



Work Plan Implementation:

Potential Health and Safety Impacts of Chemicals in Nail Products

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Introduction

The Department of Toxic Substances Control's (DTSC) Safer Consumer Products (SCP) Regulations specify the process and criteria by which DTSC evaluates consumer products for possible designation as Priority Products. Every three years, DTSC issues a Priority Product Work Plan, which "... identifies and describes the product categories that [DTSC] will evaluate ..." over the next three years. DTSC's current Work Plan includes seven product categories and lists the five policy priorities that informed their selection.

Since issuing the Work Plan, DTSC has conducted a review of the product categories and has identified specific subcategories, chemicals, and chemical classes that align with our policy priorities. This document is one of three that summarizes the findings of the research on a specific topic. It describes our preliminary findings and concerns around the topic and identifies data gaps we would like to fill and specific questions we hope our stakeholders can help answer. This document signals the beginning of an ongoing dialogue with interested stakeholders from all sectors (manufacturers, NGOs, governments, and academia). We believe the dialogue will ultimately inform our selection of future Priority Products.

Topic Summary

Nail products in salons and at home have the potential to expose workers, pregnant women (including their fetuses), and children to harmful chemicals. These sensitive subpopulations may be especially vulnerable to harm from toxic chemicals. Nail salon workers have daily exposure to chemicals in these products and may have longer work days and work weeks compared to employees in other sectors. In California, chemical exposure of nail salon workers is an environmental justice issue as a large majority of nail salon workers are people of color and of lower socioeconomic status. It is estimated that 59-80% of nail salon workers in California are women of Vietnamese descent, many of whom face workplace safety challenges as a result of language barriers, limited education on chemical exposure from products, and limited availability and use of personal protective equipment (Quach *et al.* 2008).

Studies indicate that nail salon workers may suffer from a higher incidence of certain health problems than the general population. For instance, a 2007 study examined self-reported health effects of nail salon workers participating in a community outreach program. The nail salon workers surveyed were predominantly Vietnamese, female, and generally worked long hours. Health effects reported included musculoskeletal disorders, respiratory symptoms, skin problems, and headaches (Roelofs *et al.* 2007).

In 2012, DTSC performed an investigation of nail products from California distributors and analyzed these products for metals, volatile, and semi-volatile compounds. This effort was focused on three chemicals used in nail products which have clear hazard traits – formaldehyde, toluene, and dibutyl phthalate (DBP) – which are commonly referred to in the media as the "toxic trio." This study found that a number of products advertised as "3-free" (formaldehyde, toluene, DBP-free) actually contained DBP and/or toluene (DTSC 2012). This study also detected other chemicals in the tested nail products including some on the Safer Consumer Products Candidate Chemical list.

In the U.S. and Europe, market trends are moving toward the elimination or minimization of the use of certain chemicals in nail products. For example, Walmart has asked its suppliers to remove formaldehyde, DBP, and toluene from their products. Under the Walmart policy, manufacturers must

list the targeted ingredients on packaging by 2018 and work to find alternatives (Coleman-Lochner and Martin 2016). In Europe, DBP may not be intentionally added to cosmetics and formaldehyde content in cosmetics may not exceed five percent.

Other recent efforts in California have focused on nail products. In 2010, the San Francisco Department of the Environment (SF Environment) conducted a voluntary recognition program for nail salons that choose safer alternative chemicals in nail products, train their employees on safer practices that reduce exposure, provide and require employees to use personal protective equipment, and improve indoor air quality by installing mechanical ventilation units.

Additionally, several other counties and cities are implementing Healthy Nail Salon Programs that recognize salons that use less toxic polishes and other nail salon products, improve ventilation, and participate in trainings that focus on best practices for a healthier workplace (<http://www.cahealthynailsalons.org>).

New California laws have focus on the health, safety, and education of nail salon workers statewide:

AB 2125 (2015-2016) – The Healthy Nail Salon Recognition Program

- Includes incentives for businesses to use less toxic nail polishes and polish removers and to improve ventilation.
- Calls upon DTSC to publish guidelines for cities and counties to implement voluntary local healthy nail salon recognition (HNSR) programs, including a list of chemicals that should not be used by salons seeking HNSR program recognition.

AB 2025 (2015-2016) -- Barbering and Cosmetology: Labor Law Education Requirements

- Provides provisions for improved education and language access for salon workers.

AB 2437 (2015-2016) -- Barbering and Cosmetology: Establishments: Posting Notice

- Requires salons to post notices in English, Spanish, Vietnamese, and Korean regarding workplace rights and wage and hour laws.

