

South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765



March 23, 2026

RE: Fumigation Facilities and Proposed Rule 1495

Dear Chair Cacciotti,

This letter is to discuss public health concerns for residents living near fumigation facilities.

Pesticide exposure broadly, including fumigants, is linked to a higher risk of asthma-related complications, decreased lung function, and increased wheezing. Methyl bromide (MeBr) is an odorless, colorless gas. It is a highly reactive chemical with a broad toxicological profile, ranging from respiratory toxicity to neurotoxicity.^{3, 4} Three decades ago, MeBr was formally listed under CA Proposition 65 as a known toxicant.^{5, 6} MeBr, which is quickly absorbed following inhalation, can accumulate in the lungs and is associated with respiratory damage in animals studies.⁷⁻¹¹ In workplace environments, MeBr exposures have been associated with various adverse health symptoms, including shortness of breath, headaches, dizziness, lung irritation, chest pain, coughing, and nasal irritation.^{13, 14} Long-term studies of the wives of MeBr pesticide applicators found an increased risk of chronic bronchitis.¹⁵ In CA, significant associations were observed between asthma emergency department (ED) visits and ambient air concentrations of MeBr among children (age 6-18).¹⁶ Examining data from 2005 to 2011, each 0.01-ppb increase in ambient MeBr concentration was associated with a 7.1% (95% CI, 2.9%-10.8%) greater likelihood of an asthma-related ED visit.¹⁶ Proximity to agricultural applications of MeBr correlates with lower lung function among asthmatic children in rural communities.¹

A recognized toxic effect of MeBr exposure is its impact on autonomic nervous system regulation.^{3, 18, 19} Impaired autonomic nervous system function may trigger inflammation and arrhythmia and may alter dynamics between blood pressure and blood flow, all of which may increase the risk of adverse cardiovascular health effects.²⁰ Among healthy port fumigation workers, urinary bromide ions were associated with lower HRV and weakening of the autonomic nervous system,¹⁹ as well as decreases in blood vessel volume.²¹ Animal studies of chronic exposure to MeBr found an increased incidence of cardiovascular damage, including lesions in the heart, thrombi, and myocardial degeneration.¹⁰

Further, MeBr has also been shown to accumulate in the kidneys. Renal damage and dysfunction have been observed with exposure to a range of pesticides, including MeBr.^{22, 23} Acute poisoning cases of MeBr have resulted in severe kidney damage, including acute renal failure and anuria. Studies have seen associations between biomarkers of pesticide exposure and reduced kidney

function among occupationally exposed adults with chronic kidney disease.²⁴⁻²⁷ Given that early renal development and maturation is susceptible to nephrotoxic exposures, as well as the intertwined nature of kidney function and cardiovascular health in children, MeBr exposure could have multifactorial impacts on these systems.²⁸⁻³⁰

MeBr is heavier than air, and therefore, children's exposure to this pesticide may be greater than that of adults, due to their smaller stature.³¹ Risks to children are uniformly higher than those of adults due to a greater inhalation rate-to-body weight ratio and other factors. Inhalation of fumigation pesticides is a children's exposure pathway that is rarely investigated.³² While few studies have specifically examined the health effects of MeBr in children, a vast body of literature supports a role for early-life pesticide exposure in myriad health consequences.^{2, 33-38} Environmental exposures at different life stages can differently influence the risk of developing chronic diseases later in life, and measures of child health, including respiratory, cardiovascular, and renal outcomes, are important predictors of chronic conditions in adulthood.

Levels of concern detected in the community. Regional monitoring of toxic air contaminants conducted by the South Coast Air Basin through the Multiple Air Toxics Exposure Study V (MATES V) in 2018 across Southern CA revealed the average concentrations of MeBr in West Long Beach, identified as an AB 617 community, were 10 times higher than other monitoring stations (1.4 ppb vs 0.139 ppb).^{41, 42} The CA Office of Environmental Health Hazard Assessment set non-cancer reference exposure level (REL) values for acute air exposure to methyl bromide at 0.05 parts per million (neurologic targeted toxicity) and for chronic REL for the respiratory tract target (based on degenerative and proliferative lesions of the olfactory epithelium of the nasal cavity) to be 0.005 mg/m³ (0.0012 ppm).⁴³ Data from the MeBr monitor in West Long Beach from January 2023 to April 2024 showed that, on average, *more than double* the long-term health-protective reference exposure level — 2.1 parts per billion (ppb) compared to 1.0 ppb as measured CARB's ambient air monitor in the community.

Episodic spikes in methyl bromide continue in 2026, but large data gaps remain. Of the ~35 facilities with active methyl bromide permits in the SCAQMD region, only two (located in the same complex) have an active methyl bromide monitor. From January 1st to March 15th, 2026, the monitor located in West Long Beach recorded data for a total of 1369 hours. This means that approximately 406.8 hours (~23% of the time) the monitor was not actively recording or reporting data. The missing data limits accurate assessment of potential exposure.

