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An Outdoor Health Risk Assessment of Emissions from Nail Salons

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Stationary Source Division

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SUMMARY OF FINDINGS

The chemicals, xylenes, toluene, formaldehyde, and dibutyl phthalate are used to formulate many nail care products such as nail coatings. Our definition of nail coatings includes nail polishes, base coats, top coats, and nail treatment products that form a hard film. The ARB has formally identified xylenes, toluene, formaldehyde, and dibutyl phthalate as Toxic Air Contaminants (TACs). The United States Environmental Protection Agency has designated them as Hazardous Air Pollutants (HAPs). When nail salons use nail coatings containing these chemicals, emissions from the salons have the potential to adversely affect people's health. This report was developed to assess the potential public health impacts from the release of the TACs from nail salons into outdoor air. The report does not evaluate any potential health impacts of the TACs on salon workers.

Specifically, Air Resources Board (ARB) staff conducted a health risk assessment (HRA) on the outdoor emissions from nail salons and their operations. To develop the HRA, staff analyzed the presence of the TACs in nail coatings using data from ARB's 2003 Consumer Products Survey. Emission release scenarios were formulated based on nail salon characteristics and activities observed during nail salon site visits. Air dispersion modeling was used to estimate the outdoor air levels of TACs near salons. The results of the dispersion modeling were then combined with available health effects values to characterize the potential public health risks.

The risks are characterized by deriving hazard indices (HI) for non-cancer health effects and estimating the cancer risks for formaldehyde, the only TAC in this study with potential cancer health effects. The HI is the ratio of the estimated outdoor air concentration to the chronic reference exposure levels (RELs). If the HI is less than one, it indicates that no adverse non-cancer health effects are expected. If the estimated cancer risk is less than one in a million, it is below the benchmark where risk managers would consider action to protect public health.

The results for a multi-salon scenario, which is considered the worst case, highest emitting scenario in the HRA, are presented in Table i-1 below.

Table i-1: Summary of Hazard Indices and Cancer Risk Estimate for Multi-Salon Scenario

Chemical	Estimated Outdoor Air Concentration in microgram per cubic meter (ug/m3)	Hazard Index: Non-cancer	Estimated Risk: Cancer
Xylenes	0.0045	6 x10-6	NA
Toluene	2.2	7 x10-3	NA
Formaldehyde	0.003	3.3 x10-4	1.8 x 10-8
Dibutyl Phthalate	0.25	0.5	NA

As shown in Table i-1, the HIs for toluene, formaldehyde, xylenes, and dibutyl phthalate are less than one. The estimated cancer risk for formaldehyde is about 2 orders of magnitude below one in a million. Based on the results of this HRA, the emissions into outdoor air from the use of nail coatings, containing toluene, formaldehyde, xylenes, and dibutyl phthalate, in nail salons are not expected to have adverse health impacts to the public breathing the emissions outside of nail salons.

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

I. INTRODUCTION

The California Air Resources Board (ARB or Board) conducted a health risk assessment (HRA) to evaluate the health impacts associated with toxic air contaminants (TACs) emitted from the use of nail coatings in nail salons in California. Our definition of nail coatings includes nail polishes, base coats, top coats, and nail treatment products that form a hard film**.** This HRA focuses on nail coatings emissions into outdoor air which would have the potential to impact public health. It does not determine the potential health impacts on nail salon workers from occupational exposures to the TACs.

A. WHY IS ARB CONCERNED ABOUT THE EMISSIONS FROM NAIL SALONS?

Nail salons are located in urban and suburban areas and often in close proximity to residences, offices, retail businesses, or food establishments. Chemicals used in nail coatings are emitted from the nail salons and have the potential to affect outdoor air quality. This potential impact has raised concerns that people living and working near nail salons may be adversely affected by breathing outdoor air contaminated with TACs emitted from nail salons. To address the concerns raised, we initiated a process to assess the potential outdoor air exposures that may impact the health of people near nail salons.

B. WHAT ARE HEALTH RISK ASSESSMENTS (HRAs)?

Health risk assessments use available scientific data and mathematical models to evaluate the health impacts from exposure to certain chemicals or TACs released from a facility or found in outdoor air. HRAs provide information and estimates of potential long term cancer and non-cancer health risks. HRAs do not gather information or health data on specific individuals, but estimate the potential health impacts on a population at large.

An HRA consists of four major components: evaluating the types of health effects, determining the dose-response relationships, estimating the environmental levels and exposures, and estimating the health risks. HRAs prepared by ARB focus on evaluating population exposures and estimating population risks. The evaluation of the types of health effects, and dose-response relationships are performed by the Office of Environmental Health Hazard Assessment (OEHHA).

Major components of ARB health risk assessments include: determining facility emissions, estimating environmental levels using dispersion models, and estimating population risks. The air pollution emission inventory provides an understanding of how the air toxics are generated and emitted. The air dispersion modeling uses information from the emission inventory and meteorological data such as temperature, wind speed, and wind direction as inputs to predict the distribution of air toxics in the air with computer models. In the absence of facility specific emissions inventory data, other measures such as facility characteristics and business operations are combined with assumptions to estimate the emissions as inputs for the dispersion modeling. Based on the estimated levels of the pollutants in the air, and the health effects values provided by OEHHA, an assessment of the potential health risks of the air toxics to an exposed population is performed. The results are expressed in a number of ways, as summarized below.

- For potential cancer health effects, the risk is usually expressed as the number of chances in a population of a million people. The number may be stated as “10 in a million” or “10 chances per million”. The methodology used to estimate the potential cancer risks for this HRA is consistent with the Tier-1 analysis of Air Toxics Hot Spots Program Risk Assessment Guidelines (OEHHA, 2003). A Tier-1 analysis assumes that an individual is exposed to an annual average concentration of a given pollutant continuously for 70 years.

- The potential cancer risk from a given carcinogen estimated from the health risk assessment is expressed as the incremental number of potential cancer cases that could be developed per million people, assuming the population is exposed to the carcinogen at a constant annual average concentration over a presumed 70-year lifetime. For example, if the cancer risk was estimated to be 100 chances per million, the probability of an individual developing cancer would not be expected to exceed 100 chances in a million. If a population (e.g., one million people) were exposed to the same potential cancer risk (e.g., 100 chances per million), then statistics would predict that no more than 100 of those million people exposed would be likely to develop cancer from a lifetime of exposure (i.e., 70 years) due to a carcinogenic TAC emitted from a facility.

- For non-cancer health effects, a reference exposure level (REL) is used to predict if there would be certain identified adverse health effects, such as lung irritation, liver damage, or birth defects. These adverse health effects may happen after chronic (long-term) or acute (short-term) exposure. To calculate a non-cancer health risk number, the concentration that a person is exposed to is divided by the REL to provide a “hazard index” (HI). Typically, the greater the HI is above 1.0, the greater the potential for possible adverse health effects. If the HI is less than 1.0, then it is an indicator that adverse non-cancer health effects are less likely to happen.

A health risk assessment is a complex process that is based on current knowledge. It uses assumptions to bridge gaps in knowledge and mathematical modeling to estimate dose-response relationships, environmental levels of TACs and the associated risks to health. There are uncertainties associated with each step in the process of a HRA. The uncertainty arises from lack of data in many areas necessitating the use of assumptions. The assumptions used in the assessments are often designed to be conservative on the side of health protection in order to avoid underestimation of risk to the public. As indicated by the OEHHA Guidelines, the Tier-1 evaluation is useful in comparing risks among a number of facilities and similar sources. Thus, the risk estimates should not be interpreted as a literal prediction of disease incidence in the affected communities but more as a tool for comparison of the relative risk between one facility and another. In addition, the HRA results are best used to compare potential risks to target levels to determine the level of mitigation needed. They are also effective tools for determining the impacts of specific control strategies on reducing risks.

C. HOW IS THIS REPORT STRUCTURED?

The next chapter (Chapter II) provides a summary of the nail salon characteristics, emissions, air dispersion modeling, and health risk assessment results. Following the summary, the third chapter presents the nail salon TAC emissions. After that, the fourth chapter explains how the air dispersion modeling was conducted, and the fifth chapter provides the health risk assessment for nail salon emissions. The appendices present the technical supporting documents for the analyses discussed in the main body of the report.

II. SUMMARY

Below is a summary of the nail salon emissions, air dispersion modeling, and health risk assessment results.

A. GENERAL DESCRIPTION OF NAIL SALONS

Nail salons are located in urban and suburban areas and often in close proximity to residences, offices, retail businesses, or food establishments. The average floor area of a large salon is about 3,200 square feet, and the average ceiling height is 12 feet. A medium salon is about 1,100 square feet, and the typical facility ceiling height is 12 feet. Small salons are typically less than 1000 square feet, with varying ceiling heights. Large salons are more likely to be located in shopping malls with active facility ventilation. Medium and small salons rely on natural ventilation (i.e., opened doors, opened windows, and roof vents for ventilation).

With the exception of some large salons, many are co-located, with people living next to or directly above the salons. A large number of the medium sized salons are located in strip malls next to other businesses. In contrast, many small salons are next to or within 20 to 50 feet of private residences. Some salons are within 1,000 feet of schools, day care facilities, hospitals, and senior communities. Details on nail salon characteristics, general nail salon business operating information, and receptor distance are discussed in Appendix C1.

B. WHAT ARE THE NAIL COATING EMISSIONS FROM NAIL SALONS?

The emissions of concern are the four TACs, xylenes, toluene, dibutyl phthalate, and formaldehyde used in formulating the nail coatings. Our definition of nail coatings includes nail polishes, base coats, top coats, and nail treatment products that form a hard film.

A large size nail salon is estimated to use five ounces (141.7 grams) of nail polish per day and a medium size nail salon is estimated to use two ounces (56.7 grams) of nail polish per day. The emissions for multiple salons (ten medium sized) are assumed to be ten times that of an individual medium sized salon.

The emissions of the TACs from the nail salons are summarized in Table II-1.

Table II-1: Summary of Nail Coating Emissions from Nail Salons

Chemical	Estimated Amount Released (grams/day)		
	Large Salon	**Medium Salon**	**Multiple Salons**
Toluene	**36**	**14.7**	**147**
Dibutyl phthalate	**4.25**	**1.7**	**17**
Formaldehyde	**0.03**	**0.02**	**0.2**
Xylenes	**0.08**	**0.03**	**0.3**

*Estimated by multiplying the number of bottles of nail coatings used per salon per day by the maximum likely weight percent of the ingredient and the weight content per bottle.

C. HOW ARE THE EXPOSURES TO THE EMISSIONS OF THE TOXIC AIR CONTAMINANTS DETERMINED?

We developed scenarios for individual, as well as multiple nail salons, to estimate the potential emissions of these compounds that can occur. We then used accepted United States Environmental Protection Agency (U.S. EPA) air dispersion modeling methods (U.S. EPA, 1995) to determine how the salon emissions are dispersed into outdoor air and the resulting concentrations of the pollutants at various distances from the salons. The goal of the analyses was to determine the potential health risk of people living in close proximity to these salons as emission sources. The study does not determine the indoor exposures of nail salon workers or nail salon customers to these pollutants. See Appendix D: ARB Authority to Regulate Indoor Air and Consumer Products, which summarizes the Air Resources Board's authority to regulate indoor air and its authority to regulate consumer products.

