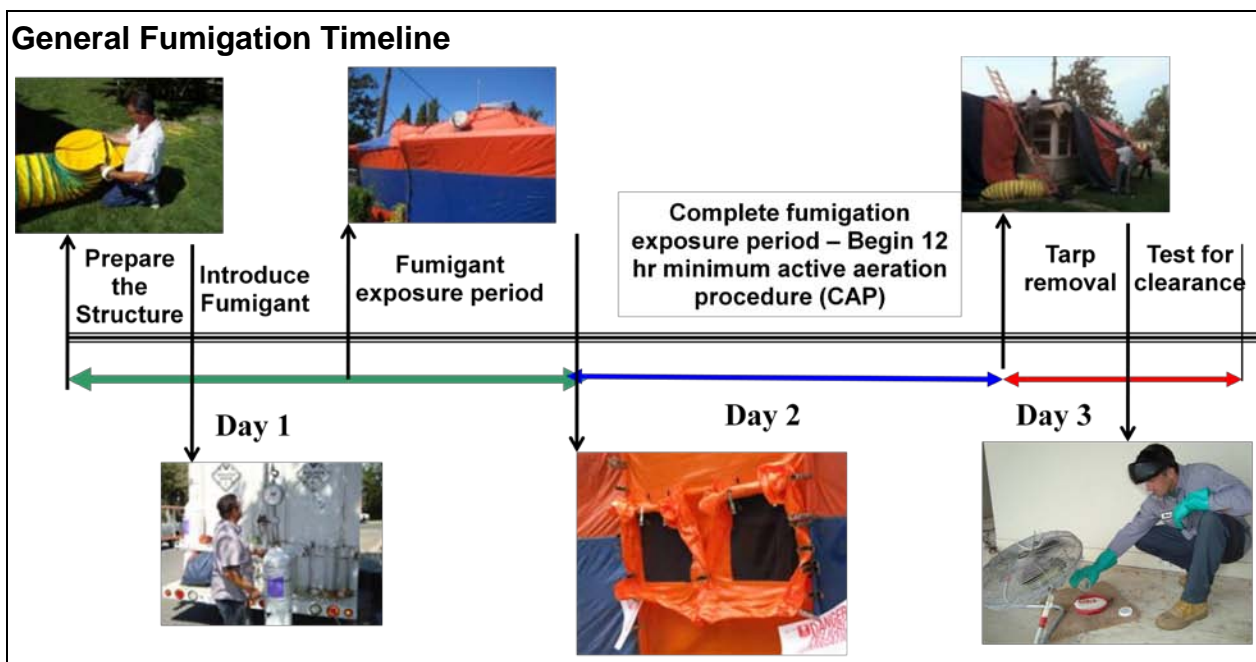




- *The Personal Chemical Exposure Program (PCEP) in the Department of Entomology conducts human and environmental studies intended to clarify and define important chemical exposure issues.*
- *Concepts in chemical exposure assessment related to our research include risk assessment, mitigation, perception and regulation.*

## Sulfuryl Fluoride Structural Fumigation Research

In September and October, 2010, Dr. Krieger and PCEP research assistants from the University of California, Riverside, monitored sulfuryl fluoride residential fumigations for the treatment and control of drywood termites at two typical, single-family residences in Riverside, CA. The fumigations were performed by commercial applicators. PCEP<sup>®</sup> monitoring was assisted by Dow AgroSciences scientists. Concentrations of Vikane<sup>®</sup> gas fumigant at standard commercial rates were measured to assess potential worker, resident and bystander sulfuryl fluoride exposure. The California Aeration Plan (CAP) was evaluated.



Interior and exterior fumigant concentrations of each residence were monitored during all stages of actual fumigations (fumigant introduction, exposure, and aeration). The major objectives of our monitoring study were the following: 1) to evaluate potential bystander (e.g. neighbor) exposure during the fumigation and aeration procedures, and, 2) to determine if the required California Aeration Plan (CAP) satisfies California and federal safety standards for re-occupancy following fumigation.



