

PRELIMINARY SURVEY REPORT:

Karastan Rug Mill  
Fieldcrest Mills, Inc.  
Eden, 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:

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

EMPLOYER REPRESENTATIVES CONTACTED:

Mr. Lee Ivester, Industrial Hygienist  
Mr. F. D. Matheson, Plant Manager, Karastan Rug Mill  
Mr. J. F. Somers, Foreman, Backsizing Department

STANDARD INDUSTRIAL CLASSIFICATION CODE OF PLANT:

2271: Woven Carpets and Rugs

ANALYTICAL WORK PERFORMED BY:

Ms. Karen J. Schulte, Chemist, NIOSH/MRSB

## 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 second phase 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 preliminary visit, the primary contact was Mr. Lee Ivester, Corporate Industrial Hygienist for Fieldcrest. Also contacted were Mr. Jerry Somers, the day shift section foreman of the backsizing area of the plant, and Mr. Charles Coleman, an experienced research chemist.

## Description of Facilities

The Karastan Rug Mill in Eden, North Carolina manufactures oriental-style rugs and a woven broadloom carpet bearing the "Karaloc" trade name. Some of the building's structure is concrete and steel, but much of the framing and flooring is wood, characteristic of an old textile mill.

The areas where adhesives are handled are shown in Figure 1. The backsizing area, where the adhesive binder is applied to the carpet, is located in the main building at the east end of the burling room. The adhesives are mixed in a small room jutting out from the exterior wall just beyond the roll-up area of the backsizing operation. The latex/adhesive storage facility is housed in a small, concrete block building constructed adjacent to these areas.

The backsizing operation consists of two similar lines, side by side with process flow in the same direction. At one end is the carpet feed and roller/coating operation. These are followed by a drying oven, a cool-down unit, and the roll-up or doffing area. The two ovens are separated, but not enclosed, by a wall.

The compounding room provides floor level access to the top of the mixing reactor as well as space for storing most of the chemicals which are used to formulate the adhesive backing. An overhead door opens to a loading dock, and a stairway leads down to the level of the reactor base.

The latex storage building contains four 20,000 gallon tanks. Two store the virgin latex, the other two hold the compounded adhesive. The liquid latex is moved through the connecting pipes by applying air pressure to the source vessel, not by mechanical pumps.

Usually, two workers per shift, an operator and a doffer, are required on each backsizing line. The number of shifts and the number of lines operating

depends on the work load. This mill was running three shifts, and some part-time workers had been added to help on the day shift. Only one line was operating during the survey. A compounder mixes adhesives during the day shift. Workers are represented by the Amalgamated Clothing and Textile Workers Union.

#### Description of Process

The underside of the woven broadloom carpet is coated with a latex adhesive to bind the carpet fibers to the backing and to stiffen the carpet. The carpet is fed through a series of rollers to a pair of coating rollers which transfer the adhesive from a trough to the carpet back. A doctor blade scrapes off the excess adhesive to assure a uniform coating thickness. The carpet then passes through a steam-heated drying oven to cure the adhesive binder. After leaving the oven, the carpet passes through a cooling unit and then over another series of rollers to the doffing area where it is folded onto a cart.

A number of additives are blended into the latex base to make the adhesive binder. The virgin latex is delivered by tank truck and stored in 20,000 gallon tanks. As needed, 6000 lb portions of liquid latex are moved to the mixing room reactor where a 13,000 lb batch of adhesive is compounded. The mixture can be pumped directly to the coating trough reservoir or returned to the tank building for storage.

For years, a Goodrich styrene-butadiene (SBR) latex, containing ammonia as an emulsion stabilizer, has been used as the base. To this base, Paragum 104 thickener, Tamol 731, tetrasodium phosphate (buffer), dichlorophene (fungicide), zinc oxide, DB31 antifoam, and a clay slurry are added to formulate the adhesive. At the time of the survey, a carboxylated SBR, with acrylonitrile as a curing agent, was being tried. It also required additives with similar functions (thickner, defoamer, etc); Tamol 731 being the only one retained from the other recipe.