D. WHAT ARE THE POTENTIAL CANCER RISKS OF EMISSIONS FROM NAIL SALONS?

Risks for cancer are estimated by multiplying the chemical specific unit risk factors by their estimated outdoor air concentrations. For this assessment, the only TAC with cancer effects is formaldehyde. The estimated potential cancer risks for residents 20 meters (~66 feet) downwind, breathing air contaminated with the maximum levels of formaldehyde for 70 years, emitted from the multiple salon exposure scenario (ten nail salons stacked as a single emission source), is two additional cases in 100 million people exposed (See Tables II-2 and V-5). This is a worst case scenario and the risk is well under one excess case of cancer per million people.

Risk managers and decision-makers use different risk levels as benchmarks for safety. Proposition 65 uses 10 in a million risk as a notification level that a chemical may cause cancer. Many air pollution control districts also use 10 in a million as a risk level at which facilities are required to notify people around them of exposure from the emissions from their facility. The ARB has issued risk management guidelines that suggest local air districts may permit facilities with risk between 10 to 100 in a million, if best available control technology is in place.

E. WHAT ARE THE ESTIMATED NON-CANCER RISKS OF EMISSIONS FROM NAIL SALONS?

The risks for non-cancer effects are estimated by deriving HIs. The HI is the ratio of the estimated outdoor air concentration to the chronic reference exposure levels (RELs). If the HI is less than one, it indicates that no adverse non-cancer health effects are expected.

As shown in Table II-2, the HIs for toluene, formaldehyde, xylenes, and dibutyl phthalate are lower than one (See also Tables V-3, V-4, and V-5). As discussed above, the results in Table II-2 are for the multi-salon scenario which is the worst case, highest emitting scenario in the HRA.

Table II-2: Summary of Hazard Indices and Cancer Risk Estimate for Multi-Salon Scenario

Chemical	Estimated Outdoor Air Concentration microgram per cubic meter (ug/m^3)	Hazard Index: Non-cancer	Estimated Risk: Cancer
Xylenes	0.0045	6×10^{-6}	NA
Toluene	2.2	7×10^{-3}	NA
Formaldehyde	0.003	3.3×10^{-4}	1.8×10^{-8}
Dibutyl Phthalate	0.25	0.5	NA

F. WHAT ARE THE LIMITATIONS AND UNCERTAINTIES OF THE ASSESSMENT RESULTS?

Limitations of this assessment include but not limited to:

a. the salon survey data used are qualitative in nature;

b. no direct measurements of facility dimensions or receptor distances were made;
c. the dimensions of nail salons and receptor distances used in this report were estimated by site visit observations;
d. the use or purchase records of nail coatings by salon owners were not obtained; and
e. the potential releases of chemicals from the use of nail polishes were estimated.

III. NAIL SALON TOXIC AIR CONTAMINANT EMISSIONS

In this chapter we present our estimation of emissions of the four TACs from the use of nail coatings in salons. Monitoring of outdoor air concentrations of the TACs near nail salons was not conducted. Therefore, emissions are estimated using surrogate information, such as the amount of nail coatings used per day and the weight percent of the TAC in the nail coating described below.

A. AMOUNT OF TACS IN NAIL COATINGS

The amounts of TACs in nail coatings were determined from data reported for nail coatings in our 2003 Consumer Products Survey.

Sixty-nine companies responded to our 2003 Survey providing information on 845 liquid nail coatings with California sales of 0.86 tons/day.

- Four hundred and seventy two of the 845 products reported the use of dibutyl phthalate in concentrations ranging from 0.5 to 9 percent by weight with the majority containing about 6 percent. The estimated annual amount of dibutyl phthalate used in nail coatings sold in California is 12,196 pounds.

- Twenty products listed formaldehyde as an ingredient that ranged in concentration from 0.2 to 1.8 percent with the exception of a nail hardener which contained 10 percent. The estimated annual amount of formaldehyde used in nail coatings sold in California is 64 pounds.

- Sixty-nine products reported the use of toluene. The concentration ranged from 5 to 45 percent. The majority (51) of them have concentrations of 25 percent by weight or below. The estimated annual amount of toluene used in nail coatings sold in California is 22,307 pounds.

- Five products reported the use of xylenes and the concentration ranged from 0.8 to 26 percent. The estimated annual amount of xylenes used in nail coatings sold in California is 27 pounds.

B. AMOUNT OF NAIL COATINGS USED IN SALONS

Data for the amount of nail coatings used were collected during salon site visits and facility surveys as summarized below.

On average, salons are estimated to use one bottle of nail polish for about ten customers. The numbers of clients seen on a busy day ranged from about 100 for a large to 40 for a medium salon.

Based on the above information and assuming 100 clients per day for a large salon, 40 clients a day for a medium, and usage of a standard 0.5 ounce bottle of nail coating for every 10 clients, we estimated the amount of nail coatings used per day to be ten bottles for a large salon and four bottles for a medium salon.

C. ESTIMATES OF EMISSIONS OF TACS FROM NAIL SALONS

The emission estimates are based on:

- the number of bottles of nail coatings used per day,
- the most likely maximum weight percent of the chemicals used in the formulation of nail coatings, and
- the assumption that all of the xylenes, toluene, and formaldehyde and 50 percent of the dibutyl phthalate in the formulation are released into the outdoor air.

Details of this analysis and assumptions used are found in Appendix B: Nail Salon Modeling Scenarios, Emission Parameters, Estimated Emissions, and Assumptions.

We began the estimate of emissions by reviewing our 2003 Consumer Products Survey on nail coatings sold in California in 2003. Information obtained from the survey includes State-wide sales, and the weight percent of ingredients used in nail coatings formulations. For the 2003 survey, nail coatings as a category includes nail polishes, top coats, base coats/undercoats, and nail treatment products that form a hard film. It does not include nail glues or adhesives, products for cuticle care and removal, nail soaks, nail creams and lotions, products designed exclusively for the creation of artificial nails/nail enhancements such as acrylic, gel, wrap and sculptured nails, and antifungal treatment (ARB, 2004).

Our next step was to use the gathered information about nail salon characteristics and business operations to estimate the emission rate of xylenes, toluene, formaldehyde, and dibutyl phthalate from salons. We used the nail salon survey information and our 2003 consumer products survey data on nail coatings formulations to estimate the amount of the chemicals of concern that can be released into outdoor air. When data are absent, we used conservative assumptions to bridge the information gaps.

A large size nail salon is estimated to use five ounces (141.7 grams) of nail polish per day and a medium size salon is estimated to use two ounces (56.7 grams) of nail polish per day. The emissions from multiple salons (ten medium sized) are assumed to be ten times that of an individual medium sized salon. Table III-1 summarizes nail coating emissions for each of the three scenarios.

Table III-1: Summary of Nail Coating Emissions from Nail Salons

Chemical	Estimated Amount Released (grams/day)		
	Large Salon	Medium Salon	Multiple Salons
Toluene	36	14.7	147
Dibutyl phthalate	4.25	1.7	17
Formaldehyde	0.03	0.02	0.2
Xylenes	0.08	0.03	0.3

*Estimated by multiplying the number of bottles of nail coatings used per salon per day by the maximum likely weight percent of the ingredient and the weight content per bottle.

IV. AIR DISPERSION MODELING

In this chapter ARB staff describes the selection of the air dispersion model, emission source characteristics, emission parameters, meteorological data used, and the estimated outdoor air concentrations.

A. AIR DISPERSION MODEL SELECTION

Air dispersion models are often used to simulate atmospheric processes for applications where the spatial scale is in the tens of meters to tens of kilometers. Selection of air dispersion models depends on many factors, such as characteristics of emission sources (point, area, volume, or line), the type of terrain (flat or complex) at the emission source locations, and source-receptor relationships. For the nail salon health risk assessment, the dispersion model used for estimating exposures analysis is SCREEN3. SCREEN 3 is a regulatory screening analysis model with the same dispersion formulation as the Industrial Source Complex Short Term (ISCST3) air dispersion model (U.S. EPA, 1995). SCREEN3 uses worst case meteorological data for plume centerline calculations for one source at a time. AERSCREEN, which is U.S. EPA's replacement for SCREEN3 is not yet available. As such, SCREEN3 is an applicable regulatory model for screening assessments.

We selected the U.S. EPA's SCREEN3 air dispersion model because we are using a tiered approach for this assessment. If the SCREEN3 analysis for the Tier-1 dispersion modeling gave results that would signal concerns for public health, then a more refined analysis using other U.S. EPA approved models would be employed.

B. SOURCE CHARACTERIZATION AND PARAMETERS

Three generic nail salon scenarios were used for the air dispersion modeling. These generic scenarios were created from information obtained from site visits, surveys of nail salon operations, and ingredients reports from our 2003 consumer products survey of nail coatings. The generic release scenarios address the physical dimensions and emission release parameters used in the HRA. The generic release scenarios are presented in Appendix B: Nail Salon Modeling Scenarios, Emission Parameters, Estimated Emissions, and Assumptions.

Risk assessment results are based on unit emission rates and can be adjusted to reflect any emission rate scenario. Therefore, emissions of the TACs from nail salons for the risk assessment were based on unit emission rates, (number of bottles of nail coatings used per day), multiplied by the weight percent of the toxic ingredient in grams per day for daily emissions and in grams per hour for hourly emissions.

These emissions were based solely on estimates from site visits and the summary of nail salon operations. Data gaps in parameters for modeling the emission estimates were bridged using information from the assessment of dry cleaning operations in California (ARB, 2006).

C. METEOROLOGICAL DATA

The meteorological data used is Screening Meteorological Data (Worst Case Meteorological Data). It is a matrix of 54 different combinations of wind speed and stability class designed to evaluate a full range of possible 1-hour average meteorological conditions. As an example, unstable conditions (i.e., stability class A) are defined for winds speeds up to 3 meters per second (m/s) only. It is inappropriate to evaluate stability class A with wind speeds greater than 3 m/s. Table G.1 of Appendix A: Air Dispersion Modeling of Nail Salon Emissions, shows the matrix used in the SCREEN3 air dispersion model. This matrix may also be used in other air dispersion models (e.g., ISCST3) for screening purposes.

Screening meteorological data are useful to estimate the maximum 1-hour average concentration possible from emissions evaluated with an air dispersion model. The screening level maximum annual average concentration may be estimated by multiplying the maximum 1-hour average concentration by 0.08 ± 0.02 (EPA 1992, Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised, EPA-454/R-92-019).

D. ESTIMATED OUTDOOR AIR CONCENTRATIONS NEAR NAIL SALONS

The downwind outdoor air concentrations of xylenes, toluene, formaldehyde, and dibutyl phthalate released from nail salons were estimated using the U.S. EPA SCREEN3 air dispersion model under worst case meteorological conditions. See Appendix A: Air Dispersion Modeling of Nail Salon Emissions. The emissions from the salons were estimated from information gathered about salon operations and weight percent of ingredients of interest in nail coatings. See Appendices B: Nail Salon Modeling Scenarios, Emission Parameters, Estimated Emission, and Assumptions, and Appendix C: Data on Nail Salon Characteristics from Salon Site Visits for more details. Table IV-1 lists the key parameters for the SCREEN3 air dispersion modeling.

Table IV-1: Key Parameters for SCREEN3 Air Dispersion Modeling

Air Dispersion Model	U.S. EPA SCREEN3
Source Type	Point and Volume
Dispersion Setting	Urban
Stack Height	1.5 feet above building
Receptor Distance	20 to 500 meters
Meteorological Data	Screening Meteorological Data. A matrix of 54 different combinations of wind speed and stability class designed to evaluate a full range of possible 1-hour average meteorological conditions.

