

## Survey Approval

The undersigned have read and understood the methodology used to conduct the aforementioned Department of Pesticide Regulation methyl bromide survey before the initiation of the survey.

*[Original signed by Lisa Ross]*

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Lisa Ross  
Environmental Program Manager II  
Worker Health and Safety

*[Original signed on 7/30/14]*

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Date

*[Original signed by Saturnino Yanga]*

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Saturnino Yanga  
Environmental Program Manager I  
Worker Health and Safety

*[Original signed on 7/29/2014]*

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Date

*[Original signed by Harvard R. Fong]*

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Harvard R. Fong, CIH  
Study Director,  
Worker Health and Safety

*[Original signed on 7/29/2014]*

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Date

*[Original signed by Parissa Tehrani]*

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Parissa Tehrani  
Associate Industrial Hygienist  
Worker Health and Safety

*[Original signed on 7/30/14]*

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Date

**7/28/2014**

# **Survey of Ambient Air Levels of Sulfuryl Fluoride Near Fumigated Structures, Adjacent Structures and In Aerated Structures (Protocol A)**

**Project Number:**

Project 1402

**Test Substance:**

Structural fumigation formulations containing sulfuryl fluoride.

**Active Ingredient:**

Sulfuryl Fluoride (CAS # 2699-79-8).

**Test Locations:**

Primarily counties of San Diego, Los Angeles, and Orange.

**Study Director/ Primary Field Investigator:**

Harvard R. Fong, CIH  
Senior Industrial Hygienist  
California Department of Pesticide Regulation (DPR)  
Worker Health and Safety Branch (WH&S)  
1001 I Street  
Sacramento, CA 95812  
(916) 445-4211

**Alternate Field Investigators:**

Parissa Tehrani  
Associate Industrial Hygienist  
California Department of Pesticide Regulation  
Worker Health and Safety Branch  
1001 I Street  
Sacramento, CA 95812  
(916) 324-6174

**Field Testing Facilities:**

Various houses, under fumigation, located in California and homes adjacent to fumigated houses.

**Proposed Survey Start Date:**

July 2014

**Proposed Survey Termination Date:**

December 2014 or when 50 residential structures have been monitored to characterize sulfuryl fluoride offgassing through tarpaulins and internal residues within structures post-aeration.

**1. Title:**

Survey of Ambient Air Levels of Sulfuryl Fluoride Near Fumigated Structures, Adjacent Structures and In Aerated Structures

**2. Purpose:**

The purpose of this monitoring is to investigate air concentrations of sulfuryl fluoride during a structural fumigation. During the fumigation phase, air levels near fumigated structures may be affected by tarpaulin

permeation, integrity breaches and non-perfect tarpaulin-to-tarpaulin and tarpaulin-to-surface sealing. Monitoring of the near-perimeter will assist in characterizing such leakage. If possible, sulfur dioxide concentrations in adjacent structures will also be monitored. Finally, post-aeration sampling of the fumigated structure will be conducted when available. Given the variability in the layout of the structures that may be monitored, this protocol provides only general guidelines for monitoring. Investigators will have to assess each structure monitored and may have to make adjustments to the protocol to obtain the best possible data needed by the branch. These data will be used to characterize air levels of sulfur dioxide near fumigated structures during fumigation and to ascertain if further regulatory action or industry innovation is required. These data will also be communicated to representatives of the structural fumigation industry in a contemporaneous fashion to allow on-going modification of both structure wrapping procedures and fumigation/aeration protocols. This continuing assessment of both the containment and aeration effectiveness will allow for adjustment of subsequent fumigations, using information developed from completed fumigations to be potentially used in reducing leakage and post-aeration exposures in future fumigations.

### **3. Test System:**

#### *A. Types:*

Residential single family dwelling houses.