#### Description of Controls

Since the primary emissions from this process occur during the drying, exhaust ventilation is provided for the oven. At the time of the survey, this system appeared adequate in that air was drawn in through both openings. Make up air is supplied from the carpet-feed end of the room. Three exhaust fans are installed on the exterior wall. The plant services section is scheduled to conduct a weekly visual inspection and to perform monthly preventative maintenance on all ventilation systems.

Ammonia was the only contaminant that was noticeable in the workplace environment. Detector tubes (Drager - Ammonia 5/a) were used to sample for ammonia: the sampling sites are shown in Figure 1. The highest levels were obtained at the coating end. At the edge of the coated carpet as it was entering the oven, a level of approximately 25 ppm was measured. A level of 30 ppm was measured alongside the coating rollers. Further back from the trough, near the operator's station, 5 ppm was detected. At the carpet exit end, both along side of the oven and near the carpet folder, less than 5 ppm was measured. No strong odors were detected. On the day of the survey, the windows and doors were open; however, not all the wall fans were running.

After the preliminary visit, five samples were collected by Mr. Ivester on diffusion-type organic vapor monitors supplied by NIOSH. By this time, Fieldcrest was once again using the Goodrich latex. Qualitative analysis of these samples by the Measurements Support Section of NIOSH identified Styrene and 4-Vinyl-1-cyclohexene as being present. Although this sampling was not intended for quantitative analysis, a rough estimate of Styrene concentrations indicates levels on the order of 1 to 10 ppm, with the highest level occurring along the side of the roller coater pan. The presence of Acrylonitrile and Butadiene could not be determined with the analysis procedures used.

In the compounding room, a canopy hood was added to draw away dust pulvated when adding powdered chemicals to the reactor. No components were added to the reactor while we were there, so we could not observe the effectiveness of this system under actual conditions. However, when the fan was turned on, the air flow seemed more than adequate to extract the dust. Whether or not the breathing zone of the compounder was protected could not be determined.

An exhaust fan is mounted on the wall opposite the doorway of the latex storage building. Since this room is unoccupied most of the time, additional ventilation is not warranted. The compounder does enter this building daily for brief periods of time to manipulate valves. The tank loading connection is outside the building. No spills or leaks were evident anywhere in this building.

#### Description of Occupational Health Programs

The Industrial Hygiene and Safety Section and the Medical Section are organized under the Industrial Relations Department in the corporate offices. They provide services for all of Fieldcrest's plants.

In addition to an industrial hygienist, there are two industrial hygiene technicians. This team is responsible for semi-annual sampling for cotton dust, and a monitoring program for formaldehyde in selected areas is being established. Other services are provided in response to requests from individual plant managers. Some sampling for styrene and ammonia had been conducted in the backsizing area. A comprehensive corporate respiratory protection program involving qualitative fit testing has been initiated. A plan covering entry into enclosed spaces is being developed.

Two engineers staff the corporate safety office, and the Columbus, Georgia plant has a management level position covering safety and worker compensation. In addition to establishing safety policies and procedures, the safety office conducts quarterly visits and provides training materials. Day to day safety is the responsibility of plant management.

The corporate medical staff consists of a full-time physician and seven nurses. They provide emergency medical care, conduct periodic tests, and administer the pre-employment physical examination required of each prospective employee. Yearly audiometric screening is given to all employees exposed to noise levels greater than 90 dB on the A-weighted scale. Periodic pulmonary function tests and, if necessary, appropriate follow-up procedures are given to workers exposed to cotton dust. The outlying plants have nurses to conduct the medical program.

## Conclusions and Recommendations

Venting oven exhaust has controlled the major source of emissions in the backsizing area. However, sampling for Ammonia with detector tubes indicated local concentrations approximating the threshold limit value were present in the coating area. Although neither Styrene or Acrylonitrile have been detected in excess of permissible limits, sampling for Acrylonitrile, Styrene, and Ammonia should be conducted periodically in the coating area, and occasionally in the compounding and the latex storage areas to make certain that the control measures are performing adequately.

