

Commercial Ambient Scenting: An Under-Characterized Exposure Source

PUBLIC COMMENT — DRAFT 2026 ROADMAP TO REDUCE AIR TOXICS

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Background: Commercial scenting—also called ambient or “signature” scenting—deliberately disperses fragrance chemicals into occupied shared air, either directly from a scenting device or through a building’s HVAC system. Businesses use commercial scenting for odor control, air freshening, branding, and ambiance, and scenting can be found in hotels, retailers, offices, healthcare facilities, transportation hubs, and other shared spaces. Because scenting systems are often discreet or out-of-view and notice may not be provided, workers and the public may have difficulty determining whether their air is being intentionally scented.

Core Proposal: Commercial scenting appears to be deployed at substantial scale and growing, yet its prevalence in California, primary emissions, secondary chemistry, potential toxic air contaminants, worker exposure, outdoor transport, and health implications remain poorly characterized. For people with medical conditions triggered or worsened by fragrance exposure, scented environments can create barriers to employment, essential services, and access to public spaces.

Request: Include commercial scenting in the 2026 Air Toxics Roadmap as an under-characterized **non-diesel** source and exposure pathway and support focused research to characterize its use, emissions, secondary chemistry, and resulting exposures.

A Lived Experience: Recently, I went to a local bank to open an account that could not be opened online. About 50 yards from the building, I began to react to fragrance from the commercial scenting system. The branch manager agreed to meet me outside across the street. As he approached, I also reacted to the fragrance residue carried on his clothing from his indoor exposure. I explained. He asked what it smelled like, because he said he could not smell anything, “...is it a metallic smell?” We agreed to a virtual meeting. I have a highly sensitive sense of smell, and I understand the science behind his olfactory habituation—**and this is what scares me**. I’m going to try to make a compelling argument that commercial scenting warrants further research, and I ask you to keep an open mind if your initial reaction is “I can’t really smell it.”

Important Note: I confirmed that the scenting system at my local bank is integrated with the building’s HVAC system, per the branch manager who stated: *“They came to install it and we did not know it was coming.”* An onsite teller also told me she was **unaware** that the branch was being intentionally scented.

Key Definitions:

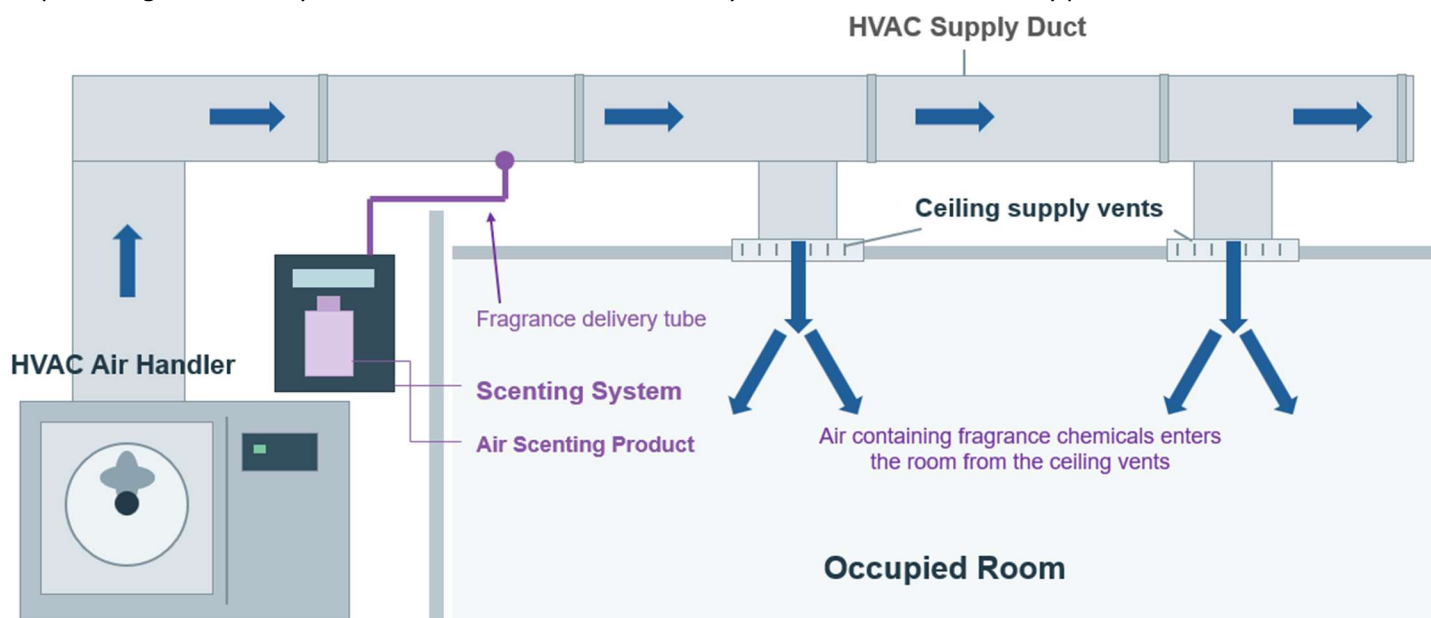
“Air scenting product” means a fragranced formulation or material, including a refill, cartridge, concentrate, liquid, oil, gel, or aerosol, intended for use in a scenting system to disperse scent into indoor or outdoor air.

