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DYEING AND FINISHING OF TEXTILES STRATEGIES FOR IDENTIFYING PROBLEM AREAS REPORT NUMBER 1

GEOMET TECHNOLOGIES, INC., GERMANTOWN, MD

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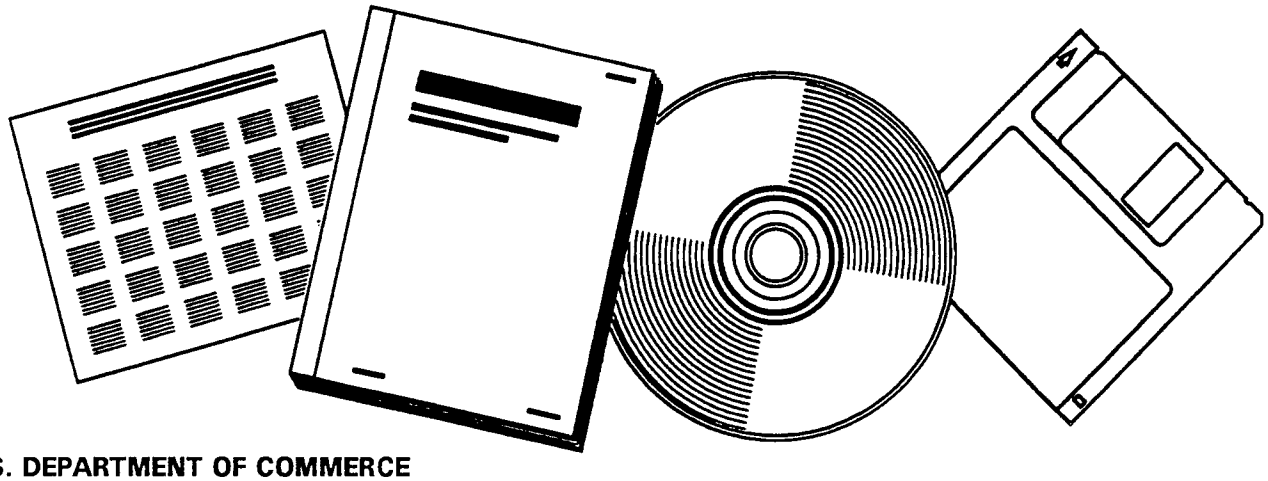

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THE DYEING AND FINISHING OF TEXTILES

STRATEGIES FOR IDENTIFYING PROBLEM AREAS

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16. Abstract (Limit: 200 words) A strategy was developed for identifying problem areas in the dyeing and finishing portion of the textiles industry. Information on sources and extent of worker exposures could be obtained from numerous sources. The major sources for illness and injury statistics would be the SIC codes, the Bureau of Labor Statistics, and Supplementary Data System. Using available published literature, the biologic effects of chemicals and physical agents used in the textile dyeing and finishing industry would be considered. Pertinent case studies and epidemiologic data would be included. Agents to which workers were exposed would be identified and various routes of exposure would be examined, including inhalation, ocular, and dermal routes. Specific hazards found in each of the processes used in dyeing and finishing were considered for the preparatory processes, dyeing processes including printing, and finishing processes. Engineering controls used in the industry would be identified from published information, site visits, and reports from trade associations, labor unions, and NIOSH. A review would be included of standard development for all relevant physical and chemical agents.

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b. Identifiers/Open-Ended Terms NIOSH-Publication, NIOSH-Contract, Contract-210-79-0001, Textiles-industry, Textile-workers, Dyeing-industry, Skin-exposure, Occupational-exposure, Industrial-hygiene, Inhalants, Bleaching-agents, Hazardous-materials

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THE DYEING AND FINISHING OF TEXTILES

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JUNE 16, 1980

Statistics for 1979 indicated that 856,000 workers were employed in the textile industry, while 60,000 worked in dyeing and finishing of textiles (SIC 226). In 1979 the industry produced 14 billion pounds of textiles worth $47 billion. The proportions of different fibers consumed were 75% manmade, 24% cotton, and 1% wool.

In order to identify problem areas in the textile dyeing and finishing industry, several types of data must be acquired and evaluated. They are as follows:

* (1) Characterization of the industry
  (2) Sources, extent, and biologic effects of exposure
  (3) Control of exposure
  (4) Various current standards

Characterization of the Industry

Most of the dyeing and finishing of textiles is carried out in SIC group 22 - textile mill products. There is a separate subgroup for dyeing and finishing, SIC 226, but there are several other categories which also include these operations: dyeing and finishing of wool (SIC 223); knitted goods (SIC 225); carpets (SIC 227); yarn goods (SIC 228); and miscellaneous, ie, nonwoven, laminated, etc (SIC 229).

The textile dyeing and finishing industry may be classified into six segments:

(1) Wool scouring and finishing
(2) Woven fabric finishing
(3) Knit fabric finishing
(4) Carpet finishing
(5) Stock yarn finishing
(6) Nonwoven manufacturing and felted fabric processing

The major dyeing and finishing processes can be divided into three groups: preparatory processes, dyeing (including printing) processes, and finishing processes.

