



GAVIN NEWSOM
GOVERNOR

JARED BLUMENFELD
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

October 17, 2019

Karl Palmer,
Acting Deputy Director
Safer Products and Workplaces Program
Department of Toxic Substances Control
1001 I Street
Sacramento, CA 95814

SUBJECT: REQUEST FOR EXTERNAL PEER REVIEW FOR THE PROPOSED ADPOTION OF NAIL PRODUCTS CONTAINING TOLUENE AS A PRIORITY PRODUCT

Dear Mr. Palmer:

This letter responds to the attached July 29, 2019 request for external scientific peer review for the subject noted above. The review process is described below. All steps were conducted in confidence. Reviewers' identities were not disclosed.

To begin the process for selecting reviewers, I contacted the University of California, Berkeley (University) and requested recommendations for candidates considered qualified to perform the assignment. The University was provided with the July 29, 2019 request letter to me and attachments. No additional material was asked for. This service by the University includes interviews of each promising candidate and is supported through an Interagency Agreement cosigned by CalEPA and the University.

Each candidate who was both qualified and available for the review period was asked to complete a Conflict of Interest (COI) Disclosure form and send it to me for review, with Curriculum Vitae. The cover letter for the COI form describes the context for COI concerns that must be taken into consideration when completing the form. "As noted, staff will use this information to evaluate whether a reasonable member of the public would have a serious concern about [the candidate's] ability to provide a neutral and objective review of the work product."

E. JOAQUIN ESQUIVEL, CHAIR | EILEEN SOBECK, EXECUTIVE DIRECTOR

1001 I Street, Sacramento, CA 95814 | Mailing Address: P.O. Box 100, Sacramento, CA 95812-0100 | www.waterboards.ca.gov

Later, I sent approved reviewers letters to initiate the review. These letters provided access instructions to a secure FTP site where all material to be reviewed was placed. Attachment 2 to the July 29, 2019 request memorandum was highlighted as the focus for the review. Each initiating letter identified specific conclusions which that reviewer committed to address. This commitment is detailed in the paragraph following "Attachment 2", appearing on page 2 of the letter. Thirty days were provided for the review. I also asked reviewers to direct enquiring third-parties to me after they have submitted their reviews.

With the same letter, I provided the attached October 2018 Supplement to the CalEPA Peer Review Guidelines, which, in part, serves two purposes: a) it provides guidance to ensure confidentiality through the course of the external review, and b) it notes reviewers are under no objection to discuss their comments with third-parties after reviews have been submitted. **We recommend they do not.** All outside parties are provided opportunities to address a proposed regulatory action through a well-defined rulemaking process.

Reviewers' names, affiliations, curriculum vitae, and reviews are being sent to you now with this letter. All attachments can be electronically accessed through the bookmark icon at the left of the screen.

Approved reviewers are as follows:

1. Clifford P. Weisel, Ph.D.
Professor
Environmental and Occupational Health Sciences Institute
School of Public Health – Rutgers University
170 Frelinghuysen Road
Piscataway, N.J. 08854
2. Lupita D. Montoya, Ph.D.
Research Associate
University of Colorado, Boulder
4001 Discovery Drive
607 UCB – S286A
Boulder, CO 80303
3. Scott E. Bowen, Ph.D.
Professor and Chair
Department of Psychology
Wayne State University
5057 Woodward Avenue, Suite 7906.1
Detroit, MI 48202

If you have any questions, or require clarification from the reviewers, please contact me directly.

Regards,



Gerald W. Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board
1001 "I" Street, 13th Floor
Sacramento, California 95814

Telephone: (916) 341-5567
Email: gerald.bowes@waterboards.ca.gov

Attachments:

- (1) July 29, 2019 request by Karl Palmer for Scientific Peer Review
- (2) Letters to Reviewers Initiating the Review
 - (a) Clifford P. Weisel, Ph.D.
 - (b) Lupita D. Montoya, Ph.D.
 - (c) Scott E. Bowen, Ph.D.
- (3) October 22, 2018 Supplement to Cal/EPA Peer Review Guidelines
- (4) Curriculum Vitae
 - (a) Clifford P. Weisel, Ph.D.
 - (b) Lupita D. Montoya, Ph.D.
 - (c) Scott E. Bowen, Ph.D.
- (5) Reviews
 - (a) Clifford P. Weisel, Ph.D.
 - (b) Lupita D. Montoya, Ph.D.
 - (c) Scott E. Bowen, Ph.D.



Jared Blumenfeld
Secretary for
Environmental Protection




Department of Toxic Substances Control

Meredith Williams, Ph.D.
Acting Director
1001 "I" Street
P.O. Box 806
Sacramento, California 95812-0806



Gavin Newsom
Governor

TO: Gerald Bowes, Ph.D., Manager
CalEPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board

FROM: Karl Palmer 
Acting Deputy Director
Safer Products and Workplaces Program
Department of Toxic Substances Control

DATE: July 29, 2019

SUBJECT: REQUEST FOR EXTERNAL PEER REVIEW FOR THE PROPOSED ADOPTION OF NAIL PRODUCTS CONTAINING TOLUENE AS A PRIORITY PRODUCT

The subject of this review is a proposed regulation to adopt the following product-chemical combination as a Priority Product:

Nail Products Containing Toluene

The California Safer Consumer Products (SCP) regulations¹ require the Department of Toxic Substances Control (DTSC) to identify product-chemical combinations that pose risks to people or the environment and to adopt them as Priority Products² in regulation. In accordance with

¹ California Code of Regulations, Title 22, sections 69503 – 69503.7

² "Priority Products" are consumer products that a) contain chemicals included in DTSC's Candidate Chemicals List; b) may expose people or the environment to these chemical(s) through normal use; and c) have been adopted in regulation. Candidate Chemicals exhibit hazard traits or environmental or toxicological endpoints and are included on authoritative lists established by government agencies or scientific organizations (www.dtsc.ca.gov/SCP).

Health and Safety Code section 57004, DTSC requests external scientific peer review of the basis for proposing nail products containing toluene as a Priority Product. As required by regulation, DTSC reviewed reliable scientific literature and concluded that this product-chemical combination meets the required regulatory criteria³ for listing as a Priority Product based on the following conclusions:

1. Toluene has hazard traits that can potentially cause significant adverse impacts on human health including neurotoxicity, developmental, and respiratory toxicity. Among other effects, scientific evidence suggests that toluene can be linked to adverse impacts on kidneys, eyes, skin, and immune system.
2. There is a potential for consumers and workers (i.e., nail technicians, salon workers) to be exposed to toluene during the use of nail products, and these exposures in nail technicians and salon workers are exacerbated by the working conditions (e.g., ventilation, long shifts, lack of personal protective equipment).
3. Certain sensitive subpopulations including nail industry workers, pregnant women (and their fetuses), infants, children, and adolescents may be especially susceptible to the adverse impacts of toluene.
4. Nail products containing toluene have the potential to cause or contribute to significant or widespread adverse impacts in consumers and workers due to the hazard trait and exposure considerations described in the chemical-product profile.

For this review, DTSC recommends that reviewers have expertise in the following areas, in order of importance:

- Human toxicology. This expertise is needed for Conclusions 1 and 3, as defined in the attachment.
- Human exposure assessment or industrial hygiene, particularly with a focus on indoor air exposure. This expertise is needed for Conclusion 2, as defined in the attachment.

We estimate that three reviewers will be adequate to cover all needed areas of expertise.

DTSC intends to initiate the formal rulemaking process late-2019 or early 2020. The documents are ready for review at any time, and the preferred period of review is 30 days. The following attachments are enclosed:

³ Prior to proposing a product-chemical combination for adoption as a Priority Product, DTSC must ensure that the product-chemical combination meets both of the following criteria: 1) there must be potential public and/or environmental exposure to the chemical(s) in the product; and 2) there must be potential for one or more exposures to contribute to or cause significant or widespread adverse impacts (22CCR section 69503.2(a)).

- Attachment 1: Plain English summary of the proposal to list Nail Products Containing Toluene as a Priority Product
- Attachment 2: Scientific Conclusions to Be Addressed by Peer Reviewers
- Attachment 3: List of Participants
 - Section A: DTSC Participants
 - Section B: External Participants
- Attachment 4: References

Please direct inquiries regarding this request to Nancy Ostrom, of my staff, at nancy.ostrom@dtsc.ca.gov or 916-445-3077.

Attachment 1:

Plain English Summary of the Proposal to Nail Products containing Toluene as a Priority Product

A. Brief Statement of Conclusions⁴

Toluene has been recognized as a neurotoxicant by the Agency for Toxic Substances Disease Registry (ATSDR), the U.S. Environmental Protection Agency (EPA), the California Office of Environmental Health Hazard Assessment (OEHHA) Reference Exposure Level (REL) database, and the U.S. Centers for Disease Control and Prevention (CDC) Fourth National Report on Human Exposure to Environmental Chemicals. Human and animal exposure studies demonstrate that toluene may cause nervous system damage. In occupational settings, effects linked to toluene exposure include dizziness, fatigue, headache, and decreased manual dexterity. Further, toluene is identified as a developmental toxicant by OEHHA and a toxic air contaminant by the California Air Resources Board. Additional hazard traits associated with toluene include respiratory, kidney, and dermal toxicity.

Toluene is used as a solvent in nail coatings and nail polish thinners. Toluene is a liquid at room temperature and readily volatilizes into air. Use of nail products in salons and at home has the potential to expose nail technicians, other salon workers, patrons, and nail product consumers to toluene. The primary exposure route from nail products is vapor inhalation. Toluene has been detected in air in nail salons at levels above California regulatory standards, and nail technicians have an especially high potential for exposure. Nail industry workers' exposure to chemicals is an environmental justice issue. In California, most nail technicians are Vietnamese immigrants of low socioeconomic status and are often women of childbearing age. Pregnant women (and their fetuses), infants, children, and adolescents are also especially vulnerable to toluene exposure from nail products.

DTSC has concluded that human exposure to toluene-containing nail products has the potential to cause significant and widespread adverse impacts, especially to certain sensitive subpopulations.

B. Overview of the Safer Consumer Products Regulatory Program

The SCP program's primary goal is to ensure safer products and healthier lives by reducing and eliminating use of toxic chemicals in consumer products sold in California.

⁴ From "*Product-Chemical Profile for Nail Products containing Toluene.*"

The SCP regulations, implemented on October 1, 2013, specify the process for identifying consumer products that contain hazardous chemicals, evaluating safer alternatives to those chemicals, and eliminating or reducing potential exposures to and adverse impacts from these products. The regulations intentionally use a narrative standard for identifying and prioritizing product-chemical combinations, rather than a traditional risk-assessment-driven decision-making standard. This approach provides DTSC with a flexible process that allows the SCP program to make decisions based on a reasonable amount of reliable information and the potential for exposure and adverse impacts. The SCP regulations also use the hazard traits, toxicological and environmental endpoints, and other relevant data contained in Chapter 54 of the California Code of Regulations, Title 22.

To adopt a Priority Product listing, DTSC must follow the procedure described in the SCP regulations and adopt the listings through a rulemaking procedure. These regulations use the following prioritization factors⁵ for listing Priority Products:

- There must be potential⁶ public and/or aquatic, avian, or terrestrial animal or plant organism exposure⁷ to the Candidate Chemical(s) in the product; and
- There must be the potential for one or more exposures to contribute to or cause significant or widespread adverse impacts.⁸

Once DTSC adopts a Priority Product listing, DTSC requires product manufacturers to submit a Priority Product notification⁹ and conduct one of several types of Alternatives Analyses to determine if safer alternatives exist.¹⁰ Alternatively, product manufacturers may elect to: remove or replace the chemical of concern in the product with a safer alternative, or remove the product from the California marketplace. If the product manufacturers do not comply, DTSC is authorized to require importers, assemblers, or retailers to stop selling the product in California.