“Commercial scenting” means intentionally dispersing an air scenting product into an indoor or outdoor area using a scenting system (as defined below) for odor control, air freshening, branding, marketing, ambiance, or another purpose.

“Scenting system” means a mechanical or powered device or installation designed to disperse an air scenting product continuously or intermittently. Examples include HVAC-integrated, cold-air diffusion, nebulizing or atomizing, standalone powered, and automatic aerosol systems.

How it Works: HVAC-Integrated Fragrance Chemical Dispersion

The schematic below illustrates how some commercial scenting systems connect to a building's HVAC system, introducing fragrance chemicals into the supply air for distribution through ceiling vents into occupied spaces. Other scenting systems disperse fragrance directly from a standalone device, which may be out-of-view or discreetly positioned.



Illustrative example of fragrance delivery through HVAC supply ducts. System designs vary. Return-air and outdoor-air connections are omitted for clarity. Arrows indicate airflow, not visible fragrance.

Why Does Commercial Scenting Belong in the Air Toxics Roadmap?

CARB already recognizes fragrance emissions as an air quality and health concern.

Commercial scenting is a logical extension of CARB's existing work. CARB has acknowledged that acute or chronic health effects can result from fragrance exposure, and that fragrance chemicals have been associated with headaches, respiratory symptoms, and other effects. [3]

CARB's consumer product VOC limits have reduced fragrance-related emissions, including by restricting monoterpenes in cleaning products and eliminating the Two Percent Fragrance Exemption for specified categories. In 2021, CARB adopted lower VOC limits for personal fragrance products and several categories of aerosol air fresheners. [3]

CARB is also conducting the 2025 Personal Fragrance Products Technical Assessment to evaluate the continued feasibility of meeting the 50% VOC standard using existing or new technologies. [1] More broadly, CARB surveys consumer and commercial products to support emissions inventories, chemical speciation, modeling, and rulemaking. [2]

CARB has also funded research examining emissions and secondary chemistry from fragrance-containing consumer products.[9]

Commercial scenting appears to be deployed at substantial scale and is projected to grow, yet remains largely invisible and poorly characterized.

Available evidence suggests substantial global deployment. One scenting provider reports more than 300,000 installed locations across 95 countries, reaching more than 100 million people daily. Another provider reports serving more than 50,000 brands in 119 countries. Although these company-reported figures are not independently verified, they indicate considerable scale.

At the same time, commercial scenting **can be difficult to detect**. Unlike plug-ins, candles, reed diffusers, and other visible fragranced products, commercial scenting systems may operate out of view, including through HVAC systems.

Occupants therefore may have no practical way to know that their air is being scented or to identify the air scenting product being dispersed. Basic California data on where and how commercial scenting systems are used are also lacking.

Proposed Research:

- Determine the prevalence (i.e., number of businesses using it) and extent (e.g., number of scented locations, square footage, indoor and outdoor deployment, hours of operation, or geographic reach) of commercial scenting in California.
- Characterize scenting system delivery technologies and operating parameters, including duty cycles (time actively releasing fragrance), product consumption, emission rates, and intensity settings under realistic operating conditions.

Commercial scenting presents a distinct and poorly understood exposure scenario.

Commercial scenting can disperse fragrance throughout large occupied spaces on a continuous or intermittent basis. Provider materials describe systems capable of serving several thousand square feet with programmable duration and intensity. Although most commonly associated with indoor environments, providers also market scenting systems for outdoor hospitality, retail, and event spaces.

