.05 TPD in the Chicago NAA and no reductions in the Metro-East NAA.

### 7.0 OTHER STATES' STANDARDS

#### 7.1 Lithographic Printing

Appendix B of the CTG for Lithographic and Letterpress Printing contains a list of state standards for lithographic printing across the country. Rather than reproduce the entire list here, the reader is referred to that list.<sup>2</sup> A key point to note is that all states with ozone NAAs will need to implement the same Group II CTGs as Illinois is implementing with this rulemaking.

#### 7.2 Letterpress Printing

Appendix C of the CTG for Lithographic and Letterpress Printing contains a list of state standards for letterpress printing across the country. Rather than reproduce the entire list here, the reader is referred to that list.<sup>2</sup> A key point to note is that all states with ozone NAAs will need to implement the same Group II CTGs as Illinois is implementing with this rulemaking.

#### 7.3 Flexible Packaging Printing

Section V of the CTG for Flexible Package Printing contains a list of state standards for flexible package printing across the country. Rather than reproduce

the entire list here, the reader is referred to that list.<sup>3</sup> A key point to note is that all states with ozone NAAs will need to implement the same Group II CTGs as Illinois is implementing with this rulemaking.

#### 7.4 Industrial Cleaning Solvents

The CTG for Industrial Cleaning Solvents contains some information on other state standards throughout the document.<sup>4</sup> Besides those rules, of particular note are regulations in California – South Coast, Bay Area, and San Joaquin Valley – as well as Wisconsin and a proposed regulation in Ohio, from which Illinois obtained most of its proposed limits for activities that have a limit different from the basic one suggested in the CTG.

Appendix A contains a table (originally provided by Ohio and modified to include proposed Illinois limits) that is a comparison of Illinois' proposed limits with the above areas' limits.

#### 7.5 Flat Wood Paneling Coatings

Section V and Appendix B of the CTG for Flat Wood Paneling Coating contains information on state standards for these operations across the country. Rather than reproduce the entire list here, the reader is referred to that list.<sup>5</sup> A key point to note is that all states with ozone NAAs will need to implement the same Group II CTGs as Illinois is implementing with this rulemaking.

### 8.0 SUMMARY

The regulations proposed in this rulemaking, covering the CTGs from Group II of USEPA's Consumer and Commercial Products category, add new requirements or tighten existing requirements for lithographic printing, letterpress printing, flexible packaging printing, flat wood paneling coating, and industrial cleaning solvents. The Agency believes that all the proposed changes are technically feasible and economically reasonable. Incorporating these additions and modifications to existing Illinois regulations is required by the CAA and USEPA; specifically, Section 182(b)(2)(A) of the CAA requires that SIPs must be revised to include RACT for VOM emissions sources that are covered by a CTG issued by USEPA after November 15, 1990, and before the area's date of attainment.

The Illinois EPA made multiple rounds of outreach efforts in relation to this proposed rulemaking. The first was accomplished electronically, with the second involving follow-up calls from the Agency to sources that had submitted comments as well as detailed discussions between the Agency and industry group representatives. In addition, the Agency has had frequent discussions with USEPA personnel in both the regional office and headquarters, and has gathered information from other states. After this extensive effort, the Agency has proposed

this rulemaking, which incorporates the requirements of the CTGs and USEPA plus comments from industry.

While the Agency recognizes that it is difficult to quantify specific emission reductions that will be achieved through these rule modifications, the environment will see a real reduction of VOM emissions. As previously noted, USEPA strengthened the eight-hour ozone standard last year. It is likely that the same areas in Illinois that are currently designated as nonattainment for the present standards will soon be designated as nonattainment for this revised standard. Any reduction in VOM emissions in the NAAs will help Illinois to achieve the newly revised NAAQS as well as satisfy CAA obligations.

