DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

Centers for Disease Control
and Prevention
National Institute for Occupational
Safety and Health
1090 Tusculum Avenue
Cincinnati OH 45226-1998

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HHE 2019-0136

Ms. Belinda Hall
General Manager - Corporate Safety
Delta Airlines
1020 Delta Blvd
Atlanta, Georgia 30354

Dear Ms. Hall:

This letter is in response to an employee request to the National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control and Prevention (CDC) for a health hazard evaluation (HHE) regarding symptoms among Delta Airlines employees related to wearing new uniforms. The HHE requestors were specifically concerned about health effects being experienced by flight attendants. As you know, the new Delta uniforms were put into use in May 2018 for all Delta employees. During this evaluation we performed a number of activities to (1) better understand flight attendants' concerns related to their uniforms and (2) review actions taken by Delta since May 2018 in response to reported symptoms.

**Methods**

We spoke to you and an employee requestor to gather pertinent information. We also reviewed the information in the following list. Our activities were focused on information related to the inflight services operating division.

- Summary data (including timelines) on reports of health effects related to uniform wear, organized by employee operating division (i.e., inflight services [the group that includes flight attendants], customer service, and technical operations)
- Focus group summaries, including the "Delta Above Wing Wear Tester Focus Groups, Midway Report, January 4&5, 2017;" and "Delta Below Wing Wear Tester Focus Groups, Final Report, Midway Groups: February 7/8, 16/17, 2017, Final Groups: March 27-28, 2017"
- Uniform testing results, consisting of 22 Technical Reports on 13 new uniform fabrics and 6 previous uniform components, from a laboratory external to Delta and the uniform manufacturer, dated between July 20, 2017 and February 14, 2019
- Delta document "Delta Uniform Testing Comparison Report", Updated March 1, 2019
- Delta document "Process for Reporting IFS Uniform Concerns"
- A portion of the Delta employee health and safety manual

- Current literature and standards related to textile and garment manufacturing
- Current literature related to health effects from exposure to textiles and garments.
- Employee reports sent to us via communication with the employee requestors

During this HHE we also communicated with:

- A representative of the uniform manufacturer
- Representatives from the Michigan Occupational Safety and Health Administration (MIOSHA) and Utah Occupational Safety and Health (UOSH) offices – those representatives were responding to complaints concerning potential work-related health effects reported in their jurisdictions.

In this letter we present a summary of the information we reviewed and related discussion points. At the end of the letter we provide recommendations intended to help Delta flight attendants and management address the issue of health effects potentially related to uniform wear.

## Findings and Discussion

*Summary of timeline*

In October 2016, Delta began a process of introducing the proposed new uniforms. The uniform components are made up of various percentages of the following materials: cotton, polyester, spandex, nylon, rayon, viscose, and wool. From December 2016 – March 2017, 300 (1.3% of the approximately 22,985) inflight service employees, 540 (2%) customer service employees, and 160 (1.3%) technical operations employees participated in an initial wearing of the uniforms ("wear-testing"). The wear-test was used to "evaluate the fit, form, and function of the new uniforms." Feedback from employees participating in the wear testing included the use of focus groups. Uniform fittings were conducted for most employees from January 2018 – April 2018. On May 29, 2018, all employees began wearing the new uniforms. The overall process of development and rollout of the new uniforms has been overseen by a "Uniform Committee" comprised of management and non-management representatives of the three operating divisions.

*Wear-testing*

The focus groups noted above were conducted by a consulting firm and included 60 "above the wing" employees (including flight attendants) and 60 "below the wing" employees who wear-tested the new uniforms. Most of the feedback included in the summaries was about quality or utility of the uniform garments. Aside from a report of chafing caused by the trouser lining in the male pant, the wear-test summaries we reviewed did not discuss the presence or absence of health impacts of the garments among focus group participants. The wear-test report did not discuss instances of dye transfer from garments to skin or work materials. The wear-testing focus

group reports did not include information on location of uniform manufacture or any information on the manufacturing processes of the garments used in the wear-testing.