⁵ CCR §69503.2 *et seq.*

⁶ “Potential” is defined as reasonably foreseeable, based on reliable information (CCR §69503.1(a)(51)).

⁷ The potential for exposure is evaluated by considering one or more of the following factors: market presence of the product, the occurrence or potential occurrence of exposures to the Candidate Chemical in the product, the household and workplace presence of the product, potential exposure to the Candidate Chemical in the product during the product’s lifecycle (CCR §69503.3(b)).

⁸ 22 CCR §69503.2 and §69503.3. The potential to contribute to or cause adverse impacts is evaluated by considering reasonably available information about one or more of the following factors: hazard traits, endpoints, aggregate effects, cumulative effects, physicochemical properties, environmental fate, affected populations or organisms, potential for the Candidate Chemical(s) to degrade, form reaction products, or metabolize into another chemical that exhibits hazard traits or endpoints. DTSC shall give special consideration to the potential for adverse impacts to sensitive subpopulations, environmentally sensitive habitat, endangered and threatened species, and impaired environments. DTSC may also evaluate and consider adverse impacts associated with structurally or mechanistically similar chemicals with known toxicity profiles.

⁹ CCR §69503.7.

¹⁰ CCR §69505.1 *et seq.*

C. Overview of the Proposal to List Nail Products containing Toluene as a Priority Product

The proposed regulation describes nail products including nail coatings and nail polish thinners. The term “nail coatings” refers to any clear or colored coating product marketed or sold for application to the fingernails or toenails. The nail coatings category encompasses subproducts including nail polish, lacquers, enamels, base coats, undercoats, top coats, gel nails, gel nail polish, and paint for airbrush nail art. The term “nail polish thinner” means any liquid product that is marketed or sold for the use of reducing viscosity of nail coatings. It may be marketed for the use of increasing the fluidity or restoring the consistency of nail coatings.

As required by regulation, DTSC considered factors including the hazard traits and toxicological endpoints for toluene, and the potential adverse impacts on sensitive subpopulations including nail industry workers, pregnant women (and their fetuses), infants, children, and adolescents.

After reviewing available reliable information, and obtaining stakeholder input via a public workshop and comment period, DTSC has determined that there is potential for significant and widespread exposure to toluene during the use of nail products containing toluene, and human exposures may lead to significant and widespread adverse impacts, especially to sensitive subpopulations including nail industry workers, pregnant women (and their fetuses), infants, children, and adolescents.

Available reliable information suggests that toluene may display one or more hazard traits including:

- Neurotoxicity,
- Developmental toxicity,
- Neurodevelopmental toxicity,
- Respiratory toxicity,
- Nephrotoxicity,
- Dermatotoxicity
- Immunotoxicity,
- Ocular toxicity, and
- Ototoxicity.

In determining that exposure to toluene during the use of nail products, such as nail coatings and nail thinners, has the potential to adversely affect workers, consumers, and sensitive subpopulations, DTSC has met the regulatory requirements for adoption of this ‘product-chemical’ combination as a Priority Product in regulation. Once the proposed regulation is adopted, DTSC will have the authority to require manufacturers to determine if there are safer alternatives to toluene for use in nail products.

Attachment 2:

Scientific Conclusions to Be Addressed by Peer Reviewers Regarding DTSC's Proposal to List Nail Products containing Toluene as a Priority Product

The statutory mandate for external scientific peer review (Health and Safety Code section 57004) states that the reviewer's responsibility is to determine whether the scientific portion of the proposed regulation is based on sound scientific knowledge, methods, and practices.

DTSC requests that you make this determination for each of the following conclusion statements that constitute the scientific portion of the proposed regulation. An explanatory statement is provided for each conclusion to focus this review.

The subject of this review is a proposed regulation to list *Nail Products Containing Toluene* as a Priority Product under the Safer Consumer Product regulatory framework. This framework requires DTSC to ensure that all product-chemical combinations proposed as Priority Products meet the following criteria:

- There is potential for exposure to the Candidate Chemical(s) in the product, and
- Exposures may contribute to or cause significant or widespread adverse impacts to people or the environment.

Following a review of available scientific literature, DTSC concluded that the proposal to list *nail products containing toluene* as a Priority Product meets the required regulatory criteria and requests that this review focus on the following conclusions:

1. Toluene has hazard traits that can potentially cause significant adverse impacts on human health including neurotoxicity, developmental, and respiratory toxicity. Among other effects, scientific evidence suggests that toluene can be linked to adverse impacts on kidneys, eyes, skin, and immune system.
2. There is a potential for consumers and workers (i.e., nail technicians, salon workers) to be exposed to toluene during the use of nail products, and these exposures in nail technicians and salon workers are exacerbated by the working conditions (e.g., ventilation, long shifts, lack of personal protective equipment).
3. Certain sensitive subpopulations including nail industry workers, pregnant women (and their fetuses), infants, children, and adolescents may be especially susceptible to the adverse impacts of toluene.
4. Nail products containing toluene have the potential to cause or contribute to significant or widespread adverse impacts in consumers and workers due to the hazard trait and exposure considerations described in the chemical-product profile.

The results of DTSC's literature review are presented in the report, "Product-Chemical Profile for Nail Products Containing Toluene" completed in March of 2019 and updated in May of 2019 in response to public comments. This report, the references listed in this report, and the framework regulations for the SCP program will be provided to the reviewers for upload from an FTP site.

Conclusion 1

Toluene has hazard traits that can potentially cause significant adverse impacts on human health.

Toluene is a neurotoxicant. Published human toluene exposure studies demonstrate nervous system damage caused by toluene abuse or occupational exposure. Particularly, occupational exposure studies performed at high and low concentrations have shown adverse outcomes to workers' health. Animal studies also demonstrate that toluene inhalation exposure affects behavior, memory, and motor coordination.

Toluene is also a developmental toxicant. In humans, expectant mothers who inhale toluene as a recreational drug have given birth to infants with mental deficiencies and abnormal head size. Animal studies have demonstrated impairment in fetal growth, decreased birth weight, and fetal mortality.

Research studies suggest that toluene exhibits other hazard traits including neurodevelopmental toxicity, respiratory toxicity, and kidney toxicity. Toluene has also been linked to immunotoxicity and vision and hearing impairment.

The sections of the product-chemical profile (noted above) that pertain to Conclusion #1 include:

- Summary of the Rationale for Product-Chemical Selection
- Section 1.1 - Scope of Candidate Chemical
- Section 2.3 - Hazard Traits and/or Environmental or Toxicological Endpoints
- Section 2.5 - Populations That May Be Harmed by the Candidate Chemical

Conclusion 2

There is a potential for exposure to toluene during the use of nail products, and these exposures may contribute to or cause significant or widespread adverse impacts to humans.

Toluene is used in nail products, including nail coatings and nail polish thinner, and has been detected at concentrations up to 17.7 percent. Use of nail products in salons and at home has the potential to expose nail technicians, other salon workers, patrons, and nail product consumers to toluene. The primary exposure route from nail products is vapor inhalation. Toluene has been detected in air in nail salons at levels above California regulatory standards, and nail technicians (also known as manicurists) have an especially high potential for exposure.

Nail products and professional manicure/pedicure services are popular in the United States. In California alone, there are over 9,000 nail salons and more than 130,000 licensed manicurists. Nail products, including ones containing toluene, are also widely used at home. Retail sales of nail products exceed \$1 billion per year in the U.S. In 2015-16, nail polish sales represented \$741 million of this amount.

Based on all the available information, DTSC has concluded that there is a significant potential for human exposure to toluene during the use of nail products, and these exposures have the potential to cause widespread or significant adverse human health impacts, especially for nail industry workers, pregnant women (and their fetuses), infants, children, and adolescents.

The sections of the product-chemical profile (noted above) that pertain to Conclusion #2 include:

- Summary of the Rationale for Product-Chemical Selection Section 2.5 - Populations That May Be Harmed by the Candidate Chemical
- Section 3 - Factors Related to Potential Exposure to the Candidate Chemical in the Priority Product

Conclusion 3

Nail industry workers, pregnant women (and their fetuses), infants, children, and adolescents may be especially susceptible to the adverse impacts of toluene.

Nail industry workers may be impacted by exposure to toluene due to its frequent use in the workplace and some nail technicians work while pregnant; thus, their fetuses are also at risk of toluene exposure. Nail salon workers may have daily exposure to toluene. They often have longer workdays and workweeks compared to employees in other sectors. California's nail industry work force is composed of approximately 130,000 licensed nail technicians. Reportedly, 97 percent of U.S. nail technicians are female, and many are of childbearing age. Pregnant women and their fetuses may be at greater risk of adverse impacts from toluene exposure.

Studies indicate that nail salon workers may suffer from a higher incidence of certain health problems than the general population. In addition to a higher incidence of specific health problems, a recent study suggests that nail care technicians experience a faster deterioration of their overall health compared to controls as a result of chronic exposure to low levels of VOCs.

Infants and children are especially vulnerable to toluene exposure from nail products if they accompany their parents to work at a nail salon or are nail salon customers. They are a sensitive subpopulation because of their increased ingestion and inhalation rates per unit of body weight, rapid development, immature physiological ability to detoxify environmental contaminants, and behavioral characteristics that predispose them to increased exposures to environmental contaminants. Even if they are not directly exposed to toluene-containing nail

products, nursing infants and children may be exposed to toluene as indicated by toluene detected in human milk.

The sections of the product-chemical profile (noted above) that pertain to Conclusion #3 include:

- Summary of the Rationale for Product-Chemical Selection Section 2.3 – Hazard Traits and Environmental or Toxicological Endpoints
- Section 2.5 – Populations That May Be Harmed by the Candidate Chemical

Conclusion 4

Nail products containing toluene have the potential to cause or contribute to significant or widespread adverse impacts in consumers and workers due to the hazard trait and exposure considerations described in the chemical-product profile.

Exposure to toluene through normal use of nail products may cause significant adverse impacts to Californians, including workers, pregnant women and their fetuses, infants, children and adolescents. This determination is based on toluene's volatility and the characteristics of the enclosed environment in nail salons and homes, as based on measured toluene levels in air samples, in addition to the hazard traits associated with toluene.

The sections of the product-chemical profile (noted above) that pertain to Conclusion #4 include:

- Section 2.3 - Hazard Traits and/or Environmental or Toxicological Endpoints
- Section 3 - Factors Related to Potential Exposure to the Candidate Chemical in the Priority Product
- Section 6 – Discussion of Potential for Significant or Widespread Adverse Impacts

References included in these sections are listed in Attachment 4 and will be provided to the reviewers as part of this request.

The Big Picture

Reviewers are not limited to addressing only the specific issues presented above and are asked to contemplate the following questions.

- (a) In reading the product-chemical profile report and proposed implementation language, are there any additional scientific issues that are part of the scientific basis of the proposed regulation not described above? If so, please comment.**
- (b) Taken as a whole, is the scientific portion of the proposed regulation based upon sound scientific knowledge, methods, and practices?**

Reviewers should also note that some proposed regulatory actions might rely significantly on professional judgment where available scientific data are not as extensive as desired to support the statutory requirement for absolute scientific rigor. In these situations, the proposed course of action is favored over no action.

Reviewers should recognize that DTSC has a legal obligation to consider and respond to all feedback on the scientific portions of the proposed regulation. Because of this obligation, reviewers are encouraged to focus feedback on the scientific issues that are relevant to the central regulatory elements being proposed.