**Appendix A: Comparison of Proposed Illinois Industrial Cleaning Solvent Limits to Those in Other States**

<b>Solvent Cleaning Operation</b>	<b>Illinois Rule (proposed)</b> <b>VOM content [lbs/gallon, as used]</b>	<b>Ohio Rule (proposed)</b> <b>VOM content [lb/gallon, as used]</b>	<b>South Coast Rule (2006)</b> <b>VOM content [lbs/gallon, as used]</b>	<b>Bay Area Rule (2002)</b> <b>VOM content [lbs/gallon, as used]</b>	<b>San Joaquin Valley (2003)</b> <b>VOM content [lbs/gallon, as used]</b>	<b>Wisconsin Rule (2004)</b> <b>VOM content [lbs/gallon, as used]</b>
(a) Product cleaning during manufacturing process or surface preparation for coating, adhesive, or ink application:						
(i) General	0.42	0.42	0.21	0.42	0.42	0.42
(ii) Electrical apparatus components and electronic components	0.83	0.83	0.83	Exempt ?	4.2	4.2
(iii) Medical devices and pharmaceuticals	6.7	6.7	6.7	Exempt ?	6.7	6.7
(b) Repair and maintenance cleaning:						
(i) General	0.42	0.42	0.21	0.42	0.42	0.42
(ii) Electrical apparatus components and electronic components	0.83	0.83	0.83	Exempt ?	7.5	7.5
(iii) Medical devices and pharmaceuticals				Exempt ?		
(a) Tools, equipment and machinery	6.7	6.7	6.7	?	6.7	6.7
(b) General work surfaces	5.0	5.0	5.0	?	5.0	5.0
(c) Cleaning of ink application equipment:						
(i) General	0.42	0.42	0.21	0.42	0.42	0.42
(ii) Flexographic and Rotogravure printing that does not print flexible packaging	0.83	0.42	0.21	6.8	0.42	0.42
(iii) Screen printing	4.2	4.2	4.2	2.5	6.3	6.4
(iv) Ultraviolet ink and electron beam ink application equipment, except screen printing	5.4	5.4	5.4	6.7	6.7	6.7

## Appendix B: Potentially Affected Sources

### **Lithographic Printing Sources**

Chicago Nonattainment Area:

<u>BOA ID Number</u>	<u>Source Name</u>
031012AGH	Nuart
031015AAR	Sleepeck Printing Co
031015ACC	Douglas Press Inc
031018AAK	The Buhl Press Inc
031030ACU	Kelvyn Press Inc
031030ACW	H&W Graphics Inc
031030ADM	Rapid Impressions Inc
031051ABM	Unique Printers & Lithographers
031051ADK	Royal Continental Box Co
031063AHP	Chromatech Printing Inc
031063AHU	Des Plaines Printing LLC
031096AAD	TIN Inc DBA Temple-Inland
031096ANR	Tukaiz LLC
031120AAF	Cadore-Miller Printing Inc
031123ABZ	Darwill
031123ACD	Creative Automation
031126AAZ	Liberty Suburban Chicago Newspaper
031186AGD	MeadWestvaco Consumer Packaging Group LLC
031201ADU	Johnson & Quin Inc
031201AEG	Ed Garvey & Co
031201AEQ	SKM Ventures LLC
031288AJJ	Great Lakes Graphics
031297ABT	Calumet Carton Co
031440AFJ	Bruce Offset Co / Pearson I Inc
031440ALJ	Elk Grove Graphics
031440ALO	Quality Color Graphics Inc
031440ALR	Premier Card Solutions LLC
031440AMW	Impact Printers & Lithographers
031600AWL	Lakeside Lithography LLC
031600BGU	Color Communications Inc
031600BKC	Goes Lithographing Co Inc
031600CAG	Chicago Press Corp
031600CHZ	Cardinal Colorprint Printing
031600FAN	Chicago Tribune Co
031600FOV	Seven Worldwide Inc
031600GBC	Newsweb Corp
031600GFC	Melar Litho Inc
031600GHF	American Thiessen LLC
031600GHI	Palmer Printing Inc
031600GJN	Enteron Group LLC
031600GQV	Diemand Printing Co
031821ABB	Ideal Box Co

<u>BOA ID Number</u>	<u>Source Name</u>
043005ALJ	Advantage Printing Inc
043005AMK	Lakewood Printing Inc
043005AMS	ABS Graphics Inc
043020ABI	Tempo Graphics Inc
043020ACM	Flint Ink North America Corp
043030ADL	Johnson Printers
043030AEG	Diamond Web Printing Inc
043030AEL	Jet Lithocolor Inc
043065ACG	Dow Jones & Co Inc
043120AAR	Madden Communication
043452AAW	Vis-o-Graphics
089010ACG	Tegrant Alloyd Brands Inc
089020ABH	Carlith Printing Co
089407AAO	Voris Communications Co Inc d/b/a Kelmscott Press
089438AFT	Hagg Press Inc
089483ACC	InterCo Print LLC
089483ACM	Perfect Plastic Printing Corp
089800ABV	Freedom Imaging Systems Inc
097190ACR	Nosco Inc
097190AFK	Lake County Press Inc
111015ACP	Corporate Express
197025AAM	Joliet Pattern Works Inc
197080AAN	Fox Valley Publications
197491AAD	Vision Integrated Graphics LLC