For workers and other occupants, actual exposure will depend on system design and operating conditions—including emission rate, duty cycle, HVAC configuration, ventilation, room volume, and other environmental conditions. Manufacturer-recommended settings therefore cannot establish real-world exposure; field measurement is needed. I have not identified adequate independent, peer-reviewed field research measuring breathing-zone exposure from modern whole-space commercial scenting across full work shifts and repeated workdays.

Proposed Research:

- Evaluate factors affecting exposure, including HVAC configuration, ventilation, temperature, ozone, and other environmental conditions.

Primary emissions: Existing ingredient-based assessments do not characterize whole-space commercial scenting.

“Fragrance” can represent a complex mixture of chemicals. Chemical identities may be withheld on safety data sheets as trade secrets, limiting the ability of occupants and regulators to identify the formulation and characterize primary emissions. [11]

A 2024 analysis by the Research Institute for Fragrance Materials (RIFM) and Creme Global modeled¹ aggregate exposure to approximately 3,000 fragrance ingredients. At 95th-percentile exposure, 99% fell below inhalation Threshold of Toxicological Concern (TTC) limits and 76% below systemic TTC limits. [5] This analysis provides useful ingredient-level information, but it does not directly characterize primary emissions, indoor concentrations, secondary chemistry, or worker exposure **from commercial scenting systems** in occupied buildings.

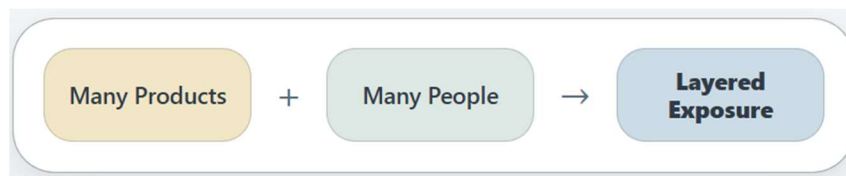
Commercial scenting occurs within a broader volatile chemical product (VCP) exposure environment. Personal care products, laundry products, cleaning products, air fresheners, and other fragranced products can emit VOCs into the same occupied space. Commercial scenting adds another intentional source to that background.

This broader context matters. VCPs—including personal care and cleaning products—now account for approximately half of fossil-fuel VOC emissions in industrialized cities, and modeling has attributed an estimated 41% of summertime

¹ The Creme RIFM Aggregate Exposure Model.

photochemical organic PM_{2.5} in Los Angeles to VCPs. These estimates apply to VCPs broadly, not fragrance or commercial scenting specifically. [12] [13]

Ingredient- and product-specific assessments may not capture the cumulative exposure encountered when commercial scenting is added to other VOC and fragrance-related sources.



Proposed Research:

- Characterize the physical forms of air scenting product emissions, including gases, aerosol droplets, condensable material, and particle-size distributions.
- Characterize the chemical composition of air scenting product formulations and primary emissions, and identify air toxics and other chemicals of concern.
- Measure real-world concentrations and characterize exposure among workers and other occupants, including worker exposure over full shifts and repeated schedules and cumulative exposure from multiple fragranced products.
- Evaluate whether existing consumer product exposure assumptions and safety assessments adequately represent commercial scenting.

Secondary chemistry: Primary emissions and settled surface residues can react to form additional pollutants.

Characterizing what a scenting system directly emits is only the first step. Reactive VOCs can undergo gas-phase and surface reactions indoors, producing additional pollutants—including formaldehyde, other carbonyls, secondary organic aerosol (SOA), and ultrafine particles. Research involving other fragranced consumer products provides a scientific basis for evaluating whether similar processes occur with commercial scenting. [9] [4]

Monoterpenes are reactive VOCs used as tracers for fragrance-containing volatile chemical products (VCPs). [14] Cleaning products and air fresheners can emit substantial quantities of terpenoids indoors. [8] In chamber studies, reactions between emissions from such products and ozone produced **formaldehyde**—at approximately a 20–30% molar yield relative to ozone consumed—along with **acetaldehyde**, other oxygenated compounds, and secondary particles. [9]

A realistic test-room study demonstrates the same general chemistry. In a mechanically ventilated ~50 m³ test room with an office-like air-change rate, use of a monoterpene-containing commercial cleaner produced monoterpene concentrations roughly two orders of magnitude above outdoor levels, accompanied by rapid formation of oxidation products and newly nucleated particles at ozone concentrations as low as 5–10 ppb. [10]