Attachment 3: List of Participants

Section A. California Department of Toxic Substances Control Personnel

Name	Title	Program	Location
Christine Papagni	Senior Environmental Scientist	Safer Products and Workplaces Program	Chatsworth, CA
Eric Sciuolo	Staff Toxicologist	Human and Ecological Risk Office	Sacramento, CA
Diana Phelps	Hazardous Substances Engineer	Safer Products and Workplaces Program	Sacramento, CA
Andrew King*	Research Program Specialist II	Safer Products and Workplaces Program	Sacramento, CA
Kyle Harris	Research Program Specialist II	Safer Products and Workplaces Program	Sacramento, CA
Thomas Booze	Senior Toxicologist	Human and Ecological Risk Office	Sacramento, CA
Coby Graham	Senior Industrial Hygienist	Safer Products and Workplaces Program	Berkeley, CA
Vivek Mithrani	Staff Toxicologist	Human and Ecological Risk Office	Berkeley, CA
Dennis Guo	Research Scientist III	Safer Products and Workplaces Program	Sacramento, CA
Anne Cooper Doherty	Senior Environmental Scientist	Safer Products and Workplaces Program	Sacramento, CA
Daphne Molin	Senior Environmental Scientist	Safer Products and Workplaces Program	Sacramento, CA
Efrem Neuwirth	Staff Toxicologist	Human and Ecological Risk Office	Cypress, CA
Patrick Kerzic*	Staff Toxicologist	Human and Ecological Risk Office	Chatsworth, CA
Christopher Leonetti	Environmental Scientist	Safer Products and Workplaces Program	Sacramento, CA
Dicle Yardimci	Senior Hazardous	Safer Products and Workplaces	Sacramento, CA

Name	Title	Program	Location
	Substances Engineer	Program	
Lynn Goldman	Attorney	Office of Legal Affairs	Sacramento, CA
Nancy Ostrom	Senior Environmental Scientist	Safer Products and Workplaces Program	Sacramento, CA
André Algazi	Senior Environmental Scientist	Safer Products and Workplaces Program	Sacramento, CA
Karl Palmer	Environmental Program Manager I	Safer Products and Workplaces Program	Sacramento, CA
Meredith Williams	Acting Director	DTSC	Sacramento, CA

* No longer works for DTSC

Section B. External Participants

Name	Title	Department / Program	Location
Sara Hoover	Research Scientist III	Scientific Affairs Division, Office of Environmental Health Hazard Assessment	Sacramento, CA
Gail Krowech	Staff Toxicologist	Scientific Affairs Division, Office of Environmental Health Hazard Assessment	Sacramento, CA

Attachment 4: Reference Titles

Regulatory:

California Code of Regulations, Title 22, sections 69401 – 69407.2

California Code of Regulations, Title 22, sections 69503 – 69503.7

Product-Chemical Profile for Nail Products Containing Toluene

California Code of Regulations, Title 22, proposed sections 69511(b)(6) and 69511.6

Literature Relied Upon:

40 C.F.R. §63 (2006) Code of Federal Regulations. Title 40: Protection of Environment. Chapter I: Environmental Protection Agency. Part 63- National Emission Standards for Hazardous Air Pollutants for Source Categories. Appendix Table 2 to Subpart F of Part 63, Organic Hazardous Air Pollutants. In: Regulations CoF (ed). vol Title 40, Ch. I, §63,

40 C.F.R. § 716.120 (1994) Code of Federal Regulations. Title 40: Protection of Environment. Chapter I: Environmental Protection Agency. Part 716.120 - Substances and listed mixtures to which this subpart applies. In: Regulations CoF (ed). vol Title 40, Ch. I, §716.120,

42 U.S.C. § 7412 (1999) 42 U.S. Code § 7412 - Hazardous air pollutants. In: Code US (ed) 42 US Code Title 42: The Public Health and Welfare Chapter 85: Air Pollution Prevention and Control § 7412 - Hazardous air pollutants. vol Title 42, Ch. 85, Sub Chapter I, Part A, § 7412,

Abbate C, Giorgianni C, Munao F, Brecciaroli R (1993) Neurotoxicity induced by exposure to toluene. An electrophysiologic study. *Int Arch Occup Environ Health* 64(6):389-392

Aitio A, Pekari K, Jarvisalo J (1984) Skin absorption as a source of error in biological monitoring. *Scand J Work Environ Health* 10(5):317-320

Alaves VM, Sleeth DK, Thiese MS, Larson RR (2013) Characterization of indoor air contaminants in a randomly selected set of commercial nail salons in Salt Lake County, Utah, USA. *Int J Environ Health Res* 23(5):419-433 doi:10.1080/09603123.2012.755152

Andersen I, Lundqvist GR, Molhave L, et al. (1983) Human response to controlled levels of toluene in six-hour exposures. *Scand J Work Environ Health* 9(5):405-418 doi:10.5271/sjweh.2393

Anderson C, Sundberg K, Groth O (1986) Animal model for assessment of skin irritancy. *Contact dermatitis* 15(3):143-151

Anderson HR, Dick B, Macnair RS, Palmer JC, Ramsey JD (1982) An investigation of 140 deaths associated with volatile substance abuse in the United Kingdom (1971-1981). *Hum Toxicol* 1(3):207-221

Arnold GL, Kirby RS, Langendoerfer S, Wilkins-Haug L (1994) Toluene embryopathy: Clinical delineation and developmental follow-up. *Pediatrics* 93(2):216-220

Arnold GL, Wilkins-Haug L (1990) Toluene embryopathy syndrome. *Am J Hum Genet* 47(suppl. 3):A46

- Arora H, Tosti A (2017) Safety and efficacy of nail products. *Cosmetics* 4(4):1-19
doi:10.3390/cosmetics4030024
- Atkinson R (1990) Gas-phase tropospheric chemistry of organic compounds: a review. *Atmos Environ* 24A(1):1-41
- ATSDR (2011) Toxic Substances Portal. Neurological (Nervous System). Toluene. Agency for Toxic Substances and Disease Registry (ATSDR). In.
<https://www.atsdr.cdc.gov/substances/toxorganlisting.asp?sysid=18> Accessed July 2017
- ATSDR (2015) Public Health Statement. Toluene. Agency for Toxic Substances and Disease Registry (ATSDR)
- ATSDR (2017) Toxicological Profile for Toluene. Agency for Toxic Substances and Disease Registry (ATSDR)
- Baelum J, Andersen IB, Lundqvist GR, et al. (1985) Response of solvent-exposed printers and unexposed controls to six-hour toluene exposure. *Scand J Work Environ Health* 11(4):271-280 doi:10.5271/sjweh.2221
- Basch C, Yarborough C, Trusty S, Basch C (2016) Use of protective gloves in nail salons in Manhattan, New York City. *J Prev Med Public Health* 49(4):249-251
doi:10.3961/jpmph.16.017
- Battle DC, Sabatini S, Kurtzman NA (1988) On the mechanism of toluene-induced renal tubular acidosis. *Nephron* 49(3):210-218 doi:10.1159/000185057
- Bauer PJ, Pathman T (2008) Memory and Early Brain Development. In: Tremblay RE, Barr RG, Peters RD, Boivin M (eds) *Encyclopedia on Early Childhood Development* [online].
- Bennett DH, Fisk W, Apte MG, et al. (2012) Ventilation, temperature, and HVAC characteristics in small and medium commercial buildings in California. *Indoor Air* 22(4):309-320
doi:10.1111/j.1600-0668.2012.00767.x
- Berenguer P, Soulage C, Perrin D, Pequignot JM, Abraini JH (2003) Behavioral and neurochemical effects induced by subchronic exposure to 40 ppm toluene in rats. *Pharmacol Biochem Behav* 74(4):997-1003
- Boey KW, Foo SC, Jeyaratnam J (1997) Effects of occupational exposure to toluene: A neuropsychological study on workers in Singapore. *Ann Acad Med Singapore* 26(2):184-187
- Boman A, Hagelthorn G, Magnusson K (1995) Percutaneous absorption of organic solvents during intermittent exposure in guinea pigs. *Acta dermato-venereologica* 75(2):114-119
- Bonzel KE, Müller-Wiefel DE, Ruder H, Wingen AM, Waldherr R, Weber M (1987) Anti-glomerular basement membrane antibody-mediated glomerulonephritis due to glue sniffing. *Eur J Pediatr* 146:296-300
- Bosch X, Campistol JM, Montoliu J, Revert L (1988) Myelofibrosis and focal segmental glomerulosclerosis associated with toluene poisoning. *Hum Toxicol* 7(4):357-561
- Bowen SE, Balster RL (1998) A direct comparison of inhalant effects on locomotor activity and schedule-controlled behavior in mice. *Exp Clin Psychopharmacol* 6(3):235-247
- Bowen SE, Hannigan JH (2013) Binge toluene exposure in pregnancy and pre-weaning developmental consequences in rats. *Neurotoxicol Teratol* 38:29-35
doi:10.1016/j.ntt.2013.04.002

- Bowen SE, Irtenkauf S, Hannigan JH, Stefanski AL (2009) Alterations in rat fetal morphology following abuse patterns of toluene exposure. *Reproductive toxicology* (Elmsford, NY) 27(2):161-169 doi:10.1016/j.reprotox.2009.01.002
- Brookman F (2013) "The Nail Care Battle." *Women's Wear Daily*.
- Brown HS, Bishop DR, Rowan CA (1984) The role of skin absorption as a route of exposure for volatile organic compounds (VOCs) in drinking water. *Am J Public Health* 74(5):479-484
- Bruckner JV, Peterson RG (1981) Evaluation of toluene and acetone inhalant abuse. II. Model development and toxicology. *Toxicol Appl Pharmacol* 61(3):302-312
- Bushnell PJ, Evans HL, Palmes ED (1985) Effects of toluene inhalation on carbon dioxide production and locomotor activity in mice. *Fundam Appl Toxicol* 5(5):971-977
- Cal/OSHA (2018) Title 8, California Code of Regulations, § 5155, Table AC-1, Permissible Exposure Limits for Chemical Contaminants. California Division of Occupational Safety and Health (Cal/OSHA). In. https://www.dir.ca.gov/Title8/5155table_ac1.html Accessed February 2018
- Callan SP, Kott JM, Cleary JP, McCarthy MK, Baltus BB, Bowen SE (2016) Changes in developmental body weight as a function of toluene exposure: A meta-analysis of animal studies. *Hum Exp Toxicol* 35(4):341-352 doi:10.1177/0960327115591377
- Camara-Lemarroy CR, Rodriguez-Gutierrez R, Monreal-Robles R, Gonzalez-Gonzalez JG (2015) Acute toluene intoxication--clinical presentation, management and prognosis: A prospective observational study. *BMC Emerg Med* 15:1-7 doi:10.1186/s12873-015-0039-0
- Cao G, Jang M (2008) Secondary organic aerosol formation from toluene photooxidation under various NO_x conditions and particle acidity. *Atmos Chem Phys Discuss* 8:14467-14495
- Caravati EM, Bjerk PJ (1997) Acute toluene ingestion toxicity. *Ann Emerg Med* 30(6):838-839
- CARB (2010) An Outdoor Health Risk Assessment of Emissions from Nail Salons. California Air Resources Board (CARB), California Environmental Protection Agency
- CARB (2011) Toxic Air Contaminant Identification List. California Air Resources Board (CARB), California Environmental Protection Agency. In. <https://www.arb.ca.gov/toxics/cattable.htm#Note> and <http://www.dtsc.ca.gov/SCP/upload/2-C-Toxic-Air-Contaminant.pdf> Accessed July 7, 2017
- CARB (2014) Background. Consumer Products Program. California Air Resources Board (CARB), California Environmental Protection Agency. In. <https://www.arb.ca.gov/consprod/background.htm> Accessed December 2017
- CARB (2015) The California Consumer Products Regulations. California Air Resources Board (CARB), California Environmental Protection Agency
- CARB (2017) Email communication from Joseph Calavita of California Air Resources Board (CARB) to Christine Papagni of DTSC on November 13, 2017.
- CARB (2018) Consumer Products Enforcement. California Air Resources Board (CARB), California Environmental Protection Agency. In. <https://www.arb.ca.gov/enf/consprod.htm> Accessed February 2018
- CDC (2016) Biomonitoring summary. Toluene. Centers for Disease Control and Prevention (CDC). In. https://www.cdc.gov/biomonitoring/Toluene_BiomonitoringSummary.html Accessed October 2017

