CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

Gavin Newsom, Governor
Yana Garcia, Secretary for Environmental Protection
Kristina Thayer, Ph.D., Director

MEMORANDUM

TO: David Harris
Engineering Manager
Air Pollution Control District
Santa Barbara County

FROM: Kimberly Gettmann, Ph.D.
Deputy Director
Division of Scientific Programs

DATE: December 24, 2025

SUBJECT: PCO TECHNOLOGY FOR CANNABIS ODOR CONTROL

This memo is in response to a request from Santa Barbara APCD for OEHHA to review potential health hazards associated with Photocatalytic Oxidation (PCO) Air Purifiers, particularly for use in the cannabis industry. Combining PCO with traditional filtration has been suggested as an approach to enhance volatile organic chemical (VOC) removal, including in the cannabis industry. OEHHA has not identified original research specifically evaluating PCO air purifiers for the cannabis industry. Due to lack of such data, OEHHA currently does not recommend widespread use of PCO technology without further research and regulatory safeguards, such as certification to ensure ozone emissions remain within safe limits. If additional information becomes available, then a reevaluation may be warranted at a future date.

PCO is a technique that uses ultraviolet (UV) or visible light combined with a catalyst (often titanium dioxide) to break down airborne pollutants. While PCO systems are intended to improve indoor air quality, they can produce secondary pollutants, thereby introducing new health hazards. A lack of standardized testing and regulatory standards may lead to variations in safety and performance across manufacturers.

Health concerns related to the use of PCO:

- Ozone Emissions: Some PCO systems produce ozone, which is a known respiratory irritant that can inflame lung tissue and exacerbate asthma and other pulmonary diseases.

- Secondary Pollutants Formation: The chemical reactions initiated by PCO can produce unintended byproducts, many of which may be toxic and/or not yet fully characterized. One study (CARB 2014) reported that a PCO device led to an increase in the net emissions, rather than removal, of volatile organic compounds (VOCs).

Several studies (see Reference list) and US EPA's (2018) assessment have identified substances of concern that can be released during PCO operation:

- Acetaldehyde: a carcinogenic VOC
- Carbon monoxide: a toxic gas that interferes with oxygen transport in the body
- Formaldehyde: an irritant and known human carcinogen
- Nitrogen dioxide: Contributes to indoor air pollution and respiratory irritation
- Benzene and toluene from the decomposition of toluene and p-xylene, respectively: benzene is a carcinogen; toluene can cause neurotoxicity, reproductive toxicity, hearing and color vision loss, among other health impacts

The harmful substances released by PCO depends on the profile of indoor air pollutants. See Section 6 of the publication by Li and Ma (2021) for more information on the potential release of intermediate byproducts from a variety of indoor air pollutants.

These substances can be formed and released as intermediates during the step-wise process of photocatalytic oxidation (whereas the desired final products with complete oxidation are CO_2 and H_2O) (Huang et al 2016; Link et al 2024). Depending on the type of PCO used, additional potential byproducts can include octane, decane, nonane, decanal, decanoic acid, and p-benzoquinone, from benzene degradation (Zhong 2017). Potential byproducts of n-decane photocatalytic reaction from PCO systems with titanium dioxide-based coatings include C_6–C_{11} alkanes, 4-methylnonane, 2,6-dimethyloctane, butanoic acid, propanoic acid, and butanal (Monteiro et al 2014).

It is well known that cannabis facilities emit a variety of biogenic VOCs. These VOC emissions are high and can be concentrated, especially in indoor growing and processing operations. While the use of PCO at cannabis facilities aims to remove VOCs, the same concern applies that it may generate harmful byproducts including VOCs and ozone. Terpenes (aromatic compounds found in cannabis, particularly limonene and pinene) can undergo oxidation to form more toxic compounds such as aldehydes. The reaction of terpenes with the PCO system is not well-characterized, and incomplete oxidation can lead to accumulation of hazardous byproducts. For example, myrcene undergoes photo-oxidation to produce formaldehyde and acetone under atmospheric conditions and a similar reaction is expected during PCO use (Tan 2021). The full range of VOC emissions from cannabis and potential PCO byproducts is not well studied.

In summary, while PCO has potential for addressing hard-to-remove gaseous contaminants, its safety profile remains uncertain. Besides the listed chemicals of concern, there may also be unknown toxic chemical byproducts. Until further evidence and regulations are available, traditional filtration methods offer a more reliable solution for air quality management in cannabis facilities.

Please see the attached list of reference materials for additional information. Please contact our office with questions, or if new information becomes available.

Attachment

cc: Meng Sun, Ph.D.
Chief, Air and Site Assessment and Climate Indicators Branch

Rima Woods, Ph.D.
Chief, Air Toxicology and Risk Assessment Section

References

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