O. METHYL BROMIDE SOIL FUMIGATION WITHIN A GREENHOUSE

Definitions

Application includes treatment and aeration; it is complete when each application block has been aerated.

Application block is the actual area within a greenhouse that will be fumigated in any 24-hour period. The application block cannot exceed 50,000 square feet. The maximum square footage may be reduced due to the distance to an occupied structure, previously fumigation application blocks, future greenhouse fumigations, and adjacent workers.

Application rate, in pounds/acre, is equal to the amount of methyl bromide (active ingredient) in the formulated product.

Application site is the treatment area within a greenhouse which may be comprised of more than one application block.

Buffer zone is the area that must be maintained between the application block and those places where people conduct certain activities or practices. Buffer zones are in effect until the tarp has been removed and aeration is complete. For greenhouse soil fumigations, the two types of zones to be considered are:

1. **Resident Buffer Zone** is the area surrounding an application block outside of which people may "dwell." See the definition: dwell.

2. **Worker Buffer Zone** is the area surrounding an application block outside of which people may "work or occupy." See the definition: work or occupy.

The **buffer zone duration** for an application block begins at the start of fumigation and ends 48 hours after the tarpaulin has been removed, when aeration is considered complete. The length of this period depends upon the timing and method of tarp removal.

Dwell means that a person is able to or will occupy a structure for any or all parts of a 24-hour period. This includes, but is not limited to: homes, hospitals, convalescent homes, boarding schools, day schools, parks, hotels, apartment complexes, and other sensitive areas.

Frequency of applications refers to the interval of time elapsed from the beginning of the application of methyl bromide at one application block to the beginning of the application of methyl bromide at another application block.

An **isolated block** is one that is 1,300 feet or more from another greenhouse soil fumigation **or** at least 48 hours has elapsed, or will elapse, before another greenhouse soil fumigation is conducted.

A **non-isolated block** is one that is less than 1,300 feet from another greenhouse soil fumigation **and** less than 48 hours have elapsed, or will elapse, before another greenhouse soil fumigation is conducted.

Pesticide Handler includes employees involved in fumigation, aeration activities, tarp repair, and tarp removal **prior** to the completion of aeration.

Work or occupy means that a person is able to or will be at a place for **eight hours or less**. This includes, but is not limited to: fields, offices, warehouses, stores, malls, factories, greenhouses, packing sheds, and workshops

Worker Safety Requirements

Restricted Entry and Warning Sign Posting Requirements

1. As a condition of the permit, warning signs shall be posted around the application block for the duration of the restricted entry interval. Refer to 3 CCR section 6776(b) for the requirements.

2. The restricted entry interval for an application block begins at the start of fumigation and ends when aeration is complete.

3. Aeration is considered complete 48 hours after the tarp has been removed and when the requirements listed in Section VIII, Tarpaulin and Soil Aeration Procedures have been met.

   For example, if the tarp is removed from the application block after three days (the minimum required fumigation time) and the soil is aerated for two days (minimum aeration time), then the restricted entry interval lasts for five days from the start of fumigation.

4. Fieldworkers shall not be allowed to enter an application block to perform cultural activities until the restricted entry interval has elapsed and warning signs have been removed.

5. Title 3 of the California Code of Regulations section 6782(c), covering fumigation of enclosed spaces, requires that warning signs be posted on or near all greenhouse entrances until fumigation and ventilation are complete and the premises are safe for reentering. Refer to section 6782(c) for the warning sign requirements.

Pesticide Handler and Field Worker Requirements

1. The employer must maintain use records for all employees involved in application, tarp repair, and tarp removal activities. The record shall identify the person, work activity(ies), date(s), duration of handling, U.S. Environmental Protection Agency Registration Number, and brand name of the methyl bromide product handled.

2. The employer must maintain these use records at a central location for two years and make them available to the county agricultural commissioner upon request for review.

Tarpaulin Repair

1. The decision to conduct tarp repair must be made by a certified applicator (the permittee, the permittee's authorized representative, or the pest control operator) on a job-by-job basis. The decision should be based on, but not limited to, hazard to the public, residents, or workers; size of the damaged area(s); timing of damage; and feasibility of repair.

2. Title 3, California Code of Regulations section 6780 requires the use of approved respiratory protective equipment if the concentration of methyl bromide cannot be controlled and an employee's exposure would exceed 5 ppm. Areas to be repaired must be tested by the certified applicator, using an appropriate testing device, and shown to have less than 5 ppm of methyl bromide in the projected work areas before unprotected employees are allowed to enter to conduct tarp repair. The certified applicator must wear approved respiratory protective equipment when conducting these tests.