- CDC (2017) Fourth National Report on Human Exposure to Environmental Chemicals Updated Tables, January 2017, Volume One. Centers for Disease Control and Prevention (CDC)
- CDPH (2016) Cosmetics Containing Ingredients Linked to Cancer or Reproductive Harm. Data Reported to the California Safe Cosmetics Program 2009-2015. California Department of Public Health (CDPH)
- CDPH (2017) California Safe Cosmetics Program Product Database. California Department of Public Health (CDPH). In. <https://safecosmetics.cdph.ca.gov/search/categories.aspx> Accessed October 2017
- Chen HH, Lin YR, Chan MH (2011) Toluene exposure during brain growth spurt and adolescence produces differential effects on N-methyl-D-aspartate receptor-mediated currents in rat hippocampus. *Toxicol Lett* 205(3):336-340 doi:10.1016/j.toxlet.2011.06.026
- CHNSC (2018) Find a Healthy Nail Salon. California Healthy Nail Salon Collaborative (CHNSC). In. <https://cahealthynailsalons.org/find-a-healthy-nail-salon-2/> Accessed February 2018
- Chouanier D, Wild P, Fontana JM, et al. (2002) Neurobehavioral disturbances arising from occupational toluene exposure. *Am J Ind Med* 41(2):77-88
- CIIT (1980) A 24 month inhalation toxicology study in Fischer-344 rat exposed to atmospheric toluene. Executive summary and data tables. October 15, 1980. Conducted by Industrial Bio-Test Laboratories, Inc., Decatur, IL, and Experimental Pathology Laboratories, Inc., Raleigh, NC for Chemical Industry Institute of Toxicology (CIIT), Research Triangle Park, NC [As described in ATSDR 2017]
- CIR (1989) Final report on the safety assessment of ethyl acetate and butyl acetate. Cosmetic Ingredient Review Expert Panel (CIR). *J Am Coll Toxicol* 8(4):681-705
- Coleman-Lochner L, Martin A (2016) Wal-Mart Asks Its Suppliers to Stop Using Eight Chemicals. In: Bloomberg. <https://www.bloomberg.com/news/articles/2016-07-20/wal-mart-asks-suppliers-to-remove-eight-chemicals-from-products> Accessed October 2017
- Conti AC, Lowing JL, Susick LL, Bowen SE (2012) Investigation of calcium-stimulated adenylyl cyclases 1 and 8 on toluene and ethanol neurobehavioral actions. *Neurotoxicol Teratol* 34(5):481-488 doi:10.1016/j.ntt.2012.06.005
- Courtney KD, Andrews JE, Springer J, et al. (1986) A perinatal study of toluene in CD-1 mice. *Fundam Appl Toxicol* 6(1):145-154
- Curry KK, Brookman DJ, Whitmyre GK, et al. (1994) Personal exposures to toluene during use of nail lacquers in residences: Description of the results of a preliminary study. *J Expos Anal Environ Epidemiol* 4(4):443-456
- da Silva VA, Malheiros LR, Paumgartten FJR, de Matos Sa-Rego M, Riul TR, Golovattei MAR (1990) Developmental toxicity of in utero exposure to toluene on malnourished and well nourished rats. *Toxicology* 64(2):155-168
- DCA (2017) Email communication from Laurel Goddard of California Department of Consumer Affairs (DCA) to Diana Phelps of DTSC on August 14, 2017.
- DCA (2018) Email communication from Laurel Goddard of California Department of Consumer Affairs (DCA) to Christine Papagni of DTSC on January 26, 2018.
- Deschamps D, Géraud C, Dally S (2001) Cognitive functions in workers exposed to toluene: Evaluation at least 48 hours after removal from exposure. *Int Arch Occup Environ Health* 74(4):285-288

- Dick ALW, Lawrence AJ, Duncan JR (2014) Chronic intermittent toluene inhalation initiated during adolescence in rats does not alter voluntary consumption of ethanol in adulthood. *Alcohol* 48(6):561-569
- Donald JM, Hooper K, Hopenhayn-Rich C (1991) Reproductive and developmental toxicity of toluene: A review. *Environ Health Perspect* 94:237-244
- Drug Store News (2016) "Artificial nails boast consistent growth." *Drug Store News*. vol 38(8), p 88
- DTSC (2012) Summary of Data and Findings from Testing of a Limited Number of Nail Products. Department of Toxic Substances Control (DTSC), California Environmental Protection Agency
- DTSC (2018a) Candidate Chemical Database. Department of Toxic Substances Control (DTSC), California Environmental Protection Agency. In. <http://cit.dtsc.ca.gov/scp/chemicalsearch/ChemicalSearch.aspx> Accessed August 2018
- DTSC (2018b) Healthy Nail Salon Recognition Program Guidelines. Department of Toxic Substances Control (DTSC)
- Dutkiewicz T, Tyras H (1968) Skin absorption of toluene, styrene, and xylene by man. *Br J Ind Med* 25(3):243
- EC (2003) European Union Risk Assessment Report. Toluene. CAS No. 108-88-3. EINECS No. 203-625-9. European Commission (EC), European Chemicals Bureau
- Echeverria D, Fine L, Langolf G, Schork A, Sampaio C (1989) Acute neurobehavioural effects of toluene. *Br J Ind Med* 46(7):483-495
- Einav S, Amitai Y, Reichman J, Geber D (1997) Bradycardia in toluene poisoning. *J Toxicol Clin Toxicol* 35(3):295-298
- Eklund BM, Burkes S, Morris P, Mosconi L (2008) Spatial and temporal variability in VOC levels within a commercial retail building. *Indoor Air* 18(5):365-374
- Eller N, Netterstrøm B, Laursen P (1999) Risk of chronic effects on the central nervous system at low toluene exposure. *Occup Med (Lond)* 49(6):389-395
- Encyclopædia Britannica (2017) Rotogravure printing. In. <https://www.britannica.com/topic/rotogravure-printing> Accessed March 2018
- Encyclopædia Britannica (2018) Neurotransmitter. In. <https://www.britannica.com/science/neurotransmitter> Accessed July 2018
- Erramouspe J, Galvez R, Fischel DR (1996) Newborn renal tubular acidosis associated with prenatal maternal toluene sniffing. *J Psychoactive Drugs* 28(2):201-204 doi:10.1080/02791072.1996.10524392
- EWG (2017) Environmental Working Group's (EWG) Skin Deep Cosmetics Database. In. <http://www.ewg.org/skindeep#.WhXRcOSWzIU> Accessed November 2017
- Fabietti F, Ambruzzi A, Delise M, Sprechini MR (2004) Monitoring of the benzene and toluene contents in human milk. *Environ Int* 30(3):397-401 doi:10.1016/j.envint.2003.09.007
- FDA (2009) Fair Packaging and Labeling Act. Title 15 - Commerce and Trade Chapter 39 - Fair Packaging and Labeling Program. Food and Drug Administration (FDA). In. <https://wayback.archive-it.org/7993/20170722051950/https://www.fda.gov/RegulatoryInformation/LawsEnforcebyFDA/ucm148722.htm> Accessed December 2017

- FDA (2016) FDA Authority Over Cosmetics: How Cosmetics Are Not FDA-Approved, but Are FDA-Regulated. U.S. Food and Drug Administration (FDA). In. <https://www.fda.gov/Cosmetics/GuidanceRegulation/LawsRegulations/ucm074162.htm> Accessed October 2017
- FDA (2017) Nail Care Products. U.S. Food and Drug Administration (FDA). In. <http://www.fda.gov/Cosmetics/ProductsIngredients/Products/ucm127068.htm#note> Accessed February 2018
- FDA (2018) Milestones in U.S. Food and Drug Law History. In. <https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm2007256.htm> Accessed July 2018
- Filley CM, Halliday W, Kleinschmidt-DeMasters BK (2004) The effects of toluene on the central nervous system. *Journal of neuropathology and experimental neurology* 63(1):1-12
- Fischman CM, Oster JR (1979) Toxic effects of toluene: A new cause of high anion gap metabolic acidosis. *JAMA* 241(16):1713-1715
- Foo SC, Jeyaratnam J, Koh D (1990) Chronic neurobehavioural effects of toluene. *Br J Ind Med* 47(7):480-484
- Ford AR (2014) "Overexposed, Underinformed": Nail Salon Workers and Hazards to Their Health / A Review of the Literature. National Network on Environments and Women's Health (NNEWH).
- Forkman BA, Ljungberg T, Johnson AC, et al. (1991) Long-term effects of toluene inhalation on rat behavior. *Neurotoxicol Teratol* 13(5):475-481
- Franke C, Studinger G, Berger G, et al. (1994) The assessment of bioaccumulation. *Chemosphere* 29(7):1501-1514
- Garcia E, Sharma S, Pierce M, et al. (2015) Evaluating a county-based healthy nail salon recognition program. *Am J Ind Med* 58(2):193-202 doi:10.1002/ajim.22379
- Gjølstad M, Thorud S, Molander P (2006) Occupational exposure to airborne solvents during nail sculpturing. *J Environ Monit* 8(5):537-542 doi:10.1039/b601917j
- Goldin LJ, Ansher L, Berlin A, et al. (2014) Indoor air quality survey of nail salons in Boston. *J Immigr Minor Health* 16(3):508-514 doi:10.1007/s10903-013-9856-y
- Goodwin TM (1988) Toluene abuse and renal tubular acidosis in pregnancy. *Obstet Gynecol* 71(5):715-718
- Gotohda T, Nishimura A, Morita K (2009) Immunohistochemical studies on early stage of hepatic damage induced by subacute inhalation of toluene vapor in rats. *J Appl Toxicol* 29(6):505-509 doi:10.1002/jat.1435
- Grandjean P, Landrigan PJ (2006) Developmental neurotoxicity of industrial chemicals. *Lancet* 368(9553):2167-2178 doi:10.1016/S0140-6736(06)69665-7
- Greenberg MM (1997) The central nervous system and exposure to toluene: A risk characterization. *Environ Res* 72(1):1-7 doi:10.1006/enrs.1996.3686
- Grešner P, Świercz R, Król MB, Twardowska E, Gromadzińska J, Wąsowicz W (2016) Does the Low-level occupational exposure to volatile organic compounds alter the seasonal variation of selected markers of oxidative stress? A case-control study in nail technicians. *Journal of Occupational Medicine and Toxicology* 11(36):1-11