In consideration of these ongoing efforts, DTSC is evaluating nail products in the Safer Consumer Products program. Nail products include, but are not limited to, nail polish, enamel, lacquers, basecoats, undercoats, base adhesives, topcoats, nail colors, nail hardeners, nail conditioners, nail treatments, nail strengtheners, acrylic powders, artificial nails, gel nails, gel polish, nail product thinners, and nail polish removers.

The Priority Products Work Plan (Work Plan) was a helpful means of continuing the investigation into these products and their chemical constituents by prioritizing product categories containing Candidate Chemicals with clear exposure pathways, have been detected in biomonitoring studies, have been observed in indoor air and dust studies, and may impact children or workers. Under the Work Plan's category of beauty, personal care, and hygiene products, DTSC identified and evaluated four Candidate Chemicals believed to be used in nail products: formaldehyde, toluene, DBP, and triphenyl phosphate (TPP). Below is a brief summary of the function, hazard traits, and exposure pathways for these chemicals as a result of this initial research.

FORMALDEHYDE

Formaldehyde is used as a preservative and antimicrobial agent, and it is also used in nail hardeners to cross-link keratin to strengthen the nail plate (SCCS 2014). Formaldehyde's hazard traits include carcinogenicity, respiratory toxicity, and ocular toxicity. It is a volatile chemical with potential inhalation exposure to humans via indoor air. Formaldehyde concentrations have been detected as high as 4.5% in nail hardeners and their use may result in a high short-term exposure (ATSDR 2010). Kelly *et al.* (1999) found that fingernail polish and hardeners exhibited relatively high formaldehyde emission rates. A study found that formaldehyde exposure levels were higher in salons with no ventilation than in salons with local exhaust ventilation (Hollund and Moen, 1998). It is often found in solution as formalin/methylene glycol, as a tosylamide formaldehyde resin, or in the form of formaldehyde releasing preservatives, which can be potential sources for formaldehyde release from nail products. California Department of [Public Health's \(CDPH\) Safe Cosmetics Program Product Database](#) and [Environmental Working Group's](#) (EWG) Skin Deep database identified > 40 different nail products reported to contain formaldehyde.

TOLUENE

Toluene is used as a solvent in a variety of nail product formulations and is also sometimes added to products at nail salons as a supplemental thinner. EWG's Skin Deep database identifies 24 nail products that contain toluene as recent as 2013. Hazard traits for toluene include developmental toxicity and neurotoxicity. It is a volatile chemical with potential inhalation exposure to humans via indoor air. Studies have identified toluene in indoor air of select nail salons above reference exposure levels for chronic exposure (Quach *et al.* 2011, McNary and Jackson 2007). These studies showed that while salons using table ventilation systems had significantly lower measured personal levels of toluene, the average toluene levels measured from personal air monitoring at these salons nevertheless exceeded the California Office of Health Hazard Assessment's (OEHHA) reference exposure levels of 0.08 ppm, which is based on neurological toxicity.

DIBUTYL PHTHALATE (DBP)

In nail products, phthalates are used primarily as plasticizers to reduce cracking typically at concentrations of less than 10% (FDA, 2014). Hazard traits for DBP include potential endocrine disruption, developmental and reproductive toxicity, immunotoxicity, and neurotoxicity. The primary route of human exposure to DBP from nail products is dermal. DBP, together with other phthalates, cumulatively contributes to anti-androgenic effects seen in animal studies. Further, human exposure studies are finding associations between phthalate exposure during pregnancy and certain male birth defects (Adibi *et al.* 2016, Swan *et al.* 2015). Nail products contribute to aggregate and cumulative exposure to DBP and other anti-androgenic phthalates (CHAP 2014). DBP is banned for use in cosmetics in the European Union (European Union 2009). U.S. EPA Chemical and Products Categories Database (CPCat) identified approximately 20 nail products which contain DBP. Triphenyl phosphate (TPP) is a commonly-used alternative to DBP.

TRIPHENYL PHOSPHATE (TPP)

TPP is used in some nail polish and nail enamels, basecoats and undercoats, and manicuring products as a plasticizer or adhesive (CosmeticsInfo.org). TPP was found to be the most commonly used plasticizer in

nail products when DBP was not present (DTSC 2012). Hazard traits for TPP include potential neurotoxicity, reproductive toxicity, and endocrine disruption. TPP is absorbed dermally which can lead to significantly increased urinary levels over background exposures (Mendelsohn *et al.* 2016).