*Reporting and tracking of health concerns*

The standard operating procedures we reviewed (for reporting health concerns about the new uniform) call for inflight service personnel to report injury or illness claims to Delta's third party workers' compensation administrative organization. After making a report, employees are provided follow-up regarding proper medical care (via the workers' compensation organization and/or Delta representative) and use of alternative uniform options (via the uniform manufacturer and/or Delta representative). Reports of concerns are also required to be submitted into a separate system ("SafetyNetOGS") by the end of the employee's shift or duty day and are followed up on by a Delta representative according to an outlined procedure.

We reviewed summary data that included the numbers of reports of health effects and summary data regarding the status of worker compensation claims submitted. The data were provided to us at several points in time during the course of this HHE. According to our analysis of the reporting data, the rate of uniform-associated health and safety reports was highest during the two-week period following rollout of the new uniforms. As of the second week of April 2019, about 11 months after the official uniform roll out, 223 uniform-related health reports among inflight service personnel had been made to Delta. Of these, 18% had been submitted in the two weeks immediately after the uniform rollout and the remainder of the reports were made over the ensuing months. As of mid-May 2019, the total number of uniform-related health reports reported among inflight service personnel was 277.

Based on communications with employees, the management representative, and the MIOSHA and UOSH representatives, skin problems have been the most commonly reported health effects. According to the summary information we reviewed, patch tests[1] are among the medical tests being conducted by healthcare providers for employees reporting health effects potentially related to uniform wear. As of mid-May 2019, 33 employees have had patch testing incorporated within their medical evaluations for the potential uniform-related health effects.

Among the interventions offered by Delta to address uniform-related health effects is the modification of the new uniform pieces and use of alternative uniform pieces (see below). It was reported to us that some employees were hesitant to formally report health and safety problems related to the uniform due to the possibility of being removed from their assigned flights while acquiring approval to wear alternatives uniforms or while uniforms were modified.

[1] A patch test is a method used to determine if a specific substance causes allergic inflammation of the skin.

In addition to health effects being reported by employees, employees have also expressed concern about dye transfer ("bleeding of dye") from purple and red garments to employee skin and to the work environment (for example, to seat belts and beverage carts). We learned that employees are able to report these types of concerns, which may not be directly related to health effects, via a Flight Attendant Comment Tracking System (FACT) report. This is a mechanism Delta uses for reporting work-related issues that need to be addressed.

*Response to reported concerns – alternative uniform pieces*

Several interventions were initiated by Delta in response to the reported concerns related to the new uniforms. We reviewed information from you and from the requestor regarding the Delta policy offering alternative uniform choices to employees who reported having health effects when wearing the new uniform. First, employees could choose to wear a blouse that had not been treated with finishes (treatments to textiles or garments for various purposes), rather than one that had been treated. If the employee's uniform-related health effects continued, then employees could opt to have selected uniform pieces lined by the uniform manufacturer. If those alternatives had been exhausted and health effects persisted, employees could wear 'off the rack' black clothing as a work uniform. As of May 2019, 80 employees in inflight service were utilizing this latter alternative. The information we received indicated that use of this black uniform has been limited to 60 days. As noted above, employees expressed concern about missing work while waiting for approval to use alternative uniforms or while their new uniform was with the manufacturer being lined. These same concerns were expressed related to awaiting appointments regarding medical follow-up to workers' compensation claims. We were informed that Delta and the uniform manufacturer will begin providing additional uniform pieces prepared without finishes (in addition to the finish-free blouse) to employees who have experienced documented health effects that were potentially related to the new uniform. These uniform pieces are slated to be available in June 2019.

*Response to reported concerns - Delta uniform testing results*

We reviewed sampling data from a laboratory contracted by the uniform manufacturer for testing of both new uniform fabric and legacy uniform pieces. The testing reports were dated between July 20, 2017 and November 12, 2018 for the new uniform fabric and dated February 14, 2019 for testing on legacy uniform pieces. We were told this laboratory data and the 'Delta Uniform Testing Comparison Report' (see below) were available to all employees on the Delta intranet site. The contracted analytical laboratory tested new uniform fabrics provided by the uniform manufacturer for properties such as pH and presence of common textile chemicals (such as dyes and formaldehyde) that can cause irritation and allergic reaction when included in textiles. According to the contracted lab's analytical reports, the client limits for individual chemicals or classes of chemicals are primarily based on OEKO-TEX® Standard 100 [OEKO-TEX 2019] and

Apparel and Footwear International Restricted Substances List Management Group (AFIRM) [AFIRM 2019] textile chemical safety limits. The concentrations of the tested chemicals in the textiles did not exceed client (Delta), AFIRM, or OEKO-TEX, where comparisons could be made. More information about these textile safety standards can be found below.