- Grešner P, Świercz R, Wąsowicz W, Gromadzińska J (2017) Faster health deterioration among nail technicians occupationally exposed to low levels of volatile organic compounds. *Int J Occ Med and Env Health* 30(3):469-483
- GS1 (2017) Global Product Classification (GPC). In. <https://www.gs1.org/gpc/browser> Accessed October 2017 - February 2018
- Halliday-Bell JA, Gissler M, Jaakkola JJK (2009) Work as a hairdresser and cosmetologist and adverse pregnancy outcomes. *Occup Med (Lond)* 59(3):180-184
doi:10.1093/occmed/kqp017
- Hannigan JH, Bowen SE (2010) Reproductive toxicology and teratology of abused toluene. *Syst Biol Reprod Med* 56(2):184-200 doi:10.3109/19396360903377195
- Harris-Roberts J, Bowen J, Sumner J, et al. (2011) Work-related symptoms in nail salon technicians. *Occup Med (Lond)* 61(5):335-340 doi:10.1093/occmed/kqr096
- Hass U, Lund SP, Hougaard KS, Simonsen L (1999) Developmental neurotoxicity after toluene inhalation exposure in rats. *Neurotoxicol Teratol* 21(4):349-357
- Herd-Loosavio ML, Lin S, Druschel CM, Hwang SA, Mauer MP, Carlson GA (2009) The risk of having a low birth weight or preterm infant among cosmetologists in New York State. *Matern Child Health J* 13(1):90-97 doi:10.1007/s10995-008-0324-6
- Hersh JH (1989) Toluene embryopathy: Two new cases. *J Med Genet* 26:333-337
- Hersh JH, Podruch PE, Rogers G, Weisskopf B (1985) Toluene embryopathy. *J Pediatr* 106(6):922-927
- HHS (2017) Household Products Database, Health and Safety Information on Household Products. U.S Department of Health and Human Services (HHS), National Institute of Health, National Library of Medicine. In. <https://householdproducts.nlm.nih.gov/index.htm> Accessed September 2017
- Hillefors-Berglund M, Liu Y, von Euler G (1995) Persistent, specific and dose-dependent effects of toluene exposure on dopamine D₂ agonist binding in the rat caudate-putamen. *Toxicology* 100(1-3):185-194
- Hogie M, Guerbet M, Reber A (2009) The toxic effects of toluene on the optokinetic nystagmus in pigmented rats. *Ecotoxicol Environ Saf* 72(3):872-878
doi:10.1016/j.ecoenv.2008.02.016
- Hollund BE, Moen BE (1998) Chemical exposure in hairdresser salons: effect of local exhaust ventilation. *Ann Occup Hyg* 42(4):277-281
- Hougaard KS, Hass U, Lund SP, Simonsen L (1999) Effects of prenatal exposure to toluene on postnatal development and behavior in rats. *Neurotoxicol Teratol* 21(3):241-250
- Howard PH, ed. (1991) *Handbook of Environmental Degradation Rates*. CRC Press, Lewis Publishers Chelsea, MI [As described by ATSDR 2017]
- HSDB (2012) N-Butyl Acetate. Hazardous Substances Data Bank (HSDB). In. <https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm> Accessed October 2017
- HSDB (2015) Ethyl Acetate. Hazardous Substances Data Bank (HSDB). In. <https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm> Accessed October 2017
- HSDB (2016) Toluene. Hazardous Substances Data Bank (HSDB). In. <https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm> Accessed July - October 2017

- Hsieh GC, Parker RDR, Sharma RP, Hughes BJ (1990) Subclinical effects of groundwater contaminants. III. Effects of repeated oral exposure to combinations of benzene and toluene on immunologic responses in mice. *Arch Toxicol* 64(4):320-328
- Hsieh GC, Sharma RP, Parker RDR (1989) Immunotoxicological evaluation of toluene exposure via drinking water in mice. *Environ Res* 49(1):93-103
- Hsieh GC, Sharma RP, Parker RDR (1991) Hypothalamic-pituitary-adrenocortical axis activity and immune function after oral exposure to benzene and toluene. *Immunopharmacology* 21(1):23-32
- Huerta-Rivas A, López-Rubalcava C, Sánchez-Serrano SL, Valdez-Tapia M, Lamas M, Cruz SL (2012) Toluene impairs learning and memory, has antinociceptive effects, and modifies histone acetylation in the dentate gyrus of adolescent and adult rats. *Pharmacol Biochem Behav* 102(1):48-57
- IARC (1999) IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 71. Re-evaluation of Some Organic Chemicals, Hydrazine and Hydrogen Peroxide. Toluene. International Agency for Research on Cancer (IARC)
- IPCS (2005) Concise International Chemical Assessment, Document 64. Butyl Acetates. International Programme on Chemical Safety (IPCS). In. <http://www.inchem.org/documents/cicads/cicads/cicad64.htm> Accessed October 2017
- John EM, Savitz DA, Shy CM (1994) Spontaneous abortions among cosmetologists. *Epidemiology* 5(2):147-155
- Kamijima M, Nakazawa Y, Yamakawa M, et al. (1994) Metabolic acidosis and renal tubular injury due to pure toluene inhalation. *Arch Environ Health* 49:410-413
- Kang SK, Rohlman DS, Lee MY, Lee HS, Chung SY, Anger WK (2005) Neurobehavioral performance in workers exposed to toluene. *Environ Toxicol Pharmacol* 19(3):645-650 doi:10.1016/j.etap.2004.12.049
- Killus JP, Whitten GZ (1982) A mechanism describing the photochemical oxidation of toluene in smog. *Atmospheric Environment* (1967) 16(8):1973-1988 doi:[https://doi.org/10.1016/0004-6981\(82\)90468-1](https://doi.org/10.1016/0004-6981(82)90468-1)
- Kim DB, Lee JK, Jung KJ, Yoon YP (1998) Effects of toluene inhalation on the concentrations of the brain monoamines and metabolites. *J Toxicol Pub Health* 14(4):495-500
- Kishi R, Harabuchi I, Ikeda T, Yokota H, Miyake H (1988) Neurobehavioral effects and pharmacokinetics of toluene in rats and their relevance to man. *Br J Ind Med* 45(6):396-408
- Kiyokawa M, Mizota A, Takasoh M, Adachi-Usami E (1999) Pattern visual evoked cortical potentials in patients with toxic optic neuropathy caused by toluene abuse. *Jpn J Ophthalmol* 43(5):438-442
- Kodavanti PRS, Royland JE, Moore-Smith DA, et al. (2015) Acute and subchronic toxicity of inhaled toluene in male Long-Evans rats: Oxidative stress markers in brain. *Neurotoxicology* 51:10-19 doi:10.1016/j.neuro.2015.09.001
- Kopelovich L, Perez AL, Jacobs N, Mendelsohn E, Keenan JJ (2015) Screening-level human health risk assessment of toluene and dibutyl phthalate in nail lacquers. *Food Chem Toxicol* 81:46-53 doi:10.1016/j.fct.2015.04.011
- Kroeger RM, Moore RJ, Lehman TH, Giesy JD, Skeeters CE (1980) Recurrent urinary calculi associated with toluene sniffing. *J Urol* 123(1):89-91

- Kronevi T, Wahlberg J, Holmberg B (1979) Histopathology of skin, liver, and kidney after epicutaneous administration of five industrial solvents to guinea pigs. *Environ Res* 19(1):56-69
- Laslo-Baker D, Barrera M, Knittel-Keren D, et al. (2004) Child neurodevelopmental outcome and maternal occupational exposure to solvents. *Arch Pediatr Adolesc Med* 158(10):956-961 doi:10.1001/archpedi.158.10.956
- Leeder JS, Kearns GL (1997) Pharmacogenetics in pediatrics. Implications for practice. *Pediatr Clin North Am* 44(1):55-77
- Lindemann R (1991) Congenital renal tubular dysfunction associated with maternal sniffing of organic solvents. *Acta Pediatr Scand* 80(8-9):882-884
- López-Rubalcava C, Hen R, Cruz SL (2000) Anxiolytic-like actions of toluene in the burying behavior and plus-maze tests: Differences in sensitivity between 5-HT_{1B} knockout and wild-type mice. *Behav Brain Res* 115(1):85-94
- LoSasso GL, Rapport LJ, Axelrod BN (2001) Neuropsychological symptoms associated with low-level exposure to solvents and (meth)acrylates among nail technicians. *Neuropsychiatry Neuropsychol Behav Neurol* 14(3):183-189
- LoSasso GL, Rapport LJ, Axelrod BN, Whitman RD (2002) Neurocognitive sequelae of exposure to organic solvents and (meth)acrylates among nail-studio technicians. *Neuropsychiatry Neuropsychol Behav Neurol* 15(1):44-55
- Malnou A (2014) Water-based nail-polish composition. U.S. Patent No. US 8,883,126 B2. France Patent,
- Marlow DA, Looney T, Reutman S (2012) An Evaluation of Local Exhaust Ventilation Systems for Controlling Hazardous Exposures in Nail Salons. EPHB Report No. 005-164. Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH), Division of Applied Research and Technology, Engineering and Physical Hazards Branch (EPHB)
- Mayer AS, Brazile WJ, Erb S, Autenrieth DA, Serrano K, Van Dyke MV (2015) Developing effective worker health and safety training materials: Hazard awareness, identification, recognition, and control for the salon industry. *J Occup Environ Med* 57(5):537-542 doi:10.1097/JOM.0000000000000400
- McNary JE, Jackson EM (2007) Inhalation exposure to formaldehyde and toluene in the same occupational and consumer setting. *Inhal Toxicol* 19(6-7):573-576 doi:10.1080/08958370701270946
- McWilliams ML, Chen GD, Fechter LD (2000) Low-level toluene disrupts auditory function in guinea pigs. *Toxicol Appl Pharmacol* 167(1):18-29 doi:10.1006/taap.2000.8978
- Meulenbelt J, de Groot G, Savelkoul TJF (1990) Two cases of acute toluene intoxication. *Br J Ind Med* 47(6):417-420
- Miller MD, Marty MA, Arcus A, Brown J, Morry D, Sandy M (2002) Differences between children and adults: Implications for risk assessment at California EPA. *International Journal of Toxicology* 21:403-418 doi:10.1080/1091581029009663
- Mintel (2018) Mintel's Global New Products Database. In. <http://www.mintel.com/global-new-products-database> Accessed January 2018

- Mullin LS, Krivanek ND (1982) Comparison of unconditioned reflex and conditioned avoidance tests in rats exposed by inhalation to carbon monoxide, 1,1,1-trichloroethane, toluene or ethanol. *Neurotoxicology* 3(1):126-137
- Muttray A, Wolters V, Jung D, Konietzko J (1999) Effects of high doses of toluene on color vision. *Neurotoxicol Teratol* 21(1):41-45
- Nails Magazine (2015) Industry Statistics Highlights. In: 2014-2015 Nails Big Book. <http://www.nailsmag.com/page/70218/market-research> Accessed September 2017
- Nails Magazine (2016) 2015-2016 Nails Big Book. In. <http://files.nailsmag.com/Feature-Articles-in-PDF/NABB2015-16stats.pdf> Accessed October 2017
- Nails Magazine (2017) 2016-2017 Industry Statistics. In. <http://www.nailsmag.com/page/70218/market-research> Accessed September 2017
- Nakajima T, Wang RS, Katakura Y, et al. (1992) Sex-, age- and pregnancy-induced changes in the metabolism of toluene and trichloroethylene in rat liver in relation to the regulation of cytochrome P450IIE1 and P450IIC11 content. *J Pharmacol Exp Ther* 261(3):869-874
- Nelson BK, Brightwell WS, MacKenzie-Taylor DR, et al. (1988) Teratogenicity of n-propanol and isopropanol administered at high inhalation concentrations to rats. *Food Chem Toxicol* 26(3):247-254
- Nguyen C (2016) Indoor air quality of nail salons in the greater Los Angeles area: Assessment of chemical and particulate matter exposures and ventilation. Thesis UCLA, UCLA
- NIOSH (1999) Controlling Chemical Hazards During the Application of Artificial Fingernails. National Institute for Occupational Safety and Health (NIOSH). In. <https://www.cdc.gov/niosh/docs/99-112/pdfs/99-112.pdf> Accessed July 18, 2017
- NIOSH (2016) Workplace Safety & Health Topics, Hierarchy of Controls. The National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention. In. <https://www.cdc.gov/niosh/topics/hierarchy/> Accessed April 2018
- NTP (1990) Toxicology and Carcinogenesis Studies of Toluene (CAS No. 108-88-3) in F344/N Rats and B6C3F₁ Mice (Inhalation Studies). Technical Report Series No. 371. NIH Publication No. 90-2826. National Toxicology Program (NTP)
- NYSDOH (2016) Review of Chemicals Used in Nail Salons. New York State Department of Health (NYSDOH)
- O'Brien ET, Yeoman WB, Hobby JAE (1971) Hepatorenal damage from toluene in a "glue sniffer". *Br Med J* 2(752):29-30
- OEHHA (1991) Chemicals Known to the State to Cause Cancer or Reproductive Toxicity (Prop 65 List). Office of Environmental Health Hazard Assessment (OEHAA). In. http://www.dtsc.ca.gov/SCP/upload/1-A-Prop65list_04-19-13.pdf Accessed July 2017
- OEHHA (1999) Public Health Goal for Toluene In Drinking Water. February 1999. Office of Environmental Health Hazard Assessment (OEHHA)
- OEHHA (2008) Air Toxics Hot Spots Risk Assessment Guidelines, Technical Support Document For the Derivation of Noncancer Reference Exposure Levels (RELs), Appendix D.2 Acute RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines (OEHHA 1999). Office of Environmental Health Hazard Assessment (OEHHA)

