Bay Area Air Quality Management District

939 Ellis Street
San Francisco, CA 94109

Bay Area Ozone Strategy
Control Measure SS-2
BAAQMD Regulation 8, Rule 20: Graphic Arts Printing and Coating Operations

Workshop Report
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WORKSHOP REPORT

Proposed Amendments to Regulation 8, Rule 20

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I. INTRODUCTION

Bay Area Air Quality Management District (District) Regulation 8, Rule 20 limits the emissions of volatile organic compounds (VOC) from graphic arts operations during printing, coating, adhesive application, and cleaning activities. The District is considering amendments to Regulation 8, Rule 20 to further reduce VOC emissions and to fulfill Bay Area 2005 Ozone Strategy Control Measure SS-2, which commits the District to examine potential further reduction of VOC from printing operations.

Currently, Bay Area graphic arts businesses that have permits to operate and are subject to Regulation 8, Rule 20 emit 5.2 tons of VOC per day into the region's atmosphere. These VOC emissions include some, but not all VOC emissions from digital printing operations, a type of graphic arts operation that have a permit to operate. Staff estimates that digital printing operations, which currently are not subject to Regulation 8, Rule 20, emit an additional 0.07 – 0.10 tons of VOC per day (TPD). Not all digital printing operations require a permit to operate.

Staff estimates that proposed amendments to the graphic arts rule will result in total reductions of VOC emissions of approximately 1.6 TPD, based on estimated reductions of 0.6 TPD attributable to controls that would take effect in 2008-09 and additional reductions of 1.0 TPD attributable to further controls that would take effect in 2010.

District staff recommends amendments to Regulation 8, Rule 20 that in general will modify exemptions from the rule, modify VOC limits for certain flexographic printing inks, modify VOC limits for graphic arts cleaning products, require labeling of ink and cleaning products containers for sale and distribution, and impose registration requirements for low-emitting facilities.

District staff also recommends amending Regulation 2, Rule 1, Section 119 to limit the requirement to obtain a permit to operate to those graphic arts operations that emit 400 lbs of VOCs or more per month.

II. BACKGROUND

The District adopted Regulation 8, Rule 20 on April 12, 1980 and amended it five times thereafter. The regulation has significantly reduced VOC emissions from Bay Area graphic arts operations by establishing VOC emission limits for inks, cleaning products, and other graphic arts products and requiring the use of add-on control (abatement) devices for graphic arts operations using materials that exceed specified VOC limits.

The District adopted the last amendments in 1999. The District added VOC limits for cleaning materials used in graphic arts operations and lowered the threshold of VOC emissions that triggers subjecting a graphic arts operation to regulation under this rule.

The Bay Area 2005 Ozone Strategy's Stationary Source Measure SS-2 committed the District to examine potential further emission reductions, based in part on the regulatory activities of other air districts. For example, the South Coast Air Quality Management District (SCAQMD) solvent cleaning rule, Rule 1171, has more stringent VOC limits for

cleaning solvents than does the Air District currently. The San Joaquin Valley Unified Air Pollution Control District is considering amending graphic arts rule, Rule 4607, to adopt cleaning product VOC limits that are similar to those in the SCAQMD's solvent cleaning rule Also, there are air districts that regulate graphic arts operations at a lower VOC-emissions threshold than the District's current exemption for 175 lbs of VOC emissions per month.

There are 261 permitted graphics arts facilities in the Bay Area. Printing establishments range in size from single-person print shops to large newspaper, packaging, and flexible packaging operations. Most graphic arts operations are low-emitting facilities, many of which are currently exempt from the requirements of Regulation 8, Rule 20. Some facilities use a single printing technology; others use a combination of printing technologies, including lithographic, flexographic, screen printing, and gravure.

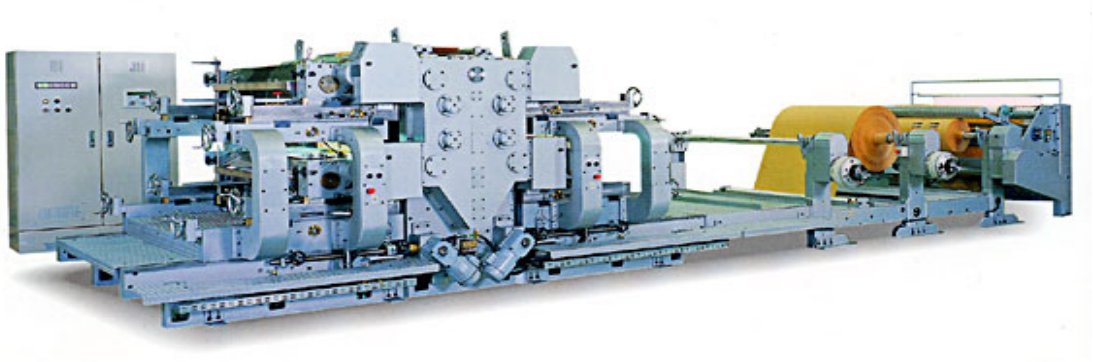
Graphic Arts Overview

Graphic arts facilities use printing presses to produce "images" on substrates. A substrate is the base material that images are printed onto. Each press is comprised of one or more printing units that print one color at a time. Substrates onto which images are printed are either continuous (web) or in pieces (sheets). The Bay Area's graphic arts industry can be divided into six different printing technologies, five of which are currently subject to Regulation 8, Rule 20:

1. Letterpress – The oldest method of printing in which a raised inked surface prints directly onto the substrate. Letterpress printing was a common technique for periodicals and newspapers, but it is being replaced by other types of printing, such as lithography and digital printing.
2. Flexographic – A printing method in which the image carrier is made of rubber or other elastomeric material and the image is raised above the non-image areas. Typical substrates include textiles, paper, paperboard, plastic, acetate film, and foil.