The company provided a 'Delta Uniform Testing Comparison Report' that summarizes these data as well as data from tests on the previous uniform. There were a few inconsistencies between the 'Delta Uniform Testing Comparison Report' and the data we reviewed from contract laboratory reports. As an example, the summary report indicated negative findings for extractable metals testing (results were either "0" or below a certain concentration) for several fabrics, however, the data being summarized in the comparison report were not included in the data we reviewed.

The rationale for deciding which tests to include was not made clear in the technical reports nor in the 'Delta Uniform Testing Comparison Report.' In some cases, the types of testing done were not consistent between similar fabrics. For example, in most instances, the data we reviewed indicated that synthetic fabrics were not tested for extractable metals, pesticides, and chlorinated phenols. However, for one case of a synthetic fabric (non-wool "BRCF" dress), these tests were done. Additionally, while no alkylphenols were reported as present in these textile samples, the limits of detection for the individual alkylphenols (10 milligrams per kilogram [mg/kg]) were too high to be able to compare data to the limit for alkylphenols.[2]

In talking with the uniform manufacturer, we learned that, while parts of the standards noted above were used in the testing process, the manufacturer does not require materials or suppliers to be certified by any particular organization or standard.

**Summary of Literature Review**

*Background information on textile testing and standards related to garment manufacturing*

Textile finishes and resins are used to reduce shrinking, wrinkling and staining and to improve quality, texture, and appearance of the textile. Historically, exposure to formaldehyde from textile resins has been associated with skin problems. However, formaldehyde concentrations in resins have been reduced in response to these reports and international regulations or guidelines that have been developed [DeGroot and Maibach 2010; GAO 2010].

[2] The client limit for the sum of two alkylphenols was 10 mg/kg. Each individual alkylphenol's limit of detection is 10 mg/kg, then it is possible that each individual chemical may be below 10 mg/kg, but that the sum of the two chemicals could be greater than the limit.

The United States has not developed requirements for chemical or metal contents of adult apparel. National and international organizations have developed voluntary standards that are used by textile and garment manufacturers to standardize textile chemical contents. These standards are not explicitly in place to prevent allergic and irritation symptoms among wearers, but most take into account dermal contact of the specific product. OEKO-TEX Standard 100 is a voluntary standard placing limitations on a set of substances based partially on lists established by European Union's Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) program [OEKO-TEX 2019].

AFIRM has published limits for selected substances. The group was established with the purpose of "[reducing] the use and impact of harmful substances in the apparel and footwear supply chain." Among other goals, AFIRM stated that one aim is to provide a tool for compliance with the group member brands' chemical restrictions [AFIRM 2019].

In 2009, the American Apparel and Footwear Association (AAFA) published their Restricted Substance List (which has similar standards to the OEKO-TEX Standard 100) and encouraged its members to voluntarily follow these textile parameters [DeGroot and Maibach 2010; Reich and Warshaw 2010]. Some individual companies also publish the limit values and internal standards they apply to their finished products [H&M 2017].

*Textiles and health effects*

Skin symptoms are relatively common in the working and working-age population. Data from the 2010 National Health Interview Survey showed that the overall prevalence of dermatitis reported among 17,524 current/recent workers in the previous 12 months was 9.8% [Luckhaupt et al. 2013]. In the United States, a study found the prevalence of dermatitis in adults could be as high as 10%, while the prevalence of atopic dermatitis, which has an immunological/allergic/genetic component, could be 6% of U.S adults [Hanifin et al. 2007].

Data regarding potential harmful effects from wearing textiles that may contain potentially hazardous substances are limited. Researchers have found that textile-related substances, including azo dyes and fragrances, of potential risk to human health may be present in final textile garments [Swedish Chemicals Agency 2015]. Among potential health effects related to wearing of textiles, contact dermatitis ('clothing dermatitis') is the most well reported [Lazarov 2004; Lisi et al. 2014]; however, the occurrence of contact dermatitis from these types of exposures is hard to predict because of various individual and environmental factors [Kimber et al. 2012; Zhong et al. 2006].