- OEHHA (2016) Acute, 8-hour and Chronic Reference Exposure. Office of Environmental Health Hazard Assessment (OEHHA). In. <http://www.dtsc.ca.gov/SCP/upload/2-E-CA-RELEs.pdf> Accessed July 7, 2017
- Ono A, Sekita K, Ohno K, et al. (1995) Reproductive and developmental toxicity studies of toluene. I. Teratogenicity study of inhalation exposure in pregnant rats. *J Toxicol Sci* 20(2):109-134
- Ørbæk P, Nise G (1989) Neurasthenic complaints and psychometric function of toluene-exposed rotogravure printers. *Am J Ind Med* 16(1):67-77
- Ørbæk P, Österberg K, Åkesson B, Bergendorf U, Karlson B, Seger L (1998) Suprathreshold intensity and annoyance reactions in experimental challenge to toluene and n-butyl acetate among subjects with long-term solvent exposure. *Scand J Work Environ Health* 24(5):432-438 doi:10.5271/sjweh.366
- OSHA (1993) 29 CFR Part 1910. Air contaminants. Federal Register 58:35338-35351. In: Occupational Safety and Health Administration (OSHA). <https://www.osha.gov/laws-regs/federalregister/1993-06-30-0> Accessed October 2017
- OSHA (2012) Stay Healthy and Safe While Giving Manicures and Pedicures. A Guide for Nail Salon Workers. Occupational Safety and Health Administration (OSHA)
- OSHA (2017) Health Hazards in Nail Salons. Occupational Safety and Health Administration (OSHA). In. <https://www.osha.gov/SLTC/nailsalons/chemicalhazards.html#steps> Accessed October 2017
- OSHA (2018a) Permissible Exposure Limits – Annotated Tables. Occupational Safety and Health Administration (OSHA). In. <https://www.osha.gov/dsg/annotated-pels/> Accessed January 2018
- OSHA (2018b) Toluene. Occupational Exposure Limits. Occupational Safety and Health Administration (OSHA). In. https://www.osha.gov/SLTC/toluene/exposure_limits.html Accessed January 2018
- OSHSB (2012) Airborne Contaminants. General Industry Safety Orders, Division 1, Chapter 4, Subchapter 7, Article 107, Section 5155. Occupational Safety & Health Standards Board (OSHSB). In. http://www.dir.ca.gov/oshsb/Airborne_Contaminants_2011.html January 2018
- Österberg K, Ørbæk P, Karlson B, Åkesson B, Bergendorf U (2003) Annoyance and performance during the experimental chemical challenge of subjects with multiple chemical sensitivity. *Scand J Work Environ Health* 29(1):40-50 doi:10.5271/sjweh.703
- Páez-Martínez N, Ambrosio E, García-Lecumberri C, Rocha L, Montoya GL, Cruz SL (2008) Toluene and TCE decrease binding to mu-opioid receptors, but not to benzodiazepine and NMDA receptors in mouse brain. *Ann N Y Acad Sci* 1139:390-401
- Páez-Martínez N, Cruz SL, López-Rubalcava C (2003) Comparative study of the effects of toluene, benzene, 1,1,1-trichloroethane, diethyl ether, and flurothyl on anxiety and nociception in mice. *Toxicol Appl Pharmacol* 193(1):9-16
- Pak VM, Powers M, Liu J (2013) Occupational chemical exposures among cosmetologists: Risk of reproductive disorders. *Workplace Health & Safety* 61(12):522-528
- Park SA, Gwak S, Choi S (2014) Assessment of occupational symptoms and chemical exposures for nail salon technicians in Daegu City, Korea. *J Prev Med Public Health* 47(3):169-176 doi:10.3961/jpmph.2014.47.3.169

- Pearson MA, Hoyme HE, Seaver LH, Rimsza ME (1994) Toluene embryopathy: Delineation of the phenotype and comparison with fetal alcohol syndrome. *Pediatrics* 93(2):211-215
- Peters LI, Hawker D, Bartkow ME, Tapper S, Gore W (2007) Indoor air concentrations of various volatile organic compounds in a suburban nail salon. *Clean Air and Environmental Quality* 41(1):39-42
- Pierce CH, Chen Y, Dills RL, Kalman DA, Morgan MS (2002) Toluene metabolites as biological indicators of exposure. *Toxicology Letters* 129(1):65-76
doi:[https://doi.org/10.1016/S0378-4274\(01\)00472-6](https://doi.org/10.1016/S0378-4274(01)00472-6)
- Pryor GT, Rebert CS, Dickinson J, Feeney EM (1984) Factors affecting toluene-induced ototoxicity in rats. *Neurobehav Toxicol Teratol* 6(3):223-238
- Quach T, Gunier R, Tran A, et al. (2011) Characterizing workplace exposures in Vietnamese women working in California nail salons. *Am J Public Health* 101 Suppl 1(Supplement 1):S271-S276 doi:10.2105/AJPH.2010.300099
- Quach T, Liou J, Fu L, Mendiratta A, Tong M, Reynolds P (2012) Developing a proactive research agenda to advance nail salon worker health, safety, and rights. *Prog Community Health Partnersh* 6(1):75-82 doi:10.1353/cpr.2012.0005
- Quach T, Nguyen KD, Doan-Billings PA, Okahara L, Fan C, Reynolds P (2008) A preliminary survey of Vietnamese nail salon workers in Alameda County, California. *J Community Health* 33(5):336-343 doi:10.1007/s10900-008-9107-7
- Quach T, Varshavsky J, Von Behren J, et al. (2013) Reducing chemical exposures in nail salons through owner and worker trainings: An exploratory intervention study. *American Journal of Industrial Medicine* 56:806-817 doi:10.1002/ajim.22146
- Rister R (2016) Health Problems Caused by Biting Painted Nails are Not Limited to Chemical Toxicity. In: SteadyHealthcom. <https://www.steadyhealth.com/articles/can-you-poison-yourself-by-biting-your-nails-toxic-chemicals-abound-in-most-brands-of-nail-polish/health-problems-caused-by-biting-painted-nails-are-not-limited-to-chemical-toxicity> Accessed April 2018
- Roberts LG, Bevans AC, Schreiner CA (2003) Developmental and reproductive toxicity evaluation of toluene vapor in the rat. I. Reproductive toxicity. *Reproductive toxicology* (Elmsford, NY) 17(6):649-658 doi:10.1016/s0890-6238(03)00106-0
- Roberts LG, Nicolich MJ, Schreiner CA (2007) Developmental and reproductive toxicity evaluation of toluene vapor in the rat II. Developmental toxicity. *Reproductive toxicology* (Elmsford, NY) 23(4):521-531 doi:10.1016/j.reprotox.2007.01.009
- Roelofs C, Azaroff LS, Holcroft C, Nguyen H, Doan T (2008) Results from a community-based occupational health survey of Vietnamese-American nail salon workers. *J Immigr Minor Health* 10(4):353-361 doi:10.1007/s10903-007-9084-4
- Roelofs C, Do T (2012) Exposure assessment in nail salons: An indoor air approach. *ISRN Public Health* 2012:1-7 doi:10.5402/2012/962014
- Roelofs C, Do T, Truong T (2007) "Indoor Air Quality in Nail Salons." Presentation, American Industrial Hygiene Conference and Exhibition. June 6, 2007. Philadelphia, PA
- Romanowski S (2015) The trends polishing up the US nail care market. Mintel. In. <http://www.mintel.com/blog/beauty-market-news/the-trends-polishing-up-the-us-nail-care-market> Accessed September 2017

- Saito A, Tanaka H, Usuda H, et al. (2011) Characterization of skin inflammation induced by repeated exposure of toluene, xylene, and formaldehyde in mice. *Environmental toxicology* 26(3):224-232 doi:10.1002/tox.20547
- Sally Beauty Supply (2017) How often should I get a professional manicure? In. https://www.sallybeauty.com/FAQ_NAILS_048.html Accessed December 2017
- Samuel-Herter SR, Slaght SL, McKay BE (2014) Age-dependent time courses of recovery for motor functions following acute toluene intoxication in rats. *Dev Psychobiol* 56(4):657-673 doi:10.1002/dev.21134
- Sato A, Nakajima T (1978) Differences following skin or inhalation exposure in the absorption and excretion kinetics of trichloroethylene and toluene. *Br J Ind Med* 35(1):43-49
- SCCP (2008) Opinion on Toluene (its use as a solvent in nail cosmetics). Scientific Committee on Consumer Products (SCCP), European Commission
- Schikler KN, Lane EE, Seitz K, Collins WM (1984) Solvent abuse associated pulmonary abnormalities. *Adv Alcohol Subst Abuse* 3(3):75-81 doi:10.1300/J251v03n03_07
- SF Environment (2017) Email communication from Megan Kalsman of San Francisco Department of the Environment (SF Environment) to Dicle Yardimci of DTSC on July 5, 2017.
- SF Environment (2018) Healthy Nail Salon Program. San Francisco Department of the Environment (SF Environment). In. <https://sfenvironment.org/article/healthy-nail-salon-program> Accessed March 2018
- Shendell DG, Graber JM, Milich LJ, Pratt ME (2018) Assessing acute symptoms related to occupational exposures among nail salon technicians. *J Occup Environ Med* 60(4):343-349 doi:10.1097/JOM.0000000000001210
- Shibata K, Yoshita Y, Matsumoto H (1994) Extensive chemical burns from toluene. *Am J Emerg Med* 12(3):353-355
- Soberanes-Chávez P, López-Rubalcava C, de Gortari P, Cruz SL (2013) Exposure to toluene and stress during pregnancy impairs pups' growth and dams' lactation. *Neurotoxicol Teratol* 40:9-16 doi:10.1016/j.ntt.2013.07.011
- Statista (2017a) U.S. population: Do you use nail polish / nail care products? In. <https://www.statista.com/statistics/276463/us-households-usage-of-nail-polish-and-nail-care-products/> Accessed December 2017
- Statista (2017b) U.S. population: How many times have you used nail polish/nail care products in the last 30 days? In. <https://www.statista.com/statistics/276469/us-households-usage-frequency-of-nail-polish-and-nail-care-products/> Accessed November 2017
- Statista (2017c) U.S. population: Usage of nail polish / nail care products from 2011 to 2020. In. <https://www.statista.com/statistics/286905/usage-nail-polish-nail-care-products-us-trend/> Accessed December 2017
- Streicher HZ, Gabow PA, Moss AH, Kono D, Kaehny WD (1981) Syndromes of toluene sniffing in adults. *Ann Intern Med* 94(6):758-762
- SWRCB (2012) Final 2012 California Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report). State Water Resources Control Board (SWRCB). In. http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2012.shtml Accessed July 2017