#### *B. Justification for Test Systems:*

Residential sites - typical of most structural fumigation. Anecdotal reports from one agricultural commissioner's office has informed DPR of measurable levels of fumigant, up to 20 ppm, at distances of one to two meters away from the tarpaulin surface. These have all been residential structures, which are numerically the greatest use of structural use sulfur dioxide.

### **4. GLP Compliance**

This study will not be in complete compliance with Good Laboratory Practice Standards but will follow WHS Standard Operating Procedures and the sampling guidelines of the OSHA Technical Manual (Jan 1999).

### **5. Quality Assurance:**

A calibrated real-time monitor will be used for sampling sulfur dioxide concentrations in the air. Survey forms (both new and used) and pre-publication reports will be made available to the WH&S QA staff for review.

### **6. Experimental Design:**

#### *A. Number of Test Sites:*

Residential sites: Up to fifty fumigated houses are to be monitored to characterize tarpaulin leakage and post-aeration residual levels of sulfur dioxide. Additionally, adjacent structures will also be monitored, if available. The number of adjacent structures that will be monitored is dependent on availability and willingness of home owners.

#### *B. Number of Sampling Locations at Each Test Site:*

Four: Initial fumigation perimeter walk; adjacent house interior/exterior sampling; aeration sampling; clearance/post-clearance interior sampling.

#### *C. Distances and Locations of Sampling:*

*Perimeter walk:* The investigator will be holding the monitoring device at approximately 1 meter from the ground (approximate breathing zone of small child) and 1 to 2 meters (closest reasonable approach distance of a bystander) from the structure, with distance from structure potentially variable if blockages or other impediments prevent maintaining the 1 to 2 meter distance. If, in the

judgment of the investigator, other distances or locations may yield important information, these variances will be noted. The investigator will walk around the perimeter of the fumigated structure one hour or more after introduction of fumigant, continuously monitoring for sulfuryl fluoride. This perimeter walk will be conducted hourly for the first 3 hours, data logging and identifying areas of leakage

*Adjacent house interior/exterior:* If access is granted to adjacent homes, samples will be drawn, if possible, from rooms located on the side facing the fumigated structure. These will be drawn, if available, both during fumigation and initial aeration. Additionally, if accessible air monitoring at the exterior wall of the monitored interior room will be conducted

*Aeration sampling:* During initiation of aeration, investigator will locate as near as feasible to aeration ducting and begin sampling, walking slowly away from the house and in a down-wind direction, to attempt to sample from any part of the fumigant plume touching down. The investigator will attempt to walk at least 50 meters down-wind of the aeration duct, and continue to sample for at least the first 15 minutes of aeration.

*Clearance/post-clearance:* Investigator will accompany applicator into house as part of initial, label required clearance (target value 1 ppm). Monitoring will be done with the ExploreIR in “diagnostic mode”. If access is available to the structure post-clearance (at least 4 hours post, with a maximum of 24 hours post), a walk-through air sampling of the main living area (e.g. bedroom, kitchen, living room, etc.) will be conducted, again in “diagnostic mode”, with results recorded manually.

**D. Application Rates:**

Typical of sulfuryl fluoride treatment ( up to 10 lbs. per 1,000 cubic feet)as determined by customary application rates published in the VIKANE APPLICATORS MANUAL.

**E. Type of Application:**

Tarpaulin-covered structural fumigation.

**F. Sampling Intervals:**

Not applicable

**G. Sampling Technique:**

An SF-ExplorIR real time monitoring device will be used to take samples of the air to measure the sulfuryl fluoride being emitted by the fumigated structure. This device, using an infrared spectrophotometer, can detect sulfuryl fluoride concentrations as low as 300 ppb. The monitoring unit is capable of data logging 200 data points, at minute intervals, and this capability will be used. Data logging only records values equal or greater than 1 ppm. All monitoring below 1 ppm (“diagnostic mode”) will require manual recording, on data sheets designed for this purpose, concentrations less than 1 ppm, noting location and any anomalies of the tarpaulin/wrap job. Diagnostic mode will be used primarily for clearance and post-clearance monitoring.