Clothing dermatitis generally occurs in areas where clothing fits snugly, and the lesions are sometimes symmetrical [Rietschel et al. 2008]. Friction, warmth, and moisture tend to increase

the appearance of clothing dermatitis. The clinical pattern is generally described as affecting the neck, major skin folds, and inner thighs. Prevention of skin contact with textile by use of underclothing or by a lining of a skirt or pants may be helpful in limiting clothing dermatitis [Le Coz 2011].

Among the difficulties in assessing clothing-related dermatitis is that there is evidence in the literature that subthreshold concentrations of irritants can have an additive effect on the skin [Tur et al. 1995]. There are limited data regarding specific agents and the amount of dermal exposure necessary to cause allergic sensitization or to cause an allergic reaction in a sensitized individual [Kimber et al. 2012; RPS Advies- EN Ingenieursbureau BV 2013;]. The detection of potential allergens associated with textiles is also difficult because specific information regarding chemicals used in textile production and/or processing is not always available [Lisi et al 2014].

## Conclusions

Flight attendants have reported symptoms and health concerns after the new Delta uniforms were put into widespread use in May 2018. It is possible that textile chemicals in the uniforms or the physical irritant properties of the uniform fabrics have caused skin symptoms among Delta employees. The Delta summary reports we reviewed on uniform-related health effects provide insight about the extent of the health effects that have been reported.

Testing textiles for chemicals or pH may be useful to determine if the textiles meet voluntary textile chemical safety standards, providing a baseline expectation of garment safety for the general population. Conforming to one or more textile chemical safety standards is likely to help prevent garment-related skin problems, but we do not expect that conformation to available standards would necessarily prevent all work-related skin problems attributed to textiles. Some individuals may have allergies or sensitivities to textile chemicals at levels below limits established by representative organizations or to ingredients for which there are no standards. In general, non-specific chemical testing is not useful when searching for the cause of textile-related health effects. It is difficult to interpret the relationship between the data created by such testing and health effects among individual workers when there is no specific suspected contaminant or a standard for comparison.

Textile-related occupational health issues can be addressed multiple ways. Delta has taken several actions to address employees' symptoms and health concerns attributed to uniform wear; examples of some of the actions taken include making alternate uniform options available, providing testing reports for review, and making medical evaluations available via the Delta workers' compensation system. We recommend the following actions to further address employee symptoms and health concerns.

## Recommendations

While this health hazard evaluation primarily addresses the concerns of flight attendants (inflight service personnel), the recommendations may also be helpful in addressing uniform-related concerns among all employees who wear the new uniforms.

Our recommendations are based on an approach known as the *hierarchy of controls*. This approach groups actions by their likely effectiveness in reducing or removing hazards. In most cases, the preferred approach is to eliminate hazardous materials or processes. This hierarchy also includes, when applicable, other types of controls to reduce exposure or shield employees. When the types of controls noted above are not possible (or not applicable), administrative measures may be needed. Frequently, a mixture of these types of interventions is necessary to control occupational hazards. Overlying these types of workplace occupational safety and health controls are issues related to communication – effective communications between all groups within a workplace can help to facilitate effective occupational safety and health programs.

<u>Communication</u>

1. Emphasize effective and consistent communication between all groups – for example, between managers and employees and between employees and healthcare providers addressing work-related health effects. A supervisor or manager who is sensitive to the employees' concerns should communicate directly with employees. Examples of effective communication include the following:
    a. Actively listening to employees' concerns in a nonjudgmental manner. Employees should feel that their concerns are taken seriously.
    b. Regularly informing employees of exactly what steps should be taken to report concerns, what steps are being taken to assess identified problems, what has been determined, and what remains to be determined. For example, the one-page document "Process for Reporting IFS Uniform Concerns" is a good example of clear written communication on a reporting mechanism. Other similar one-page documents would likely be helpful in addressing other aspects of the ongoing concerns. Routinely sharing information with employees (even as interventions or changes are being developed or early in implementation) is an effective practice as work-related health concerns are addressed.

2. Continue to provide a mechanism for employees to provide feedback; if the information being shared does not require specific attention to an individual employee include a mechanism allowing for anonymous feedback. Provide employees with the management response as to what is or is not being done (and rationale) to address work-related health concerns.

