

Evaluation of Contact Dermatitis Among Ink Ribbon Manufacturing Employees

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Although the type of ink (ink ribbon) referenced in this NIOSH evaluation is not manufactured by any of NAPIM's members, the ink ingredients used to manufacture the ink ribbon may be similar to those used by NAPIM's members. The NIOSH occupational health and industrial hygiene recommendations from this evaluation are appropriate for many chemicals used throughout the industry.

The National Institute for Occupational Safety and Health (NIOSH) received a management request for a Health Hazard Evaluation (HHE) at an ink ribbon manufacturing company in New York (see “The Health Hazard Evaluation (HHE) Program”). The company manufactured wax, wax resin, and resin-based ink ribbons. These consisted of sturdy plastic films onto which single or multiple coatings of ink mixtures were applied (to one or both sides of the film depending on the product configuration). Company managers requested NIOSH’s assistance to evaluate dermatitis (rash) among employees exposed to inks and solvents used to make the ink ribbon products. They were also concerned that the dust created when the ink ribbons were cut might be responsible for the rash. There were approximately 400 employees working at the facility at the time of our initial evaluation, and 27 of them had reported having dermatitis at some time in the two years prior to the NIOSH site visit. Some of the affected employees had seen a dermatologist, and a few had undergone specialized skin testing to see if they could determine the specific agent causing the rash. Some managers and production employees thought that exposure to a new product, referred to as “Ink Ribbon A,” could have

been responsible for the new cases of dermatitis. Other production employees thought that blue hand wipes (which contained hexahydro-1,3,5-tris(2hydroxyethyl)-s-triazine) but not green hand wipes (with no hexahydro-1,3,5-tris(2hydroxyethyl)-s-triazine) used at work could be the cause.

The production process occurred in two plants (Plant 1 and Plant 2). Plant 1 contained the kitting room, solvent ink area (consisting of the solvent ink room, solvent mixture making center, and backing room), wax ink area, coating area, and slitting area. Plant 2 contained an additional coating area (which used different coating technology from that used in the coating area of Plant 1) and the parts washing room. In the kitting room of Plant 1, dry chemical ingredients were weighed and placed into bags in a batch process. In the solvent ink area, solvent was weighed and added to large heated stainless steel vessels, along with the dry ingredients from the kitting room. Additionally, some coating mixtures that required agitation and mixing were created in mixing vessels in the solvent ink area. The main solvents used at the facility were toluene, methyl ethyl ketone, and isopropyl alcohol. The wax ink area contained mixing vessels to which waxes were added along with dispersing agents (hyperdispersants) and color pigments. These coating mixtures were used in the coating machines and coated onto the plastic film in the coating areas of both plants. The coated film passed by a drying lamp and was wound onto wide rolls (called “jumbo rolls”) as finished product. Lastly, slitting machines cut these rolls to the required width in the slitting area, and the finished ribbon product was wound on cores and packaged in shrink wrap.

On the first site visit, a team of NIOSH occupational physicians and industrial hygienists toured the two plants. The physicians held confidential interviews with a selected group of employees and examined their skin. Eighteen of the 22 employees interviewed had visible dermatitis; 17 had the dermatitis on their hands and wrists. The NIOSH industrial hygienists took

air samples for volatile organic compounds and evaluated the effectiveness of the local exhaust ventilation systems and the gloves used at the plant. The NIOSH team reviewed material safety data sheets and medical records, and tested workplace substances to see if they could cause skin allergy. They found that some ingredients in the inks, hand wipes, and hand cleaners being used were known irritants and skin allergens (materials capable of causing an allergic skin reaction in susceptible individuals upon repeated exposure). Employees who develop skin allergy to a workplace substance can react to tiny amounts of the allergen and may need to be transferred to an area without exposure. A NIOSH toxicologist performed animal testing on the blue hand wipes containing hexahydro-1,3,5-tris(2hydroxyethyl)-s-triazine and an ink suspected of causing dermatitis. The blue hand wipes and polyvinyl butyral, the main ingredient in the suspect ink, were found to be skin allergens. Although air sampling results detected only very low levels of chemicals in the air, production employees had the potential for skin contact with chemicals. These chemicals included powder hyperdispersants and ink dusts, which were found on work surfaces. In addition, the gloves that some employees were using did not protect them from certain solvents. The NIOSH team recommended substituting less irritating hand products; discontinuing the use of the blue hand wipes, making improvements in ventilation, work practices, and housekeeping; controlling skin exposure to chemicals with better hand hygiene; and using gloves that are protective towards chemicals used at the plant.