Workers in Adjacent Sites

1. The property operator and/or pest control operator must be aware of adjacent sites where activity is likely while the Worker Buffer Zone is in effect, following the start of the application. They must ensure that the adjacent property operators are advised, prior to the fumigation, to keep their workers outside of the Worker Buffer Zone during that period of time.

2. The property operator and/or pest control operator may give notice to adjoining property operators verbally or in writing.

3. If entry occurs as the result of a failure to be aware of worker activity and subsequent failure to advise adjacent property operators to keep workers out, the operator of the property fumigated and the person performing pest control are in violation of the methyl bromide permit conditions.

Application Requirements

1. **Soil injections using tractor-drawn chisels or similar devices are prohibited within a greenhouse.**

2. All soil application of methyl bromide within a greenhouse shall comply with the raised tarp fumigation methods specified on the registered pesticide label. **All delivery tubes shall be anchored in place under the tarp and shall not be moved during the application of methyl bromide**. Follow the manufacturer's recommendations for application tubing.

3. The fumigant must be introduced from outside of the greenhouse. If entry into the greenhouse enclosure is required to perform a function necessary for the application, a Self-Contained Breathing Apparatus must be worn.

4. All fittings, connections, and valves must be checked for methyl bromide leaks prior to fumigation. If cylinders are replaced during the fumigation process, the connections and valves must be checked for leaks prior to continuing the job.

5. Only the tarpaulins listed on the approved manufacturers list are to be used. (See Section IX, List of Manufacturers of High Barrier Approved Tarpaulins.) They have been determined to meet or exceed the following standards for a "high barrier" tarpaulin: a permeability factor of less than eight millimeters methyl bromide per hour, per square meter, per 1,000 ppm of methyl bromide under the tarpaulin at 30 degrees Celsius. Polyethylene tarp of six-mil thickness or greater meets these criteria.

6. A **maximum of 450 pounds** of methyl bromide (active ingredient) per acre is allowed.

7. A **maximum aggregate of 50,000 square feet** will be allowed in a 48-hour period.

8. All greenhouse fumigations must be isolated from all other types of methyl bromide fumigations.

9. When a school property, Kindergarten through 12th grade, is within 1/4 mile (1320 feet) of a fumigation block, the injection must be completed 36 hours prior to the start of a school session. School sessions are those times when students are attending scheduled classes.

Buffer Zone Determination

1. A buffer zone is the area surrounding an application block **outside** of which certain activities or practices are allowed. The buffer zone is in effect until the tarp has been removed and aeration is complete (See Section VIII, Tarp Removal). The size of the buffer zone will be determined by the proposed size of the application block and the application rate. The buffer zone surrounding an application block may have to be modified due to the proximity to occupied structures, distance to adjacent workers, and nearness to completed or proposed greenhouse fumigations.

2. The buffer zone is partitioned into the Resident Buffer Zone and the Worker Buffer Zone. The size of the Resident Buffer Zone is based on the assumption that a person may "dwell" at a place for any or all parts of a **24 hour-period**. The size of the Worker Buffer Zone is based on the assumption that people work or recreate at a place for **eight hours or less**.

3. Transit through the Worker Buffer Zone by the permittee's employees is limited to infrequent and unavoidable trips. Routine or repeated transit through this buffer zone is prohibited.

4. The buffer zones begin at the edges of the treated piles and extend in all directions regardless of buildings or property boundaries.

5. Procedures: Isolated Blocks

    a. To determine the **Resident Buffer Zone** surrounding an isolated block, use the application rate and the area of the application block and apply these values to Table 1.

    b. To determine the **Worker Buffer Zone** surrounding an isolated block, first divide the application rate by **three**. Then, using the adjusted application rate and the area of the application block, apply these values to Table 1.

6. Procedures: Non-Isolated Blocks

    a. Determine the highest application rate for all application blocks within 1,300 feet.

    b. Compute the sum of the areas, in square feet, of the block to be evaluated and the next largest block within 1,300 feet.

    c. To determine the **Resident Buffer Zone**, use the highest application rate and the sum of the application block areas and apply these values to Table 1.

    d. To determine the **Worker Buffer Zone**, divide the highest application rate by **three**. Use the adjusted application rate and the sum of the application block areas and apply these values to Table 1.

    e. If there are only two non-isolated application blocks, then the buffer zones determined above will be the same for each block.

If there are more than two non-isolated blocks, then each pair of blocks, the one under evaluation and the next largest, will have to be considered individually. This may result in each block having different buffer zones even though they are not isolated from the others.