The air modeling results and emissions estimates are more likely to overestimate rather than underestimate ground level air concentrations. The use of representative meteorological data and actual salon releases could change the results. For an individual nail salon as the emission source, two scenarios were modeled: large salon (3,200 square feet) with a point and a volume source, and medium salon (1,100 square feet) with only a volume source. Table IV-2 shows results for the large salon, and Table IV-3 shows results for the medium salon.

For the large salon scenario, shown in Table IV-2, 60 percent of the emissions were assumed to be released from the stack 1.5 feet above the building, and 40 percent of the emissions were assumed to be released from vents (doors and windows). The results show that the maximum annual average concentrations for a receptor 20 meters from the source, is 0.40 microgram per cubic meter (ug/m^3) for toluene, 0.047 ug/m^3 for dibutyl phthalate, 0.00033 ug/m^3 for formaldehyde, and 0.00088 ug/m^3 for xylenes.

Table IV-2: Estimated Maximum Annual Average Concentration for a Person 20 Meters from a Large Size Salon

Chemical	Large Size Salon	
	Emissions (grams per day)	Maximum Annual Average Concentration at 20 Meters (ug/m^3)
Toluene	36	0.40
Dibutyl phthalate	4.25	0.047
Formaldehyde	0.03	0.00033
Xylenes	0.08	0.00088

For the medium salon scenario, shown in Table IV-3, 100 percent of emissions were assumed to be released from vents. The results show that the maximum annual average concentrations for a receptor 20 meters from the source, is 0.22 ug/m^3 for toluene, 0.025 ug/m^3 for dibutyl phthalate, 0.0003 ug/m^3 for formaldehyde, and 0.00045 ug/m^3 for xylenes.

Table IV-3: Estimated Maximum Annual Average Concentration for a Person 20 Meters from a Medium Size Salon

Chemical	Medium Size Salon	
	Emissions (grams per day)	Maximum Annual Average Concentration at 20 Meters (ug/m^3)
Toluene	14.7	0.22
Dibutyl phthalate	1.7	0.025
Formaldehyde	0.02	0.0003
Xylenes	0.03	0.00045

For a multi-salon scenario, such as the cluster of ten medium size salons along Grand Avenue in Oakland, California as an emission source, we assumed that the total emissions is the sum of emissions from ten individual salons (i.e., 147 grams of toluene/day, 17 grams of dibutyl phthalate/day, 0.2 gram of formaldehyde/day, and 0.3 gram of xylenes/day). The estimated 20 meter downwind maximum annual average concentrations are 2.2 ug/m^3 for toluene, 0.25 ug/m^3 for dibutyl phthalate, 0.003 ug/m^3 for formaldehyde, and 0.0045 ug/m^3 for xylenes.

V. HEALTH RISK ASSESSMENT

This chapter discusses how to characterize potential cancer and non-cancer risks associated with exposure to TACs, especially, xylenes, toluene, dibutyl phthalate, and formaldehyde. In addition, the HRA results are presented and the associated uncertainties are discussed.

An HRA is an evaluation that a risk assessor (e.g., ARB, an air quality district, a consultant, or a facility operator) develops to describe the potential a person or population may have of developing adverse health effects from exposure to a facility's emissions (OEHHA, 2003). Health effects that are evaluated could include cancer, developmental and reproductive effects, respiratory illness, neurological, and immunological effects. The pathways of exposure to the chemicals of concern can include inhaling air, contact with skin, drinking liquids or eating food.

For this HRA, we are evaluating the health impacts of xylenes, toluene, dibutyl phthalate, and formaldehyde from inhaling outdoor air affected by emissions from nail salons. We are not evaluating health impacts from indoor exposure to the chemicals. Three of the compounds are clearly volatile and inhalation is the predominant pathway for exposure. Multiple exposure pathway (multipathway) assessments are traditionally used for semivolatile compounds such as dibutyl phthalate when a significant fraction of the airborne chemical exists in the particulate phase. Since we are using a tiered approach, we conducted a conservative screening analysis where we assumed that dibutyl phthalate is 50 percent volatile (Jones, D, 2009). If this worst case scenario resulted in an unacceptable outdoor exposure concentration, then more refined air dispersion modeling would be performed using more realistic assumptions and parameters to determine the outdoor concentrations.

Generally, to develop an HRA, the risk assessor would perform or consider information developed under the following four steps: hazard identification, dose-response assessment, exposure assessment, and risk characterization.

For this assessment, we focused our efforts on the estimation of outdoor air concentrations of chemicals emitted from the use of nail coatings in salons detailed in Chapter III, Nail Salon Toxic Air Contaminant Emissions and Chapter IV, Air Dispersion Modeling. The hazard identification and the dose-response assessment have already been completed by OEHHA.

To characterize the risks, we will derive hazard indices (HIs) for non-cancer health effects. The HIs are derived by dividing the estimated concentrations of the chemicals in outdoor air by the existing health effects values. If the HI is less than one, it indicates that no adverse non-cancer health effects are expected and more refined air dispersion modeling is not warranted.

Cancer risk estimates are derived by multiplying the chemical specific unit risk factors by their estimated outdoor air concentrations. Risk managers and decision-makers use different risk levels as benchmarks for safety.

Proposition 65 uses 10 in a million risk as a notification level that a chemical may cause cancer. Many air pollution control districts also use 10 in a million as a risk level at which facilities are required to notify people around them of exposure from the emissions from their facility. The ARB has issued risk management guidelines that suggest local air districts may permit facilities with risk between 10 to 100 in a million, if best available control technology is in place. Some regulatory agencies view one in a million risk as an acceptable risk level. Some regulatory agencies have established higher risk levels for certain activities, due to cost or technological reasons. For this assessment, formaldehyde is the only chemical that has been designated as a carcinogen.

A. HEALTH RISK ASSESSMENT GUIDELINES

For this HRA, ARB staff is estimating the potential health impacts of the four TACs emitted from the use of nail coatings in nail salons. This risk assessment is based on the methodology in OEHHA's, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments (OEHHA, 2003). In conjunction with the OEHHA guidelines, staff also consulted the ARB's Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (ARB, 2003).

B. COMPONENTS OF THE HEALTH RISK ASSESSMENT

The following section describes the components/steps in the HRA process for evaluating the health risks from exposures to emissions from nail salons.

1. Hazard Identification

In the first step, the risk assessor would determine if a hazard exists, and if so, would identify the pollutant(s) of concern and the type of effect, such as cancer, and non-cancer effects. Non-cancer effects include those affecting respiration, neurology, development, or reproduction. This component of the HRA has been developed by OEHHA.

Toluene, formaldehyde, xylenes, and dibutyl phthalate have been formally identified as TACs under the California Toxic Air Contaminant Program (Assembly Bill 1807: HSC sections 39660-39662). Dibutyl phthalate is also listed as a Proposition 65 known reproductive toxicant (The Safe Drinking Water and Toxic Enforcement Act of 1986, California Health and Safety Code Section 25249.5 et seq., and OEHHA, 2009b). All four chemicals are included in the U.S. EPA's original list of hazardous air pollutants (U.S. EPA, 2009). The types of toxic effects and the dose-response information for these chemicals are presented in Table V-1.

2. Dose-Response Assessment

In this component of the risk assessment, the assessor would characterize the relationship between a person's exposure to a pollutant and the incidence or occurrence of an adverse health effect. This step of the HRA has already been completed by OEHHA. OEHHA provides the dose-response relationships in the form of unit risk factors (URF) and cancer potency factors (CPF) for carcinogenic effects (OEHHA, 2009a) and reference exposure levels (REL) for non-cancer effects (OEHHA, 2000a). The currently available URF and RELs from OEHHA are used for this HRA. There is no currently available inhalation REL for dibutyl phthalate. In consultation with OEHHA staff, we estimated an inhalation REL for dibutyl phthalate using the OEHHA 2007 adult oral Proposition 65 maximum allowable dose level (MADL) of 8.7 ug/day for reproductive effects and assuming 100 percent absorption by the inhalation route of exposure to be 0.44 ug/m^3 using the formula: REL= oral MADL in ug/day divided by 20 m^3/day.

The CPFs and RELs that are used for these compounds in California are presented in Table V-1 below. Only data for the chronic inhalation route of exposure are presented because inhalation is the route of exposure of concern in this assessment.

Table V-1: Health Effects, Reference Exposure Levels, and Cancer Potency Factors

Chemical	Health Effects	Chronic Inhalation REL in ug/m^3	Cancer Potency Factor in $(mg/kg\text{-}day)^{-1}$
Xylenes	Nervous and respiratory system	700	NA
Toluene	Nervous and respiratory system, Development	300	NA
Formaldehyde*	Respiratory system; Eye; Cancer	9	$2.1x10^{-2}$
Dibutyl Phthalate	Reproductive system	**Not available (Estimated to be $0.44\ ug/m^3$)	NA

*The Cancer Inhalation Unit Risk Factor (URF) is $6x10^{-6}\ (ug/m^3)^{-1}$.

**Using the OEHHA 2007 adult oral MADL of 8.7 ug/day for reproductive effects and assuming 100 percent absorption by the inhalation route of exposure, an inhalation REL is estimated to be about $0.44\ ug/m^3$ using the formula: REL= oral MADL in ug/day divided by $20\ m^3$/day.

Dose-response or pollutant specific health values are developed to characterize the relationship between a person's exposure to a pollutant and the incidence or occurrence of an adverse health effect. A CPF or URF is used when estimating potential cancer risks and a REL is used to assess potential non-cancer health impacts.

As discussed, exposure to the toxic ingredients may result in cancer (formaldehyde) and non-cancer (formaldehyde, xylenes, dibutyl phthalate and, toluene) health effects. The inhalation URF and CPF (OEHHA, 2009a) and non-cancer chronic RELs (OEHHA, 2000a) that are used for this HRA are listed in Table V-1. Table V-2 includes the estimated downwind concentrations.

Table V-2: Health Effects, Reference Exposure Levels, and SCREEN3 Estimated Concentrations for Xylenes, Toluene, Formaldehyde and Dibutyl Phthalate

Chemical	Health Effects	Chronic Inhalation REL in ug/m^3	SCREEN3 Estimated Concentrations in ug/m^3
Xylenes	Nervous and respiratory system	700	Large: 0.00088 Medium: 0.00045 Multiple: 0.0045
Toluene	Nervous and respiratory system, Development	300	Large: 0.4 Medium: 0.22 Multiple: 2.2
Formaldehyde	Respiratory system, Eye Cancer	9 CPF is 2.1×10^{-2} (mg/kg-day)$^{-1}$ *	Large: 0.00033 Medium: 0.0003 Multiple: 0.003
Dibutyl Phthalate	Reproductive	**Not available (Estimated to be 0.44ug/m^3)	Large: 0.047 Medium: 0.025 Multiple: 0.25

*The Cancer Inhalation Unit Risk Factor (URF) is 6×10^{-6} (ug/ m^3)$^{-1}$.

**Using the OEHHA 2007 adult oral MADL of 8.7 ug/day for reproductive effects and assuming 100% absorption by the inhalation route of exposure, an inhalation REL is estimated to be ~0.44 ug/m^3 using the formula: REL= oral MADL in ug/day divided by 20 m^3/day.