**H. Sampling Location and Duration**

Monitored structures will be throughout California, with most sampling expected to be in Los Angeles County, Orange County and San Diego County. Structures will be selected through cooperation with the various County Agricultural Commissioners offices and assistance from the Pest Control Operators of California (PCOC). Estimated sampling duration per structure is a minimum of 3 days.

**I. Sample Storage and Analysis**

Not applicable

**7. Weather Monitoring**

Ambient temperature and an estimate of the magnitude and direction of any wind will be noted at the time of sample collection using a Kestrel 4000.

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## **8. Statistical Method**

**None.**

## **9. Retention of Raw Data**

A. Study data will be archived in accordance with SOP WHS-AR02, Archiving Study Data.

B. Raw data from the study, either paper or electronic, (except raw data retained by the Chem Lab) will be maintained by WHS in accordance with SOP WHS-AR02, Archiving Study Data.. All WHS correspondence pertaining to the study, including phone logs, e-mails, letters, memos, etc., will be considered raw data. Photographs do not constitute raw data.

## **10. Other Data Collection**

Photographic evidence of each structure monitored will be collected. This evidence will include, but is not limited to, whole site photo, detail photos, especially to document any tarpaulin breaches or evidence of integrity loss (i.e. excess wear, taping of tears, etc.).

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# Sampling Checklist

## Pre-Fumigation

- Collect fumigation information from applicator
- Scout site for potential wrap problems and access restrictions, sketch structure perimeter for mapping of leakage points
- Contact neighboring houses to secure access during fumigation/aeration

## Fumigation

- Monitor structure exterior > 1 hour after completion of fumigation (photos of leakage points)
- Monitor structure exterior 2 more cycles after initial monitoring, with minimum of 1 hour between each cycle
- Monitor neighboring house(s) if available, preferably after 2<sup>nd</sup> monitoring cycle (use “diagnostic mode”)

## Aeration

- At initiation of aeration, begin walk along plume sampling, starting at approximately 1 meter from duct and traveling away from structure, down-wind for approximately 100 meters (conditions permitting), then return. Continue oscillation walk-sampling for 30 minutes.
- Monitor neighboring house(s) if available after 30 minutes of aeration (use “diagnostic mode”)

## Clearance

- Co-clear structure with applicator (use “diagnostic mode”)
  - Reenter structure 4 hours after structure cleared and closed (use “diagnostic mode”).
  - Reenter structure 24 hours after structure cleared and closed (use “diagnostic mode”).
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## Survey Approval

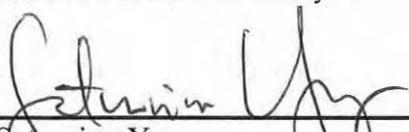
The undersigned have read and understood the methodology used to conduct the aforementioned Department of Pesticide Regulation methyl bromide survey before the initiation of the survey.



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Lisa Ross  
Environmental Program Manager II  
Worker Health and Safety

7/30/14

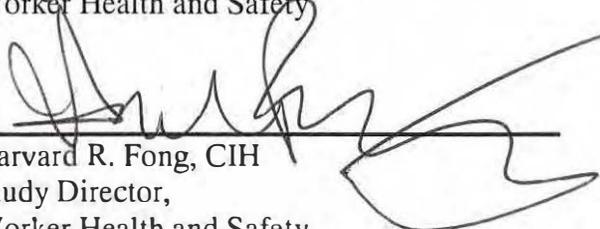
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Date



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Saturnino Yanga  
Environmental Program Manager I  
Worker Health and Safety

7/29/2014

\_\_\_\_\_  
Date



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Harvard R. Fong, CIH  
Study Director,  
Worker Health and Safety

7/29/2014

\_\_\_\_\_  
Date



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Parissa Tehrani  
Associate Industrial Hygienist  
Worker Health and Safety

7/30/14

\_\_\_\_\_  
Date

**7/28/2014**

# **Survey of Ambient Air Levels of Sulfuryl Fluoride Within Structures Under Fumigation, Near Fumigated Structures, In Adjacent Structures And In Aerated Structures (Protocol B)**

**Project Number:**

Project 1402

**Test Substance:**

Structural fumigation formulations containing sulfuryl fluoride.

