



# Department of Pesticide Regulation



Brian R. Leahy  
Director

## MEMORANDUM

Edmund G. Brown Jr.  
Governor

TO: Marylou Verder-Carlos, DVM, MPVM  
Assistant Director  
Pesticide Programs Division

FROM: Susan McCarthy, M.S. *(original signed by S. McCarthy)*  
Environmental Program Manager II  
Chief, Worker Health and Safety Branch  
(916) 324-4116

DATE: November 16, 2017

SUBJECT: COMPLETION OF WORKER MITIGATION MEASURES FOR STRUCTURES  
FUMIGATED WITH SULFURYL FLUORIDE

---

The memoranda by Beauvais (2013) and Stefanova-Wilbur (2017) summarize human exposures calculated from three sulfuryl fluoride monitoring studies conducted by Dow AgroSciences (DAS). The studies were conducted to determine the effectiveness of a new aeration procedure, known as the California Aeration Plan (CAP), in reducing exposure to sulfuryl fluoride when used as a structural fumigant. The following information summarizes only occupational exposures calculated in the memoranda, and the relevant target values designed to mitigate potential exposures.

The Department of Pesticide Regulation (DPR) completed a risk characterization document (RCD) in 2006, for sulfuryl fluoride in its use as a structural fumigant (CDPR, 2006). The RCD identified potential occupational exposures that pose health concerns. Subsequently DPR issued a risk management directive (RMD) instructing staff to initiate measures to mitigate acute and repetitive exposures for workers involved in structural, non-food, fumigations (Gosselin, 2007). The RMD set an acute, 24-hour time-weighted average (TWA) target concentration of 2.57 ppm, a seasonal concentration of 0.14 ppm, and a chronic target concentration of 0.04 ppm. In 2017, DPR scientists evaluated a recently submitted developmental neurotoxicity study and proposed reference concentrations specifically for female workers of 2.6 ppm for an 8-hour TWA and 0.13 ppm for short term (1-2 week) exposure (Dong, et al., 2017).

When the 2006 RCD was written, the aeration procedure used to clear sulfuryl fluoride from fumigated structures was the Tarpaulin Removal and Aeration Plan (TRAP). Worker exposure estimates in the RCD were made with data collected while TRAP was in use. In an effort to reduce worker exposure, as required in the RMD, industry tested the new CAP. This new aeration procedure eliminated specific worker activities that had a high potential for exposure to sulfuryl fluoride gas. Under CAP, fumigators would no longer have to enter structures to initiate and conduct aeration, and tent crew workers would no longer remove tarps before aeration is complete.



Two air monitoring studies conducted by DAS under the newly developed CAP procedure (Barnekow and Byrne, 2006; and Barnekow, 2010), are summarized in Beauvais (2013) and used to estimate worker exposure in and around structures fumigated with sulfuryl fluoride. Both studies were conducted at rates often used to control bed bugs, about twice the rate used for dry wood termite control. Barnekow and Byrne (2006) measured air concentrations in and around individual homes, while Barnekow (2010) also included multi-unit structures and a multi-storied school. Beauvais (2013) concludes that occupational exposures measured under the newly developed CAP, were below the RMD targets of 2.57 ppm for acute and 0.04 ppm for chronic exposures (Beauvais, 2013). Occupational exposures were also below the reference concentrations proposed specifically for female workers of 2.6 ppm for 8-hours and 0.13 ppm for short-term (1-2 week) exposures (Dong, et al., 2017).

In addition, a third study was conducted at maximum rates used to control powder post beetles (about ten times the termite rate) (Barnekow and Rotondaro, 2015). This study employed CAP II, (a slightly modified CAP procedure implemented in 2013), which provided improved aeration and venting of the fumigated structures. The air concentrations measured in this study were used to calculate worker exposure estimates by Stefanova-Wilbur (2017). The conclusions resulting from this evaluation also indicate worker exposures are below the target values established in the RMD of 2.57 ppm for acute exposure and 0.04 ppm for chronic exposure, and also below proposed reference concentrations for female workers of 2.6 ppm for 8-hours, and 0.13 ppm for short-term (1-2 week) exposures (Dong, et al., 2017).

Worker Health and Safety has determined that occupational exposures to sulfuryl fluoride when used for structural fumigation of residences have been mitigated. However, we recommend staff continue to monitor illness data to assess exposures that may occur when workers fumigate larger structures. If such illnesses occur, additional air monitoring for worker exposures may be warranted.

## References

- Barnekow, D. E., and S. L. Byrne. 2006. Sulfuryl fluoride and chloropicrin concentrations in air during fumigation, aeration and post clearance of residential structures. Dow AgroSciences Study #040099. DPR Vol. 50223-0091, Record # 242458.
- Barnekow, D. E. 2010. Sulfuryl fluoride and chloropicrin concentrations in air during aeration and post-clearance of residential and multi-unit structures observed during the development of the California Aeration Plan. Dow AgroSciences Study #091166. DPR Vol. 50223-0097, Record # 253822.
- Barnekow, J. A., and A. Rotondaro. 2015. Monitoring of sulfuryl fluoride and chloropicrin concentrations in ambient air around residential structures during a beetle rate fumigation, aeration and post-clearance. Dow AgroSciences Study #140355. DPR Vol. 50223-0134, Record # 287400.

Beauvais, S. 2013. Conclusions of review of sulfuryl fluoride concentrations associated with fumigation of residential structures as measured in studies conducted during the development of the California aeration plan. Health and Safety Memorandum 13008, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, CA, <http://www.cdpr.ca.gov/docs/whs/memo/hsm13008.pdf>.

CDPR. 2006. Sulfuryl fluoride (vikane) risk characterization document. California Department of Pesticide Regulation. California Environmental Protection Agency. July 2006.

Dong, Q., C. Lewis, S. Koshlukova. 2017. Establishing sulfuryl fluoride uncertainty factors for acute and short-term exposures. Memorandum from Q. Dong, C. Lewis and S. Koshlukova to S. DuTeaux, March 3, 2017. Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, CA, [http://www.cdpr.ca.gov/docs/risk/rcd/establishing\\_sulfuryl\\_fluoride.pdf](http://www.cdpr.ca.gov/docs/risk/rcd/establishing_sulfuryl_fluoride.pdf).

Gosselin, P. 2007. Risk management directive for sulfuryl fluoride. Memorandum from P. Gosselin to J. Campbell, April 6, 2007. Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, CA, [http://www.cdpr.ca.gov/docs/whs/pdf/sulfuryl\\_fluoride\\_rmd\\_040607.pdf](http://www.cdpr.ca.gov/docs/whs/pdf/sulfuryl_fluoride_rmd_040607.pdf).

Stefanova-Wilbur, M. 2017. Summary of review of study 287400: Monitoring of sulfuryl fluoride and chloropicrin concentrations in ambient air around residential structures during a beetle rate fumigation, aeration and post-clearance. Health and Safety Memorandum HSM-17004, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, CA, <http://www.cdpr.ca.gov/docs/whs/memo/hsm17004.pdf>.

Approved by: *(original signed by Marylou Verder-Carlos)*  
Marylou Verder-Carlos, Assistant Director, Pesticide Programs Division

Approval date: *December 8, 2017*