The Health effects values were obtained from:
a) The OEHHA Air Toxics “Hot Spots” Program Risk Assessment Guidelines, Part II, Technical Support Document for Describing Available Cancer Potency Factors, 2009a, (OEHHA, 2009a);

b) The Air Toxics Hot Spots Program Risk Assessment Guidelines; Part III; Technical Support Document for the Determination of Non-cancer Chronic Reference Exposure Levels, 2000a, (OEHHA, 2000a);

c) The Air Toxics Hot Spots Risk Assessment Guidelines; Part IV; Exposure Assessment and Stochastic Analysis Technical Support Document, September 2000, (OEHHA, 2000b); and

d) The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. (August 2003, OEHHA).

The inhalation URF is defined as the estimated upper-confidence limit (usually 95th percentile) probability of a person contracting cancer as a result of constant exposure to a concentration of 1.0 microgram per cubic meter (μg/m^3) over a 70-year lifetime. Formaldehyde, the TAC with cancer effects, has a URF of 6×10^{-6} (μg/m3)$^{-1}$.

RELs are defined as a concentration level at or below which no adverse health effects are anticipated. RELs are designed to be protective of sensitive individuals in the population by including uncertainty factors in their development and are available for infrequent acute 1-hour exposures, 8-hour repeated exposures, and chronic exposures. Chronic RELs are protective for 24 hour a day exposures for at least a significant fraction of a lifetime.

3. Exposure Assessment

In the exposure assessment step of a risk assessment, the risk assessor estimates the extent of the public's exposure, by looking at who is likely to be exposed, how exposure will occur (e.g., inhalation and ingestion), and the magnitude of exposure (OEHHA, 2000b).

For nail salon operations, the people that are likely to be exposed to nail salon emissions via outdoor air include residents and off-site workers located near the salons. Exposures to nail salon customers and on-site workers are not included in this HRA because we do not have the authority, with the exception of indoor air cleaners, to limit toxic pollutants in the indoor environment.

Exposure to the TACs in nail coatings at residential and off-site work locations was evaluated via the inhalation exposure pathway. Emission estimates and release parameters for the generic release scenarios were designed from site visit data. Computer air dispersion modeling was used to provide downwind ground-level concentrations of the compounds at near-source locations using the estimated emissions. In addition, the modeling was supplemented by using parameters from previous work on dry cleaning facilities, which have similar physical characteristics to nail salons (ARB, 2006). Cumulative emissions from multiple salons were modeled to estimate the downwind ground-level concentrations of the compounds at near source locations. The physical description of the source and emission release parameters is detailed in Chapter III, Nail Salon Toxic Air Contaminant Emissions, and in Appendix B: Nail Salon Modeling Scenarios, Emission Parameters, Estimated Emission, and Assumptions. Summaries of the estimated outdoor air concentrations 20 meters downwind from the salons can be found in Chapter IV, Air Dispersion Modeling. The details of the air dispersion modeling, including meteorological data used, can be found in Appendix A: Air Dispersion Modeling of Nail Salon Emissions. The estimated outdoor levels are presented in Table V-2 above.

It should be noted that the outdoor air levels do not fully represent the extent of possible exposures. Exposure is the amount of pollution that someone actually breathes or ingests. Exposure varies and depends on the combination of many physiological (e.g., metabolism and genetic polymorphism) and environmental factors. The depth of exposure analysis is dependent on the decision needs and the nature and quality of the data. For this assessment, we used outdoor air concentrations 20 meters downwind from the emission source as a measure of exposure.

4. Risk Characterization

This is the final step of risk assessment. For this step of the HRA, the risk assessor integrates information from the previous steps to quantify the potential cancer risk and non-cancer health impacts. Modeled concentrations, which are determined through exposure assessment, are combined with the URFs (for estimating cancer risk), and chronic RELs (for estimating non-cancer effects) determined under the dose-response assessment.

For this HRA we characterized the risks, by deriving HIs from the modeled outdoor air levels and the chronic RELs for non-cancer effects. The HI is the ratio of the estimated outdoor air concentration to the chronic reference exposure levels. Risks for cancer are estimated by multiplying the chemical specific unit risk factors with the modeled outdoor air levels (See Tables V-3, V-4, and V-5).

The results of the estimated cancer risk and HIs for non-cancer risks for emissions from large salons are summarized in Table V-3. The results for medium size salons are summarized in Table V-4. Finally, the results for multiple salons, a worst case scenario, are summarized in Table V-5.

As can be seen from Tables V-3, V-4, and V-5, the HIs for toluene, formaldehyde, xylenes, and dibutyl phthalate are lower than one and the estimated cancer risks are well below one additional cancer case per million people exposed.

As an illustration, we will discuss the derived HIs and estimated cancer risk for the multiple salon assessment (Table V-5). The HIs for toluene, formaldehyde, and xylenes are two, three, and five orders of magnitude below one respectively. Even for dibutyl phthalate, where we assumed 50 percent is released into outdoor air from the use of nail coatings in salons, the HI is 0.5. The HI for dibutyl phthalates will be much lower than 0.5 using more realistic assumptions for this multiple salon worst case scenario. The estimated cancer risk from exposure to the estimated ten salon cumulative level of 0.003 ug/m^3 of formaldehyde is 1.8 x 10^{-8}, or two additional cases of cancer from 100 million people exposed. This cancer risk is about two orders of magnitude below one excess cancer case per million people exposed.

The HRA results indicate that the emissions from the use of nail coatings in salons are not expected to cause either cancer or non-cancer adverse health effects at the highest estimated concentrations 20 meters from the salons. A more detailed modeling analysis is not warranted because the refined analysis would estimate exposure levels lower than those from SCREEN 3 air modeling.

Table V-3: Reference Exposure Levels, Cancer Unit Risk Factors, Estimated Outdoor Air Concentrations, Hazard Indices, and Cancer Risk Estimates* for Large Salons

Chemical	REL ug/m^3	URF $(ug/m^3)^{-1}$	Estimated Outdoor Air Concentration in ug/m^3	Hazard Index: Non-cancer	Estimated Risk: Cancer
Xylenes	700	NA	0.00088	1.3 $x10^{-6}$	NA
Toluene	300	NA	0.4	1.3 $x10^{-3}$	NA
Formaldehyde	9	6 $x10^{-6}$	0.00033	$3.7x10^{-5}$	2 x 10^{-9}
Dibutyl Phthalate**	0.44	NA	0.047	0.10	NA

*Hazard Index (HI) is the ratio of the ambient air concentration (the SCREEN3 estimated outdoor air concentrations here) to the Reference Exposure Level (REL). Estimated cancer risk is the product of the unit risk factor at 1 ug/m^3 and the SCREEN3 estimated outdoor air concentrations 20 meters downwind from the salons.

**Dibutyl phthalate is semi volatile with a vapor pressure of 0.01 mm Hg at 20^0 C. Here we assumed that it is 50 percent volatile and the whole content is released into outdoor air. Also, the inhalation REL for dibutyl phthalate is not available. Using the OEHHA 2007 adult oral MADL of 8.7 ug/day for reproductive effects and assuming 100 percent absorption by the inhalation route of exposure, an inhalation REL is estimated to be ~0.44 ug/m^3 using the formula: REL= oral MADL in ug/day divided by 20m^3/day.

Table V-4: Reference Exposure Levels, Cancer Unit Risk Factors, Estimated Outdoor Air Concentrations, Hazard Indices, and Cancer Risk Estimates* for Medium Salons

Chemical	REL ug/m^3	URF $(ug/m^3)^{-1}$	Estimated Outdoor Air Concentration in ug/m^3	Hazard Index: Non-cancer	Estimated Risk: Cancer
Xylenes	700	NA	0.00045	6 $x10^{-7}$	NA
Toluene	300	NA	0.22	7 $x10^{-4}$	NA
Formaldehyde	9	6 $x10^{-6}$	0.00030	3 $x10^{-5}$	1.8 x 10^{-9}
Dibutyl Phthalate**	0.44	NA	0.025	0.05	NA

*Hazard Index (HI) is the ratio of the ambient air concentration (the SCREEN3 estimated outdoor air concentrations here) to the Reference Exposure Level (REL). Estimated Cancer Risk is the product of the unit risk factor at 1 ug/m^3 and the SCREEN3 estimated outdoor air concentrations 20 meters downwind from the salons.

**Dibutyl phthalate is semi volatile with a vapor pressure of 0.01 mm Hg at 20^0 C. Here we assumed that it is 50 percent volatile and the whole content is released into outdoor air. Also, the inhalation REL for dibutyl phthalate is not available. Using the OEHHA 2007 adult oral MADL of 8.7 ug/day for reproductive effects and assuming 100 percent absorption by the inhalation route of exposure, an inhalation REL is estimated to be ~0.44 ug/m^3 using the formula: REL= oral MADL in ug/day divided by 20m^3/day.

Table V-5: Reference Exposure Levels, Cancer Unit Risk Factors, Estimated Outdoor Air Concentrations, Hazard Indices, and Cancer Risk Estimates* for Multi-Salons

Chemical	REL ug/m^3	URF (ug/m^3)$^{-1}$	Estimated Outdoor Air Concentration in ug/m^3	Hazard Index: Non-cancer	Estimated Risk: Cancer
Xylenes	700	NA	0.0045	6 x10^{-6}	NA
Toluene	300	NA	2.2	7 x10^{-3}	NA
Formaldehyde	9	6 x10^{-6}	0.003	3.3 x10^{-4}	1.8 x 10^{-8}
Dibutyl Phthalate**	0.44	NA	0.25	0.5	NA

*Hazard Index (HI) is the ratio of the ambient air concentration (the SCREEN3 estimated outdoor air concentrations here) to the Reference Exposure Level (REL). Estimated Cancer Risk is the product of the unit risk factor at 1 ug/m^3 and the SCREEN3 estimated outdoor air concentrations 20 meters downwind from the salons.

**Dibutyl phthalate is semi volatile with a vapor pressure of 0.01 mm Hg at 20^0 C. Here we assumed that it is 50 percent volatile and the whole content is released into outdoor air. Also, the inhalation REL for dibutyl phthalate is not available. Using the OEHHA 2007 adult oral MADL of 8.7 ug/day for reproductive effects and assuming 100 percent absorption by the inhalation route of exposure, an inhalation REL is estimated to be ~0.44 ug/m^3 using the formula: REL= oral MADL in ug/day divided by 20m^3/day.

C. UNCERTAINTIES AND LIMITATIONS

Risk assessment is a complex procedure which requires the integration of many variables and assumptions. The estimated outdoor air concentrations of the TACs and the associated health risk estimates are based on assumptions designed to be health protective. This is to ensure that the potential risks to populations or an individual are not underestimated.

The uncertainty associated with the assessments of the health effects and dose-response of the TACs can be found in the OEHHA reports for theses TACs (OEHHA, 2007, OEHHA, 2009b, OEHHA, 2009c). As described previously, this health risk assessment focused on three steps: (1) estimation of the emissions in Chapter III, (2) air dispersion modeling in Chapter IV, and (3) risk estimation in Chapter V. Results from each of these steps have a certain degree of uncertainty associated with their estimations and predictions due to the assumptions made. Therefore, there are uncertainties and limitations with the overall risk estimates.

Limitations of this HRA are that the salon survey data used are qualitative in nature; no direct measurements of facility dimensions or receptor distances were made; the dimensions of nail salons and receptor distances used in this report were estimated by site visit observations; the use or purchase records of nail coatings by salon owners were not obtained; and we assessed only the potential emissions of TACs from the use of nail coatings.