**Metro-East Nonattainment Area:**

<u>BOA ID Number</u>	<u>Source Name</u>
119055AAZ	Dow Jones and Co Inc
119819AAA	Highland Supply Corp
133025AAK	Mar Graphics

**Letterpress Printing Sources**

**Chicago Nonattainment Area:**

<u>BOA ID Number</u>	<u>Source Name</u>
031288ABA	Federal-Mogul Corp
111015ADP	Stephen Fossler Company

## Flexible Packaging Printing Sources

Chicago Nonattainment Area:

<u>BOA ID Number</u>	<u>Source Name</u>
031003ACU	Duro Bag Mfg Co
031009AAS	Weber Marking Systems Inc
031012ACA	Packaging Corp of IL d/b/a Acorn Corrugated Box Co
031012AFM	International Paper Co
031012AGJ	International Paper Co
031015AAM	Alcan Packaging Food & Tobacco Inc
031027AAS	Smurfit-Stone Container Corp
031045AGI	CFC International Inc
031063ADM	International Paper Co
031063AFT	Deluxe Manufacturing Operations Inc
031063AHT	Pamco Printed Tape & Label Co
031096AMM	Formel Industries Inc
031096AOB	Prairie State Group
031186AFK	Wagner Zip Change
031440AHX	Clear-Lam Packaging Inc
031489AAU	Paddock Printing Center
031497AAM	Bio-Industries
031600ACL	Bagcraft Packaging LLC
031600AIL	Solo Cup Operating Corporation
031600BGU	Color Communications Inc
031600BTT	General Packaging Products
031600CKM	MeadWestvaco Packaging Systems LLC
031600DNZ	Bio Star Films LLC
031600GEI	Cenveo
031600GFH	TIN Inc d/b/a Temple - Inland
031600GIB	American Labelmark Co
031600GLJ	General Packaging Products Inc
031820AAI	Bluegrass Flexible Packaging Co LLC
043005AJS	Rollprint Packaging Products Inc
043005ALB	Quality Bags Inc
043020AAC	Graphic Packaging International Inc
043020ACH	Meyercord Revenue Co
043020ACJ	Packaging Personified Inc
043035ACX	Bema Poly Tech d/b/a Bema Film Sys Inc
043462AAA	Genesis Packaging & Design
043806AAN	Pro-pak Industries Inc
089010ACC	Pechiney Plastic Packaging Inc
089055AAK	International Paper
089407AAZ	Covalence Specialty Materials Corp
089438ADW	Printpack Inc
089438AFL	Multifilm Packaging Corp.*
089438AGQ	TIN Inc DBA Elgin Corrugated Box
089483ABV	Dopaco Inc
089483ACY	Moore Wallace North America Inc

<u>BOA ID Number</u>	<u>Source Name</u>
097035ABE	Nosco Inc
097080AAY	Colbert Packaging Corp
097084AAI	Vonco Products Inc
097115ABC	Amcors Flexibles Healthcare Inc
097115ACJ	Parade Packaging
097125AAY	Stone Container Corp
097190ACR	Nosco Inc
097418AAL	Fisher Container Corp
097803AAB	CTI Industries Corp
097809ABG	Kraftseal Corp
111010AAT	AMPAC Flexicon LLC
111035AAP	HS Crocker Co Inc
111065AAR	Diversapack LLC
111803AAF	Catty Corp

Metro-East Nonattainment Area:

<u>BOA ID Number</u>	<u>Source Name</u>
119040ATD	Gateway Packaging Inc
119055AAL	Highland Supply Corp
119819AAA	Highland Supply Corp

**Flat Wood Paneling Coating Sources**

Chicago Nonattainment Area:

<u>BOA ID Number</u>	<u>Source Name</u>
031600AFA	William Yuenger Manufacturing Co
031600FZW	Interior Crafts Inc
031600GGJ	FCI Inc
197815AAH	Illinois Flush Door Inc

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3. Control Techniques Guidelines for Flexible Package Printing, United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 2006.
4. Control Techniques Guidelines: Industrial Cleaning Solvents, United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 2006.
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