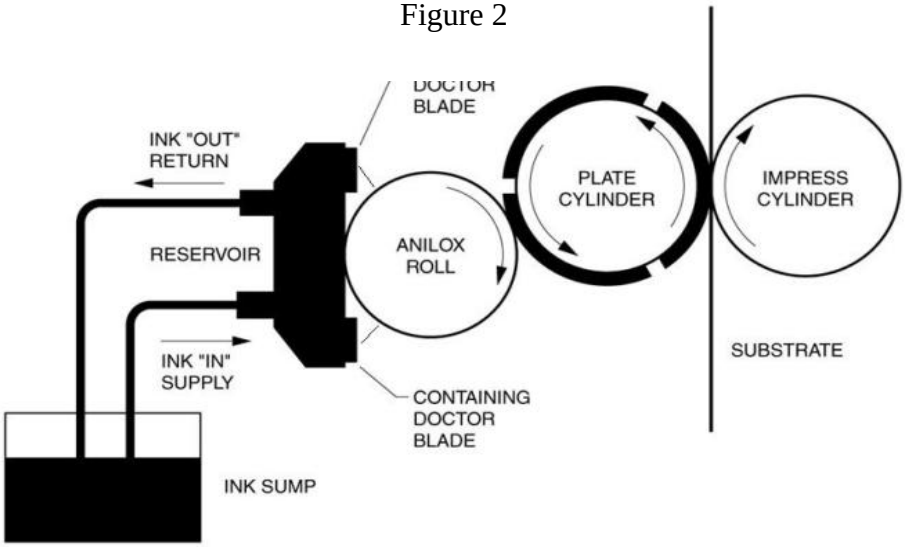
Figure 1 is a large flexographic press.

Figure 1



Source: PIA Northern California

Figure 2



Source: PIA of Northern California

Figure 2 is a schematic diagram of a flexographic press.

3. Gravure – A printing method in which the ink is transferred from minute etched wells in a plate to the substrate, which is supported by an impression roller. When a rotating drum or cylinder is used to transfer an image to the substrate, this process is called rotogravure printing.

4. Lithographic – A printing method in which the image and non-image areas are on the same plane. (Lithographic printing is also known as planographic printing.) Lithography is a technique in which the inked image is transferred (or "offset") from a plate to a rubber blanket, then to the printing surface. The lithographic process is based on the principle that water and oil do not mix. The non-image area is receptive to water, and the image area is receptive to ink and repellent to water.

   There are two types of lithographic printing: sheet-fed and web. Sheet-fed presses run individual sheets of paper through the press, while web presses feed paper continuously from a large roll and can use either heatset or non-heatset inks. Once the image is printed onto the substrate, the paper is either fed back onto a roll or cut and/or trimmed into specific shapes and sizes. Web lithography is designed to print large jobs; it prints newspapers, books, catalogs, periodicals, advertising and business forms. Sheet-fed lithography is used mostly for short runs of books, periodicals, posters, advertising flyers, brochures, greeting cards, packaging and fine art reproduction.

   Lithographic printing operations account for over 50 percent of the permitted graphic arts operations in the Bay Area.

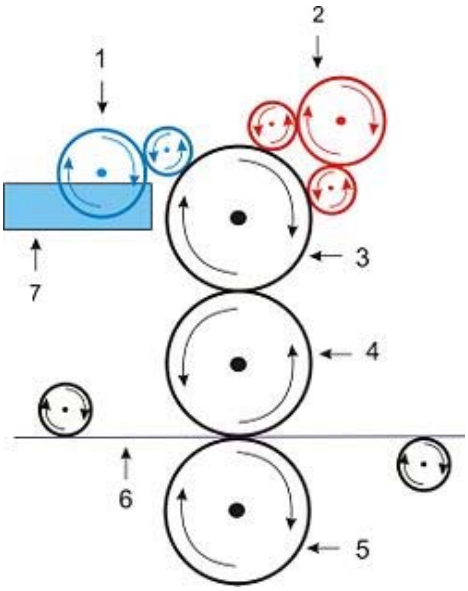
Figure 3 is a small, sheet-fed lithographic press.

Figure 3

Source: Heidelberg

Figure 4 is a schematic diagram of a lithographic transfer process.

Figure 4



1. water rollers
2. ink rollers
3. plate cylinder
4. offset cylinder
5. impression cylinder
6. paper substrate
7. water

Source: Wikipedia

4. Screen Printing – A method of printing, also known as silk screening, which utilizes a stenciling technique. The ink is forced through the open areas of a stencil and deposited onto a substrate.