Of the 1369 hours of data available from January 1st to March 15th, 2026, the average concentration during this time is 1.19 ppb; the OEHHA Chronic REL is 1.2 ppb. The measured concentrations exceeded the OEHHA Chronic REL of 1.2 ppb for a total of 118 hours, or 8.6% of the time. When the monitor is above the 1.2 ppb REL, the average hourly concentration was 11.6 ppb (hourly range: 1.23-265 ppb). The concentrations were the highest in the evening and late-night hours. This suggests that methyl bromide continues to be released from the facility during fumigation activities.

Reducing MeBr use or capturing emissions would reduce potential public health impacts for local residents.

Sincerely,

A handwritten signature in black ink, appearing to read "Jill Johnston".

Jill Johnston, PhD
Associate Professor
Department of Environmental and Occupational Health
University of California, Irvine
Jillj1@hs.uci.edu

A handwritten signature in blue ink, appearing to read "Yoshira Ornelas Van Horne".

Yoshira Ornelas Van Horne, PhD
Assistant Professor
Department of Environmental Health Sciences
University of California, Los Angeles
yoshira@ucla.edu

Sylvia Betancourt
Program Manager
Long Beach Alliance for Children with Asthma
SBetancourt@memorialcare.org

References

- (1) Benka-Coker, W.; Hoskovec, L.; Severson, R.; Balmes, J.; Wilson, A.; Magzamen, S. The joint effect of ambient air pollution and agricultural pesticide exposures on lung function among children with asthma. *Environ Res* **2020**, *190*, 109903. DOI: 10.1016/j.envres.2020.109903 From NLM.
- (2) Van Horne, Y. O.; Farzan, S. F.; Razafy, M.; Johnston, J. E. Respiratory and allergic health effects in children living near agriculture: A review. *Science of The Total Environment* **2022**, 155009.
- (3) Bulathsinghala, A.; Shaw, I. The toxic chemistry of methyl bromide. *Human & Experimental Toxicology* **2014**, *33* (1), 81-91. DOI: 10.1177/0960327113493299.
- (4) Yang, R. S.; Witt, K. L.; Alden, C. J.; Cockerham, L. G. Toxicology of methyl bromide. *Rev Environ Contam Toxicol* **1995**, *142*, 65-85. DOI: 10.1007/978-1-4612-4252-9_3 From NLM.
- (5) OEHHA. *Methyl Bromide, as a structural fumigant*. 1993. <https://oehha.ca.gov/proposition-65/chemicals/methyl-bromide-structural-fumigant> (accessed).
- (6) Gemmill, A.; Gunier, R. B.; Bradman, A.; Eskenazi, B.; Harley, K. G. Residential Proximity to Methyl Bromide Use and Birth Outcomes in an Agricultural Population in California. *Environmental Health Perspectives* **2013**, *121* (6), 737-743. DOI: doi:10.1289/ehp.1205682.
- (7) Alexeeff, G. V.; Kilgore, W. W.; Muñoz, P.; Watt, D. Determination of acute toxic effects in mice following exposure to methyl bromide. *Journal of Toxicology and Environmental Health, Part A Current Issues* **1985**, *15* (1), 109-123.
- (8) Eustis, S.; Haber, S.; Drew, R.; Yang, R. Toxicology and pathology of methyl bromide in F344 rats and B6C3F1 mice following repeated inhalation exposure. *Fundamental and Applied Toxicology* **1988**, *11* (4), 594-610.
- (9) Jaskot, R.; Grose, E.; Most, B.; Menache, M.; Williams, T.; Roycroft, J. The distribution and toxicological effects of inhaled methyl bromide in the rat. *Journal of the American College of Toxicology* **1988**, *7* (5), 631-642.
- (10) Reuzel, P.; Dreef-Van Der Meulen, H.; Hollanders, V.; Kuper, C.; Feron, V.; Van der Heijden, C. Chronic inhalation toxicity and carcinogenicity study of methyl bromide in Wistar rats. *Food and chemical toxicology* **1991**, *29* (1), 31-39.
- (11) Medinsky, M. A.; Dutcher, J. S.; Bond, J. A.; Henderson, R. F.; Mauderly, J. L.; Snipes, M. B.; Mewhinney, J. A.; Cheng, Y. S.; Birnbaum, L. S. Uptake and excretion of [¹⁴C]methyl bromide as influenced by exposure concentration. *Toxicol Appl Pharmacol* **1985**, *78* (2), 215-225. DOI: 10.1016/0041-008x(85)90285-6 From NLM.
- (12) Bond, J. A.; Dutcher, J. S.; Medinsky, M. A.; Henderson, R. F.; Birnbaum, L. S. Disposition of [¹⁴C]methyl bromide in rats after inhalation. *Toxicol Appl Pharmacol* **1985**, *78* (2), 259-267. DOI: 10.1016/0041-008x(85)90289-3 From NLM.
- (13) Akca, E. T.; Serpil, S.; Sezer, U.; Ozlem, E.; Ayse, G.; Canan, C.; Hakan, B.; Ozgur, K.; Banu, O.; Hulya, G. Health profiles of methyl bromide applicators in greenhouses in Turkey. *Ann Acad Med Singapore* **2009**, *38*, 707-713.
- (14) Deschamps, F. J.; Turpin, J. C. Methyl bromide intoxication during grain store fumigation. *Occup Med (Lond)* **1996**, *46* (1), 89-90. DOI: 10.1093/occmed/46.1.89 From NLM.
- (15) Valcin, M.; Henneberger, P. K.; Kullman, G. J.; Umbach, D. M.; London, S. J.; Alavanja, M. C. R.; Sandler, D. P.; Hoppin, J. A. Chronic Bronchitis Among Nonsmoking Farm Women in the Agricultural Health Study. *Journal of Occupational and Environmental Medicine* **2007**, *49* (5), 574-583. DOI: 10.1097/JOM.0b013e3180577768.
- (16) Gharibi, H.; Entwistle, M. R.; Schweizer, D.; Tavallali, P.; Thao, C.; Cisneros, R. Methyl-bromide and asthma emergency department visits in California, USA from 2005 to 2011. *Journal of Asthma* **2020**, *57* (11), 1227-1236.