Buffer Zone Duration

1. The Resident and Worker Buffer Zones that surround an application block are in effect *from the start of the fumigation* until aeration is complete. Aeration is considered complete **after** the tarp has been removed **and** 48 hours have elapsed since tarp removal was completed. See Section VIII, Tarp Removal.

   For example: the tarp was removed three days (minimum time allowed) after the fumigation was completed and the block was allowed to aerate for the required 48 hours following tarp removal. The buffer zone would be in effect for five days from the start of fumigation in an application block.

2. Determine the proposed Resident Buffer Zone by measuring the distance between the edge of the application block and the **edge of the property line**, not the physical structure associated with the property. This includes places where people are occupying.

   People are not allowed to "dwell" within the Resident Buffer Zone. Residences within the buffer zone **must** be vacated while the buffer zone is in effect. If the resident(s) cannot or will not vacate the building(s), then the property operator must decrease the acreage to be treated or the rate of methyl bromide to be used so that the building lies outside of the buffer zone.

3. If there is an occupied commercial building or workers within the proposed Worker Buffer Zone and the workers were unable to vacate the premises, then the application must either be rescheduled to coincide with the worker's day off or the acreage/rate must be decreased to reduce the buffer zone.

4. If there is a recreational area within the Worker Buffer Zone where people are expected to spend large amounts of time, the application must be rescheduled or amended to accommodate this activity. If the people are just walking, bicycling, or driving through the area without stopping, the application does not need to be changed.

5. This requirement applies to all persons, including the property operator.

6. If the application is stopped due to weather or breakdowns, then the buffer zone duration starts over at the beginning of the next day's application

Notice of Intent Modification

1. The county agricultural commissioner must receive a Notice of Intent at least 96 hours prior to commencement of fumigation of any application block with methyl bromide for a greenhouse soil fumigation. The Notice of Intent must indicate the day and the hour the application is intended to commence.

2. Unless a waiver is granted by the county agricultural commissioner, fumigation of any application block must not commence sooner than the starting time indicated on the Notice of Intent. Nor, must the fumigation commence later than 12 hours after the intended starting time submitted with the Notice of Intent. If fumigation of an application block does not commence within this time frame, a new Notice of

Intent must be submitted, but no 24-hour waiting period is required unless notified by the county agricultural commissioner.

3. For multiple application blocks to be fumigated sequentially, the county agricultural commissioner may allow a Notice of Intent with a "schedule" to be submitted in lieu of a Notice of Intent for each application block to be fumigated. The schedule must include a map and must specify the date and time each application block is intended to be fumigated.

4. The 24-hour Notice of Intent waiting period may be waived if the county agricultural commissioner determines that effective pest control cannot be attained otherwise, or, 24 hours are not necessary to adequately evaluate the intended application.

5. The reasons for granting each waiver must be documented and a record maintained by the county agricultural commissioner.

6. The operator of the property to be treated and the person performing pest control, if different, must be aware of adjacent sites where there is a reasonable possibility of **work activity** occurring while the **Worker Buffer Zone is in effect**, and must ensure that operators of those adjacent properties are advised to keep fieldworkers out of those areas during that period of time.

Greenhouse Reentry Requirements

1. If the greenhouse is **not enclosed**, the air monitoring requirements listed in this section may be waived. This determination should be based on the size and number of openings in the greenhouse, length of time the greenhouse will remain open, local wind conditions, the proximity to obstructions, the application rate, and the size of the fumigation. Other parameters may apply according to the specific situation. If only doors and vents are opened (regardless of ventilation), the greenhouse should be considered **enclosed**.

2. Entry by any person, other than a trained and protected pesticide handler into an **enclosed** greenhouse, is **prohibited** from the start of application until 48 hours after application AND the air concentration has been measured and found to be less than 5 ppm in the working area(s).

3. Entry by any person, other than a trained and protected pesticide handler, is **prohibited** for 24 hours following the start of aeration (tarp cutting, tarp removal, breaking seals). Note: 3 CCR section 6782(d) **prohibits** the release of a fumigant into an enclosed, occupied work area.

4. Entry into an enclosed greenhouse by unprotected workers, when not prohibited above, will be allowed only after air monitoring is conducted according to the protocol listed in Appendix 1. Work time restrictions will be based on the air monitoring test results. Air monitoring and entry restrictions will continue until aeration is complete.

5. The permittee shall prohibit all work activities within the Worker Buffer Zone surrounding a fumigated application block. The Worker Buffer Zone is in effect until soil aeration is complete. This prohibition shall be in effect for all greenhouse types, whether enclosed or open.