5. Digital Printing – A non-traditional, non-impact printing method that is not currently subject to the requirements of Regulation 8, Rule 20. Digital printing includes inkjet, electrophotographic, thermal transfer, and dye sublimation technologies. There are several differences between digital printing and traditional printing. First, most digital printing processes do not use a permanent or semi-permanent physical plate to create images. Rather, it sends computer-generated electronic signals to the printing press to create a temporary plate that may last for only one impression. Consequently, the digitally-created image plates are not static. The electronic signal can create images that can vary from one impression to the next. Digital printing requires considerably less time to set up a print job than the traditional printing methods. Traditional printing plates can only produce a single image for the length of the press run. Second, digital printing can be used on a variety of substrates, and, unlike most traditional printing, is not limited to flat substrates, such as paper, cardboard, and other packaging materials. Digital printing is an evolving technology, which only now air districts are beginning to examine. Only recently have air districts learned that some digital printing methods utilize inks and solvents that contain significant amounts of VOC and that may produce significant VOC emissions.

   Graphic arts operations can be further classified by the type of substrates that are printed on by the specific printing technologies. Substrates include foil, paper, cardboard, film, plastic, metal, and vinyl, and three-dimensional surfaces. The graphic arts industry prints images onto a wide array of substrates. Due to market demand, the types of printing substrates continue to increase. Consequently, graphics arts operations must use an increasing variety of coatings, inks, and adhesives to keep up with the demand.

Table 1 illustrates products that are typically printed on by specific printing technologies.

Table 1 -- Products Printed By Each Graphic Arts Technology

Printing Technology	Examples of Products
Letterpress	announcements, business cards, letterhead, proofs, form documents, posters, embossing and hot-leaf stamping
Flexographic	flexible packaging materials, cups, cartons, bags, pressure sensitive labels, film, plastic, and foil
Gravure	books, greeting cards, and packaging materials
Lithographic	newspapers, books, business forms, financial and legal documents
Screen	clothing, textiles, flyers, billboard advertisements, and skate boards
Digital	documents, packaging material, medical devices, billboards, plastic, car seat foam, clothing, vinyl signs, rubber tubing, and metal products

Inks, Coatings, and Adhesives

Graphic arts operations use inks, coatings, and adhesive materials during printing processes. Some of these materials may contain VOC.

Each graphic arts technology requires the use of inks that are specific to the printing process and the substrates. Therefore, the composition of inks varies significantly from one process to another. Inks are petroleum-based, water-based, or agriculturally-based materials (such as vegetable oils). As a result, the physical properties of inks vary, such as their viscosity, tackiness, and drying time. Further, each printing technology usually requires the application of a precise thickness of ink to a substrate to produce an optimum image.

Graphic arts inks also dry by various methods. Traditional inks, such as newspaper printing inks and sheetfed printing inks, dry by one of three methods: absorption into the substrate, evaporation, and oxidative polymerization. In the oxidative polymerization process, ink additives react with oils to speed up polymerization, thus turning wet inks into a solid. It is a process that improves the glossiness of an ink and can make the

surface scratch and rub-resistant.

Lithographic, flexographic, gravure, and screen printing operations can use ultraviolet (UV) inks that are based on radiation curing technology. It is a technology that utilizes short wavelength UV, or high energy electrons from electron beam (EB) sources, to cure (cross-link) special reactive inks, coatings, varnishes, and adhesive formulations. The benefits of UV and EB printing inks include: (1) their very quick curing, which allows for higher press speeds, (2) their improved adhesion to substrates, and (3) their ability to render final products with physical and chemical resistant properties. Ultraviolet and electron beam inks emit almost no VOC. However, printing industry representatives have stated that in the Bay Area, many of the products used to clean equipment that use UV inks are solvent-based and contain VOC. The District seeks to learn whether graphic arts operators use ultraviolet printing inks in the Bay Area.

Graphic arts operations utilize coatings in a variety of ways. Coatings include varnishes, aqueous-based and solvent-based coatings, UV coatings, and laminates. Coatings can provide a background color onto which inks may be applied. Coatings also protect the surface of the final product from damage due to abrasion, water, or chemicals. One example of a chemical-resistant coating is the anti-corrosion coating applied to orange juice cartons to protect them against deterioration caused by the acid. Applications also include textiles such as those used for hot and cold air inflatable advertising media, displays, and banners.

Graphic arts operations use adhesives in both the printing and production processes. Operators print on pressure-sensitive adhesive products, such as labels, decals, and tapes. Graphic arts operations use adhesives in production processes, including to bind books and magazines; temporarily secure textile substrates during screen printing operations; and manufacture flexible packaging products, such as boxes, cans, and wraps.

Cleaning Products

The graphics arts industry uses a variety of cleaning products to remove excess printing inks, oils, grease, coatings, and adhesives and to remove unwanted dust, debris and other pressroom contaminants.

Most Bay Area graphic arts operators use VOC-containing cleaning products to clean external parts of the printing press manually and to clean internal areas of the press manually and mechanically. Press operators apply small amounts of cleaning solvent to a cloth and hand wipe blankets, rollers, cylinders, drums, and ink tools, ink trays, ink cans, ink rails, pipe rollers, and spray bars. Used cloths are disposed of as hazardous waste. Automated systems clean internal parts of the press, such as those that apply blanket washes on lithographic presses. One of the advantages of an automated press cleaning feature is the ability of a press operator to clean a press while simultaneously printing jobs.