**Active Ingredient:**

Sulfuryl Fluoride (CAS # 2699-79-8).

**Test Locations:**

Primarily counties of San Diego, Los Angeles, and Orange.

**Study Director/ Primary Field Investigator:**

Harvard R. Fong, CIH  
Senior Industrial Hygienist  
California Department of Pesticide Regulation (DPR)  
Worker Health and Safety Branch (WH&S)  
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**Alternate Field Investigators:**

Parissa Tehrani  
Associate Industrial Hygienist  
California Department of Pesticide Regulation  
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1001 I Street  
Sacramento, CA 95812  
(916) 324-6174

**Field Testing Facilities:**

Various houses, under fumigation, located in California and homes adjacent to fumigated houses.

**Proposed Survey Start Date:**

July 2014

**Proposed Survey Termination Date:**

December 2014 or when 50 residential structures have been monitored to characterize sulfuryl fluoride offgassing through tarpaulins and internal residues within structures post-aeration.

**1. Title:**



# Survey of Ambient Air Levels of Sulfuryl Fluoride Within Structures Under Fumigation, Near Fumigated Structures, In Adjacent Structures and In Aerated Structures

## 2. Purpose:

The purpose of this monitoring is to investigate air concentrations of sulfuryl fluoride during a structural fumigation. During the fumigation phase, air levels near fumigated structures may be affected by tarpaulin permeation, integrity breaches and non-perfect tarpaulin-to-tarpaulin and tarpaulin-to-surface sealing. Monitoring of the near-perimeter will assist in characterizing such leakage. Monitoring of the interior during the fumigation and aeration phases will assist in understanding and potentially developing a model for passive fumigant loss and active aeration removal. If possible, sulfuryl fluoride concentrations in adjacent structures will also be monitored. Finally, post-aeration sampling of the fumigated structure will be conducted when available. Given the variability in the layout of the structures that may be monitored, this protocol provides only general guidelines for monitoring. Investigators will have to assess each structure monitored and may have to make adjustments to the protocol to obtain the best possible data needed by the branch. These data will be used to characterize air levels of sulfuryl fluoride near fumigated structures during fumigation and to ascertain if further regulatory action or industry innovation is required. These data will also be communicated to representatives of the structural fumigation industry in a contemporaneous fashion to allow on-going modification of both structure wrapping procedures and fumigation/aeration protocols. This continuing assessment of both the containment and aeration effectiveness will allow for adjustment of subsequent fumigations, using information developed from completed fumigations to be potentially used in reducing leakage and post-aeration exposures in future fumigations.

## 3. Test System:

### A. Types:

Residential single family dwelling houses.

### B. Justification for Test Systems:

Residential sites - typical of most structural fumigation. Anecdotal reports from one agricultural commissioner's office has informed DPR of measurable levels of fumigant, up to 20 ppm, at distances of one to two meters away from the tarpaulin surface. These have all been residential structures, which are numerically the greatest use of structural use sulfuryl fluoride.

## 4. GLP Compliance

This study will not be in complete compliance with Good Laboratory Practice Standards but will follow WHS Standard Operating Procedures and the sampling guidelines of the OSHA Technical Manual (Jan 1999).

## 5. Quality Assurance:

Calibrated real-time monitors will be used for sampling sulfuryl fluoride concentrations in the air. Survey forms (both new and used) and pre-publication reports will be made available to the WH&S QA staff for review.