Substitution

3. Continue to offer alternatives to the new uniform to employees who have developed symptoms and/or health effects related to wearing the new uniforms. Allow employees to use alternative uniforms on a long term basis, if symptoms resolve with this alternative.

4. Allow employees to wear alternatives when their uniforms are being lined (or other uniform alternatives are being considered) so work schedules are not negatively impacted due to potential uniform-related health effects.

Administrative

5. Instruct employees to launder new uniforms before wearing them for the first time. Follow manufacturer instructions when laundering uniforms.

6. Consult with the manufacturer to develop laundering or uniform care instructions to minimize dye transfer from the existing new uniform garments to the extent possible. Work with the uniform manufacturer to choose fabrics and dyes that do not have (or have minimal) dye transfer when worn or laundered.

7. Ensure that the uniform manufacturer uses textile suppliers that incorporate one or more generally accepted textile chemical safety standard(s) into their manufacturing process. For example, textiles and/or textile manufacturers can be certified to meet OEKO-TEX Standard 100, AFIRM, AAFA, or other certifying organization requirements. Tell employees which and how specific standards are being met.

8. Continue to encourage employees to report potential work-related health conditions to their supervisor and to the other appropriate outlets as specified in standard operating procedures. Current procedures call for immediate notification of the worker compensation contractor and entry of information to the SafetyNetOGS system.

9. Continue to encourage employees to report other uniform issues, such as dye transfer from the uniform to skin or equipment, via the appropriate outlet as specified in standard operating procedures. Ask employees to report which specific uniform item is transferring color. Systematically review this information with the uniform manufacturer so that appropriate actions can be taken for uniform pieces which have persistent, excessive dye transfer.

10. Systematically review reports of potential work-related health conditions among workers in the Operating Divisions, submitted via both the workers compensation system and SafetyNetOGS, as a medical surveillance action.

a. Follow up on the systematic review of the surveillance data with more detailed investigations (for example, investigating all reports of health problems with common exposures, such as wearing of a specific new uniform component). Follow up investigations and interventions based on this surveillance effort may include some or all of the following:
    i. Focused survey or intervention among identified groups
    ii. Further chemical testing of particular garment or garment pieces
    iii. Removal from service of particular garments or garment pieces

11. Continue with provision of individual evaluations by healthcare providers with experience in occupational health and other medical specialties as appropriate.
    a. Resources to help locate healthcare providers with experience and expertise in occupational medicine include The Association of Occupational and Environmental Clinics (http://www.aoec.org/directory.htm) and the American College of Occupational and Environmental Medicine (https://acoem.org/Find-a-Provider ).
    b. Persistent rash should be evaluated by a dermatologist with expertise in occupational health and skin patch testing. The dermatologist may then decide if skin patch testing with textile chemical allergens and with pieces of the uniform is warranted.
    c. Healthcare providers may recommend interventions such as the need for removal from exposure(s) of employees with work-related health problems. If employees are moved to different locations or job duties due to work-related health concerns they should retain pay and benefits associated with the original job duties.

Future preparation of new uniforms

12. When preparing new uniform pieces in the future, consider the following for preliminary testing – including wear testing and laboratory testing.
    a. Conduct wear tests with uniforms made with textiles from mills where final textiles will be sourced.
    b. Include health and safety questions during wear test evaluations and focus groups.
    c. Include questions about "garment bleeding" or dye transfer during work or during laundering of the new uniform. Use this feedback to both (1) prevent dye "bleeding" or transfer in the final uniform and (2) develop laundering instructions for employees to quickly address these issues when they are provided with the final uniforms.
    d. When considering future garment testing, develop a rationale and strategy for testing that takes into account relevant textile safety standards. Coordinate the testing with the manufacturer to the extent possible. Explain to all stakeholders the rationale for the tests conducted and the criteria expected to be met.

This letter serves as a final report and concludes this health hazard evaluation. NIOSH recommends that employers post a copy of this letter for 30 days at or near work areas of affected employees. We are sending a copy of this letter to the Occupational Safety and Health Administration Region V Office and the Minnesota Department of Health.

Thank you for your cooperation with this evaluation. If you have questions, please call Douglas Trout at 513-841-4558 or Kendra Broadwater at 513-841-4543.

Sincerely yours,

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cc: Employee Requestors
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Denise Marshall, Michigan Occupational Safety and Health Administration
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