Another source of VOC emissions relates to the cleaning of press parts that are not directly involved in the creation or application of images or that do not typically come

into contact with printing inks ("other press parts"). Other press parts are cleaned with products containing solvents. Other press parts include, but are not limited to, non-image areas of printing plates, catwalks, motors, belts, die cutters, side frames, gripper bars, delivery units, ink pumps, dryer boxes, drip pans, and ink trays.

Cleaning products are available in a range of quantities, ranging from 1-gallon to 50-gallon drums. Distributors state that cleaning products that are purchased in large containers are transferred into smaller containers, such as squirt bottles, to clean printing presses.

District staff is aware that some Bay Area facilities use non-traditional techniques to clean printing presses that do not involve the use of VOC-containing products. One such cleaning method involves the "blasting" press parts with dry-ice (CO2). The District seeks comments on the extent of the use of such techniques in the Bay Area.

III. TECHNICAL REVIEW

Emissions Inventory

The District estimates that the total VOC emissions from permitted Bay Area graphic arts operations is 5.2 tons per day (TPD), based on the District's emissions inventory. The District's graphic arts emission inventory is derived from the sum of VOC emissions reported on annual update forms submitted by all permitted graphic arts facilities to the District prior to renewing their permits to operate. Update forms contain the throughput of various printing-related materials used by facilities during the previous twelve months. The sources of VOC emissions include inks, coatings, and certain cleaning solvents from letterpress, lithographic, gravure, screen and flexographic printing operations. Emissions from permitted digital printing operations that use solvent cleaning products, such as inkjet and bubble jet printers, are also included in the emissions inventory.

The emissions inventory does not include the VOC emissions from the use of adhesive materials or from cleaning products used to clean adhesive application materials, nor does it include VOC emissions from the use of cleaning products to clean equipment with cured ultraviolet inks and coatings, nor does it include VOC emissions from solvents and inks used in digital printing operations that do not have a permit to operate.

Digital printing operations are not regulated by Regulation 8, Rule 20. However, they require a permit to operate if they use more than 30 gallons of inks and coatings per year or if they use more than 20 gallons of solvent per year pursuant to Regulation 2, Rule 1. Based on solvent usage for permitted inkjet printing operations in the Bay Area as well as permitted electrophotographic printing operations, staff estimates the emissions from digital printing operations to be in excess of 0.07 tons per day but less than 0.10 tons per day. Accordingly, the estimated total of VOC emissions from all graphic arts operations and printing operations in the Bay Area, including DP, is between 5.22 TPD and 5.25 TPD. Table 2 illustrates emissions for each printing technology on a tons-per-day TPD basis.

Table 2 – Graphic Arts Emissions Inventory – Current		
Printing Technology	**Ink and Coating Emissions VOC in TPD**	**Solvent Cleaning Emissions VOC in TPD**
Flexography	0.53	.05
Letterpress	0.04	0.036
Lithography	0.18	3.02
Gravure	0.09	0.002
Screen	1.04	0.09
Digital	0.07	0.07 - 0.10
Total Emissions	**1.95 TPD**	**3.27 – 3.30 TPD**

Controlling VOC Emissions

Regulation 8, Rule 20 limits VOC emissions from graphic arts operations three ways. First, the District has set VOC emissions limits for inks, coatings, fountain solutions, adhesives, and cleaning products; second, the District has set collection and destruction efficiencies for District-approved VOC emissions control devices; and third, the District has established work practice standards that minimize solvent evaporation. The District also requires graphics arts operations to monitor and keep records for certain sources of emissions and requires an extreme performance petition for other sources.

The District proposes to delete Section 8-20-304, the Alternate Emission Control Plan provision. There are currently no graphic arts facilities using this provision. Staff seeks comments from industry on the proposal to delete this seldom-used optional method of complying with Regulation 8, Rule 20.

Since the development of Regulation 8, Rule 20 in 1980, the majority of the emission reductions have been achieved through lowering the allowable VOC limits for all printing products. Many products which were previously solvent-based are now either water-based or soy-based. At this time, the largest source of VOC emissions from the graphic arts industry is from solvents used for cleaning. Manufacturers have begun reformulating graphic arts cleaning products with grains and other vegetable-based ingredients. Some graphic arts operators have informed District staff that they have experienced negative impacts on printing presses and printed images as described in detail below. However, as cleaning product manufacturers continue to reformulate during the next two years, they expect to produce cleaning products that perform well and have a VOC content of 100

grams of per liter or less. District staff seeks comments on the efforts to reduce VOC emissions from graphic arts cleaning products.

Inks and Coatings

Currently, all flexographic inks used in the Bay Area are subject to a single VOC limit of 300 grams per liter. Flexographic inks used on porous substrates must penetrate the surface for proper adhesion. Inks containing a VOC content of 225 grams per liter have been used successfully on porous substrates in other California air districts for several years. On the other hand, ink penetration is not important for successful flexographic printing on non-porous substrates. For non-porous substrates, an adhesion process occurs between the flexographic ink and the substrate that is based on the resin's capacity to form a continuous film on the non-absorbent surface. The VOC content of inks used on non-porous substrates is a vital part of the adhesion process and thus must be maintained at 300 grams per liter.