- (17) Gunier, R. B.; Raanan, R.; Castorina, R.; Holland, N. T.; Harley, K. G.; Balmes, J. R.; Fouquette, L.; Eskenazi, B.; Bradman, A. Residential proximity to agricultural fumigant use and respiratory health in 7-year old children. *Environmental research* **2018**, *164*, 93-99.
- (18) Choi, J.; Cha, W.; Park, M. G. Evaluation of the effect of photoplethysmograms on workers' exposure to methyl bromide using second derivative. *Front Public Health* **2023**, *11*, 1224143. DOI: 10.3389/fpubh.2023.1224143 From NLM.
- (19) Choi, J.; Hong, Y.-S.; Cha, W.; Mo, H.-h.; Park, M.-G. Heart rate variability analysis in workers exposed to methyl bromide as a quarantine treatment. *Journal of occupational and environmental medicine* **2021**, *63* (1), e32-e38.
- (20) Tiwari, R.; Kumar, R.; Malik, S.; Raj, T.; Kumar, P. Analysis of Heart Rate Variability and Implication of Different Factors on Heart Rate Variability. *Curr Cardiol Rev* **2021**, *17* (5), e160721189770. DOI: 10.2174/1573403x16999201231203854 From NLM.
- (21) Choi, J.; Cha, W.; Park, M.-G. Evaluation of the effect of photoplethysmograms on workers' exposure to methyl bromide using second derivative. *Frontiers in Public Health* **2023**, *11*, 1224143.
- (22) Hurtt, M. E.; Morgan, K. T.; Working, P. K. Histopathology of acute toxic responses in selected tissues from rats exposed by inhalation to methyl bromide. *Fundamental and Applied Toxicology* **1987**, *9* (2), 352-365. DOI: [https://doi.org/10.1016/0272-0590\(87\)90057-1](https://doi.org/10.1016/0272-0590(87)90057-1).
- (23) de Souza, A.; Narvencar, K. P.; Sindhoora, K. The neurological effects of methyl bromide intoxication. *Journal of the neurological sciences* **2013**, *335* (1-2), 36-41.
- (24) Hassanin, N. M.; Awad, O. M.; El-Fiki, S.; Abou-Shanab, R. A.; Abou-Shanab, A. R.; Amer, R. A. Association between exposure to pesticides and disorder on hematological parameters and kidney function in male agricultural workers. *Environmental Science and Pollution Research* **2018**, *25* (31), 30802-30807.
- (25) Shearer, J.; Sandler, D.; Andreotti, G.; Murata, K.; Shrestha, S.; Parks, C.; Landgren, O.; Beane Freeman, L.; Hofmann, J. Pesticide use and kidney function among pesticide applicators in the biomarkers of exposure and effect in agriculture study. *Environmental Epidemiology* **2019**, *3*, 362-363.
- (26) Prudente, I. R. G.; Cruz, C. L.; de Carvalho Nascimento, L.; Kaiser, C. C.; Guimarães, A. G. Evidence of risks of renal function reduction due to occupational exposure to agrochemicals: A systematic review. *Environmental Toxicology and Pharmacology* **2018**, *63*, 21-28.
- (27) Bolt, H. M.; Gansewendt, B. Mechanisms of carcinogenicity of methyl halides. *Critical reviews in toxicology* **1993**, *23* (3), 237-253.
- (28) Brathwaite, K. E.; Levy, R. V.; Sarathy, H.; Agalliu, I.; Johns, T. S.; Reidy, K. J.; Fadrowski, J. J.; Schwartz, G. J.; Kaskel, F. J.; Melamed, M. L. Reduced kidney function and hypertension in adolescents with low birth weight, NHANES 1999-2016. *Pediatr Nephrol* **2023**, *38* (9), 3071-3082. DOI: 10.1007/s00467-023-05958-2 From NLM.
- (29) Tsur, A. M.; Akavian, I.; Derazne, E.; Tzur, D.; Vivante, A.; Grossman, E.; Rotem, R. S.; Fishman, B.; Afek, A.; Coresh, J.; et al. Adolescent Blood Pressure and the Risk for Early Kidney Damage in Young Adulthood. *Hypertension* **2022**, *79* (5), 974-983. DOI: 10.1161/hypertensionaha.121.18748 From NLM.
- (30) Karbasi-Afshar, R.; Saburi, A.; Taheri, S. Pediatric patients with renal disease and cardiovascular complications: A literature review. *ARYA Atheroscler* **2014**, *10* (2), 118-128. From NLM.
- (31) Etzel, R. A. The special vulnerability of children. *International journal of hygiene and environmental health* **2020**, *227*, 113516.
- (32) Lee, S.; McLaughlin, R.; Harnly, M.; Gunier, R.; Kreutzer, R. Community exposures to airborne agricultural pesticides in California: ranking of inhalation risks. *Environmental Health Perspectives* **2002**, *110* (12), 1175-1184.

