

PRELIMINARY SURVEY REPORT:

Hillcrest Veneer Plant
Burlington Furniture Industries, Inc.
High Point, North Carolina

SURVEY CONDUCTED BY:
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REPORT WRITTEN BY:
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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health
Division of Physical Sciences and Engineering
Engineering Control Technology Branch
4676 Columbia Parkway
Cincinnati, Ohio 45226

PURPOSE OF SURVEY:

To observe the processes involving adhesives, with emphasis on the method of application and the associated occupational health hazard controls.

EMPLOYER REPRESENTATIVES CONTACTED:

Mr. Gerald Burklow, Safety Director, Furniture Division
Mr. William Dyson, Corporate Industrial Hygienist
Mr. Anthony Millward, Engineer

STANDARD INDUSTRIAL CLASSIFICATION CODE OF PLANT:

2511: Wood Household Furniture

Abstract

Without appropriate controls, some industrial adhesives may cause occupational health problems. This NIOSH research study should provide information for industry to more effectively control the exposure of workers to potentially harmful adhesives. The information gathered during this preliminary survey will enhance the effectiveness of future work on this project

The Hillcrest Veneer Plant produces veneered panels for other Burlington furniture plants, having been converted for this function in 1980. The pieces of veneer are trimmed and assembled into sheets. These sheets are then bonded to both sides of a processed wood base to form a panel. The predominant bonding process involves heat-cured urea/formaldehyde adhesives.

Workplace air concentrations of formaldehyde are now less than 1 ppm due to an excellent local exhaust ventilation system. Burlington maintains active and progressive health and safety programs. This facility will be selected for an in-depth survey if the furniture/wood products area is chosen for further study.

Introduction

Industrial adhesives may involve agents, such as formaldehyde, organic solvents, and a variety of additives, which pose potential occupational health hazards. An appropriate implementation of control technology may prevent the overexposure of workers to these substances.

The Engineering Control Technology Branch of NIOSH is conducting a research study to document control methods associated with the industrial use of adhesives. The first phase of this project involves preliminary surveys to assess the application of control technology in conjunction with the use of adhesives in a number of industries. The information gathered will be used to focus Phase II efforts on the industry which can benefit most from further study and to plan for a second, more detailed survey at this plant if it is selected for in-depth study.

On this Phase I preliminary visit, the NIOSH survey team met with Messrs. William Dyson (Ph.D.) Gerald Burklow, and Anthony Millward. Dr. Dyson is a Corporate Industrial Hygienist in the Department of Health and Safety of Burlington Industries. Mr. Burklow is the Furniture Division's Safety Director. Mr. Millward, an engineer in the corporate Environmental Air Systems Office, designed the local exhaust ventilation at this plant.

Description of Facilities

The Hillcrest Veneer Plant manufactures veneered panels for furniture made by Burlington at other plants in this geographical area. The building is a concrete and steel-frame structure originally built as a textile plant. This facility was bought and converted to a veneer plant by Burlington about 1 1/2 years ago. At that time, extensive modifications were made to the heating and air conditioning system and to the ventilation system. Most of the local exhaust ventilation system is new.

The layout of the plant is diagrammed in Figure 1. The hot presses are located within a separate room within the building approximately 12,000 square feet in area with a 25 foot ceiling height. Particleboard and fiberboard panels are stored in a warehouse on the south side of the building. Bundles of veneer pieces are received at the west end of the plant. Some of the intermediate processing steps are trimming, applying an edge glue, and covering imperfections with tape or plastic wood. The adhesive mixing and coating area is located in the center of the building, just west of the hot press room. The cold press operation is set up on the other side of the south wall of the hot press room.

The Hillcrest Veneer Plant employs a total of approximately 140 people. Only about 12% of the workforce is salaried, including some production department supervisors. Approximately 20 workers are assigned to one of the hot press operations.

Veneer Preparation

The veneer pieces are first trimmed, and then the edges of a stack of 3 to 6 inches wide veneer strips is sprayed with a high-solids urea/formaldehyde

adhesive. These strips are then laid side by side and the edges are butt-glued on a heat-activated splicer machine to form a sheet of veneer. Some sheets featuring intricate patterns are formed using a similar process plus additional trimming. Surface imperfections (cracks, knot-holes, etc.) are dressed with tape or plastic wood.

The Hot-Press Veneering Process

The veneer sheets and the fiberboard or particleboard cores are assembled just prior to the press operation. A urea/formaldehyde adhesive is applied to both sides of a core using a roller/coater. To prevent premature hardening, the resin contains one to three percent excess formaldehyde. The core is placed on top of a sheet of veneer and then covered with another veneer sheet. Stacks of these "sandwiches" are moved into the press room.

These veneer/core triplets are then laid side by side on the loading table of a press. The matrix of uncured boards is mechanically moved into the press where heat and pressure are applied for a few minutes. After being mechanically moved out of the press, the boards are manually stacked for cooling and storage until the edges and surfaces can be finished.