We conclude that for this HRA, a worst case screening analysis, the results show that the emissions into outdoor air from the use of nail coatings, containing toluene, formaldehyde, xylenes, and dibutyl phthalate, in nail salons are not expected to have adverse public health impacts. The estimated emissions and environmental levels are largely assumption based. Since we used worst case assumptions and worst case scenarios for the air dispersion modeling, the risks presented in this report are likely to over estimate the potential public health impacts from outdoor exposures to emissions from nail salons.

VI. REFERENCES

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APPENDICES

APPENDIX A

AIR DISPERSION MODELING OF NAIL SALON EMISSIONS

APPENDIX A: AIR DISPERSION MODELING OF NAIL SALON EMISSIONS

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Date: October 15, 2009

Summary/Results

The emissions from bottles of nail products from nail salons are evaluated to estimate the downwind air concentration. The pollutants evaluated were toluene, DBP, formaldehyde, and xylenes. The emissions are input into the US-EPA SCREEN3 air dispersion model to determine the worst-case above ambient levels. Because we used the SCREEN3 air dispersion model, the results are biased towards overprediction. There were two scenarios modeled: Large Salon (3,200 square feet) with a point and volume source and Medium Salon (1,100 square feet) as a volume source. Table 1 shows results for the Large Salon, and Table 2 shows results for the Medium Salon.

For the Large Salon scenario, Table 1, 60% of emissions were released from the stack 1.5 feet above the building, and 40% released from vents (doors and windows). The results show that the maximum concentration at the nearest receptor, 20 meters from the source, is 0.40 ug/m3 for toluene.

For the Medium Salon scenario, Table 2, 100% of emissions were released from vents. The results show that the maximum concentration at the receptor, 20 meters from the source, is 0.22 ug/m3 for toluene.

Table 1 – Large Salon Maximum Impacts

Large Salon		Toluene	DBP	Formaldehyde	Xylenes
Emissions	Grams/Day	36	4.25	0.03	0.08
Max Annual Average concentration at 20 meters	(ug/m3)	0.40	0.047	0.00033	0.00088

Table 2 – Medium Salon Maximum Impacts

Medium Salon		Toluene	DBP	Formaldehyde	Xylenes
Emissions	Grams/Day	14.7	1.7	0.02	0.03
Max Annual Average concentration at 20 meters	(ug/m3)	0.22	0.025	0.00030	0.00045

Details/Analysis

A detailed description of the analysis is as follows:

Information on the source (available in Appendix 1) provided by staff of the Stationary Source Division (SSD) was used to establish the source receptor relationship in the US-EPA SCREEN3 air dispersion model. An example of the SCREEN3 output file for Large Salon is attached in Appendix 2. The analysis includes building downwash dimensions based on data provided by the SSD.

Tables 3, 4, and 5 below show detailed screening results based upon the information obtained from SSD staff for each source. Tables 6 and 7 show the source parameters input into the SCREEN3 model. Additional parameters needed by the model and not provided by SSD staff, in Tables 6 and 7, are derived from the Health Risk Assessment Method for Dry Cleaning Operations April 7, 2006, which are similar to nail salons in that both are typically found in strip malls. The emission rate is assumed to be constant (24 hours per day, 365 days per year) for screening purposes. The US-EPA screening factor of 0.08 is applied to the screening maximum 1-hr concentration to estimate the screening level annual average concentration.

Table 3 – Large Salon, Point Source, Intermediate Results

Large Salon (point source Dry Cleaning fig D)		60% of 1hr max			
Staff Report: ISOR released April 7, 2006		Toluene (ug/m3)	DBP (ug/m3)	Formaldehyde (ug/m3)	Xylenes (ug/m3)
Annual Chi/q	0.08 x 1hr max	620.64	620.64	620.64	620.64
Ann Avg(pollutant)	Chi/q x g/s(poll)	0.25881	0.03054	0.0002154	0.0005747

Table 4 – Large Salon, Volume Source, Intermediate Results

Large Salon (volume source Dry Cleaning fig D)		40% of 1hr max			
Staff Report: ISOR released April 7, 2006		Toluene (ug/m3)	DBP (ug/m3)	Formaldehyde (ug/m3)	Xylenes (ug/m3)
Annual Chi/q	0.08 x 1hr max	330.56	330.56	330.56	330.56
Ann Avg(pollutant)	Chi/q x g/s(poll)	0.13784	0.01626	0.00011470	0.00030610

Table 5 – Medium Salon, Intermediate Results

Medium Salon (volume souce Dry Cleaning fig F)		100% of 1hr max			
Staff Report: ISOR released April 7, 2006		Toluene (ug/m3)	DBP (ug/m3)	Formaldehyde (ug/m3)	Xylenes (ug/m3)
Annual Chi/q	0.08 x 1hr max	1282.4	1282.4	1282.4	1282.4
Ann Avg(pollutant)	Chi/q x g/s(poll)	0.21801	0.02526	0.000297517	0.000444993

Table 6a – Source Parameters, Large Salon, Stack Source

Large Salon		
60% point source	Grams/Day	Grams/Second
Toluene	36	0.000417
DBP	4.25	0.0000492
Formaldehyde	0.03	0.000000347
Xylenes	0.08	0.000000926
Source Type	Point	
Stack Height	5.94	Meters
Stack Diameter	0.3	Meters
Stack Exit Velocity	1	Meter/second
Stack Exit Temp	293	Kelvin
Ambient Air Temp	293	Kelvin
Receptor Height	2	Meters
Urban/Rural	Urban	
Terrain	Simple	
Building Height	5.49	Meters
Min Horz Bldg Dim	15	Meters
Max Horz Bldg Dim	15	Meters

Table 6b – Source Parameters, Large Salon, Volume Source

Large Salon		
40% volume source	Grams/Day	Grams/Second
Toluene	36	0.000417
DBP	4.25	0.0000492
Formaldehyde	0.03	0.000000347
Xylenes	0.08	0.000000926
Source Type	Volume	
Source Height	2.74	Meters
Init. Lateral Dimension	3.49	Meters
Init. Vertical Dimension	2.55	Meters
Receptor Height	2	Meters
Urban/Rural	Urban	
Terrain	Simple	

Table 7 – Source Parameters, Medium Salon, Volume Source

Medium Salon		
100% volume source	Grams/Day	Grams/Second
Toluene	14.7	0.00017
DBP	1.7	0.0000197
Formaldehyde	0.02	0.000000232
Xylenes	0.03	0.000000347
Source Type	Volume	
Source Height	2	Meters
Init. Lateral Dimension	2.33	Meters
Init. Vertical Dimension	1.70	Meters
Receptor Height	2	Meters
Urban/Rural	Urban	
Terrain	Simple	

Model Results

Tables 8 and 9 show the estimated downwind concentration for the pollutants at distances between 20 meters to 500 meters for the large and medium salons, respectively. Figures 1 and 2 show the concentration as a function of distance from the source for an emission rate of 1 gram/sec for the large and medium salons, respectively.

Table 8 – Large Salon, Model Results

Nail Salon Large 60% + 40%	
DIST (M)	CONC (UG/M**3)
20	1.189E+04
25	1.012E+04
50	5.593E+03
75	3.550E+03
100	2.433E+03
125	1.769E+03
150	1.345E+03
175	1.059E+03
200	8.577E+02
250	5.992E+02
300	4.455E+02
350	3.465E+02
400	2.787E+02
450	2.301E+02
500	1.941E+02

Large Salon 60% + 40%			
Toluene (ug/m3)	DBP (ug/m3)	Formaldehyde (ug/m3)	Xylenes (ug/m3)
3.97E-01	4.680E-02	3.301E-04	8.808E-04
3.38E-01	3.984E-02	2.810E-04	7.499E-04
1.87E-01	2.202E-02	1.553E-04	4.143E-04
1.18E-01	1.398E-02	9.855E-05	2.630E-04
8.12E-02	9.580E-03	6.755E-05	1.803E-04
5.90E-02	6.965E-03	4.911E-05	1.310E-04
4.49E-02	5.295E-03	3.734E-05	9.965E-05
3.53E-02	4.168E-03	2.940E-05	7.845E-05
2.86E-02	3.376E-03	2.381E-05	6.354E-05
2.00E-02	2.359E-03	1.663E-05	4.439E-05
1.49E-02	1.754E-03	1.237E-05	3.300E-05
1.16E-02	1.364E-03	9.618E-06	2.567E-05
9.30E-03	1.097E-03	7.736E-06	2.064E-05
7.68E-03	9.060E-04	6.389E-06	1.705E-05
6.48E-03	7.640E-04	5.388E-06	1.438E-05

Figure 1 – Large Salon

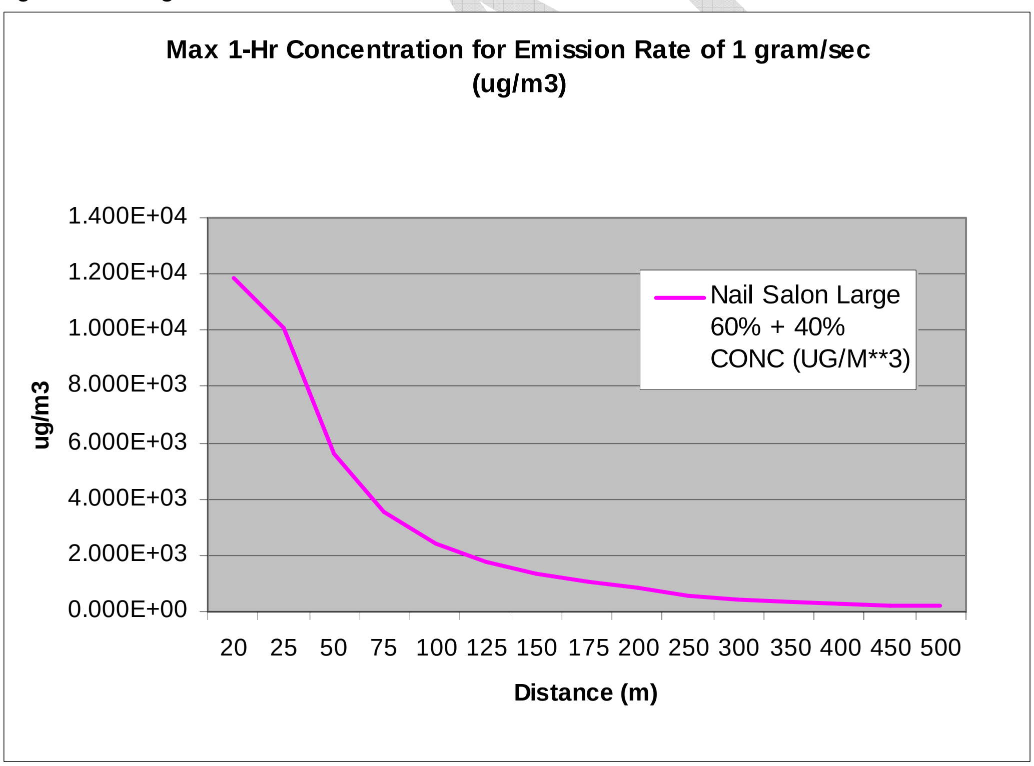
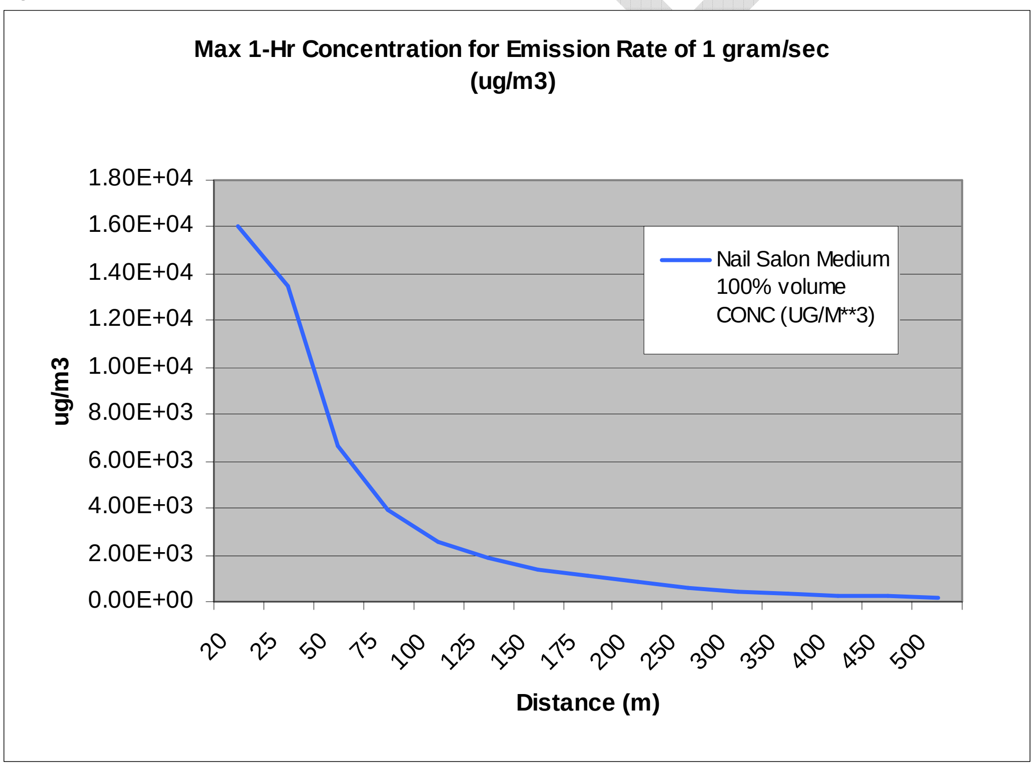


