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Generic Scenario: Newspaper Printing

Newspapers are found globally and are printed in every major city as well as in many smaller cities in the United States. In 1992, there were 1,570 daily, 893 Sunday, and 7,406 weekly newspapers in operation in the United States. They represent a circulation of 60,083,265 daily, 62,542,031 Sunday, and 55,445,601 weekly newspapers. The newspaper industry employed 453,000 workers in 1992 [1].

Newspaper Printing Processes

Three different processes are used in printing newspapers: lithography, letterpress, and flexography. In 1989, offset lithography was used by 84% of the daily newspapers and accounted for 58% of the daily circulation. Letterpress was used by 14% of daily newspapers, accounting for 31% of the daily circulation. The remaining 2% of daily newspapers representing 11% of the daily circulation used di-litho and flexography [2,3]. Letterpress is one of the oldest printing processes and is still used for printing newspapers, but it is gradually being replaced by offset lithography and flexography.

In lithographic printing of newspapers, a copy is first produced, usually through a computerized type-setting process. A copy is the physical layout of each page including text and artwork. A film negative is then made of the copy and a plate produced. The photographic image is transferred to the plate through a developing process. The plate contains the image and the non-image areas in the same plane, the distinction is made by the physicochemical properties of the plate. The image areas are grease receptive, whereas the non-image areas are water receptive.

Ink is applied to the plate and is then transferred to a rubber-covered blanket cylinder and then to the paper (illustrated in Figure 1). The printing ink adheres to the grease-receptive areas. A dampening or fountain solution is applied prior to the ink to coat the water-receptive areas [4].

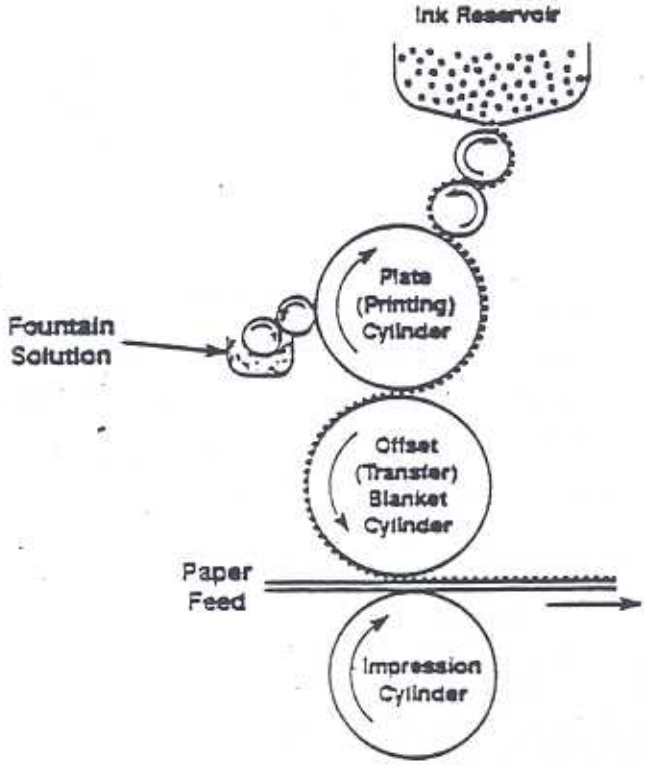

Figure 1. Offset Planographic (Lithographic) Printing

Recently, there has been more use of alcohol-free solutions. The major substitute for this is 2-butoxyethanol. Most of the fountain solution evaporates during the printing process, although some liquid waste is generated through the periodic replacement (1 to 6 weeks) of the solution in the tanks [5].

Developers and fixers are used for photographic development in the making of copy and the printing of plates. Waste solutions of the developers and fixers contain silver. Due to the market value of silver, many printers have equipment to recover the silver from spent photographic solutions.

Throughout all the printing processes, ink builds up on various parts of the printing unit. Therefore, the presses must be cleaned to maintain high print quality and ease of operation. Solvents most commonly used are chlorinated compounds (such as 1,1,1-trichloroethane or methylene chloride) or petroleum distillates. Solvents with the ability to dry quickly often are chosen to minimize downtime. The primary waste generated by cleaning is in the form of air emissions. Some spent solvent contaminated with ink also is generated.

Solvent Usage

The use of cleaning solvents usually is the most significant use of hazardous chemicals in a newspaper printing plant. Inks may also be a concern, but because the majority of news ink is black, hazardous pigments are limited. In the printing industry much concern is focused on the poor air quality caused by solvents that are used in cleaning. Typically cleaning is performed after each press run, although complications or color changes may require cleaning more often. A press run lasts anywhere between ½ hour to 6-8 hours depending on the size of the newspaper. Cleaning usually is done with a cloth saturated with solvent. The entire blanket cylinder is wiped with the cloth for cleaning. This cloth is then placed in a drum for eventual cleaning at a laundromat.

Sometimes a reusable sponge is used for this process, but typically a sponge requires more solvent usage resulting in more drips. The solvent is put into a pail where the sponge is continually wrung out. The spent solvent is then drummed for disposal while the sponge is reused.