- SWRCB (2014) Maximum Contaminant Levels and Regulatory Dates for Drinking Water, U.S. EPA vs. California. State Water Resources Control Board (SWRCB). In. http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/dwdocuments/MCLsEPAsDWP-2014-07-01.pdf Accessed July 2017
- Taher SM, Anderson RJ, McCartney R, Popovtzer MM, Schrier RW (1974) Renal tubular acidosis associated with toluene "sniffing". *N Engl J Med* 290(14):765-768
- Tähti H, Aaran RK, Vapaatalo H (1983) An inhalation method for testing the toxicity of volatile compounds in small laboratory animals. A study on short-term and long-term toluene inhalation in rats. *Meth Find Exp Clin Pharmacol* 5(10):667-671
- Tardif R, Laparé S, Plaa GL, Brodeur J (1991) Effect of simultaneous exposure to toluene and xylene on their respective biological exposure indices in humans. *Int Arch Occup Environ Health* 63:279-284
- Tardif R, Plaa GL, Brodeur J (1992) Influence of various mixtures of inhaled toluene and xylene on the biological monitoring of exposure to these solvents in rats. *Can J Physiol Pharmacol* 70:385-393
- Taylor JD, Evans HL (1985) Effects of toluene inhalation on behavior and expired carbon dioxide in macaque monkeys. *Toxicol Appl Pharmacol* 80(3):487-495
- Tomaszycki ML, Aulerich KE, Bowen SE (2013) Repeated toluene exposure increases c-Fos in catecholaminergic cells of the nucleus accumbens shell. *Neurotoxicol Teratol* 40:28-34 doi:10.1016/j.ntt.2013.09.001
- Tsigionia A, Lagoudi A, Chandrinou S, Linos A, Evlogias N, Alexopoulos EC (2010) Indoor air in beauty salons and occupational health exposure of cosmetologists to chemical substances. *Int J Environ Res Public Health* 7(1):314-324 doi:10.3390/ijerph7010314
- U.S. EPA (2018) TSCA Chemical Substance Inventory. In. <https://www.epa.gov/tsca-inventory/how-access-tsca-inventory#download> Accessed July 2018
- U.S. Census Bureau (2012) Survey of Business Owners (SBO) - Characteristics of Businesses: 2012 Tables. In. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=SB0_2012_00CSA01&prodType=table Accessed October 2017
- U.S. EPA (2000) Section 131.38 of title 40 of the Code of Federal Regulations. Establishment of numeric criteria for priority toxic pollutants for the State of California. Environmental Protective Agency (EPA).
- U.S. EPA (2003) Toxicological Review of Methyl Ethyl Ketone (CAS No. 78-93-3) In Support of Summary Information on the Integrated Risk Information System (IRIS). U.S. Environmental Protection Agency
- U.S. EPA (2005a) Integrated Risk Information System (IRIS), Chemical Assessment Summary, Toluene; CASRN 108-88-3. U.S. Environmental Protection Agency (U.S. EPA). In. https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0118_summary.pdf Accessed July 2017
- U.S. EPA (2005b) Toxicological Review of Toluene (CAS No. 108-88-3) In Support of Summary Information on the Integrated Risk Information System (IRIS). U. S. Environmental Protection Agency (U.S. EPA)
- U.S. EPA (2007) Protecting the Health of Nail Salon Workers. U.S. Environmental Protection Agency (U.S. EPA)

- U.S. EPA (2011) Exposure Factors Handbook: 2011 Edition. U.S. Environmental Protection Agency (U.S. EPA), Washington, DC
- U.S. EPA (2012) Toluene - Factsheet. U. S. Environmental Protection Agency (U.S. EPA). In. <https://www.epa.gov/sites/production/files/2016-09/documents/toluene.pdf> Accessed January 2018
- U.S. EPA (2018) U.S. EPA ChemView, Chemical Data Reporting. U.S. Environmental Protection Agency (U.S. EPA). In. <https://chemview.epa.gov/chemview> Accessed October 2017
- Uaki H, Kawai T, Mizunuma K, et al. (1995) Dose-dependent suppression of toluene metabolism by isopropyl alcohol and methyl ethyl ketone after experimental exposure of rats. *Toxicol Lett* 81(2-3):229-234
- Ungváry G, Tátrai E (1985) On the embryotoxic effects of benzene and its alkyl derivatives in mice, rats and rabbits. *Arch Toxicol Suppl* 8:425-430
- Ungváry G, Tátrai E, Szeberényi S, Rodics K, Lorincz M, Barcza G (1982) Effect of toluene exposure on the liver under different experimental conditions. *Exp Mol Pathol* 36(3):347-360
- Vieira I, Sonnier M, Cresteil T (1996) Developmental expression of CYP2E1 in the human liver. Hypermethylation control of gene expression during the neonatal period. *Eur J Biochem* 238(2):476-483
- von Euler G, Ogren SO, Li XM, Fuxe K, Gustafsson JA (1993) Persistent effects of subchronic toluene exposure on spatial learning and memory, dopamine-mediated locomotor activity and dopamine D₂ agonist binding in the rat. *Toxicology* 77(3):223-232
- Vural M, Ogel K (2006) Dilated cardiomyopathy associated with toluene abuse. *Cardiology* 105(3):158-161 doi:10.1159/000091344
- Wang RS, Nakajima T, Tsuruta H, Honma T (1996) Effect of exposure to four organic solvents on hepatic cytochrome P450 isozymes in rat. *Chem Biol Interact* 99(1-3):239-252
- Weschler CJ, Nazaroff WW (2014) Dermal uptake of organic vapors commonly found in indoor air. *Environmental science & technology* 48(2):1230-1237 doi:10.1021/es405490a
- White H, Khan K, Lau C, Leung H, Montgomery D, Rohlman DS (2015) Identifying health and safety concerns in Southeast Asian immigrant nail salon workers. *Arch Environ Occup Health* 70(4):196-203 doi:10.1080/19338244.2013.853644
- WHO (2000) Air Quality Guidelines for Europe. Second edition. World Health Organization (WHO) Regional Publications, European Series, No. 91, Denmark
- Wilkins-Haug L, Gabow PA (1991) Toluene abuse during pregnancy: Obstetric complications and perinatal outcomes. *Obstet Gynecol* 77(4):504-509
- Win-Shwe TT, Fujimaki H (2010) Neurotoxicity of toluene. *Toxicol Lett* 198(2):93-99 doi:10.1016/j.toxlet.2010.06.022
- Win-Shwe TT, Kunugita N, Yoshida Y, Nakajima D, Tsukahara S, Fujimaki H (2012) Differential mRNA expression of neuroimmune markers in the hippocampus of infant mice following toluene exposure during brain developmental period. *J Appl Toxicol* 32(2):126-134 doi:10.1002/jat.1643
- Wolf K (2016) Safer Alternative Nail Polish Removers for Salons and Consumers. Prepared for: Paul H. Johanson Fund, Bay Area Air Quality Management District. Institute for Research and Technical Assistance

- Wolf MA, Rowe VK, McCollister DD, Hollingsworth RL, Oyen F (1956) Toxicological studies of certain alkylated benzenes and benzene. Experiments on laboratory animals. *AMA archives of industrial health* 14(4):387-398
- Wood RW, Colotla VA (1990) Biphasic changes in mouse motor activity during exposure to toluene. *Fundam Appl Toxicol* 14(1):6-14
- Wood RW, Rees DC, Laties VG (1983) Behavioral effects of toluene are modulated by stimulus control. *Toxicol Appl Pharmacol* 68(3):462-472
- Wu XM, Bennett DH, Ritz B, Cassady DL, Lee K, Hertz-Picciotto I (2010) Usage pattern of personal care products in California households. *Food Chem Toxicol* 48(11):3109-3119 doi:10.1016/j.fct.2010.08.004
- Yang JH, Han DH (2010) Occupational exposure of nail technicians to airborne chemicals and biological monitoring. *J Korean Soc Occup Environ Hyg* 20(1):53-62
- Zavalic M, Mandic Z, Turk R, Bogadi-Sare A, Plavec D (1998) Quantitative assessment of color vision impairment in workers exposed to toluene. *Am J Ind Med* 33(3):297-304
- Zhou W, Wang PG, Wittenberg JB, Rua D, Krynitsky AJ (2016) Simultaneous determination of cosmetics ingredients in nail products by fast gas chromatography with tandem mass spectrometry. *J Chromatogr A* 1446:134-140 doi:10.1016/j.chroma.2016.04.003

State Water Resources Control Board

September 3, 2019

Clifford P. Weisel, Ph.D.
Professor
Environmental and Occupational Health Sciences Institute
School of Public Health – Rutgers University
170 Frelinghuysen Road
Piscataway, N.J. 08854

SUBJECT: INITIATION OF EXTERNAL PEER REVIEW OF THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL FOR THE PROPOSED ADOPTION OF NAIL PRODUCTS CONTAINING TOLUENE AS A PRIORITY PRODUCT

Dear Professor Weisel,

The purpose of this letter is to initiate the external review.

The Department of Toxic Substances Control (DTSC) will receive reviewers' comments and curriculum vitae from me after the review has concluded, and not be a party to the process.

Documents for review are being provided through a secure FTP site. Sections I and II below give instructions for accessing the FTP site and list the documents on the site.

You can access this site through the one month period of review. The URL, username and password are as follows:

I. <https://ftp.waterboards.ca.gov/WebInterface/login.html>

Username: gbowes-ftp13
Password: 8kQFvn

II. List of Documents at FTP site:

A. **July 29, 2019, Memorandum signed by Karl Palmer, "Request for an External Peer Review for the Proposed Adoption of Nail Products Containing Toluene as a Priority Product."**

Attachment 1: Plain English Summary of the Proposal to Nail Products Containing Toluene as a Priority Product.

E. JOAQUIN ESQUIVEL, CHAIR | EILEEN SOBECK, EXECUTIVE DIRECTOR

Attachment 2: Description of Scientific Assumptions, Findings, and Conclusions for Peer Review.

These are the focus for the review. Earlier, you indicated you would be able to address Conclusion 1 with confidence. Please do so, and preface your comments with that perspective, and address other conclusions with any qualification you wish to make. DTSC also would like reviewers to address the two subjects in the Big Picture section.

Attachment 3: List of participants, Section A: DTSC Participants, and Section B: External Participants.

Attachment 4: Reference Titles.

B. Regulatory References: Product-Chemical Profile for Toluene in Nail Products.

- California Code of Regulations, Title 22, sections 69401-69407.2.
- California Code of Regulations, Title 22, sections 69501-69511.
- California Code of Regulations, Title 22, proposed sections 69511(b) (7)-69511.7.

C. Copies of Literature Relied Upon.

D. October 18, 2018 Supplement to the CalEPA Peer Review Guidelines.

Please send your reviews to me on October 1, 2019 to ensure I receive all on the same day.

Questions about the review should be for clarification, in writing – email is fine, and addressed to me. My responses will be in writing also. All this information will be posted at the DTSC program web site for this proposal. Your acceptance of this review assignment is most appreciated.

Sincerely,



Gerald W. Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board
1001 "I" Street, MS-16B
Sacramento, California 95814

Telephone: (916) 341-5567

Email: Gerald.Bowes@waterboards.ca.gov

State Water Resources Control Board

September 3, 2019

Lupita D. Montoya, Ph.D.
Research Associate
University of Colorado, Boulder
4001 Discovery Drive
607 UCB – S286A
Boulder, CO 80303

SUBJECT: INITIATION OF EXTERNAL PEER REVIEW OF THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL FOR THE PROPOSED ADOPTION OF NAIL PRODUCTS CONTAINING TOLUENE AS A PRIORITY PRODUCT

Dear Dr. Montoya,

The purpose of this letter is to initiate the external review.

The Department of Toxic Substances Control (DTSC) will receive reviewers' comments and curriculum vitae from me after the review has concluded, and not be a party to the process.