Table 9 – Medium Salon, Model Results

Nail Salon Medium 100%	
DIST (M)	CONC (UG/M**3)
20	1.60E+04
25	13490
50	6670
75	3940
100	2601
125	1851
150	1390
175	1085
200	873.6
250	606.0
300	448.8
350	348.2
400	279.7
450	230.7
500	194.5

Medium Salon 100%			
Toluene (ug/m3)	DBP (ug/m3)	Formaldehyde (ug/m3)	Xylenes (ug/m3)
2.18E-01	2.527E-02	2.975E-04	4.450E-04
1.83E-01	2.126E-02	2.504E-04	3.745E-04
9.07E-02	1.051E-02	1.238E-04	1.852E-04
5.36E-02	6.210E-03	7.313E-05	1.094E-04
3.54E-02	4.099E-03	4.827E-05	7.220E-05
2.52E-02	2.917E-03	3.435E-05	5.138E-05
1.89E-02	2.191E-03	2.580E-05	3.859E-05
1.48E-02	1.710E-03	2.014E-05	3.012E-05
1.19E-02	1.377E-03	1.621E-05	2.425E-05
8.24E-03	9.550E-04	1.125E-05	1.682E-05
6.10E-03	7.075E-04	8.330E-06	1.246E-05
4.74E-03	5.490E-04	6.463E-06	9.666E-06
3.80E-03	4.408E-04	5.191E-06	7.764E-06
3.14E-03	3.636E-04	4.282E-06	6.404E-06
2.65E-03	3.066E-04	3.610E-06	5.399E-06

Figure 2 – Medium Salon



Screening Meteorological Data aka Worst-Case Meteorological Data: A matrix of 54 different combinations of wind speed and stability class designed to evaluate a full range of possible 1-hour average meteorological conditions. As an example, unstable conditions (i.e., stability class A) are defined for winds speeds up to 3 m/s only. It is inappropriate to evaluate stability class A with wind speeds greater than 3 m/s. Table G.1 shows the matrix used in the SCREEN3 air dispersion model. This matrix may also be used in other air dispersion models (e.g., ISCST3) for screening purposes.

Screening meteorological data are useful to estimate the maximum 1-hour average concentration possible from emissions evaluated with an air dispersion model. The screening level maximum annual average concentration may be estimated by multiplying the maximum 1-hour average concentration by 0.08 $\pm$ 0.02 (EPA 1992, Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised, EPA-454/R-92-019).

Table G.1 Wind Speed and Stability Class Combinations Used by the SCREEN3 Model

Stability Class	10-m Wind Speed (m/s)												
A	1	1.5	2	2.5	3	-	-	-	-	-	-	-	-
B	1	1.5	2	2.5	3	3.5	4	4.5	5	-	-	-	-
C	1	1.5	2	2.5	3	3.5	4	4.5	5	8	10	-	-
D	1	1.5	2	2.5	3	3.5	4	4.5	5	8	10	15	20
E	1	1.5	2	2.5	3	3.5	4	4.5	5	-	-	-	-
F (rural only)	1	1.5	2	2.5	3	3.5	4	-	-	-	-	-	-

Source: SCREEN3 Model User's Guide, September 1995, US-EPA, EPA-454/B-95-004

Appendix 1: Nail Salon Emission Release Characteristics and Nail Salon Emissions Modeling Scenarios

1. Large Salon Modeling Scenario

Size:
Nail Salon: 3,200 Square feet
Shopping Mall: 20,600 square feet with ten business establishments and no adjacent residences.

Business hours:

M-F:	9:30 a.m. to 7 p.m.
Saturday:	9 a.m. to 6 p.m.
Sunday:	10 a.m. to 5 p.m.
Busiest:	4:30 to 7 p.m.

Ventilation: 4,500 cfm exhaust in middle vented 3 feet off roof
Door closed most of the time

Amount of nail polish used: 5 oz/day

Estimated emissions (releases):

Toluene	36 grams/day
Dibutyl Phthalate (DBP)	4.25 grams/day
Formaldehyde	1.3 gram/day*
Xylenes	14.2 grams/day**

*This estimate is highly unlikely. Only 3 percent of products sold in California have this ingredient. Using the 3 percent figure the estimated release will be about 0.03 gram/day.

**This estimate is highly unlikely. The total sale of nail care products in California with this ingredient was reported to be only 27 pounds/year. So using the 0.6 percent of products with this ingredient the estimated release would be 0.08 gram/day.

2. Medium Salon Modeling Scenario

Size:
Nail Salon: 1,100 Square feet

Business hours:

M-F:	9:30 a.m., or 10 a.m. to 7 p.m.
Saturday:	9 a.m. to 6 p.m.
Sunday:	10 a.m. to 5 p.m.
Busiest:	4:30 to 7 p.m.

Ventilation: Opening doors and windows some with reversible window fan on top of doors and some with roof vents 6 feet off the roof. Door opens most of the time

Amount of nail polish used: 2 oz/day

Estimated Emissions (Releases):

Toluene	14.7 grams/day
Dibutyl Phthalate (DBP)	2.7 grams/day
Formaldehyde	0.1 gram/day*
Xylenes	5.7 grams/day**

*This estimate is highly unlikely. Only 3 percent of products sold in California have this ingredient. Using the 3 percent figure the estimated release will be about 0.02 gram/day.

**This estimate is highly unlikely. The total sale of nail care products in California with this ingredient was reported to be only 27 pounds/year. So using the 0.6 percent of products with this ingredient the estimated release would be 0.03 gram/day.

Appendix 2: Sample SCREEN3 Model Output

03/18/09
16:46:19

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

Nail Salon Large 60% point source

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      1.00000
   STACK HEIGHT (M)       =       5.9400
   STK INSIDE DIAM (M)    =        .3000
   STK EXIT VELOCITY (M/S)=       1.0000
   STK GAS EXIT TEMP (K)  =     293.0000
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       2.0000
   URBAN/RURAL OPTION     =        URBAN
   BUILDING HEIGHT (M)    =       5.4900
   MIN HORIZ BLDG DIM (M) =      15.0000
   MAX HORIZ BLDG DIM (M) =      15.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =     .000 M**4/S**3;  MOM. FLUX =     .023 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES
***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
20.	.1293E+05	6	1.0	1.0	10000.0	5.94	2.19	3.64	SS
100.	2597.	5	1.0	1.0	10000.0	5.94	10.79	9.02	SS
200.	898.7	5	1.0	1.0	10000.0	5.94	21.17	15.42	SS
300.	461.3	5	1.0	1.0	10000.0	5.94	31.18	21.19	SS
400.	286.4	5	1.0	1.0	10000.0	5.94	40.85	26.45	SS
500.	198.5	5	1.0	1.0	10000.0	5.94	50.21	31.30	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND   20. M:

20.	.1293E+05	6	1.0	1.0	10000.0	5.94	2.19	3.64	SS

```
 DWASH=   MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB


*********************************
*** SCREEN DISCRETE DISTANCES ***
*********************************
```

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
20.	.1293E+05	6	1.0	1.0	10000.0	5.94	2.19	3.64	SS
25.	.1087E+05	6	1.0	1.0	10000.0	5.94	2.74	3.94	SS
50.	5980.	6	1.0	1.0	10000.0	5.94	5.45	5.43	SS
75.	3802.	5	1.0	1.0	10000.0	5.94	8.13	7.30	SS
100.	2597.	5	1.0	1.0	10000.0	5.94	10.79	9.02	SS
125.	1879.	5	1.0	1.0	10000.0	5.94	13.42	10.69	SS
150.	1422.	5	1.0	1.0	10000.0	5.94	16.03	12.31	SS
175.	1114.	5	1.0	1.0	10000.0	5.94	18.61	13.89	SS
200.	898.7	5	1.0	1.0	10000.0	5.94	21.17	15.42	SS
250.	623.7	5	1.0	1.0	10000.0	5.94	26.22	18.38	SS
300.	461.3	5	1.0	1.0	10000.0	5.94	31.18	21.19	SS
350.	357.3	5	1.0	1.0	10000.0	5.94	36.06	23.88	SS
400.	286.4	5	1.0	1.0	10000.0	5.94	40.85	26.45	SS
450.	235.9	5	1.0	1.0	10000.0	5.94	45.57	28.92	SS
500.	198.5	5	1.0	1.0	10000.0	5.94	50.21	31.30	SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** REGULATORY (Default) ***
PERFORMING CAVITY CALCULATIONS
WITH ORIGINAL SCREEN CAVITY MODEL
(BRODE, 1988)
****

*** CAVITY CALCULATION - 1 ***		*** CAVITY CALCULATION - 2 ***	
CONC (UG/M**3) =	8096.	CONC (UG/M**3) =	8096.
CRIT WS @10M (M/S) =	1.78	CRIT WS @10M (M/S) =	1.78
CRIT WS @ HS (M/S) =	1.78	CRIT WS @ HS (M/S) =	1.78
DILUTION WS (M/S) =	1.00	DILUTION WS (M/S) =	1.00
CAVITY HT (M) =	5.74	CAVITY HT (M) =	5.74
CAVITY LENGTH (M) =	15.60	CAVITY LENGTH (M) =	15.60
ALONGWIND DIM (M) =	15.00	ALONGWIND DIM (M) =	15.00

****
END OF CAVITY CALCULATIONS
****

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)	
SIMPLE TERRAIN	.1293E+05	20.	0.	
BLDG. CAVITY-1	8096.	16.	--	(DIST = CAVITY LENGTH)

```
BLDG. CAVITY-2      8096.          16.       --  (DIST = CAVITY LENGTH)


***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************
```

APPENDIX B

NAIL SALON MODELING SCENARIOS, EMISSION PARAMETERS, ESTIMATED EMISSION, AND ASSUMPTIONS

APPENDIX B: NAIL SALON MODELING SCENARIOS, EMISSION PARAMETERS, ESTIMATED EMISSION, AND ASSUMPTIONS

1. Large Salon Modeling Scenario

Size:
Nail Salon: 3,200 Square feet
Shopping Mall: 20,600 square feet with ten business establishments and no adjacent residences.

