I. INTRODUCTION AND BACKGROUND

Volatile Organic Compound (VOC) emissions from solvent cleaning operations contribute significantly to the South Coast Air Basin's emission inventory. The South Coast Air Quality Management District (SCAQMD or District) periodically adopts an Air Quality Management Plan (AQMP). This AQMP calls for significant reductions in VOC emissions from cleaning and degreasing operations by 2010 to achieve attainment status.

One of the District's rules that focuses on cleaning applications has future compliance limits for which technology has not yet been developed. This rule is SCAQMD Rule 1171 "Solvent Cleaning Operations." One of the categories of cleaning regulated in Rule 1171 is lithographic printing cleanup operations. This is an important category because VOC emissions of cleanup solvents for lithographic printers amount to about four tons per day. When this project was initiated, the VOC limits for materials used in cleaning the on-press application equipment ranged from 600 to 800 grams per liter. On July 1, 2005, the VOC limits were reduced to 500 grams per liter, an interim limit requested by the industry. The VOC limit is scheduled to be reduced even further, to 100 grams per liter, in July, 2007. Table 1-1 summarizes the VOC limits specified in the rule for this category.

Table 1-1
VOC Limits for Cleanup Solvents Used in Lithographic Printing

Cleaning Activity	Historical VOC Limit (grams/ liter)	Current VOC Limit (grams/liter)	VOC Limit on July 1, 2007 (grams/liter)
Lithographic or Letter Press Printing			
Roller Wash--step 1	600	500	100
Roller Wash--step 2, Blanket Wash & On-Press Components	800	500	100
Removable Press Components	25	25	25
Ultraviolet Ink/ElectronBeam Ink Application Equipment	800	500	100

The values of Table 1-1 show that cleaners used in off-press cleaning have a VOC limit of 25 grams per liter and that the cleaners used for cleanup of ultraviolet (UV) and electron beam (EB) ink on press have the same limits as cleaners used for other ink types.

PROJECT STRUCTURE

The Institute for Research and Technical Assistance (IRTA) is a nonprofit organization established in 1989. IRTA works with companies to test and demonstrate alternatives to ozone depleting, VOC and toxic solvents. IRTA also conducts projects that focus on finding low-VOC, low toxicity alternatives for whole industries. IRTA runs and operates the Pollution Prevention Center, a loose affiliation of local, state and federal governmental organizations and a large electric utility company.

Cal/EPA's Department of Toxic Substances Control (DTSC), with DTSC and U.S. EPA Region IX funding, contracted with IRTA to work with lithographic printers to identify, test and demonstrate alternative low-VOC, low toxicity cleanup solvents. The SCAQMD provided DTSC with additional funding from U.S. EPA Region IX to expand the DTSC project with IRTA. In these two projects, IRTA worked with 10 lithographic printing facilities to test alternative low-VOC, low toxicity on-press cleanup materials. A report entitled "Alternative Low-VOC, Low Toxicity Cleanup solvents for the Lithographic Printing Industry" dated November 2004 summarized the results of this earlier project.

The SCAQMD also contracted with IRTA separately to conduct the technology assessment that is called for in Rule 1171 to investigate alternative low-VOC on-press cleanup materials. As part of the SCAQMD project, IRTA tested alternatives with an additional 11 lithographic printing facilities in the South Coast Basin. The purpose of this project was to find, develop, test and demonstrate suitable alternative cleaning agents that have a VOC content of 100 grams per liter or less that will meet the July 1, 2007 VOC limits in Rule 1171 and will help to satisfy the AQMP's goals for reducing VOC emissions.

The SCAQMD project included a technical working group consisting of representatives from printing facilities, a trade organization, roller manufacturers, blanket manufacturers, solvent suppliers, printers and government agencies. It also involved an effort to investigate the compatibility of the alternative cleaning agents with the materials used to make rollers and blankets. The University of Tennessee (UT) conducted the compatibility testing with assistance from the roller and blanket manufacturers. The Graphic Arts Technical Foundation (GATF), an industry supported technical organization, was charged with developing low-VOC cleaning materials by reformulating existing cleaners.

IRTA conducted the two DTSC projects and the SCAQMD project jointly with one another. Together, the three projects focused on finding viable alternative on-press cleaners for 21 lithographic printing facilities. This document reports the results of the work with the 21 lithographic printing facilities.