More recently, a Schwink et al. 2026 chamber study found that perfumes, deodorants, and cleaning liquids formed secondary organic aerosol (SOA) when exposed to ozone, with greater total monoterpene content generally corresponding to greater SOA formation. [4]

Secondary chemistry may continue after initial use: product residues can contribute to indoor pollution even after drying. In laboratory tests, exposing dried household-product residues to ozone generated formaldehyde, other carbonyl compounds, and ultrafine particles—even, for one product, when no primary VOC emissions were detected. These findings suggest that chemicals remaining on surfaces may generate additional airborne pollutants through reactions on the surface or after slowly releasing back into the air. [9]

Proposed Research:

- Characterize secondary pollutants formed through reactions of primary emissions or surface-deposited residues—including formaldehyde, other carbonyls, and SOA—and identify any regulated or emerging air toxics of concern.
- Evaluate sorption to surfaces, textiles, and skin; subsequent re-emission; and transport of residues on occupants and clothing.

Outdoor pathways: Commercial scenting emissions can reach ambient air.

Commercial scenting also presents an indoor-to-outdoor emissions pathway. Indoor-generated VOCs can leave buildings through ventilation and air exchange. A recent building study found VCP-related species consistently more abundant in exhaust air than incoming air, confirming the influence of indoor sources on outdoor emissions. [7] Outdoors, VCP emissions can contribute to ozone and secondary organic aerosol (SOA) formation. [15]

Proposed Research:

- Assess outdoor exposure from indoor emissions transported outdoors and direct outdoor scenting, including dispersion and dilution with distance under varying weather conditions.

Fragranced product surveys identify health, susceptibility, and access concerns.

Steinemann's 2021 synthesis summarized results from four population-based surveys of adults ages 18–65 in the United States, Australia, the United Kingdom, and Sweden (combined n = 4,435); each national sample was designed to be representative by age, gender, and region. The summary below is adapted and condensed under CC BY 4.0; selection, grouping, and wording were modified. [6]

Across the general population: [6]

- **32.2%** reported one or more adverse health effects from fragranced consumer products;
- **17.4%** reported health problems from air fresheners or deodorizers; and
- **9.0%** reported losing workdays or a job during the prior year from workplace fragranced product exposure.

Asthmatic respondents reported higher frequencies: [6]

- **57.8%** reported one or more adverse health effects from fragranced consumer products;
- **36.7%** reported health problems from air fresheners or deodorizers; and
- **20.6%** reported losing workdays or a job during the prior year from workplace fragranced product exposure.

Autistic respondents reported the highest frequencies: [6] [16] [17]

- **75.8%** reported one or more adverse health effects from fragranced consumer products;
- **62.9%** reported health problems from air fresheners or deodorizers; and
- **59.4%** reported losing workdays or a job during the prior year from workplace fragranced product exposure.

These subgroup figures come from self-reported surveys and are presented to identify reported functional barriers, not to quantify risk from commercial scenting. [6] The surveys concern fragranced consumer products generally; they did not isolate commercial scenting, so their frequencies cannot be assumed to apply to it.

Additional susceptible populations and exposure contexts warrant attention:

- People with COPD or other respiratory conditions, migraines, fragrance sensitivity, or chemical intolerance;
- Children, pregnant women, older adults, and immunocompromised people;
- Patients in healthcare settings, especially those unable to leave;

- Workers in scented spaces, whose exposure may be sustained and unavoidable; and
- Companion animals.

When scenting is out of view and no notice is posted, susceptible occupants cannot make an informed choice before entering; for those who react quickly, it is often too late when the exposure has already occurred.

Proposed Research:

- Conduct epidemiological, clinical, and exposure-response research on the health effects of acute and repeated exposure, with attention to susceptible populations.

“Wellness” marketing underscores the need for independent characterization.

Despite reported health effects from fragrance exposure, commercial scenting is promoted in healthcare, fitness, corporate, hospitality, and wellness settings using language associated with calm, comfort, and well-being. Such claims describe an intended experience, not air-quality or health outcomes.

Focused CARB research could help resolve the uncertainty.

CARB's expertise in inventories, speciation, reactivity, modeling, and source characterization positions it to investigate this exposure scenario. [1] [2] [3] The proposed research discussed throughout this proposal is summarized below.