Business hours:

M-F:	9:30 a.m. to 7 p.m.
Saturday:	9 a.m. to 6 p.m.
Sunday:	10 a.m. to 5 p.m.
Busiest:	4:30 to 7 p.m.

Ventilation: 4,500 cfm exhaust in middle vented 3 feet off roof
Door closed most of the time

Amount of nail polish used: 5 oz/day

Estimated emissions (releases):

Toluene	36 grams/day
Dibutyl Phthalate	4.25 grams/day
Formaldehyde	1.3 gram/day*
Xylenes	14.2 grams/day**

*This estimate is highly unlikely. Only 3 percent of products sold in California have this ingredient. Using the 3 percent figure the estimated release will be about 0.03 gram/day.

**This estimate is highly unlikely. The total sale of nail care products in California with this ingredient was reported to be only 27 pounds/year. So using the 0.6 percent of products with this ingredient the estimated release would be 0.08 gram/day.

2. Medium Salon Modeling Scenario

Size:
Nail Salon: 1,100 Square feet

Business hours:

M-F:	9:30 a.m., or 10 a.m. to 7 p.m.
Saturday:	9 a.m. to 6 p.m.
Sunday:	10 a.m. to 5 p.m.

Busiest: 4:30 to 7 p.m.

Ventilation: Opening doors and windows some with reversible window fan on top of doors and some with roof vents 6 feet off the roof. Door opens most of the time

Amount of nail polish used: 2 oz/day

Estimated Emissions (Releases):

Toluene	14.7 grams/day
Dibutyl Phthalate	2.7 grams/day
Formaldehyde	0.1 gram/day*
Xylenes	5.7 grams/day**

*This estimate is highly unlikely. Only 3 percent of products sold in California have this ingredient. Using the 3 percent figure the estimated release will be about 0.02 gram/day.

**This estimate is highly unlikely. The total sale of nail care products in California with this ingredient was reported to be only 27 pounds/year. So using the 0.6 percent of products with this ingredient the estimated release would be 0.03 gram/day.

1. **Multiple Medium Salon Modeling Scenario (Emissions/releases from a cluster of ten salons were assumed to be the sum of releases of ten medium salons stacked on top of one another as a single unit source).**

Size:

Nail Salon:	Ten 1,100 Square feet nail salons
Street Blocks:	2,000 feet in length with ten nail salons and other businesses

Business hours:

M-F:	9:30 a.m., or 10 a.m. to 7 p.m.
Saturday:	9 a.m. to 6 p.m.
Sunday:	10 a.m. to 5 p.m.
Busiest:	4:30 to 7 p.m.

Ventilation: Opening doors and windows some with reversible window fan on top of doors and some with roof vents 6 feet off the roof. Door opens most of the time

Amount of nail polish used: 20 oz/day/ten salons

Estimated Emissions (releases):

Toluene	147 grams/day/ten salons
Dibutyl Phthalate	27 grams/day/ten salons
Formaldehyde	1 gram/day/ten salons*
Xylenes	57 grams/day/ten salons**

*This estimate is highly unlikely. Only 3 percent of products sold in California have this ingredient. Using the 3 percent figure the estimated release will be around 0.2 gram/day.

**This estimate is highly unlikely. The total sale of nail coating products in California with this ingredient was reported to be only 27 pounds/year. So using the 0.6 percent of products (five of 845) with this ingredient the estimated release would be 0.3 gram/day.

4. Assumptions

a. Number of Clients:

100 clients/day for large salons
40 clients/day for medium salons

b. Number of Clients/bottle of nail polish:

Ten clients/0.5 oz bottle of nail polish

c. Ingredients Weight Percent in Nail Polish:

Toluene	26 percent
Dibutyl Phthalate	six percent
Formaldehyde	one percent
Xylenes	ten percent

d. Other assumptions:

100 percent of the weight percent of xylenes, toluene, and formaldehyde as volatile nail polish ingredients are released into outdoor air.

Dibutyl phthalate is assumed to be 50 percent volatile, hence 50 percent of its weight percent in nail polishes are released into outdoor air.

e. Formula for Estimating Emissions/Releases into Outdoor Air:

bottles used/salon/day X maximum likely weight percent of ingredient X weight content/bottle

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APPENDIX C

DATA ON NAIL SALON CHARACTERISTICS FROM SALON SITE VISITS

APPENDIX C: DATA ON NAIL SALON CHARACTERISTICS FROM SALON SITE VISITS

This appendix includes: Appendix C1: Nail Salon Characteristics Appendix C2: Data from Julia Liou of Asian Health Services for Grand Avenue Cluster of Salons , and Appendix C3: Salon Information Gathering Form.

One of the tools used to estimate human exposures for evaluating potential health impacts of emissions from nail salons is air dispersion modeling. Information needed for dispersion modeling includes physical dimensions of the nail salons, as well as emission estimates and pollutant release parameters. Surveying nail salons is a means to collect the needed information.

Because of language barriers and apprehension of nail salon owners, we worked with the Asian Health Services (AHS) and their Nail Salon Collaborative Partners, to conduct limited on-site visits of nail salons. At the beginning of the process, California Air Resources Board (ARB) staff developed a form (Appendix C3) as a guide to gather the needed information. We first visited the clusters of salons on Piedmont and Grand Avenues in Oakland, California.

Subsequently, AHS and associated organizations accompanied us on specific individual nail salon visits, in Oakland, San Francisco, and Orange County. Salons were selected to gain knowledge about the spectrum of physical characteristics and operations of nail salons. Information collected included salon dimensions, ventilation types, business operations including the amount of nail coatings used, and receptor distances. The data obtained are used to derive pollutant release parameters, and to estimate nail salon emissions Detailed in Appendix B.

The average floor area of a large salon is about 3,200 square feet, and the average ceiling height is 12 feet. A medium salon is about 1,100 square feet, and the typical facility ceiling height is 12 feet. Large salons are more likely to be located in shopping malls with active facility ventilation. Medium and small salons rely on natural ventilation (i.e., opened doors, opened windows, and roof vents for ventilation).

With the exception of some large salons, many are co-located, with people living next to or directly above the salons. A large number of the medium sized salons are located in strip malls next to other businesses. In contrast, many small salons are next to or within 20 to 50 feet of private residences. Some salons are within 1,000 feet of schools, day care facilities, hospitals, and senior communities. Details on nail salon characteristics, general nail salon business operating information, and receptor distance are discussed in Appendix C1

Appendix C1: Nail Salon Characteristics.

a. Ventilation

Ventilation information is needed for emission release parameters in air dispersion modeling. Ventilation is the supply and circulation of air in a building. Ventilation can be provided by natural or mechanical means. Natural ventilation is simply the supply of outside air by opening windows and doors. Mechanical ventilation requires the installation of fans, ducts and other equipment to draw air in and out of the building.

During our site visits and in our collaborators' facility surveys, the nail salon owners were asked about the use of open doors, open windows, window fans, powered ceiling fans, non-powered ceiling fans, and/or a local ventilation system (ventilated tables) in their facilities.

Natural Ventilation

Many salons do not have mechanical ventilation systems. This means that solvent vapors emitted from products used inside the nail salons, such as toluene, are removed through doors, windows, roof vents, and other openings into outdoor air by the natural movements of air. We found that large salons are more likely to be located in shopping malls with mechanical ventilation. Medium and small salons rely on natural ventilation.

Window Fans

Window fans were sometimes found in medium size nail salons.

Local Ventilation (not observed)

"Local ventilation" describes a ventilation system housed within a nail table which has an exhaust fan that pulls vapors away from the workers and customers. This system is frequently called "ventilated nail tables" and is designed to capture vapors from nail care products. Emissions are exhausted through a stack on the roof of the facility. We did not find ventilated tables in the salons we visited.

b. Business Information

Nail salons in California are mostly small businesses employing less than five employees. Nail salons are usually independently owned and are often operated by the owner and family members. Equating 40 hours worked by several part time employees to one full time employee, it is estimated that over half of the nail salons employ two or less equivalent full time employees. Most of the remaining salons are medium in size, and employ about five full time technicians.

Business Hours

Most salons are open from 10 a.m. to 7 p.m., Monday through Friday. On Saturdays, they generally are open from 9 to 9:30 a.m. and close at 7 p.m. On Sundays, a few large salons will open from 10 a.m. to 5 p.m. while most others are closed.

Operating Information

A large salon may have about 20 nail tables and over 15 pedicure spas or chairs. A typical medium size nail salon has five nail tables and five to six pedicure chairs. A typical small size nail salon has one nail table and a couple of chairs for hair cuts. Emissions from the smaller salons are predictably much lower than the medium and large salons, therefore we only evaluated large and medium size salon exposure scenarios. If the emissions from large and medium size salons do not pose a public health threat, then the emissions from small salons should not pose a public threat.

Salon Size

Large nail salons are usually located in shopping malls and are typically occupied floor spaces of over 3,000 square feet with a ceiling height of about 12 feet. The typical area of a medium size salon is about 1,100 square feet with a ceiling height of 12 feet.

Receptor Distance

We visited several neighborhoods where nail salons are located in Oakland and San Francisco. Information on whether there are people living above or next to a nail salon (i.e., co-location information) and the distance of residences to the salons were collected. We noted the physical characteristics of the salons, the distance to businesses, residences, schools, day care facilities, hospitals, and senior communities. This information was used in the modeling scenarios to characterize exposure and health risk.

Nail salons are often located next to or below private residences. Many salons are next to or within a short distance of each other, or other businesses in strip malls. It was estimated that about 85 percent of the facilities are about 50 feet from the nearest residence. In some locations salons are a few blocks from schools, day care facilities, hospitals, public parks, and/or senior communities.

c. Nail Salons Cluster Characteristics

To understand the relationship between nail salon locations and community exposures, we investigated the location characteristics of multiple nail salons. It was found that nail salons are often found in “clusters”. One such cluster of salons is on Grand Avenue, in Oakland, California. This cluster of salons stretched from 456 Santa Clara Avenue to 3794 Grand Avenue and was “surveyed” by AHS and their collaborators (Liou, J., Personal communications, February 2, 2009 and Appendix C2).

The survey findings are summarized below. Data from the survey are used for modeling multiple facility emissions.