Fieldcrest has a well-developed and responsive industrial hygiene program. If the carpet industry is included in the in-depth study phase, this plant should be scheduled for a detailed survey.

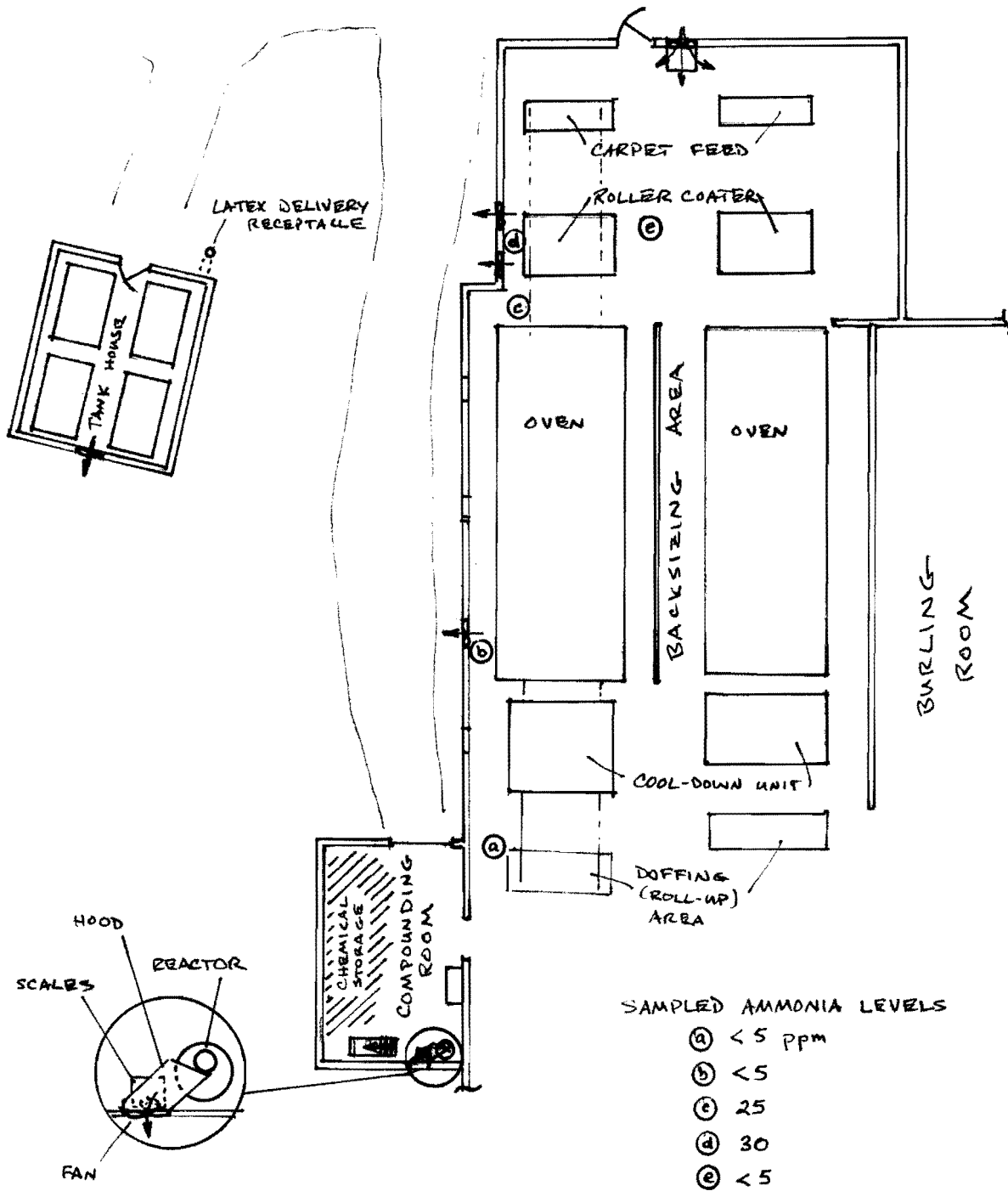


FIGURE 1. CARPET BACKSIZING FACILITIES