LITHOGRAPHIC PRINTING

The number of lithographic printers in the U.S. is about 54,000. Most of the printing companies are located in six states, one of them California. The state has about 8,300 lithographic printers and many of them are located in southern California. There are about 2,000 newspapers in California and many of them also use the lithographic printing process.

Lithographic printing is often referred to as offset printing and it is based on the fact that oil and water do not mix. The ink is offset from the plate to a rubber blanket on an intermediate cylinder and from the blanket to the substrate--which could be paper, plastic or metal--on an impression cylinder. On the plate, the printing areas are oil or ink receptive and water repellent and the non-printing areas are water receptive and ink repellent. When the plate, mounted on a cylinder, rotates, it contacts rollers that have been wet by water or dampening solution and rollers wet by ink. The dampening solution wets the non-printing areas of the plate, which prevents the ink from wetting these areas. The ink wets the image areas and these are transferred to the blanket cylinder. As the substrate passes between the blanket cylinder and impression cylinder, the inked image is transferred to the substrate.

Some of the lithographic presses used by the industry are sheet fed where the image is printed on sheets of a substrate and some are web presses where the image is printed on a continuous web. Sheet fed presses are used for printing products like advertising, books, catalogs, greeting cards, posters, labels, packaging and coupons. Web presses, which print on rolls of paper, are used for printing business forms, newspapers, inserts, long-run catalogs, books and magazines.

PARTICIPATING FACILITIES

The Printing Industries Association of Southern California (PIASC) assisted IRTA in finding lithographic printing facilities to participate in the DTSC and SCAQMD projects. The on-press cleanup solvents used in this industry are influenced by three factors: the type of press; the substrates; and the type of ink. In facility selection, IRTA and PIASC tried to find facilities that would represent the range of different press, substrate and ink types used by the industry. Table 1-2 shows the 21 facilities that participated in the project and provides information on their presses, the substrates they print on and the type of ink they use. In some cases, the facilities had more than one press type but the table presents information on only the press types where alternative cleanup materials were tested.

The second column of Table 1-2 shows that 10 facilities participated in the DTSC projects and 11 facilities participated in the SCAQMD project. Nelson Nameplate participated in both the DTSC and the SCAQMD projects.

The third column of Table 1-2 shows the type of press used at each facility. PIP, the Santa Monica Print Shop and the SCAQMD Print Shop have very small A.B. Dick automated presses. The Printery also has one small duplicator type press. Oberthur and The Printery have two color sheet fed presses. Nelson Nameplate has two small manual sheet fed presses. Presslink, The Castle Press, Print 2000 Graphics and Fanfare Media Works have four color sheet fed presses. The Dot Printer, Anderson, Oberthur, Tedco, Lithographix and The Printery have six color sheet fed presses. Three of the facilities, the Los Angeles Times, the San Bernardino Sun and J.S. Paluch, have coldset web presses. RR Donnelley & Sons, Anderson and Vertis have heatset web presses. Western Metal Decorating has a sheet fed heatset press.

Table 1-2
Facilities Participating in DTSC and SCAQMD Projects

Company	Project	Press Type	Substrate(s)	Ink Type
Los Angeles Times	DTSC	coldset web	newsprint	soy
San Bernardino Sun	DTSC	coldset web	newsprint	soy
J.S. Paluch	DTSC	coldset web	newsprint	solventborne
Nelson Nameplate	DTSC, SCAQMD	sheet fed	metal, plastic	soy
PIP	DTSC	sheet fed	coated, un-coated paper	solventborne
SCAQMD Print Shop	SCAQMD	sheet fed	coated, un-coated paper	solventborne
City of Santa Monica Print Shop	DTSC	sheet fed	coated, un-coated paper	soy
Presslink	DTSC	sheet fed	coated, un-coated paper	solventborne
Vertis	SCAQMD	heatset web	coated, un-coated paper	solventborne
RR Donnelley & Sons	DTSC	heatset web	coated, un-coated paper	solventborne
Fanfare Media Works	SCAQMD	sheet fed	coated, un-coated paper	solventborne
The Castle Press	DTSC	sheet fed	coated, un-coated paper	solventborne
Print 2000 Graphics	SCAQMD	sheet fed	coated, un-coated paper	solventborne
Western Metal Decorating	SCAQMD	heatset sheet fed	metal	solventborne
The Dot Printer	DTSC	sheet fed	coated, un-coated paper	solventborne
Lithographix	SCAQMD	sheet fed	coated, un-coated paper	ultraviolet curable
Anderson Litho-graph	SCAQMD	sheet fed	coated, un-coated paper	solventborne
		heatset web	coated, un-coated paper	solventborne
		sheet fed	coated, un-coated paper	ultraviolet curable
The Printery	SCAQMD	sheet-fed	coated, un-coated paper	soy
Tedco	SCAQMD	sheet fed	paper, plastic	ultraviolet curable
Oberthur Card	SCAQMD	sheet fed	plastic	solventborne
		sheet fed	plastic	ultraviolet curable
Huhtamaki	SCAQMD	web	coated paper	electron beam curable