The Grand Avenue cluster has ten nail salons and two hair salons with manicuring stations located on a stretch of blocks approximately one half mile long. The entire stretch is populated with numerous businesses including restaurants, cafes, offices, and other commercial establishments. Each salon is, on average, about 1,100 square feet. Each salon is next to at least one other business. Behind most of the salons are residential apartments or private homes. Owners and operators of six salons indicated that their back doors are open all the time during business hours. One salon has an open window with a reversible fan in the back. The salons are within one to five blocks of Lakeview Elementary School and two to seven blocks of Lakeview Preschool. Seven salons have residences immediately above, and four of the salons have windows right above the front door for ventilation. Some salons have reversible fans on the windows that blow inside air out to the street and towards the residences above. The majority of salons here depend on open front/back doors and windows as the sole means of ventilation.

The heaviest business flow occurs in the months of June, July and August on Wednesday, Thursday, Friday and Saturday, in late afternoon and evening hours. The average number of employees in a shop is four to five. In general, salons reported nearly three times more employees and customers two or three years ago when business was much better. For example, a salon that used to have 15 full time employees now has four full time and one part time employee. We believe that the current economic downturn is responsible for the reduced business flow in nail salons. This is likely to be temporary and the flow of customers in prior years is probably more representative of a normal nail salon business pattern. Therefore, we used the heavier business flow for estimating emissions for the dispersion modeling.

Appendix C2: Data from Julia Liou of Asian Health Services for Grand Avenue Cluster of Salons

Characteristics of a cluster of salons on Grand Avenue, Oakland, CA
(From 456 Santa Clara Avenue – 3794 Grand Avenue)

Summary of Findings:

- Ten full nail salons, two hair salons with manicuring station
- All located on one stretch of blocks approximately +/- .5 miles long
- Entire stretch of blocks included numerous businesses, restaurants, cafes, offices, etc
- Each salon was, on average, +/- 1,100 sq. ft.
- Each salon was next to at least one business
- Entire area behind all these businesses were residential apartments or private homes
- Six salons have back doors that are constantly open, 1 with open window w/ reversible fan in back
- Salons were in 1–5 blocks proximity of Lakeview Elementary School
- Salons were in 2-7 blocks proximity of Lakeview Preschool
- Seven salons had residences right on top. Four of which had windows right above the front door, some of which had reversible fans on them to blow inside air out to the street and residences above
- Majority of salons depended on keeping front/back doors + windows open as ventilation
- Months reported with heaviest business flow are: June, July, August
- Days reported with heaviest business flow are: Wednesday, Thursday, Friday, Saturday
- Hours reported with heaviest business flow are: late afternoon, evenings
- Average number of employees in a shop is 4-5

- Across the board, each salon reported having nearly three times more employees and customers only just 2-3 years prior(ex: salon that used to have 15 employees full time now only with 4 full time, one part time)

- Across the board, salons on average estimated that one bottle of nail polish can be used for anywhere from 7-10 customers

- Numbers of clients seen per day on a busy day ranged from 50+ (for the largest, busiest salon) to an average of 20-30 clients for smaller salons on busy days

- Number of clients seen per day on a light day averaged about 10 clients per day

- Based on these estimates, if we say 1 bottle = 7 clients:
  @ 50 clients per day/7 days week = 7.14 bottles a day –or- 200 bottles a month

- @ 25 clients per day/7 days week = 3.57 bottles a day –or- 100 bottles a month

- @ 10 clients per day/7 days week = 1.42 bottles a day –or- 40 bottles a month

- If we say 1 bottle = 10 clients:
  @ 50 clients per day/7 days week = 5 bottles a day –or- 140 bottles a month

- @ 25 clients per day/7 days week = 2.5 bottles a day –or- 70 bottles a month

- @ 10 clients per day/7 days week = 1 bottle a day –or- 28 bottles a month

Appendix C3: Salon Information Gathering Form

Nail Salon Visit Information Gathering Form

Date:_______________
Name:_______________

Goal: To gather information that would allow us to estimate the potential of nail products used in nail salons that can affect quality of outdoor air.

General Information:

Salon Name	
Address	
Phone	
Email	
Website	
Contact	

Salon:

Sq. Footage		Dimensions L x W x H	
#of Doors/Windows Open? When?	Front: ________Back: ________Side:_________ Windows:___________		
#of Chairs (spa/pedicure)		# of Tables (Nail)	
#of Employees	FT: PT:		
# of Extra Rooms	Bath Room?__________Break room?__________ Waxing?___________ Facial?______________Storage?_____________		
Location: Mall? Size? #of other salons?	Mall?___________ Size of Mall?________________________________ #of Stores?_______ #of Nail Salons?_______ #of Beauty Salons?______		

Operation:

Service Provided:	Manicure?______Pedicure?______Waxing?______ Acrylic Nails?________Others?_________
Hrs of Operation	Days: Time: | Weekend | Days: Time:
Customer Traffic Heavy Medium Light	Day/Time: M:_______T:_______W:_______TH:________ F:______ S:______ S:______ M:_______T:_______W:_______TH:________ F:______ S:______ S:______ M:_______T:_______ W:_______TH:________F:______S:_______S:______
Customer Traffic Heavy-Medium-Light	Month: Jan:______ Feb:______ Mar:______ Apr:______ May:______ Jun:______ Jul: ______ Aug:______ Sep:______ Oct:______ Nov:______ Dec:_______
Products Used:	Name/ Manufacturer/ Amount per day: *** List in the back of this form

Ventilation:

Building Vent System Where?	Side?__________ Roof?_______ Height of exhaust?_______ Others?_____
Salon Vent System Where?	Table vents?_______ AC Units?________ Fans?______ Others?______
Distance of salon from nearest	Residence?________ Business?________ Schools?_______
Other Descriptions	

Remarks:

ARB contact	
Other remarks	

APPENDIX D

ARB AUTHORITY TO REGULATE INDOOR AIR AND CONSUMER PRODUCTS

APPENDIX D: ARB AUTHORITY TO REGULATE INDOOR AIR AND CONSUMER PRODUCTS

ARB Authority to Regulate Indoor Air Quality

ARB does not have the authority, with the exception of use of indoor air cleaners, to limit toxic pollutants in the indoor environment. For indoor workplace exposures, such as nail salons, the California Occupational Health and Safety Administration (Cal/OSHA) regulates employee exposures by setting Personal Exposure Limits (PEL) to limit worker exposure to specific contaminants. By their nature, PELs indirectly establish an indoor air concentration limit for the contaminant of interest, when workers are indoors. Mitigation measures typically used by Cal/OSHA include specified ventilation and product use requirements, but do not include regulation of the product's emissions.

While ARB does not have direct authority to regulate indoor air quality, we have developed guidelines designed to educate the public on ways to reduce exposures to toxic pollutants indoors. These guidelines have addressed many serious indoor air pollutants and exposures. Guidelines for formaldehyde, indoor combustion pollutants, and chlorinated solvents were developed because of the known, substantial toxicity of these contaminants and because exposures to them are elevated, widespread, and of long duration throughout the population.

ARB Authority to Regulate Consumer Products

ARB's authority to regulate consumer products is found in three different statutes:

(1) Health and Safety Code section 41712.
(2) AB 1807 -- Toxic Air Contaminant Identification and Control Act of 1983 (Health and Safety Code section 39650 et seq.).
(3) The California Environmental Quality Act.

Each of these statutes provides ARB with some authority to regulate consumer products, but the authority granted by each statute is subject to certain limitations. Each of these statutes is discussed below.

Health and Safety Code Section 41712

Health and Safety Code section 41712 provides ARB with explicit authority to regulate consumer products. This statute grants ARB the authority to adopt regulations to reduce volatile organic compounds (VOC) emitted by consumer products, and requires that the regulations must be technologically and commercially feasible and do not result in the elimination of a product form (such as aerosol sprays) for any product category.

It is important to note that ARB's authority under section 41712 is limited to adopting regulations that are necessary to attain the State and federal ambient air quality standards. Ambient air quality standards (such as the federal ozone standard) are standards for the "outside" air, and section 41712 does not provide ARB with any direct authority to adopt regulations for the purpose of improving indoor air quality. Section 41712 also does not give ARB the authority to directly prohibit or restrict individual toxic chemicals used in consumer products, if such a prohibition or restriction is not for the purpose of attaining ambient air quality standards. However, the consumer product regulations adopted by ARB have set limits on the maximum amount of VOCs that can be used in numerous categories of consumer products, and reducing overall VOC content often has the ancillary effect of both improving indoor air quality and limiting the amount of toxic chemicals found in consumer products.

AB 1807 (Toxic Air Contaminant Identification and Control Act of 1983)

AB 1807 (Health and Safety Code section 39650 et seq.) provides ARB with the authority to adopt airborne toxic control measures (ATCM) to control Toxic Air Contaminants (TAC). A substance must first be formally identified by ARB as a TAC before ARB can adopt an ATCM to control the substance. A good overview of AB 1807 can be found on ARB's website at http://www.arb.ca.gov/toxics/overview.htm, so we will not further describe the details of AB 1807's regulatory scheme.

AB 1807 does not provide ARB with the authority to adopt ATCMs solely for the purpose of improving indoor air quality. Before an ATCM can be adopted, ARB must first demonstrate that the ATCM will reduce the risk to public health from exposures to a TAC in the ambient (i.e., outside) air. If the source of a particular TAC poses a risk to public health from indoor exposures but does not pose any health risk from outdoor exposures, ARB cannot use the authority provided by AB 1807 to regulate that source. ARB has adopted several ATCMs to control TACs found in consumer products. For each of these ATCMs, ARB was able to demonstrate that the ATCM would reduce public health risk from outside exposures to a TAC. In these cases, the ancillary effect of reducing outside exposure risk was also a substantial reduction in the risk from indoor exposures.

The California Environmental Quality Act(CEQA)

CEQA requires public agencies to adopt feasible mitigation measures if a project undertaken by the agency may result in a significant adverse environmental impact. When ARB adopts a consumer product regulation, this action qualifies as a "project" under CEQA. If the regulation may result in significant adverse environmental impacts, ARB must adopt appropriate mitigation measures (if feasible).

ARB has used the authority provided by CEQA to adopt mitigation measures in situations where adopting a VOC limit for a particular consumer product category may cause the increased use of TACs, and thereby result in potential adverse environmental impacts on public health. For example, a proposed new VOC limit for “degreasers” may provide an incentive for a manufacturer to reduce VOCs (in order to meet the limit) by substituting methylene chloride (a non-VOC) for some of the VOCs currently used in the manufacturer’s product. Even though methylene chloride is not a VOC, it is a toxic compound that may pose a risk to public health. In this situation, ARB may decide that an appropriate mitigation measure is to include in the regulation a prohibition on any increased use of methylene chloride in degreasers.

Under the authority provided by CEQA, it does not matter whether the adverse environmental impact on public health from a toxic compound is the result of increased indoor exposures or increased outdoor exposures. Nor does it matter if the toxic compound has been formally identified as a TAC under AB 1807. CEQA does not impose such limitations. This means that as a mitigation measure under CEQA, ARB can impose restrictions on the use of a toxic compound in a consumer product if the adverse environmental impact on public health is solely the result of increased indoor exposures to the toxic compound. However, the authority provided by CEQA can only be used if the potential adverse environmental impact is the result of a project undertaken by ARB, such as the adoption of a new VOC limit that could result in an increased use of a toxic compound. ARB cannot use CEQA to justify a prohibition on a toxic compound that is currently used in a consumer product, when the use of the toxic compound is not the result of some action (i.e., a project) undertaken by ARB.