The NIOSH team made a second visit to the facility to administer health questionnaires to employees and observe workplace health and safety improvements. One improvement was replacing the powder hyperdispersants with a waxy solid that was kept in the liquid phase by heating the material to around 95 degrees Fahrenheit. The material was dispensed by a hand pump, greatly reducing its potential for becoming airborne (Figure 1). The company also

discontinued the use of the blue hand wipes, changed to less irritating soaps and skin moisturizers (those without solvents, grit, and known strong irritants), and instituted “Healthy Skin” and “Best Practices” employee education. The health questionnaires were used to evaluate possible associations between dermatitis and employee exposures, work practices, and personal protective equipment (PPE) use. The NIOSH team also asked the employees about demographic information, pertinent medical history, and non-work exposures. Data analysis revealed that employees who reported they were exposed to ink production work and/or had a history of allergic disease (defined as asthma, atopic eczema, or allergic rhinitis/hay fever) were more likely to have reported work-related dermatitis than employees with minimal ink exposure or those without a history of allergic disease.

Initial findings suggested skin allergies were causing the employees’ dermatitis, so NIOSH physicians made a final visit to the facility to perform skin patch testing. They tested 13 employees who had a history of dermatitis (the study group) to assess for allergic reactions to newly-identified workplace allergens and to common allergens. They also tested employees without a history of dermatitis (the comparison group). None of the employees reacted to any of the workplace substances, but seven of the study group employees reacted to common allergens. A NIOSH contracted dermatologist diagnosed eight of the study group employees with irritant contact dermatitis. Employees were exposed to several irritants at work including solvents, dusts, and hand cleaners. Several employees with dermatitis reported that their symptoms worsened when they were exposed to cold, dry weather. As a result of the company implementing the NIOSH initial recommendations, most skin patch test study participants experienced improvement or resolution of their dermatitis symptoms. Although none of the study participants experienced allergic skin reactions to workplace substances, the NIOSH team recommended

taking precautions when handling allergenic substances, including inks containing polyvinyl butyral or the use of hand wipes containing hexahydro-1,3,5-tris(2hydroxyethyl)-s-triazine, because prolonged and/or frequent exposures to them may cause an allergic skin reaction in allergy-prone employees.

Recommendations:

The NIOSH team made recommendations to the company to improve employee health and safety. Many of the recommendations below may also apply to your facility:

Managers

- **Replace chemicals found to cause skin allergy with ones that do not.**
- **Require good housekeeping practices and provide training to reduce skin exposure to chemicals.**
- **Provide soaps and skin moisturizers that do not contain solvents, grit, or known strong irritant ingredients.**
- **Provide annual training on how to maintain healthy skin.**
- **Provide employees with non-latex gloves that are protective towards chemicals employees encounter during their work.** Gloves should be resistant to the specific chemicals in the products used. Consult a reference guide such as *Quick Selection Guide to Chemical Protective Clothing* (see “Resources and Links”) to find appropriate gloves. Latex is not an appropriate glove material to use when working with inks because the solvents in the inks can damage the latex relatively quickly, and some people are allergic to latex.
- **Provide employees who are allergic to certain gloves with alternative gloves.**
- **Refer employees with persistent dermatitis to a dermatologist with experience in occupational health.**

Employees

- **Avoid getting chemicals on your skin.**
- **Promptly clean up chemicals that spill onto work surfaces.**
- **Use the correct gloves for the work you are doing and wear them as directed.**
- **Use good skin cleaning and moisturizing practices to keep your skin healthy.**
- **Promptly report skin problems to your supervisor.**

For more detailed information on the methods, results, and recommendations of this evaluation, see the full report at <http://www.cdc.gov/niosh/hhe/reports/pdfs/2007-0261-3122.pdf>.

The Health Hazard Evaluation (HHE) Program

Based on a federal law, NIOSH conducts Health Hazard Evaluations (HHEs) to investigate possible workplace health hazards. Employees, employers, or union representatives can ask our comprehensive team of experts to investigate their health and safety concerns by requesting an HHE. Our team contacts the requestor and discusses the problems and how to solve them. This may result in sending the requestor information, referring the requestor to a more appropriate agency, or making a site visit (which may include environmental sampling and medical testing). If we make a site visit, we prepare a report that includes recommendations specific to the problems found, as well as general guidance for following good occupational health practices. HHE reports are available on the Internet (<http://www.cdc.gov/niosh/hhe/>).

Resources and Links:

NIOSH HHE Program information:
www.cdc.gov/niosh/hhe/HHEprogram.html

Link to this HHE report:
<http://www.cdc.gov/niosh/hhe/reports/pdfs/2007-0261-3122.pdf>

For more information on selecting appropriate gloves and PPE:

Forsberg K, Mansdorf SZ [2007]. Quick selection guide to chemical protective clothing. 5th ed. Hoboken, NJ: John Wiley & Sons, Inc.

Occupational Safety and Health Administration (OSHA) guidance on PPE:
<http://www.osha.gov/SLTC/personalprotectiveequipment/>

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