Another alternative is the use of an automatic blanket cleaner, however the use of these in the newspaper industry is rare. The automated system uses spray bars to spray solvent onto the cylinder. The excess solvent is collected in the trays below the presses. Typically, worker exposure to cleaning solvent is lower because the solvent is in an enclosed system.

Periodically, some disassembly of the press is performed so that parts can be washed in the parts washer. This usually is a sink equipped with a solvent sprayer and collection system. The solvent usually is reused until highly contaminated and is then sent for disposal or recycling [5].

During disassembly of the press, contact with the solvent typically is through air emissions and skin contact through handling. The first point of contact is through handling of the incoming solvent. Solvent usually is received in 30- to 55-gallon drums. This is then transferred to spray bottles, buckets, or canisters for use at each press. Depending on the type of solvent and the container used, much of it may evaporate in these small containers before being used. Often the canisters are equipped with lids to reduce evaporation.

The next point of contact is by the actual cleaning process and handling of the wetted cloth. Gloves may be worn for this step, but it this not necessarily the case. After cleaning the cylinders, the cloths usually are placed in a covered drum. If the drum is left uncovered, the solvent may evaporate from the cloths resulting in air emissions. The cloths are then sent to a laundromat for cleaning. In some cases a centrifuge is used on the solvent-contaminated cloths before they are sent for cleaning. This retrieves some of the solvent from the cloths that can be reused in the parts washer, sent for disposal, or recycled. Recycling usually is done off site by a vendor but can be performed on site. Solvent waste can be disposed of at a landfill or an incinerator [5].

Besides liquid wastes that are drummed for disposal or recycling, there is a potential for wastewater emissions to the treatment facility. These emissions include unrecovered silver from developing, fountain solution, and developers. Volumes are dependent on activities at specific printers.

Waste ink is difficult to measure along as it is usually found in other wastes such as cleaning cloths, fountain solution, and solvent. Ink has low volatility (3 to 10% for nonheatset inks). Therefore most of the ink not absorbed to the paper is in the form of liquid emission.

%PMN/100 * W (lb/yr) * (1 − %Production/100 − %Recovered/100 − %Air Emissions/100) = lb/yr at one facility.

The %VOC (by wt) retained by paper is 95% as per December 14, 1992 draft Control Techniques Guideline for Offset Lithography. One large newspaper, with a daily circulation of 225,000, generates approximately 200 gallons of waste ink per week.

Worker Exposure

Worker exposure to the PMN chemical is expected to be primarily through the inhalation and dermal routes. Workers typically are exposed to solvent vapors during cleaning operations, as well as during initial solvent transfer and handling of used cleaning cloths. Similarly, dermal exposure is expected from the actual cleaning operations, as well as during solvent and waste handling operations. Very few facilities use automatic blanket cleaners, which are designed to minimize worker exposure.

The extent of worker exposure to the PMN chemical in these process steps depends on the nature of the operations used in individual facilities. Accurate quantification of the various routes for potential worker exposure is difficult with the limited information currently available for the generic PMN chemical. A search of National Technical Information Service (NTIS) literature was conducted to identify worker exposures to cleaning solvents currently used in newspaper printing. A series of Health Hazard Evaluation (HHE) reports issued by the National Institute for Occupational Safety and Health (NIOSH, Cincinnati, Ohio) were identified. However, in our limited review of the abstracts of these reports, we were unable to find specific information on the concentrations of solvent vapors to which workers in the newspaper printing industry were exposed. Nevertheless, the abstracts of the reports did provide the following information that may be helpful in this assessment:

- In a worker exposure study conducted at The Boston Globe [9], NIOSH researchers concluded that "there was a potential for significant dermal exposure to organic solvents, particularly glycol ethers." The lack of glove use by some workers and improper glove materials were noted to be important factors in dermal exposure.

- In a worker exposure study conducted at The Boston Herald [8], NIOSH researchers found that isopropyl alcohol (IPA), used to clean the printing equipment, was present as vapors in workroom air at levels below the acceptable standards. The NIOSH/OSHA time-weighted average (TWA) for IPA is 400 ppm (980 mg/m^3). The report may present details of the actual concentrations of IPA measured in breathing zone and work area air at the printing facility, but these details were unavailable in the abstract.

<u>Inhalation (mg/day):</u> Inhalation of the PMN solvent is expected to be a significant route of worker exposure to the PMN chemical, because of the volatility of the cleaning solvent and its method of application. It is very difficult to theoretically estimate the breathing zone concentration of the PMN chemical that would result from its use in the cleaning solvent. The most practical means of estimating worker exposure from the inhalation route would be to use personal monitoring data from worker exposure studies conducted of cleaning operations

Disposal Concerns

The containers used to transport the PMN chemical to the facility are assumed to be recycled, cleaned to remove contamination, and appropriately landfilled or incinerated. All liquid and water wastes are assumed to be reused, reprocessed or air dried, and then disposed of as solid wastes. Solid wastes containing the PMN chemical are assumed to be disposed of using appropriate mechanisms.

References

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