This plant has three different types of presses: platen, shuttle, and a "Wemhoner". There are two platen presses, which permit multiple layers of boards/separated by metal sheets called platens) to be processed at one time. As observed, the 10 platen press was set to apply 1200 psi at 255°F for 5 minutes. The 6 platen press cycled for 3 1/2 minutes at 270°F, applying 1500 to 1700 psi. The shuttle press handles two layers at a time, but it can apply approximately twice as much pressure, permitting shorter press times. The "Wemhoner" press handles only a single layer of boards, but it can accommodate more boards due to a larger press area, and its unique load and unload mechanism permits automated continuous operation. These features make possible even shorter press cycles. Actual operating conditions depend on the number and size of boards being pressed.

The Cold-Press Veneering process

In this process, a water-based aliphatic resin glue (Franklin Titebond 50) is applied to both sides of a fiberboard or particleboard core, and the core is stacked between two sheets of veneer, much the same as in the hot-press process. For curing, the stack is placed in a hydraulic press developing 150 psi for 30 to 60 minutes at room temperature.

Description of Controls

Canopy hoods are installed above the inlet and outlet openings and above the unloading stations for all hot presses. Fresh air is blown down on the loaders and unloaders of the hot presses to cool them and to dispell the formaldehyde vapors from their breathing zones while they are at their work stations. Roof fans extract some of the vapors which are not captured by the local exhaust ventilation and those which are given off by the boards as they cool. The ventilation system is balanced so that the press room is always at a negative pressure with respect to the other plant areas, and air flow is always through the doorways into this room.

A bench-top spray booth is provided for the edge gluing operation. Supply vents of the heating and air-conditioning system are well distributed throughout the building. General ventilation is provided in the warehouse to counter the build-up of formaldehyde vapors from the stacks of fiberboard and particleboard.

Air sampling conducted by Dr. Dyson (See Table 1) shows low levels of formaldehyde in the workplace air. These samples were collected using impingers with 10% sodium bisulfite and analyzed using colorimetric methods with chromotropic acid. The low formaldehyde values obtained in May are due, at least in part, to a rebalancing of the ventilation system after the samples were collected in March. Overall, these levels represent a significant reduction from the concentrations present in the outdated facilities which were replaced by this plant.

Table 1. Workplace air concentrations of formaldehyde

Location	5 Mar 81 ppm	21 May 81 ppm
Warehouse - left rear corner	1.05	
- right rear corner		0.79
Glue Spreader - above roller	2.02	
- Offloader		0.57
- Offloader		0.34
Ten Platen Press - Loader/Operator	0.44	0.34
- Offloader	0.77	0.65
- Offloader	1.15	0.72
Six Platen Press - Loader/Operator	0.77	0.23
- Offloader	0.71	0.44
- Offloader	0.41	
Shuttle Press - Loader/Unloader	1.10	0.45
- Loader/Unloader	0.60	
Wemhoner Press - Offloader	0.53	0.38
- Offloader	1.21	0.50
Cooling Area - above stack of boards	1.39	0.56
Cold Press Area	0.16	

To reduce skin contact, gloves are worn by workers who handle the boards after the resin has been applied. The rollers of the coating machine are water cooled to increase pot life and reduce formaldehyde emissions.

Unfortunately, no substitute processes or materials are acceptable. The hot-press operation using urea/formaldehyde resin yields both economy of produc-

tion and a high quality product. Phenol/Formaldehyde resins release less formaldehyde but cost at least twice as much. The exclusive use of the cold press process is too costly due to low productivity.

Description of Occupational Health Programs

Burlington Industries has an Industrial Hygiene Department and a Medical Department, which together form the Division of Health and Safety under the Corporate Personnel Director. In addition to two Industrial Hygienists, they have an Industrial Hygiene Technologist and a laboratory certified under the NIOSH Proficiency Analytical Testing program. The corporate medical staff consists of a physician and three nurses, and there are four engineers under the Corporate Safety Director. The Furniture Division is the only one which has its own Safety Director. Each plant has at least one nurse. Most are Registered Nurses, many are Certified Occupational Health Nurses, and a few are Occupational Health Nurse Practitioners.

Each employee must undergo a pre-employment physical exam, which may be given at least partly by members of the nursing staff. Other than hearing tests for those exposed to noise, no periodic medical evaluations are required, nor is a post-employment physical given. There is a blood pressure screening program, but no other routine medical monitoring of employees. Workers can receive some medical care/counseling from the plant nurse, and they are informed of the results of medical tests either by the plant personnel director or the nurse.

Education and training is a plant responsibility. At this plant, the workers are informed about the hazards of formaldehyde. They are told that it can be released from the stacks of cores in the warehouse as well as from the adhesive during coating, pressing, and cooling.