The District's most recent emissions inventory -- from 2005 -- indicates that flexographic inks and coatings emit 0.53 TPD of VOCs. In the Bay Area, flexographic facilities printing on non-porous substrates tend to print in larger volumes than flexographic facilities printing on porous substrates; therefore, their ink throughput is greater. Operators of some non-porous flexographic printing operations use abatement equipment in order to use high-VOC inks and coatings and/or to increase their permitted materials throughput. Staff estimates that 10% of the flexographic facilities in the Bay Area print on non-porous (plastic) substrates. Staff bases its estimate on a 1999 SCAQMD staff report that estimates a similar distribution in the South Coast Air Basin.

Cleaning Products and the Composite Partial Pressure Standard

Many cleaning products used in the Bay Area's printing industry are derived from petroleum-based solvents which are often blended with surfactant and/or water. Cleaning products may consist of a single solvent, such as kerosene, isopropyl alcohol (IPA), toluene, or a combination of solvents including methanol. Composite Partial Pressure (CPP) standards were developed approximately fifteen years ago as an alternative to using graphic arts cleaning products with low VOC content. Lower CPP products evaporate from a surface more slowly, reducing emissions. However, any remaining solvent film evaporates to the surrounding area. Most Bay Area graphic arts facilities use cleaning products that comply with the CPP standard and contain a VOC content that is typically 700 – 800 grams per liter.

Cleaning products with a VOC content lower than the District's current VOC limits, in the range of 500 g/l to 600 g/l, have been used successfully in the SCAQMD. However, while significant progress has been made reformulating cleaning products for the graphic arts industry, issues exist with some cleaning products that have been formulated to meet the technology-forcing VOC standards of 100 g/l (or less) the SCAQMD adopted in 1999. The 100 g/l VOC standard became effective for certain technologies in 2005, while for other printing technologies, the standard became effective in 2006. However, some compliance dates were delayed until 2008 due to problems with the new products.

The Printing Industries of Southern California informed BAAQMD staff that recent testing revealed mixed success with the newly formulated cleaning products. Staff is seeking comment on experience with low-VOC cleaning products.

Adhesive Application Equipment

The District does not currently have a VOC limit for products that clean graphic arts adhesive application equipment. District staff estimates that most Bay Area graphic arts facilities use adhesive application equipment cleaning products that have a high VOC content. However, District staff also understands that for several years, graphic arts facilities in other California air districts have complied VOC standards by using adhesive application cleaning products with VOC content lower than what is currently used in Bay Area facilities.

Digital Printing

Digital Printing is a relatively new technology that is not currently regulated by any of the California air districts. Some digital printing operations create images by using dry toners, inks, and waxes that contain virtually no VOC. However, other DP operations, including inkjet printing and some newer technologies, use high-VOC content inks. The extent of VOC emissions from digital printing printing sources is not yet well known. Staff proposes to further investigate the feasibility of reducing VOC emissions from commercial DP for future possible rule making and seeks comments on digital printing operations in the Bay Area.

IV. RULE AMENDMENTS

Proposed Amendments

The District proposes amendments that will reduce VOC emissions from the Bay Area's printing industry in three ways: (1) lowering the exemption limit; (2) lowering the VOC limit for flexographic ink used on porous substrates; and, (3) lowering the VOC limits for graphic arts cleaning products in two stages. The majority of the VOC emission reductions will be achieved by tightening the VOC standards for existing graphic arts cleaning products and by adopting VOC standards for other cleaning products.

District staff also proposes a number of other amendments. They include the modification of numerous definitions, including that of "graphic arts operations," and the addition of others in order to clarify the scope and applicability of the Rule Section 8-20-200. In addition, staff is proposing to correct and update other provisions, including modifications to Recordkeeping Requirements (Section 8-20-503) and Method of Determining VOC Emissions from graphic arts operations abated by an emission control system (Section 8-20-602). Staff also recommends deleting the Alternate Emission Control Plan (Section 8-20-304) and the Extreme Performance Screen Printing Petition for low-VOC emitters (Section 8-20-407). Staff is considering modifying recordkeeping requirements to a 12-month rolling basis.

Exemption: Low VOC-Emitting Facilities

Most California air districts provide an exemption from their graphic arts regulations for low-emitting graphic arts operations. There are 261 permitted graphic arts facilities within the District. Eighty-five of the 261 facilities emit less than 175 lbs of VOC per month and thus, currently are exempt from the standards of Regulation 8, Rule 20. As a review of all feasible measures associated with the printing industry, staff considered lowering the threshold of graphic arts operations that are subject to Regulation 8, Rule 20 and eliminating the low-emitting operations exemption altogether. After reviewing the Bay Area's graphic arts emissions inventory, staff determined that eliminating the low emissions exemption is not warranted because considerable District resources (engineering, inspection, and technical staff) would be required to address a minimal emission reduction. However, staff determined there would be a benefit to lowering the threshold.

Staff analyzed the emissions from those permitted graphic arts facilities that are currently exempt from Regulation 8, Rule 20. Staff identified a cluster of facilities emitting substantially more than 75 pounds per month of VOC and a second cluster of facilities emitting at least 10 pounds less than 75 pounds per month were identified. Based on that break at 75 pounds per month, staff proposes to lower the threshold from 175 pounds VOC per month to 75 pounds VOC per month that become subject to the requirements of Regulation 8, Rule 20. The lower threshold will result in 77% of currently-exempt graphic arts facilities becoming subject to the standards of the graphic arts rule.