The major preparatory processes include singeing, bleaching, scouring, mercerizing, and desizing. Dyeing includes jet dyeing, pressure

dyeing, jig dyeing, atmospheric dyeing, and padder dyeing. Printing processes include screen printing (flat bed and rotary) and roller printing. Finishing includes both mechanical and chemical processes. The major mechanical processes are calendering, schreinering, and sanforizing. The major chemical processes include durable press, waterproofing, flameproofing, mothproofing, fade protection, and softening. In addition, dyeing and finishing processes may differ according to type of textile and class of dye. All of the processes mentioned above were discussed in more detail in the PRPP submitted to NIOSH on April 25, 1980.

Sources, Extent, and Biologic Effects of Exposure

The sources and extent of worker exposure will be obtained from numerous data bases. The SIC codes, the Bureau of Labor Statistics (BLS), and Supplementary Data System (SDS) will be major sources for illness and injury statistics. We may also request worker attendance records while on plant visits. Statistics on workplace exposure to various chemical and physical agents will be obtained from OSHA and NIOSH data bases (ie, NOHS and NIOSHTIC) and other sources (eg, Standard Data Base Search).

The biologic effects of chemicals and physical agents used in the textile dyeing and finishing industry will be considered, using available published literature. Specific health effects on workers from direct exposures

will be discussed where possible. Worker health records may be requested at plant sites or from the labor unions' health record files. Recent legal decisions on access to health records may make them easier to obtain when no other sources of data are available. Pertinent case studies and epidemiologic data can be evaluated to determine their suitability as sources of health effects information. Consultants familiar with current technology can provide insight into the types of health problems that require further study. In the absence of more definitive information, extrapolations based on animal toxicologic studies in the literature may indicate types of adverse effects that should be examined more closely.

The Bureau of Labor Statistics data show higher illness and accident rates for the textile industry than the national average for other industries. The agents that may produce these hazards can be chemicals, both organic and inorganic, used in various dyeing and finishing processes. These agents include acids, bases, salts, enzymes, dyes, dye components, carriers, surfactants, solvents, and various types of resins. Some of the characteristic dyeing and finishing processes use high temperatures, open-batch reactions, bath agitation, heat-setting ovens, or movement of fabric through solutions containing various dyes and chemicals. Under these circumstances, exposure of workers to chemicals in the workplace is possible by inhalation, ocular, and dermal routes. Some of the major chemicals used in dyeing and finishing operations are: sodium hydroxide, mineral spirits, sodium chloride, hydrogen

peroxide, acetic acid, sulfuric acid, formaldehyde, sodium hydrosulphite, polyvinyl alcohol, polyvinyl chloride, and sodium silicate.

Specific hazards found in each of the processes used in dyeing and finishing are discussed below.

Preparatory Processes - Preparatory processes involve five main operations (singeing, scouring, bleaching, mercerizing, and desizing). Each of these processes may pose hazards to the worker. In singeing, there may be excessive fumes from spinning oils and sizing ingredients when exhaust systems are not efficient. Sodium hydroxide used in mercerization and scouring and acids used in desizing can cause severe burns if mishandled. Sodium hypochlorite and hydrogen peroxide may cause adverse health effects if they are allowed to vaporize into the ambient air because of poor or faulty ventilation.

Dyeing Processes (including printing) - In rooms where dyestuffs are stored and handled, the chemicals may cause dermatitis. Steaming processes involved in dyeing may liberate steam volatile substances that can be inhaled. In some dyeing processes, nitrogen dioxide may be released into the air and can cause pulmonary edema if inhaled. Exposure to naphthol may be more hazardous in cases where the dye is formed directly on the fiber. Vat dyes must be solubilized by the addition of caustics, which can cause ulcerative burns on the skin if not properly handled. Heat treatments necessary in pigment processes may generate toxic chemicals such as formaldehyde.

Finishing Processes - In durable-press treatments, formaldehyde has long been recognized as a potent irritant to the respiratory tract. Recent tests indicated that inhalation of 15 ppm formaldehyde for 18 months caused squamous cell carcinomas of the nasal cavity in rats. Surfactants used in finishing processes may increase the absorption of other chemicals on the skin. Some bromoalkyl triazine flame retardants have been found to be mutagenic.

Control of Exposure

Engineering controls used in the industry are identified from published information, plant visits, and reports from trade associations, labor unions, and NIOSH. Consultants familiar with current technology can provide an evaluation of the types of engineering controls that work best.

Current Standards

A review of standard development for all relevant physical and chemical agents can be provided based on sources such as literature reports and reviews, ACGIH recommendations and documentation, and foreign standards. Information needed to recommend new standards can also be indicated.

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SIC 2231 Weaving and finishing mills, wool
SIC 2251 Women's hosiery, except socks
SIC 2252 Hosiery, NEC
SIC 2253 Knit outerwear mills
SIC 2254 Knit underwear mills
SIC 2257 Circular knit fabric mills
SIC 2258 Warp knit fabric mills
SIC 2259 Knit mills, NEC
SIC 2261 Finishing plants, cotton
SIC 2262 Finishing plants, manmade fibers
SIC 2269 Finishing plants, NEC
SIC 2272 Tufted rugs and carpets
SIC 2292 Lace goods
SIC 2299 Textile goods, NEC
SIC 3552 Textile machinery

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