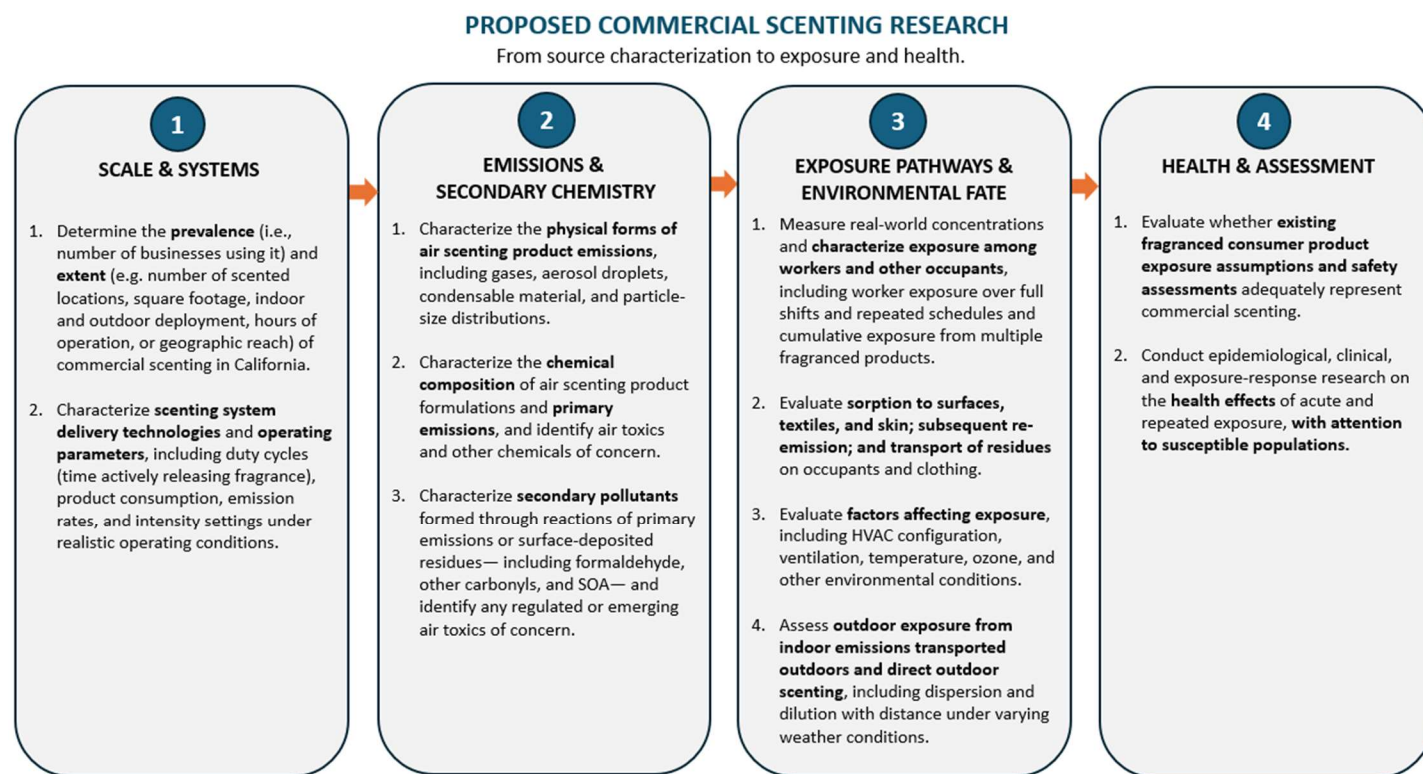


Figure 1. Proposed research coverage for commercial scenting.

Conclusion

Commercial scenting's prevalence, emissions, secondary chemistry, and real-world exposures—especially for workers—remain poorly characterized. Research on other fragranced products establishes relevant emissions and secondary chemistry pathways and identifies health and access concerns, but it does not characterize real-world exposure from commercial scenting. Direct study is needed.

Recommended CARB Action: Include commercial scenting in the 2026 Roadmap as an under-characterized source of indoor and outdoor emissions and human exposure, including the potential formation of toxic air contaminants (TACs) through secondary chemistry, and conduct or sponsor the focused research outlined above.

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Luxury Has No Scent LLC is an independent public-education project on fragrance chemistry, air quality, health, and access. This comment was prepared without funding or sponsorship, and I have no financial interest in any fragrance, scenting, or air-quality company. I submit it as a member of the public. I reside in Delaware and submit this comment because CARB's consumer products work has relevance beyond California. I am not a scientist; this comment relies primarily on published, peer-reviewed research and CARB program materials, supplemented by provider-reported figures, and my own experience where noted.

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