6. If the Worker Buffer Zone extends into adjacent greenhouses, workers may occupy those areas within the adjacent greenhouse that are outside of the Worker Buffer Zone without additional air monitoring or restriction.

7. A Self-Contained Breathing Apparatus shall be worn when entry into an enclosed greenhouse is required during the time periods listed in VII-B and VII-C. A Self-Contained Breathing Apparatus shall be worn when entry into a Worker Buffer Zone and/or the application block is required before aeration is complete regardless of greenhouse type (enclosed or open).

8. If the greenhouse is enclosed, the measured airborne levels of methyl bromide must be less than 1 ppm **and** soil aeration must be complete before unrestricted entry into all areas of the greenhouse is permitted.

   If the greenhouse is not enclosed, then soil aeration must be complete before unrestricted entry is permitted.

Tarpaulin Removal and Soil Aeration Procedures

1. The tarpaulin must remain on the application block for at least three days (72 hours) following the application.

2. A Self-Contained Breathing Apparatus **shall** be used while the tarpaulin is being removed (without aeration), slit, or while breaking soil-to-tarp or tarp-to-tarp seals.

3. If the tarp is slit or the seals broken, rather than being completely removed, the treated area shall be aerated for a minimum of one day (24 hours) after finishing this activity.

   The tarpaulin may be removed, without using a Self-Contained Breathing Apparatus, only after the aeration period is complete and air monitoring has been done according to the requirements listed in Appendix I. The same limitations listed in Appendix I apply to persons engaged in tarp removal.

4. The soil must remain undisturbed for a minimum of two days (48 hours) after the tarpaulin has been completely removed. When this time period has elapsed and air levels have been tested and shown to be less than 1 ppm methyl bromide (as required in Section VII-H), then the restricted entry interval and buffer zone periods are over.

List of Manufacturers of High Barrier Approved Tarpaulins

1. The current list of approved tarpaulins is available at DPR's web site at: http://www.cdpr.ca.gov/docs/emon/methbrom/tarps.pdf

Buffer Zones (feet) for Greenhouse Applications of Methyl Bromide

1. There are two steps in determining the appropriate size of the Resident and Worker Buffer Zones for an application block. First, determine if the block is isolated or not; refer to the definitions in Section I.

   To determine the size of the Resident Buffer Zone, select the appropriate number of square feet in the left-hand column. Then, select the application rate (pounds/acre) from the top row. The Resident Buffer Zone is the value where the square foot row and the rate column intersect. To determine the Worker Buffer Zone, divide the application rate by three and follow the instructions for the Resident Buffer Zone.

Area Treated (Round up)		Application Rate: Pounds Per Acre (Round up to next highest value)											
Square feet	Acres	175	200	225	250	275	300	325	350	375	400	425	450
5,000	0.11	20	20	20	20	20	20	20	20	20	25	25	30
10,000	0.23	20	20	20	25	25	30	35	40	45	50	55	60
15,000	0.34	20	20	25	30	40	50	55	65	70	80	90	95
20,000	0.46	20	20	30	40	50	60	75	85	95	105	115	125
25,000	0.57	20	25	40	50	60	75	85	100	115	125	140	155
30,000	0.69	20	30	45	60	70	85	105	115	135	150	165	180
35,000	0.80	20	30	50	65	80	95	115	135	150	165	180	200
40,000	0.92	20	35	55	70	90	105	125	145	165	180	200	220
45,000	1.03	20	40	60	75	95	115	140	160	180	200	220	240
50,000	1.15	25	40	60	85	105	125	150	175	190	215	235	260

Testing Procedure

1. If more than two hours have elapsed since the last test, then a Self-Contained Breathing Apparatus must be worn or testing must be performed remotely.

2. Air monitoring must be performed within the work area where concentrations are assumed to be the highest. The test location(s) will depend on the proximity of people to the application block and the ventilation patterns within the enclosed greenhouse. If the work location is not known or changes over time, several locations need to be tested.

3. The first test must be performed shortly before each work shift and before any people are allowed to enter the greenhouse.

4. The air monitoring results will determine the length of time people will be allowed within the enclosed greenhouse. Work time is the cumulative amount of time a person spends within the greenhouse. It does not include time spent outside of the greenhouse.

   Use the following work and testing schedule for each work shift. If the work shift will be longer than two hours, then subsequent tests are required. If they show higher concentrations than the initial test, then the work schedule must be adjusted to the new concentration. For example: the first test shows 1 ppm methyl bromide in the work area. People may occupy that area for up to four hours, providing a second test is performed after two hours. If the second test shows that the level of methyl bromide has risen to 3 ppm, then the people must be removed from the work area because according to the chart, they are allowed two hours of exposure at that level of methyl bromide.

