WALK-THROUGH SURVEY REPORT:

CONTROL TECHNOLOGY FOR ADHESIVES USE

AT

Drew Shoe Plant
Lancaster, Ohio

REPORT WRITTEN BY:
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NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
Division of Physical Sciences and Engineering
Engineering Control Technology Branch
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PURPOSE OF STUDY:	To observe the processes involving adhesives in a leather shoe plant, with emphasis on the method of application and the associated use of occupational health hazard controls.
DATE OF SURVEY:	June 29, 1982
SURVEY CONDUCTED BY:	Vincent D. Mortimer, Jr. Bruce A. Hollett
EMPLOYER REPRESENTATIVES CONTACTED:	Mr. Frank Shyjka, Plant Manager
EMPLOYEE REPRESENTATIVES CONTACTED:	Ms. Jan Richards, President, UFCW Union Local 214-F
STANDARD INDUSTRIAL CLASSIFICATION OF PLANT:	3144: Women's Footwear, Except Athletic

INTRODUCTION

The Engineering Control Technology Branch of NIOSH is conducting research to document and evaluate occupational health hazard control methods associated with the industrial use of adhesives. The shoe industry was identified as one in which some workers come in close contact with solvent-based adhesives. The emission of solvent vapors from adhesives may create an exposure hazard. However, if appropriate controls are employed, the exposures may be kept within acceptable limits.

This walk-through survey of the Drew Shoe Plant was conducted to learn more about the processes and associated controls involved in manufacturing shoes. Prior to this field trip, two other shoe plants had been visited: one which manufactured athletic shoes and one which produced boots and "heavy-duty" shoes. It was felt at least one more field survey was needed before deciding whether to initiate an in-depth study of this industry at this time.

The primary contact for this visit was the Plant Manager, Mr. Frank Shyjka. We also met with Ms. Jan Richards, President of United Food and Concessionaire Workers Union Local 214-F.

DESCRIPTION OF FACILITIES

Drew Shoe manufactures a variety of women's leather shoes and sandals. The company has been in business since the 1930's, and the building predates its transformation into a shoe plant. The brick structure has 3 floors, each with approximately 15,000 square feet of floor space, plus an attic for storage of inactive equipment.

At the time of our visit, the plant employed around 300 people, and approximately 90% of these were production workers. Over half the workforce is female. The workers are represented by the United Food and Concessionaire Workers Union.

PROCESS DESCRIPTION

Basic shoe manufacturing operations found at this plant include die-cutting the individual parts, assembling the upper, attaching the bottom and heel, applying a finish, and packing the shoes in boxes. For the most part, these operations are performed using manually operated equipment, although there are still some hand operations. Adhesives are used for permanently bonding some parts and for temporarily joining other parts to be stitched together later. Fitting, backing, and forming are three assembly areas where a solvent-based rubber cement is used for permanent bonding. A latex adhesive is typically used for temporary holding.

Bottoming, welting, and insole/outsole cementing involve large quantities of adhesives in this plant. One is a 30%-solids chloroprene adhesive dissolved in a mixture of both aliphatic and aromatic hydrocarbon solvents. It is used to attach the welt to the upper and to cement the sole to the shoe. This adhesive is applied at room temperature, although it can be cured in less than 10 seconds if it is heated above 130°F. Bottoming sandals is a similar but separate process, using a 19%-solids urethane-based adhesive.

After bottoming, the shoes are transferred to the floor below for attaching the heel, finishing, and packing. A small amount of adhesives are used in heel attaching. One worker divides her time about equally between gluing a piece onto a heel block with a solvent-based cement and attaching a heel to a different type of shoe with a hot-melt adhesive.

DESCRIPTION OF CONTROLS

General ventilation is heavily relied on in warm weather for comfort and vapor concentration control. Recently, all windows were blocked off on three sides of the building, and three large wall fans installed on the east side of the first and second floors. A small fan has been installed on the south wall of the first floor. The windows on the west side may be opened to allow fresh air to enter, flow across the room, and be exhausted by the fans. There are also two fans in the attic. A stairway opening connects all floors. There are no fans and no adhesives operations in the basement.

The large wall fans each had an enclosure face area of approximately 20 ft^2. The smaller fan was about half this size; the attic fans around 20% larger. The average face velocities ranged from approximately 500 feet per minute for the larger attic fan to over 1000 ft/min for one of the wall fans. The total air volume exhaust rate for these fans was determined to be approximately 150,000 ft^3/min. There is no supplied make-up air, so this amount is dependent on the number of open windows. In cold weather, the wall fans are blocked-off, and a few windows are opened.

Two adhesives application processes were performed under canopy hoods. Although the hoods were similarly sized, the volume flow rates differed substantially. The one over a welt cementing station had an average face velocity of 200 ft/min, with some values less than 100 ft/min. The canopy over the sole cementing station averaged 700 ft/min for hood face velocity; however, airflow from a small fan mounted less than 10 feet away interfered with the capture of vapors by this hood. The two hoods together added about 12,000 cfm to the total exhaust flow rate.

The station where heels were attached with hot-melt featured a partial enclosure and a pop-up applicator, with a swing-away cover, activated by a foot pedal. The adjacent heel attaching operation using a solvent-based cement was conducted in a ventilated enclosure. The two hoods were connected to the same exhaust duct, and flow from one could be shut-off when not in use to increase the exhaust rate of the other. Some solvent-based adhesives application were performed without local ventilation, a few of these in areas with little air movement.

Many operations not involving adhesives utilized local exhaust ventilation. The various coatings and finishes were applied within small spray booths, and the buffing and grinding equipment was fitted with ventilation.

DISCUSSION

On the day of the survey, solvent odor was barely noticeable, in most areas of the plant. Thus, the ventilation appeared adequate for the adhesives usage. It is not known if this would hold true in cold weather when the general ventilation was blocked-off. The few workers questioned did not indicate that the odor was particularly worse in the winter.

Most of the adhesives were spread manually with a brush. Even when the adhesive was applied by passing the piece of leather through a roller-coater, a worker usually finished the job with a brush or spatula to assure a uniform coating. This necessitates the worker getting close to the application point. Auxiliary fans can aid in dispersing vapors for operations without local exhaust ventilation, but they can interfere with the capture of vapors where local exhaust is used.

CONCLUSIONS AND RECOMMENDATIONS

A number of shoe manufacturing operations use solvent-based adhesives, although the quantities used for a given procedure may not be great. General ventilation may be adequate to maintain solvent exposures within acceptable limits, but the large volume flow rate required to control solvent vapor exposures in a large shop may be prohibitively expensive to heat and/or cool for year-round operation. Properly designed local exhaust ventilation would be more effective for many operations.

Thus, a control technology study of the use of adhesives in making shoes may promote cost effective methods to reduce solvent vapor concentrations in the workplace. Such a study should include a look at the alternatives to currently used adhesives, in addition to ventilation, automation, and work practices.

Similar operations and equipment have been observed in three different shoe plants. The familiarity gained with the basic manufacturing steps and typical health hazard controls will provide a starting point for any future surveys.