The current low-emitting facilities exemption in Regulation 8, Rule 20 is based on the quantity of VOC emissions per month from graphic arts operations. Currently, some of these exempt facilities require a permit to operate because they either emit 150 lbs of VOC per year, or use 30 gallons of ink or coating per year, or use 20 gallons of solvent per year. (See District Regulation 2, Rule 1.) Staff proposes to change Regulation 2, Rule 1 to require only those facilities that emit 400 lbs VOC or more per month to obtain a permit to operate. Staff proposes to require those facilities that emit less than 400 lbs VOC per month but at least 75 lbs VOC per month (the level at which Regulation 8, Rule 20 standards will become effective) to register with the District in lieu of obtaining a permit.

There are several reasons for this proposal. First, the amendment will correlate the thresholds that trigger the requirement for a graphic arts operation to obtain a permit to operate and the applicability of Regulation 8, Rule 20 requirements to those operations. That correlation will help clarify the applicability of District requirements to the printing industry. Second, permit fees do not fully recover the cost of permit administration and enforcement activities for so many low-emitting facilities. Based on a Dun and Bradstreet's graphic arts operations mailing list, there appear to be approximately 2,000 low-emitting facilities in the Bay Area that are not subject to this Rule currently, but that would become subject to the Rule if the exemption limit were eliminated entirely or below the currently-proposed limit. The permitting and enforcement staff would be overwhelmed by so many new sources. Finally, small businesses in this industry can incur significant permitting costs, particularly under "Waters Bill" notification

requirements for use of any amount of a toxic air contaminant or a hazardous air pollutant within 1,000 feet of a school.[1]

The District proposes to assist low VOC-emitting facilities, while obtaining important information about the graphic arts operations by requiring these facilities to register rather than obtain a permit to operate. Staff is proposing an initial registration fee of $215.00 and an annual renewal fee of $135.00. By contrast, currently, a low-emitting facility will pay approximately $500.00 for the initial permit to operate and related fees and will pay approximately $260.00 each year thereafter for the permit renewal and related fees, depending on the number of sources. If a facility is subject to the Waters Bill, there may be a requirement to submit a public notice for schools that will cost between $2,000.00 and $3,000.00.

This registration requirement would replace the permitting requirements for low-emitting facilities subject to the graphic arts rule. Some low VOC-emitting facilities that currently require permits to operate would become exempt from the permit requirement, although they would be required to register as described above. These facilities have the option of retaining their permits or switching to the registration system. The District is currently developing a web-based registration system to simplify the registration procedure.

Facilities that emit less than 75 lbs of VOC per month or use less than 8 gallons of solvent per month will be exempt from the rule except for certain recordkeeping requirements. The 8 gallons of solvent is an approximation of 75 pounds and is based on District permit experience. It is included as an alternative for ease of calculation on small operators.

Ink and Coating Standards

Currently, Regulation 8, Rule 20 contains a VOC limit of 300 grams/liter (g/l) for all flexographic ink. District staff proposes to divide flexographic printing into porous and non-porous categories by proposing a VOC limit of 225 g/l for flexographic inks applied to porous substrates while retaining the existing 300 g/l limit for non-porous substrates.

The purpose of this amendment is to align the Rule with current printing industry practices and regulatory standards elsewhere in the State. Flexographic inks containing less than 225 grams of VOC per liter have been used on porous substrates for several years. The SCAQMD has prohibited the use of flexographic printing inks for porous materials containing more than 225 grams VOC per liter since 2000. The District anticipates achieving a modest VOC emission reduction as a result of this amendment because our emissions data indicates that emissions from flexographic ink applied to porous substrates account for less than 5% of VOC emissions from all Bay Area graphic arts operations.

[1] California Health and Safety Code 42301.6(b) and BAAQMD Regulation 3, Section 318.

Cleaning Product Standards

District staff proposes three changes to the current VOC standards for graphic arts operations' cleaning products.

First, staff recommends the deletion of all Vapor Pressure or Composite Partial Pressure limit (CPP limit) for cleaning products. Currently, the cleaning products used in flexographic printing, specialty flexographic printing, and ultraviolet printing operations must comply with both a VOC standard and CPP limit, whereas cleaning products used in lithographic printing, screen printing, and gravure printing operations must comply with either the applicable VOC limit or a CPP limit. Cleaning products meeting the CPP limit have a higher VOC content. The goal of this rule amendment is to reduce VOC emissions. Deleting the option to use cleaning products meeting CPP limits will help to achieve that goal.

Second, District staff recommends adopting VOC standards for cleaning products that have a lower VOC content but are effective in cleaning graphic arts equipment. Cleaning products with lower VOC contents, in the range of 500 g/l to 650 g/l, have been used successfully in other air districts. District staff recommends reducing the lower VOC limits in two phases – lowering the limit initially in 2009 and then finally in 2010. This approach will provide cleaning product manufacturers sufficient time to further refine low-VOC formulations and to ramp up production. An additional benefit of the phase-in period is that the printing industry will have time to adapt to using the new products. The final VOC limits will be the same as those required by the SCAQMD.