Documents for review are being provided through a secure FTP site. Sections I and II below give instructions for accessing the FTP site and list the documents on the site.

You can access this site through the one month period of review. The URL, username and password are as follows:

I. <https://ftp.waterboards.ca.gov/WebInterface/login.html>

Username: gbowes-ftp13
Password: 8kQFvn

II. List of Documents at FTP site:

A. **July 29, 2019, Memorandum signed by Karl Palmer, "Request for an External Peer Review for the Proposed Adoption of Nail Products Containing Toluene as a Priority Product."**

Attachment 1: Plain English Summary of the Proposal to Nail Products Containing Toluene as a Priority Product.

E. JOAQUIN ESQUIVEL, CHAIR | EILEEN SOBECK, EXECUTIVE DIRECTOR

Attachment 2: Description of Scientific Assumptions, Findings, and Conclusions for Peer Review.

These are the focus for the review. Earlier, you indicated you would be able to address Conclusions 2 and 4 with confidence. Please do so, and preface your comments with that perspective, and address other conclusions with any qualification you wish to make. DTSC also would like reviewers to address the two subjects in the Big Picture section.

Attachment 3: List of participants, Section A: DTSC Participants, and Section B: External Participants.

Attachment 4: Reference Titles.

B. Regulatory References: Product-Chemical Profile for Toluene in Nail Products.

- California Code of Regulations, Title 22, sections 69401-69407.2.
- California Code of Regulations, Title 22, sections 69501-69511.
- California Code of Regulations, Title 22, proposed sections 69511(b) (7)-69511.7.

C. Copies of Literature Relied Upon.

D. October 18, 2018 Supplement to the CalEPA Peer Review Guidelines.

Please send your reviews to me on October 1, 2019 to ensure I receive all on the same day.

Questions about the review should be for clarification, in writing – email is fine, and addressed to me. My responses will be in writing also. All this information will be posted at the DTSC program web site for this proposal. Your acceptance of this review assignment is most appreciated.

Sincerely,



Gerald W. Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board
1001 "I" Street, MS-16B
Sacramento, California 95814

Telephone: (916) 341-5567

Email: Gerald.Bowes@waterboards.ca.gov

State Water Resources Control Board

September 3, 2019

Scott E. Bowen, Ph.D.
Professor and Chair
Department of Psychology
Wayne State University
5057 Woodward Avenue, Suite 7906.1
Detroit, MI 48202

SUBJECT: INITIATION OF EXTERNAL PEER REVIEW OF THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL FOR THE PROPOSED ADOPTION OF NAIL PRODUCTS CONTAINING TOLUENE AS A PRIORITY PRODUCT

Dear Professor Bowen,

The purpose of this letter is to initiate the external review.

The Department of Toxic Substances Control (DTSC) will receive reviewers' comments and curriculum vitae from me after the review has concluded, and not be a party to the process.

Documents for review are being provided through a secure FTP site. Sections I and II below give instructions for accessing the FTP site and list the documents on the site.

You can access this site through the one month period of review. The URL, username and password are as follows:

I. <https://ftp.waterboards.ca.gov/WebInterface/login.html>

Username: gbowes-ftp13
Password: 8kQFvn

II. List of Documents at FTP site:

A. **July 29, 2019, Memorandum signed by Karl Palmer, "Request for an External Peer Review for the Proposed Adoption of Nail Products Containing Toluene as a Priority Product."**

Attachment 1: Plain English Summary of the Proposal to Nail Products Containing Toluene as a Priority Product.

E. JOAQUIN ESQUIVEL, CHAIR | EILEEN SOBECK, EXECUTIVE DIRECTOR

Attachment 2: Description of Scientific Assumptions, Findings, and Conclusions for Peer Review.

These are the focus for the review. Earlier, you indicated you would be able to address Conclusions 1 and 3 with confidence. Please do so, and preface your comments with that perspective, and address other conclusions with any qualification you wish to make. DTSC also would like reviewers to address the two subjects in the Big Picture section.

Attachment 3: List of participants, Section A: DTSC Participants, and Section B: External Participants.

Attachment 4: Reference Titles.

B. Regulatory References: Product-Chemical Profile for Toluene in Nail Products.

- California Code of Regulations, Title 22, sections 69401-69407.2.
- California Code of Regulations, Title 22, sections 69501-69511.
- California Code of Regulations, Title 22, proposed sections 69511(b) (7)-69511.7.

C. Copies of Literature Relied Upon.

D. October 18, 2018 Supplement to the CalEPA Peer Review Guidelines.

Please send your reviews to me on October 1, 2019 to ensure I receive all on the same day.

Questions about the review should be for clarification, in writing – email is fine, and addressed to me. My responses will be in writing also. All this information will be posted at the DTSC program web site for this proposal. Your acceptance of this review assignment is most appreciated.

Sincerely,



Gerald W. Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board
1001 "I" Street, MS-16B
Sacramento, California 95814

Telephone: (916) 341-5567

Email: Gerald.Bowes@waterboards.ca.gov

**Supplement to Cal/EPA External Scientific Peer Review Guidelines –
“Exhibit F” in Cal/EPA Interagency Agreement with University of California
Gerald W. Bowes, Ph.D.**

1. **REVISIONS.** If changes are made in the final, signed request for review, and before the review has begun, a revised request must be discussed with, and submitted to the review manager. Normally, this is the CalEPA program manager for scientific peer review. The accepted revision must clearly describe changes, and at the time of review initiation, be sent to the reviewers by the program manager as the basis for the review. The original final request had been sent earlier to candidate reviewers and discussed with them during an interview. Candidates that were eventually approved as reviewers, must clearly understand parts of the request have been changed, and where.

A revised cover letter must a) indicate in red text at the top right corner, “**Revised**” and date of revision; and b) be re-signed by the requesting party.

The cover letter also must describe in red text the nature of the changes and where they occur, e.g. in Attachment 2. “**Revised**” and date of revision must be typed in red text at the top right corner on each page where a change has been made. Revised text also must be highlighted in red, and presented in strikeout/underline format.

2. **DOCUMENTS REQUIRING REVIEW.** All scientific underpinnings of a proposed science-based rule must be submitted for external peer review. The underpinnings include all publications, conference proceedings, reports, model descriptions, and raw data upon which the proposal is based. Data from proprietary models cannot be used to support a proposal.
3. **DOCUMENTS NOT REQUIRING PEER REVIEW.** The Cal/EPA External Peer Review Guidelines note that there are circumstances where external peer review of supporting scientific documents is not required. An example would be "A particular work product that has been peer reviewed with a known record by a recognized expert or expert body." This allowance should be treated with caution. The context of the work product must be taken into account, and considered with respect to relevance to the proposal to be reviewed. The reviewers' independence and objectivity for the prior review must be considered. A safe approach would be to provide such a document to the reviewers, and let them decide if their review is needed, or at least for parts of the work product.
4. **REVIEW OF IMPLEMENTATION STRATEGY.** Publications which have a solid peer review record, such as a US EPA Criteria document, do not always include an implementation strategy. The Cal/EPA Guidelines require that the implementation of the scientific components of a proposal, or other initiative, must be submitted for external review.

5. **CONFIDENTIALITY OF REVIEWER IDENTITIES, AND REVIEWS.** External reviewers must not know the identity of other reviewers. Their identities can only be known to the CalEPA program manager for peer review (who manages the reviews), or other person delegated to managing the review. After the reviews have been completed and submitted by the program manager to the organization which requested the review, the timing of release of the reviews and identities of reviewers and their curriculum vitae, is a decision to be made by the organization, including participating legal staff.
6. **REQUESTS FROM REVIEWERS FOR ADDITIONAL SPECIFIC SUPPORTING DOCUMENTS, OR CLARIFICATION.** This should be provided to the requesting reviewer, and to all other reviewers to ensure all reviewers have the same information.
7. **USE OF PANELS.** Formation of reviewer panels is not appropriate. Panels can take on the appearance of scientific advisory committees and the external reviewers identified through the Cal/EPA process are not to be used as scientific advisors.
8. **USE OF EXTERNAL EXPERTS TO ASSIST IN PREPARATION OF RESPONSES TO EXTERNAL REVIEWERS.** California Health and Safety Code Section 57004 directs external reviewers to critically analyze CalEPA staff-developed assumptions, findings, and conclusions as the basis for proposed science-based rules. These are derived from staff's review and interpretation of relevant scientific literature. They are described in the review request, Attachment 2.

Normally, staff prepares responses to reviewers' comments, which are reviewed by the respective executive offices. On rare occasions, staff may solicit outside expert assistance in preparing these responses. Staff must be careful that rules of confidentiality are followed by assisting experts to protect reviewers' identities and nature of the reviews. Each review sent to such experts must be marked, "Highly Confidential – Not to be Shared". Communications must be directly between the staff person designated as the contact for the assisting experts, and the experts.

Prior to this engagement, the CalEPA organization seeking outside assistance must ensure through a conflict of interest vetting process that the enlisted experts meet certain criteria. First, the experts must have no financial interest in the outcome of the review. Second, they have no working relationships with any private or public sector entity that would benefit by, or be restricted in some way by, the proposed regulation.

If the outside assistance takes the form of experts brought together as a panel (not recommended) with a designated chair, assuring confidentiality becomes more of a challenge. Further, a panel report implies the expert reviews represent a consensus of panel members on the stated conclusions. This would be misleading. The panel expertise is identified as a critical mass which collectively could cover the range of conclusions described as the basis for the proposed rule. It would mirror the critical mass expertise originally identified and approved as reviewers of the proposal itself. The reviewers agree to address one or a few of the conclusions, based on expertise. Similarly, staff is best served by receiving independent and objective comments from individual advising experts on the reviews, based on expertise.

The path taken to solicit such assisting experts, and the path back for this assistance, must be described and approved before such steps are taken. This must include a description of measures designed to protect reviewers' identities and the substance of their reviews.

Guidance to Reviewers:

1. Discussion of review.

Reviewers are not allowed to discuss the proposal with individuals who participated in development of the proposal. These individuals are listed in Attachment 3 of the review request.

Discussions between staff and reviewers are not permitted.

Reviewers may request clarification of certain aspects of the review process or the documents sent to them. The requests and responses must be in writing. These communications will become part of the administrative record.

The organization requesting independent review should be careful that organization-reviewer communications do not become collaboration, or are perceived by others to have become so. The reviewers are not technical advisors. As such, they would be considered participants in the development of the proposal, and would not be considered by the University of California as external reviewers for future revisions of this or related proposals. The statute requiring external review of science-based rules proposed by Cal/EPA organizations prohibits participants serving as peer reviewers.

2. Disclosure of reviewer identity and release of review comments.

Confidentiality begins at the point a potential candidate is contacted by the University of California. Candidates who agree to complete the conflict of interest disclosure form should keep this matter confidential, and should not inform others about their possible role as reviewer.

Reviewer identities must be kept confidential until review comments are received by the organization that requested the review. After the comments are received, reviewer identity and comments must be made available to anyone requesting them, within a reasonable time period specified by legal staff.

Reviewers are under no obligation to disclose their identity to anyone enquiring. It is recommended reviewers keep their role confidential until after their reviews have been made public by requesting CalEPA organization.

3. Requests to reviewers by third parties to discuss comments.

After they have submitted their reviews, reviewers may be approached by third parties representing special interests, the press, or by colleagues. Reviewers are under no obligation to discuss their comments with them, and we recommend that they do not.

All outside parties are provided an opportunity to address a proposed regulatory action during the public comment period and at the Cal/EPA organization meeting where the proposal is considered for adoption. Discussions outside these provided avenues for comment could seriously impede the orderly process for vetting the proposal under consideration.

4. **Reviewer contact information.**

The reviewer's name, professional affiliation, and date should accompany each review. Home address and other personal contact information are considered confidential and should not be part of the comment submittal.