## Preparation

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Two Riverside, CA residences were fumigated with sulfuryl fluoride to treat and control drywood termites in September and October 2010. The fumigations were done by trained, licensed fumigators who followed product label and California regulations. Equipment including tarps, ladders, and fumigant cylinders are shown here.



The residences were tarped, fumigated at the labeled drywood termite control rate, and aerated by a licensed fumigator following product label requirements and state regulations.





For the California Aeration Plan (CAP), sealed ducting (1 and 2) attached to an aeration fan (3) inside the fumigated space and sealed inlet vents (4) were installed during the tenting process, before the fumigant was introduced.



A custom amount of fumigant, based on factors such as the target pest, building size, construction and environmental conditions, was accurately determined using a custom electronic calculator required by the fumigant label.



PCEP staff confirmed the building measurements and amount of sulfuryl fluoride required at each residence before introduction of fumigant.





## Introduction of Fumigant

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The warning agent, chloropicrin, was introduced into the building per label directions prior to the introduction of the fumigant sulfuryl fluoride. Chloropicrin at low levels of about 0.07 ppm causes eye irritation. Chloropicrin serves to warn of the presence of the odorless and colorless sulfuryl fluoride and is a deterrent to intruders. Chloropicrin is removed from the building with the sulfuryl fluoride during aeration.



The fumigant was weighed to introduce the prescribed amount into the fumigated space.





## Monitoring

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Interior and exterior fumigant concentrations were continuously monitored during the fumigant introduction, exposure, and aeration periods.



## Exterior Fumigant Concentration

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Exterior fumigant concentrations were continuously monitored at eight locations that were evenly spaced and close to the tarp. At each exterior sample location, a calibrated air pump attached to a stand continuously drew air into a gas-tight bag (air sample locations circled).



At timed intervals, the air bags were removed from the pumps and immediately replaced with clean, empty, gas-tight bags attached to the pumps to continue with uninterrupted air sampling. Fumigant concentration in each removed bag was measured using a sensitive gas monitor, the SF-ExplorIR, which can accurately measure sulfurly fluoride concentrations to 1 part per million (1 ppm).



The exterior fumigant concentrations of air sample intervals were used to determine the potential exposure of bystanders, such as neighbors, to the fumigant throughout the fumigation process. The potential acute exposure is called a “Time Weighted Average,” or TWA, and is based on a 24-hour exposure period.





## ***Interior Fumigant Concentration***

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Interior fumigant concentrations were measured by drawing air samples through hoses placed at three locations indoors using the following validated testing procedures.

An SF-ReportIR was used to measure interior fumigant concentrations during fumigation and initial aeration.



An RDA Fumiscope was also used to measure interior fumigant concentrations during fumigation and initial aeration.



## Aeration

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For the California Aeration Plan (CAP), aeration was initiated by unsealing the ducting (1) and screened inlet vents (2, 3). The airflow created by the aeration fan draws fresh air into screened inlet vents (4). Tarps remained on the houses during aeration as required by the CAP.



After aerating for at least 12 hours, as required by the California Aeration Plan, the tarpaulins were removed and the houses were tested for clearance.







## Conclusions

**Conclusion 1:** Air sampling showed that sulfuryl fluoride concentrations outside the fumigated residences were negligible throughout the fumigation and aeration periods. Possible worker and bystander exposures were well below the NOAEL (No Observed Adverse Effect Level) of the US EPA and California Department of Pesticide Regulation.

**Conclusion 2:** Fumigant concentrations decline rapidly during aeration. Interior air sampling (see graph below) showed that sulfuryl fluoride concentrations declined very rapidly during aeration using the California Aeration Plan (CAP). Fumigant concentrations were at or below the permissible exposure limit for occupants of 1 ppm established by the US EPA and California Department of Pesticide Regulation following the aeration time (minimum 12 hours) required by the CAP.