Third, District staff proposes to adopt VOC limits for the cleaning products not currently subject to Regulation 8, Rule 20. Staff recognizes the additional opportunity to reduce VOC emissions from the graphic arts industry by imposing VOC standards on products used to cleaning the following equipment:

- adhesive application equipment,
- letterpress printing parts; and,
- other press parts (maintenance and repairs for non imaging equipment).

The proposed VOC standards are set forth in the table below.

Table 3 is a summary in chart form of the current and proposed VOC standards for cleaning products. The chart includes flexographic printing ink VOC limits, current and proposed VOC and CPP limits for cleaning products used in traditional printing operations, and corresponding compliance dates.

Table 3 – Proposed VOC Limits			
Graphic Arts Operation	**Current VOC limits in (g/l) & Vapor Pressure Limits in (mm Hg @ 20º C)**	**Proposed January 2009 VOC limits (g/l)**	**Proposed January 2010 VOC limits (g/l)**
Flexographic Ink (porous substrate)	300	225	225 – no change
Flexographic Ink (non-porous substrate)	300	300 - no change	300 – no change
Adhesive Application Equipment Cleaning Products	N/A	500	25
Flexographic Printing Cleaning Products	810 AND 21	500	25
Specialty Flexographic Cleaning Products	880 AND 25	500	100
Gravure Publication Cleaning Products	800 OR 25	450	100
Gravure Packaging Cleaning Products	800 OR 25	450	25
Ultraviolet Ink and Coating Cleaning Products	800 AND 33	650	100
Letterpress Cleaning Products	N/A	500	100
Lithographic Hand Cleaning Products	300 OR 10*	500	100
Lithographic Automated Cleaning Products	300 OR 25*	650	100
Screen Printing Cleaning Products	300 OR 10*	500	100
Other Press Parts Cleaning Products	N/A	450	25

*Most facilities use high VOC-containing products (700 – 800 grams/liter VOC) and comply with the vapor pressure requirements, based on conversations with industry representatives.

Emission Reductions

The calculations for estimated VOC emission reductions are based on the emissions inventories and reports from permitted Bay Area graphic arts operations. District staff calculated the estimated emission reductions based on the anticipated reduction of VOC

emissions from the current VOC limits multiplied by the quantities of each type of product used. The estimated quantities and emissions reductions are based on industry data and District permit information. District staff also calculated estimated emissions reductions to be achieved when the VOC emissions exemption limit for low- emitting facilities is lowered. Table 4 is a summary in chart form of the approximate emission reductions the proposed rule amendments will yield during calendar year 2009 and 2010. The emission reductions in the 2010 column represent additional reductions beyond those achieved in 2009, for a cumulative total of 1.65 TPD.

Table 4 – Estimated VOC Emission Reductions

Printing Technology	2009 Emission Reductions (TPD)	2010 Emission Reductions (TPD)	Total Emissions Reduction
Flexographic Porous Ink	0.1	--	0.1
Adhesive Cleaning Products	0.022	0.034	0.056
Flexographic Cleaning Products	0.02	0.028	0.048
Gravure Cleaning Products	0.0009	0.0001	0.0010
Letterpress Cleaning Products	0.013	0.018	0.031
Lithographic Hand Cleaning Products	0.26	0.52	0.78
Lithographic Automated Cleaning Products	0.113	0.41	0.523
Screen Printing Cleaning Products	0.029	0.05	0.08
Ultraviolet Ink Cleaning Products	.0005	.008	0.0085
New Exemption Limit	0.023	--	0.023
Emission Reductions	**0.58 TPD of VOC**	**1.07 TPD of VOC**	**1.65 TPD**

Costs

VOC reductions will be achieved by lowering the low-VOC emissions exemption limit, by lowering current and adopting new VOC limits for graphics arts cleaning products, and by lowering the VOC limit for flexographic printing inks on porous substrates.

Staff have compared the cost of petroleum-based graphic arts cleaning products to lower VOC-containing cleaning products. Based on statements from distributors, staff estimates that the current costs of petroleum-based graphic arts cleaning products are the same as or in some cases higher than the costs for lower VOC-cleaning products. This is because many lower VOC-containing cleaning products are formulated with water or other materials that are less expensive than petroleum-based products. The cost increase for flexographic printers to switch to inks containing 25% less VOC for porous substrates is expected to average from 3% to 4%, as illustrated in Table 5. For specialty flexographic inks used on porous substrates, the cost may be 25% or more.

For a graphic arts operation to switch from traditional, solvent-based cleaning products to soy-based, water-based, or other low-VOC cleaning products might not be a simple substitution. Print shop equipment varies; thus, business decisions regarding which cleaning products best work for a given operation have to be made on a shop-by-shop basis. The use of a new cleaning product will sometimes require adjustments to other work processes to address compatibility issues. For instance, representatives from the Printing Industries of Northern California inform the District that cheaper metal press parts may rust when exposed to water-based washes if such parts are not dried adequately. One permitted facility in the Bay Area states that the introduction of a new chemical into an established printing process can have unintended consequences. There may be costs associated with converting graphic arts operations to lower-VOC products; however, the District is unable to quantify the cost impact at this point. Depending on the type of press parts and the number of press parts that might have to be modified, the cost of complying with a new VOC standard can vary from one graphic arts facility to another. Also, printing products such as inks and fountain solutions might have to be replaced as well, which can result in additional costs.