Next Steps

DTSC is seeking information from stakeholders on the use of potentially hazardous chemicals in nail products, their functions and prevalence in these products, and any safer alternatives that are under development or are already in use. To begin this process, DTSC has compiled a list of Candidate Chemicals for which there is some evidence of continued use in nail products (see Table 1, below). Sources for this list include [DTSC’s 2012 Summary of Data and Findings from Testing of a Limited Number of Nail Products](#) report and the [California Department of Public Health Safe Cosmetics Program Product Database](#). This is not meant to be an all-inclusive list of all every potentially hazardous chemical used in nail products (Candidate Chemical or otherwise); rather, it is intended as a starting point for identifying Candidate Chemicals currently used in nail products and prioritizing them for further research.

Table 1. Candidate Chemicals (CC) in nail products reported in the California Department of Public Health Safe Cosmetics Program Products Database or Identified in the 2012 DTSC Nail Products Testing Report

Chemical	Functional Uses	Hazard Traits
Formaldehyde	Antimicrobial agent, preservative	Carcinogenicity, respiratory toxicity, ocular toxicity
Toluene	Solvent	Developmental toxicity, neurotoxicity, respiratory toxicity, cardiovascular toxicity
Dibutyl phthalate	Plasticizer	Endocrine disruption, developmental toxicity, reproductive toxicity
Triphenyl phosphate	Plasticizer	Neurotoxicity, reproductive toxicity
Acetone	Solvent	Neurotoxicity
Acrylamide	Binding, thickening agent	Carcinogenicity, dermatotoxicity, developmental toxicity, genotoxicity, hematotoxicity, neurotoxicity, reproductive toxicity, respiratory toxicity
Benzophenone	Light stabilizer, fragrance ingredient	Carcinogenicity
Butylated hydroxyanisole (BHA)	Antioxidant, fragrance ingredient	Carcinogenicity
Cocamide diethanolamine*	Surfactant	Carcinogenicity
Diethanolamine	pH adjuster	Carcinogenicity, hematotoxicity, respiratory toxicity, cardiovascular toxicity
Ethyl acrylate	Plasticizer	Carcinogenicity, hepatotoxicity, neurotoxicity, respiratory toxicity

Lead	Colorant	Carcinogenicity, cardiovascular toxicity, developmental toxicity, neurotoxicity, nephrotoxicity, hematotoxicity, reproductive toxicity
Methyl isobutyl ketone (MIBK)	Denaturant, fragrance ingredient, solvent	Carcinogenicity, developmental toxicity, hepatotoxicity, nephrotoxicity, neurotoxicity, ocular toxicity
N-Methylpyrrolidone	Solvent	Developmental toxicity, reproductive toxicity
Tertiary butyl alcohol (TBA)	Denaturant, fragrance ingredient, solvent	Carcinogenicity
Xylene	Fragrance ingredient, solvent, masking	Developmental toxicity, hepatotoxicity, nephrotoxicity, neurotoxicity, ocular toxicity, reproductive toxicity, respiratory toxicity
Carbon black**	Colorant	Carcinogenicity
Talc***	Anticaking agent, opacifying agent, skin protectant, slip modifier, abrasive, absorbent, bulking agent	Carcinogenicity
Titanium Dioxide****	Colorant, opacifying agent, sunscreen agent, ultraviolet light absorber	Carcinogenicity
Silica, crystalline	Abrasive, absorbent, anticaking agent; bulking agent, opacifying agent; suspending agent-nonsurfactant	Carcinogenicity, respiratory toxicity
Retinol/retinyl esters	Skin conditioning	Developmental toxicity

* Listed on Candidate Chemical (CC) database under coconut oil diethanolamine condensate

**Carbon black appears on two of the constituent lists that make up the Candidate Chemicals List: the Proposition 65 list and the IARC Class 2B list. For Proposition 65, the listing is: "Carbon black (airborne, unbound particles of respirable size)." In nail products, carbon black may not be present as airborne, unbound particles; the inhalation exposure pathway, if any, for such products is unknown.

***Listed on CC database as containing asbestos. The inhalation exposure pathway, if any, for this chemical in nail products is unknown.

**** Listed on CC database as airborne, unbound particles of respirable size. The inhalation exposure pathway, if any, for this chemical in nail products is unknown.

SCP plans to engage with stakeholders to address the questions listed below. This dialogue will help inform our continuing research to identify potential future Priority Products. Written information and comments may be submitted via our online information management system, [CaISAFER](#). We are also planning an in-person public workshop and/or roundtable meeting(s) to discuss these questions.

Prior to scheduling workshops or meetings, we will conduct a survey to better understand the types of input stakeholders may offer and preferred ways to engage with us throughout this process. If you are interested in participating in the workshop and/or roundtable meetings, please fill out this survey by November 30, 2016: https://www.surveymonkey.com/r/Nail_Products

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