## 6. Experimental Design:

### A. Number of Test Sites:

Residential sites: Up to fifty fumigated houses are to be monitored to characterize tarpaulin leakage and post-aeration residual levels of sulfuryl fluoride. Additionally, adjacent structures will also be

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monitored, if available. The number of adjacent structures that will be monitored is dependent on availability and willingness of home owners.

***B. Number of Sampling Locations at Each Test Site:***

Five Aggregating Sites: The investigators will walk around the perimeter of the fumigated structure, continuously monitoring for sulfuryl fluoride, using an ExplorIR (Site One). Air sampling intakes for a non-portable multiport Low Range (1 to 100 ppm) SF detector will be located as required around the perimeter of the structure (Site Two). Fumigant levels within the structure during both the fumigation and aeration phases will be monitored by an external non-portable multiport High Range (250 to 75,000 ppm) SF monitoring unit (Site Three). Post-clearance (Site Four) and adjacent structure monitoring, when available, (Site Five) will also use the ExplorIR.

***C. Distances and Locations of Sampling:***

*Perimeter walk:* The investigator will be holding the monitoring device at approximately 1 meter from the ground (approximate breathing zone of small child) and 1 to 2 meters (closest reasonable approach distance of a bystander) from the structure, with distance from structure potentially variable if blockages or other impediments prevent maintaining the 1 to 2 meter distance. If, in the judgment of the investigator, other distances or locations may yield important information, these variances will be noted. The investigator will walk around the perimeter of the fumigated structure one hour or more after introduction of fumigant, continuously monitoring for sulfuryl fluoride. This perimeter walk will be conducted hourly for the first 3 hours, data logging and identifying areas of leakage.

*Exterior Fumigated Structure:* Intakes for the Low Range multiport will be located around the structure, approximately 1 meter from the tarp surface, unless being deployed at leak locations identified by the portable detector, in which case the intake will be moved as close as 30 cm to the suspected leakage site. Likewise, if the exterior sampling is to be compared to a simultaneous interspace air sample from under the tarp, the intake for the exterior unit will be within 30 cm, directly opposite (as can be accomplished) the interior High Range sampling intake.

*Interior Fumigated Structure:* Inlet lines to the exterior located real-time monitor will be positioned in the room where the fumigant injection line is placed, in an adjoining room without an injection line, in an accessible interspace (area between structure and tarpaulins) and one will be deployed as available and at the discretion of the IH on site.

*Adjacent house interior/exterior:* If access is granted to adjacent homes, samples will be drawn, if possible, from rooms located on the side facing the fumigated structure. These will be drawn, if available, both during fumigation and initial aeration. Additionally, if accessible air monitoring at the exterior wall of the monitored interior room will be conducted

*Aeration sampling:* During initiation of aeration, investigator will locate as near as feasible to aeration ducting and begin sampling, walking slowly away from the house and in a down-wind direction, to attempt to sample from any part of the fumigant plume touching down. The investigator will attempt to walk at least 50 meters down-wind of the aeration duct, and continue to sample for at least the first 15 minutes of aeration.

If possible, previous to the commencement of aeration, the SF-400 Low Range intakes will be removed from the perimeter of the structure and placed at an appropriate distance downwind of the aeration stack to monitor potential plume touchdown. This monitoring will continue until all monitoring intakes report 0 ppm for 5 minutes.

*Clearance/post-clearance:* Investigator will accompany applicator into house as part of initial, label required clearance (target value 1 ppm). Monitoring will be done with the ExploreIR in “diagnostic mode”. If access is available to the structure post-clearance (at least 4 hours post, with a maximum of 24 hours post), a walk-through air sampling of the main living area (e.g. bedroom, kitchen, living room, etc.) will be conducted, again in “diagnostic mode”, with results recorded manually.

***D. Application Rates:***

Typical of sulfuryl fluoride treatment ( up to 10 lbs. per 1,000 cubic feet) as determined by customary application rates published in the VIKANE APPLICATORS MANUAL.