Hearing protection is required in high noise areas, and eye protection is required around certain pieces of equipment. These areas are marked with warning signs. Each month, plant management meets to discuss safety items, and supervisor/worker teams from each department inspect their workplace for unsafe conditions. Each supervisor takes a course on "Job Safety Analysis."

Conclusions and Recommendations

The overexposure of many workers to formaldehyde in the furniture and wood products industries is highly likely without appropriate engineering controls. Dr. Dyson reports that the stacks of cores in the warehouse give off detectable amounts of formaldehyde, especially in hot weather. He also reported that significant emissions have been obtained when just the cores with no adhesive were run through a hot press cycle. Thus, high levels of formaldehyde are to be expected in factories using particleboard or fiber board and/or urea/formaldehyde resin, especially when the temperature in the building is high.

The local exhaust ventilation installed to control formaldehyde exposure at this plant is impressive. It demonstrates that this substance can be adequately controlled to the levels recommended by NIOSH. If the furniture/wood products industry is chosen for in-depth study, evaluating this control scheme will be an important part of our research.

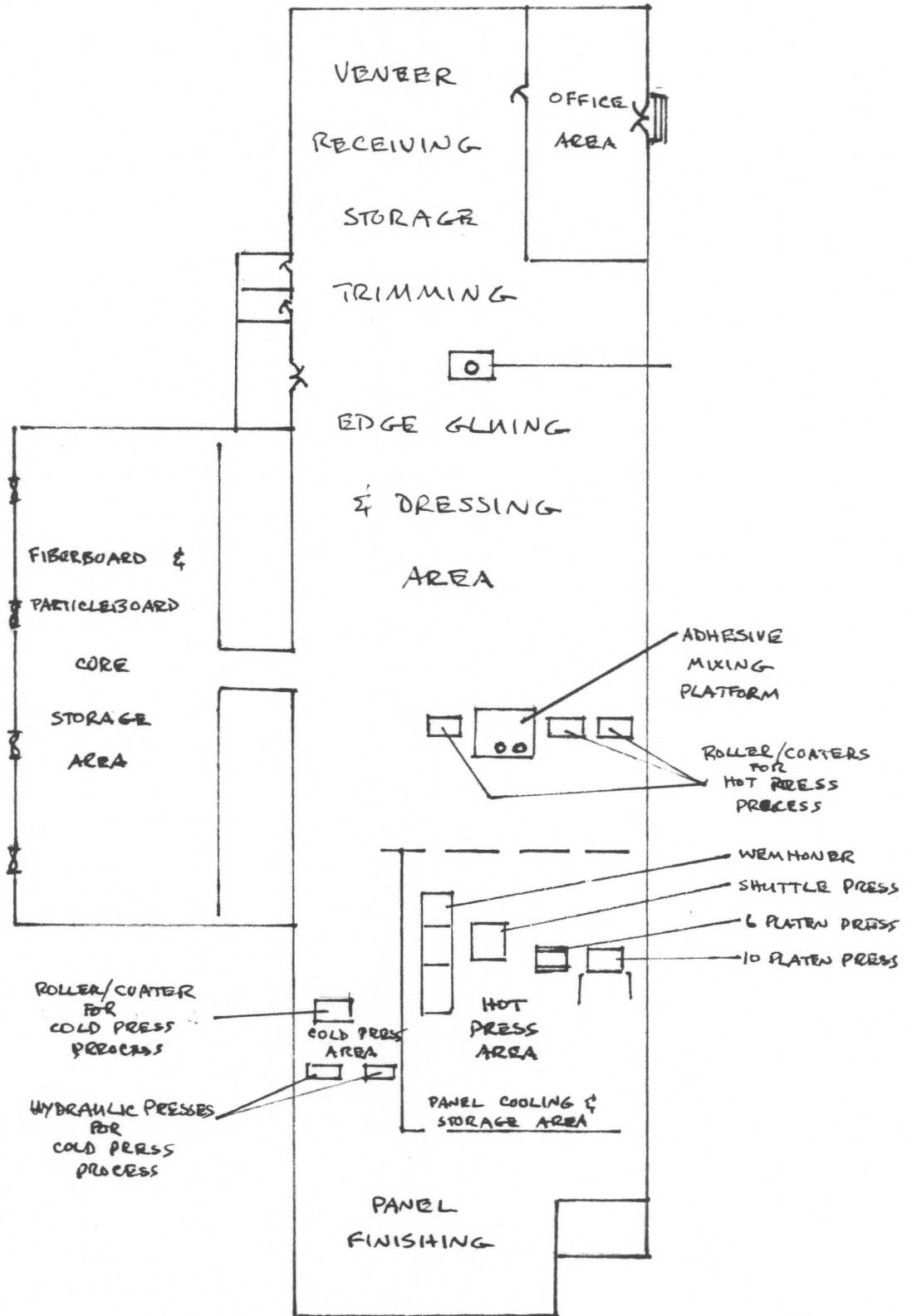


FIGURE 1. DIAGRAM OF HILLCREST VENEER PLANT