Other indirect costs printing operators might have to consider when incorporating a new cleaning product include:

- learning new application techniques;
- longer drying times;
- impacts on imaging process by oily deposits on rollers;
- diminished roller life;
- more than one press wash required to clean all press parts; and,
- possible creation of larger waste streams, due to the use of additional cleaner on a per job basis.

Table 5 compares the average list price for graphic arts products currently used by print shops in the Bay Area, versus the anticipated price increase after new VOC limits are implemented as of January 1, 2009. Table 6 reflects the predicted price adjustment in

2010 when the VOC limits for graphic arts products are lowered again. Both tables assume a 3.5 percent price increase for press washes, based on discussions with five manufacturers.

Table 5 – Cost for Graphic Arts Products After Rule 2008 Amendment			
Graphic Arts Cleaning Products	**Cost at Current VOC Limits**	**Assuming 3.5% Cost Increase**	**Maximum Price Increase**
Lithographic Printing Hand Press Wash	$10 - $12 per gallon	$10.35 - $12.42 per gallon	$0.35 - $0.42 per gallon
Lithographic Printing Automated Press Wash	$11 - $13 per gallon	$11.40 - $13.45 per gallon	$0.40 - $0.45 per gallon
Rotogravure Press Cleaning Product	$10.50 - $11.50 per gallon	$10.87 - $11.90 per gallon	$0.37 - $0.40 per gallon
Flexographic Press Cleaning Product	$11 - $13 per gallon	$11.40 - $13.45 per gallon	$0.40 - $0.45 per gallon
Screen Printing Press Wash	$28 per gallon	$28 per gallon	$0.00 per gallon
Adhesive Cleaning Product	$11.50 – $12.75 per gallon	$11.90 – $12.75 per gallon	$0.40 - $0.45 per gallon
Screen Printing Adhesive Cleaning Product	$76.00 per pound	$76.00 per pound	$0.00 per pound
Flexographic Ink	**Cost at current VOC Limit 300 g/l**	**Cost when VOC Limit is 225 g/l**	**Price Differential**
Flexographic Ink for Porous Substrate	$1.00 - $5.00 per pound	$1.29 – $5.18 per pound	$0.35 - $0.175 per pound

Based on discussions with representatives from Flint Ink and the Printing Industries of Northern California, staff estimates that the cost of lower-VOC containing flexographic ink applied onto porous substrates will not significantly impact operational costs for flexographic printers. Several vendors informed staff that price increases would not increase more than 3 to 4 percent in most cases. However, one vendor, who has a large share of the Bay Area market, stated that the price for a reformulated flexographic ink for porous substrates that is as effective as the higher VOC-containing inks could increase by as much as 25 percent. The current price for a batch of such flexographic ink can vary between $1.00 to $5.00 per pound, depending on the type and degree of customization specified by individual print shops. The potential price increase for flexographic ink in Table 5 conservatively reflects the higher cost estimate.

Table 6 – Cost for Cleaning Products After Rule 2010 Amendment			
Graphic Arts and Printing Product	**Cost at Current VOC Limits**	**Assuming 3.5% Cost Increase**	**Maximum Price Increase**
Lithographic Printing Hand Press Wash	$10.35 - $12.42 per gallon	$10.71 - $12.86 per gallon	$0.36 - $0.44 per gallon
Lithographic Printing Automated Press Wash	$11.40 - $13.45 per gallon	$11.80 - $13.92 per gallon	$0.40 - $0.47 per gallon
Rotogravure Press Cleaning Product	$10.87 - $11.90 per gallon	$11.25 - $12.32 per gallon	$0.38 - $0.42 per gallon
Flexographic Press Cleaning Product	$11.40 - $13.45 per gallon	$11.80 - $13.92 per gallon	$0.40 - $0.47 per gallon
Screen Printing Press Wash	$18.63 - $23.80 per gallon	$19.28 - $24.63 per gallon	$0.65 - $0.83 per gallon
Adhesive Cleaning Product	$11.90 – $12.75 per gallon	$12.32 - $13.20 per gallon	$0.42 - $0.45 per gallon
Screen Printing Adhesive Cleaning Product	$14.50 - $17.60 per pound	$15.01 - $18.22 per pound	$0.51 - $0.62 per pound

V. RULE DEVELOPMENT/PUBLIC CONSULTATION PROCESS

Publication of this Workshop Report and conducting the public workshops are the latest steps in the District's consultation process with stakeholders as the District considers amendments to Regulation 8, Rule 20: Graphic Arts Printing and Coating Operations. District staff has met with representatives from other air districts, industry representatives, graphic arts operators, equipment manufacturers, and distributors to discuss printing technologies, VOC limits, costs, health effects, and future trends in the graphic arts and printing industry.

The purpose of the public workshops is to solicit comments from the public on the proposed amendments to Regulation 8, Rule 20. During the workshops, District staff will seek comments to questions posed in this Workshop Report and will respond to questions about information set forth in this Workshop Report. Staff will review and consider all comments received during the public workshops.

District staff is conducting its environmental review of the proposed rule amendments pursuant to the California Environmental Quality Act (CEQA).

Staff will complete its CEQA analysis and prepare a final proposal for Rule amendments that will be available for public comment prior to a public hearing of the District's Board of Directors.

VI. REFERENCES

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18. Consultation with Moquin Press January 16, 2007 and May 8, 2007.
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