The fourth column of the table shows the type or types of substrates each of the facility prints on. Fourteen of the facilities print on coated and/or uncoated paper. Three of the facilities print on newsprint. Three of the facilities print on plastic and two print on metal.

The fifth column of Table 1-2 shows the type of ink used for printing in each of the facilities. Five of the facilities use soy based ink, thirteen use solventborne ink, five of the facilities use ultraviolet (UV) curable ink and one uses electron beam (EB) curable ink.

PROJECT APPROACH

The first step in the project was to visit each of the participating facilities. During these visits, IRTA toured the facility and focused particularly on the press or presses. IRTA also discussed the type of ink or inks used by the printer and the current cleaning process with the facility representatives. IRTA requested a sample of ink or inks from the facilities.

The second step in the project was to perform preliminary tests at the IRTA office using the ink and several alternative cleaning agents. At this stage, IRTA wanted to screen alternative cleaning materials to see if they could clean the ink. IRTA obtained a blanket from one of the printers. The ink was applied to the blanket and the different cleaning agents were rubbed on the ink with a paper towel to see if they could effectively remove the ink. This test procedure allowed IRTA to determine which alternatives might be effective in cleaning the ink on a press.

The third step in the project was to visit the facilities and test the alternatives that appeared effective in the preliminary testing for cleaning the ink on the blankets and rollers on the presses with the press operators. The on-press cleaning is much more difficult than the preliminary testing so IRTA visited the facilities often and conducted testing on some presses as many as 30 times.

Printing facilities have different practices for cleaning the blankets and rollers. A picture of a blanket at one of the facilities is shown in Figure 1-1. Press operators commonly apply the solvent to a wipe cloth and wipe across the blanket to remove the ink. In some cases, this completes the blanket cleaning process. Some operators rinse the blanket after applying the solvent with a wipe cloth wet with water. Other operators apply a dry wipe cloth to the blanket after cleaning with the solvent to dry the blanket. Some printing companies have automated blanket wash systems where the solvent is applied to the blankets with a spray bar. It is generally necessary with these automated systems to periodically also clean the blankets by hand since they are not cleaned adequately with the automated systems.


Figure 1-1. Blanket on lithographic printing press

A picture of a roller train is shown in Figure 1-2. Press operators commonly clean the ink roller train by standing above the rollers and dispensing the cleaner from a squeeze bottle across the length of the top roller. Pressure is applied to the rollers with a squeegee and an ink tray is placed at the bottom of the roller train to catch the solvent/ink combination after it passes through the train. Operators generally apply the roller cleaner three to five times. Some facilities use two cleaners on the rollers; the first cleaner, called a Step 1 cleaner, is applied a few times to the roller train; application of the Step 1 cleaner is followed by application of the second cleaner, called a Step 2 cleaner, which also may be applied a few times. In some facilities, the press operators rinse the rollers with water after cleaning.

In some cases, facilities use the same cleaner on both the blankets and the rollers. In other cases, different cleaners are used. Blankets are cleaned at the end of a job and they are often also cleaned several times during a run. Rollers are generally cleaned at the end of a job when the ink color is changed or at the end of the day if no color changes have been made. Blanket cleaning requires a cleaner that solubilizes the ink but the aggressive action of hand pressure on the wipe cloth helps substantially with the cleaning. In roller cleaning, the cleaner must pass through a long series of rollers so it must solubilize the ink effectively. Although there is some pressure during cleaning when the roller train is engaged, this does not help as much in the cleaning as the hand action on blanket cleaning. With automated blanket wash system cleaning, there is no hand pressure and this is the reason that automated blanket wash system cleaning is generally supplemented with hand blanket wash cleaning.

The fourth step in the project was to conduct scaled-up testing with each of the facilities on one or more of their presses. For scaled-up testing, IRTA provided the facilities with the blanket and roller wash that were found to be most effective by the operators during the on-site testing. IRTA generally provided enough cleaner for the facilities to clean for a week.