***E. Type of Application:***

Tarpaulin-covered structural fumigation.

***F. Sampling Intervals:***

Not applicable

***G. Sampling Technique:***

An SF-ExplorIR real time monitoring device will be used to take samples of the air to measure the sulfuryl fluoride being emitted by the fumigated structure. This device, using an infrared spectrophotometer, can detect sulfuryl fluoride concentrations as low as 300 ppb. The monitoring unit is capable of data logging 200 data points, at minute intervals, and this capability will be used. Data logging only records values equal or greater than 1 ppm. All monitoring below 1 ppm (“diagnostic mode”) will require manual recording, on data sheets designed for this purpose, concentrations less than 1 ppm, noting location and any anomalies of the tarpaulin/wrap job. Diagnostic mode will be used primarily for clearance and post-clearance monitoring.

The SF-400 Low Range multiport sampling device (Spectros Instruments) will be used to collect real-time air samples from around the exterior of the fumigated structure during fumigation and also downwind during initial aeration.

The SF-400 High Range multiport sampling device (Spectros Instruments) will be used to collect real-time air samples from the interior of the tarped fumigation.

#### ***H. Sampling Location and Duration***

Monitored structures will be throughout California, with most sampling expected to be in Los Angeles County, Orange County and San Diego County. Structures will be selected through cooperation with the various County Agricultural Commissioners offices and assistance from the Pest Control Operators of California (PCOC). Estimated sampling duration per structure is a minimum of 4 days.

#### ***I. Sample Storage and Analysis***

Not applicable

#### **7. Weather Monitoring**

Ambient temperature and an estimate of the magnitude and direction of any wind will be noted at the time of sample collection using a Kestrel 4000.

#### **8. Statistical Method**

None.

#### **9. Retention of Raw Data**

A. Study data will be archived in accordance with SOP WHS-AR02, Archiving Study Data.

B. Raw data from the study, either paper or electronic, (except raw data retained by the Chem Lab) will be maintained by WHS in accordance with SOP WHS-AR02, Archiving Study Data.. All WHS correspondence pertaining to the study, including phone logs, e-mails, letters, memos, etc., will be considered raw data. Photographs do not constitute raw data.

#### **10. Other Data Collection**

Photographic evidence of each structure monitored will be collected. This evidence will include, but is not limited to, whole site photo, detail photos, especially to document any tarpaulin breaches or evidence of integrity loss (i.e. excess wear, taping of tears, etc.).

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# Sampling Checklist

## Pre-Fumigation

- Collect fumigation information from applicator
- Scout site for potential wrap problems and access restrictions, sketch structure perimeter for mapping of leakage points
- Contact neighboring houses to secure access during fumigation/aeration
- Place intakes for interior sampling with SF-400 High Range

## Fumigation

- Place intakes for exterior sampling with SF-400 Low Range
- Monitor structure exterior > 1 hour after completion of fumigation (photos of leakage points)
- Monitor structure exterior 2 more cycles after initial monitoring, with minimum of 1 hour between each cycle
- Monitor neighboring house(s) if available, preferably after 2<sup>nd</sup> monitoring cycle (use “diagnostic mode”)

## Aeration

- Redeploy intakes for downwind sampling with SF-400 Low Range
- At initiation of aeration, begin walk along plume sampling, starting at approximately 1 meter from duct and traveling away from structure, down-wind for approximately 100 meters (conditions permitting), then return. Continue oscillation walk-sampling for 30 minutes.
- Monitor neighboring house(s) if available after 30 minutes of aeration (use “diagnostic mode”)

## Clearance

- Co-clear structure with applicator (use “diagnostic mode”)
  - Reenter structure 4 hours after structure cleared and closed (use “diagnostic mode”).
  - Reenter structure 24 hours after structure cleared and closed (use “diagnostic mode”).
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**7/28/2014**