- (33) Van Horne, Y. O.; Johnston, J. E.; Barahona, D. D.; Razafy, M.; Kamai, E. M.; Ruiz, B. C.; Eckel, S. P.; Bejarano, E.; Olmedo, L.; Farzan, S. F. Exposure to agricultural pesticides and wheezing among 5–12-year-old children in the Imperial Valley, CA, USA. *Environmental Epidemiology* **2024**, *8* (5), e325.
- (34) Ben-Shlomo, Y.; Kuh, D. A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. *Int J Epidemiol* **2002**, *31* (2), 285-293.
- (35) Osmond, C.; Barker, D. J.; Winter, P. D.; Fall, C. H.; Simmonds, S. J. Early growth and death from cardiovascular disease in women. *BMJ* **1993**, *307* (6918), 1519-1524. DOI: 10.1136/bmj.307.6918.1519.
- (36) Suarez-Lopez, J. R.; Amchich, F.; Murillo, J.; Denenberg, J. Blood pressure after a heightened pesticide spray period among children living in agricultural communities in Ecuador. *Environ Res* **2019**, *175*, 335-342. DOI: 10.1016/j.envres.2019.05.030 From NLM.
- (37) Gilden, R. C.; Harris, R. L.; Friedmann, E. J.; Han, M.; Hackney, A. J.; Olorunyemi, E.; Spanier, A. J. Systematic Review: Association of Pesticide Exposure and Child Wheeze and Asthma. *Curr Pediatr Rev* **2023**, *19* (2), 169-178. DOI: 10.2174/1573396318666220510124457 From NLM.
- (38) Mowafi, S.; Dabbish, A. M.; Chukwuma, C. C.; Adel, L.; Abdelnaser, A. Toxic sprays, fragile brains: assessing pesticides exposure and disparities on neurodevelopment. *Neuroscience* **2025**, *579*, 344-354. DOI: 10.1016/j.neuroscience.2025.06.021 From NLM.
- (39) Landrigan, P. J. Children's Environmental Health: A Brief History. *Acad Pediatr* **2016**, *16* (1), 1-9. DOI: 10.1016/j.acap.2015.10.002.
- (40) Magnussen, C. G.; Smith, K. J.; Juonala, M. When to prevent cardiovascular disease? As early as possible: lessons from prospective cohorts beginning in childhood. *Curr Opin Cardiol* **2013**, *28* (5), 561-568. DOI: 10.1097/HCO.0b013e32836428f4.
- (41) MATES, V. Multiple Air Toxics Exposure Study. South Coast AQMD: 2021.
- (42) Maestas, M. M.; Epstein, S. A.; Schulte, N.; Li, X.; Zhang, X.; Lee, S.-M.; Polidori, A.; Low, J.; Ghosh, J. K. Trends in air toxics cancer risk in Southern California, 1998-2018. *Environmental Research: Health* **2024**, *2* (2), 025005. DOI: 10.1088/2752-5309/ad2f09.
- (43) Assessment, O. o. E. H. H. OEHHA Acute, 8-hour and Chronic Reference Exposure Level (REL) Summary. 2016.