Figure 1-2. Rollers on Small Lithographic Press

The fifth step in the process was to conduct extended testing. Extended testing involved testing the best alternative low-VOC blanket and roller wash on one or more presses for a three-month period. Extended testing was conducted with seven of the twenty-one facilities participating in the projects.

The sixth step in the project was to analyze and compare the cost and performance of the alternative and currently used cleaners. Section II of this document presents this analysis for the 21 facilities participating in the projects.

In addition to the roller and blanket testing described above, IRTA conducted limited analysis and testing of cleaners used to clean metering rollers, dampening rollers and plates which are the other on-press components described in the regulation.

CURRENT CLEANUP SOLVENTS

Solvents of various types are used in the inks utilized by lithographic printers. These solvents are emitted during the printing process. Cleanup materials used by the industry for cleaning blankets, ink rollers, dampening rollers, metering rollers and plates also contain solvents. In fact, the emissions from the solvents used for cleanup are much higher than the emissions from the solvents used in the inks. As mentioned earlier, VOC emissions of cleanup solvents from the lithographic printing process in the South Coast Basin are estimated to be about four tons per day.

Solvents used for on-press cleanup in lithographic printing include mineral spirits, methyl ethyl ketone, toluene, xylene, glycol ethers, terpenes, heptane and hexane. All of these solvents are classified as VOCs and many of them are toxic. Mineral spirits contain trace quantities of benzene, toluene and xylene. Benzene is an established human carcinogen; toluene causes central nervous system damage and xylene causes birth defects. Benzene, toluene and xylene are listed on California's Proposition 65, The Safe Drinking Water and Toxic Enforcement Act. Hexane causes peripheral neuropathy, a nervous system disease.

The project sponsors are concerned about the VOC emissions from the solvents and the exposure of the workers and community members to the solvents. The aim of the projects was to identify, develop, test and demonstrate alternative low-VOC, low toxicity cleanup materials. The alternative cleaners were tested for blanket and ink roller cleaning and, in a more limited way, for dampening roller, metering roller and plate cleaning.

ALTERNATIVE CLEANUP MATERIALS

The alternative low-VOC, low toxicity cleanup materials IRTA tested during this project can be classified into three categories. The first category is water-based cleaners. The second category is solvents that are exempt from VOC regulations. The third category is methyl esters which have a very low VOC content. Each of these categories of cleaners is discussed in more detail below.

Water-Based Cleaners

These cleaners sometimes contain a high concentration of water. They are often diluted further with water when they are used for cleaning. Some water-based cleaners are based on surfactants; others contain solvents that are miscible with water. Water-based cleaners are most applicable for cleaning the soy based ink used by newspapers or the UV or EB curable ink used by some lithographic printers.

One of the facilities participating in the DTSC project, the Los Angeles Times, has been using a water-based cleaner called Super Clean BW for a number of years. A Material Safety Data Sheet (MSDS) for this cleaner is shown in Appendix A of this report. The cleaner contains a VOC solvent, d-limonene, and a surfactant. The VOC content of the cleaner is 495 grams per liter. The Los Angeles Times dilutes the cleaner in a five to one ratio of water to cleaner. In diluted form, the VOC content of the cleaner is about 83 grams per liter, which meets the SCAQMD Rule 1171 VOC limit specified for July 1, 2007.

Another facility participating in the DTSC project, the San Bernardino Sun, has also been using a water-based cleaner called Mirachem Pressroom Cleaner for several years. An MSDS for this cleaner is shown in Appendix A of this report. This cleaner contains small quantities of two VOC solvents, a surfactant and water. The VOC content of the cleaner concentrate is 75 grams per liter. The San Bernardino Sun uses the cleaner in a

50 percent concentration with water. The VOC content of this cleaner during use is about 38 grams per liter which meets the SCAQMD Rule 1171 VOC limit for July 1, 2007.

A water-based cleaner, called Daraclean 236, was tested by IRTA at the Los Angeles Times. This cleaner contains surfactants but does not contain solvents. The VOC content of the cleaner is 60 grams per liter. IRTA tested the cleaner at a one-third concentration in water; the VOC content of this cleaner is 20 grams per liter as used. The Daraclean 236 would comply with the SCAQMD Rule 1171 VOC limit that becomes effective in July 2007.