Suggested Table for Time Restrictions: Colorimetric Tube Monitoring Maximum

Maximum PPM Allowed Per Test Required	Work Time Restriction (Per 24 hours)	Colorimetric Tube	Tests Required
5 ppm	1 hour	5 ppm or less	initial test
3 ppm	2 hours	3 ppm or less	initial test
1 ppm	4 hours	1 ppm or less	initial test, repeat at 2 hours
ND*	8 hours	0.5 ppm or less	initial test, repeat every 2 hours

*ND – no detectable amount

Suggested Table for Time Restrictions: Real-time Monitoring Restriction

Restriction (Per 24 hours)	Real-time Monitoring Results	Restriction (Per 24 hours)	Real-time Monitoring Results
1 hour	2.6 to 5 ppm	6 hours	0.72 to 0.83
2 hours	1.67 to 2.50	7 hours	0.64 to 0.71
3 hours	1.27 to 1.66	8 hours	ND to 0.63 ppm
4 hours	1.10 to 1.26	Unlimited	<0.5 ppm (ND*)
5 hours	0.84 to 1.09		

*ND – no detectable amount

5. Testing and work time restrictions continue until the end of soil aeration and air monitoring within the greenhouse shows that airborne levels of methyl bromide are less than 1 ppm. Testing may be discontinued, prior to completion of aeration, if no further work will take place within the greenhouse.

6. Employers must maintain records of the air monitoring results. The record must include, at least, the date/time of fumigation and air monitoring; person performing the test(s); greenhouse site identification; location of the fumigation within the greenhouse; location(s) of the air monitoring test(s); colorimetric tube model number and detection limit; and the colorimetric tube reading(s). The information may be recorded on the following form. These records must be made available to employees upon request.

Greenhouse Site Identification			
Fumigation Location			
Application Block Size			
Rate of Methyl Bromide			
Date/Time Start of Fumigation			
Date/Time Start of Aeration			
Person Performing Test(s)			
Date/Time of Test(s)			
Test Location(s)			
Test Results (ppm)			
Colorimetric Tube Model No.			
Colorimetric Tube Detection Limit			
Comments			

Air Monitoring Equipment

1. There are different methods available for air monitoring. These include colorimetric detector tubes (e.g., National Draeger, Sensidyne, Matheson-Kitagawa, MSA) and real time remote sensing monitors (e.g., PureAire Monitoring Systems**). NOTE: These air monitoring methods apply to enclosed areas, including greenhouse soil fumigation and commodity fumigation.**

   Colorimetric detector tubes (approximately ¼" X 6") produce a color change when methyl bromide is present. The length of this color change indicates the methyl bromide concentration. A specific pump must be used with these tubes; both must be purchased from the same manufacturer. The (upper and lower) detection limits of these tubes vary with manufacturer and model.

   Select the tube model which best fits your needs; contact the test equipment manufacturer. The choice of detector tube is in part determined by the duration of exposure. If short-term access (less than one hour) is necessary, a detector tube that measures to 5 ppm would be adequate. To determine entry for longer times or to document that control methods are adequate, a detector tube that measures to a lower detection limit would be appropriate.

   A real-time remote sensing monitor could be used as a continuous monitor for methyl bromide concentrations in fumigation chamber control rooms, commodity storage facilities, commodity chilling rooms, and other processing and storage areas where methyl bromide-treated commodities may be present. Areas monitored by this type system, or its equivalent, should not require colorimetric tube sampling.

   A real-time monitoring system, equipped with remote sensors or sensor intake ports capable of a minimum detection value of 500 ppb methyl bromide and having a detection lag-time of two minutes or less, may be used to monitor areas where methyl bromide air concentrations may immediately exceed DPR guideline values (630 ppb) or where the buildup of methyl bromide from the off-gassing commodity may also cause concentration greater than 630 ppb. Such a system must include a warning function to indicate where air concentrations have exceeded 630 ppb and an alarm for when concentrations exceed 5 ppm. The system must also include a digital display and be capable of data-logging. Before installation of this type of system, it is strongly recommended that DPR's Worker Health and Safety (WHS) Branch be consulted for proper placement of remote sensors/ports. All manufacturer's requirements and recommendations must be followed. Facilities that install these units as a replacement for colorimetric tube testing should be required to contact WHS staff to confirm the unit's monitoring results.