IRTA tested the Mirachem Pressroom Cleaner at several of the other facilities participating in the DTSC projects. It was effective in only one case, the City of Santa Monica Print Shop. As described in the Section II analysis for this facility, the shop converted to this cleaner for blanket cleaning. An MSDS for the cleaner is shown in Appendix A. One of the reasons the cleaner worked effectively for this facility might be because the City used soy based ink. In facilities where solventborne ink is used, the cleaner was not effective even at full concentration or in blends with other materials.

IRTA tested other water-based cleaners for cleaning ultraviolet and electron beam curable ink. An MSDS for one of these cleaners, called Brulin 815MX, is shown in Appendix A; it was effective for cleaning the EB curable ink at Huhtamaki, primarily for cleaning off-press components.

An MSDS for another water-based cleaner called Seibert Magic UV is also shown in Appendix A. It was designed to clean UV curable ink and it worked effectively at Oberthur, Lithographix, Huhtamaki and Tedco either alone or in combination with other materials. The cleaner has a VOC content of 90 grams per liter.

Exempt Solvents

There are a number of solvents that have been specifically deemed exempt from VOC regulations by U.S. EPA and SCAQMD. Some of these contribute to ozone depletion and their production has been banned. The use of others, perchloroethylene and methylene chloride, is severely restricted because they are classified as carcinogens. One of the volatile methyl siloxanes and parachlorobenzotrifluoride, have potential toxicity problems.

Two solvents that are exempt from VOC regulation could be used for on-press cleaning. Acetone is an aggressive solvent that is very low in toxicity. It evaporates readily and its disadvantage is its low flash point. IRTA tested acetone extensively during this project and it is a very effective ink cleaner. Methyl acetate, also an aggressive solvent, is more toxic than acetone. It has similar properties to acetone, a fast evaporation rate and a low flash point. It is more expensive than acetone. Because of its higher toxicity and cost, IRTA did not test methyl acetate during this project.

Methyl Esters

This class of chemical generally contains methyl esters that have a 16 to 18 carbon chain length. Materials like soy, canola oil, rape seed oil and coconut oil are composed of methyl esters. These materials clean most types of inks very effectively. During this project, IRTA relied heavily on soy based cleaners in the alternative roller and blanket washes. Soy was selected because it is more widely available and lower cost than some of the other methyl esters. IRTA had several different formulations tested by the SCAQMD lab to determine the VOC content of the soy materials and the VOC content ranged from five grams per liter to 25 grams per liter. MSDSs for two of the soy based cleaners tested extensively in the project, Soy Gold 2000 and Soy Gold 2500, are shown in Appendix A.

Other Formulations

During the projects, IRTA tested water-based cleaners, acetone, soy based cleaners, blends of these cleaners with one another and blends of the cleaners with VOC solvents. All the cleaners that were blended with VOC solvents had a VOC content at or below 100 grams per liter.

COMPATIBILITY

Rollers are generally replaced once every six months or once a year and are very expensive. Blankets, which are less expensive, are replaced much more often. Most lithographic printers using soy or solventborne inks use rollers and blankets made of nitrile. Printers using UV or EB curable inks generally use rollers and blankets made of EPDM. The EPDM is compatible with these inks.

All solvents damage rollers and blankets to some extent but some solvents damage them more and some damage them less. For example, acetone is compatible with EPDM but high concentrations of the solvent may damage nitrile. Solvents like toluene and xylene damage EPDM. Compatibility of the cleaners with the roller and blanket material is a very important issue and, accordingly, the SCAQMD project involved a compatibility testing task. As mentioned earlier, the University of Tennessee (UT) conducted the compatibility testing and is providing compatibility results on some of the cleaners used today and the alternatives tested by IRTA and GATF. UT worked with the roller and blanket manufacturers to develop test protocols and the manufacturers provided UT with samples of rubbers of various types for the testing. UT's final report is not available at this time so the detailed results are not reported here.

IRTA relied on guidance from the roller and blanket manufacturers and some of the preliminary results of the UT compatibility testing to determine what alternative materials to test with the printers involved in the projects. The information indicated that water-based cleaners are compatible with nitrile and EPDM, soy based cleaners are compatible with nitrile but not EPDM and acetone in high concentrations is compatible with EPDM but not nitrile.

Most of the printers involved in the projects have blankets and rollers made of nitrile. IRTA identified water-based cleaning and soy based cleaning alternatives wherever possible. In the case of blanket washes, when the facility personnel requested that the cleaner evaporate more quickly, IRTA generally provided an acetone blend. According to the UT test results, formulations containing acetone above about 25 percent will damage nitrile. As discussed later, the results of the extended testing with the seven facilities did not indicate a problem with blanket washes containing, in some cases, very high concentrations of acetone.

CLEANER PERFORMANCE

Performance of the alternative cleaning agents at each facility was evaluated on a case-by-case basis. In each instance, the plant personnel provided information on their requirements for the cleaning process. In all cases, it was important for the cleaning agent to effectively clean the ink from the rollers or the blankets in a reasonable period of time. The facility personnel were the judges of which cleaners cleaned effectively. In addition, IRTA suggested that the facility print after cleaning to make sure that the print quality was acceptable and to ensure that the press came back up to color without generating an excessive amount of paper waste. In all cases, the alternatives were required to meet or exceed the current production rates and to provide the same print quality as the high VOC cleaners. Any cleaning alternative that did not meet or exceed the current requirements was rejected.

In the case of blanket cleaning, IRTA requested information from the press personnel on how fast they needed the cleaner to evaporate. Acetone has a very high vapor pressure and evaporates too quickly to effectively clean the blankets when it is used alone. IRTA used acetone in some of the alternative blanket washes but it was always blended with one or more other cleaners to slow down the evaporation. In general, if the facility wanted a very fast evaporating blanket wash, IRTA formulated with a high percentage of acetone.

In the case of roller cleaning, acetone alone was not an effective cleaner. Its high evaporation rate prevented it from traversing the entire roller train before it evaporated. In most cases, IRTA tried to find a roller wash based on soy based cleaners for the facilities that used conventional ink. In a few cases, the soy which is very oily, could not be sufficiently rinsed from the rollers and the print quality was not adequate or there was an increase in the amount of waste paper generated before the press came back up to color. In those cases, IRTA tested various alternatives that contained some acetone. For facilities that used UV or EB curable ink, IRTA generally tested water-based cleaners or water-based cleaners in combination with acetone for roller cleaning.

COST ANALYSIS

IRTA performed cost analysis for each of the alternatives that was sucessfully tested at the facilities participating in the DTSC and SCAQMD projects. The cost of using the alternative was compared with the cost of using the current higher VOC cleaner or cleaners on an annual basis. The cost analysis was based on the results of the testing and the feedback from the personnel. In all cases, IRTA evaluated the cost components that changed with use of the alternatives during the testing. During the testing and when the testing was completed, factors including increased cleaner usage, labor and paper waste were discussed explicitly with every participating facility. If the facility noticed a change in any of these parameters, it was taken into account in the cost analysis. None of the facilities needed to purchase capital equipment to use the alternatives. In a number of cases, use of the alternative cleaner was higher. In four cases, there was a change in labor with use of the alternative. In one case there was a change in waste paper generation.

COMPANY APPROVAL

In all cases except one, IRTA provided the performance and cost analysis writeup to the facilities for review. In some cases, the personnel requested changes and these were incorporated. All of the facilities approved the writeup for publication and the cost and performance analysis presented for each facility in Section II reflected the facility's conclusions from the testing. The one exception was Anderson Lithograph. This company dropped out of the testing before it was completed. IRTA prepared the writeup summarizing the incomplete testing results without obtaining approval from Anderson.

TIMING OF TESTS AND ANALYSIS

Alternative cleaners were tested at the 21 participating facilities over the last several years. All of the work with the facilities participating in the DTSC project was completed before November 2004. Testing with the other facilities involved in the extended testing was concluded by February of 2006. In all cases except The Printery, the cost of the alternative cleaners was compared with the cost of the 800 gram per liter VOC cleaners that were used by the facilities during the testing. The Printery converted from 800 gram per liter VOC cleaners to 500 gram per liter VOC cleaners in July 2005, well before the extended testing was started. For The Printery, IRTA compared the costs of using the alternatives with the cost of using the 800 gram per liter VOC cleaners and the cost of using the 500 gram per liter VOC cleaners.

REPORT ORGANIZATION

Section II of this report includes the analysis of the most effective alternative blanket and roller washes for each facility. It presents cost analysis and comparison of the current and alternative cleaning agents. It also discusses the more limited test results for cleaning other on-press components including dampening rollers, metering rollers and plates. Section II briefly discusses the findings during the testing and extended testing with the facilities in terms of performance and compatibility. Finally, Section II summarizes information provided by the California Department of Health Services Hazard Evaluation System & Information Service that compares the toxicity of the currently used cleaning agents and the low-VOC alternative cleaning agents. Section III summarizes the results of the testing for the participating facilities.